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MESSAGE FROM THE DEAN

To our BSIT Student Researchers and Technical Advisers,

As the Dean of the Institute, I wanted to take a moment to extend my heartfelt congratulations on the successful completion of your teams' capstone project amidst the challenges posed by the ongoing COVID-19 pandemic. Your dedication and perseverance have truly shone through, and I am immensely proud of each and every one of you.

In spite of the challenges posed by the pandemic, you have demonstrated extraordinary determination, flexibility, and a strong drive for excellence. It is amazing to see how, in these difficult circumstances, you have created a remarkable capstone project, created innovative systems, and successfully defended and presented your work via virtual platform and networking events. Your proficiency in navigating the virtual environment is evidence of your dedication to learning and your unwavering will to achieve.

Furthermore, I want to acknowledge the incredible teamwork and collaboration that have been evident throughout this process. Despite the hindrances imposed by the pandemic, you have remained connected and engaged with your capstone team members, ensuring effective collaboration and the production of high-quality capstone documents and systems. This level of dedication and unity is a testament to your strength as individuals and as a collective.

Lastly, I express my heartfelt gratitude and admiration for the students whom remarkable research presented at the IRCITE 2021 virtual conference. Your dedication, expertise, and innovative approach truly stood out. Thank you for sharing your invaluable insights and for being an influential figure in the IT research community.

DENNIS L. TACADENA, PCpE, DIT

Dean, Institute of Computing Studies

Mabalacat City College

MESSAGE FROM THE RESEARCH INSTRUCTOR

Dear BSIT Student Researchers,

It gives me great pleasure to congratulate each and every one of you for finishing your capstone project successfully! Your remarkable abilities and knowledge are demonstrated by your hard work, devotion, and perseverance, which have paid off. The way you've interacted virtually, worked as a team, and used virtual venues to showcase your creative efforts is astounding. Your accomplishments are a reflection of your passion for technology and your ability to adapt to the ever-changing landscape of the IT industry.

I hope you will consider this as a chance to celebrate your accomplishments and feel proud of yourself. The culmination of all your work, your capstone project is a significant turning point in your academic career.

I'm honored to have played a part in guiding you through this process, and I'm confident that your skills and knowledge will serve you well in your future endeavors.

Congratulations once again on a job well done!

JONA P. TIBAY, LPT, DIT

Capstone Project Adviser, Institute of Computing Studies

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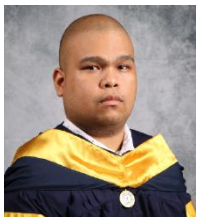

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BSIT

FULL PAPER PRESENTATION

ABSTRACTS

APARTMENT MOTO: A Mobile Application for Apartment Seekers in Mabalacat, Pampanga

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ABSTRACT
The study is to develop a mobile application for finding apartments in Mabalacat City, Pampanga. During the development phase, the researchers used Java as the programming language and Firebase Firestore as the database. Other services from Firebase were also used in the development aid the researchers implement the built-in solutions from Firebase. The objectives are to post, search, and to manage an apartments. With the data gathered, it is recommended for future studies to implement this using IOS and web browser with more advanced or smart filtering and payment methods added.

Categories and Subject Descriptors
Mobile Application

General Terms
Apartment Renting

Keywords
Combinatorial Algorithm, Apartment App, GPS

INTRODUCTION
For young people who have a decent job, but are not ready to buy a home yet, renting an apartment is a good idea; but renting can often be a long and nervous process. To find an apartment that will suit your needs and be cost-effective, proper planning and research is needed. In your search, you will most likely have to invest a lot of time and effort. The following are some tips that will ease the process of renting an apartment. [1]

Some people don't now have the privilege of owning a home, some rely on renting houses while dealing with their everyday struggles with their families or loved ones. Renting an apartment is a big benefit for those individuals who can't afford to buy a new home. And with the pandemic we are facing right now it is not safe to look for an apartment by stepping outside the field.

Apartment building, sometimes referred to as apartment block, or apartment block, consists of more than one residential unit, much of which is intended for domestic use, but also contains shops and other non-residential features. [2]

The online apartment listing industry is competing to offer more detailed accessibility and improved search choices, which helps tenants as a tap of a finger offers more valuable information. As rental apps grow, they not only make it easier to locate available apartments, but also provide prospective landlords with financial details from renters and allow tenants to pay rent after a lease has been signed. [3]

A tenant is a person renting a unit for a pre-determined lease period from a property owner or landlord. Typically, any person occupying the unit is called a tenant, so multiple tenants are often in a single unit. Tenants do not own the land, but the law and a signed agreement called a lease still have rights. [4]

Tenants don't get to just freeload housing from property owners. Though tenants have rights, they also have responsibilities, such as paying rent in full regularly, maintaining cleanliness and order in the unit, and not violating the quiet enjoyment of your neighbors

The best way to be a good tenant is to be familiar with the lease and to follow the rules set out there. Secondly, it is necessary to maintain an open and truthful line of

communication with the proprietor of the land. Beyond that, being friendly and accountable often does not hurt.

For individuals living outside their town or country, accommodation has been a major problem [5]. Accommodation for discomfort can cause tension, physical and psychological problems, as well as misery [6]. It is not easy to find an acceptable boarding house, limited data, relationships, mobility, and time were the key problems [6]-[10]. Several interrelated factors, including facility, price, reference, location, operation, protection, reputation, and advertisement, mainly account for the difficulty of boarding searches. The rental price, for instance, would be influenced by the distance from the campus of the boarding house, the facilities and the services offered at the boarding house. Although there are many suggested applications for boarding houses, most of them only show pictures, prices and other facilities defined by the owner. The popularity of smart mobile devices is growing fast [11].

A main reason for the popularity of smart mobile devices is the technological capabilities of these devices. Big displays, high resolution, lightweight, easy-to-use and ergonomic design, quick start-up time, multimedia content accessibility, just to name a few. [12]-[14]. Mobile touchscreen technologies, also known as tablet technologies, are revolutionizing young people's immersive digital experiences. Smart devices that accompany applications (apps) will hopefully create exciting and efficient learning and entertainment environments.

The search for an apartment and boarding has become a difficult task, whether for rent or permanent residence. But these tasks can be made simpler with the assistance of mobile apps and websites that can help people search for a home. Since mobile apps would make this job simple in the era of smart phones.

The researchers came up with the concept of making a mobile application, APARTMENT MOTO: A Mobile Application for Apartment Seekers in Mabalacat, Pampanga, helps apartment seekers rent an apartment by just browsing apartment listing, viewing details and images uploaded by the landlord, viewing the location of the apartment, and applying for tenant of the apartment. The application will also help landlord to rent their property in the application by just giving the details, images, and using the integrated map to locate their property.

General Objectives

The general objective of this study is to develop a mobile application for finding apartments in Mabalacat City, Pampanga.

Specific Objectives

1. To develop an android application apartment finder in Mabalacat City that provides apartment details such as number of bedrooms, square meters, location, images, and videos.
2. To integrate Firebase Authentication to handle the registration and login of the users.
3. To integrate Firebase Cloud Messaging services to Android's native notification for receiving notifications.
4. To integrate Google Maps API for displaying the location of the apartments.
5. To develop the application using Java as the programming language, Android Studio as the IDE, and Adobe XD for designing the application's user interface.

Scope and limitations

The study covers the android application that helps you find an apartment. The application will give you a list of apartments uploaded by the landlord. Apartment details can be seen in the application such as the location, images, price, number of bedrooms, and the square

meters of the apartment. Apartment seekers can apply to be the apartment's tenant.

The landlord, who uploaded the apartment, will now receive a notification that apartment seekers wants to be a tenant of the said apartment. The landlord will select the seeker he/she wants to be a tenant.

After the selection of the apartment's tenant, apartment seekers who sent an application will receive a notification. Notification for the accepted seeker will be receiving a different notification from the unaccepted seeker. Notification will be playing an important role in this application to give users a response from their action just like the said scenario.

Firebase was the primary service implemented in the application. The following services were used: Firebase Firestore was used in this application as the database. The researchers used Firestore because scalability is the thing in using this NoSQL database. Firebase Storage was used to store images. Easy to use, just call the function. Firebase Authentication was used for user registration and login. Firebase Authentication will handle user data security.

Cloud Messaging was used for handling notifications. Google Maps API was used for location the apartment. Geolocation was used to provide the user's current location and decoding the Latitude and Longitude to a human readable address of the apartment.

The study covers only within Mabalacat City, Pampanga because of the design restrictions, so it will not be available in other cities and regions. For payment methods, the researchers did not use any of the existing payment methods such as PayMaya, GCash, PayPal, and others. The researchers interviewed some apartment owners in Mabalacat City for gathering information. This application will be beneficial for apartment seekers who want to rent an apartment in Mabalacat City.

SYSTEM DEVELOPMENT METHODOLOGY

To gather information on the internet about the old ways of finding a rental apartment and how the new online Apartment Finder application operates, this study used descriptive analysis techniques.

In software development, Iterative Model was used in developing the application.

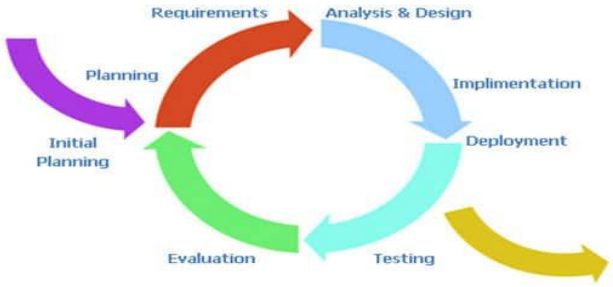


Figure 2. The Prototyping Model

Data Gathering

The Iterative Model is a basic implementation of a life cycle of software development (SDLC) that focuses on an original, simplified implementation that gradually gains more complexity and a wider feature set before completion of the final framework. The definition of incremental growth can also often be used liberally and interchangeably when describing the iterative process, which defines the incremental improvements made during the design and implementation of each new iteration.

Planning and Requirements

In order to diagram the design materials, define software or hardware requirements, and generally plan for the next cycle stages, the first stage is to go through an initial planning process. The researchers investigated the old ways of finding apartments with the new online apartment finder in Mabalacat city as the question was identified. The information collected was used to assess the needs of this report.

Analysis and Design

If the planning has been completed, a review is conducted at this stage to nail down the

required business ideas, software models, and the like for the project. The stage of architecture also occurs here, specifying the functional requirements (languages, levels of data, infrastructure, etc.) that will be needed to meet the needs of the research stage. To design the submission, the following were used:

Storyboard

Consists of a display of the screens in an app and their transitions.

Visual Table of Contents

A top-down hierarchical structure is used to analyze, discuss and better understand the functions of structures and their relationships.

Entity Relationship Diagram

A structural schematic sort used for the design of the database. The scientists used the logical ERD model to enrich a conceptual model, specifically identifying columns of individual entities and adding operational and transactional entities for this study.

Use Case Diagram

This demonstrates the function and the interaction between each user and applications. It refers to the relationship between external items and the application itself and thus to the purpose of application. The use of Case Diagram is a virtual method for displaying, using and preserving system actors.

Implementation

Up to this point, all planning, specification and design documents are coded and implemented for this initial project iteration.

Testing

Developers may decide how their coding and technologies perform according to the customer requirements through the assessment process. Even if it is not possible to solve all the problems you might face during the testing process, the results of this phase will be used to minimize the number of errors within the software framework. During the testing process, the following software tests are used:

Software Testing

Since they cover many common screen sizes and aspect ratios, these devices were chosen. Emulators are beneficial when checking user interface configurations, but they often operate substantially slowly compared to physical device. For evaluating performance issues, physical devices should be used. During creation and research, the program was evaluated on the following physical devices:

Compatibility Testing

It is a type of test in which the behavior and operation of software, web servers, equipment and network settings are validated in a particular context.

Testing for compatibility ensures that the programs, different databases, multiple apps and their variants can run on a specific device. The testing department does the assurance of reliability.

Evaluation Phase

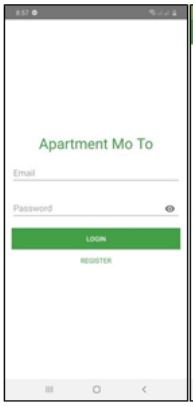
If all the previous stages have been completed, it is time for a thorough evaluation of progress up to this stage. It helps the whole organization to determine where the project is now where it needs to be what may or would change, etc., as well as stakeholders or other third parties. In this phase, the researchers used Formative Testing to ensure that an implementation operation is realistic, acceptable, and fair before it is fully implemented. Usually, when a new method or procedure is being developed or an existing one is being revised or modified, the researchers conduct the assessment.

RESULTS AND OUTCOME

In this section the results of the study are presented and discussed with reference to the aim of the study, which was to develop a mobile application for finding apartments in Mabalacat City, Pampanga.

Android Application Storyboard

Login



Register

Apartment Listing

Map View

Account

Development and Testing Results

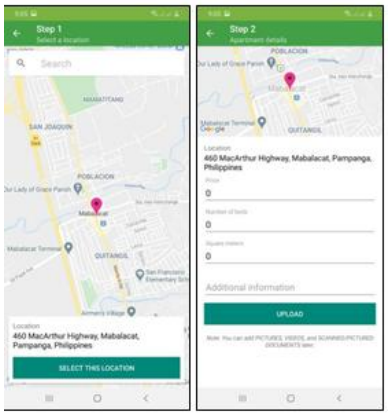
During the development phase, the researchers used Java as the programming language and Firebase Firestore as the database. Other services from Firebase are also used in the development to help the researchers to implement the built-in solutions from Firebase.

For authentication, the researchers used Email and Password, Google sign-in, and Facebook sign-in. Authentication is necessary to make sure that no one is anonymously using the application.

The researchers implemented features that available in existing applications and added some own features to make the user experience better.

The application was tested by the researchers using their android phones to make sure that all functionalities are working. The following are the android phones used in testing:

Post Apartment



Test Case is a specification of the inputs, execution conditions, testing process, and expected outcomes that describe a particular test to be conducted to achieve a specific software testing objective, such as exercising a specific program path or checking compliance with a specific condition. Test cases are based on methodical rather than haphazard experiments. With the optimal coverage of the software being tested, a battery of test cases may be built. Formally specified test cases

allow the repeated running of the same tests against successive versions of the program, allowing efficient and reliable regression testing.

The test case was conducted by the researchers in order to ascertain whether the application is actually working for the application's actual release. Testing is the final step by step verification before the application is finally published to potential applicant users.

Prototype

The application prototype directs user interface programming and business logic in the application. In addition, the prototype provides a navigation guide for activities in the program, which corresponds to specific behaviors in the user interface. Different UI components will be used in each operation based on the application's different behaviors.

Bottom Navigation is the main navigation system based on prototype navigation methods. Bottom Navigation will allow a group of activities to jump from the root activity to each individual feature, as well as provide intuitive back/forward functionality for the user.

Implementation Results

It wasn't easy to get the Android app up and running. The researchers, on the other hand, used the Iterative Model as a reference in designing the program. Using available tools such as software, hardware, the internet, and thesis, the researchers were able to implement the application.

The next major move for the researchers was to implement functionality, but the researchers were able to do so with the aid of online tutorials and guides. The researchers were able to find the bugs and errors in the application by repeatedly testing it.

DISCUSSIONS

The researchers needed requirements in developing and testing the android application. The software needed to develop and design the application is Android Studio. For hardware requirements a personal computer was used with specs of Intel Core i7 8th gen, 16 GB of ram and a graphics card of NVIDIA 1660ti. In order for the android application to be tested the researchers should have at least have an Android Version 5.1 (Lollipop), 1GB Ram and a 4GB internal storage.

In development phase, the researchers used Firebase services as the back-end of the application. It makes the development easy, fast, and secured. Firebase helped the researchers implement features and to shorten the development time.

Testing the application many times is necessary before the deployment. The researchers used the test cases with the criteria of: Performance Security, Compatibility, Portability, Functional Suitability, Reliability, Usability, and Maintainability. Testing results were great and during testing phase bugs/errors were found and fixed immediately.

Conclusions

The focus of this study is to develop a mobile application for finding apartments in Mabalacat City, Pampanga. The objectives are to post an apartment, search for an apartment, and to manage apartments.

The researchers were able to achieve the study’s aim. The application worked very well on the supported Android operating system, and users were able to achieve the expected performance from the application. The user interface design of the application performed well on device screens used during the testing phase. Users were able to understand and use the framework modules with ease, while developers received limited assistance.

The Iterative approach motivated the program's supporters while designing it.

The diagrams used allow the researchers to interpret the application flow; these diagrams served as a reference for the researchers during application development to describe the overall application flow.

Recommendations

Based on the results of the findings and conclusions gathered, the researchers would like to recommend the following:

Implement the project in web and IOS.

Add more advanced or smart.

Add an Artificial Intelligence to recommend apartments by checking the user's most searched and most visited apartments.

Add a payment method like Gcash and Paymaya.

Add a feature that will filter it by barangay.

Use other database for more query features.

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AquaPhoto Matrix: A Microcontroller-Based Culturing of Plants and Fish for Energy Efficiency with Mobile Application Interface

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ABSTRACT
The Philippines weather has been erratic through the years due to the climate change. Farming has been affected because our soil hardens causing the plants to die. Food distribution is being affected as well. This project will introduce the integration of cultivating tilapia and growing vegetable together through aqua-photo matrix. The researchers built a prototype aquaphonic with an automated watering and feeding system. Water system consist of two pumps – one from reservoir going to aquarium and the other from aquarium going to the plants all through pipes. For the feeding system, linear actuator is the main control in which this will open and close on the specified time the fishes are fed. Environment parameters such as pH water level, water temperature, and tank's water level are observed through a real-time monitoring mobile application. On the mobile app, the end-user could check the status of the water quality. Moreover, the user could manually be activated the water pumps and feeder assembly. The researchers met all the objectives set in doing this project. The researchers were able to construct an aquaponics with watering and feeding system where user could monitor the parameters and control the water pump and feeding system. Though, it is recommended to use curve traces to measure the efficient of the sensor modules. Also, it is advisable to include more water quality factors like water cleanliness and water supply to further improve the system.

INTRODUCTION
The food production and distribution systems look disastrous nowadays. Excessive use of pesticides, fertilizers, soil sterilization and mono-cultural crops has a huge impact on natural ecosystems and biodiversity on Earth. Climate change and increasingly severe droughts, in return, hinder farming and cause drastic increases in food prices. If that was enough, about one third of the bins and landfills while one in nine people in the world suffer from malnutrition, the situation calls for a redefinition of agriculture, as we know today. There is no simple remedy for complicated problems of modern agriculture and food distribution. Many people say, however that hydroponics can be one of the steps to repair them. In this study, the researchers are interested in the creation of a well-innovated farming of fish and plants at the same time.
The researchers then thought of Aqua-photo matrix system and hardware assembly to help on the food distribution currently facing by the society. Aqua-photo matrix system is the one responsible for the cultivation of basic farming through fishes and plants. Hardware system, on the other hand, makes use of microcontrollers such as water pump connected to other sensors inside the aqua-photo system to create an automated regulator. Data from the system will be sending through a server to a wireless network feature so that user can monitor via web application and android application. This application software can also help the user control the parameters and actions needed to do by the system. This will help the user efficiently do farming without physical be present near their fishes and plants.

Background of the Study
The climate in the Philippines is high humidity and high temperature. PAGASA forecasted that during the period of May 26 to May 28, 2015 in Pampanga, the temperatures ranged from 38.9°C to 40.5°C [1]. Philippines' topography

and weather is perfect for an Aqua-photo matrix. The problem also being faced on most aqua-photo system is the formation of algae, which will affect the nutrition of water and could deplete the oxygen. Another is maintaining the right temperature of water. However, many aqua-photo systems nowadays do not have real-time monitoring of PH level, temperature, water level and feeding systems for plants and fish feature. This feature is useful in giving food at particular times of the day for both parties without a man control. Moreover, the system can check water level thus will act to supply water given the minimum requirement set by the user. This can help in minimizing the workload of the user to initiate a contact with the cultivation of plants. The real time monitoring system in this study provides a measurement of the right cycle process. The project will use crayfish or tilapia because they are normally dirty and produce a type of nutrients that the plants like [2].

Objectives of the Study

The project is focused on the design and development of aqua-photo matrix system feature with real-time remote monitoring and controlling. It aimed to optimize the amount of energy cost to run a basic farming and give you the control in feeding and supplying the need in cultivating a farm. The following specific objectives are the following:

1. Construct integrated fish pond and plantation with attached watering system and feeding system
    1.1 Create a watering system to sprinkle water to the vegetable plants and refill water tank for the fishes.
    1.2 Automatic feeding module for the fish tank considering the age and quantity
2. Develop a mobile app that will monitor the following parameters of water:
    2.1 Fish tank water level.
    2.2 Fish tank water temperature
    2.3 Fish tank water pH level
3. Develop a mobile app that will control the following water pumps:
    a. Activate the vegetable plants water pump
    b. Activate the fish tank water pump
    c. Activate the fish tank reservoir water pump.

Scope and Limitation of the Study

The prototype will include three different monitoring parameters through mobile application which are: fishpond water level, temperature and PH level. The capability of the proposed aqua phonic would be activating the two water pumps to automatically water the vegetable plants and fill the pond when it reaches minimum volume of water. In addition, the aqua phonic system will also include feeding the fish.

The proposed system will not include automatic distribution of external fertilizer aside from the natural cycle of providing the plants the nutrients coming from the water of the pond and vice versa. The need for automatic cleaning of the water in the pond is another consideration for one of the future references. Instead of automatically turning on the pump to water plants based on the moisture content of the soil, the amount of volume of water will depend on the set length of time the water pump is activated. Additionally, the over flowing of water from the fishpond will be another factor for future improvement of the system. The responsiveness capability of the mobile application is another limitation. Other factors that are not mentioned will also be part of the limitations of this project.

SYSTEM DEVELOPMENT METHODOLOGY

The research design model used by the developers was prototype model. Prototyping Model is a software development model in which prototype is built, tested, and reworked until an acceptable prototype is achieved. It also creates base to produce the final system. Figure 8 Shown below will describe the steps on how to achieve the final product.

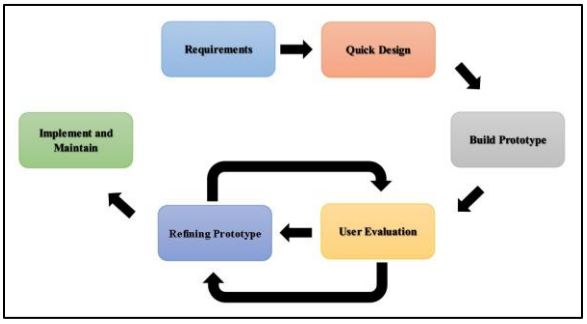

Figure 8. Prototyping Model

Requirements gathering and analysis
A prototyping model starts with requirement analysis. In this phase, the requirements of the system are defined in detail. During the process, the users of the system are interviewed to know what is their expectation from the system.

Quick design
The second phase is a preliminary design or a quick design. In this stage, a simple design of the system is created. However, it is not a complete design. It gives a brief idea of the system to the user. The quick design helps in developing the prototype.

Build a Prototype
In this phase, an actual prototype is designed based on the information gathered from quick design. It is a small working model of the required system.

Initial user evaluation
In this stage, the proposed system is presented to the client for an initial evaluation. It helps to find out the strength and weakness of the working model. Comment and suggestion are collected from the customer and provided to the developer.

Refining prototype
If the user is not happy with the current prototype, you need to refine the prototype according to the user's feedback and suggestions. This phase will not over until all the requirements specified by the user are met. Once the user is satisfied with the developed prototype, a final system is developed based on the approved final prototype.

Implementation and product maintainance
Once the final system is developed based on the final prototype, it is thoroughly tested and deployed to production. The system undergoes routine maintenance for minimizing downtime and prevent large-scale failures.

Experimental Hardware Design Prototype Testing
The experimental hardware design prototype will use independent statistical
t-test analysis to compare the output generated of a common fixed-tilt orientation of the solar panel to the experimental hardware design of a variable-tilt orientation of the solar panel.

Testing
In this step, the prototype and the mobile application are then put forward as a trial to observe and examine their possible strengths. Note that test cases were considered according the functionalities of the product.

Refining Prototype
In this step, all the feedbacks, additional observations, ideas, and recommendations from the clients were analyzed and added to enhance both the hardware prototype and the mobile application. The researcher had to make some adjustments to the prototype based on the client's feedback.

Final Product
When all the steps and several repetitions the researchers came up with a working prototype. Product implementation is finally achieved.

RESULTS AND OUTCOMES

Construction of the Watering System
Figure 9 illustrate the aquaponics system with attached feeding system and water system installed on a 115cm x 91cm x 51cm aquarium and reservoir. To allow the water to flow uniformly across the aquarium and to water the plants and others, a tube made of polyvinyl chloride with a diameter of 2.5cm and with length of 1051cm for aquarium and 185cm for reservoir was used. Big pipe was drilled with holes and had a distance from one another to have space for the plant to grow specially the leafy vegetables. Additionally, reducer is used

as the pump is design for a tube of 3.5 cm tube.

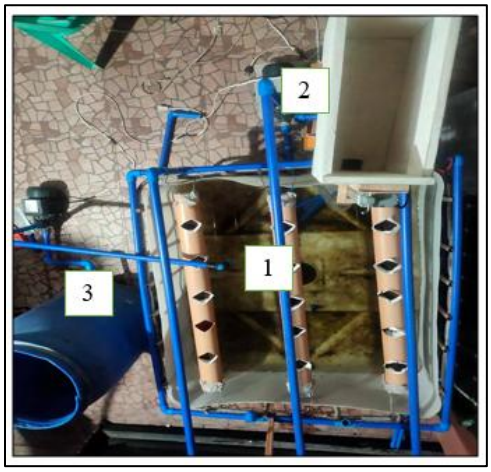

Figure 9. Top View 1- Aquaponics system, 2 – feeding system, 3 – water system

Creation of Water System

The water system has two main functions. The green arrows in Fig 10 show the flow of water coming from the aquarium going to the plants through the pipes. The pump will help suck out the over flowing water from the aquarium and transport it upwards to the pipes. The pipes have holes in which directly sprinkle water to the plants located on the big orange pipes. Once the aquarium is below the required water level, the pink arrow in Fig 10 shows the flow of water to refill the aquarium. From the drum, serves as water reservoir, the pump will suck out water and push it through the pipe going to the aquarium.

Figure 10. Watering System Setup

Pump 1 will on when the water temperature in the fish tank increases to 36 Celsius above until it decreases to its standard temperature of 36 percent below. If the pH level of water in the fish tank increases to 7 and the water decreases to 4, the first pump will release water out of the tank. While the second pump will refill the tank until the pH level return to the standard pH level in the fish tank. The first water pump will also un-fill water as the water level rises at 25cm while the second water pump will on when the water level in the fishpond drops at 20cm for the supply of water up until the water level back to the standard level. See below Fig 11 to understand the water system flow chart.

Automatic Feeding Module

The linear equator, the metal part in Fig. 12, is used to control the feeder. The system will feed the fish twice a day at 8AM and 3PM. If the food released by the feeder is short, the user can feed the fish manually. There is an option in the user interface of the application to feed the fishes again with desired grams, which you can calculate depending on the age and quantity of the fish, seen on Fig. 13. There is an option at the bottom to increase the grams.

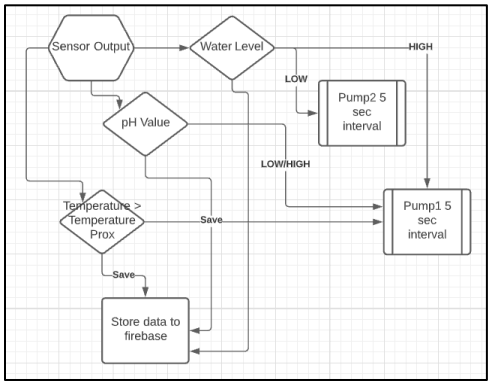

Figure 11. Watering System Flow Chart

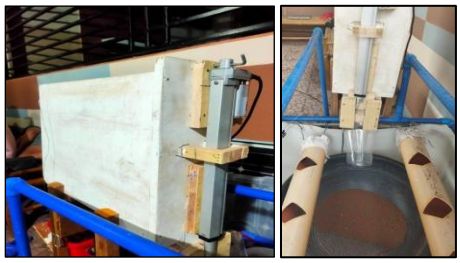
Figure 12. Fish Feeding System

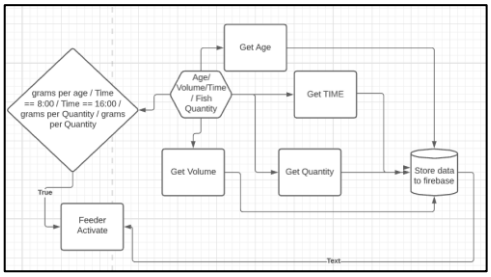

Figure 13. Fish Feeding System Flow Chart

Development of Mobile Application to Monitor Fish Tank Parameters

The researchers were able to construct real-time monitoring for the plants and fishes. The transmission of data was done through a cloud database (Firebase) with the help of internet connection through wireless connect. Users could monitor through wifi as long as connected in the local router. The generated energy produced from modules was loaded to the firebase and the mobile application reacts to the data in the firebase.

Data were displayed in the mobile application. Figure 14 displays the home page of the mobile application. The AquaPhoto Matrix App is a web-based mobile application that appears on a Mobile Remote Application that has a title bar, image, label and buttons for the layout that connects with firebase for the function of the system to interact with different users. Users require the MIT App Inventor connects with their phone in order to control the Mobile Remote App to feed the fish, water level and the full cycle of water in the fish tank. Lastly, Mobile Remote App refers to the fully function of the Aquaphoto

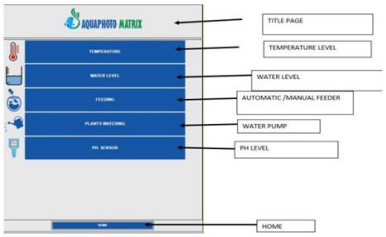

Figure 14. Mobile Application Homepage

Matrix to control manually the pH level, water level and the fish feeder. Mobile Remote App Allows you to see the label of pH level, temperature level, water level whether it is in good or bad condition, water pump if it is active or non-active and process of feeder in case it is on/off. The real-time monitoring system was able to measure the water temperature, water level, and pH level with accuracy.

Fish Tank Water Level

The distance sensor was used to monitor the water level of the fish tank. The distance sensor was place on the top of the water in the fish tank detects the water level if it is below 15 cm; the second pump will automatically turn on that refill until it maintains the standard water level of the fish tank. The distance sensor detects the water level is above 25cm, the first pump will automatically turn on to un-fill the fish tank and water the plants. The researchers tried to test the accuracy of the distance sensor. When a hand covered the pet bottle (signifies highest level), shown in Fig. 15 that sensor detected and obstruction resulting to 100% meaning full height. On the other hand, when hand was removed, the sensor did not detect anything resulting to 0%. In Fig. 16, the actual water

level was measured using a meter tape and as detected by the distance sensor both accurately shows 33cm.

Figure 15. Testing the Distance Sensor

Figure 16. Water Level

Fish Tank Water Temperature

The temperature sensor - is used to monitor the water temperature of the fish tank. It was observed that the monitoring interface reacts based on the temperature sensor. Figure 17 illustrates the difference of the two modules via thermal gun and DS18-b20. The monitor on the left is using DS18-b20 and the module on the right is the thermal gun. It denotes that the temperate being sent to the mobile application is accurate. Using a temperature gun showed a -1 degrees Celsius variance compared to the 2 different modules to calibrate the water temperature of the pond. Their variance won't affect the flow of the system as the temperature safe for the fish and plants is calculated on the range of 17 – 34 degrees Celsius.

Figure 17. Temperature Sensor vs Thermal Gun

Fish Tank Water pH Level

Using the liquid pH sensor, water pH level was able to measure. In Fig. 18, the mobile app shows a value of 6 which is within the set allowable acidity of the water. Whenever the pH is beyond the range of 4 to 7 pH, the water will be released because this water is believed to be not healthy for both plants and fishes. The sensor and pump were successfully working to maintain the right pH level of the system.

Figure 18. pH Sensor Monitoring System

Development of Mobile Application to Control Water Pump

Figure 19 are screen shots from mobile app for the pH level, water level, water temperature. As seen, there's an "ON" button box for each parameter. This button is the switch and the control of the user to manually activate the water pumps. For example , the water becomes dirty and it is beyond the factors being considered by the system, the user could activate the needed water pump to clean the water.

Figure 19. "ON" Button to Activate Water Pump

Aside from the water pump, the user could also manually increase the amount of feeds being given to the fishes may it be because of the weather or the need for more nutrients. In Fig. 20, additional feeds are by increment of 100 grams only.

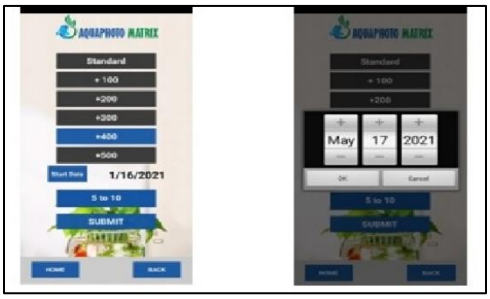

Figure 20. Options to Increase Amount of Fish Feeds

DISCUSSIONS

The constructed aquarium is made of plastic container with pipes surrounding it as pathways of water. The watering system is functioning as way to refill the fish tank and to water the plants. The pumps will turn on if the water level is beyond the range of 15cm to 23cm, out of the threshold temperature, and if the pH level is below 4 and above 7. Feeding system is dependent on the fish age, quantity and standard feeding amount.

Several modules and sensors were attached to monitor the pH of the water, the temperature, and water level respectively. Measured values were transmitted to the microcontroller and send via Wi-Fi module so that user could view it on their mobile phones. The watering system and feeding system will react based on the measured values so that it will maintain the water quality on its healthiest state for the fishes and plants. Users have also the power to control and navigate the parameters through the mobile app.

The researchers were able to construct an AquaPhoto Matrix system and provide a watering system for the plants and fishes, feeding system for the fishes and able to monitoring each factor: threshold temperature, flow rate, pH level, water level, fish quantity, plants status and water storage material. The real-time monitoring system was able to measure the pond/aquarium and plant pots and was able to obtain the total efficiency and accuracy of data monitoring.

The problems encountered by the researchers are the troubleshooting of the electrical circuiting, a device that measures the grams of feeding system, its efficiency, and the pandemic. The research can gather more reasonable data during the GCQ General community Quarantine.

As for the recommendations,

- Use curve tracers or similar technology to measure the efficiency of the modules.
- Consider adding cleaning chemicals to water to clean the smudges and particles in the surface pond to prevent manual cleaning.
- Build the watering system setup with source from the unlimited source for water replenishing.
- Improve the construction of the module position to have a stronghold that can surpass any environmental impact.

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BALIKTANAW: Filipino Tribes Cultural Mobile-Based Application for Android

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ABSTRACT
The researchers studied the lifestyle, culture and biography of the Filipino Tribes and learned that they are rich in meaningful history, making up a big part of the Philippine history. The study aimed to create and develop a mobile application that can give importance to the Filipino Tribes most especially from remote areas of the Philippines. Specifically, the researchers wanted to develop an android mobile based application about Filipino Tribes where the lifestyle, culture, and biography of each tribe were presented. This mobile application can help share the lifestyle, culture, and biography of the Filipino Tribes to other interested audience. The application was proven to be functioning correctly based on the identified objectives. Adobe Phonegap was used in developing the application, Adobe Photoshop CS6 in editing the images, Kinemaster Pro in editing video presentations and Ibiz Paint in drawing the images of specific tribes. The application had undergone testing using test cases. Its functionalities were working correctly based on specifications and was proven to be usable and compatible with android version 7.0 and above. The researchers also uploaded the application to Google Play after refinement was done to it.

Categories and Subject Descriptors
Mobile Application, Educational Application

General Terms
Android Applications, Mobile Applications

Keywords
Baliktanaw, Filipino Tribes, Filipino Culture

INTRODUCTION
Indigenous term refers to an ethnic group; they are the Filipino tribes. Over the time, many people have become accustomed to listening and to reading the lifestyle, culture and biography of indigenous people in different books and newspapers.
It is such an interesting thing to know the life, culture and biography of the indigenous people. Apart from the colorful cultures, people can learn a lot from indigenous people that can past onto the next generation.
Since most of the people are already using cellphones, laptops, and various modern devices, the mobile application entitled "BALIKTANAW" can be a means to reach more audience and instill knowledge pertaining to our own tribes in the Philippines. The word BALIKTANAW comes from the Tagalog word which means *"to look back from the past".* This mobile application contains lifestyle, culture and biographies of the native Filipino people. This mobile application uses animation, actual photos and videos to make it even more interesting to the users.

General Objectives
The purpose of this study is to create and develop an android mobile application about the lifestyle, culture and biography of the native Filipino tribes.
Specifically, the study aims;

1. To design and develop a mobile application that details about different tribes, images and videos associated with them.
2. To develop the application using Adobe Phnegap, Adobe Photoshop CS6, Kinemaster Pro and Ibiz Paint.
3. To test application's functionality, usability and compatibility using test cases.

Scope and limitation
This application include 30 Filipino tribes. The applicaont will provide details about the different tribes.
Description about culture and biography of the Filipino tribes was presented and included in

the applicaiton. The application also provide important images of the different tribes. Videos associated with them are also included.
The application was developed using Adobe Phonegap was utilized, Adobe Photoshop CS6 for editing the images, Kinemaster pro for editing video presentation and finally Ibiz Paint for drawing images included in the application
After development the applicaiton will undergo testing of its funcitonality, usability and compatibiliyt. This criteria will be tested uisng test cases created by the proponets in order to fully test the said criteria. The application is compatible with android versions 7.0 (Kitkat) and up.

SYSTEM DEVELOPMENT METHODOLOGY

The Prototyping Model was used to develop the application. The phases of the model include requirements gathering, quick design, building prototype, refining prototype and finally deployment of the final product.

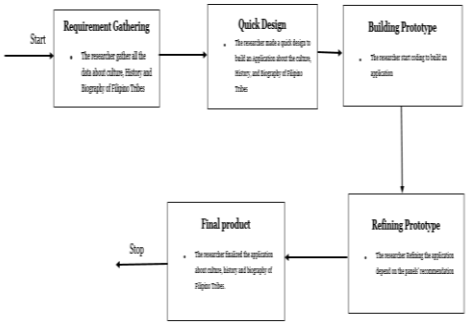

Figure 1: Prototype Model
(Source: http://tryqa.com/what-is-prototype-model-advantages-disadvantages-and-when-to-use-it/)

In Gathering Requirements Phase of the Project, the proponents will identify the primary requirements that were needed. The proponents will make a data gathering through research of online sources and finding a History expert afterwards, some of the questions that were asked were: what would be the content that should be seen inside the application? What would be the other features that in the end, will provide the overall experience of learning? The goal was to define the user requirements, to analyze the flowchart of the application and its algorithm.

In the Quick Design Phase, the proponents listed down some possible concepts and designs of the application to be worked out. After some time, the proponents came up to an idea to create designs based on the history of the Tribes. The concept was based on the Philippines Tribes, where it shows their past life and history that has been part of the country's major part of literature. Then, the proponents put in place the designs for the application.
To develop the application Adobe Phonegap was utilized, Adobe Photoshop CS6 for editing the images, Kinemaster pro for editing video presentation and finally Ibiz Paint for drawing images included in the application.
The first version was updated based on the additional feedback and suggestions obtained from the panel members during defenses. The assigned graphic artist completed the designs as quickly as possible, and the programmer began building and developing the app. The application's features were also designed to make the programmer's job easier. The splash screen, menu, and the other features were also provided to the programmer to be developed in order to achieve the desirable outcome of the application and its objective.
The prototype's development and refinement continued until all of the feedback and recommendations were taken into account. Final prototype was developed and each and every one of feedback and recommendation are addressed. The application had undergone testing using test cases. Functionality, usability and compatibility were tested.
The final version was published in the Google Play Store. This would make the application available to potential users of the application.

RESULTS AND OUTCOMES

This section entails if the objectives presented in the study had been achieved.

Figure 2: Baliktanaw Logo

The figure 2 is the application's logo that represents the knowledge, his eyes symbolized of words Baliktanaw or looking back from the past. The Pluma pen which represents the written history and the brown color represents the Filipino tribes. After several venture to create the logo this was the final result.

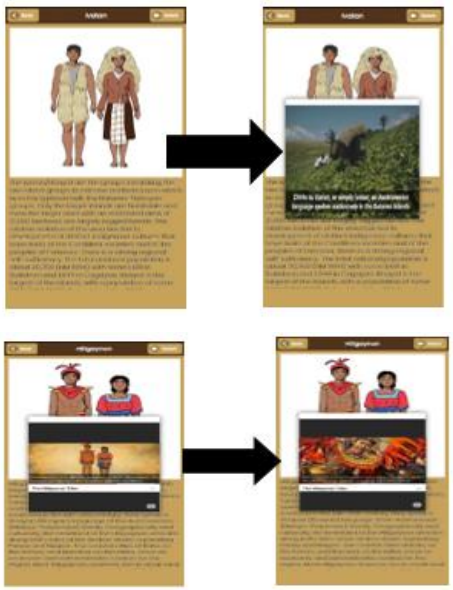

Figure 3: Baliktanaw Tribe Details and Descriptions

Figure 3 show details and description of one tribe included in the application. It includes images and associated videos about the tribe.

Figure 4: More Images about a particular tribe

Figure 4 shows more images associated with particular tribes included in the application.

The application was developed using Adobe Phonegap was utilized, Adobe Photoshop CS6 for editing the images, Kinemaster pro for editing video presentation and finally Ibiz Paint for drawing images included in the application.

Finally, the application's functionality, usability and compatibility was tested using test cases. The test cases results were gathered and used to refine further the application. After the final refinement of the application it was tested again based on the same criteria and no errors and bugs was seen. The application passed all the test cases utilized to check functionality, usability and compatibility. The application can be installed and used in android version 7 and up.

DISCUSSIONS

It is concluded that the application met all the requirements specified in the objectives. The proponent was able to design and develop an application that included 30 Filipino tribes. These tribes were described based on their culture, livelihood and biography. Different images depicting their culture is also provided in the application. Videos regarding how they live, how they dress and other important aspect of their culture were also presented. The application provided text description, images and even videos in order for users of the application to gain understanding about the tribes included in the application.

The software development tools used proved to be useful in developing the said application.

Testing proved to be important in order to deploy an application that is free from bugs and errors. The result of test cases was also relevant in the refinement of the functionalities and usability of the system. The application is proven to be compatible and working properly with android versions 7 and above.

For the improvement of the application future researchers can:

1. Include more or all Filipino tribes.
2. Include a means to communicate with people belonging to this tribe.
3. Include their location and how to reach them.
4. Include a more interactive experience like for customs, user can take photos with these customs.

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CERBERUS: An IOT Based Crowd Entry Limiter to Prevent the Spread of Covid-19

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ABSTRACT
This study aims to develop an IOT Based Crowd Entry Limiter to help establishments monitor and control entry of people. Crowd Entry Limiter also monitors the temperature of each customer that will enter the premises and a body temperature higher than 37 degrees Celsius are not allowed to enter. This prototype will count the number of people on both entrance and exit passageways, the counter will increment when someone enters the premises and the counter will decrement when someone leaves the establishment. Crowd Entry Limiter also monitors the gas concentration, when it senses a smoke inside the premise the siren will be activated to notify the stakeholders who are inside the premises. The application has a feature wherein the authorized personnel can set and override the maximum capacity of establishments in order to help ensure a strict implementation of the 1-meter physical distancing set Inter-Agency Task Force (IATF). Crowd Entry Limiter is operated by Alternating Current only and not battery operated.

INTRODUCTION
The world is facing a global health crisis because of Coronavirus. Covid-19 originated in Wuhan, China and now the virus spread all over the globe. Covid-19 can be transmitted through droplets when an infected person coughs or sneezes without covering their mouth or nose. Scientists all over the world are now working to develop a vaccine to the said virus. The best way to prevent the spread of Covid-19 is to wear facemask properly, regular disinfection and avoiding crowded places.

The World Health Organization advised the public to avoid crowded places and to practice the 1-meter physical distancing. There is no concrete way to identify who are the carrier of the virus because sometimes they do not show any symptoms. Implementing physical distancing will be hard in crowded places. Physical distancing helps to break the chain of transmitting the virus. And being vigilant to ones' surroundings is very important.
In order to slow the spread of a communicable disease, social distancing is advised. Social distancing refers to efforts to minimize the number and length of interactions and increase the physical distance between people. Social distancing activities, apart from hand hygiene and the use of personal protective equipment such as facemasks, include acts that create more space between students in classrooms and hallways; cancelling events that bring about close interaction between students (e.g., assemblies, field trips), and others. In the early phases of influenza pandemics, social distancing activities may buy crucial time to produce vaccines and relieve pressure on overburdened healthcare and public health systems. Cancelling events that bring about close interaction between students (e.g., assemblies, field trips), and others. As various stakeholders with diverse needs (e.g., teachers, staff, parents, students, public health departments, state and local government agencies) are involved, schools often represent a complex environment for social distancing. Moreover, colleges, with several conflicting goals, could be under-resourced. Social distancing study and instruction in US schools centered on the closing of schools [13]
Nowadays, modern technology makes the life of everyone easier and more efficient. Bidirectional Visitor Counter is a project focused on the interface of various components. With this, it can count the number of people in both directions. This circuit can be used to count the number of

persons entering the hall/mall/home/office at the entrance gate and it can count the number of persons leaving the hall by decrementing the count at the same gate or exit gate and depends on the position of the sensor in the mall/hall. [14]. This study is also similar with the Crowd Entry Limiter that aims to limit the number of people in a certain premise. Crowd Entry Limiter is a means of restricting the crowd in an establishment. It will help to monitor and reduce the number of people. Also, it will help to limit the number of people who are allowed to enter the premises. Crowd Entry Limiter will help to implement the physical distancing of each individual and to avoid crowded places. And it will help to prevent the spread of Covid-19 by following the protocol of Inter-Agency Task Force (IATF) which is the 1-meter physical distancing.

General Objectives

The general objectives of this study is to develop an IOT Based Crowd Entry Limiter to prevent the spread of Covid-19. In line with this, this study aims to achieve the following specific objectives:

1. To gather relevant data through researches on related literature and studies.
2. To design and develop a prototype of microcontroller for the crowd entry limiter using Ultrasonic sensors, Wi-Fi Module and Arduino IDE.
3. To design and develop a mobile application to monitor the crowd capacity and set the number of people allowed inside the premises.
4. To integrate the IOT hardware component of the system and mobile application.
5. To test the system's functionality and reliability using test cases

Scope and limitations

The proposed IOT Based Crowd Entry Limiter is designed and developed for monitoring the capacity of an establishment. The design and platform of the project is an IOT Based System with Mobile Application that can manage and ensure the control of the crowd. The IOT Based Crowd Entry Limiter would count the number of people who would enter the establishment and the head count would decrement when a customer leaves the establishment. The head count inside the establishment would be shown on the LCD and the buzzer would make a sound to notify the stakeholders once the establishment reached the maximum capacity. It would also measure the temperature of each customer/s that would enter the establishment, customer/s with a body temperature higher than 37 degrees Celsius are not allowed to enter the premises and the buzzer would make a noise to notify that the customer has a high body temperature. In case of fire, when the smoke is detected, the siren would be activated to send an alert to the establishment. The purpose of the Mobile Application is to monitor and set the number of people that are allowed inside the establishment. Also, it would total the actual number of people who enters the establishment on that day and it would be send to the owner(s) as a daily report. And in case of fire, an SMS notification would be sent to the owner(s) once there is a smoke detected at the establishment. Only the administrator will have the access to manipulate the mobile application and the user is only limited to monitor the number of people.

There are two switches that needs to be activated in order for the sensors to work and respond properly. If switch A is on and B is off, only the proximity sensor is active on entrance and exit. If switch B is on and switch A is off, only the temperature sensor is active on entrance and exit. If both switch A and switch B is on, proximity sensor and temperature sensor are active on entrance and exit. And by default, the smoke sensor is activated. Crowd Entry Limiter is only operated by Alternating Current and it is not battery operated, in case of power interruption the prototype will not be able to perform its tasks and it would not function. The researchers are not responsible when third-party companies (e.g., power supply, telecommunications, internet) had some malfunctions or issues.

SYSTEM DEVELOPMENT METHODOLOGY

The Prototype Model that was used in the development of both the hardware prototype and the mobile application. A prototype methodology is defined as a Software Development model in which a prototype is built, tested, and then reworked, if needed, until an acceptable prototype is achieved

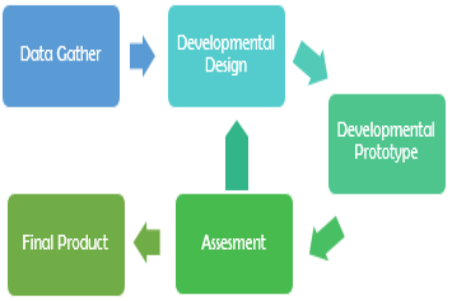

Figure 1. Prototyping Methodology

Figure 1 show the different phases of the Prototyping Methodology. The phases include data gathering, development design, development prototype assessment and final product. The development design, development prototype and assessment can be done iteratively until such time that the system is already at its best which means that functionalities are already accepted by the client.

Data Gather

This refers to analyzing the processes used in a field of study. It is composed to accomplished a certain task and characterized as a set of processes, methods, resources and documentation aids that help the developer simplify the process of creation. The researchers gathered the necessary information by conducting a study and reviewing previous related literature about the proposed study. This was done with the researchers to more insights and understanding about the system.

Developmental Design

Based on the gathered data and after analysis, the researchers would now be developing the design of the system. Requirements should be implemented in the design for both the hardware and mobile application of the system. Different design tools can be used in order to understand and present requirement better. Consider all identified and specified functionalities in the objectives of the study. System requirements should be reflected on the design that had been developed by researchers.

Developmental Prototype

An actual prototype hardware and application were built in this stage. The version was incomplete although a small working model of the system based on the block diagram and conceptual framework was made for the hardware and mobile application from quick design. This prototype was tested and with these, the modifications, revisions and improvement were determined.

Assessment

After the development, both prototype and the mobile application will undergo testing of functionality and reliability using test cases. Result of testing was then utilized to further improve the system. Once testing was completed the system was presented to the panel members. Feedback and recommendations would then be used to refine system.

Final Product

When all the stages and several iterations were done, the researchers were able to come up with a working prototype – the prototype hardware was integrated to the mobile application providing accurate information – that was accepted by panel members.

RESULTS AND OUTCOMES

In this section, the results and the discussions were laid out to determine if the researchers met the objectives of the project. As a result, the researchers reviewed related literatures to gain concepts and ideas from previous researchers before proceeding to the planning stage. After analyzing all the data gathered, the researchers identified the hardware requirements as shown at the Table 1 and design a mobile application using MIT App Inventor as shown in Table 2. Identification of Hardware and Mobile Application Requirements of the study is very important.

Table 1: Hardware Requirements

Electronics components	Functions
1. Arduino UNO	Microcontroller
2. ESP 8266	Wi-Fi Module
3. Ultrasonic Sensor	Measures the distance
4. 16x2 LCD	Displays the number of visitors
5. Piezzo Buzzer	Serves as the alarm or siren
6. MQ2	Smoke Sensor
7. MLX90614	Temperature Sensor
8. GSM Module SIM 800L	Sends an SMS alert

Table 2: Mobile Application Requirements

Application	Functions
1. MIT APP Inventor V.2	Mobile Application Developer/Programmer
2. Google Firebase	Online Database Account

The development phase was divided into two simultaneous parallel tasks: the development of the circuit diagram design and the development of the application user interface.

To measure the distance and temperature, MLX90614 and Ultrasonic was used. The Arduino microcontroller then processed and converted the detected distance and temperature content into digitally readable format. The next step was the measurements data were wirelessly transferred to the online database google firebase using the Node MCU ESP 8266 Wi-Fi module while integrating the online database address and SSID into the Arduino program.

The code blocks of the mobile application were included in the online address of the Google database account and the Application Program Interface (API) key to link the mobile application to the Google Firebase.

Test cases were used to validate the functionalities of both hardware and software based on the research objectives. After the functionalities were validated using test cases, the researchers were able to establish that the output measurements from the serial monitor of the microcontroller were the same as the output measurements that are shown by the mobile application.

Figure 2: Crowd Entry Limiter Life Sized Door Model

As shown in Figure 2, the LCD will display the number of people and the message alert that shows there is smoke detected. At the lower portion of the LCD is the buzzer, that serves as the alarm and siren. Also, the temperature sensor that measures each person that will enter the premises, person with a body temperature of 37 degrees Celsius are not allowed to enter. Switches were positioned at the bottom part. The smoke sensor was placed at the top part, to sense the smoke concentration inside the premise and when there is a smoke detected it will send a SMS notification to the owner(s).

As shown in Figure 3, the Mobile Application would set and update the capacity of a certain premise. Also, it would monitor the number of people inside the establishment. Mobile application can be manually reset by the administrator and the app will generate the total number of people once it is manually reset and an SMS would be sent to the owner as a daily report.

Figure 3: Cerberus Mobile Application

DISCUSSIONS

Based on the previous related literature reviewed by the researchers, they correctly identified all of the specific requirements required to complete the study. In order to develop the prototype model, the researchers used diagrams that such as the Schematic diagram, flow diagram, story board and block

diagram. Mobile application is important to gain a better understanding of the process and outcome.

The integration of the prototype model and mobile application was required to meet specific requirements, which were verified and validated through test cases to ensure that both the mobile application and the prototype model functioned and interacted with one another

The development of Crowd Entry Limiter was designed and developed based on the stated objective wherein the researchers developed an IOT based system that can monitor and control the crowd. To measure the temperature of each customer that will enter the premises and to sense the gas concentration of the establishment through the use of different sensors, microcontroller. Mobile application that allows the administrator to set, manipulate and override the number of people that are allowed inside the premises, also the users to monitor the number of people. The researchers' objectives were achieved with the help of the prototype methodology.

For improvement of the study the following recommendations were listed:

1. Use other more efficient sensor to detect people.
2. Improve on the design and interface of the system.
3. Details of the person entering the vicinity can be recorded for contact tracing purposes.
4. Develop a mobile application compatible with IOS.

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Development of a Micro-Controller based Coinvert: Coin Counter, Sorter and Exchange Machine

Presented on International Research Conference on Information Technology Education (IRCITE) 2021 – Paper Presentation

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ABSTRACT

This study is focused on providing automation on coin segregation through collecting by means of exchanging coins to cash or e-money. Thus helping coins go back to circulation which is beneficial for the country's economy. This study Arduino UNO and Arduino programming language respectively. The machine will only process the Philippine peso coins: 10 cents, 25 cents, 1 peso, 5 peso and 10 peso. The machine passed the overall evaluation of the committee. Hence the result indicates that the machine is of good quality evidently to be technically and physically functional, capable of performing its system process. To validate the functionalities, test cases were considered as the validation of the specific functionalities of both the hardware and the mobile application on the research specific objectives. Based on the experimental test results, the output measurements from the serial monitor of the microcontroller are the same as the output measurements being displayed by the mobile application.

Categories and Subject Descriptors

Kiosk Machine

Keywords

Coin sorting, coin counting, coin segregating

INTRODUCTION

Money comes in three different basic forms that include paper bills, coins, and digital money. The Philippines always encounter artificial shortage of coins because it is often used in automated water dispenser, coffee, peso-net, church contributions, and also the illegal numbers game or jueteng

Dr. Gregorio Baccay, a senior research specialist at the Economic and Financial Learning Center, only about 10 percent of the 18.9 billion pieces of coins are being recirculated in the system [1]. The newspaper reported Baccay telling a recent Kapihan Forum held in Dumaguete, Banko Sentral ng Pilipinas (BSP) has printed over 680 billion worth of banknotes in circulation, 25 billion of which are coins.

Baccay identified that "people keep too many coins at home, the numbers of coins being placed on religious altars, kept in piggy banks, and swertres accumulations as the real reasons coins don't circulate. He also blamed Automatic Tubig Machines and pisonet Internet cafes where a peso is paid for every five minutes service. Baccay went as far as to identify the café coffee maker as a place where coins are being hoarded."

Data showed that there are about 18.9 billion pieces of coins worth P18.9 billion in circulation denominated in P10, P5, P1, and 25 centavos, 10 centavos, and five centavos. This translates to about 198 pieces of coins for each of the 94 million Filipinos [2]

It wa mentioned from the article posted on the legacy senate website in December 2014, Sen. Serge Osmena warned that "We have been experiencing coin shortage for years now. If this continues, it will result in a wider-reaching negative impact on the economy". He stressed that it would cost the government a substantial outlay of funds to replace the circulation coins [3]

Baccay noted that about 21 billion coins are being minted. He did not identify over what time period. However, it now costs more to strike a coin than is that coin's face value. As an example, the 1-centavos coin now costs 1.12 centavos to make.

Releasing new coins could help alleviate coin shortage, but taking back the coins that are already on consumer's hands to circulate will be another aspect to be considered.

The researchers suggest developing Coinvert: A Coin Collection Machine that will help collect the Philippines' coins. The machine will be placed at Supermarkets and Financial Institutions to help lessen the Philippines' artificial shortage of coins. The collected coins will be change to banks to help bring back the coins to circulation. The study aims to provide convenience to Filipinos for counting and sorting coins accumulated by their businesses or merely the coins they saved on their houses and exchange it to paper bills or digital money. This will keep the coins moving in circulation.

General Objectives

The general objective of this study is to design and develop Coinvert: A Micro Controller Based Coin Counter, Sorter and Exchange Machine. Specific objectives are as follows:

1. To design and develop a microcontroller based system that accepts, segregates and counts coins by denomination.
2. To design and develop a display screen for the system.
3. To design and develop mobile applications for the system.
4. To use Wi-Fi module connection for kiosk tablet and cashier.
5. To test the system's functionality and reliability using test cases.

Scope and limitations

The study focuses on the design and development of a system that accepts, segregates and count different coin denomination**.** The customer needs to insert coins into the Coin Funnel of the system, the system will then begin to sort and count all of the coins inserted. The display screen will provide a user-friendly experience for easier and faster transactions. All the deposited money can be exchanged for paper bill or digital money, depending on the customer's preference. The connection of the machine to the cashier is through the Wi-Fi module. The brain of the system will be the Arduino Uno microcontroller, which will manage the flow of data and handle the command on all the machine processes from counting and sorting to sending information to the display screen and mobile application

All data will be kept on the devices that are connected to the router where Arduino is connected. The Application will have one access for admin that can create cashier access. The Application will only have a maximum of three registered cashier accounts. Once there is a power outage, the hopper will stop, and the cashier will need to assist the customer in manually retrieving the coins inside the coin hopper.

The system sensor is limited to read five various denominations such as 10 cents, 25 cents, 1 peso, 5 pesos, and 10 pesos which means the exclusion of 5 cents due to its small size that coin slot sensor cannot detect and 20 peso coin due to its limited distributions from the Banko Sentral ng Pilipinas. There will be a Coins Return Box where dented coins, foreign coins, and excess coins will fall over. Once the machine detects that one-coin bin has reached its limit after check out, the machine will turn off and display offline status on the kiosk screen. The machine will send a text message notification to the cashier when there is a new transaction, coins collected, the engine reaches its maximum coin capacity, and the device is. News will also pop up on the machine to notify the customer that the machine will no longer accept any coins if the machine reaches its maximum coin capacity.

SYSTEM DEVELOPMENT METHODOLOGY

The Prototype Model was used in the development of both the hardware prototype and the mobile application. development team understands the exact requirement of the proposed system.

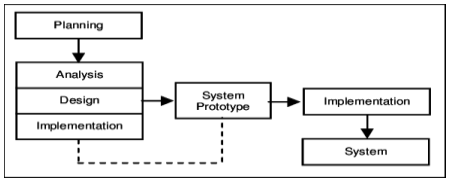

Figure 1: Prototyping

(Source: Mohd Helmy Abd Wahab, 2013)

Figure shows the Prototyping Model that include different phases starting with planning, analysis, design, building of system prototype then implementation.

The researchers gathered the necessary information by studying and reviewing previous related literature about the proposed study. This was done to give the researchers more insights and understanding of the system.

In this stage, all the required information was gathered and evaluated. These requirements were essential in developing the system because they served as the guidelines in determining the system's functionalities and constraints.

The following diagrams were used to create a functional application that will suit the system's design and requirements.

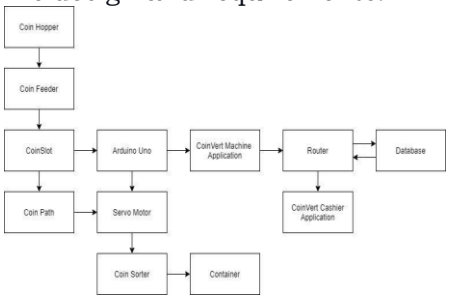

Figure 2: Block Diagram

Figure 2 shows the processes of the system. The block diagram helped the researches to grasp the processes needed to be undertaken in order to design properly the system.

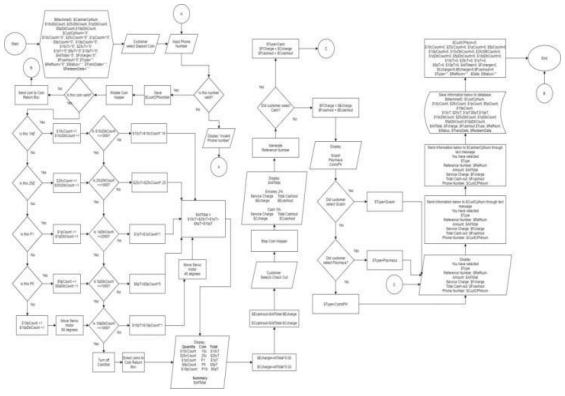

Figure 3: System Data Flow

Figure 3 shows the system data flow that consist of the detailed logical flow of data of the system.

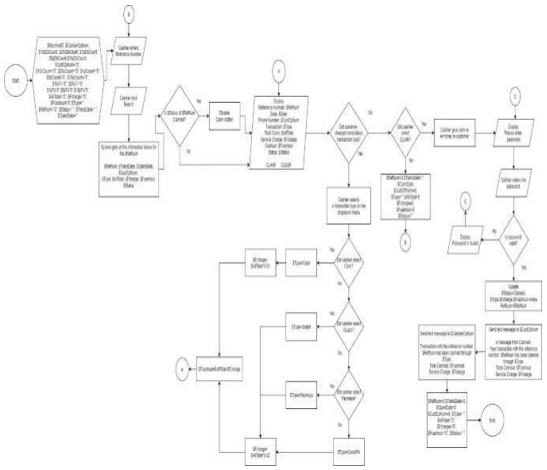

Figure 4: Cashier Data Flow

Figure 4 contains the flow of data from the cashier's perspective. The Coin Hopper receives the random bulk collection of coins that needs to be segregated and counted. The hopper ensures that only one coin at a time is fed to the system for processing. The hopper has a spinning disc of 17.5 centimeters and has a hole that takes one coin at a time.

The coin path has a length of 26.5 centimeters and a height of 5.25 centimeters. It has an inner width of 1/8 inch. The coin path has an angle of inclination of 30 degrees. A hole is made 9.1 centimeters away from the hopper's spot and 0.5 centimeters from the path's bottom. The fix is rectangular and has a dimension of 2.20 by 5.54 centimeters. The size of the hole and the coin path's tilted position are the essential features that play a significant role in the coin path. These features make it possible for the one-peso coin to be segregated directly without using any electronic device.

The Coin feeder catches the coins from the coin hopper and makes sure that the coins are in proper orientation to fit the whole on the coin slot.

The Coin separator serves as a separator for 10 cents, 25 cents, 1 peso, and 5 pesos. The coin separator has holes from small to large. The

coins drop to the respective denomination coin bin using the holes that will match each coin's size.
The Coin Slot serves as the coin detector if the coin is valid or not. It has sensors that are assigned for each denomination. If the coin is valid, it sends a pulse to Arduino that will be interpreted, and the data will be shown on the coinvert application if coin is invalid, the coin will be rejected and will be sent to the coin return box.
The Coin Bin serves as a container where sorted coins are stored. Coin Bin has divisions which make sure that the different coin denominations will not be mixed.
The system was assembled using acrylic sheets and installed with various components like the servo motor, microcontrollers, sensors, and relay to complete the whole process.
The display screen is a 10' inch android touch screen tablet that serves as a device where customers can interact with the machine. The customer can input his phone number, which will receive the coinvert reference number used to redeem the coin amount displayed on the tablet. The customer will see each coin's quantity denomination and the amount of each denomination, and the total amount. Customers can also choose what type of transaction they want if Digital Money or Cash out for customer's reference. Tablet also shows how much the charge is for each transaction which is 2% for digital money and 3% for cash.
The Counter display consists of a collection that shows the number of coins that were already counted. The counter display also sends feedback to the microcontroller to complete the system process that needs the counter display values.
This stage built actual prototype hardware and a mobile application. Although a small working model of the system based on the block diagram and conceptual framework was made for the hardware and a storyboard for the mobile application from quick design, the versions were incomplete. These prototypes were tested, and with these, the modifications, revisions, and improvements were determined

RESULTS AND OUTCOME

In this section, the results and the discussions were laid out to determine if the researchers met the objectives of the project.
The development phase was broken down into two simultaneous parallel tasks: the development of the electronic circuit diagram design and the development of the mobile application user interface.

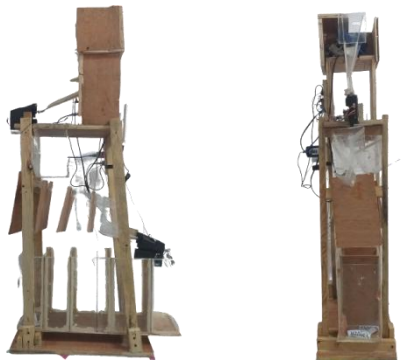

Figure 5: Skeletal Model of Coinvert System

As shown from figure 5, the top of the machine contains the coin hopper where the coins are being put. It will flow down to the first coin slot which is set to count 5 kinds of denomination such as 10 cents, 25 cents, 1 peso, 5 pesos and 10 pesos coins. This coin slot is also set to reject foreign coins and coins with dents. After going through the first coins slot, the coin will flow through the coin paths and will fall on their corresponding hole with their corresponding different sizes. The coin path is attached to the second coin slot which is a function to differentiate 5 pesos coins and 10 ten pesos coins for the reason that they have a very similar size. The second coin slot is set to accept 10 pesos coins and to reject 5 pesos coins which will fall on different coin bins. All the coins will fall on their corresponding coin bins which have the capacity of 500 pcs of coins per bin. The kiosk screen will be placed right in front of the coin hopper.
The first image in Figure 6 shows the case model of the Coinvert system. It shows the placement of the coin funnel, display screen, coin return box and coin collection box. The

second image shows the dimensions of the Coinvert. The height is 55 inches and the width is 27 inches.

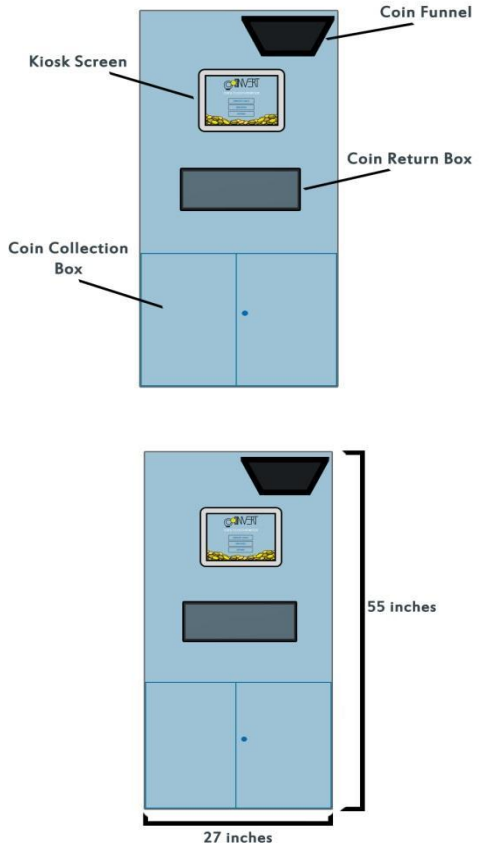

Figure 6: Case Model of Coinvert System

Figure 7: System Screen Homepage of Coinvert Application

Figure 7 shows the system screen of homepage of Coinvert application. This displays deposit coins, services and offers buttons.

Figure 8: Coin deposit phase of Coinvert Application

Figure 8 show coin deposit details. It displays the different denominations, the quantity, amount and total amount of coins. Check out, add coins and back buttons are also displayed.

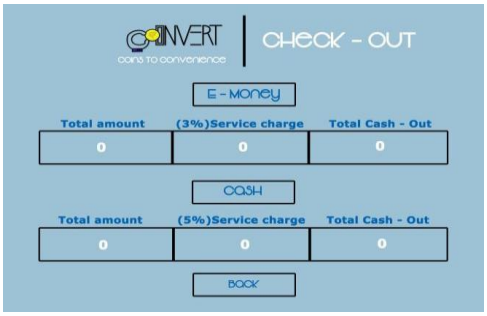

Figure 9: Check-out phase of Coinvert Application

Figure 9 shows the check-out phase of Coinvert Application. The customer can either choose to convert his/her coin into digital money (E-Money) or cash (paper bills). It shows the total amount of coins, service charge and total cash out.

Figure 10: Digital money option of Coinvert Application (Portrayal)

Figure 10 show the digital money options available for Coinvert application. Chooses includes GCash, PayMaya and Coins.ph.

Figure 11: Mobile number submission phase of Coinvert Application

Figure 11 shows where the customer will input his/her phone number for transaction confirmation.

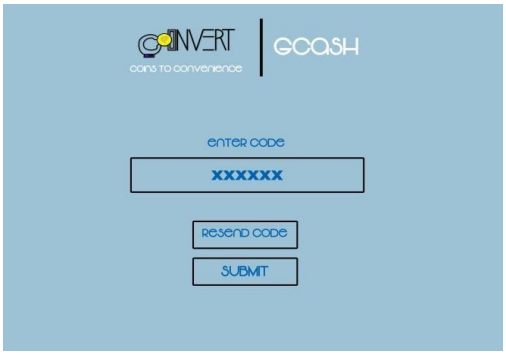

Figure 12: Transaction confirmation phase of Coinvert Application

Figure 12 show the transaction confirmation phase of Coinvert Application. The customer needs to input code send in his/her phone number. If the code was not received by the customer a resend button can be click.

Figure 13: End of transaction phase of Coinvert Application

Finally figure 13 shows the end of transaction of the Coinvert Applicaiotn. A thank you message is displayed.

Testing was done to ensure the functionality of the system and the application, the researchers conducted functionality and reliability testing for the system.

Functionality and reliability tests, the researchers were able to determine that all the coins that were inserted and processed had a high accuracy rate on counting, segregating and rejecting foreign and dented coins. It is also showed that the kiosk screen shows 100% exact count of coins based from the coin slot.

DISCUSSIONS

This section discussed the conclusions and recommendations of the study.

Conclusions

The development of Coinvert followed its stated objectives wherein the researchers developed a system that can count coins, sort by denominations and exchange them to paper bill or digital money. Customers can choose their desired transaction thru the tablet that is attached to the machine. The main purpose is to segregate enormous amounts of coins which is beneficial for business establishment and the country's economy.

With the use of the prototype methodology, the researchers' objectives in developing the system were achieved. The researchers were able to develop a system that communicates well with the mobile application.

Finally, based on the results of the test cases, the researchers have proved that the Coinvert Machine functioning properly based on the requirements specification and the result of counting and segregation of coin counting were reliable.

Recommendations

In addition to conclusions of the study, the researchers mentioned some future improvement of the system that includes:

1. Improve the design of the casing of the Coinvert machine.
2. Improve the graphical user interface (GUI) design of the mobile application.
3. Create a web-based application/system with reports as an alternative in the absence of the mobile application.

4. Create a cash dispenser for an on the spot cash exchange.
5. Connect directly on digital wallet services
6. Animation for logo on the application
7. Develop coin slot to detect 5 cents and 20 pesos coin
8. Removable coin bin for easier coin collection

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Doctor Vaccine: The fight against COVID19 2D platform game for Android

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ABSTRACT
The study focuses on the design and development of a 2d platform game entitled as Dr. Vaccine which is relevant to the current pandemic situation. This game is designed to provide an alternative form of entertainment and at the same time it can also help to spread awareness on the COVID19 virus as the whole world is experiencing right now. The objectives entail single and multiplayer mode, game functions like background music, image, timer, character health, puzzle feature, unique enemy, platform, and power-ups. It includes 3 stages with 5 levels each with boss per stage. Unity 2020 was used as the game engine to design and develop stages such as collision detection for enemy and character, platforms, background and theme, enemy, and other menu that included in the game. Visual studio was used as an IDE and C# as the programming language in building the game for Dr. Vaccine's movement and designing of assets and to profiling graphics. Photon Unity Network or PUN was used to develop the multiplayer mode of the Game. The collision detection algorithm was utilized using the unity physics 2d and applied in the box collision and wall collider. Test cases was utilized to check functionality, operability and compatibility of the application. The application is compatible with android Kitkat versions and above. Recommendations for future improvement includes converting the 2d game to 3d game, adding more characters, compatibility of the game to other operating system, make the sound more thrilling, more stages and levels, and adding some trivia script to spread more awareness about the pandemic to the user.

Categories and Subject Descriptors
2D Mobile Platform Game (Android OS)

General Terms
Power-ups, Platformer, Game engine, COVID19

Keywords
2d platform, Physics 2d, Collision Detection

INTRODUCTION
Life has truly become much easier with the advancement of computers. It is everywhere today, at home, in the office, in schools. Computers opened up a world of new possibilities and saved time by making life more comfortable. From those vacuum tubes that brought the dawn of electronic age to the newest design today. Computer technology is the method of designing, creating, and programming machines. Computer technology provides a list of numerous software programs and devices being built. [1]
Technology, including operating systems, platforms, hardware and application and has evolved very fast. Technology are improving every year, computers became more and more flexible with what they could do. File sharing and entertainment have become popular for personal computers and have countless applications in the entertainment field such as music, using the internet there are wide variety of music sites that are available, people can listen the music they want to in different kind of genre, movie is also a form of entertainment, going to cinema or renting DVD is very expensive, but in computer there are website that search and watch movies for free. Another form of computer entertainment is gaming, people can play and enjoy the games using computers and just need to download the chosen game to the internet and play. It can also use smartphones to play those games in the mobile version. [2]
At the present time, the gaming industry became more popular and still growing. Gaming has quickly become a lifestyle. Video game publishers and developers are under high

pressure to produce the content that their gamers want. At the same time, manufacturers need to consider how their content and hardware communicate with gamers so that they can enhance the best gaming experiences. [3]

Game development is the art of creating games that describes the design that involve concept, build, test and release of the game and a game developer is the software developer specializing in video game development, they spend their time programming and developing games that includes programming for console, computer and mobile video games. Mobile phones are small computers with minimal computing power by desktop standards but enough power to run a game. Mobile phone industry has grown dramatically, the versatility of mobile phone apps is phenomenal that ranging from different apps. Mobile games refer to a video games that are played on a mobile device like smartphones or tablets. [4]

Mobile game development is a process of creating, planning, designing games for mobile. Games have become an important part of mobile devices with a rising number of mobile platforms and their capabilities and also mobile phones are commonly used now among youth and adults. In line with this study, the proponents are planning to develop a 2D platform game called Doctor Vaccine. [5]

The topic of the game which is COVID 19 is very timely. Focusing on this topic enabled the proponent to gain understanding on COVID 19.

General Objectives

The general objective of the study is to develop Doctor Vaccine: The fight against COVID19: 2D platform game for Android

1. To design and develop 2D platform game with the following features:
   - 1.1 Single and Multiplayer Mode
   - 1.2 Game function such as background music and background image, timer and character health.
   - 1.3 Puzzle Feature, unique enemy and platform, power ups
   - 1.4 3 stages with 5 level each with boss per stage, option to show all levels,
2. To develop the game with the collision detection algorithm.
3. To develop the game using the following software development tools which includes Unity 2020, Adobe Photoshop, Photon Unity Network, and Visual Studio 2019.
4. To test the game using test cases focusing on functionality, operability and compatibility.

Scope and limitations

The proponents would design and developed a 2D platformer game with a theme regarding Covid-19 that can help to spread awareness and can be used to remind users that there is a dangerous pandemic facing the whole world. The game can show the importance of front liners especially those doctors who has a major role to kill and suppress the spread of viruses. It can also show that even if you are a doctor, viruses still has effect on your health.

In real life, the shooting mechanic would represent on how the doctors would kill the viruses using the injection. The user controls Dr. Vaccine or Dra. Vaccine, the goal of the player is to survive by avoiding and destroying viruses, the player must destroy the virus that reigns in the body and reach the end of the level by fighting the boss and destroy it. The player needs to use the injection gun to damage and kill the viruses and the boss; once the boss is killed the game is won. There are obstacles and enemies that are added to the difficulty of the game such as traps, platforms and enemies like normal enemies and the boss. The normal enemies patrol an area, enemy deals damage if the player is hit, the player can avoid them or if they unlock the gun, they can destroy them using it. The platforms can either make it hard or easier for the player, this has two types: moving and falling platform and spike traps. The game has 3 stages and 5 levels per stage, the 5^{th} levels is for the boss battle and each world has a varying difficulty from easy to difficult and each world has a unique enemy and platform.

The player can unlock the shooting mechanic by obtaining three puzzle pieces to form the

gun. The puzzle feature is available in levels 6, 7 and 8. The player needs to step on to triggers to spawn platforms. The game also has power-ups features that players can pick-up throughout the levels to help them make progress. The player can use high jump. High jump allows the player to jump higher by holding down the jump button.

The power-ups have two types, permanent and temporary. Temporary power-ups can be obtained throughout levels and it has the power to increase a player's stat by a set amount and has a set duration, speed boost temporarily increases the speed and invulnerability causes a player to not take damage. Unlockable skills like permanent power-ups include double jump and heal. Double jump is obtainable in level two of the game. Double jump allows the player to jump mid-air. Heal recovers an amount of health.

The game has a single and multiplayer function and it means that one or two players can play together and multiplayer had an option for creating and joining a game. In the multiplayer it has two main characters which is a guy and a girl where the players can choose and pick who he or she wants to use in every start of the game.

The game also uses the collision detection using wall box collider, circle collider and oval shape collider. Some of the game function includes background music, background image, health indicator, an option to show selected stages and levels, areas, stages per world, an option to load previous game, scoring system and countdown timer, an option to show all levels locked and unlocked to provide access to previous levels and to monitor progress and an option for multiplayer to join on a game.

Doctor Vaccine is a Mobile game application that can only be played in Android devices. Also, this Mobile game has a minimum requirement of API level 19 (Kitkat) or later to be able to download this application.

SYSTEM DEVELOPMENT METHODOLOGY

For the application that the Researchers have come up with, the Rapid Application Development (RAD) methodology is suitable for the project and it was used by the proponents because it is a fast design process. The products can be developed much faster with higher quality, endless and most of all was cost-effectiveness and the precision. It is affordable way to prototype product because it is an automated process which won't requires a lot of people to operate. Cost-effectiveness in a sense that it can act fast and solve any problem in order to lessen the risk of the cost errors while on the development stage and also it lessen the amount of material that is wasted, it is highly interactive system development approach, it can reduce development process and the difficulty of understanding the system.

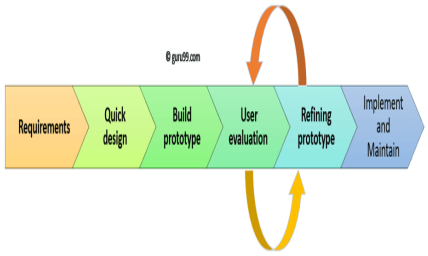

Figure 1: Prototyping Model Phases
(Source:https://www.guru99.com/images/1/051719_0618_Prototyping1.png)

Figure 1 show prototyping model phases. It is a software development model in which prototype is built, tested and reworked until an acceptable prototype is achieved.

The prototyping Methodology includes the following phases: Requirements Gathering; Quick Design; Building Prototype; Refining Prototype and Implement and Maintain.

In the Requirement Phase, the researchers would gather together for an online project meeting. Identify the current problem and situation like on this time of pandemic and which will be the best project that can make while the whole world implementing the health and safety protocol and then researchers also define the requirements needed for the project, brainstorming different ideas to meet the goals and expectation of the project and issues that would need to address during the development and finalizing requirements with the approval on each members.

In the Quick Design Phase, the researchers identified on what will be the project and the requirements needed, the development stage will start. Graphic designer and programmer/developer will begin working together to make a quick design prototype. The developer will build a design and then test the game if there is a bug and discuss on what will be the solution.

In the Build Prototype phase, the proponent developer would work on the actual prototype which includes characters Dr. Vaccine and some viruses. The developer built a small working model for Dr. Vaccine that comes from the requirement gathered from the first phase.

In the User Evaluation Phase, Dr. Vaccine is presented to the user for an initial evaluation. All the weaknesses of the model, recommendations, opinions, additional functionality from the users were considered and added for the refining of the prototype. The proponents will still work together to achieve the expectation of the users.

In the Refining Prototype Phase, gives the opportunity for the developer and graphic designer to adjust the game base on the initial user evaluations to reach a satisfactory design before the final product. The proponent constructed the final working model and making sure that the system are working and the final product or result of Dr. Vaccine is satisfying.

In the the final phase where the 2D platform game Dr. Vaccine would be ready to deploy, the proponent made thorough test for all the final changes because of errors and the final stage is to launch game in Google Play Store.

RESULTS AND OUTCOMES

In this section, the proponent project aims to develop an application named as Doctor Vaccine, the fight against COVID19, a 2D platform game for android users. The results and the discussions were shown to determine if the researchers fulfilled the project's objective.

The application was developed using prototyping model. The researchers gained knowledge and understanding thru brainstorming, internet research and news on television. Also related literature studies and review of concepts from previous researches further enriched their understanding with regards to the topic under study.

After the data gathering, the design and development of features were presented in order to check whether the objectives were achieved

Figure 2: Dr. Vaccine

Figure 2 show the main logo design of the application. It consists of a character of a doctor holding a syringe. The background entails representation of the COVID 19 virus.

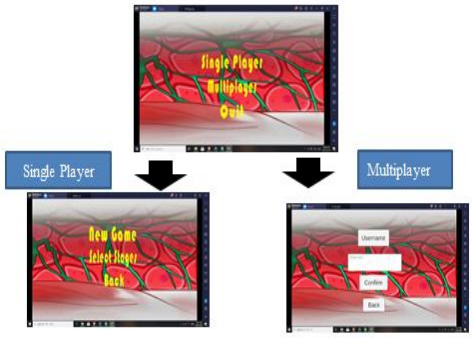

Figure 3: Dr. Vaccine Main Menu

Figure 3 shows the Main menu of the applilcation; the users can choose whether to play single player or multiplayer or just quit the game if the user does not intend to play the game.

Figure 4: Background image, timer, health

Figure 4 shows the application function such as background image, timer, character health, and option that displays all levels.

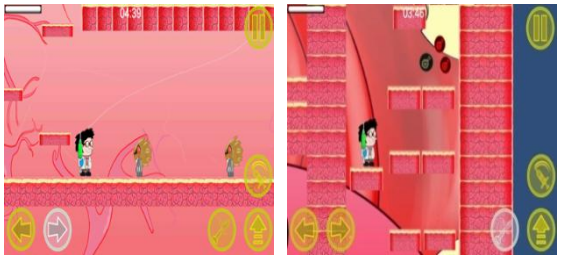

Figure 5: Puzzle feature, power ups, shooting mechanic, enemy and platform

Figure 5 shows puzzle feature, unique enemy, platform, and power ups that can be unlocked. The enemies, platforms and power ups can be seen throughout all the levels.

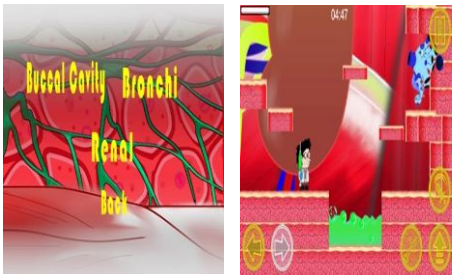

Figure 6: 3 Stages and boss

Figure 6 shows the three stages with 5 levels each with boss per stage. The Buccal Cavity stage includes level 1-5, Bronchi stage includes level 6-10 and Renal stage includes level 11-15. The researchers listed down all software to be used in preparation to the development of the game such as Unity 2020, Photon Unity Network, Adobe Photoshop, and Visual Studio 2019 Discussion on each of the software and tools would be provided to show how each of those would be used.

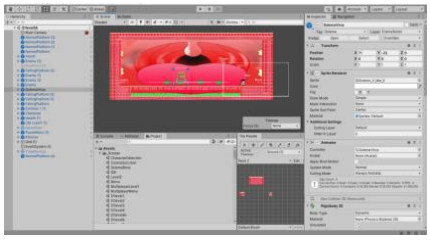

Figure 7: Unity 2020

Figure 7 shows the development game engine used to design and develop stages such as collision detection for enemy and character, platforms, background and theme, enemy, and other menu that included in the application.

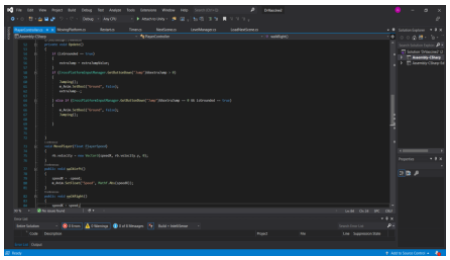

Figure 8: Visual Studio

Figure 8 shows how each levels, character, and other platform had been coded in Visual Studio 2019 in order to play Dr. Vaccine smooth and functional

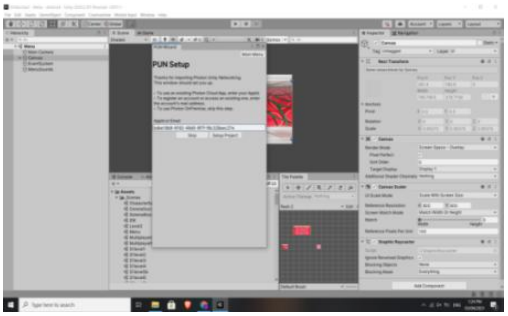

Figure 9: Photon Unity Network

Figure 9 shows how Photon Unity Network (PUN) had been used to the development of Dr. Vaccine from proper set-up to unity. This was used to make multiplayer setting of the application for the users.

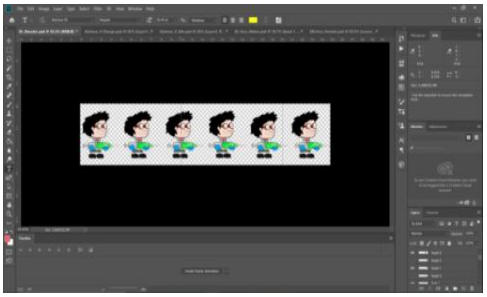

Figure 10: Dr. Vaccine

Figure 10 shows how the main character were design in Adobe Photoshop. Dr. Vaccine is the main character in the application the designer was able to decide and used appropriate color, shape and sizes that would be suitable for the game.

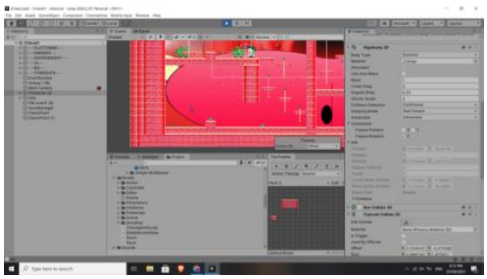

Figure 11: Collision Detection

Figure 11 shows physics 2d for collision detection that used in Dr. Vaccine using continuous collision detection and box collider 2d.

The researchers also include test cases and proved that the application is functioning correctly and properly. The application is compatible with android Kitkat version and up. The application also uses 143 megabyte of ram. Controllers and flow of the application is easy to understand.

DISCUSSIONS

Objectives of the study was achieved with the design and development of the application. The main character depicted a doctor fighting the COVID 19 virus. Elements of the virus is presented in the game. Different organs affected by the virus were also illustrated in the application.

The following software development tools which includes Unity 2020, Adobe Photoshop, Photon Unity Network, and Visual Studio 2019 are very appropriate and useful in developing the application.

Overall the application was design and developed according to specifications. Test cases were utilized to check applications functionality, operability and compatibility. The functions are properly working. Design and layout of buttons allow easy access for users and it is compatible with most android versions starting from Kitkat and above. The application is launched in Google Play Store without errors and bugs

In addition, to conclusions of the study, the researchers mentioned some future improvement of the game, thus the following recommendations are listed.

1. Convert the 2d platform Dr. Vaccine to 3d platform.
2. Add more character doctors for the users to have more choice of selections.
3. To design and develop a game that is compatible with other mobile operating system platform.
4. Make more thrilling sound for every stages of the game.
5. Create more stages and levels on the game.
6. Add some trivia script for the game for the user to let them know more about viruses and pandemic.

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DOKTORIST: An Android-based Medical Specialist Finder Application with Appointment Setting

Presented on International Research Conference on Information Technology Education (IRCITE) 2021 – Paper Presentation

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ABSTRACT
The study focuses on the design and development of an android based medical specialist finder application with appointment setting. The application provides a way for the user to search and locate a medical specialist in Mabalacat City vicinity. It enables the user to set appointments and schedules to the chosen specialists and clinics. A chat interface is provided in the system where patient and medical specialist can communicate and frequently asked questions are shown and automatically answered by the application via bot. E-prescription and E-medical certificate can also be issued to the patients in an image format. The application was tested in terms of the functionality, reliability, usability, efficiency, maintainability and portability using test cases. The functionalities of the application were proven to be working correctly based on design and specification. The application is compatible to devices with Android version 5 and up. The application is reliable because it provides correct output. In terms of operability, the application features are easy to access and use. The application was successfully developed based on specifications but can be further improved by including a feature for prescription supervision, widen scope of implementation in terms of location and finally to develop the application which is also compatible with IOS.

Categories and Subject Descriptors
Specialist Finder and Appointment Setting Mobile Application

General Terms
Appointment, Specialist Finder, Clinics, Hospitals

Keywords
Medical App, GPS, Medical Specialist Finder, Appointment Setting

INTRODUCTION
Health care, delivered by health professionals and related health fields, is the maintenance or improvement of health by means of prevention, diagnosis, treatment, recovery, or cure of disease, illness, injury, and other mental impairments in people [1]. Health service is medical care administered by medical practitioners, organizations, and health care workers [2]. Services are centered on making health care accessible, excellent, and patient-centered. Many different types of care and providers are necessary in order to offer successful health services.
In December 2019, the outbreak of the coronavirus disease (COVID-19) was known and started in Wuhan, China. The infectious disease is caused by a new strain of coronavirus. The first case of COVID-19 in the Philippines, reported by the Philippine Department of Health on 30th of January 2020, was a 38-year-old woman and a Chinese national [3]. Due to an outbreak that became known as a pandemic, a lockdown in Metro Manila, Philippines was ordered from March 15 to April [4]. Other provinces had also undergone a lockdown or community quarantine which was extended and later became enhanced community quarantine and general community quarantine. Because of the pandemic that still exists, healthcare is crucial, and getting healthcare services is not as easy as before.
In the Philippines, according to the World Health Organization (WHO), health care is fragmented - a large gap is visible for

healthcare between the rich and poor [5]. Different reasons behind this large gap include low budget, low number of manpower, or general neglect for the poor.

One of the first important parts of a person's treatment is finding the right physician for the disease. A person may have symptoms of an identified illness that require a medical specialist. Whether it'll be a primary care physician or specialist, choosing the right physician is a very important decision to make and will impact how any medical care will be received.

Health care can also be acquired through a specific time by having an appointment. Scheduling an appointment has improved over the years, but the task is still time-consuming. Much online scheduling software and appointment scheduling software have surfaced and is now the most effective and efficient means to manage appointments [6]. Technology is making scheduling appointments easy for entrepreneurs, clients [7] and including in the field of health care.

Patient's appointment and scheduling system improved the quality and efficiency of web-based appointment systems and reduced waiting time [8]. This trend of adopting web-based appointment scheduling is also growing [9].

With this in mind the proponent thought of developing a mobile application that could help users to find a medical specialist in their vicinity.

Objectives of the Study

The project titled "DOKTORIST: An Android-based Medical Specialist Finder Application with Appointment Setting" generally aims to provide a way to search and locate medical specialists, provide appointment setting and online interaction with specialists with the use of technology.

Specifically, the project aims to:

1. To design and develop an application that can search a medical specialist, provide an online specialist appointment, and scheduling using an android based application.
2. To develop a chat interface and feature wherein frequently asked questions are shown and automatically answered by the application via bot.
3. To develop a feature to generate E-prescription and E-medical certificates for the patient, and integrate a website or landing page for the users to know the app's and system's nature.
4. To test the application's functionality, reliability, usability, efficiency, maintainability and portability using test cases.

Scope and Limitation of the Study

The application is divided into three users: the specialist, the patient, and the clinic.

Any medical specialist located in Mabalacat City can register to the application by providing necessary requirements like PRC license for verification purposes. The specialist needs to input other details like description of specialization, schedules and clinics and hospitals affiliations and pin point location via google map. These inputs will be used in the other features of the application.

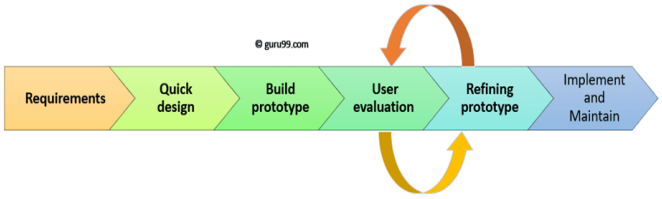
A user that can become a potential patient needs to register on the application. Important registration requirements need to be inputted into the app. The application provides a search feature to find and locate a medical specialist. The application provides a dashboard that entails important details about the medical specialist. The user can set appointments using the appointment feature of the app. A calendar that displays available schedules of the medical specialist is included in the app. Once the appointment is confirmed it will be reflected in the calendar. A notification feature for scheduled appointments is also incorporated in the app. Notification is provided so that the patients will not forget about their appointment schedule. A chat interface also enables the user patient and medical specialist to communicate. A bot on the apps chat interface to answer the frequently asked questions was also an included feature of the application. An E-prescription and E-medical certificate in image format can also be provided to patients. The

app has also a website intended for promotional purposes and to provide additional information about the mobile application.

The application's functionality, reliability, usability, efficiency, maintainability and portability was tested using test cases. The mobile application was developed using Java on Android Studio and is compatible with Android devices version 5.0 (Lollipop) and up. The website was developed using HTML, CSS, JavaScript, PHP, and the map will be integrated into Google Map API.

The application has its limitations that may be encountered through the process. One of the limits of the proposed application is that it cannot tell if a specialist is still in the same clinic or hospital if the specialist didn't update his/her details. Also, the app won't work without the use of the internet.

SYSTEM DEVELOPMENT METHODOLOGY



Prototyping Model
(Source:https://www.guru99.com/software-engineering-prototyping-model.html)

In the Requirements Phase, the proponents gathered all the needed information to conceptualize the research. This phase is about research and brainstorming to build ideas. The proponents used all the resources that can be utilized like books, magazines, and the internet. The proponents also conducted interviews with three medical practitioners in Pampanga. The interview was all about the needs and problems that the practitioners are facing nowadays. Also, the proponents asked the said interviewees about the traditional methods used which can be innovated with technology. Gathering those data gave the proponents the idea of what kind of system is needed to be integrated and presented with the said medical practitioners to give solutions to the problems and to make the daily lives of the target users much better. After the information was gathered, the proponents analyzed those data and established the system requirements.

In the Quick Design Phase, proponents constructed different designs for the application. Both preliminary and quick designs were shown to the target users for them to give opinions on which design will best suit them. Specific analysis tools were used to clarify and analyze the system requirements for the project. The following was created during this phase: layout design of the application, storyboard, data flow diagram, entity-relationship diagram and use case diagram. A final design was then chosen.

In the Build Prototype Phase, the proponents proceeded with the development of the prototype. In this stage, the proponents built the prototype based on the final design chosen. The mobile application was developed using Java on Android Studio and is compatible with Android devices version 5.0 (Lollipop) and up. The website was developed using HTML, CSS, JavaScript, PHP, and the map will be integrated into Google Map API.

In the User Evaluation Phase, the proponents and interviewees tested the application's functionality, reliability, usability, efficiency, maintainability and portability using test cases. The proponents gathered all data from the testing process.

In the Refining Prototype Phase, the gathered data from the test cases were used to correct bugs and errors of the application. Recommendations and feedback from the defenses were also used to further develop features of the application. Some features were removed and some were re-structured to meet its best output.

Finally, in the Implementation and Maintain Phase, the final developed application was uploaded to google play store for use. The website will also be used for promotional purposes in order that the application will be made known to potential users.

RESULTS AND OUTCOMES

This section discusses and explains how the objectives of the study were achieved which is

mainly to develop a medical specialist finder application with appointment setting for Android operating system compatible with version 5.0 (Lollipop) and up.

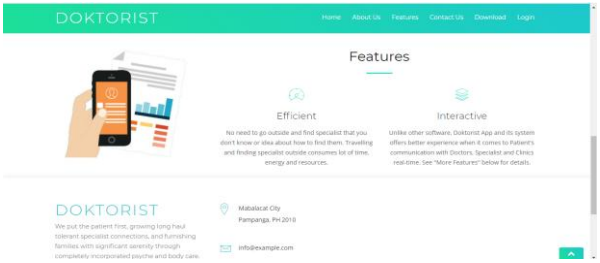


Figure 1: Website

Figure 1 shows the website of the app where features are being shown. This is meant for the application to be made known to potential users.

Figure 2 shows the developed mobile application that started on the Login Page. The different users include medical specialists, patients and clinics. The different users need to register first before they can use the application. This page provides potential users to register using the Register Button. The potential user of the system needs to supply needed information and upload needed requirements for registration. Once approved the different user can now login by providing username and password to the application and clicking the Login Button.

Figure 2: Mobile Application

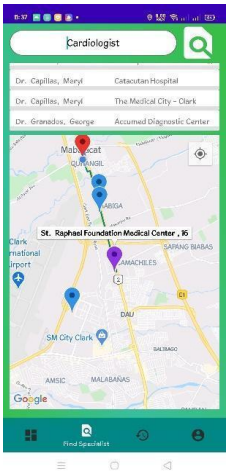


Figure 3: Search Specialist

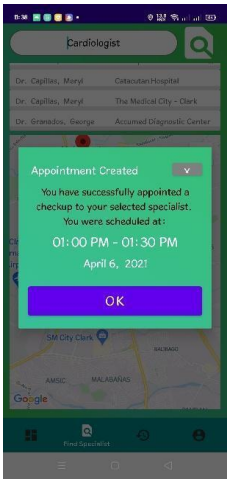


Figure 4: Create Appointment

Figure 3 shows the specialist search feature including the clinic location. The user can type in the medical specialization on the search bar or keywords related to the specialization of the medical practitioner and by clicking the search icon or by pressing enter key, the application displays details regarding the keyword being searched.

The location will also be displayed provided that this detail had been inputted and determined by the medical specialist and the clinic at the time of registration. The location is shown via google map which can show how far away the patient is to the location of the medical specialist. Details like barangay, roads, highways and streets are displayed. Mode of transportation and estimated time of arrival can be displayed. These are now the features provided by the google map.

Figures 4 show the appointment setting of the application with the chosen specialist. The message displayed here informs the patient that an appointment had been created with the specific time and date.

Figure 5: Dashboard

Figure 5 shows active and upcoming other appointments that the patient booked on the "top 4" section in ascending order. Details of the appointments are displayed with the specific date and time. This section also shows additional information of the medical specialist like the image or photo, name, schedule and specialization description.

Figure 6 shows the chat interface on the specialist's end. It has also an attached image option wherein a medical specialist can upload a photo of the prescription in case of a change of medicine brand. Figure 7 shows the chat interface on the patient's end. It shows that the patient can chat with the medical specialist and the medical specialist can reply. The patient details like name and contact information is also displayed in the upper portion of the chat interface.

Figure 6: Specialist's Chat Interf

Figure 7: Patient's Chat Interface

Figure 8: Patient's Prescription

Figure 9: Patient's Medical Certificate

Figure 8 shows a Patient Prescription that had been sent from the medical specialist's end. The e-prescription is in an image format. Figure 9 shows the e-medical certificate that can be provided to the patient through an image attachment.

Figure 10: Verify Clinic

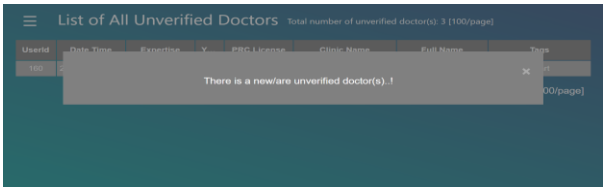


Figure 11: Verify Specialist/specialist

As shown in figures 10 and 11, the City Health Office can verify or decline the user's registration as it has the official list of all the authentic specialists and clinics in the city. The admin-level 2 account access will be given to the City Health Office personnel for the said task. The proponents made this process to ensure that all registered doctors/specialists and clinics/hospitals on the app are legitimate for the safety of the patient users.

After the whole application is done, the proponents conducted a series of testing in accordance with IEC 9126 of International Organization of Standardization (ISO) for quality assurance to ensure the functionality, reliability, usability, efficiency, maintainability and portability of the mobile application and the website. As a result, the application passed remarkably on the said series of testing except for portability due to the mobile application limitation to specific mobile operating systems (i.e. android) and maintainability that did pass but not in terms of changeability due to the same reason the portability issue has.

The results of the testing show the successful development of the application. In the functionality test, the proponents prove in the results that the developed application is functioning well in its desired functionalities. While in the usability and reliability test, the results show that the developed application is working in the stated objectives and requirements. In the other test results also, it prove that the developed application can be operated by the target users. And the results for the data reliability, it shows that the developed application has reliable data for it displays correct and accurate information.

Marked by quantitative rating from one (1) to five (5) indicating from very poor to excellent consecutively followed by additional legends as a remark, evaluated by alpha testers (i.e. proponents, defense panelist and interviewees) the proponents where able to identify that the development was a success.

Table 1: Functionality Test for Quality Assurance

Target Capabilities	Suitability	Accurateness	Interoperability	Security
Users registration (patients, specialist, clinics)	5	5	5	3
Users verification (specialist, clinics)	5,F,B	5	5	4
Use-case variance (patients, specialist, clinics)	5	5	5	5
Schedule setting for specialist and clinics	5	5	4	5
Supports specialist' different careers	5	5	5	5
Supports specialist' different clinics	5	5	5	5
Users' dashboard	5,A,C	5	5	5
Patient's search to specialist	5,E	5,E	5	5
Patient's identifying specialist	4,E,F	4,E,F	5	5
Patient's direction to specialist	5,C	5	5	5
Patient's set appointment to specialist	5	5	5	5
Detail views for set appointments	4,C	5	5	5
Upcoming appointment notification	5	4	5	5
Users' appointment cancellation	5	3	3	3
Appointment completion	5	3	3	3
Appointment histories	5	5,E	5	5
Specialist's e-prescription to patient	4,D	4,D	5	4
Specialist's e-medical certification to patient	4,D	4,D	5	4
Users' chat system flow	5,D,F	4,D,F	5	5
Chat bot for FAQs	5,D,E	4,D,E	5	5
Mobile Application Promotion	5	4	3	3

The table above shows the result of the developed application in terms of functionality. Testing data results show that the developed application passed the test and met the target requirements.

Table 2: Reliability Test for Quality Assurance

Target Capabilities	Maturity	Fault Tolerance	Recoverability
Users registration (patients, specialist, clinics)	5	4	3
Users verification (specialist, clinics)	4,F	4	3
Use-case variance (patients, specialist, clinics)	5	5	5
Schedule setting for specialist and clinics	5	4	4
Supports specialist' different careers	5	5	5
Supports specialist' different clinics	5	5	5
Users' dashboard	5	5	5
Patient's search to specialist	5,B,E	5,E	5
Patient's identifying specialist	4,E,F	5,E,F	5
Patient's direction to specialist	5,C	5	5
Patient's set appointment to specialist	5	5	5
Detail views for set appointments	5,C	5	5
Upcoming appointment notification	5	4	5
Users' appointment cancellation	5	5	5
Appointment completion	5	5	5
Appointment histories	5	5,E	5
Specialist's e-prescription to patient	5,D	5,D	5
Specialist's e-medical certification to patient	5,D	5,D	5
Users' chat system flow	4,D,F	3,D,F	4
Chat bot for FAQs	4,D,E	3,D,E	3
Mobile Application Promotion	5	5	5

The table above shows the result of the developed application in terms of reliability. Testing data results shows that the developed application passed the test in terms of reliability and displays reliable data and information.

Table 3: Usability Test for Quality Assurance

Target Capabilities	Understandability	Learnability	Operability	Attractiveness
Users registration (patients, specialist, clinics)	5	5	5	5
Users verification (specialist, clinics)	4,F,D	5	5	4,C,D
Use-case variance (patients, specialist, clinics)	5	5	5	5
Schedule setting for specialist and clinics	5	5	5	3
Supports specialist' different careers	5	5	5	5
Supports specialist' different clinics	5	5	5	5
Users' dashboard	5,A,C	5	5	3,A,C
Patient's search to specialist	5,E	5,E	5,E	4
Patient's identifying specialist	4,E,F	4,E,F	5	3
Patient's direction to specialist	5,C	5	5	4
Patient's set appointment to specialist	4,C	5	5	3,A,C
Detail views for set appointments	4,C	4	5	3,C
Upcoming appointment notification	5	5	5	4
Users' appointment cancellation	5	5	5	3,E
Appointment completion	5	5	5	3,E
Appointment histories	5	5	5	4,E
Specialist's e-prescription to patient	5,D	5,D	5	4,D
Specialist's e-medical certification to patient	5,D	5,D	5	3,D

Users' chat system flow	5,D,F	5,D,F	5	4,E
Chat bot for FAQs	5,D,E	5,D,E	5	5
Mobile Application Promotion	5	5	5	4

Table above shows the testing results in terms of usability. Usability testing determines how usable the developed application is and how useful it is for the target users. Data shows that the developed application has passed the usability test and met the target requirements.

Table 4: Efficiency Test for Quality Assurance

Target Capabilities	Time Behavior	Resource Utilizati
Users registration (patients, specialist, clinics)	5	5
Users verification (specialist, clinics)	5	5
Use-case variance (patients, specialist, clinics)	5	5
Schedule setting for specialist and clinics	5	4
Supports specialist' different careers	5	5
Supports specialist' different clinics	5	5
Users' dashboard	5	5
Patient's search to specialist	5	5
Patient's identifying specialist	5	5
Patient's direction to specialist	5	5
Patient's set appointment to specialist	5	4
Detail views for set appointments	5	5
Upcoming appointment notification	4	4
Users' appointment cancellation	5	5
Appointment completion	5	5
Appointment histories	5	5
Specialist's e-prescription to patient	5	4
Specialist's e-medical certification to patient	5	4
Users' chat system flow	4	4
Chat bot for FAQs	4	4
Mobile Application Promotion	5	5

The table above shows the result of the developed application in terms of efficiency. Testing data results shows that the developed application is efficient, passed the test and met the target requirements.

Table 5: Maintainability Test for Quality Assurance

Target Capabilities	Analyzability	Changeability	Stability	Testability
Users registration (patients, specialist, clinics)	5	3	5	5
Users verification (specialist, clinics)	5	3	5	5
Use-case variance (patients, specialist, clinics)	3	3	5	4
Schedule setting for specialist and clinics	5	2	4	5
Supports specialist' different careers	5	3	5	5
Supports specialist' different clinics	5	3	5	5
Users' dashboard	4	2	3	4
Patient's search to specialist	4	2	5	4
Patient's identifying specialist	5	3	5	5
Patient's direction to specialist	5	4	4	4
Patient's set appointment to specialist	5	4	4	4
Detail views for set appointments	4	3	5	5
Upcoming appointment notification	5	3	4	3
Users' appointment cancellation	5	4	5	5
Appointment completion	5	4	5	5
Appointment histories	5	3	5	5
Specialist's e-prescription to patient	5	4	5	5
Specialist's e-medical certification to patient	5	4	5	5
Users' chat system flow	3	2	3	4
Chat bot for FAQs	3	2	3	4
Mobile Application Promotion	5	5	5	5

The table above shows the result of the developed application in terms of Maintainability. Maintainability means that the developed application is easy to maintain and fix. Data shows that the developed application passed and met the requirements.

Table 6: Portability Test for Quality Assurance

Target Capabilities	Adaptability	Installability	Conformance	Replaceability
Users registration (patients, specialist, clinics)	5	5	2	3
Users verification (specialist, clinics)	5	5	5	3
Use-case variance (patients, specialist, clinics)	5	5	2	3
Schedule setting for specialist and clinics	3	5	2	2
Supports specialist' different careers	3	5	2	2
Supports specialist' different clinics	3	5	2	2
Users' dashboard	3	5	1	1
Patient's search to specialist	4	5	2	3
Patient's identifying specialist	4	5	2	3
Patient's direction to specialist	4	5	2	3
Patient's set appointment to specialist	4	5	1	3
Detail views for set appointments	4	5	2	3
Upcoming appointment notification	3	5	2	3
Users' appointment cancellation	5	5	3	4
Appointment completion	5	5	3	4
Appointment histories	5	5	2	4
Specialist's e-prescription to patient	5	5	4	3
Specialist's e-medical certification to patient	5	5	4	3
Users' chat system flow	4	4	2	2
Chat bot for FAQs	4	4	2	2
Mobile Application Promotion	5	4	5	5

The table above shows the results of the developed application in terms of portability. The data above proved that the developed application is portable and can operate anytime, anywhere. Limitations may be encountered but still portable in terms of overall performance.

Matrix Legends:

A. Font sizes inconsistencies to different phone screen sizes (i.e. some are big, some are small).
B. Non-standard photo sizes for users' photo upload
C. Bland aesthetics (color scheme, font, structure, icons, etc.)
D. Limited to photo file type only
E. Limited to filter options
F. Some information for account profiling to other users is restricted

Overall, the above tables represent the rating of the developed software in terms of EIC 9126 standards. For the functionality, reliability, usability, and efficiency tests, it all rated excellently in terms of percentage consecutively as 92.14, 93.65, 92.86 and 95.24 lastly (see below table for detailed results). The other two characteristics have fair results due to the fact that the software is limited to a specific mobile operating system. It totaled to 88.35% quality rating concluding that the developed software is more than just being operational; it can work for production release to be used by public end users.

Table 7: Summary of EIC9126 Quality Test

Characteristics	**Sub-characteristics**	**Rating %**	**Total %**
Functionality	Suitability	96.19	92.14
	Accurateness	89.52	
	Interoperability	93.33	
	Security	89.52	
Reliability	Maturity	96.19	93.65
	Fault Tolerance	92.38	
	Recoverability	92.38	
Usability	Understandability	96.19	92.85
	Learnability	98.09	
	Operability	100.00	
	Attractiveness	77.14	
Efficiency	Time Behavior	97.14	95.24
	Resource Utilization	93.33	
Maintainability	Analyzability	91.43	84.0
	Changeability	62.86	
	Stability	90.48	
	Testability	91.43	

Portability	Adaptability Installability Conformance Replaceability	83.81 97.14 49.52 58.1	72.14
Compliance	Laws, Regulations (i.e. privacy, etc.)	YES	-
Total Software Quality Rating			**88.35**

Legends:
Suitability – Can software perform the task required?
Accurateness – Is the result as expected?
Interoperability – Can the software interact with another software?
Security – Does the software prevent unauthorized access?
Maturity – Most faults of software solved during development
Fault Tolerance – Capability to handle errors
Recoverability – Software resume working after failure
Understandability – User comprehension to the system
Learnability – Can users learn to use the system easily?
Operability – Can the user use the system w/o much effort?
Attractiveness – Does the interface look good?
Time Behavior – How does the system quickly respond?
Resource Utilization – Is the system utilizing resources efficiently?
Analyzability – Can faults be easily diagnosed?
Changeability – Can the software be easily modified?
Stability – Can the software continue if changes are made?
Testability – Can the software be tested easily?
Adaptability – Can software be moved to other environments?
Installability – Can software be installed easily?
Conformance – Does the software comply with the portability standard?
Replaceability – Does software easily replace other software?
Compliance – Does the software comply with laws?

DISCUSSIONS

After careful analysis of the results of the study, the proponents made conclusions and gave recommendations for future researchers.

Conclusions

The application was successfully designed and developed based on the required specifications. Both hardware and software tools enabled the proponents to develop the prototype of the mobile application. The gathered data and findings become the basis of the proponents in developing the application. Those data were used to improve and enhance the application. The search specialist, book appointment features for specialists and patients were achieved and serve their purpose for the developed application. It enabled the users to search and book appointments in their desired clinics and specialists.

In terms of user communication, the proponents provide a chat interface wherein the patients can ask questions directly to the specialists. This feature was successfully made to serve its best purpose. Aside from that, this feature also provides an image format attach feature wherein the specialists can provide changes to the prescription given. A website was also provided so that intended users can check and see anything they wanted to know about the developed application on a web browser. The proponents tested the last step of the development and concluded that the developed application and the website were functioning well and have passed results in terms of functionality, reliability, usability, efficiency, maintainability and portability.

Recommendations

Upon execution of the developed application, the proponents listed some recommendations for future researchers to enhance the developed application and provide better functionalities and usefulness. These recommendations include:

Prescription Supervision

Prescription supervision was recommended for the proponents who thought that it may help a lot in both patients and specialists. The

patient supervision enabled the specialist to know or have an idea of whether the patient was really taking his/her prescribed medicine. Also, supervision notification was recommended so that patients will be reminded of their medication.

Widen the scope area of Mappings/Locale

The proponents recommended widening the scope of search which to be specific the whole province of Pampanga or the whole of the Philippines instead of just Mabalacat City. This was because some specialization cannot be found in Mabalacat City.

iOS Support Compatibility

As the developed application provided the most convenient way of medical specialist search and bookings right at the fingertips of the user which were the mobile devices, the proponents recommended extending the compatibility of the application. The developed application was limited only to the android operating system, the proponents recommended applying it also on the iOS operating system.

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E-Diary: A Personal Diary with Lock Mobile Application

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ABSTRACT
The study is to develop a suitable diary mobile application that matches the current lifestyle and enhances the experience of diary writing on the go as people are spending more time on their smartphone. The researchers developed E-Diary: A Personal Diary with Lock Mobile Application is an application that resembles closely to a physical diary with better features to overcome physical problems and such. Considering that in our generation nowadays, expressive writing in a physical diary or personal journal may not be favorable in our current lifestyle. Not only users will have access to their personal journal instantly, researchers also believed that incorporating expressive writing in our daily life yields positive effects to the user especially in terms of psychological health. The researchers developed using Android SDK, Android Studio, Fire Cloud Messaging, Adobe Photoshop, and Adobe Illustrator; and for the backend web server Php 7.2 and MySQL were used for development. The integration of the mobile application and the back-end server needed to satisfy the user by validated test cases to check if the mobile application and back-end server was worked integrated properly. The researchers developed and tested the functionality, reliability, compatibility, security, and operability of the mobile application and can downloaded it free in Google Play.

Categories and Subject Descriptors
Mobile Application

General Terms
Diary, Calendar, Mood Tracker, Pin code, Emoji

INTRODUCTION
Smartphones have become a tool for both entertainment and work for many people. Regarding a recent study, the number of smartphone users in 2020 is 3.5 billion, which translates to 45.4% of the world's population with several million mobile applications out there; the application industry is arguably the most influential and crucial for its growth. In line with this mobile application, development is rapidly growing and evolving which made lives much easier. [1]
Younger generations today are tech-savvy and always on their phones. This growth of users over the years provides a great opportunity for developers to produce mobile applications and introduce them to the market. The number of mobile app downloads each year has been steadily increasing. In 2019, there were 204 billion app downloads worldwide (excluding re-installs and app updates). As App Annie reports, this is a 45% increase from 2016. [2]
With several advantages of mobile applications, the most encouraging approaches is going mobile and reducing paper usage that offers innumerable short and long-term benefits starting from environmental awareness to boosting on-site logistics.
Now is the age of the phone and technology and application such as the traditional diary has evolved. Diaries are your secret companion and a place where you can be honest with yourself. Diaries and journals have been around for centuries. They are great spots to express your innermost feelings.
With scientific research, according to Benjamin Franklin writing, a diary had many psychological benefits few of them are it improves self-awareness, the ability to reduce anxieties and settle nerves in potentially stressful situations, it
improves metacognition research has shown that people who keep diaries experience greater metacognition through the development of self-regulatory strategies such as effective preparation, monitoring, and self-questioning,

it reduces procrastination and it improves memory and well-being. [3]

With countless benefits of keeping a diary and with the help of technology Diary is now available at your fingertips in the form of a mobile app. Having a diary app can change your life. It comes down to one simple fact; a diary app is much more flexible in its uses. You have nearly complete control over what you want in the diary and it is all in the lightweight version of your phone. This is not to mention the fact that creating a diary entry is extremely simple when you carry it around everywhere. [4]

The researchers came up with the study entitled "the desired outcome of this research is to address some problems, that the traditional way of practicing expressive writing using a diary by converting the concept to a mobile application which is more relevant to the current lifestyle.

General Objectives

The general objective of the study is to develop an application entitled "E-Diary: A Personal Diary with Lock Mobile Application".

Specifically, the study sought to achieve the following:

1. To gather data and identify the needed requirement specifications
2. To design and develop a mobile application and back-end server with the following features:
2.1 Log In
2.1.1 Email Address;
2.1.2 Verification Code;
2.1.3 Password; and
2.1.4 Forgot Password
2.2 Diary
2.3 Calendar
2.4 Emojis/Mood;
2.4.1 Happiness;
2.4.2 Sadness;
2.4.3 Disgust;
2.4.4 Fear; and
2.4.5 Anger
2.5 Mood Tracker;
2.5.1 Mood Chart; and
2.5.2 Mood Count
2.6 Pincode
3. To create a mobile application using the following software 3.1 Android Studio;
3.2 Android SDK;
3.3 Adobe Photoshop; and
3.4 Adobe Illustrator
3. To test the system in terms of functionality, compatibility, security, and operability of the mobile application and integration testing of the application and web-based backend server.

Scope and limitations

The proponents aim to develop a mobile application named E-Diary. It is a mobile application that is developed for android devices from version 6.0 (Marshmallow) to android version 10 (Android Q). After the planning phase, the proponents gathered information from the internet searches, articles, journals, social media, and books. All information gathered was used in developing and designing the mobile application. For the application to be developed, the proponents used Android Studio and Android SDK. Adobe Photoshop, Adobe Illustrator, and Picsart were used for web design.

Once the application is installed, the first screen that the user will see is the login page. The user should register by using a valid Email Address and a verification code will be sent on the registered email. Once the verification is done, the user needs to complete the registration by setting up the name, gender, and password that has a restriction of at least six characters with one uppercase, one lowercase, one digit, and one special character. The verification code is an added security feature of the app that ensures that the user is authorized to gain access to the application. The Forgot Password is another security feature of the Mobile Application that uses Token. The Forgot Password is in the Log in page, the user need to enter Email Address; the application will send an email that contains the token or the encrypted code. User need to copy and paste it on the application and once verification is successful, the application will ask for a new password. Tokens have limits, it is for a one-time use only and it was set to self-destruct after four (4) hours. Once the user had finish registering to the application he or she

can already start using the application. Login will secure the user's daily entries in the application.

On the Diary feature of the application the user needs to choose one of the emoji or mood before the user will be directed to the diary pad. In the diary pad, the user is free to express and write anything. Writing down feelings can help to "brain-dump" the user's anxieties, frustrations, and pains. This can help users to reduce and release any stress that is accumulated over time. It can be a "brain-booster" because the brain will make stronger connections with the information that the user has learned after typing it down in a diary, making it easier for a user to recall in the future. The Diary pad should at least contain 12 characters. Once submitted, the pop-up quotes will be shown on the screen. The quotes can encourage and cheer up and may brighten up the mood of the user. The application has a Mood Tacker. In the mood tracker, it will show the graphical data by using a chart. The application has the capability to count the different moods for the past seven days, thirty days, sixty days and a year. Charting or tracking moods can be an effective tool for the user to see his or her mood for a specific span of time. Overall, expressing one's self in a diary is a good way to free up any tension that prevents one from feeling happy.

Calendar will give user a timeline view of the entries at one glance, which help the user to keep track on all of their entries and moods at the same time on a specific day, month and year.

Pin code is another security feature of the application that can prevent unauthorized access from other people. The pin code is a four-digit code that the user needs to set in the application.

The system was developed using the following software tools: Android Studio; Android SDK; Adobe Photoshop; Adobe Illustrator and PHP.

The application will be tested according to its functionality, compatibility, security, and operability. An integration testing will also be done in order to make that the application and back end are correctly integrated and will not yield any errors when the system will be used.

The application needs an internet connection for the users to access the application and save the data. The application also needs enough memory/storage on the phone if the application needed an update or a newer version.

SYSTEM DEVELOPMENT METHODOLOGY

The Proponents decided to use the Prototyping Methodology in developing the Mobile Application. Prototyping method is a software development model in which prototype is built, tested, and reworked until an acceptable prototype is achieve. It also creates base to produce the final system or software. This method is actively involved in the development so if there are errors it can be detected on the initial process stages of the development of the system. [5]. The Prototyping Model is a straightforward model and it is easy for the proponents to understand the changes that will happen on developing the system.

The prototyping method always starts with data gathering and planning. The proponents start gathering information by searching the internet for articles, journals, social media and books related to the topic that will be used in developing the Mobile Application. After gathering necessary information, the researchers conducted brainstorming in order to get each other's idea. These ideas are combined and the researchers came up with the title of "E-diary: A Personal Diary with Mobile Lock Application." After the data gathering, the researchers also sort out all the requirements needed in order to make the Mobile Application. This is also the phase where the researchers started to layout the design of the Application and create the logos needed. After all the requirements are identified the researchers start to build the Prototype.

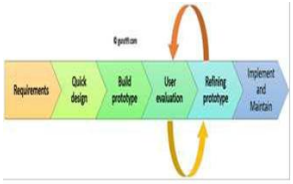

Figure 1: The Prototyping Model Data Gathering

Design tools was utilized in order to gain more insight about the application.

Figure 2 show the use case diagram that had been utilized by the researchers. The use case diagram show how the user will perform the task on the Application because it outlines the user's point of view and how the application will respond to the request of the user.

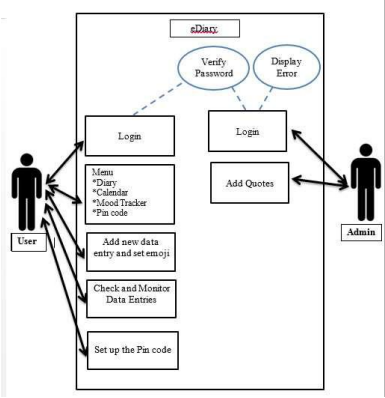

Figure 2: Use Case Diagram of E-Diary

Figure 3: The System Architecture of E-Diary

The Figure 3 shows on how the back end server will respond on the mobile application request. It will show the interaction between the Mobile Application, Back end server and the database. All request that was made inside the Mobile Application like registration, adding, saving and deleting diary entries will be sent to the back end server by the means of internet. Without internet the back end server won't be able to do the request and the data sent won't be save in the database.

Use Case Diagram and System Architecture helped the researchers to gain more understanding about the system.

During the development, the researchers able to determine the specific icons, logos and gif for the design of the Application and that is with the help of the Photo Editing Software's like Adobe Photoshop and Adobe Illustrator

The researchers also identified the hardware and software components needed to develop the application such as; Test devices like Real Me 6 with Android version 10. A Desktop which has a processor of AMDA4-6300APU, 4GB RAM and 64-bit OS. Software tools utilized to develop the system includes Android Studio, Android SDK, Adobe Photoshop, Adobe Illustrator for the application and MySQL and PHP for the back end server.

The application was tested according to its functionality, compatibility, security, and operability. An integration testing will also be done in order to make that the application and back end are correctly integrated and will not yield any errors when the system will be used.

The researcher gathered feedback during defense in order to refine the system. This phase will have continued until all the specified requirements were achieved.

RESULTS AND OUTCOMES

This section presents the results and outcome of the study based on achieving the specified objectives.

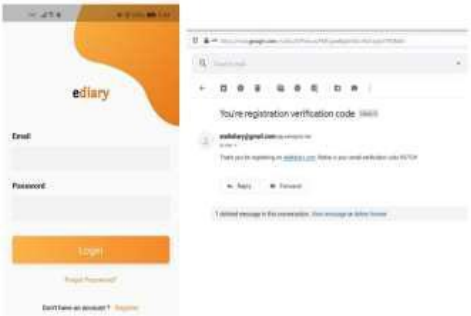

Figure 4: Login Page

Figure 4 shows the Login page where the user can input user name and password in order to access the application.

Figure 5. Welcome Note

Figure 5 show the Welcome Page of the application. It describes how to use the application.

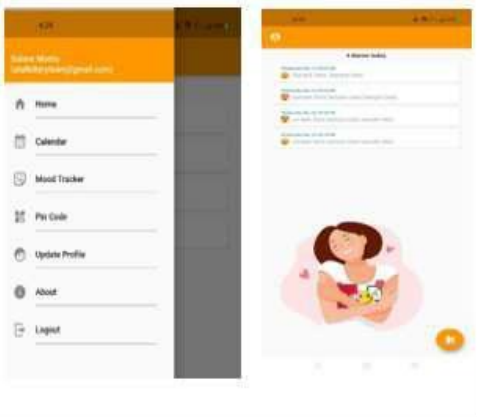

Figure 6. Menu Page

This page let the user to navigate the application also the user can add an entry on this page. Once the entries were entered it will be saved and user can view it on this page. Also user can update the profile on this page, set up a pin code for added security and can check the mood were entered while writing an entry.

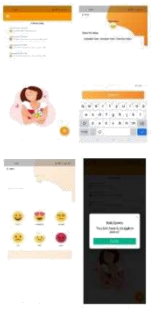

Figure 7. Home Screen

This is the home screen where user can add a certain entry or activity in a day. By simply tapping the yellow plus sign on the lower right bottom of the screen. Upon starting an entry, the application will ask the mood of the user and it will be added on mood tracker that can be used in the future needs.

Figure 8. Calendar

This is the calendar where the user can view the timeline of the diary added on a certain day. It is a big help for the user to track and go back on the entries. Old entries cannot be edited.

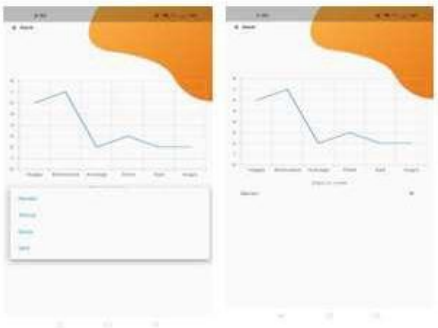

Figure 9. Mood Tracker

Mood tracker a user can track the moods that was added while writing the journal and other purpose of this feature is to help the user in the future if decided to consult to an expert can be a huge help to track the moods. This can be viewed 7 days, 30 days or a year.

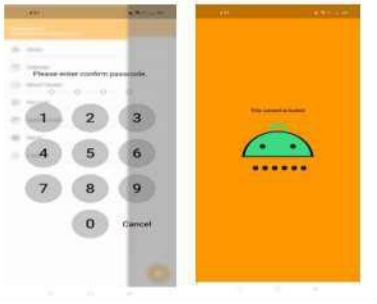

Figure 10. Pin Code

This feature a user can set up a pin code for the additional security on the application to avoid intruder.

Figure 11. Update Profile

This page the user can update the profile on the application.

Figure 12. About page and log out button

This page will help the user to retrieve the password in any case a user forgot the password was set up on the application or account. The verification or token will be sent via registered email on the application.

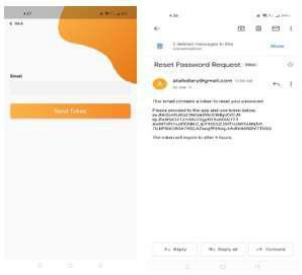

Figure 13. Forgot password button

The forget password button enables the user to reset his or her password.

The application was develop using the following software Android Studio; Android SDK; Adobe Photoshop; Adobe Illustrator, PHP 7.2 and MySQL. Using the software tools the specified objectives of the study was achieved. All specified functionalities were developed and included in the system for both the application and the web based back end.

The system was tested in terms of functionality, compatibility, security, and operability of the mobile application and integration testing of the application and web-based backend server. All functionalities were reflected in the develop system. The application is considered easy to operate and access because of intuitive layout for the buttons and features of the application. The application can be downloaded and installed with android version 6 and up. Finally, the application is secured since it includes more security features like user name and password, forget password, verification code and pin code.

DISCUSSIONS

Based on the given objectives and results of the study the researchers concluded that the application met all the requirements specified in the objectives. The mobile application was developed using Android SDK, Android Studio, Fire Cloud Messaging, Adobe Photoshop, Adobe Illustrator; and for the backend web server Php 7.2 and MySQL. Using these software tools

enabled the users to developed the system successfully. Testing using test cases were successful that the final system no longer contain errors. Functionality, compatibility, security and operability was proven using the different test cases developed by the researchers.

The researchers identified some recommendations for future researchers in order to improve this study that includes the following:

1. Improve the design more and include theme or a means to change the background or skin of the application.
2. Include an offline version of saving entries in the journal and if internet connection is available the application will notify the user to save it in the cloud.
3. Allow users to edit entries and provide history or edit logs that the user can review if he or she wanted it to.
4. Provide a means to insert image, videos, voice in journal entries.
5. Develop a similar application intended for IOS users.

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ESKRIMA: An Android Based Educational 3D Simulator Game for Arnis

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ABSTRACT
The aim of this study is to develop an Android-Based Educational 3D Simulator and Fighting Game for Arnis to help the students of Mabalacat City College who are taking the subject in PE-Module 3 (Arnis). This mobile application can be used an alternative teaching material on the said topic. This Simulator Application contains the details and different movements of Arnis that can be used by students in studying and practicing the Arnis. This is designed as an offline application for the students so that they can learn and practice Arnis without the need for Internet. As an added feature of the application, it has an Arnis fighting game where user can enjoy 3D Arnis fighting styles and combos in a single and multiplayer console.

Categories and Subject Descriptors
Mobile Application

General Terms
Students, Teachers, Colleges

INTRODUCTION
Nowadays, mobile phones are very useful to everyone. It can make things easier for everyone, just a click on phone people can connect, communicate, access, study, watch, play games and get what they want. Mobile phones provide the users a power to do lot of things, but without the use of internet some of these are not accessible for everyone. Especially, now a days those citizens of most countries are experiencing the pandemic, mobile phones now are very in demand most especially in the field of studies. Classes now are being done online because of the Covid19 safety protocol. For the safety of everyone, face-to-face classes and meetings are being avoided. The study of Arnis can be learning to paradigm in the college level to enhance students' knowledge and skills. Due to the pandemic that the people are facing right now especially in the education sectors, this affects the way of studying of the students. Eskrima is an offline Simulator mobile application that will surely help the students to study and practice Arnis while they are studying at home.

According to (NCSL) National Conference of State Legislatures, the outbreak of the coronavirus has become a major disruption to colleges and universities around the world that causes of cancellation of the face-to-face classes and transformed into online classes to prevent the spread of the said pandemic [1].

General Objectives
The general objective of this study is to develop an Android-Based Educational 3D Simulator Game for Arnis.

Specific Objectives
- To develop a 3D Simulator Game for Arnis with the following features:
    A. Educational 3D Simulator
    B. A multi-player Arnis fighting game
- To develop the app using the following tools:
    A. Unity 3D game Engine 2020.1.4 fi (64 bit)
    B. Blender
    C. Unity Remote 5
- To evaluate the game in terms of functionalities.

Scope and limitations
The project will be focusing on creating an Arnis Simulation Application for the students to study and learn the Arnis using 3D animations and will also have a multi-player

Arnis Fighting Game that will entertain the potential user(s).

The Simulator Module will be available offline so that the user(s) can access the application without the use of internet connection or mobile data that might consume the money and waste of time for the user(s). The Game Module will have a Single Player Mode and a Multiplayer Mode. The Simulator Module will be based on the **MCC PE-3 MODULE**. Where in this project all the Arnis movements that are required in academic learning will be compressed into one Android Application. Students don't have to search individually for different techniques of Arnis online or on YouTube to be able to watch and learn the Arnis because this application contains thirty-eight (38) individual movements that will create five (5) different Arnis combinations. The application will be available for the Android phone user(s) only.

For Educational 3D Simulator, the following movements will be covered:

- Single Stick & Double Stick;
- Salutation;
- Foot works;
- Striking;
- Basic Striking Techniques;
- Combination of striking;
- Blocking Techniques;
- Basic Stance;
- Brief History of Arnis;

And for the Arnis game, the researchers will be creating a multiplayer Arnis Fighting Game as the added feature of the application for entertainment purpose, so that the user(s) can enjoy the application. While having time in learning Arnis, user(s) also have time to enjoy the Arnis Fighting Game using this wonderful application.

For Arnis Fighting Game, the following will be covered: Multi-Player Game, this will be available online to connect to another player and Single Player Game that will be available offline for solo game. This Game application has a Player Controller & movements;(Left, Right, Up, Down, Attack and Jump) Player Health System; (Health Bar) and Player Animation.

The Game Module will contain Single Player mode and Multiplayer mode. On the Single Player mode, the player can choose on the menu. The level of difficulty that will be able to choose from Easy, Medium, and Hard level. On the Single Player gameplay, the player will have a UI (User Interface) that contains joystick to move the player around the game. A basic attack button, a skill button and jump button to interact on the game. On the difficulty level will be based on the number of enemies that will be spawned in the game. The game can be won by defeating all the enemies in the game and the game can be lose when the player's health bar turns to zero. On the in-game menu, the player has Restart Button, to restart the game, Pause Button in able for the player to pause the game when needed and Play Button so that it can resume to the game and, it has a Quit Button to end your gameplay.

On the Multilayer Mode, as you enter the first menu a button "connect to master" will appear to be able to connect to the server online after the button is clicked. The next button that will appear on your screen is the "Join Random Room". When the player is able to join a room, the player will be brought to a game scene where the player will wait for another player to interact in the game and play against each other. The players will have their own UI to control their own characters in the game. The game will have a three (3) round battle. The game can be won by defeating the enemy player for two (2) rounds.

The Simulator module will be available offline, and the Game module will be available for an online environment to connect to the other player. The Arnis Simulator will strictly follow the PE-3 module in implementing the application. The Game module can be played by a single player or multiplayer. The system cannot be installed on computer operating system environment. It's a software crafted for touch screen pads or touchscreen phones only. With the exception of android phones, this is not supported.

The 3d Simulator module will be implemented in portrait mode only, whereas the multiplayer

game module will be implemented in landscape mode.

SYSTEM DEVELOPMENT METHODOLOGY

Figure 1: Scrum Methodology

For the application that the researchers have come up with, the SCRUM methodology was suitable for the project. Scrum is a subset of the agile approach. It is a framework used for project management that prioritizes accountability, teamwork, and iterative progress to achieve a clear goal [2]. The scrum method is based on a simple premise: begin with what is easily seen or known.

By using this methodology, the researchers have created and have present the application according to the requirements and features presented to the panel during the title defense.

Aims and objectives of the research

The researchers aim to create a 3D Arnis Simulator Game that will help the user who wants to learn the Arnis on a proper way and improve the student's abilities and to assess what the students have learned while using the application.

Based on all the information that has been gathered, the construction of a preliminary design or the quick design was implemented on this stage.

Following the planning and determining all the required data, the researchers constructed a designed prototype which include the design for the Arnis Simulator module and for the multiplayer Arnis Game using the Blender and Unity 3D.

Sprint Week

Product Backlog

A product backlog is a list of the new features, changes to existing features, bug fixes, infrastructure changes or other activities that a team may deliver in order to achieve a specific outcome.[3]

In this stage, the researchers gathered and talked about the project and finalized the project requirements such as project goals, expectations and timelines. The team gathered all the things that will be added to the project that is easily to remove and change when needed. The team worked on stories, bug fixes and development of the project for the desired outcome.

Sprint Backlog

A sprint backlog is the set of items that a cross-functional product team selects from its product backlog to work on during the upcoming sprint.[4]

As soon as the researchers gathered all the information needed for the project, researchers started to the development stage. Designers and developers worked together, created and improved the working prototypes until the final product was ready.

The product team conducted regular product refinement backlog, to ensure that sprint planning meetings were productive and that the team was able to quickly identify the right tasks to place on the next sprint backlog. This strategy helped the team to ensure the right stories were prioritized so that the development will continue smoothly, and it lessen the work of the team.

The purpose of a sprint is to exponentially advance a concept, reducing ambiguity by rapidly developing and testing a prototype.[5]

In this stage, the researchers met the timeframe given to the team. Each member of the team received a different concept of the project that came from the product backlog and each member able to finished and presented it to the developer in order to get the best concept for the project. To meet the desired outcome of the project, continuous development was applied to this project. Prototypes were

converted into working models. The developers used 3D model for the mobile application that the team were building. All the feedbacks, additional features, suggestions, and recommendations from the client were considered and added to improve the mobile application that the researchers have done.

Sprint Review Meeting Release

The purpose of the Sprint Review is to inspect the outcome of the Sprint and determine future adaptations.[6]

Finally, the scrum team reviewed what was accomplished in the sprint and what has changed in their project. The product backlog has been adjusted to meet new opportunities for a better project that the team developed. The Product Owner (The Product Owner is accountable for effective Product Backlog management) explains what Product Backlog items have been done and what has not been done; then the developers discussed what went well during the Sprint, what problems it ran into, and how problems were solved. The entire group collaborates on what to do next, review the timeline, budget, potential capabilities, and target market for the next anticipated releases of functionality and capability of the product.

RESULTS AND OUTCOMES

In this phase, the study's findings were presented and discussed with reference to the aim of the study. As a result, the researchers conducted a related literature review to gain concepts and ideas from previous researchers before brainstorming and proceeding to the planning stage.

The researchers began working on this project by performing and learning all the moves in Arnis, which would then be implemented by the game developer into a simulator application.

Implementation

When all the movements of Arnis and features of the fighting game are implemented to the 3D model – it will be applied to the designed and developed mobile application which is ESKRIMA, and it will be a working prototype. The movements of the 3D model on the application are accurate from a person's movement. This will serve as a resource of the students in learning and practicing the Arnis and will be easily to copied by the user. As well as the game that the researchers added to the application for the user can enjoy the app while they're having a break in studying the Arnis.

Design and Development

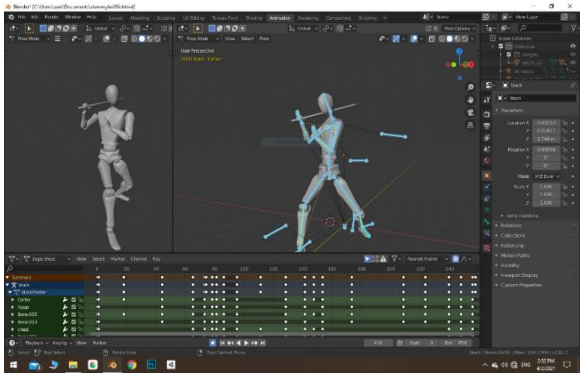

Figure 2: 3D Modeling

As shown in Figure 2, Blender was used by the developer for the 3D modeling of the character that will be needing for the application that the researchers were creating. The developer used the recorded video of the researcher's movement who studied the Arnis. The avatar`s movements were based on the movement of the real person.

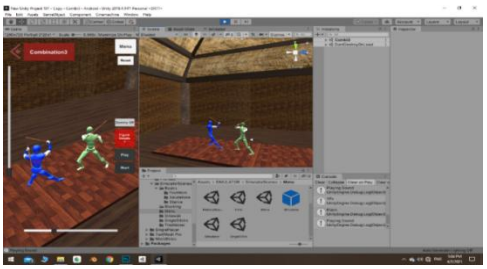

Figure 3: Development of the 3D environment for the simulator using Unity

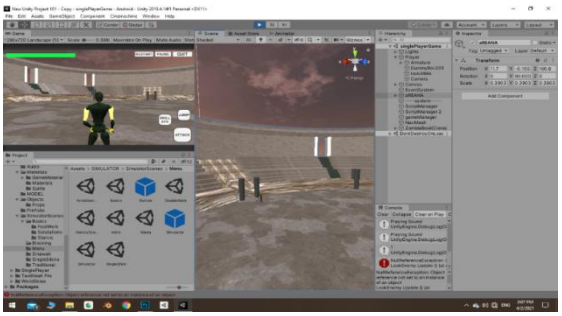

Figure 4: Development of the 3D environment for the game using Unity

In Figures 3 and 4 showed how the developer created the 3d environment using Unity for both the simulator and game applications. In order for the user to see all of the avatar's various angles in the simulator and play the Arnis game in 3D environment.

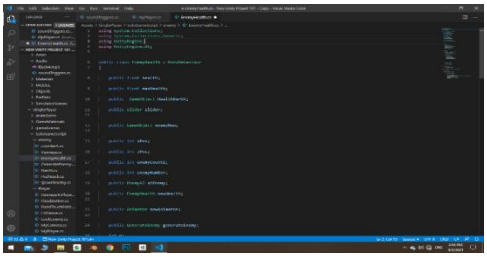

Figure 5: Visual Studio

To make it a working application, the developer used Visual Studio for coding and used the C# (C Sharp) as the programming language to connect all the things that were needed for the application such as options, sounds, movements, health bar, controller (up, down, left, right, jump and attack) and the scenes.
To validate the specific functionalities of the mobile application based on the researchers' specific objectives, test cases were used.
After validating the functionalities using the test cases, the researchers were able to determine what are the problems that needs to be fix by the developer in order to meet the desired output for the users.

Figure 6: Simulator Application

As shown in Figure 6, the developer implemented the prototypes for the application. It was already a developed application; the user can now use it to study the different movements of the Arnis without the use of internet.

Figure 7: Game Application

As shown above, the prototype for the Arnis Game is a survival mode. The researchers added it to the application for the user to enjoy the game while learning the Arnis at the same time. In this mode the user can use basic attack and skill to kill the AI (Artificial Intelligence) while moving around with its 3D environment. The game will be over when the user's health bar runs out or the player accidentally jump off to the ground where the player's character stands.

DISCUSSIONS

Based on the previous analysis, test results and objectives that was conducted in the research evaluation and testing, researchers created conclusion. That conclude all the requirements written in the objectives of study were all achieved. The application can now use by the students. It is now a fully developed application where Simulator Application can use as a resource in studying Arnis and the game application can play by the users.
Simulator Application provides the different movements of Arnis like blocking techniques, striking techniques, combinations, and the rest of the movements which includes in PE-3 Module of MCC. It contains the details of the movements that can be read before practicing

Arnis in order for the user to understand what is to be done by the movement they choose to practice. The 3D environment and 3D model were implemented in this application for better angles so that it can be easily copy by the user.
The Scrum Methodology that the researchers used in developing this app was a big help for them. It serves as a guideline for the researchers in order to fully developed this application.
After the series of test cases, the researchers achieved the stated objectives on the previous phases wherein the researchers developed an application for Arnis Simulator and Arnis Game that will be use by the students of MCC (Mabalacat City College).
The development of the application was continuous until the researchers meet all the recommendations of the panelist to achieve the desired output of the application for the users. And as the most recommended by the panelist was to add a sound in the application to make it more attractive to the users.
Finally, based on the test cases gathered, the researchers have proved that learning the Arnis can be easy and fun with the help of the application that researchers developed. Without the use of internet, students can now learn and practice the Arnis using the ESKRIMA application.

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e-TimeTable: A DepEd Task Management System with Workweek Plan and Individual Accomplishment Report

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ABSTRACT
This study aims to develop a web-based task management system for the educators of Mabalacat City Highschool. This system is developed to enable our educators to manage their tasks as long as they're connected to the internet. This system allows educators to manage their tasks, create subtasks, track progress, and show graphical displays of reports. The system was developed using WordPress, PHP, HTML, CSS and JAVASCRIPT. The system's functionality, reliability, usability and security using test cases.

Categories and Subject Descriptors
Web-based System

General Terms
Teacher, Master Teacher, System Administrator, Principal

Keywords
Wordpress.org Development, Website

INTRODUCTION
In today's globalizing economy, the Philippines' educational system is adapting to a new normal standard, it is essential to allow educators to properly manage their tasks when working at home or in the office. Faced with reality, educators have arrived unprepared and need assistance in implementing proper ways of managing their tasks. Each educator is given their own set of responsibilities, one of which is to complete assigned tasks, which is composed of a subtask list. The school heads should be aware of what the subordinates are doing. Resources should be considered, deadlines may need to be adjusted, workloads must be managed, and progress must be tracked.
The lack of reliable task reports, the continued use of paper to submit documents, the problem with task communication, and finally, the inefficient way of completing tasks [1] should be addressed.
The essential of task management is something that should be taken into consideration. Task management includes planning, analyzing, evaluating, and reporting about a particular task's progress. It is an important aspect of the management of a project because it helps to follow every task thoroughly. Regardless of the size and complexity of the task, task management is an absolute necessity [2]. Task management systems solve problems with regards to inaccurate task time estimates and poor workflow management. Time management is crucial in finishing assigned tasks [3].
The focus of this study is to design and develop a task management system to help educators manage their tasks and outputs properly and to accurately track the progress of their tasks.

General Objectives
The general objective of this study is to build a web-based system entitled "E-Timetable: A DepEd Task Management System with Workweek Plan and Individual Accomplishment Report".
The following are the specific objectives of the study:

1. To design and develop a system with the following features:
   - 1.1. Create and assign tasks
   - 1.2. Create a workweek plan for all teachers
   - 1.3. Track progress of assigned tasks
   - 1.4. Generate of Reports

2. To develop the system using the following software tools: WordPress, PHP, HTML, CSS and JAVASCRIPT.
3. To test the system's functionality, reliability, usability and security using test cases.

Scope and limitations

The researchers developed a Web Based Task Management System. The system enables users to register. The school head or any teacher assigned by the school head can create tasks and sub- tasks. The system provides a means to efficiently assign tasks to the registered teachers in the system. The system can generate a workweek plan for each teacher. The task and sub-task created in the system is associated with milestones. These milestones are used to monitor progress pertaining to the task assigned to each teacher. The system enables teachers to generate accomplishment reports. The system can generate reports associated with the task of the teachers. The system was developed using WordPress, PHP, HTML, CSS, JAVASCRIPT. The system's functionality, reliability, usability and security were also tested using test cases.

SYSTEM DEVELOPMENT METHODOLOGY

In this study, the group utilized the Prototyping software development methodology. This methodology consists of different phases that include brainstorming, design, development, quality assurance and deployment [4].

Figure 1: Prototyping Model

To gather data, the researchers started by conducting an interview with the Mabalacat City District's I.T. Head, Mr. Michael Villanueva about their existing systems and problems they encountered pertaining to the task assigned to teachers and the means of tracking progress of assigned tasks. An interview with a school principal was also conducted to further understand issues and problems associated with the topic at hand. Internet researches were also utilized by the researchers to gather more relevant data to understand the problem and identify solutions using technology to solve their problems.

The solution to the existing problem for the locale is to develop a task management system with a workweek plan and a means to generate individual accomplishment reports for teachers and school heads.

In the design phase, the researchers used design tools like context diagrams and use case diagrams. The context diagram enabled the researchers to understand needed input for the system including the different processes that should be included in the system. The use case diagram was utilized to capture core functionalities of a system and visualize the interactions of various users of the system. The use case diagrams enabled the researchers to understand further the core parts of a system and the workflow between them. Once the design process was completed the researchers proceeded with the development phase.

In the development phase, the identified functionalities were established and coded. WordPress, PHP, HTML, CSS, JAVASCRIPT were used to develop the system.

The developed system has undergone testing. Test cases were used to check functionality, reliability, usability and security. Testing is employed to make sure that the system is working correctly according to established functionalities.

After the testing is completed and the system is refined it will now be released to the locale.

RESULTS AND OUTCOMES

This section discusses the results of study.

The researchers were able to come-up with the user interface design of the system and fully customize it for better user experience.

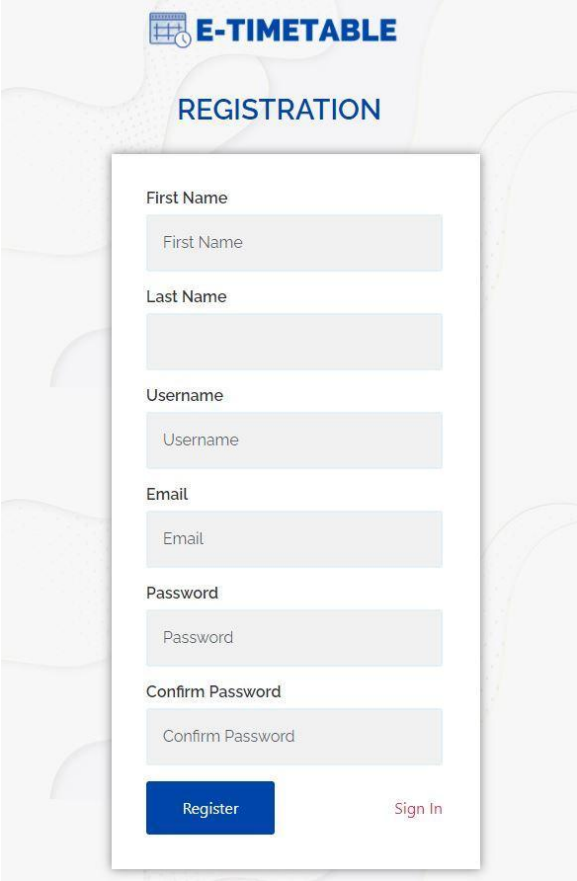

Figure 1: Web Based Task Management System

Figure 1 shows the developed and customized web based system that starts on a Registration page. Once the users logged in, the admin will need to accept or reject the user for security measures.

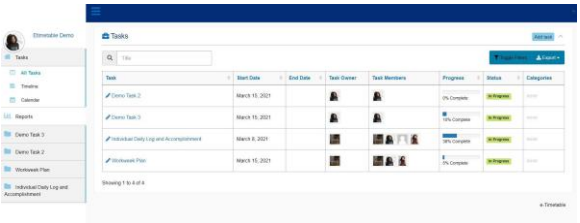

Figure 2 Home Page

Figure 2 shows the Home Page where the users can view all tasks in table format. The details included here are the task title, start and date, task owner, task members, progress, status and categories. The tasks title can be edited using the pen image beside every task. Photo of the task owner and members are the ones indicated in the table. Progress are in percentage.

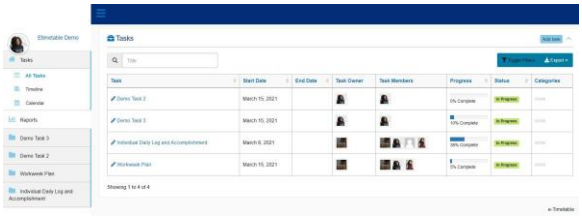

Figure 3: Add Task

Figure 3 shows how to add a new task to the system. Details about the task should be include when creating it.

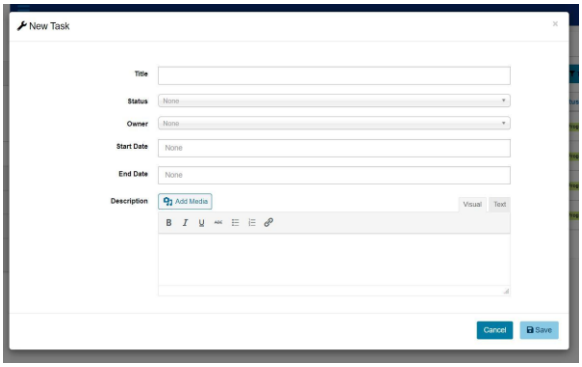

Figure 4: Fill out Task Details

Figure 4 shows where to fill out all task details. Details about the task include title, status, owner, start date, end date and description. The page provides the user with a Cancel and Save buttons.

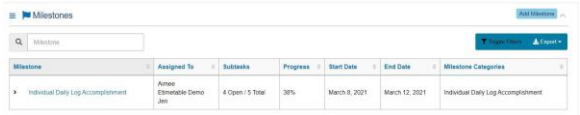

Figure 5: Milestone

Figure 5 shows Milestone to track progress of all subtasks. The details are presented in a table format where milestones are listed including the who is assigned to, the sub-tasks associated with this milestone, the progress

shown in percentage, start and end date and finally the milestone category.

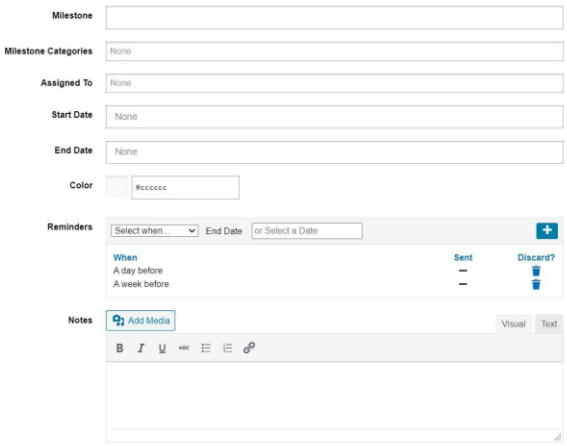

Figure 6: Subtask Details

Figure 6 shows how to add subtask. The details needed to be inputted in order to add subtasks include milestone, milestone category, assigned to, start and end date, color, reminders and notes.

Figure 7: View Subtasks

Figure 7 shows interface on how to view subtasks. This page also allows users to search titles of subtasks. The user can also export the subtasks using the Export button.

The researchers tested all testing necessary to be done on the website. To verify a website for potential bugs before its made live and is accessible to the general public. Testing using test cases checks the system's functionality, functionality, reliability, usability and security

DISCUSSIONS

The objectives of the study were accomplished by the researchers. The task management system was designed and developed according to required specifications. Task created, assigned and progress can be monitored. Time frames for the different tasks were also provided in order for users to be able to manage their time and accomplish assigned tasks. Milestones also provided a means for users to track their progress. The users were able to create their own accomplishment reports using the system. Reports can also be generated that can help school heads to check progress of every teacher. The system was developed with WordPress, PHP, HTML, CSS, JAVASCRIPT. The system's functionality, reliability, usability and security were also tested using test cases.

The system can be improved further by future researchers. Recommendations for improvement are as follows:

1. The system can be implemented in DEPED divisions not only in a particular school.
2. The system can accept upload of evidence for the accomplished tasks.
3. The tasks identified can be generated to become part of the teachers IPCR.
4. Automatic assignment of task based on specialization of teachers and availability of schedule.
5. Notifications for pending unfinished tasks when nearing the end date.
6. Notification when tasks are assigned to particular teachers.
7. The system can include collaboration means for teachers who are assigned the same task.

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MedEaseSeen: A Smart Pharmacy Finder Mobile Application within Mabalacat City

Presented on International Research Conference on Information Technology Education (IRCITE) 2021 – Paper Presentation

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ABSTRACT
MedEaseSeen is a mobile application for Android users on OS 5 (Lollipop) and up. The proponents of this study aimed to develop a smart pharmacy-finder mobile application within the City of Mabalacat in Pampanga. It was designed for Mabalaqueños to be able to locate which pharmacy offers the availability of medicine(s) they need. MedEaseSeen will also locate via Google Maps the exact location of the pharmacy and show a route from the customer's current location to the pharmacy's place. It also has a feature where the pharmacist(s) can respond to customers' inquiries. The web-based server provides pharmacists to manage their product inventory and/or their pharmacy's account. The integration testing was done successfully that no errors were generated and the system was still correctly functioning. The objectives of the study were met and therefore ready to be used by the Mabalaqueños. Future researchers may expand the scope of the locale, may develop app for different platforms and may add more features such as incorporating monetary transactions and delivery options.

Categories and Subject Descriptors
Pharmacy Management, Mobile Tracking Application

General Terms
Pharmacy Finder, Mobile Tracking, Messaging

Keywords
Pharmacy, mobile application, web-based server, medicine, GPS

INTRODUCTION
Over the last few years, the healthcare industry has been booming and continuously evolving and seeking to incorporate the newest modes of technology in order to improve its working. To add on this, the Philippines is the third largest market for pharmaceutical products among the ASEAN countries. In Mabalacat City alone, which was the target location of this study, there are at least 70 pharmacies offering a wide range of medicinal products [1]. There are now several possibilities for mobile applications (apps) applicable to the healthcare sector [2]. With the exponential development in technology, the Internet is becoming a significant one-stop-shop for customers to meet most of their needs. Be it communication, entertainment, shopping, knowledge quest, the internet serves as a panacea for all their needs. Inquiring for medications online is no exception of this. [3] In the year 2020, there is a higher demand from people to be in need of taking their medications as the world is battling with COVID-19 - a global health crisis which everyone has been grappling with. In the midst of this pandemic, some of the most common challenges for consumers are the difficulty of locating a pharmacy that offers the medicine(s) they need; and the hassle of waiting in line for a few minutes only to find out that the pharmacy has no stock of the medicine they are looking for. More people now are in need of vitamins, basic goods, and medicines; and one of the most common struggles of consumers is to look for a pharmacy that offers the medicines/products they need. In the midst of a pandemic when the majority of the people will not want to go outside and take risk of contracting the spreading virus, it is a hassle to go from one pharmacy to another and wait in line just to look for medicine(s).
In line with these, this study and the development of the *MedEaseSeen* Mobile Application aimed to offer assistance to

customers around Mabalacat City in looking for their needed medicines and essential goods online. This app also aimed to assist pharmacists in Mabalacat City to have less interaction with their customers.

General Objectives

The general objective of this study is to provide a technological means of helping Mabalaqueños to locate pharmacies in Mabalacat City that offer the medicine(s) they need. The main aim of this study is to develop a mobile app that aimed to give Mabalaqueños the ability to search for the available pharmacies that offer the medicines they need without going out physically.

Specific objectives include the following:

- To gather reliable information in identifying initial requirements for the system development;
- To brainstorm and design diagrams based on the features of the proposed system;
- To develop an Android-based mobile application for searching medicines and/or other basic goods, and locating pharmacies that offer them, and a web-based server for pharmacies;
- To test the web and mobile applications for integration using test cases;
- To publish the mobile application on a digital distribution service platform, and the web-based system through a hosting service platform.

Scope and Limitations

This study entitled "*MedEaseSeen*: A Smart Pharmacy Finder Mobile Application within Mabalacat City" covers the objective to provide a technological means of helping users of Mobile Application to locate pharmacies within Mabalacat City that offer the medicine(s) they need. The researchers aim to develop an Android-based mobile application that will allow the users to search for medicine(s) and/or other basic good(s), and to locate pharmacies within Mabalacat city that offer them; and will also develop a web-based for pharmacists when managing their pharmacy inside the *MedEaseSeen* app. This study focuses only on the benefits that can be available for people within Mabalacat City. The pharmacies that can register to the system are only those that are in Mabalacat City. The size of the MedEaseSeen mobile application on its current version is 8.4 MB.

Mobile App for Customers: For customers, the mobile application can be downloaded from a digital distribution service called GetJar (*https://www.getjar.com/categories/health-apps/medicine/MedEaseSeen-984839*) and can be installed on any device that is running Android OS 8.0 (Lollipop) or above. Once the *MedEaseSeen* mobile app is installed to the user's device, the user should tap the "I Am A Customer" button. Then, the user needs to input a name and a phone number, and agree to the *MedEaseSeen* Terms and Conditions. Once the needed information are placed, the user can tap the "Get Started" button and a one-time-password will be sent to the user's provided phone number. The user will then need to verify the password, and once done, the screen will be routed to a page where the user can search for the medicine(s) and/or basic product(s) they are looking for. It is advisable that the customer turns on the GPS feature of the mobile device while using the app to make sure that it can work efficiently, especially in terms of locating pharmacy. The only medicines available for searching are the ones that the *MedEaseSeen*-registered pharmacies added on their "Products" databases. Whenever the user tries to search for a medicine/product that is not available in the database, the app will prompt a message suggesting to try a different medicine/product. While the user is typing on the search bar, the app will also suggest medicine(s)/product(s) that are available in the database. Once the user found the right medicine/product they are looking for, the user can then tap the "Search" button. The *MedEaseSeen* app will show all the active pharmacies. The user can tap the "Inquire" button for a specific pharmacy that will send an inquiry to see whether they have the stock for that medicine or not. If the pharmacy is receiving many inquiries at the moment, the system will prompt a message informing the customer of the status of the queue (e.g. You are now #3 in the queue.) There are two (2)

possible responses that the customer may receive from the pharmacy: 1. “In Stock Now” which means that at that moment, the pharmacy has a stock for the medicine/product the customer is looking for; and 2. “Out of Stock” which means that at that moment, the pharmacy has no stock or does not sell the medicine/product the customer is looking for. Each response has a timestamp showing the time and date the pharmacy responded. The response is accurate at the moment of inquiry yet the stock or availability of products may vary from time to time, depending on the circumstances. These changes may occur without any prior notice to the customers. The *MedEaseSeen* mobile application covers neither reservation nor monetary capabilities; but is limited only for inquiring and for giving information online. If a pharmacy responded “In Stock Now”, the current price of the product for that specific pharmacy will be shown and the next options available for the customer is to either tap the “Locate” button to use the geo-location feature of the mobile application and get directions on how to go to the pharmacy’s location via Google Maps API; or search for a different medicine/product by going to the search bar available on the top part of the screen. If a pharmacy responded “Out of Stock”, the price will not be shown for that specific pharmacy and the user can either tap the “Locate” button to use the geo-location feature of the mobile application and get directions on how to go to the pharmacy’s location via Google Maps API; or search for a different medicine/product by going to the search bar available on the top part of the screen. The response will stay on the system for five (5) minutes, which means that after five (5) minutes, the “Inquire” button will be available again for the same product and pharmacy. As long as the pharmacy is still active/online, it will be visible on the users’ end and they can send an inquiry to that pharmacy.

BMI (Body Mass Index) Calculator and Bantay Covid: Aside from searching and inquiring for medicine(s) and/or basic product(s), the *MedEaseSeen* mobile application users can also use the BMI Calculator section. This section allows the app users to input their weight (unit by kilogram), and height (unit by feet and inches) and tap the “Compute BMI” button. Once tapped, the app will show the computed Body Mass Index of the user based, and the summary (Underweight/Normal/Overweight/Obese) of their BMI result. The mobile app users can also go to the “Bantay COVID” section where information about COVID-19 updates in the Philippines, and specifically in Mabalacat City, are shown. Information such as health tips, number of COVID-19 cases in Mabalacat City, and IATF regulations are shown on “Bantay COVID” section.

Mobile App for Pharmacists: As a pharmacist, the *MedEaseSeen* mobile application can also be installed from GetJar (*https://www.getjar.com/categories/health-apps/medicine/MedEaseSeen-984839*) and once the app is installed in their device, the pharmacist will need to tap the “I Am A Pharmacist” button. The pharmacist will then need to enter his/her username and password. Once logged in, the “Inquiries” tab will be available where the pharmacist can see all the current inquiries from their customers. It is advisable that the pharmacist allows the *MedEaseSeen* mobile app to turn on the notification on the mobile device to make sure that they can receive and be notified every time a new inquiry comes in. If a new inquiry is sent to their pharmacy, the pharmacist will be notified and will need to respond as soon as possible. All inquiries from the customers will remain on the “Inquiries” tab of the pharmacist and will not be deleted unless responded to. The pharmacist has 2 options when responding to customers’ inquiries: 1. “Yes (check button)” which means that the pharmacy has the stock for the medicine/product being inquired for; and 2. “No (X button)” which means that the pharmacy has no stock for the medicine/product, or does not offer that medicine/product at all. The “Price” bar is also available for each response which shows the current price of the medicine/product based on the pharmacy’s “Products” database. If the

medicine/product is not yet added on the pharmacy's database, the pharmacy will still receive the inquiry but the price will be zero (0). The pharmacy can tap "Yes (check button)" but the app will give an error message asking the pharmacist to update the price first. If the pharmacist updated the price and responded "Yes (check button)", the response will be sent to the customer, and the "Products" database of their pharmacy will be automatically updated, adding the new medicine to their database. If the medicine/product is already on their database, but the price is not updated, the pharmacist can simply update the price through the "Price" bar before responding to the inquiry, and the "Products" database will be automatically updated. It is always the discretion of the pharmacist whether to respond or not to each customer's inquiry. Human behaviour and/or discretion is beyond the scope of *MedEaseSeen* and this study. Upon registering to *MedEaseSeen*, the pharmacy agreed to the Terms and Conditions of the system including the responsibility to always respond to inquiries whenever possible. If in case that the pharmacy will be unable to respond inquiries, the pharmacist needs to log out their account from all devices so their pharmacy will not show as active on customers' mobile app interface. All unanswered inquiries will be deleted from the system every 11:00 p.m. Manila time.

Pharmacist Website Dashboard: Once the pharmacist signed in to their *MedEaseSeen* account via the website, the pharmacist will be prompted to their Pharmacy's dashboard where they can see the Inquiries tab and answer all inquiries from the customers. The functions available will be the same with the mobile application. The pharmacist can also access the "Products" tab where they can update their products (Add/Edit/Delete). The pharmacist can choose a CSV file to mass update their database. When using a CSV file for adding/updating the medicines/products to their database, the Column headings should match to the headings in the Products database (Product Name, Price). When adding a medicine/product, the product name should also have the dosage (usually in milligrams) in it (e.g. Biogesic 500mg) and the price is in Philippine Peso. Aside from using a CSV file, the pharmacist can also add a single medicine/product by tapping the "Add a Single Product" button on the upper part of the page. When tapped, the website will ask for the information of the medicine/product which are the Product Name and Product Price. On the pharmacy's dashboard, the pharmacist can also go to the "TEAM" tab where he/she can view all the members of their team or pharmacy account. If the pharmacist is the admin/owner, he/she can delete an account or send a reset password email for a specific member. If the pharmacist is a regular member, he/she only has the viewing capability without any option to delete or edit accounts.

SYSTEM DEVELOPMENT METHODOLOGY

The study used the Prototyping method in designing and developing both the *MedEaseSeen* mobile application and the web-based system. Prototype methodology is a software development model in which a prototype is built, tested and then reworked when needed until an acceptable prototype is achieved. Prototyping is critical to the success of product development efforts [4].

This approach enables the detection of risks and the correction of errors at the initial stage of production. The researchers easily scaled it in anticipation of the customer, see if they are on the mark and make adjustments if necessary.

Figure 1: Prototyping Methodology

Planning and Gathering Initial Requirements

The researchers gathered information through brainstorming and reading research scholarly articles over the internet. Through this, they came up to an idea of creating a system that would help solve a current and timely crisis – healthcare. At this point, the refining of all problems was addressed in order to devise a reliable system that removes the manual process of going to pharmacies just to look and/or for medicines.

Other mobile applications that were already available in the online market were thoroughly reviewed by the researchers to come up with various features that can be added in the development of *MedEaseSeen* mobile application.

Designing Phase

In this phase, the researchers established comprehensive requirements that emphasize the physical solution to the needs of the information technology customer. A site map is a list of pages of a web site within a domain [5]. The researchers used a Site Map as shown in figure below:

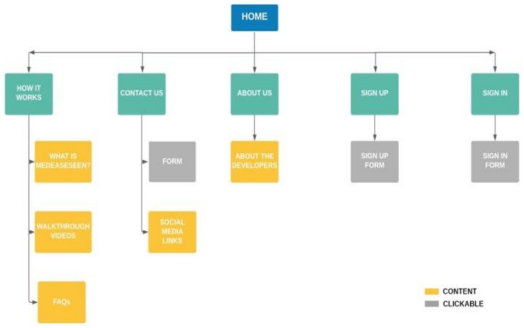

Figure 2: Site Map

For the mobile applications features to be visualized and to show how a user's journey would look like when using the *MedEaseSeen* mobile application, the researchers used the method of Storyboarding.

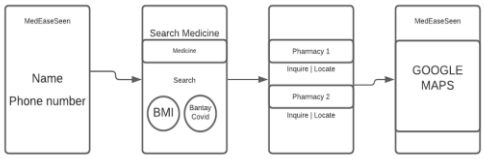

Figure 3: Storyboard for searching medicine and locating pharmacy

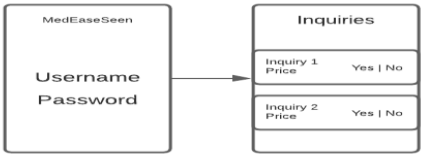

Figure 4: Storyboard for responding to customers' inquiries as a pharmacist

Storyboarding can strengthen the user experience elements of a design, and software for building prototypes from those sketches can be an invaluable tool. They help the developers gather and share information about users, tasks, and goals. They put a human face on analytic data [6]. The researchers also used a Use Case Diagram to represent the different user's goals and how one interacts with the system. The Use Case below is shown which includes the system of *MedEaseSeen*, 3 Actors, and use cases.

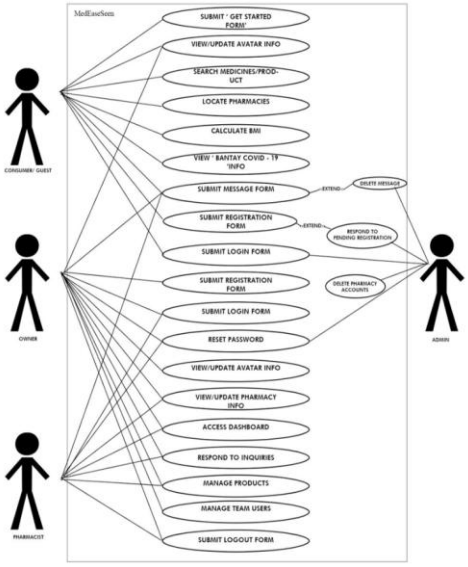

Figure 5: Use-Case Diagram

The researchers also used a Context Diagram to define the boundary between the system and actors and to show the entities that interact with the system.

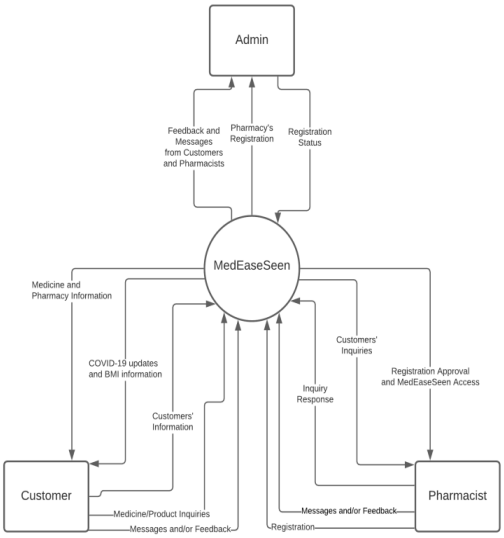

Figure 6: Context Diagram

Finally, the researchers also created an Entity Relationship Diagram to show the relationships of entity sets stored in the *MedEaseSeen* database and to illustrate its logical structure.

Prototyping Phase

At this phase, the researchers have designed and developed a prototype or a test model designed to solve consumers' problems or validate ideas which they can use to test in the next stage of the process. A prototype allowed building a scaled-down example of the product to gauge testers' reactions, thoughts, and interactions with the item.

Customer/QA Evaluation

A review of the sample model of the system, the mobile application and the web site server, was conducted and was the basis for the refinement of the current model.

Review and Refinement

This is the phase where the researchers added, deleted, and enhanced the features or sections of the system that need to be changed to make sure that it passed all the requirements to cater the user's needs and accomplish all the objectives of this study.

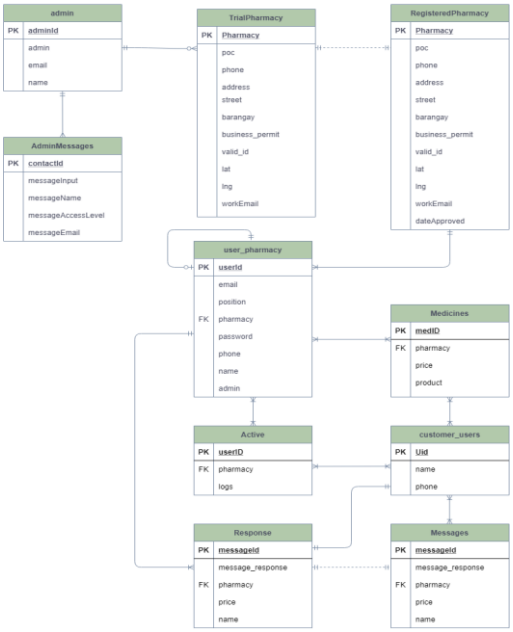

Figure 7: Entity Relationship Diagram

Development

During the development phase, the researchers the following software and hardware requirements as shown below:

Table 1: Hardware Requirements for Development

CPU	Intel ® Core ™ i3 – 4005U CPU @ 1.70 GHz 1.70 GHz
Random Access Memory (RAM)	4GB
Hard Drive	256GB SSD
Operating System	Windows 10 Pro
System Type	64-bit Operating System
Mobile Phone	Real Me 6, 4GB RAM/128 ROM, Android 10

Table 2: Software Requirements for Development

Android Studio
Firebase
Java
Google Maps API
Adobe Photoshop Creative Cloud 2018.

Microsoft Visual Studio Code Text Editor
HTML/CSS
Javascript
jQuery
Bootstrap
Sweetalert
Papa Parse (CSV to JSON)
Android Emulator

Testing

The researchers created and used Test Cases in terms of compatibility, efficiency, security, and the integration of the whole system before deployment and maintenance.

Maintenance

At this stage, once the system is fully developed and has passed the test cases, the researchers deploy the whole system. The mobile application was uploaded through a free account on http://slideme.org/ while the web site was published and hosted using a free account on *https://firebase.google.com/docs/hosting*.

RESULTS AND OUTCOMES

The results shown on this section are guided by the objectives of the study and the steps included on the Prototyping Methodology. The main objective of the study is to develop both a web-based and a mobile application that serves as a pharmacy-finder for Mabalaqueños.

The researchers held online brainstorming meetings and were able to decide the type of system that was created based on necessity and feasibility factors. All references to support this study were searched via the internet as due to restrictions, the researchers were not able to go out and stay in an actual library.

The researchers created diagrams and visual representations such as:

- Site Map
- Storyboards
- Use-Case Diagram
- Context Diagram
- Entity Relationship Diagram

The researchers used tools and software programs such as Android Studio, Firebase, Java, Google Maps API, and Adobe Photoshop Creative Cloud 2018, HTML/CSS, Javascript, jQuery, Bootstrap, Sweetalert, Papa Parse (CSV to JSON), Canva Online, for the mobile app and the web-based server.

The Android-based mobile application for searching medicines and/or other basic goods, and locating pharmacies that offers them.

It provided registration for both for pharmacies and customers. After the registration process, the application provides the user access for both users.

Figure 9: Mobile Application Interface

Figure 9 shows the customer can search the name of the medicine in the app.

Figure 10: Medicine Search Interface

The app also allows the locations of pharmacies via Google Maps.

Figure 11: Google Maps Pinning Interface

The customers are able to send message inquiries to the pharmacy.

Figure 12: Send Inquiry Interface

The app allows seeing the status of request/inquiry.

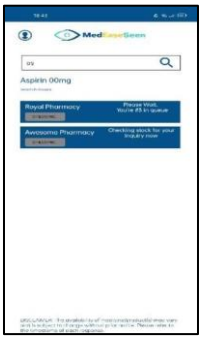

Figure 13: Inquiry and Stock Status Interface

The app also allows computing for the BMI (Body Mass Index) and providing updates of the COVID-19 information for the customer.

Figure 14: BMI (Body Mass Index) Calculator and Bantay COVID

The web-based server for pharmacies provides the management of the inventory of the medicines.

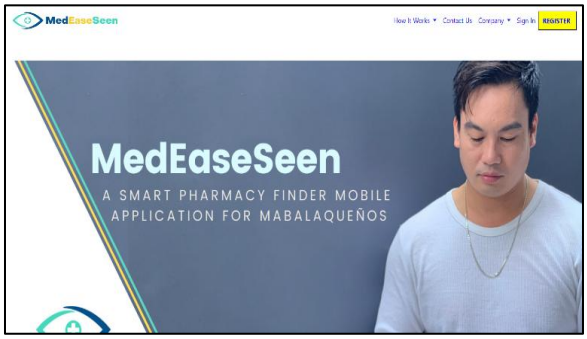

Figure 15: Website Home Page

The system, both mobile app and web-based, are tested using test cases for integration. The mobile application was uploaded through a free account on http://slideme.org/ and the web site will be published and hosted using a free account on *https://firebase.google.com/docs/hosting*.

DISCUSSIONS

This section entails the conclusions and recommendations of the study.

Conclusions

The researchers concluded that both the web-based system and mobile application met all the requirements written in the objectives and scope of this study.

The researchers were successful in providing a technological means in helping Mabalaqueños to locate pharmacies in Mabalacat City that offer the medicine(s) they need. The researchers of this study were able to create a whole integrated system of a web-based server and mobile application that can give Mabalaqueños the ability to search for the available pharmacies that offer the medicines they need. The pharmacy was able to manage its inventory using the web-based application and able to communicate with the customer using the web-based and mobile application.

The results of the test cases ensured that every feature within the project is working as expected.

Recommendations

Based on the results of the findings and conclusions gathered, the researchers would like to recommend the following:

- Future researchers/developers who will encounter this study may try to do this on a different locale if found feasible;
- Future researchers may consider developing the mobile application in a different platform like iOS;
- Future researchers may add more features that are beyond the scope of this study such as incorporating monetary transactions and delivery options.

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Orkoi: An Automated Vertical Aquaponic Garden With Mobile Application User Interface Monitoring And Controlling System

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ABSTRACT
In this study, the researchers are interested in the creation of a well innovated vertical ornamental design of plants and modified fish pond at the same time. Hardware of this study will be controlled mainly by microcontroller, other hardware device, and power output. This prototype can monitor parameters from a mobile application such as water level, temperature, and pH level from the koi pond and humidity in the perimeter. It has automated feature where it moves spontaneously based on its input time and limitations such as water pump, feeder, and light, it can be also manually controlled. The proposed system will not include automatic cleaning of the water in the pond, it is another consideration for one of the future references. The number of fish inside the pond is limited due to the limited supply of oxygen in the pond. The chosen ornamentals is only limited, it must have the same range of pH as of the koi (6-8 pH level) and can be watered anytime to avoid drowning. The responsiveness capability of the mobile application is another limitation. The propose system cannot detect any minor or major damages of hardware. The limits also include necessary repairs that require manpower. The research design model used by the developers was prototype model. Prototyping Model is a software development model in which prototype is built, tested, and reworked until an acceptable prototype is achieved.

INTRODUCTION
Ornamental plants are one example of different plants that have been part of the cultures of all known great civilizations that are used in gardening. These plants are typically grown for their beauty, color, accent or aesthetic purposes.
The first thing that everyone thinks of when they hear the words "vertical ornamental garden design" is space. It goes without saying that growing upwards will save a lot of space on the ground. This comes in handy when you live in an area that doesn't have a lot of outdoor space to offer — or if you're looking to maximize the space you do have to grow even more plants. [1]
Koi fish are active and so are bacteria. This is a prime time for algae to spring up, so make sure to clean your filters and water valves each week. The koi fish will likely be eating more, swimming more, and producing more waste, so keeping on top of cleaning is especially essential during the summer. Consider adding some shade to the pond to cut down on bacteria growth. Continue to perform a 10 percent water change each week too. Koi fish have a natural beauty and most people believe that it brings luck and strength, especially to the Japanese culture that cherishes the koi fish and its relation to luck and good future. Koi fish are also not as expensive to take care of as a pet. It also relieves stress and its beauty cab increase property value.[2][3]
In this study, the researchers are interested in the creation of a well innovated vertical ornamental design of plants and modified fish pond at the same time. Hardware of this study will be controlled mainly by microcontroller, other hardware device, and power output. This parameter will be sent from the prototype itself to the mobile/system of the user via web application and android application to view the Orkoi innovational system and project status of it.

General Objective
The general objective of the study is to develop Orkoi: An Automated Vertical Aquaponic Garden with Mobile Application User Interface Monitoring And Controlling System. The proponents should be able to:

1. Develop a mobile app that will monitor the following parameters:
1.1real-time water temperature
1.2 pH level
1.3 water level of the pond thru the mobile application.
1.4 humidity of the perimeter
1.5 water level of the reservoir
2. Develop a mobile app that will control the following parameters:
    2.1 Water pump for watering plants
    2.2 Water pump for refilling the pond
    2.3 Lightings
    2.4 Fish feeder
3. Develop a prototype module that will notify the user if reservoir level is low.
4. Develop a prototype that automatically activate the following at specific time or a specific condition:
    4.1 Water pump one and pump two
    4.2 Fish feeder
    4.3 Lightings

Scope and limitation

This prototype can monitor parameters from a mobile application such as water level of the reservoir and pond, temperature and pH level of the koi pond and humidity in the perimeter. It notifies the user when reservoir level is low. Additionally, it has automated feature where it moves spontaneously based on its input time and limitations such as water pump, feeder, and light, it can be also manually controlled.
The proposed system will not include automatic cleaning of the water in the pond, it is another consideration for one of the future references. The number of fish inside the pond is limited due to the limited supply of oxygen in the pond. The chosen ornamentals is only limited, it must have the same range of pH as of the koi (6-8 pH level) and can be watered anytime to avoid drowning. The responsiveness capability of the mobile application is another limitation. The propose system cannot detect any minor or major damages of hardware. The limits also include necessary repairs that require manpower.

SYSTEM DEVELOPMENT METHODOLOGY

The research design model used by the developers was prototype model. Prototyping Model is a software development model in which prototype is built, tested, and reworked until an acceptable prototype is achieved. It also creates base to produce the final system. Figure 12 Shown below will describe the steps on how to achieve the final product.

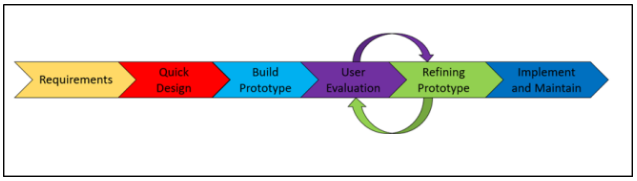

Figure 13. Methodology

Requirements Gathering and Analysis

A prototyping model starts with requirement analysis. In this phase, the requirements of the system are defined in detail. During the process, the users of the system are interviewed to know what their expectation from the system is.

Quick design

The second phase is a preliminary design or a quick design. In this stage, a simple design of the system is created. However, it is not a complete design. It gives a brief idea of the system to the user. The quick design helps in developing the prototype.

Build a Prototype

In this phase, an actual prototype is designed based on the information gathered from quick design. It is a small working model of the required system.

Initial User Evaluation

In this stage, the proposed system is presented to the client for an initial evaluation. It helps to find out the strength and weakness of the working model. Comment and suggestion are collected from the customer and provided to the developer.

Refining Prototype

If the user is not happy with the current prototype, you need to refine the prototype according to the user's feedback and suggestions. This phase will not over until all the requirements specified by the user are met.

Once the user is satisfied with the developed prototype, a final system is developed based on the approved final prototype.

Implementation and Product Maintenance

Once the final system is developed based on the final prototype, it is thoroughly tested and deployed to production. The system undergoes routine maintenance for minimizing downtime and prevent large-scale failures.

RESULTS AND OUTCOMES

In this section, the results and the discussions were laid out to determine if the researchers met the objectives of the project.

Figure 14. ORKOI mobile application user interface

The first screen shown in figure 14 shows the Home page of the mobile app, it displays three buttons that let the user choose what function will be activated. Dashboard button shows the monitoring of water level of pond and reservoir, temperature and pH of the pond and humidity of the area. Ornaments Button shows list of ornamental plants that can be used for the Orkoi System. About button show a brief description about the Orkoi System.

Figure 15. Feeder Grams Verification

Figure 15 shown above is the right amount of grams of food needed to feed the koi, a weighing scale was also used to verify the weight of the feeds.

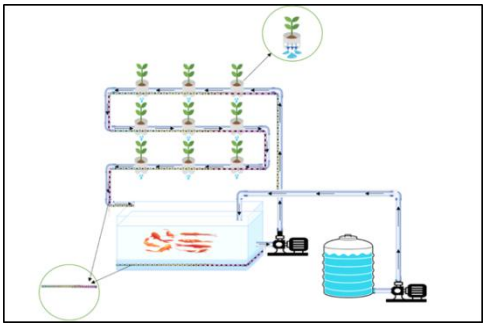

Figure 16. Water System

The water system has two functions. The pump attached from the pond shown in figure 16 shows the flow of water coming from the pond through the pipes to water the plants. Once pond water level is low, the pump attached from the reservoir shown in figure 16 shows the flow of water coming from the reservoir through the pipes to refill the koi pond.

As shown on Figure 17, The mobile application Displays the data that the sensors gathered. At the lower portion of the Mobile Application are the switches to turn on/off the lights, feeder, and water pump one and water pump 2

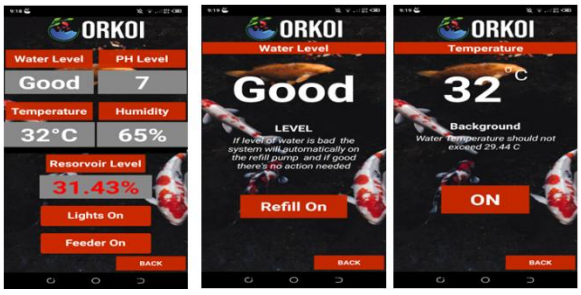

Figure 17. Orkoi Dashboard and controls

Figure 18. Orkoi Prototype

The reservoir tank serve as the source of water supply, while the water pump will suck the water coming from the reservoir according to the set control of the mobile application. The water will be distributed to the plants from top. The excess water will be will fall down the koi fish pond. Coconut husk was chosen as the basin for the plants since they are good in terms of absorbing ammonia.

DISCUSSIONS

This section discussed the findings, conclusion and recommendations based on the analysis of the results of the study entitled Orkoi: An Automated Vertical Aquaponic Garden with Mobile Application User Interface Monitoring and Controlling System.

Summary of findings

Based on the previous related literature reviewed by the researchers, they correctly identified all of the specific requirements required to complete the study.

In order to develop the prototype model, the researchers used diagrams that such as the Schematic diagram, flow diagram, story board and block diagram. Mobile application is important to gain a better understanding of the process and outcome.

The integration of the prototype model and mobile application was required to meet specific requirements, which were verified and validated through test cases to ensure that the both the mobile application and the prototype model functioned and interacted with one another.

Conclusions

The development of Orkoi was designed and developed based on the stated objective wherein the researchers developed an IOT based system that can monitor and maintain the condition of the pond. To monitor the temperature, water level and pH level of the pond, humidity of the area and the condition of the reservoir through the use of different sensors, microcontroller. Mobile application that allows the user to control Lightings, water pump one and water pump two. The researchers' objective were achieved with the help of the prototype methodology.

Recommendations

In addition to the results and conclusion, the following recommendations are given to improve this study:

1. Improve the design of ORKOI to make all the devices secured and make it more appealing to the users.
2. Improve the Graphical User Interface (GUI) of the mobile application
3. To add more ornamental plants that can be used for the prototype
4. Consider adding pH balance solutions to balance pH level even well.

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PARAM: A Web-based Booking and Management System with Mobile Tracking Application for Param Car Rentals

Presented on International Research Conference on Information Technology Education (IRCITE) 2021 – Best Poster Presentation

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ABSTRACT

The focus of the study is to design and develop a Web-based Booking and Management System with Mobile Tracking Application for Param Car Rentals. The system has 3 user types that include the admin, the renters and the business partner. The system will have a Car Management where Admin can add and update a car information, also it will have a Car Scheduling for viewing of availability of units. For Bookings, the Admin can check the new bookings, review the information, and it will be either approve or cancel. Renters need to register and PARAM will send a link for the validation of the email. After registration the renter can now book cars. The system has a mobile application tracker for renters. For car owners who wished to be Param's business partner, the system enables them to register first and be part of the Param car rental business. The system was develop using Prototyping Methodology. Functionality, reliability, compatibility and security of the system is tested using test cases. This just proved that the developed system follows the requirements specified. The system had been implemented successfully and had undergone numerous modifications. Based on the findings and conclusions reached, the researchers suggest that future researchers consider developing a mobile app that is also available on the IOS platform, an SMS notification for booking applications, and a web-based framework that is built into a mobile app type.

Categories and Subject Descriptors

Car Rental System and Mobile Tracking Application

General Terms

Booking, Management System, Mobile Tracking

Keywords

Web-based system, car rental system, SDLC, iterative model, Mobile Tracking App, GPS

INTRODUCTION

People in today's era are living in the computer age, where technology has given humanity so much convenience, especially in communication and transportation since the advent of automobiles, cell phones, and computers. Traveling from one location to another becomes more convenient and quicker when you own a car or other vehicle, but not everyone can afford one, and people have discovered that there is a need for this issue. As a result, the car rental industry thrives to meet the demands of customers.

Car rental owners can at the very least use technology to help solve challenges that they are experiencing as a result of the industry's high competition, such as how to launch their business, what facilities and conveniences can their car rental business offer to persuade potential customers, and so on. Car rental owners should also think about technical innovations like websites and systems that can help them avoid the manual or conventional way of advertising their business, such as using printed materials like posters, flyers, and billboards, and think of a convenient way for their customers to reach out to them, as a result, the primary focus of technology spread across countries is on how global growth is driven and transmitted across countries. [1]

The transition from manual to digitalization, technological innovation, and automation has improved the car rental industry's profile, and today's consumers are trying to meet a range of

needs rather than just one. The car rental industry is expected to expand dramatically in the future as the growth of mobility, businesses, and individual users expose the use of carpooling and car-sharing services, which make markets more potent and competitive. Accordingly, the car rental industry's fundamental key performer is operating more improving the demand utilization of applications, which make it more efficient and decreases the manual work. [2]

In a vehicle rental company, a Car Rental Management system offers resources and methods for staff productivity. Comprehensive online car rental management is determined to be a rental solution in making business more profitable and optimizing return on investment by lowering significant expenses. Procedures for car servicing, monitoring, booking, and, in some cases, payment processing are included. [3]

In the field of business, an owner likely has a lot on their plate in terms of increasing productivity, and schedules will change on a regular basis. Using scheduling systems in the company will eventually help with the problem. [4]

Adding a layer of protection helps to reduce a risk that involves stolen vehicles, which is curiously growing each year. Companies who operate and maintain Car Rental services must be aware that the risks are real and that they could become victims at any moment. Security is critical not only for the vehicle, but also for the customers' protection.[5]

The researchers found Param Car Rentals, a car rental business in Pampanga, by conducting researches and interviews. One specific problem that the researchers have discovered in this business is the minimized use of technology and media platforms, where Param is presenting their business. Currently, they are using social media for promoting and advertisement, and Microsoft Excel in keeping a record of their reports. Hence, they can improve their system by upgrading it, especially for a website and a booking management system, which owners can use to maximize the business growth and manage their business accurately and effectively without consuming much time and effort.

A web-based system intended for car rentals service with a booking and management system and mobile application for their unit tracking. An application that can help Param Car Rentals introduce and reach their business online and eradicate the current manual process of booking and provide security for their car units through a tracking application.

General Objectives

The general objective of the study is to a web-based system and tracking application entitled "PARAM: A Web-based Booking and Management System with Mobile Tracking Application for Param Car Rentals".

Specifically, the study aims to:

1. To design and develop the system
1.1 3 access levels
1.2 Registration of renters and potential business partners.
1.3 Car booking
1.4 Car scheduler
1.5 Driver assignment
2. To design and develop online mobile tracking for car renters and drivers.
3. To test the system in terms of functionality and compatibility using test cases.

Scope and limitations

The study composes of three modules which is also act base on their user access level.

For Admin

The system is designed for the Admin to have the ability to navigate and manage the whole system like adding, selecting, updating, and deleting information. The Admin will have full access to manage that improves its business growth by eliminating the manual business processes.

The system will have a Car Management where Admin can add and update a car information, also it will have a Car Scheduling for viewing of availability of units. For Bookings, the Admin can check the new bookings, review the information, and it will be either approve or cancel. For the With Driver option, the admin will assign a driver for the service. Also, the Admin can manage information for the list of

drivers for Param and have a calendar scheduling for the monitoring of availability of drivers.

For applicants that will apply for business partner, they will submit the application online and once its approved, applicants will present in Param office, since signing of contract is not covered by the system. In the Sales Report, the Admin can filter the sales report by date range or by car type, also select it by Business Partner's car. In addition, PARAM will generate an excel file format of the sales reports that provides a hardcopy of every report.

Moreover, the Admin and track the unit's location using the system's tracker feature. The renter will log in to their account in the mobile application, and it will send the information for latitude and longitude in the Admin system. With the use of the embedded Google Map, the system will automatically show the actual location of the car/s that are currently in use.

For Renters

The car rental system is designed to the Renters that provides a simple process for the renter to book a car with ease and without any hassle.

Renters need to register and PARAM will send a link for the validation of the email. If users forgot their password, they will provide their registered email address, and the system will send a link on the email to change their password. Once logged, the users can now and search for a car for their travel. When the users search by dates for their travels, the system will provide the cars that are available.

In Booking, once the renter decides for a car, they will input their travel dates and destination. Before submitting, the renter must review the information they've provided, read and agree to the Param Terms and Conditions. For Payment Options, the renter can choose cash, bank to bank, and through remittances. For bank to bank or by remittance, they need to upload a picture for the proof of payment. The Admin reviews the information for approval and users may check their booking status on the Booking feature.

Renters can still cancel if the request is still pending, but if it is approved, renters will need to contact Param for the cancellation, and it must be at least two (2) days before their travel dates. For all the changes of booking details renters need to contact Param. All discussion will be internal and refund transactions is not covered by the system.

PARAM does not cover the contract signing between renter and Admin. Also, the payment process does not cover credit or debit card transactions and the services offered to the renter will be on a first-come, first-serve basis.

The Mobile Tracking Application, renters need to log in to their account, where renter can view their information and booking details. However, it cannot update a booking details, see car listing, or book a car because it is mainly for tracking purposes only.

For Business Partner (Applicants)

For car owners who wished to be Param's business partner, the website is designed and developed to make the registration user-oriented.

Applicants need to log in or register using an active email address. In the Profile, applicants will select the Business Partner tab to make an application and provide their basic information. Applicants will receive an email message that the request is approved and further instructions on how to complete the process. After the contract signing conducted in the main office, they will become part of Param as their business partner, and they can already start doing business with them. If the application is declined, applicants will also receive an email message regarding the canceled application due unqualified reasons.

BP can list their car by providing the information and the Admin will review the liability of the information. If the car is approved it will be list on the website open for booking. BP will have a feature where they can check their car listing, and track their car if it is out for travel. Using the Google Map designed in their account, and they can view booking details of the renter.

The system does not cover the contract signing between applicants and Admin. If the application was approved, they must attend in the main office for further processing of the

application. For classified transactions like the computation of commissions it will discuss by both parties internally and will not be featured in the system.
Lastly, if the business contract is already ended and does not wish to renew the contract, they will receive an email message from Param as an appreciation of their contribution in business with the Param Team.

SYSTEM DEVELOPMENT METHODOLOGY

The System Development Methodology refers to the standard process to conduct all steps necessary to a framework that is used to structure, plan, and control this process of development of the system. The methodology that the study's researchers used, as well as how they implemented and step, will all be discussed.

Figure 1: Prototyping Model

Figure 1 shows the Prototyping Model used in this study. The prototyping model is a system development method which a prototype that involves building, testing, and reworking as needed until an appropriate outcome is achieved to help develop the entire system or product. This model works best when all of the requirements or conditions aren't known ahead of time. It is primarily a trial-and-error mechanism that is iterative which takes place between the developers and the users.

Gather Requirements

The researcher conducted a series of meetings, collected data from the internet, and performed an interview with Param Admin and staff who know the Car Rentals business to know what would be the possible car rental system functions and features that are needed to be developed. The researcher also consults their Technical Adviser for additional information that might help to the project functionalities. Thus, to fully understand their study, the researchers described its advantages, intent, risks, and issues, which help the researchers in deciding and finalizing their software and web application resources and specifications.

Quick Design

This quick design gives the user a quick overview of the hardware and software, which helps the researchers in designing and developing the system. An idea of how the system will function and will look like, although this was not done in a detailed design. The researchers used designing tools such as Context Diagram (see Figure 2) and Use Case Diagram (see Figure 3) to illustrate the activities that the user will be expected on the web-based system and mobile application.
The researchers identify the needed software tools and programming language for designing the framework and coding their project. The researchers used PHP for coding the logical functions; HTML and Bootstrap for the Graphical User Interface; MySQL for storing and retrieving data; and Visual Studio Code as Code Editor. Android Studio is used for developing their mobile tracking app and coding is Java Script.

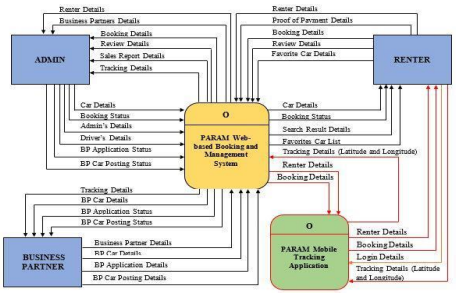

Figure 2: Context Diagram

Build Prototype

This is where the actual prototyping, coding, and programming that the researchers needed to develop the system based on the identified requirements and from the gathered designed information in the quick design. And, for it to function properly, the software and hardware

resources listed should operate as one. During this step, the researchers had to find system bugs and errors as soon as possible so that they could be fixed before moving on to the user evaluation. This process had to be repeated until the researchers were satisfied with the results based on the system's defined functionalities.

Evaluate

To prepare for prototype refinement, feedbacks and suggestions are gathered. The researchers needed to conduct a series of tests by using the test cases to see whether the developed system might experience any problems. This phase will continue as long as there are bugs or errors needed to be refined, or until all the identified functionality and requirements specified by the user are met. Before moving on to the refinement process, the researchers needed to rework the framework by taking into consideration of the suggestions and recommendations of their adviser and committees.

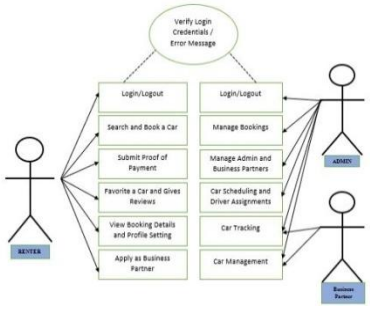

Figure 3: Use Case Diagram

Refine Prototype

From the feedback and suggestion of the users throughout the use, errors, and failure, the researchers went back to the quick design process to correct system features. The researchers wanted to improve the hardware and software as a result of all the feedback and recommendation. Thus, any bug and failure in the system and mobile application will be refined before it is fully released to the user. On the mobile application Android version between 7.0 to 10.0 is used to evaluate the compatibility of the application from different smartphone devices.

Product

The researchers are now in the final step of the project, where they have successfully developed a web-based car rentals system with a mobile tracking application. Although the system is at 100%, the system undergoes a maintenance process involving correcting errors that were not identified in the earlier phase. If it is fully functional, the researchers were finally deployed and presented the system to panels and users to test the capabilities and to see what are the configured functions.

RESULTS AND OUTCOMES

These results and outcomes were based on the objectives of the study, complete analysis, testing, and evaluation of the developed system and mobile application.

The researchers searched through the internet for a car rental business in Pampanga and found Param Car Rentals, which are currently in need of a management and booking system. They conduct interviews to the locale, held frequent meetings to test and monitor the progress of their research, and each member is given a set of assignments with deadlines.

After finalizing the requirements analysis process of the project prototyping, the researchers identified the hardware and software resources to be used. For Hardware, researchers use a personal computer with a specification Ryzen 3 3100 Windows 10 with 16GB RAM, 500GB HDD and 128 GB SSD. For Smartphones requirement, researchers use an Android phone and the location services must be enabled, also the Android version must be at least 7.0 (Nougat) and an API level of 24.

In developing the Web-Based System, the system requirements were used by the researcher and project objectives are met. It includes Visual Studio Code for coding and designing the system; Google Map API, for car tracking interface feature of the system. For Mobile Application development, the researchers used Android Studio for coding and designing, and Android Emulator to simulates the application.

3.1 Design and Development

Using the Prototyping Model as a guide, the researchers used it in developing and designing the system and the mobile application. During the development phase, the researcher first decided what software requirements and what back-end services to use. Designing tools such as context diagram and use case diagram we're used to develop system with features such as car tracker, driver assignment, and car scheduling.

3.2 Testing Phase and Evaluation

The researchers used the hostinger.ph for the hosting and domain of the website for the execution of the website. In the testing phase of the tracker feature, the researchers installed the APK file, logged in the registered account and for those accounts must have a confirm booking. Table 1 shows the devices and device specification used for testing the mobile application.

Table1: Device Specification for Testing

Device	Specification
Huawei Nova 7i	Android 10 Huawei Kirin 810 8GB Ram 128GB Internal Storage
OPPO F9	Android 10 Octa Core 6GB Ram 64GB Internal Storage

Following the evaluation, the researchers performed a series of tests and analyses during the evaluation process, using test cases provided by the researchers. The researchers repeated this kind of process until the system went through the final product

Implementation Results

Implementing the project was quite hard especially the tracking feature for the mobile application, but with the guide of the Prototyping Model, the researchers used it as a lead in developing the system. The researchers were able to implement the system and mobile application by using the available requirement and resources for software, hardware, literature and studies.

The researchers finally came to successfully develop a web-based system that has a car scheduling management, where the Admin can monitor the schedules of booking in every car. PARAM that also have a driver assignment feature, for those renters who wants to book a car with driver services. Lastly, a mobile application that can track the location of each unit and provides a complete information of the renters.

Based on the research's outcome and results, the researchers have successfully developed and implement a system that is capable for business and booking management, and a mobile application for a car tracking purposes

DISCUSSIONS

Based on the completed analysis, objectives, and test cases results that were conducted for the system and application in testing and evaluation, the researchers draw some conclusions. The researchers concluded that the web-based system and mobile application met all the requirements written in the objectives of the study.

The researchers were successful in developing a web-based management system for Param that can manage and monitor their business processes and sales. A booking system for those renters who look for a car for rental. Also, a mobile application that serves as a tracker in every unit that is out for travel. The system was successfully developed and had gone through many modifications and tests. Moreover, the methodology used was the Iterative Model that requires testing in development and designing.

The research was designed and developed using Visual Studio, Android Studio, and Google Map API. The system and mobile application were tested using Test Cases, and the results of the test case ensure that every feature within the project is working as expected. It also validates the software if it is free of errors and if it is working as per the expectations of the Admin and the end-users. The outcomes from the Test Cases were used and applied for further changes and improvement of the project. The errors and

bugs that were encountered during the development phase were fixed and resolved.

The web-based system performed very well for the Admin that can successfully manage the Param business and for the users that we're able to book a car for their travel. The tracking feature for system and mobile applications functions fully and provides accurate data for its location information. The researchers use the Prototyping Model Methodology in developing the project. The Context Diagram and Use Case Diagram serves as a guide during the development to identify the overall flow of the project. The analysis and studies included in this analysis were used to conceptualize the study in full.

Based on the results of the findings and conclusions gathered, the researchers would like to recommend that the Future researchers may consider developing the mobile application in another smartphone platform like IOS; Future researchers may consider developing a mobile application for the whole web-based system where it can be accessed through smartphones; The researchers recommend the future researcher enhance the development of the system which can accept a credit and debit card payment during the booking process; Future researchers may add different features where notifications for booking requests or applications as a business partner can be sent through SMS.

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REPOCAP: A Web-Based Capstone Management System For Mabalacat City College

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ABSTRACT
It is an evolution of distance learning which involves learning that takes place between student(s) and tutor without physical contact. Learning thru a browser is referred to as the use of mobile or handheld IT devices such as computers, laptops, smartphones, etc. in teaching and learning. The general objective of this study is to develop a Repocap: a web-based Capstone Management System for Mabalacat City College. The researchers used Iterative model. It is a System Development Life Cycle (SDLC) model process starts with a simple implementation of a small set of the software requirements and iteratively enhances the evolving versions until the complete system is implemented and ready to be deployed. The developed system has a four-access level: Admin account for managing the system and accounts; faculty account would be assign as a panel or adviser of particular study; students account would be the one to upload a study files. It has also project catalog and smart search for easily find the desired study. The students and faculty can access the forum wherein the discussion and presenting document by stage happened. Inside the forum, there is a section where the document has been archive. Using test case researchers successfully test the functionality, usability, interface, compatibility performance and security. It is also successfully deploy on a browser through hosting service.

INTRODUCTION
Over the years, there has been a rapid increase in Internet usage as users have taken pleasure in them in various ways such as portability and flexibility. Availability of Telecommunications services provides easy access to the world wide web with the help of the internet, but in recent times, devices like smartphones, desktops, and laptops are used more frequently for various applications. That device has unique application in learning activities, although, conventional learning activities still play an important role in the learning process, it suffers from the limited finding of their study. Hence, different sectors of society are adopting the use of internet technology for a wide range of services and this trend has necessitated the restructuring of the educational system.
Learning thru a browser is referred to as the use of mobile or handheld IT devices such as computers, laptops, smartphones, etc. in teaching and learning. It is an evolution of distance learning which involves learning that takes place between student(s) and tutor without physical contact [1]. The first explicit record of distance learning is an advertisement featured in the Boston Gazette of 20th March 1728. This advert was a call made by 'Caleb Phillips, Teacher of the new method of Short Hand' to people interested in learning shorthand. Thereafter, some other attempts surfaced a century later from Isaac Pitman who incorporated a feedback system. The system allows the teacher to receive assignments from students, correct them and send the corrections back to them via correspondence [2], [3]. Early attempts at distance education involved the use of mails and postal services. However, in the present day and time and with the advent of the internet, distance learning TELKOMNIKA Telecomm Compute El Control r Development of a research project repository (Some fun T.E.) 157 involves online education (e-learning), with the proliferation of mobile devices bringing on board the concept of mobile learning (m-learning). It is very interesting to note that although University education dates as far back as AD 859 and there were no educational programs using the internet before 1996, it is strongly believed that mobile devices

could contribute positively to the learning process and is now a key interest of educational practitioners at different stages [4] [5].

Mobile learning has been defined as the form of learning aided by the use of mobile devices such as computers, laptops, smartphones, tablets, etc. It supports learners within and outside of the formal education system, enabling them to be active participants and not just passive recipients of knowledge. Via the platform created by mobile learning, students and researchers can obtain access to useful resources without being physically present at the geographical location where such materials are stored in libraries. This platform breaks through the constraints which the classroom introduces in terms of its temporal and physical boundaries, thus making information available and not restricted by time or place of learning. Due to its many benefits, mobile learning has been widely accepted. [6]

Making Web-based capstone management available through repositories are some things that are increasingly mandated by leaders of institutes in college or university, especially nowadays in the pandemic. A capstone management repository provides several instruction-based opportunities to advance learning. In research methods courses, students and faculty members can easily examine samples of the thesis to familiarize themselves with the writing styles and formatting in their discipline. Similarly, during a forum-style course that addresses diverse topics, students and college can use the repository with research approaches and writing styles outside of their discipline; this may be a particular advantage for undergraduates because, as they progress in their course of study and definitely once they begin graduate or professional programs, they rarely have time for this sort of cross-disciplinary interaction. The repository mentioned might be a bank of capstone project, with a gaggle of services to capture, store, index, preserve, and disseminates an institution's scholarly output in digital format. It is for storing the Capstone project output for the Institute of Computing Studies of Mabalacat City College.

Storage could also be a digital archive of the intellectual project created by students of an institution and accessible to end-users both inside and out of doors the institution with permission from the admin. School capstone project hard copies are vital, but a variety of those are missing after borrowed & used as references by incoming fourth-year students for his or her capstone preparation.[7] The Capstone Management Repository for references will allow the user to browse and secure all the data stored within the repository by the registered user including students, faculty, and guest. The student can browse Project as references that provide a spread of resources which will be the premise for the upcoming study. The key characteristics of this developed system basically can build electronic document storage that's reliable, functional, and usable.

When research product materials availability is limited thanks to inaccessibility, this can lead to wastage of knowledge within the tutorial research community. As an example, the quality research output of students suddenly put to an end when not digitally archived and shared with future researchers in a specific institution. Additionally, the efforts and ideas poured into the research work is stop when it is not adequately shared to the net community of researchers as an additional knowledge realm for future researchers to collaborate and innovate [2]. This could be one all told the various challenges of certain Institutions. In the Academe, a Capstone project significantly improves the study impact factor. Students can have rich references and are able to avoid repeatedly performed similar capstone projects. [3]

On other hand, teachers can suggest other studies to students and be able to extend the related research work identified from the repository. A growing number of developments and efforts are initiated to implement an online digital repository and have made a certain level of public access to the project.

Background of the Study

Mabalacat City College (MCC) was founded during the tenure of Mabalacat City Mayor, Marino P. Morales. Mabalacat City College opened in its temporary location at Northville Subdivision, Atlu Bola, Mabalacat last June 2008 when a resolution was decided after a technical group mainly constituted of academicians administered a feasibility study in September 2007. The statutory establishment of the College was devised by the SB members. On October 4, 2007, Municipal Ordinance No. 2, series of 2007 named "An ordinance establishing a local College in the Municipality of Mabalacat to be known as the Mabalacat City College and granting its charter providing for the Rules, Regulations and Pertinent Guidelines for its establishment and operation thereof," was enacted (Mabalacat City College handbook, 2016). On January 14, 2008, Mayor Morales appointed Dr. Leonardo C. Canlas as the First Ad Interim President of the College.

The first courses offered were BS in Elementary Education, BS in Secondary Education with major fields in Mathematics and Biological Science, and BS Information Technology. Now, MCC offers 18 education programs with 4 institutes namely Institute of Arts, Sciences and Teacher Education (IASTE), Institute of Computing Studies (ICS), Institute of Hospitality Management (IHM), Institute of Business Education (IBE), and is looking to add more in the future. Mabalacat City College officially had its first day of classes on June 9, 2008, with 35 enrollees in the Institute of Teacher Education, and 27 in the College of Information Technology. In the present day, the number of students enrolled reached 3000+ and is expected to rise in the years to come.

The Institute of Computing Studies (ICS), formerly called Institute of Information Technology Education (ITE), is one of the pioneer institutes of the College that offered a 4-year degree program, the Bachelor of Science in Information Technology (BSIT), on June 9, 2008. Bachelor of Science in Information Technology is Level I Accredited by the Association of Local Colleges and Universities Commission on Accreditation (ALCUCOA).

The Information Technology student's in Mabalacat City College are making a capstone project for the requirements before graduation. School capstone project hard copies are very important, but some of these are missing after borrowed & used as references by incoming fourth-year students for their capstone preparation. Capstone Projects in the Institute of Computing Studies have already been submitted to the Mabalacat City College and yet it cannot be accessed anywhere and at any time without having to come to the school and reaching those concerns. In case of fire incidence or water, the copies of the Capstone projects curated by the school could be damaged or totally lost. Searching for projects is very hectic and slow due to the number of projects and limited human effort. Also, access to projects can be delayed due to the official procedures and protocols involved in the process. Therefore, a digital repository is beneficial to solve this problem.

Results of this study provide a web-based repository for Capstone project references that can help the students, or the faculty browses the references conveniently. Also, helps secure and store reliable documents. This system has the same relevance to students in providing repositories used for research and capstone projects for retrieval of information purposes. Also, the said system is useful and helpful for all the students and faculties as it serves as the basis or guidelines in creating research and capstone projects.

Repocap will allow end-users to browse and secure all the data stored in the electronic repository by the registered user including students, faculty, and guest. The student can browse capstone studies that provide a variety of resources that can be the basis for the upcoming study.

Objectives of the Study

The general objective of this study is to develop a Repocap: a web-based Capstone Management System for Mabalacat City College.

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

1. To gather and analyze data identifying the requirements need for the system development;
2. To design and develop an online capstone repository with the following features:
1.1 Four Access Level
1.1.1 Administrator;
1.1.2 Faculty;
1.1.3 Student;
1.1.4 Guest;
1.2 Capstone Project Catalog;
1.3 Smart Search;
1.4 Forum;
1.5 Back-End Support;
1.6 Presenting Documents by Stage;
1.7 Capstone Document Archiving;
3. To develop the system using Python, Bash, MariaDB and PyCharm for back end of the system. And for front end HTML5, CSS3, JavaScript, Typescript and JQuery.
4. To test the Functionality, Usability, Interface, Compatibility, Performance and Security of the system using test case
5. To deploy the web-based repository on a browser through a hosting service.

Scope and Limitations of the Study

This study is focused on the development of a Repocap: Web-Based Repository for Capstone Management System for Mabalacat City College. The system has four user roles such as administrator, faculty, student, and guest.

The administrator can manage the whole system and is responsible for the creation and updating of user logins. Admin can log in and log out. The admin can view and delete the users, the admin can approve and disable the user, and in case the user forgets his credentials, the admin will be able to reset the forgotten password. Admin can also view the data of the user who upload the capstone project.

For adding an account admin has the privilege to create an account for the Sub-admin who will be the Capstone Teachers. For Adding faculty and Students Accounts, the admin needs to fill up the personal information form for the new account. Progress of the user project can view the admin and status of the user. Admin can search a specific user or account in the search bar.

System accounts module, admin can manage the user under management. It can also view the role, the status of a user, and for system logs, the admin can monitor the timestamp and activity of the user. It also allows the admin to download the logs.

Under the Capstone module, an admin can view the studies uploaded to the Repocap system, where the group details such as name, assigned panels, adviser, and version history of the project were shown.

The setting in admin allows editing the admin information and uploading a new profile picture. It can also change the previous password.

Capstone Teacher has the privilege to add the account of the students, assigned the panels of a group, and composes the group of the students.

For the faculty users, they can log in to their account using information such as; username and password given by the admin. Faculty can reset the personal information and password fill up by the admin. Faculty can also view the student's information and status.

Faculty can search accounts under the student's module. Under capstone in faculty account, faculty can view the list of the studies uploaded in Repocap. They can also view the information in all the studies like who is the adviser, the group member, and assigned panels. Faculty can be assigned panels and add a group member. Faculty can view also the version of the uploaded capstone projects.

As a faculty member and adviser of the group, the faculty can join the forum and leave a comment below on the study. Also, the assigned panelist of the group can join a forum and it has a section in the forum where they can upload the recommendation.

For the students, they can view capstone projects. Students can log in/logout. Student can reset their basic information, contact information username, and password under settings. Students can upload profile pictures and under profile students were display.

A student has a capstone project module where they can upload study. In terms of downloading documents, they can download the projects for revisions of the study. Upon uploading the capstone project, the version of the study will change. In the title defense students need to upload three capstone studies for their Title proposal.

Under student capstone projects students can view the following information; assigned adviser, group members, assigned panel, and version history. Group members allow using the forum for their discussion including their adviser and assigned panels. In terms of queries, the student may post a comment in projects uploaded provided by the Repocap. Users can investigate the depth of their learning. Student accounts will be automatically verified if they are already in an existing group or research team. Documents will be visible to either respective panels' account

Guests can visit the site Repocap. They can view and download the finished capstone project uploaded by the students of the Institute of Computing studies in Mabalacat City College.

Repocap will be only accessible online (for instance, with an active internet connection and with the aid of a browser) and cannot be accessed offline. The system needs a hosting domain, so the users can view the uploaded projects.

The back end of the system was developed using Python, Bash, MariaDB, and PyCharm. The frontend utilized HTML5 to display each element on the webpage alongside CSS3, which defines how those elements are displayed. Ajax and JavaScript made the webpage interactive. Typescript made the code easy to read and understand. jQuery simplified and standardized interactions between JavaScript codes and HTML elements.

ISO 25010 criteria will be the basis of the evaluation of the system. Functional Suitability checks whether the system is complete, correct, and appropriate. Performance efficiency checks whether the response and processing time of each page load, resource utilization, and the capacity of the app meet the requirements. Compatibility was measured based on the degree to which the developed system can exchange information with other platforms. Usability is based on how the users can easily learn, operate, access, and recognize whether the web app is appropriate for their needs. Reliability checks the application's fault tolerance, availability, and recoverability. Security means the system can protect the information or data that is stored in the database. Maintainability represents how effective and efficient a system can be when changed to improve it, correct it or adapt it to changes in the environment, and in requirements. Portability tests the effectiveness and efficiency in which an app can be transferred from one platform to another.

SYSTEM DEVELOPMENT METHODOLOGY

This section contains research design and the methodology used by the proponents in developing the Repocap a web-based Capstone Management system for Mabalacat City College. The method used to develop the system for Repocap was the system development life cycle in an Iterative model method.

System Development Methodology

System Development Methodology explains the method used in developing the Repocap a web-based capstone management system for Mabalacat City College. The researchers used Iterative model. It is a System Development Life Cycle (SDLC) model process starts with a simple implementation of a small set of the software requirements and iteratively enhances the evolving versions until the complete system is implemented and ready to be deployed.

An iterative life cycle model does not attempt to start with a full specification of requirements. Instead, development begins by specifying and implementing just part of the software, which is then reviewed to identify further requirements. This process is then repeated, producing a new version of the software at the end of each iteration of the model.

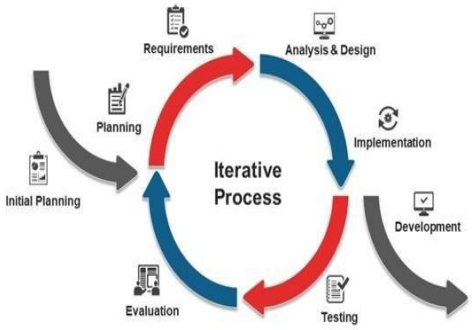


Figure 2: Iterative model Development Methodology
(Source: https://www.researchgate.net/figure/SDLC-Iterative-Model-2_fig4_338911407)

Initial Planning phase

The first stage of Iterative model is Initial planning phase. The researchers conducted a meeting and brainstormed about what possible system was currently needed in Mabalacat City College. The researchers collected information for the system to be developed. They found out what else needs to be added to the repository system to make it more useful to the institute of computing studies in Mabalacat City College. Researchers are looking at relevant studies for the system they will develop. At this stage, the researchers collected idea how to handling and secured a files.

The current system in Institute of Computing Study in Mabalacat City College on how to keep the previous capstone project via library is not much secured. Over the past few years the location of the library has shifted several times. There is a chance that there will be missed studies. Thus, the development of a repository system is to fill the gaps for keeping the capstone projects of IT students in Mabalacat City College.

Planning Phase

After the title and study agreed to develop, researchers started gathering information to fully understand the system design, functions and purpose. They researched over the internet then consulted their adviser for additional information. The proponents had a series of brainstorming sessions which helped them decide on the final objectives of their study. Based on the information collected, the researchers understood the functions that were needed to be incorporated in the system. They also were able to finalize the purpose of the system to be implemented.

Requirement Phase

Based on the information gathered and related studies of the repository system, it was determined that the requirements to be used for the development of the decided study. The information gathered was used and analyzed for the study

Project Requirements

There are requirements for developing this system the hardware and software to be used. This is necessary to ensure the effectiveness of the repository system and to be built properly.

Table 1: Software and Hardware Specifications Used for System Development

Hardware	Software
Intel i3 3.8 GHz Processor 4GB RAM 500 HDD	XAMPP Window 10 Google Chrome Python Visual Studio code Bash MariaDB Pycharm HTML5 CSS3 JavaScript JQuery

Shown in table no.1 all hardware and software tools used for Repocap. For back-end Python, Bash, Maria DB and pycharm was used in developing the system. HTML5, CSS3, JavaScript, Typescript and jQuery was used for front-end.

Analysis and Design Phase

After the concise and detailed requirements have been determined, the researchers proceeded to design the repository system. The researchers first determined what functions needed to be used to fill the submitted study title. The System was designed for a prototype

so that IT students of Mabalacat City College had storage of their Capstone projects.

To design the system, the researchers used the gathered information to obtain the specific functions of the system. Analysis tools are used to illustrate the existing and the proposed systems as well as the requirements of the object. The analysis tools were used are:

1. Visual table of content diagram - A top-down hierarchical structure is used to analyze, discuss and better understand the functions of structures and their relationships. See appendix A.

2. Use Case Diagram - its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well. The use cases are represented by either circles or ellipses. See appendix B.

3. Entity Relationship Diagram - An Entity Relationship Diagram (ERD) shows how entities (such as people, objects or concepts etc.) relate to each other in a particular system. Generally, an ERD does not define business processes, but graphically displays business data patterns. In this case, the entity can be regarded as a noun and the relation can be considered as a verb. ERD can help users conceptualize abstract elements in order to discuss and understand the relationship between different concepts. See appendix C.

4. Data flow Diagram - Data flow diagrams are used to graphically represent the flow of data in a business information system. DFD describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation.

Data flow diagrams can be divided into logical and physical. The logical data flow diagram describes flow of data through a system to perform certain functionality of a business. The physical data flow diagram describes the implementation of the logical data flow.

Implementation Phase

After the design stage, the programmer applies all the functions in the diagram shown to create the Repocap system. The previous stage was made to guide the programmer to ensure that such functionality in the diagrams was filled.

Testing Phase

At this stage, the repocap system is tested before it is hosted in the browser. The repocap prototype was thoroughly investigated to find out more about the shortcomings and faults of the system. All errors, bugs and changes that need to be changed are identified at this stage. The test results can be used to repair and improve the system. See appendix E.

Evaluation Phase

In the previous stage there are still things that need to be fixed before deploying the system. According to the system analysis almost all functions are working but an error appears. Such errors can be easily fixed before being used by the person in charge.

When all the previous stages are completed, a thorough review will be done to further develop the system and make it more useful. It allows the entire team, as well as users and external parties, to evaluate where the project is, where it is needed, what can or should change, and more.

Deployment Phase

After evaluation and testing, the system was completely developed; the programmer ensures that the entire system is fully functional; the system was ready for deployment. The plan was needed for the preparation and maintenance of the web application. The system was uploaded on a web hosting server with a DNS (Domain Name Servers) name www.repocap.info. The system administrator account was tasked to introduce or transfer accountability to MIS personnel for further study and testing of the web application. Student and Faculty would log-in in their own user account. The administrator must create the student and faculty account and provide the credentials to them. The administrator maintains and monitors the activity within the system.

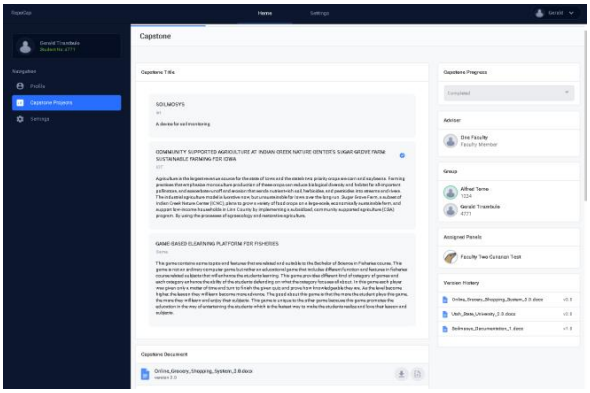
RESULTS AND OUTCOMES

This study aims to build a repository for capstone of IT Students in Mabalacat City College. This system will greatly help the students to secure their capstone study. The system developed using the Iterative model methodology. The researchers gained understanding of the topic by conducting internet researchers and surveys.

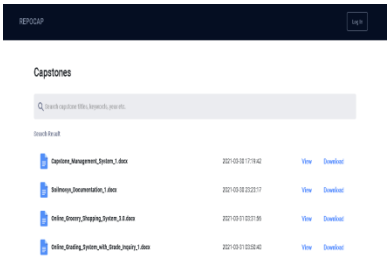
In This section, the researchers present evidence that the goals has achieved.

Design and development

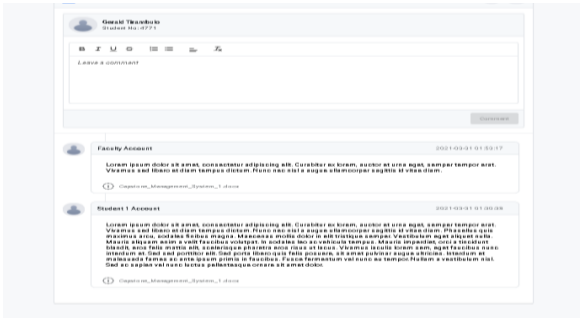
Based on the information gathered and recommendation for the repository system, along with the design and usability is mainly the focus to have storage and have a stage process of Capstone for the IT students of Mabalacat City College.



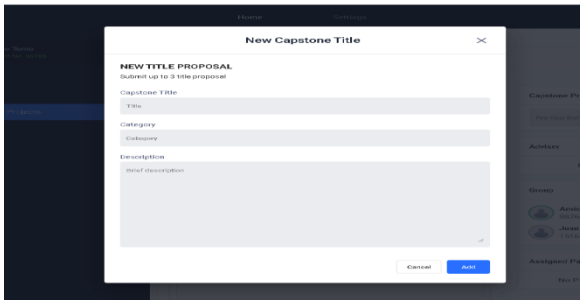
After the initial survey has conducted, the researchers have come up with a particular design of the Web-Based Repository system that aligned with the subject, which is storage for the Capstone study. The image below is the homepage of the system; it will show all the complete study and it has a search bar.



The image below shows the comment section where all the participants in the study with the panel and adviser can write down a comment.



The Image below is the first stage in the process where the students need to create at least three-proposal title for title defense.



The back end of the system developed using Python, Bash, MariaDB, and PyCharm. The frontend utilized HTML5 to display each element on the webpage alongside CSS3, which defines how those elements displayed. Ajax and JavaScript made the webpage interactive. Typescript made the code easy to read and understand. jQuery simplified and standardized interactions between JavaScript codes and HTML elements.

Integrate and testing the system

The Web-based system and backend are integrated. The researchers made sure that the integration process would not result to any error. The backend was update and the system was check if the data updated in the backend was reflecting in the system.

The researchers assigned members for testing the system. There was a checklist for testing

the system to make sure the system was working properly. (See appendix E)
In testing used, the checklist ensured that all processes were tested, the errors detected were rearranged by the programmer, and tested again to determine if the error function was fix.

DISCUSSIONS

This section discusses the researchers' findings for the study. There are also recommendations included to give ideas for the future researchers that plan to do a related project.

Summary of findings

The Repocap Web-Based capstone management system for Mabalacat City College was designed and developed successfully. The system has a four-access level, which is the Admin for managing the system and accounts, Faculty will be assign as a panel or adviser of particular study, students who will be the one to upload a study and guest user.
It has also project catalog and smart search for easily find the desired study. The students and faculty can access the forum wherein the discussion and presenting document by stage happened. Inside the forum, there is a section where the document has been archive.
For the Back-end support researcher has used Python, Bash, MariaDB and PyCharm. Researcher used HTML5, CSS3, JavaScript, Typescript and JQuery for the front-end of the system.

Conclusions

The Repocap web based capstone management for Mabalacat City College develops based on the requirement specification. The features is complete and their functionality. All gathered information and analyzed data was enabling for the system development. The required software for developing the backend such as Python, Bash, MariaDB and PyCharm was used, and for front end HTML5, CSS3, JavaScript, Typescript and JQuery.
Using test case researchers successfully test the functionality, usability, interface, compatibility performance and security. It is also successfully deploy on a browser through hosting service.

Recommendations

The following recommendations are given for the future researchers to improve this study:

- Create a system that can access offline for the sake of the students who cannot afford through online.
- Deploy the system in the trusted domain hosting and fully plan.
- Add some integrations API for other features.
- Create large database storage.

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SUNWAVE: An Internet of Things-Based Solar Panel with Cooling, Tilting Thru Mobile Application User Interface Monitoring and Controlling System

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ABSTRACT
The researchers developed a prototype of a solar panel system named “SunWave” with an automatic water spraying sub module to clean and cool down the solar panels when it reached the temperature of 65 degrees Celsius and above. Note that the water pump can also be activated manually to give the user a choice of manually spraying the solar panel module. Additionally, a linear motor mechanism was added to automatically set the solar panel to eleven tilting positions with corresponding time intervals respectively. A mobile user application was also developed with the following remote controlling capabilities; to monitor the temperature of the solar panel module, to manually activate the water spray pump. Both the mobile application and the prototype have separate tables of test cases. Each test case was repeatedly performed up to ten trials to assure that the functionalities were achieved according to the design requirements. The developers used the prototyping model as a guide on how to complete the SunWave prototype and its mobile user interface. The panelists suggested that the developers can remove the manual settings of tilting positions of the solar panel modules and that is because the time intervals of tilt positions are fixed throughout the day.

Categories and Subject Descriptors
Groupings and IoT based Solar Panel with Cooling, Tilting Thru Mobile Application User Interface Monitoring and Controlling System

General Terms
Households

Keywords
App Story Board, MIT App

INTRODUCTION

The Philippines is one of the countries on track to be a leader in Asia’s shift to clean energy. Solar renewable energy was conducted for the Filipino people for a sustainable source of electricity. Photovoltaic PV module, a device that is composed of solar cells when struck by photons of light from the sun, generates an electrical current which can then be used to power electrical loads. The solar panel generates energy by pointing straightforwardly to the sun's rays. Solar tracker system can increase the effectiveness of such panel modules over any fixed position to monitor sunray.

Having a technology-neutral energy policy is important for fast economic growth and expansion of Asian economies. For instance, despite the decades-long lobby to glamorize and subsidize wind-solar and other renewable resources, fossil fuels provided 74% of total electricity age in Asia-Pacific in 2017, with numerous nations being over 80% petroleum derivatives subordinate — India, Australia, Indonesia, Malaysia, Thailand, Taiwan, and so on [1]

Solar panel gathers clean sustainable power source as daylight and convert that light into power which would then be able to be utilized to give capacity to electrical burdens. Solar panels include a few individual solar panel cells which are themselves made out of layers of silicon, phosphorous to give the negative charge and Boron to give the positive charge. Solar panels ingest the photons and in doing so, it will start an electric flow. The subsequent energy created from photons strike the outside of the solar panel which then permits electrons to be taken out of their nuclear circles and be delivered into the electric field produced by the solar cells. At that point, it will maneuver these

free electrons into a directional flow. This entire cycle is known as the Photovoltaic Effect.[2]

Solar panels can overheat. Solar panels are tested at 25 °C; thus, solar panel temperature will generally range between 15 °C and 35 °C during which solar panel will create its greatest productivity. Notwithstanding, sunlight-based boards can get as hot as 65 °C (149 °F) so, all things considered, sun-powered cell productivity will be hindered.[3]

Tilting sun tracker is for orienting a solar photovoltaic panel, day lighting reflector or concentrating solar reflector or lens toward the sun. Solar panels generate best when pointed straightforwardly to the sun, a solar tracker system can increase the effectiveness of such equipment over any fixed position. The solar panels must be direct to the sun's rays for maximum energy generation. Going astray from this ideal point will diminish the productivity of energy age from the panels.[4]

The purpose of solar panels is to fulfill the developing demand for renewable energy resources. In the modern world, the demand for electricity has developed at disturbing rates to address the issues of society. Numerous advantages to solar energy include the lack of pollution directly created by these frameworks and their cheap and practical nature in the long term. As the interest for solar panels grow, so will the need for ways to optimize their energy collection.

A Solar board or Photovoltaic (PV) module is a social event of photograph voltaic cells mounted in a framework for the foundation. Photovoltaic cells use daylight as a source of energy and produce direct flow electricity. A collection of PV modules is known as a PV Panel, and an arrangement of Panels is an Array. Varieties of a photovoltaic framework flexibly sun powered power to electrical equipment. [5]

The orientation of solar panels is just as important as which type of solar panel is used in a given situation. A solar panel harnesses the most power when the sun’s rays hit its surface perpendicularly. Guaranteeing that sunlight based boards face the right course and have a suitable slant will help guarantee that they produce the most extreme energy as they are presented to the most noteworthy intensity of sunlight for the greatest period of time. Some solar arrays follow the sun. They would agree with the idea that putting a solar panel array in the hottest parts of the world is the best way to generate the most energy. Although for generating a lot of power using photovoltaic panels, too much heat can be a bad thing. If solar panels get too hot, they can in fact overheat. When a sunlight-based board overheats, its productivity drops definitely, causing it's anything but a ton of the energy it would somehow or another assemble from the sun.

General Objective

The general objective of the study is to develop a solar panel prototype named SunWave - an internet of things-based solar panel with cooling, tilting thru mobile application user interface monitoring and controlling system with the following specific objectives:

- The system shall monitor the real-time temperature of the solar panel module thru the mobile application.
- The prototype shall automatically spray water when the solar panels reached a temperature of sixty-five Degrees Celsius.
- The user shall manually spray the solar panel thru the mobile phone.
- The mobile application shall have login username and password to secure the system.
- To describe the comparison between the average temperature of the sensors to the reference temperature measuring gun.
- To evaluate the mobile application functionalities using a set of specific test cases.
- To evaluate the prototype functionalities using a set of specific test cases.
- To design the tilting mechanism with eleven positions with respect to time preferences.

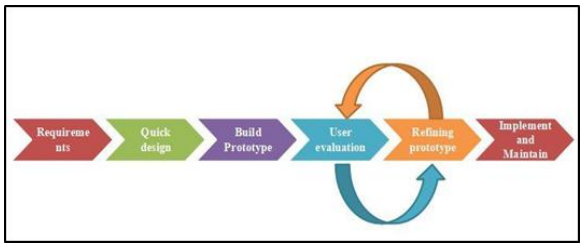
Scope and limitation

The prototype has an automatic setting of the solar panel into eleven different tilt orientations

according to time preference. Additionally, the SunWave system can manually and automatically spray water on the solar panel module when it reached the threshold temperature value thru the mobile user interface. Finally, mobile application interface displays the temperature of the solar panel.
The study does not cover the electric billing reporting in the mobile application and the monitoring of the generated energy of the SunWave system. Additionally, the system is limited to tilting the solar panel in an x and y coordinates direction only as opposed to freely follow the exact x, y, z orientation of the sun.

SYSTEM DEVELOPMENT METHODOLOGY

The research design model used by the developers was prototype model. The SunWave is an integration of the mobile application user interface and design of the solar panel module of the whole system. The figure given below describes the said design model. Figure 12 describes the steps on how to achieve the final product.



Prototyping Model

Requirements gathering and analysis

A prototyping model starts with requirement analysis. The researchers were able to apply the knowledge learned from the related literature and studies. Likewise, after gathering concepts and ideas from related studies, the researcher came up to seek the need for an additional mobile application interface. The researchers found out that, a mobile application developer named MIT APP inventor was suitable for the user interface development. With the help of the technical adviser in terms of electronics technology and electrical knowledge part of the study, the researchers were able to come up with their own prototype design. Finally, the software and hardware requirements were adopted for the system. Refer to Appendix L for the hardware and software requirements.

Quick design

The subsequent stage is a fundamental plan or a speedy plan. In this stage, a basic plan of the framework is made. However, it is not a complete design yet. It gives a brief idea of the system to the user. The quick design helps in developing the prototype. Please refer to the storyboard in Appendix N for the interface application development plan while appendix N shows the initial design concept of the prototype.

Build a Prototype

In this stage, a genuine model is planned dependent on the data accumulated from the fast plan. It is a small working model of the required system. Initially, the researcher studied two different motors-- a DC motor and a linear motor, and have found out that, the mechanism of the linear motor was easy to use for the tilting capability of the prototype. See appendix O.

Initial user evaluation

In this stage, the proposed system was presented to technical expert for an initial evaluation. Comments and suggestions were collected to provide inputs about the strength and weakness of the working model. Additionally, the mobile applications and prototype test cases were conducted or answered to assure the functionalities of both prototype and mobile application user interface respectively, see appendix E.

Refining prototype

Prior to declaring a final product, this phase is not over until all the requirements specified by the user are met. When the client is happy with the created model, the last framework is created dependent on the endorsed last model. The researcher, technical adviser and panelist have found out that security of using the user interface had an issue that the mobile application can be used by multiple users simultaneously. The developers were able to resolve the said issue by thoroughly refining

the code blocks of the integrated development environment for the mobile application.

Implementation and product maintainance

Once the final system is developed based on the final prototype, it is thoroughly tested and deployed to production. The system undergoes routine maintenance for minimizing downtime and prevent large-scale failures, since the development of the prototype is bounded only up to the final presentation to the panelists. Implementation and product maintenance is beyond the scope of the study. For discussion purposes, this stage was discussed above.

RESULTS AND OUTCOMES

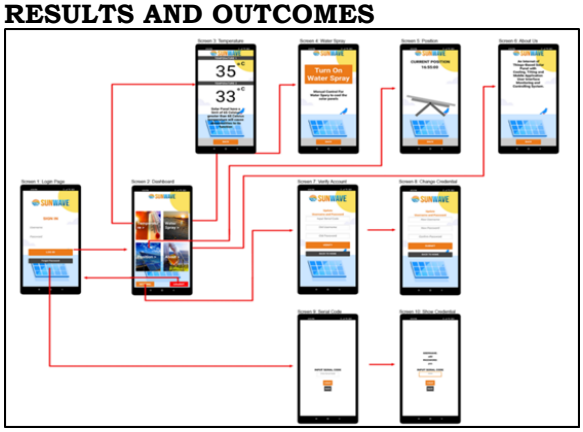


Figure 13. The SunWave mobile application user interface

SunWave Mobile Application User Interface

The first screen shown in figure 13 has login details. Once correct user name and password was entered, the second screen will display four buttons to let the user choose what function will be activated. Temperature button will show the monitoring of temperature. Water display button will lead to manual control of water pump to spray the solar panel module. Aside from the 'About' button to describe the system, the position button will display the current tilting position of the solar panel module.

Design and Development

Figure 14. Temperature Verification

Mobile Application Temperature Display Versus Temperature Measuring Device

Illustrated above is the mobile application interface displaying the correct temperature value. Further, temperature measuring device was also used to verify the mobile app temperature. To assure the output temperature verification was displaying correct values, three trials per time interval of temperature comparison between the output display of the mobile application and the temperature measuring gun output. see appendix D.

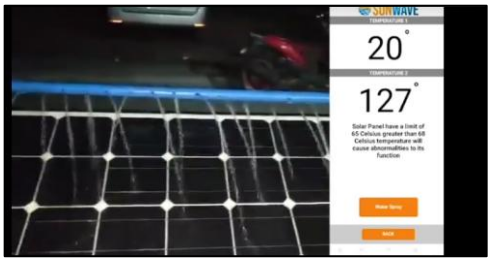


Figure 15. Water Spray Module

The water supply Module

As reflected on Figure 15, there is the water spray module. A PVC-plastic pipe was chosen instead of metal pipe for easy drilling process of water pipe holes. The figure shows that the water was automatically sprayed when above sixty-five degrees Celsius was reached. Note that the portion where the right part sensor has been installed was intentionally heated to meet a temperature value higher than sixty-five degrees Celsius while the upper temperature (20 degrees Celsius) value is the normal temperature of the panel.

Figure 16. Experimental Photovoltaic Solar Panel Prototype

The Solar Panel Module

Figure 16 illustrates the SunWave experimental prototype product. The solar panel used is a common household solar panel module. The tilting functionality was achieved thru the use of a linear motor (silver cylinder at the lower part. A PVC type of pipe was used to distribute the water along the surface of panel. See the figure 17 for the motor pump and water reservoir used in the system. The motor pump used is a one-half horsepower motor which is high enough deliver the water from reservoir to water pipe of the system.

Figure 17. Water Reservoir and Water Pump

Water Reservoir and Water Pump

Shown above in Figure 17 is the SunWave water reservoir. To allow the water to flow uniformly across the solar panel, a pipe made of polyvinyl chloride with a diameter of 2.5 centimeter and with the length of 6 feet for solar panel and 185 cm for reservoir was used. Pipe was drilled with holes and had a distance from one another to have space for the solar panel to be watered.

The water pump labeled 2 of fi is used for the water spray system. The water pump automatically activates once the solar panel exceeds the temperature to 65 Degrees Celsius or higher the water spray system will continuously release water until the solar panel decreases its temperature to 64 Degree Celsius below.

Testing Results

Test Cases Results Prototype

Table 1. SunWave Prototype Test Cases

Hardware	Yes	No
1. Does the water spray motor pump turn on when the temperature reach 65°c?	3	0
2. Does the water spary motor pump turn off when the temperature is below 65°c?	3	0
3. Does the temperature sensor 1 module match with the temperature gun?	3	0
4. Does the temperature sensor 2 module match with the temperature gun?	3	0
5. Does the linear motor activate to tilt the solar panel and follow the eleven set time preferences?	3	0

No. of trials for each test case =3

The test cases shown in table 1 three represent the functionalities of the prototype submodules. Note that each of the functionality buttons were tested three times to assure that each prototype submodule reacts according to its function. At the initial stage of testing the prototype functionalities, it was found out that the speed of the Wi-Fi connectivity affects how immediately the system responds. Eventually, the motor pump turned at a temperature lower than sixty-five degrees.

When the researchers tested the water spray submodule, it was found out that the water pump pressure is enough to distribute the water throughout the solar panel surface even though the water pipe is seated at one end of the panel. Note that the water pump automatically turned on the motor pump water supply when the researcher intentionally had heated the surface of the solar panel to a temperature value above sixty-five degrees Celsius.

The temperature of the solar panel was tested and validated with the use of calibrated temperature gun meter. The temperature sensors at both ends are considered accurate since the allowable deviation range in reading the temperature was achieved and happened to

be the same as the solar panel nominal operating temperature. See appendix D for the real-time average temperature of the solar panel in comparison to the solar panel nominal operating temperature specification.
The eleven tilting positions were achieved and captured thru screenshots from the recorded videos for verification and presentation purposes. The shifting of the tilt positions was smooth in motion and that is because the mechanism includes a bearing to allow the linear motor additional ease of moving the solar panel module.
Additionally, after finalizing the prototype wiring connections and proper orientation of mechanisms, all the modules responded according to the user interface buttons and were found out to be working properly.

Table 2. Mobile Application User Interface Test Cases.

User Interface (UI) Test Cases	YES	NO
1. Does the UI display the real-time solar panel temperature and as accurate as the temperature gun meter display?	3	0
2. Does the UI can set the automatic time settings of the solar panel eleven tilting positions?	3	0
3. Does the mobile app UI button activate the water reservoir motor pump ?	3	0
4. Does temperature 1 display show accurate degrees celcius value?	3	0
5. Does temperature 1 display show accurate degrees celcius value?	3	0
6. Does the UI will not allow a multiple users at a time by implementing username and password details?	10	0

Test cases 1 to 11 Number of Trials = 3 .
Test case number 10.

Table no. 2 shown above is the test cases for the functionalities of the mobile application interface. Three trials were considered for each test case to assure that the hardware prototype responded according to the corresponding button. Note that all buttons and screens responded according to the design elements and buttons of the system.
The temperature displayed values the integrity of the mobile user application was achieved and verified using a new and calibrated temperature gun. The accuracy of the displayed temperature values of the installed sensors is more accurate when the temperature gun was placed on top of the solar panel module.

The researchers were able to set eleven automatic tilting positions thru the mobile application and that the linear motor was able to follow the set eleven tilting positions concerning the set time preferences. Refer to the appendix F for the eleven tilting solar panel tilting positions.
Manual control testing of the motor pump was also tested three times to check if the water is distributed throughout the solar panel module. The researchers consulted the motor pump seller if it is capable of giving enough pressure to our system. The seller suggested a 0.5 horsepower water pump and said that it is a common motor pump used in a household water supply reservoir.
Finally, the user interface access test case was tested ten times to assure the security access of the mobile application. During the capstone final presentation, the panelists were able to detect an issue regarding the security access level of the mobile application. The panelists suggested fixing the mobile application from having the application being accessed with multiple users. Upon resolving the issue, the researchers were able to fix and restrict the mobile application into a single-user only by fixing the code blocks and revising the login details. Note that security level is one of the most important factors in the evaluation.

DISCUSSIONS

This section consists of the summary of findings, conclusions and recommendations based on the results of the study SUNWAVE: Cooling, Tilting and Mobile Application User Interface Monitoring and Controlling System

Summary of Findings

To achieve the prototype SunWave and mobile application integrated output product, the researchers used the steps of a prototyping model. Specific objectives were formulated according to the functionalities and design parameters. Experimental trials were performed to check the integrity of the temperature display of the mobile application and the used temperature sensors. Note that a temperature gun measuring device was considered as a reference value in terms of

temperature measurement integrity. Test cases were formulated for both the mobile app and SunWave prototype. Product owner panelists suggestion in terms of login security was also achieved by refining the system codes. Additionally, the researchers came up with intentionally heating the panel to meet a temperature threshold value of 65 degrees Celcius and verified that the water spray module will be activated. Finally, the developer came up with automatic eleven tilting positions.

Conclusions

The researchers used test cases to test the hardware and software functionalities. Based on the results of the test case responses, both hardware and software were working properly. Additionally, there are a total of thirty-three trials of temperature measurements conducted for the sensors, three trials per time interval of eleven tilting positions of the solar panel, and are compared to thirty-three temperature measurements using temperature gun. The sensors used and the capability of the mobile application is displaying the temperature values were optimized because the comparison of gun temperature device measurement is very much the same as the average temperature display value of the mobile application temperature display. See appendix H. Note that the solar panel nominal operating temperature specification is 47 Degrees Celsius with a plus or minus of 1 Degree Celsius and that the prototype SunWave experimental trials yielded an average value of 48 Degree Celsius. Thus, developed mobile application and sensors used were proven to be effective in terms of displaying the solar panel surface temperature.

The developers were able to develop the functionality of login security issues; that is, providing a username and password to prevent the mobile application from being used by multiple mobile devices.

The researchers were able to construct a water-cooling mechanism for the solar panel module to maximize its generated power and prevent the panels from overheating above 65 Degrees Celsius by automatically turning on the water spray module.

The developers were able to design a tilting mechanism to follow the sun rays' positions with eleven tilting positions concerning time preferences from 6 am to 4 pm.

Recommendations

The researchers considered the following recommendations for future improvement of the developed SunWave prototype.

- Use of solar ray tracking sensors to move the tilt position with x, y, and z-axis positioning.
- Consider adding cleaning chemicals to the water to clean the smudges and particles on the surface of the PV module where it can affect heat dissipation.
- Build the water-cooling setup with a source from the faucet for water replenishing.
- Improve the construction of the casing of the hardware designed for the house roof.
- The hardware should be connected directly to the PV module for its power source.

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PARAM: A Web-Based Booking and Management System with Mobile Tracking Application for Param Car Rentals

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Abstract

The focus of the study is to design and develop a Web-based Booking and Management System with Mobile Tracking Application for Param Car Rentals. The system has 3 user types that include the admin, the renters and the business partner. The system will have a Car Management where Admin can add and update a car information, also it will have a Car Scheduling for viewing of availability of units. For Bookings, the Admin can check the new bookings, review the information, and it will be either approve or cancel. Renters need to register and PARAM will send a link for the validation of the email. After registration the renter can now book cars. The system has a mobile application tracker for renters. For car owners who wished to be Param's business partner, the system enables them to register first and be part of the Param as a business oartner. The system was develop using Prototyping Methodology. Functionality, reliability, compatibility and security of the system is tested using test cases. This just proved that the developed system follows the requirements specified. The system had been implemented successfully and had undergone numerous modifications. Based on the findings and conclusions reached, the researchers suggest that future researchers consider developing a mobile app that is also available on the IOS platform, an SMS notification for booking applications, and a web-based framework that is built into a mobile app type.

Objectives

General Objectives

The general objective of the study is to a web-based system and tracking application entitled "PARAM: A Web-based Booking and Management System with Mobile Tracking Application for Param Car Rentals. Specifically, the study aims to:

1. **TO DESIGN AND DEVELOP A SYSTEM**
   - 1.1 3 access levels
   - 1.2 Registration of renters and potential business partners.
   - 1.3 Car booking
   - 1.4 Car scheduler
   - 1.5 Driver assignment
2. **TO DESIGN AND DEVELOP ONLINE MOBILE TRACKING FOR CAR RENTALS AND DRIVERS**
3. **TO TEST THE SYSTEM IN TERMS OF FUNCTIONALITY AND COMPATIBILITY USING TEST CASES.**

Methodology

The System Development Methodology refers to the standard process to conduct all steps necessary to a framework that is used to structure, plan, and control this process of development of the system. The methodology that the study's researchers u tsed, as well as how they implemented and step, will all be discussed.

FIGURE 1: Prototyping Model

Figure 1 shows the Prototyping Model used in this study. The prototyping model is a system development method which a prototype that involves building, testing, and reworking as needed until an appropriate outcome is achieved to help develop the entire system or product. This model works best when all of the requirements or conditions aren't known ahead of time. It is primarily a trial-and-error mechanism that is iterative which takes place between the developers and the users.

Gathering Requirements

The researcher conducted a series of meetings, collected data from the internet, and performed an interview with Param Admin and staff who know the Car Rentals business to know what would be the possible car rental system functions and features that are needed to be developed. Thus, to fully understand their study, the researchers described its advantages, intent, risks, and issues, which help the researchers in deciding and finalizing their software and web application resources and specifications.

Quick Design

This quick design gives the user a quick overview of the hardware and software, which helps in designing and developing the system. The researchers used designing tools such as Context Diagram (see Figure 2) and Use Case Diagram (see Figure 3) to illustrate the activities that the user will be expected on the web-based system and mobile application.

The researchers identify the needed software tools and programming language for designing the framework and coding their project. The researchers used PHP for coding the logical functions; HTML and Bootstrap for the Graphical User Interface; MySQL for storing and retrieving data; and Visual Studio Code as Code Editor. Android Studio is used for developing their mobile tracking app and coding is Java Script.

FIGURE 2: Context Diagram

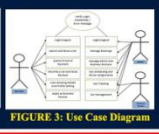

FIGURE 3: Use Case Diagram

Build Prototype

This is where the actual prototyping, coding, and programming that the researchers needed to develop the system based on the identified requirements and from the gathered designed information in the quick design. During this step, the researchers had to find system bugs and errors as soon as possible so that they could be fixed before moving on to the user evaluation and repeated until the researchers were satisfied with the results.

Evaluate

To prepare for prototype refinement, feedbacks and suggestions are gathered. The researchers needed to conduct a series of tests by using the test cases to see whether the developed system might experience any problems. This phase will continue as long as there are bugs or errors needed to be refined, or until all the identified functionality and requirements specified by the user are met.

Refine Product

From the feedback and suggestion of the users throughout the use, errors, and failure, the researchers went back to the quick design process to correct system features. The researchers wanted to improve the hardware and software as a result of all the feedback and recommendation. Thus, any bug and failure in the system and mobile application will be refined before it is fully released to the user. On the mobile application Android version between 7.0 to 10.0 is used to evaluate the compatibility of the application from different smartphone devices.

Product

The researchers are now in the final step of the project, where they have successfully developed a web-based car rentals system with a mobile tracking application. Although the system is at 100%, the system undergoes a maintenance process involving correcting errors that were not identified in the earlier phase. If it is fully functional, the researchers were finally deployed and presented the system to panels and users to test the capabilities and to see what are the configured functions.

Results & Outcomes

These results and outcomes were based on the objectives of the study, complete analysis, testing, and evaluation of the developed system and mobile application.

The researchers searched through the internet for a car rental business in Pampanga and found Param Car Rentals, which are currently in need of a management and booking system. They conduct interviews to the locale, held frequent meetings to test and monitor the progress of their research, and each member is given a set of assignments with deadlines.

After finalizing the requirements analysis process of the project prototyping, the researchers identified the hardware and software resources to be used. For Hardware, researchers use a personal computer with a specification Ryzen 3 3100 Windows 10 with 16GB RAM, 500GB HDD and 128 GB SSD. For Smartphones requirement, researchers use an Android phone and the location services must be enabled, also the Android version must be at least 7.0 (Nougat) and an API level of 24.

In developing the Web-Based System, the system requirements were used by the researcher and project objectives are met. It includes Visual Studio Code for coding and designing the system; Google Map API, for car tracking interface feature of the system. For Mobile Application development, the researchers used Android Studio for coding and designing, and Android Emulator to simulates the application.

DESIGN & DEVELOPMENT	TESTING PHASE & EVALUATION	IMPLEMENTATION RESULTS
Using the Prototyping Model as a guide, the researchers used it in developing and designing the system and the mobile application. During the development phase, the researcher first decided what software requirements and what back-end services to use. Designing tools such as context diagram and use case diagram we're used to develop system with features such as car tracker, driver assignment, and car scheduling.	The researchers used the hostinger.ph for the hosting and domain of the website for the execution of the website. In the testing phase of the tracker feature, the researchers installed the APK file, logged in the registered account and for those accounts must have a confirm booking. Following the evaluation, the researchers performed a series of tests and analyses during using test cases. The researchers repeated this kind of process until the system went through the final product	The researchers finally came to successfully develop a web-based system that has a car scheduling management, where the Admin can monitor the schedules of booking in every car. PARAM that also have a driver assignment feature, for those renters who wants to book a car with driver services. Lastly, a mobile application that can track the location of each unit and provides a complete information of the renters.

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