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MCC-IT Research Journal 2025

EDITOR	:	Dennis L. Tacadena, DIT
TECHNICAL ADVISER / EDITORS	:	Khyle L. Alegre Engr. Robhert M. Bamba, MEECE Alfonso D. Barcelon Jr. Marilou B. Cabuñag Dessalyn J. De Castro Ritchell Z. Escoto, MIT Engr. Ernie Lee E. Pineda, MIT Jocelon C. Sanguyu, DIT Engr. Dennis L. Tacadena, DIT Lovely Ruth C. Valdez-Santos
COVER DESIGN / LAYOUT	:	Dennis L. Tacadena, DIT
POSTAL ADDRESS	:	Institute of Computing Studies, Mabalacat City College, Rizal St., Brgy. Dolores, Mabalacat City, Pampanga 2010 Philippines
Email Address	:	dennis.tacadena@mcc.edu.ph

MESSAGE FROM THE DEAN

TO OUR BSIT Student Researchers, Technical Advisers and BSIT Program Head/Assistant Dean

It is with great pride and joy that I extend my heartfelt congratulations to our Bachelor of Science in Information Technology students for successfully completing their Capstone Projects, which now stand ready for publication in this Capstone Journal.

The capstone journey is more than just an academic requirement—it is a culmination of years of learning, discipline, creativity, and perseverance. Through your projects, you have demonstrated not only technical knowledge and skills but also the ability to solve real-world problems with innovative and practical solutions. This is a true reflection of the values and standards upheld by the Institute of Business and Computing Education.

Your dedication and hard work have resulted in research and outputs that contribute meaningfully to the growing field of Information Technology. May this milestone inspire you to pursue excellence in your professional careers and to continue advancing knowledge and innovation for the benefit of society.

I also extend my appreciation to our Assistant Dean, Dr. Dennis Tacadena, your faculty advisers, mentors, and peers who have guided and supported you throughout this journey. Their commitment has been invaluable in helping you reach this point of success.

As you move forward, may this achievement serve as a solid foundation for your future endeavors, and may you always carry with you the spirit of integrity, innovation, and service.

Once again, congratulations on this significant accomplishment. We celebrate your success and look forward to seeing the impact you will make as future IT professionals.

MYRNA E. CUENTO-CALMA, CPA, FRIAcc, Ph.D.

Dean, Institute of Business and Computing Education

Mabalacat City College

MESSAGE FROM THE BSIT PROGRAM HEAD

Dear BSIT Student Researchers,

In my capacity as the program head of B.S. in Information Technology, we extend our heartfelt commendation to the BSIT student researcher for their exceptional effort and unwavering dedication in completing the Community-based Web System and Mobile Application controlled Internet of Things (IoT) Capstone Project. This research project is not only a reflection of their technical prowess but also perfectly fits certain Sustainable Development Goals. Through the exploitation of cutting-edge technology, the researchers have created a solution that addresses pressing community needs, showcasing their commitment to making a positive impact.

The hard work and perseverance evident throughout this project have reaped incredible reward, leading to a research undertaking that greatly enhances our business sector and its ultimate users. The outcomes of this community-based capstone project reflect a thoughtful approach to problem-solving, ensuring that the solutions are sustainable and beneficial for all stakeholders involved. We celebrate this achievement and can only hope that this groundbreaking effort will serve to motivate others within the profession.

Best wishes for a prosperous and shining future ahead!

DENNIS L. TACADENA, DIT

Asst. Dean & BSIT Program Head, Institute of Business and Computing Education

Mabalacat City College

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Frederic D. Santos, MIT
Panel Member

Lovely Ruth C. Valdez-Santos
Technical Adviser / Panel Member

Engr. Dennis L. Tacadena, DIT
Capstone Project Adviser

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ACM PAPER PRESENTATION

AcademiaVault: Empowering Students in Research through Capstone and Thesis Projects in Mabalacat City College

PAUL JOSHUA T. DAVID, MABALACAT CITY COLLEGE
ERICSON F. DELA CRUZ, MABALACAT CITY COLLEGE
ANDREI SANDLER R. LOZANO, MABALACAT CITY COLLEGE
LUIS NICOLE T. MANLUTAC, MABALACAT CITY COLLEGE
BRIAN KHYLE M. MOLINA, MABALACAT CITY COLLEGE
MARILOU B. CABUÑAG (Technical Adviser – CAP1), MABALACAT CITY COLLEGE
KHYLE L. ALEGRE (Technical Adviser – CAP2), MABALACAT CITY COLLEGE

ABSTRACT
AcademiaVault: Empowering Students in Research through Capstone and Thesis Projects at Mabalacat City College aims to address the inefficiencies in accessing and managing research resources through a centralized digital repository. The system is designed to enhance research accessibility, collaboration, and data management for students, faculty, and librarians. Capstone and thesis projects are critical in fostering academic excellence and research innovation. This study's objective is to develop a digital repository that integrates resource search, consultation management, and administrative tools tailored to Mabalacat City College's needs. The researchers utilized the Software Development Life Cycle (SDLC) approach, specifically the modified waterfall model, to ensure systematic development and quality assurance. Alpha and beta testing results demonstrated the system's exceptional performance across ISO 25010 standards, including functionality, usability, and security. The system received high ratings from IT experts and students, indicating strong alignment with user needs. AcademiaVault streamlined resource accessibility and enhanced research collaboration, ultimately fostering a more inclusive and efficient academic environment. AcademiaVault significantly improves the research experience at Mabalacat City College, aligning with sustainable development goals in education and innovation. Future iterations could incorporate advanced analytics and broader integrations to further elevate its impact.

Keywords: Information System, Information Management, File Management System

INTRODUCTION

In higher education, the integration of capstone and thesis projects represents a transformative approach to enhancing student learning and empowerment. Globally, universities have increasingly recognized these culminating research endeavors as pivotal in fostering not only academic excellence but also essential skills such as critical thinking, problem-solving, and independent inquiry (Chickering & Gamson, 2020; Kuh, 2022). These projects are multifaceted tools that bridge theoretical knowledge with practical application, preparing students for complex challenges in their chosen fields.

According to a study by Kim and colleagues (2019), capstone and thesis projects provide students with opportunities to engage deeply in their disciplines, promoting a deeper understanding of subject matter beyond mere classroom instruction. This experiential learning approach has been shown to significantly enhance student motivation and retention rates (Jones & Jenkins, 2020). Moreover, global trends indicate a growing emphasis on student-centered educational practices that empower learners to take ownership of their academic journeys (UNESCO, 2023).

The success of capstone and thesis projects relies heavily on the accessibility and availability of relevant academic resources, which are often housed in institutional libraries. Libraries are integral to student research, providing access to an extensive range of books, journals, and digital resources essential for in-depth academic inquiry (Sharma & Patel, 2022). As higher education institutions continue to embrace digital

Libraries must adapt to transformation by offering online platforms that enhance student and faculty experiences. At Mabalacat City College, the proposed Digital Repository System represents a significant advancement in achieving this goal, providing a centralized and accessible repository of research materials for capstone and thesis projects.

In the context of developing countries, where limited funding and infrastructural challenges can hinder educational progress, the digitization of library services is especially impactful (Adebayo et al., 2021). It enables institutions to overcome geographical barriers, allowing students to access vital academic materials regardless of their physical location. The implementation of such systems is crucial not only for improving student learning outcomes but also for addressing issues of equity and inclusion. By ensuring that all students have equal access to educational resources, Mabalacat City College is taking a significant step towards bridging the digital divide and promoting social equity in higher education (Yeboah & Amponsah, 2021).

Furthermore, the proposed Digital Repository System at Mabalacat City College aligns with the broader goal of integrating technology into various aspects of the academic experience. According to research by Zhang and Li (2022), the use of information and communication technology (ICT) in educational settings can significantly enhance learning outcomes, particularly when it comes to research and data analysis. With the integration of features like E-note, students can easily annotate and organize their findings, allowing for more efficient analysis and synthesis of data. This, in turn, will contribute to the overall quality of their capstone and thesis projects, as well as foster digital literacy—a skill that is increasingly important in today's job market.

One of the key challenges faced by students working on capstone and thesis projects is the ability to navigate and manage vast amounts of information effectively. The proposed Digital Repository System aims to address this challenge by providing a powerful search feature that allows students to quickly locate the materials they need for their research (O'Connor, 2021). This feature is particularly valuable for students who are new to academic research and may struggle to find the right sources in a traditional library setting. By simplifying the research process, the system can help reduce students' anxiety and improve their confidence in conducting independent research.

The role of faculty in guiding students through their capstone and thesis projects cannot be overstated. Effective faculty mentorship is critical to the success of these projects, as it ensures that students are on the right track and receive timely feedback (Gonzalez & Rivera, 2021). The new repository system supports this mentorship process by allowing faculty members to easily access students' research progress and provide feedback promptly. Additionally, the system's digital interface will enable more structured communication between students and mentors, facilitating a more organized and transparent review process, which can ultimately lead to higher-quality research outputs.

In addition to supporting students and faculty, the digital repository system also holds significant value for the institution as a whole. By digitizing records and data related to capstone and thesis projects, the system allows for more efficient data management and reporting (Liu et al., 2021). This data can be used by the administration to evaluate the effectiveness of the college's academic programs and make informed decisions about future curriculum development. Moreover, having a comprehensive digital archive of past projects can provide valuable insights for future students, serving as a reference and inspiration for their work.

The introduction of an automated repository system also reflects a commitment to sustainable practices within the institution. The transition from a traditional paper-based system to a digital platform significantly reduces the need for physical storage space and the consumption of paper, aligning with the growing emphasis on environmental sustainability in education (Kumar & Singh, 2022). By adopting digital tools and reducing paper usage, Mabalacat City College is contributing to environmental conservation efforts while also improving operational efficiency. This shift towards sustainability is increasingly being recognized as an important component of responsible educational management in the 21st century.

Beyond the immediate benefits for students, faculty, and the institution, the Digital Repository System also has the potential to foster a culture of research and innovation at Mabalacat City College. Access to comprehensive digital resources and the tools to effectively utilize them will encourage students to engage in more rigorous research, explore new ideas, and contribute to knowledge creation within their fields (Rahman et al., 2023). As students become more confident in conducting independent research, they are more likely to pursue advanced studies or entrepreneurial endeavors that can contribute positively to the community and economy.

Lastly, the implementation of this system reflects the evolving role of academic libraries in higher education. Once considered mere repositories of books, modern academic libraries are now dynamic hubs for learning, research, and collaboration (Martin & Smith, 2022). By incorporating digital technology, libraries can offer a wider range of services that cater to the diverse needs of students, including access to multimedia resources, digital learning tools, and collaborative spaces. Mabalacat City College's Digital Repository System exemplifies this evolution, as it seeks to transform the library into a proactive partner in students' academic and professional journeys.

METHODOLOGY

The Software Development Life Cycle (SDLC) is a systematic approach used by software development teams to conceive, develop, test, and deliver high-quality software products. The modified waterfall technique divides development procedures into flexible iterative stages, allowing for adequate documentation and design evaluations for custom software quality, dependability, and maintainability (See Figure 1).

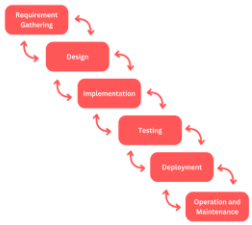

Figure 1: The Modified Waterfall Model

Requirements Gathering

The researcher engaged in collaborative brainstorming sessions and exchanged ideas to gather essential information and data crucial for developing a successful digital repository system. Through these discussions, the researcher aims to identify key features and functionalities that would enhance the web's usability and attractiveness to meet the target users.

The researcher chose to build the front end and back-end of the system using the development tool for software such as Microsoft Visual Studio 2022 (see Table 3) on the desktop computer. To run the system (see Table 2) with the device name NIKKO specified as a workstation, a processor of Ryzen 5 3550H determines the computer's processing power and performance. 8 GB of RAM for storing data and accessing it quickly, 1 TB of hard disk, and 128 GB of SSD capacity and type are essential considerations for storing operating systems, and the NVIDIA GeForce RTX 1650 is used for rendering images and video. The researcher was using database management to develop a system by using C Language, Microsoft Visual Studio, and SQL Server Management Studio (SSMS) as the database to utilize for the Developing and Delivering System, and Adobe Photoshop CC 24.3.0 will be used to design and edit the system.

Design

In this phase, the proponents will use the following analysis tools and diagrams to design and develop the application and administrator panel: storyboard, visual table of contents, use case Diagram, and system architecture.

Our designer used the Canva application to create the visual elements for our web development. With some help from Google Images, they were able to incorporate various elements into the designated designs as needed. By leveraging Canva's intuitive interface and extensive repository of templates, our designer efficiently produced high-quality graphics that aligned with our project's aesthetic goals. Additionally, Google Images provided a vast array of supplementary visuals that were integrated seamlessly into the designs, ensuring that each component was visually appealing and met the project's specifications. This combination of tools enabled our designer to maintain a consistent and professional look throughout the app, enhancing the overall user experience.

Implementation

AcademiaVault's implementation phase will leverage a solid development stack to build a high-quality, functional, and secure digital repository system. The frontend will be constructed with HTML, CSS, JavaScript, and frameworks such as React or Vue.js, while the backend will be C as scripting language. The program will be hosted on a Linux server to provide scalability and dependability. The homepage will feature a visually appealing and intuitive layout, showcasing recent and popular theses and projects, while a filter search bar will be prominently displayed for quick access to resources. Users will be able to browse the website interface, with each project entry displaying details like the title, author, and year of publication. Filtering options will allow sorting by discipline, author, and institute, providing a smooth and efficient search experience. The administrator panel includes a dashboard for tracking project data, user activity, and system analytics. Administrators can add, edit, and delete data, check documents for quality assurance, and manage user access for students, staff, and librarians. Testing will be rigorous, including unit testing for important features such as search, authentication, and uploads, as well as integration testing to ensure that components work together seamlessly. Beta testing with students will allow us to improve usability and functionality. By following this systematic method, AcademiaVault will achieve its goal of developing an accessible, efficient, and student-centered research library that is fully aligned with Mabalacat City College's goals.

Figure 2: Dashboard

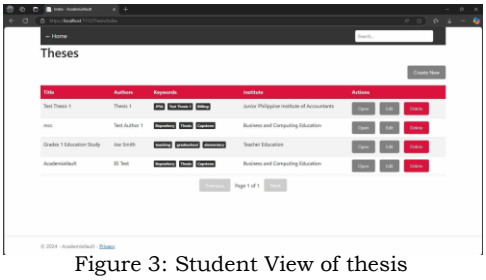

Figure 3: Student View of thesis

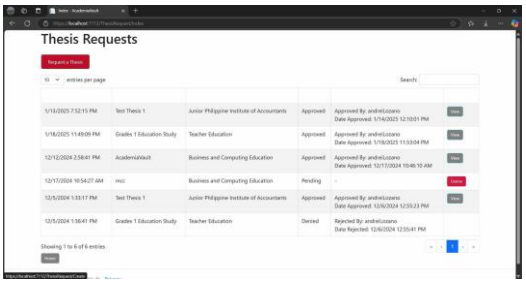

Figure 4: Student Thesis Request

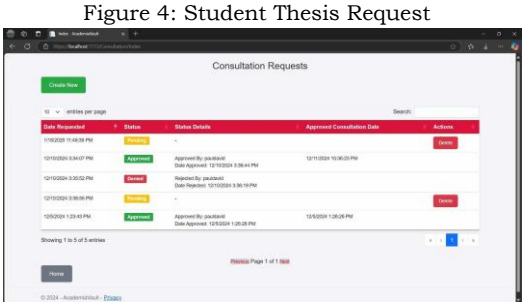

Figure 5: Student Consultation Request

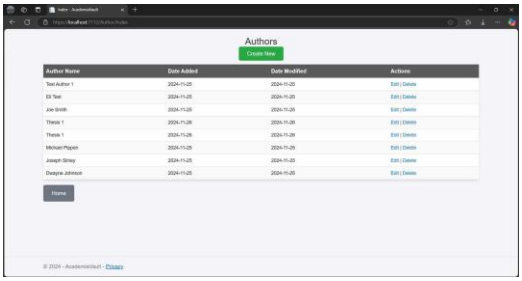

Figure 6: Research Teacher/Authors

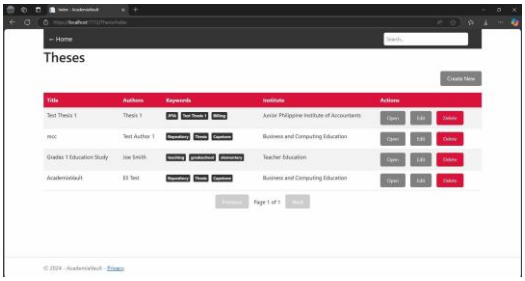

Figure 7: Librarian thesis view

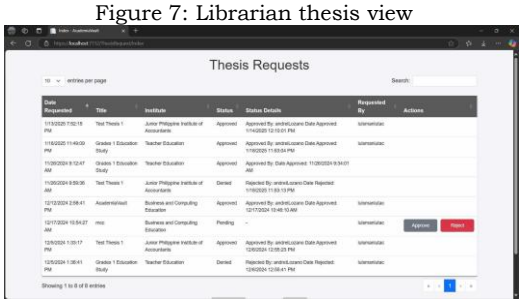

Figure 8: Thesis Request in Library Account

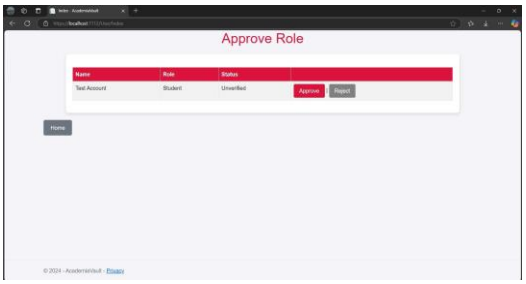

Figure 9: Dean Approval of Accounts

Testing

The Develop website will be evaluated after a preliminary assessment in the testing phase. The proponents will use various testing tools for the study, including unit, system, and alpha and beta testing. Before being finalized for administration, the questionnaire's validity was assessed during the testing phase. The procedures for data collection, analysis, and processing, as well as the sampling method and instruments utilized, were also addressed.

Questionnaire Validity

The researchers ensured the reliability and accuracy of the data collected and conducted a thorough validity assessment of the questionnaire used in this study. The primary aim of this assessment was to confirm that each question effectively measures the intended aspects of user experience, satisfaction, and usability of the Academia Vault platform.

Sampling Method

The researchers employed a purposive sampling technique to ensure that the participants selected were directly relevant to the study's objectives. This non-probability sampling method was chosen because it focuses on individuals who are actively involved in capstone or thesis-related activities and have meaningful insights about the Academia Vault platform. By targeting participants with specific roles and responsibilities in these academic processes, the study ensures that the data collected is highly relevant and actionable.

The sample population included graduate students, faculty members, librarians, and research teachers who actively contribute to or benefit from the platform's features. Graduate students were selected for their direct use of Academia Vault in managing capstone and thesis projects, while faculty members and research teachers were included for their roles in mentoring and supervising students' research activities. Librarians were involved due to their role in managing research materials and ensuring accessibility through the platform. This multi-stakeholder approach provided a comprehensive understanding of how Academia Vault supports

various aspects of academic research at Mabalacat City College.

The researchers selected a total of 30 participants to achieve a balance between depth and breadth of feedback. This sample size was deemed sufficient to identify patterns, trends, and challenges while remaining manageable within the study's timeframe. Participants were drawn from diverse academic programs and departments, ensuring that the data reflected the perspectives of various user groups within the institution. To maximize the relevance of responses, priority was given to individuals actively engaged in capstone or thesis projects during the data collection period.

This targeted sampling method enabled the researchers to gather detailed and meaningful feedback on the platform's strengths and areas for improvement. By incorporating input from multiple perspectives—students, faculty, librarians, and research teachers—the study captured a well-rounded view of Academia Vault's role in supporting research and academic success at Mabalacat City College.

Instrumentation

The research created a validated questionnaire to achieve the necessary goal of the development system. The system utilized by the proponents was registered as a domain and published by November 5, 2024, to the repository site. During the beta testing, the researcher approached 30 people that are using the digital repository system to test and evaluate the developed system.

Questionnaire Administration

The researcher conducted a survey at Mabalacat City College from October 21 to 28, 2024, providing participants with an overview of the questionnaire and encouraging them to express their thoughts and experiences clearly in English to create a comfortable setting for open feedback.

Data Analysis

Descriptive statistics was used in this study to compile and examine the data. This study is able to understand the position and distribution of the data points with the use of descriptive statistics. It provides a clear understanding of the features and characteristics of the data. The following statistical treatments were used for data reduction. Percentages were used to find the relative frequency of the respondents' demographic profiles and see how the categories relate to each other. The formula to calculate the percentage is

$$f = \frac{f \times 100}{N} = \frac{100f}{N}$$

The mean is also known as the average or approximately center value of a set of numbers. The mean formula for a set, according to statisticians, is the sum of the observations divided by the total number of observations. The mean formula may be written as Mean = (Sum of Observations) ÷ (Total Numbers of Observations) for a set of provided data.

$$\bar{x} = \Sigma fx/\Sigma f$$

where,

$\bar{x}$ = the mean value of the set of given data.
f = frequency of each class
x = mid-interval value of each class

The Likert scale is a rating system that was used in questionnaires and is designed to measure respondent's attitudes, opinions, or perceptions. In the following computation of the average score for each survey tool sub-criterion and criterion, the researcher used the Likert scale to clarify the result. The respondents are asked to rate how much they agree or disagree with the statement using this scale, which has a range of 1 to 5, with each point indicating a certain level of agreement or disagreement.

Response Categories	Numerical Value	Range / Interval		Verbal Interpretation
Strongly Agree	5	4.21 5.00	–	Excellent
Agree	4	3.41 4.20	–	Good
Neutral	3	2.41 3.20	–	Acceptable
Disagree	2	1.81 2.60	–	Marginal
Strongly Disagree	1	1.00 1.80	–	Poor

Operation and Maintenance

Academia Vault, a system developed by capstone advisers, technical advisers, alpha and beta testers, and panelists, is now available at academiavault.com. It provides a platform for archiving and sharing academic resources, establishing a strong web presence, and attracting a larger number of scholars. The platform improves access to academic publications and opens new collaboration options, making it a trusted repository for intellectual resources in the digital environment.

RESULTS

This chapter details the study's objectives, highlighting the researchers' achievement of their goals. It covers the functionality, design, development, and testing of the web system, including data from Alpha and Beta tests and ISO 25010 evaluations. To evaluate the experience of the participants in Academia Vault: Empowering Students in Research through Capstone and Thesis Project in Mabalacat City College" to complete a survey, the researcher must prepare a report that summarizes the study's result. The result from the studies should be presented in a reasonable, organized, and understandable way.

The proponents used alpha and beta tests. In alpha testing, three (3) respondents were asked to evaluate the system, namely Ivanjo Sarmiento, Rassel Jan David, and Robbert Bamba, MEECE. All the respondents in alpha testing are all working in the IT industry and teaching IT-related. They were selected based on their experience in the field of information and technology.

Testing Result

The researcher conducted alpha and beta tests to evaluate the Academia Vault system. During the alpha testing, the system underwent a comprehensive evaluation by three IT professionals. During the beta testing transition, a total of thirty (30) respondents from individuals that are using online ordering platforms have contributed significant insight into the system. The evaluation, conducted according to ISO 25010 guidelines, encompassed various dimensions such as Functional Suitability: Functional Completeness, Functional Correctness, Functional Appropriateness, Compatibility, Coexistence: Interoperability, Interaction Capability: Inclusivity, Security: Confidentiality, Integrity, Accountability, Authenticity, Flexibility: Adaptability, Scalability. This comprehensive evaluation provided specific data on the effectiveness of Academia Vault: Empowering Students in Research through Capstone and Thesis Project in Mabalacat City College.

Summary result of Alpha test

				Criteria	Mean Score	Sub-Criteria	Mean Score
FUNCTIONAL COMPLETENESS:	2.60	FUNCTIONAL SUITABILITY	2.54	Functional Suitability	4.64	Functional Completeness	4.87
FUNCTIONAL CORRECTNESS:	2.33					Functional Correctness	4.26
FUNCTIONAL APPROPRIATENESS:	2.68					Functional Appropriateness	4.80
COEXISTENCE:	2.33	COMPATIBILITY	2.59	Compatibility	4.79	Coexistence	4.87
INTEROPERABILITY:	2.84					Interoperability	4.70
APPRORIATENESS RECOGNISABILITY:	2.75	USABILITY	2.55	Usability	4.86	Appropriateness Recognizability	4.90
OPERABILITY:	2.75					Operability	5.00
USER ERROR PROTECTION:	2.30					User Error Protection	4.80
USER INTERFACE AESTHETIC:	2.53					User Interface Aesthetic	5.00
ACCESSIBILITY:	2.40					Accessibility	4.47
ADAPTABILITY:	2.75	PORTABILITY	2.42	Portability	4.50	Adaptability	4.60
INSTALLABILITY:	2.10					Installability	4.40
		Total Mean	2.53	**Total Mean**	**4.70**		

Summary Result of Beta test

				Criteria	Mean Score	Sub-Criteria	Mean Score
FUNCTIONAL COMPLETENESS:	10.66	FUNCTIONAL SUITABILITY	11.03	Functional Suitability	4.46	Functional Completeness	4.37
FUNCTIONAL CORRECTNESS:	11.36					Functional Correctness	4.44
FUNCTIONAL APPROPRIATENESS:	11.14					Functional Appropriateness	4.56
COEXISTENCE:	11.57	COMPATIBILITY	11.35	Compatibility	4.57	Coexistence	4.43
INTEROPERABILITY:	11.13					Interoperability	4.70
APPRORIATENESS RECOGNISABILITY:	11.98	USABILITY	12.41	Usability	4.63	Appropriateness Recognizability	4.48
LEARNABILITY:	12.95					Learnability	4.80
OPERABILITY:	12.68					Operability	4.50
USER ERROR PROTECTION:	11.75					User Error Protection	4.60
USER INTERFACE AESTHETIC:	12.60					User Interface Aesthetic	4.63
ACCESSIBILITY:	12.50					Accessibility	4.77
ADAPTABILITY:	12.40	PORTABILITY	12.30	Portability	4.69	Adaptability	4.67
INSTALLABILITY:	12.20					Installability	4.70
		Total Mean	11.77	Total Mean	4.59		

The Alpha and Beta testing phases were conducted to evaluate the website's functionality and usability across several key criteria: Functional Suitability, Compatibility, Usability and Portability. Both testing phases yielded "Excellent" ratings across all criteria, indicating a high level of performance. In Alpha testing, Functional Suitability scored 4.64, Compatibility 4.79, Usability received 4.86, and Portability scored 4.50, resulting in a total mean score of 4.70. During Beta testing, while the scores slightly decreased, all criteria maintained an "Excellent" rating: Functional Suitability scored 4.46, Compatibility 4.57, Usability 4.63, and Portability 4.69, with a total mean of 4.59. The website's initial functionality and performance were good throughout Alpha testing, with minor changes influencing Beta results. Despite these adjustments, the overall quality and user experience were still great.

DISCUSSION

This chapter explains the study's goals and how the researchers achieved them. It talks about the design, development, and testing of the web system, including the results from Alpha and Beta tests and the ISO 25010 evaluations. The purpose of the study was to evaluate the experience of participants in the Academia Vault project at Mabalacat City College. To do this, the researcher will prepare a report summarizing the results.

In the Alpha testing, three respondents—Ivanjo Sarmiento, Rassel Jan David, and Robbert Bamba—were asked to evaluate the system. All of them are in the IT industry and teach IT-related subjects. They were chosen because of their expertise in the field. For Beta testing, 30 students from Mabalacat City College participated in evaluating the system.

The system was tested based on the ISO 25010 criteria, which include functionality, performance, compatibility, usability, reliability, security, maintainability, and portability. The results were analyzed using the Likert scale. The findings will be presented clearly and organized in the report.

Limitations

While Academia Vault offers numerous advancements in managing capstone and thesis projects, certain limitations remain that primarily involve the library process, search functionality, and external factors impacting system usage. The platform enhances the digital aspects of the library process, yet it does not fully replace the physical library's administrative operations. Some older capstone and thesis projects that exist only in physical format may not be readily accessible in the digital repository, limiting the platform's comprehensiveness. Additionally, manual processes such as document verification and cataloging remain outside the platform's scope. The search functionality is dependent on the accuracy of metadata input, such as categories, tags, and

keywords, which are manually managed by librarians and research teachers. Any inconsistencies or delays in updating metadata could affect the search experience for users. The system currently does not integrate with external academic databases or third-party repositories, which limits its capability to provide access to broader academic resources outside of Mabalacat City College's collection. Furthermore, the system requires consistent participation from librarians and faculty to ensure timely updates to the repository. Any lapses in these processes could lead to outdated or incomplete records. External factors such as internet connectivity issues or hardware limitations may also hinder users' access to the platform, particularly for those in areas with unstable internet access or insufficient technological resources. In conclusion, while Academia Vault significantly improves resource accessibility and academic collaboration, these limitations highlight areas for future enhancement. Further integration with external databases, automation of metadata entry, and infrastructure improvements are potential directions for overcoming these challenges.

Conclusions

In this study, the proponents successfully developed Academia Vault. The digital repository system has considerably enhanced Mabalacat City College students' research experiences by increasing access to academic materials, boosting cooperation, and reducing physical obstacles while fulfilling worldwide software quality requirements.

Academia Vault strengthens Mabalacat City College's instructional goal by incorporating digital technology, encouraging lifelong learning, and harmonizing with the Sustainable Development Goals, which promote equitable access to education, sustainable resource use, and infrastructure modernization.

The study highlights the power of digital repository systems to improve educational experiences by encouraging independent inquiry and addressing access differences. It promotes Academia Vault as a model for other universities to better academic resource management, with further enhancements required.

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Our heartfelt thanks go to our board of panelists for their invaluable contributions to the refinement of this project. To Ma'am Dessa Lyn De Castro, Ma'am Lovely Ruth C. Valdez-Santos, and Sir Mark P. Lagman, MIT as our panel chair, your constructive feedback and professional insights greatly enhanced the quality and feasibility of our system. Your time and dedication to reviewing and guiding our work are deeply appreciated.

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ACCOUNTIFY: A Web-Based Accountant Prep and Review Platform with Integrated Study Tools

Best Capstone (*Information System Category*)
Presented at International Research Conference on Information Technology Education (IRCITE) 2025

KRISTHINE D. AGUAS, MABALACAT CITY COLLEGE
JOSHUA REUBEN B. CAMON, MABALACAT CITY COLLEGE
MARY ANGELINE M. DELA CRUZ, MABALACAT CITY COLLEGE
CYRIL JAN O. DELA PEÑA, MABALACAT CITY COLLEGE
VERNI JAHZREAL A. SERRANO, MABALACAT CITY COLLEGE
DENNIS L. TACADENA (Capstone Adviser), MABALACAT CITY COLLEGE
DESSA LYN J. DE CASTRO (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT
The platform aims to enhance academic performance and preparation for the Certified Public Accountant Licensure Examination (CPALE). Equipped with curated study materials, interactive learning modules, practice exams, review flashcards, a lesson progress tracker, Pomodoro techniques, and study music, the system fosters effective learning and exam readiness. The platform was developed using the modified Waterfall Model of the Software Development Life Cycle (SDLC), emphasizing systematic design, implementation, and evaluation. Both phases adhered to ISO 25010 standards, assessing criteria such as Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. Alpha test results demonstrated an overall mean score of 4.37, categorized as "Excellent," while beta testing further improved the mean score to 4.53. The proposed web-based accountant preparation and review platform for Mabalacat City College (MCC) aligned with several Sustainable Development Goals (SDGs), primarily targeting Goal 4 (Quality Education) and Goal 9 (Industry, Innovation, and Infrastructure).

Keywords: Web-Based Learning Platform, Pomodoro Timer, Interactive Learning, Study Modules, Academic Preparation, Accounting

INTRODUCTION

Technology has a bigger impact on our daily lives than we often realize, and it keeps advancing quickly. It has changed the way we find information and learn new things. Communication, for example, is almost instant; we can send a quick message instead of using slower ways like letters or face-to-face meetings. This change has transformed how we interact. As our needs and expectations grow, technology continues to expand its reach and influence in our lives (Kumar, A., 2024). A digital learning platform serves as a centralized repository for educational content, organizing courses into topics or subjects curated by educators or affiliated institutions. Access may be membership-based or freely available, depending on the platform. These platforms benefit both students and instructors, offering organized course material, progress tracking tools, and avenues for peer collaboration, enriching the overall learning experience (G, J., 2021). Accounting entails the process of documenting, summarizing, analyzing, and reporting a company's financial transactions. This process results in the creation of financial statements, which succinctly capture the business's financial activities over a specific period, showcasing its performance, financial position, and cash flows. It is a vital tool for decision-making, cost management, and assessing financial performance, irrespective of the organization's size. While routine accounting tasks are often handled by bookkeepers, more complex activities are typically overseen by Certified Public Accountants (CPAs). Businesses primarily utilize two significant branches of accounting: managerial accounting, which supports internal decision-making, and cost accounting, which focuses on determining the costs of products and setting prices. Professional accountants follow the Generally Accepted Accounting Principles (GAAP) when preparing financial statements to ensure accuracy and compliance. In essence, accounting is integral to strategic planning, regulatory compliance, raising capital, and managing business operations effectively (Fernando, J, 2024). The Certified Public Accountant Licensure Examination (CPALE) represents the final hurdle for aspiring accountants and potentially future lawyers in the Philippines. Recognized as one of the most challenging licensure exams, CPALE has a notably low passing rate of just 22%, a trend that has been declining since 2016. In contrast, the American Institute of Certified Public Accountants reports an average passing rate of 50%, highlighting a significant discrepancy between the

two countries' certification processes. This raises the question of whether it is time to reconsider the content and difficulty level of the CPALE. Educational institutions play a critical role in the performance of CPA examinees. The effectiveness of accounting programs is heavily dependent on the competence of faculty members, who must possess substantial skills and knowledge in accounting and related subjects (Calubayan, 2020). The proposed system is a web-based platform designed to streamline and enhance the academic experience of Bachelor of Science in Accountancy and Bachelor of Science in Management Accounting students at Mabalacat City College (MCC). In addition to supporting their studies, the system is tailored to help students prepare effectively for the CPALE (Certified Public Accountant Licensure Examination. It offers an extensive range of features, including access to curated study materials, practice exams, review flashcards, interactive learning modules, and lesson progress indicator. These resources are specifically designed to reinforce key concepts and competencies needed for academic success and professional exam preparation. Additionally, the system incorporates study music and implements Pomodoro techniques to help students manage their study time effectively and maintain focus during their learning sessions. The proposed system aims to address key challenges faced by accountancy students at MCC, such as limited access to study materials and difficulties in tracking academic progress. By providing a unified platform for accessing educational resources and monitoring performance, the system enhances student engagement, improves learning outcomes, and fosters a supportive environment that promotes academic success. This streamlined solution is designed to empower students by making learning materials readily available and providing tools to track their progress in real time, ensuring a more efficient and effective learning experience.

With its user-friendly interface and extensive features, the proposed system is set to offer substantial advantages for both students and administrators at MCC. By providing students with access to high-quality educational resources and empowering administrators with efficient course management tools, the system aims to elevate the overall academic experience and contribute to the academic excellence of MCC's Bachelor of Science in Accountancy and Bachelor of Science in Management Accounting programs.

Objective of the Study

The primary objective of this study was to develop an efficient and user-friendly web-based platform, "Accountify: A Web-Based Accountant Prep and Review Platform with Integrated Study Tools." In line with this, this study aimed to achieve the following specific objectives:

To gather information and best practices for system development from accounting institutions, academic journals, textbooks, study systems, and research on educational technology.

1. To identify and specify the hardware and software requirements for developing the system platform. Hardware requirements include desktop computers, tablets, and mobile phones for compatibility testing and accessibility.
2. To design the system using visual and analytical tools, such as a Storyboard, Use Case Diagram, Visual Table of Contents, Entity Relationship Diagram (ERD), and Gantt Chart, to ensure proper planning and development.
3. To develop a system with integrated features that enhance functionality and user experience. Security features include login verification through user credentials and database checks, email-based account validation, Google login, access limitations for unverified users, and features like password recovery and profile-based password management.
4. To test the system using developer testing, alpha testing, and beta testing to ensure functionality, compatibility, and usability.
5. To integrate an algorithm with functionalities to optimize system performance.
6. To incorporate user-friendly functionalities to enhance the overall experience.
7. To test the system using developer testing, alpha testing, and beta testing phases.
8. To evaluate the system's performance based on the ISO 25010 criteria: Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility.
9. To deploy the system using Name.com for domain registration, Heroku for hosting and SSL encryption, JawsDB for database management, and Amazon S3 for storing user-uploaded files.
10. To deploy and implement the system to the Mabalacat City College Dapdap.

Each specific objective interconnects to support the successful development, deployment, and operation of the Accountify platform. Together, they form a comprehensive approach to achieving the study's primary goal of enhancing learning and study support for accounting students at MCC Main Campus.

METHODOLOGY

The research employed the Modified Waterfall Model, a structured yet flexible approach that facilitated iterative refinements at each development stage. This approach ensured adaptability to user feedback and addressed challenges effectively (see Figure 1). The process began with gathering requirements, which

established the foundation of the system through surveys, interviews, and literature reviews. Feedback from students, staff, and administrators ensured a user-centric design aligned with real-world needs. Stakeholder input guided the evolution of initial concepts to cover various use-case scenarios comprehensively.

The system's design employed tools such as Storyboards, Visual Tables of Contents, Use Case Diagrams, Entity Relationship Diagrams (ERD), and Gantt Charts to visualize the user interface, functionality, and workflows. These tools provided structure and clarity, supporting effective project management and ensuring alignment with user needs. Visual Studio Code served as the IDE, while Laravel and MySQL were used for backend development and database management, respectively.

The system was incrementally built, incorporating features like lesson content, flashcard study tools, progress tracking, and administrative capabilities. Designed specifically for accounting students, the system ensured robustness and ease of use through continuous refinement, guided by feedback and testing.

The researchers conducted alpha testing with IT experts to identify bugs and vulnerabilities. Beta testing involved 40 students from the BSA and BSMA programs, alongside a professional evaluator. Feedback from both phases informed system refinement, ensuring usability and functionality in real-world scenarios.

The system was assessed using the ISO 25010 Software Quality Model, focusing on Functional Suitability, Compatibility, Security, Interaction Capability, and Flexibility. Descriptive statistics were applied to analyze results, providing a comprehensive evaluation of system performance and user satisfaction.

After deployment, the system was monitored using metrics such as user feedback, usage statistics, and performance data. Regular updates and improvements ensured the platform's reliability and adaptability to evolving user needs.

The Modified Waterfall Model provided a structured yet iterative framework, enabling the development of Accountify as a reliable and effective web-based learning platform tailored to accounting students' educational needs.

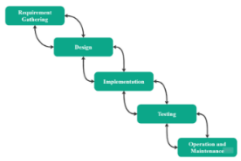

Figure 1: The Modified Waterfall Model

Requirements

The requirements gathering phase identified essential hardware components, including a desktop computer, tablet, and mobile phone to facilitate system development and testing across multiple platforms. The software requirements included Vite.js for fast development and optimized performance, Laravel 11 for server-side logic and operations, and Tailwind CSS v3 for designing the user interface with a utility-first approach.

To enhance front-end interactivity, Alpine.js v3 and Livewire v3 were utilized, integrating seamlessly with the Laravel ecosystem. PHP 8 served as the primary programming language for back-end development, with MySQL 9 and MySQL Workbench managing the platform's data storage and schema design. Node.js 20 handled dependency management and supported the development environment, while Visual Studio Code provided a lightweight yet robust editor for writing and debugging code.

Version control and collaboration were facilitated using Git. For creating visual assets and mockups, Canva was employed, while Miro supported brainstorming, planning, and wireframing tasks. This combination of hardware and software ensured a versatile, efficient, and collaborative environment for developing the Accountify system.

Design

The Accountify system integrates inputs, processes, and outputs to create a cohesive and user-focused platform. Inputs include educational and technological requirements, with a focus on analyzing the curriculum for Bachelor of Science in Accountancy and Bachelor of Science in Management Accounting programs, understanding students' study material preferences, examination patterns, and learning objectives.

The processes encompass detailed system requirements analysis, system design, and iterative development phases. These steps incorporate features such as centralized access to study materials, interactive learning modules, progress tracking tools, and streamlined communication channels, ensuring that the system meets the academic and administrative needs of its users. The integration of these processes leads to the creation of a robust web-based platform for accounting preparation and review, enhancing both student learning outcomes and administrative efficiency.

The system architecture comprises a secure database and an intuitive user interface. The database manages educational resources, student data, and progress tracking, while the user interface provides an accessible and seamless platform for students and administrators. This design ensures smooth interactions, enabling users to access study tools, monitor progress, and manage user accounts

effectively. By transitioning from traditional methods to a comprehensive digital platform, the system enriches the educational experience and supports student achievement in accounting programs.

Figure 2: Modified Visual Table of Contents Diagram

Development

The development phase of the Accountify system involved the use of various analysis tools and diagrams to guide the system's creation. An Entity-Relationship Diagram (ERD) (see Figure 4) was developed to model data entities and their relationships, forming the foundation for the system's database design. This database securely manages educational resources, user data, and progress tracking information, ensuring data integrity and efficient retrieval.

Storyboards were created to visually represent the user interface and application flow, helping the development team align their efforts with user expectations. Storyboard - User 2 (see Figure 5) outlined interactions specific to students, such as navigating between modules, accessing flashcards, and monitoring progress. Storyboard - Admin (see Figure 6) depicted the administrative user flow, illustrating functionalities such as managing content, overseeing user activity, and generating reports. These visual aids facilitated clarity in interface design and system functionality, ensuring an intuitive experience for both students and administrators.

The Home Page design (see Figure 7) was carefully planned to provide users with a centralized hub for accessing all system features. It offered seamless navigation to key areas, such as courses, progress tracking, and flashcards, ensuring users could efficiently engage with the platform's educational resources. Administrators were equipped with robust tools on the Home Page to manage system operations, ensuring comprehensive oversight and control.

Visual Studio Code served as the primary integrated development environment (IDE) for designing and coding the platform. The interface was crafted using modern frameworks, including Tailwind CSS v3 for styling, Alpine.js v3 for interactivity, and Livewire v3 for dynamic user interactions. Laravel 11 and MySQL ensured a secure, scalable, and efficient back-end. Throughout the development process, iterative testing was conducted to refine features and guarantee they met the specific needs of Bachelor of Science in Accountancy (BSA) and Bachelor of Science in Management Accounting (BSMA) students at Mabalacat City College (MCC).

The final platform integrated academic tools and resources seamlessly, providing students with an interactive and efficient study environment. It was designed to enhance learning outcomes and support academic achievement while equipping administrators with tools for effective system management.

Figure 3: Storyboard – User

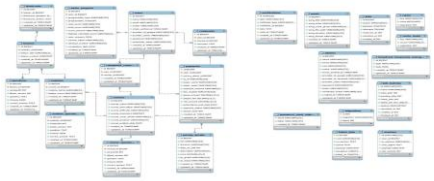

Figure 4: Entity-Relationship Diagram (ERD)

Figure 5: Storyboard – User 2

Figure 6: Storyboard – Admin

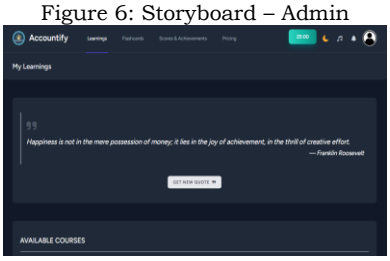

Figure 7: Home Page

TESTING

The testing phase of Accountify was comprehensive and methodical, employing multiple testing approaches to ensure functionality, reliability, and user satisfaction. Alpha and beta testing formed the core of the evaluation process, involving iterative refinement and feedback collection.

Sampling was conducted using homogeneous purposive sampling to focus on participants who shared specific characteristics relevant to the system. This included accounting students enrolled in the Bachelor of Science in Accountancy (BSA) and the Bachelor of Science in Management Accounting (BSMA) programs at Mabalacat City College (MCC). Additionally, a professional evaluator, Dean Madam Myrna E. Cuento-Calma, CPA, FRIAcc, Ph.D., the Dean of the Institute of Business and Computing Education at MCC, participated in the beta testing phase, providing expert insights into the system's applicability and effectiveness.

During alpha testing, three Information Technology (IT) experts rigorously examined the system to identify bugs, vulnerabilities, and areas for improvement. Feedback from this phase informed several refinements to ensure a stable and functional platform before beta testing commenced.

Beta testing involved 40 students from the BSA and BSMA programs for the academic year 2024–2025. Participants were selected to represent the primary user demographic, ensuring that the testing results were directly aligned with the needs and expectations of the target audience. Feedback was collected using structured questionnaires designed to assess key aspects of the system, including usability, functionality, and overall satisfaction.

To measure the system's quality, the researchers adopted the ISO 25010 software quality product model. This framework evaluated critical attributes such as functional suitability, performance efficiency, reliability, security, and usability. Data gathered during the beta testing phase indicated high levels of user satisfaction and system performance, affirming the platform's readiness for deployment.

The systematic testing approach ensured that the platform effectively addressed the educational needs of its intended users, delivering a reliable and user-friendly solution designed to meet the specific requirements of accounting students and administrators at MCC. The evaluation process incorporated a 5-point Likert scale to assess various aspects of the system. To evaluate the system, a 5-point Likert scale was used:

Table 1: Likert Scale used by the Researchers

Response Categories	Numerical Value	Range Interval	Verbal Interpretation
Strongly Agree	5	4.21 - 5.00	Excellent
Agree	4	3.41 - 4.20	Good
Neutral	3	2.61 - 3.40	Acceptable
Disagree	2	1.81 - 2.60	Marginal
Strongly Disagree	1	1.00 - 1.80	Poor

Deployment

The system, Accountify, was deployed on Heroku, leveraging its secure PaaS capabilities for seamless development and management. A domain was registered via Name.com, and secure access was ensured through Heroku's SSL support. Additional integrations, such as JawsDB for database management and Amazon S3 for file storage, enhanced functionality and scalability. Traditional and public beta testing were conducted to gather user feedback, refine the platform, and prepare for the official release.

Maintenance

Regular maintenance protocols were established to ensure Accountify's reliability and effectiveness. Key metrics, such as user feedback and system performance, were monitored regularly to address issues promptly. Periodic updates enhanced functionality and resolved bugs, while administrators were trained to report concerns efficiently for swift resolution.

RESULTS

The website platform interface was evaluated during the alpha testing phase using the ISO 25010 software quality standards, focusing on Functional

Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The evaluation, conducted with three IT experts on September 27, 2024, demonstrated excellent performance across all criteria.

Table 2: Summary of Alpha Test Results

ISO25010 Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.39	Excellent
Compatibility	4.67	Excellent
Interaction Capability	4.32	Excellent
Security	4.33	Excellent
Flexibility	4.38	Excellent
Overall Mean Score	**4.37**	**Excellent**

The alpha test results demonstrated exceptional performance across all evaluated criteria, with an overall mean score of 4.37, interpreted as "Excellent." Compatibility received the highest score of 4.67, reflecting seamless integration across various platforms and devices. Functional Suitability scored 4.39, while Interaction Capability, Security, and Flexibility also achieved "Excellent" ratings, scoring 4.32, 4.33, and 4.38, respectively. These results highlight the platform's reliability, security, and adaptability, showcasing its strong functional stability during the alpha phase.

Table 3 provides the summary of the beta test results, which reflect improvements after incorporating feedback from the alpha test phase. A comprehensive evaluation of the website platform interface was conducted during the beta testing phase, focusing on Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility, as outlined in ISO 25010 standards. The beta test took place from September 30 to October 7, 2024, with forty (40) students from the Bachelor of Science in Accounting and Bachelor of Science in Management Accounting programs at Mabalacat City College.

The beta test results showcased significant improvements, achieving an overall mean score of 4.53, interpreted as "Excellent." Functional Suitability, Compatibility, and Security each received the highest scores of 4.55, indicating exceptional performance in fulfilling user needs, seamless integration, and robust security features. Interaction Capability scored 4.53, while Flexibility scored 4.48, demonstrating the platform's adaptability and user-friendly interface. These results underscore the platform's excellent user-centered design and its ability to meet the ISO 25010 criteria effectively.

Overall, the beta test results highlight the platform's significant improvements since the alpha testing phase. The platform demonstrated excellent usability, robust security, seamless cross-platform compatibility, and adaptability. These findings confirm the system's readiness for deployment and its ability to effectively meet user expectations.

Table 3: Summary of Beta Test Results

ISO25010 Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.55	Excellent
Compatibility	4.55	Excellent
Interaction Capability	4.53	Excellent
Security	4.55	Excellent
Flexibility	4.48	Excellent
Overall Mean Score	**4.53**	**Excellent**

DISCUSSION

The development of Accountify: A Web-Based Accountant Prep and Review Platform with Integrated Study Tools aimed to provide accounting students with a comprehensive and efficient learning environment. This study sought to address the limitations of existing study systems by introducing a user-centered, feature-rich platform tailored to the needs of accounting students. Specifically, the study identified the current systems utilized for exam preparation and the challenges faced by students in managing their studies. Based on these findings, the researchers designed a platform that incorporates essential features to enhance the overall learning experience. Conducted at Mabalacat City College (MCC), the research involved accounting students and faculty members, including administrators such as the Professional Dean. Their insights were pivotal in shaping the platform's features, ensuring that Accountify meets the specific academic and administrative needs of its users.

The study concluded that Accountify successfully provides a secure and interactive learning environment. Features such as robust authentication and secure exam tools ensure data protection and academic integrity, making it suitable for institutions and individual learners alike. The platform's interactive tools, including flashcards, quizzes, and progress tracking, provide practical and engaging exam preparation methods. These tools, combined with the platform's intuitive design, enhance learning outcomes and retention among students. The system emphasizes ease of use and adaptability, benefiting both students and

administrators. Students gain access to tailored tools that support their academic success, while administrators enjoy efficient content management and real-time progress tracking. Features like badges, certificates, and progress tracking incentivize students to stay engaged and complete their courses. This gamification aspect makes the learning process more enjoyable and rewarding. Additionally, the platform offers administrators significant control over course management, user monitoring, and content updates. This functionality ensures flexibility and responsiveness to the evolving needs of users.

To further engage students, the platform could include advanced features such as timed flashcards, interactive accounting diagrams, and real-world practice simulations. Adding more authentication options, such as biometric login or OAuth integration for additional platforms, would improve security and provide more convenience for users. Incorporating advanced analytics for performance tracking, completion rates, and usage statistics would allow administrators to make data-driven decisions, improving user engagement and course effectiveness. Peer-to-peer discussion boards, group study rooms, or a forum-based Q&A section could enhance collaboration and foster a sense of community among users. These features would encourage students to learn from one another and improve knowledge retention. By addressing these recommendations, Accountify can evolve into a more comprehensive, secure, and user-friendly platform that continues to meet the needs of accounting students while fostering academic success and engagement.

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The successful completion of this capstone project is the result of collective support and guidance from numerous individuals and organizations. We begin by expressing profound gratitude to Almighty God, who bestowed upon us the strength, wisdom, and resilience to navigate through the myriad challenges encountered during this academic endeavor.

We extend our deepest appreciation to Engr. Dennis L. Tacadena, DIT, our Capstone Adviser, whose unwavering commitment and insightful guidance were instrumental in shaping the trajectory of our project. His continuous mentorship and constructive feedback provided us with critical direction and inspiration throughout the development process.

Our sincere gratitude is also directed to Dessa Lyn J. De Castro, our Technical Adviser, whose expertise, dedication, and patient guidance were crucial in helping us overcome technical obstacles. Her meticulous approach and technical acumen were pivotal in ensuring the system's robust design and functionality.

We are immensely thankful to Dr. Myrna C. Calma, CPA, FRIAcc, Ph.D., Dean of the Institute of Business and Computing Education (IBCE), whose strategic insights and leadership significantly influenced our project. Her profound understanding of accounting students' needs guided our feature prioritization, and her provision of contemporary modules enhanced the system's relevance and applicability. Her supportive presence during our panel defense was both reassuring and motivating.

The contributions of our Alpha and Beta testers cannot be overstated. Their thorough engagement and constructive feedback were essential in refining the system's design, functionality, and user experience.

We are eternally grateful to our families, friends, and team members, whose unwavering encouragement, collaborative spirit, and emotional support sustained us through this challenging yet rewarding journey.

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BINhi: Seed Engagement of Barangay Mamatitang Through Reverse Vending Machine.

Best Capstone (Internet of Things Category)

CHOQHO L. BORROMEO, MABALACAT CITY COLLEGE
CHARLES P. CABRERA, MABALACAT CITY COLLEGE
GYAN IVERSON G. GARCIA, MABALACAT CITY COLLEGE
JOHN RENDELL P. MANALOTO, MABALACAT CITY COLLEGE
MANUEL RAFAEL D. TOLENTINO, MABALACAT CITY COLLEGE
ROBHERT M. BAMBA (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT
The Barangay Mamatitang community is now overwhelmed with concern about waste management and the promotion of sustainable agricultural practices. This study presents solutions to these problems through the development of "BINhi," a reverse vending machine that rewards the user with plantable seeds in exchange for recycled materials. The objective was to create a friendly, efficient machine for promoting recycling and more greener environment as well as community involvement. This has made researchers utilize the SDLC (Systems Development Life Cycle) in an organized and iterative manner for the development process. The alpha and beta testing results that were obtained yielded positive results across the key performance indicators of more or less 4.44 for the alpha result and 4.46 for the beta result, which translates to Excellent, thus generally showing high user satisfaction and system functionality. However, some of the limitations discovered include failure in detecting some materials and operability for future improvements. With these, BINhi shows the potential to be a community-based solution for sustainable waste management and promoting a more greener environment.

Keywords: Internet of Things, IoT, Mobile Application, Microcontroller.

INTRODUCTION

In the contemporary world, environmental sustainability has a greater significance and importance. An increase in population aggravated by fast urbanization and industrialization makes it hard to minimize waste and promote ethical consumption. In such circumstances as climate change and depletion of natural resources, there is a need for exploration of the latest approaches to address these challenges through reducing environmental degradation alongside promoting sustainable lifestyle choices within communities. Recycling is a crucial operation with multiple environmental merits according to Recycle Now (n.d.). It helps in restraining environmental pollution; for instance, air or water contamination since it prevents extracting materials from them. Glass, metals, and paper can be re-used to save approximately 95% of the energy consumed when developing new ones. Consequently, there is a need for energy conservation as a way of reducing global warming resulting from decreasing amounts of carbon dioxide (Why Is Recycling Important? | Recycle Now, n.d.). Recycling plastic waste can lead to a decrease in greenhouse gas emissions (GHG). There are two solutions to this recycling problem, using plastic as an energy source and trash for recycling other used materials. As observed, this latter case only has a
small reduction in emission levels as compared to the former ones. The primary consideration for reducing emissions without affecting the quality of plastic waste is by examining its properties (Plastics, 2023). The need for plastic trash recycling and considering its properties becomes obvious during the search for decreasing greenhouse gas emissions and supporting a more sustainable environment.
Waste disposal poses serious problems in the Philippines, contributing to greenhouse gases and pollution, and to uncovered dumps which lead to pollution in Manila streets and waterways. Solid Waste Management Program (CPF, n.d.-b) suggests that nearly a third of garbage produced each day in Manila has not been gathered, which is almost equal to 8,000 tons. Manas and Manas (2024) have noted that the Philippines is among the three largest contributors to plastic pollution found in the East Asian Seas. Reducing the adverse effects on the environment and enhancing sustainable waste-handling practices are important considerations. (Manas & Manas, 2024). Additionally, people are now promoting agroforestry, which
entails the planting of trees and crops together as a sustainable climate-smart agriculture solution that can help increase the resilience against changing

climates on farms while at the same time leading to the reduction of emissions of Green House Gas (GHG) in the atmosphere and give rise in productivity levels (Philippines: Why Planting Trees on Farms Benefits Farmers Under a Changing Climate, 2019).

There are multiple advantages associated with recycling to the environment, economics, and society at large. Recycling helps save natural resources, cuts down on pollution, conserves energy and it also provides employment. In addition to the environmental benefits, there are economic rewards that come with recycling activities which involve the generation of jobs along the lines of waste disposal and recycling (Wilson, 2023; Megan, 2021). A reverse vending machine is a device that is programmed to recover recyclable materials and bring back used items that are suitable for reuse like plastic bottles and metal cans (Asa (n.d.)). Therefore, reverse vending machines or RVMs, are designed to promote recycling habits by awarding reward points to depositors for each recycled item they make, according to (Mariya et al., 2020). The reverse vending machine process is easy to grasp, consumers put empty cans into the machine, which will analyze, kind and even wash them based on either branding or material type. Once an item gets scanned and accepted, all such detected materials are then crushed before being separated and put into effective storage areas. They give extra goodies like cash or coupons as rewards to those using product-recycling bins (Kuruüzüm, 2022). An innovative method some reverse vending machines use to motivate recycling is the reward that a seed gives. Growing plants and trees with seeds when given them helps in maintaining a green environment courtesy of the people. It not only benefits the individual but also the entire ecosystem.

Various nations in the world have installed more than a hundred thousand reverse vending machines (RVMs). These can be found especially in countries like the US, Canada, Sweden, Norway, and Australia where laws say you must recycle, according to Kuruüzüm (2022).

Introducing a reverse vending machine that distributes and dispenses seeds in Barangay Mamatitang is an excellent approach to improve waste management and encourage planting. The involvement of people in waste collection and tree planting will ensure that 55 hectares of available land will be used to make the Barangay green and sustainable. The population of 2,284 living there as of the year 2020 (Mabalacat City. (n.d.) Reference List: Mamatitang. Retrieved from MAMATITANG | Official Website of the Mabalacat City Government). In addition, this approach will make the neighborhood more vibrant and environmentally friendly, fixing waste issues while promoting community participation and environment-conscious behavior.

Objective of the Study

The general objective of this study was to develop a microcontroller-based system entitled “BINhi: Seed Engagement of Barangay Mamatitang Through Reverse Vending Machine”, aimed at promoting seed engagement, and environmental and agricultural sustainability through a reverse vending machine in the Barangay of Mamatitang. Specifically, the study targeted plastic bottles and metal/aluminum cans, the system incentivized recycling by rewarding users with seeds based on the number of points obtained. The study sought to develop a sustainable waste management solution while fostering community involvement in environmental conservation through seed planting, thereby contributing to the long-term agricultural health of Barangay Mamatitang.

In line with this, this study aimed to achieve the following specific objectives:

- To gather data in Barangay Mamatitang through a survey.
- To design a system using tools such as block diagrams, flowcharts, system diagrams, and storyboards. This involves visualizing the system's architecture through a block diagram, outlining the major components and their interactions. .
- To identify and specify the hardware and software requirements for the development of the reverse vending machine system, manipulating tools and technologies such as Arduino Mega 2560 as micro-controller, Sensors, motors, Arduino Software (IDE) for programming, Blynk for creating a user-friendly app and interface, and Canva for graphical elements.
- To Develop a reverse vending machine that can dispense a variety of seeds.
- To develop a system that incorporates several essential features. At its core, the system featured a sensing mechanism with an Inductive proximity sensor, Capacitive proximity sensor, and Ultrasonic sensor enabling swift and accurate detection of incoming plastic bottles or metal cans.
- To develop a comprehensive mobile application, the focus was on seamlessly integrating features that enhanced the functionality and user experience of the system.
- To evaluate the developed system, the ISO 25010 standard was applied, focusing on Function Suitability, Interaction capability, and Flexibility. Function Suitability checks whether the system performs the required tasks and functions as expected. Interaction Capability assesses how difficult or easy it is for the user to use or interact with the system. Flexibility determines how easily the system can adapt in response to change, either

by adding a new feature or changing the system's environment. It thus defines how well the system can perform its intended duties while promoting usability and adaptability.

Scope and Limitations

The concept of sustainable development has become a global imperative, with the United Nations' Sustainable Development Goals (SDGs) serving as a universal framework for addressing some of the most pressing challenges of our time. This study, entitled "BINhi", aimed to contribute to these global efforts by developing an innovative, microcontroller-based system designed to promote environmental and agricultural sustainability at the local level. In Barangay Mamatitang, the project sought to address multiple SDGs through the creation of a reverse vending machine that incentivizes the recycling of plastic bottles and metal/aluminum cans. The system rewards users with seeds, encouraging them to engage in environmental conservation by planting and nurturing local vegetation. This initiative was directly aligned with several key SDGs.

Scope

The primary focus of the machine design was to facilitate the acceptance of plastic bottles and metal/aluminum cans. This was achieved by using sensors to detect and identify plastic bottles and metal cans during insertion, while other types of waste will be promptly detected and rejected by the machine, subsequently being directed to a rejection box for removal. Upon successfully accepting the plastic bottles or the metal cans, the sensors will prompt the microcontroller to provide information regarding the ongoing process on the LCD screen**.**

In link with the system, a mobile application was developed to facilitate efficient management of the reversed vending machine's operations. The mobile application will serve as a vital tool for monitoring the machine in real time, providing users with timely notifications to streamline management tasks. One of the key features of the mobile application is real-time monitoring, allowing the admin to receive notifications when specific events occur, such as when the bin is ready for emptying. This feature enhances waste management efficiency by alerting users to take prompt action, thus ensuring the uninterrupted operation of the recycling process. The mobile application also allows for material tracking, so the admin or owner can track and count materials that have been inserted into the system. That could be plastic bottles or cans. Whenever a material is inputted into the system, the application updates the total count automatically, thereby providing an accurate overview of the materials processed by the system in real time. It also helps the admin monitor activities in the system with the means to maintain accurate tracking of recyclable materials.

Limitations

The BINhi reverse vending machine faced several limitations in functionality. It accepts plastic bottles and metal cans within
13.5 inches (length) and 3.7 inches (width) but struggles with oversized items. The system lacks a size sensor, causing multiple items to be counted as one and limiting its ability to handle a variety of recyclables. Detection issues also occur, with certain non-plastic materials being accepted due to sensor limitations.

Incentive challenges emerged as the seed-based rewards and point-saving system were not engaging or intuitive enough to encourage consistent use. Hardware reliance on Arduino Mega 2560, NodeMCU, and various sensors increased vulnerability to failures, requiring technical expertise for maintenance and repairs. Additionally, the mobile app could only monitor bin capacity and seed supply in real-time, lacking advanced features or analytics for administrators.

The manual restocking process, combined with limited beta testing involving 30 subjects in Barangay Mamatitang, reduced feedback diversity. Continuous Internet dependency posed challenges in areas with unreliable networks, disrupting real-time monitoring. Furthermore, the mobile app's limited customization options and the need for technical skills in system maintenance increased operational costs and user dissatisfaction.

These limitations highlight areas for improvement to enhance reliability, user-friendliness, and efficiency in future designs of the BINhi reverse vending machine.

METHODOLOGY

This chapter outlines the required materials, and the steps involved in creating the reverse vending machine, along with detailing how the researchers acquired the data and information crucial for result analysis. It surrounds the participants involved in product testing, explains the process of data collection, and describes the tools utilized. Furthermore, it digs into the nature of the research, the methodology used, and the location where the study took place. The rough outline of the project is shown in Figure 1.

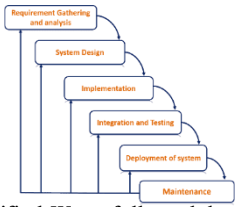

Figure 1. Modified Waterfall model according to Prashant (2023)

Requirements Gathering and Analysis

The researchers conducted thorough research through reliable sources on the internet and data gathered from interviews to ensure that the requirement analysis has validity. The researchers brainstormed via MS Teams for the possible features, components, and functionality of the project and planned how to carry out these ideas. The researchers have sought advice and recommendations from their technical adviser and capstone ideas to make the project better. Various sets of tasks are distributed to the researchers and each one provides their idea and perspective about the project.

The researchers gathered information about the locale in Barangay Mamatitang on May 3, 2024, by the appointment given by the barangay official. The researchers will be responsible for the management of the beta surveys, which will be collected afterward. The participants are then expected to answer the questionnaire after using the developed reverse vending machine and being able to experience it, taking less than 30 minutes. The researchers also interviewed some of the officials of Barangay Mamatitang for the survey about how many people residing in that specific Barangay, how many hectares of land can be used for agriculture, and what the current programs that the barangay is implementing for the agricultural sustainability of Barangay Mamatitang.

The researchers developed the reverse vending machine system using a laptop with a hardware specification of an Intel(R) Core (TM) i3-10110U CPU running at 2.59 GHz and 8 GB of memory, using the Microsoft Operating System, as shown in Table 1. For the system application that is integrated with the reverse vending machine, the researchers used Blynk, Arduino IDE, and Canva; it is listed in Table 2.

Table 1. Desktop Hardware Specifications

Component	Specifications
Processor	Intel(R) Core(TM) i3-10110U CPU @ 2.10GHz 2.59 GHz
Memory	8 Gigabyte RAM

System Design

During the design phase of the project, the researchers acquired various tools for design work, thereby bringing efficacy to the illustration of system functionalities and activities of the project. A storyboard was utilized to graphically depict the flow applied by the system, presenting frames or panels that depicted the sequence of actions or user interactions to visualize the system's operation (Appendix A). Moreover, a block diagram was designed (Appendix B) to provide a simplified overview of the components of the system and their interactions, which gives an unambiguous structure of how the system was organized. Furthermore, a flowchart (Appendix C) was created to explain further the system's processes by outlining the step-by-step workflow to clarify the logic and functionality of the system. A Gantt chart, Appendix D, was utilized to portray the timeline of tasks, milestones, and deadlines for keeping the project on schedule, thus organizing and monitoring the activities of the project. In addition, a costing chart, Appendix E, was used to manage the project's budget with detailed projected costs of various tasks and resources. The circuit diagram in Appendix F shows the connection between all the components and how they work with one another. In Appendix G, a 3D model is used to show how the whole machine looks like and where every components and machine parts are placed. In addition to these design tools, the various hardware and software tools on which the research relies in developing the system, as shown in Figures 2 ensure the aspects of functionality and technology are also well addressed.

Table 2. Software development tools

Software	Description
Blynk	is a flexible platform for the Internet of Things (IoT) that enables users to develop mobile applications that interact with a variety of hardware, including microcontrollers and Raspberry Pi single-board computers. Its ease of use, which has made it possible to have remote management and monitoring of devices without understanding how to program them, specially makes it very popular.
Canva	A versatile design tool ideal for education, providing a platform for creating visually appealing projects, designs, diagrams, etc.
Arduino IDE	An open-source IDE that allows users to write code and upload it to any Arduino board. Arduino IDE is written in Java and is compatible with Windows, macOS and Linux operating systems.

Implementation

This stage is the transition from concepts into theoretical ideas into practical impactful technology, laying the foundation for the wider work of the study by ensuring that the RVM system is technically complete, community-centered, and capable of contributing to environmental and agricultural sustainability.

Based on the diagrams and research design that the researchers made, they started the prototype. They added features based on all the research and suggestions from consulting from their technical and capstone advisers and from the officials that they talked to in Barangay Mamatitang.

Once the hardware materials were carefully chosen, like an Arduino Mega 2560 as the micro-controller, 12V 5A power supply as the main source of power for the machine, ultrasonic, inductive, capacitive sensors for detecting the materials, servo motors as the actuators, step motors for dispensing seed rewards, the researchers started developing the machine. In software applications, the researchers used Arduino IDE as it provides an easier way to program the Arduino Mega and it uses C++ language which is easier for the researchers.

The researchers consulted with Barangay Officials in Mamatitang regarding the implementation of the reverse vending machine in the locale. The officials were enthusiastic and supportive of the proposed idea of a reverse vending machine that exchanges plastic bottles and aluminum cans for seed rewards. The barangay officials had suggested multiple ideas such as using the collected plastic bottles and metal cans for future barangay projects and using recycled plastic bottles to make plastic chairs.

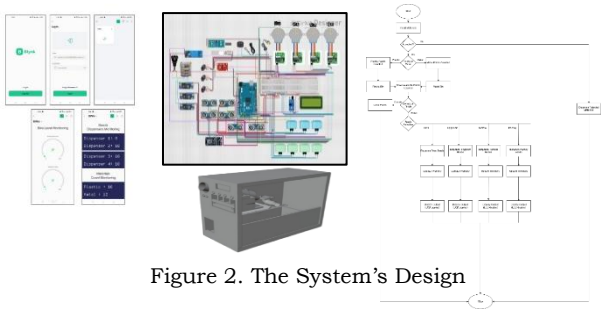

Figure 2. The System's Design

Integration and Testing

Analysis

In this study, researchers employed Descriptive Statistics. A descriptive Statistic summarizes the data in order to determine the point where the data are placed as well as how widely distributed the data are.

Frequency Distribution

In a set of observed data, values are grouped into intervals or categories that are equal. Afterward, the quantity of cases that fall under each interval is determined. This eventually creates a table or graph that reveals data frequency distributions thus showing how different values appear in the dataset; this simplifies understanding patterns within data as well as identifying potential outliners or unexpected extreme values. These categories serve as a core element during summarization and visualization exercises which require statistical methods. Frequency distributions are widely used in different statistical analyses as they play a crucial role in helping us summarize and present information visually.

Mean

The mean is a measure of central tendency, indicating where the center of a distribution lies. It's sensitive to extreme values, often called outliers, which can significantly influence its value. The mean formula can be expressed as, mean = (Sum of Observation) ÷ (Total Number of Observations). $\bar{X} = \sum fx / \sum f$ where $\bar{x}$ = the mean value of the set of given data, f = frequency of each class, x = mid interval of each class.

Table 3. The Likert Scale

Response Categories	Numerical Value	Range Interval	Verbal Interpretation
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.21 – 4.20	Good
Neutral	3	2.61 – 3.20	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly Disagree	1	1.00 – 1.80	Poor

Likert Scale

The reverse vending machine will be evaluated using the Likert scale, a rating system that is used in questionnaires to evaluate respondents' views, opinions, or impressions. A 5-point Likert scale will be provided to respondents so they can express how much they agree or disagree. After doing the necessary computations, the researcher will use the Likert scale to translate each mean score of each sub-criteria and criteria from the survey tool into its verbal equivalent. The strengths and potential improvement areas of the reverse vending machine, as well as the general level of user satisfaction, are all possible to be determined with the use of this analysis

Deployment of System

In the later stages of the research, the machine was deployed to check how well it could work and its reliability. This was done at Barangay Mamatitang wherein they placed the system in a controlled area to determine how useful the system would be in real-life situations.

Barangay Mamatitang was chosen as the deployment site because of its active participation in environmental programs. Its accessible location made it convenient for residents to use the reverse vending machine (RVM). Additionally, barangay officials were highly supportive, providing a safe and visible area for the system. This strategic location allowed the machine to serve a wide audience, particularly those motivated to engage in recycling activities.

The deployment process began with thorough planning and securing approval from the barangay officials. Once the site was finalized, the area was cleaned, and the necessary electrical connections were prepared. The RVM was carefully installed, followed by a series of tests to ensure it functioned properly. Adjustments were made to stabilize the system and make it accessible to children and adults.

An orientation session was conducted for barangay residents to familiarize the community with the RVM. This included a straightforward demonstration of how to use the machine and an explanation of its benefits, such as promoting proper recycling and offering incentives for waste disposal. Residents were encouraged to use the system regularly, and barangay officials committed to monitoring its usage. Feedback from the community was collected to ensure the system met their needs effectively.

Maintenance

The maintenance phase of the reverse vending machine is the subsequent step after the testing stage. Its main goal is to ensure that the machine is working consistently at all times, is durable, and functions effectively over a long period of time. This phase, therefore, encompasses continuous checks to establish and correct technical flaws or breakdowns that may occur after the installation and while in use.

At this stage, the users contribute by generating feedback through a reporting system that is accessible both at the machine location and online. It allows users to report problems, make enhancements, or even share their experiences. This type of feedback is fundamental to identifying areas that need improvement and ensuring the machine continues to meet the needs of users.

It will comprise periodic hardware inspections such as wire connections to ascertain that all parts are working properly, routine cleaning to prevent wear and damage, and updates of the software to correct bugs, improve performance, or introduce new capabilities. The maintenance team will carry out periodic on-site evaluations to identify and fix any issues that would not have been identified during earlier tests.

Analysis of data on the trend of system usage would also be done. For example, analyzing patterns in user interactions or material processing activities. This would enable the team to predict and address potential issues before they become profound and thus prevent disruptions or optimal performance.

User feedback will guide continual refinement, from improving material sorting accuracy in the machine to making the user interface more intuitive. Regular updates will ensure the system's efficiency, ease of use, and adherence to its intended purpose.

It is also very important to keep the reverse vending machine reliable and effective in promoting sustainability within the maintenance phase. Quickly dealing with problems and implementing continuous improvements will ensure it continues to be a resource for waste management and community involvement.

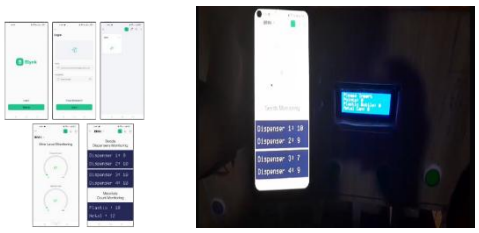

Figure 3. BINhi's Blynk mobile application interface.

Blynk is a significant part of the reverse vending machine system, and it drives the mobile application of this capstone project. This has integrated the physical components with mobile devices excellently. This application develops Wi-Fi connectivity using a NodeMCU8266 module for integration in controlling and remote monitoring of the Reverse Vending Machine. The application provides real-time updates on the system's operations, hence making it easy for the admin or the owner to monitor such aspects as tracking the bins' status. It gives warnings to the admin that the bins are almost full and allows the maintenance of bins through timely checks. This application also brings to the admin's interface the remaining seeds that can be earned, thus helping the admin monitor progress in use. It can monitor the insertion of the material into the system and show if it is a plastic bottle or a can and hence show

the admin every material being recycled. It also has a lock machine feature which the admin can turn off the lock feature of the tilt sensor and buzzer to not cause an alarm when the admins are modifying the machine.

Blynk provides one with a dashboard architecture that avails drag-and-drop support to allow for smooth customization of the user interface at ease. Users can enjoy using the system by focusing on specific functionalities, hence being able to receive time-sensitive alerts on maintenance issues or operational anomalies. This introduces the aspect of ease: monitoring remotely is now possible from a great distance location, and there's also the possibility of optimizing system performance or even detecting fault conditions from anywhere that has internet access. The introduction of Blynk has amazingly increased access, participation, and efficiency of Reverse Vending Machines, hence growing into a more energetic and impactful waste management.

RESULT

This section proves that the reverse vending machine gave excellent outcomes during alpha testing, with an aggregate score on all assessed criteria amounting to a creditable 4.44. In Functional Completeness, the Likert scale got a mean of 4.62 which means the alpha testers felt that the machine was fully functional when conducting the testing. Functional Correctness got a 4.52 mean, which indicates that the machine has done what it intend to do such as segregation of materials and proper dispensing of seeds. Not only does the machine do its desired functions, but based on the 4.22 score on Functional Appropriateness the testers believe that the function of this machine aligns with its goals which are seed engagement and waste management for the community. With a score of 4.22 from the testers, it is believed that the machine is easy to understand for everyone ranging from kids to adults, and is understandable even for people who can't read. The Operability of the machine got the lowest mean with a score of 4.11. The low scores on the scale are because of some technical issues that the testers encountered during the testing. Although it is the lowest score on the scale it is still considered excellent based on the mean interpretation. User Error Protection has a mean of 4.44 on the Likert scale which indicates that the instructions put in the machine are useful in preventing users from making user-caused issues to the machine. User Interface Engagement has scored a 4.67 mean, which means that the machine itself gains the attention of the users to use it again. Adaptability has the highest mean of 4.75, it is because the alpha testers believed that the machine has so many possibilities for adaptation of other researchers. Overall, the total mean of every category is 4.44 which is excellent and the alpha testing is a major success.

Table 4. Summary of Alpha tests

Criteria	**Weighted**	**Mean Interpretation**
Functional Completeness	4.62	Excellent
Functional Correctness	4.52	Excellent
Functional Appropriateness	4.22	Excellent
Learnability	4.22	Excellent
Operability	4.11	Excellent
User Error Protection	4.44	Excellent
User Interface Engagement	4.67	Excellent
Adaptability	4.75	Excellent
Total	**4.44**	**Excellent**

Table 5. Summary of Beta Tests

Criteria	**Weighted**	**Mean Interpretation**
Functional Completeness	4.60	Excellent
Functional Correctness	4.57	Excellent
Functional Appropriateness	4.46	Excellent
Learnability	4.57	Excellent
Operability	3.94	Good
User Error Protection	4.49	Excellent
User Interface Engagement	4.44	Excellent
Adaptability	4.63	Excellent
Total	**4.46**	**Excellent**

Table 6. Comparison of Alpha and Beta results

Criteria	Alpha	Interpretation	Beta	Interpretation
Functional Completeness	4.62	Excellent	4.60	Excellent
Functional Correctness	4.52	Excellent	4.57	Excellent
Functional Appropriateness	4.22	Excellent	4.46	Excellent
Learnability	4.22	Excellent	4.57	Excellent
Operability	4.11	Excellent	3.94	Good
User Error Protection	4.44	Excellent	4.49	Excellent
User Interface Engagement	4.67	Excellent	4.44	Excellent
Adaptability	4.75	Excellent	4.63	Excellent
Total	**4.44**	**Excellent**	**4.46**	**Excellent**

DISCUSSION

In this section, the conclusions and recommendations of the capstone project entitled "BINhi: Seed Engagement of Barangay Mamatitang Through Reverse Vending Machine" are discussed based on the analysis of the data acquired through alpha and beta testing phase of the research. Witnesses to the introductory tests and pilot implementation phases were the residents of Barangay Mamatitang, as they showed visible enthusiasm for the project. The RVM implemented an Innovative system that allows residents to trade recyclable materials for different rewards such as seeds. It has been shown to be very effective in boosting engagement levels, particularly amongst the more youthful residents and family members. The responses from the users reflect an interest in serving in waste reduction efforts. Many of the

respondents were encouraged to care about the importance of waste management in the right way and taking care of the environment.The alpha and beta testing phases indicated that the simple nature of the interface of the machine made the depositing of recyclables very convenient for the user, but the retrieval of incentives is relatively easy. However, some minor problems have cropped up on the side of maintenance and technical problems, which point to areas in which the operational efficiency of the RVM can be improved.

The BINhi project will play a strong role in various Sustainable Development Goals, including environmental awareness, skills building for transformation, and sustainable practices. In support of SDG 4.4, the community will be given hands-on experience in waste management and recycling while developing an interest in green industries. The initiative also fits SDG 9.5, 9. b, and 9. c due to its innovative community-based technology that inspires good digital access, eco-friendly solutions, and in-house research and development. BINhi aligns with SDGs 12.2, 12.4, and 12.5 by advocating for recycling and minimizing waste while encouraging responsible use of resources. It also helps to strengthen the connection between urban and rural areas (SDG 11. a) while fostering awareness of climate action (SDG 13.3), which encourages the community toward environmentally friendly habits and collaborative partnerships in addressing climate change. Through its efforts, BINhi integrates modern technology as well as education into its model for development that is sustainable and replicable in local communities.

In general, the project outcomes demonstrate that the concept of a reverse vending machine could positively affect the minimization of waste and intensify environmental awareness. Further adjustments can, therefore, make BINhi an effective tool in supporting the enhancement of environmental awareness in Barangay Mamatitang.

In conclusion, the "BINhi: Seed Engagement of Barangay Mamatitang Through Reverse Vending Machine" is a creative way to promote waste management in which the whole community can be involved and engaged towards sustainability through its reverse vending machine. Encouraging results are seen with proper segregation of recyclable items as tested during alpha and beta testing on plastic bottles and metal cans. However, the system could not detect other materials, such as paper and plastic bags with articles, and lacked features such as size measurement. Despite these setbacks, the project highly elevated the consciousness of recycling and waste management in Barangay Mamatitang in support of larger objectives to bring about environmental sustainability and reduce waste. In addition, the project mentioned areas that would improve features in terms of material detection and increasing the capabilities of the machine. In the future, it would be advisable for the reverse vending machine to be upgraded with such features and probably scale it to other communities to have a large impact. Ultimately, the project will, therefore, possess strong potential to promote the culture of sustainability and improve the impacts both on the community and the environment.

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Dentally: A Patient Record Tracking System for Tooth Impressions Dental Clinic

WENGMIR A. AFRICA, MABALACAT CITY COLLEGE
JOHN IVAN A. MAGTOTO, MABALACAT CITY COLLEGE
JOHN DALE P. MANALOTO, MABALACAT CITY COLLEGE
TIZHA NICOLE A. PEÑAMANTE, MABALACAT CITY COLLEGE
JUSTIN ALLAN Y. VILLAMIN, MABALACAT CITY COLLEGE
LOVELY RUTH C. VALDEZ-SANTOS (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT
Good dental health is essential for overall well-being, impacting physical health, and disease prevention. Maintaining dental health enhances physical, psychological, social, and professional well-being, while neglect can harm these areas. Many clinics still use paper records, leading to inconvenience, excess paperwork, and limited patient access. This study developed a system for Tooth Impression Dental Clinic, which operates in three branches across Dau, Angeles, Sindalan and seeks to improve the clinic's ability to access patient records across locations.The researchers used a modified waterfall approach to systematically progress through the project stages. The system was subjected to a thorough evaluation, achieving an overall score of 4.23 in the alpha test and an improved rating of 4.34 in the beta test. The higher beta test result indicates that enhancements were made to address any weaknesses identified during the alpha testing phase. The system successfully met the criteria for functional suitability, compatibility, interaction capabilities, security, and flexibility. It effectively performed all intended functions, was easy to use, featured robust security protocols, and demonstrated high adaptability. The developed system was designed to align with and support the attainment of specific Sustainable Development Goals (SDGs).

Keyword: Information System, Web System

INTRODUCTION

Having good dental health is crucial for an overall well-being and quality of life. This can impact your physical health and prevent different dental diseases and be able to eat properly. With good dental health, you have far-reaching benefits for physical, psychological, social and professional aspects of life. Investing in dental care and adopting good hygiene practices can significantly improve overall quality of life.

According to Wolf et al. (2021), non-communicable diseases (NCDs) such as cardiovascular and metabolic diseases, diabetes, cancer and diseases of the oral cavity such as caries or periodontitis represent a global and highly relevant problem due to demographic and epidemiological shifts have led to a rise in non-communicable diseases (NCDs), which are responsible for millions of deaths globally and impose significant costs on national economies due to the healthcare needs of populations.

According to Experian Health (2024), online scheduling software appeals to patients because it satisfies their needs for efficiency, convenience, and control over their medical care. Online scheduling software's 24/7 accessibility is among the main reasons for using it. Appointments can be made by patients at any time of day. By using online scheduling software, patients may choose the times that work best for them, cutting down on the amount of time they spend in crowded waiting rooms or pausing during phone conversations. It is simple for patients to view and compare availability, which simplifies scheduling appointments.

This study aims to understand the importance of having electronic dental records for patients. Implementing electronic dental records not only enhances the experience of dentists but also makes their work more effective in comparison to traditional pen-and-paper methods.

Objective of the Study

The general objective of the study is to develop a system entitled "Dentally: A Patient Record Tracking System for Tooth Impression Dental Clinic" for Tooth Impressions Dental Clinic.

In line with this, this study aims to achieve the specific objectives:

1. To gather information about the requirements for the record system of Tooth Impressions Dental Clinic through interview research with the owner and brainstorming.
2. To identify the specific hardware and software components used to develop the website.

3. To design the website using the following analysis, diagrams, and design tools throughout the development process:
4. To evaluate the system using ISO 25010's Software Product Quality Standards: Functional Suitability, Compatibility, Interaction Capability, Security, Flexibility
5. To deploy and implement the system to Tooth Impression Dental Clinic.

Limitations

The researchers set limitations on the initial storage capacity of the records; it was made to handle only the present patient volume across the three branches. An increase in patient numbers might have necessitated an increase in storage capacity in the future. Core functionalities were not available during internet outages because the features present in Dentally needed real-time data synchronization, which the system retrieved from the cloud database. Additionally, backups also relied on a stable internet connection.

Security was a major concern, and the system incorporated features to protect patient privacy. However, as time passed, new security vulnerabilities emerged, and the system's security required extensive monitoring and updates to prevent potential threats.

The initial deployment of the system focused on its core set of functionalities that were essential for more efficient patient record management. Furthermore, future updates could introduce additional features based on the clinic's user feedback and evolving needs. The researchers prioritized features based on the clinic's current needs and developed the essential features first.

The system was designed to manage the needs of the three existing branches. While it handled data sharing and record access across these locations, important plans and actions might have required upgrades to ensure full and efficient performance with an increasing number of branches. The system's scalability was monitored, and future development was required to meet the needs of a growing dental clinic.

METHODOLOGY

The researchers used the Modified Waterfall methodology (figure 1) to monitor the system's development. Each task was thoroughly discussed and the outputs of every development phase were documented. The researchers ensured that every task was executed to meet its specific goals, and that the final system accomplished the expected results.

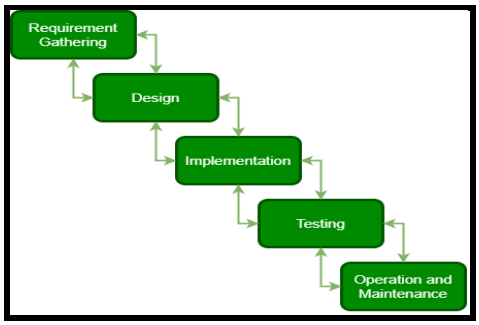

Figure 1: Modified Waterfall Model

Requirements Gathering

The researchers would work together to collect ideas on how to create an efficient management of dental clinic records systems. This procedure included group discussions and brainstorming.

The researchers chose to build the back-end and front-end system of the application using development software tools such as Visual Studio Code 1.89. For the database management system (DBMS) the researchers would utilize Cloud Firestore, a cloud-based database. Canva would be used for prototyping and storyboarding. XAMPP for its all-in-one package that eliminates the necessity of individually installing and setting up each component, saving time and effort and it allows the developers to build and test their web applications on their local machine before deploying them on a live server. The PC would be using a Microsoft operating system. With an AMD Ryzen 5 5600X processor, 16 GB RAM, 1 TB HDD, and GTX 1650 Graphics Card.

Table 1. Desktop computer hardware specifications used for the project development

Component	Specification
Processor	AMD Ryzen 5 5600X
Memory	16 GB
Graphics Card	GTX 1650 8 GB
Hard Disk	1 TB

Design

In this phase, the researchers used the following analysis tool and diagrams to design and develop the dental clinic record system: Storyboard, Visual Table of Contents, Use Case Diagram, and Gantt chart.

The researchers used the Storyboard diagram to design the user interface and provide better flow and visualization of the application. The Storyboard

diagram would also help the developers who designed, programmed, and controlled the initial user interface to see the system more clearly before the development phase. The Use Case diagram was used for the representation of functions and scope of the system, as well as its relationship with the users. A Visual Table of Contents Diagrams were implemented. A Gantt Chart was employed to provide a clear timeline for each stage of the project, enabling the researchers to manage their time and resources effectively while allowing the researchers to keep track of the development, spot any potential obstacles or problems, and allocate resources wisely.

Table 2. Software development tools that would be used for the project development.

Software	Description
Visual Studio Code 1.89	Integrated Development Environment
XAMPP	Local Environment Server & Database
Canva	Diagram Development
Laravel 10	PHP Framework
Tailwind CSS	CSS Framework
Mailtrap	Email service
Laravel Forge	Web hosting provider
Digital Ocean	Server provider
Namecheap	Domain name provider

Implementation

In the development phase, the researchers designed and implemented Dentally's system functionalities and features using Visual Studio Code as the integrated development environment. The focus was placed on creating not only an aesthetically appealing interface but also a user-friendly design that fits the established scope and limitations of the system. The Dashboard would serve as the main page of the system, with a side panel for easy navigation. The Admin page would allow the admin to add, view, edit and delete the dentist, staff, patient, patient record, schedule, procedures, branches, inventory and view the walk-in/online appointments, view sales report, view audit logs, forget password, update password and delete account. The Dentists page would allow the dentist to add and view walk-in appointments, approve/decline online appointments, add patients payment, forget password, update password and delete account, while the Staff page provides similar management capabilities for the dentist page where the staff can add, view, edit, archive patients, add, view walk-in/online appointments, add, view, edit, delete inventory. Patient management would feature the ability to add and view appointments, view next visit, add and view payment, view patient record information. A summary of patient transactions would also be accessible. Appointment system includes handling both walk-in and online appointments, with features of selecting what branch, dentist, schedule, procedure and selecting time slot. Additionally, the system would support the addition and management of branches, procedures, inventory, sales reports and audit logs. Each user role: administrator, client, staff and dentist would have specific functionalities, ensuring efficient operations and secure access.

Testing

In this phase, the researchers conducted system testing to ensure the software met all specifications and was free of errors. The researchers used simple random sampling to select participants, as it ensures fairness, removes bias, is easy to use and relies on statistical methods to provide accurate information about the target population. The system underwent three types of testing: Developer Testing for developers, Alpha Testing for IT experts and Beta Testing for non-IT experts. For Alpha Testing, the researchers involved three IT experts to evaluate the system. For Beta Testing, thirty (30) end-users, including dentists, staff and patients from Tooth Impressions Dental Clinic, were selected to test the system's functionality. The evaluation followed ISO 25010 standards, focusing on functional suitability, compatibility, interaction capability, security, and flexibility.

Questionnaire Administration

The study was conducted in Mabalacat City from October 28, 2024 to October 31, 2024. When the questionnaire was distributed and presented, respondents were given a summary of how to complete the checklist using their own experiences. To guarantee clarity and correctness, the researchers provided respondents with instructions in English. This method intended to improve their comprehension and precision when completing the questionnaire.

Data Gathering

The survey was conducted in Mabalacat City between October 28, 2024 and continued until October 31, 2024. During the distribution and presentation of the questionnaire, respondents were given an overview of how to fill out the checklist based on their experience. The researchers used

English for the respondents to ensure that they completely understood the instructions, which is a great way to improve their understanding and accuracy in answering the questionnaire.

Data Analysis

Descriptive statistics were employed to analyze the study, identify the data, including its range and distribution and summarize the results.

The mean was the average or computed central value of a group of numbers and was utilized to ascertain the central tendency of the data. In statistics, the mean of a set was described as the total of the observations divided by the overall count of observations. To calculate the mean of a collection of observations, the formula used was: Mean = (Sum of Observations) ÷ (Total Number of Observations).

$\bar{x} = \Sigma fx/\Sigma f$

where,

$\bar{x}$ = the mean value of the set of given data.

f = frequency of each class

x = mid-interval value of each class

Likert Scale

The Likert scale is a rating system frequently utilized in surveys to evaluate respondents' attitudes, opinions or perceptions. After calculating the mean score for each sub-criteria and criteria of the survey instrument, the researchers applied the Likert scale to convert the results into its appropriate verbal interpretations.

Table 3. The 5-point Likert Scale – level of agreement.

Response Categories	Numerical Value	Range / Interval	Verbal Interpretation
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.21 – 4.20	Good
Neutral	3	2.61 – 3.20	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly Disagree	1	1.00 – 1.80	Poor

Deployment

All of these were accomplished with the success of the web-based system that was allowed by the capstone adviser, technical adviser, beta tester, alpha tester and to the board of panelists. The researchers designed a web-based platform that could be accessed and used for free using the domain repository website address at toothimpressionsdentalclinic.xyz (figure 5)

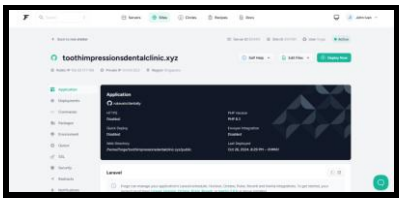

Figure 5: Deployment of the System

Maintenance

This is the last phase of the Modified Waterfall Model, following the testing phase. In this phase, the software is delivered to the end users, and the project team ensures the software's continued operation and usability. This would be the path where the user may be able to report errors or any aspects of the system that need improvement for the rectification of the system that has been created. The researchers would do updates by monitoring the progress, errors, and the features and operations of the system. With this, the researchers developed a web-based system that the users could freely access and utilize at the domain repository website address of Tooth Impressions Dental Clinic online.

RESULTS

Table 4. The overall results of the respondents agreement on the ISO 25010 criteria in the areas of Functional Suitability, Compatibility, Interaction Capability, Security and Flexibility.

Evaluation	Mean	Verbal Description
Functional Suitability	4.29	Excellent
Compatibility	3.92	Good
Interaction Capability	4.26	Excellent
Security	4.33	Excellent
Flexibility	4.16	Good
Total	**4.19**	**Good**

The researchers used software development tools to translate the designed diagrams into a working system. The researcher successfully developed and created a Web application for Tooth Impressions Dental Clinic that would be able to support the owner, dentists, staff, and clients in managing their records and schedules. Clients could quickly see their different records in the clinic that is keeping them in track with their oral health. The owner can

set schedules for dentists in different branches and view the clinic's sales report by daily, monthly, and total revenue. Additionally the sales report also shows the most purchased procedures in the clinic. The dentist can view pending appointments in which the clients who have appointed them, the dentists can approve or decline the appointments that are appointed to them. The personnel of the clinic can manage clients payments and records, which are patient health background, contract, and x-rays.

Table 5. The overall feedback from the respondents showed that they agreed with the ISO 25010 standards in the areas of Functional Suitability, Compatibility, Interaction Capability, Security and Flexibility.

Evaluation	Mean	Verbal Description
Functional Suitability	4.56	Excellent
Compatibility	4.09	Good
Interaction Capability	4.42	Excellent
Security	4.44	Excellent
Flexibility	4.22	Excellent
Total	**4.34**	**Excellent**

DISCUSSION

The study aims to create a website application for Tooth Impressions Dental Clinic that handles appointments, patient records, dentist and staff, dentist schedules, inventory branches, dental procedures, and sales reports. The researchers began by planning through meetings and brainstorming strategies. The researchers collected data, studied how the system should work and analyzed its different functions to build a complete dental clinic administration system.

The admin can create, view, update, and delete accounts for both dentists and staff. Both walk-in appointments are added as well as view, able to approve or decline an online appointment. The admin can create, view, update, and delete inventory items, procedures of the patients, and branches of the clinic. The admin is capable to create, view, update, archive, and sort patients as well as the patient's schedule. Apart from the above features, the admin can create or view patient contracts, patient backgrounds, patient X-rays, patient payments, and patient payment history. Only the admin can access the audit log to track staff and dentist action to the system. The admin can also add or submit appointments, log in or log out accounts, reset their forgotten passwords, change the password, and delete the account (figure 8). The staff can create, view, update, archive, and sort patient records; similarly, the clinic's scheduling system can be managed as well. The staff can also add and view walk-in appointments and manage patient payment history. Also included in the Staff control is the inventory item with the capabilities of creating, viewing, updating, and deleting it. Like the Admin, Staff can create or view patient records including contracts, patient backgrounds, and X-rays. Both the staff and the dentist can log in or logout their account, reset their forgotten passwords, change passwords, and delete their account (figure 9). The dentist can approve or decline appointments as well as add and view walk-in appointments, able to handle patients' payments by creating payment records and viewing the payment history. The patients can add or request appointments and also view their health records including x-rays, contracts, and patient background (figure 10). The patients can create payment records for transparency and self-service in financial matters. The patients can register an account and also log in or log out of their accounts, reset their forgotten passwords, change passwords, and delete their accounts (figure 11). All roles will also need to verify their account emails first before they are able to operate the system and its features.

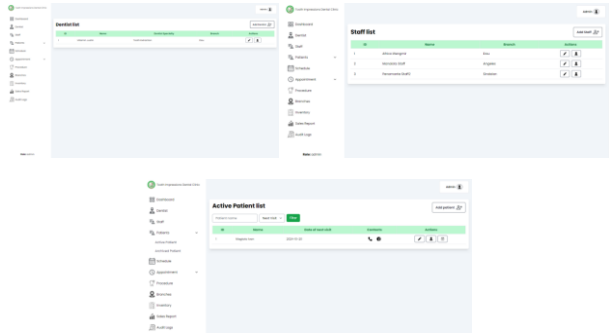

Figure 8: Dentist, Staff and Patient Section Controlled by Admin

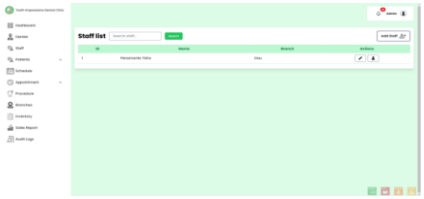

Figure 9: Staff Page

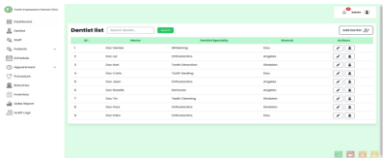

Figure 10: Dentist Page

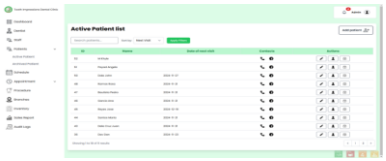

Figure 11: Patients Page

Conclusions

The objective of the study is to create a website for Tooth Impressions Dental Clinic to manage appointments, patient records, dentist schedules, inventory and sales reports. The researchers gathered information through research, interviews, and surveys to determine the required hardware and software for the system. The researchers used tools like storyboards, use case diagrams, and a visual table of contents to design and map out the system's workflow. This approach helped make the development process more efficient and reduced the chances of errors.

The researchers successfully established a dental clinic system with roles for admin, staff, dentists, and clients. The system includes features such as dentist management, staff management, appointment scheduling, inventory tracking, sales report viewing, and patient record management. All the project's objectives were achieved as planned. The main goal during development was aimed at establishing a solution that is environmentally friendly, socially beneficial, and economically practical, and the system succeeded in meeting these goals. The project team's hard work and commitment were key to reaching these objectives. The system has also contributed to sustainable development, as shown by the successful achievement of these goals.

The system went through developer testing, alpha testing, and beta testing. The researchers assessed it based on ISO 25010 standards, looking at functional suitability, compatibility, interaction capability, security, and flexibility. The system is now hosted on a virtual private server using Laravel Forge.

The survey results showed that the system worked very well in both the alpha and beta testing stages. It earned a score of 4.19 in the alpha test, meaning it met the necessary requirements. In the beta test, it scored even higher at 4.34, proving it performed very well. Based on these results, the researchers concluded that the system is an excellent solution that fully meets all the requirements.

When developing the researchers involved in the system encountered some limitations. The system was designed specifically for Tooth Impressions Dental Clinic, without addressing how it would be integrated into the clinic's current workflow. Additionally, the study did not include creating a mobile application, but the system was made to work on mobile web browsers.

ACKNOWLEDGEMENT

To begin with, the researchers are grateful to God for directing and bringing them on this educational journey. If it were not for His favor, this research would not have been possible.

The researchers would like to thank Ms. Lovely V. Santos, researchers capstone adviser, for her unwavering patience, support, and guidance as they worked to complete this study.

Additionally, the Committee who were present during the oral examination phase of the research process. Their combined efforts, suggestions, and thoughts influenced the researcher's choice and the study.

Finally, the researchers express their gratitude to their families and friends for providing unwavering support, particularly in the form of financial aid, throughout their time as students.

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Mabalacat Dorm: A Web Application for Enhanced Tenant Monitoring and Management

CALIUAG, ABEGAIL M.
CALMA, JUNELL S.
CORDOVA, ARLYN R.
DELOS REYES, DENZEL L.
GOPEZ, GILBERT G.
CABUÑAG, MARILOU B. (Technical Adviser – CAP1)
ALEGRE, KHYLE L. (Technical Adviser – CAP2)

ABSTRACT
The research presents Mabalacat Dorm, a web application designed to streamline tenant monitoring and management processes. It addresses challenges like record management, payment tracking, inquiries and communication logistics. The application offers registration, real-time updates, and data analytics for better decision-making. Testing and implementation show Mabalacat Dorm enhances operational efficiency, reduces errors, and improves tenant satisfaction, making it a valuable contribution to the owner and tenant. Mabalacat dorm was developed using the Waterfall Model, which adheres to a systematic system development lifecycle. While front-end tools like HTML, JavaScript, and Tailwind CSS offer a smooth and user-friendly interface, back-end technologies like PHP and MySQL guarantee reliable database administration and server-side functionality. Secure transactions and effective order administration are ensured by clearly defined responsibilities for administrators, guest user, and user. Excellent system performance was demonstrated by the testing results, which showed satisfaction ratings of 4.30 in alpha testing and 4.64 in beta testing. These findings demonstrate significant improvements in security, usability, and functional suitability. As a revolutionary paradigm for empowering artisans and promoting traditional companies in the digital age, Mabalacat Dorm promotes economic growth, cultural preservation, and digital innovation in Mabalacat City by aligning with the Sustainable Development Goals.

Keywords: Information System, Web System

INTRODUCTION

An apartment is a self-contained living area within a larger building, featuring rooms such as bedrooms, kitchens, and bathrooms. They come in various sizes and designs, making them adaptable options for different needs and lifestyles. In urban areas, apartments play a significant role in addressing housing demands, providing convenient and cost-effective living spaces for individuals and families. Apartments are essential because they offer a practical solution to the limited space and high population density in cities.

They help maximize land use, accommodate different financial capacities, and enhance urban living by being close to workplaces, schools, and essential services. Additionally, living in apartments can foster a sense of community, as residents often share amenities and common spaces, promoting social interactions.

Apartments have become very important in today's city life because they provide homes for a large and varied population. As cities grow and space becomes scarce, apartments help use land wisely by putting many families in one building and preventing the spread of cities into the countryside.

With the cost of owning a home going up, apartments give people a cheaper option for housing. They are especially good for young workers, students, and families with lower incomes who want a stable home without the high costs of owning a house. Their lower starting costs and flexible rental agreements make them very attractive.

From an environmental perspective, apartments help promote sustainability by sharing walls, heating, and cooling systems, which use less energy than single-family homes. They are often located in or near city centers, encouraging a lifestyle with less car use and more reliance on public transportation.

Many apartment buildings have shared facilities like gyms, recreational areas, and lobbies that encourage social interaction and community spirit, which can reduce feelings of loneliness in today's digital world. This community aspect offers a valuable social support system, especially in crowded urban areas.

Apartments are designed for various lifestyles, accommodating young professionals, families, students, and retirees. They provide adaptable living spaces and useful services such as maintenance and security. Situated close to workplaces, schools, and essential services, they reduce travel time, enhancing residents' quality of life. Apartments also

support local economies by creating jobs and boosting business for nearby stores and restaurants. They offer flexible rental options, making them ideal for those needing temporary or transitional housing due to work, study, or life changes. Overall, apartments play a key role in urban development, offering adaptable, affordable, and sustainable living that improves city life and economic growth.

In the constantly changing world of property management, using digital tools is very important for apartment owners who want to make their operations smoother, keep tenants happy, and stay ahead in the market. In this context, websites have become a key tool, providing many features designed to help apartment owners, especially when it comes to keeping track of tenants and managing properties. This final project looks deeply into how digital tools can help apartment owners, with a special focus on using websites to monitor tenants.

The core of this investigation is the understanding that technology can greatly improve how property management works. By using websites, apartment owners can go beyond old ways of doing things and get new insights into tenant habits, property conditions, and how well their operations are running. Websites help track rent payments, handle maintenance requests, and make it easier for tenants and managers to talk to each other. They act as a main place for sharing information and making decisions, helping apartment owners solve problems quickly and create better experiences for tenants.

This project carefully examines how websites work and how people use them to understand online systems that track tenants. By looking closely at the design of the user interface, how data is connected, and how the system is managed behind the scenes, this study aims to find out what makes these monitoring platforms work well or not. Additionally, by studying real examples and industry standards, this project aims to provide useful advice and practical suggestions for apartment owners to improve their digital systems and property management.

Beyond the confines of technical functionalities, this capstone project also delves into the broader implications of website-based tenant monitoring for the apartment rental industry as a whole. By contextualizing digital solutions within the larger framework of industry trends, regulatory requirements, and evolving tenant expectations, this endeavor seeks to shed light on the transformative potential of technology in shaping the future of property management.

Through a multidimensional approach that encompasses technological, operational, and strategic perspectives, this project aspires to equip apartment owners with the knowledge, tools, and insights needed to thrive in an increasingly digitized and competitive landscape.

In conclusion, this capstone project serves as a testament to the pivotal role of digital solutions in revolutionizing the apartment rental industry. By embracing the power of websites for tenant monitoring, apartment owners have the opportunity to not only streamline their operations and improve efficiency but also to elevate the overall quality of the tenant experience. As technology continues to advance and reshape the dynamics of property management, the insights gleaned from this project will serve as a guiding beacon for apartment owners navigating the complexities of the digital age.

Objectives of the Study

The main goal of this research project was to create a web application that helps manage and keep track of tenants in the Mabalacat Dormitory. The system made it easier to handle tasks like tenant registration, room assignments, payment tracking, and maintenance requests. By combining an easy-to-use interface with effective backend processes, the system gave administrators quick access to tenant information, helped with communication, and improved dormitory management. Also, the application helped increase tenant satisfaction by providing clear and easy-to-find information about their stay, payments, and dormitory services.

The general objective of this study was to develop a system entitled: Mabalacat Dorm: A Web Application for Enhanced Tenant Monitoring and Management. This study aimed to achieve the following objectives:

1. To gather data from the system.
2. To design the system with the following tools.
3. To develop the web-app with the following feature: Security, Features available for Admin, and Features available for Tenant.
4. To primarily develop the front-end and back-end of the system interface using the following frameworks, technologies and programming languages.
5. To assess the simulation software in terms of function sustainability, performance efficiency, compatibility, usability, credibility, security maintainability, and ease of using the ISO 25010 Software Product Quality Standards.
6. To deploy and implement the application to the following web domain and application respiratory site; mabalacatdorm.website.

Scope and Limitations

This project, titled “Mabalacat Dorm: A Web Application for Enhanced Tenant Monitoring and Management,” aimed to make dormitory management easier and improve tenant oversight using various features. The system helped the owner keep track of tenant requests, manage tenant

information, handle payments, and monitor occupancy. The online application includes user account management, where administrators and tenants have different roles and access levels. Administrators can use detailed dashboards to monitor tenant status, overdue payments, and dorm capacity, while tenants can log in to view their profiles, rental history, payment records, and submit maintenance requests. The application also has a notification system to remind users of important dates, such as payment deadlines.

Mabalacat Dorm: A Web Application for Enhanced Tenant Monitoring and Management offers a complete set of tools to simplify the process of managing tenants and the dormitory. The system begins with a Login Page to ensure secure access, allowing only tenants and administrators to log in. A key feature is the Inventory system, which tracks the availability of rooms, indicating which ones are occupied and which are vacant, thereby making it easier to manage room assignments. To assign rooms. For managing finances, a Sales Report generator creates monthly and yearly reports that can be saved as Excel files, making it easier to do detailed financial analysis. Security is better with a Reset Password feature, which lets users easily get back into their accounts, and an Email Verification process that checks each user's email when they sign up. Notifications and reminders are automatic through Email Notification, sending payment reminders to tenants from the admin, which helps make sure payments are done on time. Tenants can use the Print PDF of the Receipt feature to get a digital copy of their payment records. The Status Bills option shows each tenant's payment status as pending, due, or paid, using a calendar-like interface for easy tracking.

To make it easier for new residents to get started, the Requirements Fields Landing feature provides a form for new tenants to complete. The Landing Page introduces the system to visitors, while the About Page and Contact Us sections offer essential information about the dorm and how to get in touch. User Management allows administrators to oversee all user accounts, with an admin-style layout available for users. Payments can be made using QR Code Integration for GCash or other contactless methods, giving tenants convenient payment options. The Room Page displays tenants' current room assignments, and the Tenant Slot feature lets admins manage room availability. A Soft Delete feature is also included, allowing admins to temporarily deactivate users or data, keeping the information intact but not accessible. This set of features creates a well-organized, secure, and user-friendly platform for managing dormitory operations. The researchers set limitations on online reservations, or what is usually referred to as e-commerce. The availability and completeness of data available through web-based sources may also affect the study's outcomes. Some information, like internal apartment records, might not be accessible to anyone else. This could potentially limit the analysis's depth. SMS alerts were turned off due to a delay that might give tenants wrong information about their bills. The government is checking short text messages using the SMS API, which is causing problems with the system. The SRA, or SIM card registration law, also affects this, as it considers these messages as a type of business SMS or something similar.

Another important consideration in this study is privacy constraints. The researchers comprehend that only first-level and consent monitoring are allowed under the current Data Privacy Act of the Philippines; the researchers also chose to exclude features that might gather and contain sensitive data. The system was tested with 30 tenant participants to get a wide range of opinions. The 30 people who tried it found some important issues that could affect how well the Mabalacat dorm system works.

METHODOLOGY

This chapter, user describes the methodology used to look into how apartment owners are using digital solutions to keep an eye on their renters, with a particular focus on website usage. The research design, demographic and sample selection, data collection strategies, and data analysis procedures are covered in this chapter.

The researchers chose the Modified Waterfall Model (see figure. 1.) as the System Development Life Cycle approach and was applied in this study. The Modified Waterfall method provides an orderly flow of development processes with repetitive phases that provide sufficient documentation and design assessments to guarantee the quality, consistency, and maintainability of the system.

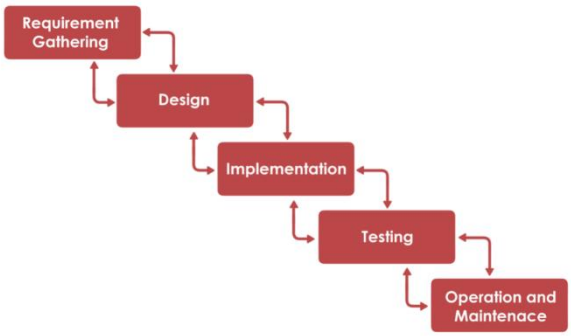

Figure 1. The Modified Waterfall Model

Requirement Gathering

Important hardware and software tools were needed to build the Mabalacat Dorm website system. A

laptop was used for the former, and Canva were used for the latter in order to work on the storyboard and Visual Studio Code. The team was able to work on the storyboard as a result. It made it easier to see and map out the website's features in terms of their various functionalities in a structured manner. To guarantee that the flow and design are appropriately refined and optimized, In order to ensure efficient and well-organized website development, Visual Studio Code was utilized for coding, editing, and simple debugging.

Table1. Computer Hardware Specifications

COMPONENTS	SPECIFICATION
Processor	AMD Ryzen 7 7435HS
Memory	16 GB
Operating System	Windows 11

Table 2. Software Development Tools

COMPONENTS	SPECIFICATION
Visual Studio Code	Integrated Development Environment
Canva	Storyboarding

Design

At this point, the system was created by the researchers utilizing several visualizations and analytical tools. These included the Storyboard, Visual Table of Contents, Use Case Diagram, Entity Relationship Diagram, and Gantt Chart. The Use Case Diagram showed what the system can do, how it can be accessed, and how it connects with its users. This helps to explain the different ways users can interact with the system and to clarify what the system needs to do. The Storyboard diagram was used to design and show how the application works and what its user interface looks like. This visual guide helped the developers who are working on creating, programming, and managing the initial user interface to understand it better. User can get the information they require more rapidly because of the Visual Table of Contents, which serves as an understandable and thorough guide that describes. The Entity Relationship Diagram was important for defining the data items and how they relate to each other, which is crucial for designing the database. It also visually represents the data needed for the system. Finally, the Gantt Chart was used to create a clear timeline for each project phase.

This helped the researchers manage their time and resources effectively, track the development process, and identify potential issues that could affect productivity. By using these analysis tools and diagrams, the researchers were able to follow a design framework that guided the development process, ensured alignment with user needs, and enabled efficient project management throughout the system's lifecycle.

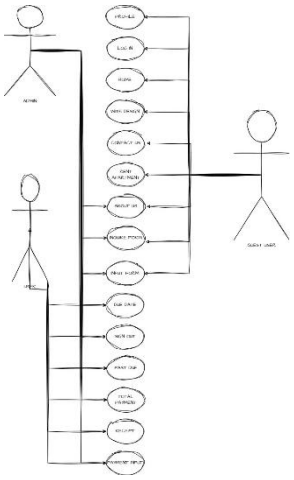

Figure 2. Use Case Diagram of Mabalacat Dorm

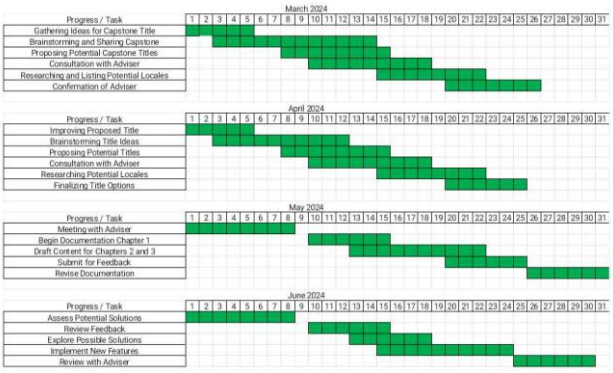

Figure 3. Gantt Chart of Mabalacat Dorm

Implementation

The Mabalacat Dorm website system's design plans are transformed into functional software during the implementation phase. As shown in design papers, developers integrate different system components when writing and testing the code.

Targeting front-end developers to carefully choose color schemes, icons, fonts, and images that accurately represent the Mabalacat Dorm brand with new inventiveness while maintaining an aesthetically pleasing and user-friendly design would encourage both apartment owners and tenants to peruse and engage with the site with ease, improving the user experience overall.

A secure database that can manage room queries, tenant accounts, payment tracking, and billing functions was designed for the back-end. An admin dashboard for room availability, user accounts, and bill posting was also included in the system. To make it easier and safer for administrators and tenants to handle their affairs, more tools for tracking payments, user roles, and transactions were incorporated.

Testing

The system underwent alpha testing, utilizing ISO25010 as a guideline for its development. A comprehensive questionnaire was designed based on ISO25010 to assess various attributes, including functional suitability, compatibility, interaction capability, security and flexibility. IT experts, with experience in the relevant field, answered the questionnaire to ensure that the system adheres to established industry standards and best practices.

Subsequently, the system underwent beta testing, which involved the locale and the tenants. The locale evaluated whether the system met their specific business requirements and operational standards. Feedback was gathered on aspects such as user interface, performance, and integration with existing processes.

The tester examined the Mabalacat Dorm internet system to see if it could enhance the process of finding and managing apartments. Room availability, user account setup, room inquiry procedures, payment processing, and other typical tenant management elements are included in this review. It will test and validate its capabilities through alpha and beta testing. As a result, it guarantees that the system meets the requirements of the users—tenants, apartment owners, and administrators. Users should be able to easily navigate the system and perform duties like billing, questions, and user accounts with ease thanks to its outstanding user experience.

To choose participants for testing on Anne Lalic's Mabalacat Dorm website system—which aims to offer an effective apartment owner tenant-to-tenant platform for interaction, inquiries, and all transactions—researchers employed homogeneous purposive sampling and basic random sampling techniques.

The alpha testers were selected via the purposive sampling, which guaranteed that the test features are those that helped fully understand the system's functionality and design. Three (3) IT specialists conducted the alpha testing for the Mabalacat Dorm website. These experts are well-equipped to provide thorough criticism and guidance that ultimately increased the website's overall efficacy in meeting the needs of apartment owners and their tenants.

Researchers chose to choose volunteers for the beta testers using basic random sampling. For this stage of beta testing, thirty (30) local users were available to interact with the website system using real-world conditions. Another participant was added to the beta testers in addition to the community testers. One of the beta testers is Anne Lalic, the proprietor of Mabalacat Dorm. This kind of interaction guarantees that the website benefits not just apartment renters but, more crucially, other user types that might be using the system.

A popular grading scheme in surveys that evaluates respondents' attitudes, beliefs, or views is the Likert scale. After determining the mean score for each survey tool sub-criteria and criteria, the Likert scale will be used to interpret the results into verbal categories, such as "Excellent," "Good," "Acceptable," "Marginal," or "Poor." This qualitative interpretation complements the quantitative data gathered from the survey responses. The statements or items in the Likert scale range from "Strongly Agree" to "Strongly Disagree."

Table 3. The 5 – point Likert Scale – level of agreement

Response Categories	Numerical Value	Range Interval	Verbal Interpretation
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.41 – 4.20	Good
Neutral	3	2.61 – 3.40	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly Disagree	1	1.00 – 1.80	Poor

Operations and Maintenance

Following the verification phase, Hostinger was used to host the web domain. This stage involves regular updates, bug fixes, and improvements to the website's features and functionality as well as its content. As room availability and pricing information were updated and the overall user experience was streamlined for both apartment owners and tenants, this team brought technological troubles to a complete halt.

To find areas for improvement, address security vulnerabilities, and keep an eye on website performance to ensure system efficiency, another maintenance task was involved looking for client feedback. The updates' contents, which included things like room availability for future use and tenant paying details, fell under the purview of maintenance.

The latter includes all of the ongoing administrative duties, such as answering tenant questions, scheduling rooms, and processing payments, as well as the operational levels, which include managing domain registration, data backup, and making sure the website is always fully working. Therefore, the key to long-term maintenance of the Mabalacat Dorm online system is the continuous monitoring of these elements, which guarantees a smooth and effective functioning experience.

RESULTS

This section shows the results and outcomes based on the objectives of the study and it is important

that the research output is presented in an organized and presentable manner. These discussions and conclusions are based on the objectives of the study, completed analysis, and testing of the developed web system.

The needed information was gathered from numerous books, journal publications, and previous research writings. It shows the local business owner was interviewed by the researchers to get recommendations on features to be included and what still needs improvement.

The User Management (see figure 4) function of the apartment system gives administrators the ability to oversee tenant accounts while guaranteeing that all user interactions are effective and safe. In order to give tenants easy access to their profiles, billing details, and notifications, this module enables administrators to establish, manage, and update tenant accounts.

The User Management system strikes a compromise between security and usability; both administrators and users will find the interface easy to use because features are readily available and load rapidly. In addition to providing secure login credentials and robust activity logs, the system also has easily accessible notification tools that inform tenants of all tenancy-related updates. This user-friendly and well-structured interface facilitates effective communication and information management for tenants.

The Admin Page (see figure 5) system makes it accessible to manage tenant and apartment data via an easy-to-use dashboard. Editing room listings, updating profiles, modifying payment information, and classifying unit facts are all aspects of the admin interface. In order to facilitate financial administration by keeping the administrator and users informed of the billing status, the dashboard will have sections on Payment, Due Date, Past Due Amounts, Total Payments, and Payment Receipt.

Since the landing page (see figure 6) serves as the website's entrance, it gives an idea of the overall user experience. It is intended to be visually appealing, easy to use, educational, and captivating for users from the outset. The landing page enables users to check on services, register, or submit an inquiry while also communicating the main features and services offered.

Key components are positioned to represent simple navigation and the strategically to draw attention to the platform's value proposition in a way that is easy for users to understand. Overall, it has a clean design that makes it easier for users to find and access crucial information, guaranteeing a seamless transition into the platform's full functionality. The landing page is an essential element since it draws users in and directs them to the platform's main features and advantages.

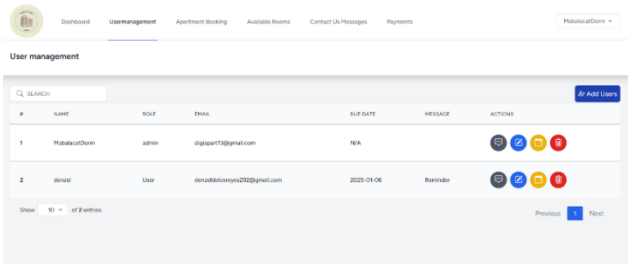

Figure 4. Screenshot of User Management

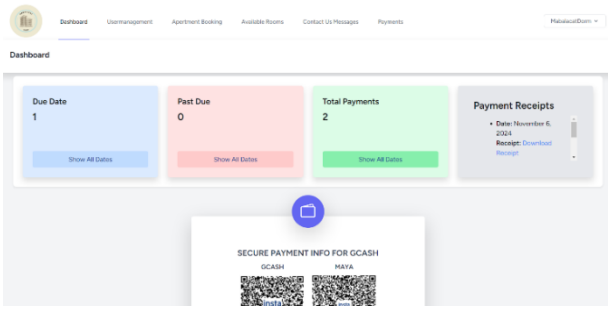

Figure 5. Screenshot of Admin Profile

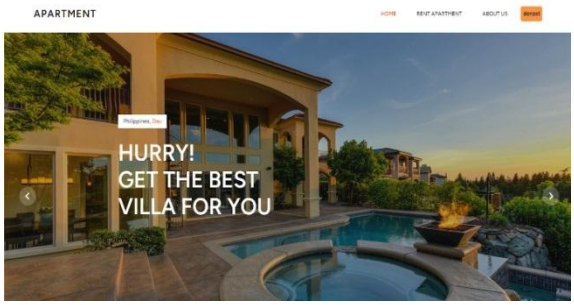

Figure 6. Screenshot of Landing Page

The researchers conducted alpha and beta tests to evaluate the Mabalacat Dorm system. During the alpha testing, the system underwent a comprehensive evaluation to three IT professionals. During the beta testing transition, a total of thirty (30) respondents from individuals that are tenants have contributed significant insight in the system. The evaluation, conducted a survey according to ISO 25010 guidelines, encompassed various dimensions such as Functional Suitability: Functional Completeness, Functional Correctness, Functional Appropriateness, Compatibility, Coexistence: Interoperability, Interaction Capability: Inclusivity, Security: Confidentiality, Integrity, Accountability, Authenticity, Flexibility: Adaptability, Scalability.

The system's average score for Functional Suitability in alpha testing is 4.40, while in beta testing, it increased to 4.73. This indicates an improvement in

the system's ability to function well during the beta testing phase. In terms of Security, the alpha testing score was 4.33, which rose to 4.55 in beta testing, showing that the security features of the system were enhanced. The overall average score for the system in alpha

Table 4. Comparison of Aloha and Beta Testing

Alpha Testing

Categories	Results
Functional Suitability	4.40
Compatibility	4.21
Interaction Capability	4.14
Security	4.33
Flexibility	4.30
TOTAL	4.3

Beta Testing

Categories	Results
Functional Suitability	4.73
Compatibility	4.60
Usability	4.7
Security	4.55
TOTAL	4.64

DISCUSSION

The "Mabalacat Dorm" project aimed to use an online system to make it simpler to track and manage dormitory residents. The research identified several common issues with dormitory management, such as slow manual processes, difficulty in quickly accessing up-to-date information, and communication challenges between residents and staff. These problems often resulted in delays in addressing resident needs, errors in record-keeping, and a lack of transparency, which negatively impacted resident satisfaction and the overall management of the dorm. The study revealed that managers struggled to maintain accurate and current records about resident status, payments, and other crucial information, leading to delays and bottlenecks in the dorm's operations.

As a result, a web application was created to bring together and automate important management tasks. It includes features like online tenant registration, automatic check-ins and check-outs, payment monitoring, and a live tenant dashboard. Both dorm staff and tenants tested the application, and they mostly had a very good opinion of how easy it was to use and how clear the design was. The study also found that the app's automatic reminders for payment due dates and maintenance issues led to fewer late payments and quicker responses to tenant needs. Overall, the results show that the web application can help make dormitory management more efficient, increase tenant happiness, and simplify daily operations.

The project's development involved the strategic use of planning and design tools such use case diagrams, system architecture diagrams, entity-relationship diagrams, a Gantt chart, storyboards, and data flow diagrams to ensure an organized and user-centered system. The Gantt chart made effective project management possible, and these tools made it possible to visualize the system's processes and structure in great detail.

The ISO 25010 standard was followed in the system's evaluation, which looked at quality criteria such as interaction, interoperability, and functional adequacy. During testing rounds, capability, security, and adaptability were all given good ratings. Additionally, the project aligns with the United Nations Sustainable Development Goals (SDGs) 8, 9, and 11, which promote quality economic growth, sustainable communities, and industry innovation.

Both the Alpha and Beta phases underwent extensive testing, with IT specialists conducting the Alpha testing to verify the website's superior performance across all evaluated domains. The system's efficacy and usability were further confirmed by beta testing with local users, which produced a high overall satisfaction rating. The findings show that Mabalacat Dorm successfully connects traditional way of dorm paying with digital convenience, satisfying local companies' demands while providing customization choices that boost tenant happiness and provide tenant with a competitive advantage.

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Barangay-Connect: Enhancing Barangay Santa Ines through a Community Website

RAMZEL D. AQUINO, MABALACAT CITY COLLEGE
JULIUS A-RON M. CAPARAS, MABALACAT CITY COLLEGE
JOSHUA M. LAYUG, MABALACAT CITY COLLEGE
SHERWIN M. LAYUG, MABALACAT CITY COLLEGE
DENNIS L. TACADENA, MABALACAT CITY COLLEGE
DESSA LYN J. DE CASTRO (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT
This study introduces Barangay-Connect, a web-based platform designed to enhance community engagement and communication among residents of Barangay Santa Ines. The platform aims to improve access to local information, services, and events, fostering a sense of community and collaboration, and is equipped with features such as a carousel display for announcements, a directory of local services, and discussion forums with feedback options, promoting effective interaction and participation among residents. Developed using the modified Waterfall Model of the Software Development Life Cycle (SDLC), the platform emphasizes systematic design, implementation, and evaluation, with alpha testing conducted by IT experts and beta testing with community members, both adhering to ISO 25010 standards that assess criteria such as Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. Alpha test results demonstrated an overall mean score of 4.63, categorized as "Excellent," while beta testing further improved the mean score to 4.46; notable enhancements in Security and Interaction Capability were observed between the testing phases, underscoring the platform's robust functionality, user-friendly design, and adaptability. This study highlights the potential of Barangay-Connect to revolutionize how residents engage with their community, ultimately supporting improved communication, participation, and a stronger sense of belonging in Barangay Santa Ines.

Keywords: Web-Based Platform, Local Information Access, Information System, Web System

INTRODUCTION

In the current technological era, integrating technology into local governance is essential to improve communication, service delivery, and civic engagement. The capstone project *Barangay-Connect* addresses these needs by developing a community website for Barangay Santa Ines. This initiative aims to empower residents, enhance transparency, and foster participation in governance, aligning with Republic Act No. 7160 (Local Government Code of 1991), which mandates local government units (LGUs) to utilize technology to support accountability and participatory governance.

At the national level, the Local Government Code encourages LGUs to adopt modern technologies to improve public service delivery (Department of the Interior and Local Government, 2021). Locally, Barangay Santa Ines faces challenges in communication and service provision. Residents often lack timely information about events, opportunities, and services, which creates a gap between barangay officials and constituents. The existing manual system for processing requests—relying on handwritten records in a "blue book"—is inefficient, prone to errors, and time-consuming. Residents must physically visit the barangay office for certificates, while staff manually verify and process applications. Similarly, census surveys are conducted manually during the summer, causing delays and logistical challenges.

To address these issues, Barangay-Connect introduces a centralized, web-based system that simplifies access to information and services while promoting active community participation. The platform allows residents to register and request various documents, such as certificates of residency, indigency, and barangay clearance. It integrates secure payment options, including GCash and over-the-counter methods, ensuring convenience and accuracy. Payments are validated by the barangay secretary, and documents can be picked up after ID verification.

The platform streamlines data management by transitioning from manual entries to a secure, digital system. Resident information and transactions are stored securely using Firebase, reducing risks of data loss or corruption. Netlify hosts the website, ensuring accessibility and performance. This approach significantly minimizes administrative workload, improves efficiency, and enhances service delivery for barangay staff and residents alike.

Barangay-Connect also focuses on fostering communication between barangay officials and the community. Through streamlined processes and a user-friendly design, residents can access

announcements, local resources, and opportunities to engage with barangay leaders. The project aligns with global and local initiatives, supporting Sustainable Development Goals (SDGs), specifically **Good Health and Well-Being**, **Decent Work and Economic Growth**, and **Zero Hunger**. The platform facilitates collaboration with organizations such as the Department of Health, ensuring essential services like food and medications reach the community.

Historically, Barangay Santa Ines has relied on manual processes to manage its growing population, which increased from 4,089 in 2022 to 4,733 in 2023. As revealed through interviews with Barangay Captain Noel Sicat and the barangay secretary, the need for a digital system became evident due to inefficiencies in verifying residency, managing records, and processing certificates. The blue book, which served as the primary record-keeping tool, complicated the verification process and consumed valuable administrative time.

Barangay-Connect addresses these challenges by providing a secure, efficient, and accessible platform for barangay management. The system empowers residents to access information, request services, and engage with their local government seamlessly. For barangay staff, it offers tools to streamline administrative tasks, minimize errors, and enhance data management. The platform also incorporates robust security measures to ensure resident data is protected.

In summary, *Barangay-Connect* represents a strategic initiative to modernize local governance in Barangay Santa Ines. By leveraging technology, it enhances transparency, accountability, and citizen engagement, fostering a stronger sense of community. This project not only addresses immediate administrative challenges but also lays the foundation for sustainable development, empowering residents to participate actively in local governance and improving their overall quality of life.

Objective of the Study

The general objective of the study was to develop *"Barangay-Connect: Enhancing Barangay Santa Ines Through a Community Website."*

The study aimed to achieve the following specific objectives:

- The project gathers data and information about Barangay Santa Ines by conducting research, interviewing the barangay captain and secretary, and observing current processes and challenges. This comprehensive approach aims to understand the community's needs and identify areas for improvement.
- The project identifies the required software and hardware tools necessary for the development of the system. It specifies hardware requirements, including Windows 10, an Intel Core i5-8265U processor, 16GB of RAM, and compatible devices such as desktop computers, tablets, and mobile phones for testing. It also outlines software requirements, which consist of Visual Studio Code, React.js, HTML & SASS, Firebase, Draw.io, Netlify, and Twilio.
- The project utilizes system design and analytical tools to ensure proper development by creating a storyboard, use case diagram, entity-relationship diagram (ERD), visual table of contents, and website mapping.
- The project develops a secure and user-friendly system with role-based access for both the admin (root admin) and residents. It incorporates essential system features and functionalities, including a home page, barangay profiles, a contact us page, rules and regulations, a feedback system, a search bar, and services for document requests such as Certificates of Residency, Indigency, Barangay Clearance, Good Moral, Guardianship, No Objection, Cohabitation, Appreciation, Late Registration, and Barangay Identification.
- The project includes user functionalities that encompass login, sign-up, and profile account management, along with upload validation and email verification, and payment integration via G-Cash QR Code and over-the-counter methods. It defines admin functionalities that include a home dashboard, account management for pending and approved accounts, record management for user records, service requests and printing services, content updates (news and posts), logs, reports, filtering, and SMS messaging integration.
- The project conducts systematic testing of the system through both alpha and beta testing phases to ensure functionality and reliability.
- The project evaluates the system based on ISO 25010 criteria, focusing on functional suitability, compatibility, interaction capability, security, and flexibility to ensure it meets high standards.
- The project creates a comprehensive maintenance plan that details system support, updates, bug fixes, and performance monitoring after deployment, ensuring the system remains effective and user-friendly over time.

Each specific objective supports the systematic development, testing, and deployment of *Barangay-*

Connect, ensuring an efficient, secure, and user-friendly community website for Barangay Santa Ines.

METHODOLOGY

The researchers selected the modified waterfall model for the Software Development Life Cycle (SDLC) method to develop the "Barangay-Connect" system, aimed at enhancing the community of Barangay Santa Ines through an interactive website. This section outlines the SDLC techniques, analysis diagrams, and data collection tools utilized in the application's development. The SDLC process includes key phases such as requirements gathering, software design, software implementation, software testing, software deployment, and software maintenance. By following this structured approach, the researchers ensure that the Barangay-Connect system effectively meets the needs of the community, fostering better communication, access to information, and engagement among residents. This thoughtful methodology not only streamlines the development process but also enhances the overall user experience for the people of Barangay Santa Ines.

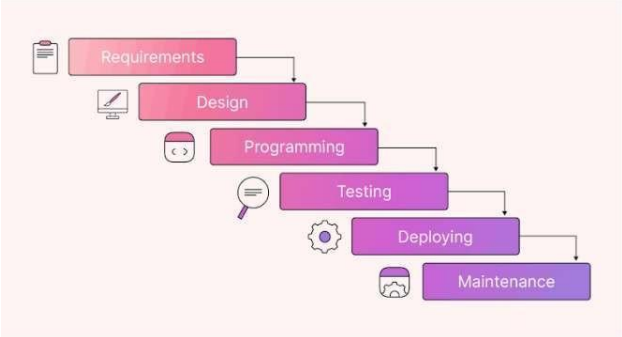

Figure 1: The Modified Waterfall Model

Requirements

The researchers commenced the project by compiling a comprehensive record of the project requirements. At this stage, it was essential to conduct an in-depth study and gain a thorough understanding of the client's needs, the expectations of end users, and the limitations of the project. The targeted area for this initiative was Barangay Sta. Ines.

To gather crucial data for the project's future development, the researchers not only conducted interviews with Barangay officials to ascertain the total population, the daily number of transactions, the documents most frequently requested by residents, and the hierarchy of the organizational chart, but they also engaged in extensive research. This research involved reviewing existing literature, analyzing relevant statistics, and exploring best practices in community engagement. By combining insights from both interviews and research, the researchers were able to collect vital information that ensured the project aligned with the community's needs and effectively addressed the challenges faced by its residents.

Design

In this phase, the actual design and development of the application and the administrator panel were carried out by the researchers using various analysis tools and diagrams, including a Gantt chart, storyboard, visual table of contents, use case diagram, entity relationship diagram, website mapping diagram.

To aid the developers who designed, coded, and managed the first user interface, the researchers employed the Storyboard diagram (see Appendix C) to design and describe the application's user interface and flow. Next, a Use Case Diagram (see Appendix E) was utilized to outline the capabilities and scope of the system, as well as its interactions with various actors. Following this, a Website Mapping Diagram (see Appendix F) was used to organize the interfaces of the e-Barangay Portal, providing a hierarchical listing of the menu items and navigation links.

The Visual Table of Contents (see Appendix D) serves as an organized overview of the content and structure of the e-Barangay Portal System. It provides users with a clear navigation guide, allowing them to easily access different sections and functionalities of the application. Furthermore, a Gantt chart (see Appendix H) assisted the researchers in efficiently managing time and resources, tracking the project's progress, and identifying potential roadblocks or issues to allocate resources wisely. Lastly, the Entity-Relationship Diagram (ERD) (see Appendix G) provided a graphical representation of the data needed for the system or application, visually defining the relationships between data entities.

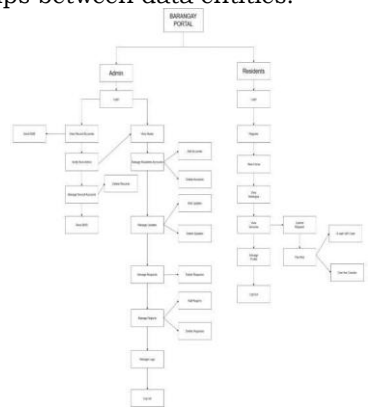

Figure 2: Modified Visual Table of Contents Diagram

Development

In the implementation of the Barangay Portal, the project was carefully developed based on the requirements identified during the initial design phase. To ensure the system operated effectively, the researchers utilized Visual Studio for coding, which facilitated a robust development environment. Additionally, Firebase was employed for database management and security, providing a reliable backend solution that ensured data integrity and user authentication. The portal was hosted on Netlify, which offered seamless deployment and scalability.

The Barangay Portal encompassed a variety of features designed to enhance user experience and streamline administrative processes. The Home Page served as the central hub, while sections such as Barangay Profiles, Contact Us, and Rules and Regulations provided essential information to residents. The inclusion of a Search Bar allowed users to quickly find relevant services, which included various certificates such as Barangay Clearance and Certificates of Residency.

Moreover, the portal facilitated user engagement through functionalities like Login for residents and admins, enabling them to manage their accounts and access necessary services. The SMS Messaging feature ensured timely notifications, while the integration of GCash QR Code for payments simplified financial transactions. Overall, the Barangay Portal was designed to benefit both residents and the barangay by improving access to services, enhancing communication, and fostering a more connected community. This implementation not only addressed current administrative challenges but also promoted a more efficient and transparent governance model.

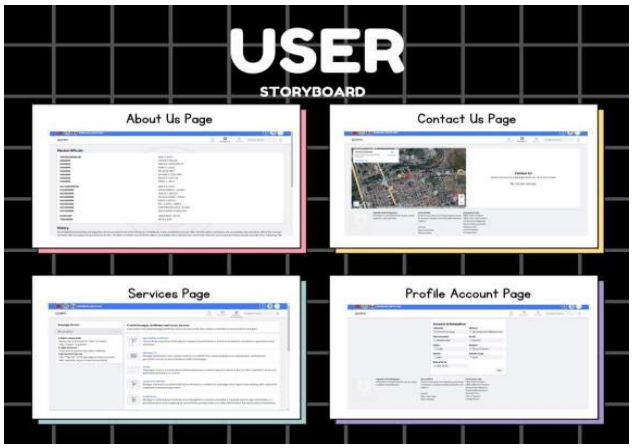

Figure 3: Storyboard – User

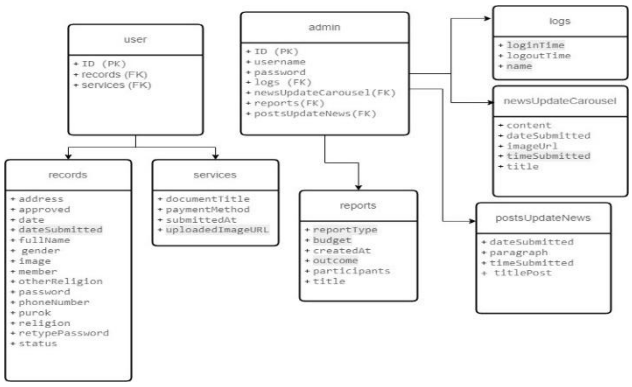

Figure 4: Entity-Relationship Diagram (ERD)

Figure 5: Storyboard – Admin

Figure 6: Storyboard – Admin 2

Figure 7: Home Page

Testing

The Alpha and Beta testing phases were two critical stages in the evaluation of the Barangay-Connect system. Following the ISO 25010 standards, which address key quality characteristics such as Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility, the researchers conducted a thorough assessment of the administrator interface and platform features during the alpha test.

The alpha testing phase focused on making a preliminary assessment of the software's performance and reliability, ensuring that the core functionalities met the specified requirements. In contrast, the beta test involved a broader audience and concentrated on evaluating the same key aspects: Functional Suitability, Compatibility, Interaction Capability, and Security. This phase aimed to gather feedback from actual users to understand their experiences and identify any potential issues.

These assessments provided a detailed understanding of the system's functionality, security measures, and overall user experience, forming the foundation for the more in- depth analyses presented in the following sections. By systematically evaluating these critical areas, the researchers ensured that the platform was robust and user-friendly, ready for deployment within the community:

Table 1: Likert Scale used by the Researchers

Response Categories	Numerical Value	Range Interval	Verbal Interpretation
Strongly Agree	5	4.21 - 5.00	Excellent
Agree	4	3.41 - 4.20	Good
Neutral	3	2.61 - 3.40	Acceptable
Disagree	2	1.81 - 2.60	Marginal
Strongly Disagree	1	1.00 - 1.80	Poor

Deployment

The data would be securely stored in Firebase, while the system would be hosted on Netlify for optimal performance and accessibility. Netlify was chosen as the web hosting platform to simplify deployment, allowing the system to be easily hosted online with continuous updates from a Git repository. It is the best hosting and backend for sites and web applications. This cloud-based service enables developers to easily design and deploy modern web projects. Focusing on JAMstack architecture, mainly JavaScript, APIs, and Markup, it integrates with GitHub and GitLab through its version control systems in order to support continuous deployment that will automatically update the live site whenever updates are pushed to the code repository. Netlify has even more features like handling forms, serverless functions, SSL, and custom domains. Therefore, it is very popular with developers for static websites and one-page applications.

Maintenance

After deployment, a support system was established to address any issues or faults that might occur in a live environment. Continuous maintenance and support services were implemented to ensure the system's performance, security, and stability for users. The technician's responsibilities included ensuring the system operated smoothly, resolving problems promptly, and keeping all features updated until new upgrades initiated a restart of the maintenance cycle.

The maintenance plan is designed to keep the system running efficiently and securely, incorporating regular updates to introduce new features and resolve any issues. System performance is actively monitored, with alerts in place to detect problems early and routine maintenance scheduled to prevent potential issues. Regular data backups are performed to facilitate quick recovery in the event of significant problems. User feedback is collected and utilized to guide ongoing improvements. Additionally, support and training services are provided to assist users with any challenges they may encounter, keeping residents informed about updates or changes to the system.

RESULTS

The alpha testing phase for the Barangay-Connect platform, designed to enhance Barangay Santa Ines through a community website, took place online from October 28 to October 31, 2024. Researchers engaged potential alpha testers via Messenger, inviting them to participate in the testing process. A total of three IT experts took part in this phase, during which the platform's functionalities and user experience were thoroughly evaluated. The testing included hands-on interaction with the platform,

followed by discussions to gather feedback, criticisms, and suggestions. Participants completed survey questionnaires assessing the platform against ISO 25010 standards, focusing on criteria such as Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The results of these assessments, documented in Appendix I, provide valuable insights into the system's functional stability and user-centered features, along with detailed findings and response tables for each criterion.

Table 2: Summary of Alpha Test Results

ISO25010 Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.67	Excellent
Compatibility	4.83	Excellent
Interaction Capability	4.49	Excellent
Security	4.71	Excellent
Flexibility	4.44	Excellent
Overall Mean Score	**4.63**	**Excellent**

The result of the alpha test for the website platform interface, based on ISO 25010, is excellent in all dimensions-that is, Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The overall mean score for Functional Suitability was found to be 4.67. That means the platform is generally effective in meeting the needs of users. The mean score relating to Compatibility was as high as 4.83, reflecting the excellent capability of the platform to perform well across different environments. Based on its interaction capability, Interaction Capability scored 4.49, with an expression of very strong user experience. The mean score of security measures was 4.71, thereby emphasizing how effective they were in helping to ensure the protection of data and safety to the user. Flexibility showed commendable performance with a mean score of 4.44, thus showing the platform's adaptability in such contexts. Additionally, since the overall mean stood at 4.63, then at the alpha testing stage, the interface of the website platform performed well, showing a "Excellence" performance with a guarantee of its reliability and also user-centered design.

During the beta testing phase of the Barangay Connect platform from November 2 to November 5, 2024, residents and clerks of Barangay Santa Ines evaluated the website interface through questionnaires. Researchers conducted house-to-house presentations and demonstrations at the Barangay Hall to familiarize participants with the platform. After a live demonstration, participants completed surveys focused on ISO 25010 criteria: Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The results and outcomes of the beta test are documented in Appendix J, including detailed findings for each criterion assessed.

Table 3: Summary of Beta Test Results

ISO25010 Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.65	Excellent
Compatibility	4.35	Excellent
Interaction Capability	4.44	Excellent
Security	4.42	Excellent
Flexibility	4.46	Excellent
Overall Mean Score	**4.46**	**Excellent**

Based on the ISO 25010 criteria. The overall mean score of 4.53 indicated an "Excellent" level of performance. Notably, the platform's Functional Suitability received a high score of 4.65, demonstrating its effectiveness in meeting user needs. Additionally, the Compatibility score of 4.35 reflected good performance across various platforms, while the Interaction Capability was rated at 4.44, highlighting the user-friendly interface that enhances the overall user experience. The Security Features scored 4.42, indicating strong protective measures in place, and the Flexibility of the platform was rated at 4.46, suggesting its adaptability to different scenarios. These impressive scores collectively underscore the effectiveness of user-centered design and the overall quality of the Barangay-Connect platform.

Overall, the beta test results highlight the platform's significant improvements since the alpha testing phase. The platform demonstrated excellent usability, robust security, seamless cross-platform compatibility, and adaptability. These findings confirm the system's readiness for deployment and its ability to effectively meet user expectations.

DISCUSSION

The researchers aimed to develop Barangay-Connect, a web-based platform supposed to enhance the system of communication and service delivery within Barangay Santa Ines. Specifically, the study aims to identify the current system that is being utilized by the residents in accessing barangay services; identify the problems encountered using such existing system; and kind of platform that could be developed for such encountered challenges. It sought to determine which features could be integrated into the proposed system that would help enhance the general experience of residents and administrators.

With the involvement of the residents, barangay officials, and administrators like the barangay captain and council members, the study was conducted in deriving helpful insights. These helped the researchers to clearly define which needs the intended users have at stake with designs that are effective in supporting their interactions involving the barangay-in these features: account management, service information, and communication tools. Findings like these point toward the very real potential of Barangay-Connect to make a lot of difference in the efficiency and accessibility of the barangay services laid down to form the foundations for a better connected and informed community.

ACKNOWLEDGMENTS

The completion of this research project would not have been possible without the guidance, support, and assistance of several individuals who generously shared their expertise and time.

First and foremost, we express our deepest gratitude to the Almighty God, whose wisdom and guidance served as our strength throughout this journey.

We extend our heartfelt thanks to Ms. Dessa Lyn J. De Castro, our Technical Adviser, and Engr. Dennis L. Tacadena, DIT, for their invaluable guidance, patience, and encouragement. Their expertise and insights were instrumental in helping us navigate challenges and refine our work.

We would also like to express our sincere appreciation to Hon. Noel A. Sicat, the Barangay Captain of Santa Ines, for his support and encouragement in facilitating our research. His endorsement has been invaluable to the success of this study.

We are grateful to our Alpha testers, a group of Information Technology experts, who provided crucial feedback on the system's functionality. Additionally, we thank our Beta testers—residents of Santa Ines—for their active participation and honest responses, which significantly contributed to the study's validation process.

Finally, we acknowledge and deeply appreciate the dedication, effort, and collaboration of every member of the research team. Each individual's specialized contributions played a vital role in completing this project.

To everyone who supported and guided us along the way, thank you.

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EPASADYA: AN E-COMMERCE SYSTEM WITH PRODUCT CUSTOMIZATION FOR GAWANG GAMAT

AUDREY LYNNE L. CASTRO., MABALACAT CITY COLLEGE
JAIRHA L. CORTEZ., MABALACAT CITY COLLEGE
AREL LOISEL R. GUILAS MABALACAT CITY COLLEGE
KYLA KARYLLE SAGCAL., MABALACAT CITY COLLEGE
ALECKZANDRA M. TIAMZON, MABALACAT CITY COLLEGE
ERNIE LEE E. PINEDA (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT
Digital commerce has significantly reshaped the global business landscape, requiring traditional enterprises to adapt to evolving consumer demands and increasing competition. This study presents ePasadya, an e-commerce system designed for Gawang Gamat, a shop integrating traditional handicrafts with electronic retailing. The platform enhances operational efficiency by enabling product customization, improving customer satisfaction, and fostering stronger connections between artisans and consumers. It bridges the gap between handmade goods and digital markets, demonstrating the feasibility of integrating traditional businesses into e- commerce. The development of ePasadya used the Waterfall Model, following a structured system development lifecycle. Back-end technologies, such as PHP and MySQL, ensured robust database management and server-side functionality, while front-end tools, including HTML, JavaScript, and Tailwind CSS, provided a seamless and intuitive user experience. Clearly defined roles for administrators, sellers, and customers ensured efficient order management and secure transactions. Testing outcomes highlighted commendable system performance, with satisfaction scores of 4.30 in alpha testing and 4.64 in beta testing. These results reflected notable advancements in functional suitability, usability, and security. By aligning with Sustainable Development Goals, ePasadya fosters economic growth, cultural preservation, and digital innovation within Mabalacat City, serving as a transformative model for empowering artisans and advancing traditional businesses in the digital era.

Keywords: Information System, Web System, E-Commerce System, Ordering System

INTRODUCTION

The increasing use of communication and online platforms has led to an instant shift in the global business landscape. In this development, literature on e-commerce has been analyzed to identify emerging trends and possibilities that are changing the context of global competition by creating new opportunities and intensifying competition as more businesses enter the market (Mofokeng,T.E.,2021).

E-commerce involves the online buying and selling of goods or services by individuals or businesses. This happens through various channels such as smartphone apps, websites, social media platforms, or online marketplaces, as long as there is an internet connection. Examples of e-commerce activities include online shopping, electronic payments, auctions, and internet banking. Sellers aim to boost their online sales through digital marketing techniques (Winter, 2024).

E-commerce has been rapidly evolving due to automation and artificial intelligence, making operations smoother and enhancing customer experiences. Multi-channel integration plays a big role in this transformation, offering a seamless shopping experience across various platforms and helping businesses reach more customers while building stronger brand loyalty.

According to Chevalier (2024), as reported by Statista, global ecommerce sales exceeded $4.2 trillion in just one year, underscoring the profound influence of digital technology on people's daily lives. In 2023, the portion of retail sales conducted online in the United States reached 22.0%, up from 21.2% in 2022. This data came from an analysis by Digital Commerce 360 of information provided by the U.S. Department of Commerce (Haleem, 2024). These statistics indicate the increasing prevalence of online retail transactions, reflecting a consistent upward trend in consumer engagement with e-commerce platforms.

The emergence of local businesses within the digital realm has been constantly evolving. It has become essential, especially in light of evolving technology. This integration presents both challenges and opportunities for local businesses to adjust or risk falling behind in the rapidly evolving digital market, which is characterized by increased competition and the possibility of reaching a larger audience. The efficiency it brings reshapes the way businesses operate and interact with customers, impacting small-scale businesses and bringing communities closer together (Chaffey & Ellis-Chadwick, 2019).

Product customization has become the new trend in e-commerce. Taking advantage of this, ePasadya offers products that are customized to meet the demands of the customer, increasing its uniqueness and customer loyalty. On the other hand, growing

competitiveness and the development of the digital divide present a challenge. ePasadya needs to continue developing constant innovation and responsiveness to this dynamic digital environment as larger enterprises capitalize on the advantages of new technology, allowing it to more effectively meet the specific desires and preferences of its customers
This product customization not only enhances the overall consumer experience but also boosts brand loyalty and satisfaction among consumers. An increasing number of online retailers—including well-known brands like Nike—have started to incorporate product personalization and customization into their marketing strategies. This is because it allows customers to select extras and elements that better reflect their preferences and identity than the mass-produced original product could (Murdock, 2021)
ePasadya operates as a customizable gifts shop that merges traditional Filipino craftsmanship with online entrepreneurship to meet the demands of a rapidly evolving digital market. By offering customizable products that reflect local culture, the business has been able to adapt to consumer preferences while leveraging technology to streamline operations. Despite the challenges posed by increased competition and the need for constant innovation, ePasadya has maintained its authenticity and commitment to sustainability, which has been the key to its resilience in a competitive environment. Eventually, ePasadya plays a significant role in promoting local craftsmanship, although there are hurdles in growing the business to ensure its long-term sustainability. Moreover, despite their efforts to establish a digital presence through Facebook and Instagram, small enterprises face challenges. While these platforms have enabled them to compete with larger corporations, they are often overcrowded, making it difficult for smaller brands to stand out among the more popular ones.
The researchers proposed the development of ePasadya: An E- commerce System with Product Customization, which is designed to optimize operations and provide a quality experience for customers while also enhancing work efficiency for Gawang Gamat.

Objective of the Study

The general objective of the study is to develop an e-commerce website entitled “ePasadya: An E-commerce System with Product Customization for Gawang Gamat.” It aims to create a website that enhances the customer experience and provides a smoother and more efficient working experience for the owner of ePasadya. Tools."+-
In line with this, this study aimed to achieve the following specific objectives:

- To gather information on optimizing online presence and customer satisfaction through interviews, articles, and published books and journals.
- To identify and specify the required hardware and software tools for developing the system platform. The hardware requirements included a laptop, while the software requirements consisted of Canva, Figma, Visual Studio Code, XAMPP, and Composer.
- To design the system using visual and analytical tools, such as a Storyboard, Visual Table of Contents, Use Case Diagram, and Gantt Chart, to ensure proper planning and development.
- To develop the front-end and back-end system interfaces using JavaScript, Tailwind CSS, and HTML for the front end, and PHP and MySQL for the back-end, ensuring robust functionality and seamless user experience.
- To create system features and functionalities tailored for specific user levels. The Administrator can create and manage categories, view and generate sales reports, manage products and orders, receive feedback, create and manage accounts, access the activity log, manage account information, and archive users, products, and categories. The Seller can view and generate sales reports, manage products and orders, and handle product archives and account information. The Buyer can browse products, add items to their cart, customize products, proceed to checkout, write feedback, manage account information, and rate products. Guest users are provided with functionalities such as product browsing and writing feedback.
- To test the system through Alpha and Beta testing to ensure functionality, compatibility, and usability.
- To evaluate the system's performance based on ISO 25010 criteria, including functional suitability, compatibility, interaction capability, security, and flexibility.
- To deploy the website using Hostinger as the web domain repository site.

Each specific objective contributed to the successful development, testing, and deployment of the ePasadya platform. Collectively, they formed a comprehensive approach to achieving the study's primary goal of enhancing the online presence and customer satisfaction for Gawang Gamat.

METHODOLOGY

The research employed the Modified Waterfall Model, a structured yet flexible approach that facilitated iterative refinements at each development stage. This

approach ensured adaptability to user feedback and addressed challenges effectively (see Figure 1). The process began with gathering requirements, which established the foundation of the system through interviews, online research, and feedback from key stakeholders. The feedback from the business owner, potential users, and other stakeholders guided the evolution of initial concepts to address a wide range of e-commerce use-case scenarios.

The system's design utilized tools such as Storyboards, Visual Tables of Contents, Use Case Diagrams, Entity Relationship Diagrams (ERD), and Gantt Charts to visualize the user interface, functionality, and workflows. These tools provided clarity, ensured alignment with business and user needs, and supported effective project management. Visual Studio Code was used as the integrated development environment (IDE), while Laravel and MySQL were employed for backend development and database management, respectively.

The ePasadya platform was incrementally developed, incorporating features such as product listing management, shopping cart functionality, secure payment processing, order tracking, and user management. Designed specifically for an e-commerce context, the system ensured robustness and scalability through continuous refinement, guided by testing and feedback from various user groups.

The researchers conducted alpha testing with IT experts to identify bugs and vulnerabilities, followed by beta testing with 30 users, including customers and the business owner, Ms. Camille Jane E. Jocson. Feedback from both testing phases was collected and analyzed, ensuring that the system met the needs of both end- users and administrators.

The system was evaluated using the ISO 25010 Software Quality Model, focusing on key quality attributes such as Functional Suitability, Compatibility, Security, Interaction Capability, and Flexibility. Descriptive statistics were used to analyze feedback and assess overall system performance and user satisfaction.

After deployment, the system was monitored using key metrics, including user feedback, usage statistics, and performance data. Continuous updates and improvements were planned to ensure the platform's reliability and adaptability to evolving business needs.

The Modified Waterfall Model provided a structured yet iterative framework, enabling the development of ePasadya as a reliable and effective e-commerce platform that is tailored to meet the needs of online shoppers and business administrators alike.

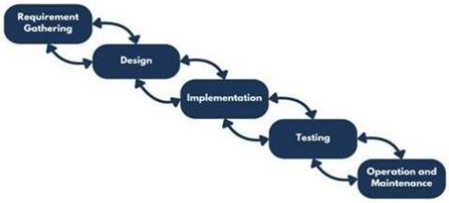

Figure 1: The Modified Waterfall Model

Requirements

The requirements gathering phase identified essential hardware components, including a desktop computer, tablet, and mobile phone to facilitate system development and testing across multiple platforms. The software requirements included Laravel 11 for server-side operations, Tailwind CSS v3 for a responsive, utility-first user interface, and MySQL 9 for database management.

In addition to these core technologies, PHP 8 was used for backend development, and Node.js 20 managed project dependencies. For the development environment, Visual Studio Code was used as the integrated development environment (IDE), with version control managed through Git.

To facilitate user interaction, the system incorporated Canva and Figma. Canva was employed for creating mockups and visual assets, while Figma was used for wireframing, prototyping, and tools ensured a seamless and collaborative design process, helping to visualize the system's user interface and layout effectively. These hardware and software components ensured a versatile, efficient, and collaborative environment for developing the ePasadya system.

Design

The ePasadya system integrates inputs, processes, and outputs to create a cohesive and user-focused e-commerce platform. Inputs include business requirements such as product management, order tracking, payment gateway integration, and customer preferences, with a focus on ease of navigation, efficient product search, and a seamless checkout process.

The processes involve detailed system requirements analysis, design, and iterative development. These steps ensure that the platform incorporates essential features such as centralized product listings, an intuitive shopping cart, secure payment integration, and an administrative dashboard for inventory and order management. A key feature of the platform is its customization options, which allow customers to personalize products (such as engraving, color selections, or size adjustments) based on their preferences. This feature enhances the customer

experience by providing tailored products that better meet their individual needs.

The system architecture consists of a secure and scalable database that handles user accounts, product listings, orders, and payments. The user interface is designed to be responsive and intuitive, ensuring a seamless experience for users across both desktop and mobile devices. The customization feature is integrated into the product pages, enabling users to interact with and personalize their selected items before completing their purchase. The administrative backend allows business owners to efficiently manage products, including customization options, track orders, and monitor user activity, simplifying the operational aspects of the platform.

By integrating these features, the ePasadya system transitions traditional retail models to a robust, digital e-commerce platform that enhances the customer shopping experience with personalized products and optimizes business operations.

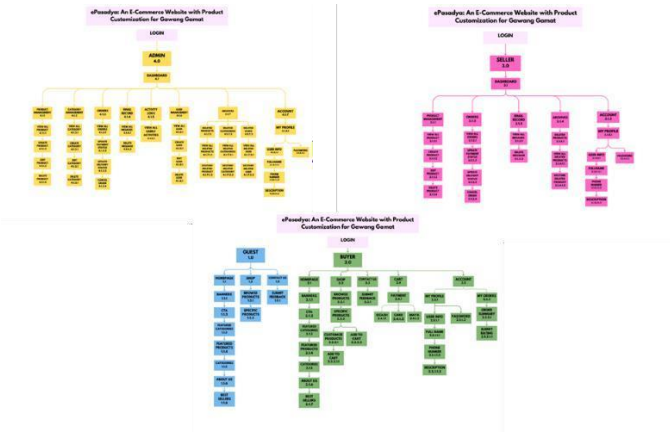

Figure 2: Modified Visual Table of Contents Diagram

Development

The development phase of the ePasadya system involved the use of various analysis tools and diagrams to guide the system's creation. Storyboards were created to visually represent the user interface and application flow, helping the development team align their efforts with user expectations.

Storyboard - User outlined interactions specific to regular users, such as browsing products, adding items to the cart, and completing orders. Storyboard – Admin depicted the administrative user flow, illustrating functionalities such as managing product listings, tracking orders, and monitoring user activity. Storyboard – Seller detailed interactions for sellers, such as adding and updating product listings, managing inventory, and processing orders. Storyboard – Guest showcased the flow for guest users, who can browse products, view pricing, and register or log in for further actions like making a purchase. These visual aids facilitated clarity in interface design and system functionality, ensuring an intuitive experience for all user roles—Admin, Seller, User, and Guest.

The Home Page design (see Figure 3) was carefully planned to provide users with a centralized hub for accessing all system features. It offered seamless navigation to key areas, such as products, cart, and account settings, ensuring users could efficiently engage with the platform's offerings. Administrators were equipped with robust tools on the Home Page to manage system operations, ensuring comprehensive oversight and control.

Visual Studio Code served as the primary integrated development environment (IDE) for designing and coding the platform. The interface was crafted using modern frameworks, including Tailwind CSS v3 for styling. Laravel 11 and MySQL ensured a secure, scalable, and efficient back-end. Throughout the development process, iterative testing was conducted to refine features and guarantee they met the specific needs of users.

The final platform integrated business tools and user functionalities seamlessly, providing customers with an efficient and secure e-commerce experience. The system was designed to enhance shopping experiences and support business operations, equipping administrators with tools for effective system management.

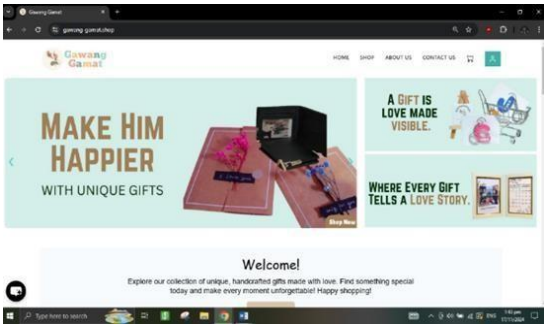

Figure 3: Home Page

Testing

The testing phase of ePasadya was comprehensive and methodical, employing multiple testing approaches to ensure functionality, reliability, and user satisfaction. Alpha and beta testing formed the core of the evaluation process, involving iterative refinement and feedback collection.

Sampling was conducted using homogeneous purposive sampling to focus on participants who shared specific characteristics relevant to the system. This included thirty (30) consumers from the local community and Ms. Camille Jane E. Jocson, the proprietor of a gift shop, who provided valuable insights from a business perspective. Additionally, three IT professionals were selected to

participate in the alpha testing phase, offering expert evaluation on system performance and security.

During alpha testing, the three IT professionals rigorously examined the system to identify bugs, vulnerabilities, and areas for improvement. Their feedback informed several refinements to ensure a stable and functional platform before beta testing commenced.

Beta testing involved a subgroup of thirty (30) consumers, who tested the system's e-commerce and product customization features. Feedback was collected using structured questionnaires designed to assess key aspects of the system, including usability, functionality, and overall satisfaction.

To measure the system's quality, the researchers adopted the ISO 25010 software quality product model. This framework evaluated critical attributes such as functional suitability, performance efficiency, reliability, security, and usability. Data gathered during the beta testing phase indicated high levels of user satisfaction and system performance, confirming the platform's readiness for deployment.

The systematic testing approach ensured that ePasadya effectively addressed the needs of its intended users, delivering a reliable and user-friendly solution. The evaluation process incorporated a 5-point Likert scale to assess various aspects of the system. To evaluate the system, the following 5-point Likert scale was used:

Table 1: Likert Scale used by the Researchers

Response Categories	Numerical Value	Range Interval	Verbal Interpretation
Strongly Agree	5	4.21 - 5.00	Excellent
Agree	4	3.41 - 4.20	Good
Neutral	3	2.61 - 3.40	Acceptable
Disagree	2	1.81 - 2.60	Marginal
Strongly Disagree	1	1.00 - 1.80	Poor

Deployment

The system, ePasadya, was deployed through web hosting via Hostinger, utilizing its reliable services to make the website live and accessible. A domain was registered, ensuring that the platform could be accessed online through web browsers. The website became fully operational, allowing users to visit it from any device capable of connecting to the internet. The platform supports the required/recommended Windows versions 7, 10, and 11, ensuring compatibility across a range of devices.

Maintenance

Regular maintenance procedures were implemented to ensure the ongoing reliability and performance of ePasadya. After the verification stage, the website was hosted on Hostinger, where it underwent frequent updates, bug fixes, and feature improvements. This phase focused on resolving technical issues, updating product listings and pricing, and enhancing the overall user experience.

Maintenance also involved monitoring user feedback, detecting security issues, and tracking website performance to identify areas for improvement. Daily operational tasks, such as managing orders, updating products, and providing customer service, were carried out to ensure smooth business operations. Furthermore, the maintenance process included crucial activities like data backup, domain management, and website hosting, all aimed at keeping the website available and fully functional.

RESULTS

The website platform interface was evaluated during the alpha testing phase using the ISO 25010 software quality standards, focusing on Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The evaluation, conducted with three IT experts on September 27, 2024, demonstrated excellent performance across all criteria.

Table 2: Summary of Alpha Test Results

ISO25010 Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.40	Excellent
Compatibility	4.21	Excellent
Interaction Capability	4.14	Excellent
Security	4.33	Excellent
Flexibility	4.30	Excellent
Overall Mean Score	**4.30**	**Excellent**

The alpha test results demonstrated solid performance across all evaluated criteria, with an overall mean score of 4.30, interpreted as "Excellent." The highest score of 4.40 was achieved in Functional Suitability, indicating strong system performance in fulfilling user needs. The Security criterion scored 4.33, reflecting robust security measures, while Flexibility and Compatibility also achieved excellent ratings with scores of 4.30 and 4.21, respectively

Following the alpha testing phase, significant improvements were made based on the feedback collected. A comprehensive evaluation of the website platform interface was conducted during the beta testing phase, focusing on the same ISO 25010 criteria. The beta test took place with thirty (30) consumers, showcasing notable improvements from the alpha phase.

Table 3: Summary of Beta Test Results

ISO25010 Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.73	Excellent
Compatibility	4.60	Excellent
Usability	4.70	Excellent
Security	4.55	Excellent
Overall Mean Score	**4.64**	**Excellent**

The beta test results demonstrated significant improvements, achieving an overall mean score of 4.64, interpreted as "Excellent." Functional Suitability scored 4.73, reflecting enhanced system functionality. Usability also showed significant improvement, with a score of 4.70, indicating a user-friendly interface. Security received a score of 4.55, reinforcing the system's strong security features. The overall performance across all criteria highlights the platform's improvements, with higher scores indicating better usability, security, and functionality compared to the alpha testing phase.

In conclusion, the beta test results reflect substantial advancements in the platform's capabilities. The system demonstrated excellent usability, robust security, and strong functional suitability, confirming its readiness for deployment and ability to meet user expectations effectively.

DISCUSSION

The development of ePasadya, an e-commerce platform with product customization, aimed to provide consumers with a seamless and personalized shopping experience. This study sought to address gaps in existing e-commerce systems by offering a user-centered platform that not only focuses on product variety but also empowers users to tailor their purchases according to their preferences. The research identified the challenges customers face in current online shopping experiences, such as limited customization options and inefficient user interfaces. Based on these insights, the researchers designed ePasadya to enhance the overall shopping experience for both customers and administrators. The platform was tested with consumers from Mabalacat City, including the store owner, to gather valuable feedback that guided the system's design and functionality.

The study concluded that ePasadya successfully provides a secure, interactive, and user-friendly online shopping experience. Features such as secure payment gateways, easy product customization, and personalized recommendations ensure that the platform not only meets customer expectations but also promotes a secure shopping environment. These features, combined with the intuitive design, contribute to high customer satisfaction and make shopping more engaging and enjoyable. The system is designed for ease of use, benefiting both consumers and store administrators. Customers enjoy a seamless and customized shopping experience, while administrators benefit from efficient inventory management, order tracking, and content updates. Additionally, features like product recommendations, personalized offers, and customization options further enhance customer engagement, leading to higher retention and satisfaction.

To further enhance the platform, ePasadya could incorporate additional features such as advanced filtering options, augmented reality (AR) for virtual product previews, and AI-driven personalized shopping assistants. Improving security by integrating more authentication methods, such as biometric verification or two-factor authentication, would provide added protection and convenience for users. The platform could also benefit from incorporating advanced analytics to monitor customer behavior, product popularity, and purchase trends, which would help administrators optimize product offerings and marketing strategies. Furthermore, integrating social media sharing features and customer reviews could foster a sense of community and encourage peer-based recommendations, which would likely improve trust and engagement.

By addressing these future enhancements, ePasadya can evolve into a more comprehensive, secure, and engaging platform, continuously adapting to the needs of its customers while providing an enhanced and customized shopping experience.

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HAPPYTEETH: A WEB-BASED APPOINMENT SYSTEM FOR OCAMPO DENTAL CLINIC

ADRIAN C. DAIZ, MABALACAT CITY COLLEGE
CASANDRA KHRISTYN T. AGUILAR, MABALACAT CITY COLLEGE
NIKKI MAE P. MAGLALANG, MABALACAT CITY COLLEGE
PRINCE MENDOZA, MABALACAT CITY COLLEGE
JOASH FALUTA PATAWARAN, MABALACAT CITY COLLEGE
DESSA LYN J. DE CASTRO (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT
As people grow increasingly aware of the role of oral health in general well-being, there is a growing demand for easily available dental treatment. As technology evolves, integrating digital solutions such as online appointment systems has become essential in modernizing dental practices. This study's purpose is to develop and implement a web-based appointment system called "Happy Teeth" for Ocampo Dental Clinic. Simplifying the process of making appointments, including secure payment processing, and digitizing the system of patient record management are the objectives, with the intent to achieve efficient operations, increased patient satisfaction, and accessible, transparent, and high-quality dental care. The research's purpose is to minimize overbooking problems and eliminate administrative burdens through the secure e-wallet payment option and patient records digitization. These features collectively enhance operational efficiency and patient satisfaction. It improves the clinic's workflow, provides accessible and convenient services for patients, and ensures transparency through automated notifications and detailed records. The system was developed using the Modified Waterfall Methodology or SDLC and tested based on ISO 25010 standards, achieving an alpha test score of 4.06 and 4.18 for the beta test. The results demonstrate effectiveness in functional suitability, compatibility, usability, security, and portability. Guaranteeing reliability and user-friendliness for both dental staff and patients. The system was aligned with the Sustainable Development Goals (SDG) Goal 3, Goal 9, and Goal 16. That way, it has been able to ensure that access is fair to high-quality dental services, operations are updated in the clinics, and transparency is improved through secure, systematic data management.

Keywords: Web-based Application; Appointment System, Web System, Information System

INTRODUCTION

In the modern world, technology plays a critical role in understanding the practical purposes of human life. It has become ingrained in daily routines and has influenced communication and online engagement. We now live in an era where technological advancements have made life more convenient and efficient. These advancements enhance productivity, collaboration, and innovation across industries, from healthcare to client interaction, contributing to success in the modern workplace (Smith, 2022; Johnson & Lee, 2021).

In the community, technology catalyzes innovation, reshaping diagnosis, treatment, and patient care. It is now integral to every aspect of healthcare and related facilities, significantly improving efficiency, accuracy, and accessibility. In the digital era, constructive collaboration between healthcare and technology not only streamlines processes but also empowers healthcare practitioners to provide personalized, timely, and effective interventions. This collaboration is poised to transform the future of medicine, enhancing patient outcomes on a global scale (Smith & Taylor, 2022; World Health Organization, 2021).

The practice of dental medicine is a vital component of the healthcare system, focusing not only on treating dental issues but also on promoting preventive measures to maintain long-term oral health. Dental clinics cater to patients of all ages, offering services ranging from routine cleanings to complex restorative treatments, thus ensuring comprehensive care (Smith et al., 2020; American Dental Association, 2021).

In modern dentistry, some clinics continue to rely on traditional appointment methods, requiring patients to visit clinics in person, fill out forms, and wait for extended periods despite arriving early. Traditional systems often involve phone bookings through a

receptionist or staff or walk-ins on a first-come, first-served basis. However, many clinics have embraced online booking systems, enabling patients to schedule appointments through websites, access service details and pricing, review dental records, and confirm appointment times. These systems streamline clinic operations by reducing wait times, enhancing workflow efficiency, and ensuring patients receive timely and personalized care (Johnson et al., 2021; American Dental Association, 2020).

Objective of the Study

The general objective of this study is to develop an efficient appointment system that has payment and dental history entitled "Happy Teeth: A Web-Based Appointment System for Ocampo Dental Clinic," tailored to the needs of Ocampo Dental Clinic. This system aims to streamline appointment scheduling processes, improve patient convenience, and enhance overall clinic efficiency. By leveraging technology to digitize appointment management and payment processing, the system seeks to optimize resource utilization, reduce wait times, and improve patient satisfaction. Additionally, the system aims to provide a user-friendly experience for both patients and clinic staff, contributing to a more seamless and effective dental care experience.

The study's general objective was to develop a Web-Base appointment System for Ocampo Dental Clinic. In line with this, this study aims to achieve the following specific objectives: To gather information about the dental clinic services from the owner of Ocampo Dental Clinic, as well as from journals, books related to the system, and studies, through interviews and surveys.To identify the hardware and software specifications required for the development of the system.

To design the system using analysis tools:

- Storyboard
- Use Case Diagram
- Visual Table of Contents
- Website Map

To create user-level access using both front-end and back-end systems.

To develop a system with the following features:

- Online appointment system for clients.
- Guest page
- Information on dental health
- Product and service prices with time duration
- Real-time chat with a dentist for inquiries
- Social media hyperlinks (Facebook, Instagram, Email)
- Google Maps location of Ocampo Dental Clinic
- Register/Login
- Two access levels:
    - Admin
    - Client

To integrate the following user-level functions:

- Administrators:
    - Manage user accounts and roles
    - Appointment verification management
    - Dental history records management
    - Payment verification and financial management
    - Admin dashboard and content management
    - Notifications and reminders
    - Export patient records
- Users:
    - Account creation and profile management
    - Appointment scheduling
    - Secure payment processing
    - Cancel booking
    - View and access dental history records
    - Notifications and reminders

To test the system through Alpha and Beta testing.

To evaluate the system using the Software Product Quality standards of ISO 25010 in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.

To deploy and implement the system to the web hosting site:

- Hostinger

Scope of the Study

This study focuses on creating a web-based appointment system called "Happy teeth" for Ocampo Dental Clinic. The system aims to make appointment scheduling easier and more convenient for patients while improving the clinic's overall operations.

The target users of the system include the clinic's administrative staff and patients. The system will provide features such as real-time appointment scheduling, secure payment options via e-wallet, and access to patient dental records. Administrators will have tools for managing user accounts, verifying appointments and payments, and accessing patient records. The system will be accessible on desktop and mobile devices, ensuring convenience and usability across platforms.

The "Happy Teeth" System requires specific hardware and software to ensure its functionality and efficiency. For hardware, the system is designed in a desktop computer with at least an Intel i5 10th Gen processor, 8 GB of RAM, and 500 GB of SSD storage. It is also compatible with tablets and mobile phones capable of running modern web browsers such as Chrome, Safari, or Edge. A stable internet connection is necessary for seamless access to the

system. The software requirements include Visual Studio Code for coding for development. The system uses programming languages such as HTML, CSS, TypeScript, and CSharp for front-end and back-end development. For design, Canva and Sketchbook are utilized to create graphics and interface visuals.

The researchers implemented a range of analytical tools to adopt a systematic methodology in the design and development of "Happy Teeth: A Web-Based Appointment System for Ocampo Dental Clinic." Among these tools is the Use Case Diagram, which outlines the interactions between users and the system and depicts the flow of data throughout the system. Furthermore, a Visual Table of Contents was utilized to hierarchically arrange the system's features, alongside a Storyboard that was created to design and represent the user interface. These instruments played a crucial role in converting user requirements into a coherent framework, thereby facilitating the development of an effective and user-centric appointment system.

Two user roles were established by the researchers which are the “Admin and User”. User roles offer personalized features for clinic staff and patients receiving treatment. The admin role provides thorough monitoring of system management, including managing user accounts, validating appointments, accessing dental history records, and processing payments. At the same time, the user role allows patients to sign up, schedule appointments, complete secure transactions, and access their dental records. This two-tiered system enhances system security, user convenience, and clinic operations effectiveness by granting each user group appropriate permissions and access to relevant features.

The registration function guarantees a safe and easy process for setting up patient accounts on the Happy Teeth platform. Guest users are welcome to browse the website to find information about the clinic's location, office hours, and services. Nevertheless, to schedule appointments, patients must first sign up and validate their accounts through an email confirmation process. Adding this extra step boosts security, guarantees the accuracy of patient information, and enhances user experience. The registration process requires patients to provide the following details: first name, last name, email address, mobile number, password, and confirm password. After completing the registration form, the system automatically sends a confirmation email to the provided email address. Patients must click the URL in the email to verify and activate their account before gaining full access to features such as booking appointments and viewing their dental history.

The service page allows patients to view the dental treatments available, such as dental cleaning, tooth extractions, and other services, and their prices. It offers new patients the chance to compare rates from other clinics and appreciate the services offered by the clinic. Also, the patients get a chance to choose any service at any given appointment time, hence making an easier approach to dental care planning.

The system offers an appointment feature that enables patients to conveniently book, manage, and cancel their appointments online through an intuitive interface. Patients can easily check available dates and times, choose their desired schedule, and receive confirmation through email or SMS notifications. For administrators, the system facilitates effective management of appointment schedules, allowing them to verify bookings and keep track of clinic capacity to prevent overbooking. This functionality promotes efficient scheduling, minimizes waiting times, and enhances patient satisfaction by delivering a straightforward and accessible appointment experience.

The system’s scheduling function distinguishes between appointments made online and walk-in appointments. Patients can use the system to schedule their preferred date and time for online appointments, but same-day bookings are not allowed. Online appointments are scheduled to start the next day to give the clinic time to prepare and organize resources. Once patients submit the online appointment form, it must first be approved by the clinic administrator. Only after approval will the appointment be confirmed, and patients will receive a notification via email or SMS. The system enables the clinic's administrator or dentist to schedule patients for the same day if there are available slots for walk-in appointments. This guarantees the ability to adapt to patient needs quickly while still following an organized scheduling system. The system maintains a balance between accommodating patients who schedule appointments online and attending to walk-in patients in need of same-day services by categorizing appointments.

The system contains a payment feature that is both secure and convenient, making booking easier and enhancing clinic operations. Patients have the option to make online payments using an integrated e-wallet service that guarantees a quick and easy transaction process. Utilizing online payment boosts the dental administrator's approval rate for appointments and decreases the probability of cancellations. After successfully scheduling an appointment and making an online payment, the patient will receive a confirmation receipt via email for their records. The clinic offers services at a set price, regardless of the tooth's condition or the procedure's complexity.

Administrators can add, modify, or remove services as necessary to make sure the clinic's system accurately shows current offerings and prices. If the

dentist is unable to provide the scheduled service, such as for complex procedures needing extra tests like X-rays, the appointment can be canceled by the administrator. In these cases, the system enables the patient to receive a refund, guaranteeing transparency and upholding trust. The integration of these features allows the payment system to improve patient convenience, simplify clinic workflows, and guarantee fair and efficient management of service cancellations, refunds, and service handling.

The "Contact Us" page on HappyTeeth serves the purpose of providing users with essential contact information, such as the clinic's address, phone number, email, and working hours. Additionally, the website features a user-friendly contact form that allows patients to submit inquiries, feedback, or appointment-related concerns directly on the page. This functionality ensures smooth interaction between the clinic and its clients, fostering a responsive and customer-oriented experience. When a user submits a message through the contact form, it is automatically directed to the admin's inquiry system for efficient handling. Once the admin responds to the patient's question, the reply is sent to the patient's Gmail account, ensuring smooth two-way communication.

The site also provides an easy-to-use map to help patients locate the clinic, making it more accessible. Furthermore, the page supports the system's goal of delivering effective, patient-centered services with clarity, accessibility, and functionality.

The dental record system simplifies tracking patient histories for the clinic. It enables admin staff to upload various files, such as X-rays, medical certifications, and other documents, directly into the patient's records and provides access to appointment details. Additionally, the system allows for the creation and saving of digital prescriptions, ensuring that all patient data is carefully organized and readily available for future use.

The admin dashboard in the HappyTeeth system acts as a central hub for managing the clinic's operations. It allows the admin to view the number of registered users, access patient records, and monitor pending appointments in real-time. The dashboard also includes a sales report feature that provides financial insights. Admins can securely access this report by entering a password and filtering data based on specific periods, ensuring accurate and customized tracking of clinic performance.

The sales report feature, which requires a password, ensures that only the clinic owner can view financial details, enhancing security and confidentiality regarding information access at the clinic. This feature enables the owner to analyze and sort sales data by selected time intervals, gaining insights into the clinic's revenue trends over time. To ensure accuracy, the sales data is included in the report once appointments are marked as "done" by the administrator. Furthermore, the sales report can be hidden after the owner finishes reviewing it, ensuring that confidential financial information remains secure and inaccessible to unauthorized individuals. This approach helps minimize reporting errors and provides a method for tracking completed transactions and evaluating the clinic's financial success.

The notification feature keeps patients informed about appointment confirmations, reminders, and cancellations via email and SMS. It also sends electronic receipts to patients after online payments. Admins receive alerts for new inquiries, appointment requests, and pending tasks, ensuring timely communication and streamlined operations.

Limitation of the Study

The study identifies several limitations inherent in the development and deployment of the appointment and payment system for the Ocampo Dental Clinic. Firstly, the system's effectiveness may be contingent upon stable internet connectivity, potentially posing challenges for users in areas with limited or unreliable internet access. Secondly, there exists a possibility of susceptibility to cyber threats, emphasizing the need for regular security updates and vigilant monitoring to mitigate potential risks. Moreover, the extent of customization available to users may be constrained by the predefined templates and features offered by the selected development tools and platforms. Additionally, the initial testing phase is limited to a small sample of users, overlooking the diverse needs and varying technical competencies within the patient community. It is essential to gather feedback from a more extensive user base to ensure inclusivity and address a broader spectrum of user requirements adequately.

Furthermore, the implementation of the system may be hampered by the technical proficiency and resources available to the development team, potentially influencing the breadth and complexity of features that can be incorporated. The integration of new technologies and tools is subject to compatibility issues with existing infrastructure and the learning curve associated with their adoption, potentially impacting the overall acceptance and utilization among clinic staff and patients. Lastly, the system cannot ensure that dental treatments will be completed within the time outlined in the appointment schedule. Challenges with the treatment, unforeseen issues that arise during the process, or complications related to the patient can extend the time required beyond what was planned. As a result, patients may experience longer wait times because the system cannot guarantee that

each service will be finished precisely within the allotted time.

Despite these recognized limitations, the study endeavors to deliver a functional and user-centric system that caters to the primary needs of Ocampo Dental Clinic, with a commitment to continual enhancement based on user feedback and advancements in technology.

METHODOLOGY AND DESIGN

The software development life cycle method the proponents created the modified waterfall model. The Modified Waterfall Model offers a systematic flow of development processes with some flexible, iterative phases that give enough documentation and design evaluations to ensure the application's quality, consistency, and maintainability the proponents had built.

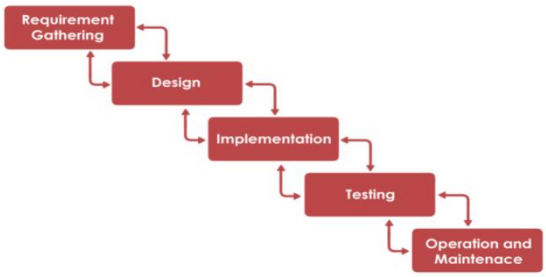

Figure 1: The Modified Waterfall Model

Requirement Gathering

The proponents collaborated to gather requirements and insights for the development of the appointment scheduling and payment system for Ocampo Dental Clinic. This process involved brainstorming sessions, discussions, and interviews with clinic staff and patients to understand their needs and preferences. Surveys were conducted to gather feedback on the desired features and functionalities of the system. Additionally, consultations were held with relevant stakeholders, including dental professionals and IT experts, to ensure that the system met the clinic's requirements and aligned with industry standards.

In terms of technology, the proponents utilized development software tools such as Visual Studio Code for coding and local server testing. The system was developed using HTML, CSS, C#, TypeScript, and Rider.net for the back-end and front-end components. Hardware requirements included a desktop computer with specified specifications, including an Intel i5 10th Gen processor, 8 GB RAM, and a 500 GB SSD. Graphic design tools such as Visual Studio were used for designing assets. The database management system (DBMS) was hosted on GitHub.io for real-time updates and seamless integration. The requirement-gathering process ensured that the appointment scheduling and payment system met the needs of Ocampo Dental Clinic and provided a user-friendly experience for both clinic staff and patients.

Design

In this phase, the proponents utilize a specific set of analysis tools and diagrams tailored to design and develop the appointment scheduling and payment system for Ocampo Dental Clinic. These tools include the Use Case Diagram, Website Map, Visual of Table Contents, and Storyboard.

Implementation

During the implementation phase, the proponents focused on translating the design specifications into a functional appointment scheduling and payment system for Ocampo Dental Clinic. This phase involved the actual development and coding of the system, as well as the integration of necessary software components and features.

Using the design specifications outlined in the previous phase, the proponents began by creating the necessary database structure based on the Entity Relationship Diagram. This involved setting up tables and relationships to store patient information, appointment details, and service records effectively.

Next, the proponents proceeded to develop the user interface and back-end functionality of the system based on the Storyboard and Use Case Diagram. Front-end development involved designing user-friendly interfaces for patients to schedule appointments and make payments, while back-end development focused on implementing the logic and processes required to handle appointment requests, process payments securely, and update the database accordingly.

The Data Flow Diagram guided the implementation of data flow processes within the system, ensuring that information was routed correctly between different components and modules. This involved developing APIs and integration points to facilitate seamless communication between the front-end and back-end of the system.

Throughout the implementation phase, the proponents adhered to coding best practices and standards to ensure the reliability, scalability, and maintainability of the system. Regular testing and debugging were also conducted to identify and address any issues or bugs that arose during development.

By the end of the implementation phase, the appointment scheduling and payment system for Ocampo Dental Clinic was fully developed and ready for deployment, marking a significant milestone in the project's progress.

Testing

The developed system was evaluated after a preliminary assessment in the testing phase. The researcher used various testing tools for the study,

including unit, integration, system, and alpha and beta testing. Before being prepared for administration, the validity of the questionnaire was also evaluated during the testing phase. The procedures for acquiring, analyzing, and processing the data, along with the sampling method and instruments used, were covered.

Operation and Maintenance

Upon concluding the verification phase, the operation and maintenance phase commenced for the web-based clinic appointment system. The application was deployed on the designated web domain hosted by Githubpages, while the administrator panel was made accessible through the same domain, streamlining accessibility for both users and administrators. This setup provided a convenient platform for reporting any issues or proposing enhancements for future iterations of the system. Leveraging analytics tools, the proponents monitored various metrics, such as application installations, user feedback, and system performance, to assess user satisfaction and pinpoint areas for enhancement. Furthermore, regular updates and maintenance checks were scheduled to ensure the system's compatibility with various web browsers and promptly address any emerging issues.

RESULTS

This section contains the research goals, the study conducted, and the analysis of the discussions and conclusions achieved with the help of the working system. The results and deductions based on the study objectives are described in this section. Also, the researchers' perspective and evaluation of the beta testing are provided below this chapter. The researchers have carefully analyzed the findings and implications. The researchers' present task is to compile a report outlining the study's conclusion. The required data will be collected and processed. The results of the investigation must be explained logically and understandably. The design, development, and testing of websites are the main topics of this study. Additionally, the research produced for the project HappyTeeth: A Web-Based Appointment System for Ocampo Dental Clinic.

Alpha Testing Result

The results were presented using the frequency and percentage tabular presentations for the alpha testing. The researchers successfully achieved alpha testing by administering a web-based system and collecting the alpha questionnaires from three (3) I.T. expert respondents. The testers were Mr. Magsino Ariel C., Senior Full Stack Web Developer; Mr. Japee B. Patdu, CS/IT Instructor; and Mrs. Ritchell Z. Escoto, Information Technology Instructor. Respondents had to complete the form in less than ten (15) minutes after using, navigating, and experiencing the designed web-based system. The researchers began running alpha tests and gathering data on November 2-4, 2024 and continued until November 19, 2023. The researchers also compiled more thorough survey results .

Evaluation	Mean	Verbal description
Function Suitability	3.83	Good
Compatibility	4.38	Excellent
Usability	4.34	Excellent
Security	4.01	Good
Flexibility	4.37	Excellent
Total	4.18	Good

Table 7: The totality of respondents agrees on ISO 2501 criteria in terms of educational Suitability, Compatibility, Usability, Security, and Flexibility.

Evaluation	**Mean**	**Verbal description**
Function Suitability	3.99	Good
Compatibility	4	Good
Usability	4.34	Excellent
Security	3.88	Good
Portability	4.1	Good
Total	4.06	Good

As indicated, the system underwent a thorough review and was highly suited for its intended purpose based on various factors, including functional suitability, compatibility, usability, security, and portability. The system's functional appropriateness, which refers to how effectively it meets its goals and objectives, was evaluated at 3.99, indicating satisfactory performance. Similarly, the system's compatibility with similar systems was rated 4.34. The system usability system, which refers to how easy it is to use and learn, received a good rating (weighted mean of 3.88). The system's security was also evaluated and determined to be very secure, with a weighted mean of 4.1. Finally, the system's portability, which assesses its ability to be used across multiple platforms and environments, was rated 4.06, indicating exceptional performance. Overall, the system performed exceptionally well in various areas, making it a highly recommended choice for its intended purpose.

Beta Testing Result

The beta testing findings were reported in frequency and percentage tabular format. The researchers completed beta testing by running a web-based system and gathering beta questionnaires from respondents. Respondents had to complete the form in less than ten (10) minutes after using, navigating, and experiencing the designed web-based system. From November 04, 2024, to November 06, 2024, the researchers ran beta testing and collected data. The researchers also compiled more thorough survey results.

Table 8: The totality of respondents agrees on ISO 2501 criteria in terms of educational Suitability, Compatibility, Usability, Security, and Flexibility.

As shown in the Table, the thirty respondents to the beta test rated the system's functional suitability weighted mean as 3.83, which had the verbal description of Good and had the higher rating because of the completeness of the functions. The system correctly executed each function and delivered the functions required to complete the specified user-level tasks. The system was evaluated, and the results demonstrate that it performed exceptionally well across all parameters studied. The system's compatibility was rated with a weighted mean of 4.38, placing it in the "excellent" category, indicating that it can function seamlessly with other systems and software. The system received a weighted mean of 4.34, placing it in the "excellent" category, meaning that it is user-friendly, simple to navigate, and efficient in executing its intended purposes. The system's security was rated "Good," with a weighted average of 4.01. It signifies that the system is secure and free of vulnerabilities, dangers, and illegal access. Furthermore, the system's Flexibility received a weighted mean score of 4.37, indicating that it can be easily transported and set up in various locations without losing functionality. According to the researchers' survey results, the system met all the needed standards regarding Functional Suitability, Compatibility, Usability, Security, and Flexibility, earning a total score of 4.18. The poll indicated that the system performed excellently in all the areas above and was rated Good overall.

COMPARISON OFALPHA & BETA RESUT

Table 9: Comparison of Alpha Test and Beta Test Result.

Evaluation	Alpha Test Result	Verbal Description	Evaluation	Beta Test Result	Evaluation
Functional Suitability	3.99	Good	Functional Suitability	3.83	Good
Compatibility	4	Good	Compatibility	4.38	Excellent
Usability	4.34	Excellent	Usability	4.34	Excellent
Security	3.88	Good	Security	4.01	Good
Flexibility	4.1	Good	Flexibility	4.37	Excellent

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Comparison of alpha and Beta Result

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Security	3.88	Good	Security	4.01	Good
Flexibility	4.1	Good	Flexibility	4.37	Excellent

An overall comparative study of the results obtained at both alpha and beta test phases, analyzing different assessment criteria, provides elaborate perceptions of the changing performance of the system. For the criterion of functional suitability, an in-depth analysis depicts the precise enhancements made between the alpha and beta phase.

The alpha test scored 3.99, which means that it falls under the 'Good'category.It included identifying areas of functionality requiring improvements. The beta test result was 3.83 and classified as a 'Good' decrease because we had some problems in the system during the first day of beta testing because deployment depicts an intention with efforts to improve the inherent shortcomings. This may be attributed to more defined functionalities bugs fixed or new features that form a robust and user-friendly system. Similarly, compatibility remains one of the key areas while considering the required seamless integration.

Demonstrates significant upgrading in terms of performance. Translating from a 'Good' rating of

4.00 in the alpha test to an 'Excellent' rating of 4.38 in the beta phase mirrors thorough debugging, optimization, and compatibility upgrades to make it a more flexible and interactive product. Usability, an essential element of user experience, remains excellent, with ratings of 4.34 in the alpha test and 4.34 in the beta test. This score, although minuscule, could be a sign of incremental design improvements, interface enhancements, or the addition of user feedback to make the overall product usability even better. Security, being the major issue in today's cyber world, is well satisfactory. The alpha test score of 3.88 (Good) gets slightly better in the beta test cycle with a score of 4.01.

This refinement would be a subtlety in adding features of security along with the issues that arise from alpha testing to refine its flexibility, and more concern to make the application adaptable with diversified environments has a satisfactory high. The score achieved from the alpha test is carried on and improved a little bit to 4.01 in the beta test 4.37. This could show that there is still much interest in enabling the product to smooth out its functions across different platforms and environments. Beta and alpha tests: Output Description Alpha and beta tests depict a highly fine and chiseled product. The system is tested, and enhancements to the functionality, compatibility, usability, security, and portability levels are made.

DISCUSSION

These debates and findings are rooted in the objectives of the research. The research variable is extensively analyzed. Including evaluation and experiments of the web-based application created. The document elucidates the improvements to the web-based platform that developers use for the benefit of researchers in the future.

Summary of Findings

The goal of the study is to create an online appointment system and a monitoring system for Ocampo Dental Clinic to create an online curriculum. The researchers started working on the Online Monitoring System by integrating detailed system function analysis, empirical evidence collection, and group brainstorming for strategic decision-making.

Upon completion of preparations, the research team observed in detail all the technical properties of the system, where it is possible to create a rather complex user-level front-end and back-end system, wons that is a web-based application, provides details of pricing and duration of services offered, includes secretary assistance through a chat feature, utilizes a bot for answering routine questions, has links to social websites. After identifying the system's characteristics, the researcher then identified the hardware and software components, as well as the knowledge requirements.

Incorporating Visual Studio Code, JetBrains Rider, MSSQL, and NodeJs was necessary as both were employed as a local web server and for coding as well as text.

The accomplishments regarding the knowledge requirements which underpinned the construction of systems were HTML5, Angular, SQL, CSharp, CSS, Typescript, and VS Coed. The system was developed using the appropriate hardware, which is a computer and a mobile device. The researcher employs analysis instruments in the form of a storyboard, utilization case diagrams, and a website map to facilitate and even reduce the time taken in the development process.

After completing the system development, the researcher successfully hosted it with Monsterasp.net. It was assigned to its proper section of Ocampo Dental Clinic, which is undergoing an online trial.

The Alpha test was thoroughly reviewed, and the conclusion was that the system was unquestionably appropriate for its intended function. Several factors were examined when performing the evaluations, including functional suitability, compatibility, usability, security, and portability. Many aspects of the system were done exceptionally successfully, making it an extremely recommendable system for the intended purpose. Assessment of the system's functional adequacy, compatibility, usability, security, and portability revealed similar and proper achievement of these criteria, with an overall score of 4.06. As a result, the total system was assessed as a high standard, implying that it is operational, interoperable with other systems and devices, simple to use, safe, and adaptable to different contexts.

The Beta test survey results showed that the system excelled in all evaluated criteria, including functionality, compatibility, usability, security, and flexibility. The system received average ratings, with weighted mean scores of 3.83 for functional suitability, 4.38 for compatibility, 4.34 for usability, 4.01 for security, and 4.37 for flexibility. The system was rated good and excellent and met all required standards.

In addition, the results of a comparative analysis of a system's Alpha and Beta test phrases are presented. The analysis considers various evaluation criteria, including functional suitability, compatibility, usability, security, and flexibility. The results show that the Beta test phase outperformed the Alpha test phase in all areas, indicating a concerted effort to address and improve the identified shortcomings. The improvement could be attributed to refined functionalities, bug fixes, or a more user-friendly system. System features that contribute more robustly consistently demonstrate a

high level of performance across all evaluation criteria, indicating meticulous debugging. Optimization and design improvements to ensure a versatile and interoperable product.

Conclusion

he purpose of this study is to create a website for Ocampo Dental Clinic that addresses issues in appointment scheduling and access to past treatments and history, making it more convenient for the patients of Ocampo Dental Clinic. The researchers conducted interviews and surveys to support this objective. To develop the system, the researchers gathered valuable insights on the necessary software and hardware, such as Visual Studio Code, JetBrains Rider, GitHub, and database management tools. With the use of diagrams and a storyboard, the researchers visualized the design and identified the system's flow.

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HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun

Best Capstone (Information System Category)
Presented at International Research Conference on Information Technology Education (IRCITE) 2025

JOSHUA ALLAN D. BAUTISTA, MABALACAT CITY COLLEGE
MARTIN S. BAUTISTA, MABALACAT CITY COLLEGE
VINCE STEPHEN S. DAVID, MABALACAT CITY COLLEGE
JULLIEN D. EDUARTE, MABALACAT CITY COLLEGE
JUSTIN JOHN M. SANTOS, MABALACAT CITY COLLEGE
ROBHERT M. BAMBA (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT

In today's digital age, technology plays a transformative role in the management of homeowner associations (HOA s). The integration of innovative tools, such as self-managed HOA software, automates many labor-intensive tasks, making operations more efficient while reducing human error. The General objective of the study was to develop a system entitled "HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun". The researchers chose the Modified Waterfall Model as the Software Development Life Cycle (SDLC) approach for the development of the HOA-Unity system, integrating feedback loops and evaluations at each phase to promote continuous improvement. As a result, three (3) IT experts evaluated the HOA-Unity system during alpha testing. Functional Suitability, Compatibility, Interaction Capability, Security and Flexibility were among the criteria that were evaluated during live demonstrations, and survey questions are based on ISO-25010 standards. The highest among criteria were Interaction Capability, garnered a weighted mean score of 4.83 with a verbal interpretation of "Excellent" Also, the beta tester involving thirty (30) residents of Mabalacat Fiesta Tabun. The highest among criteria were Functional Suitability, garnered a weighted mean score of 4.41 with a verbal interpretation of "Excellent". In conclusion, the evaluations show that the system excels in Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility, effectively meeting its requirements, ensuring seamless platform integration, offering an intuitive user experience, protecting user data, and being adaptable and portable.

Key words: Community Management System, Web-Based Management, HOA, Modified Waterfall Method, Sustainable Development Goals (SDGs), ISO25010.

INTRODUCTION

In today's world, the use of technology in the In today's digital age, technology plays a transformative role in the management of homeowner associations (HOA s). Initially, technology in HOAs was limited to basic digitization tasks, but it has since evolved into a critical tool that reshapes community living. From streamlining day-to-day operations to enhancing communication between homeowners and board members, technological advancements are improving the overall quality of life for residents. As communities face rapid changes and growing challenges, embracing technology is no longer an option, but a strategic necessity. This shift is essential for creating dynamic, connected, and thriving communities that adapt to new needs and opportunities (Ireland, D. n.d.).

The integration of innovative tools, such as self-managed HOA software, automates many labor-intensive tasks, making operations more efficient while reducing human error. This is particularly beneficial for volunteer boards that may lack extensive property management experience. These technological solutions also enhance transparency, enabling both residents and board members to stay informed with real-time, easily accessible information. As automation, cloud-based management, and specialized platforms continue to evolve, they are reshaping the entire landscape of community association management, offering tailored solutions for everything from financial oversight to maintenance tracking (HOALife, 2024).

A Homeowners' Association (HOA) is a private entity that oversees the management of residential communities or condominiums. While the rules and dues imposed by an HOA may limit certain

freedoms, they serve the broader purpose of preserving property values and maintaining communal spaces. In the Philippines, for example, homeowners are required to join the HOA in their residential subdivision or complex, ensuring access to essential services and community maintenance (Alex, 2023). By adhering to regulations that promote safety, order, and peace, the HOA plays a pivotal role in enhancing the living experience for all residents (JJS Realty & Development, 2021).

The study developed a web-based community management platform for Fiesta Tabun, utilizing technology to modernize and streamline its management. This platform serves as a comprehensive tool for residents, homeowners associations (HOAs), and administrators, facilitating efficient communication, simplifying administrative processes, and fostering a stronger sense of unity within the community. HOA-Unity includes a variety of features tailored to the specific needs of Fiesta Tabun, such as personalized resident accounts that enable easy submission of requests, direct access to community announcements, and a clear overview of upcoming events.

The platform significantly enhances operational efficiency by reducing manual tasks, improving transparency, and ensuring that residents and administrators stay connected in real-time. HOA-Unity addresses common challenges faced by traditional HOA management systems, such as delayed responses and fragmented communication channels. Furthermore, the platform's user-friendly design not only improves access to information but also makes it easier for residents and HOA administrators to collaborate and make informed decisions.

Ultimately, this web-based solution aims to enhance the overall living experience in Fiesta Tabun by creating a more cohesive, efficient, and engaged community. As the platform evolves, future updates will continue to refine its features and expand its functionalities to meet the growing needs of the community.

Objective of the Study

The General objective of the study was to develop a system entitled "HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun". The HOA-Unity system aims to improve management and communication within the community by facilitating efficient interaction between the Homeowners Association (HOA) and residents. It streamlines administrative tasks, enables easier sharing of important information, and promotes greater resident engagement.

In line with this, this study aimed to achieve the following specific objectives: (1) To gather relevant information using the; (2) To identify the required specifications for hardware and software used for development and testing of the web-based community management; (3) To design the software using the following diagrams and analysis tools; (4) To create and develop a system that has the following specific features; (5) To test the system through Alpha and Beta testing tools;

(6) To evaluate the performance of the system based on the following ISO25010 standards; (7) To deploy and implement the system to web hosting site.

METHODOLOGY

The researchers picked the Modified Waterfall Model as the Software Development Life Cycle method to use when making the simulation software. The Software Development Life Cycle (SDLC) technique, analysis diagrams, and the data collection tool employed by the researchers in the development of the application will all be displayed in this section. The software development life cycle (SDLC) encompasses requirements gathering, software design, software implementation, software testing, software deployment, and software maintenance.

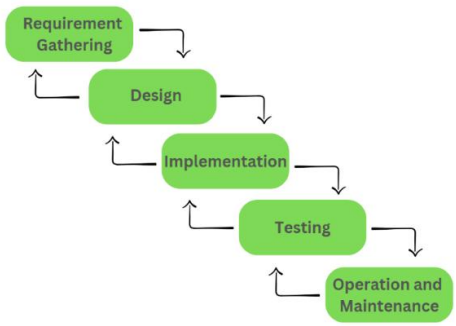

Figure 1: The Modified Waterfall

Requirements Gathering

The researchers worked collaboratively to gather ideas and gather information aimed at developing a reliable and effective web-based community management. This involved engaging in group discussions and facilitating the exchange of ideas among team members. The researchers will conduct interviews in Fiesta Communities Mabalacat and acquired data to assist with the development of the system in order to make it more functional and intriguing. Through these procedures, the researchers aimed to ensure a comprehensive understanding of the project requirements and to foster creativity in devising innovative solutions.

Design

The researchers used the following analysis tools and diagrams: Storyboard, Use Case Diagram, Data Flow Diagram, Entity Relationship Diagrams and Visual Table of Contents. The researchers utilized various diagrams and analytic tools in designing the web-based HOA-UNITY system. Storyboarding structured the user interfaces and workflows, while

Use Case Diagrams outlined key functions and features. Data Flow Diagrams visualized information movement, identifying potential challenges and improvements. Entity Relationship Diagrams clarified database entity interactions, aiding in database design. Visual tables of contents provided an efficient overview of document structures. These tools collectively facilitated a comprehensive understanding of the system's design, interface, and user journey, enabling thorough assessment and potential enhancements.

Implementation

In the implementation phase, the researchers utilized Visual Studio Code 1.88 as the integrated development environment for both front-end and back-end programming of the HOA-UNITY system. This comprehensive approach allowed for careful design and programming of the resident and admin functionalities. The system was developed to operate within defined limitations and established scope, focusing on a user-friendly interface.

Resident features include essential functionalities such as user authentication through sign-in and sign-up processes. Residents can stay informed via a dedicated news and announcements display and can create, view, search, and paginate reports efficiently. Payment management is streamlined, enabling users to view their payment history, paginate through their entries, and track amenities and services. Users are empowered to request amenities and services, and a notification system ensures that residents remain informed about updates. Profile management allows users to view and update their information seamlessly.

For administrators, the HOA-UNITY system offers robust management tools. Admins can sign in, change passwords, and create and manage user accounts, including searching, updating, and archiving accounts as needed. The ability to view and manage reports is crucial, allowing for deletion and updates of reports with pagination for ease of access. Admins can also handle amenities and service requests, maintaining a clear overview of the system's operations. Additional functionalities include viewing finance reports and activity logs, providing detailed insights into the system's performance.

Secretaries are equipped with features to manage amenities and reports effectively. They can sign in, view and update amenities requests, and paginate through amenities, ensuring efficient handling of resident requests. Reporting functionalities allow secretaries to view, update, and delete reports while managing news and announcements. This structure ensures that information is up-to-date and easily accessible.

The treasurer's functionalities include signing in and managing financial transactions. Treasurers can view transaction lists, search, and paginate through them, facilitating smooth financial operations. They also have access to finance reports, allowing for updates and detailed tracking of financial data. QR codes can be generated, viewed, and managed within the HOA-UNITY system, further enhancing transaction efficiency.

Auditors have a streamlined experience with the capability to sign in, view financial reports, and generate comprehensive financial reports in PDF format. This feature ensures transparency and accountability within the system.

The development utilized XAMPP and MySQL for database management and local hosting, ensuring a robust backend structure. JavaScript, PHP, and CSS were employed as scripting languages to enhance the HOA-UNITY system's functionality and aesthetics.

This thorough and systematic approach during the implementation phase has established the HOA-UNITY system as a reliable and flexible management tool. It offers residents an engaging experience while providing administrators and other roles with essential tools to manage their responsibilities effectively. The comprehensive design guarantees that the system is functional and ready for subsequent development phases.

Testing

In this phase, the researchers made some adjustments to the system based on the recommendations of the panel and technical and capstone adviser's feedback. The testing phase covers the evaluation of the whole study if the system performs as specified by the requirements. The agreed recommendations, suggestions from the panels/clients were analyzed and added to enhance developed system. The researchers conducted the alpha and beta testing using the researchers' made survey tool anchored with the criteria of ISO25010 Software Product Quality Standard to review and correct any application glitch or defects. The researchers created a survey questionnaire (See Appendix H) based on the functional suitability, compatibility, interaction capability, security and flexibility criteria of the ISO25010 model in order to evaluate the quality of the developed system.

The ISO25010 questionnaire underwent validity testing in order to ensure that the results of this study are neutral and unaffected by the extraneous factors of the researcher, the respondents, or the environment in which the evaluation was carried out.

Deployment

In this phase, the developed system attained formal approval from the capstone adviser, technical adviser, and both alpha and beta testers. Consequently, the researchers have made the

system freely accessible at the following domain repository: https://hoa-unity.site/.

The deployment of the developed local website for the Web-Based Community Management system by the researchers on a prominent domain repository site will serve as a powerful tool for effectively promoting their innovative community management solutions, enhancing engagement and facilitating smoother interactions among residents.

Sampling Method

The researchers employed three sampling methods to gather insights on the web-based HOA-UNITY system. Purposive sampling involved selecting respondents based on specific characteristics relevant to the study. This approach allowed the researchers to target individuals with experience related to the system. They identified three Information Technology experts as Alpha testers due to their expertise, ensuring that feedback during the testing phase came from knowledgeable individuals capable of providing valuable input on the system's functionality and user experience.

Homogeneous sampling, a type of purposive sampling, involved selecting respondents who shared similar characteristics to ensure uniformity in responses. For the Beta testing phase, thirty residents from Fiesta Communities Mabalacat were chosen. This selection aimed to capture a consistent group of users with similar experiences, which helped the researchers understand how these residents interacted with the system and provided focused insights into its functionality.

Random sampling, a probability technique, gives every member of the population an equal chance of selection. The researchers considered integrating random sampling to enhance the depth and diversity of the findings. By randomly selecting a subset of residents from Fiesta Communities Mabalacat, the study aimed to capture a broader range of demographics and experiences. This approach would provide varied perspectives on the system's usability, improving the generalizability of the insights gained.

Instrumentation

The researchers made validated questionnaire was used to know if the developed system has met the objectives needed. The researchers' system was uploaded and published in Hostinger repository site. In the beta testing, the researchers approached thirty (30) residents of Fiesta Communities Mabalacat to test and evaluate the system

Questionnaire Administration

The questionnaire was administered at Fiesta Comunities Mabalacat from October 29, 2024 until October 31, 2024. A basic introduction detailing how the respondent will complete the checklist based on their usage experience aids in the distribution and administration of the questionnaire. The researcher used English to encourage clarity and comprehension, therefore creating a comfortable setting in which participants could freely express their ideas and experiences.

Data Analysis

This study used descriptive statistics to summarize and analyze the data. Descriptive statistics help us understand where the data points are located and how they are spread out. It provides a clear picture of the data's characteristics and patterns.

The following statistical treatments were used for data reduction:

1. Frequency Distribution

Frequency distribution was used in the study to indicate the number of cases at each score. The scores of the demographic profile of the respondents were grouped in categories defined by step intervals, each of which was a set of contiguous possible scores. A variable with values that indicate the order of the cases was divided into a number of categories. The number of cases tabulated in any category was the frequency.

2. Mean

The mean is the average or a calculated central value of a set of numbers and is used to measure the central tendency of the data. The mean formula in statistics for a set is defined as the sum of the observations divided by the total number of observations. The mean formula for a set of given observations can be expressed as, Mean = (Sum of Observations) ÷ (Total Numbers of Observations)

$\bar{x} = \Sigma fx / \Sigma f$

where,

$\bar{x}$ = the mean value of the set of given data.

f = frequency of each class

x = mid-interval value of each class

3. Likert Scale

The Likert scale is a rating system that used in questionnaires and is designed to measure respondent's attitudes, opinions, or perceptions. After the calculations each mean score of each survey tool sub-criteria and criteria, the researcher used the Likert scale to interpret the result into its corresponding verbal interpretation.

Table 1: Likert Scale – level of agreement.

Response Categories	Numerical Value	Range / Interval	Verbal Interpretation
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.41 – 4.20	Good
Neutral	3	2.41 – 3.20	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly Disagree	1	1.00 – 1.80	Poor

Data Processing

Tally sheets were used for data processing. The finalized tally summary was prepared as the respondents finished filling out the beta surveys. The researchers used a tally sheet form to enter data.

Operation and Maintenance

In this phase, the researchers methodically collected and assessed user feedback to guide improvements for the HOA-Unity system, pinpointing specific areas that needed enhancement and assessing the effectiveness of various features. Regular maintenance and updates were conducted to promptly address issues and integrate new functionalities based on user input, ensuring the system remained high-quality and relevant. Routine tasks included performance assessments and software updates to maintain optimal operation. Additionally, data from user interactions was analyzed to understand engagement patterns.

RESULTS

The researchers conducted alpha and beta tests to evaluate HOA-UNITY. During the alpha testing phase, the system underwent a comprehensive evaluation by three IT professionals. During the transition to the beta testing phase, a total of thirty (30) individuals from Fiesta Mabalacat Communities Tabun contributed significant insights. The evaluation, conducted according to ISO 25010 standards, encompassed various dimensions such as Functional Suitability: Functional Completeness, Functional Correctness, Functional Appropriateness, Compatibility, Coexistence: Interoperability, Interaction Capability: Inclusivity, Security: Confidentiality, Integrity, Accountability, Authenticity, Flexibility: Adaptability, Scalability. This comprehensive evaluation offered specific insights regarding HOA-UNITY effectiveness within the Fiesta Communities Mabalacat.

Three (3) IT experts evaluated the web-based system during alpha testing. Functional Suitability: Functional Completeness, Functional Correctness, Functional Appropriateness, Compatibility, Coexistence: Interoperability, Interaction Capability: Inclusivity, Security: Confidentiality, Integrity, Accountability, Authenticity, Flexibility: Adaptability, Scalability were among the criteria that were evaluated using live demonstrations, discussions, and survey questions based on ISO 25010 standards. An overall weighted mean score or 4.42 with a verbal interpretation of "Excellent" was accomplished on IT Experts.

Table 2 shows that summary of Alpha test result by (3) IT Experts. The highest among criteria were Interaction Capability, garnered a weighted mean score of 4.83 with a verbal interpretation of "Excellent". This means that the system users with different levels of expertise may utilize the system more easily since it supports a clear English language. This emphasis on inclusion allows users to efficiently utilize the system without linguistic barriers, fostering community engagement and a sense of belonging.

Table 2: Summary of Alpha Test Result

Criteria	Mean Score	Verbally Interpretation
Functional Suitability	4.39	Excellent
Compatibility	4.29	Excellent
Interaction Capability	4.83	Excellent
Security	4.50	Excellent
Flexibility	4.11	Good
Total Mean	**4.42**	**Excellent**

The Flexibility criteria garnered a lowest weighted mean of 4.11 with a verbal interpretation of "Good". This means that there are still needs of improvement in ensuring more seamless functionality across various platforms and operating systems. Specifically, addressing any performance inconsistencies or user experience challenges could enhance overall accessibility. And also, there is a need for improvement in the system's ability to maintain optimal performance during high user activity and to manage increasing data volumes more effectively. Users may have encountered performance lags during peak times, suggesting that enhancements are required to ensure a consistently smooth experience.

An overall weighted mean score or 4.42 with a verbal interpretation of "Excellent" was accomplished on IT Experts.

Table 3: Summary of Beta Test Result

Criteria	Mean Score	Verbally Interpretation
Functional Suitability	4.41	Excellent
Compatibility	3.99	Excellent
Interaction Capability	4.38	Excellent
Security	4.24	Excellent
Flexibility	3.90	Good
Total Mean	**4.18**	**Excellent**

Table 3 shows that summary of Beta test result by (30) respondents from Fiesta Communities Mabalacat. The highest among criteria were Functional Suitability, garnered a weighted mean score of 4.41 with a verbal interpretation of "Excellent". This means that the HOA-UNITY system effectively meets the needs and expectations of the residents, demonstrating strong functional completeness, correctness, and appropriateness. The positive feedback indicates that respondents feel confident in the system's ability to support their tasks and objectives, reflecting a high level of user satisfaction with its features and performance.

The Flexibility criteria garnered a lowest weighted mean of 3.90 with a verbal interpretation of "Good". This means that there is still room for improvement to achieve more seamless functionality across different platforms and operating systems. Addressing any performance flaws or user experience problems could significantly improve general accessibility. Also, the researchers need to improve the system's capacity to handle rising data volumes more effectively and sustain best performance during high user activity periods. Peak periods may have caused users to have performance delays, which emphasizes the necessity of improvements to guarantee an always seamless experience.

An overall weighted mean score or 4.18 with a verbal interpretation of "Excellent" was accomplished on respondents.

DISCUSSION

The researchers examined user needs to create a complete system for Fiesta Communities Mabalacat in order to achieve the whole system and functionality of the HOA-UNITY system. Researchers collaborated with community officials and residents to gain insights into community processes and administrative workflows. Also, the researchers read papers on best practices and residential digital solutions, examining case studies and similar systems to understand how other groups use and interact with technology. In order to facilitate the development process and match technical choices with project goals, researchers assessed the hardware and software requirements for an extensive project. The researchers developed "HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun" using Visual Studio Code 1.88, XAMPP, MySQL, JavaScript, PHP, and CSS. These tools enabled efficient coding, robust data storage, dynamic interactions, and a user-friendly platform for community management, enhancing the overall experience for users. Researchers used various diagrams to plan the system's features and workflows, including Storyboard, Use Case Diagram, Data Flow Diagram, Entity Relationship Diagram, and Visual Table of Contents, to outline user interactions and database structure.

Conclusions

The research process for the capstone project began with a thorough examination of user needs to develop a comprehensive system for Fiesta Communities Mabalacat. The initial phase involved collaborating with community officials and residents to gain insights into existing community processes and administrative workflows. To further enrich their understanding, the researchers reviewed literature on best practices and digital solutions for residential management, analyzing case studies and similar systems to learn how other communities utilize and interact with technology. This groundwork laid the foundation for the functionality and effectiveness of the HOA-Unity system.

The HOA-Unity system effectively addresses the need for streamlined community management by providing an integrated platform that supports various user roles, including residents, administrators, secretaries, treasurers, and auditors. This all-in-one solution enhances communication and operational efficiency within residential communities, successfully meeting the objective of creating a cohesive management tool.

The system includes user-focused features tailored to each role. Residents can sign in, access news and announcements, manage payments, and request amenities. Administrators handle user accounts, view resident information, and manage community reports. Secretaries oversee service requests and community announcements, while treasurer access transaction lists and finance reports. Auditors can generate financial reports in PDF format. This design ensures that all users are equipped with the necessary tools for effective engagement, successfully fulfilling the study's objectives.

Advanced data management features, including pagination for reports and accounts, streamline the user experience by allowing easy navigation through extensive information. This capability improves efficiency and enhances decision-making processes for all roles within the community management system.

The inclusion of financial management tools for treasurers and auditors promotes transparency and accountability within the community. By enabling detailed transaction tracking and financial reporting, the system fosters trust among community members and ensures responsible management of resources. Although this objective was achieved, challenges arose regarding the training needed for users to fully utilize these financial tools.

The HOA-Unity system facilitates proactive communication through notifications and announcements, keeping users informed of important updates and community news. This feature enhances user engagement and encourages active participation in community activities. While the implementation of this feature successfully met the communication objectives, adjustments may be necessary to refine the effectiveness of notifications based on user interactions.

While the system shows good performance, there may be some limitations in adapting to varying user needs or preferences. This suggests an area for improvement to further enhance user engagement.

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Kapepongtsa: A Web-Based Ordering and Inventory Management System for YOBS Cafe

RONALD KRIS F. DELARA, MABALACAT CITY COLLEGE
ANGELO GOMEZ, MABALACAT CITY COLLEGE
JUNEL O. GUECO, MABALACAT CITY COLLEGE
JAIMEE P. ROMERO, MABALACAT CITY COLLEGE
ALLEN SHERWIN H. WAJE, MABALACAT CITY COLLEGE
RITCHELL Z. ESCOTO (Technical Adviser), MABALACAT CITY COLLEGE
DENNIS L. TACADENA (Capstone Adviser), MABALACAT CITY COLLEGE

ABSTRACT
The rapid advancement of technology has significantly impacted various industries, including the food and beverage sector, where digital transformation has become essential for improving efficiency and customer satisfaction. The general objective of the study was to develop a system entitled "Kapepongtsa: A Web-Based Ordering and Inventory Management System for YOBS Cafe." The system was developed using the Modified Waterfall Model as the Software Development Life Cycle (SDLC) methodology, which incorporated ongoing feedback and evaluation at each phase to ensure continuous improvement and adaptability to changing requirements. Alpha and Beta testing were conducted based on ISO 25010 standards, assessing Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The overall mean score for Alpha testing, as evaluated by three (3) IT experts, was 4.53 with a verbal interpretation of “Excellent.” Meanwhile, Beta testing, evaluated by thirty (30) customers and staff from YOBS Cafe, scored 4.46, also interpreted as “Excellent.” The testing results indicate that the system successfully meets its functional requirements, performs well across platforms, offers an intuitive user experience, ensures secure data management, and is adaptable for future updates. In conclusion, Kapepongtsa successfully meets its objectives, offering an intuitive, secure, and flexible solution that improves the operational efficiency of YOBS Cafe, while also supporting sustainable business practices.

Keywords: Web-based System, Ordering, Inventory Management, Modified Waterfall Method, ISO 25010.

INTRODUCTION

The relentless pace of technological change continues to redefine how businesses operate, fostering a culture of continuous innovation and growth. Web-based solutions have revolutionized customer experiences and transformed business operations, enabling companies to adapt to evolving demands. Businesses allocate 2 to 5% of earnings to enhance technological capabilities, staying ahead in an ever-changing landscape (Hart, n.d.). In the food sector, modern technologies have significantly improved operational efficiency, reducing lead times and waste while ensuring timely delivery (Muscad, 2024).

Globally, technology has become essential for businesses to remain competitive. The pandemic further accelerated the adoption of digital solutions, making mobile ordering and delivery services vital for meeting consumer expectations and retaining market position (Edgeworks Solutions Pte Ltd., 2023). The coffee industry is no exception, with global coffee consumption increasing at an annual growth rate of 2.5% in 2022, highlighting its profitability and cultural significance. Technology integration, particularly in inventory management, helps coffee shops optimize stock levels, reduce waste, and promote sustainable practices (Kroon, 2024).

In the Philippines, where coffee is a staple for nine out of ten households, coffee shops are a growing industry catering to the preferences of younger demographics (Tampon, 2023; Agoot, 2018). The rise of specialty coffee and the merging of coffee with technology, as seen in Bo's Coffee Daily, underscore the importance of innovation in staying relevant (Dagooc, 2021). Pampanga, the country’s "food capital," is experiencing a surge in coffee shop popularity, particularly in Angeles City and Clark, where cafes offer unique experiences that attract both locals and tourists (Layug, 2021).

Despite the growth, many coffee shops still rely on manual processes, leading to operational inefficiencies such as inaccurate inventory tracking and delayed stock replenishment (Zeekoi, 2023). These challenges emphasize the need for digital transformation to support customer demands and operational growth.

This study aimed to develop a web-based ordering and inventory management system for YOBS Cafe that would improve the accuracy and efficiency of the cafe's current operation process, which currently rely on verbal communication and handwritten records. The system emphasizes the innovative use of technology to enhance operational efficiency, elevate customer satisfaction, and ensure precise inventory management, particularly valuable in high-traffic settings where customer flow is paramount.

Objectives of the Study

The general objective of the study was to develop a system entitled "Kapepongtsa: A Web-Based Ordering and Inventory Management System for YOBS Cafe." In line with this, this study aimed to achieve the following specific objectives: (1) To gather information for the study and the system of YOBS Cafe from articles, journals, related literature, previous studies and interviews; (2) To identify the hardware and software requirements for the development of the system; (3) To design the system using diagrams and analysis tools; (4) To create a system with the following features: Order Management, Sales and Payment Management, Promotions Management, and Inventory Management; (5) To integrate the following user-levels: Customer, Admin, and Staff; (6) To test the system through Alpha and Beta testing; (7) To evaluate the performance of the system based on ISO 25010 standards in terms of Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility; and (8) To deploy the system on a locally hosted server.

Scope and Limitation

The study was primarily focused on the design, development, testing, and evaluation of the system/application entitled "Kapepongtsa: A Web-Based Ordering and Inventory Management System for YOBS Cafe" that aims to improve the accuracy and efficiency of the cafe's current operations by replacing traditional manual processes with a digital system.

Also, the researchers identified that this study aligns with three specific Sustainable Development Goals (SDGs): SDG 8, SDG 9, and SDG 12. SDG 8, focused on decent work and economic growth, promotes ongoing, inclusive, and sustainable economic advancement, advocating for full, productive employment and fair working conditions for all individuals. This study particularly aligns with Sub-goal 8.2, which seeks to increase economic productivity through diversification, technological advancement, and innovation, prioritizing high-value and labor-intensive industries. SDG 9, centered on Industry, Innovation, and Infrastructure, emphasizes the development of resilient infrastructure, sustainable industrialization, and innovation. This goal encourages investment in infrastructure and technology to drive economic growth while minimizing environmental impacts and promoting sustainability. The study is particularly aligned with Sub-goal 9.b, which emphasizes fostering domestic technology development, research, and innovation in developing nations. Additionally, it supports SDG 12: Responsible Consumption and Production, which aims to establish sustainable consumption and production patterns. This goal encourages the responsible use of resources, waste reduction, and the adoption of sustainable practices in both industry and consumer behavior to protect the environment and enhance quality of life globally. Additionally, the study aligns closely with Sub-goal 12.a, which highlights the importance of helping developing countries build their scientific and technological capacities to adopt more sustainable consumption and production practices.

The researchers collaborated to gather the necessary information for the study and system of YOBS Cafe. This included reviewing articles, journals, and related literature, as well as analyzing previous studies. The researchers had conducted interviews with the owner and staff of YOBS Cafe to gather comprehensive insights and identify areas for improvement in the cafe's operations.

The study utilized the required specifications for hardware and software development tools as the primary platform for both front-end and back-end development of the system. The system was developed using a desktop computer equipped with an AMD Ryzen 3 5300U with Radeon Graphics Processor, 12GB of RAM, a 256 GB SSD running on the Windows 11 operating system by Microsoft, along with a tablet for web browser testing.

The researchers utilized Visual Studio Code as the primary IDE for coding. Microsoft SQL Server 2022 served as the database solution. The researchers used SQL Server Management Studio 20.2 for managing the databases and .NET SDK 8.0 for application development. Git and GitHub were employed for version control and collaboration. Canva was used to create the system diagrams, illustrating the system's structure. For the design and prototyping of the system's user interface, Figma was applied to create a visually appealing and user-friendly interface.

The researchers designed the system using various diagrams and analysis tools. A storyboard helped the researchers conceptualize and visualize the flow and user interface of the system. The Use Case Diagram allowed the researchers to depict the interactions between users and the system. The Visual Table of Contents (VTOC) helped the researchers organize the content and navigation. A Data Flow Diagram (DFD) was used to illustrate how data was input,

processed, and output or stored in the system. Additionally, the researchers used a Gantt chart for project planning, and tracking tasks over a timeline.

The customer can create an order by selecting an item which will automatically be added to cart. They can adjust the quantity of each item or remove items from the cart if they are no longer needed. Customers can apply a valid promo code to receive discounts on their order. Once the order is placed, customers can track their order status.

The admin role has full control over the system's functionalities. Upon logging in, the dashboard will show up where the admin can see the system's overview and view the notification. In sales management, the admin can view completed sales, create new sale, search specific orders, update order statuses, void orders as necessary, and generate invoices and sales report. This enables the admin to oversee order flow and ensure that transactions are accurate. Payment management capabilities allow the admin to view payment records and search through transactions to verify and reconcile sales. Promo code management enables the admin to edit existing codes, delete outdated or unused codes, and search for specific promotions to enhance customer engagement. Admin can also view inactive promo codes, enabling them to view past promotions and reactivating it later. To manage inventory, the admin can view, create, edit details, delete records, and search for specific items and stock items. The system allows the admin to apply date filters across different data sets, allowing them to monitor or view daily, weekly, monthly, or yearly records.

The staff role is designed to assist with daily operations while restricting access to critical functions. Although staff have similar functionalities to the admin, they are not authorized to delete records, including promo codes, items, and stock items.

The system integrated three distinct user levels, each with specific roles and access permissions to ensure efficient management and resource utilization. Customers had access to order management functionalities, allowing them to place orders, view their order details, and track their order status. Admin had full access to all system functionalities, including managing orders and inventory, as well as performing administrative tasks such as adding, updating, or deleting data. Staff have limited access, enabling them to manage orders and inventory, but do not have the ability to delete data to ensure that important data is protected from being accidentally deleted.

The study specifically targeted three (3) Information Technology experts as Alpha testers. Thirty (30) customers and staff from YOBS Cafe were chosen as Beta testers. Their feedback and insights helped the researchers refine and enhance the system. Additionally, the researchers used ISO 25010 to evaluate the system's Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility.

The researchers deployed the system on a locally hosted server, configuring it to ensure all necessary resources were in place to support the project. The system was made accessible to users through the local network, utilizing localhost for the hosting setup.

The study has set limitations for Kapepongtsa as the study recognizes that Kapepongtsa does not offer online ordering or delivery services. Customers must visit YOBS Cafe on-site to place their orders, which may limit convenience for those who prefer the ease of online transactions. This limitation emphasizes the importance of on-site customer interaction and the personal service staff can provide.

Another limitation lies in its inability to accommodate customized orders. While the system manages standard menu offerings efficiently, it lacks the capability to handle detailed customer preferences or specific dietary requests. This limitation may affect customer satisfaction, particularly for those customers with specific preferences. Furthermore, the system does not include a feature for managing loyalty programs. Currently, promo codes may be supported, but there is no built-in mechanism to track customer points, generate rewards, or analyze customer retention trends.

By understanding the limitations and assumptions of the system, the cafe can ensure that it operates smoothly. It is important to note that the system operates on a local server, which may result in occasional pauses or lags due to the limitations of the physical hardware. Despite this, the system remains fully functional overall and it does not provide support for challenges that may arise outside its defined scope.

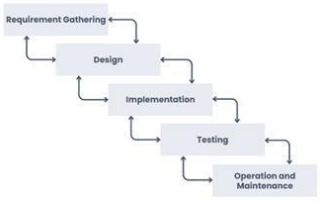

Figure 1. The Modified Waterfall Model

METHODOLOGY

The researchers chose the Modified Waterfall Model (See Figure 1) as the Software Development Life Cycle (SDLC) method for developing the system. This model combined iterative phases with a structured development flow, ensuring thorough documentation and design reviews at each stage. This approach

guarantees that the developed system was high-quality, consistent, and manageable.

Requirements Gathering

The requirement gathering is the first phase of the modified waterfall model. In this phase, the researchers started with brainstorming, sharing opinions and ideas regarding what the system is supposed to achieve. Additionally, to create a dependable and successful web-based ordering and inventory management system, the researchers conducted an interview with the owner and staff of YOBS Cafe to gain valuable insights with their current operations and enhance the development of the system, making it more engaging and functional.

The system was developed using a desktop computer equipped with an AMD Ryzen 3 5300U with Radeon Graphics Processor, 12GB of RAM, a 256 GB SSD running on the Windows 11 operating system by Microsoft (See Table 1).

For the development of the system, a selected suite of specialized software tools has been identified to enhance both efficiency and effectiveness in the development process (See Table 2). Various software tools such as Canva and Figma that were used to create the diagrams and prototyping. Visual Studio Code was used as the primary Integrated Development Environment (IDE) for coding. For database management, Microsoft SQL Server 2022 served as the database solution which provides a reliable and efficient solution for handling data. SQL Server Management Studio 20.2 was employed to handle the databases effectively, facilitating manage management tasks. Git and GitHub played essential roles in version control and collaboration.

Table 1. Computer hardware specifications

Component	Specification
Processor	AMD Ryzen 3 5300U with Radeon Graphics
System Type	x64-based PC
Solid State Drive	256GB
Random Access Memory	12GB
Windows Specification	Microsoft Windows 11 Home Single Language

Table 2. Software development tools

Component	Description
Visual Studio Code	Integrated Development Environment
Microsoft SQL Server 2022	Relational Database Management System
SQL Server Management Studio 20.2	Integrated SQL management environment
NET SDK 8.0	.NET development toolkit
Git	Version control system
Github	Collaboration platform
Canva	Illustrating diagrams
Figma	Designing and prototyping

Design

In the design phase, the researchers used various design tools to illustrate, design, and develop the system. The Storyboard was used to visualize the user journey, illustrated how users would navigate through the application from start to finish, and identify areas for improvement in the interface and workflow. Researchers created a series of figures to represent different screens and interactions a user would have, focusing on the user experience. The Use Case Diagram (See Figure 2) allowed the researchers to represent the interactions between different users and the system. This tool helped researchers to define and clarify the system's functionality from the user's perspective, highlighting the main actions each type of user (Admin, Staff, and Customer) could perform. The Visual Table of Contents (See Figure 3) was created to provide a graphical layout of the different sections and pages within the application. This helped researchers to plan the navigation structure of the site, ensuring that users could easily find and access the information they needed. The Data Flow Diagram was used to visualize how data moves within the system. This tool allowed the researchers to track how data is input, processed, and output at different stages of the system. Researchers mapped out the system's major processes and how these interact with the data sources and data stores.

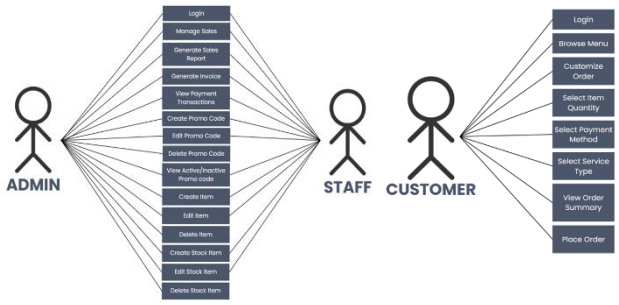

Figure 2. Use Case Diagram of Kapepongtsa

Implementation

In the implementation phase, the researchers turned the diagrams into code, beginning with both front-end and back-end development. The researchers used Visual Studio Code as the primary IDE for coding. Researchers utilized Angular 18 for the front end and ASP.NET Core with C# (.NET Framework) for the back end to build a robust system architecture. For the front-end development, the researchers employed a combination of HTML, TypeScript, and Tailwind CSS to create a responsive and visually appealing user interface. Tailwind CSS simplified the styling process, ensuring a modern and user-friendly design. The npm package manager

assisted in efficiently managing front-end dependencies and packages.

On the back end, the researchers leveraged ASP.NET Core with C# (.NET Framework) to handle server-side logic and database interactions. This technology stack provided a secure and efficient development environment, supporting structured application logic and seamless database communication. SQL Server managed and maintained the application's database, enabling efficient handling of data related to inventory, orders, and customer information.

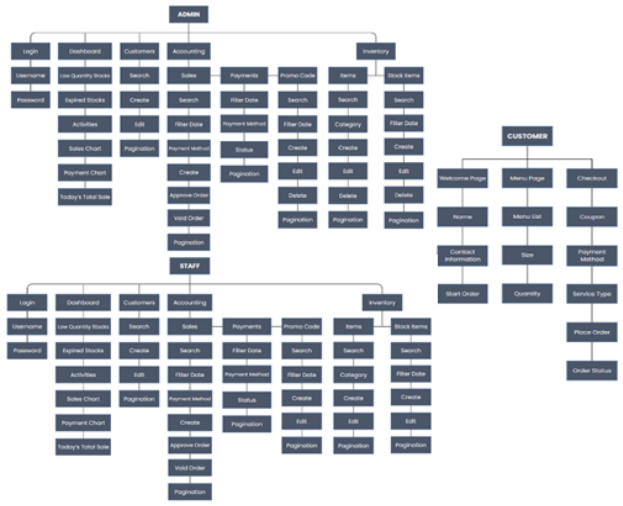

Figure 3. Visual Table of Contents (VTOC) of Kapepongtsa

Kapepongtsa was implemented to streamline cafe operations across three distinct user levels, which are Admin, Staff, and Customer. For admin, secure login was implemented with username and password verification to maintain user authentication. After login, an overview of the dashboard will show up, displaying key statistics. The sales management enables admin to view completed sales, create new sales, search specific orders, update order statuses, void orders as necessary, and generate invoice and sales report. Admin have the ability to view and search payment records, as well as manage promo codes. Admin are able to manage the inventory by creating, viewing, editing, deleting, and searching items, as well as stock items. Staff have similar features to the admin but without the ability to delete records of promo codes, items, and stock items, ensuring essential data is not unintentionally removed.

The customer interface provided a simple and intuitive display of products, allowing customers to browse the menu. Customers can place an order by selecting an item, increasing their desired quantity, and remove an item if it is no longer need. Before checking out, customer can apply a valid promo code for discount. Customers can choose their preferred payment method and service type. Once an order is placed, customers can track the status of their order.

Testing

In this phase, the researchers conducted both alpha and beta testing using a survey tool designed by the researchers and anchored to the criteria of ISO 25010. These tests aimed to identify and resolve any system issues. The survey tool assessed various aspects of the system, including Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility.

Prior to being prepared for the system, the validity of the questionnaire has been evaluated during the testing phase. The procedure for acquiring, analyzing, and processing the data, as well as the sampling method and instruments to be used are all covered.

The questionnaire underwent a thorough validity testing process to guarantee that the study's findings remained unbiased and were not influenced by external factors such as the researchers, respondents, or the evaluation environment. Prior to the survey's launch, the questionnaire was pre-tested to identify any potential issues, gather feedback, and implement necessary revisions before the final system was completed.

The researchers employed two sampling methods to gather insights on a web-based ordering and inventory management system for YOBS Cafe. Purposive sampling involved selecting participants based on specific characteristics or criteria. This approach allowed researchers to target individuals with insights or experiences related to the study's focus. The researchers identified three (3) Information Technology experts as Alpha testers due to their expertise and relevant experience in the field. This targeted selection ensured that the feedback and insights gathered during the testing phase came from individuals with the knowledge necessary to provide valuable input on the system's functionality and user experience. Homogeneous sampling was a type of purposive sampling where the researchers selected participants who shared similar characteristics to ensure a uniformity of responses. This method helped mitigate bias and ensured that the sample accurately reflected the population. For the Beta testing phase, thirty (30) customers and staff from YOBS Cafe were selected. By choosing participants from the same cafe, the researchers ensured that the testers shared similar experiences and interactions with the cafe's environment, menu, and service. This approach helped in understanding how a consistent group of users interacted with the system, leading to focused insights into its usability and functionality.

The survey was conducted at YOBS Cafe, located in Mabiga, Mabalacat City, Pampanga. During the

distribution and presentation of the questionnaire, the respondents were given an overview and a clear description of how to fill out the checklist based on their judgment. The researchers used the respondents' native language to ensure they fully understood the instructions, allowing them to answer the questionnaire accurately.

The study has used descriptive statistics to examine and interpret the data, focusing on key metrics such as central tendency, variability, and distribution. Descriptive statistics were used to organize and simplify the data, providing insights into its overall patterns, positioning, and range. The following statistical techniques were employed for data reduction: (1) Frequency distribution was utilized in the study to display the frequency of occurrences for each score. The demographic profile scores of the respondents were segmented into defined categories based on step intervals, with each category encompassing a range of possible scores. A variable representing the sequence of cases was partitioned into multiple categories. The frequency denoted the number of cases recorded within each category; (2) The mean, also known as the average or estimated center value of a group of numbers, was used to determine the data's central tendency. The statistician's definition of the mean formula for a set is the sum of the observations divided by the total number of observations. The mean formula can be written as Mean = (Sum of data) ÷ (Total number of observations) for the provided data set; and (3)

The Likert Scale is a rating system commonly employed in surveys intended to assess respondents' attitudes, opinions, or perceptions. The researchers used the Likert Scale to translate the results into their appropriate verbal interpretations following the computation of each mean score for each survey instrument, sub-criteria, and criteria.

Tally sheets will be used for data processing. The finalized tally summary was prepared as the respondents finished filling out the beta test questionnaires.

Table 3. The 5-point Likert Scale - Level of Agreement

Response Categories	Numerical Value	Range / Interval	Verbal Interpretation
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.41 – 4.20	Good
Neutral	3	2.41 – 3.20	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly Disagree	1	1.00 – 1.80	Poor

Operation and Maintenance

During this phase, the system was deployed locally using localhost and made accessible within the local network. The maintenance phase included several processes to monitor and support the system's performance over time. Regular monitoring allowed the researchers to observe how the system operated under actual conditions, which helped in identifying any potential issues early. Reviews were conducted periodically to assess the system's functionality, ensuring it met all specified requirements and continued to perform as expected. Organized maintenance tasks were essential for addressing any issues that arose after deployment. This included applying updates, fixing bugs, and optimizing system performance based on feedback from users. Overall, continuous monitoring and maintenance during this phase were crucial to maintain smooth operations, enhancing user experience.

Figure 4. Sales and Payment Management

RESULT

The developed system for YOBS Cafe effectively addresses the inefficiencies of manual processes by integrating key features for seamless operations. The order management (See Figure 4) streamlines the ordering process with a digital menu, real-time order tracking, and checkout options. The sales and payment management (See Figure 5) enable detailed tracking of transactions, order management, and accurate financial reports. Promotions management allows for efficient handling of promo codes, ensuring proper oversight. Lastly, the inventory management optimizes stock tracking, item updates, and reporting. Together, these features enhance operational efficiency, accuracy, and customer satisfaction, meeting the goals of YOBS Cafe.

The researchers conducted alpha and beta testing to evaluate Kapepongtsa. During the alpha testing phase, the system underwent a comprehensive evaluation by three (3) IT Experts. During the transition to the beta testing phase, a total of thirty (30) individuals from YOBS Cafe contributed significant insights. The group consisted of twenty-six (26) customers and four (4) staff of YOBS Cafe. The system's testing was evaluated based on test cases created by the researchers using the criteria of ISO 25010 standards, encompassing various aspects such as Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. This comprehensive evaluation offered specific insights regarding the effectiveness of the Kapepongtsa within YOBS Cafe.

Table 4. Summary of Alpha Test Result

Criteria	Mean Score	Verbally Interpretation
Functional Suitability	4.15	Good
Compatibility	4.67	Excellent
Interaction Capability	4.67	Excellent
Security	4.47	Excellent
Flexibility	4.67	Excellent
Total Mean	**4.53**	**Excellent**

Table 4 shows the summary of Alpha testing results, as evaluated by three (3) IT experts, providing a well-rounded assessment of the system's performance across several criteria. The alpha testing results provide valuable insights into the system's performance across various criteria, with an overall mean score of 4.53, which is interpreted as Excellent.

Several aspects of the system received the highest mean score of 4.67, including Compatibility, Interaction Capability, and Flexibility with verbal interpretation of Excellent. These results demonstrate that the system excels in key areas. Its ability to operate seamlessly across various devices, platforms, and operating systems ensures accessibility and versatility.

The Functional Suitability scored the lowest with a mean score of 4.15, which is interpreted as Good. While this indicates that the system performs its core functions effectively, certain subcategories within this criterion received lower scores.

Table 5. Summary of Beta Test Result

Criteria	Mean Score	Verbally Interpretation
Functional Suitability	4.52	Excellent
Compatibility	4.34	Excellent
Interaction Capability	4.70	Excellent
Security	4.51	Excellent
Flexibility	4.21	Excellent
Total Mean	**4.46**	**Excellent**

Table 5 provides a summary of the Beta testing results, based on evaluations by thirty (30) customers and staff from YOBS Cafe. The system earned an overall Excellent rating, with a mean score of 4.46, reflecting its ability to meet intended requirements effectively.

The Interaction Capability with a mean score of 4.70, emerged as the highest area, with users praising the interface's clarity and inclusivity. The system's use of accessible language scored exceptionally high, enhancing user satisfaction across varied technical proficiencies.

Flexibility with a mean score of 4.21 was the lowest-rated criterion, with challenges in scalability, such as managing peak orders. While the system adapts well to different environments, backend improvements are necessary to sustain consistent performance under heavy loads.

DISCUSSION

This research project successfully achieved its primary objective of developing Kapepongtsa, a web-based ordering and inventory management system tailored for YOBS Cafe. The researchers were able to meet their goal by thoroughly analyzing the cafe's operational needs and incorporating these insights into a functional, user-friendly system. By using both primary and secondary data, the researchers ensured that the system was designed to address specific requirements and optimize workflows for end-users, including customers, staff, and management at the cafe. Data for this project was gathered from a wide range of sources, providing a well-rounded foundation for development. Secondary sources included academic publications, journals, web articles, and consultations with technical advisers, professors, and industry professionals, which helped refine the conceptual and technical framework of the system. Meanwhile, primary data was collected directly through interviews,

observations, and assessments of YOBS Cafe's current processes.

To ensure that Kapepongtsa adhered to industry standards, the researchers crafted a detailed questionnaire based on the ISO 25010 model. This questionnaire assessed critical aspects such as Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. Following these guidelines allowed the researchers to evaluate the system's quality and ensure it met established Software Product Quality Standards, aligning the project with real-world expectations and benchmarks.

The development process was further structured through the use of visual aids, including diagrams and storyboards, which played a significant role in planning and organizing the system. A storyboard was used to provide a sequential flow of user actions, which facilitated a streamlined interface design. The Use Case Diagram clarified the interactions between user roles and system functions, while the Visual Table of Contents (VTOC) improved navigation by helping users access various sections intuitively. Additionally, a Data Flow Diagram (DFD) mapped data movement within the system, illustrating how inputs were processed and transformed into outputs. A Gantt Chart was also used to keep the project timeline organized, ensuring tasks were completed on schedule.

Specific hardware and software resources were utilized for the successful development and implementation of Kapepongtsa. The hardware included a desktop computer with an AMD Ryzen 3 5300U processor, Radeon Graphics, 12GB of RAM, and a 256GB SSD, which supported the system's technical demands. A tablet was also used for web browser testing to confirm compatibility across devices. Key software tools included Visual Studio Code, which served as the main Integrated Development Environment (IDE) for coding, Microsoft SQL Server 2022 for data management, and SQL Server Management Studio for database oversight. The researchers also relied on .NET SDK 8.0 for application development, while Git and GitHub facilitated version control, and Canva and Figma were used to create diagrams, prototypes, and user interface designs.

Testing was conducted in two phases to ensure the system met quality standards and user expectations. In the alpha testing phase, three IT experts reviewed the core functionalities, providing essential feedback for improvement. The system achieved a "Good" rating in Functional Suitability (4.15), an "Excellent" rating in Security (4.47), while Compatibility, Interaction Capability, Flexibility received an "Excellent" rating of 4.67. Based on this feedback, the system was refined and prepared for beta testing. The beta testing phase involved 30 participants, including YOBS Cafe's customers and staff, who evaluated the system in a real-world setting. In this phase, Kapepongtsa demonstrated "Excellent" ratings across all criteria, including Functional Suitability (4.52), Compatibility (4.34), Interaction Capability (4.70), Security (4.51), and Flexibility (4.21). These scores validated the system's functionality, usability, and security, confirming its readiness for deployment and demonstrating its effectiveness in streamlining YOBS Cafe's operations. The successful implementation of Kapepongtsa illustrates the project's achievement of its goals and highlights its potential to enhance efficiency and customer satisfaction in the cafe environment.

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CycloTrace: Microcontroller-based Smart Vest Warning System with User Interface and Cyclist Emergency Locator

CHARLES M. AGUILAR, MABALACAT CITY COLLEGE
STEPHEN S. DAVID, MABALACAT CITY COLLEGE
KEANT A. FERNANDEZ, MABALACAT CITY COLLEGE
MARK IAN L. SALALAC, MABALACAT CITY COLLEGE
WENCY S. SUING, MABALACAT CITY COLLEGE
ROBHERT M. BAMBA (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT

The CycloTrace project focuses on improving cyclist safety through a microcontroller-based smart vest with integrated GPS tracking, LED signaling, and emergency communication features. Using the Systems Development Life Cycle (SDLC), the project developed a wearable system that enhances visibility, connectivity, and safety. Alpha and beta testing yielded excellent results, with high scores in usability, performance, and reliability. Challenges like hardware communication issues were addressed through iterative development. The CycloTrace vest showcases the potential of wearable technology to enhance personal safety, aligning with modern safety practices and sustainable development goals.

Keywords: Cyclist Safety, Smart Wearables, GPS Tracking, LED Signaling, IoT.

INTRODUCTION

In the modern era, wearable technology has become a pivotal tool for enhancing personal safety across various contexts, including outdoor activities and transportation. Smart vests, equipped with features like GPS tracking and LED signaling, have revolutionized the way users interact with their surroundings. These vests provide real-time visibility and safety enhancements, making them indispensable for cyclists navigating urban and rural roads.

Cycling is increasingly popular worldwide due to its environmental and health benefits. However, cyclists face significant safety challenges, particularly in low-visibility conditions or high-traffic areas. Traditional safety measures like reflective gear often fall short, necessitating innovative solutions to bridge this safety gap. Addressing these concerns, the CycloTrace vest integrates modern technology into a wearable device, enabling cyclists to enhance their safety and connectivity on the road.

The CycloTrace project aligns with Sustainable Development Goals (SDGs) such as ensuring health and well-being (SDG 3) and fostering innovation and sustainable infrastructure (SDG 9). This study focuses on developing a smart vest system that combines microcontroller technology, real-time GPS tracking, and user-friendly mobile applications to address critical safety issues for cyclists.

Related Studies

Cycling safety has been a critical focus of recent wearable technology research. Several studies highlight the integration of smart wearables to enhance visibility and communication for cyclists.

Amirul et al. (2022) developed a smart jacket equipped with ultrasonic sensors and LED-based turn signals to address cyclists' safety concerns. The jacket successfully displayed turn signals in arrow-shaped LED patterns and detected nearby obstacles using ultrasonic sensors. This innovation provided cyclists with advanced warning of potential collisions, significantly improving road safety.

Mariam et al. (2021) explored a smart LED bike jacket designed to enhance safety and visibility for cyclists. The study emphasized the necessity of integrating blind-spot detection and directional signaling into wearable devices. The development aimed to reduce cyclist accidents, particularly in urban environments with shared road spaces.

Rajaram et al. (2020) conducted an experiment on visibility-enhancing systems for cyclists, comparing active systems like LED lights to passive retroreflective clothing. Their findings indicated that flashing LED lights provided superior visibility, especially in low-light conditions, compared to traditional reflectors. The study underscored the importance of incorporating active visibility systems into cycling gear.

In a similar vein, Boularas et al. (2021) examined wearable air pollution sensors designed for cyclists in urban areas. The integration of real-time air quality monitoring allowed cyclists to make informed decisions about their routes, improving both health and safety outcomes.

These studies collectively highlight the growing role of smart wearables in addressing cyclist safety through innovative technologies. The CycloTrace vest builds on these advancements by integrating GPS

tracking, emergency alerts, and LED signaling into a single system, offering a comprehensive solution to cyclist safety challenges.

METHODOLOGY AND DESIGN

The CycloTrace vest was developed using the SDLC methodology, ensuring a systematic approach to design, implementation, testing, and maintenance.

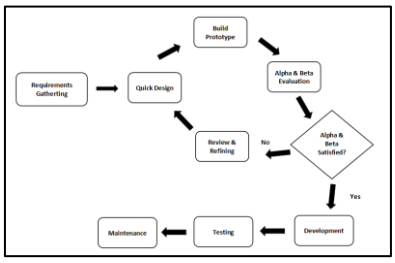

Figure 1: Flowchart of the System Development

Requirements Gathering

Data from cyclists and stakeholders was collected through surveys and interviews to identify the most pressing safety concerns and define system requirements. The researchers focused on features that would directly impact cyclist safety, such as improved visibility and emergency response mechanisms.

The proponents chose to build the Mobile application and the code of the system using development software tools (See Table 2) on a Desktop Computer (See Table 1) running on the Microsoft operating system, with an AMD Ryzen 5 5600x processor, 16 GB RAM, 1 TB M.2 SSD, and 6 GB Video RAM. The proponents will use Arduino IDE for the System Code. MIT App Inventor will be used for the mobile app, and Canva was used for storyboard. Additionally, Blender was used for 3D. On a three-dimensional platform with optimized visuals, the simulator would work smoothly on devices running Windows 10 or later.

Table 1: Desktop computer hardware specifications used for the project development.

Component	Specification
Processor	AMD Ryzen 5 5600x
Memory	16 GB
Video RAM	6 GB
Hard Disk / SSD	1 TB

Design

The system was designed with modules for GPS tracking, LED signaling, and emergency alerts. Researchers used tools like flowcharts and system architecture diagrams to visualize how the various components would interact. This phase ensured that the hardware and software components were compatible and met the outlined requirements.

Implementation

Key components, including the ESP8266 D1 Mini, GSM module, and GPS module, were integrated during this phase. The researchers programmed the vest's functions using Arduino IDE. A mobile application developed with MIT App Inventor provided an intuitive interface for controlling the vest's features. This phase also included prototype assembly and initial hardware testing to confirm functionality.

Table 2: Software development tools used for project development.

Component	Specification
Arduino IDE	System Code
MIT App Inventor	Mobile App
Canva	Storyboard
Blender	3D Model

Testing

Alpha tests were conducted by IT experts to evaluate the vest's functionality, including GPS tracking, LED signaling, and GSM communication. Beta tests involved 50 cyclists who assessed the vest's usability and reliability under real-world conditions. Testing was guided by ISO/IEC 25010 standards to ensure thorough evaluation of system performance and user satisfaction.

Sampling Method

Convenience sampling was employed to recruit participants for surveys and testing. Local cyclists were chosen for their accessibility and relevance to the research objectives. While this method allowed for efficient data collection, the researchers acknowledged its limitations in representing a broader population. The insights gained were instrumental in tailoring the CycloTrace vest to meet the needs of the target users.

Questionnaire Administration

The questionnaire was administered on November 11, 2024. During the distribution and administration of the questionnaire, a brief introduction and explanation of how the respondent should fill out the checklist based on their application experience was provided. The proponents used the mother tongue.

Data Analysis

Descriptive statistics was employed to review the study, identify the data, assess their distribution and variability, and provide a summary of the outcomes. These techniques helped in

understanding the central tendencies, patterns, and overall structure of the data set.

Frequency Distribution

Frequency distribution was used in the study to show how many situations fell into each score range. The demographic information about the respondents scores were used to produce the next phase intervals defined the classification, which represented the collection of continuous possible scores. The number of categories used to determine frequency was determined by a variable whose values reflect the order in which the situations occurred.

Mean

The average or approximately middle value of a collection of numbers is another name for the mean. According to statisticians, the mean formula for a set is the sum of the data divided by the total number of data. For a given set of data, the mean formula can be expressed as Mean = (Sum of Observations) ÷ (Total Numbers of Observations).

$$\bar{x} = \Sigma fx/\Sigma f$$

where,

$\bar{x}$ = the mean value of the set of given data.

f = frequency of each class

x = mid-interval value of each class

Likert Scale

The rating system used in questionnaires that evaluate respondents beliefs, opinions, or perceptions is the Likert scale. The researcher used the Likert scale to explain the results after calculating the average score for each survey instrument sub-criteria and criterion. A scale with a range of 1 to 5 is used to ask respondents to rate how much they agree or disagree with the statement; each point represents a different level of agreement or disagreement.

Response Categories	Numerical Value	Range / Interval	Verbal Interpretation
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.41 – 4.20	Good
Neutral	3	2.41 – 3.20	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly Disagree	1	1.00 – 1.80	Poor

Data Processing

Tally sheets were used to process the data. The final tally summary appeared as the respondents finished the beta questionnaires. The researchers used a tally sheet form to enter the data.

Maintenance

Post-deployment, the vest was monitored for bugs and areas for improvement. User feedback was collected to inform updates and ensure the system remained functional and user-friendly over time.

RESULTS

The researchers gathered information for the requirement analysis step by consultations and online research. The researchers guaranteed the correctness and reliability of the data. The researchers carefully designed, discussed, and conducted research in online to gather ideas for the capstone project. To keep up with the project's progress, the researchers talked with the technical and capstone advisers during the development of the system and documentation. To make sure the study worked efficiently, researchers gave certain tasks, set plans, and shared ideas. As a result, they organized and cooperative approach was important to the research and project development process.

Alpha and Beta Testing

Alpha testing by three IT experts evaluated functional suitability, compatibility, and usability, yielding an overall score of 4.55. Beta testing, involving 30 cyclists, confirmed the system's reliability and effectiveness with a slightly lower overall score of 4.37. Feedback highlighted areas for improvement, such as hardware robustness and app usability.

Testing Results

The Alpha and Beta testing phases were two crucial testing stages for the system. Based on ISO 25010 standards, the researchers thoroughly evaluated the administrator interface and mobile application during the alpha test. The beta test engaged a larger audience focusing on specific criterias. These evaluations offer a comprehensive understanding of the system, laying the foundation for in-depth analysis.

The table summarizes the results of alpha testing using five criteria: functional suitability, compatibility, interaction capability, security, and flexibility. Each criterion obtained a mean score, which is orally interpreted as "Excellent." Of the criteria, Functional Suitability received the greatest score of 4.79, while Security received the lowest at 4.36. The aggregate mean score for all categories is 4.55, which can also be translated as "Excellent." These findings indicate that the system performed extraordinarily well in all areas assessed during the alpha testing phase.

The table shows the summary results of beta testing, evaluating the system based on five criteria: Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The mean scores for these criteria range from 4.29 to 4.40, all classified as "Excellent." The overall total mean score is 4.35, which is also interpreted as "Excellent." These results suggest that the system performs exceptionally well in its beta testing phase, showing strong reliability, usability, and effectiveness across all assessed aspects.

Table 3: Alpha Test Total Results

Criteria	Mean Score	Verbally Interpretation
Functional Suitability	4.57	Excellent
Performance Efficiency	4.49	Excellent
Compatibility	4.55	Excellent
Interaction Capability	4.79	Excellent
Reliability	4.36	Excellent
Total Mean	**4.55**	**Excellent**

Table 4: Beta Test Total Results

Criteria	Mean Score	Verbally Interpretation
Functional Suitability	4.37	Excellent
Performance Efficiency	4.29	Excellent
Compatibility	4.34	Excellent
Interaction Capability	4.39	Excellent
Reliability	4.40	Excellent
Total Mean	**4.35**	**Excellent**

Table 5: Alpha and Beta Test Comparisons

Criteria	Alpha	Verbally Interpretation	Beta	Verbally Interpretation
Functional Suitability	4.57	Excellent	4.37	Excellent
Performance Efficiency	4.49	Excellent	4.29	Excellent
Compatibility	4.55	Excellent	4.34	Excellent
Interaction Capability	4.79	Excellent	4.39	Excellent
Reliability	4.36	Excellent	4.40	Excellent
Total Mean	**4.55**	**Excellent**	**4.35**	**Excellent**

Results from both alpha and beta testing demonstrate that the smartvest operates satisfactorily and is ready for implementation. "Excellent" ratings for all evaluation criteria--functional suitability, interaction capability, and flexibility demonstrate that the system is well aligned with the design objectives and intended functionality. The total score received from all participants in alpha testing is 4.55, whereas in beta testing it is 4.35.

During alpha testing, the Smart Vest received an overall score of 4.55. The functional suitability score was 4.57. It demonstrated that it could do the majority of the critical duties, such as turning on signal lights, communicating longitude and latitude, and even working consistently throughout the trials. The performance efficiency score of 4.49 showed that the smart vest performed its functions within 10 seconds of time from receiving text to sending it back with the location of the user, it also responded within the time of 1 second upon pressing the button and using the voice command through the application. Overall it showed that the smart vest was responding very quickly to each function. With the compatibility score of 4.55 the smart vest has demonstrated that it is compatible with other applications installed on smartphone as it wasn't interfered while using the application, the compatibility of each components was also shown as it was able to send the signal it received to other components of the vest. The Interaction Capability score of 4.79 indicated that consumers found the interface intuitive and simple to use, which aligned nicely with the project's objective of involving the community. The score of 4.36 was quite impressive based on how reliable the smart vest is under some specific condition such as it being waterproof it showed that it can work for a while.

The beta testing phase simply solidified the system's quality, resulting in a cumulative score of 4.37. The Functional Suitability score decreased to 4.29, indicating that although alpha testing worsened the system's ability to meet user expectations and operational requirements by a little bit it still is an excellent score. With the performance efficiency going down to 4.29 it still was able to present an excellent efficient performance. The Compatibility was scored at 4.34, though it might be lower than the initial alpha testing it still is compatible. The Interaction Capability score was lower by a little bit with the score of 4.39, it still established a stable and usable foundation for the interface in front of a large cross-section of users. The reliability score showed that it improved by a little with the score of 4.40, it became better than the initial alpha testing as the reliability was more appealing to the users than before.

The process of iterative development and the system's improvement following changes made throughout the testing phase could be the cause of the differences in scores between the alpha and beta phases.

DISCUSSION

GPS Tracking

Real-time GPS tracking ensures that the cyclist's location can be monitored at all times. This feature is especially crucial for emergency response scenarios, where immediate access to location data can expedite assistance. The GPS module communicates with satellites to provide precise coordinates, which are accessible via the mobile application.

LED Signaling System

Programmable LED strips embedded in the vest are designed to enhance visibility and improve communication on the road. The LEDs can display clear signals for turns and stops, making it easier for other road users to anticipate the cyclist's actions. These patterns are optimized for both daytime and nighttime visibility, significantly reducing the risk of accidents.

Emergency Communication

In the event of an emergency, the GSM module enables the vest to send SMS alerts containing the cyclist's real-time location to pre-designated contacts. This feature adds a layer of safety by ensuring that help can be summoned quickly and effectively, even in remote areas.

Mobile Application

The user-friendly mobile app serves as the control center for the CycloTrace vest. It allows users to customize LED patterns, access GPS data, and activate emergency alerts. Designed with an intuitive

interface, the app ensures that cyclists can interact with the system effortlessly, even while riding. The CycloTrace mobile app has a simple design that allows you to easily adjust the system's lighting signals. Using Bluetooth and Wi-Fi modules, the software talks with the hardware to control the LED light signals for navigation and safety. The program has simple buttons like Left, Right, and Stop that users may tap to trigger the proper signals on the LED strips. The software also contains a Voice Mode that allows for hands-free control. When active, users can control the lights by just saying commands like "left," "right," or "stop," which is especially useful while cycling. The combination of touch and voice controls offers adaptability and accessibility, which enhances both functionality and user experience.

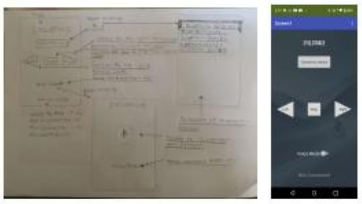

Figure 2: CycloTrace Mobile Application

Challenges and Solutions

Initial development faced challenges such as hardware communication failures and inconsistent LED connections. These issues were addressed through iterative testing and refinement. For example, hardware components were reconfigured to improve reliability, and software algorithms were optimized to enhance system performance. The iterative approach ensured that the final product met the desired standards of functionality and reliability.

Limitations

This study has some limitations, mainly due to environmental factors and how the technology performs in different conditions. The vest's GPS and wireless features depend on signal strength, which can be weak in remote or crowded areas. This might impact the accuracy of location data and the system's overall reliability. Although the vest was tested in a variety of settings, extreme weather and difficult terrain may not be adequately recreated, affecting its performance in real-world scenarios.

Another limitation is the battery life and power efficiency of the system. The vest's functionality, particularly the GPS tracking and LED signaling, depends on sustained power usage. As such, the duration of operation may be limited by how long the battery can last, which could affect the user experience, especially during long rides or shifts. If the battery life is too short, it could reduce the vest's usefulness, especially for users who need continuous safety features and monitoring. The study have also encounter scalability issues because the vest relies on specific hardware and network requirements. If the battery doesn't last long enough, it could affect the vest's reliability for users who need it to provide ongoing monitoring and safety features.

Finally, the study's ability to expand was limited by the hardware and network requirements of the vest. Since the vest uses specific technology, it may not work well in all regions or with devices that aren't compatible. Additionally, although feedback were gathered from users, the sample might not represent all types of users, which could limit how well the vest adapts to different body shapes, preferences, or cultural needs.

Conclusions

The CycloTrace smart vest represents a significant advancement in wearable technology for cyclist safety. By integrating GPS tracking, LED signaling, and emergency communication into a single device, the system addresses critical safety concerns while offering a user-friendly experience. The project demonstrates the potential of IoT-driven solutions in enhancing personal safety and contributing to sustainable development goals.

Future iterations of the CycloTrace vest will explore expanded functionality, such as advanced health monitoring and compatibility with smart traffic systems.

Recommendations

This section contains the recommendations made by panelists, alpha testers, beta testers, and technical advisers to the researchers.

To improve the CycloTrace system's functionality and safety, multiple suggestions could be followed. Adding hazard lights would increase visibility for cyclists in emergency situations, alerting others to possible hazards or requiring a sudden stop. Adding a gyroscope and accelerometer would allow for more accurate monitoring of the cyclist's movement, allowing the system to adapt to the lighting signals in response to the cyclists direction or changes in motion, such as sudden twists or quick stops. A heat indicator might also be used to monitor the environment's heat while cycling. Implementing a start-to-end distance function would enable the app to track the whole distance traveled during a ride, giving cyclists with useful information about their activities. Furthermore, including a speed indicator could provide cyclists with real-time information about their cycling speed, allowing them to maintain a safe pace. These changes would improve the overall user experience by giving more detailed feedback and increased safety features for bikers.

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MINUM: IOT-Based Drinking Water Vending Machine with Sales and Level Monitoring

RONRIC JOEL L. BINUYA, MABALACAT CITY COLLEGE
JIMMUEL P. MICLAT, MABALACAT CITY COLLEGE
JOHN LLOYD V. PACIS, MABALACAT CITY COLLEGE
CEDRICK JOHN A. SOLIS, MABALACAT CITY COLLEGE
PATRICK LORENCE M. TEVES, MABALACAT CITY COLLEGE
KGERONE LORENZ M. TORRES, MABALACAT CITY COLLEGE
ERNIE LEE E. PINEDA (Technical Adviser), MABALACAT CITY COLLEGE
DENNIS L. TACADENA (Capstone Adviser), MABALACAT CITY COLLEGE

ABSTRACT

The IoT-Based Drinking Water Vending Machine with Sales and Level Monitoring addresses the growing demand for clean and accessible drinking water. This system focuses on providing sustainable solutions tailored for educational institutions. Developed using the Modified Waterfall Model, the system integrates real-time water level tracking, automated sales monitoring, and a mobile application for administrative oversight. Testing, based on ISO 25010 standards, yielded "Excellent" performance ratings, demonstrating reliability and user satisfaction. Key features include coin-operated dispensing, automated refill mechanisms, and intuitive mobile app functionality. This study contributes to Sustainable Development Goals (SDGs) 6, 9, and 12, promoting resource efficiency and innovation.

Keywords: IoT, Mobile Application, Smart Water Management, Vending Machine

INTRODUCTION

The Internet of Things (IoT) has emerged, signing a prompt and enhanced monitoring and control of everyday appliances, including water dispensers. Recent research shows how the application of IoT in water management makes the systems efficient and sustainable. For example, IoT technologies of water and wastewater improve the ways of real-time, they provide remote solutions of water to the appropriate demands regarding the conservation and accessibility (Alshaam, et al. 2024).

Furthermore, smart water management through the utilization of the IoT-based water distribution system is characterized by sensors and automated controls. It can also automate the process of dispensing water depending on the amount of water present in it; these systems would effectively be applicable in schools, colleges, and in those societies where water scarcity is a big hurdle (Abebe, A 2024). Additionally, there are Arduino coin operated IoT water dispensers which definitely make and ease resource and operation hence, thereby proving that IoT applies in making the availability of resources while sustainably preparing for the future (Kuthe N, et al. 2024).

Water vending machines provided a user-friendly and cost-effective solution to support community access to purified water, meeting the essential human need for drinking water. For instance, Koh et al. (2024) highlighted how IoT-enabled water dispensers could operate with coin payments, utilizing smart cards and IoT to facilitate payment options and process monitoring. This minimized the need for human intervention and allowed users to access purified water with ease. Examples like Smart Water ATMs, incorporating Arduino integration and RFID authentication, encouraged people to consume water in appropriate measures. These machines, positioned in urban and rural areas, provided an additional potable water source without necessitating immediate infrastructure investments. This approach promoted public health, reduced environmental impact, and lessened the transportation burden for bottled water in remote regions.

The incorporation of IoT into water dispensing systems offered numerous environmental benefits. Data Alliance (2023) demonstrated how IoT in water pumping, processing, and treatment systems enhanced energy efficiency, reducing both operational costs and environmental impact. Further, cellular IoT solutions were proving effective in combating water pollution by adhering to environmental regulations and optimizing wastewater quantities (Nordic Semiconductor, 2022). These IoT advancements not only optimized water management but also contributed to broader environmental objectives, which were critical in addressing modern issues like climate change and resource scarcity.

A study by Widiatmoko et al. (2023) highlighted an Arduino-based water dispensing system using ultrasonic sensors to monitor water levels and LCDs for user feedback, improving reliability and water efficiency. Similarly, IoT-based dispensers in the Philippines optimize water usage, reduce waste, and support sustainability by maintaining water levels and providing real-time data (Typeset, 2024; Aqua SmartGuard, 2023).

The researchers aimed to developed an IoT-based drinking water vending machine with sales and level monitoring capabilities. This technology sought to transform water supply management, promoting more effective resource utilization. The system, monitored through a mobile application, benefited community members and supported water conservation efforts. Equipped with a coin slot module, microcontroller, and sensors, the system enabled users to insert coins to access water. The microcontroller relayed signals from the sensors to dispense water equitably. By enhancing energy efficiency and water management, this smart dispenser system presented a sustainable solution to meet community water needs, promoting efficient water usage and minimizing waste.

Objective of the Study

The general objective of the study is to develop an IOT Based Drinking Water Vending Machine with Sales and Level Monitor for MCC Dapdap.

The study aims to achieve the following specific objectives:

- To collect data regarding the IoT-based water dispenser vending machine through research, reputable sources such as articles, published books, and previous capstone projects.
- To identify the hardware and software development tool requirements for the application, back-end system development, and integration of the IoT-based water dispenser.
- To design, the system, application using the following diagrams and analysis tools.
- To construct and configure the ESP32, ESP8266, Arduino UNO microcontrollers for the development of the application and dispensing algorithm.
- To develop an application capable of interacting seamlessly with a mobile application.
- To create hardware IoT-based that integrates advanced features for enhanced functionality and performance.
- To integrate an algorithm with functionalities to optimize system performance.
- To incorporate user-friendly functionalities to enhance the overall experience.
- To test the system using developer testing, alpha testing, and beta testing phases.
- To Evaluate the system's performance using ISO 25010 criteria. Functional Suitability, Performance Efficiency, Compatibility, Interaction Capability, Reliability, Security, Flexibility, Safety.
- To deploy and implement the system to the Mabalacat City College Dapdap.

Each specific objective interconnects to support the successful development, deployment, and operation of the IoT-Based Drinking Water Vending Machine. Together, they form a comprehensive approach to achieving the study's primary goal of improving water management and accessibility for MCC Dapdap.

METHODOLOGY AND DESIGN

The research employed the Modified Waterfall Model, a structured yet flexible approach to system development that allows iterative refinements at each stage. This model was particularly suitable for the project as it combined the strengths of a linear approach with the adaptability needed to incorporate feedback and address challenges effectively (See Figure 1). The process comprised the following iterative phases: requirements gathering, design, development, testing, deployment, and maintenance, each contributing significantly to the system's improvement.

The requirement’s gathering phase was critical to establishing a strong foundation for the system. Surveys, interviews, and literature reviews were conducted to identify the specific needs and expectations of students, staff, and administrators. This phase ensured that the system design would be user-centric and aligned with real-world operational needs. Stakeholder feedback was continuously incorporated, ensuring that initial concepts evolved to address potential use-case scenarios comprehensively.

In the design phase, both hardware and software components were carefully selected and integrated. Hardware components, including ESP32, ESP8266, and Arduino UNO microcontrollers, ultrasonic sensors, buttons, and an electronic coin slot, were chosen for their reliability and efficiency. On the software side, Android Studio was utilized for mobile application development, with Firebase providing real-time database integration. Comprehensive system architecture diagrams, flowcharts, and storyboards were created to visualize and document the system’s functionality and workflows. This phase also allowed for iterative refinements based on feedback, ensuring clarity and alignment with the project objectives.

During development, the system's core features were implemented incrementally. Water level monitoring was achieved using ultrasonic sensors, which tracked tank levels and triggered notifications when capacity dropped below 25% or exceeded 90%. A robust coin validation system was developed to handle transactions accurately, allowing users to dispense specific water volumes (e.g., 1 peso for 100 mL and 5 pesos for 500 mL). The iterative nature of the Modified Waterfall Model enabled developers to test and refine individual features continuously, ensuring each component functioned optimally before full system integration.

The testing phase was divided into alpha and beta stages. Alpha testing involved IT experts who evaluated the system's functionality, identifying bugs and providing recommendations for improvement. Beta testing engaged end-users, including students and staff, to assess usability, functionality, and reliability in real-world scenarios. Feedback from both testing phases was instrumental in refining the system, addressing issues, and enhancing user experience.

Once the system passed rigorous testing, it was deployed at MCC Dapdap. Deployment included training sessions for administrators and users to ensure effective operation and adoption. Monitoring during this phase provided additional insights, enabling minor adjustments to optimize system performance.

The final phase, maintenance, focused on ensuring the system's long-term reliability. Regular updates and monitoring mechanisms were established to address potential issues, adapt to changing user needs, and incorporate technological advancements.

The project encountered several challenges throughout its development. One notable issue was ensuring compatibility between the hardware components, particularly the integration of microcontrollers with the ultrasonic sensors and the coin slot mechanism. This was resolved through extensive testing and iterative adjustments to the wiring and firmware. Another challenge was optimizing real-time communication between the mobile application and Firebase, which was initially hindered by latency issues. Adjusting the database structure and optimizing query handling significantly improved performance. Additionally, user feedback during beta testing highlighted the need for enhanced security features, which were addressed by implementing stricter validation protocols and error-handling mechanisms.

By leveraging the Modified Waterfall Model, the project effectively balanced structure and flexibility, ensuring that each phase contributed to
a robust and reliable IoT-Based Drinking Water Vending Machine.

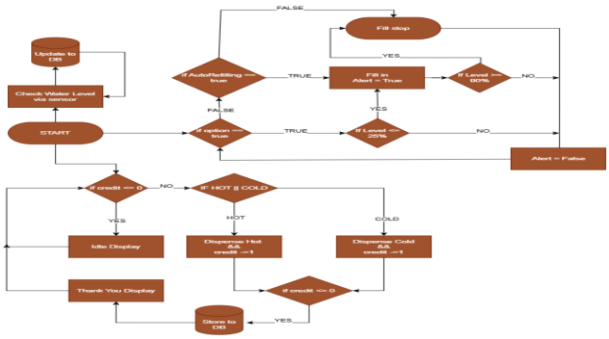

Figure 1: Modified Waterfall Model

Requirements

The requirements gathering phase identified essential hardware components such as ultrasonic sensors for water level detection, a coin slot validator for payment processing, and an ESP32, ESP8266 and Arduino UNO microcontroller for data handling. The software requirements included the development of an Android application for real-time monitoring and notifications. The system was designed to operate in environments with limited resources, ensuring reliability and ease of use.

Design

The system's design process involved creating a comprehensive flowchart to illustrate the operational flow. The water vending machine accepts coins, validates their denominations, and dispenses water accordingly. Ultrasonic sensors monitor water levels, triggering notifications for refill needs. The mobile application provides administrators with a dashboard for tracking sales and water availability, ensuring seamless operation.

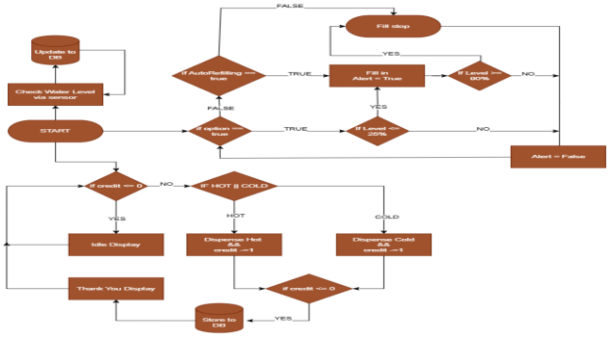

Figure 2: System Flowchart

Development

The development phase of the IoT-Based Drinking Water Vending Machine involved the integration of various hardware and software components to create a reliable, efficient, and user-friendly system. The system incorporates multiple microcontrollers, including the ESP32, ESP8266, and Arduino UNO,

each performing specific tasks to ensure seamless functionality. The ESP32 serves as the central processing unit, managing sensor inputs and controlling the water dispensing process. It records data such as date and total volume, which is transmitted via Wi-Fi through RTDB Firebase. Additionally, the ESP32 handles the overall dispenser system, ensuring accurate and efficient operation.

The ESP8266 focuses on monitoring the main water gallon, controlling the system either automatically or manually. It manages data such as water level (String), and options such as Auto Refilling (Boolean), sending and receiving real-time data to and from the Arduino UNO through serial communication. The Arduino UNO oversees auto-refilling and controls both pumps using MOSFETs. One MOSFET operates independently, connected to its dedicated ultrasonic sensor, while the other is managed via serial communication. This coordination ensures precise water dispensing and refilling.

The mobile application, developed using Android Studio, provides a user-friendly interface for administrators to monitor and manage the system. It integrates several software tools, including Flutter, an open-source framework developed by Google, to enhance user experience. RIVE is used to create interactive, real-time graphics and animations, enriching the application's functionality. The application also features Firebase Real-time Database, a cloud-based, real-time NoSQL database, ensuring seamless data synchronization between the mobile application and hardware components.

The application offers various features such as real-time sales tracking, water level monitoring, and security alerts, improving operational efficiency. It is designed to connect effortlessly with the hardware via Wi-Fi or mobile data, allowing remote management and control. Security measures are embedded within the app to prevent unauthorized access, and the notification system provides timely updates for maintenance or system updates, ensuring a secure and efficient user experience.

To visualize the user interface and system functionalities, a comprehensive storyboard was created during the design phase (see Figure 3). This storyboard outlined key user interactions, such as the coin validation process, water dispensing workflow, and notification alerts. It served as a blueprint for the development team, ensuring alignment with user expectations and system goals.

The database structure was meticulously planned using an Entity-Relationship Diagram (ERD), which defined the relationships among core entities, including the administrator, vending machine, and sales database (see Figure 4). The ERD facilitated efficient data retrieval and ensured that critical data points, such as transaction histories and inventory levels, were accurately captured and managed. This robust database structure supported seamless integration between the mobile application and hardware components.

A block diagram was developed to illustrate the overall system architecture, detailing the interconnections between hardware elements, software modules, and the mobile application (see Figure 5). This diagram provided a clear representation of the data flow, from coin validation through water dispensing to real-time notifications. It served as a critical reference for both the hardware and software teams, ensuring a cohesive and integrated development process.

The hardware prototype showcased both the initial and final versions of the IoT-based water vending machine (see Figure 6). Initially, the prototype featured basic elements such as the ESP32, ESP8266 and Arduino UNO microcontroller, ultrasonic sensors, buttons, and a simple coin slot, designed to test core functionalities like coin validation and water dispensing. Over time, the prototype evolved to incorporate a more refined and durable design, with enhanced integration of the water dispensing mechanism, improved sensor calibration, and a more robust housing to ensure the system's reliability and safety.

The mobile application interface presented three main sections: Home, Monitoring, and Sales (see Figure 7). The Home section provided an interactive guide on how to use the vending machine, featuring a visual depiction of the user workflow alongside the names of the research team. The Monitoring section allowed administrators to track water levels, with options for both auto and manual control modes to ensure efficient operation. Lastly, the Sales section provided a detailed overview of sales data, including daily, weekly, and yearly summaries, enabling thorough performance analysis and decision-making. Each section was designed to offer a seamless and intuitive user experience, facilitating real-time system management and monitoring.

Figure 3: Storyboard

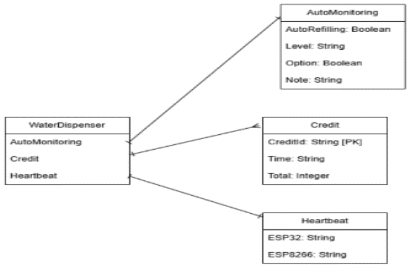

Figure 4: Entity-Relationship Diagram (ERD)

Figure 5: Block Diagram

Figure 6: Hardware Prototype

Figure 7: Mobile App Interface

Testing

Testing was a comprehensive process encompassing multiple approaches to evaluate the functionality, reliability, and user satisfaction of the IoT-Based Drinking Water Vending Machine. A Likert scale was employed during user feedback collection, enabling a structured assessment of participant satisfaction and system usability. The survey used a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree," (See table 1) allowing for quantitative analysis of user responses.

The study utilized purposive sampling, specifically targeting participants who were likely to interact with the vending machine system. This included students and staff at Mabalacat City College, selected based on their daily routines and likelihood of benefiting from the system. Homogeneous purposive sampling ensured a focused group with shared characteristics, providing consistent and relevant feedback.

The tools and instruments used during testing included the IoT vending machine itself, the mobile application, and standardized questionnaires designed to measure user satisfaction and functionality. These instruments were tested beforehand to ensure reliability and consistency.

The software quality product model of the ISO 25010 tool survey questionnaire was used to evaluate the Drinking Water Vending Machine with Sales and Level Monitor. To assess the quality of the developed machine and its sales and level monitor, the researchers designed a survey questionnaire based on the Functional Suitability, Performance Efficiency, Compatibility, Interaction Capability, Reliability, Security, Flexibility, Safety.

Testing was conducted in phases, starting with alpha testing by IT professionals to identify and resolve initial flaws. Beta testing involved 30 participants from Mabalacat City College to evaluate real-world usability. The system scored highly in functionality, reliability, and user satisfaction based on ISO 25010 standards, affirming its readiness for deployment.

To evaluate the system, a 5-point Likert scale was used:

Table 1: Likert Scale used by the Researchers

Response Categories	Numerical Value	Range Interval	Verbal Interpretation
Strongly Agree	5	4.21 - 5.00	Excellent
Agree	4	3.41 - 4.20	Good
Neutral	3	2.61 - 3.40	Acceptable
Disagree	2	1.81 - 2.60	Marginal
Strongly Disagree	1	1.00 - 1.80	Poor

Deployment

The system was deployed at Mabalacat City College, with the vending machine installed in a high-traffic area for accessibility. The mobile application was provided to administrators for monitoring and management. Training sessions were conducted to ensure proper operation and maintenance. The deployment phase also included user orientation to familiarize students and staff with the machine's features.

Maintenance

Regular maintenance protocols were established to ensure the system's long-term functionality. Weekly inspections were conducted to check hardware components, including sensors and dispensing

mechanisms. The mobile application was periodically updated to enhance features and address potential bugs. Administrators were trained to report issues promptly, enabling swift resolution by the development team.

RESULTS

The system was evaluated using the ISO 25010 software quality standards, focusing on various performance criteria, including functional suitability, performance efficiency, compatibility, interaction capability, reliability, security, flexibility, and safety. The evaluation demonstrated notable improvements throughout the testing phases, with user feedback playing a crucial role in refining the system.

Table 2 shows the summary of the alpha test results based on the ISO 25010 criteria. The system demonstrated good performance across most quality attributes, with an overall mean score of 4.15, reflecting a generally positive user experience.

Table 2: Summary of Alpha Test Results

ISO25010 Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.18	Good
Performance Efficiency	4.15	Good
Compatibility	4.39	Excellent
Interaction Capability	4.33	Excellent
Reliability	4.08	Good
Security	4.02	Good
Flexibility	4.32	Excellent
Safety	3.89	Good
Overall Mean Score	**4.15**	**Good**

The highest-rated criterion in the alpha test was Compatibility, with a mean score of 4.39 and a verbal interpretation of "Excellent." This indicates that the system performed well in terms of integration with various platforms and devices. Interaction Capability and Flexibility also received "Excellent" ratings, suggesting that the system offered smooth and adaptable user interactions. On the other hand, Safety received the lowest score (3.89), indicating potential areas for improvement, particularly in the system's ability to handle critical failure situations.

Table 3 provides the summary of the beta test results, which reflect improvements after incorporating feedback from the alpha test phase. The overall performance improved, with the system achieving an overall mean score of 4.81, categorized as "Excellent."

Table 3: Summary of Beta Test Results

ISO25010 Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.86	Excellent
Performance Efficiency	4.72	Excellent
Compatibility	4.76	Excellent
Interaction Capability	4.83	Excellent
Reliability	4.79	Excellent
Security	4.86	Excellent
Flexibility	4.81	Excellent
Safety	4.83	Excellent
Overall Mean Score	**4.81**	**Excellent**

The highest-rated criterion in the beta test was Functional Suitability, which received a mean score of 4.86, reflecting the system's excellent performance in terms of usability and its ability to meet user needs. Security also performed exceptionally well, with a score of 4.86, indicating that the system has robust security features. Safety, which was a concern in the alpha test, improved significantly in the beta phase, receiving a score of 4.83 and moving into the "Excellent" range.

Overall, the results suggest that the system has successfully met its objectives, with excellent usability, performance, and security features. The improvements between the alpha and beta testing phases highlight the system's adaptability and the effectiveness of iterative development. Moving forward, continued focus on Performance Efficiency and Safety will further enhance the system's robustness and reliability in real-world scenarios.

DISCUSSION

The IoT-Based Drinking Water Vending Machine with Sales and Level Monitor is a state-of-the-art solution designed to provide clean and accessible drinking water while promoting sustainability and efficiency. This system integrates advanced IoT technologies with hardware and software components to address common challenges in water dispensing, sales tracking, and resource management.

At its core, the system operates using a combination of microcontrollers (ESP32, ESP8266, and Arduino UNO), sensors, and a user-friendly interface. These components work harmoniously to deliver seamless

functionality. Ultrasonic sensors continuously monitor water levels within the gallon, ensuring timely notifications and automated refilling when water levels drop below a set threshold (25%). The MOSFET driver module controls the water pump, ensuring precise and efficient dispensing of water.

Users interact with the machine via a simple coin-operated mechanism. The system accepts Philippine peso coins in 1-peso and 5-peso denominations, corresponding to water volumes of 100ml and 500ml, respectively. Once a coin is inserted, the machine validates it through the electronic coin slot. If the coin is accepted, the user can select their preferred water temperature using buttons that are color-coded for clarity: red for hot water, blue for cold water, green to start dispensing, and canceling the transaction if needed. The system then activates the appropriate dispensing mechanism and delivers the selected amount of water into the user's container.

The machine features an intuitive LCD screen that guides users through the process. Upon starting, the screen displays a welcome message and operational instructions. During dispensing, it updates the user on the amount of water being dispensed. If an error occurs such as an invalid coin or insufficient water the screen provides clear notifications to help users resolve the issue.

For administrators, the system offers robust monitoring and control features via a dedicated mobile application. Built using Android Studio and Flutter, the app connects to the vending machine through Wi-Fi or mobile data, providing real-time updates on water and coin levels. Administrators can remotely activate the water refill process, track sales data, and receive alerts when maintenance is required.

The vending machine promotes sustainability by encouraging the use of reusable containers, reducing reliance on single-use plastic bottles. Its efficient design ensures minimal waste of water and energy. The integration of IoT technologies not only enhances operational efficiency but also aligns with environmental goals by lowering the carbon footprint associated with traditional water vending methods.

Security and reliability are key aspects of the system. The electronic coin slot is designed to prevent tampering and counterfeit coins. The machine's microcontrollers continuously monitor system components, ensuring optimal performance. Additionally, the hardware is enclosed in a sturdy structure, protecting sensitive electronics from environmental factors and unauthorized access.

While the development and implementation of this system have brought numerous benefits, several limitations were encountered. Firstly, the mobile application was limited to admin use only and designed exclusively for Android devices, restricting accessibility for users who lacked smartphones or technical proficiency. Additionally, real-time monitoring required a stable internet connection, which could lead to operational disruptions when connectivity was lost. Another limitation is the coin-operated mechanism, which supports only Philippine peso coins (1 peso and 5 pesos), with no support for higher denominations (10 pesos, 20 pesos) or paper money. Occasional issues with coin validation also led to inaccuracies in readings, impacting user convenience. Furthermore, data transmission delays were common due to factors such as network latency, hardware limitations (sensor and actuator response times), and environmental conditions like temperature and humidity, which affected the system's responsiveness. Safety concerns were raised regarding high-voltage operations, the risk of water spillage, and the removable water gallon, which posed potential risks to sensitive electronics. Additionally, while the system could operate on lower-end devices, user experience was compromised, resulting in reduced frame rates and display quality. To address these limitations, future improvements could include expanding accessibility to cross-platform applications, enhancing coin validation, optimizing data transmission, ensuring safer design features, and improving device compatibility. Compared to similar IoT-based vending systems, the IoT-Based Drinking Water Vending Machine excels in flexibility, interaction capability, and sustainability, though similar challenges regarding payment methods and connectivity persist. The societal impact of this system is notable, promoting sustainability by reducing single-use plastics and encouraging reusable containers, while its scalability allows deployment in various public spaces. Through ongoing refinement and customization, the system has the potential to become a more reliable and adaptable solution for clean water management, ensuring both environmental and user-centric benefits.

Based on the findings and conclusions, the researchers offer the following recommendations for the IoT-based Drinking Water Vending Machine with Sales and Level Monitor. To enhance user experience, especially for individuals with disabilities, incorporating auditory features is suggested to ensure that all users can easily access vital information. Additionally, introducing features within the mobile application, such as a user feedback system or customizable alerts, could further enhance user engagement. Allowing users to set their own preferences for notifications would help them stay informed about water availability and sales, promoting a more personalized experience. To cater to a broader audience, the integration of

additional vending options, such as snacks or beverages, is recommended. This would increase user satisfaction and improve the overall utility of the vending machine in educational settings. Expanding the system's analytics capabilities to track consumption trends and user interactions could provide valuable insights for optimizing vending machine operations. Remote diagnostic capabilities would also be beneficial for proactive maintenance, allowing administrators to identify potential issues early and reduce downtime. Introducing promotional features, such as discounts or loyalty rewards, could encourage higher engagement and usage rates, communicated seamlessly through the mobile app. Furthermore, exploring energy-saving modes or solar power integration would promote sustainability and reduce the environmental impact of the vending machine. Lastly, adding e-payment features would improve convenience and accessibility, particularly for users who prefer digital transactions, alongside support for paper money to broaden payment options and accommodate a more diverse user base.

The IoT-Based Drinking Water Vending Machine is a testament to the potential of technology in addressing critical needs. By providing an accessible, efficient, and environmentally friendly solution for clean water dispensing, it offers a valuable resource for academic institutions and other public spaces. Its ability to monitor and manage operations in real time ensures reliability and ease of use for both users and administrators, making it a sustainable and innovative approach to modern water management.

The research aligns with multiple Sustainable Development Goals (SDGs) by promoting environmental sustainability, technological innovation, and public well-being. Specifically, it contributes to SDG 6 (Clean Water and Sanitation) by ensuring access to clean and safe drinking water through an efficient and user-friendly vending system. The IoT-based solution minimizes water wastage by monitoring levels in real time and automating the refill process, supporting responsible water usage. Additionally, the project addresses SDG 9 (Industry, Innovation, and Infrastructure) by incorporating advanced IoT technologies into the water dispensing system, fostering innovation and laying a foundation for scalable, eco-friendly infrastructure. Lastly, the system encourages the use of reusable containers and reduces reliance on single-use plastics, aligning with SDG 12 (Responsible Consumption and Production). This approach not only reduces environmental impact but also educates users about sustainable practices, fostering a culture of environmental responsibility. Together, these contributions reflect a holistic effort to integrate sustainability into everyday life.

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PICKINTEGRATE: Implementing an Integrated Ordering and Delivering Solutions for YCM Glass and Aluminum Supply

ALEGRE, EUGENE ANGELO O., MABALACAT CITY COLLEGE
AYSON, ERICA O. , MABALACAT CITY COLLEGE
LALANGAN, GEMALYN F. , MABALACAT CITY COLLEGE
LIPALAM, ARMEL FRANCE D. , MABALACAT CITY COLLEGE
SAGARIO, APRIL JOY Y. , MABALACAT CITY COLLEGE
PINEDA, ERNIE LEE E. (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT

There is a growing demand for better, more patient-friendly solutions regarding the growing field of healthcare. Healthcare facilities have difficulty scheduling patients and maintaining accurate records of their progress. The goal of this study is to develop a web-based online appointment and monitoring system. The researchers employed a modified waterfall methodology to move through project phases methodically. The system underwent a comprehensive evaluation process, wherein the system received an overall score of 4.32 from the alpha test and an overall rating of 4.57 from the beta test. The alpha test result is marginally enhanced in the beta phase which signifies the implementation of additional enhancement addressing potential vulnerabilities identified in the alpha testing phase. The ISO 25010 software quality standards criteria were achieved wherein the system performed all intended functions. It was ensured that the developed system aligned with and contributed towards the achievement of specific Sustainable Development Goals (SDGs). After conducting a thorough study, it has been concluded that the goals have been achieved successfully. However, to further enhance the system's performance, several improvements have been suggested. By implementing these suggestions, we can ensure the best possible system performance, which will ultimately benefit the users.

Keywords: Online Ordering, Order processing, Websites, E-commerce platforms, Real-time Updates, Modified Waterfall Methodology

INTRODUCTION

In the past, businesses relied heavily on manual processes to manage transactions, promote products, and communicate with customers. Local glass and aluminum shops, for instance, often used handwritten notes for orders and quotations. Advertising was typically done by capturing photos and uploading them to platforms like Facebook. Communication with customers was limited to phone calls, making it challenging to provide timely updates, especially for delivery notifications. These traditional methods, though functional, are time-consuming, prone to errors, and fail to meet the expectations of today's tech-savvy customers.

In the modern era, technological advancements have revolutionized the way businesses operate. Websites and e-commerce platforms have become essential tools for companies to stay competitive. Customers now expect the convenience of online ordering, real-time updates, and easy access to product information. Businesses without an online presence risk falling behind, as they struggle to match the efficiency and accessibility offered by digital solutions.

Recognizing these trends and challenges, The Researcher proposed the development of "PickIntegrate: YCM Glass and Aluminum Supply", a website e-commerce platform designed to address the specific needs of local glass and aluminum shops. This system not only streamlines the ordering process but also incorporates features like product Ordering, appointment scheduling, and delivery. For example, customers can quickly find and order custom-sized products, check out seamlessly, and stay updated on their order's status all within the website.

The PickIntegrate system provides numerous benefits, such as saving time, offering convenience, and enhancing user experience. By transitioning to an online platform, YCM Glass and Aluminum Supplies can attract modern customers, improve operational efficiency, and strengthen its competitive edge in the industry.

Objectives of the Study

The purpose of this study is to create PickIntegrate, a system that will combine ordering, delivery and appointment for YCM Glass Aluminum Supply. Increasing client satisfaction, streamlining

procedures, and fostering business expansion are the objectives. In line with this, this study aimed to achieve the following specific objectives:

- To gather information and best practices for developing the system platform from Local and international e-commerce platforms, research papers, case studies, existing tools and technologies on user-friendly interfaces and customer design.
- To identify the hardware and software specifications tools in of the system.
- To design the system and application using diagrams and analysis tools.
- To build the system incorporating the following features and functions: Security, Point of Sales, Ordering, Delivery, Payment Management, and Inventory management.
- To test the system through Alpha and Beta Testing.
- To evaluate the performance of the system based on the following ISO25010 standards: Functional Stability, Compatibility, Interaction Capability, Security, and Flexibility.
- To completely deploy and implement the system to the web hosting site.

Scope and Limitations of the Study

This study focuses on the development and implementation of PickIntegrate: YCM Glass and Aluminum Supplies, an e-commerce platform designed to streamline the ordering, appointment, and delivery processes for local glass and aluminum shops. The system's back-end functionality enables the admin to efficiently manage inventory, process orders, oversee sales, handle customer accounts, manage appointments, and monitor delivery statuses. Along with strong security features like email verification, CAPTCHA, and Google login integration, it also has an extensive dashboard for analytics, content, management, and payment option. On the front end, the system empowers customers to explore products with filtering options, view detailed descriptions and reviews, and choose preferred payment methods, including PayPal or cash on delivery. Customers can book appointments for custom measurements, track order statuses, and engage in real-time chat for customer service inquiries. The platform also features a booking calendar, social media integration, an interactive map, and a seamless checkout process, making it user-friendly and efficient for modern customers.

The study supports the United Nations Sustainable Development Goals (SDGs), specifically SDG 4: Quality Education, SDG 9: Industry, Innovation, and Infrastructure, and SDG 11: Sustainable Cities and Communities. By utilizing modern technologies and fostering digital literacy through the platform's implementation, this project contributes to SDG 4. The development of an innovative, secure, and scalable e- commerce solution aligns with SDG 9, promoting industry growth and infrastructure modernization. Furthermore, the platform enhances urban services, making transactions more sustainable and efficient, addressing the objectives of SDG 11.

The researchers set limitations only on ordering over the internet or popularly known as E – Commerce. The findings in the study may also be limited by the availability and completeness of data accessible through web-based sources. Some relevant data, such as internal company records or information may not be publicly available. This may potentially constrain the depth of analysis. The system was evaluated through 30 individuals engaged in the construction industry who participated in the study. Some of these are customers of YCM Glass and Aluminum Supply, while others are employees working in related industries. Specific selections were utilized to ensure insightful information that was essential to the study's outcomes. Integrated Ordering and Delivery Solutions for YCM Glass and Aluminum Supply, represents a significant technological advancement that aims at enhancing operational efficiency and customer satisfaction. However, an innovation system, particularly one that serves a diverse user base, there are inherent limitations that must be considered. The 30 respondents reveal the several key challenges that could impact the success of this integration. The system is only accessible within Mabalacat Pampanga, Philippines.

The study includes the gathering of best practices from local and international e-commerce systems, utilizing technologies such as

Visual Studio Code, MySQL Workbench, and XAMPP to build and test the platform. Through alpha and beta testing, the system's performance will be evaluated using ISO25010 standards, including functional suitability, compatibility, security, and flexibility. The final implementation will be hosted on the domain Ycmglass.shop, secured with SSL via Namecheap, ensuring safe and reliable access for its users.

METHODOLOGY AND DESIGN

The software development life cycle method the proponents chose to create the application with is the modified waterfall model. The Modified Waterfall Model offers a systematic flow of development processes with some flexible, iterative phases that give enough documentation and design evaluations to ensure the application's quality, consistency, and maintainability the proponents had built.

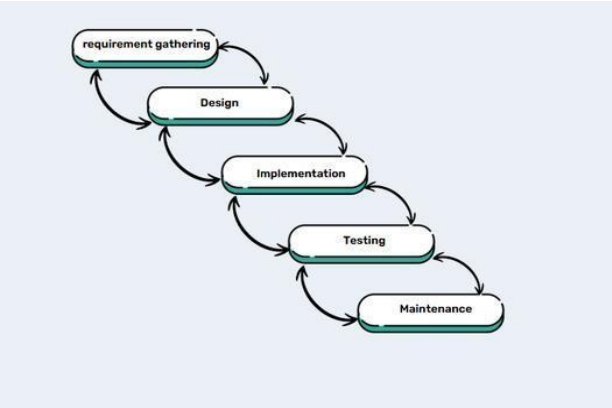

Figure 1. The Modified Waterfall Model

Requirements Gathering

The team conducted user interviews, looked at existing workflows, and recorded hardware and software needs in order to create a comprehensive list of system requirements. Design: Storyboards are created at every stage of the design process to illustrate user interactions and processes. Create use case diagrams that outline the interactions between users and the system. Create wireframes for visual design layouts and user interfaces using Canva or similar tools. Implementation: A MySQL database was configured, PHP functionality was coded, and a responsive front-end was created using Tailwind CSS. The system was then put into use on a local server for testing. Testing: Real users took part in beta testing to ensure system stability and usability, while alpha testing was used to identify and address system issues.Maintenance: Regular updates, user support, and system monitoring were implemented in order to fix issues, improve performance, and provide new features depending on user feedback.

Table 1. Computer Hardware Specifications

COMPONENT	SPECIFICATION
Device Name	DESKTOP- 57SCA3J
Processor	Intel (R) Core (TM) i7
Memory	4 GB
Video Ram	4 GB
Hard Disk / SSD	500 GB

Design

In this phase, the researchers employed various analysis tools and diagrams to design and develop the system: Storyboard, Visual Table of Contents, Use Case Diagram, Entity Relationship Diagram (ERD), and Gantt Chart. The Use Case Diagram [See Figure 2] was employed to illustrate the system's capabilities and accessibility, as well as the connections between the system and its users. This helped to define the several ways in which users would engage with the system and to make clear the functional needs. The Entity Relationship Diagram [See Figure 3] helped define data items and their relationships, which was essential for database architecture, and graphically represented the data needed for the system. The researchers were able to produce a thorough design framework that directed the development process, guaranteed alignment with user needs, and enabled efficient project management throughout the system's Lifecyle by employing these analysis tools and diagrams. The order placement process is streamlined to minimize the steps required for customers to complete their purchases. A secure and straightforward checkout system ensures that transactions are smooth and reliable. The platform incorporates various payment options, including credit cards, digital wallets, and bank transfers, all protected by robust encryption protocols to safeguard user data.

Table 2. Software Development tools used

COMPONENT	SPECIFICATION
Desktop Computer	DESKTOP-57SCA3J
Testing Device	Desktop Computer
Visual Studio Code 1.76.1	Integrated Development Environment
Mysql Workbench	Database
Adobe Photoshop CC 24.3.0	Assets Designing
Node.JS	JavaScript Environment
Docker	Compose and Configure

Inventory management is integrated within the platform, providing real- time updates on stock levels. This feature helps prevent over-ordering and ensures that customers are always aware of product availability. The delivery tracking system allows customers to monitor their orders from dispatch to delivery, offering real-time updates on the status and location of their shipments. The website is fully responsive, ensuring a seamless experience across desktops, tablets, and smartphones. The design incorporates a consistent color scheme and typography that reflect the brand identity of YCM Glass and Aluminum Supply, enhancing brand recognition and user trust. Navigation is intuitive, with a fixed menu bar providing easy access to all main sections, and quick links to frequently accessed pages such as the customer service portal, FAQs, and contact information. Security and privacy are prioritized, with features such as user authentication, encrypted communications, and compliance with data protection regulations. The back-end is built using robust technologies that ensure scalability, reliability, and maintainability, allowing the platform to grow alongside the business.

Overall, the "PickIntegrate" website is designed to provide an efficient, secure, and pleasant shopping experience for customers while supporting the operational needs of YCM Glass and Aluminum Supply through integrated management tools and real-time data insights.

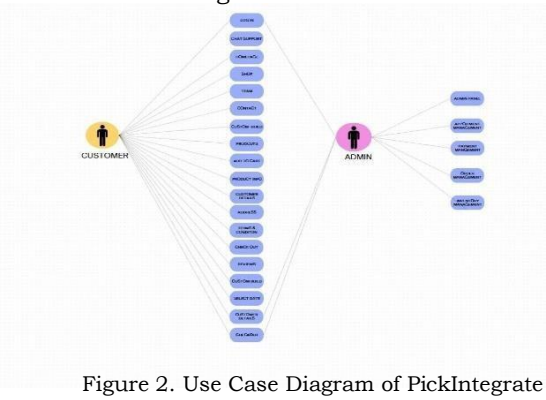

Figure 2. Use Case Diagram of PickIntegrate

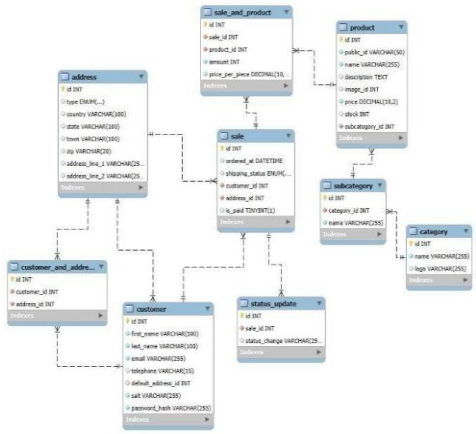

Figure 3. Entity Relationship Diagram of PickIntegrate

Implementation

During the implementation phase, Word-press served as the development environment for designing and programming the web application, along with the administrator panel and its key functionalities. Each feature was developed within the project's defined scope and limitations. The proponents focused on creating an aesthetically pleasing, user-friendly experience, with the homepage highlighting best-selling items for immediate customer engagement. Users can browse a wide range of products and services, enhanced by an integrated search and filter feature for streamlined navigation. This allows customers to easily find products matching their preferences.

Acknowledging the importance of quality control, the administrator panel was designed to efficiently manage sales and inventory. Administrators can review client profiles, monitor product stock, and analyze sales performance, ensuring thorough oversight. All materials are processed with admin approval, guaranteeing that clients view only verified product information. A specialized "Custom-Build" section was added to allow customers to personalize products and schedule appointments for consultations. This feature enables users to customize their orders and select booking times, improving the customer experience and tailoring services to their needs.

The implementation of the integrated ordering and delivery solution for YCM Glass and Aluminum Supply centered on building an e-commerce website using Wordpress, chosen for its versatility and extensive e- commerce capabilities. The platform's appointment scheduling, secure payment options, and sales analytics are crucial for managing client interactions and tracking sales performance. The design emphasizes ease of use, allowing customers to view products, make purchases, and book appointments for consultations or delivery services. This supports YCM's goal of enhancing accessibility and convenience for clients.

The website development began with customizing the platform through Wordpress drag- and-drop tools, establishing a layout consistent with YCM's brand. High-quality images and product details allow customers to make informed purchasing decisions. Key functionalities, including appointment scheduling and secure payment processing, were set up to support YCM's operational needs. The appointment booking system enables customers to select their preferred consultation or pickup times, reducing manual scheduling efforts.

An admin panel with a centralized dashboard was implemented to give YCM's management team control over site activity. This panel provides real-time access to sales analytics, order tracking, and customer engagement data, helping to identify trends and optimize inventory and customer service efforts. Sales analytics were integrated to provide insights into purchasing patterns and site performance, supporting inventory management, marketing, and engagement strategies.

After rigorous testing for functionality and mobile responsiveness, the website was launched with a monitoring system in place for continuous updates and performance tracking. Ultimately, this implementation not only digital is YCM's ordering and delivery processes but also provides a strong foundation for enhanced customer service and operational efficiency, supporting sustainable growth experience. Users can communicate through chat-bot or the admin side. This feature was designed to improve user engagement and accessibility, complying with the important objectives of the website.

Testing

During the testing phase, the researcher made adjustments to the system due to recommendations of the panel, technical and capstone adviser's feedback. The testing phase covers the evaluation of the whole study if the system performs as described in the requirements. The agreed opinion of recommendations, suggestions from the panel were analyzed and added to build up the developed system. The researcher conducted the alpha and beta testing using the researcher's survey questionnaire that was anchored in the ISO25010 Software Product Quality Standard to review and correct the error of the developed system. The researcher generates the survey questions that are based on the functionality suitability, compatibility, interaction capability, security and flexibility criteria based on ISO25010 in order to evaluate the developed system.

The ISO25010 questionnaire has undergone validity testing to make sure that the results are objective and unaffected by the researcher, the respondents or the environment in which the study was carried out. The questionnaire was pre-tested before the survey started.

The researcher employed a combination of random and purposive sampling methods to connect with individuals who actively use online ordering systems, reaching out to a diverse group to gather meaningful insights about their experiences. To enhance the development of the PickIntegrate system, three skilled Information Technology specialists were recruited as alpha testers. Their constructive feedback and thoughtful suggestions were instrumental in refining the system, ensuring it met user needs while improving functionality and overall user experience. This collaborative approach aimed to create a well-rounded understanding of the system's performance in real-world scenarios, ultimately leading to a more effective and user-friendly integrated solution.

In addition to gathering feedback from alpha testers, the researcher organized focus group sessions with regular users of the online ordering system. These sessions encouraged open dialogue about user experiences, pain points, and suggestions for improvement.

Participants felt valued and appreciated the opportunity to share their opinions, fostering a sense of community around the development of the PickIntegrate system. This inclusive method not only enriched the feedback received but also helped to build user buying and excitement for the new features being implemented.

Furthermore, the researcher also analyzed usage data from the online ordering system to identify trends and patterns in user behavior. By examining this quantitative data alongside the qualitative feedback from testers and focus groups, the researcher was able to draw more comprehensive conclusions about user needs. This dual approach ensured that the improvements made to the PickIntegrate system were based on a solid foundation of real-world usage and direct user input, ultimately leading to a more robust and effective solution.

By blending these various methods of data collection and user engagement, the researcher aimed to create a well-informed, user-centric development process. The collaborative effort not only aimed to enhance the functionality of the PickIntegrate system but also ensured that it resonated with the end-users, fostering a seamless experience that encourages continued usage and satisfaction.

The Likert scale is a rating system that was used in questionnaires and is designed to measure respondent's attitudes, opinions, or perceptions. The following computation of the average score for each survey tool sub criteria and criterion, the researcher used the likert scale to clarify the result. The respondents are asked to rate on how much they agree or disagree with the statement using this scale has a range of 1 to 5 with each point indicating a certain level of agreement or disagreement.

Table 3. The 5-point Likert Scale – Level of Agreement

Response Categories	Numerical Value	Range / Interval	Verbal Interpretation
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.41 – 4.20	Good
Neutral	3	2.41 – 3.20	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly Disagree	1	1.00 – 1.80	Poor

Operation and Maintenance

During the completion of the developed system, it was accepted by the capstone adviser, technical adviser, alpha and beta testers and the board of panelists was achieved. The system created by the researcher may be freely accessed at the domain repository website address of https://www.ycmglass.shop The researchers would have the most effective instrument to market their unique business items to a broad and wide audience of potential clients if they deployed the produced locale company's website into a well-known domain repository site. By creating an online presence inside the esteemed domain, the administrator would be able to talk about the unique qualities and values that make the services or goods stand out, drawing in potential customers and increasing traffic and visibility to his business. In turn, this action will expand their audience and put them in a strong position for access and trust, creating deep

relationships and opening up new commercial prospects in the online marketplace.

RESULTS

The results and outcomes based on the objectives of the research are presented in this chapter, which demonstrates the way the researchers achieved their primary goals. The functionality, design, development, and testing of the produced web system are covered in this chapter, along with the presentation of the data collected from the Alpha and Beta tests and requirements for software and hardware. The alpha and beta tests, researchers tested the system's functionality and completeness using ISO 25010. To evaluate the experience of the participants in "PickIntegrate:

Implementing an Integrated Ordering and Delivery Solution for YCM Glass and Aluminum Supply" to complete a survey. The researcher must prepare a report that summarizes the study's result. The result from the studies should be presented in a reasonable, organized and understandable way.

The developed system for PickIntegrate effectively addresses the inefficiencies of manual processes by integrating key features for seamless operations. Here is the product info page [See Figure 4], where you can choose your sizes and view detailed descriptions of the products. You can also read customer reviews to help you make the best choice. High-quality photos that present the goods from several perspectives are also included, so you can be sure you know exactly what you're buying. Here is the sales and order admin panel [See Figure 5], where you can monitor and manage all sales activities. You can view detailed reports on sales performance, track order statuses, and process customer orders efficiently. This section also allows you to manage returns and exchanges, ensuring customer satisfaction. Here is the reports and analytics section [See Figure 6], where you can access detailed insights into your business performance. You can view comprehensive reports on sales trends, customer behavior, and inventory levels. This section enables you to analyze data over different time periods, helping you identify patterns and make informed decisions. With visual graphs and charts, you can easily track key metrics and KPIs, allowing you to optimize operations and strategize for future growth. Here is the inventory management section, where you can oversee and control all aspects of your stock.

The researchers conducted alpha and beta tests to evaluate the PickIntegrate system. During the alpha testing, the system underwent a comprehensive evaluation to three IT professionals. During the beta testing transition, a total of thirty (30) respondents from individuals that are using online ordering platforms have contributed significant insight in the system. The evaluation, conducted a survey according to ISO 25010 guidelines, encompassed various dimensions such as Functional Suitability: Functional Completeness, Functional Correctness, Functional Appropriateness, Compatibility, Coexistence: Interoperability, InteractionCapability: Inclusivity, Security: Confidentiality, Integrity, Accountability, Authenticity, Flexibility: Adaptability, Scalability. This comprehensive evaluation provided specific data on the effectiveness of PickIntegrate to the individuals that are using online ordering platforms for Glass and Aluminum Supply.

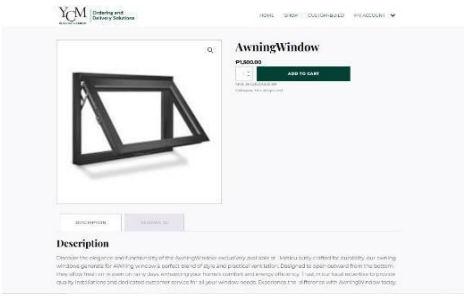

Figure 4. Screenshot of Product Info and Order

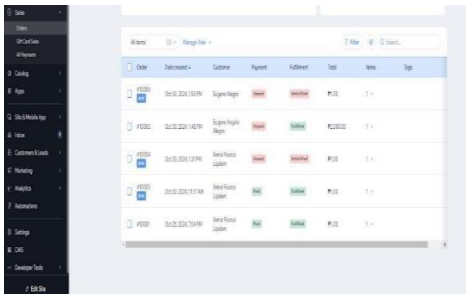

Figure 5. Screenshot of Sales and Order

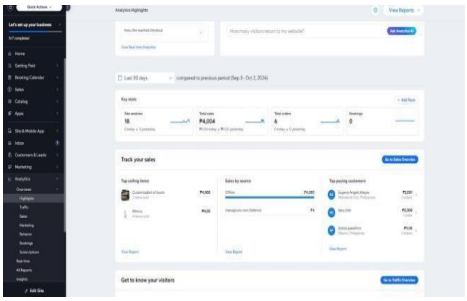

Figure 6. Screenshot of all reports and analytics

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Table 4. Summary Results for Alpha Testing

Criteria	Mean Score	Verbally Interpretation
Functional Suitability	4.76	Excellent
Compatibility	4.67	Excellent
Interaction Capability	4.69	Excellent
Security	4.63	Excellent
Flexibility	4.67	Excellent
Total Mean	4.68	Excellent

The table represents the summary results of alpha testing based on five criteria: Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. Each criterion received a mean score, which is verbally interpreted as "Excellent." Among the criteria, Functional Suitability scored the highest at 4.76, while Security had the lowest score at 4.63. The overall mean score for all criteria is 4.68, which is also interpreted as "Excellent." These results suggest that the system performed exceptionally well in all areas evaluated during the alpha testing phase.

Table 5. Summary Results for Beta Testing

Criteria	Mean Score	Verbally Interpretation
Functional Suitability	4.78	Excellent
Compatibility	4.71	Excellent
Interaction Capability	4.71	Excellent
Security	4.75	Excellent
Flexibility	4.69	Excellent
Total Mean	4.73	Excellent

The table shows the summary results of beta testing, evaluating the system based on five criteria: Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The mean scores for these criteria range from 4.69 to 4.78, all classified as "Excellent." The overall total mean score is 4.73, which is also interpreted as "Excellent." These results suggest that the system performs exceptionally well in its beta testing phase, showing strong reliability, usability, and effectiveness across all assessed aspects.

DISCUSSION

The research successfully achieved its primary objective: developing PickIntegrate, an e-commerce platform designed specifically for purchasing and customizing products like glass, aluminum, doors, and windows. This website, built using Wordpress Studio, aims to provide Mabalacat City residents with a convenient, digital marketplace that simplifies the traditionally time-consuming process of buying and customizing construction materials. By implementing unique features such as product customization and an integrated appointment scheduler, PickIntegrate enhances customer satisfaction and supports the needs of both local buyers and sellers.

The system operates on a comprehensive e-commerce platform with distinct user roles: administrators, sellers, regular users, and guests, each with specific levels of accessibility. It incorporates essential features of a modern e-commerce site, including product management, order processing, inventory control, secure payment options (PayPal and COD), and detailed analytics. The platform was built using an 8 GB RAM, 500 GB HDD, Intel Core i3 computer setup, with Wordpress Studio's drag-and- drop functionality simplifying the design and allowing for efficient implementation of images, functions, and design elements.

In order to guarantee an orderly and user-centered system, the project's development entailed the strategic use of planning and design tools such use case diagrams, system architecture diagrams, entity-relationship diagrams, a Gantt chart, storyboards, and data flow diagrams. These tools allowed for a thorough visualization of the system's structure and workflows, and the Gantt chart facilitated efficient project management. The system's assessment followed the ISO 25010 standard, evaluating quality attributes like functional suitability, compatibility, interaction capability, security, and flexibility, all of which were rated highly during testing phases. Additionally, the project aligns with the United Nations Sustainable Development Goals (SDGs) 4, 9, and 11, which promote quality education, industry innovation, and sustainable communities.

Thorough testing was conducted in Alpha and Beta phases, with Alpha testing by IT professionals confirming the website's excellent performance in all assessed areas. Beta testing with local users further validated the system's effectiveness and usability, yielding a high overall satisfaction rating. The results demonstrate that PickIntegrate effectively bridges the gap between traditional product purchasing and

digital convenience, meeting the needs of local businesses while offering customization options that enhance customer satisfaction and give sellers a competitive edge.

By implementing comprehensive security protocols, user role management, and an intuitive interface, PickIntegrate ensures secure and efficient operations for all stakeholders. The administrative tools provide flexibility and control for sellers, while the customization options offer buyers a personalized shopping experience. In conclusion, PickIntegrate successfully fulfills its technical objectives, supporting the digital transformation of local businesses and contributing to community economic development in alignment with broader goals of digital inclusion

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Lastly, we would like to thank our family for supporting us in finishing this capstone project successfully. To God Be All the Glory.

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QRCodeConnect: Elevating Student Attendance and Monitoring at MCC Computer Laboratory

SHANLOYD C. DELIZO, MABALACAT CITY COLLEGE
NATHANIEL N. LEE, MABALACAT CITY COLLEGE
WALTER D. MARTINEZ, MABALACAT CITY COLLEGE
HENRY S. MORENO, MABALACAT CITY COLLEGE
RIA S. SABILE, MABALACAT CITY COLLEGE
ALFONSO D. BARCELON JR. (Technical Adviser), MABALACAT CITY COLLEGE
DENNIS L. TACADENA (Capstone Adviser), MABALACAT CITY COLLEGE

ABSTRACT
Technology plays an integral role in modern education, streamlining processes and enhancing operational efficiency. This study introduces QRCodeConnect: Student Attendance and Computer Monitoring System, designed to improve attendance tracking and computer usage monitoring at Mabalacat City College. Employing the modified waterfall model for development, the system integrates QR code technology and real-time analytics to optimize resource allocation and reduce administrative workload. It was evaluated using ISO 25010 standards, achieving an "Excellent" overall mean score of 4.49 in alpha testing by IT experts. Specific scores included Functional Suitability (4.47), Compatibility (4.42), Interaction Capability (4.52), Security (4.51), and Flexibility (4.53). Beta testing with 30 student respondents reaffirmed the system's reliability and user satisfaction. Despite its tailored focus, limitations were identified, such as scalability, offline functionality, and integration with external databases, paving the way for future enhancements. While the study focused on a controlled laboratory environment, limitations such as scalability, offline functionality, and integration with external databases were identified, offering pathways for future enhancement. Despite these constraints, QRCodeConnect demonstrates the potential to redefine institutional processes by leveraging modern technology, making it adaptable for other educational institutions.

Keywords: QRCodeConnect, Technology in Education, Student Attendance Monitoring, Computer Laboratory Management.

INTRODUCTION

Technology has revolutionized resource management and administrative tasks in education, improving efficiency and precision. Globally, educational institutions have adopted advanced technologies, including QR codes and IoT devices, to streamline processes, enhance security, and ensure accurate data management, aligning with international standards and fostering digital literacy (Analytixlabs, 2024).

Traditional manual methods for monitoring student attendance and computer usage were labor-intensive and error-prone, often lacking real-time data. QR code-based solutions address these challenges by offering rapid, reliable, and user-friendly methods to track attendance and computer use, reducing administrative burdens and errors (Jercy, 2020).

In the Philippines, national education plans emphasize integrating digital tools to modernize schools, reduce paperwork, and improve operational efficiency. Using QR codes for attendance and computer monitoring aligns with these goals and enables institutions to optimize resource allocation and ensure secure usage of facilities (Mohammed & Zidan, 2023). Specifically, schools in Pampanga have started leveraging digital technologies to enhance the learning environment and streamline operations, aligning with global trends in educational innovation (Johnson et al., 2019).

The researchers developed a QR Code attendance monitoring system for Mabalacat City College, integrating computer usage monitoring to enhance supervision and resource management. This system provides real-time data and analytics, enabling informed decision-making and fostering a safer, more organized, and user-friendly environment. The initiative represents a step towards continuous improvement in laboratory operations and demonstrates the college's commitment to technological advancement and student success.

Efficient management of student attendance and computer usage is vital for ensuring administrative accuracy and optimizing resource use in educational institutions. This study focuses on implementing a QR code-based system integrated with a desktop application for attendance monitoring and computer usage tracking at Mabalacat City College (MCC) in Pampanga. Established in 2008, MCC has grown into a prominent institution offering 23 academic programs to over 5,000 students.

Traditional attendance and computer monitoring methods, such as manual sign-ins, are prone to errors and inefficiency, necessitating modern technological solutions. By employing QR code technology, the system aims to enhance precision, streamline administrative processes, and provide

real-time data analytics for better decision-making. This project also addresses challenges like user adoption and data security by incorporating training and robust data protection measures.

Aligned with Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education) and SDG 9 (Industry, Innovation, and Infrastructure), the system promotes technological innovation and the effective management of educational resources. This initiative represents a scalable model for digital transformation in educational administration, offering insights and best practices for similar institutions seeking to modernize their operations.

The study offers a modernized and innovative solution to enhance the efficiency and precision of monitoring systems in educational institutions, particularly at Mabalacat City College. By integrating QR code technology into a desktop application for student attendance and computer usage monitoring, the project aims to optimize resource management and administrative processes. The primary objective of the study is to develop a system titled "QRCodeConnect: Student Attendance and Computer Monitoring System at MCC Computer Laboratory," aligning with the institution's goal of fostering technological advancement and operational excellence.

Related Studies

The related studies explored various applications of advanced technologies in attendance monitoring systems. In Montenegro, a study titled "Smart Attendance System using QR Code" highlighted the inefficiencies of traditional attendance methods in higher education. It proposed a QR code-based system to streamline and modernize attendance management, offering a reliable and efficient alternative for tracking student participation in lectures and exercises (Nuhi et al., 2020).

In Mumbai, India, a study titled "Smart Student Attendance System Using QR Codes" showcased a QR code-based solution for attendance. This system ensured secure authentication using data-hiding techniques and allowed students to log their attendance by scanning a QR code displayed by the teacher. It emphasized identity verification to prevent fraudulent registrations, demonstrating the potential for QR codes in educational settings (Patel et al., 2019).

Another study in India, "Deep Learning-based Smart Attendance Monitoring System," proposed a facial recognition system leveraging deep learning algorithms. This system automatically logged entry and exit times through real-time camera surveillance, offering a dependable and efficient alternative to manual or biometric methods. It enabled partial attendance tracking and eliminated the need for additional effort from institutions or students, making it a practical solution for attendance monitoring (Halder et al., 2019).

These studies underscore the growing adoption of QR codes and advanced technologies for enhancing accuracy, security, and efficiency in attendance management. Their methodologies and findings provide valuable insights for developing innovative systems like the QRCodeConnect at Mabalacat City College.

METHODOLOGY

The software development life cycle method that the researchers chose to design the application is the modified waterfall model. The Modified Waterfall Model provides a structured flow of development processes with some flexible, iterative phases that provide enough documentation and design evaluations to ensure the application's quality, consistency, and maintainability, which the researchers had designed. (Prashant., 2023).

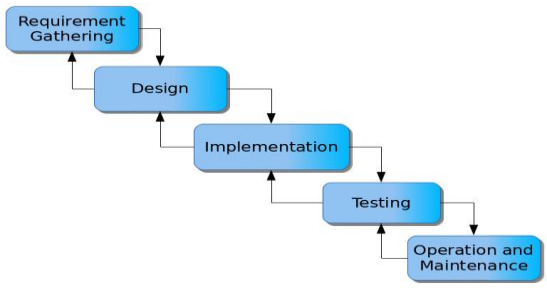

Figure 1. The researcher was guided by the Modified Waterfall Model

Requirements Gathering

The requirements-gathering phase for the QRCodeConnect project at Mabalacat City College involved a collaborative effort to ensure the system met user needs and institutional standards. Researchers engaged in group discussions and consultations with MCC administrative and IT professionals to gather insights. The focus was on usability for teachers and students, accuracy in attendance tracking, and system compatibility with the existing laboratory infrastructure.

To achieve this, appropriate hardware and software requirements were identified. Tools like Visual Studio Code were used for coding, with Python handling back-end development due to its versatility and robust library support. SQLite and PostgreSQL managed database operations, while PySide6/Qt for Python supported desktop application development. For interface design, Adobe Photoshop enabled intuitive prototyping, and Draw.io facilitated system diagram creation. Version control was handled using Git and GitHub to track updates and changes. A high-performance development environment, featuring an AMD Ryzen 5 PRO processor, 16GB

RAM, and Windows 10 Pro, ensured reliability during testing. These tools and processes were integral to creating a dependable and efficient system that aligns with the project's goals of enhancing attendance and computer usage tracking in MCC's computer laboratory.

Specifications and Design

In this phase, the researchers would use the following analysis tools and diagrams per the discussion and studies related to the proposed QRCodeConnect desktop application: Storyboard, Use Case Diagram, Data Flow Diagram, Entity Relationship Diagrams and Visual Table of Contents. The researchers used Storyboard Diagram to organized the user interface flow and procedures, while Use Case Diagrams defined important functions and features. Data flow diagrams depicted information transportation, suggesting possible difficulties and solutions. Entity Relationship Diagrams explained database entity interactions, which helped with database architecture. Visual tables of contents provide a good perspective of document structures. These technologies helped to provide a full knowledge of the system's architecture, interface, and user journey, allowing for extensive evaluation and prospective improvements.

Implementation

The implementation phase of the QRCodeConnect system focused on building a comprehensive and responsive application for monitoring student attendance and computer usage at Mabalacat City College. The system's front-end was developed using PySide6, which provided a cross-platform graphical user interface, ensuring usability and consistency. For the back-end, PostgreSQL was selected for its robust data management capabilities, while Supabase offered real-time synchronization and simplified API integration, enhancing the system's responsiveness and user experience.

Role-based access control was integrated via Supabase's authentication system, assigning permissions for students, instructors, and administrators. This ensured secure and streamlined interactions, such as QR code-based logins for students, attendance tracking for instructors, and comprehensive oversight for administrators. The system also supported real-time updates, enabling immediate access to lab usage, attendance, and monitoring data, improving operational efficiency.

Additionally, reporting features allowed the export of attendance, usage, and inventory data into Excel, providing valuable insights for resource optimization and historical analysis. The development process included overcoming challenges in API integration and database management, which significantly improved the researchers' technical expertise in handling complex systems.

Overall, the implementation combined Python, PySide6, PostgreSQL, and Supabase to create a reliable and user-friendly solution tailored to the needs of MCC's computer laboratory, enhancing operational efficiency and technological capability.

Testing

In this phase, the researchers made certain changes to the system based on the panel's suggestions as well as technical and capstone adviser comments. The testing phase evaluates the overall research to see if the system functions as expected. The agreed-upon opinions and suggestions from panels/clients were assessed and included into the established system. The researchers conducted the alpha and beta testing using the researchers' made survey tool anchored with the criteria of ISO25010 Software Product Quality Standard to review and correct any application glitch or defects. The researchers created a survey questionnaire based on the functional suitability, compatibility, interaction capability, security and flexibility criteria of the ISO25010 model in order to evaluate the quality of the developed system.

The ISO25010 questionnaire underwent testing for validity to guarantee that the study's conclusions are neutral and unaffected by external influences such as the researcher, respondents, or the setting in which the evaluation was conducted.

Sampling Method

The researchers applied two sampling approaches to acquire information about the desktop application QRCodeConnect system. Homogeneous sampling, a type of purposive sampling, involved selecting respondents with comparable features in order to ensure that replies were consistent. Mabalacat City College's thirty students were chosen for the Beta testing phase. This selection was aimed at gathering a consistent group of users with similar experiences, allowing the researchers to better analyze how these students engaged with the system and provide focused insights on its functionality.

Random sampling is a probability approach that gives every member of the population an equal chance of being chosen. The researchers contemplated using random sampling to increase the depth and diversity of their findings. The study sought to represent a larger diversity of demographics and experiences by randomly selecting a subset of students from Mabalacat City College. This method would offer a variety of perspectives on the system's usability, increasing the generalizability of the insights gathered.

Instrumentation

The researchers will involve three (3) IT specialists to serve as alpha testers, ensuring a thorough evaluation of the system's technical components and functionality. Additionally, twenty-five (25) BSIT students from Mabalacat City College will be selected

as beta testers to assess the QRCodeConnect system under real-world conditions. Table 1 show the computer hardware specification with installed QRCodeConnect system used during beta testing. The researchers utilized a survey based on the ISO25010 criteria to determine if the simulator application met the required objectives.

Table 1. Computer hardware specifications used during Beta Testing administration

Component	Capacity
Processor	Ryzen 5 PRO 4650G
Memory	16 GB
Video Ram	6 GB
Hard Disk / SSD	500 GB

Questionnaire Administration

The questionnaire was administered at Mabalacat City College from November 4, 2024 until November 5, 2024. A basic introduction detailing how the respondent will complete the checklist based on their usage experience aids in the distribution and administration of the questionnaire. The researcher used English to encourage clarity and comprehension, therefore creating a comfortable setting in which participants could freely express their ideas and experiences.

Data Gathering

The researchers administered, distribute and collected the beta questionnaires. Respondents fill-out the form in less than ten (10) minutes after they access the QRCodeConnect system. The researchers start conducting beta test and gathering data on October 29, 2024 until November 4, 2024

Data Analysis

This study would employ descriptive statistics to both summarize and analyze the collected data. Descriptive statistics are crucial for comprehending the overall trends and distributions within the dataset. This approach allows us to clearly visualize the characteristics and underlying patterns in the data, providing a comprehensive picture of the information.

For data analysis, descriptive statistics were utilized to examine the study, incorporating frequency distribution, percentage calculations, mean computation, and the Likert scale. Frequency distribution indicated the number of cases at each score, grouped into categories based on demographic profile scores. Percentages were used to measure the relative frequency of demographic profiles. Percentage is a number or ratio expressed as a fraction of 100. This study used the following formula:

$$\frac{f}{N} = f \times \frac{100}{N} = \frac{100f}{N}$$

The mean calculated the average of a set of numbers. The mean formula in statistics for a set is defined as the sum of the observations divided by the total number of observations. The mean formula for a set of given observations can be expressed as Mean = (Sum of Observations) ÷ (Total Numbers of Observations)

$\bar{x} = \Sigma fx / \Sigma f$

where,

$\bar{x}$ = the mean value of the set of given data.

f = frequency of each class

x = mid-interval value of each class

The Likert scale (See Table 2), employed for sub-criteria and criteria mean scores interpretation, categorized responses into levels of agreement, ranging from "Poor" to "Excellent."

Table 2. The 5-point Likert Scale - Level of Agreement

Response Categories	Numerical Value	Range / Interval	Verbal Interpretation
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.41 – 4.20	Good
Neutral	3	2.41 – 3.20	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly Disagree	1	1.00 – 1.80	Poor

Data Processing

The researchers utilized tally sheets as a method for processing the data. The completed tally summary was compiled as respondents completed the beta surveys. Data entry was performed using a specific tally sheet format provided by the researchers.

Maintenance

After the verification phase, the maintenance phase was performed. The operation and maintenance of the QR Code Student Attendance and Computer Monitoring System at MCC Computer Laboratory would focus on regular updates, issue fixes, and data backups to ensure smooth performance. Users would receive training, while IT staff would handle system monitoring and support. Preventive maintenance, like routine checks, would address potential problems early. The system is built to scale for future improvements and upgrades. Security measures would be in place to protect data, ensuring the system remains reliable and efficient over time, meeting the lab's management needs.

RESULTS

This section presents the research findings from the study. The study's goals as well as the administrator panel's and application's Testing provided a framework for the meticulous examination that resulted in the outcomes displayed here. This section offers an overview of the conclusions, evaluations of their ramifications, and general

crucial, offering a thorough examination of the study's conclusions.

Testing Results

The alpha and beta testing phases were critical in evaluating QRCodeConnect's performance. Following ISO 25010 standards, the alpha test assessed the system's core functionalities, involving three (3) IT professionals who rigorously evaluated Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility.

The testing utilized live demonstrations, discussions, and structured surveys. The results showcased the system's strong functional and technical foundation.

The beta testing phase involved thirty (30) BSIT students from Mabalacat City College. Surveys focused on key ISO 25010 criteria, such as Functional Completeness, Security, and Adaptability. The system demonstrated excellent performance across all metrics, reinforcing its readiness for deployment in the MCC community.

Table 3. Summary of Alpha Test Result

Criteria	**Mean Score**	**Verbally Interpretation**
Functional Suitability	3.54	Excellent
Compatibility	3.84	Excellent
Interaction Capability	4.17	Excellent
Security	4.83	Excellent
Flexibility	3.48	Excellent
Total Mean	**3.88**	**Excellent**

Table 4. Summary of Beta Test Result

Criteria	**Mean Score**	**Verbally Interpretation**
Functional Suitability	4.47	Excellent
Compatibility	4.42	Excellent
Interaction Capability	4.52	Excellent
Security	4.51	Excellent
Flexibility	4.53	Excellent
Total Mean	**4.49**	**Excellent**

The alpha testing phase shown in table 3, conducted by three IT experts, yielded an overall weighted mean of 3.88, interpreted as "Good." Security scored the highest with a weighted mean of 4.83, showcasing the system's strong confidentiality, integrity, and reliability. However, Flexibility scored the lowest at 3.48, indicating areas for improvement in scalability, adaptability, and installability to enhance the system's versatility and user-friendliness. In beta testing, 30 BSIT students evaluated the system, resulting in an overall weighted mean of 4.49, rated as "Excellent." Flexibility received the highest score of 4.53, reflecting inclusivity and user satisfaction. Compatibility, scoring 4.42, also rated "Excellent," highlighted minor areas for enhancement in functionality across diverse platforms and user levels. Both phases demonstrated the effectiveness of the system, with room for refinement to ensure optimal performance and adaptability.

DISCUSSION

The researchers conducted a thorough analysis of user needs, a crucial step in the development of QRCodeConnect. The primary objective was to identify the key components necessary to build a comprehensive desktop application system for Mabalacat City College. Through collaboration with students, custodians, and instructors, the researchers gained valuable insights into how to improve student attendance and computer monitoring, streamline administrative processes, and optimize laboratory resource management. In addition to conducting interviews, the researchers reviewed papers on school best practices and students' digital solutions. Reading case studies and researching effective desktop application systems online yielded some useful theoretical information. Moreover, the researchers examined similar systems to better understand how different groups used and interacted with technology. The researchers determined which hardware and software were required to make the system's features work.

The researchers used a variety of software tools for the development of QRCodeConnect. Visual Studio Code was the primary IDE for both front-end and back-end development, while Draw.io facilitated the creation of system flowcharts and data flow diagrams. Adobe Photoshop was used for designing an intuitive user interface. PySide6 enabled the creation of interactive desktop application interfaces, with Python handling back-end processes. PostgreSQL and SQLite were chosen for managing data, with Git and GitHub ensuring version control and team collaboration. These tools collectively enabled the creation of a robust system tailored to the needs of Mabalacat City College's computer laboratory.

Figure 2. Student, Instructor and Admin/Custodian Login Page

Limitations

The QR Code Student Attendance and Computer Monitoring System's limitations focus on its defined scope and functional constraints. The system is exclusive to the Mabalacat City College computer laboratory, designed as a cross-platform application

for attendance tracking and monitoring. Advanced features, such as remote access, external database integration, and AI-based behavior analysis, were excluded due to time and resource limitations. Data gathering was restricted to interviews and literature reviews, lacking broader surveys. Testing was confined to the college laboratory environment, potentially missing real-world variability. Internet dependency limits functionality, as unstable or unavailable connectivity could affect real-time features like cloud synchronization and reporting. Evaluation using ISO 25010 Software Product Quality criteria occurred in controlled settings, which may not fully represent performance in diverse scenarios. Additionally, scalability and adaptation to other departments or institutions would require further customization and development for broader implementation.

Conclusions

The research process for the capstone project began with a thorough examination of user needs to develop a comprehensive system for Mabalacat City College. The initial phase involved collaborating with custodians, instructors, and students to acquire insights into the operational requirements of the computer laboratory. Through these interactions, the researchers gained an understanding of existing processes and identified areas for improvement in attendance monitoring and resource management. Additionally, a review of related literature and case studies on digital monitoring solutions helped inform the design and functionality of QRCodeConnect, ensuring alignment with best practices in educational and resource management systems.

The QRCodeConnect system transformed the way attendance and computer use were managed in the laboratory. It bridged the gap between traditional paper-based methods of attendance taking and adopting digital versions, helping shift administrative work to a more streamlined alternative through quick access to attendance records those instructors and administrator might require.

This capstone project has helped the researchers team relate some practical challenges faced while integrating an API and managing a database which enhanced our skills to understand the system development process. Furthermore, the QRCodeConnect system has tremendous scope to be extended further by some features of analyzing usage in detail and adaptability in similar resource monitoring contexts. This project will have an excellent foundation for digital solutions in the management of academic resources and goes a long way in demonstrating how well this change could be made toward even a more efficient paperless workflow.

While the system performs well, there may be certain limits in adjusting to changing user needs or preferences. This identifies a potential area for improvement in order to increase user engagement.

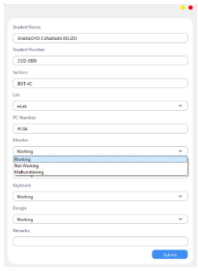

Figure 3. Student Form

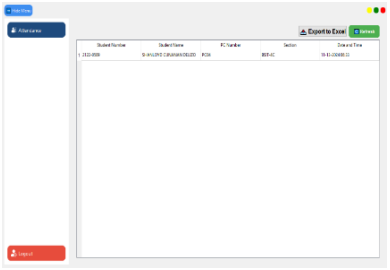

Figure 4. Instructor Dashboard and Admin/Custodian Dashboard

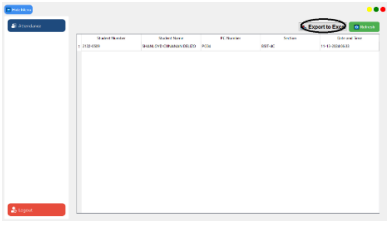

Figure 5. Export File for Student Attendance

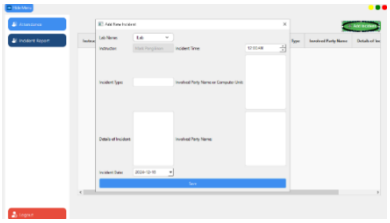

Figure 6. Incident Report

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Transforming Pediatric Services with PatientPlus: A Web Application for Mabalacat Child Care Clinic

EDRIAN T. MARIÑAS, MABALACAT CITY COLLEGE
PRINCE JOIE R. MAEDINA MABALACAT CITY COLLEGE
JERALD R. MUÑOZ MABALACAT CITY COLLEGE
LUIS DANIEL G. PEREZ, MABALACAT CITY COLLEGE
JOHN VERGEL C. TISUELA , MABALACAT CITY COLLEGE
KHYLE L. ALEGRE (Technical Adviser), MABALACAT CITY COLLEGE

ABSTRACT
Intensive medical care focuses on children with severe illnesses, while pediatric care emphasizes growth and development, nutrition, disease prevention, and treatment of illnesses in children. Immunization, also known as vaccination or booster shots, is one of the most effective ways to protect a child's health. The general objective of this project is Transforming Pediatric Services with PatientPlus: A Web Application for Mabalacat Child Care Clinic, designed to modernize and enhance pediatric services in the Mabalacat Child Care Clinic. The Modified Waterfall Model was utilized as the Software Development Life Cycle (SDLC) approach in developing the web system, ensuring an iterative and organized flow of development activities. During alpha testing, the web-based application achieved an average score of 4.68, labeled as "Excellent," excelling in learnability, operability, and user engagement. Strong data protection and threat resistance were noted as key strengths, although improvements in non-repudiation were recommended. Beta testing resulted in an average score of 4.73, also rated as "Excellent," with functional appropriateness, compatibility, interaction capability, security, and flexibility meeting user expectations. These results highlight the system's potential to optimize pediatric services, support clinic operations effectively, and provide a user-friendly experience while identifying areas for further refinement to achieve optimal functionality.

Keywords: Information Systems, Web System, Appointment System

INTRODUCTION

Pediatric care is initiated during infancy, as well as through well-baby visits designed to maintain optimal health and guide future development. Typically, the pediatrician will see a newborn after discharge from the hospital and one to two times before reaching an age of one month, at which time growth, developmental milestones, weight, and feeding are monitored. Visits are made every two to three months after the first month of life until two years of age, and then biannually until annually. These visits give the pediatrician an opportunity to monitor the child's growth and development and to address issues that may have arisen regarding the child's growth and health milestones. Consultation with a pediatrician is therefore important from infancy through adolescence to enable early detection and treatment of conditions that would significantly impact long-term health outcomes. (The Importance of Pediatric Care: Monarque Health & Wellness: Family Medicine and Functional Medicine, n.d.; SmartClinic Urgent Care, n.d.)

Pediatric care focuses on the comprehensive welfare of children aged less than 18 years, which includes growth and development, nutrition, prevention of disease, and control of illnesses. Specialized care is given to those children who experience serious illness, preterm birth, inherited diseases, or chronic illnesses. Such an interdisciplinary approach involving doctors, nurses, and other professionals ensures that not only the child but the parent or family gets sufficient support and counseling. It is used not only to relieve symptoms such as pain, nausea, and sleep problems but also to empower caregivers so they may provide effective care to enhance the quality of life of the patient and his family. (Phrc, 2022)

Immunization is important to provide protection to the health of children as it prevents more than twelve deadly diseases. Without immunization, the risk of such serious and even fatal infections exists, especially in infants, as compared to immunized people. Vaccines train an individual's immune system to identify and combat specific pathogens that cause disease by exposing that person to a weakened or inactive disease-causing microorganism. Thus, this process develops immunity, resulting in not only the protected child but also the general public. Despite occasional fears about the safety of vaccines, extensive research has consistently demonstrated that the benefits far outweigh the potential risks. Vaccination is an important part of public health, preventing such diseases as polio, tetanus, and diphtheria, and improving the general health of the population. (Why Are Immunizations Important for My Infant's

Health? 2021; Why Childhood Immunizations Are Important, n.d.)

The capstone project, Transforming Pediatric Services with PatientPlus: A Web-Based Application for Mabalacat Child Care Clinic, aims to address inefficiencies in pediatric healthcare delivery through the implementation of a secure, user-friendly platform. PatientPlus facilitates online appointment scheduling, electronic medical records (EMRs), and real-time healthcare information. Features include advanced vaccine and booster dose tracking, enabling timely immunizations and empowering caregivers with accessible vaccination records. This system modernizes clinic operations, reduces administrative tasks, and enhances vaccine compliance, leading to improved health outcomes for children and the community. By streamlining processes and promoting proactive health management, PatientPlus represents a significant advancement in pediatric healthcare systems, ensuring better protection against preventable diseases.

Background of the Study

Mabalacat Child Care Clinic, located at Casmor Phase II, Mabiga, Mabalacat City, Pampanga, is recognized as one of the most renowned child clinics in Mabalacat City. The facility began its operations in June 2000, as stated by Mrs. Aiza Torres, the clinic's secretary. Since its inception, the clinic has remained at its original location, consistently serving the community. Dr. Ma. Cristina R. Fernandez completed a Doctor of Medicine degree on April 13, 1993, at Angeles Foundation University. As a pediatrician, medical and professional work has been focused on the health, development, and well-being of children. Extensive experience treating and managing childhood illnesses has established a reputation for professionalism and warmth. In alignment with advocacy for child health, Mabalacat Child Care Clinic was established in June 2000 to provide quality pediatric care to improve children's health and development within the community.

Clinic operations begin at 7 a.m., with walk-in appointments recorded on bond paper managed by a neighboring facility. Services commence at 10 a.m. and continue until 5 p.m., with a patient limit of fifty (50) per day due to high demand. Services include general check-ups for children aged 12 years and below, vaccines for infants under 12 months, and booster shots for children over 12 months. Vaccines include BCG, Hepatitis B, DTwP-Hib-Hep B, DTap combination, Measles, Influenza, PCV, and Rotavirus for those under 12 months. Boosters for children over 12 months include DTwP, JEV, MMR, Varicella, Hepatitis A, Meningococcemia, and Typhoid. Vaccination prices range from 850 pesos to 4,500 pesos, with up to two vaccine shots administered per visit, depending on infant tolerance.

The childcare clinic prioritizes children with disabilities while addressing challenges posed by traditional paper-based record-keeping. Patient records are maintained in baby booklets, brief pamphlets containing essential information on baby care and development. The clinic also faces a high workload due to limited staff. Appointment scheduling requires a manual process involving in-person visits and handwritten slips, increasing the risk of lost or incomplete data.

To address these challenges, an innovative solution, "Transforming Pediatric Services with PatientPlus: A Web Application for Mabalacat Child Care Clinic," has been proposed. This advanced web-based application introduces a digital platform to modernize healthcare procedures, significantly improving over traditional methods. Features include appointment scheduling, patient registration, doctor profiles, an online patient portal, email verification for registration, appointment reminders with queuing and cutoff times, vaccine pricing, e-booklets, medication reminders, patient body mass index (BMI) tracking, and digital doctor prescriptions.

The proposed system addresses issues related to untimely updates to patient records, inefficient data management, appointment scheduling, and the risks associated with lost or damaged information. The project aims to create a centralized repository for medical records, leveraging advanced technologies and strict data management guidelines to ensure secure and accessible data.

PatientPlus enhances the accuracy and accessibility of patient information, promotes effective communication among medical professionals and clinic staff, and strengthens continuity of care. By fostering proactive health-seeking behaviors within the community, this web application supports a culture of wellness and empowerment in healthcare management.

General Objective

The general objective for this project is Transforming Pediatric Services with PatientPlus: A Web Application for Mabalacat Child Care Clinic which is the web application designed to modernize and enhance pediatric services in the Mabalacat Child Care Clinic. Operations regarding digitization of registration, appointment management, medical record management, and vaccine information, with e-booklets and reminding them of appointments will enhance efficiency and accuracy alongside guaranteeing that patient care is dealt with. With the new technological upgrade, the project hopes to make the clinic workflows well streamlined, reduce risks related to loss of data, ease administrative workloads from the staff, and finally create a proactive environment as well as accessible health care as will be needed by the community.

Specific Objectives

In line with the objective of the study, the researchers achieved the following:

- To gather information on optimizing online presence and customer satisfaction from interviews, articles, and published books.
- To develop the required specifications for hardware and software developmental tools to use the web application PatientPlus on Windows 10, and 11.
- To develop a Front-end and Back-end web-based application interface using the following:
- To design the web-based application using the diagrams and analysis tools
- Created a web-based application
- To test the website and web-based application through Alpha and Beta testing.
- To evaluate the website using the Software Quality standards of ISO 25010 in terms of functional suitability, compatibility, interaction capability, security, and flexibility.
- To deploy and implement the website to the web domain repository site

Scope of the Study

The scope of this study is focused on the design, development, and implementation of PatientPlus, which is a web application developed for the Mabalacat Child Care Clinic. It addresses some key operational challenges at the clinic, such as scheduling using mainly paper-based records to keep track of documents, and most importantly, unmanageable patient load. This study aims to shift the clinic from traditional practices to a more efficient, digitalized web-based application and improve patient management, record accuracy, and the quality of services rendered.

PatientPlus will include core features such as online patient registration and appointment scheduling to streamline the clinic's processes. Parents or guardians can easily create accounts and enter the children's medical information online, so the clinic will be able to keep updated patient records. The manual paperwork at the clinic will be reduced, and waiting times will be reduced; in addition, patients will be allowed to make appointments from anywhere in the world. The web-based application will also be designed with an email notification feature reminding the patients about the appointments and prescribed medication schedules, thus boosting patient engagement and curbing appointment defaults.

The web-based application has a digital patient record management feature, which will replace the traditional "baby booklet" used to track a child's medical history. All medical information related to a patient, including vaccination records, check-ups with a general, and even doctor's notes, will be kept within this e-booklet. Digitization has ensured through this web-based application that the data of the patients are secure, easily accessible, and much less likely to be lost or damaged. Further, one available module is vaccine information, where one can view all the details and prices of vaccines, hence, helping in better decision-making processes. The project is designed specifically for pediatric services at the Mabalacat Child Care Clinic. The scope of the project shall focus on children 12 years old and below. In this scope, the following shall be included: vaccination management consisting of babies under 12 months and booster vaccines of children above 12 months; general pediatric check-ups; and developmental milestones tracking. However, it is still only limited to pediatric care. All other medical specialties or services outside that expertise will not be covered by this web-based application. For that, the web-based application will aim at streamlining present operations within the childcare clinic, rather than expansion into telemedicine or more complex third-party integrations at this point.

The data security and privacy management that the web application offers are the other key aspects of the study. As the information from the patients could be sensitive, the overall project will emphasize an accurate data protection program that includes login security, encryption for the storage of patient records, and adherence to all applicable laws regarding data privacy. In addition, the scope encompasses a user-friendly interface so that clinic staff and parents can easily navigate the platform. The implementation phase will provide technical support and user training for the clinic staff, so things go smoothly during the shift toward this digital web-based application.

This study will primarily focus on how the improvement of in-clinic operations can impact the efficiency of the operation, relieve administrative burden, and promote a better continuum of care for pediatric patients. Telemedicine consultations and automatic billing web-based applications, for example, would not be included because this project's scope is grounded on fixing the most urgent needs in the clinic—namely, in patient record management, scheduling of appointments, and communication. Expanding the web-based application or even scaling it for several clinics would lie beyond this scope but is something that could be pursued in a later development phase. To summarize, the scope of this study is aimed at enhancing the effectiveness of the operations and delivery of patient care in the designed PatientPlus of this clinic. It only catered to pediatric services in a childcare clinic: mainly concentrating on core

enhancements such as appointment scheduling, management of patient records, and communication. The web-based application design shall be friendly to the user, secure, and scalable, providing a good foundation for potential growth, but within the main scope of enhancing pediatric care at the local level.

Limitations of the Study

The study is focused exclusively on the Mabalacat Child Care Clinic, making its findings and conclusions relevant only to this specific setting and limiting its generalizability to other clinics or healthcare environments. Additionally, the PatientPlus web application is designed specifically for pediatric services, meaning it does not address non-pediatric medical needs, which could limit its usability in a broader healthcare context. Resistance from the clinic's staff and users may also arise during the initial deployment of the web application, as individuals often find it challenging to adapt to new technologies.

The reliance on SMS notifications, such as verification and one-time password (OTP) authentication, introduces additional limitations in this study. Issues such as delayed message delivery, service provider disruptions, or user access to mobile networks could reduce the effectiveness of these features.

Furthermore, while the PatientPlus application tracks immunization records, it does not include advanced features for automated vaccine stock management. This limitation may affect clinics looking for a fully integrated vaccine inventory system. Similarly, the system cannot provide predictive insights or visually compare growth data against global pediatric benchmarks, which could have enhanced its utility for pediatricians and parents.

The absence of telemedicine capabilities, such as video consultations or real-time virtual check-ups, is another limitation. Offering such features would require additional infrastructure, technical resources, and compliance with data privacy regulations such as Republic Act No. 10173 (Data Privacy Act of 2012). Real-time emergency alert systems, which could notify caregivers of urgent medical advisories like disease outbreaks, are also not included in this version of the application, potentially reducing its responsiveness during public health emergencies.

While the inclusion of a Real-Time Chat System improves user communication, the feature may still be limited in addressing complex medical inquiries, as it focuses on general engagement rather than offering in-depth medical guidance. These limitations highlight areas where future enhancements to PatientPlus could focus, ensuring its continuous evolution to meet the demands of modern pediatric care.

METHODOLOGY AND DESIGN

Software Development Life Cycle (SDLC) makes it feasible to produce high-quality, low-cost software in the least amount of time. The SDLC aims to create excellent software that satisfies and surpasses all client requirements and expectations. A comprehensive plan with stages, or phases, that each include the own procedures and outputs is defined and outlined by the SDLC. Following the SDLC accelerates development and reduces project risks and expenses related to using different production techniques. The researchers chose the Modified Waterfall Model as the Software Development Life Cycle (SDLC) approach to be used in the creation of the simulation program. The Modified Waterfall Model will consist of phases that will be iterative and an organized flow of developmental activities.

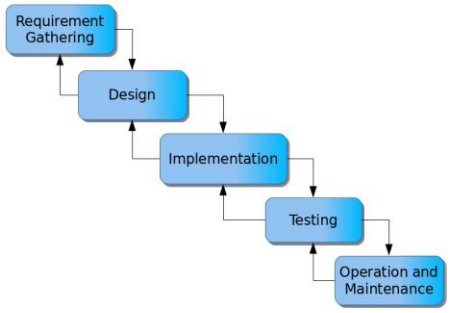

Figure 1: The Modified Waterfall Model.

Planning and Data Gathering

The researchers thoroughly studied and observed the needs of the community to plan the titles presented at the title defense. The researchers cooperated with the chosen technical adviser to further improve the initial plans for the function of the project and staff of the clinic. Furthermore, studying the requirements of the project, learning from online platforms prepared by developers, and brainstorming with the technical adviser helped to finalize the title presented before the title defense began.

The researchers met with the technical adviser weekly after class to confirm the essential information and functions of the study to finalize the project's documents. Additionally, researchers had an interview with the clinic staff to gather the method that the clinic used for appointment scheduling and the process of checkups, and the rest of the questions were accommodated through messenger. The decided process in appointment scheduling is to set an appointment on the PatientPlus web application with a queuing number to set up an appointment. The researchers also had weekly meetings with the technical adviser through

Messenger and MS teams to share knowledge and ideas to create a web-based project entitled "Transforming Pediatric Services with PatientPlus: A Web-Based Application" The software and hardware specifications for website development are the following (See Table 1).

Table 2. Desktop computer hardware specifications used for the project development.

Component	**Specification**
Processor	Intel Core i5-2300 CPU 2.80GHz
Memory	4gb RAM
Web-based application Type	64-bit operating web-based application, x64-based processor
Hard Disk	500 Gigabyte of free space

Table 3. Software development is used for web-based application development.

Software	**Description**
Visual Studio Code	Integrated Development Environment
XAMPP	Database
Figma	UI designing software

The goal of PatientPlus is to digitize the pediatric services of Mabalacat Child Care Clinic, customizing features with a user-friendly website design where guardians or parents of babies will be able to avail of the clinic's offered services like appointment booking, digitalized patient booklet, and discovering the clinic's location and Managing visits and sales reports on the website and using Electronic Medical Record to operate more efficiently. The researchers planned to develop a web-based application that everyone could access anytime with the features needed to meet the requirements of the said goals. With the data gathered by the researchers, the clinic is offering vaccines, boosters and general checkup for babies by using manual appointment where clients must physically write down the patient's name for an appointment early in the morning. Additionally, vaccines and boosters are administered in multiple doses, with doses taken at different intervals, depending on the vaccine type

Designing

During the Design Phase of the PatientPlus project, it is focused on creating a comprehensive blueprint for the web-based application. This phase involves defining the high-level and low-level design aspects of the software, including interface design, data architecture, and web-based application flow. The researchers utilize industry-standard design tools such as VSCode(IDE), which provides a user-friendly interface for visualizing and conceptualizing the layout, structure, and functionality of PatientPlus. With VSCode(IDE), the researchers collaborate to create wireframes, mockups, and prototypes that capture the intended look and feel of the web-based application. Through iterative design iterations and feedback loops, researchers refine the designs to ensure it aligns with the project objectives and meets the needs of healthcare providers, patients, and community health workers. The researchers have come up with modal windows for a user-friendly design because modal windows enhance user experience by focusing attention on important tasks or messages, ensuring users complete actions without distractions. It also improves efficiency by providing instant feedback or additional information without navigating away from the main page. Body Mass Index (BMI) of patients are within the admin features to regularly monitor the patients before proceeding with the vaccinations or boosters. Lastly, the validation of every input by the user was added to avoid untrusted sources or links.

Analysis

The researchers used user diagram, data flow diagram, and visual table of contents to be the guidelines on how to implement the web-based application properly, also it helps the researchers to know all the features of the web-based application that the users need. The researchers decided to use it as analysis tools to define the important part of the design process, at least for both user experience as well as for user interface design. A storyboard is a visual method of storytelling: designers can express the many interactions that can occur between the user and the application. The user diagram and data flow diagram were created to provide a clear and structured representation of the general workflow and processes within the web application. These diagrams outline the interactions between users (such as guest users, registered users, and administrators) and the system, as well as the features each user can manipulate within the web application.

Implementation

In the Implementation Phase of this capstone project, the researchers begin building the PatientPlus web-based application based on finalized designs, employing VSCode for a comprehensive development environment. This tool supports the methodology the researchers use, allowing tasks to be made sequentially from Planning & Data Gathering, Designing, Analysis, Implementation. The researchers focused on functional suitability,

compatibility, interaction capability, security, and flexibility by adhering to best coding practices and industry standards. To begin with interview and survey Questionnaire the researchers deployed the web application by using Z.com Philippines for hosting, the app remains accessible, with PatientPlusccc.com as its registered domain for easy user identification. Key tools or features that help to efficiently process the development in this phase include:

1. Cross-Platform Compatibility
2. IntelliSense & Code Navigation
3. Community Support
4. Z.com Philippines

Testing

In the Testing Phase, the researchers thoroughly evaluate the functionality, performance, and usability of the PatientPlus web-based application to identify and address any issues or defects before deployment. Utilizing comprehensive testing tools such as XAMPP, a popular and widely used software package that provides a complete development environment for web developers. It includes Apache, MySQL, PHP, and Perl, making it suitable for testing web-based applications which title presented relies on PHP for backend functionality and MySQL for database management. Alpha and beta testing are crucial phases in the development of the PatientPlus web application for Mabalacat Child Care Clinic. Alpha testing focuses on identifying and fixing bugs, usability issues, and performance problems by engaging internal testers such as healthcare staff and selecting patients. This phase helps refine the web-based application's features like appointment scheduling, patient records, and data security to ensure compliance with healthcare standards. Beta testing, on the other hand, involves a larger group of real-world users to assess the web-based application's performance, scalability, and usability in diverse environments. Feedback from beta testing allows developers to address any remaining issues, optimize the web-based application, and ensure readiness for its full release, ultimately enhancing the clinic's pediatric services and patient experience.

Questionnaire Validity

A thorough validity testing plan is developed to guarantee both the accuracy and dependability of the questionnaire intended to assess the customization feature of our PatientPlus web-based application. With the validator's comments and suggestions, the survey questionnaire was finalized to proceed with Alpha and Beta Testing.

Preparation: Careful planning entails defining protocols, choosing a suitable sample size, creating a schedule, and identifying specific objectives. The researchers come up with the idea of having a specialist for the said goal. The researchers asked 3 IT experts with experience of validating survey questionnaires to validate every question before proceeding with Alpha and Beta testing, these are various important phases in the plan.

Design: The survey's questions are thoughtfully formed and validated to gather convenient information on the patient's parent or guardians' satisfaction levels and preferences for the clinic's services.

Recruitment: To ensure validity of the data, participants must come from the desired customer group which is (Parent or Guardian).

Conducting: The survey questionnaires were sent over to participants, allowing them to give feedback while using the web-based application.

Analysis: To find efficient insights, quantitative data from survey answers and qualitative input are examined.

Report: A detailed report is put together, covering the results, pros, cons, and recommendations to help shape future improvements for the customization feature. This comprehensive approach also ensures that the questionnaire is both effective and reliable in capturing client insights and experiences with the web-based application process.

Sampling Methods

The researchers of this study employed Homogeneous purposive sampling as a sampling method. This was utilized in selecting participants who share similar characteristics or traits relevant to the research study. This ensures that the sample is uniform and representative of a particular subgroup within the population.

To choose the beta testers for the study, Homogeneous purposive sampling will be used. The researchers chose three (3) validators who had experience of validating questionnaires in a capstone project survey questionnaire, and three (3) IT professionals to carry out the alpha testing. Experts can advise, offer feedback and suggestions for improving the effectiveness and efficiency of the web-based application.

To select beta testers, the researchers will also employ Homogeneous purposive sampling. The users who have experience using record-keeping and traditional appointment booking will conduct the beta testing; Thirty (34) clients together with Ms. Aiza Torres, the secretary of the clinic.

Instrumentation

The researchers used the software product quality requirements of the ISO 25010 model to evaluate the PatientPlus: A Web-based application. Based on functional suitability, compatibility, interaction capability, security and flexibility, a survey questionnaire was created. Extensive validity testing was conducted on the ISO 25010 questionnaire to guarantee unbiased and trustworthy results. A pre-test that included the following steps was carried out before the start of the survey:

Questionnaire Administration

The questionnaire was administered at Mabalacat City from October 23, 2024, until October 30, 2024. During the distribution and administration of the questionnaire, there will be a simple introduction on how will the respondent fill-up the checklist based on the experience.

Ethical Consideration

Consent: Respondents were advised of the study's goals, methods, and any sensitive information, including any potential drawbacks. Respondents were made aware that the involvement was completely voluntary and not obliged to provide information or take part in surveys; furthermore, the respondents were told that the participation was only being made for purposes of research and respondents agreed to participate.

Confidentiality: In compliance with the Data Privacy Act of 2012 (Republic Act No. 10173), all personally identifiable information and newly obtained data collected from respondents was handled with the utmost confidentiality. To protect respondents, researchers assumed full responsibility and put safety measures in place. Standard citation guidelines were followed in order to give credit to the sources and summarize the results.

Do no harm: In order to comply with the Cybercrime Prevention Act of 2012 (Republic Act No. 10175), all information, including ideas and expressions—was properly credited to respect intellectual property rights.

On October 23, 2024, Mabalacat City College administer the survey. Users receive a brief introduction during distribution outlining the goal of the questionnaire and how it should reply based on the familiarity with the features and functionalities of the website.

Data Gathering

The distribution and data gathering for the questionnaire was managed by the researchers. The user is expected to fill out the form as soon as possible after using the website. October 23, 2024, will mark the start of data collecting, which will last until October 30, 2024.

Data Analysis

Descriptive statistics were used to analyze the data once data collection was complete. This entailed summarizing the main findings and examining the distribution and dispersion of replies.

1. Frequency Distribution

Data is categorized using frequency distribution, which also counts the number of occurrences within each category. Step intervals will be used to categorize the respondents into groups for the purpose of analyzing the demographic profiles in this study. A summary of the response distribution is obtained by tabulating the number of respondents that fall into each group, which indicates a range of scores or values.

2. Mean

The mean, also called the average, is a measure of central tendency that represents the typical value within a dataset. It is calculated by summing up all observations and dividing them by the total number of observations. In this study, the means will help measure the central tendency, including the average satisfaction score reported by participants. This single figure effectively summarizes the overall attitude or opinion expressed by respondents.

$\bar{x} = \Sigma fx/\Sigma f$

Notation 2: The mean computation formula.

where,

$\bar{x}$ = the mean value of the set of given data.

f = frequency of each class

x = mid-interval value of each class

3. Likert Scale

The Likert scale is a popular survey tool for assessing attitudes, beliefs, or opinions. After calculating the average score for each survey section, the Likert scale interprets results into categories like "Excellent," "Good," "Acceptable", "Marginal," or "Poor". This provides a clear, qualitative summary alongside the survey's numerical data. Likert scale options typically range from "Strongly Agree" to "Strongly Disagree," offering a simple way to understand respondent perspectives.

Table 4. The 5-point Likert Scale – level of agreement.

Response	Numerical	Range	Verbal
Strongly Agree	5	4.21 – 5.00	Excellent
Agree	4	3.41 – 4.20	Good
Neutral	3	2.61 – 3.40	Acceptable
Disagree	2	1.81 – 2.60	Marginal
Strongly	1	1.00 – 1.80	Poor

Maintenance

Following the testing phase, the proposer entered the maintenance phase, which involved routine monitoring, bug fixing, performance optimization, security updates, user support, feature enhancements, and documentation maintenance to ensure the long-term effectiveness and reliability of the PatientPlus web-based application.

RESULTS

Testing Results

The alpha test results showed outstanding performance in all criteria with a high score in functional suitability of 4.84, interaction capability of 4.83, and flexibility of 4.78. The results show that the PatientPlus application meets the users' needs, is user-friendly, and is flexible for different scenarios. Security is strong with an average of 4.57, though there is room for improvement in non-repudiation, which scored 3.11. Compatibility was consistent at 4.78, ensuring that the system coexists and inter-operates with other systems without any problems.

In contrast, the beta test results showed slightly lower scores in all metrics. Functional suitability (4.11) and interaction capability (3.79) indicated that the system was still robust but some areas, such as user engagement and functional appropriateness, had minor declines in user satisfaction. Security (4.07) remained solid but showed persistent challenges under security in non-repudiation (3.30). Flexibility (3.93) and compatibility (4.02) also suggested room for optimization, especially in scalability and interoperability.

Table 5. Alpha and Beta Test Results

ALPHA TEST RESULT		BETA TEST RESULT
Functional Suitability	4.89	4.11
Compatibility	4.78	4.02
Interaction Capability	4.83	3.97
Security	4.57	4.07
Flexibility	4.78	3.93

A minor drop in beta test scores compared total alpha tests might be due to general user involvement, presenting varied insights and more practical implementation scenarios. Such feedback is essential in areas of improvement and in ensuring the application would answer all users' needs appropriately. Even with the lower scores, the system still performed well overall, as all metrics scored satisfactory levels or higher, affirming that this system has the potential for delivering high-quality pediatric healthcare services.

Implementation Results

The registration process is, therefore, meant for new users who are willing to have an account opened on the web-based application of PatientPlus. For the sake of registration, users need to provide the name, telephone number, and email among other information pertaining to one's health during the course of registration. Each user is given a distinct profile through this process, allowing for quick access to medical records and individualized services. The registration stage may be accompanied, most often, by a verification phase where users input the phone number or, for reasons of accuracy and security, the email addresses. Once registered, a user can access all those options that help the user manage health easily.

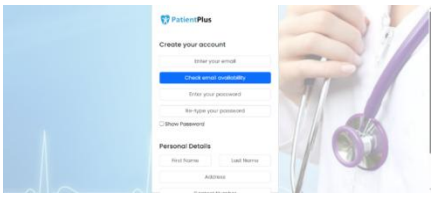

Figure 27: Register account

The add patient feature is a major tool that can enable administrators to add new patient information in the PatientPlus web-based application. Administrators sometimes insert the full name of the patient, contact information, birthdate, and even medical history in the process of creating a new patient. Medical records are important for delivering quality treatment since this information supports the process. This feature enables the cleaning of patients' data that is easily accessed for subsequent use by hastening the process of patient registration. Improved follow-up care, treatment planning, and scheduling of appointments are also realized with an extensive database for patients. All in all, this feature ensures proper delivery of healthcare services as well as improved clinical effectiveness.

The sales report tool gave the administrator insight into the clinic's financial performance. The generation of reports allowed them to track income from co-pays, patient payments, and other services. This financial data was important for understanding overall performance, trends, cash flow management, and informed budgeting decisions. It helped pinpoint the most profitable services, which guided marketing efforts and possible service expansions, ensuring that the clinic remained viable and continued to deliver high-quality care.

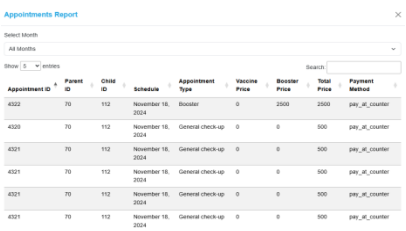

Figure 2: Appointment Report

The Monthly Appointment Report feature offers a detailed summary of appointments for each month, with an option to view data from all past months or for the entire year. This feature allows easy tracking and analysis of appointment trends, helping to monitor patient flow and clinical activity over time. It provides flexibility in generating reports for a specific month or a comprehensive overview of the whole year, aiding in efficient planning and decision-making.

The appointment reminder tool allows administrators to send automated reminders to patients via the application about an impending appointment. This includes in-app alerts, email reminders for ascertaining the patients have an appointment. Such a setup can significantly reduce missed appointments, and clinics further benefit patient care and efficiency by including this functionality. Besides that, reminders motivate people to take an active role in managing health, hence enhancing patient engagement. Additionally, the integrated queuing system facilitates the efficient management of numerous appointments by healthcare providers, reducing delays and overlaps and guaranteeing a seamless functioning of the healthcare facility.

The digital prescription generation feature allows the admin, including the secretary and doctor, to create prescriptions electronically. This ensures accuracy and eliminates the need for handwritten prescriptions. Users can conveniently view the prescriptions through the system, providing them with easy access to the medical instructions and promoting efficient communication between patients and healthcare providers.

The payment tool offers a simple and secure method of processing payments on services rendered, giving the consumer the ability to manage the medical bills over the internet. Users at the PatientPlus site are allowed to review the treatment charges and co-pays and make transactions over the internet immediately. Both the patients and the service providers find it easy when processing the billing, eradicating the need to use cash. It is also more accessible in the sense that it will take several different payments, including digital wallets and credit/debit cards. PatientPlus allows patients easy control over the health-care bills while relieving the clinic staff of burdens associated with administration through effective alternative payment.

DISCUSSIONS

The research can, therefore, succeed in its objective toward transforming services delivered at pediatric care to be achieved with the construction of the patient plus. The web-based application aimed for modernizing the delivery web-based application of the service, besides digitizing activities like management of all cases registered as well as taking vaccines information which are significant others in healthcare delivery within a hospital in addition, by developing its e-booklet and appointing web-based application based on its automated mode as an activity to give higher efficiency about the quality and good care being offered at hospitals.

The implementation of PatientPlus was able to present considerable improvements in many operational aspects of the area. It enabled the clinic to evolve from the traditional paper records into a comprehensive digital web-based application, streamlined workflows, and reduced administrative burden. It allowed online appointment scheduling, digital patient records, and automated reminders, which would help to create a much more efficient and accessible environment for both the staff and the patients in the healthcare department.

The web-based application was designed taking into consideration the requirements in terms of hardware and software to provide optimal performance and access. It was constructed and tested on an AMD Ryzen 5 2600 Six-Core Processor at 3.40 GHz, which ensures smooth running and efficient processing of health care data. In fact, the development process used this application with web technologies as the latest development using front-end technologies as HTML, CSS, and JavaScript while using Bootstrap at the client side and used PHP at the back end combined with the use of MySQL to result in a firm and agile user experience throughout desktop or mobile devices.

A well-designed, useful web-based application was produced after careful consideration of design tools and analysis techniques. It kept the Visual Table of Contents well-structured and an outline of design whereas storyboards allowed for optimization of user interface and experience. The Use Case diagram pointed out the salient features and a Menu Tree diagram represented all the links in navigation well. This streamlined the project management by Gantt Chart to implement the timely, effective, and friendly web-based application.

Three IT experts completely test the web-based application with live demos, discussions, and questionnaire-based detailed surveys according to ISO 25010. The major aspects are functional suitability, compatibility, interaction capability, security, and flexibility. The holistic test shows excellent performance along the criteria assessed to prove the effectiveness and dependability of the web-based application.

In the beta test stage, it involved 30 participants from Mabalacat City, further ascertaining the web-based application's goodness. The evaluation is made in accordance with the surveys made in

relation to the criteria based on ISO 25010. This focuses on testing the parameters in relation to functional suitability, compatibility, interaction capability, security, and flexibility. With this, the overall mean obtained is 4.89, thus manifesting excellent performance with a very high rate of user satisfaction with the parameters tested.

It would therefore be concluded that PatientPlus has successfully attained its desired goals of modernizing pediatric services at Mabalacat Child Care Clinic. The web-based application was able to address the traditional paper-based web-based applications' limitations while also introducing efficient digital solutions in managing healthcare.

The implementation has shown clearly great positive effects on multiple contexts: academic, entrepreneurial, global, economic, environmental, and societal. Of course, a great impact has been realized through its contribution to cost-saving operations, improved efficiency of services, and easy accessibility of healthcare services for the local community.

Successful implementation of PatientPlus at patientplusccc.com has marked an important stage in the digital healthcare transformation process. Featuring overall enhanced e-booklets, appointment management, and secure access to medical records, the web-based application created a much more streamlined, efficient healthcare delivery web-based application.

Although there are some disadvantages, including challenges in the adaptation of first-time users and potential problems with technical infrastructure, PatientPlus's overall success in its implementation indicates that the web-based application can be used as an example for other healthcare digitization projects. The willingness of both healthcare providers and patients to embrace the web-based application is a testament to how it has enhanced the administration of pediatric care and, at the same time, helped create a foundation for other technological innovations in healthcare delivery management.

Conclusion

The PatientPlus web application designed for the Mabalacat Child Care Clinic is the transformation step toward the betterment of pediatric services quality. The main purpose of the project was to upgrade the quality of care delivered to children aged twelve and below. Modern technology will allow the web application, PatientPlus, to offer early access to health services with a resultant impact on more healthy lifestyles and better wellbeing among the pediatric patients.

PatientPlus was thus developed considering a holistic approach with the Agile methodology applied during its application in the Software Development Life Cycle. As such, all requirements, from the healthcare provider through to the end-user-patient, are met at every level of its whole application. Major tools involved include the use of a solid processor, which is AMD Ryzen 5, coupled with 16 GB RAM for robust performance.

PatientPlus contributes toward many Sustainable Development Goals. First, it supports SDG 3, namely, Good Health and Well-being, through the betterment of quality healthcare with health outcomes in children resulting from better data management and automated record-keeping. It also supports SDG 4, Quality Education, by offering health education materials to parents, hence developing greater health literacy and an active role in the children's health.

This application also supports SDG 8: Decent Work and Economic Growth. The administration processes are streamlined, hence enhancing job satisfaction among the clinic staff. PatientPlus reduces reliance on old paper web-based applications while modernizing health delivery along the lines of SDG 9: Industry, Innovation, and Infrastructure. The application addresses SDG 10: Reduced Inequalities where all members of the community are guaranteed equal access to health care, including persons with disabilities. Lastly, the initiative supports SDG 11 (Sustainable Cities and Communities) through the promotion of resilient health web-based applications and encourages partnerships for sustainability as outlined in SDG 17.

In conclusion, PatientPlus is a tool that has to be at the core of transforming pediatric healthcare services in the Mabalacat Child Care Clinic. It has systematic web-based application development and proper evaluation procedures that could bring about better healthcare delivery significantly. It aligns with the Sustainable Development Goals through its contribution to the well-being of the community while also improving the operations of the clinic.

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VaXeen: A Website Utilizing Data Analytics to Monitor Animal Bite Rates at Mabalacat District Hospital

GABRIEL T. DELOS REYES, MABALACAT CITY COLLEGE
FAITH ANNE M. LITAN, MABALACAT CITY COLLEGE
JADEN RENZO P. LUMANLAN, MABALACAT CITY COLLEGE
PATRICK JAMES OMANDAM, MABALACAT CITY COLLEGE
JON IRIS O. SAN BUENAVENTURA, MABALACAT CITY COLLEGE
ERNIE LEE E. PINEDA (Technical Adviser), MABALACAT CITY COLLEGE
DENNIS L. TACADENA (Capstone Adviser), MABALACAT CITY COLLEGE

ABSTRACT
The unexpected outbreak of health issues such as the COVID-19 pandemic demonstrated how crucial technology is to medicine. Data analytics was utilized to predict diseases, but has not been used to track local diseases such as cat and dog rabies in the Philippines. The general objective of the study was to develop a system named "VaXeen: A Website Using Data Analytics to Monitor Animal Bite Rates at Mabalacat District Hospital." This system was developed using the Modified Waterfall Model as the Software Development Life Cycle (SDLC) approach. This systematic approach ensures there is clear progress and documentation at each stage of developing the system. Alpha and Beta testing were conducted according to ISO 25010 standards, ensuring Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. The average Alpha testing score, rated by three (3) IT experts, was 4.09, which is rated as "Good." Meanwhile, Beta testing, rated by thirty (30) representatives from Mabalacat District Hospital, was 4.23, also rated as "Good." The test results indicate that the system is meeting its functional requirements, performs well on various platforms, has an easy user interface, secures data, and can be adjusted in the future. In conclusion, VaXeen successfully accomplishes its goals by offering a user-friendly, safe, and adaptable system that improves the Mabalacat District Hospital's animal bite rate monitoring, enabling more successful public health initiatives.
Keywords: Data Visualization, Web-based System, Cat and Dog Bites, Rabies, Vaccine Inventory Management, Public Health, Modified Waterfall Model, ISO 25010, Sustainable Development Goal

INTRODUCTION
A health outbreak is one of the things that unexpectedly occurred. One example of this is the COVID-19 pandemic that happened in 2019. The usage of technology during this era was crucial. Technology offers huge benefits to society, not just in work-from-home jobs but in healthcare as well. The medical industry already makes extensive use of technology, especially data analytics. Data analytics can forecast patterns in the spread of disease, enabling people, schools, hospitals, and doctor's offices to make appropriate preparations.

As an example, the coronavirus (COVID-19) pandemic is comparable to the flu. By using data analysis to forecast future case surges, hospitals can make sure that workers have enough Personal Protective Equipment (PPE) and patient beds. School administrators may use it to determine if in-person instruction is a safe alternative, and people can use it to make wise decisions about travel, social distance, and personal cleanliness and safety (Cote, 2021). Just like any other health outbreak, cat and dog rabies are among the categories that cause a human life to end. Rabies is curable if assessed immediately, but like other diseases as well, rabies was deadly if cured too late. Once the virus infects the central nervous system and clinical symptoms appear, rabies is fatal in 100% of cases. Via saliva, rabies is typically transmitted to humans and animals through bites, scratches, or direct contact with mucosa, such as the mouth, eyes, or open wounds (WHO, 2024).

Although there are no worldwide estimates of the frequency of dog bites, research indicates that tens of millions of injuries are caused by dog bites each year. For instance, almost 4.5 million people are attacked by dogs annually in the United States of America. Although data from low- and middle-income countries are more dispersed, some studies show that between 76 and 94 percent of animal bite injuries occur in dogs (WHO, 2024). With the use of data analytics, its usage can be optimized by identifying trends in dog bite cases. Including high incidence among children and adolescents and low vaccination rates, guiding policies for prevention and control. Data analytics was utilized to examine surveillance data from 2015 to 2019 in Ghana's Volta Region in order to determine the epidemiology of dog bite incidents and how they relate to rabies. Policies for prevention and control were informed by the study's use of descriptive statistics to synthesize data on gender, age, geography, and vaccine delivery. These statistics revealed patterns, including

low vaccination rates and greater occurrences among children and adolescents (Gborie et al., 2023).

In the areas of the Philippines, there is a huge public problem of dog and cat bites. The fundamental issue is that dog owners are not utilizing the offer of subsidized rabies vaccinations, and public knowledge of the disease is still low, according to Dr. Jose Abella, head of the Department of Health's Communicable Disease Control Service. The human and animal health sectors' rabies control efforts are primarily carried out independently. Only a small percentage of animal rabies infections are detected by the present national monitoring, and many human cases are reported without any details about the animal source (Dizon, 2023).

Despite the widespread recognition of technology's usage, its usefulness is not being taken advantage of in the healthcare sector. For this reason, some records of numbers, and health cases are not recorded properly, that could lead to missing beneficial data, and improper patient assessment.

According to the International Trade Administration (ITA), Microsoft Philippines and the Philippine Department of Health are collaborating to establish the COVID-19 Bakuna Center Registry and the National Health Facility Registry. In order to effectively deliver improved healthcare services to Filipinos, the agency was able to solve problems, concentrate its reaction, and boost productivity through the use of health IT analytics. In order to improve patient care management and standardize clinical procedures, private hospitals are likewise eager to acquire health IT services.

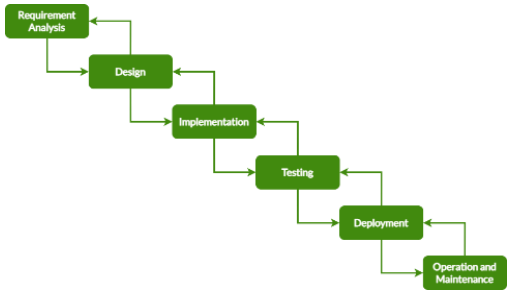
Mabalacat City doesn't have data analytics yet to utilize for cat and dog bites surveillance. As of now, the city of Mabalacat builds medical units to fight the large number of people that are victims of cat and dog bites each year. In this case, the government units provide free vaccination to its residents and animal bite centers that are accessible to the masses (Rosario, 2024)

Realizing the importance of addressing this issue, the researchers would develop a system that utilizes data analytics in enhancing rabies management in Mabalacat City through analyzing bite incidents, high-risk barangays identification, and informing interventions. It features an online scheduling system for patient registration and vaccination, which eliminates paper forms to ensure timely immunizations, as well as first aid instructions for the dog and cat bite victims.

Additionally, a events page that monitors medical missions, and a vaccine inventory system that tracks vaccine stock levels, expiration dates, and vaccine types. This platform promotes better prevention and health responsiveness for Mabalacat District Hospital, residents, and the local government.

The development of the systen aligns with Sustainable Development Goals 3, 4, 9, 11, and 17. It supports SDG 3 by helping prevent communicable diseases like rabies through improved monitoring and vaccination planning. It also contributes to SDG 4 by promoting public awareness and education on disease prevention. The use of digital tools reflects SDG 9 by fostering innovation in healthcare services. It promotes safer communities under SDG 11 and encourages collaboration between local health units under SDG 17.

The general objective of the study is to develop a web system called "VaXeen - A Website Utilizing Data Analytics to Monitor Animal Bite Rates at Mabalacat District Hospital." that aims to raise awareness about the frequency of animal bites, specifically from cats and dogs and by analyzing these bite incidents, the platform will inform the public and assist in planning future animal vaccination campaigns.



METHODOLOGY

The Modified Waterfall Model (See Figure 1) was adopted by the researchers from among the Software Development Life Cycle (SDLC) methodologies to develop the system. This approach consists of several phases, including requirement gathering and analysis, design, implementation, verification, and

maintenance. It allows the researchers to respond and adapt to sudden changes in user requirements without jeopardizing the project timeline. Additionally, it helps reduce errors and significantly improves the quality of the final product (Prashant, 2024).

Figure 1: The Modified Waterfall Model

Requirements Gathering

The researchers gathered the necessary information for the development of the web system from related literature, published articles, online journals, trusted websites, and similar systems to gain a better understanding of utilizing technology for public health and cat and dog bite monitoring. Collaboration with Mabalacat District Hospital was conducted through an interview with the administrative aide and nurse (See Figure 2), providing valuable insights into the hospital's current workflows and administrative practices.

Figure 2: Interview at Mabalacat District Hospital

For the system development, a desktop computer was used by the researchers for both front-end and back-end development of the web system and admin panel. The computer was equipped with the following hardware specifications: AMD Ryzen 5 2600 processor, 32 GB RAM, 2 GB video memory, 250 GB SSD, and 1 TB HDD, running on Windows 11 Pro.Software such as Adobe Photoshop CC, Balsamiq, Figma, Visual Studio Code, and XAMPP was installed to support the design and development process. A high-resolution monitor was also utilized to enhance visual clarity during graphic and coding tasks.

Design

In the design phase, the researchers used various diagrams and design tools, including a storyboard, menu tree, use case diagram, system architecture, and Gantt chart for the designing of the web system and administrator panel. The Storyboard serves as a visual representation of the system's user interface (Warner, 2025). A Menu Tree is the system's hierarchical navigation for office administrators and user requests (Arora, 2022). On the other hand, the Use Case Diagram shows the system's functionality and its interaction with the users (Gupta, 2024). The System Architecture Diagram, presents the various system components and shows how each component interact with one another (KaaShiv, 2023). Furthermore, a Gantt Chart, enumerates the steps performed to complete the project and helps to guarantee that the assigned resources are efficient and that the work is completed on time (Shweta, 2024).

Implementation

During the implementation phase, the system was developed using a desktop computer and several development tools to support its design and functionality. Visual Studio Code served as the primary environment for writing and debugging the code, while XAMPP provided the local server environment for testing the web-based components. Figma and Balsamiq were used to collaboratively design the interface and plan system features, ensuring usability and consistency. Adobe Photoshop CC was utilized to enhance and optimize the system's visual elements. The VaXeen system was built with features tailored to the needs of Mabalacat District Hospital and its community. The Home feature provides a welcoming interface and an overview of the services offered. The Analytics feature presents bite case data through categorized summaries and an interactive map, helping identify high-risk areas and guide targeted interventions. The About section shares background information about the hospital, highlighting its role and achievements in the community. The Contact page offers communication channels and location guidance through a map tool. The News and Events sections keep users updated with announcements and upcoming activities, encouraging awareness and participation. The Services feature informs users about available medical services, including treatment for animal bites, general consultations, and emergency care. It also provides first-aid instructions for bite incidents. To ensure effective management, an Administrator Panel was developed with several key modules. These include tools for managing news, events, user accounts, vaccine inventory, appointment schedules, and patient records. The admin dashboard provides a clear overview of all system operations, allowing smooth navigation and access to critical information. Administrators can add, update, archive, or print records, ensuring efficient workflows and organized data handling. This combination of user and administrative features was designed to make the system both functional and responsive to the operational needs of the hospital.

Testing

The developed system underwent a testing phase to evaluate its functionality and performance prior to deployment. The researcher's used different testing simulations such as, Alpha and Beta testing to identify potential issues and ensure the system operated as intended. During this stage, the questionnaire content was also reviewed to validate its relevance and clarity. Feedback from testers and end-users played an important role in refining the system, particularly in improving how data was collected, processed, and displayed.

Questionnaire Validity

The questionnaire underwent thorough validity testing to minimize the impact of external factors like researcher bias, respondent misinterpretation, or environmental influence. Before the actual survey, it was reviewed for potential issues, incorporating expert feedback to enhance clarity and relevance. The process began with clear objectives and a defined target population. A draft was created to guide meaningful data collection. Experts provided feedback to refine unclear items, ensuring the questionnaire's quality. During distribution, clear instructions and support were provided to reduce confusion. Post-survey feedback was gathered to assess clarity and user experience. Responses were analyzed to identify trends and improve both the questionnaire and system. Finally, pretest results and feedback were documented to justify revisions. The final version was refined to ensure reliability, relevance, and alignment with the system's development goals.

Sampling Method

To evaluate the system's effectiveness within the context of Mabalacat District Hospital, the researchers used a combination of purposive and random sampling techniques based on specific participant qualifications and study relevance.

Purposive sampling, a non-probability method, was employed to intentionally select individuals with relevant experiences or characteristics aligned with the study's objectives. This approach allowed the researchers to gather more focused and meaningful data by targeting participants who could provide in-depth insights. Selecting respondents based on specific criteria helped enhance the reliability and relevance of the data collected, ultimately strengthening the study's overall validity (Nikolopoulou, 2023). To complement this, simple random sampling was also applied to ensure fairness and reduce selection bias. In this method, every individual in the defined population had an equal chance of being chosen. By randomly selecting participants, the researchers ensured the representativeness of the sample, promoting generalizability of the findings and increasing the credibility of the results. This method is valued for its simplicity and effectiveness in minimizing sampling errors while providing an unbiased view of the population (Thomas, 2022; MasterClass, 2022).

By combining purposive and simple random sampling, the researchers balanced depth and diversity in participant selection, allowing for both targeted insights and broader representation in assessing the VaXeen system's performance.

Instrumentation

The system and administrator panel were evaluated using a validated survey questionnaire grounded in the ISO 25010 software quality model. This tool assessed the system based on key quality criteria and sub-criteria, including Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility.

To ensure objectivity and avoid bias from the researchers, respondents, or testing environment, the questionnaire underwent validity testing before it was used in the evaluation process. The researchers hosted the system on a web hosting service to allow smooth deployment and accessible testing for users and administrators.

For the alpha testing phase, three (3) IT professionals were invited to assess the overall functionality of the system and provide expert feedback, which was taken into consideration for further improvement. For beta testing, the researchers collaborated with one (1) hospital staff member and twenty-nine (29) residents of Mabalacat City, who participated at Mabalacat District Hospital. This allowed the researchers to evaluate the effectiveness and usability of both the system and administrator panel in a real-world setting.

Questionnaire Administration

The questionnaire was administered at Mabalacat District Hospital, Mabalacat City. Before its distribution, the researchers provided a brief introduction to the respondents, explaining the purpose of the survey and giving clear instructions on how to complete the checklist based on their experience with the system. This approach helped participants fully grasp the purpose of the study and respond at their own pace without feeling rushed.

Data Analysis

Descriptive statistics were used to analyze the data gathered in the study, which included frequency distribution, mean computation, and the use of the Likert scale.

Frequency distribution showed the number of responses for each score, categorized according to the participants' demographic profiles.

The mean was used to determine the average value from a set of data. In statistics, it is calculated by dividing the total sum of all observations by the number of observations. The formula used is: Mean = (Sum of Observations) ÷ (Number of Observations).

$\bar{x} = \Sigma fx/\Sigma f$

were,

$\bar{x}$ = the mean value of the set of given data. f = frequency of each class

x = mid-interval value of each class

The Likert scale (refer to Table 1) was used to interpret the mean scores of both criteria and sub-criteria, classifying responses according to levels of agreement, from "Poor" to "Excellent."

Table 1. The 5-point Likert Scale – level of agreement.

Response Categories	Numerical Value	Range/ Interval	Verbal Interpretation
Strongly Agree	5	5.00 – 4.50	Excellent
Agree	4	4.49 – 3.50	Good
Neutral	3	3.49 – 2.50	Acceptable
Disagree	2	2.49 – 1.50	Marginal
Strongly Disagree	1	1.49 – 0.00	Poor

Data Processing

The data were processed using pre-formatted tally sheets to ensure accurate and organized recording of responses. This streamlines data collection, helped maintain completeness, and supported accurate analysis by providing a clear summary of all feedback.

Ethical Consideration

The researchers observed ethical principles in order to protect the confidentiality and privacy of all the respondents who took part in the study. The following principles were adhered to in order to safeguard the integrity of the research.

Consent: Respondents were advised of the study's goals, methods, and any sensitive information, including any potential drawbacks. Respondents were made aware that their involvement was completely voluntary and that they were not obligated to provide information or take part in surveys; furthermore, they were told that their participation was only being made for purposes of research.

Confidentiality: In compliance with the Data Privacy Act of 2012 (Republic Act No. 10173), all personally identifiable information and newly obtained data collected from respondents was handled with the utmost confidentiality. To protect respondents, researchers assumed full responsibility and put safety measures in place. Standard citation guidelines were followed in order to give credit to the sources and summarize the results.

Do No Harm: In order to comply with the Cybercrime Prevention Act of 2012 (Republic Act No. 10175), all information—including ideas and expressions—was properly credited to respect intellectual property rights.

Operation And Maintenance

The operation and maintenance phase were carried out, and the system was deployed on a web hosting platform, making it accessible via https://vaxeen.in. Hosting the system online increased its visibility and showcased the locale's innovative services to a wider audience. The researchers aimed to attract potential clients and encourage user engagement through this web tool, helping expand the user base, build trust, and open opportunities for partnerships.

RESULTS

This section presented the findings of the study based on the study's objectives. It covered the results from requirements gathering, system features and design, and data collected during the Alpha and Beta testing phases. The researchers discussed the key outcomes, highlighting their relevance and impact. All results were carefully calculated and organized to ensure clarity and allow for an accurate and fair evaluation.

Testing Results

The Alpha and Beta testing phases were instrumental in identifying areas for improvement, ensuring the system was user-centric, and enhancing the overall performance and usability of VaXeen. The system was evaluated based on the ISO 25010 quality standards, which provided a comprehensive framework for assessing overall quality. The evaluation considered several key aspects, including Functional Suitability, which encompasses the following, functional completeness, functional correctness, and functional appropriateness. Compatibility was also assessed through coexistence and interoperability. Interaction

Capability was examined in terms of appropriateness recognizability, learnability, operability, user interface engagement, and inclusivity. Security was evaluated through confidentiality, integrity, and authenticity. Lastly, Flexibility was measured based on adaptability, scalability, and replaceability.

Alpha testing was conducted by three (3) IT experts who assessed the system's performance according to these criteria. Their evaluation revealed that the system met its intended purpose and performed as expected. It received an overall average score of 4.09, which corresponds to the verbal interpretation of "Good." This result suggests that the system demonstrated strong performance, although there remained areas for further enhancement.

The Beta testing involved one (1) hospital staff member and twenty-nine (29) residents of Mabalacat City at Mabalacat District Hospital. The results showed that the system received a total mean score of 4.23, which also falls under the "Good" rating. This indicates that the system effectively addressed the users' needs and expectations. Respondents expressed confidence in the system's ability to assist them in their tasks and goals, reflecting a high level of satisfaction with its functionality and performance.

Table 2: Summary of Alpha Test Results

Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.02	Good
Compatibility	4.09	Good
Interaction Capability	4.28	Good
Security	4.00	Good
Flexibility	4.05	Good
Total Mean	4.09	Good

Table 3. Summary of Beta Test Results

Criteria	Mean Score	Verbal Interpretation
Functional Suitability	4.44	Excellent
Compatibility	4.20	Good
Interaction Capability	4.41	Excellent
Security	3.96	Good
Flexibility	4.16	Good
Total Mean	4.23	Good

As shown in Table 2, the Alpha testing results yielded a total mean score of 4.09, with all quality criteria, such as functional suitability, compatibility, interaction capability, security, and flexibility, receiving a "Good" rating. Among these, interaction capability scored the highest with 4.28, reflecting the system's user-friendly design. Table 3 presents the Beta testing results, where the system achieved an improved total mean score of 4.23. Notably, functional suitability and interaction capability both received an "Excellent" rating, indicating the system's strong alignment with user expectations. These consistent and positive outcomes from both tables affirm that VaXeen met its quality objectives and is well-prepared for real-world application, demonstrating both technical soundness and user acceptance.

DISCUSSION

Through a thorough process of collaboration and technical development, a web-based system was created to transform hospital records on animal bite cases and treatments into a user-friendly platform. This effort resulted in the successful development and implementation of VaXeen: A Website Utilizing Data Analytics to Monitor Animal Bite Rates at Mabalacat District Hospital.

Close coordination with hospital staff and local residents provided valuable insights into how users interact with technology, helping shape the system's design. The researchers supported development by reviewing relevant literature, consulting technical experts, and incorporating feedback to improve both functionality and usability.

The system was built on a Windows 11 desktop with an AMD Ryzen 5 processor, 32GB RAM, and used tools including XAMPP, Visual Studio Code, Figma, Balsamiq, and Adobe Photoshop CC. Planning methods such as storyboards, menu trees, use case diagrams, system architecture, and a Gantt chart guided the project's structure and timeline. Ultimately, VaXeen was successfully deployed as an accessible and responsive platform, delivering timely data insights, supporting bite case monitoring, and

enhancing communication between the hospital and the community.

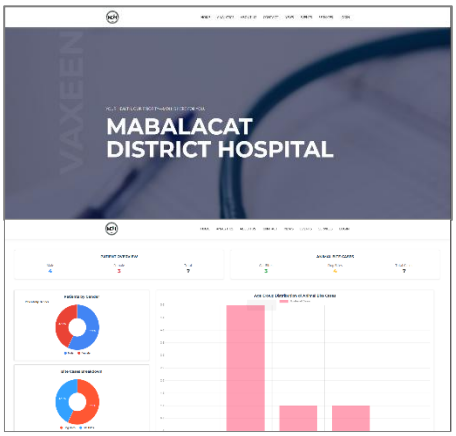


Figure 3: Home page of the web system

The VaXeen web system serves as the main platform for residents and hospital staff (See Figure 3). It includes a home, analytics dashboard, and dedicated sections for news, events, services, and contact page.

The home page introduces the system and provides easy navigation across all features. The analytics page displays visualized data such as patient statistics, gender distribution, and bite case trends, helping users monitor and interpret key health metrics. The about us section offers background information on the hospital. The contact page includes a location map, direct contact details, and a form for inquiries. The news and events pages share updates on hospital announcements, vaccination drives, and health seminars. The services section lists available healthcare offerings, including outpatient care and emergency services. The system is designed to be responsive, accessible, and informative for both the hospital and the community.

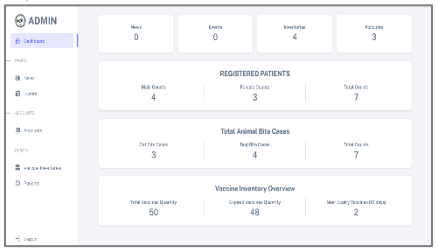


Figure 4: Dashboard page of the administrator panel.

The administrator panel provides core management features for the admin, doctor, and secretary after logging in (See Figure 4). The dashboard presents an overview of active events, news, inventory, user accounts, registered patients, bite cases, completed treatments, and pending cases. The news section allows the admin to create, edit, delete, print, and archive news items, with access to both active and archived posts. The events section provides similar functionality for managing community health activities. The accounts page lists all active users and allows the admin to create new accounts, edit user details, or delete users if needed. The vaccine inventory tab manages available stock, enabling the admin to update, archive, or add new vaccine entries. The patients page, accessible to the admin, doctor, and secretary, displays patient records. It supports adding new patients, updating existing information, printing, deleting, and archiving records, ensuring organized and efficient patient management.

The implementation of the VaXeen system shows the successful development of both the main website and the administrator panel. The website gives residents an easy way to access important features like analytics, news, events, and service information, making the experience simple and helpful. The administrator panel allows staff to manage content, user accounts, patient records, and vaccine inventory without hassle. This outcome reflects how the system now serves its purpose effectively by improving health service delivery and communication within the community.

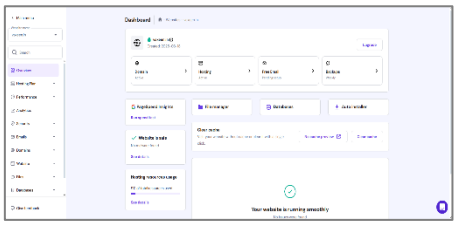


Figure 5: VaXeen System live on the Web Hosting Service

After conducting extensive internal and external testing to ensure system stability, usability, and performance, the VaXeen web system was successfully deployed online using Hostinger, a reliable and widely-used web hosting service (see Figure 5).

With the hosting configuration completed, the system is now live and accessible to users, enabling real-time monitoring and interaction with its features.

Limitations

One limitation of the VaXeen web system is its reliance on the English language, which may present challenges for users who are more fluent in Filipino or local dialects. This language barrier can lead to misunderstandings of important information, such as bite case updates, vaccination schedules, hospital announcements, and system instructions. As a result, users with limited English proficiency may need external assistance, reducing the system's usability and accessibility for independent use. Another limitation is the system's dependence on stable internet connectivity. Since VaXeen is a web-based platform, all data retrieval, updates, and interactions require a reliable internet connection. Users and administrators with poor connectivity may experience delays or interruptions when accessing essential features like bite case monitoring, scheduling vaccination appointments, or receiving timely updates. These disruptions can impact the accuracy of records, the efficiency of hospital services, and the overall user experience.

CONCLUSIONS

The development of the VaXeen web system followed a thorough and structured process. It began with brainstorming sessions and problem exploration, which led to extensive research, data collection, and collaboration. Vital inputs were provided by an administrative aide and a nurse from Mabalacat District Hospital, along with technical advisors and professors. Their contributions ensured the system would meet the hospital's needs for managing animal bite cases and raising public awareness. This collaborative effort laid the foundation for VaXeen: A Website Utilizing Data Analytics to Monitor Animal Bite Rates at Mabalacat District Hospital. From there, the development team focused on designing a user-centered interface and system structure. After finalizing the design, the system was carefully developed and rigorously tested to ensure both functionality and reliability. Over time, VaXeen evolved into a robust and dependable platform ready for real-world use. The project adopted the Modified Waterfall Model of the Software Development Life Cycle, which helped maintain both structure and flexibility. Feedback loops within the model allowed for continuous improvements through in-field testing and user input, ensuring the system remained adaptable and effective at every phase. VaXeen was also aligned with several United Nations Sustainable Development Goals (SDGs). It directly supports SDG 3 (Good Health and Well-Being) by enhancing the monitoring of cat and dog bite incidents and helping prevent communicable diseases. It contributes to SDG 4 (Quality Education) by raising awareness about animal bite prevention and public health. The system's innovative design reflects SDG 9 (Industry, Innovation, and Infrastructure) by leveraging technology to address local healthcare needs.

By promoting safer and more resilient communities, it aligns with SDG 11 (Sustainable Cities and Communities). Lastly, the collaboration between health workers, researchers, and local authorities reflects SDG 17 (Partnerships for the Goals). Overall, the VaXeen system serves as a vital tool for Mabalacat District Hospital, replacing traditional paper-based tracking with a digital platform that enhances data accuracy and response efficiency. It not only streamlines hospital operations but also raises community awareness, enabling quicker access to critical health information. As a scalable, web-based solution, VaXeen demonstrates the potential of technology to address public health challenges, foster collaboration, and drive sustainable progress within communities.

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Workonnect: WFH Client Monitoring with Payroll for Client-Based Employees

DARRELL JOHN D. DELA CRUZ, MABALACAT CITY COLLEGE
JOECES IAN D. DIZON, MABALACAT CITY COLLEGE
RAMBO JOHN D. SALANGSANG, MABALACAT CITY COLLEGE
JEREMY N. SANCHEZ, MABALACAT CITY COLLEGE
JOHN ANDREI S. TELAN, MABALACAT CITY COLLEGE
ONALEE G. TOLENTINO, MABALACAT CITY COLLEGE
ERNIE LEE E. PINEDA (Technical Adviser – CAP2), MABALACAT CITY COLLEGE
JOCELON C. SANGUYU (Technical Adviser – CAP1), MABALACAT CITY COLLEGE

ABSTRACT
The capstone project, titled "Workonnect: WFH Client Monitoring with Payroll for Client-based Employees," focuses on designing, developing, testing, and evaluating a system that streamlines the management of remote work environments for client-based employees. It addresses key tasks such as attendance tracking, request management, and payroll processing, making these operations more efficient for both employees and administrators. The project aligns with SDGs 4 (Quality Education), 8 (Decent Work and Economic Growth), and 9 (Industry, Innovation, and Infrastructure), promoting educational access, improving work processes, and fostering innovation in remote work technologies. The researchers used the Modified Waterfall Methodology to guide the development, incorporating feedback loops for continuous improvement. The system underwent rigorous alpha and beta testing, focusing on functional suitability, performance efficiency, compatibility, usability, security, and portability. The results confirmed the system's reliability and effectiveness, with strong performance across all key areas. In conclusion, the system successfully meets its objectives, providing accurate monitoring, efficient payroll management, and streamlined processes for remote employees. It demonstrates strong security, portability, and compatibility across platforms, significantly improving productivity and operational efficiency in client-based work environments.

General Terms
Desktop Application

Keywords:
Workonnect, WFH (Work from Home), Client Monitoring, Payroll Management, Client-based Employees, Attendance Tracking, Request Management, Remote Work Environments, SDGs (Sustainable Development Goals), Modified Waterfall Methodology, ISO25010.

INTRODUCTION
The COVID-19 pandemic spurred the adoption of remote work, demonstrating its feasibility and benefits, such as flexibility, better work-life balance, and cost savings (Choudhury et al., 2020; Gallup, 2020). Many organizations have kept remote work due to improved productivity and job satisfaction, especially as technology continues to evolve and meet the demand for flexible work environments (Brynjolfsson & McAfee, 2020). However, remote work presents problems in accountability, performance management, and payroll compliance. Traditional feedback and monitoring methods are less effective, requiring digital tools that balance productivity tracking with employee trust and avoid burnout (Bhave, 2020; Chory & Banfield, 2021). Furthermore, payroll management becomes complicated when considering labor laws and tax regulations in various regions (Collins et al., 2021; Hill et al., 2018).

Client-facing jobs also have setbacks since virtual interactions interfere with the development of trust and long-term satisfaction than face-to-face interactions (Ollier-Malaterre et al., 2020). For remote employees, managing their performance also entails tracking productivity, attendance, and other changes, such as leaves or schedules. Traditional ways do not work and require flexible tools that do not violate employees' rights and are adaptive to specific job positions (Kharub et al., 2021; Beckel & Seifert, 2020). Effective time-tracking and payroll systems must be flexible enough to allow for irregular schedules and regional labor laws. Flexibility and updated HR policies are necessary for accuracy and compliance (Golden & Eddleston, 2020; Dulebohn et al., 2021). Organizations are increasingly turning to self-service HR platforms to streamline leave and schedule requests, which must ensure fairness and efficiency in remote settings (O'Neill & Hambley, 2020).

Traditional clock-in systems are not applicable for remote working, and therefore, digital time tracking is required. Such systems must consider flexible and

irregular working hours because maintaining accurate logs of time worked remains a difficult task for remote workers (Golden & Eddleston, 2020). Payroll management also becomes complex due to regional differences in tax laws, wages, and overtime regulations. Updating flexible payroll systems for compliance prevents errors and maintains the trust of employees (Dulebohn et al., 2021; Parker et al., 2021).

Efficient payroll software should address leave requests, schedule changes, and multi-regional regulations while giving employees real-time access to payroll information. These systems increase transparency, reduce administrative burdens, and decrease errors, leading to worker trust and satisfaction (Smith et al., 2020). More advanced tools with strong data protection also ensure that sensitive information is safe from breaches, protecting both employees and employers (Gallagher & Doherty, 2021).

Technology is the critical response to the challenges caused by remote work. Digital platforms make productivity tracking, payroll processing, and communication seamless. Project management software and productivity trackers help the manager monitor progress without invasive methods, making the work more visible and blocking identifications (Beckel & Seifert, 2020). Real-time communication tools, such as video conferencing and collaborative platforms (e.g., Slack, Microsoft Teams), bridge gaps between remote employees and employers. These tools ensure alignment on goals, enhance accountability and improve client satisfaction by facilitating immediate feedback and seamless resource sharing (Gallagher & Doherty, 2021). Workonnect is an all-in-one system that addresses the needs of companies dealing with remote, client-based workers. It provides improved employee monitoring and payroll transparency through real-time attendance tracking, accurate payroll processing, and streamlined management of leave, schedule changes, and overtime requests. Centralizing these functions will ensure that workflows are efficient while encouraging trust and accountability in distributed work environments. Workonnect is an innovative desktop application that has been developed to support WFH client monitoring and payroll management. It has tools such as attendance tracking, user management, payroll generation, and request approvals, including leaves and schedule adjustments. The employees can view payslips and make requests, while the administrators get a better view of things and processes, which are streamlined. Workonnect helps organizations stay productive, ensures payroll accuracy, and improves communication and accountability in remote settings with its user-friendly interface and robust functionality.

Objective of the Study

This study aims to achieve several specific objectives to ensure the successful development and implementation of the system. Firstly, it seeks to gather information on best practices for monitoring remote work and managing payroll for client-based employees by consulting trusted sources, conducting interviews, and adhering to industry standards. Additionally, the study identifies the required hardware and software tools essential for the system's development, including a desktop computer, C# programming language, Visual Studio 2022, SQL Server Management Studio (SSMS), Adobe XD, Miro, Tailscale, and Windows Form. It further aims to design the system using various diagrams and analysis tools such as storyboards, Gantt charts, use case diagrams, entity-relationship diagrams, and visual tables of contents.

The system to be developed will feature functionalities tailored for three types of users: employees, HR admins, and superadmins. Employee features include dashboards for monitoring work status and announcements, attendance tracking with date filtration and export options, payslip viewing and acknowledgment, submission and tracking of various requests, and profile management. HR admin features encompass user management, monitoring attendance, handling fees and deductions, managing holidays, screenshots, payslips, announcements, client information, and requests, as well as profile updates. Superadmin features provide similar capabilities to HR admins but with higher-level user management authority.

The system will undergo rigorous testing, including Alpha and Beta testing phases, to validate its functionality. Finally, its performance will be evaluated based on ISO 25010 standards, covering aspects such as functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. These objectives collectively ensure the development of a robust and efficient system.

Scope of the Study

The study developed the Workonnect system, a work-from-home application using C# to enhance remote work management and organization. The system features attendance tracking, payroll management, and request handling, automating work-from-home processes through user-friendly interfaces for superadmins, admins, and regular users. Designed for deployment on desktop computers, it utilizes SQL Server Management Studio for database management and Visual Studio 2022 for development, optimized with an Intel Core i5 processor, 16 GB RAM, and SSD for smooth performance on Windows 10.

Prototypes were created using Adobe XD, while tools like Miro supported storyboard creation, Gantt chart

planning, use case and entity-relationship diagram development, and a visual table of contents. Users can track work statuses such as "Work," "Break," and "Meeting," with time spent displayed, alongside announcements, anniversaries, and birthdays. Attendance records are accessible with filtering options, showing detailed logs of work, break, and meeting hours.

The Requests section enables users to submit and track leave, log, schedule adjustments, overtime, and undertime requests. Payslips detail salaries, deductions, bonuses, and net pay, providing transparency. Profile management allows users to update personal information and passwords securely.

The system will be validated by six IT experts—three as validators and three as alpha testers—to assess design and functionality. Additionally, 30 work-from-home employees and 5 HR Admins will beta test the system, offering feedback to improve usability. The system's effectiveness will be evaluated using ISO 25010 standards, covering functional suitability, performance, compatibility, usability, reliability, security, maintainability, and portability, ensuring a high-quality, efficient tool for remote work.

Limitations of the Study

The system does not have a self-service password recovery method for users who forget their passwords. Users must contact the admin to reset the password to a default setting before logging into the system. From the login, users are allowed to update their passwords. This setup provides additional account security but might inconvenience users who need to remember their login credentials.

The user profile details are only viewable and not editable, as the admin does the information to be submitted and updated by default. If the user has inaccuracies about the data provided, then the user must contact the administrator for corrections to the update. This restriction has been implemented to prevent unauthorized personal information changes and maintain data integrity.

The system also has an auto screenshot capture feature that captures screenshots of all activity by any logged-in user every fifteen minutes if the admin configures it. Users have no rights to activate or deactivate the feature; instead, it's a feature controlled solely by the admin to monitor the user's activity and ensure the adoption of policies around the system. Users who might not like monitoring activities could question it.

General encryption techniques are being applied to user data; however, the system currently does not support MFA-based login authentication, which may bring security levels about account access down the line. The platform follows data privacy regulations, yet all the user data is persisted in centralized servers, leaving the users with limited powers concerning which data they want to be stored and processed. Additionally, the system does not permanently enable a user to delete his account; data about an account stays in the system even after deactivation.

In the section for managing users, admins are given different permissions than superadmins because admins only read authorization regarding user details. In contrast, superadmins have permission to edit and manage user details. This makes it more secure because higher-level roles control the most sensitive information and critical actions.

For the system to be secured and well-linked, it should be hosted online via safe platforms, notably Azure or AWS. If this isn't the case, then data within the system could be compromised in security-related risk events associated with the hosting of local systems, and connectivity issues could present themselves to the users that would hinder their access to the platform.

As mentioned above, the testing phase is allowed to a sample of 30 users, sorted from a specific working-from-home employee within the administration using the homogenous sampling technique. Though the issues may be pointed out and corrected through feedback in this sample, the customers' overall base cannot be generalized due to the small number and narrow scope. Further, since the sample is drawn from specific industries, the feedback may not comprehensively depict the system's usability in any other sector.

METHODOLOGY AND DESIGN

A combination of what was chosen as the SDLC methodology is the Modified Waterfall Model, hence selected for the development of this system. This model was chosen because of its structured yet flexible approach; it shows systematic progression through the development phases while allowing iterative enhancements at every step. Contrary to the traditional waterfall model, the modified one allows one to go back and improve previous stages to benefit from changes and improvements throughout the course. The iterative nature, solid documentation, and rigorous design evaluations ensure the software is high quality, consistent, and maintainable. Through this methodology, the researchers could develop a solid system with well-documented processes and designs conducive to long-term reliability and ease of updates.

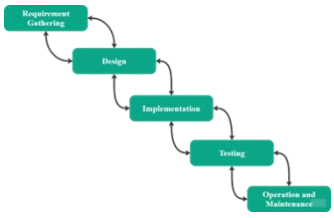

Figure 1: The Modified Waterfall Model

Requirements Gathering

The research team collaborated to gather key concepts and information for developing a functional client-based software system. This process included brainstorming sessions, expert consultations, interviews, and surveys to understand user needs and preferences. They also reviewed textbooks, online resources, and academic journals to align the system with industry standards and user expectations.

Visual Studio 2020 was used for front-end and back-end development, while Adobe XD and Miro supported prototype design and system structure planning. The system was developed on a Microsoft-powered desktop with an Intel i5 10th Gen processor, 8 GB RAM, and a 500 GB SSD, ensuring optimal performance. Tailscale was utilized to secure and streamline access across devices and networks.

By combining these tools with insights from experts and research, the team ensured the system was user-friendly, functional, and capable of meeting the project's objectives. The careful selection of technology, including Tailscale for hosting multiple servers, was crucial to the system's success.

Design

In this phase, the research team will use the following analysis tools and diagrams to design and develop the application and administrator panel: storyboard, Gantt Chart, Use Case Diagram, Entity Relationship Diagram (ERD), and Visual Table of Contents.

The research team used the Storyboard diagram to design and illustrate the user interface and flow of the system, providing better visualization to the developers who designed, programmed, and controlled the initial user interface. Organizing the interfaces on the application used a Visual Table of Contents diagram. A Gantt Chart was used, detailing the timeline for each stage of the project, to help the researchers manage their time and resources effectively while allowing them to track development, spot any potential obstacles or problems, and allocate resources wisely. The Use Case Diagram would have been applicable for the representation of functions and scope of the system and its relationship to the actors. The Entity Relationship Diagram has been used to present the system's data structure and how various entities may inter-relate, ensuring total comprehension of designing the database application.

Implementation

In the implementation phase of the Workonnect system, the researchers used Visual Studio as the IDE to design and program the system and administrator panel. C# ensured compatibility with Windows OS, enabling robust desktop application functionality. The user interface was designed to be professional, user-friendly, and approachable for super admins, admins, and users.

The Dashboard served as the system's core, providing an overview of user statuses, announcements, anniversaries, and birthdays. For super admins and admins, it included tools to manage holidays, announcements, and user statuses. The User Page supported user management, attendance tracking, requests, and agency fee management. Features for users included leave requests, overtime, schedule adjustments, and personal data management, with a Request Management section for approvals and rejections.

The system included a Payslip feature for transparent access to earnings, deductions, and net pay. Administrators could manage holidays, announcements, and user activity, with all actions recorded for transparency. Super admins had overarching control, while admins handled day-to-day operations. Password management ensured system security.

Attendance tracking and report generation allowed users to monitor records and export data.

Overall, the implementation phase ensured Workonnect was a robust, holistic tool for managing users, payrolls, requests, and more, ready for testing, feedback, and continuous improvement.

Testing

During the testing phase, the Workonnect system will undergo comprehensive evaluation to ensure all functionalities and features meet or exceed required standards. Testing will include unit tests to validate individual components like user account management and time tracking, integration tests to verify seamless interaction between modules, and system tests to confirm overall functionality and efficiency. Performance testing will assess the system’s responsiveness under heavy workloads, such as multiple logins or task updates.

Alpha testing with internal users will identify bugs and usability issues, simulating real-world usage to refine the system. After resolving these issues, beta testing with external users will provide practical feedback in a real-world environment, identifying any remaining shortcomings.

Tests will also ensure accurate reporting of work hours and task monitoring, robust security measures like data encryption, and a user-friendly interface. Feedback from testers will guide improvements, and all detected issues will be addressed. Once testing confirms stability, efficiency, and usability, Workonnect will be ready for deployment, effectively meeting organizational needs for task management, scheduling, and communication.

Preliminary Testing

The preliminary testing phase of the Workonnect system begins with unit testing, focusing on

individual components like user authentication, task assignment, and time tracking. This ensures each part works correctly in isolation, helping detect and resolve bugs early to prevent more complex issues later (Ashraf, 2021). This proactive approach enhances system reliability and stability, critical for its success.

Next, integration testing assesses how different modules, such as employee management, task scheduling, and notifications, work together. This phase ensures compatibility, seamless communication, and data integrity among features (Smith & Jones, 2022). For instance, it verifies that task assignments trigger real-time notifications, with any errors promptly resolved.

System testing follows, evaluating the entire software in real-world scenarios. It ensures the system meets its functional and security requirements while performing well under various conditions, such as high user loads (Ahmed, 2023). Simulated interactions like logging in, task updates, and data transfers test functionality, security, and data protection.

Finally, preliminary testing identifies any remaining issues before alpha and beta testing. Core features like user registration, task management, and report generation are reviewed to ensure stability. Bugs found during this phase are promptly fixed, preparing the system for external testing and eventual deployment (Jones, 2021).

Questionnaire Validity

The Workonnect System underwent rigorous validity testing to ensure reliable and unbiased data collection, confirming it met its goals without external interference. A pre-testing phase was conducted to identify and resolve issues before release.

In the preparation stage, a plan was created with clear objectives, procedures, and input from the Technical Advisor. During design, pre-test tools like questionnaires and prototypes were developed to assess functionality and user experience.

Participants were selected from relevant institutions to provide diverse feedback. Data was collected through surveys, interviews, and usability tests, identifying both major and minor issues.

The feedback was analyzed to pinpoint areas for improvement, guiding further development. Finally, the results were reported back to participants, detailing changes made to ensure the software met user expectations and was ready for implementation.

Sampling Method

This study utilized homogenous purposive and random sampling to evaluate the Workonnect System for work-from-home employees. Participants will be selected based on their experience with hybrid or remote work, focusing on their insights into the system's functionality. Organizations with remote workforces will be consulted for cooperation.

Homogenous purposive sampling targets participants with specific traits, ensuring the data collected aligns with the study's goals. This approach enhances the study's validity and reliability. Combining it with random sampling ensures a broader representation and captures diverse perspectives.

For testing, three IT experts will conduct alpha testing, providing feedback to refine the software. In beta testing, thirty work-from-home employees and five HR administrators will assess the system's functionality, performance, and usability. This mix of purposive and random sampling will ensure the system's technical soundness and practical applicability.

Instrumentation

The ISO 25010 software quality product model survey questionnaire was used to evaluate the software system developed for work-from-home and hybrid employees. The researchers designed a structured questionnaire based on the ISO 25010 quality attributes: Functional Suitability, Reliability, Performance Efficiency, Usability, Security, Compatibility, Maintainability, and Portability. This framework ensured an objective assessment, free from bias or external influences. Prior to distribution, the questionnaire underwent a validity testing process. Experts in the fields of capstone instruction, technical advisory, and IT were consulted to ensure the questionnaire's alignment with the ISO 25010 model. Specific criteria and sub-criteria from the model were carefully selected and cross-checked to ensure proper evaluation. The questionnaire was then reviewed and adjusted based on expert feedback, and the responses from the pre-test were analyzed using statistical methods like frequency distribution, mean scores, and the Likert Scale to refine the survey instrument.

Questionnaire Administration

The questionnaire will be released online using MS Teams on November 11, 2024. Before the questionnaires are delivered to the participants, the researchers shall demonstrate the system to the respondents to familiarize them with the system and its features. Survey questionnaires will be issued on Microsoft Forms so that every respondent can easily access and fill them out. A brief description will guide the respondents in answering the questionnaire based on their experiences with the system. On an essential basis, the instructions and questions will be presented in the respondents' primary language for greater clarity.

Data Analysis

Descriptive statistics will be used to analyze and summarize the study's data, including their spread and dispersion. To reduce the data, several

techniques will be applied. First, frequency distribution will categorize the scores from respondents' demographic profiles into predefined intervals, and the number of cases in each category will be counted. Percentage will be used to determine the relative frequency of the demographic profiles on a nominal scale, calculated with the formula:

$$f=f/N\times100=100f/N$$

Where f is the frequency of each category and N is the total number of respondents. The mean will be used to measure the central tendency of the data, calculated using the formula:

$$\bar{x}=\Sigma fx/\Sigma f$$

Where x is the mean, f is the frequency of each class, and x is the mid-interval value of each class. Additionally, the Likert scale will be applied in the questionnaires to measure respondents' attitudes or opinions. After calculating the mean score for each sub-criteria and criteria, the Likert scale will interpret the results based on the following table:

Table 1. The 5-point Likert Scale – level of agreement.

Response Categories	Numerical Value	Range / Interval		Verbal Interpretation
Strongly Agree	5	4.21 5.00	–	Excellent
Agree	4	3.41 4.20	–	Good
Neutral	3	2.61 3.40	–	Acceptable
Disagree	2	1.81 2.60	–	Marginal
Strongly Disagree	1	1.00 1.80	–	Poor

For data processing, tally sheets will be used to enter and summarize data as respondents complete the beta test questionnaires. The final tally summary will be prepared once the data collection is complete.

Operation and Maintenance

After the validation phase, maintenance was conducted for the Workonnect system. The system was deployed for client-based use and made accessible through the official domain of the system. In this phase, the system is monitored daily for smooth operation. Users of the system have a channel to report bugs or to suggest future improvements for the system. The researchers collect feedback from the users and have updates periodically to correct issues and keep the system running smoothly.

The researchers tracked vital metrics such as active users, bugs reported, and feature request status to assess the system's functionality and its areas for improvement. These insights helped maintain the system's functionality by making it responsive to the user's needs. Regular updates on bugs were also sent across to troubleshoot, improve the security aspect, and improve the interface according to the feedback collected from administrators and end-users. Furthermore, the researchers monitored the system's compatibility with different client devices so that users could always enjoy consistent results without compatibility problems.

RESULTS

The testing phase of the "Workonnect: WFH Client Monitoring with Payroll for Client-Based Employees" system was conducted to assess its quality based on the ISO 25010 Software Quality Model, divided into Alpha and Beta Testing phases. Alpha Testing involved 5 IT experts who analyzed the system's technical aspects, such as functionality, performance, security, and portability. Beta Testing, conducted by 30 WFH employees and 5 HR administrators, focused on usability, functional suitability, and reliability under real-world conditions. The evaluation aimed to identify strengths, weaknesses, and opportunities for improvement.

Key quality characteristics were assessed during the evaluation. Functional Suitability was tested on completeness, correctness, and appropriateness to ensure the system met user needs. Performance Efficiency was evaluated through time behavior, resource utilization, and capacity to ensure optimal performance. Compatibility was assessed by testing co-existence and interoperability with other software. Usability was a focal point in Beta Testing, focusing on recognizability, learnability, operability, and user interface aesthetics. Reliability was measured through maturity, availability, fault tolerance, and recoverability to ensure system stability. Security was assessed based on confidentiality, integrity, non-repudiation, accountability, authenticity, and resistance to threats. Lastly, Portability was tested through adaptability and installability to ensure the system performs across various platforms and devices.

The results of both testing phases revealed valuable insights. Alpha Testing identified technical issues, while Beta Testing highlighted usability and functionality in practical use. This comprehensive evaluation ensures the system meets user expectations and software quality standards, providing a foundation for future improvements.

Table 2. Summary of Alpha Testing Results

Criteria	Mean	Verbal Interpreter
Functional Suitability	4.71	Excellent
Performance Efficiency	4.80	Excellent
Compatibility	4.83	Excellent
Usability	4.76	Excellent
Reliability	4.82	Excellent
Security	4.81	Excellent
Portability	4.80	Excellent

The results of the Alpha Test for the system indicate outstanding performance across all evaluated criteria, with the overall outcome achieving an impressive mean score of 4.79 (Excellent). Each criterion reflects the system's strong capabilities, ensuring that system meets and exceeds user expectations in various important areas.

Functional Suitability scored 4.71 (Excellent), indicating that the system delivers features that are highly aligned with user requirements and provides a comprehensive set of functions for its intended use. The system efficiently supports the tasks and goals of its users, ensuring a strong foundation for its overall functionality.

In terms of Performance Efficiency, the system achieved 4.80 (Excellent), demonstrating optimal system performance. It operates swiftly and without significant delay, ensuring that users experience minimal waiting times, even under heavy usage or demanding conditions.

Compatibility received an excellent score of 4.83 (Excellent), showcasing that Workonnect integrates seamlessly with different software, hardware, and operating systems. This ensures that users can work without compatibility issues, regardless of their individual setups.

For Usability, the system scored 4.76 (Excellent), confirming that it offers a highly intuitive and user-friendly experience. Users can navigate through the system with ease, benefiting from an interface that is clear, well-structured, and efficient for both novice and experienced users.

The Reliability score of 4.82 (Excellent) demonstrates that the system performs consistently, with minimal interruptions or errors, and ensures stability and dependability over extended use periods.

With a 4.81 (Excellent) score in Security, Workonnect exhibits robust measures to protect user data and ensure privacy. The system effectively prevents unauthorized access and provides secure mechanisms for maintaining data integrity, making it a trustworthy platform for users.

Finally, Portability received 4.80 (Excellent), showing that Workonnect is easily adaptable to different environments and installable on various systems, ensuring flexibility for users with different hardware setups or configurations.

Overall, the high scores across all criteria reflect the Workonnect system's well-rounded and high-quality performance, providing users with a secure, efficient, and user-friendly platform that excels in functionality, compatibility, and reliability. The overall mean score of 4.79 (Excellent) further underscores the system's effectiveness and the successful outcome of the Alpha Test.

Table 3. Summary of Beta Testing Results

Criteria	Mean	Verbal Interpreter
Functional Suitability	4.59	Excellent
Performance Efficiency	4.58	Excellent
Compatibility	4.55	Excellent
Usability	4.64	Excellent
Reliability	4.66	Excellent
Security	4.59	Excellent
Portability	4.57	Excellent

The combined beta test results for HR Admins and WFH Employees reveal an outstanding overall performance of the Workonnect system, achieving an impressive overall mean score of 4.60, which is interpreted as Excellent. This result reflects the system’s ability to meet and exceed the expectations of both user groups, showcasing its effectiveness, reliability, and user-centric design.

For Functional Suitability, the system attained a mean score of 4.59, indicating that Workonnect delivers its intended features and functionalities efficiently. Users found the system highly capable of supporting their tasks and ensuring that essential operations are performed accurately and without limitations.

The Performance Efficiency criterion achieved a strong score of 4.58, reflecting the system's ability to operate with excellent speed, responsiveness, and resource optimization. Both HR Admins and WFH Employees highlighted the system’s smooth and consistent performance, even under demanding workloads or extended usage.

In terms of Compatibility, Workonnect received a score of 4.55, demonstrating its ability to function seamlessly across various platforms, devices, and configurations. This flexibility ensures that users, regardless of their working environment, experience consistent functionality and system integration.

The Usability of Workonnect emerged as one of its strongest aspects, with a high score of 4.64. This rating highlights the system’s user-friendly interface, intuitive navigation, and ease of operation. Users praised its well-structured design, which minimized complexities and made the system accessible for both experienced and new users.

For Reliability, the system achieved an impressive score of 4.66, underscoring its dependability and stability. Workonnect demonstrated minimal errors, downtime, or interruptions, ensuring a seamless

user experience and fostering confidence in its consistent performance.

The Security criterion also received an excellent score of 4.59, reflecting the system's robust measures for safeguarding sensitive data and ensuring protection against unauthorized access or breaches. This instilled trust among users, as Workonnect effectively upholds data privacy and confidentiality.

Finally, for Portability, Workonnect earned a strong score of 4.57, highlighting its adaptability and ease of use across different environments. Users found the system accessible, easy to install, and highly functional, regardless of varying technical setups or device configurations.

With an overall mean score of 4.60, Workonnect is proven to be an Excellent system that meets the diverse needs of both HR Admins and WFH Employees. The system's consistent high performance across all evaluated criteria—Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, and Portability—demonstrates its capability to deliver a seamless, secure, and user-friendly experience. These results affirm Workonnect as a reliable and effective solution for managing work processes efficiently, providing significant value to its users.

DISCUSSIONS

The testing phase of the "Workonnect: WFH Client Monitoring with Payroll for Client-Based Employees" system was conducted to assess its quality based on the ISO 25010 Software Quality Model, divided into Alpha and Beta Testing phases. Alpha Testing involved 5 IT experts who analyzed the system's technical aspects, such as functionality, performance, security, and portability. Beta Testing, conducted by 30 WFH employees and 5 HR administrators, focused on usability, functional suitability, and reliability under real-world conditions. The evaluation aimed to identify strengths, weaknesses, and opportunities for improvement.

Key quality characteristics were assessed during the evaluation. Functional Suitability was tested on completeness, correctness, and appropriateness to ensure the system met user needs. Performance Efficiency was evaluated through time behavior, resource utilization, and capacity to ensure optimal performance. Compatibility was assessed by testing co-existence and interoperability with other software. Usability was a focal point in Beta Testing, focusing on recognizability, learnability, operability, and user interface aesthetics. Reliability was measured through maturity, availability, fault tolerance, and recoverability to ensure system stability. Security was assessed based on confidentiality, integrity, non-repudiation, accountability, authenticity, and resistance to threats. Lastly, Portability was tested through adaptability and installability to ensure the system performs across various platforms and devices.

The results of both testing phases revealed valuable insights. Alpha Testing identified technical issues, while Beta Testing highlighted usability and functionality in practical use. This comprehensive evaluation ensures the system meets user expectations and software quality standards, providing a foundation for future improvements.

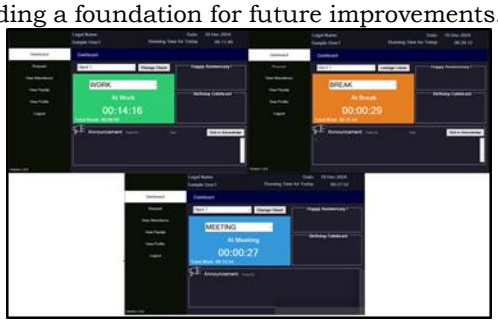

Figure 2. Employee Dashboard

The Dashboard section was developed to be at the system core, giving an overview of the Workonnect system with essential elements like user status, notices, anniversaries, and birthday celebrants. It acted as the main page for users to view critical features and update snapshots.

Users can change their status on the dashboard to indicate what they are doing at a given time. The statuses include Work (indicating one is working), Break (which gives the impression that one is on break), and Meeting (which means they are in a meeting). These status options are menu-driven via a dropdown menu, and the system will track the time spent in each status and display the cumulative minutes for each. Further, it will show significant Announcements that the users can accept, anniversary notices for those users who have completed a full year of service, and all the Birthday celebrations for the current month to keep users aware of the critical events and anniversaries of the organization.

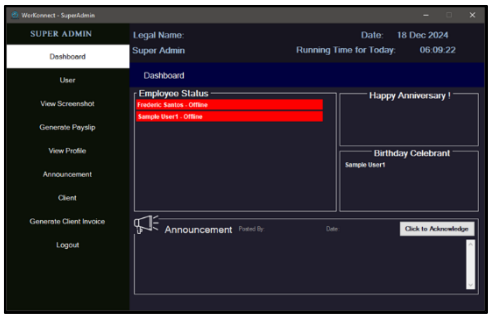

Figure 3. Admin Dashboard

The admin dashboard is designed to provide a comprehensive overview of the employees' current statuses, enabling administrators to monitor the real-time activity of work-from-home (WFH) or hybrid employees. One of the key features of the dashboard is the employee status tracking system, which allows the admin to see whether each employee is online, on break, in a meeting, or offline. This is done through a live status indicator, which updates in real-time based on the employee's actions or input in the system. When an employee logs into the system, their status is automatically set to "online," signaling that they are actively working. If an employee marks themselves as "on break," the status changes accordingly, notifying the admin that the employee is not currently available for work tasks. In case the employee joins a meeting, their status is updated to "in meeting," allowing the admin to understand that the employee is engaged in a work-related discussion or collaboration. Finally, if the employee is offline, the system marks them as such, indicating that they are either not logged into the system or have ended their workday. The admin can view this status for each employee, which is essential for ensuring smooth communication, tracking work productivity, and managing employee attendance effectively. This feature helps the admin stay informed about the real-time availability of their workforce, making it easier to allocate tasks, manage schedules, and address any potential issues promptly.

Conclusions

The Workonnect system development was a good step forward in the optimization of administrative processes for client-based organizations, especially in managing remote workforces. It starts with an understanding of organizations' challenges in monitoring employees' attendance, managing requests, and processing payroll. Extensive research and evaluation led to this system that streamlines some of these administrative tasks and further improves efficiency, accuracy, and user experience.

The team used several technologies during the development phase, including C#, Microsoft SQL Server, and Tailscale VPN, to ensure that the system would meet performance and security standards. The client-based architecture of the Workonnect system was developed using the C# programming language, ensuring compatibility with Windows operating systems for easy installation and smooth operation across a range of devices. In addition, there is UI design with the use of Adobe XD and prototyping in Miro, which assisted in the creation of an intuitive, user-friendly interface that ensures seamless interactions for both HR admins and remote workers.

The system underwent comprehensive testing, Alpha and Beta, that was evident enough with regard to robustness in the system's practical deployment. Some minor difficulties were found during the beta testing, which involved variations of performances for different hardware set-up configurations. It performed well by sustaining the system's functions to high levels of security and usability. It showed some functionality on its attendance tracking, request management, and payroll processing, which tested the administrative burdens on tasks that were made easy for organization productivity.

The Workonnect system has succeeded in its primary goal of simplifying remote employee monitoring and payroll management. With its effective automation of key administrative tasks, the system has not only enhanced operational efficiency but also ensured a secure and reliable platform for managing client-based workforces. The successful development, testing, and evaluation of the system affirm its potential to streamline the day-to-day operations of organizations with remote employees, thus positioning Workonnect as a highly valuable tool in the modern business landscape.

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Oral Defense


IOT BASED DRINKING
WATER VENDING MACHINE
WITH SALES AND LEVEL
MONITOR
Presented by Group 1
Binuya, Ronric Joel L.
Miclat, Jimmuel P.
Pacis, John Lloyd V.
Solis, Cedrick John A.
Teves, Patrick Lorence M.
Torres, Kgerone Lorenz M.


IOT BASED DRINKING
MONITOR
Presented by Group 1


CAPSTONE 2
FINAL DEFENSE
ACCOUNTIFY:
A WEB-BASED ACCOUNTANT PREP
AND REVIEW PLATFORM
WITH INTEGRATED STUDY TOOLS
PRESENTED BY GROUP 2
Aguas, Kristhine D.
Camon, Joshua Rinabin B.
Dela Pena, Cyrl Jan O.
Dela Cruz, Mary Angeline
Serrano, Verni Jakzreal A.

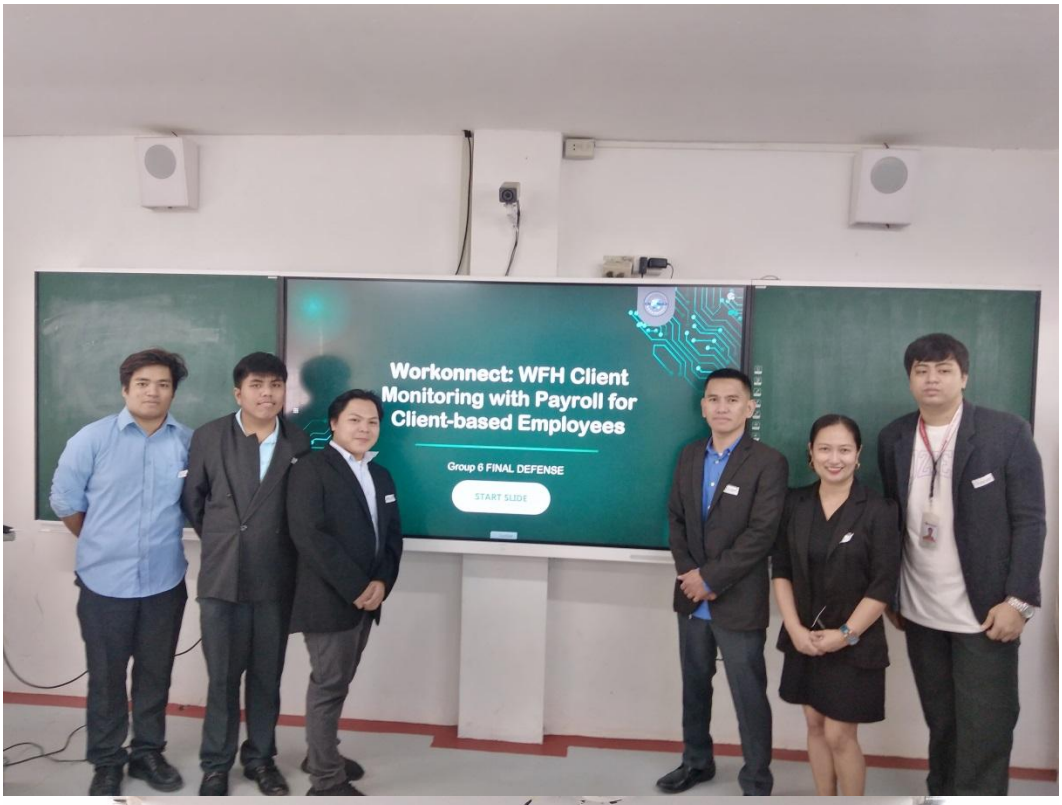

"HOA-UNITY:
EMPOWERING WEB-BASED
COMMUNITY MANAGEMENT
FOR FIESTA TABUN"
BAUTISTA, JOSHUA ALLAN D.
BAUTISTA, MARTIN S.
DAVID, VINCE STEPHEN S.
EDUARTE, JULLIEN D.
SANTOS, JUSTIN JOHN M.


"HOA-UNITY:
EMPOWERING WEB-BASED
COMMUNITY MANAGEMENT
FOR FIESTA TABUN"
DAVID, VINCE STEPHEN S.
EDUARTE, JULLIEN D.


GROUP 4
Dentally: A Patient Record Tracking for Tooth Impression Dental Clinic
Dale
Tizha
Allan
Went


GROUP 4
Dale
Allan


QRCODECONNECT:
ELEVATING STUDENT ATTENDANCE AND COMPUTER
MONITORING AT MABALACAT CITY COLLEGE
COMPUTER LABORATORY
Presented by Group 5
Group Members:
Delizo Shanloyd C.
Lee, Nathaniel N.
Martinez, Walter D.
Moreno, Henry S. jr.
Sabile Ria S.
November 13, 2024
QRCODECONNECT:
COMPUTER LABORATORY
Presented by Group 5


Workonnect: WFH Client
Monitoring with Payroll for
Client-based Employees
Group 6 FINAL DEFENSE
START SLIDE


VaXeen - A Website Utilizing
Data Analytics to Monitor
imal Bite Rates at Mabalacat
District Hospital
Presented by:
eyes, Gabriel T.
Litan, Faith Anne M.
Lumanlan, Jaden Renzo P.
Omandam, Patrick James
San Buenaventura, Jon Iris O.


KAPEPONGTSA:
A WEB-BASED ORDERING AND
INVENTORY MANAGEMENT
SYSTEM FOR YOBS CAFE
DELARA, RONALD KRIS F.
GOMEZ, ANGELO
OLECO, JUNEL O.
ROMERO, JAIMEE P.
WAJE, ALLEN SHERWIN H.


PickIntegrate: Implementing an
Integrate Ordering and Delivery Solution
for YCM Glass and Aluminum Supply


Transforming Pediatric Services
ith PatientPlus: A Web-Based
Application
MEMBERS:


ePasadya
An E-commerce System with Product
Customization for Gawang Gamat
Presented by:
Castro, Audrey Lynne L.
Cortez, Jairha L.
Guilas, Arel Loisel R.
Sagcal, Kyla Karylle
Tiamzon, Aleckzandra M.


ePasadya


BINHI: SEED ENGAGEMENT OF BARANGAY MAMATITANG THROUGH REVERSE VENDING MACHINE.
BSIT-4A
BORROMEO, CHOQHO L.
CABRERA, CHARLES P.
TOLENTINO, MANUEL RAFAEL D.
MANALOTO, JOHN RENDELL P.
GARCIA, GYAN IVERSON G.


Capstone Final Defense
BARANGAY-
CONNECT:
ENHANCING BARANGAY SANTA INES
THROUGH A COMMUNITY WEBSITE
PRESENTED BY GROUP 14
JULIUS
SHERWIN
JOSHUA


JULIUS
SHERWIN
RAMZEL


NIKKI
ADRIAN


Happy Teeth: A Web Based Appointment
System for Ocampo Dental Clinic


MABALACAT DORM:
A Web Application for
Enhanced Tenant Monitoring
and Management
GROUP 13:
Caliuag, Abegail M.
Calma, Junell S.
Cordova, Arlyn R.
Delos Reyes, Denzel
Gopez, Gilbert G.


CYCLOTRACE
Microcontroller-Based Smart Vest Warning
System with User Interface and Cyclist
Emergency Locator
GROUP 16


Project Title:
AcademiaVault: Empowering Students
in Research through Capstone and
Thesis Project
Luis
Paul
Andrei

Research Poster

ACADEMIAVAULT:

EMPOWERING STUDENTS IN RESEARCH THROUGH CAPSTONE AND THESIS PROJECTS IN MABALACAT CITY COLLEGE

AUTHORS

PAUL JOSHUA DAVID

LUIS NICOLE MANLUTAC

ANDREI SANDLER LOZANO

BRIAN KHYLE MOLINA

ERICSON DELA CRUZ

ABSTRACT

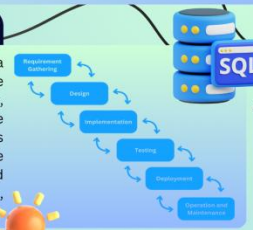
AcademiaVault: Empowering Students in Research through Capstone and Thesis Projects at Mabalacat City College aims to address the inefficiencies in accessing and managing research resources through a centralized digital repository. The system is designed to enhance research accessibility, collaboration, and data management for students, faculty, and librarians. Capstone and thesis projects are critical in fostering academic excellence and research innovation. This study's objective is to develop a digital repository that integrates resource search, consultation management, and administrative tools tailored to Mabalacat City College's needs. The researchers utilized the Software Development Life Cycle (SDLC) approach, specifically the modified waterfall model, to ensure systematic development and quality assurance. Alpha and beta testing results demonstrated the system's exceptional performance across ISO 25010 standards, including functionality, usability, and security. The system received high ratings from IT experts and students, indicating strong alignment with user needs. AcademiaVault streamlined resource accessibility and enhanced research collaboration, ultimately fostering a more inclusive and efficient academic environment. AcademiaVault significantly improves the research experience at Mabalacat City College, aligning with sustainable development goals in education and innovation. Future iterations could incorporate advanced analytics and broader integrations to further elevate its impact.

OBJECTIVES

- Establish and develop an Academia Vault website application with unique specifications that meet the standard of the Mabalacat City College
- Identify the required tools for the software and hardware development used for the application
- Construct a website for viewing and searching documents in the Digital Repository System;
- Create a system using C as the main scripting language and SQL Server Management Studio for the database;
- Test the website and system through Alpha and Beta testing;
- Evaluate the website using the software product quality standards of ISO 25010 in terms of functional suitability, performance efficiency, compatibility, reliability, security, maintainability, and portability;

METHODOLOGY

The Software Development Life Cycle (SDLC) is a systematic approach used by software development teams to conceive, develop, test, and deliver high-quality software products. The modified waterfall technique divides development procedures into flexible iterative stages, allowing for adequate documentation and design evaluations for custom software quality, dependability, and maintainability



IMPLEMENTATION

AcademiaVault's implementation phase will leverage a solid development stack to build a high-quality, functional, and secure digital repository system. The frontend will be constructed with HTML, CSS, JavaScript, and frameworks such as React or Vue.js, while the backend will be C as scripting language. The program will be hosted on a Linux server to provide scalability and dependability. The homepage will feature a visually appealing and intuitive layout, showcasing recent and popular theses and projects, while a filter search bar will be prominently displayed for quick access to resources. Users will be able to browse the website interface, with each project entry displaying details like the title, author, and year of publication.

CONCLUSIONS

In this study, the proponents successfully developed Academia Vault. The digital repository system has considerably enhanced Mabalacat City College students' research experiences by increasing access to academic materials, boosting cooperation, and reducing physical obstacles while fulfilling worldwide software quality requirements.

REQUIREMENTS GATHERING

The researcher engaged in collaborative brainstorming sessions and exchanged ideas to gather essential information and data crucial for developing a successful digital repository system. Through these discussions, the researcher aims to identify key features and functionalities that would enhance the web's usability and attractiveness to meet the target users.

DESIGN

In this phase, the proponents will use the following analysis tools and diagrams to design and develop the application and administrator panel: storyboard, visual table of contents, use case Diagram, and system architecture.

OPERATION AND MAINTENANCE

In this study, the proponents successfully developed Academia Vault. The digital repository system has considerably enhanced Mabalacat City College students' research experiences by increasing access to academic materials, boosting cooperation, and reducing physical obstacles while fulfilling worldwide software quality requirements.

TESTING

The Develop website will be evaluated after a preliminary assessment in the testing phase. The proponents will use various testing tools for the study, including unit, system, and alpha and beta testing. Before being finalized for administration, the questionnaire's validity was assessed during the testing phase. The procedures for data collection, analysis, and processing, as well as the sampling method and instruments utilized, were also addressed.

RESULTS

This chapter details the study's objectives, highlighting the researchers' achievement of their goals. It covers the functionality, design, development, and testing of the web system, including data from Alpha and Beta tests and ISO 25010 evaluations. To evaluate the experience of the participants in Academia Vault: Empowering Students in Research through Capstone and Thesis Project in Mabalacat City College" to complete a survey, the researcher must prepare a report that summarizes the study's result. The result from the studies should be presented in a reasonable, organized, and understandable way.

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ACCOUNTIFY: A WEB-BASED ACCOUNTANT PREP AND REVIEW PLATFORM WITH INTEGRATED STUDY TOOLS

AUTHORS

MABALACAT CITY COLLEGE


AGUAS, KRISTHINE D.


CAMON, JOSHUA REUBEN B.


DELA CRUZ, MARY ANGELINE M.


DELA PEÑA, CYRIL JAN O.


SERRANO, VERNI JAHZREAL A.


DE CASTRO, DESSA LYN J.


CALMA, MYRNA C.

ABSTRACT

The platform aims to enhance academic performance and preparation for the Certified Public Accountant Licensure Examination (CPALE). Equipped with curated study materials, interactive learning modules, practice exams, review flashcards, a lesson progress tracker, Pomodoro techniques, and study music, the system fosters effective learning and exam readiness. The platform was developed using the modified Waterfall Model of the Software Development Life Cycle (SDLC), emphasizing systematic design, implementation, and evaluation. Both phases adhered to ISO 25010 standards, assessing criteria such as Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. Alpha test results demonstrated an overall mean score of 4.37, categorized as "Excellent," while beta testing further improved the mean score to 4.53. The proposed web-based accountant preparation and review platform for Mabalacat City College (MCC) aligned with several Sustainable Development Goals (SDGs), primarily targeting Goal 4 (Quality Education) and Goal 9 (Industry, Innovation, and Infrastructure).

OBJECTIVES

General Objectives:

The general objective of this study was to develop an efficient and user-friendly web-based platform, "Accountify: A Web-Based Accountant Prep and Review Platform with Integrated Study Tools."

1. To gather best practices and references from accounting institutions, academic sources, and educational technology research for system development.
2. To identify and specify the necessary hardware and software requirements for building and testing the system across devices.
3. To design the system using visual and analytical tools for effective planning and development.
4. To develop a secure and feature-rich system with integrated login, validation, and profile management.
5. To conduct developer, alpha, and beta testing to ensure system functionality and usability.
6. To integrate performance-optimizing algorithms into the system.
7. To incorporate user-friendly features for an enhanced experience.
8. To evaluate the system's quality based on ISO 25010 standards.
9. To deploy the system using Name.com, Heroku, JawsDB, and Amazon S3 for hosting and data management.
10. To implement the system within Mabalacat City College Dapdap.

METHODOLOGY

The research employed the Modified Waterfall Model, a structured yet flexible approach that facilitated iterative refinements at each development stage. This approach ensured adaptability to user feedback and addressed challenges effectively

Figure 1: The Modified Waterfall Model

The process began with gathering requirements, which established the foundation of the system through surveys, interviews, and literature reviews. Feedback from students, staff, and administrators ensured a user-centric design aligned with real-world needs. Stakeholder input guided the evolution of initial concepts to cover various use-case scenarios comprehensively.

The Modified Waterfall Model provided a structured yet iterative framework, enabling the development of Accountify as a reliable and effective web-based learning platform tailored to accounting students' educational needs.

GATHERING REQUIREMENTS

The requirements gathering phase identified essential hardware—desktop, tablet, and mobile phone—to ensure cross-platform compatibility during development and testing. The team collaboratively used a robust software stack including Laravel 11, Vite.js, Tailwind CSS, Alpine.js, Livewire, PHP 8, MySQL, Node.js, and Visual Studio Code to build and manage the platform efficiently. Tools like Git, Canva, and Miro played a key role in fostering teamwork through version control, design collaboration, and strategic planning.

DESIGN

The Accountify system was designed through collaborative analysis of curriculum requirements, student learning preferences, and educational objectives from BSA and BSMA programs. The team structured a secure database and user-friendly interface to support centralized study materials, interactive modules, and progress tracking. This integrated design enhances student learning and streamlines administrative tasks, creating a comprehensive digital platform for accounting education.

DEVELOPMENT

The development of the Accountify system was guided by visual tools such as Entity-Relationship Diagrams and storyboards to ensure clear data modeling and user interface flow for both students and administrators. Using Visual Studio Code, the team built the platform with Laravel 11, MySQL, Tailwind CSS v3, Alpine.js v3, and Livewire v3 to create a secure, responsive, and interactive system. The Home Page was designed as a central hub for accessing study tools, progress tracking, and content management, tailored to the needs of BSA and BSMA students at MCC. Iterative testing throughout the process ensured that all features were refined to support effective learning and system usability.

TESTING

The Accountify system underwent a thorough testing phase that included alpha testing by IT experts and beta testing with 40 BSA and BSMA students from Mabalacat City College, using homogeneous purposive sampling. Feedback was collected through structured questionnaires and evaluated using the ISO 25010 software quality model and a 5-point Likert scale to assess usability, functionality, security, and overall satisfaction. This collaborative and systematic approach, supported by expert validation from Dean Myrna E. Cuento-Calma, ensured the system's reliability and readiness for deployment.

DEPLOYMENT

The system, Accountify, was deployed on Heroku, leveraging its secure PaaS capabilities for seamless development and management. A domain was registered via Name.com, and secure access was ensured through Heroku's SSL support. Additional integrations, such as JawsDB for database management and Amazon S3 for file storage, enhanced functionality and scalability. Traditional and public beta testing were conducted to gather user feedback, refine the platform, and prepare for the official release.

MAINTENANCE

Regular maintenance protocols were established to ensure Accountify's reliability and effectiveness. Key metrics, such as user feedback and system performance, were monitored regularly to address issues promptly. Periodic updates enhanced functionality and resolved bugs, while administrators were trained to report concerns efficiently for swift resolution

Figure 2: Modified Visual Table of Contents Diagram

RESULTS & OUTCOMES

This section presents a thorough summary of the research findings that are in line with the specified study objectives. The following conclusions have been achieved by data analysis, thorough testing of the developed system, and careful interpretation of beta testing results. The researchers have carefully computed all the results and outcomes. Following the completion of the gathering and analyzing data stages, the researchers prepared a thorough written report. This report is designed to present the research outcomes in a clear, organized, and understandable manner.

DATA AND GATHERING REQUIREMENTS

The researchers conducted a thorough analysis of user needs, a crucial step in the development of Accountify. The primary objective was to identify the key components necessary to build a comprehensive web-based study tool platform for students pursuing accounting programs. Through collaboration with the accounting students of Mabalacat City College (MCC) and the professional Dean, Madam Myrna E. Cuento-Calma CPA, FRIAcc, Ph.D. , the current Dean of Institute of Business and Computing Education from the Mabalacat City College (MCC), the researchers gained valuable insights from individuals who have direct experience with the educational context and requirements relevant to the proposed system. Surveys and discussions with students, administrators and the professional Dean provided essential information that guided the design of the system's features, particularly those related to user interaction and management.

TEST RESULTS

The thorough evaluation findings for the website platform interface's Alpha and Beta tests, focusing on the relevant ISO 25010 standards, are displayed in Appendix H and I. **Functional Suitability** scores were high for both phases, with the alpha test receiving a score of 4.39, while the beta scores improved slightly to 4.55, indicating exceptional functionality. **Compatibility** showed strong results in both tests; the alpha phase scored 4.67, while the beta phase is 4.60, giving the alpha phase the highest mean score. **Interaction Capability** maintained excellent scores, with the alpha phase at 4.32 and the beta phase excel at 4.53. **Security** exhibited notable improvement, increasing from 4.33 in the alpha test to 4.55 in the beta test. Finally, **Flexibility** demonstrated excellence in both phases, with scores of 4.38 in alpha and 4.48 in beta. The overall mean score increased from 4.37 in the alpha test to 4.53 in the beta test, both of which can be verbally interpreted as "Excellent," showcasing the platform's continuous improvement and adherence to ISO 25010 standards.

CONCLUSION

Based on the findings, the researchers concluded that Accountify effectively delivers a secure, interactive, and comprehensive learning platform tailored for accounting students. Its robust authentication system and exam environment uphold academic integrity while protecting user data. Interactive tools like flashcards, quizzes, and progress tracking enhance learning outcomes and engagement through a user-centered and intuitive design. Gamification elements such as badges and certificates further motivate students to complete courses and stay engaged. Additionally, the platform empowers administrators with real-time control over content and user monitoring, ensuring both efficiency and adaptability in managing academic resources.

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GATHERING REQUIREMENTS
The requirements gathering phase identified essential hardware—desktop, tablet, and mobile phone—to ensure cross-platform compatibility during development and testing. The team collaboratively used a robust software stack including Laravel 11, Vite.js, Tailwind CSS, Alpine.js, Livewire, PHP 8, MySQL, Node.js, and Visual Studio Code to build and manage the platform efficiently. Tools like Git, Canva, and Miro played a key role in fostering teamwork through version control, design collaboration, and strategic planning.
DESIGN
The Accountify system was designed through collaborative analysis of curriculum requirements, student learning preferences, and educational objectives from BSA and BSMA programs. The team structured a secure database and user-friendly interface to support centralized study materials, interactive modules, and progress tracking. This integrated design enhances student learning and streamlines administrative tasks, creating a comprehensive digital platform for accounting education.
DEVELOPMENT
TESTING
DEPLOYMENT
MAINTENANCE
RESULTS & OUTCOMES
This section presents a thorough summary of the research findings that are in line with the specified study objectives. The following conclusions have been achieved by data analysis, thorough testing of the developed system, and careful interpretation of beta testing results. The researchers have carefully computed all the results and outcomes. Following the completion of the gathering and analyzing data stages, the researchers prepared a thorough written report. This report is designed to present the research outcomes in a clear, organized, and understandable manner.
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TEST RESULTS
CONCLUSION
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Kumar, A. (2024, September 30). How technology changed our lives: Has it improved life today? Simplilearn.com. https://www.simplilearn.com/how-has-technology-improved-our-lives-article
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BARANGAY-CONNECT:

Enhancing Barangay Santa Ines Through a Community Website

ABSTRACT

The study presents Barangay-Connect, a web-based platform aimed at enhancing community engagement and communication in Barangay Santa Ines. Key features include a carousel for announcements, a directory of local services, and discussion forums, all designed to foster interaction and collaboration among residents. Developed through the modified Waterfall Model of the Software Development Life Cycle (SDLC), the platform underwent rigorous testing, including alpha testing by IT experts and beta testing with community members, both aligned with ISO 25010 standards. Alpha testing yielded a mean score of 4.63 (rated "Excellent"), which improved to 4.46 during beta testing, highlighting significant enhancements in Security and Interaction Capability. The study concludes that Barangay-Connect has the potential to transform resident engagement, improve communication, and strengthen community ties in Barangay Santa Ines.

OBJECTIVES

1. To gather data and information about Barangay Santa Ines through research and interviews with the barangay captain and secretary.
2. To identify the necessary software and hardware development tools.
3. To utilize analysis tools in the system design process.
4. To create a front-end and back-end system with user-level access.
5. To conduct both beta and alpha testing of the system.
6. To create a maintenance plan outlining procedures for ongoing support, updates, bug fixes, and performance monitoring after deployment.
7. To assess the system based on ISO 25010 standards

METHODOLOGY

Requirements → Design → Programming → Testing → Deploying → Maintenance

The researchers employed the modified waterfall model for the Software Development Life Cycle (SDLC) to develop the Barangay-Connect system, which aims to enhance community engagement in Barangay Santa Ines through an interactive website. This section highlights the SDLC techniques, analysis diagrams, and data collection tools used in the platform's development.

REQUIREMENTS GATHERING

The researchers initiated the project in **Barangay Sta. Ines** by identifying key requirements through interviews and extensive research. They gathered data on **population, transactions, and organizational structure,** while also analyzing literature and best practices. This approach ensured the project addressed community needs and aligned with client and end-user expectations.

DESIGN

The researchers designed and developed the application and admin panel using various tools, including a **Gantt chart, storyboard, use case diagram, ERD, and website mapping.** These diagrams guided UI design, system structure, data flow, and project tracking, ensuring efficient development and alignment with user needs and system requirements.

IMPLEMENTATION

The Barangay Portal was implemented based on the requirements gathered during the design phase. Developed using Visual Studio, with Firebase handling database management and security, and hosted on Netlify, the system ensured efficient development, reliable data storage, and smooth deployment. Key features include a Home Page, Barangay Profiles, Rules and Regulations, a Search Bar, and sections for requesting certificates like Barangay Clearance and Certificate of Residency. Login functionality for residents and admins enabled account and service management. SMS notifications and GCash QR code integration streamlined communication and payments. Overall, the portal improved access to services, enhanced transparency, and strengthened community engagement and governance.

TESTING

The Barangay-Connect system underwent extensive testing to ensure its effectiveness and quality. Testing included unit, system, alpha, and beta testing. Alpha testing was conducted by IT professionals to identify and resolve bugs, usability issues, and system flaws prior to release. Beta testing involved 50 selected residents and the Barangay Captain of Sta. Ines, who evaluated features such as certificate requests and administrative functions. The evaluation followed ISO 25010 standards, focusing on key quality attributes: functionality, compatibility, interaction capability, security, and flexibility. Questionnaire validity was ensured through expert review and pilot testing to guarantee accurate, unbiased, and reliable data collection and analysis.

DEVELOPMENT OF SYSTEM

After completing the testing phase, the system was deployed by configuring the production environment and ensuring smooth integration. The launch of the Barangay Records Management Web System was finalized without disrupting operations. Researchers prioritized user experience, making the portal fully accessible and functional for the local community of the designated barangay.

MAINTENANCE

After deployment, a support and maintenance system was implemented to ensure smooth operation, security, and stability. Technicians handled troubleshooting, updates, and performance monitoring. Regular maintenance, data backups, and alerts were in place to prevent issues. User feedback guided improvements, while training and support services helped residents adapt to system updates.

01 RESULTS

The study identified the existing issues faced by residents in accessing barangay services and gathered feedback from residents and officials. This led to the development of Barangay-Connect, a web-based platform featuring account management, service information, and communication tools. The system is designed to improve communication, streamline administrative processes, and increase accessibility to services. Initial feedback was positive, showing high satisfaction and usability among users.

02 CONCLUSION

Barangay-Connect is a web-based platform designed to enhance communication and service delivery between residents and barangay officials in Barangay Santa Ines. Developed with direct input from users and administrators, the platform features account management, service information, and communication tools tailored to meet the specific needs of the community. It improves communication through timely updates and notifications, streamlines administrative processes to reduce officials' workload, and increases accessibility by providing 24/7 access to services. The user-centered design has resulted in high satisfaction and usability, encouraging more active community participation. Positive feedback highlights the platform's potential for future enhancements, such as community forums and feedback systems, which can further strengthen community engagement and foster a better-informed, connected barangay.

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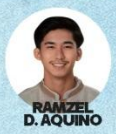
AUTHORS:


SHERWIN M. LAYUG


JULIUS A-RON M. CAPARAS


JOSHUA M. LAYUG


RAMZEL D. AQUINO


DESSA LYN DE CASTRO

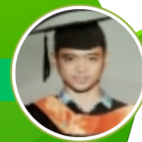
BINhi: Seed Engagement of Barangay Mamatitang through Reverse Vending Machine

PSITE
IRCITE

Authors





Choqho L. Borromeo
Charles P. Cabrera
Gyan Iverson G. Garcia
John Rondell P. Manaloto
Manuel Rafael D. Tolentino
Robhert M. Bamba

Abstract

The Barangay Mamatitang community is addressing its waste management and sustainable agriculture challenges with "BINhi," a reverse vending machine designed to reward users with plantable seeds for recycled materials. This innovative machine utilizes a user-friendly interface, likely incorporating sensors to identify and sort different types of recyclable materials. Once a recyclable item is deposited and verified, the machine dispenses a corresponding number of seeds, encouraging both recycling and planting activities. The development of BINhi followed the Systems Development Life Cycle (SDLC), resulting in positive testing outcomes demonstrating high user satisfaction. This initiative, in the context of growing global concerns about environmental sustainability and the Philippines' waste disposal challenges, integrates the use of a reverse vending machine with agroforestry projects to transform 55 hectares of land into a vibrant, eco-friendly community space. The seed reward system not only incentivizes recycling but also directly contributes to a greener environment, fostering environmentally conscious behavior among the 2,284 residents.

Objectives

General Objective:

To develop a microcontroller-based system titled "BINhi: Seed Engagement of Barangay Mamatitang Through Reverse Vending Machine," aimed at promoting environmental and agricultural sustainability by incentivizing recycling through a reverse vending machine that rewards users with seeds.

Specific Objectives:

- **To conduct a community survey in Barangay Mamatitang.**
- **To design the system using visual tools (block diagrams, flowcharts, etc.).**
- **To specify hardware/software requirements (Arduino, sensors, software).**
- **To develop a seed-dispensing reverse vending machine.**
- **To integrate sensors for efficient recyclable detection.**
- **To develop a user-friendly mobile application.**
- **To evaluate the system using ISO 25010 (functionality, interaction, flexibility).**

Methodology

This chapter outlines the materials and steps involved in constructing the reverse vending machine, and explains the researchers' data acquisition and analysis methods. It describes participant selection for product testing, data collection procedures, and the tools employed. Additionally, it discusses the research design, methodology, and study location. A schematic overview of the project is presented in Figure 1.

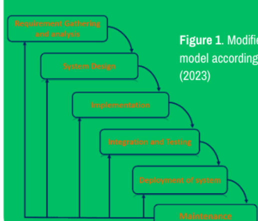


Figure 1. Modified Waterfall model according to Prashant (2023)

Requirement Gathering and Analysis

The researchers conducted thorough research using online sources and interviews to validate the requirements analysis. Brainstorming sessions using MS Teams generated initial features, components, and functionality, further refined through consultation with a technical advisor. Individual researchers contributed ideas and perspectives. On May 3, 2024, the researchers gathered information about Barangay Mamatitang through an appointment with a barangay official, and subsequently managed the beta testing surveys. Participants completed these surveys after using the reverse vending machine (approximately 30 minutes or less). Interviews with barangay officials provided data on population, land available for agriculture, and existing agricultural sustainability programs. The reverse vending machine system was developed using a laptop (Intel(R) Core(TM) i3-10110U CPU @ 2.59 GHz, 8 GB RAM, and the integrated system application utilized Blynk, Arduino IDE, and Canva.

System Design

The system design phase employed several tools to effectively illustrate system functionalities. A storyboard graphically depicted the system's workflow through a sequence of user interactions. A block diagram provided a simplified overview of system components and their interactions, while a flowchart detailed the step-by-step processes. A Gantt chart managed the project timeline, and a costing chart tracked the budget. The circuit diagram illustrated component connections, and a 3D model visualized the machine's physical layout. The functionality and technological aspects were addressed using the hardware and software tools.

Implementation

This stage transitioned theoretical concepts into a practical, community-centered reverse vending machine (RVM) system designed to support environmental and agricultural sustainability. Based on their diagrams and research design, the researchers developed a prototype, incorporating features suggested by technical and capstone advisors, and Barangay Mamatitang officials. Hardware components, including an Arduino Mega 2560 microcontroller, a 12V 5A power supply, and various sensors for material detection, were carefully selected and assembled. The researchers programmed the Arduino Mega using the user-friendly Arduino IDE and C++ language. Consultations with Barangay officials revealed enthusiastic support for the RVM, with suggestions for using collected materials in future barangay projects.

Integration and Testing

In this study, the researchers employed descriptive statistics to summarize the data, enabling them to determine the central tendency and distribution of the data points. Descriptive statistics provided insights into the overall characteristics of the dataset, illustrating how the data were positioned and how widely they were distributed.

Deployment of System

The reverse vending machine (RVM) was deployed in Barangay Mamatitang to assess its functionality and reliability in a real-world setting, leveraging the barangay's active environmental programs and supportive officials. After securing approval and preparing the site, the RVM was installed and rigorously tested, with adjustments made to ensure accessibility for all users. An orientation session familiarized residents with the machine's operation and benefits, encouraging regular use and providing a mechanism for collecting community feedback to ensure the system effectively met their needs. The barangay officials committed to monitoring usage.

Maintenance

The maintenance phase of the reverse vending machine (RVM) followed the testing stage, focusing on ensuring consistent operation, durability, and long-term effectiveness. This phase involved continuous checks to identify and correct technical issues that might arise post-installation. User feedback was generated through a reporting system accessible at the machine location and online, allowing users to report problems and share experiences, which was essential for identifying areas needing improvement. Regular hardware inspections, routine cleaning, and software updates were conducted to maintain optimal performance, while the maintenance team carried out on-site evaluations to address issues not identified during earlier tests. Analyzing data trends in system usage helped predict potential problems and prevent disruptions. User feedback guided continual refinements, enhancing material sorting accuracy and user interface intuitiveness. Maintaining the RVM's reliability was crucial for promoting sustainability, as promptly addressing issues ensured its effectiveness in waste management and community involvement. Blynk played a significant role in the RVM system, driving the mobile application that integrated physical components with mobile devices. Utilizing a NodeMCU8266 module for Wi-Fi connectivity, the application enabled remote monitoring and control of the RVM, providing real-time updates on operations. It allowed administrators to track the status of bins, receive alerts when they were nearly full, and monitor the remaining seeds that could be earned. The application could identify materials being recycled and included a feature to lock the machine for maintenance without triggering alarms. Blynk's dashboard architecture facilitated easy customization of the user interface, enabling users to receive time-sensitive maintenance alerts and monitor the system remotely. This integration significantly enhanced the accessibility, participation, and efficiency of the RVM, contributing to a more impactful waste management solution.

Result and Discussion

Result

This section presented the excellent results of the reverse vending machine (RVM) during alpha testing, achieving an aggregate score of 4.44 across all criteria. Functional Completeness scored 4.62, and Functional Correctness achieved 4.52, confirming the machine's effectiveness in tasks like material segregation and seed dispensing. The scores for Functional Appropriateness and Learnability were both 4.22, indicating ease of use for all ages. Although Operability received the lowest score of 4.11, it still reflected strong performance. User Interface Engagement was high at 4.67, and Adaptability scored the highest at 4.75. The overall performance in alpha testing was successful, with subsequent beta testing yielding a mean score of 4.46, demonstrating consistent reliability across both testing phases.

Discussion

The BINhi evaluated through alpha and beta testing, demonstrated success in engaging Barangay Mamatitang residents in waste management and recycling, particularly among youth. The user-friendly interface facilitated convenient recycling, though minor maintenance and technical issues were noted. The project strongly aligns with several Sustainable Development Goals, promoting environmental awareness, skills development, and sustainable practices through innovative community-based technology. While the RVM effectively handled plastic bottles and cans, limitations in detecting other materials and features like size measurement were identified. Despite these, BINhi significantly raised environmental awareness and showcased strong potential for future expansion to other communities, enhancing sustainability efforts and positively impacting both the environment and the community through upgrades and improved features.

Aknowledgement

The successful completion of this study was due to the invaluable support and guidance provided by numerous individuals and organizations. We extend our deepest gratitude to Engr. Robhert M. Bamba, MEECE, whose expertise in IoT, debugging, and system improvement were instrumental to the project's success. Mabalacat City College is also acknowledged for providing essential facilities and resources. We thank our panelists, Frederic D. Santos, MIT; Lovely Ruth Valdez-Santos; and Ritchell Z. Escoto, MIT, for their valuable feedback. Finally, the collaboration and contributions of the citizens and officials of Barangay Mamatitang, crucial for prototype development, testing, and data collection, are sincerely appreciated. Our gratitude extends to all others who contributed to this research.

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CYCLOTRACE:

MICROCONTROLLER-BASED SMART VEST WARNING SYSTEM WITH USER INTERFACE AND CYCLIST EMERGENCY LOCATOR

CYCLOTRACE
Light the Way, Track Your Journey

PSITE
IRCITE

AUTHORS

Charles M. Aguilar
Stephen S. David
Keant A. Fernandez
Mark Ian L. Salalac
Wency S. Suing
Robhert M. Bamba

ABSTRACT

The CycloTrace project focuses on improving cyclist safety through a microcontroller-based smart vest with integrated GPS tracking, LED signaling, and emergency communication features. Using the Systems Development Life Cycle (SDLC), the project developed a wearable system that enhances visibility, connectivity, and safety. Alpha and beta testing yielded excellent results, with high scores in usability, performance, and reliability. Challenges like hardware communication issues were addressed through iterative development. The CycloTrace vest showcases the potential of wearable technology to enhance personal safety, aligning with modern safety practices and sustainable development goals.

GENERAL OBJECTIVE:

The goal of the study "The Cyclotrace: Microcontroller-based smart vest warning system with user interface and Cyclist emergency locator" is to increase cyclist safety through a smart vest that integrates elements such as GPS tracking and LED signaling, as well as dedicated mobile software to enable ease of use during emergency communication and real time control.

SPECIFIC OBJECTIVE:

- *To gather information from users about how well the smart vest works;*
- *To Identify which module will be used for the IoT microcontroller based;*
- *To design a simple and easy-to-use mobile app for controlling the smart vest, especially for turning on the LED lights and sending emergency alerts;*
- *To create sure all parts of the smart vest (GPS, lights, sensors, and mobile app) work together perfectly;*
- *To construct the microcontroller model to be used for the smart vest;*
- *To integrate the cyclotrace project ESP8266 D1 Mini with modules such as GSM and GPS, so as to implement LED signaling, location of the user and reliable communication; and*
- *To test if the smart vest still works even when something goes wrong, like a software problem or weak GPS signal.*

METHODOLOGY

The CycloTrace vest was developed using the SDLC methodology, ensuring a systematic approach to design, implementation, testing, and maintenance.

Figure 1: Flowchart of the System Development

REQUIREMENTS GATHERING

Data from cyclists and stakeholders was collected through surveys and interviews to identify the most pressing safety concerns and define system requirements. The researchers focused on features that would directly impact cyclist safety, such as improved visibility and emergency response mechanisms.

DESIGN PHASE

The system was designed with modules for GPS tracking, LED signaling, and emergency alerts. Researchers used tools like flowcharts and system architecture diagrams to visualize how the various components would interact. This phase ensured that the hardware and software components were compatible and met the outlined requirements.

IMPLEMENTATION

Key components, including the ESP8266 D1 Mini, GSM module, and GPS module, were integrated during this phase. The researchers programmed the vest's functions using Arduino IDE. A mobile application developed with MIT App Inventor provided an intuitive interface for controlling the vest's features. This phase also included prototype assembly and initial hardware testing to confirm functionality.

TESTING

Alpha tests were conducted by IT experts to evaluate the vest's functionality, including GPS tracking, LED signaling, and GSM communication. Beta tests involved 50 cyclists who assessed the vest's usability and reliability under real-world conditions. Testing was guided by ISO/IEC 25010 standards to ensure thorough evaluation of system performance and user satisfaction.

MAINTENANCE

Post-deployment, the vest was monitored for bugs and areas for improvement. User feedback was collected to inform updates and ensure the system remained functional and user-friendly over time.

SAMPLING METHOD

Convenience sampling was employed to recruit participants for surveys and testing. Local cyclists were chosen for their accessibility and relevance to the research objectives.

RESULTS AND DISCUSSION

The researchers gathered information for the requirement analysis step by consultations and online research. The researchers guaranteed the correctness and reliability of the data. The researchers carefully designed, discussed, and conducted research in online to gather ideas for the capstone project. To keep up with the project's progress, the researchers talked with the technical and capstone advisers during the development of the system and documentation. To make sure the study worked efficiently, researchers gave certain tasks, set plans, and shared ideas. As a result, they organized and cooperative approach was important to the research and project development process.

CONCLUSIONS

The CycloTrace smart vest represents a significant advancement in wearable technology for cyclist safety. By integrating GPS tracking, LED signaling, and emergency communication into a single device, the system addresses critical safety concerns while offering a user-friendly experience. The project demonstrates the potential of IoT-driven solutions in enhancing personal safety and contributing to sustainable development goals. Future iterations of the CycloTrace vest will explore expanded functionality, such as advanced health monitoring and compatibility with smart traffic systems.

ACKNOWLEDGMENTS

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Dentally: A Patient Tracking Record for Tooth Impression Dental Clinic

Authors


Peñamante, Tizha Nicole A.


Villamin, Justin Allan Y.


Manaloto, John Dale P.


Africa, Wengmir A.


Magtoto, John Ivan A.


Santos, Lovely Ruth V.

Abstract

Good dental health is essential for overall well-being, impacting physical health, and disease prevention. It offers benefits across physical, psychological, social, and professional areas, enhancing quality of life. Modern oral care has greatly improved through the years and the increasing demand calls for more improved systems for managing appointments, inventory, patient records, and others. Many dental clinics still rely on pen and paper which can be inconvenient and can cause a lot of paperwork depending on the clinics demand, and can not be easily accessible to the patients for viewing. This study examines Tooth Impression Dental Clinic, which operates in three branches across Dau, Angel's, and Sindalan, and seeks to improve the clinic's ability to access patient records across locations. By improving the management of the dental clinic of Tooth Impressions Dental Clinic, This system is designed to enhance the overall quality of oral healthcare.

Objectives

General Objective:

The general objective of the study is to develop a system entitled "Dentally: A Patient Record Tracking System for Tooth Impression Dental Clinic" for Tooth Impressions Dental Clinic.

1. To gather information about the requirements for the record system of Tooth Impressions Dental Clinic through interview research with the owner and brainstorming.
2. To identify the specific hardware and software components used to develop the website.
3. To design the website using analysis, diagrams, and design tools throughout the development process.
4. To evaluate the system using ISO 25010's Software Product Quality Standards.
5. To deploy and implement the system to Tooth Impression Dental Clinic.

Methodology

This chapter explains the methodology and design used in order to come up with the parameters and procedures of the study. The Software Development Life Cycle (SDLC) analysis, diagrams and design tools throughout the development process researchers that would be used are going to be covered in this chapter.

FIGURE 1: Modified Waterfall Model

Figure 1: The software development life cycle method that the researchers would use to create the system is the modified waterfall model. The Modified Waterfall Model provides a structured progression of development stages, integrating adaptability, repetitive steps that provide sufficient documentation and design assessments to guarantee the quality, coherence and sustainability of the system the researchers would build.

Gathering Requirements

The researchers would work together to collect ideas on how to create an efficient management of dental clinic records systems. This procedure included group discussions and brainstorming.

Design

In this phase, the researchers used the following analysis tool and diagrams to design and develop the dental clinic record system: Storyboard, Visual Table of Contents, Use Case Diagram, and Gantt chart.

Implementation

The researchers developed Dentally's system using Visual Studio Code, focusing on a user-friendly and visually appealing interface. The Dashboard serves as the main hub with a side panel for navigation. Admins can manage users, schedules, procedures, inventory, appointments, sales reports, and audit logs, while dentists and staff handle appointments, patient records, and payments. Patients can view appointments, payments, and medical records. The system supports both walk-in and online bookings, allowing users to select a branch, dentist, schedule, and procedure. With role-based access, the system ensures efficient operations and secure management.

Testing

In this phase, the researchers conducted system testing to ensure the software met all specifications and was free of errors. The researchers used simple random sampling to select participants, as it ensures fairness, removes bias, is easy to use and relies on statistical methods to provide accurate information about the target population. The system underwent three types of testing: Developer Testing for developers, Alpha Testing for IT experts and Beta Testing for non-IT experts. For Alpha Testing, the researchers involved three IT experts to evaluate the system. For Beta Testing, thirty (30) end-users, including dentists, staff and patients from Tooth Impressions Dental Clinic, were selected to test the system's functionality. The evaluation followed ISO 25010 standards, focusing on functional suitability, compatibility, interaction capability, security, and flexibility.

Operation and Maintenance

This is the last phase of the Modified Waterfall Model, following the testing phase. In this phase, the software is delivered to the end users, and the project team ensures the software's continued operation and usability. This would be the path where the user may be able to report errors or any aspects of the system that need improvement for the rectification of the system that has been created. The researchers would do updates by monitoring the progress, errors, and the features and operations of the system. With this, the researchers developed a web-based system that the users could freely access and utilize at the domain repository website address of Tooth Impressions Dental Clinic online.

Results and Outcomes

This section presents a thorough summary of the research findings that are in line with the specified study objectives. The following conclusions have been achieved by data analysis, thorough testing of the developed system, and careful interpretation of beta testing results. The researchers have carefully computed all the results and outcomes. Following the completion of the gathering and analyzing data stages, the researchers prepared a thorough written report. This report is designed to present the research outcomes in a clear, organized, and understandable manner.

Data and Requirements Gathering

The researchers have gathered data through internet library research, internet research journals and collaborations. With this, it gives the researchers a deeper understanding and enough knowledge, information, and ideas that would greatly help in the development of the website application. The researchers conducted virtual meetings to have collaboration sessions online and brainstormed together to gather even more informative insights and ideas. The project leader would assign a number of tasks to the team members during the virtual meeting, library meetings, and library research.

Test Results

The comparison of alpha and beta test results shows significant system improvements. Functional suitability increased from 4.29 to 4.56, reflecting enhanced features and bug fixes. Compatibility improved from 3.92 to 4.09, suggesting better integration. Interaction capability remained strong, rising from 4.26 to 4.42. Security scored consistently high, improving from 4.33 to 4.44, indicating effective protection measures. Flexibility remained stable, increasing from 4.16 to 4.22. Overall, the results confirm a well-designed, thoroughly tested system with enhancements in performance, reliability, and adaptability.

Conclusion

The study aimed to develop a website for Tooth Impressions Dental Clinic to manage appointments, patient records, dentist schedules, inventory, and sales reports. Researchers gathered data through research, interviews, and surveys, using tools like storyboards and use case diagrams to streamline development.

The system was successfully implemented with roles for admin, staff, dentists, and clients, featuring dentist and staff management, appointment scheduling, inventory tracking, sales reports, and patient record management. It underwent developer, alpha, and beta testing based on ISO 25010 standards, showing strong performance with scores improving from 4.19 in alpha to 4.34 in beta. The system is hosted on a virtual private server using Laravel Forge.

Despite its success, limitations included lack of integration into the clinic's existing workflow and no dedicated mobile app, though it works on mobile web browsers. Overall, the system reduces costs, improves patient care, streamlines operations, and enhances communication, contributing to sustainability and future research.

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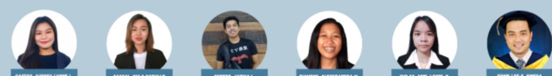
EPASADYA: AN E-COMMERCE SYSTEM WITH PRODUCT CUSTOMIZATION FOR GAWANG GAMAT

E-PASADYA
Where Every Piece Tells Your Story

AUTHORS:



CASTRO, AUDREY LYNNE L. · SAGCAL, KYLA KARYLLE · CORTEZ, JAIRHA L. · TIANZON, ALECKZANDRA M. · GULAS, ARIEL LOISEL R. · ERNIE LEE E. PINEDA

PSITE
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ABSTRACT

Digital commerce has significantly reshaped the global business landscape, requiring traditional enterprises to adapt to evolving consumerdemands and increasing competition. This study presents ePasadya, an e-commerce system designed for Gawang Gamat, a shop integrating traditional handicrafts with electronic retailing.The platform enhances operational efficiency by enabling product customization, improving customer satisfaction, and fostering stronger connections betweenartisans and consumers. It bridgesthe gap between handmade goods and digital markets, demonstrating the feasibility of integrating traditional businesses into e- commerce. The development of ePasadya used the Waterfall Model, following a structured system development lifecycle. Back-end technologies, such as PHP and MySQL, ensured robust database management and server-side functionality, while front-end tools, including HTML, JavaScript, and Tailwind CSS, provided a seamless and intuitive user experience. Clearlydefined roles for administrators, sellers,and customers ensured efficient order management and secure transactions. Testing outcomes highlighted commendable system performance, with satisfaction scores of 4.30 in alphatesting and 4.64 in beta testing. These results reflected notable advancements in functional suitability, usability, and security. By aligning with Sustainable Development Goals, ePasadya fosters economic growth, cultural preservation, and digital innovation within Mabalacat City, serving as a transformative model for empowering artisans and advancing traditional businesses in the digital era.

GENERAL OBJECTTIVE

The study aims to develop "ePasadya: An E-commerce System with Product Customization for Gawang Gamat," enhancing customer experience and streamlining operations for the owner.

SPECIFIC OBJECTTIVES

1. To gather information on optimizing online presence and customer satisfaction through research and interviews.
2. To identify and specify the required hardware (laptop) and software (Canva, Figma, VS Code, XAMPP, Composer).
3. To design the system using Storyboard, Use Case Diagram, and Gantt Chart for proper planning.
4. To develop the front-end and back-end using JavaScript, Tailwind CSS, and HTML for the front end, and PHP and MySQL for the back end, ensuring seamless functionality.
5. To create system features and functionalities for Admin, Seller, Buyer, and Guest users based on their roles.
6. To test the system through Alpha and Beta testing for functionality, compatibility, and usability.
7. To evaluate the system's performance based on ISO 25010 criteria, including functionality, security, and flexibility.
8. To deploy the website using Hostinger as the web domain repository.

METHODOLOGY

The study used the Modified Waterfall Model, allowing iterative refinements for adaptability. It began with requirement gathering through interviews, research, and stakeholder feedback, ensuring the system addressed various e-commerce scenarios (see Figure 1).

Figure 1: The Modified WaterfallModel

The ModifiedWaterfall Model provideda structured yet iterative framework, enabling the development of ePasadya as a reliable and effective e-commerce platform that is tailored to meet the needs of online shoppers and business administrators alike.

REQUIREMENTS

The requirements gathering phase identified key hardware (desktop, tablet, mobile) for multi-platform testing. Software included Laravel 11 (server-side), Tailwind CSS v3 (UI), MySQL 9 (database), PHP 8 (backend), and Node.js 20 (dependencies). Development used VS Code (IDE) with Git for version control. Canva (mockups) and Figma (wireframing, prototyping) enhanced the design process, ensuring an efficient and collaborative development environment for ePasadya.

DESIGN

The ePasadya system integrates inputs, processes, and outputs to create a user-friendly e-commerce platform. Inputs include product management, order tracking, payments, and customer preferences for seamless navigation and checkout. Processes cover system analysis, design, and development, ensuring features like centralized product listings, an intuitive cart, secure payments, and an admin dashboard. A key feature is product customization, allowing users to personalize items (engraving, colors, sizes).
The system architecture includes a secure database for users, products, orders, and payments. Its responsive UI ensures smooth use on desktop and mobile. The admin panel simplifies product and order management, including customization options.
By integrating these features, ePasadya modernizes retail into a strong e-commerce platform, enhancing user experience and business efficiency.

Figure 2: Modified Visual Table of Contents Diagram

DEVELOPMENT

The ePasadya system development used analysis tools and diagrams for a user-focused design. Storyboards outlined interactions for Users (browsing, cart, checkout), Admins (managing products, orders, users), Sellers (inventory, listings, orders), and Guests (browsing, pricing, registration). These visuals ensured intuitive navigation for all roles.
The Home Page (see Figure 3) served as a central hub, providing seamless access to products, cart, and account settings, while admins had robust tools for system management.
Development used VS Code, Tailwind CSS v3 (styling), Laravel 11, and MySQL (secure backend). Iterative testing refined features for optimal performance. The final system seamlessly integrated business tools and user functionalities, ensuring an efficient and secure e-commerce experience.

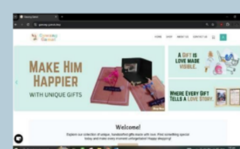

Figure 3: Home Page

RESULTS

The website platform interface was evaluated during alpha testing using ISO 25010 software quality standards, focusing on Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility. Conducted with three IT experts on September 27, 2024, the test yielded an overall mean score of 4.30, rated "Excellent." Functional Suitability scored highest at 4.40, followed by Security at 4.33, Flexibility at 4.30, and Compatibility at 4.21.
Based on feedback, improvements were made before beta testing, which involved thirty (30) consumers and assessed the same ISO 25010 criteria. The beta test showed marked improvement, with an overall mean score of 4.64. Functional Suitability rose to 4.73, Usability to 4.70, and Security to 4.55, confirming enhanced functionality, user-friendliness, and security.
In conclusion, beta testing confirmed significant advancements, demonstrating the system's readiness for deployment with excellent performance across key quality metrics.

DISCUSSION

The development of ePasadya, a customizable e-commerce platform, aimed to deliver a seamless and personalized shopping experience. It addressed common issues in existing platforms—such as limited customization and inefficient interfaces—by focusing on user-centered design. Feedback from consumers in Mabalacat City, including the store owner, informed the platform's features and functionality.
ePasadya was found to be secure, interactive, and user-friendly. Key features like secure payment gateways, easy product customization, and personalized recommendations contributed to high user satisfaction. The intuitive interface supports both customers and administrators, streamlining shopping, inventory management, and content updates. Engagement was further enhanced by personalized offers and product suggestions.
To improve further, ePasadya could integrate advanced filtering, AR previews, and AI-driven shopping assistants. Additional security features like biometric or two-factor authentication would enhance protection. Implementing analytics, social media sharing, and customer reviews could boost marketing efforts, build community, and increase trust.
By adopting these enhancements, ePasadya can evolve into a more robust, secure, and engaging platform that adapts to user needs and delivers a superior shopping experience.

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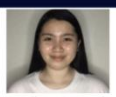
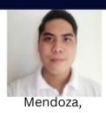
HAPPYTEETH: A WEB-BASED APPOINTMENT SYSTEM FOR OCAMPO DENTAL CLINIC

Authors


Diaz, Adrian


Maglalang, Nikki Mae P.


Aguilar, Casandra Khristyn T.


Mendoza, Prince


Patawaran, Joash Flauta

ABSTRACT

HappyTeeth is a web-based dental appointment system developed for Ocampo Dental Clinic in Mabalacat City, Pampanga. The platform allows patients to schedule appointments, make secure payments through e-wallet, and access dental history records. It aims to reduce overbooking, streamline clinic operations, and improve patient satisfaction through an accessible and transparent digital platform. Developed using the Modified Waterfall Model of SDLC and evaluated with ISO 25010 standards, the system scored 4.06 in alpha testing and 4.18 in beta testing. It aligns with SDG Goals 3, 9, 10, and 16—promoting well-being, innovation, inclusivity, and institutional transparency.

OBJECTIVES

General Objective:

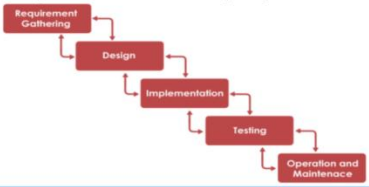
To develop an efficient web-based appointment system with integrated payment and dental record features for Ocampo Dental Clinic.

Specific Objectives:

- Gather data on clinic operations and services.
- Identify required hardware and software.
- Design the system using storyboard, sitemap, and use case diagrams.
- Develop frontend and backend with Admin and Client access.
- Integrate features: appointment booking, e-wallet payments, dental records, chat
- notifications.
- Conduct alpha and beta testing.
- Evaluate using ISO 25010 standards.
- Deploy the system via Hostinger.

METHODOLOGY

HappyTeeth was developed using the Modified Waterfall Model, ensuring a structured and iterative development process.



GATHERING REQUIREMENTS

Information was collected through interviews with the clinic owner, staff, and patients. Technical consultations were held to determine the ideal hardware (Intel i5 processor, 8GB RAM, 500GB SSD) and software (HTML, CSS, TypeScript, C#, Visual Studio Code, Sketchbook, Canva, MSSQL) requirements. User feedback shaped the system's layout, ensuring accessibility via desktop and mobile.

SYSTEM DESIGN

Happy Teeth was designed using Use Case Diagrams, a Website Map, and a Storyboard to ensure a user-friendly and organized flow. The system features secure login, role-based access, and intuitive navigation for both admins and patients. Mobile responsiveness and data privacy were key priorities.

DEVELOPMENT

The system was coded using HTML, CSS, TypeScript, and C# within Visual Studio Code and JetBrains Rider. GitHub hosted the project during development. The system integrates features such as registration with email confirmation, a secure admin dashboard, patient dental records, and a dynamic sales report system.

TESTING

The system underwent two phases of testing. Alpha testing was conducted with three IT professionals and resulted in a mean score of 4.06. Beta testing followed, involving three staff members and thirty patients from Ocampo Dental Clinic, with a mean score of 4.18. The evaluations were based on ISO 25010 software quality standards, covering criteria such as functional suitability, compatibility, usability, security, and portability. Overall, the system was rated from "Good" to "Excellent" across all categories.

DEPLOYMENT

The system was hosted on Hostinger, with a custom domain and integrated security. The Admin Panel is password-protected, and sensitive financial data is viewable only by the clinic owner. Dental history, real-time notifications, appointment logs, and payment receipts are stored securely and accessibly.

MAINTENANCE

After deployment, regular maintenance was implemented to ensure system reliability, security, and performance. The team monitors for bugs and applies updates to improve functionality. Clinic staff were trained to report issues for quick resolution. Regular data backups and security patches help protect patient information. User feedback is reviewed to guide future improvements and ensure the system continues to meet the clinic's needs.

RESULTS & OUTCOMES

DATA AND GATHERING REQUIREMENTS

Information was gathered through interviews with the clinic owner and staff, along with surveys from patients. This helped identify the clinic's challenges in appointment handling, patient records, and communication. Technical requirements such as hardware specs (Intel i5, 8GB RAM, 500GB SSD) and necessary software tools (HTML, CSS, C#, TypeScript, MSSQL) were also defined. These insights guided the system's design and ensured it met both user needs and technical standards.

TEST RESULTS

The Happy Teeth system was evaluated using ISO 25010 standards, which assess functional suitability, compatibility, usability, security, and portability. During alpha testing, three IT experts reviewed the system and gave it an overall mean score of 4.06, which was rated as Good. In beta testing, conducted with three staff members and thirty patients from Ocampo Dental Clinic, the system received a higher overall mean score of 4.18, classified as Excellent. These results indicate that the system meets quality standards and performs effectively for both technical users and actual end-users.

CONCLUSION

The HappyTeeth system successfully addressed the scheduling, payment, and recordkeeping challenges of Ocampo Dental Clinic. It provided a user-friendly and efficient platform for both patients and staff, improving overall service delivery. Based on testing results and user feedback, the system met quality standards and delivered reliable performance. With features like e-wallet payment, dental history access, and appointment tracking, HappyTeeth modernizes clinic operations and supports the goal of accessible and innovative dental care.

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HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun


JUSTIN SANTOS


JULLIEN EDUARTE


VINCE DAVID


MARTIN BAUTISTA


JOSHUA BAUTISTA

ABSTRACT

In today's ditigal age, technology plays a transformative role in the management of homeowner associations (HOA s). The integration of innovative tools, such as self-managed HOA software, automates many labor-intensive tasks, making operations more efficient while reducing human error. The general objective of the study was to develop a system entitled "HOA-Unity": Empowering Web-Based Community Management for Fiesta Tabun". The researchers chose the Modified Waterfall Model as the Software Development Life Cycle (SDLC) approach for the development of the HOA-Unity system, integrating feedback loops and evaluations at each phase to promote continuous improvement. As a result, three (3) IT experts evaluated the HOA-Unity system during alpha testing. Functional Suitability, Compatibility, Interaction Capability, Security and Flexibility were among the criteria that were evaluated during live demonstrations, and survey questions are based on ISO-25010 standards. The highest among crieria were Interaction Capability, garnered a weighted mean score of 4.83 with a verbal interpretation of "Excellent" Also, the beta tester involving thirty (30) residents of Mabalacat Fiesta Tabun. The highest among criteria were Functional Sustability, garnered a weighted mean score of 4.41 with a verbal interpretation of "Excellent", In conclusion, the evaluations show that the system excels in Functional Suitability, Compatibility, Interaction Capability, Security, and Flexibility, effectively meeting its requirements ensuring seamless plaltform integration, offering an intuitive user experience, protecting user data, and being adaptable and portable.

OBJECTIVES

GENERAL OBJECTIVES

The general objective of the study was to develop a system entitled "HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun, Specifically, the study aims to:

1. To gather relevant information
2. To identify the required specifications for hardware and software used for development and testing of the web-based community management
3. To design the software using the following diagrams and analysis tools
4. To create and develop a system that has the following specific features.

METHODOLOGY

REQUIREMENTS GATHERING

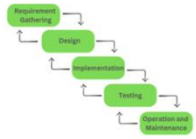
the researchers collaborated to develop a web-based community management system gathering ideas and data especially through interviews in Fiesta Mabalacat Community to enchance its functionality and innovation.

DESIGN

The researcher used tools like storyboard, diagrams, and visual contents to design and analyze the HOA-Unity system, ensuring a clear understanding of its structure, functions and user experience.

IMPLEMENTATION

The researcher used Visual Studio Code to develop the HOA-Unity system, focusing on a user-friendly design for both residents and admins, Residents can manage profiles, reports, payments and requests, while admins handle user accounts and system reports effectively.



RESULT

The researchers conducted alpha and beta testing of HOA-Unity using ISO-25010 standards. Three IT experts assessed the system during alpha testing, giving it an overall score of 4.42 ("Excellent"), In beta testing, 30 residents from Fiesta Commu nities Mabalacat participated, providing critical user-centered feedback. Their insights helped validate the system's usability, reali bility, and relevance in a real world commu nity setting. The comprehensive feedback gathered from both experts and user evaluations highlighted the effectiveness of HOA-Unity in addressing community management needs and improving user engagements.

CONCLUSIONS

The Hoa-Unity system was developed through user research and collaboration with the fiesta communities mabalacat it streamlines community management by offering role-based features for residents and officials, improving comm unication, efficiency, and financial trans parency. Despite some challenges in use r training and adaptability, the system meets the goals. The team expresses deep gratitude to their advisor, faculty families, and supporters for their vital contributions and encouragement throughout the project.

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KAPEPONGTSA

A WEB-BASED ORDERING AND INVENTORY MANAGEMENT SYSTEM FOR YOBS CAFE

Authors


Romero, Jaimee


Gueco, Junel


Gomez, Angelo


Waje, Allen


Delara, Ronald Kris


Escoto, Ritchell


Tacadena, Dennis

Abstract

The rapid advancement of technology has transformed industries, including food and beverage, where digital solutions improve efficiency and customer satisfaction. This study developed **"Kapepongtsa: A Web-Based Ordering and Inventory Management System for YOBS Cafe"** using the Modified Waterfall Model, allowing continuous feedback during development. Alpha and Beta testing, based on ISO 25010 standards, assessed the system's functionality, compatibility, interaction, security, and flexibility. Alpha testing, conducted by three IT experts, scored 4.53 ("Excellent"), and Beta testing with thirty YOBS Cafe users scored 4.46 ("Excellent"). The results confirm the system meets its goals, offers a user-friendly, secure interface, and performs well across platforms. Kapepongtsa enhances operational efficiency and supports sustainable practices at YOBS Cafe.

Keywords: Web-based System, Ordering, Inventory Management, Modified Waterfall, ISO 25010.

Objectives

The study aimed to develop "Kapepongtsa: A Web-Based Ordering and Inventory Management System for YOBS Cafe" with the following objectives:

1. Gather information from articles, journals, related studies, and interviews.
2. Identify hardware and software requirements for the system.
3. Design the system using diagrams and analysis tools.
4. Develop features like Order Management, Sales and Payment Management, Promotions Management, and Inventory Management.
5. Integrate user levels for Customer, Admin, and Staff.
6. Test the system through Alpha and Beta testing.
7. Evaluate the system's performance based on ISO 25010 standards (Functional Suitability, Compatibility, Interaction, Security, Flexibility).
8. Deploy the system on a locally hosted server.

Methodology

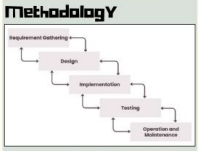

Figure 1. The Modified Waterfall Model

The researchers chose the Modified Waterfall Model for the system's development. This approach combined iterative phases with a structured flow, ensuring thorough documentation and design reviews at each stage for a high-quality, consistent, and manageable system.

Requirements Gathering

The first phase of the modified waterfall model involved requirement gathering, where the researchers brainstormed ideas and interviewed YOBS Cafe staff to understand their operations and improve the web-based ordering and inventory system.

The system was developed on a desktop with an AMD Ryzen 3 5300U processor, 12GB RAM, a 256GB SSD, and Windows 11.

For development, the researchers used several tools: Canva and Figma for diagrams, Visual Studio Code for coding, Microsoft SQL Server 2022 for database management, and Git/GitHub for version control and collaboration.

Design

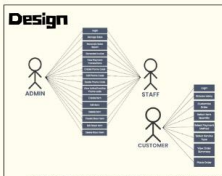

Figure 2. Use Case Diagram of Kapepongtsa

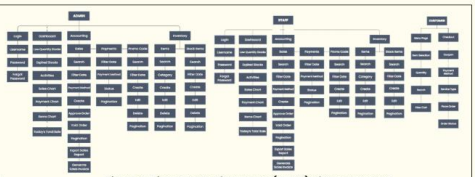

Figure 3. Visual Table of Contents (VTOC) of Kapepongtsa

During the design phase, the researchers used various tools to plan and develop the system. They created a Storyboard to map the user journey and identify areas for improvement. The Use Case Diagram showed how different users (Admin, Staff, Customer) interact with the system, defining its main functions. The Visual Table of Contents helped plan the app's navigation, while the Data Flow Diagram tracked how data moves through the system, connecting processes and data storage.

Development

In the implementation phase, the researchers developed both the front-end and back-end of the system using Visual Studio Code. For the front end, they used Angular 18, HTML, TypeScript, and Tailwind CSS to create a responsive and modern user interface. The npm package manager helped manage dependencies. For the back end, they used ASP.NET Core with C# to handle server-side logic and database interactions, with SQL Server managing the database for inventory, orders, and customer information. Kapepongtsa was built to serve three user levels: Admin, Staff, and Customer. Admin users have secure login access and can manage sales, view and update orders, generate reports, manage payments, promo codes, and inventory. Staff have similar features but cannot delete records, ensuring data integrity. The customer interface allows easy browsing of the menu, placing orders, applying promo codes, choosing payment methods, and tracking order status.

Discussion

This research successfully developed Kapepongtsa, a web-based ordering and inventory management system for YOBS Cafe. The system was designed by analyzing the cafe's needs and creating a user-friendly solution for customers, staff, and management. The development was based on both primary data (interviews, observations, and assessments of the cafe's processes) and secondary data (research articles, expert consultations, and industry resources). To ensure the system met industry standards, the researchers used a detailed questionnaire based on ISO 25010, evaluating key aspects like functionality, compatibility, security, and flexibility. The development process included visual aids such as storyboards, use case diagrams, a visual table of contents (VTOC), and a data flow diagram (DFD) to organize the system's design. A Gantt Chart was used to track the project's timeline. The system was built using a desktop with an AMD Ryzen processor, 12GB RAM, and 256GB SSD. Key software tools included Visual Studio Code for coding, Microsoft SQL Server for data management, and Git/GitHub for version control. Testing was conducted in two phases. In alpha testing, three IT experts reviewed the system, providing valuable feedback. The system received high ratings in compatibility, interaction, and flexibility, with a "Good" rating in functional suitability. In beta testing, 30 YOBS Cafe users tested the system in real-world conditions, achieving excellent ratings in all categories, confirming the system's effectiveness and readiness for deployment. Kapepongtsa successfully met its goals, improving operational efficiency and customer satisfaction at YOBS Cafe.

Acknowledgement

We would like to thank everyone who contributed to this study. First, we are grateful to Almighty God for His guidance throughout our journey.

Our sincere thanks go to our Capstone Instructor, Mr. Dennis L. Tacadena, for his support and expert guidance, and to Ms. Ritchell Z. Escoto, our Technical Adviser, for her valuable feedback that improved our work.

We also appreciate Madam Myrna E. Cuento-Calma, the IBCE Dean, and the faculty for creating a great learning environment.

Lastly, we deeply thank our parents for their love and encouragement, and our families, friends, and everyone who supported us along the way.

Result

The YOBS Cafe system improves manual processes with key features like digital ordering, real-time tracking, payment management, promotions handling, and inventory optimization, boosting efficiency and customer satisfaction.

Alpha testing by three IT experts rated the system "Excellent" with a mean score of 4.53. Compatibility, interaction, and flexibility scored the highest at 4.67, while functional suitability scored 4.15, indicating room for improvement.

Beta testing with thirty YOBS Cafe users resulted in an overall "Excellent" rating of 4.46. Interaction capability was the highest-rated feature (4.70), praised for clarity and accessibility. Flexibility scored 4.21, highlighting challenges in scalability during peak order times.

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MABALACAT DORM:

A Web application for enhanced tenant monitoring and Management

AUTHORS

CALIUAG, ABEGAIL M.
CALMA, JUNELL S.
CORDOVA, ARLYN R.
DELOS REYES, DENZEL
GOPEZ, GILBERT G.

ABSTRACT

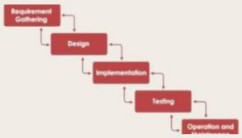
The research presents Mabalacat Dorm, a web application designed to streamline tenant monitoring and management processes. It addresses challenges like record management, payment tracking, inquiries and communication logistics. The application offers registration, real-time updates, and data analytics for better decision-making. Testing and implementation show Mabalacat Dorm enhances operational efficiency, reduces errors, and improves tenant satisfaction, making it a valuable contribution to the owner and tenant. Mabalacat dorm was developed using the Waterfall Model, which adheres to a systematic system development life cycle. While front-end tools like HTML, JavaScript, and Tailwind CSS offer a smooth and user-friendly interface, back-end technologies like PHP and MySQL guarantee reliable database administration and server-side functionality. Secure transactions and effective order administration are ensured by clearly defined responsibilities for administrators, guest users, and users.

GENERAL OBJECTIVES

The main goal of this research project was to create a web application that helps manage and keep track of tenants in the Mabalacat Dormitory. The system made it easier to handle tasks like tenant registration, room assignments, payment tracking, and maintenance requests. By combining an easy-to-use interface with effective backend processes, the system gave administrators quick access to tenant information, helped with communication, and improved dormitory management.

METHODOLOGY

As the System Development Life Cycle approach and was applied in this study. The Modified Waterfall method provides an orderly flow of development processes with repetitive phases that provide sufficient documentation and design assessments to guarantee the quality, consistency, and maintainability of the system.



SPECIFIC OBJECTIVES

- To gather data from the system
- To design the system with the following tools
- To develop the web-app with the following feature
- To primarily develop the front-end and back-end of the system interface using the following frameworks, technologies and programming languages
- To assess the simulation software in terms of function sustainability, performance efficiency, compatibility, usability, credibility, security maintainability, and ease of using the ISO 25010 Software Product Quality Standards.
- To deploy and implement the application to the following web domain and application respiratory site

REQUIREMENTS GATHERING

Important hardware and software tools were needed to build the Mabalacat Dorm website system. A laptop was used for the former, and Canva were used for the latter in order to work on the storyboard and Visual Studio Code. The team was able to work on the storyboard as a result. It made it easier to see and map out the website's features in terms of their various functionalities in a structured manner.

SYSTEM DESIGN

the system was created by the researchers utilizing several visualizations and analytical tools. These included the Storyboard, Visual Table of Contents, Use Case Diagram, Entity Relationship Diagram, and Gantt Chart. The Use Case Diagram showed what the system can do, how it can be accessed, and how it connects with its users. This helps to explain the different ways users can interact with the system and to clarify what the system needs to do.

IMPLEMENTATION

The Mabalacat Dorm website system's design plans are transformed into functional software during the implementation phase. As shown in design papers, developers integrate different system components when writing and testing the code. Targeting front-end developers to carefully choose color schemes, icons, fonts, and images that accurately represent the Mabalacat Dorm brand with new inventiveness while maintaining an aesthetically pleasing and user-friendly design

INTEFRATION AND TESTING

The system underwent alpha testing, utilizing ISO25010 as a guideline for its development. A comprehensive questionnaire was designed based on ISO25010 to assess various attributes, including functional suitability, compatibility, interaction capability, security and flexibility. IT experts, with experience in the relevant field, answered the questionnaire to ensure that the system adheres to established industry standards and best practices.

OPERATION AND MAINTENANCE

Following the verification phase, Hostinger was used to host the web domain. This stage involves regular updates, bug fixes, and improvements to the website's features and functionality as well as its content. As room availability and pricing information were updated and the overall user experience was streamlined for both apartment owners and tenants, this team brought technological troubles to a complete halt. To find areas for improvement, address security vulnerabilities, and keep an eye on website performance to ensure system efficiency, another maintenance task was involved looking for client feedback. The updates' contents, which included things like room availability for future use and tenant paying details, fell under the purview of maintenance.

RESULTS

This section shows the results and outcomes based on the objectives of the study and it is important that the research output is presented in an organized and presentable manner. These discussions and conclusions are based on the objectives of the study, completed analysis, and testing of the developed web system.

DISCUSSION

The "Mabalacat Dorm" project aimed to use an online system to make it simpler to track and manage dormitory residents. The research identified several common issues with dormitory management, such as slow manual processes, difficulty in quickly accessing up-to-date information, and communication challenges between residents and staff.

AKNOWLEDGEMENT

iThis project wouldn't have been possible without the help and support of many people who shared their knowledge, time, and assistance during this study. First, the researchers want to thank God, who gives them strength and wisdom. They are especially grateful to Mr. Khyle Alegre, their Technical Adviser, and Engr. Dennis L. Tacadena for patiently answering questions

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MINUM
IOT BASED DRINKING WATER VENDING MACHINE WITH SALES AND LEVEL MONITOR
MINUM AUTHORS:
MICLAT, JIMMUEL P.
BINUYA, RONRIC JOEL L.
SOLIS, CEDRICK JOHN A.
ENGR. ERNIE LEE PINEDA
PACIS, JOHN LLOYD V.
TORRES, KGERONE LORENZ M.
TEVES, PATRICK LORENCE M.
ABSTRACT
THE STUDY PRESENTS AN IOT-BASED DRINKING WATER VENDING MACHINE WITH SALES AND LEVEL MONITOR FOR MCC DAPDAP. IT AIMS TO PROVIDE A CONVENIENT, AUTOMATED, AND AFFORDABLE SOLUTION FOR ACCESSING CLEAN WATER. DEVELOPED USING THE MODIFIED WATERFALL MODEL (SDLC), THE SYSTEM INCLUDES REAL-TIME MONITORING, AUTOMATED COIN-BASED DISPENSING, AND A MOBILE APP INTERFACE. ALPHA AND BETA TESTING, GUIDED BY ISO 25010 STANDARDS, YIELDED HIGH USER SATISFACTION WITH MEAN SCORES OF 4.15 AND 4.81, RESPECTIVELY
METHODOLOGY
THE STUDY ADOPTED THE MODIFIED WATERFALL MODEL OF THE SOFTWARE DEVELOPMENT LIFE CYCLE (SDLC). THIS INVOLVED SEQUENTIAL PHASES OF REQUIREMENT GATHERING, DESIGN, DEVELOPMENT, TESTING, DEPLOYMENT, AND MAINTENANCE. DATA WAS GATHERED THROUGH INTERVIEWS, SURVEYS, AND TECHNICAL RESEARCH. ROLES WERE CLEARLY DEFINED AMONG TEAM MEMBERS SUCH AS PROJECT LEADER, SYSTEM ANALYST, DEVELOPERS, AND QA ENGINEER
Waterfall Model
Requirements
Design
Development
Testing
Deployment
Maintenance
OBJECTIVES
GENERAL OBJECTIVE:
TO DEVELOP AN IOT-BASED DRINKING WATER VENDING MACHINE WITH SALES AND LEVEL MONITOR FOR MCC DAPDAP.
SPECIFIC OBJECTIVES:
CONDUCT RESEARCH AND GATHER DATA ON IOT-BASED WATER VENDING SYSTEMS.
IDENTIFY HARDWARE AND SOFTWARE REQUIREMENTS.
DESIGN SYSTEM ARCHITECTURE USING TOOLS SUCH AS BLOCK DIAGRAMS, FLOWCHARTS, AND ER DIAGRAMS.
CONFIGURE MICROCONTROLLERS (ESP32, ESP8266, ARDUINO UNO).
DEVELOP A MOBILE APP FOR SALES AND WATER-LEVEL MONITORING.
CREATE A HARDWARE VENDING SYSTEM WITH COIN VALIDATION AND WATER DISPENSING.
INTEGRATE ALGORITHMS FOR INITIALIZATION, WATER-LEVEL MONITORING, AND COIN-BASED TRANSACTION HANDLING.
REQUIREMENT GATHERING AND ANALYSIS
USER REQUIREMENTS WERE OBTAINED THROUGH SURVEYS AND INTERVIEWS AT MCC DAPDAP. KEY HARDWARE COMPONENTS INCLUDED ESP MICROCONTROLLERS, ULTRASONIC SENSORS, COIN SLOTS, AND WATER PUMPS. SOFTWARE TOOLS INCLUDED ANDROID STUDIO, ARDUINO IDE, FLUTTER, AND RIVE. THE GATHERED REQUIREMENTS FORMED THE BASIS FOR SYSTEM DESIGN AND FUNCTIONALITY.
IMPLEMENTATION
THE DEVELOPMENT INVOLVED CODING THE FRONT-END AND BACK-END OF THE MOBILE APP, INTEGRATING WITH IOT HARDWARE. THE SYSTEM WAS PROGRAMMED TO TRACK WATER LEVELS, PROCESS PAYMENTS, AND DISPENSE WATER. REAL-TIME COMMUNICATION BETWEEN COMPONENTS WAS ESTABLISHED, AND THE MACHINE WAS RIGOROUSLY TESTED FOR RELIABILITY AND ACCURACY.
SYSTEM DESIGN
SYSTEM DESIGN INCORPORATED MULTIPLE TOOLS:
STORYBOARD FOR UI FLOW
BLOCK DIAGRAM FOR HARDWARE LAYOUT
FLOWCHARTS FOR LOGIC PROCESSES
ENTITY-RELATIONSHIP DIAGRAM FOR DATA STRUCTURE
SYSTEM ARCHITECTURE TO VISUALIZE OVERALL FRAMEWORK
DESIGN FOCUSED ON SEAMLESS INTERACTION BETWEEN MOBILE APP AND HARDWARE COMPONENTS.
INTEGRATION AND TESTING
BOTH ALPHA AND BETA TESTING FOLLOWED ISO 25010 STANDARDS. ALPHA TESTS WERE DONE BY THREE IT PROFESSIONALS, WHILE BETA TESTING INVOLVED 60 STUDENTS AND STAFF. TESTS EVALUATED FUNCTIONALITY, USABILITY, RELIABILITY, AND SECURITY. ISSUES WERE ADDRESSED BEFORE DEPLOYMENT BASED ON FEEDBACK.
DEPLOYMENT OF SYSTEM
THE VENDING MACHINE AND MOBILE APPLICATION WERE DEPLOYED AT MCC DAPDAP. THE MACHINE INCLUDED COIN-OPERATED FUNCTIONALITY AND REAL-TIME SENSORS. THE APP ENABLED MONITORING AND SALES REPORTING, ENHANCING ACCESSIBILITY FOR USERS AND ADMINS.
MAINTENANCE
ROUTINE HARDWARE CHECKS AND SOFTWARE UPDATES WERE PART OF THE MAINTENANCE PHASE. A NOTIFICATION SYSTEM WAS BUILT INTO THE APP TO ALERT ADMINS FOR CLEANING AND MAINTENANCE. CONTINUOUS EVALUATION ENSURED LONG-TERM FUNCTIONALITY AND PERFORMANCE.
RESULT AND DISCUSSION
THE DEVELOPMENT PROCESS EFFECTIVELY MET ALL OBJECTIVES. TESTING CONFIRMED THE VENDING MACHINE'S ACCURACY AND USABILITY. KEY INSIGHTS FROM USER FEEDBACK WERE USED TO REFINE THE SYSTEM. THE FINAL IMPLEMENTATION OFFERED A RELIABLE AND ECO-FRIENDLY SOLUTION FOR ACCESSING CLEAN WATER AT MCC DAPDAP.
ACKNOWLEDGEMENT
THE RESEARCHERS EXPRESS GRATITUDE TO GOD, ADVISERS (ENGR. DENNIS L. TACADENA AND ENGR. ERNIE LEE PINEDA), DEAN DR. MYRNA C. CALMA, ALPHA AND BETA TESTERS, FAMILY, FRIENDS, AND PEERS FOR THEIR SUPPORT AND CONTRIBUTIONS TO THE SUCCESS OF THE PROJECT.
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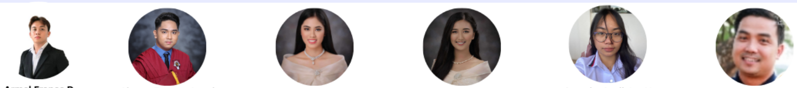
PICKINTEGRATE: IMPLEMENTING AN INTEGRATE ORDERING AND DELIVERING SOLUTIONS FOR YCM GLASS AND ALUMINUM SUPPLY

Authors



Armel France D. Lipalam
Alegre, Eugene Angelo O.
Lalangan, Gemalyn F.
Ayson, Erica O.
Sagario, April Joy Y
Ernie Lee Pineda

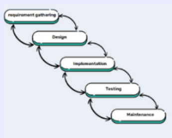
ABSTRACT

Websites and e-commerce platforms have become essential tools for companies to stay competitive. Customers now expect the convenience of online ordering, real-time updates, and easy access to product information. Businesses without an online presence risk falling behind, as they struggle to match the efficiency and accessibility offered by digital solutions. By combining order processing, inventory control, and delivery coordination into a single digital platform, the solution solves errors in these areas. Streamlined order processing, automatic delivery scheduling, and real-time inventory tracking are important elements. The purpose of this study is to develop "PickIntergrate", a system that will combine ordering delivery and appointment for YCM Glass & Aluminum supply. The researcher used the Modified Waterfall Methodology as an internal process, with little emphasis on the end user or the client involved in a project. The alpha test respondents are the three I.T. experts. The average score from the alpha test was 4.68, labelled as "Excellent," while the beta test, involving thirty respondents, resulted in an average score of 4.73, also rated as "Excellent." This indicates that the system has been well-received and meets the needs of both sets of users who tested the online ordering and delivery platform. Additionally, the staff of YCM Glass and Aluminum carried out their own evaluation and offered suggestions to improve the system's usability, ensuring it is well-suited to the specific needs of the industry. Overall, the system is capable of effectively supporting daily operations, as reflected by feedback from both customers and users.

OBJECTIVE

The purpose of this study is to create PickIntegrate, a system that will combine ordering, delivery and appointment for YCM Glass Aluminum Supply. Increasing client satisfaction, streamlining procedures, and fostering business expansion are the objectives.

METHODOLOGY



This chapter explains the methodology and design used to construct the study's parameters and development process. The Software Development Life Cycle (SDLC) technique, analysis diagrams, and the data collection tool employed by the proponents in the development of the application will all be displayed in this section.

IMPLEMENTATION

To visit our website by opening any web browser, such as Google Chrome, Firefox, or Safari. Simply type ycmpickintegrate.com into the address bar, or search for 'Ycmglass.shop' on Google, and you'll see our website at the top of the search results. Click on the link to start exploring our products and services. Once on the site, you'll have easy access to our shop, custom build options, appointment booking, and other features designed to enhance your browsing experience. With a few clicks, you can view the latest products, learn more about our services, and even schedule appointments or make purchases directly from the site.

REQUIREMENT GATHERING

The researchers gathering phase of this project involved interviews and surveys conducted at the locale, YCM Glass and Aluminum Supplies, to identify their operational challenges and gather insights for system development. Through interviews with staff and management, it was discovered that orders and deliveries were tracked manually using handwritten notes, leading to frequent errors and inefficiencies. Measurements for custom products were recorded on paper, increasing the risk of mistakes, while sales reports,

DATA GATHERING

The researcher conducted, distributed and collected the beta questionnaires. The respondents fill out the paper in more than ten (10) to twenty (20) minutes, after they access the PickIntegrate system, the researcher starts gathering information and accomplishing the beta tests on October 30, 2024 until November 03, 2024 (See Beta Test Result with photo).

DESIGN

In this phase, guarantees that the web system and administrator panel are built consistently, systematically and regularly by designing the pre-testing tool or instrument such as wireframe or prototype.

TEST RESULTS

PickIntegrate's beta test results demonstrate its outstanding interaction skills. By providing an intuitive and user-friendly experience that is simple to understand, navigate, and utilize, the system effectively meets the demands of its users

TESTING

The bar graph compares the findings from alpha and beta testing across five criteria: Functional Stability, Compatibility, Interaction Capability, Security, and Flexibility. For all criteria, the scores in beta testing are slightly higher than those in alpha testing, showing improvement in the system's performance.

CONCLUSIONS

In this study, we successfully developed PickIntegrate, a streamlined ordering and delivery system for YCM Glass and Aluminum Supply. The solution effectively addressed several core objectives, such as enhancing order management and improving customer experience through an integrated, user-friendly platform. The deployment of automated order tracking and delivery notifications proved effective in boosting operational efficiency and accuracy in real-time updates, meeting YCM's goal to modernize its logistics. However, while many objectives were met, challenges arose in data integration due to discrepancies in existing system formats, which limited full automation in some processes.

OPERATION MAINTENANCE

During the completion of the developed system, it was accepted by the capstone adviser, technical adviser, alpha and beta testers and the board of panelists was achieved. The system created by the researcher may be freely accessed at the domain repository website address of https://www.ycmglass.shop The researchers would have the most

RESULTS AND DISCUSSIONS

The results and outcomes based on the objectives of the research are presented in this chapter, which demonstrates the way the researchers achieved their primary goals. The functionality, design, development, and testing of the produced web system are covered in this chapter, along with the presentation of the data collected from the Alpha and Beta tests and requirements for software and hardware. The alpha and beta tests, researchers tested the system's functionality and completeness using ISO 25010. To evaluate the experience of the participants in "PickIntegrate: Implementing an Integrated Ordering and Delivery Solution for YCM Glass and Aluminum Supply" to complete a survey. The researcher must prepare a report that summarizes the study's result. The result from the studies should be presented in a reasonable, organized and understandable way.

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QRCodeConnect: Elevating Student Attendance Monitoring and Computer Monitoring at Mabalacat City College Computer Laboratory

QRCODECONNECT

Authors:

SHANLOYD C. DELIZO · NATHANIEL N. LEE · WALTER D. MARTINEZ · HENRY S. MORENO · RIA S. SABILE · ALFONSO D. BARCELON JR.

ABSTRACT

Technology plays an integral role in modern education, streamlining processes and enhancing operational efficiency. This study introduces QRCodeConnect: Student Attendance and Computer Monitoring System, designed to improve attendance tracking and computer usage monitoring at Mabalacat City College. Employing the modified waterfall model for development, the system integrates QR code technology and real-time analytics to optimize resource allocation and reduce administrative workload. It was evaluated using ISO 25010 standards, achieving an "Excellent" overall mean score of 4.49 in alpha testing by IT experts. Specific scores included Functional Suitability (4.47), Compatibility (4.42), Interaction Capability (4.52), Security (4.51), and Flexibility (4.53). Beta testing with 30 student respondents reaffirmed the system's reliability and user satisfaction. Despite its tailored focus, limitations were identified, such as scalability, offline functionality, and integration with external databases, paving the way for future enhancements. While the study focused on a controlled laboratory environment, limitations such as scalability, offline functionality, and integration with external databases were identified, offering pathways for future enhancement. Despite these constraints, QRCodeConnect demonstrates the potential to redefine institutional processes by leveraging modern technology, making it adaptable for other educational institutions.

METHODOLOGY

The software development life cycle method that the researchers chose to design the application is the modified waterfall model. The Modified Waterfall Model provides a structured flow of development processes with some flexible, iterative phases that provide enough documentation and design evaluations to ensure the application's quality, consistency, and maintainability, which the researchers had designed. (Prashant., 2023).

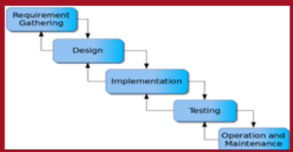

Figure 1. The Modified Waterfall Model

OBJECTIVES

The primary objective of the study was to develop and implement a QR code desktop application for monitoring student attendance and a computer monitoring system at the Mabalacat City College computer laboratory.This dual approach aimed to enhance the efficiency and accuracy of attendance records while providing detailed insights into computer usage within the laboratory.

REQUIREMENTS

The requirements-gathering phase for the QRCodeConnect project at Mabalacat City College involved a collaborative effort to ensure the system met user needs and institutional standards. Researchers engaged in group discussions and consultations with MCC administrative and IT professionals to gather insights. The focus was on usability for teachers and students, accuracy in attendance tracking, and system compatibility with the existing laboratory infrastructure.

SPECIFIC OBJECTIVES

1. To gather information about QR code student attendance and computer monitoring through interviews, published books, and reliable sources.
2. To identify the specifications for hardware and software developmental tools required for the application and back-end system development:Computer Desktop, Webcam, Visual Studio Code, Python, PySide6/Qt for Python, SQLite, PostgreSQL, Supabase, Adobe Photoshop, Draw.io, Git(Global information tracker), GitHub.
3. To design the system and application, use the following diagrams and analysis tools: Storyboard, Use Case Diagram, Data Flow Diagram, Entity Relationship, Diagram, Visual Table of Contents.
4. To create and develop the system, which has the following:
5. To test the application and system through Alpha and Beta testing tools.
6. To evaluate the effectiveness of the implemented systems.
7. To assess the functional suitability, compatibility, security, and flexibility of the system, apply the ISO 25010 Software Product Quality standards.

DESIGN

In this phase, the researchers would use the following analysis tools and diagrams per the discussion and studies related to the proposed QRCodeConnect desktop application: Storyboard, Use Case Diagram, Data Flow Diagram, Entity Relationship Diagrams and Visual Table of Contents. The researchers used Storyboard Diagram to organized the user interface flow and procedures, while Use Case Diagrams defined important functions and features. Data flow diagrams depicted information transportation, suggesting possible difficulties and solutions. Entity Relationship Diagrams explained database entity interactions, which helped with database architecture. Visual tables of contents provide a good perspective of document structures. These technologies helped to provide a full knowledge of the system's architecture, interface, and user journey, allowing for extensive evaluation and prospective improvements.

IMPLEMENTATION

The implementation phase of the QRCodeConnect system focused on building a comprehensive and responsive application for monitoring student attendance and computer usage at Mabalacat City College. The system's front-end was developed using PySide6, which provided a cross-platform graphical user interface, ensuring usability and consistency. For the back-end, PostgreSQL was selected for its robust data management capabilities, while Supabase offered real-time synchronization and simplified API integration, enhancing the system's responsiveness and user experience.

Overall, the implementation combined Python, PySide6, PostgreSQL, and Supabase to create a reliable and user-friendly solution tailored to the needs of MCC's computer laboratory, enhancing operational efficiency and technological capability.

TESTING

In this phase, the researchers made certain changes to the system based on the panel's suggestions as well as technical and capstone adviser comments. The testing phase evaluates the overall research to see if the system functions as expected. The agreed-upon opinions and suggestions from panels/clients were assessed and included into the established system. The researchers conducted the alpha and beta testing using the researchers' made survey tool anchored with the criteria of ISO25010 Software Product Quality Standard to review and correct any application glitch or defects. The researchers created a survey questionnaire based on the functional suitability, compatibility, interaction capability, security and flexibility criteria of the ISO25010 model in order to evaluate the quality of the developed system.

The ISO25010 questionnaire underwent testing for validity to guarantee that the study's conclusions are neutral and unaffected by external influences such as the researcher, respondents, or the setting in which the evaluation was conducted.

MAINTENANCE

After the verification phase, the maintenance phase was performed. The operation and maintenance of the QR Code Student Attendance and Computer Monitoring System at MCC Computer Laboratory would focus on regular updates, issue fixes, and data backups to ensure smooth performance. Users would receive training, while IT staff would handle system monitoring and support. Preventive maintenance, like routine checks, would address potential problems early. The system is built to scale for future improvements and upgrades. Security measures would be in place to protect data, ensuring the system remains reliable and efficient over time, meeting the lab's management needs.

RESULT

The alpha testing phase shown in table 3, conducted by three IT experts, yielded an overall weighted mean of 3.88, interpreted as "Good." Security scored the highest with a weighted mean of 4.83, showcasing the system's strong confidentiality, integrity, and reliability. However, Flexibility scored the lowest at 3.48, indicating areas for improvement in scalability, adaptability, and installability to enhance the system's versatility and user-friendliness. In beta testing, 30 BSIT students evaluated the system, resulting in an overall weighted mean of 4.49, rated as "Excellent." Flexibility received the highest score of 4.53, reflecting inclusivity and user satisfaction. Compatibility, scoring 4.42, also rated "Excellent," highlighted minor areas for enhancement in functionality across diverse platforms and user levels. Both phases demonstrated the effectiveness of the system, with room for refinement to ensure optimal performance and adaptability.

DISCUSSION

The researchers conducted a thorough analysis of user needs, a crucial step in the development of QRCodeConnect. The primary objective was to identify the key components necessary to build a comprehensive desktop application system for Mabalacat City College. Through collaboration with students, custodians, and instructors, the researchers gained valuable insights into how to improve student attendance and computer monitoring, streamline administrative processes, and optimize laboratory resource management. In addition to conducting interviews, the researchers reviewed papers on school best practices and students' digital solutions. Reading case studies and researching effective desktop application systems online yielded some useful theoretical information. Moreover, the researchers examined similar systems to better understand how different groups used and interacted with technology. The researchers determined which hardware and software were required to make the system's features work.

ACKNOWLEDGEMENT

We extend our deepest gratitude to everyone who supported and guided us throughout the development of our capstone project, QRCodeConnect: Student Attendance and Computer Monitoring System. To our families, thank you for your unwavering love, encouragement, and understanding during this challenging journey. Your support fueled our determination to succeed. We express our sincere appreciation to our Technical Adviser, Alfonso D. Barcelon Jr., and our Capstone Adviser, Engr. Dennis L. Tacadena, for their expert guidance, valuable insights, and encouragement, which were crucial to the completion of this project. Our heartfelt thanks go to Mr. Modesto Mari T. Chua, Mr. Kenneth Radores, and Mr. Kervin Junar D. Lopez for sharing their expertise during the alpha testing phase, helping us refine and improve our system. Lastly, we are deeply grateful to the students of Mabalacat City College who participated in the beta testing, providing invaluable feedback that enhanced the functionality and usability of our system. To all of you, thank you for being part of this milestone in our academic journey.

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PatientPlus
Mabalacat CHild Care Clinic

TRANSFORMING PEDIATRIC SERVICES WITH PATIENTPLUS:

A WEB APPLICATION FOR MABALACAT CHILD CARE CLINIC

AUTHORS MUÑOZ, JERALD R. MARIÑAS, EDRIAN T. MEDINA, PRINCE JOIE R. PEREZ, LUIS DANIEL G. TISUELA, JOHN VERGEL C.

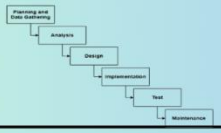
ABSTRACT

The focus of this article research is both the process of development and the process of putting into use PatientPlus, which is a web-based Application that aims to optimize the staff and service delivery of Mabalacat Child Care Clinic situated in the Philippines. In light of increased demand for pediatric health care provisions and the clinics traditional dependence on handwritten records, the study seeks to tackle several important problems such as poor data management, problems associated with appointment calendar, and chances of loss of information. With the help of the technological revolution, PatientPlus develops a single platform where parents can book appointments, manage their children's health information securely, and connect to any health provider all in one web application.

The importance of this project is consistent with the provisions of the Universal Health Care Act, which was enacted by the government of the Philippines to ensure that medical attention is both cheap and easy to access resulting in active health care throughout the country. This study points out that local authorities have a considerable part to play in the development of the healthy communities while noting the role of paediatric clinics in addressing the health care needs of children. Through the introduction of PatientPlus, this study expects improved health care provisions, increased service accessibility and better health education to the people resulting in a healthier population and in the realization of the health and wellbeing SDG targets. The results are intended to offer a guide for similar changes in the organization of care in the pediatric age group, covering the respective needs of children in Mabalacat City and further.

METHODOLOGY

Software Development Life Cycle (SDLC) makes it feasible to produce high-quality, low-cost software in the least amount of time. The SDLC aims to create excellent software that satisfies and surpasses all client requirements and expectations. A comprehensive plan with stages, or phases, that each include the own procedures and outputs is defined and outlined by the SDLC. Following the SDLC accelerates development and reduces project risks and expenses related to using different production techniques. The researchers chose the Waterfall Model as the Software Development Life Cycle (SDLC) approach to be used in the creation of the simulation program. The Waterfall Model will consist of phases that will be iterative and an organized flow of development activities.



GENERAL OBJECTIVE

The main goal of this research project was to create a web application that helps manage and keep track of tenants in the Mabalacat Dormitory. The system made it easier to handle tasks like tenant registration, room assignments, payment tracking, and maintenance requests. By combining an easy-to-use interface with effective backend processes, the system gave administrators quick access to tenant information, helped with communication, and improved dormitory management

SPECIFIC OBJECTIVE

- To gather data from the system
- To design the system with the following tools
- To develop the web-app with the following feature
- To primarily develop the front-end and back-end of the system interface using the following frameworks, technologies and programming languages
- To assess the simulation software in terms of function
- sustainability, performance efficiency, compatibility.
- usability, credibility, security maintainability, and ease of using the ISO 25010 Software Product Quality Standards
- To deploy and implement the application to the following web domain and application respiratory site

DATA GATHERING

The distribution and data gathering for the questionnaire will be managed by the researchers. The user is expected to fill out the form as soon as possible after using the website. October 23, 2024, will mark the start of data collecting, which will last until October 30, 2024.

MAINTENANCE

Following the testing phase, the proposer will enter the maintenance phase, which involves routine monitoring, bug fixing, performance optimization, security updates, user support, feature enhancements, and documentation maintenance to ensure the long-term effectiveness and reliability of the PatientPlus web-based application

IMPLEMENTATION

In the Implementation Phase of this capstone project, the researchers begin building the PatientPlus web-based application based on finalized designs, employing VSCode for a comprehensive development environment. This tool supports the methodology the researchers use, allowing task to be made sequentially from Planning & Data Gathering, Designing, Analysis, Implementation. The researchers focused on functional suitability, compatibility, interaction capability, security, and flexibility by adhering to best coding practices and industry standards. To begin with interview and survey Questionnaire the researchers deployed the web application by using Z.com Philippines for hosting, the app remains accessible, with PatientPlusccc.com as its registered domain for easy user identification. Key tools or features that help to efficiently process the development in this phase include: Cross-Platform Compatibility
IntelliSense & Code Navigation
Community Support Z.com Philippines.

RESULTS & DISCUSSION

This section showed the results and outcomes based on the objectives of the study and it is important that the research output is presented in an organized and presentable manner. These discussions and conclusions are based on the objectives of the study, completed analysis, and testing of the developed web web-based application. The needed information was gathered from numerous books, journal publications, and previous research writings. Figure 10. shows the local business owner was interviewed by the researchers to get recommendations on features to be included and what still needs improvement.

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VAXEEN: A WEBSITE UTILIZING DATA ANALYTICS TO MONITOR ANIMAL BITE CASES AT MABALACAT DISTRICT HOSPITAL

AUTHORS
DELOS REYES, GABRIEL
LITAN, FAITH ANNE
LUMANLAN, JADEN RENZO
OMANDAM, PATRICK JAMES
SAN BUENAVENTURA, JON IRIS
PINEDA, ERNIE LEE

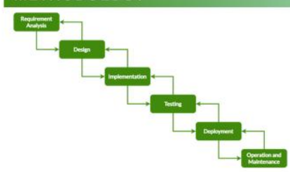
ABSTRACT

THE UNEXPECTED OUTBREAK OF HEALTH ISSUES SUCH AS THE COVID-19 PANDEMIC DEMONSTRATED HOW CRUCIAL TECHNOLOGY IS TO MEDICINE. DATA ANALYTICS WAS UTILIZED TO PREDICT DISEASES, BUT HAS NOT BEEN USED TO TRACK LOCAL DISEASES SUCH AS CAT AND DOG RABIES IN THE PHILIPPINES. THE GENERAL OBJECTIVE OF THE STUDY WAS TO DEVELOP A SYSTEM NAMED "VAXEEN: A WEBSITE USING DATA ANALYTICS TO MONITOR ANIMAL BITE RATES AT MABALACAT DISTRICT HOSPITAL." THIS SYSTEM WAS DEVELOPED USING THE MODIFIED WATERFALL MODEL AS THE SOFTWARE DEVELOPMENT LIFE CYCLE (SDLC) APPROACH. THIS SYSTEMATIC APPROACH ENSURES THERE IS CLEAR PROGRESS AND DOCUMENTATION AT EACH STAGE OF DEVELOPING THE SYSTEM. ALPHA AND BETA TESTING WERE CONDUCTED ACCORDING TO ISO 25010 STANDARDS, ENSURING FUNCTIONAL SUITABILITY, COMPATIBILITY, INTERACTION CAPABILITY, SECURITY, AND FLEXIBILITY. THE AVERAGE ALPHA TESTING SCORE, RATED BY THREE (3) IT EXPERTS, WAS 4.09, WHICH IS RATED AS "GOOD." MEANWHILE, BETA TESTING, RATED BY THIRTY (30) REPRESENTATIVES FROM MABALACAT DISTRICT HOSPITAL, WAS 4.23, ALSO RATED AS "GOOD." THE TEST RESULTS INDICATE THAT THE SYSTEM IS MEETING ITS FUNCTIONAL REQUIREMENTS, PERFORMS WELL ON VARIOUS PLATFORMS, HAS AN EASY USER INTERFACE, SECURES DATA, AND CAN BE ADJUSTED IN THE FUTURE. IN CONCLUSION, VAXEEN SUCCESSFULLY ACCOMPLISHES ITS GOALS BY OFFERING A USER-FRIENDLY, SAFE, AND ADAPTABLE SYSTEM THAT IMPROVES THE MABALACAT DISTRICT HOSPITAL'S ANIMAL BITE RATE MONITORING, ENABLING MORE SUCCESSFUL PUBLIC HEALTH INITIATIVES.

OBJECTIVES

1. TO GATHER DATA AND RELEVANT INFORMATION FOR THE STUDY AND THE SYST1. TO GATHER DATA AND RELEVANT INFORMATION FOR THE STUDY AND THE SYSTEM OF MABALACAT DISTRICT HOSPITAL
2. TO IDENTIFY THE REQUIRED HARDWARE AND SOFTWARE DEVELOPMENT TOOLS FOR THE SYSTEM
3. TO DESIGN THE SYSTEM USING THE FOLLOWING DIAGRAMS AND ANALYSIS TOOLS
4. TO DEVELOP A SYSTEM WITH THE FOLLOWING FEATURES
5. TO TEST THE SYSTEM THROUGH ALPHA AND BETA TESTING.
6. TO EVALUATE THE SYSTEM USING THE FOLLOWING ISO 25010 SOFTWARE PRODUCT QUALITY STANDARDS
7. TO DEPLOY AND IMPLEMENT THE SYSTEM USING A WEB HOSTING SITEEM OF MABALACAT DISTRICT HOSPITAL
2. TO IDENTIFY THE REQUIRED HARDWARE AND SOFTWARE DEVELOPMENT TOOLS FOR THE SYSTEM
3. TO DESIGN THE SYSTEM USING THE FOLLOWING DIAGRAMS AND ANALYSIS TOOLS
4. TO DEVELOP A SYSTEM WITH THE FOLLOWING FEATURES
5. TO TEST THE SYSTEM THROUGH ALPHA AND BETA TESTING.

METHODOLOGY



THE MODIFIED WATERFALL MODEL HAS BEEN ADOPTED BY THE RESEARCHERS AMONG SOFTWARE DEVELOPMENT LIFE CYCLE METHODS TO DEVELOP THE SYSTEM. THIS MODEL HAS ITS ADVANTAGES, SUCH AS STRUCTURED PHASES WITH DEFINED DELIVERABLES AND MILESTONES. THESE HELPS CLARIFY REQUIREMENTS EARLY IN THE PROCESS, ARTICULATE USABILITY, AND FACILITATE TRACKING PROGRESS. ISSUES CAN BE IDENTIFIED EARLIER AND RESOLVED BEFORE MOVING TO THE NEXT PHASE, THUS MINIMIZING RISKS IN THE DEVELOPMENT CYCLE. THE MODIFIED WATERFALL MODEL CALLS FOR IMPROVEMENT IN COMMUNICATION BETWEEN STAKEHOLDERS AND REDUCES REVISIONS BECAUSE ANY PRODUCT WILL MEET USER NEEDS AND EXPECTATIONS. IT ALSO SAVES TIME AND COSTS SINCE EXTENSIVE REUSE IS AVOIDED.

REQUIREMENT GATHERING

INTERVIEWS CONDUCTED WITH THE ADMINISTRATIVE AIDE AND NURSE OF MABALACAT DISTRICT HOSPITAL PAVED THE WAY FOR ACQUIRING VALUABLE INFORMATION REGARDING THE CURRENT WORKFLOWS AND ADMINISTRATIVE PRACTICES IN THE HOSPITAL.

DESIGN

RESEARCHERS USED VARIOUS DESIGN TOOLS TO DEVELOP AN EFFECTIVE, USER-FRIENDLY SYSTEM. STORYBOARDS SHOWED USER INTERACTIONS, THE MENU TREE DIAGRAM OUTLINED NAVIGATION, AND THE USE CASE DIAGRAM CLARIFIED USER ROLES. THE SYSTEM ARCHITECTURE DIAGRAM ILLUSTRATED COMPONENT INTERACTIONS, WHILE THE GANTT CHART TRACKED TIMELINES AND PROGRESS. TOGETHER, THESE TOOLS GUIDED THE STRUCTURED DEVELOPMENT OF THE SYSTEM AND ITS ADMIN PANEL.

IMPLEMENTATION

THE VAXEEN SYSTEM WAS DEVELOPED IN ALIGNMENT WITH THE REQUIREMENTS IDENTIFIED DURING THE DESIGN PHASE. THE SYSTEM OFFERS RESIDENTS ACCESS TO HOSPITAL INFO, ANALYTICS, NEWS, EVENTS, SERVICES, AND CONTACT DETAILS, ALL THROUGH A USER-FRIENDLY INTERFACE. THE ADMIN PANEL ALLOWS ADMINS, DOCTORS, AND SECRETARIES TO MANAGE CONTENT, USERS, VACCINE INVENTORY, AND PATIENT RECORDS EFFICIENTLY. DETAILED FIGURES ILLUSTRATE EACH FEATURE AND INTERFACE, WITH STEP-BY-STEP USE AVAILABLE IN THE USER MANUAL

TESTING

THE VAXEEN SYSTEM CONDUCTED ALPHA AND BETA TESTING WHEREIN ALPHA TESTING INVOLVED THREE IT EXPERTS, WHILE BETA TESTING INCLUDED ONE HOSPITAL STAFF MEMBER AND 29 MABALACAT CITY RESIDENTS. FEEDBACK HELPED IMPROVE THE SYSTEM'S USABILITY AND PERFORMANCE. EVALUATION FOLLOWED ISO 25010 STANDARDS, COVERING FUNCTIONALITY, COMPATIBILITY, USER INTERACTION, SECURITY, AND FLEXIBILITY, OFFERING KEY INSIGHTS INTO THE SYSTEM'S QUALITY AND REAL-WORLD APPLICATION.

DEPLOYMENT

THE VAXEEN SYSTEM CONDUCTED ALPHA AND BETA TESTING WHEREIN ALPHA TESTING INVOLVED THREE IT EXPERTS, WHILE BETA TESTING INCLUDED ONE HOSPITAL STAFF MEMBER AND 29 MABALACAT CITY RESIDENTS. FEEDBACK HELPED IMPROVE THE SYSTEM'S USABILITY AND PERFORMANCE. EVALUATION FOLLOWED ISO 25010 STANDARDS, COVERING FUNCTIONALITY, COMPATIBILITY, USER INTERACTION, SECURITY, AND FLEXIBILITY, OFFERING KEY INSIGHTS INTO THE SYSTEM'S QUALITY AND REAL-WORLD APPLICATION.

MAINTENANCE

THE SYSTEM WILL UNDERGO REGULAR MAINTENANCE AND UPDATES TO STAY ALIGNED WITH TECHNOLOGICAL ADVANCES AND USER FEEDBACK. THIS WILL ENHANCE TRUST, ACCESSIBILITY, AND USER GROWTH, LEADING TO POTENTIAL PARTNERSHIPS AND EXPLORATION OF NEW MARKET OPPORTUNITIES.

RESULTS

VAXEEN UNDERWENT ALPHA AND BETA TESTING, BOTH RECEIVING "GOOD" RATINGS, WITH BETA SCORING HIGHER (4.23 VS. 4.09) DUE TO SYSTEM IMPROVEMENTS. FUNCTIONAL SUITABILITY ROSE FROM 4.03 TO 4.44, REFLECTING SMOOTHER PATIENT LIST AND SCHEDULING FEATURES FOR STAFF. COMPATIBILITY AND INTERACTION CAPABILITY ALSO IMPROVED, THOUGH MINOR SLOWDOWNS OCCURRED UNDER HEAVY USE. UI ENHANCEMENTS—LIKE PAGINATION, CONFIRMATION PROMPTS, BETTER LAYOUTS, AND EXPIRED VACCINE INDICATORS—BOOSTED USABILITY AND EFFICIENCY. SECURITY REMAINED ADEQUATE BUT SLIGHTLY DROPPED DUE TO MINOR CONCERNS. OVERALL, BETA FEEDBACK CONFIRMED THAT UPDATES MADE THE SYSTEM MORE USER-FRIENDLY, RELIABLE, AND READY FOR REAL-WORLD DEPLOYMENT, WITH AREAS FOR CONTINUED REFINEMENT.

CONCLUSION

THE VAXEEN SYSTEM'S DEVELOPMENT AND DEPLOYMENT SIGNIFICANTLY IMPROVE HEALTHCARE AND PUBLIC AWARENESS AT MABALACAT DISTRICT HOSPITAL. THROUGH COLLABORATIVE, USER-FOCUSED DESIGN AND ITERATIVE TESTING GUIDED BY THE MODIFIED WATERFALL MODEL, VAXEEN EVOLVED INTO A RELIABLE, ADAPTABLE PLATFORM. ALIGNED WITH SUSTAINABLE DEVELOPMENT GOALS, IT ADDRESSES LOCAL HEALTH ISSUES WHILE SUPPORTING GLOBAL AIMS LIKE WELL-BEING, EDUCATION, INNOVATION, AND COMMUNITY RESILIENCE. BY REPLACING MANUAL PROCESSES WITH A DIGITAL SYSTEM, VAXEEN ENHANCES DATA ACCURACY, HOSPITAL EFFICIENCY, AND COMMUNITY ACCESS TO HEALTH INFORMATION, DEMONSTRATING TECHNOLOGY'S POWERFUL ROLE IN ADVANCING SUSTAINABLE PUBLIC HEALTH SOLUTIONS.

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WORKONNECT

WFH Client Monitoring with Payroll for Client-Based Employees

AUTHORS


Darrell John DELA CRUZ


Joeces Ian DIZON


Rambo John SALANGSANG


Jeremy SANCHEZ


John Andrei TELAN


Onalee TOLENTINO

ABSTRACT

The capstone project aims to streamline remote work management through attendance tracking, request handling, and payroll processing. It supports SDGs 4, 8, and 9 by enhancing education, work quality, and innovation. Developed using the Modified Waterfall Methodology, the system integrates feedback for continuous improvement. Rigorous alpha and beta testing confirmed its reliability, usability, and security. Overall, Workonnect improves productivity and operational efficiency for client-based remote work setups.

OBJECTIVES

This study aims to develop a robust system for monitoring remote work and managing payroll for client-based employees by gathering best practices and identifying essential tools like C#, Visual Studio 2022, and SQL Server. It involves designing the system using diagrams such as Gantt charts, use case diagrams, and ERDs to guide development. The system will cater to employees, HR admins, and superadmins, each with tailored functionalities for monitoring, managing requests, and handling payroll. Rigorous Alpha and Beta testing will be conducted to ensure reliability and effectiveness. Performance will be evaluated using ISO 25010 standards to guarantee quality across key metrics.

METHODOLOGY

The researchers adopted the Modified Waterfall Model, a structured but adaptable method that allowed for iterative improvements throughout each development phase. This model enabled responsiveness to user feedback and effectively tackled emerging challenges.

REQUIREMENTS GATHERING

The research team gathered essential insights through brainstorming, expert consultations, interviews, and literature reviews to guide the development of a client-based software system aligned with user needs and industry standards. They used Visual Studio 2020 for coding, Adobe XD and Miro for design, and built the system on a Microsoft-powered desktop with Tailscale for secure, multi-device access. This strategic combination of tools and research ensured a user-friendly, high-performing system that met the project's objectives.

DESIGN

To design and develop the application and administrator panel, the research team utilized several analysis tools and diagrams, including a storyboard, Gantt Chart, Use Case Diagram, Entity Relationship Diagram (ERD), and Visual Table of Contents. The storyboard and Visual Table of Contents helped visualize and organize the user interface, while the Gantt Chart guided project scheduling and resource management. The Use Case Diagram clarified system functions and actor relationships, and the ERD mapped out the data structure to support effective database design.

IMPLEMENTATION

During the implementation phase of the Workonnect system, the researchers used Visual Studio and C# to develop a professional, user-friendly desktop application compatible with Windows OS, tailored for super admins, admins, and users. Core features included a Dashboard for status updates and announcements, a User Page for attendance and request management, and tools for handling holidays, payroll, and approvals, with all actions logged for transparency and security. The system was designed to be a comprehensive platform for managing users, payroll, and administrative tasks, setting the stage for testing and future enhancements.

TESTING

During the testing phase, the Workonnect system will undergo rigorous evaluation through unit, integration, system, and performance tests to ensure all features function correctly and efficiently under various conditions. Alpha and beta testing will help identify bugs, usability issues, and gather real-world feedback from internal and external users to refine the system. Final assessments will confirm accurate reporting, strong security, and a user-friendly interface, ensuring Workonnect is ready for deployment to meet organizational needs in task management, scheduling, and communication.

OPERATION AND MAINTENANCE

Following validation, the Workonnect system was deployed via its official domain and entered a maintenance phase involving daily monitoring, user feedback collection, and periodic updates to address bugs, enhance security, and improve usability. Researchers tracked key metrics such as active users, reported issues, and feature requests to ensure consistent performance across devices and maintain responsiveness to user needs.

RESULTS AND OUTCOMES

The combined beta test results from HR Admins and WFH Employees confirm Workonnect's exceptional performance, with an overall mean score of 4.60 interpreted as Excellent, reflecting its effectiveness, reliability, and user-centered design. High scores across all criteria—Functional Suitability (4.59), Performance Efficiency (4.58), Compatibility (4.55), Usability (4.64), Reliability (4.66), Security (4.59), and Portability (4.57)—demonstrate the system's ability to deliver seamless functionality, strong security, and consistent usability across diverse environments. These findings validate Workonnect as a dependable and efficient solution for managing work processes, meeting the varied needs of its users with outstanding results.

CONCLUSIONS

The development of the Workonnect system marked a significant advancement in optimizing administrative processes for client-based organizations, particularly in managing remote workforces through streamlined attendance tracking, request handling, and payroll processing. Built using technologies like C#, Microsoft SQL Server, Tailscale VPN, Adobe XD, and Miro, the system offers a secure, high-performing, and user-friendly platform compatible with Windows devices, ensuring smooth operation and intuitive interaction for HR admins and remote employees. Comprehensive Alpha and Beta testing validated its reliability and usability, confirming Workonnect's success in automating key tasks and positioning it as a valuable solution for enhancing organizational productivity in the modern business environment.

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Accountify: A Web-Based Accountant Prep and Review Platform with Integrated Study Tools

Joshua Reuben B. Camon, Myrna E. Cuento-Calma, Kristhine D. Aguas, Mary Angeline M. Dela Cruz, Cyril Jan O. Dela Peña, Verni Jahzreal A. Serrano, Dessa Lyn J. De Castro, Dennis L. Tacadena

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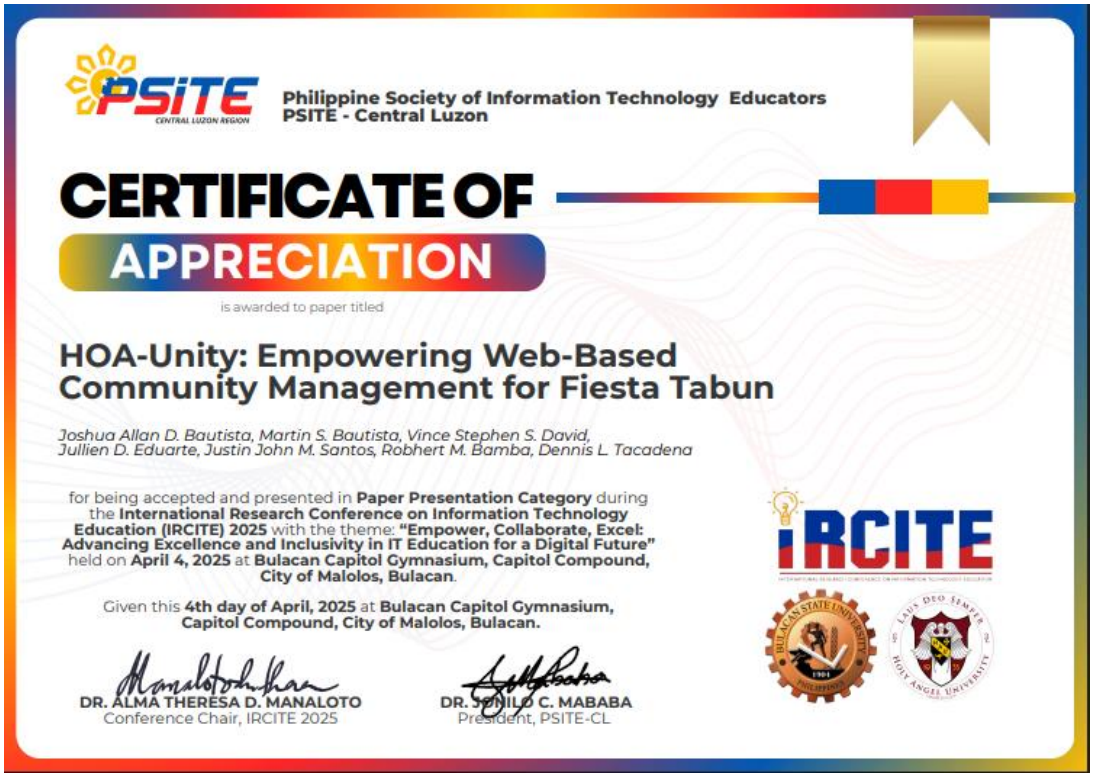

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Joshua Allan D. Bautista, Martin S. Bautista, Vince Stephen S. David, Jullien D. Eduarte, Justin John M. Santos, Robhert M. Bamba, Dennis L. Tacadena

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BREAK OUT ROOM
BUSINESS ANALYTICS

Session Chair: Dr. Virginia Franco Session
Panelist: Dr. Joseph A. Esquivel
Prof. Janette C. Carabeo

(Reminder: The researcher can have a 7-minute presentation and 3 minutes allotted for question and answer)

TIME/PRESENTER #		TITLE	AUTHORS/INSTITUTION
10:50 - 11:00	P1	GapoDeals: A Web and Mobile Marketplace for Secondhand and Best-priced Items in Olongapo City	Ehdrian Lester F. Lim, Maxinne D. Ogale, Jordan I. Magbanua, Ammiel L. Dela Fuente Gordon College
1:00 - 11:10	P2	Accountify: A Web-Based Accountant Prep and Review Platform with Integrated Study Tools	Joshua Reuben B. Camon, Myrna E. Cuento-Calma, Kristhine D. Aguas, Mary Angeline M. Dela Cruz, Cyril Jan O. Dela Peña, Verni Jahzreal A. Serrano, Dessa Lyn J. De Castro, Dennis L. Tacadena Mabalacat City College
11:10 -11:20	P3	The Importance Of Computerized Accounting Information System On Financial Reporting Quality	Melgie Monina M. Canlas, Mike Harold S. Constantino, Kyla Francheska C. Cunan, Ciella Mae B. Tongol, Kate Princess S. Villegas, Rosalinda E. Perez, Grace T. Tiqui University of Assumption
11:20 - 11:30	P4	Impact of Artificial Intelligence on the Academic Self-Efficacy of Accountancy Students in Pampanga	Kenzle L. Santos, Mikaela Janelle V. Ocay, Trisha Marie M. Ocampo, Alexa Marie T. Elveña, Aubrey Rose P. Rico, Mark Anthony D. Madalipay, Rosalinda E. Perez, Rosalinda Perez, Grace Tiqui University of Assumption

BREAK OUT ROOM INFORMATION
TECHNOLOGY

Session Chair: Dr. Lilibeth Antonio Session
Panelist: Dr. Everly M. Chua
Prof. Louella M. Salenga

(Reminder: The researcher can have a 7-minute presentation and 3 minutes allotted for question and answer)

TIME/PRESENTER #		TITLE	AUTHORS/INSTITUTION
			Gordon College
10:10 - 10:20	P5	ROOMIE: A Mobile Development For Room Scheduling And Availability Management System	Isaac Yancy Paala, Mikaela Camacho, Chabelita Dela Cruz, Hanz Philip D. Manaog, Sophia Rhyzelle T. Beloro La Consolacion University Philippines
10:20 - 10:30	P6	Web-Based Alumni Tracking System For Laverdad Christian College, Inc., In Apalit, Pampanga	Melanie Aina M. Lopez, Jade Riel H. Abuela, Monica T. Ocampo, Daniel Gaspar, Sharene T. Labung La Verdad Christian College
10:30 - 10:40	P7	"HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun"	Joshua Allan D. Bautista, Martin S. Bautista, Vince Stephen S. David, Jullien D. Eduarte, Justin John M. Santos, Robbert M. Bamba, Dennis L. Tacadena Mabalacat City College
10:40 - 10:50	P8	MINDCONNECT: A Mobile Platform For Mental Health Advocacy And Personalized Support Guidance	Iori Kel B. Biglete, Rhizza Mae C. Discaya, Aaron Carl E. Villaroman, Ken Lordian S. Derla, Florentino S. Casuco Jr. National University Baliwag
10:50 - 11:00	P9	ChefBuddy: A Mobile Application for Meal Recipe Generation Based on Available Household Ingredients	Iris H. De Jesus, Karl Gerald V. Silva, Chester Kelvin Alba, Erick C. Campano, Samuel S. Espino Jr. National University Baliwag
11:10 – 11:20	P10	Customizable Quiz App For Student Engagement And Performance Tracking	Matthew DR. Estrella, Carl Jeffrey C. Tamayo , Juan Miguel M. Escaño, Julius

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION AND CERTIFICATION OF ENGLISH CRITIC

(Full Paper - Oral Presentation)

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Bautista, Joshua Allan D., Bautista, Martin S., David, Vince Stephen S., Eduarte, Jullien D. and Santos, Justin John M. of the Institute of Business and Computing Education, **"HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun"** is valid and has 5.77 % similarity relative to internet databases.

This CERTIFICATION is issued this 12th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202478

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SCHOOLS DIVISION OF ANGELES CITY
SAPANG BATO NATIONAL HIGH SCHOOL - SHS
CAMILLA STREET, SAPANG BATO
ANGELES CITY

December 09, 2024

GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and gone through all the pages of the capstone research entitled ***"HOA-Unity: Empowering Web-Based Community Management for Fiesta Tabun"*** by Bautista, Joshua Allan D., Bautista, Martin S., David, Vince Stephen S., Eduarte, Jullien D. and Santos, Justin John M., as against the set of structural rules that govern the composition of *sentences*, *phrases*, and *words* in the English language.

Signed this 9th day of December in the year of our Lord, 2024 at Sapang Bato National High School, Senior High School, Sapang Bato, Angeles City.

Signed:

MS. LEONITA M. JACA, LPT, PAFR
Grammarian

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Aguas, Kristhine D., Camon, Joshua Reuben B., Dela Cruz, Mary Angeline M., Dela Peña, Cyril Jan O., and Serrano, Verni Jahzreal A. of the Institute of Business and Computing Education, **"Accountify: A Web-Based Accountant Prep and Review Platform with Integrated Study Tools"** is valid and has 7.54% similarity relative to internet databases.

This CERTIFICATION is issued this 10th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

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ANGELES CITY

December 09, 2024

GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and gone through all the pages of the proposed capstone research entitled ***"Accountify: A Web-Based Accountant Prep and Review Platform with Integrated Study Tools"*** as against the set of structural rules that govern the composition of *sentences*, *phrases*, and *words* in the English language.

Signed this 9th day of December in the year of our Lord, 2024 at Sapang Bato National High School, Senior High School, Sapang Bato, Angeles City.

Signed:

MS. LEONITA M. JACA, LPT, PAFR
Grammarian

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Aquino, Ramzel D., Caparas, Julius A-ron M., Layug, Joshua M., and Layug, Sherwin M. of the Institute of Business and Computing Education, **"Barangay-Connect: Enhancing Barangay Santa Ines Through a Community Website"** is valid and has 7.38 % similarity relative to internet databases.

This CERTIFICATION is issued this 10th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202476

Republic of the Philippines
Department of Education
REGION III – CENTRAL LUZON
SCHOOLS DIVISION OF ANGELES CITY
SAPANG BATO NATIONAL HIGH SCHOOL - SHS
CAMILLA STREET, SAPANG BATO
ANGELES CITY

December 09, 2024

GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and gone through all the pages of the capstone research entitled ***"Barangay-Connect: Enhancing Barangay Santa Ines Through a Community Website"*** by Aquino, Ramzel D., Caparas, Julius A-ron M., Layug, Joshua M., and Layug, Sherwin M., as against the set of structural rules that govern the composition of *sentences*, *phrases*, and *words* in the English language.

Signed this 9th day of December in the year of our Lord, 2024 at Sapang Bato National High School, Senior High School, Sapang Bato, Angeles City.

Signed:

MS. LEONITA M. JACA, LPT, PAFR
Grammarian

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Aguilar, Charles M., David, Stephen S., Fernandez, Keant A., Salalac, Mark Ian L., and Suing, Wency S. of the Institute of Business and Computing Education, **"Cyclotrace: Microcontroller-based Smart Vest Warning System with User Interface and Cyclist Emergency Locator"** is valid and has 4.82 % similarity relative to internet databases.

This CERTIFICATION is issued this 17th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202485

Grammarian Certificate

This certifies that the Capstone Research Manuscript titled **"Cyclotrace: Microcontroller-based Smart Vest Warning System with User Interface and Cyclist Emergency Locator,"** prepared by **Aguilar, Charles M., David, Stephen S., Fernandez, Keant A., Salalac, Mark Ian L., and Suing, Wency S.**, has been reviewed and edited for grammar, clarity, and language quality by the undersigned English Critic.

MR. GIAN CARLO M. PANGILINAN, LPT, MAEd
Grammarian

December 14 ,2024
Date Signed

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Africa, Wengmir A., Magtoto, John Ivan A., Manaloto, John Dale P., Peñamante, Tizha Nicole A., and Villamin, Justin Allan Y. of the Institute of Business and Computing Education, **"Dentally: A Patient Record Tracking System for Tooth Impression Dental Clinic"** is valid and has 6.07 % similarity relative to internet databases.

This CERTIFICATION is issued this 12th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga.

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202475

Republic of the Philippines
Department of Education
REGION III – CENTRAL LUZON
SCHOOLS DIVISION OF ANGELES CITY
SAPANG BATO NATIONAL HIGH SCHOOL - SHS
CAMILLA STREET, SAPANG BATO
ANGELES CITY

December 09, 2024

GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and gone through all the pages of the capstone research entitled ***"Dentally: A Patient Record Tracking System for Tooth Impression Dental Clinic"*** by Africa, Wengmir A., Magtoto, John Ivan A., Manaloto, John Dale P., Peñamante, Tizha Nicole A., and Villamin, Justin Allan Y., as against the set of structural rules that govern the composition of *sentences*, *phrases*, and *words* in the English language.

Signed this 9th day of December in the year of our Lord, 2024 at Sapang Bato National High School, Senior High School, Sapang Bato, Angeles City.

Signed:

MS. LEONITA M. JACA, LPT, PAFR
Grammarian

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Castro, Audrey Lynne L., Cortez, Jairha L., Guilas, Arel Loisel R., Sagcal, Kyla Karylle, and Tiamzon, Aleckzandra M. of the Institute of Business and Computing Education, **"ePasadya: An E-commerce System with Product Customization for Gawang Gamat"** is valid and has 5.92% similarity relative to internet databases.

This CERTIFICATION is issued this 10th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202474

GRAMMARIAN
CERTIFICATE

This certifies that the CAPSTONE RESEARCH MANUSCRIPT entitled **"ePasadya: An E-commerce System with Product Customization for Gawang Gamat"** prepared and submitted by **Castro, Audrey Lynne L., Cortez, Jairha L., Guilas, Arel Loisel R., Sagcal, Kyla Karylle, Tiamzon, Aleckzandra M.** has been duly edited and scrutinized by the English critic whose signature is affixed below.

PRINCESS R. TIAMZON-SAMSATANG, LPT, MAEd
GRAMMARIAN

DECEMBER 11, 2024
DATE SIGNED

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Borromeo, Choqho L., Cabrera, Charles P., Garcia, Gyan Iverson G., Manaloto, John Rendell P., and Tolentino, Manuel Rafael D. of the Institute of Business and Computing Education, **"BINhi: Seed Engagement of Barangay Mamatitang Through Reverse Vending Machine"** is valid and has 7.81 % similarity relative to internet databases.

This CERTIFICATION is issued this 12th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202480

GRAMMARIAN CERTIFICATE

This certifies that the CAPSTONE RESEARCH MANUSCRIPT entitled **"BINhi: Seed Engagement of Barangay Mamatitang through Reverse Vending Machine "** prepared and submitted by **Borromeo, Choqho L., Cabrera, Charles P., Garcia, Gyan Iverson G., Manaloto, John Rendell P., Tolentino, Manuel Rafael D.** has been duly edited and scrutinized by the English critic whose signature is affixed below.

GIAN CARLO M. PANGILINAN, MaEd, LPT
GRAMMARIAN

DECEMBER 11, 2024
DATE SIGNED

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Aguilar, Casandra Khrystin T., Diaz, Adrian C., Maglalang, Nikki Mae P., Mendoza, Prince, and Patawaran, Joash Flauta of the Institute of Business and Computing Education, **"HappyTeeth: A Web Based Appointment System for Ocampo Dental Clinic"** is valid and has 6.34 % similarity relative to internet databases.

This CERTIFICATION is issued this 10th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202473

CERTIFICATION

D Williams Educational Ventures
Blk 1, Lot 2 Thistle St. Sto. Domingo
Angeles City
Mikemesa94@gmail.com

CERTIFICATION OF ENGLISH GRAMMATICAL AND MECHANICAL CORRECTIONS

This is to certify that the paper titled:

HappyTeeth: A Web-Base Appointment System for Ocampo Dental Clinic

Submitted by:
Aguilar, Casandra Khristyn T.
Diaz, Adrian C.
Maglalang, Nikki Mae P.
Mendoza, Prince
Patawaran, Joash Flauta

has undergone proper English grammatical and mechanical corrections and editing. After a thorough review, it is confirmed that the paper is free from errors in grammar, mechanics, and clarity.

This certifies that the paper is now ready for presentation.

Issued this 12th day of December 2024.

MICHAEL A. MESA, LPT, Ph.D
English Grammarian
D Williams Educational Ventures, Inc
Lic#: 0049248
Valid: 09/10/2026

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Delara, Ronald Kris F., Gomez, Angelo, Gueco, Junel O., Romero, Jaimee P., and Waje, Allen Sherwin H. of the Institute of Business and Computing Education, **"Kapepongtsa: A Web-Based Ordering and Inventory Management System for YOBS Cafe"** is valid and has 7.59 % similarity relative to internet databases.

This CERTIFICATION is issued this 12th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga.

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202479

Republic of the Philippines
Department of Education
REGION III – CENTRAL LUZON
SCHOOLS DIVISION OF ANGELES CITY
SAPANG BATO NATIONAL HIGH SCHOOL - SHS
CAMILLA STREET, SAPANG BATO
ANGELES CITY

December 09, 2024

GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and gone through all the pages of the capstone research entitled ***"Kapepongtsa: A Web-Based Ordering and Inventory Management System for YOBS Cafe"*** by Delara, Ronald Kris F., Gomez, Angelo, Gueco, Junel O., Romero, Jaimee P., and Waje, Allen Sherwin H., as against the set of structural rules that govern the composition of *sentences*, *phrases*, and *words* in the English language.

Signed this 9th day of December in the year of our Lord, 2024 at Sapang Bato National High School, Senior High School, Sapang Bato, Angeles City.

Signed:

MS. LEONITA M. JACA, LPT, PAFR
Grammarian

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Caliuag, Abegail M., Calma, Junell S., Cordova, Arlyn R., Delos Reyes, Denzel, and Gopez, Gilbert G. of the Institute of Business and Computing Education, **"Mabalacat Dorm: A Web Application for Enhanced Tenant Monitoring and Management"** is valid and has 5.61 % similarity relative to internet databases.

This CERTIFICATION is issued this 12th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga.

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202481

GRAMMARIAN CERTIFICATE

This certifies that the CAPSTONE RESEARCH MANUSCRIPT entitled **"Mabalacat Dorm: A Web Application for Enhanced Tenant Monitoring and Management"** prepared and submitted by **Caliuag, Abegail M., Calma, Junell S., Cordova, Arlyn R., Delos Reyes, Denzel L., Gopez, Gilbert G.,** has been duly edited and scrutinized by the English critic whose signature is affixed below.

GIAN CARLO M. PANGILINAN, MAEd, LPT
GRAMMARIAN

DECEMBER 11, 2024
DATE SIGNED

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Binuya, Ronric Joel L., Miclat, Jimmuel P., Pacis, John Lloyd V., Solis, Cedrick John A., Teves, Patrick Lorence M., and Torres, Kgerone Lorenz M. of the Institute of Business and Computing Education, **"IOT Based Drinking Water Vending Machine with Sales and Level Monitor"** is valid and has 5.58 % similarity relative to internet databases.

This CERTIFICATION is issued this 9th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202472

Republic of the Philippines
Department of Education
REGION III – CENTRAL LUZON
SCHOOLS DIVISION OF ANGELES CITY
SAPANG BATO NATIONAL HIGH SCHOOL - SHS
CAMILLA STREET, SAPANG BATO
ANGELES CITY

December 09, 2024

GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and gone through all the pages of the capstone research entitled ***"MINUM: IOT Based Drinking Water Vending Machine with Sales and Level Monitor"*** by Binuya, Ronric Joel L., Miclat, Jimmuel P., Pacis, John Lloyd V., Solis, Cedrick John A., Teves, Patrick Lorence M., and Torres, Kgerone Lorenz M., as against the set of structural rules that govern the composition of *sentences*, *phrases*, and *words* in the English language.

Signed this 9th day of December in the year of our Lord, 2024 at Sapang Bato National High School, Senior High School, Sapang Bato, Angeles City.

Signed:

MS. LEONITA M. JACA, LPT, PAFR
Grammarian

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Mariñas, Edrian T., Medina, Prince Joie R., Muñoz, Jerald R., Perez, Luis Daniel G., and Tisuela, John Vergel C. of the Institute of Business and Computing Education, **"Transforming Pediatric Services with PatientPlus: A Web Application for Mabalacat Child Care Clinic"** is valid and has 4.64 % similarity relative to internet databases.

This CERTIFICATION is issued this 12th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202482

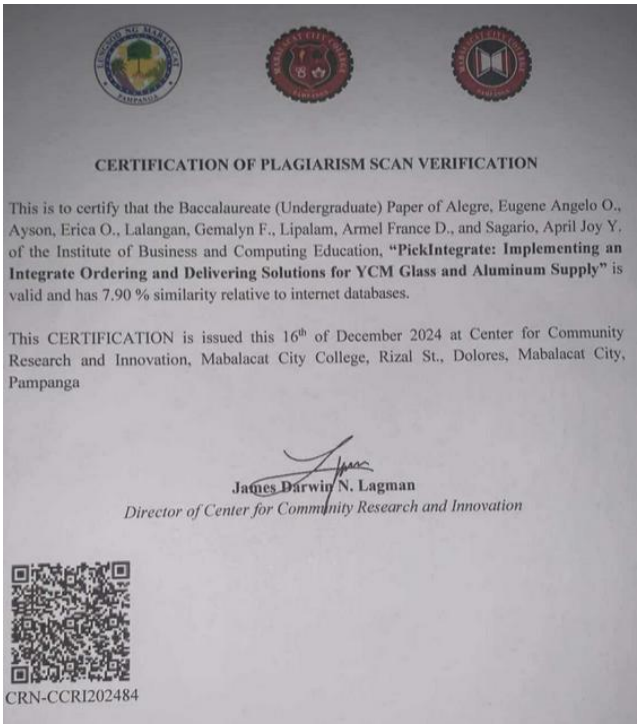
GRAMMARIAN

CERTIFICATION

This certifies that this CAPSTONE RESEARCH MANUSCRIPT entitled, **"Transforming Pediatric Services with PatientPlus: A Web Application for Mabalacat Child Care Clinic"** prepared and submitted by **Mariñas, Edrian T., Medina, Prince Joie R., Muñoz, Jerald R., Perez, Luis Daniel G., and Tisuela, John Vergel C.,** has been duly edited and scrutinized by the English critic whose signature is affixed below.

RICH PAUL S. LIM, EdD, LPT
ENGLISH CRITIC/EDITOR
Lic.No. – 133603

December 12, 2024
Date Signed



CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Alegre, Eugene Angelo O., Ayson, Erica O., Lalangan, Gemalyn F., Lipalam, Armel France D., and Sagario, April Joy Y. of the Institute of Business and Computing Education, **"PickIntegrate: Implementing an Integrate Ordering and Delivering Solutions for YCM Glass and Aluminum Supply"** is valid and has 7.90 % similarity relative to internet databases.

This CERTIFICATION is issued this 16th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202484

December 14, 2024

GRAMMARIAN'S CERTIFICATE

To whom it may concern:

This is to certify that the undersigned has reviewed and went through of the pages of the research entitled **"PickIntegrate: Implementing an Integrate Ordering and Delivering Solutions for YCM Glass and Aluminum Supply"** manuscript of,

Alegre, Eugene Angelo O.

Ayson, Erica O.

Lalangan, Gemalyn F.

Lipalam, Armel France D.

Sagario, April Joy Y.

as against the set of structural rules that govern the composition of sentences, phrases, and words in the English language.

Checked and signed:

Ms. Je-An Marie P. Cubelo
Lic. No: 1889420

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Delizo, Shanloyd C., Lee, Nathaniel N., Martinez, Walter D., Moreno, Henry Jr. S., and Sabile, Ria S. of the Institute of Business and Computing Education, **"QRCodeConnect: Elevating Student Attendance and Computer Monitoring at Mabalacat City College Computer Laboratory"** is valid and has 6.65 % similarity relative to internet databases.

This CERTIFICATION is issued this 16th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202484

Republic of the Philippines
Department of Education
REGION III – CENTRAL LUZON
SCHOOLS DIVISION OF ANGELES CITY
SAPANG BATO NATIONAL HIGH SCHOOL - SHS
CAMILLA STREET, SAPANG BATO
ANGELES CITY

December 09, 2024

GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and gone through all the pages of the capstone research entitled ***"QRCodeConnect: Elevating Student Attendance and Computer Monitoring at Mabalacat City College Computer Laboratory"*** by Delizo, Shanloyd C., Lee, Nathaniel N., Martinez, Walter D., Moreno, Henry Jr. S., and Sabile, Ria S., as against the set of structural rules that govern the composition of *sentences*, *phrases*, and *words* in the English language.

Signed this 9th day of December in the year of our Lord, 2024 at Sapang Bato National High School, Senior High School, Sapang Bato, Angeles City.

Signed:

MS. LEONITA M. JACA, LPT, PAFR
Grammarian

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Delos Reyes, Gabriel T., Litan, Faith Anne M., Lumanlan, Jaden Renzo P., Omandam, Patrick James, and San, Buenaventura, Jon Iris O. of the Institute of Business and Computing Education, **"VaXeen: A Website Utilizing Data Analytics to Monitor Animal Bite Rates at Mabalacat District Hospital"** is valid and has 8.76 % similarity relative to internet databases.

This CERTIFICATION is issued this 5th of May 2025 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202588

Republic of the Philippines
Department of Education
REGION III – CENTRAL LUZON
SCHOOLS DIVISION OF ANGELES CITY
SAPANG BATO NATIONAL HIGH SCHOOL - SHS
CAMILLA STREET, SAPANG BATO
ANGELES CITY

May 05, 2025

GRAMMARIAN'S CERTIFICATE

This is to certify that the undersigned has reviewed and gone through all the pages of the capstone research entitled ***"VaXeen: A Website Utilizing Data Analytics to Monitor Animal Bite Rates at Mabalacat District Hospital"*** by Delos Reyes, Gabriel T., Litan, Faith Anne M., Lumanlan, Jaden Renzo P., Omandam, Patrick James, and San, Buenaventura, Jon Iris O., as against the set of structural rules that govern the composition of *sentences*, *phrases*, and *words* in the English language.

Signed this 5th day of May in the year of our Lord, 2025, at Sapang Bato National High School, Senior High School, Sapang Bato, Angeles City.

Signed:

MS. LEONITA M. JACA, LPT, PAFR
Grammarian

CERTIFICATION OF PLAGIARISM SCAN VERIFICATION

This is to certify that the Baccalaureate (Undergraduate) Paper of Dela Cruz, Darrell John D., Dizon, Joeces Ian D., Salangsang, Rambo John D., Sanchez, Jeremy N., Telan, John Andrei S., and Tolentino, Onalee G. of the Institute of Business and Computing Education, **"Workonnect: WFH Client Monitoring with Payroll for Client-Based Employees"** is valid and has 5.78 % similarity relative to internet databases.

This CERTIFICATION is issued this 17th of December 2024 at Center for Community Research and Innovation, Mabalacat City College, Rizal St., Dolores, Mabalacat City, Pampanga

James Darwin N. Lagman
Director of Center for Community Research and Innovation

CRN-CCRI202486

GRAMMARIAN
CERTIFICATION

This is to certify that I, **Joyce M. Gamboa, LPT, MAEd**, have thoroughly reviewed and edited the manuscript entitled **"Workonnect: WFH Client Monitoring with Payroll for Client-Based Employees"**, authored by **Dela Cruz, Darrell John D., Dizon, Joeces Ian D., Salangsang, Rambo John D., Sanchez, Jeremy N., Telan, John Andrei S., and Tolentino, Onalee G.**.

The document has been carefully examined for grammatical accuracy, proper sentence structure, and adherence to the conventions of the English language, ensuring clarity, coherence, and consistency throughout.

This manuscript is now ready for submission, having been reviewed in alignment with established academic writing standards.

Joyce M. Gamboa, LPT, MAEd
Grammarian


INSTITUTE OF BUSINESS AND COMPUTING EDUCATION
MABALACAT CITY COLLEGE