



## POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

### **Safety Awareness For Each Resident (SAFER) of Barangay Sto. Niño Paranaque City**

A Designed Project Proposal

Presented to the Faculty of the Computer Engineering Department  
Polytechnic University of the Philippines  
Parañaque City, Metro Manila

In Partial Fulfillment of the Requirements for the Degree in  
Bachelor of Science in Computer Engineering

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## DEDICATION

The researchers would like to dedicate this work presented in this research study to the following people:

First, this work is dedicated to God Almighty for His unconditional love and care, His guidance and assistance, for giving them strength and health enabling the researchers to keep working on this research study.

Special mention goes to the researchers' family, who were always there to give their encouragement, love, and any kind of support. They meant everything to them, and they wholeheartedly dedicate this research study to them.



## ACKNOWLEDGEMENT

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Deepest gratitude to all the professors especially to Engr., Marvin De Pedro who give all their moral and continuous support. Their patience, motivation, enthusiasm, and vast knowledge helped the researchers keep on working on this research study;

To the respondents which include the people of Barangay Sto. Niño, Parañaque City, Metro Manila for giving the researchers their consent and during the data gathering;

To their fellow classmates in BSCOE 3-1 for their support. Hope that all of them, together with these researchers, can enhance their knowledge and skills that may help them achieve and successfully finish their research study;

The researchers' parents for the encouragement, moral, and financial support for the succession in this study;



And above all, the researchers sincerely thank our Creator, the Almighty God, who gave them the physical, mental strength, and good health to undertake and accomplish this work.

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### Chapter I

#### THE PROBLEM AND ITS SETTING

##### Introduction

The Philippines is located in the Pacific ring of fire along with the pacific typhoon belt which is prone to natural disasters such as floods, typhoons, landslides, earthquakes, eruptions and fires. (Center for Excellence in Disaster Management and Humanitarian Assistance, 2021). There is no specific time and seasons for disasters and hazards that can lead to thousands of avoidable deaths and property damage. People are not prepared for twenty four hours when disaster comes; however, Safety and security is highly essential for every person. (Dr. S, Mcleod, 2022). In Philippines, there are constitutional rights to life and property of people, the Disaster Risk Reduction and Management (DRRM) Act of 2010 or the RA 10121 that should be upheld by strengthening the institutional DRRM capacity of the country, building disaster resilience among local communities, and addressing the root causes of disaster vulnerabilities. The Philippine Congress enacted the National Disaster Risk Reduction and Management Act in 2010 to establish a multilevel disaster risk management system. Additionally, the Philippine Government is putting significant thought into developing resilient infrastructure to allow communities to recover swiftly by



investing in green infrastructure as a priority as the government seeks to meet climate commitments.(Center for Excellence in Disaster Management and Humanitarian Assistance, 2021)

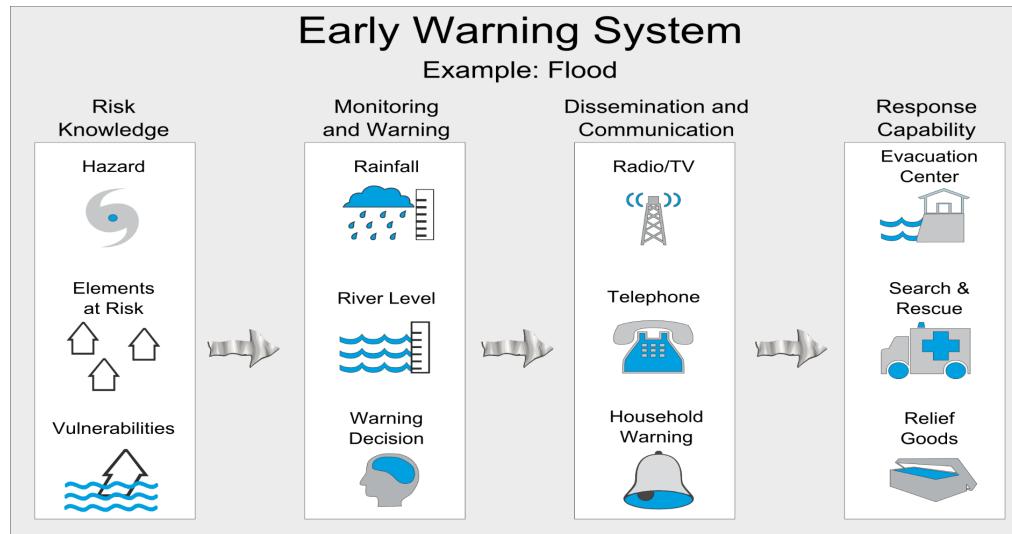
With its aim to support the efforts of the local government in Brgy. Sto. Niño, the Project Safety Awareness for Each Resident (SAFER) Brgy Sto. Niño will be providing hands-on training and workshops aimed to equip residents and barangay officials with skills necessary for DRRM. In parallel to that, the project also intends to develop a system that aims to enhance the existing engineering controls for DRRM in the said community. Statistical updates on the project objectives will be delivered regularly for the awareness of the community and sponsors as well.

### **Theoretical Framework**

The project intends to develop an Internet-of-Things (IoT) based early warning system that will enhance the existing DRRM engineering controls in the said community. Early warnings alone are ineffective in preventing hazards from becoming disasters. early action, at all time scales, is also required. It is a long-term investment that has been shown to be effective at mitigating the effects of disasters. Significant efforts are being made around the world to empower volunteers to play an active role in monitoring risks that affect their communities. As they do so, they learn to issue and respond to monitoring-generated warnings. Community early warning systems supplement governmental

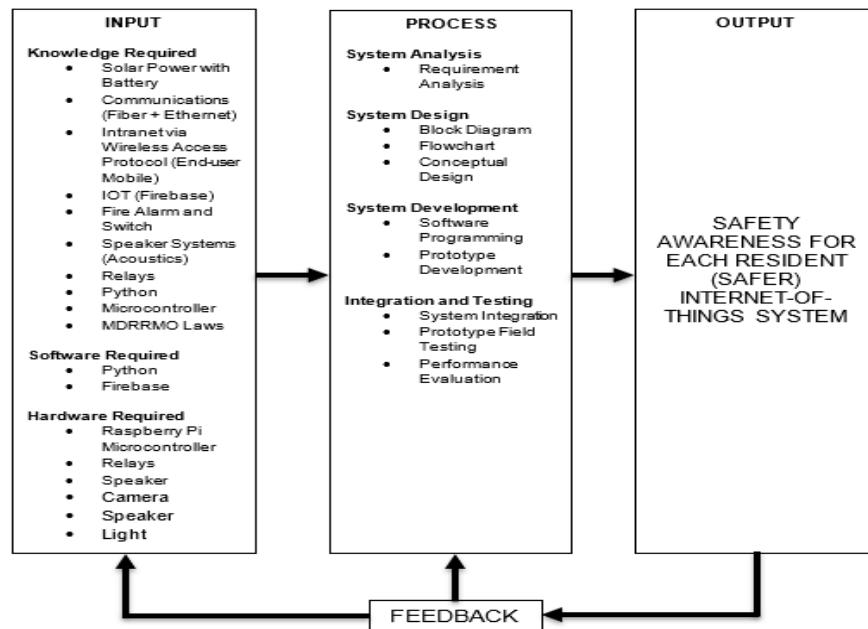


mandates to protect lives and livelihoods where and when national early warning systems are active. (Global Disaster Preparedness Center, 2017).



**Figure :** four pillars of an effective "end-to-end" early warning system

## Conceptual Framework



**Figure 1:** Research Paradigm of the Study

The input section shown in Figure 1, is a list of various areas of fields and technologies that are needed by the system which include knowledge in some areas and field, software, and hardware. Knowledge requirements is composed of solar power with battery, communications which includes fiber and ethernet, intranet via wireless access protocol (WAP), IOT using Firebase, fire alarm and switch, speaker system in the field of acoustics, relays, python, microcontroller, and MDRRM Laws. The software required in this study are python for programming and firebase for the system's database. Raspberry Pi is the main microcontroller that will be used in this study that will be connected to relays, camera, speaker, and light.

The process frame shows how the system is executed and produced. The process frame includes system analysis, system design, system development, and integration and testing. System analysis is composed or requirement analysis to identify what the system should do and its objectives by studying a system or its parts. System design is the process of defining the components or elements of the system that includes block diagram, flowchart, and conceptual diagram. System development is the development of the project's system through software programming and development of the hardware – prototype. Integration and testing are done to validate the interactions among different



software system modules. It is done to make certain that the applications are capable of functioning smoothly by assimilating and communicating with one another. Integration and testing are composed of system integration, prototype field testing, and performance evaluation.

Finally, the output frame shows the product of this study that is resulted when the input and process frames were done accordingly. As can be seen from the figure above, there is an arrow from the output going to feedback and feedback going to input and process. This means that after the development of the system, the researchers will use the feedback of the study to improve and revise the development of the project and the issues encountered during the undertaking of the project.

### **Statement of the Problem**

The study aimed to propose a project by developing an Internet of Things intended for a safer community. Specifically, the researchers needed to answer these following questions:

1. What is the current status of Barangay Sto. Nino, Parañaque City in terms of Disaster Risk Reduction and Management?
2. What are the stages undertaken in the development of Safety Awareness For Each Resident (SAFER) Internet-of-Things System using the Agile model?



3. What is the effectiveness of the proposed system in terms of parameter:

- i. Response Time of Environmental Monitoring Page
- ii. Latency of light button
- iii. Speaker

4. What is the difference between the evaluation of web application and mobile application in terms of :

- i. Response Time of Environmental Monitoring Page
- ii. Latency of light button
- iii. Speaker

5. What issues and challenges are encountered by the residents of Barangay Sto. Nino and ICT professionals in using the proposed Safety Awareness for Each Resident (SAFER) Internet-of-Things System?

6. What is the training program that can be implemented to inform the general public regarding the proposed Safety Awareness for Each Resident (SAFER) Internet-of-Things System?



## **Hypothesis**

This study aims to prove the hypothesis that there is no significant difference in the evaluation of the Web application and mobile application in terms of Latency of light button, speaker and the Response Time of Environmental Monitoring Page.

## **Scope and Limitation**

The study mainly focuses on developing the initial design of a Project SAFER that intends to build a safer community. specifically in the local government of Brgy. Sto Niño, Parañaque City in their efforts to implement DRRM for a safer community. It will be implemented by the Extension Management Office (EMO) of PUP Parañaque, under the leadership of Engr. Marvin De Pedro and the coordination of the campus administration and faculty, constituting the project team.

The initial phase of this project is expected to develop from October 2021 to July 2022. It employs survey questionnaires, observation and statistical analysis for the data gathering. The development will make use of agile methodology and will primarily consist of the following modules;

- Main Module: Web-based Public Address System
- Sub-Module 1: CCTV System with 2-way Intercom
- Sub-Module 2: Disaster Alarm System with Mobile App Notification
- Sub-Module 3: Public Information and Messaging Interface
- Sub-Module 4: Reports and Analytics Interface

However, the Sub-Module 3 and 4 are the least priority prior to the target date, and it's intended for enhancement of the project.

### **Significance of the Study**

This study is beneficial to the following entities:

**Local Government of Paranaque.** This will be beneficial as a first city that will implement a safer community that the local government will be a role model when it comes to DRRM initiatives. .by the help of project SAFER They can easily notice every area affected by the disaster or hazard and mitigate the risk.

**Emergency Response Professionals** . One of the departments that protect the lives and livelihood of communities and individuals who are most vulnerable to disasters and emergencies. This will be beneficial for ease of response to sudden events.

**Residents of Barangay Sto. Nino.** The main target of the project that will be beneficial for their safety awareness of each resident of brgy. Sto.nino. for the disaster and risk.

**Future Researchers.** This study will also open the door for future researchers for follow up events and further enhancement of the developed prototype; this also be the basis of the proposal for the succeeding year.



## DEFINITION OF TERMS

The researchers provided a list of words that are used frequently in this study. The following terms are

**Access Control System (ACS).** The automated system that facilitates the approval of authorized personnel to enter through a security portal.

**CCTV Surveillance System** - This module is basically intended to monitor the CCTV footage in the selected camera of each area, as well as to control the cameras and DVRs installed in each area.

**Fire Detection and Alarm System** - This module is basically intended to control fire detection sensors and alarms, as well as to monitor logs from fire detection and alarm devices.

**Internet-of-Things** - A system internet connected to an object that are able to collect and transfer data to a wireless network without human intervention.

**Two-way intercom** - A device that enables two-way communication between people.

## Chapter 2

### REVIEW OF RELATED LITERATURE AND STUDIES

This chapter will discuss related literature and studies that have a similarity to the present study allowing the researchers to have sufficient knowledge to understand the proposed research study.

#### **Status of Parañaque City community in terms of Disaster Risk Reduction and Management.**

The Philippines by virtue of its geographic circumstances is highly prone to natural disasters, such as earthquakes, volcanic eruptions, tropical cyclones and floods, making it one of the most disaster-prone countries in the world. The Geographical location of the Philippines is the reason why the country is exposed to a plethora of hazards, including earthquakes, typhoons and 53 active volcanoes. These active volcanoes are prone to erupting that are known as most deadly and costly globally (Doroteo, 2015). Other hazards include floods, landslides, tsunamis and wildfires.

Based on History, dealing with disasters focused on emergency response, but by the end of the 20<sup>th</sup> century it was more recognized that disaster is man-made, even if it is a natural hazard, it is worse than natural. (UNDRR, 2020). Reducing or managing the hazard is the only way to prevent loss. And



because it is happening naturally we cannot control the disaster but we can be ready when the disaster comes to prevent exposure of human beings and also nature.

The statistical study says that estimated one third of the inhabitants of Metro Manila reside in informal settlements, where inadequate housing and lack of infrastructure are often highlighted as the most prevalent issues (Morin, et al., 2016). Moreover, the effects of climate change and sea level rise are increasingly being felt in coastal areas, and these effects are further made worse by the environmental degradation (pollution, habitat destruction, and erosion) that is common in coastal communities with abundant natural resources (Sales Jr., 2009). Therefore, disaster and climate resilient urban planning is essential to protect people and promote sustainability, especially in large cities like Metro Manila, which contributes to about 35% of the Philippine GDP (The World Bank, 2017).

### **Development of Alert System of the MDRRMO**

The extreme weather events like heavy rainfalls that resulted in flooding in some regions in the Philippines which water level may rise rapidly and other natural disasters that does not leave enough time to issue warning alerts, resulting in massive losses of lives and livelihoods. In line with this, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH has developed an integrated approach for Local Flood Early Warning Systems (LFEWS) in the



Philippines. LFEWS combine the capacities of the national meteorological authority, local government units and the communities. The approach is adapted to local conditions and focuses on small to medium-sized river basins. GIS data and satellite information may be used to supplement the system as needed. Data on the extent and frequency of rising water levels are essential for risk maps that can be used to prepare or adapt land-use plans. The extreme weather events like heavy rainfalls that resulted in flooding in some regions in the Philippines which may raise the water level may rise rapidly, and often do not leave enough time to issue warning alerts.

The Early Warning System (EWS) is an important disaster risk reduction (DRR) measure. It can allow individuals, communities, governments, businesses, and others to take timely action to reduce risks before dangerous occurrences occur. However, for an EWS to be effective, it must be comprehensive and people-centered or community-based, and landscape-wide. (Ahmed, 2015) Moreover, In the municipality of Saint Bernard in the province of Southern Leyte the consistent use of a community-based, end-to-end landscape approach to early warning across hazard types, for example, flood/storm warning, typhoons, earthquakes, tsunami, and landslides. This all contributes to the effectiveness and long-term viability of various EWS. This is supplemented by a rights-based approach to all DRR activities.

### **Stages undertaken in the Development using Agile Method**



The Internet of Things (IoT) is a rapidly evolving platform in which everyday devices are transformed into an automated information system with intelligent communication protocols. According to Alec Jahnke (2020), There are four stages in IoT Architecture, the first of which is Sensors and Actuator. These sensors and actuator are in charge of monitoring the status of temperature, humidity, chemical composition, fluid levels in a tank, fluid flow in a pipe, or speed. The second stage is known as Internet Gateways and Data Acquisition Systems, and it focuses on data collection and conversion from analog to digital. Data is filtered before it is sent over the Internet. Stage 3: Pre-processing: Edge Analytics After being sent over the Internet, the data must be filtered to reduce its volume before being sent to the cloud. Stage 4: Comprehensive Analysis in the Cloud or Data Center This is the most important stage because the data must be in the IT System so that it can be secured, managed, and analyzed before being stored.

In developing projects, Agile methods have grown in popularity based on project development due to higher success rate of it based on the study of Rana. k, (2020). On the other hand, the University School of Information System concluded that agile methodologies are designed to streamline the system development process by eliminating much of the modeling and documentation overhead and time spent on those tasks. All Agile Development methodologies follow a simple cycle through the traditional stages of system development. Almost all agile methodologies work in tandem with object-oriented technologies.



Apart from this, in terms of software development Agile would imply “flexible” process to respond to changes quickly and the same is true, allowing a developer to go back to a previous stage and carry out necessary changes thereby refining the software without much delay as compared to the convention plan driven Software development methods ". (Misra, Subhas C, 2015).

### **Chapter 3**

#### **METHODOLOGY**

This chapter discusses the methodology used for the study including the research design to be used, process flowchart, description of research instrument used, data analysis, and design project flow. The design project flow will consist of architectural design, block diagram, and schematic diagram.

#### **Research Design**

This study used a mixed method research designs whereby the researchers will collect and analyze both quantitative and qualitative data. Interviews and observations were conducted to determine the stages undertaken



in the development of the prototype for the proposed system to assess the perspective of the residents regarding matters to be focused on and given utmost priority when implementing the proposed project. A narrative approach was also conducted to analyze the issues and challenges encountered by the residents of Barangay Sto. Nino and ICT professionals in using the proposed Project, this assessment is primarily composed of a quantitative research using online survey questionnaires that uses a standardized survey questionnaire for the data collection method.

### **Process Flowchart**

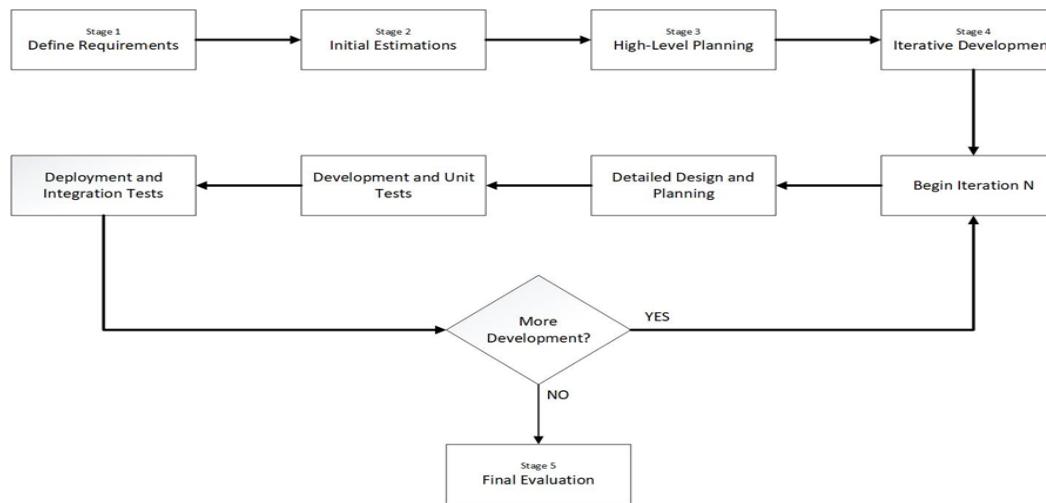
To visualize the process in the undertaking and development of the system of this project, the researcher will explain it through process flowchart. The researchers will use an iterative software development called agile development methodology. To illustrate the plan of this project, the researchers use a roadmap tool called Gantt chart to help the researchers maintain a coherent project strategy despite the iterative nature of the software development process.

SYSTEM DEVELOPMENT	OCT 2021	NOV 2021	DEC 2021	JAN 2022	FEB 2022	MAR 2022	APR 2022	MAY 2022	JUNE 2022	JULY 2022
Define Requirements										
Initial Estimations										
High-level Planning										
Iterative Development										
Final Evaluation										

Table 1: Gantt Chart of the development of the System



table 1, shows the target time frame in developing the project, The four months will be the project planning and initialization and another four months for the development of the prototype, and the last two months for final evaluation. Ten months to be exact.



**Figure 1:** Agile Development Model

### Description of Research Instrument Used

For gathering academic references, the researchers used a Mendeley together with Sci-hub that will serve as the library website and references for the study. Video tutorials and blogs were used as guidance regarding technicalities in developing the prototype.

The researchers will use a standardized survey questionnaire for the data collection method. The questions to be selected by the researchers are based on ISO/IEC 25010:2011. It will be guided by the results of these survey questions to find out the potential effects of the proposed project in terms of functional



stability, usability, reliability, security, and maintainability. It will be done through the online platform preferably Google forms and it will collect the data and tabulate it using Microsoft Excel. Also, Interview and Observation were conducted at the proposed implementation site to assess the effectiveness of the proposed system to see how well it is managed.

### Statistical Treatment

To present, analyze and interpret the data gathered from the respondents, the researchers may utilize the z-test equation for the two samples to determine if there is significant difference between the evaluation of the Web Application and Mobile Application in terms of functional suitability, reliability, usability, security, and maintainability.

$$z = \frac{(\bar{x}_1 - \bar{x}_2) - \mu}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Equation 3.4: Z-Test Hypothesis Testing for Two Samples Formula

Where:  $x_1, x_2$  = means of samples 1 and 2, respectively

$\mu$  = population mean



$s_1, s_2$  = standard deviations of samples 1 and 2, respectively

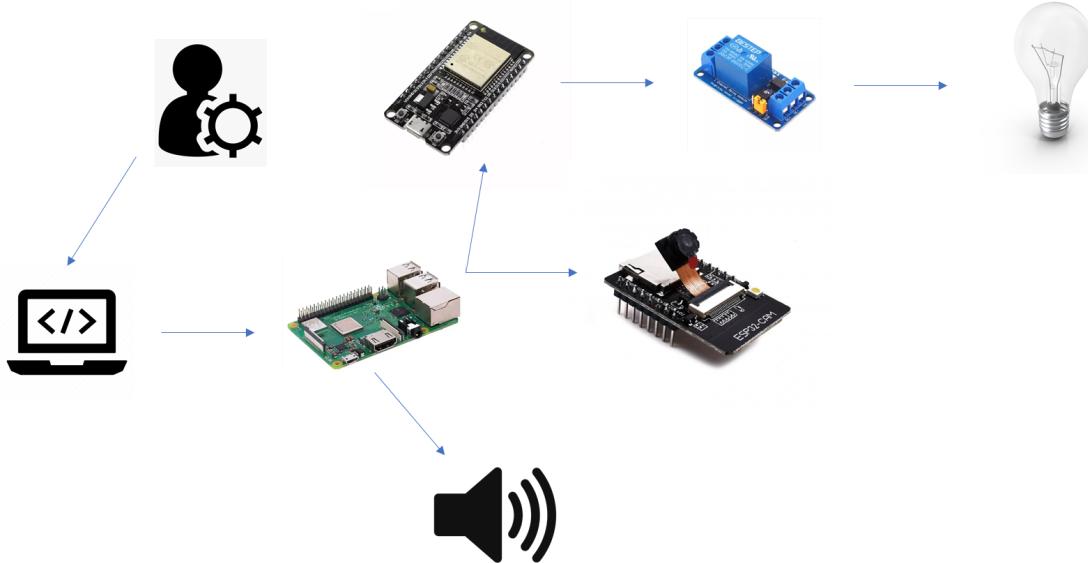
$n_1, n_2$  = size of samples 1 and 2, respectively

## Design Project Flow

### Architectural Design

In architectural design it will show the process flow of the hardware and software components and their interfaces to establish the framework for the development of the proposed project. In the figure 2 below, it represents the flow on how the system admin shall interact with the system.

**Figure 2.** Architectural design of Project SAFER

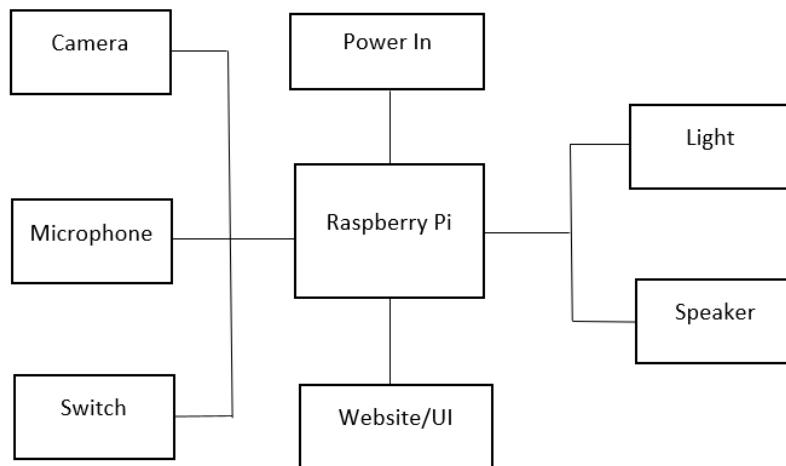


## Block Diagram



The block diagram of the system shows the key elements of the system as well as the internal processes that will let the viewers to establish connections inside a system and to understand how it works. It primarily offers the system's functional visualization.

**Figure 3.** Block diagram of Project SAFER



### Hardware Wireframe

This was used as the early stage design of the project, the figure 4 below shows the representation of the initial project design of the prototype.

**Figure 4.** Hardware wireframe of Project SAFER



## Chapter IV

### RESULTS AND DISCUSSION

In this chapter, the researchers presented the data and findings gathered through the research instruments used in conducting the study. The data were analyzed and statistically treated to evaluate data interpretations that led to the study's conclusion and recommendation.

#### **1. Current status of Barangay Sto. Nino, Parañaque City in terms of Disaster Risk Reduction and Management**

According to the recent survey, the majority of the respondents believe that typhoons and flood catastrophes represent the greatest risk to their town. It is probable, and when it does, it leaves a disastrous effect, as evidenced by Table 1's findings. The same table also demonstrates that the overall risk of fire disasters is moderate. Although it is assumed that it is unlikely to happen, if it

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does, the victims could be severely impacted. The respondents believe that man-made disasters are extremely unlikely to occur and will have little effect if they do. As a result, they have the lowest total risk level.

Table 1. Results of Disaster Risk Assessment

Disaster	Frequency/Likelihood			Severity/Impact			Overall Risk Level
	Mean	Equivalent Risk Level	Mean	Equivalent Risk Level			
1. Typhoon/Flood	3.0418	3	Likely	3.2548	4	Catastrophic	12 - Very High
2. Fire	2.4411	2	Unlikely	2.8289	3	Major	6 - Moderate
3. Earthquake	1.9772	2	Unlikely	2.3194	2	Minor	4 - Low
4. Man-Made Disasters	1.7376	1	Very Unlikely	2.1901	2	Minor	2 - Very Low
5. Other Disasters	1.8479	2	Unlikely	2.0532	2	Minor	4 - Low

Surprisingly, the outcomes are the same for both younger and older respondents, female and male respondents, as well as younger and older neighborhood residents, as shown in Table 2. The findings of Equation 3 show that both z-scores for each comparison are below the crucial value, which is 1.645 in this case. Consequently, there are no substantial variations in each comparison's individual results.

Similar to the findings, extreme flooding caused by typhoons is a major catastrophe that the local government for Paranaque City highly considers in the 2021–2030 DRRM Plan that the Brgy. Sto. Nino is also vulnerable to storm surge. The respondents don't seem to be aware of their area's vulnerability to disasters like earthquakes. The barangay is vulnerable to ground shaking, liquefaction, and tsunami disasters that could follow the occurrence of an earthquake, according to the Exposure Database Risk Analysis Project (RAP).

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Table 2. Comparison of Results of Disaster Risk Assessment

<b>Comparison in Terms of Age</b>	<b>1 to 24 y/o</b>	<b>25 to 55 y/o</b>	<b>Z-Score</b>	<b>Remarks</b>
Frequency and Likelihood of Disaster	2.1544	2.2677	<b>-0.9183</b>	No Significant Difference
Severity and Impact of Disaster	2.4824	2.5795	<b>-0.7164</b>	No Significant Difference
<b>Comparison in Terms of Sex</b>	<b>Female</b>	<b>Male</b>	<b>Z-Score</b>	<b>Remarks</b>
Frequency and Likelihood of Disaster	2.2206	2.1969	<b>0.1916</b>	No Significant Difference
Severity and Impact of Disaster	2.5574	2.4992	<b>0.4277</b>	No Significant Difference
<b>Comparison in Terms of Yrs of Residency</b>	<b>1 to 17 yrs</b>	<b>18 to 43 yrs</b>	<b>Z-Score</b>	<b>Remarks</b>
Frequency and Likelihood of Disaster	2.2642	2.1492	<b>0.9334</b>	No Significant Difference
Severity and Impact of Disaster	2.5299	2.5286	<b>0.0132</b>	No Significant Difference

### *Existing Local Government DRRM*

The respondents agree that preventive measures are in place and agree that the overall response is effective with regard to the local government's actions, but they disagree with the other points of the standards listed in Table 3. The respondents also agree on each aspect and the overall result of how the local government handles disaster relief and recovery activities when a disaster occurs. Specifically, in the lower part of the table, the respondents generally agree the most on the statement that the local government provides a secure and organized evacuation area for the disaster victims.



Table 3. Results of Existing Local Government DRRM

Action of Local Government	Mean	Indication
1. The local government provides preventive measures against disasters.	3.2548	Totally Agree
2. The local government provides an effective response when a disaster occurs.	2.8289	Agree
3. The local government provides immediate emergency response when a disaster occurs.	2.3194	Disagree
4. The local government is equipped with first-aid materials and emergency life-saving equipment.	2.1901	Disagree
5. The local government pursues continuous improvement on their disaster risk reduction and management operations, and they are open for suggestions from experts and the community.	2.0532	Disagree
<b>OVERALL MEAN</b>	<b>2.7719</b>	<b>Agree</b>
Disaster Relief and Recovery	Mean	Indication
1. The local government provides effective actions for disaster relief and recovery.	2.7947	Agree
2. The local government has enough supplies, equipment, and fund for disaster relief and recovery.	2.6882	Agree
3. The local government provides a secure and organized evacuation area for the disaster victims.	2.8935	Agree
4. The local government finds a way to deliver the fastest disaster recovery possible.	2.5817	Agree
5. The local government has good relations to organizations devoted to providing relief donations and volunteerism to assist the disaster victims.	2.8251	Agree
<b>OVERALL MEAN</b>	<b>2.7567</b>	<b>Agree</b>

## 2. Development Stages of the Prototype for the Proposed Project SAFER

The entire study took place from October, 2021 to July of 2022 the four months will be the project planning and initialization and another four months for the development of the prototype, and the last two months for final evaluation wherein, system development was divided into different stages that follows below:

**Definition of Requirements.** In this stage, the researchers have four initial requirements of the system, the first of which is the Business requirements that determine the needs of the community. The same goes in the User requirements to define the user needs. On the other hand, Functional requirements explain how the system must work while non-functional requirements explain how the system should perform.

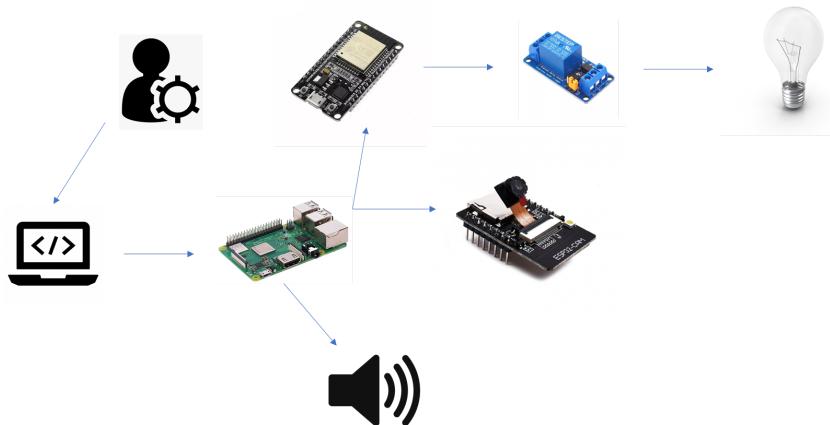


**Initial Estimations.** In this phase, the researchers represent diagrams to illustrate the systems and processes of the proposed project. The figure 5 shows the context flow of the system prototype wherein, the Non-admin user are the guest or specifically the resident of Brgy Sto.nino when they trigger the alarm system it will send the data in the SAFER system and the admin will send Public Access System alarm through the use of control signal and it will receive back in the non-admin user. In addition to that, System architecture that will be shown in figure 6, when the admin accesses the webpage he/she will be able to control the button in the webpage to give output in the devices such as light and speaker. They can also monitor the CCTV Camera in the system.

**Figure 5:** DFD Context of the Proposed System



**Figure 6.** System Architecture





**High-level Planning.** In this phase, The researcher will plan out the overall planning for the completion of the system that will be shown in the Activity Chart table in appendices part where the stages in agile methodology was established and the progress of the development has been shown in Gantt chart table. Trello board application has also been used to properly organize the progress of the project planning and scheduling.

**Iterative Development.** This phase will include the actual execution of the development of the system. The researchers conducted a trial and error phase to study the necessary requirements and for the adjustment of the system. With that, arduino is the first choice as the microcontroller for the prototype system. However, the arduino is not enough to load the proposed system so that, raspberry pi and esp32 serve as the alternative for microcontroller. Then, a CCTV camera will also be used in the trial phase but it requires cloud hosting that will be costly. so, the researcher used an esp32 camera as a substitute for this.

**Final Evaluation.** This phase will feature the evaluation of two different types of testing. The researchers conducted experimentation in the two scenarios for mobile application and web application that will test the three parameters; Speaker, latency of light button and response time of environmental Monitoring Page.



**Effectiveness of the proposed system in terms of Response Time of Environmental Monitoring Page, Latency of light button and Speaker**

The effectiveness of the System prototype is gathered using 30 trials for each parameter using web application and mobile application.

**Response Time of Environmental Monitoring Page**

**Latency of light button Speaker**

**Speaker.**

**Difference between the evaluation of Web application and Mobile Application**

The null hypothesis for this study states that there is no significant difference between the differences between the evaluation of web application and mobile application that oppose alternative hypotheses. Using the z-test formula of the two sample significant levels of 0.5 was executed.

The results of the actual hypothesis testing produced values for each evaluation parameter that is pointing in the direction of the alternative hypothesis' acceptance. In other words, the research has shown that there are no significant differences between mobile application and web application in the proposed system's prototype.



### **Issues and Challenges encountered in the use of Prototype**

The researchers encountered issues and challenges in the use of prototype when developing it, some of these challenging issues are the wifi address in raspberry pi due to changing of location then, the wiring of prototype might be loose because of weakened soldering for the hardware part. then, the two-way intercom system is not executed.

## **Chapter 5**

### **SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS**

This chapter is represented in four sections. The first section contributes to an overall summary of the study followed by the summary of the findings and their conclusions. Subsequent to this are the implications of the study and followed by recommendations for future research.

#### **Summary of Findings**

This is to present the summary information about the outcome of the study, Considering these insights would help make a more effective and efficient implementation of the proposed project possible.



## **Current status of Barangay Sto. Nino, Parañaque City in terms of Disaster Risk Reduction and Management**

Based on the collected data, it can be seen that respondents generally agree that typhoon/flood and fire disasters are something that should be given the best preparation and potential preventive measures. The findings also show that the different respondents have similar perspectives with respect to this matter.

### **Stages undertaken for the development of the proposed prototype.**

The researchers will use an iterative software development called agile methodology, the first phase to be established was defining requirements for User, Business, Functional and non-functional. for the initial estimation phase, Context Data Diagram and Architectural design was developed

### **Effectiveness of the prototype based on the System's parameters.**

### **Difference of the evaluation of web application and mobile application**

The null hypothesis of the study indicates that there is no significance difference between the evaluation of web application and mobile application however, based on the testing hypothesis of the two parameters it shows that



there is significant difference between the web app and mobile app, The web application has a monitoring access and responsive enough for the user that differ in mobile application.

**Issues and Challenges Encountered in the use of the Prototype.**

Project SAFER encountered the unresponsive page for the mobile application and the system has no database system, it is an open source web server that interacts with the microcontroller.

**Table 2.1: Business Requirement**

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BR ID No.	Requirements	Want Requirements	
		t	d
BR-01	<b>Provide a convenient and reliable communication platform between the administrators (system administrators) and the clients (residents of Brgy. Sto. Nino) about disaster risk reduction and management (DRRM).</b>		
BR-02	<b>Provide clear and understandable information, instructions, and notifications regarding facility usage and maintenance.</b>		
BR-03	<b>Enable the facilities management department to conserve resources thus reduce costs.</b>		
BR-04	<b>Operate economically will only require minimal human intervention</b>		



BR-05	Assist the facilities management department in detecting, assessing, and preventing risks about usage and maintenance of facilities.		
BR-06	Boost the security management of the building campus.		
BR-07	Not be a burden to the operators, but rather help them improve their facilities management services.		
BR-08	Allow operators to control and/or monitor the system remotely.		
BR-09	Provide accurate instrumentation results and control performances that can be accessed via web application		

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BR-10	<b>Record and retrieve relevant data on usage and maintenance of facilities.</b>		
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**Table 2.2: User Requirement**

UR ID No.	As a...	I want...	So that...	Remarks
UR-01	<b>Baraggay Officials</b>	<b>To use a convenient and reliable communication platform for emergency services</b>	<b>I could be informed immediately as needed and make an urgent response for the emergency team</b>	

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UR-02	Baraggay Respondent s	To use an ease access to communication platform for emergency services	I could be aware of the emergency alert if an incident happens in the area and make an urgent response for this.	
UR-03	Facilities Administrator	As a facilities administrator, I need to monitor and control, monitor, and manage the manage the facilities, data of the utilities, and equipment incidents and inside the area with the disasters in the system's web-based area.	I could easily monitor and control, monitor, and manage the manage the facilities, data of the utilities, and equipment incidents and inside the area with the disasters in the system's web-based area.	

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UR-04	Security	<p>As a facilities administrator and part of the security, I need to make sure that the whole Brgy. Sto. Nino is secured with the use of Project SAFER.</p>	<p>I could monitor them and give an immediate response if an incident happens in the area.</p>	
UR-05	Guest	<p>As a guest, I need to be granted permission by the facility administrator to access the webpage.</p>	<p>I could easily check updates in the system and be well informed and aware for my safety and security.</p>	



UR-06	Future Developer	<p>As a developer, I need to further develop and improve the system in line with ever-emerging technology to make it more capable of doing its supposed job, ensuring the clients' safety and security, and making whole facilities control and access user-friendly to its clients.</p> <p>I could have future resources that the will improve and update the features of this technology.</p>	
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## Appendix A

### Hardware Wireframe



### PROTOTYPE DESIGN



**Project Activities**

WBS ID	ACTIVTY	START	END	DURATIO N	BUDGE T
01-00	Define Requirements	Oct 4, 2021	Oct 16, 2021	2 weeks	500
01-01	Business requirements	Oct 18, 2021	Oct 25, 2021	1 week	1000
01-02	User requirements	Oct 25, 2021	Oct 30, 2021	1 weeks	500

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<b>02-00</b>	<b>Initial Estimations</b>	<b>Nov 1, 2021</b>	<b>Nov 8, 2021</b>	<b>1 week</b>	<b>2300</b>
<b>02-01</b>	<b>Process modeling</b>	<b>Nov 9, 2021</b>	<b>Nov 20, 2021</b>	<b>10 days</b>	
<b>02-02</b>	<b>Data modeling</b>	<b>Nov 22, 2021</b>	<b>Nov 30, 2021</b>	<b>8 days</b>	
<b>03-00</b>	<b>High level Planning</b>	<b>Dec 1, 2021</b>	<b>Dec 14, 2021</b>	<b>2 weeks</b>	
<b>03-01</b>	<b>Scope Management</b>	<b>Dec 18, 2021</b>	<b>Jan 11, 2022</b>	<b>16 days</b>	

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<b>03-02</b>	<b>Cost Management</b>	<b>Jan 15, 2022</b>	<b>Jan 29, 2022</b>	<b>2 weeks</b>	
<b>04-00</b>	<b>Iterative Development</b>	<b>Feb 1, 2022</b>	<b>Feb 19, 2022</b>	<b>19 days</b>	
<b>04-01</b>	<b>Begin Iteration</b>	<b>Feb 22, 2022</b>	<b>March 5, 2022</b>	<b>11 days</b>	
<b>04-02</b>	<b>Detailed Design and Plan</b>	<b>March 12, 2022</b>	<b>April 2, 2022</b>	<b>3 weeks</b>	
<b>04-03</b>	<b>Development and unit tests</b>	<b>April 5, 2022</b>	<b>May 7, 2022</b>	<b>4 weeks</b>	

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<b>04-04</b>	<b>Development and integration tests</b>	<b>May 10, 2022</b>	<b>May 28, 2022</b>	<b>3 weeks</b>	
<b>05-00</b>	<b>Final Evaluation</b>	<b>June 1, 2022</b>	<b>June 18, 2022</b>	<b>2 weeks</b>	
<b>05-01</b>	<b>System test</b>	<b>June 21, 2022</b>	<b>June, 29, 2022</b>	<b>1 week</b>	
<b>05-02</b>	<b>User Acceptance Tests</b>	<b>July 5, 2022</b>	<b>July 9, 2022</b>	<b>5 days</b>	



## Appendix B

### **LETTER TO THE RESPONDENTS**

Greetings!

The students of Bachelor of Science in Computer Engineering in Polytechnic University of the Philippines – Paranaque City Campus are currently conducting a research study entitled “Trash Bin Made Smarter: A Machine-driven Waste Segregation System using Machine Learning”. The researchers are asking for your help by simply answering the questions below to help us gather the necessary datas and information needed for the success of our research study.

Rest assured that any information given will remain private and confidential. This is just to analyze the data given to the proponents and will not

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violate the Data Privacy Act of 2012, RA 10173. Your engagement to the research by using the device and answering the provided survey questionnaire will help with the objective of the research and recognize the effectiveness of the device. With this, the proponents would like to express their gratitude for sparing your precious time and allowing them to conduct this survey.

Thank you and God Bless us all!

The Researchers

### Survey Questionnaire

## TRASH BIN MADE SMARTER: WASTE SEGREGATION MACHINE USING MACHINE LEARNING

### I. Personal Information:

Name (Optional): \_\_\_\_\_ Age: \_\_\_\_\_ Gender: \_\_\_\_\_

Address:

### II. Questionnaires:

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Evaluation of the "Trash Bin Made Smarter: A Machine-driven Waste Segregation using Machine Learning" is based on ISO 25010 also known as the quality model foundation of a product quality evaluation system. To determine the properties of a software product, the ISO 25010 model defines which quality characteristics will be taken into account.

Instruction: Evaluate the Sign Language Translation Equipment. Please put a check mark (✓) on the corresponding box.

5 – Strongly Agree, 4 – Agree, 3 – Neutral, 2 – Disagree, 1 – Strongly Disagree

INDICATORS	5	4	3	2	1
<b>1. Functional Suitability</b>					
1.1. Functional completeness - Degree to which the set of functions covers all the specified tasks and user objectives.					
1.2. Functional correctness - Degree to which a product or system provides the correct results with the needed degree of precision.					
1.3. Functional appropriateness - Degree to which the functions facilitate the accomplishment of specified tasks and objectives.					
<b>2. Performance efficiency</b>					
2.1 Time behavior - Degree to which the response and processing times and throughput rates of a product or system, when performing its functions, meet requirements.					
2.2 Resource utilization - Degree to which the amounts and types of resources used by a product or system, when performing its functions, meet requirements.					
2.3 Capacity - Degree to which the maximum limits of a product or system parameter meet requirements.					
<b>3. Compatibility</b>					

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<p>3.1 Co-existence - can the app share a common environment and resources with other products?</p> <p>3.2 Interoperability—can it exchange information and use the information that has been exchanged?</p>				
<b>4. Usability</b>				
3.1 Appropriateness recognizability - Degree to which users can recognize whether a product or system is appropriate for their needs.				
3.2 Learnability - Degree to which a product or system can be used by specified users to achieve specified goals of learning to use the product or system with effectiveness, efficiency, freedom from risk and satisfaction in a specified context of use.				
3.3 Operability - Degree to which a product or system has attributes that make it easy to operate and control.				
3.4 Accessibility - Degree to which a product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use.				
<b>5. Reliability</b>				
4.1 Maturity - Degree to which a system, product or component meets needs for reliability under normal operation.				
4.2 Availability - Degree to which a system, product or component is operational and accessible when required for use.				
4.3 Recoverability - Degree to which, in the event of an interruption or a failure, a product or system can recover the data directly affected and re-establish the desired state of the system.				
<b>6. Security</b>				
3.1 Confidentiality - is data accessible only to authorized people?				
3.2 Integrity - does the app prevent unauthorized access to, or modification of, computer programs or data?				
3.3 Non-repudiation - does the app collect information whether specific actions or events have taken place?				
3.4 Accountability - can the actions of an entity be traced back to that particular entity?				
3.5 Authenticity - can you prove the identity of a subject or resource?				
<b>7. Maintainability</b>				

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5.1 Analyzability - Degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified.					
5.2 Modifiability - Degree to which a product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality.					
5.3 Testability - Degree of effectiveness and efficiency with which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met.					
<b>8. Portability</b>					
8.1 Adaptability - can the app be adapted for different or evolving hardware, software or other operational or usage environments?					
8.2 Installability - can they be successfully installed and/or uninstalled in a specified environment?					
8.3 Replaceability - can the app replace another software product for the same purpose in the same environment?					

**Curriculum Vitae**



### Basic Personal Information

Complete Name : Marianne S, Argarin  
Birthday : August 9, 1999  
Birthplace : Caloocan City  
Present Address : 71 ninoy aquino avenue. Sto.nino Paranaque City  
Mother's Maiden Name : Ruchelle Acha Silpao  
Father's Name : Marlon Tanay Argarin  
Guardian's Name : Evelyn Argarin Borja

### Educational Background

Elementary : Bagong barrio Elementary School  
Junior High School : Bagong barrio National High School  
Senior High School : Olivarez College - Paranaque  
Technical/Vocational : N/A

## POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Tertiary : Polytechnic University of the Philippine – Paranaque Campus  
Course : Bachelor of Science in Computer Engineering

### Research Interests

SHS Courses	Research Title	adviser
Practical Research 1	Understanding the Classroom Owls: Exploring Effects of Nocturnalism of on Student's Academic Performance	Prof. Kenneth Oro
Practical Research 2		
Capstone	VENARI: Contact tracing application	Doc. Arvin

## Curriculum Vitae



### Basic Personal Information

Complete Name : Paulene Bulan Marquez  
Birthday : January 19, 1999  
Birthplace : Don Galo, Paranaque City  
Present Address : 237 Roces St. Phase 2 Olivarez Compound, San  
Dionisio, Paranaque City  
Mother's Maiden Name : Adora Alangilang Bulan  
Father's Name : Vicente Avancena Marquez  
Guardian's Name : Erico Catamora Bulan

### Educational Background

## POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Elementary : Quezon Elementary School  
Junior High School : Quezon National High School  
Senior High School : Quezon Senior High School  
Technical/Vocational : N/A

Tertiary : Polytechnic University of the Philippine – Paranaque Campus

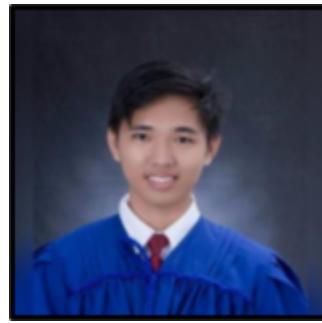
Course : Bachelor of Science in Computer Engineering

### Research Interests

SHS Courses	Research Title	adviser
Practical Research 1		
Practical Research 2	The Academic Performance of Grade 11 students of Quezon National High School during the School Year 2017-2018	Ms. Reali Gealone
Capstone	VENARI : Contact Tracing Application	Dr. Arvin De la Cruz



## Curriculum Vitae



### Basic Personal Information

Complete Name : Mhar Aven D. Tancioco  
Birthday : February 6, 2000  
Birthplace : Caloocan City  
Present Address : 53 Swaziland Barangay Don Bosco, Paranaque City  
Mother's Maiden Name : Mary Ann Dalore

## POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Father's Name : Marvin Tancioco

Guardian's Name : Marvin Tancioco

### Educational Background

Elementary : F. Serrano Elementary School

Junior High School : Moonwalk National High School

Senior High School : AMA College Paranaque Campus

Technical/Vocational : N/A

Tertiary : Polytechnic University of the Philippine – Paranaque Campus

Course : Bachelor of Science in Computer Engineering

### Research Interests

SHS Courses	Research Title	adviser
Practical Research 1	The Effectiveness of Blended Learning in students of AMA College Paranaque	Ms. Elly Gaa
Practical Research 2		



Capstone	VENARI : Contact Tracing Application	Dr. Arvin De la Cruz
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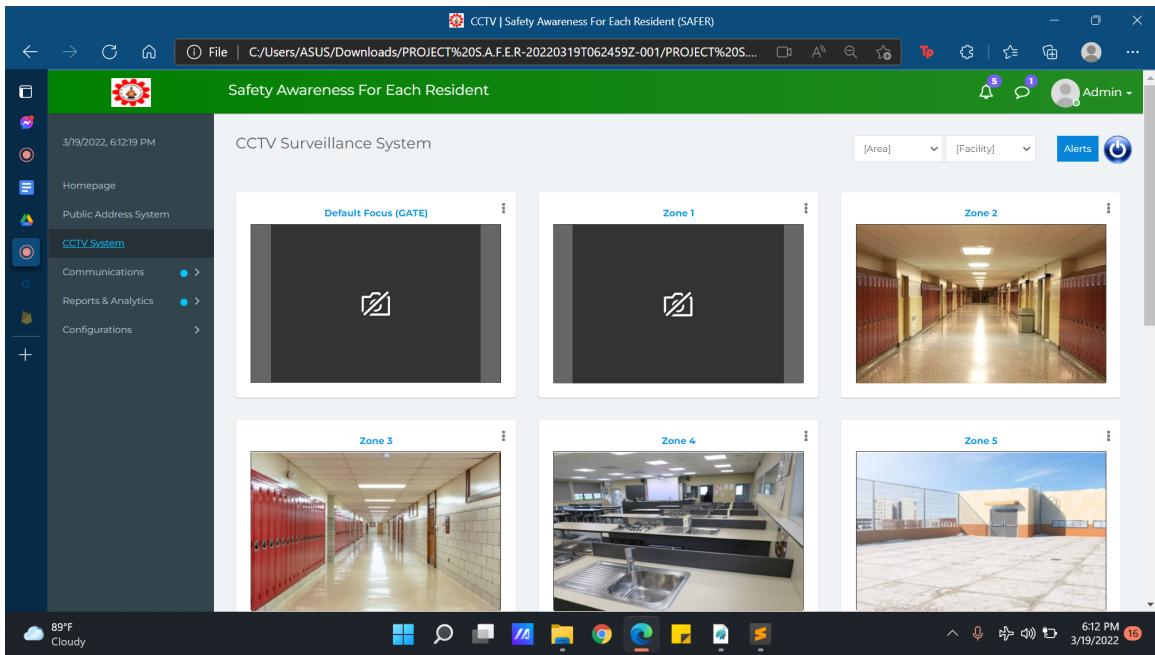
**Website Update:**

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The screenshot shows a web browser window with the title "Safety Access For Each Resident". The main content area displays a map of Parañaque City with weather conditions like Windy and 29°C. It includes sections for "REAL TIME WEATHER MONITORING", "TIDE LEVEL", and "DAILY WEATHER FORECAST". A sidebar on the right shows a "LATEST POST" about localized weather forecasts and emergency dispatches. At the bottom, there's a footer with copyright information and developer credits.

The screenshot shows a software application titled "Safety Awareness For Each Resident". The left sidebar contains navigation links: "Homepage", "Public Address System" (selected), "CCTV System", "Communications", "Reports & Analytics", and "Configurations". The main area has a green header bar with the title and a blue navigation bar at the top right with icons for "Alerts", "Admin", and other system functions. Below the header, there's a "New Alert Message" section with a play button and a preview slider set to 0.00. To the right are sections for "PAS Alarm" (with five zones) and "PAS Speakers" (with five zones). At the bottom, there are four alert preview cards: "Fire Alert", "Earthquake Alert", "Storm Alert", and "Special Alert", each with a play button, preview slider, and update/preview links.

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Notifications | Safety Awareness For Each Resident (SAFER)

File | C:/Users/ASUS/Downloads/PROJECT%20S.A.F.E.R-20220319T062459Z-001/PROJECT%20S.A.F.E.R.. Alerts

3/19/2022, 6:13:08 PM Admin

Homepage Notifications Reports & Analytics Configurations

Public Address System CCTV System Communications

Inbox Notifications Reports & Analytics Configurations

89°F Cloudy

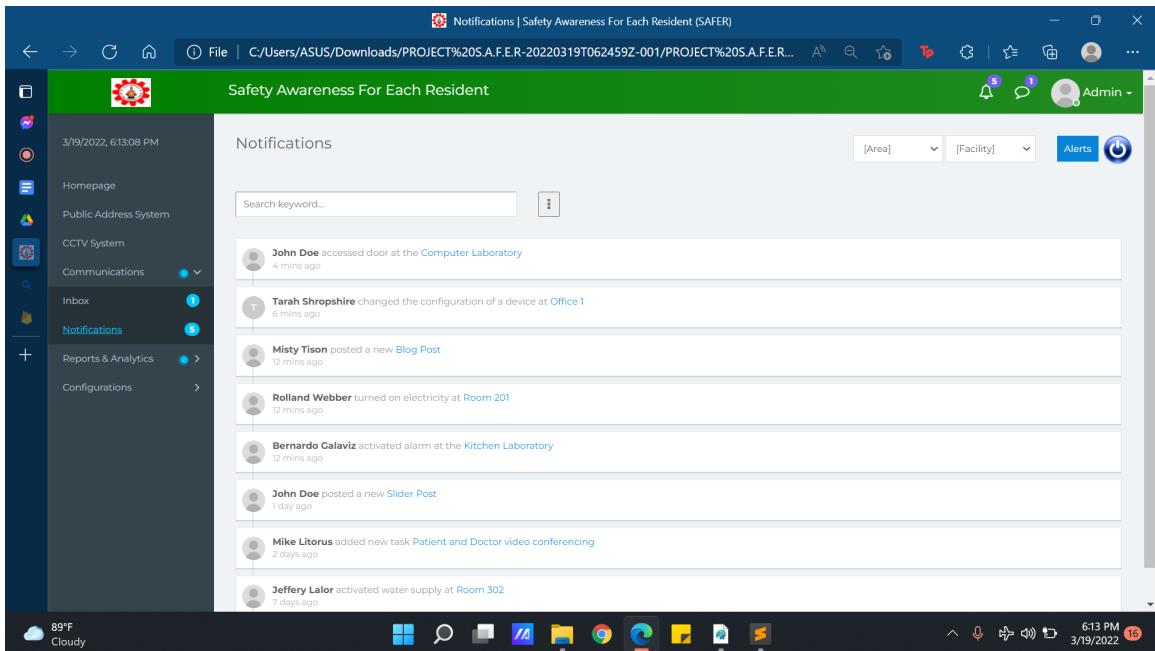
## Safety Awareness For Each Resident

### Notifications

Search keyword... [Area] [Facility] Alerts

- John Doe accessed door at the Computer Laboratory 4 mins ago
- Tarah Shropshire changed the configuration of a device at Office 1 6 mins ago
- Misty Tison posted a new Blog Post 12 mins ago
- Rolland Webber turned on electricity at Room 201 12 mins ago
- Bernardo Galaviz activated alarm at the Kitchen Laboratory 12 mins ago
- John Doe posted a new Slider Post 1 day ago
- Mike Litorus added new task Patient and Doctor video conferencing 2 days ago
- Jeffrey Lalor activated water supply at Room 302 7 days ago

6:13 PM 3/19/2022



User-Acts | Safety Awareness For Each Resident (SAFER)

File | C:/Users/ASUS/Downloads/PROJECT%20S.A.F.E.R-20220319T062459Z-001/PROJECT%20S.A.F.E.R.. Alerts

3/19/2022, 6:13:26 PM Admin

Homepage Notifications Reports & Analytics Users Activity Logs Systems Event Logs Configurations

Public Address System CCTV System Communications

Inbox Notifications Reports & Analytics Configurations

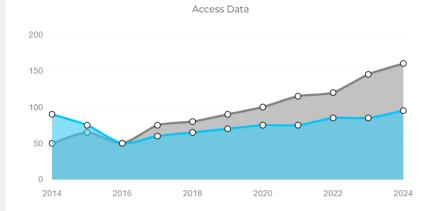
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## Safety Awareness For Each Resident

### Users Activity Logs

[Area] [Facility] Alerts

#### Access Data



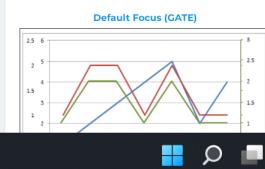
Year	Access Data
2014	~80
2015	~60
2016	~50
2017	~65
2018	~70
2019	~80
2020	~90
2021	~100
2022	~110
2023	~120
2024	~130

#### Timekeeping Data



Year	Timekeeping Data
2014	~90
2015	~80
2016	~50
2017	~70
2018	~80
2019	~90
2020	~100
2021	~110
2022	~120
2023	~130
2024	~140

#### Default Focus (GATE)



Time	Value 1	Value 2	Value 3
2014-01-01	1.0	2.0	3.0
2014-07-01	2.5	3.5	4.5
2015-01-01	1.5	2.5	3.5
2015-07-01	3.0	4.0	5.0
2016-01-01	2.0	3.0	4.0
2016-07-01	3.5	4.5	5.5
2017-01-01	2.5	3.5	4.5
2017-07-01	4.0	5.0	6.0
2018-01-01	3.0	4.0	5.0
2018-07-01	4.5	5.5	6.5
2019-01-01	3.5	4.5	5.5
2019-07-01	5.0	6.0	7.0
2020-01-01	4.0	5.0	6.0
2020-07-01	5.5	6.5	7.5
2021-01-01	4.5	5.5	6.5
2021-07-01	6.0	7.0	8.0
2022-01-01	5.0	6.0	7.0
2022-07-01	6.5	7.5	8.5
2023-01-01	5.5	6.5	7.5
2023-07-01	7.0	8.0	9.0
2024-01-01	6.0	7.0	8.0

#### Gnd Flr (Office)



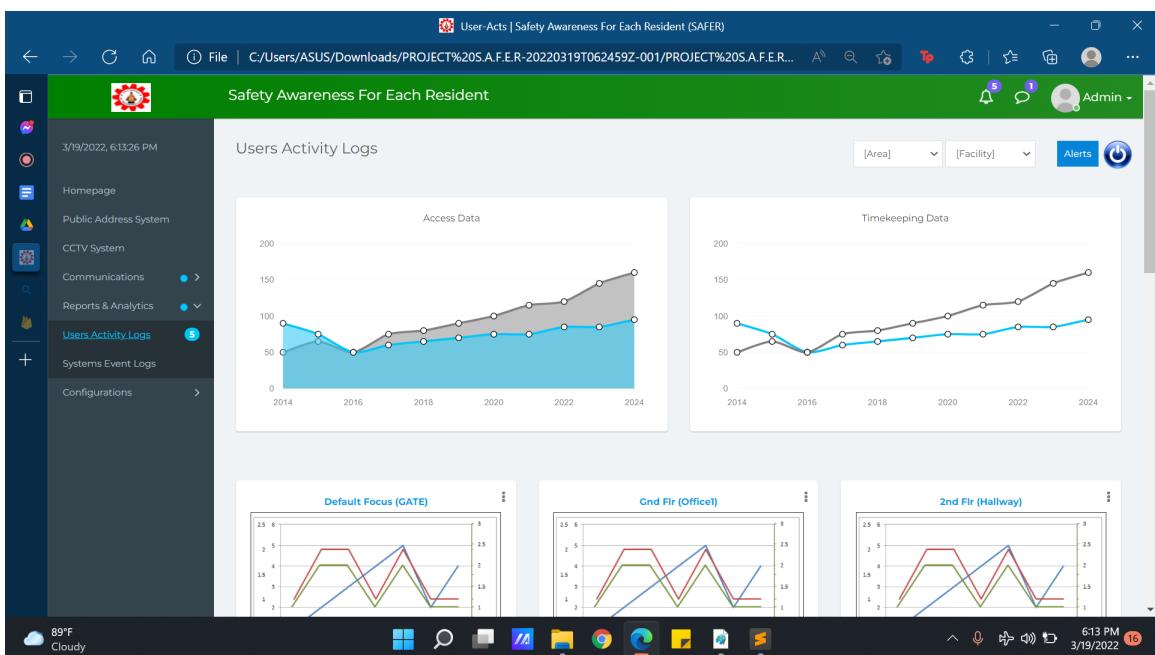
Time	Value 1	Value 2	Value 3
2014-01-01	1.0	2.0	3.0
2014-07-01	2.5	3.5	4.5
2015-01-01	1.5	2.5	3.5
2015-07-01	3.0	4.0	5.0
2016-01-01	2.0	3.0	4.0
2016-07-01	3.5	4.5	5.5
2017-01-01	2.5	3.5	4.5
2017-07-01	4.0	5.0	6.0
2018-01-01	3.0	4.0	5.0
2018-07-01	4.5	5.5	6.5
2019-01-01	3.5	4.5	5.5
2019-07-01	5.0	6.0	7.0
2020-01-01	4.0	5.0	6.0
2020-07-01	5.5	6.5	7.5
2021-01-01	4.5	5.5	6.5
2021-07-01	6.0	7.0	8.0
2022-01-01	5.0	6.0	7.0
2022-07-01	6.5	7.5	8.5
2023-01-01	5.5	6.5	7.5
2023-07-01	7.0	8.0	9.0
2024-01-01	6.0	7.0	8.0

#### 2nd Flr (Hallway)



Time	Value 1	Value 2	Value 3
2014-01-01	1.0	2.0	3.0
2014-07-01	2.5	3.5	4.5
2015-01-01	1.5	2.5	3.5
2015-07-01	3.0	4.0	5.0
2016-01-01	2.0	3.0	4.0
2016-07-01	3.5	4.5	5.5
2017-01-01	2.5	3.5	4.5
2017-07-01	4.0	5.0	6.0
2018-01-01	3.0	4.0	5.0
2018-07-01	4.5	5.5	6.5
2019-01-01	3.5	4.5	5.5
2019-07-01	5.0	6.0	7.0
2020-01-01	4.0	5.0	6.0
2020-07-01	5.5	6.5	7.5
2021-01-01	4.5	5.5	6.5
2021-07-01	6.0	7.0	8.0
2022-01-01	5.0	6.0	7.0
2022-07-01	6.5	7.5	8.5
2023-01-01	5.5	6.5	7.5
2023-07-01	7.0	8.0	9.0
2024-01-01	6.0	7.0	8.0

6:13 PM 3/19/2022



# POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Safety Awareness For Each Resident

Users Configuration

Search keyword... [Area] [Facility] Admin Alerts

3/19/2022, 6:14:03 PM

Homepage

CCTV System

Communications Reports & Analytics Configurations

Users Assets

John Doe System Admin 100010001000 johndoe@example.com 1 Jan 1982 Active

Mike Litorus Building Admin 100010001001 mikelitorus@example.com 15 Aug 1988 Active

Wilmer Deluna Building Staff 100010001002 wilmerdeluna@example.com 28 Feb 1982 Active

John Smith Building Staff 100010001003 johnsmith@example.com 28 Feb 1982 Active

Richard Miles Faculty Admin 100010001004 richardmiles@example.com 8 Feb 1979 Active

Daniel Porter Faculty Member 100010001005 danielporter@example.com 21 Apr 1992 Active

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Meet - hou-qayg-iba

https://meet.google.com/hou-qayg-iba

Marvin De Pedro

Mark Lester Policarpio

Alberto Jimena

Jayrauld P. Arquisola

Helen Caño

Mhar Aven Tancioco

Marianne Argarin

You

6:46 PM | hou-qayg-iba

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**POLYTECHNIC UNIVERSITY OF THE PHILIPPINES**



<b>UR ID No.</b>	<b>As a...</b>	<b>I want...</b>	<b>So that...</b>	<b>Remarks</b>
UR-01	Barangay Officials	To use a convenient and reliable online platform for disaster information.	I could be aware and be prepared to make an urgent response for the emergency team	
UR-02	Baraggay Respondents	To have an alert system for disasters like fire, earthquake, storm, flood, and etc.	I could be aware of the emergency alert if an incident happens in the area and make an urgent response for this.	

**POLYTECHNIC UNIVERSITY OF THE PHILIPPINES**



UR-03	Facilities	I need to control, I could easily monitor, and manage the facilities, utilities, manage the data of the area using SAFER incidents and webapp.	
UR-04	Security	I need to make sure I could monitor that the whole Brgy. Sto. Nino is secured with the use of Project SAFER.	I could monitor them and give an immediate response if an incident happens in the area.
UR-05	Guest	As a guest, I need to be granted permission by the facility	I could easily check updates in the system and be well informed and



		administrator to access the webpage.	aware for my safety and security.	
UR-06	Future	As a developer, I need Developer to further develop and improve the system in line with the ever-emerging technology to make it more capable of doing its supposed job, ensuring the clients' safety and security, and making whole facilities control and access user-friendly to its clients.	I could have future resources that will improve and update the features of this technology.	