SENSOR-BASED INTEGRATED EMERGENCY ALERT SYSTEM USING RASPBERRY PI

A Thesis
Presented to the Faculty of
Information and Communications Technology Program
STI College Lipa

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

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June 3, 2023

ENDORSEMENT FORM FOR FINAL DEFENSE

TITLE OF RESEARCH: **Sensor-based Integrated Emergency Alert System Using Raspberry Pi**

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for the degree Bachelor of Science in Computer Engineering
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ACKNOWLEDGEMENTS

First of all, we want to thank our thesis coordinator, because of his valuable suggestions and knowledge so that we can do this project correctly and properly.

We are also grateful to our adviser Sir Alvin Fajarito for supporting and guiding us. His guidance helped our team all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for our thesis.

Besides my advisor, I would like to thank the rest of my thesis Review Panel Prof., for their encouragement, insightful comments, hard questions to us and also giving to us a valuable suggestion.

We also want to thank our parents for their untiring support, giving us the things, we need and making this project possible.

We also want to thank those who inspired us to do this project, we are very grateful to our classmates because throughout the four years of being together we have been supportive of each other, and we also thank our love ones which was one of the reasons why we persevered even more and because they gave us inspiration.

Last but not the least, we would like to thank to our God, for giving birth to this world at the first place and supporting us spiritually throughout my life also for letting us through all the difficulties. We have experience your guidance day by day.

ABSTRACT

Title of Research: **Sensor-based Integrated Emergency Alert System Using Raspberry Pi**

Developers: **Carlo V. Castro**
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Degree: **Bachelor of Science in Computer Engineering**

Date of Completion:

Key words: **Emergency Alert System, Integrated Using Raspberry Pi, Sensor-based Alert System**

It's been almost a century since CCTV was invented. It evolved through different variations but one thing remains. It requires someone to monitor 24-7. Due to this limitation, it's been a common occurence specially here in the Philippines to missed an emergency and responders only arrived on the conclusion of these events. What if there is a technology that could alert responders on its own. What if instead of cctv cameras, the community used audio processing technologies to listen for emergencies. This could be implemented on banks and listen for the word 'holdap to', to trigger emergency alerts. It could also be placed on public transpo, considering that 'holdapan' are common in cities during midnight as responders would take longer to respond during those times. The developers also developed a mobile version that could perform similar features and listen to emergencies. This could be helpful to keep track of emergency situation even in dark place. Just leave the app running in the background and it would be a personal body guard. Both RPIEAS and Eartags is voice dependent, which means the users would still be able to alert responders even hand tied or blindfolded.

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INTRODUCTION

In recent years, the community continues to witness the growth of technology around the world, where many problems are also encountered, one of which is crime and fire, due to human fault or the extreme heat that causes fires. Most people can say that when it comes to problems such as fire or crime, the responders do not respond quickly enough because the information they get is too slow, so before they get to the scene of the incident, it is almost too late. The purpose of this study is to further improve the emergency response system. With the help of the Integrated Emergency System, the response will be faster and the assistance to those who have been affected will be speeded up. The Integrated Emergency System not only upgrades the response system, but also speeds up the delivery of exact information to responders. Because in a time full of tragedy, disasters, and crime, the people need a fast and efficient emergency system where it can help our community.

Background of the problem

One of the main issue the previous administration emphasized is criminality. Duterte's Administration gives its six years mostly to deal with the crimes with-in the country. According to a study published at pna.gov.ph (2022), the country's crime rate has dropped by 73.76 percent in the first five years of President Rodrigo Duterte's term. This statistics index crimes citing murder, homicide, rape, robbery, carnapping, physical injuries, and eight other special complex crimes. Despite of this effort the fight against criminality isn't over. At the final days of his term there are worries on whether the next administration will deal with this issue as bold as President Duterte. In the first months after the end of his administration there are increase of reports on crime, including an abduction and killing of 25-year-old man in Batangas. According to gmanetwork.com (2022), Del Rosario is the man abducted by several individuals from a gasoline station in Taal, Batangas last August 16, 2022. He was found lifeless on one side of the highway in Sariaya, Quezon last August 18, 2022.

Another report is about a 32-year-old man abducted by men onboard white van in Cuenca, Batangas. A municipality just around 20 kilometers from Tulay, Ibaan. According to gmanetwork.com (2022), based on a video captured by a resident, the man was taken away by a group of men in Barangay Poblacion Uno, Cuenca Batangas. The resident immediately reported the incident to the police. The Cuenca Police said he was allegedly kidnapped by four to five unidentified men riding a white van.

With the increase on reported crimes, it is important to become alert and ready for any circumstances. Barangay Tulay, Ibaan Batangas is located on a highway where it connects different cities and municipalities with in Batangas Province. This could be an alternate route for anyone trying to escape. According to the interview with barangay officials and residents with in Tulay, Ibaan Batangas, crimes happen mostly not in broad daylight. While there are not a lot of reported crimes with-in their area, their problem is that the relay of information isn't that fast. Relying just on calls could slow down the response process specially that this method is too broad and will just rely on whose official is available for that specific time forcing the residents to call different phone numbers instead of just sending a single alert that any officials could see. They also point out the same problem with fire related emergencies. The response is hindered by the availability of responders.

The Capstone Design is designed to help any person who are facing dangerous situations. With the help of a Raspberry Pi (RPI)-based system and audio processing, there is no need of contacting authorities via mobile devices, which causes further delay. The research behind this aims to provide more variations of security in order to prevent more casualties that would likely occur in rural areas. (e.g., fires, robberies, or mugging in small towns).

Overview of the current state of the technology

According to dilg.gov.ph (2020), the Department of the Interior and Local Government (DILG) announced that the Philippine Emergency Hotline 911 has resumed full operation after a brief hiatus after several of its Emergency Telecommunicators were infected with COVID-19. The E911 hotline is a DILG-run security and development program that provides response and emergency assistance to people in distress. Calls coursed through this number include those that require police assistance, fire reports, emergency medical

assistance, search and rescue, and even those that concern chemical, biological, radiological, nuclear, and explosive (CBRNE) materials.

The Philippine Emergency Hotline 911 requires an individual either the victim or a bystander to manually request for response usually done by call. It is good enough for situations where there are a significant amount of crowd capable to dial the emergency number but doesn't suit other emergencies closed to the eye of the public or scenarios where calling could endanger an individual's safety.

There are also other similar systems from the past and with the present day technologies. Some of these are Batingaw app, developed by Smart Communications, Inc. (Smart) in cooperation with the Office of Civil Defense and the National Disaster Risk Reduction and Management Council and QC Ready, official safety app of the Rock Island County and Scott County Emergency Management Agencies (EMA).

These emergency systems serve an overlapping purpose and lack integration with one another. One of the applications released is designed like social media where you post emergencies for others to see. According to Gadget Addict (2017) there are a lot of unnecessary features with-in Batingaw App. He also questioned how useful it could be in a real emergency.

Objectives of The Study

General Objectives

The general objective of the study is to develop an RPI-Based Emergency Response System that will improve the integration between different emergency response departments and civilian volunteers within Brgy. Tulay, Ibaan Batangas through a system that is designed to recognized real-time emergency situation through the help of the components integrated with in the system.

Specific Objectives

1. To develop a module that reduces time to alert authorities with the help of Raspberry Pi as the main component and GPS modules, USB microphones, and smoke sensors as its components. The USB microphone and the smoke sensors acts as the trigger of the module. As soon as either component was triggered, the Raspberry Pi would transfer the received signal to the GPS allowing the authorities to properly locate the area without the need of a person dialing them, which could cause much more damage.

   This emergency response system can help lessen the time it takes to alert the authorities therefore improving the response time.
2. To develop a module that integrates Raspberry Pi together with its sensors and components that will detect and respond to the input that it will receive from the area it covers.

   The developers will collect and integrate components such as smoke sensors, GPS module, and USB microphone to a Raspberry Pi. They will assemble the components to their own configuration and make an Emergency Response System.

3. To provide a sensor-based integrated emergency alert system in order to help the community and the authorities to have an active and fast emergency response system.

   To help the community and the authorities, the developers will provide a technology that can help the authorities to provide a faster response time in order to have a better and safe community.
4. To develop a sensor-based integrated emergency alert system that is modular, and repairable.

   The Integrated Emergency Response System will be a technology designed to be modular and repairable. Being based on Raspberry Pi made it easy to upgrade. The developers can easily modify the system and add sensors that will be beneficial on other applications of the Integrated Emergency Alert System.

Scope and limitations of the study

Scope

The scope of this project design, RPI-Based Integrated Emergency Response System, is to cover the following:

- Voice Recognition

  One of two primary functions of the Integrated Emergency Response System is to recognized keywords that possibly possessed a certain emergency situation. It could be achieved by using a good quality microphone to listen with in the area and transfer the wave forms to Google Speech Recognition API to determine keywords based on the input earlier.

- Smoke Detection

  Another primary function of the IER System is smoke detection. With a proper smoke sensitivity configuration, the system could differentiate a fire emergency from usual smoke.

- GPS Module

  The time where Global Positioning System is only intended only for military used is long gone. It is now a fundamental part of society. With the help of GPS Module emergency responders could easily locate the area of concern.

- Application For Responders

  The RPI-Based IER System requires a means for Responders to access information. This information could be access through a mobile application provided by the thesis maker. Separate technologies will be used to build the mobile application.

- Mobile Counterpart

Implementing audio processing based emergency monitoring through a mobile application increase the range of the system. Mobile devices are all over the place and could be used to monitor emergencies even in hidden places.

Limitations

- Noise

Python based Speech Recognition libraries is capable of manipulating the signals to limit ambient noise. This is a useful tool but still possessed some forms of limitations. These limitations could affect the IER System for a limited number of events.

- Audio Processing Technologies

Google Speech Recognition API is a powerful tool that is one of the dominating figures in the market. It could recognize words from a variety of languages. Using complex algorithms this technology revolutionizes the way civilization used Audio Processing Technologies. Despite of these advances it is still a working progress and requires the next few decades to come near perfect. There could be minimal error or results that won't respond based on what it is expected to do.

- Unreliable Internet Connection

The IER System is primarily designed to work dependent on APIs within the internet. With this circumstance a descent internet connection is required. Latency could limit the functionality of system or worst make the system non-functional at all.

- Platforms

The IER System Application for responders is limited on the platform chosen by the Thesis makers. The chosen platform will be choose based on efficiency and open-source technologies that could be used to designed a more effective application for responders.

LITERATURE REVIEW

Review of related literature, studies or systems

Foreign Literatures

According to research led by Khaliq et al. (2019), as soon as any kind of natural disaster ever hit a certain community, an immediate contact to rescue and relief services should be made. For this to ever happen however, communication between the rescuers and the victim of a natural disaster is required. In most certain scenarios, the aftermath of a natural disaster would result on a cut to any nearby network access, meaning that a Vehicular Ad-Hoc Network (VANET) is required to carry out any operations. This is a vital asset, because VANET does not require any pre-existing infrastructures, leading to a fast and efficient method to relay crucial information to the server. With the help of Raspberry Pi and the Global Positioning System (GPS), the client can send in any message code as they wish and send it to the server. The server then receives the message code and would then proceed to take immediate action depending on the message received.

Another useful application of an RPI based system is a method of applying a Raspberry Pi into a board and use it on various types of sensors like flame or gas sensors. This research lead by Jose et al. (2019), a BE Student, and her colleagues, focuses on fire safety and control, a common man-made disaster. Their research includes multiple functional sensors that allows their detector to easily detect fore or flames to which it has a detection distance of 100 cm. It can also detect gas leaks within its detection range. Due to its sensitivity and fast response time, a course of action can be easily applied. This research allows them to create a system to which it can easily detect fire in order to be easily sent as a form of communication. This poses convenience to a group of people as it provides not only a fast relay, but also because its information that it gathered can be easily sent via mobile phones, or any nearby laptops. Another useful benefit for this kind of sensor is that it allows any nearby gadgets that received the information to be used in any kind of investigation on the time of the aftermath of the accident. In the present times, due to the fact that technology is quickly advancing, more safety protocols are indeed required and are needed. With the

help of gadgets like Raspberry Pi, there are endless possibilities as to how people can help each other in regards to safety measurements.

Research conducted by Suganthi et al. (2018), one of the major crisis people experience during natural disasters are communication. The reason behind this is because most of the time, cellular networks, or any means of network communications are the first to go down, leaving no communication between two places, specifically between the rescuers and the victims. Thanks to the rapid development of our telecommunication sectors, there are new and possibly better networks that unfortunately requires more towers. These towers however are not mostly built to handle strong earthquakes or intense typhoons. This results on the tower collapsing, taking down most networks, returning to having serious issues with communication. Their model functions like Walkie-Talkie. They decided to use Raspberry Pi alongside LoRa (long range) so that it can send valuable information in a very wide radius and it also provides better services by performing with lesser data rates while costing very low power.

Local Literatures

According to Mina (2021), aside from the citizens struggling to live because of the COVID-19 pandemic, The Philippines has also experienced multiple major earthquakes, typhoon successions that affected more than 60 towns and cities, and a volcanic eruption that was caused by Taal Volcano. She stated that The Philippines is one of the topmost vulnerable countries in the world when it comes to natural disasters and the impacts of the climate. The National Exposure Database (NED) uses a tool called GeoMapperPH in order for them to collect data and to be kept updated. GeoMapperPH is a web/mobile application made by the Philippine Institute of Volcanology and Seismology (PHIVOLCS) that accumulates data, from vulnerability to exposures, and/or hazards and coping capacity data. Because of this, officials are kept updated whether which cities within municipalities are more exposed to severe wind conditions, flooding, or earthquakes. These are all crucial information in order for them to be more prepared for when they are about to make a move.

According to Macatangay (2019), the Mariners Polytechnic Colleges (MPC) Baras Campus has provided a flood early device to be used by the residents of the Manggayawan,

Canaman, Camarines Sur as a life-saving tool. Its purpose is to send off multiple siren sounds signifying a warning to the resident if the Manggayawan River is to ever reash its saturation state. The first alarm will emit a single siren that will indicate that the river has reached its full extent of water capacity. After which a second alarm would produce, signaling the residents of Manggayawan to prepare themselves for a possible evacuation. Finally, the third alarm, characterized by a long siren sound, indicates that all residents near the danger area should immediately evacuate. According to Dr. Robert D. Eldridge from A-PAD Management Office in Japan and Advisor of Peace Winds Japan, there is a possibility for this kind of device to be marketed, not solely because for a quick profit, but because it can help more communities to be more resilient. According to Alma Basmayor, a Purong Barangay of Manggayawan, the device is a big help, especially from the presence of an intense rainfall.

When it comes to being prepared for any kind of emergency, (The Philippine Red Cross, 2018), intensified their advocacy to shift information dissemination to proactive involvement and action in order to empower communities, workplaces, and schools to be prepared ahead, as well as reminding the public to equip themselves with necessary lifeline kits in order to cope with the increment of natural and man-made disasters. The Disaster Management Services of PRC strengthened their resilience programs in the National Headquarters by initiating cash transfer programming as a means of modality in order to provide food, non-food, shelter or livelihood assistance to any affected families. PRC Chairman Richard Gordon stated that everyone should be prepared way ahead in case a natural disaster. By forecasting ahead of any disaster, PRC helps communities be more resilient and would transform their involvement on disaster risk reduction. PRC also reminded the public to be more self-reliant in order to have the ability to survive the most crucial 72 hours of their lives after a calamity. The PRC has anchored their campaigns to National Disaster Resilience, a nationwide celebration, with the theme of “Katatagan sa Kalamidad ay Makakamtan Kapag Sapat ang Kaalaman sa Kahandaan.” PRC is a member of a group of various government, non-government organizations, and private sector organizations that are responsible for coordination, monitoring, and evaluation of the Philippines’ efforts towards building a resilient Filipino community called NDRRMC.

(Sansolis & Dumpit, 2021) has conducted a study that tackles the issue about ERT and their problems with false alarms. In their study, they have developed a device called Smart Fire Monitoring System which focuses on the development of a device that uses Agile Prototyping Methodology (APM) and Agile Software Development Technology (ASDT). The main design of creating a Smart Fire Monitoring System Software (SFMSS) is that its purpose is to detect smoke, temperature spikes, existence of fire, to broadcast GPS coordinates to fire departments, transmitting and receiving data through RF signals via long-range frequency, and having the ability to function in Low Power mode. The SFMSS system is made to be centralized on being developed for the fire department in order to monitor cities for fire outbreaks. SFMSS communicates via radio frequencies and process SMS notifications in case of any fire outbreak.

These related literatures have shown the developers the uses and the purposes of sensory based gadgets, while the others have shown the innovation and the abilities/capabilities of Raspberry Pi. It is important for the developers to take notes on these, because their own variation of an emergency response system relies on the strengths of Raspberry Pi, as well as the versatility of sensors. With the amount of knowledge, the developers received, they got a clear vision as to how they would implement their emergency response system in order to benefit the residents of Tulay, Ibaan. The developers have used the same technology of implementing a GPS system in order for the respondents of Tulay, Ibaan to easily locate any ongoing emergencies. The capstone design also uses Raspberry Pi as its main source which allows the entire capstone design to operate fully. The GPS system would reduce the time of barangay officials to respond to any emergencies that would otherwise make the situation dire. The developers have also made an application, whose purpose is to receive emergencies and would provide information on what emergency does it receive. This also reveals a map of the whereabouts of the emergency for any users of the application, because it receives the information sent by the GPS system that the capstone design carries. Fire emergencies relies on the smoke sensor that is built within the capstone design which would immediately notify any of the barangay officials so that they can then immediately proceed to call a nearby fire department.

According to (Amigo et al. 2017) it focuses on how smartphones can be a key tool to perform security checks on people's homes. Their thesis focuses on improving household doors' security, as well as to integrate web-based household platforms. They developed an Android based operation in which it is used to control electricity and lightings anywhere they are. Their security system also has the ability to notify the user of any burglary attempts as well as ongoing fire within their premises. The notification itself is transferred to the user's mobile device to receive the information. They have also implemented a live CCTV footage so that the user themselves would be alerted with what is currently happening. This all happens with the help of stable internet connectivity. This thesis is a crucial part of our research as it has the same idea in a different form. While this research uses one household as the main objective, the sensor-based integrated emergency alert system has the main objective to provide security within a barangay.

Synthesis

This project which is the PRI Based Integrated Emergency System has many benefits. This system is not only cheaper but it is upgraded which can really help in today's era. This project which is the (RPI) is more effective compared to other systems. Voice Recognition one of two primary functions of the Integrated Emergency Response System is to recognize keywords that possibly possessed a certain emergency situation. Another primary function of the IER System is Smoke detection, this can help determine if a fire emergency has occurred. The time where Global Positioning System (GPS) is only intended only for military use is long gone. It is now a fundamental part of society. It provides location and time information and the system is freely accessible by anyone with a GPS receiver and unobstructed line of sight on at least four GPS satellites. The GPS receiver calculates its position by precisely timing the signals transmitted by GPS satellites. It is widely used today and has also become an integral part of smartphones. The application for responders of the RPI-Based IER System requires a means for responders to access information. It will help the developers know that they have experience or training in properly responding to those injured in a disaster or emergency that occurs in a building. It will be easier not only to provide the right information to the responders, but also to help raise awareness in our society and reduce tragedies especially crime.

SENSOR BASED INTEGRATED EMERGENCY ALERT SYSTEM USING RASPBERRY PI

Overview of the project

The researcher provides information concerning the research design, research instrument, and data gathering procedure conducted in this chapter. It emphasizes the readings that brought the researcher's concrete information they needed to finish the project.

System Design Specification

The purpose of this study is to gather relevant information regarding the RPI based integrated response system. Quantitative research was used in attempt to establish the effectiveness of the RPI based integrated system using sensors among the general population. It shares the main goal which is to test or confirm theories and assumptions. This type of research is used to establish generalizable facts about a topic.

Research Instrument

For the research instrument, developers used developers-made questionnaires to gather the information that is needed to finish this study. The draft of the questionnaire was made based out of the developers, readings, related literatures, previous studies, published and unpublished thesis relevant to the study. In preparation of the research instrument, the requirements in designing a good data collection instrument were considered.

Data Gathering Method

The first step before collecting the data is to identify the respondents that is fit to answer the questions effectively. Upon identifying the respondents, they were informed about the questions that can be discussed. In administrating the questionnaires, the developers used the vacant time that is allotted to give the questionnaires to the respondents

to avoid distractions in their respective workplaces.

Internet Research

The developers search the internet to develop furthermore ideas with the studies regarding the RPI-Based integrated emergency responses. They found similar emergency response that focused on other types of emergencies are used as a reference for the study.

Interview

The developers conducted an interview within the premises of Brgy. Tulay, Ibaan Batangas. The developers interviewed 2 homeowners 2 store owners and 1 Brgy. Officials to gather relevant information regarding the problems that the Brgy. Tulay, Ibaan Batangas experience in a daily basis.

Quick Design

When requirements are identified, the developers will create a initial design or quick design for the system. It is not a detailed design and includes only the important aspects of the system, which gives an idea of the system to the developers. A quick design helps in developing the prototype by helping the developers to understand and plan what to do in building it.

- **Architectural Design**

  The developers used architectural design to focus on the elements and components perceived in a structural way. It also shows the design guide of building the prototype.

- **Block Diagram**

  The developers used a block diagram to show what components of the device are connected to one another regarding its function.

- **Flow Chart Diagram**

The developers used a flow chart diagram showing how the system works to understand the function of the project to show each of the component's relationships with each other.

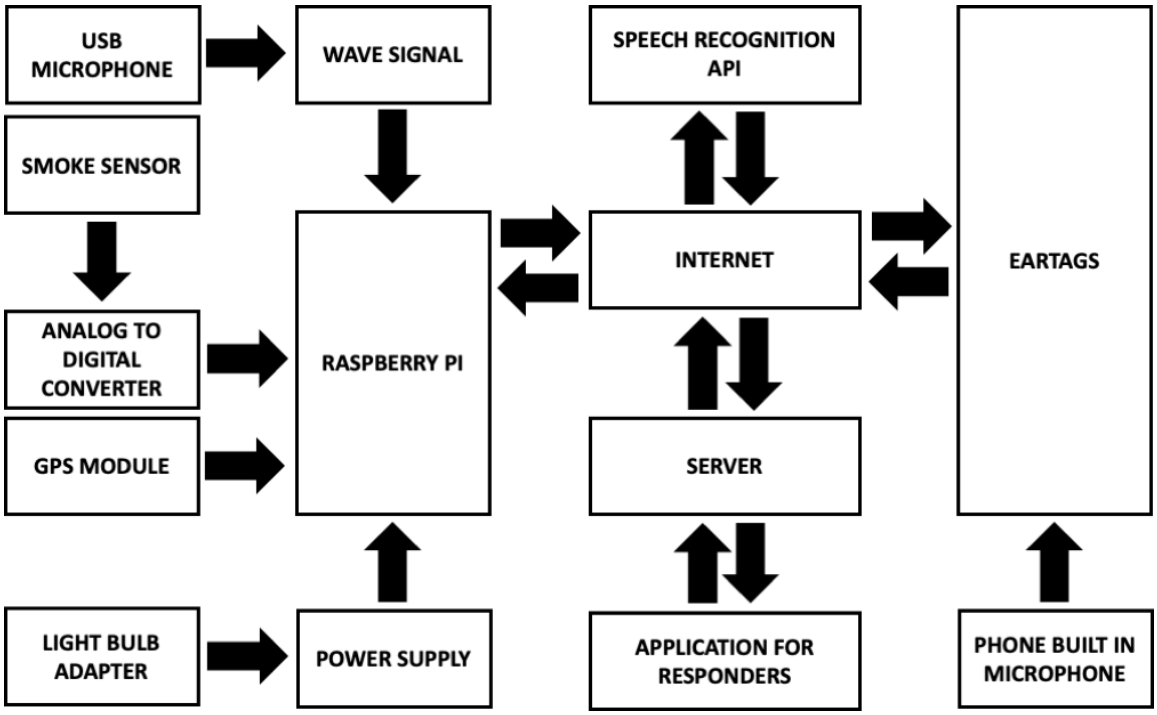


Figure 1: Block Diagram of the Raspberry Pi Components

Every component is connected to the raspberry pi which act as the main component of the system. The GPS module, and the analog to digital converter is connected to the RPI. The analog to digital converter will convert the analog input the smoke sensor perceive and convert it to a digital signal. The speech recognition is connected to the internet, which will be used by the USB microphone and if it recognizes a predefined keyword, it will be sent to the server which will redirect the message to the application for responders.

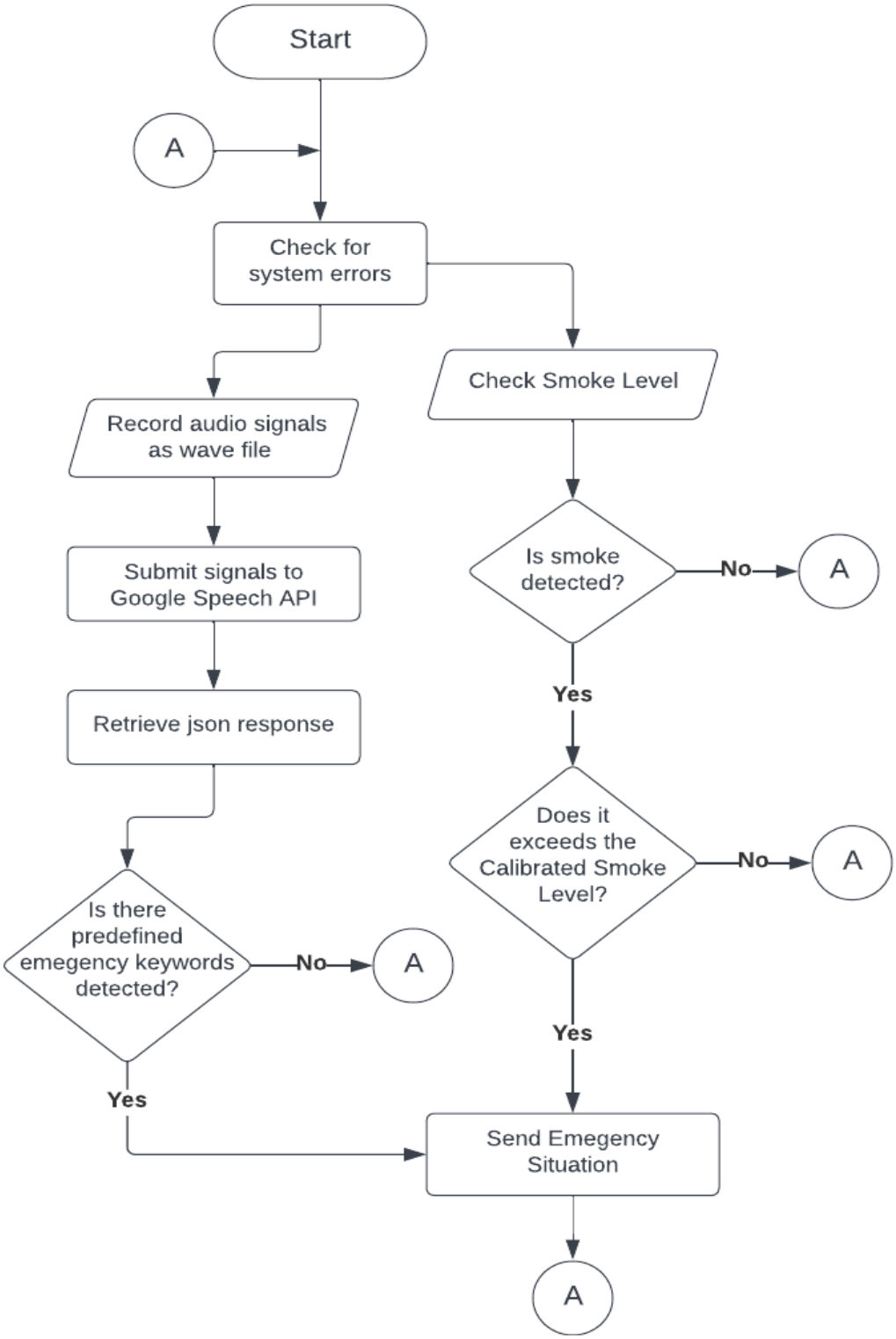


Figure 2: Flow Chart Diagram of the System

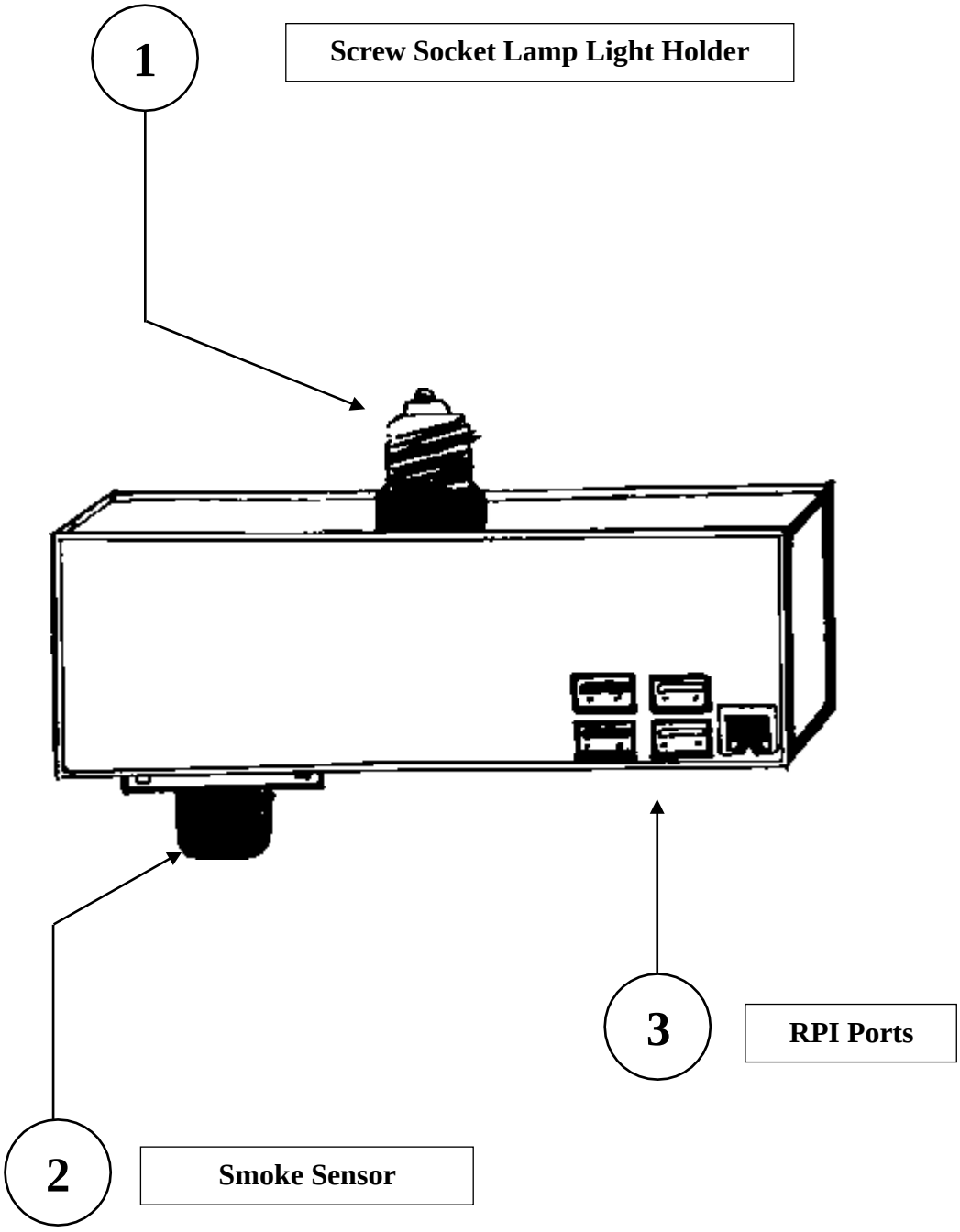
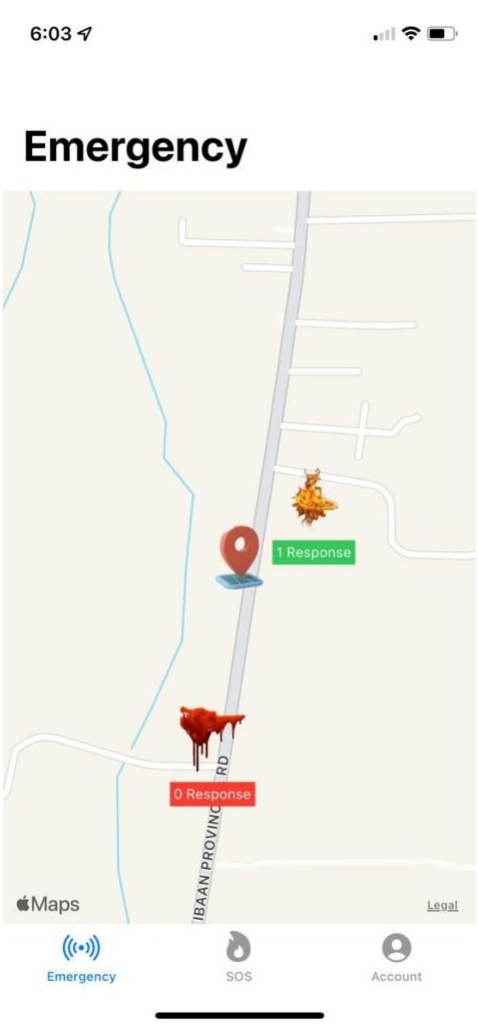
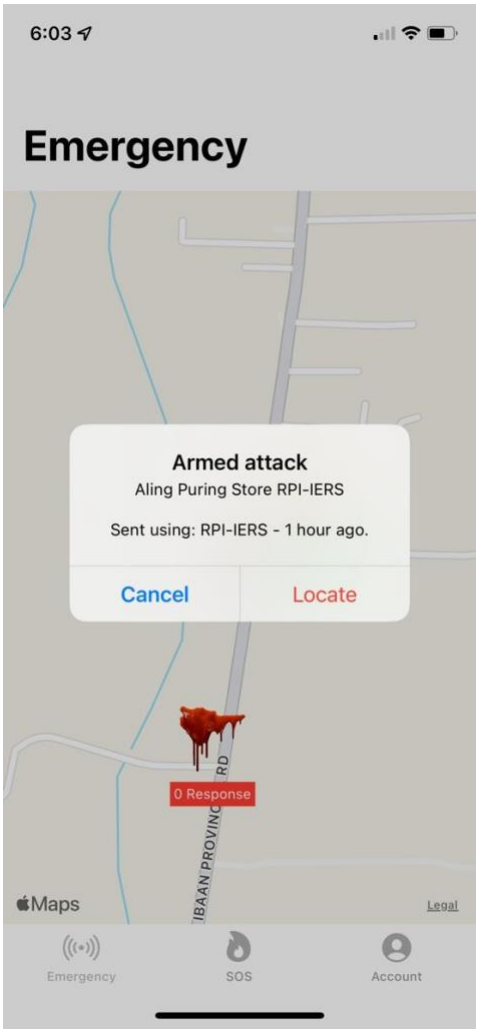


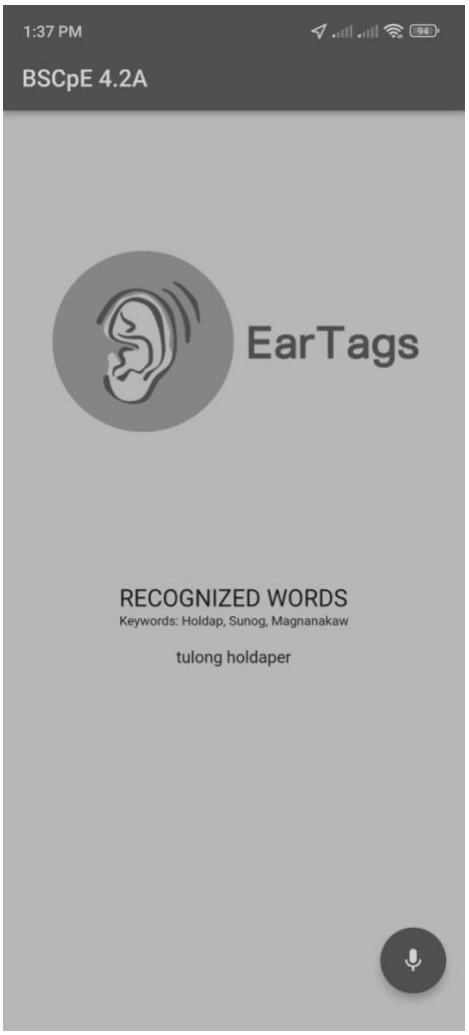
Figure 3: Initial Design

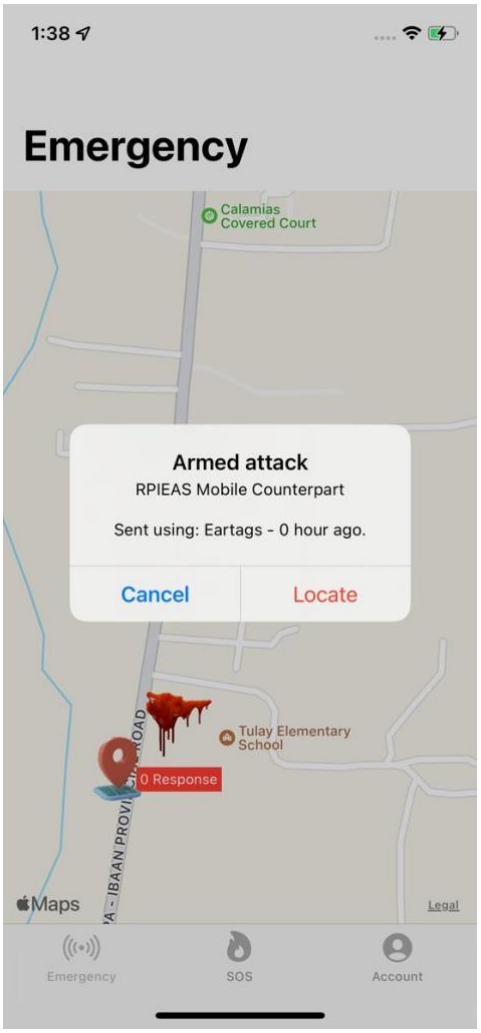
Application for Responders





Eartags – RPIEAS Mobile Counterpart





Hardware

Raspberry Pi

Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. The Raspberry Pi project originally leaned towards the promotion of teaching basic computer science in schools and in developing countries.

GPS Module

GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. From there, it'll receive timestamp from each visible satellites, along with other pieces of data.

USB Microphone

The USB Microphone is a quality microphone with a "built in" interface so that you can plug it directly into your USB port. You bypass your computer's built in sound card for recording so the result is much better. It also has the necessary amplification so the signal is at the right level.

Smoke Sensor

Smoke sensor reports smoke by the voltage level that it outputs. The more smoke there is, the greater the voltage that it outputs. Conversely, the less smoke that it is exposed to, the less voltage it outputs.

Analog to digital converter

An ADC may also provide an isolated measurement such as an electronic device that converts an analog input voltage or current to a digital number representing the magnitude of the voltage or current. Typically, the digital output is a two's complement binary number that is proportional to the input, but there are other possibilities.

Software

Raspberry Pi imager

The main use of the Raspberry Pi Imager is to write/flash operating system images to the microSD card. To select an operating system image, click on the CHOOSE OS button. Raspberry Pi Imager will list the most common operating systems for Raspberry Pi devices.

Raspberry Pi OS

Raspberry Pi OS (formerly Raspbian) is a Debian-based operating system for Raspberry Pi. Since 2013, it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the Raspberry Pi family of compact single-board computers.

Python IDLE

IDLE is an integrated development environment for Python, which has been bundled with the default implementation of the language since 1.5.2b1. It is packaged as an optional part of the Python packaging with many Linux distributions. It is completely written in Python and the Tkinter GUI toolkit.

MAMP

MAMP is a solution stack composed of free and open-source and proprietary commercial software used together to develop and run dynamic websites on Apple Macintosh computers.

Xcode

Xcode is Apple's integrated development environment for macOS, used to develop software for macOS, iOS, iPadOS, watchOS, and tvOS. It was initially released in late 2003; the latest stable release is version 13.4, released on May 16, 2022, and is available via the Mac App Store free of charge for macOS Monterey users.

Visual Studio Code

Visual Studio Code, also commonly referred to as VS Code, is a source-code editor made by Microsoft with the Electron Framework, for Windows, Linux and macOS.

RESULTS AND DISCUSSIONS

To improve system functionality, the developers conducted extensive testing and analysis. During the testing phase, the key focus was on effective sensors and device integration to create an efficient system and ensure the system's overall smooth functioning.

Experimental Procedure

The developers perform the following tests to determine whether the system accomplished its aims and scope.

SMOKE SENSOR TEST:

Objectives:

To test if the Smoke sensor is working properly by distinguishing smoke and providing an output to identify whether the smoke is at a greater volume.

MATERIALS	QUANTITY
Raspberry Pi	1
MQ-X Smoke Sensor	1
5V Power Supply for Raspberry Pi	1

Table 1: Materials for Smoke Sensor Test

Procedure:

1. Connect the Smoke Sensor to the Raspberry Pi.
2. Upload the code to the Raspberry Pi.
3. Plug the system into the socket.
4. Position a smoke to the Smoke Sensor.
5. Check if the system is able to distinguish changes in smoke level.

TEST FOR SMOKE SENSOR			
Trial	**Expected Result**	**Trial Result**	**Remarks**
1	The MQ-X sensor must be able to detect a smoke and display a constant value.	The smoke detector did not display a constant value. **Incorrect Output**	Unsuccessful
2	The MQ-X sensor must be able to detect a smoke and display a constant value.	The smoke detector did not display a constant value. **Incorrect Output**	Unsuccessful
3	The MQ-X smoke sensor must be able to detect a smoke and display a constant value.	The MQ-X smoke sensor detected a smoke and displayed a value in the console. **Correct Output**	Successful

Table 2: MQ-X Smoke Sensor Trials

GPS TEST:

Objectives:

To test if the GPS is working efficiently by identifying and providing an accurate coordinate and to be displayed in the console.

MATERIALS	QUANTITY
Raspberry Pi	1
NEO 6M GPS Module	1
5V Power Supply for Raspberry Pi	1

Table 3: Materials for GPS Test

Procedure:

1. Connect the GPS to the Raspberry Pi.
2. Upload the code to the Raspberry Pi.
3. Plug the system into the socket.
4. Run the code.
5. Check if the system can identify the coordinate.

TEST FOR GLOBAL POSITIONING SYSTEM (GPS)			
Trial	**Expected Result**	**Trial Result**	**Remarks**
1	The GPS must display an accurate coordinate.	The GPS did not display any coordinate. **Incorrect Output**	Unsuccessful
2	The GPS must display an accurate coordinate.	The GPS did not display any coordinate. **Incorrect Output**	Unsuccessful
3	The GPS must display an accurate coordinate.	The GPS did not display any coordinate. **Incorrect Output**	Unsuccessful
4	The GPS must display an accurate coordinate.	The GPS did not display any coordinate. **Incorrect Output**	Unsuccessful
5	The GPS must display an accurate coordinate.	The GPS displayed an accurate coordinate. **Correct Output**	Successful

Table 4: GPS (Global Positioning System) Trials

SPEECH RECOGNITION TEST:

Objectives:

To test if the speech recognition is working efficiently by providing an output that will display the words that were uttered accurately.

MATERIALS	QUANTITY
Raspberry Pi	1
NEO 6M GPS Module	1
5V Power Supply for Raspberry Pi	1

Table 5: Materials for Speech Recognition Test

Procedure:

1. Connect the Microphone to the Raspberry Pi.
2. Upload the code to the Raspberry Pi.
3. Plug the system into the socket.
4. Run the code.
5. Check if the system can identify and provide an output.

TEST FOR SPEECH RECOGNITION USING POCKET WIFI (SMART)			
Trial	**Expected Result**	**Trial Result**	**Remarks**
1	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
2	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful

3	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
4	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
5	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful

Table 6: Speech Recognition Trials

TEST FOR SPEECH RECOGNITION USING ETHERNET CABLE (PLDT FIBER)			
Trial	**Expected Result**	**Trial Result**	**Remarks**
1	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful
2	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful
3	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in	Successful

		the console. **Correct Output**	
4	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
5	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful

Table 7: Speech Recognition Trials

TEST FOR SPEECH RECOGNITION USING WIFI (STI LIPA LIBRARY)			
Trial	**Expected Result**	**Trial Result**	**Remarks**
1	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
2	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful
3	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful

4	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
5	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful

Table 8: Speech Recognition Trials

TEST FOR SPEECH RECOGNITION USING WIFI (STI LIPA BAR AND DINE WITHIN 1M)			
Trial	**Expected Result**	**Trial Result**	**Remarks**
1	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
2	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
3	The system must be able to detect the keywords that are set in the code.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
4	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful

5	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful

Table 9: Speech Recognition Trials

TEST FOR SPEECH RECOGNITION USING WIFI (BRGY. TULAY IBAAN BATANGAS WITHIN 1M)			
Trial	**Expected Result**	**Trial Result**	**Remarks**
1	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful
2	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful
3	The system must be able to detect the keywords that are set in the code.	The system detected the words that were uttered and were displayed in the console. **Correct Output**	Successful

Table 10: Speech Recognition Trials

TEST FOR EARTAGS			
Trial	**Expected Result**	**Trial Result**	**Remarks**
1	The system must be able to detect the keywords that was set and provide an output on the system.	The system cannot recognize the voice that was articulated. **Incorrect Output**	Unsuccessful
2	The system must be able to detect the keywords that was set and provide an output on the system.	The system recognized the voice that was articulated but the system did not provide an output. **Incorrect Output**	Unsuccessful
3	The system must be able to detect the keywords that was set and provide an output on the system.	The system detected the words that were uttered and provided an output on the system. **Correct Output**	Successful
4	The system must be able to detect the keywords that was set and provide an output on the system.	The system detected the words that were uttered and provided an output on the system. **Correct Output**	Successful
5	The system must be able to detect the keywords that was set and provide an output on the system.	The system detected the words that were uttered and provided an output on the system. **Correct Output**	Successful

Table 11: Speech Recognition Trials

OVERALL SYSTEM TEST

Objectives:

To test the functionality of the overall system combined.

MATERIALS	QUANTITY
Raspberry Pi	1
MQ-X Smoke Sensor	1
NEO 6M GPS Module	1
Microphone	1
5V Power Supply for Arduino UNO	1

Table 12: Materials for the overall system

Procedure:

1. Connect the MQ-X Smoke Sensor to the Raspberry Pi.
2. Connect the NEO 6M GPS Modules to the Raspberry Pi.
3. Connect the Microphone to the Raspberry Pi.
4. Plug the system into the socket.
5. Run the code for the Raspberry Pi.
6. Check if the system can identify smoke, coordinate and speech recognition at the same time.

TEST FOR THE OVERALL SYSTEM							
		Trial 1		**Trial 2**		**Trial 3**	
Process	**Note**	Result	Remarks	Result	Remarks	Result	Remarks
MQ-X Smoke Sensor	Detect smoke	✗	**UNSUCCESSFUL**	✓	**UNSUCCESSFUL**	✓	**SUCCESSFUL**
NEO 6M GPS Module	Identify coordinate	✗		✗		✓	
Microphone	Detect Speech	✓		✗		✓	

Table 13: Overall Process of the System Trials

TEST FOR THE OVERALL SYSTEM					
		Trial 4		**Trial 5**	
Process	**Note**	Result	Remarks	Result	Remarks
MQ-X Smoke Sensor	Detect smoke	✓	**SUCCESSFUL**	✓	**SUCCESSFUL**
NEO 6M GPS Module	Identify coordinate	✓		✓	
Microphone	Detect Speech	✓		✓	

Table 14: Overall Process of the System Trials

Through months of extensive prototyping, the developers test the compatibility of the device through different mediums. RPIEAS was tested between a Fiber PLDT connection and Smart Pocket WIFI. The Fiber-based connection returns an 80% accuracy for the word 'Holdap' while only returning 40% accuracy when connected through a Pocket WIFI. The developers have discovered that using ethernet is much more effective and would result in a much more accurate voice recognition compared to using pocket Wi-Fi.

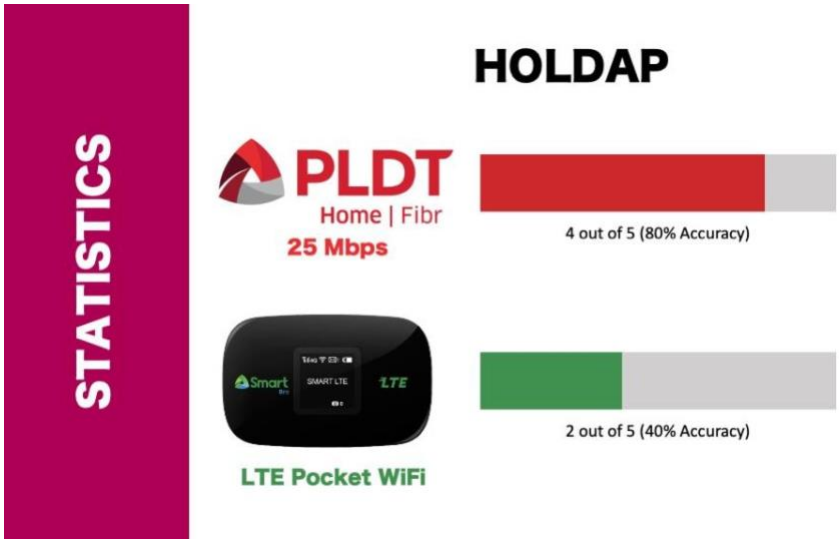


Figure 4: Speech Recognition Statistics

Considering the importance of accuracy, the developers tests proximity required for the device to detect a word and the test determines that the device is capable of detecting audio-based emergencies with-in approximately 6.28m in Circumference or approximately 1m in radius. The tests conducted for the smoke sensor gives a 100% accuracy when pins are properly connected and imperfections in solder are fixed. It could be configure based on the required sensitivity of the area, considering that certain areas could be susceptible to smoke from non-fire relatedemergencies.

The developers have also tested the prototype's accuracy in multiple locations, ranging from open areas, or places that are prone to echoes. The results vary from providing accurate responses in open areas or areas where there are multiple people, to the prototype not responding accordingly to the voices in rooms that generate a significant portion of echoes.

It is also determined that GPS Coordinates should be stored locally to ensure that the device could still determine its location during time when it's hard to find GPS Signal.

In regards to the voice recognition of the prototype, frequency of the person's voice isn't a significant portion on the accuracy of the system. The reason for this it the built in API used was already trained for a variety of pitch and human voices.

The developers have asked the residents of Brgy. Tulay, Ibaan if the prototype has met their expectations in regards to the effectiveness of the prototype. The feedbacks that the developers have received during their testing of their prototype were mixed. The local residents that reside there gave the prototype positive feedback with how functional it is and convenient for their safety. The Barangay officials gave the prototype positive feedback as well, however both the officials and the residents recommended that the device should be built smaller in order to help hide the device.

CONCLUSIONS AND RECOMMENDATIONS

Considering that criminals are already taking advantage of modern-day technologies to perform their activities it is also a requirement for the citizens to use technology to counter them. Modern day problems require modern day solutions, and it is what this research aims today.

The system accomplished the following:

1. The developers of the research developed an Integrated Emergency Alert System that takes as fast as 14 seconds to send emergency alerts.
2. The System successfully integrates different components and connect to the internet where the application for responders could easily access emergency alerts.
3. With astonishing speed of upto-14 seconds, the emergency alert system was praised and recommended by the authorities. They are confident that these types of technology could be beneficial in the near future and the development of these devices should gain a significant support.
4. Developers primarily designed the device to be modular and capable of upgrades. The main board could easily be accessed by using a screwdriver to exposed the inside of the case. Inside are components that could easily be replaced in case of damage. The PCB is also replaceable which is beneficial for repair and upgrades considering that more sensors could be integrated in further versions.

Recommendation

For the future use, the developers recommend the following:

1. Use the device on banks, money exchange, pawnshops and similar establishment.
2. Redesign the device to be powered by car charger so that it could be deployed on public utility vehicles and improve the security on public transportation.
3. Integrate with Smart Speakers, primarily Google Home, Apple HomePod, and Amazon Echo to perform emergency monitoring.

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APPENDICES

APPENDIX A. GANTT CHART

Year	2022															
Month	**September**				**October**				**November**				**December**			
	01 - 07	08 - 14	15 - 21	22 - 30	01 - 07	08 - 14	15 - 21	22 - 31	01 - 07	08 - 14	15 - 21	22 - 30	01 - 07	08 - 14	15 - 21	22 - 31
Making Speech Recognition functional																
Application for responders is finished																
Making Smoke Sensor functional																
Making GPS Module functional																
Initial demonstration for the modules is recorded																
Wirings are now transferred to fritzing																
Codes are deployed to a free online server																
The initial platform for the smoke sensor has been 3D printed																
The platform for the prototype has been 3D printed																
Etching																
The prototype was assembled																
The final recording for the demo was recorded																

Blue = Everyone Red = John Rovic Lalusin Yellow = Vince Warren Oñate Green = Angelo Jose Nulial Purple = Carlo Castro Light Blue = Vince Warren Oñate and Carlo Castro Gray = John Rovic Lalusin and Angelo Jose Nulial Dijon Mustard = John Rovic Lalusin, Angelo Jose Nulial, and Carlo Castro

Year	2023																			
Month	January				February				March				April							
	01 - 07	08 - 14	15 - 21	22 - 30	01 - 07	08 - 14	15 - 21	22 - 31	01 - 07	08 - 14	15 - 21	22 - 30	01 - 07	08 - 14	15 - 21	22 - 31				
Assembling of the casing for the prototype																				

Year	2023											
Month	May											
	01 - 07			08 - 14			15 - 21			22 - 30		
Assembling of the casing for the prototype												

Blue = Everyone Red = John Rovic Lalusin Yellow = Vince Warren Oñate Green = Angelo Jose Nulial Purple = Carlo Castro Light Blue = Vince Warren Oñate and Carlo Castro Gray = John Rovic Lalusin and Angelo Jose Nulial Dijon Mustard = John Rovic Lalusin, Angelo Jose Nulial, and Carlo Castro

APPENDIX B. ACTUAL THESIS EXPENSES

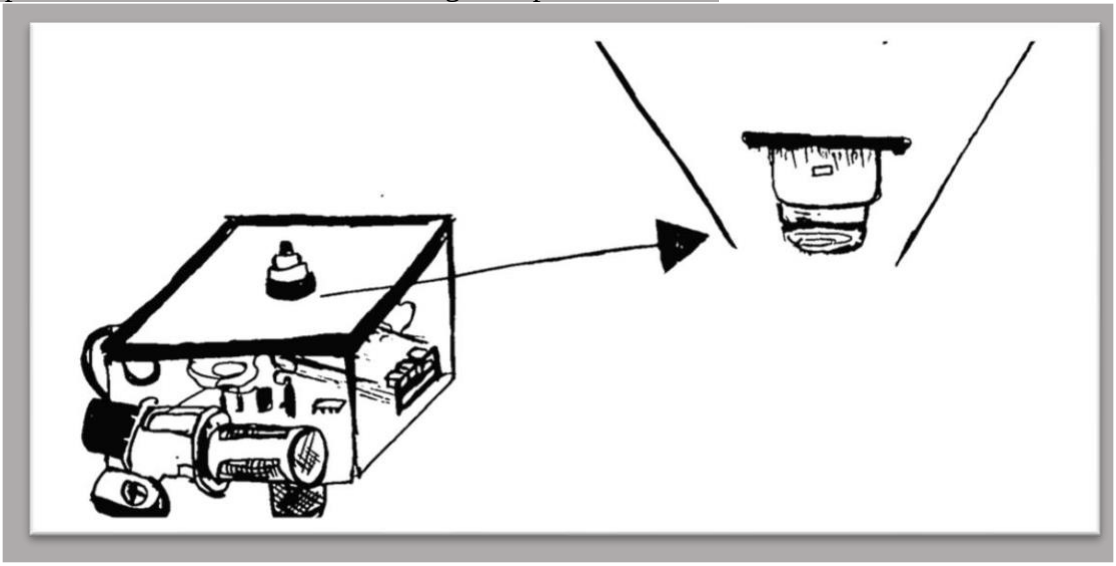
THESIS EXPENSES

	MQ – 3 Smoke Sensor	₱220.00
	Hex Nuts	₱139.00
	MCP3008	₱328.00
	Male to Female connecting wires	₱150.00
	Raspberry Pi 3 Model B Plus	₱4,000.00
	Soldering Tin	₱20.00
	Break Away Male Headers Right Angle 40 Pin	₱133.00
	500 pcs Laptop Computer Screws Kit	₱267.00
	Acrylic Glue	₱268.00
	Single Row Pin Female Header 3P	₱42.00
	Single Row Pin Female Header 15P	₱70.00
	Vinyl Decal sticker	₱236.00
	ABS Filament	₱780.00
	Buzzer	₱157.00

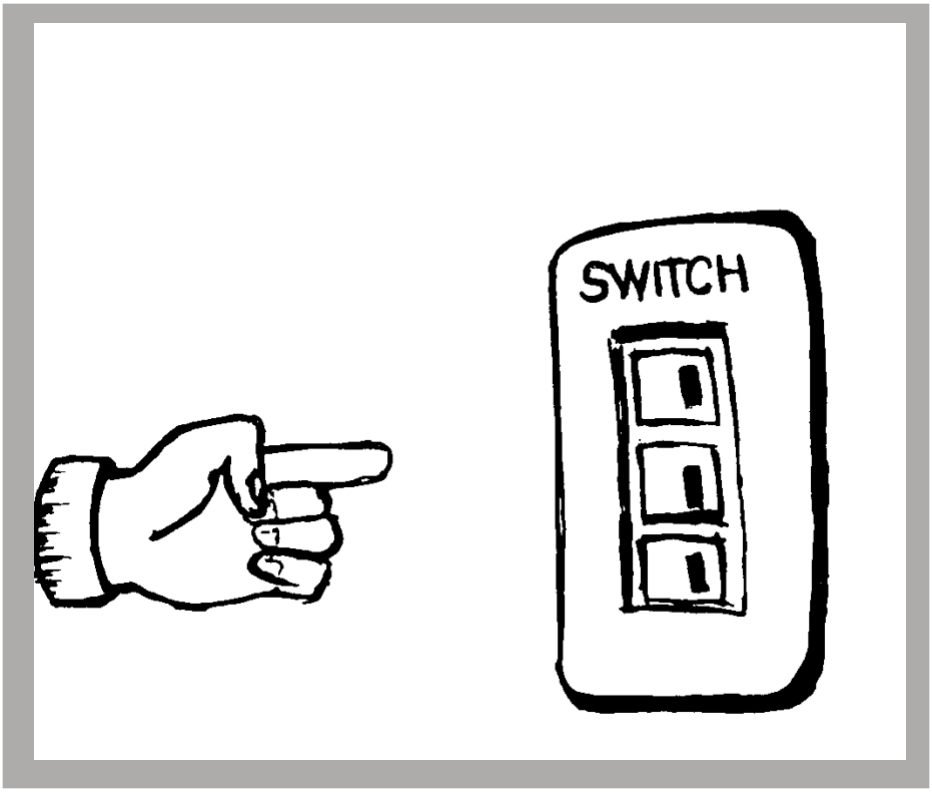
	RPI Fan	₱116.00
	Pcb board	₱216.00
	Ferric chloride	₱35.00
	Micro USB Cable	₱150.00
	Acrylic Sheet	₱378.00
	Connecting Wires	₱140.00
	GPS	₱327.00
	Light bulb adapter	₱117.00
	Door hinge	₱93.00
	Condenser Mic	₱277.00
	Sound Card	₱153.00
TOTAL		₱8,832.00

APPENDIX C. USER'S MANUAL

Step 1: Screw the device to the Ceiling Receptable Socket

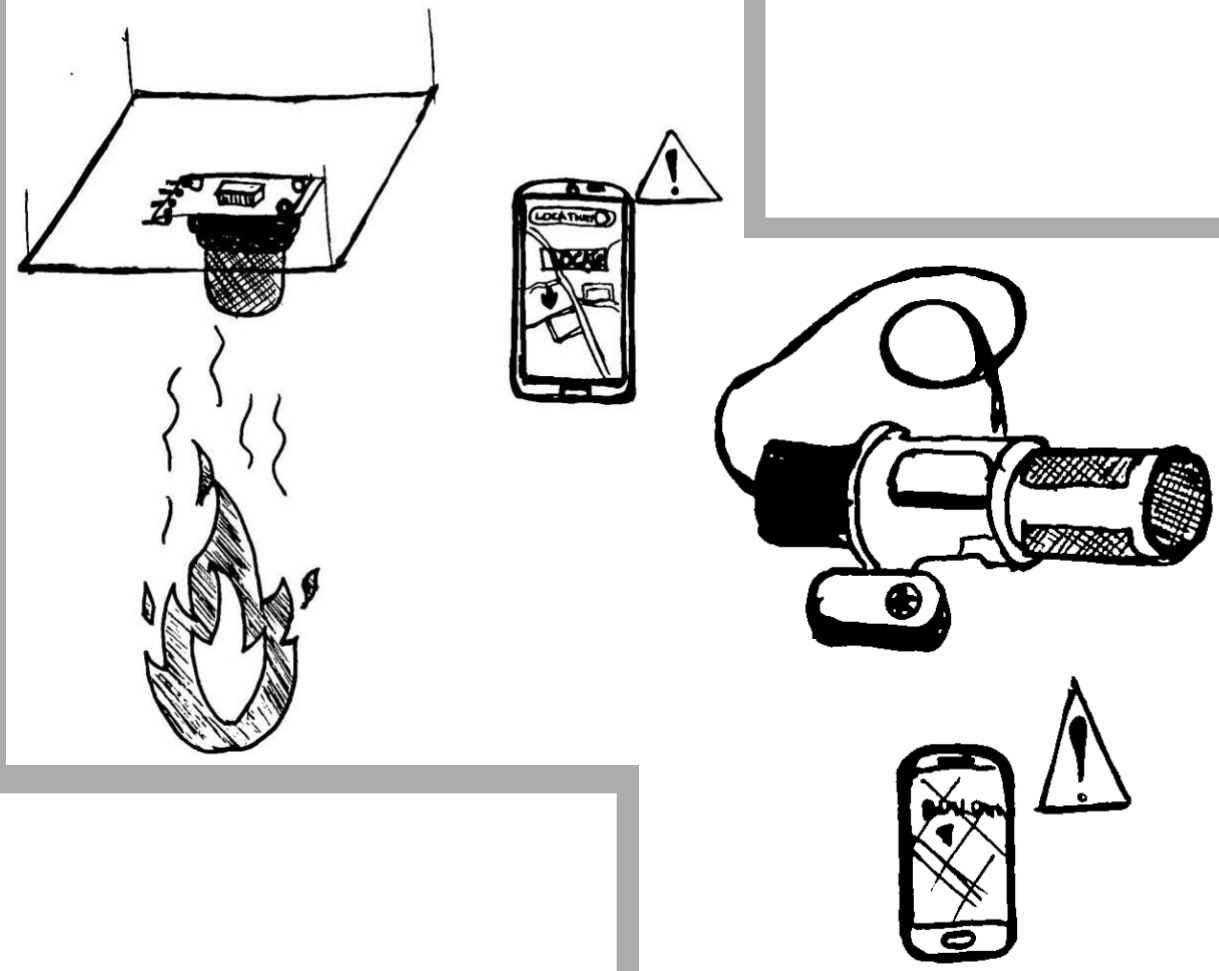


Step 2: Turn on the power



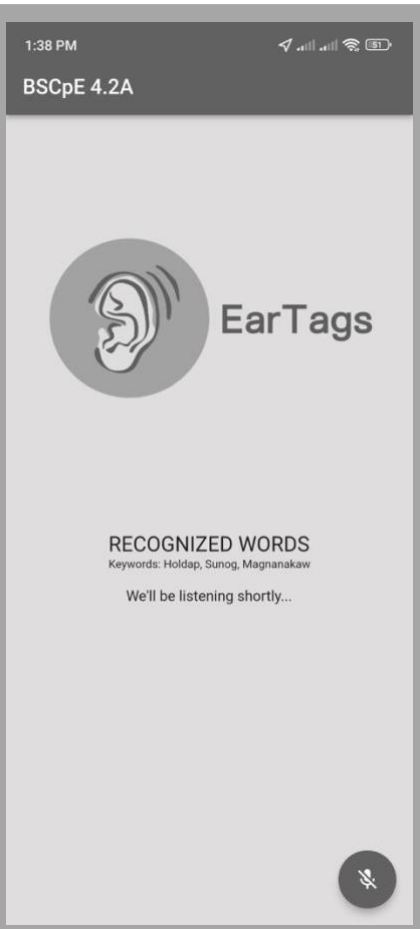
Step 3: Connect the Device online with ethernet.

Step 4: Wait for a few seconds for the device to configure itself after booting. The RPIEAS will listen to potential emergencies and monitor changes in smoke level continuously and will send emergencies if it detects one.



Eartags Manual

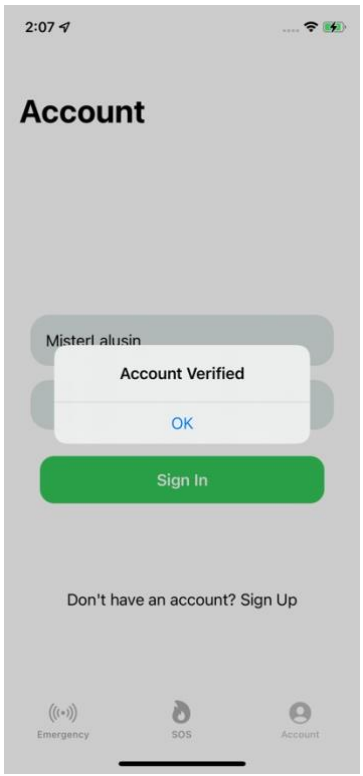
Step 1. Connect to Internet and open Eartags Application on Your Phone



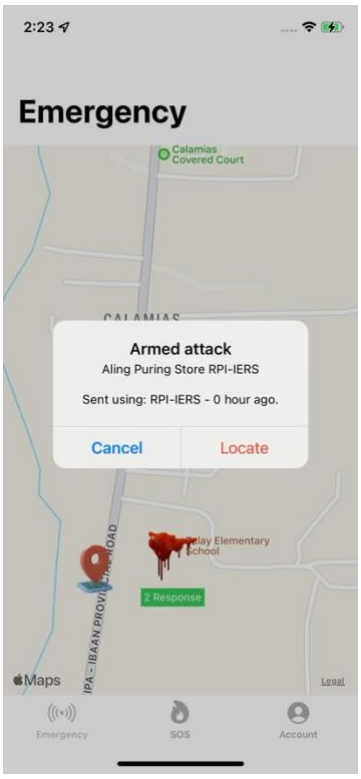
Step 2. Wait few seconds for Eartags to Connect with Google Speech API.

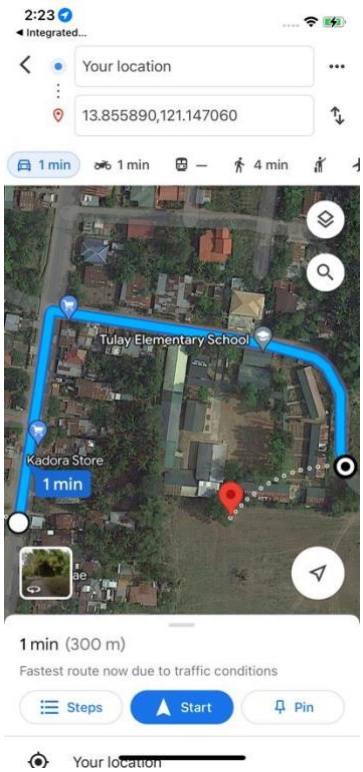
Step 3. Leave the Application open in the background to record potential emergencies.

APPENDIX D. ADMIN'S MANUAL



Step 1. Log In with your provided Emergency Responder's Account.





Step 2. Monitor emergency alerts and locate the emergency through Google Maps.

APPENDIX E. CURRICULUM VITAE OF DEVELOPERS

Curriculum Vitae of

CARLO V. CASTRO

463 Brgy. Tulay, Ibaan Batangas
Carlocastro21@gmail.com

EDUCATIONAL BACKGROUND

Level	Inclusive Dates	Name of school/ Institution
Tertiary	2019-present	STI College Lipa
Senior High School	2016-2019	STI College Lipa
Junior High School	2012-2016	Nasugbu East National High School
Elementary	2006-2012	Tulay Elementary School

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
2019	Work Immersion Trainee	Municipality of Nasugbu Batangas

Listed in reverse chronological order (most recent first).

AFFILIATIONS

Inclusive Dates	Name of Organization	Position
2017-2018	Comsci Club	Member

Listed in reverse chronological order (most recent first).

SKILLS

SKILLS	Level of Competency	Date Acquired
Programming	Mid-range	2017

TRAININGS, SEMINARS OR WORKSHOP ATTENDED

Inclusive Dates	Title of Training, Seminar or Workshop
N/A	

Listed in reverse chronological order (most recent first).

Curriculum Vitae of

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09182540378 / (042) 785-3620

EDUCATIONAL BACKGROUND

Level	Inclusive Dates	Name of school/ Institution
Tertiary	2019-present	STI College Lipa
Senior High School	2017-2019	STI College Lipa
Junior High School	2013-2017	MSEIFI San Antonio
Elementary	2007-2013	Academia De San Antonio

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
2023 - Present	Software Engineer	HiPE Japan Inc.
2022	IT Software Intern	ARC System Solutions Co.
2019-2021	IT Head	Outsourcing Solution PH
2019	Work Immersion Trainee	Nissan Lipa

Listed in reverse chronological order (most recent first).

AFFILIATIONS

Inclusive Dates	Name of Organization	Position
2019-2022	STI Lipa SSC	Engineering Dept. Representative
2018-2019	Circle Of United IT Students	Representative
2017-2018	IT Club	Member

Listed in reverse chronological order (most recent first).

SKILLS

SKILLS	Level of Competency	Date Acquired
Programming	Mid-range	2017
Arduino	Beginner	2020
Raspberry Pi	Beginner	2022
3D Printing	Beginner	2022

TRAININGS, SEMINARS OR WORKSHOP ATTENDED

Inclusive Dates	Title of Training, Seminar or Workshop
2023	NEXT Seminar Accelerating Application Development with .Net
2023	Philippine Skilling Summit
2023	Red Hat System Administration I (RH124)
2020	LP ITSC Cisco Device Management Foundation
2020	LP ITSC CCNA Nuggets – Network Fundamentals
2020	AWS Builders Series
2020	Ruijie Cloud Workshop
2020	Build On Philippines 2020
2020	CompTIA Linux and Cybersecurity
2020	Shopee Code League
2019	CompTIA ITF+ Training Fundamentals of Information Technology

Listed in reverse chronological order (most recent first).

Curriculum Vitae of

ANGELO JOSE C. NULIAL

Villa De Lipa 2, Sabang Lipa City Blk. 4, Lot 22
gelonulial.3@gmail.com
+639276144421 / +639295920237

EDUCATIONAL BACKGROUND

Level	Inclusive Dates	Name of school/ Institution
Tertiary	2019 – Present	STI College Lipa
Senior High School	2017 – 2019	The Mabini Academy
Junior High School	2013 – 2017	The Mabini Academy
Elementary	2007 – 2013	The Mabini Academy

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
2019	Work Immersion Trainee	Honda HQ, Santo Tomas Batangas

Listed in reverse chronological order (most recent first).

AFFILIATIONS

Inclusive Dates	Name of Organization	Position

Listed in reverse chronological order (most recent first).

SKILLS

SKILLS	Level of Competency	Date Acquired
Programming	Beginner	2019

TRAININGS, SEMINARS OR WORKSHOP ATTENDED

Inclusive Dates	Title of Training, Seminar or Workshop
	N/A

Listed in reverse chronological order (most recent first).

Curriculum Vitae of

VINCE WARREN L. OÑATE

Blk. 37 Lot 3, Palmdale, Summer Hills, Bugtong na Pulo, Lipa
vincewarrenonate@gmail.com
09126425272

EDUCATIONAL BACKGROUND

Level	Inclusive Dates	Name of school/ Institution
Tertiary	2019-present	STI College Lipa
Senior High School	2017-2019	STI College Lipa
Junior High School	2013-2017	Infant Jesus Montessori Center Phils.
Elementary	2007-2013	Talinong Bulilit Bahay Iskwela

PROFESSIONAL OR VOLUNTEER EXPERIENCE

Inclusive Dates	Nature of Experience/ Job Title	Name and Address of Company or Organization
2019	Work Immersion Trainee	Nissan Lipa

Listed in reverse chronological order (most recent first).

AFFILIATIONS

Inclusive Dates	Name of Organization	Position
2017-2018	IT Club	Member

Listed in reverse chronological order (most recent first).

SKILLS

SKILLS	Level of Competency	Date Acquired
Programming	Mid-range	2017

TRAININGS, SEMINARS OR WORKSHOP ATTENDED

Inclusive Dates	Title of Training, Seminar or Workshop

N/A

Listed in reverse chronological order (most recent first).

APPENDIX F. INTERVIEW RESPONSES

Barangay Officials

Question 1: "What is your name?"

(Ano ang iyong pangalan?)

Answer: Melani Valdez

Question 2: "What is your position as a Brgy. Official?"

(Ano ang posisyion mo dito sa barangay?)

Answer: Councilors

Question 3: "Is there any crime that often happens in this Barangay? If so, what kinds of crime is it?"

(May mga krimen ba na nangyayari dito sa inyong lugar? Ano ang mga krimen na ito?)

Answer: Meron, pero bihira.

Question 4: "Do you often get informed if there are crimes that happened within the Barangay?" Why do you think that it happens in your barangay?

(Madalas ba na naipapaalam sa inyo kung may nangyaring krimen dito sa Inyong lugar? Sa tingin mo bakit nangyayari ito sa inyong lugar?)

Answer: Oo, pero minsan delay na ito naipaparating sa amin. Kung halimbawa holdup ito ay aksidente lamang.

Question 5: "If a crime ever happens, how ready are you to respond"

(Kung may krimen man na mangyari, gaano kayo kahanda para rumesponde?)

Answer: Merong nakahandang sasakyan at tanod na handa rumesponde.

Question 6: "As of fire, do fire emergency often occur here in your barangay? If so, how prepared are you to respond? Do you have plans as a barangay official so that if firefighters do not arrive immediately; you will be able to put out the fire?"

(Sa sunog naman, madalas ba may nangyayaring sunog sa dito sa inyong brgy.)

Answer: Hindi madalas, ipapaalam agad sa kinauukulan. Meron plano, ang pagtutulong-tulong upang kahit papano ay maapula ang apoy.

Question 7: "Do have an internet connection?"

(May internet ba kayo?)

Answer: Meron

Question 8: "How fast is your internet connection?"

(Gaano kabilis ang internet nyo?)

Answer: Kung sa Brgy. 35mpbps / sa bahay ay mobile data

Question 9: "As part of the barangay officers, if an application is made for you to receive an information of emergency victims here in your barangay, are you willing to use this application?"

(Bilang isa sa mga opisyales ng brgy, kung makakagawa ng application upang tumanggap ng mga impormasyon ng mga biktima ng emergency dito sa inyong brgy, handa ba kayo na gamitin ang application na ito?)

Answer: Palagay ko pwede naman.

Question 10: "If you were to choose between voice recognition feature and fire detector, what would you choose and why?"

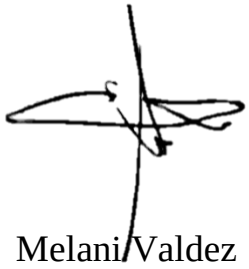
(Kung papipiliin ka sa pagitan ng voice recognition at fire detector, anong sa tingin mo ang makakatulong sa inyo at bakit?)

Answer: Lahat

Question 11: "Do you think it will help your barangay? And why?"

(Sa tingin mo, malaki ba ang maitutulong nito sa Brgy. niyo? At bakit?)

Answer: Oo, dahil tulad ng nangyaring holdup bandang 4am ng umaga wala agad makapagreport ng nangyaring aksindete.



Melani Valdez

Signature Over Printed Name

Storeowners

Question 1: "What is your name?"

(Ano ang iyong pangalan?)

Answer: Rica Javier

Question 2: "How long are you selling and/or managing this store?"

(Gaano na kayo katagal nagtitinda o namamahala ng tindahan na ito?)

Answer: 18 years

Question 3: "*During your time as a seller or store manager, have you ever experienced thefts or holdup? How often have you experienced this?"*

(Sa tagal niyo nang nagtitinda o namamhala ng tindahan, nakaranas na ba kayo ng mga pagnanakaw o panghoholdap? Gaano kadalas na kayo nakaranas nito?)

Answer: Hindi

Question 4: "If there was a robbery that happened, do you have someone to call such as tanod or barangay officials to report the crime immediately and to seek immediate help, if so, what are they? And if you experienced this, does the barangay official is quick to respond?"

(Kung may pagnanakaw mang nangyari, may matatawagan ba kayong tanod o brgy. officials para mareport agad ang krimen para makahingi agad ng agarang tulong? Kung meron ano ang mga ito? At kung nakaranas ka na Mabilis ba sila rumesponde?)

Answer: Meron naman

Question 5: "As of fire, do fire emergency often occur here in your barangay? If so, how prepared are you to respond? Do you have plans as a barangay official so that if firefighters do not arrive immediately; you will be able to put out the fire?"

(Sa sunog naman, madalas ba may nangyayaring sunog sa dito sa inyong brgy.)

Answer: Sa tingin ko madalang lang magkaron ng sunog

Question 6: "Do have an internet connection?"

(May internet ba kayo?)

Answer: Meron

Question 7: "How fast is your internet connection?"

(Gaano kabilis ang internet nyo?)

Answer: Nasa 20 mbps

Question 8: "If an Emergency Response System is made to speed up emergency response and to report a crime or fire immediately, would you be willing to use this system?"

(Kung makakagawa ng Emergency Response System upang mapabilis ang pag responde sa oras ng kagipitan at para maireport agad ang nangyaring krimen o sunog, papayag ba kayo na gamitin ang system na ito?)

Answer: Oo

Question 9: "If you were to choose between voice recognition feature and smoke sensor to detect fire, what would you choose and why?"

(Kung papipiliin ka sa pagitan ng voice recognition at smoke sensor gamit sa pagtukoy ng sunog, anong sa tingin mo ang makakatulong sa inyo at bakit?)

Answer: Lahat

Question 10: "Do you think it will help your store? And why?"

(Sa tingin mo, malaki ba ang maitutulong nito sa tindahan niyo? At bakit?)

Answer:

Rica Javier

Signature Over Printed Name

Storeowners

Question 1: "What is your name?"

(Ano ang iyong pangalan?)

Answer: Louisa Panoso

Question 2: "How long are you selling and/or managing this store?"

(Gaano na kayo katagal nagtitinda o namamahala ng tindahan na ito?)

Answer: 46 years

Question 3: "*During your time as a seller or store manager, have you ever experienced thefts or holdup? How often have you experienced this?"*

(Sa tagal niyo nang nagtitinda o namamhala ng tindahan, nakaranas na ba kayo ng mga pagnanakaw o panghoholdap? Gaano kadalas na kayo nakaranas nito?)

Answer: Hindi pa pero nakasaksi na ng holdup

Question 4: "If there was a robbery that happened, do you have someone to call such as tanod or barangay officials to report the crime immediately and to seek immediate help, if so, what are they? And if you experienced this, does the barangay official is quick to respond?"

(Kung may pagnanakaw mang nangyari, may matatawagan ba kayong tanod o brgy. officials para mareport agad ang krimen para makahingi agad ng agarang tulong? Kung meron ano ang mga ito? At kung nakaranas ka na Mabilis ba sila rumesponde?)

Answer: Wala pang experience, pero meron namang matatawagan

Question 5: "As of fire, do fire emergency often occur here in your barangay? If so, how prepared are you to respond? Do you have plans as a barangay official so that if firefighters do not arrive immediately; you will be able to put out the fire?"

(Sa sunog naman, madalas ba may nangyayaring sunog sa dito sa inyong brgy.)

Answer: Hindi madalas, meron namng matatawagan ngunit matagal

Question 6: "Do have an internet connection?"

(May internet ba kayo?)

Answer: Meron

Question 7: "How fast is your internet connection?"

(Gaano kabilis ang internet nyo?)

Answer: Medyo mabilis

Question 8: "If an Emergency Response System is made to speed up emergency response and to report a crime or fire immediately, would you be willing to use this system?"

(Kung makakagawa ng Emergency Response System upang mapabilis ang pag responde sa oras ng kagipitan at para maireport agad ang nangyaring krimen o sunog, papayag ba kayo na gamitin ang system na ito?)

Answer: Oo

Question 9: "If you were to choose between voice recognition feature and smoke sensor to detect fire, what would you choose and why?"

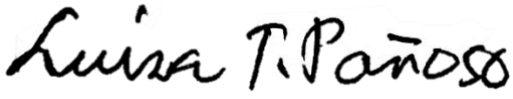
(Kung papipiliin ka sa pagitan ng voice recognition at smoke sensor gamit sa pagtukoy ng sunog, anong sa tingin mo ang makakatulong sa inyo at bakit?)

Answer: Sa tingin ko parehas

Question 10: "Do you think it will help your store? And why?"

(Sa tingin mo, malaki ba ang maitutulong nito sa tindiahan niyo? At bakit?)

Answer: Oo, para mabilis mabilis ang pagresponde.



Lousia Pañoso

Signature Over Printed Name

Homeowners

Question 1: "What is your name?"

(Ano ang iyong pangalan?)

Answer: Lolita De Castro

Question 2: "How long have you been living here?"

(Gaano na kayo katagal na nakatira sa dito?)

Answer: 15 years

Question 3: "*During your time living here, have you ever experienced thefts or holdup? How often have you experienced this? And do have relative or acquaintances who have been a victim of it?"*

(Sa tagal niyo nang nakatiradito, nakaranas na ba kayo ng mga pagnanakaw o panghoholdap? Gaano kadalas na kayo nakaranas nito? At may mga kamaganak o kakilala ba kayo na nabiktima na nito?)

Answer: Wala pa

Question 4: "If there was a robbery that happened, do you have someone to call such as tanod or barangay officials to report the crime immediately and to seek immediate help, if so, what are they? And if you experienced this, does the barangay official is quick to respond?"

(Kung may pagnanakaw mang nangyari, may matatawagan ba kayong tanod o brgy. officials para mareport agad ang krimen para makahingi agad ng agarang tulong? Kung meron ano ang mga ito? At kung nakaranas ka na, mabilis ba sila rumesponde?)

Answer: Wala pa

Question 5: "As of fire, do fire emergency often occur here in your barangay? If so, how prepared are you to respond? Do you have plans as a barangay official so that if firefighters do not arrive immediately; you will be able to put out the fire?"

(Sa sunog naman, madalas ba may nangyayaring sunog sa dito sa inyong brgy.)

Answer: Madalang po pero may matatawagan naman

Question 6: "Do have an internet connection?"

(May internet ba kayo?)

Answer: Mobile data lang

Question 7: "How fast is your internet connection?"

(Gaano kabilis ang internet nyo?)

Answer: Sakto lang

Question 8: "If an Emergency Response System is made to speed up emergency response and to report a crime or fire immediately, would you be willing to use this system?"

(Kung makakagawa ng Emergency Response System upang mapabilis ang pag responde sa oras ng kagipitan at para maireport agad ang nangyaring krimen o sunog, papayag ba kayo na gamitin ang system na ito?)

Answer: Opo

Question 9: "If you were to choose between voice recognition feature and smoke sensor to detect fire, what would you choose and why?"

(Kung papipiliin ka sa pagitan ng voice recognition at smoke sensor gamit sa pagtukoy ng sunog, anong sa tingin mo ang makakatulong sa inyo at bakit?)

Answer: Parehas po

Question 10: "Do you think it will help your home? And why?"

(Sa tingin mo, malaki ba ang maitutulong nito sa tahanan niyo? At bakit?)

Answer:

Lolita De Castro

Signature Over Printed Name

Homeowners

Question 1: "What is your name?"

(Ano ang iyong pangalan?)

Answer: Roldan Dina

Question 2: "How long have you been living here?"

(Gaano na kayo katagal na nakatira sa dito?)

Answer: 43 years

Question 3: "*During your time living here, have you ever experienced thefts or holdup? How often have you experienced this? And do have relative or acquaintances who have been a victim of it?"*

(Sa tagal niyo nang nakatiradito, nakaranas na ba kayo ng mga pagnanakaw o panghoholdap? Gaano kadalas na kayo nakaranas nito? At may mga kamaganak o kakilala ba kayo na nabiktima na nito?)

Answer: Hindi pa, pero meron ng nangyaring holdup malapit dito sa aming tirahan

Question 4: "If there was a robbery that happened, do you have someone to call such as tanod or barangay officials to report the crime immediately and to seek immediate help, if so, what are they? And if you experienced this, does the barangay official is quick to respond?"

(Kung may pagnanakaw mang nangyari, may matatawagan ba kayong tanod o brgy. officials para mareport agad ang krimen para makahingi agad ng agarang tulong? Kung meron ano ang mga ito? At kung nakaranas ka na Mabilis ba sila rumesponde?)

Answer: Meron, mga tanod

Question 5: "As of fire, do fire emergency often occur here in your barangay? If so, how prepared are you to respond? Do you have plans as a barangay official so that if firefighters do not arrive immediately; you will be able to put out the fire?"

(Sa sunog naman, madalas ba may nangyayaring sunog sa dito sa inyong brgy.)

Answer: Madalang lang, kung may ganitong pangyayari maitatakbo na lang sa barangay.

Question 6: "Do have an internet connection?"

(May internet ba kayo?)

Answer: Meron, mobile data

Question 7: "How fast is your internet connection?"

(Gaano kabilis ang internet nyo?)

Answer: Dipende sa panahon

Question 8: "If an Emergency Response System is made to speed up emergency response and to report a crime or fire immediately, would you be willing to use this system?"

(Kung makakagawa ng Emergency Response System upang mapabilis ang pag responde sa oras ng kagipitan at para maireport agad ang nangyaring krimen o sunog, papayag ba kayo na gamitin ang system na ito?)

Answer: Sa palagay ko pwede

Question 9: "If you were to choose between voice recognition feature and smoke sensor to detect fire, what would you choose and why?"

(Kung papipiliin ka sa pagitan ng voice recognition at smoke sensor gamit sa pagtukoy ng sunog, anong sa tingin mo ang makakatulong sa inyo at bakit?)

Answer: Parehas

Question 10: "Do you think it will help your home? And why?"

(Sa tingin mo, malaki ba ang maitutulong nito sa tahanan niyo? At bakit?)

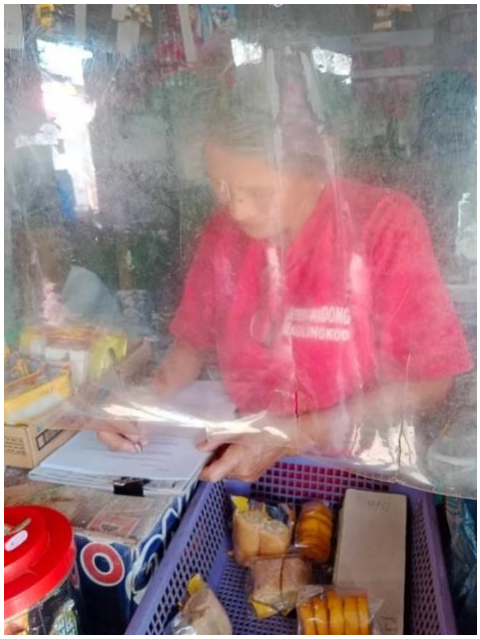
Answer:

Roldan Diña

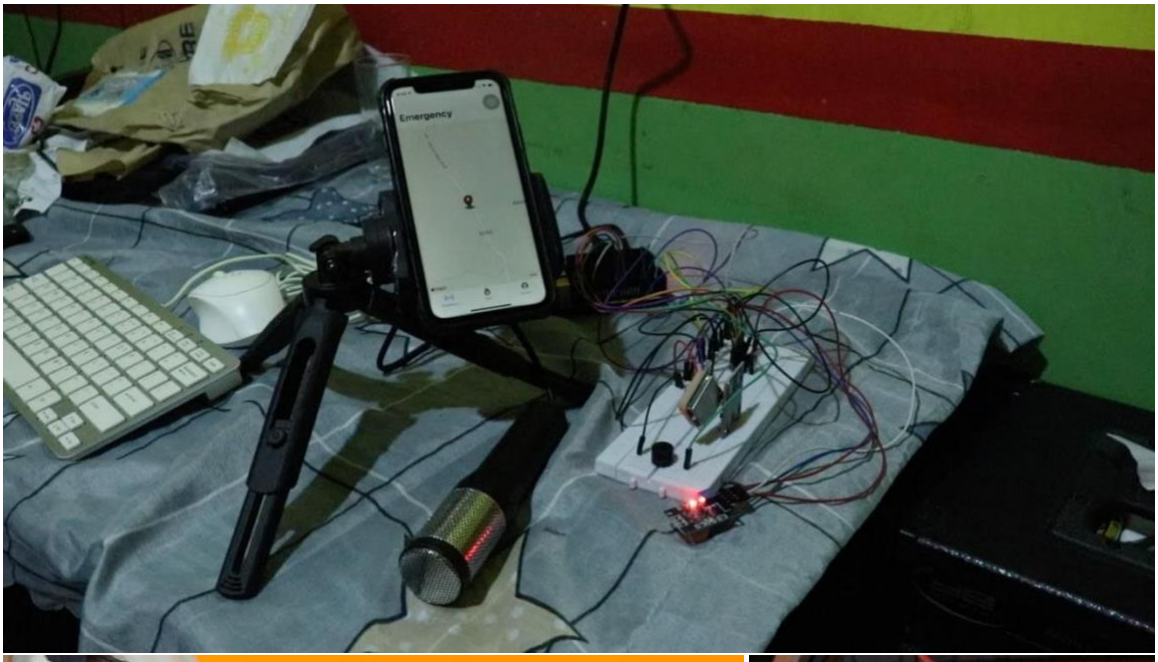
Signature Over Printed Name

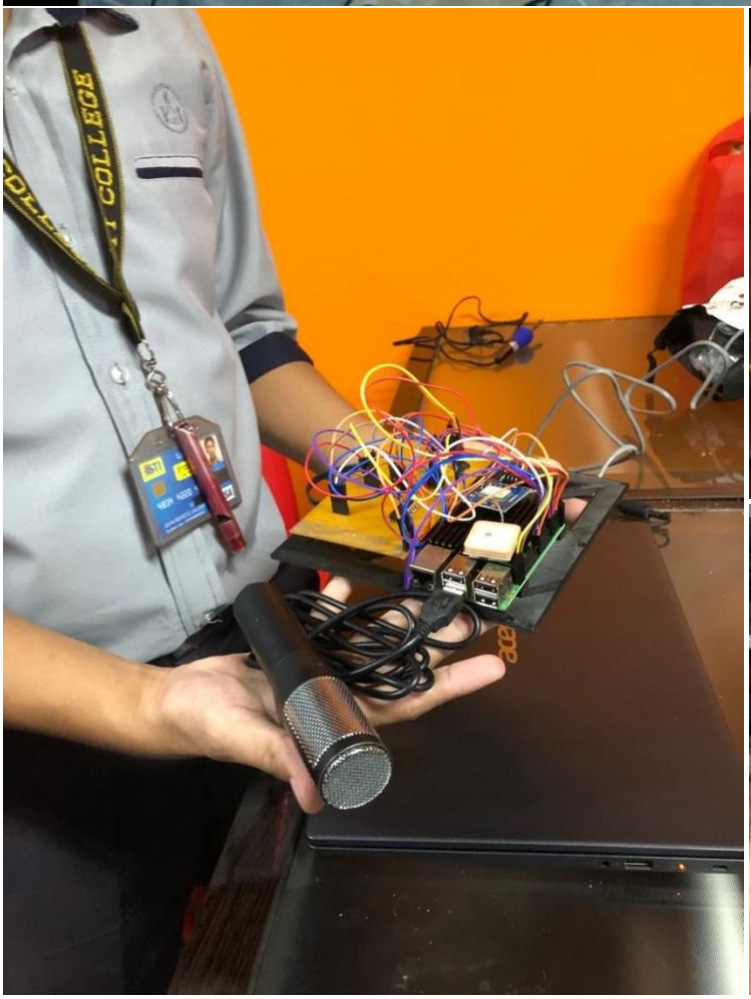
Interview Summary

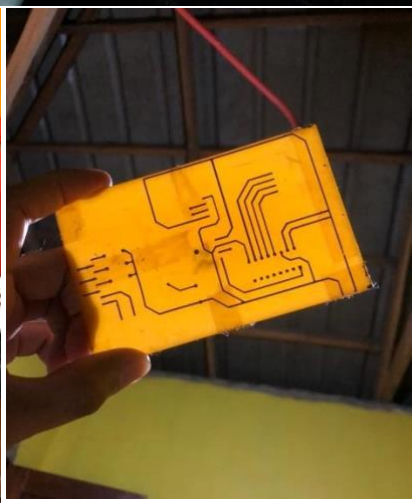
According to the interview that was given to homeowners, storeowners, and barangay officials, some of them have claimed that they have been a witness to people committing theft near their homes. If there is an emergency, there are responders that are ready to be deployed. Their problem is that there is a delay when it comes to the response of barangay officials. Another information about the responders is that their internet speed differs from one another. Some have stated that they have a strong internet connection, some have moderate speeds, and others use mobile data instead. When asked about fire emergencies, they have stated that it is uncommon for Tulay, Ibaan to experience fire. Their main problem however is that the fire department takes too long before they even reach the area of the emergency, so the barangay officials have to rely on the help of the nearby residents just to put out the fire. Upon being asked if they were to use the application that the developers would make, their response is that they would all use it. When it comes to asking if they would prefer to have voice recognition or smoke sensor to detect fire, they stated that having both would be much more useful rather having only one or the other. Lastly, most of the interviewed people have said that the capstone design that the developers have made would be a useful tool in order to maintain safety and grant them faster responses. The barangay official has also stated that with the help of the capstone design, criminal activities that occurs during nighttime would also be reduced.



APPENDIX G. PROTOTYPE


Emergency


COLLEGE

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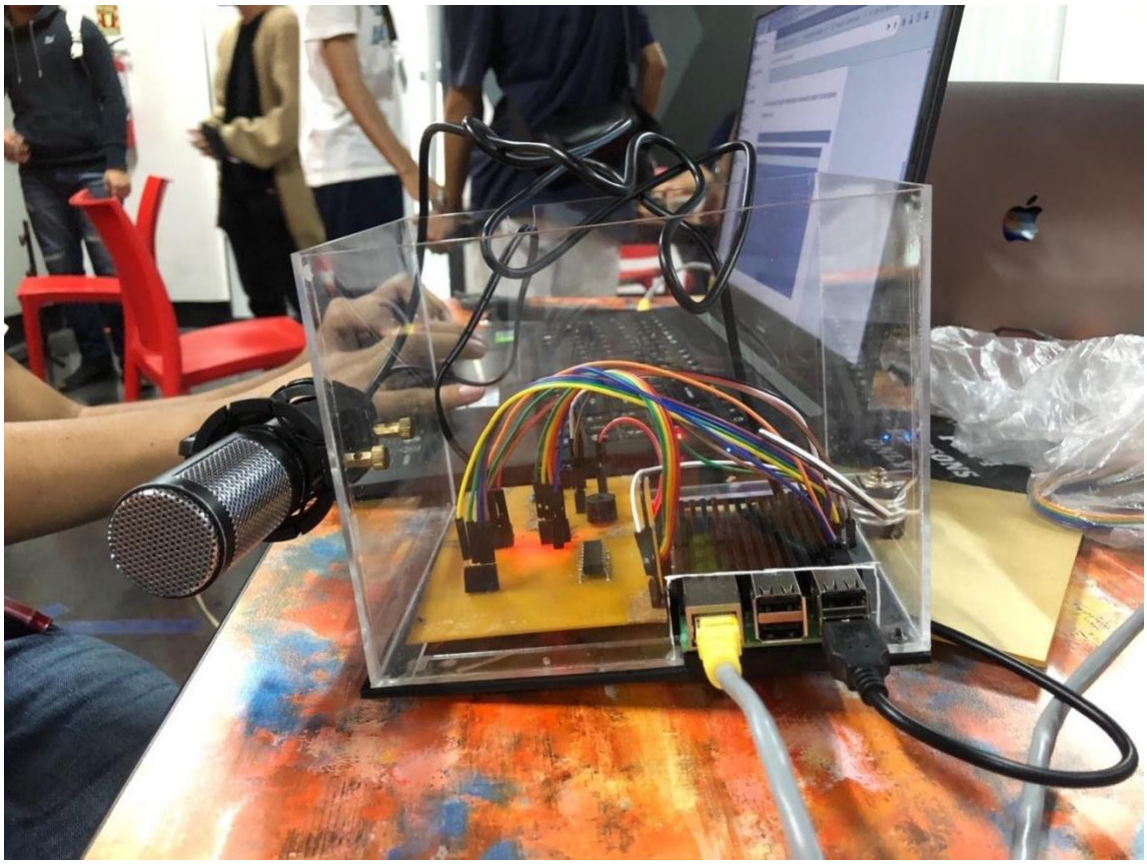
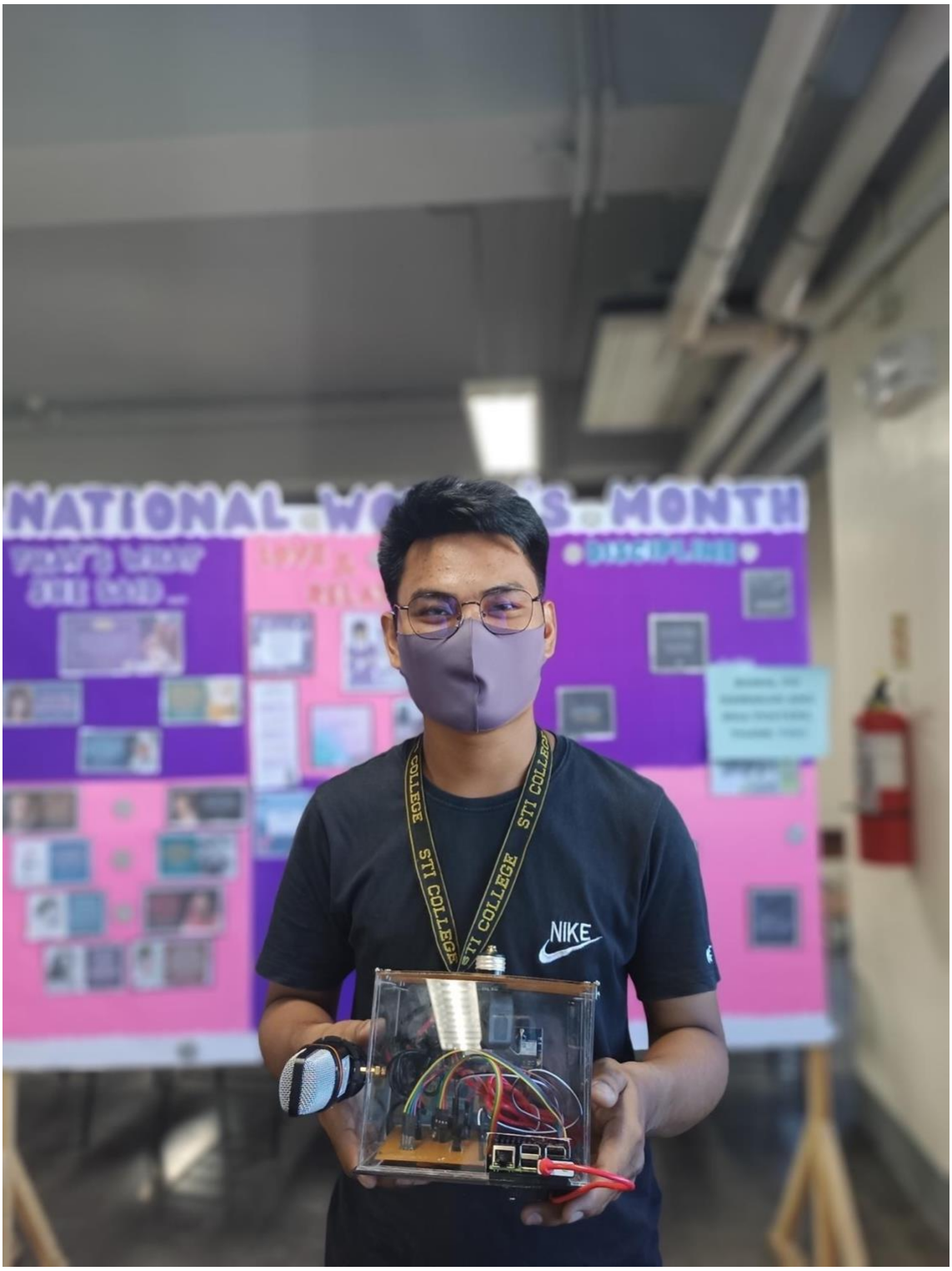
WE COULD
ALERT
RESPONDERS
WITH OUR
VOICE

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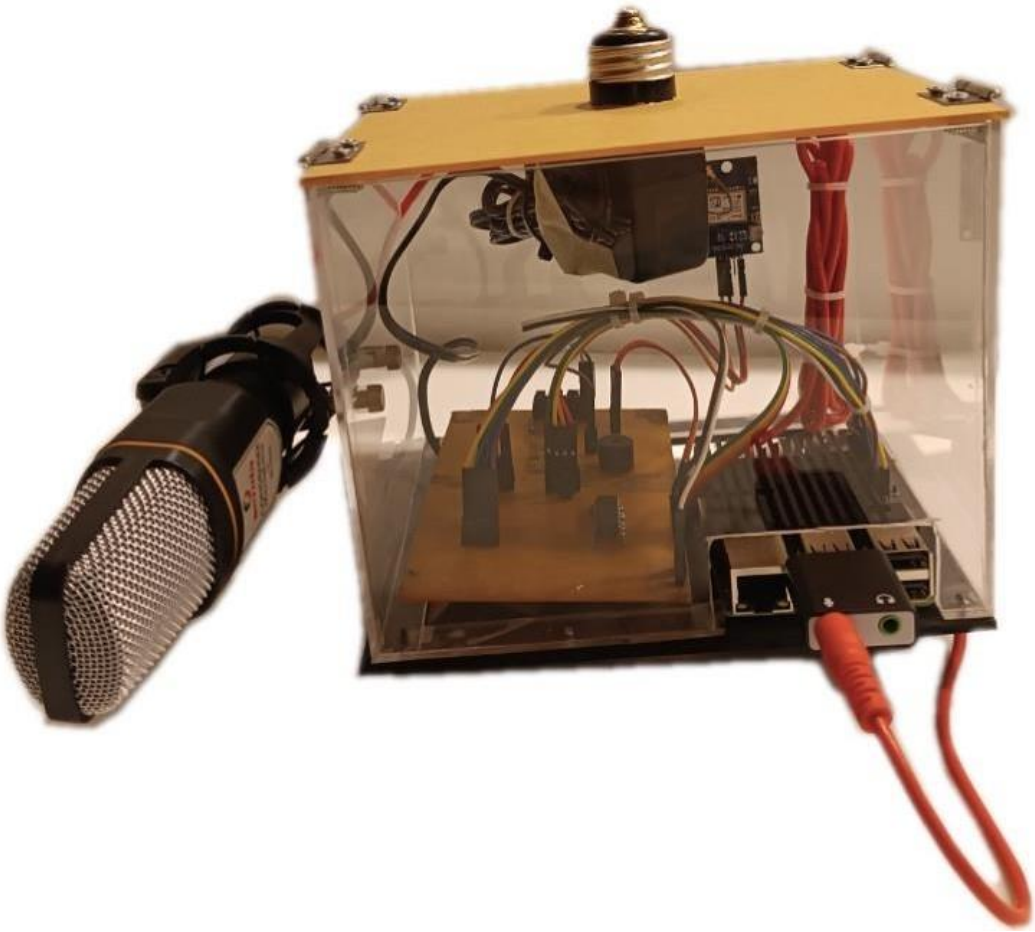


APPENDIX H. BENEFICIARY


STI COLLEGE


STI COLLEGE

According to the 5 Beneficiaries:

Maganda sya. Sa tingin ko makakatulong ito lalo na pag may biglaang aksidente o emergency na kailangan agad ng mag reresponde. Maganda din yung pag kakagawa kaaya aya sa paningin.

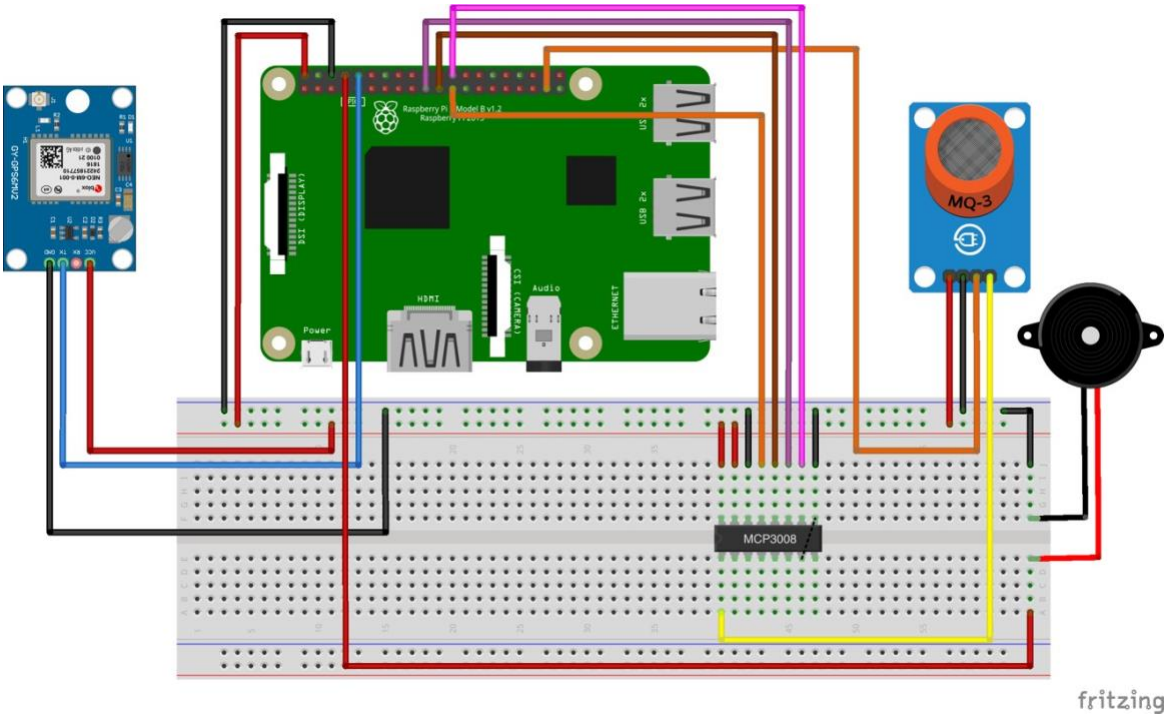
Brgy. President:

Good Job! Maganda. Ayos yung ganitong imbensyon lalo na kung makakatulong sa ating mga nasasakupan sa ating Brgy. para lalong mapabilis ang pag dating at pag responde ng ating mga responders sa mga tao na nangangailangan ng biglaang tulong,

Secretary's Recommendation:

Maganda sya pero recommend ko na medyo gawan sana ng medyo mas maliit pa na case ito, para kapag nakakabit ay hindi masyadong nakakadistract. Pero maganda talaga tong naisip nyong project good job!

APPENDIX I. CIRCUIT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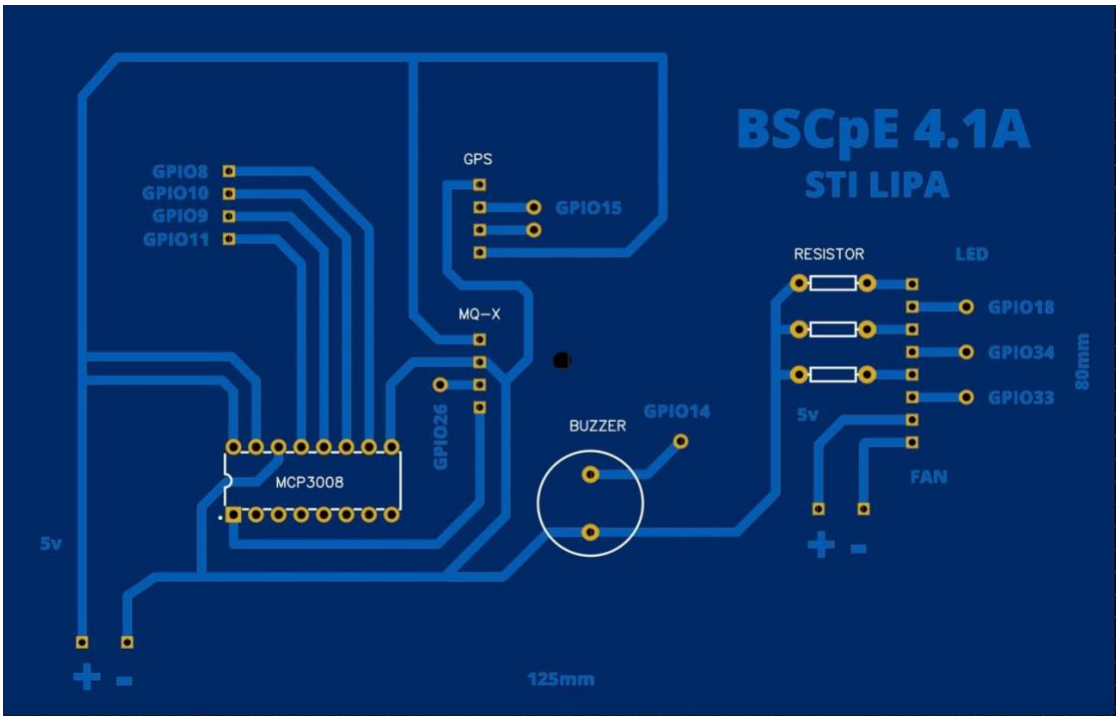
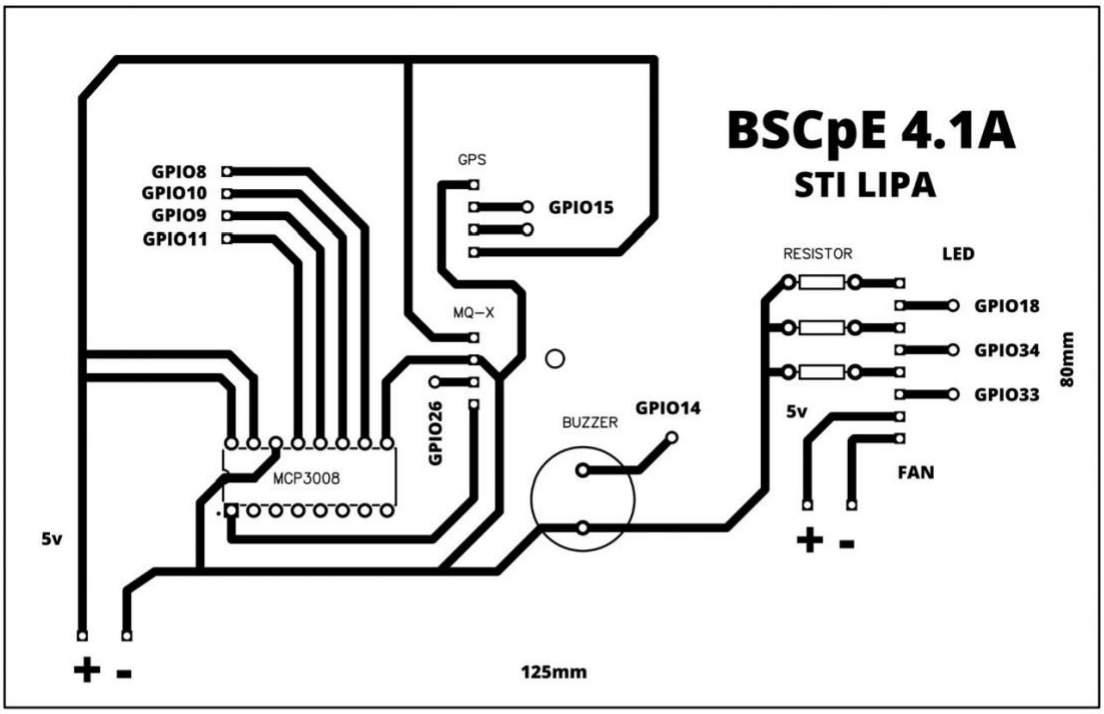
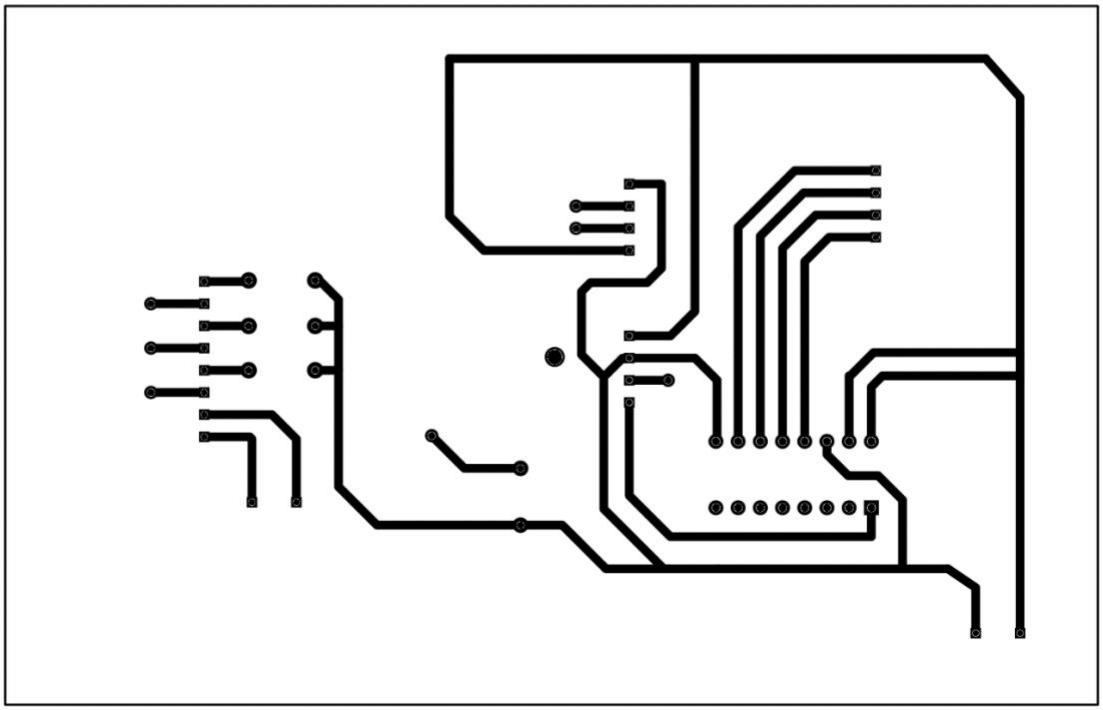
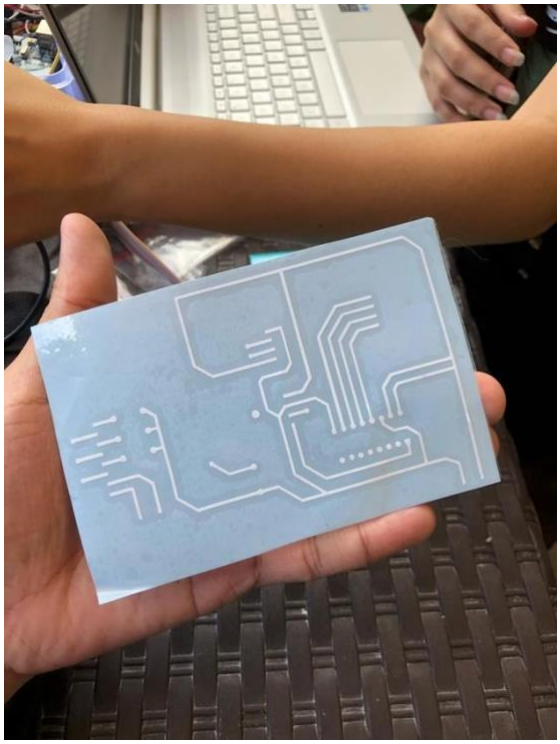
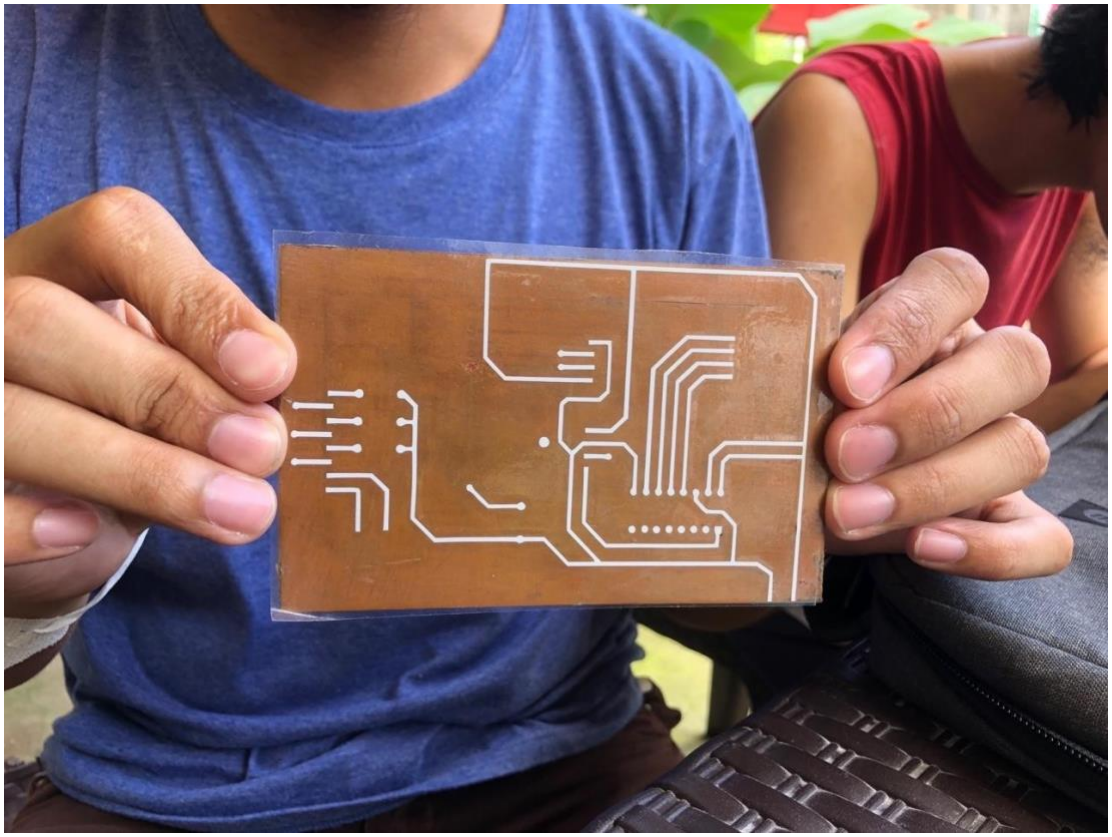
MCP3008
fritzing

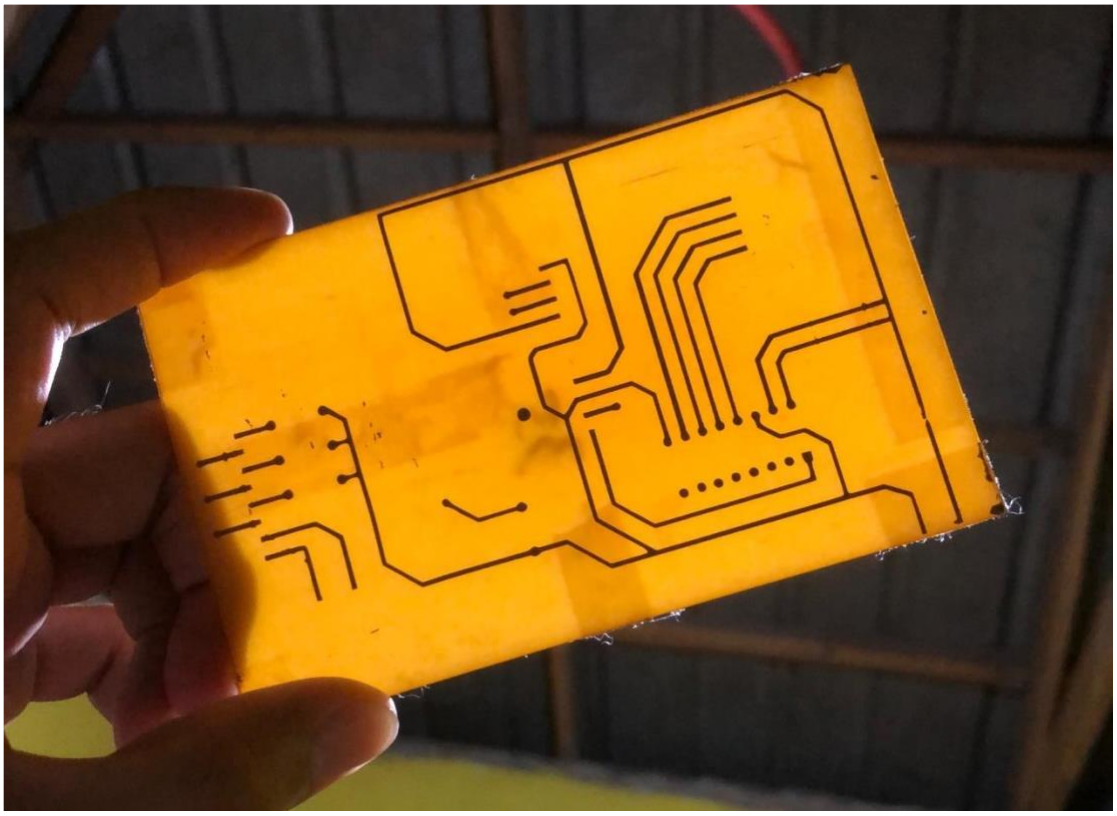

BSCpE 4.1A
STI LIPA
GPIO8
GPIO10
GPIO9
GPIO11
GPS
GPIO15
MQ-X
GPIO26
MCP3008
BUZZER
GPIO14
RESISTOR
LED
GPIO18
GPIO34
GPIO33
5v
FAN
80mm
125mm

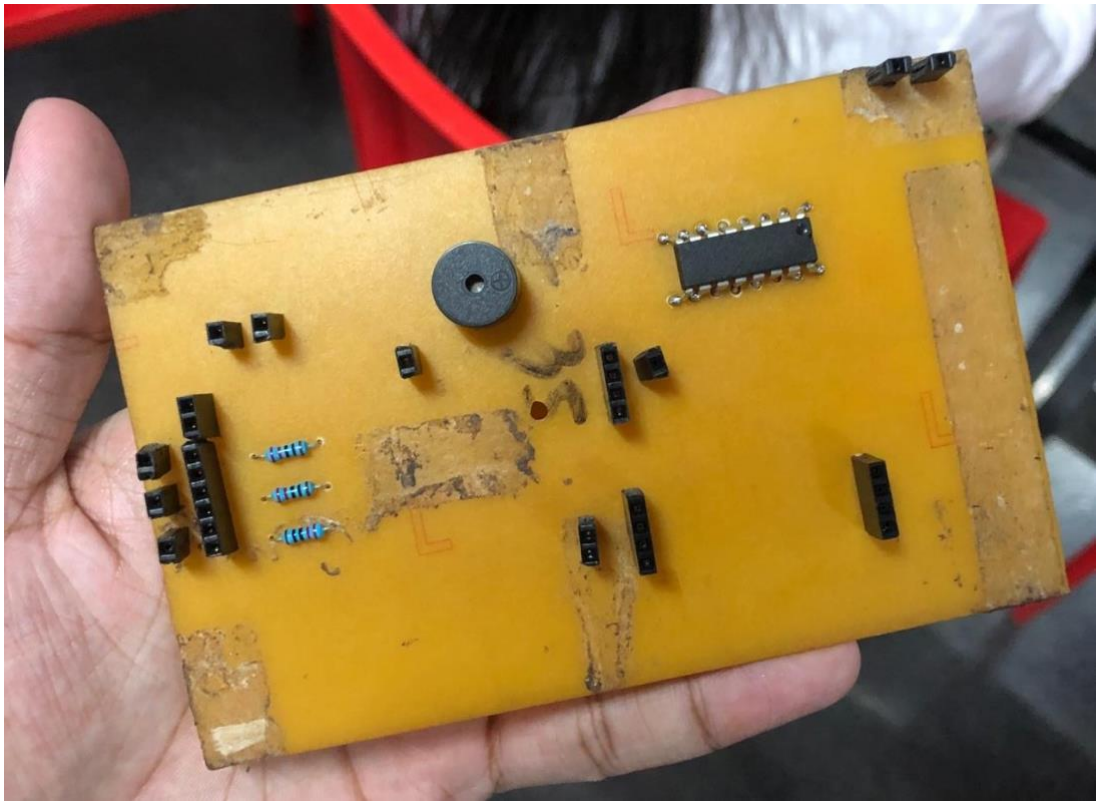

BSCpE 4.1A
STI LIPA
GPIO8
GPIO10
GPIO9
GPIO11
GPS
GPIO15
MQ-X
GPIO26
MCP3008
BUZZER
GPIO14
RESISTOR
LED
GPIO18
GPIO34
GPIO33
5v
FAN
5v
+ -
+ -
125mm
80mm



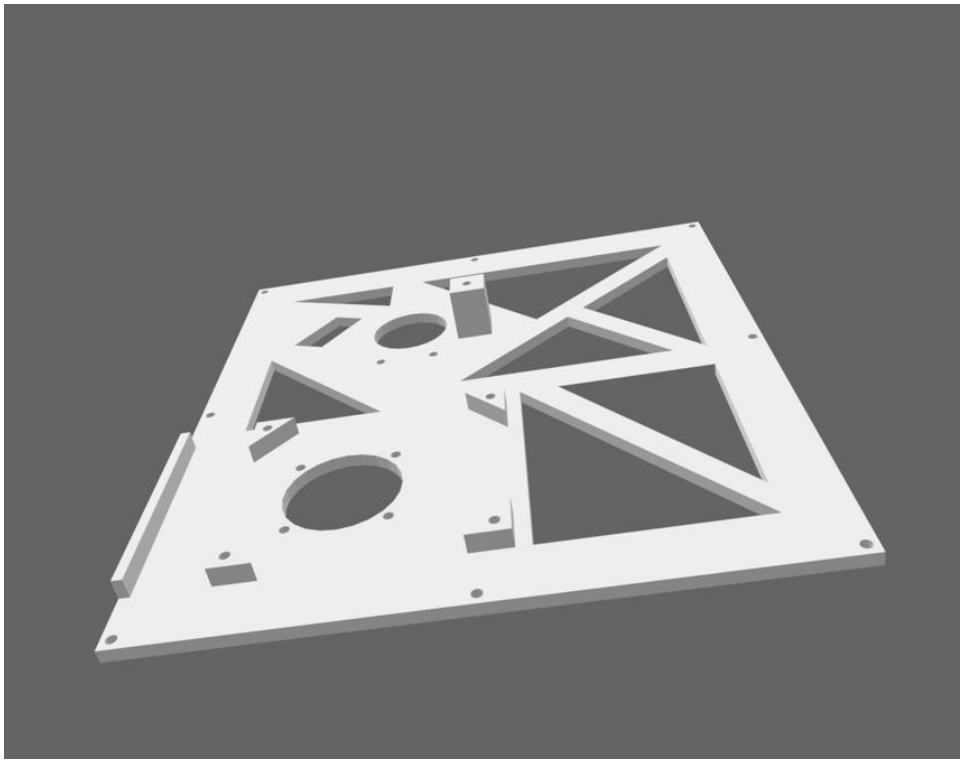


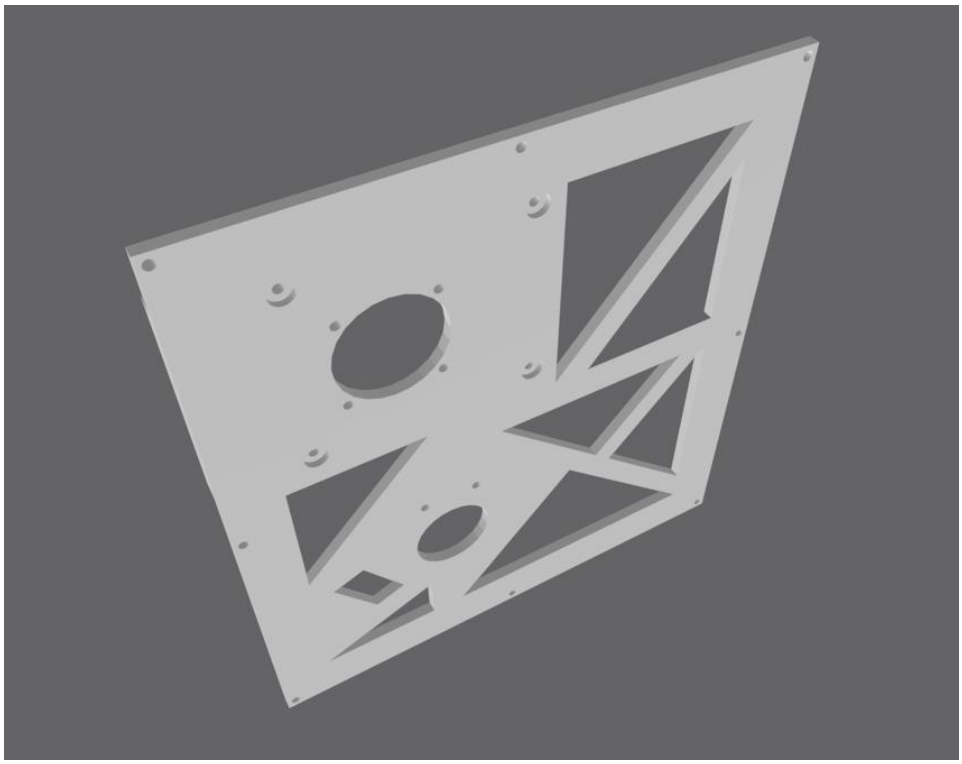






APPENDIX J. 3D PRINTING





APPENDIX K. SYSTEM CODE

```
import serial
import time
import string
import pynmea2
import sys
import RPi.GPIO as GPIO
import threading
import os
import urllib.request as url
import speech_recognition as sr
from datetime import date
from gpiozero import LED
from time import sleep

def start():
    Thread1 = threading.Thread(target=function_1)
    Thread2 = threading.Thread(target=function_2)
    Thread3 = threading.Thread(target=function_3)

    Thread1.start()
    Thread2.start()
    Thread3.start()

    Thread1.join()
    Thread2.join()
    Thread3.join()

def gps():
    while True:
        port="/dev/ttyAMA0"
        ser=serial.Serial(port, baudrate=9600, timeout=0.5)
        dataout = pynmea2.NMEAStreamReader()
        newdata=ser.readline().decode('unicode_escape')

        if newdata[0:6] == "$GPRMC":
            newmsg=pynmea2.parse(newdata)
            lat=newmsg.latitude
            lng=newmsg.longitude

            if lat != 0 and lng != 0:
                file1 = open("lastknown_lat.txt","w")
                file1.write(str(lat))
                file1.close()
                file2 = open("lastknown_lon.txt","w")
                file2.write(str(lng))
                file2.close()
```

```
def buzzer():
   triggerPIN = 14
   GPIO.setmode(GPIO.BCM)
   GPIO.setup(triggerPIN,GPIO.OUT)
   buzzer = GPIO.PWM(triggerPIN, 1000)
   buzzer.start(10)
   time.sleep(5)

SPICLK = 11
SPIMISO = 9
SPIMOSI = 10
SPICS = 8
mq2_dpin = 26
mq2_apin = 0

def init():
        GPIO.setwarnings(False)
        GPIO.cleanup()
        GPIO.setmode(GPIO.BCM)

        GPIO.setup(SPIMOSI, GPIO.OUT)
        GPIO.setup(SPIMISO, GPIO.IN)
        GPIO.setup(SPICLK, GPIO.OUT)
        GPIO.setup(SPICS, GPIO.OUT)
        GPIO.setup(mq2_dpin,GPIO.IN,pull_up_down=GPIO.PUD_DOWN)

def readadc(adcnum, clockpin, mosipin, misopin, cspin):
        if ((adcnum > 7) or (adcnum < 0)):
                return -1
        GPIO.output(cspin, True)

        GPIO.output(clockpin, False)
        GPIO.output(cspin, False)

        commandout = adcnum
        commandout |= 0x18
        commandout <<= 3
        for i in range(5):
                if (commandout & 0x80):
                        GPIO.output(mosipin, True)
                else:
                        GPIO.output(mosipin, False)
                commandout <<= 1
                GPIO.output(clockpin, True)
                GPIO.output(clockpin, False)

        adcout = 0

        for i in range(12):
```

```
            GPIO.output(clockpin, True)
            GPIO.output(clockpin, False)
            adcout <<= 1
            if (GPIO.input(misopin)):
                adcout |= 0x1

        GPIO.output(cspin, True)

        adcout >>= 1
        return adcout

def main():
        init()
        print("Configuring Smoke Sensor...")
        time.sleep(20)

        config_smoke_sensitivity = open("smoke_sensitivity.txt","r+")
        smoke_sensitivity = float(config_smoke_sensitivity.read());
        while True:
                COlevel = readadc(mq2_apin, SPICLK, SPIMOSI, SPIMISO, SPICS)
                time.sleep(1)
                smokeLevel = (COlevel / 1024.)*3.3
                print("Smoke Level: " + str(smokeLevel))
                if (smokeLevel > smoke_sensitivity):
                   sendAlert('fire')
                   buzzer()

def mq3():
   if __name__ =='__main__':
        try:
                main()
                pass
        except KeyboardInterrupt:
                pass

def sendAlert(marker):
   file1 = open("lastknown_lat.txt","r+")
   file2 = open("lastknown_lon.txt","r+")
   lat = file1.read()
   lon = file2.read()
   description = ("Aling Puring Store RPI-IERS").replace(" ", "%20" )

   threading.Timer(600,sendAlert).start()

   server = ""
   fileActiveServer = open("active_server.txt","r+")
   activeServerNum = int(fileActiveServer.read())

   print(activeServerNum)
```

```
    if (activeServerNum == 1):
        server = "http://192.168.1.201:8888/"
    elif (activeServerNum == 2):
        server = "http://bscpestilipa.000webhostapp.com/"
    print(server)
    marker = marker.replace(" ", "%20" )
    stream = url.urlopen(server +
"iers/send_emergency.php/?latitude="+lat+"&longitude="+lon+"&description="+description+"
&device=RPI-IERS&marker="+marker)
    content = stream.read()
    print(content)

def speech():
    r = sr.Recognizer()
    mic = sr.Microphone()

    print("---------Speech Recognition---------")

    while True:
        with mic as source:
            audio = r.adjust_for_ambient_noise(source)
            audio = r.listen(source)

        try:
            result = r.recognize_google(audio, language="fil-PH")
            print(result)

            if "sunog" in result:
                buzzer()
                sendAlert('fire')
                print("Emergency: Fire")

            elif "holdap" in result:
                buzzer()
                sendAlert('armed attack')
                print("Emergency: Armed Attack.")

            elif "tulong" in result and "holdap" in result :
                buzzer()
                sendAlert('armed attack')
                print("Emergency: Armed Attack.")

            elif "tulong" in result and "holdaper" in result :
                buzzer()
                sendAlert('armed attack')
                print("Emergency: Armed Attack.")

            elif "holdap" in result and "to" in result :
```

```
            buzzer()
            sendAlert('armed attack')
            print("Emergency: Armed Attack.")

        elif "tulong" in result and "sunog" in result :
            buzzer()
            sendAlert('armed attack')
            print("Emergency: Armed Attack.")

        elif "tulong" in result and "rapist" in result :
            buzzer()
            sendAlert('armed attack')
            print("Emergency: Armed Attack.")

        elif "rapist" in result :
            buzzer()
            sendAlert('armed attack')
            print("Emergency: Armed Attack.")

        elif "tulong" in result and "magnanakaw" in result :
            buzzer()
            sendAlert('armed attack')
            print("Emergency: Armed Attack.")

        elif "tulong" in result and "carnapper" in result :
            buzzer()
            sendAlert('armed attack')
            print("Emergency: Armed Attack.")

    except sr.UnknownValueError:
        print("The Voice was not recognize!")
        continue
    except sr.RequestError:
        print("RequestError!")
        print(sr.RequestError)
        continue

def function_1():
    gps()

def function_2():
    mq3()

def function_3():
    speech()

start()

GPIO.cleanup()
```

APPENDIX L. STI LIPA COLLEGE FAIR

APPENDIX M. WORLD TRADE CENTER PACKETHACKS

packetHACKS Finalists details Inbox ×

Redwizards Phils Jun 3, 2023, 11:43 AM

to bcc: me

Congratulations for making it to the next round!
To move forward, we would like to request each team to please fill out the form below :

PACKETHACKS FINALIST INFORMATION

Hope you can fill this out the soonest possible time so we can send you the packetduino the soonest possible time.

You can also specify the sizes for t he hoodie as considering those who are small and big in sizes,

We will send another email regarding your bootcamp and mentoring session

FOR THE MEAN TIME JOIN PACKETHACKS VIBER GROUP for quick update, announcements and concerns.

Thank you and Goodluck!

Elaine Cedillo
Hackmaster
packetHACKS

APPENDIX N. PRESENTATION

Research Methods Capstone Proposal - June 17, 2022

Capstone 2 Final Defense - June 3, 2023

APPENDIX O. DEMO

https://www.youtube.com/watch?v=l5mJAsWXuxQ