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# CHAPTER I

# THE PROBLEM AND ITS BACKGROUND

### INTRODUCTION

Philippines has a vast history about natural disasters. In a way or another, disasters help shape our country as it is now. Because the damage dealt is almost unpredictable, natural disasters always leave people devastated surroundings. Especially when strong storms and earthquakes hit the country, fatalities may be found at worst case scenario. There are always casualties being reported in the news every time a strong storm will pass by. There are also people being trapped in their respective homes, causing them to be suffocated and to lose their life. The rescuers could not find them because the drabbles caused by these disasters are blocking the way. In reaction to this, people used technology to its maximum potential to help them in these kinds of possibilities. For example, there are mobile applications that can detect a person if he’s trapped underneath a collapsed building. There are also prototypes of amphibian rescue boats that can be used in immediate rescue missions. But these solutions may not be really practical in life-threatening situations. Mobile applications require the user to use their device, and in real-time disasters people just don’t have time to unlock their phone while everything around them is in chaos. Mobile phones also have the power supply issue. Unless the victim has multiple power banks, their devices won’t last even a day. The researchers studied the scenarios very well, and brainstormed to create a solution that will help these people. This led the researchers to create Help Box: A Life and Body Locator System through a Designed TV Box and Mobile Application for Post-Disaster Rescue Mission in a City. The prototype is a small box that looks like a Television Box. It is made compact so that it can fit almost anywhere. Help Box can help the respondents to send signal to a rescue organizations and it will also help the rescuers locate the respondents. The prototype has a GPS Module and 2.4 GHz Transmitter. Using the device that will be called the Help Box, rescuers can locate victims using GPS and 2.4 GHz Transmitter. The researchers believe that by creating this device, casualties caused by natural disasters will significantly decrease.

### BACKGROUND OF THE STUDY

The study will use the model of a TV Box. Because it is small, the device can be placed anywhere, but the researchers will suggest the proponents to place the Life box to a convenient place. For example, they can place it near their TV Box. When it’s raining hard, people tend to shut off their Televisions because it might get damaged if the lightning hit the antenna. If they placed the Help Box near the TV Box, then they will be able to remember to press it when flood starts to elevate in a critical level. The proponents used GPS and 2.4 Ghz RF Transmitter as the primary features of the box. When the button was pressed, the Help Box will send a signal via SMS to the Central Command of the Rescue system, where they can see the location of the box because of the GPS Transmitter. When the command to rescue the victims were given, the rescuers will go to the location of the signal. With the help of the 2.4 GHz transmitter, the rescuers will be able to identify the location of the box more accurately.

### STATEMENT OF THE PROBLEM

The researchers aim to create a Life and Body Locator Device that will send data to help the respondents be rescued. By using the prototype, the researchers’ goal is to decrease casualties in times of disaster by locating victims who sent the distress signal. Because the researchers aim to create a device that is easily accessible to the users, the researchers believe that the device will help decrease the casualties caused by earthquakes and typhoons. There are mainly two disasters where the study’s usefulness can be fully utilized: storms and earthquakes. Upon using the device, it can transmit its location through GPS. This is very useful when the area is struck down by a strong typhoon. After the typhoon, the area will usually be left flooding. Many people will be stranded, especially at night where the visibility is lowered. When flooding, the victims usually reside at their roof to survive. The GPS signal will be stronger at open areas, so the signal will be greatly boosted. The 2.4 GHz transmitter will be used to send data to the rescuer’s app made by the researchers. The information sent by the transmitter will be different for each Life Box. This feature can be used when searching for a survivor in a destroyed and disaster-altered areas like collapsed buildings. The transmitter will emit frequency at 2.4 GHz which will be received by the smartphone and will be interpreted by the app programmed by the researchers.

### SIGNIFICANCE OF THE STUDY

First of all, the study will be beneficial to those areas who normally experience floods, especially if the flood level is higher than an average person’s height. There are people who doesn’t want to evacuate, and are always ending up being stranded on their roofs. With the help of the device, they can be rescued safely. It can also be done for victims of other disasters. The research will also benefit some sectors of the government like NDRRMC and local search-and-rescue groups. The study will also be of significance to the university, since the paper will be added to the roster of researches already done in the university, therefore expanding the knowledge and information available. The researchers will also benefit from the study such that skill required to perform the paper and the prototype must be developed and enhanced.

In summarization, these will be the beneficiaries of the study:

* Residents residing in flood-prone areas
* Rescue-Oriented Organizations; primarily public
* The University where the study will be archived
* Future researchers

### THEORETICAL FRAMEWORK

GPS or Global Positioning Systems is a term that most commonly conjures up images of vehicle navigation systems, space-age satellite technology, and interactive maps for outdoors-types and sportsmen. But the reality is that there are far more applications of Global Positioning Systems beyond GPS vehicle tracking or map navigation that everyday people like us can benefit from. (Dipak Patra, Editorial Today) .

The GPS tracking systems have been very useful for people to find their way on land and on water, in keeping track of people, vehicles, pets etc, in scientific studies, for map making, land surveying and countless other commercial uses. Everyday new applications are being found for the amazing NAVSTAR GPS commonly known as GPS systems. There are wide variety of GPS receiver models available suitable for a variety of applications. (Vanessa Jones, Ezine Articles)

Wherever you are on the planet, at least four GPS satellites are ‘visible’ at any time. Each one transmits information about its position and the current time at regular intervals. These signals, travelling at the speed of light, are intercepted by your GPS receiver, which calculates how far away each satellite is based on how long it took for the messages to arrive. Once it has information on how far away at least three satellites are, your GPS receiver can pinpoint your location using a process called trilateration. (Physics.org)

The separator in Lithium Polymer is made of a micro-porous polymer covered in an electrolytic gel that also serves as a catalyst that reduces the energy barrier in the chemical reaction between cathode and anode. Therefore, Li-Polymer batteries allow for a slight increase in energy density. However, this advantage is offset by a 10% to 30% cost increase. Therefore, because the same materials are used for cathode and anode, Li-Polymer batteries follow the same chemical process as Li-Ion batteries and so are not a distinct class.

Because the solid polymer is flexible, it is possible to construct flexible batteries and batteries that can be easily formed into various shapes and sizes, even thin films. So you'll most often see Li-Poly used for batteries which are relatively thin (e.g. Nokia's 'hero' BP-4L battery used in a dozen devices) or oddly shaped (e.g. to fit round other components in a tightly packed phone). (Gilson, All About Symbian).

Many components contribute to the successful transmission and reception of RF signals and these are the key components. First, there is a transmitter which begins the RF communication. The transmitter takes the initial data and modifies the signal using a modulation technique to encode the data into the signal. The transmitter is also responsible for determining the power level of the wave, which is ultimately regulated by local domain authorities.

Next, an antenna collects the signal that it receives from the transmitter and directs the RF waves away from the antenna. As the RF waves move away from the transmitting antenna they move towards another antenna attached to the receiver, which is the final component in the wireless medium. The receiver takes the signal that it received from the antenna and translates the modulated signals and passes them on to be processed. (Gunther, Aerohive Networks)

A band of frequencies clustered around 2.4 GHz has been designated as unlicensed frequency band and is useful as the Industrial, Scientific, and Medical radio bands. "A lot of the unlicensed stuff — for example, Wi-Fi — is on the 2.4-GHz or the 900-Mhz frequencies, the ISM bands. You don't need a license to operate on them." That's Ira Kelpz, Deputy Chief, Office of Engineering and Technology at the Federal Communications Commission, explaining precisely why these ISM bands are attractive to gadget makers: They're free to use. If routers and cordless phones and whatever else are relegated to a small band 2.4 GHz, then their radio waves won't interfere with, say, cellphones operating at 1.9 GHz, or AM radio, which broadcasts between 535 kHz and 1.7 MHz. The ISM is, in effect, a ghetto for unlicensed wireless transmission, recommended first by a quiet little agency in a Swiss office of the UN, called the ITU, then formalized, modified and codified for practical use by the governments of the world. (John Herman, WIRED)

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.

There are various cell sizes in a GSM system such as macro, micro, pico and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes in a GSM network macro, micro, pico and umbrella cells. The coverage area of each cell varies according to the implementation environment.

Time Division Multiple Access (TDMA) technique relies on assigning different time slots to each user on the same frequency. It can easily adapt to data transmission and voice communication and can carry 64kbps to 120Mbps of data rate.

GSM Architecture

A GSM network consists of the following components:

A Mobile Station: It is the mobile phone which consists of the transceiver, the display and the processor and is controlled by a SIM card operating over the network.

Base Station Subsystem: It acts as an interface between the mobile station and the network subsystem. It consists of the Base Transceiver Station which contains the radio transceivers and handles the protocols for communication with mobiles. It also consists of the Base Station Controller which controls the Base Transceiver station and acts as a interface between the mobile station and mobile switching center.

Network Subsystem: It provides the basic network connection to the mobile stations. The basic part of the Network Subsystem is the Mobile Service Switching Centre which provides access to different networks like ISDN, PSTN etc. It also consists of the Home Location Register and the Visitor Location Register which provides the call routing and roaming capabilities of GSM. It also contains the Equipment Identity Register which maintains an account of all the mobile equipments wherein each mobile is identified by its own IMEI number. IMEI stands for International Mobile Equipment Identity.

The security strategies standardized for the GSM system make it the most secure telecommunications standard currently accessible. Although the confidentiality of a call and secrecy of the GSM subscriber is just ensured on the radio channel, this is a major step in achieving end-to- end security.

A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. It can be connected to a computer through serial, USB or Bluetooth connection.

A GSM modem can also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer. GSM modem is usually preferable to a GSM mobile phone. The GSM modem has wide range of applications in transaction terminals, supply chain management, security applications, weather stations and GPRS mode remote data logging.

In these days, the GSM mobile terminal has become one of the items that are constantly with us. Just like our wallet/purse, keys or watch, the GSM mobile terminal provides us a communication channel that enables us to communicate with the world. The requirement for a person to be reachable or to call anyone at any time is very appealing.

### CONCEPTUAL FRAMEWORK

INPUT

Knowledge in:

1. Rescue Operations

2. Skills needed in crafting a wrist watch

3. Mobile Application Development

Hardware:

1.Waterproof Materials

2. GPS Module and 2.4 GHz Transmitter

3.Smartphone

4. Arduino Pro Mini

Software

1. Android Studio

2. Arduino IDE

3. Java Programming Language

4 C++

Peopleware

1.Respondents

2.Rescuers

3.Proponents

PROCESS

Device

Activation

Transmission of Signal

Receiving of Signal

Sending of Signal to the Command Center

Relaying the Location of the Help Box to the Rescuers

OUTPUT

HELP BOX: A LIFE AND BODY LOCATOR SYSTEM THROUGH A DESIGNED TV BOX AND MOBILE APPLICATION FOR

POST-DISASTER RESCUE MISSION IN A CITY

USER MANUAL

**FEEDBACK**

*Research Paradigm of the Input, Process and Output of the Study*

The INPUT is the part where the proponents specify the knowledge, hardware, and software that is needed in producing the prototype. The PROCESS involves the analysis, design, development, and testing of the system. Lastly, the output will be the **Help Box: A Life and Body Locator System Through a Designed TV Box and Mobile Application for Post-Disaster Rescue Mission in a City** and its User Manual.

### SCOPE AND LIMITATION

**Scope:**

* Has GPS to locate the Life Box
* Has 2.4 GHz for additional functionality
* Focused on areas with high chance of flooding
* Has a small size the shape of a box to fit anywhere
* Easy to operate

**Limitations:**

* Cannot completely detect the victim’s consciousness state after pressing the button
* 2.4 GHz Transmitter has its limitation range
* Prioritizes worst-case scenarios
* Relies on SMS to send signals

### 

### DEFINITION OF TERMS

**1. DISASTER** – a sudden event, usually catastrophic, that causes great damage and has a great possibility of causing a loss of life of a person

**2. GPS** – The Global Positioning System (GPS) is a U.S.-owned utility that provides users with positioning, navigation, and timing (PNT) services. (*gps.com*)

**3. FREQUENCY** - the number of periods or regularly occurring events of any given kind in unit of time, usually in one second (*dictionary.com)*

**4. GHZ(GIGAHERTZ)** – One gigahertz is equal to 1,000 megahertz (MHz) or 1,000,000,000 Hz. It is commonly used to measure computer processing speeds. *(techterms.com)* In this study, GHz is used as a measurement of frequency.

**6. TRANSMITTER** – is an electronic device that sends data (usually in the form of radio waves) to send data

**7. MOBILE APPLICATION** – a program that is specifically made for mobile phones (usually smart phones) to be used by the user for specific purposes

**8. SIGNAL** - a detectable physical quantity or impulse (such as a voltage, current, or magnetic field strength) by which messages or information can be transmitted (*Merriam-Webster*)

**9. RADIO FREQUENCY (RF)** – is a term called to the frequencies of specific range of 20 KHz to 300 GHz. In this research, RF is used as a synonym for radio and other uses of wireless communications.

**10. BAND** – a term that is used as a synonym for range. It is commonly used in conjunction to frequency.

**11. SMS (SHORT MESSAGE SERVICE) –** a way to send short, text-only messages from one phone to another and are sent over a cellular data network. (*Lifewire)*

**12. NETWORK –** A collection of computers, servers, mainframes, network devices, peripherals, or other devices connected to one another to allow sharing of data.(*Computer Hope)*

**13. TRANSCEIVER –** A transceiver is a device comprising both a transmitter and a receiver which are combined and share common circuitry or a single housing. *(Cozlink)*

# CHAPTER II

# REVIEW OF RELATED LITERATURE AND STUDIES

This chapter discusses some literature and studies related to the study Help Box: A Life Locator System through a Designed TV Box and Mobile Application for Post-Disaster Rescue Mission in a City.

### FOREIGN LITERATURE

According to Leigh-Ann Topfer in her article entitled “GPS locator devices for people with dementia”, Locator devices that use GPS (global positioning system) are assistive technologies that can help in promoting safe walking for people with dementia by alerting the caregivers that their patients wandered outside their designated area by giving geographic coordinates of the person so they can be found more easily. She also stated that because locator devices are a form of surveillance, they raise ethical and legal issues regarding privacy and autonomy, but they will be a great help to the caregivers and the potential benefits would outweigh the potential harms. The researches thought that this article is related to the study because of the concept that we will be applying on the Life Box such that we will be using GPS to rescue disaster victims within a certain area given.

GPS World Staff stated in their article that the Galileo Search and Rescue(SAR) service was made possible by the Galileo satellite constellation is now active, and it is Europe’s contribution to a satellite-based search and rescue distress alert detection and information distribution system best known for detecting and locating emergency beacons activated by aircraft, ships and hikers in distress. They also said that with the Galileo, the time to identify the location of the beacon signal is reduced from several hours to minutes. The Search and Rescue transponders on Galileo satellites can pick up signals emitted from any 406-MHz distress beacon anywhere in the service coverage area and transmit this information to the dedicated ground stations. Since this article is an innovation for the convenience of search and rescue operations, the researchers thought that the concept would support the study to be conducted.

In an article by Defense IQ Press, they quoted Commander Sirio Faé’s statement with regards to the most challenging aspect in mass search and rescue operations which is communication. Communication among the rescuers are important to reduce the amount of redundant information; to route that data that is not strictly relevant to the operation to other areas in order to only focus on what is directly involved. The researchers thought that communication with the victims are just as important in order to make the rescue operation easier.

In an article by Emma Sloan, she lists some of the pros and cons of GPS phone tracking apps. One of the pros of GPS phone tracking apps she mentioned is in the case where you or anyone you know gets lost or goes missing, Law enforcement officers can use their own programs to track where the phone is of the individual they are looking for. As long as the GPS is turned on, the location will come up on a map in just a few minutes. Since this study is an innovation for search and rescue operations, the statement above supports the idea of using GPS for locating people.

According to an article in www.gps.gov regarding GPS accuracy, a GPS-enabled smartphones are typically accurate to within a 4.9 m (16 ft.) radius under open sky but their accuracy worsens near buildings, bridges and trees. Which is why high end users make use of dual frequency signal to boost GPS accuracy. With this in mind, the researchers thought of using a 2.4 GHz frequency transmitter in the Life Box to heighten the accuracy of locating people in search and rescue operation.

The researchers will be creating a mobile application for this study and decided to make use of the programming language Java. According to an article by Jamil Velji, Java is the most used app development language. Android OS is written in Java so if you learn Java, you will be able to create Android apps of all types and this will put you in the driving seat because you will be in control over the future of app technology. Java is the most suitable mobile app development language because it runs on all the platforms including the all-famous Android.

In another article by James Frew, he stated Java’s key features which are: it runs on nearly all platforms, object orientated language, open source libraries, strong community support for Java and Android, easy to learn, easy to read and powerful Integrated Development Environments (IDE) reduces errors and gives clear explanations and suggestions.

### LOCAL LITERATURE

“Project Kwago”, a drone made by a three-man Filipino team, Mac Eugenio, Ari Trofeo and Vince Villena can boost search and rescue operations, especially during disasters. The team said most drones used in search and rescue operations in the Philippines only take photos and videos of damages in disaster areas. Also, most can only be used during daytime. Kwago aims to provide more. It is also said to specialize at night operations, given that it was installed with a thermal camera that can detect heat signatures from the ground. It also has pattern recognition, auto take-off and landing, collision avoidance and sonars. "Since Kwago is an app-based system, we have the option to create other apps where we can use Kwago for other relevant purposes," Eugenio said. Also, the drone will make a high altitude thermal scan of the coordinates plotted using the Kwago App. The system marks an area once a thermal scan has been detected. A low altitude sweep will follow to get the exact location of the coordinates of the detected heat signature and also to get more detailed information of the subject. The coordinates would then be transmitted to the ground station or to the rescuer nearest to the location in real time.The Kwago operator can also hover and beam a light on the detected subject while waiting for aid or it can resume with the sweep.

In creating a wrist watch, toughness is a factor. According to an article by Matthew Ang, in more recent history, with the turn of better technology and improved design, the wristwatch has turned itself into more than just a tool. It has turned itself into a symbol and as a window into the persona of an individual. While the digital watch, and to an extent, the smartphone has become the go-to tool to which people use to tell time, there are people at the other end of the spectrum who still stay true to the elaborately crafted wristwatch as a symbol of luxury, affluence and timelessness. PVD stands for Physical Vapor Deposition, and is essentially a very thin layer of chemicals coated onto certain parts of the watch that enables it certain benefits (think of armor, or a case for your cellphone). PVD coating is simply a process that is done to make things more durable in varying facets of its physical limitations. While it has already been in existence as early as 1838 when it was first used by Michael Faraday, it has found a wide variety of uses today in a number of products such as aerospace parts, fire arms, cutting tools, and recently, watch parts. that comes the need to preserve such expensive timepieces with technology called PVD. By coating watch parts with PVD coating, people should expect it to be more wear resistant or “harder" (resists scratches), which means that the watch also becomes more impervious to corrosion, and more impact resistant or “tougher” (resists damage from impact with other objects). Coating watches with PVD coating also allows for certain aesthetic improvements to the coated part as for what would normally be just a stainless steel or titanium brushed item can now acquire a certain “finish” (smoothness), and a certain color depending on the chemicals used in the coating. Because the coating process takes place at extremely high temperatures, the produced part also results in high heat resistance, and lasts longer compared to anodized parts or powder coated parts.

### FOREIGN STUDY

In recent years, technology has become so adaptable and innovative that anything can be integrated with technology. With this, the industry has caught up with the trend. From fitness trackers to wrist bands, companies produce wearable technology as a way to help the population and the industry itself. Among of these, wrist wearables such as wrist watches became most commonly-bought. A thorough observation will reveal why wrist watches became mainstream. The wrist wearable mentioned gives off comfortability and functionality. While wearing one, the user will be able to tell the time without taking out the phone in his pocket. Wrist watches also act as an additional accessory. Many wrist watches integrated with technology, often called as smart watch, also has the function to monitor the user’s physical data. The use of smartphones is being designed specifically to carry out research centered on the detection of human data and features, including information about the user’s sleep and stress data and as well as analyzing human daily activities such as writing, drinking coffee, eating and many more. Also, according to the study, there are two kinds of data transfer covering smart watches. Wearable data transfer is taking the data directly from the wearable sensors while warehouse data transfers the data from the proprietary warehouse. There are some disadvantages of using the warehouse transfer data than the wearable transfer data. One disadvantage of the warehouse transfer data is that it will need to fetch the data from the source to the device. Usually the data transfer is done at random intervals, which could take days. With the wearable data transfer, the transferring of data is at a specified interval. Another drawback of the warehouse data transfer is related to the nature of data. In warehouse data transfer, since the data will not be coming from the device, there is usually a process like the simplification of data involved in the nature of data transfer. Also, according to the same study, it can be distinguished where access to the data can be fetched; direct access and indirect access. Direct access is when the third-party collects the data directly from the source in which it is available, whether wearable or warehouse. Indirect access is when some kind of intermediary system, such as a smartphone or a PC, is needed as a gateway to the third-party server. The information above is from the study of Francisco de Arriba-Perez et. al, titled “Collection and Processing of Data from Wrist Wearable Devices in Heterogeneous and Multiple-User Scenarios.”

According to a study done by Medhat Omur, portable navigation may seem similar to other problems of navigation such as system availability, reliability, and accuracy. Also, the portability of the device itself is a problem that is facing the developers. One problem will be the orientation and position of the portable device when worn by the user. Also, sensors, components, computation capabilities, and battery life poses a huge problem as every one of these is an essential in making the device complete and effective. Global Navigation Satellite Systems (GNSS) such as Global Positioning System (GPS) has been widely used for vehicular and outdoor navigation. Using GPS has the advantage of high accuracy. However, it being integrated in a portable device is a huge obstacle. Also, users who spend more time indoors or in other natural activities like urban canyon seeing suffers from the accuracy being given by the system. A solution for these is using other sensors and signals like WiFi and GSM functions. Smartphones, tablets, wearable devices that have the capability to compute and process like smartwatches and smartglasses, have microelectromechanical sensors (MEMS). The advantage of MEMS is that they have s relatively small size, light weight, low power consumption, and low cost. Because of these, MEMS are frequently used in these kinds of devices. However, there are a few drawbacks of MEMS, like high noise and drifts which makes it inaccurate and less useful when used in tracking functions. Also, according to the study, computational efficiency may degrade on adding more devices to be integrated in the solution. After adding certain number of devices, the solution may not be feasible since the limited computation capabilities of the host devices are limited. The study also pointed out that the device must be user-friendly. The device must not have no constraints on how the user use or position the devices. The user should be able to freely use the device. Because the GNSS was used by the researcher of the study, a general idea of the reference frames needed by the navigation system and the transformation from one another is given. Reference frame are fundamental to describe any navigation state element such as position, velocity, and altitude. GNSS is used to locate the position of people and places, and to provide navigation information to moving platforms such as ships, aircrafts, and automobiles anywhere on the surface of the earth.

A study by Ian Martinez Garcia was centered about a Fall Detection Alarm using a portable device. Hi concept that would like to be integrated by the researchers should be the Energy harvester. Energy Harvesting, also known as power harvesting or energy scavenging, is the process by which energy is derived from external sources like solar power, thermal energy, wind energy, salinity gradients, and kinetic energy that is usually captured and stored for small, wireless autonomous devices, like those used in wearable electronics and wireless sensor networks. The concept of Energy Harvesting will play a key role in the implementation, in future lines, of autonomous tele-assistance devices. The objective of the project may be synthesized as the study and development of possible improvements in these kinds of concepts. The concept of power having must be a concern in making a portable smart device, since the portable device is small, thus limiting its capability to produce and contain enough power to supply the device. From a theoretical viewpoint, a general study about power saving techniques in some IoT devices will be developed as well as the concept of Energy Harvesting to be studied for helping everyone to define future lines for incoming systems, to optimize the power usage. With the introduction of IoT devices and technology in general into even smaller size devices, one of the most interesting fields under study, offering a possible improvement over the methodologies currently used, is called Energy Harvesting. The study also introduced Piezoelectric Materials.

Piezoelectricity is defined as the capability to obtain power from a specific pressure. Piezoelectric materials accumulate electrical charge on a solid material as a result of mechanical tension. The movement of the human body, low frequency vibrations or acoustic noise are some of the sources from which a piezoelectric material can collect energy.

### LOCAL STUDY

In a study conducted in Colegio de San Juan de Letran in Calamba, Laguna entitled “Crime Tracking Device using GPS and SMS Technologies”, The project’s objective is to prevent theft cases and home intrusions with the use of the wireless technology. They conducted experimentation to develop the device using program simulators and trainers to test the functionality of the hardware and the software. The GSM module was interfaced to send and receive notifications and they connected the application they developed on Google map to know the precise locations of the user.

According to a study conducted in LPU, the emergence of Global Positioning System (GPS) gives tracking units the sense of power and modification which helps one to identify the exact location, time and speed of a person, vehicle, pets and other things including one's assets to which the unit is attached to. Moreover, the development of a compact, portable and economical GPS device or receiver has made a lot of difference in today's living; aside from GPS devices, GPS can also be implemented in mobile phones and computers with Internet. When it comes to its value, GPS is a benefit to almost all areas -- agriculture, military, maritime, automotive, surveying, aviation and forestry, environmental and public safety. This can also be applied to mobile phones through the creation of Global Positioning System navigation via online applications such as Waze and Google Maps. Navigation and offline applications including iGo and Maverick. Also, the researcher defined that a mobile application is an application for mobile devices like smartphone or tablet. It varies from simple application to sophisticated application that contains a lot of functions. In order to develop an application, an Integrated Development Environment (IDE) is needed. The proponents developed the mobile application using Basic4Android IDE that uses Basic Programming Language instead of Java Programming Language.

The Philippines is the third country most vulnerable to disaster worldwide due to the frequency of calamities. Floods, which are usually caused by strong typhoons, heavy rainfall or tsunamis caused by earthquakes, are responsible for 40% of all natural disaster occurrences. The Philippines' drainage systems are inferior, it only takes a short stretch of flooded road to make a whole road impassable, especially by vehicles, according to the study of Katrina Ivy Mae Cabrera et. al. Also, an android app is a very efficient way to monitor a certain area with ease.

### 

### SYNTHESIS AND RELEVANCE OF THE STUDY

For most of the people, watching television became a part of their daily lives. When the weather condition gets bad, people turn off their television to avoid casualties with regards with the lightning hitting the antenna. With this, they would recognize the Life Box and would not fail to notify the command center with regards to their current condition in such case that the flood condition gets worse. The reliability given by its main function is undoubtedly essential for everyone. The prototype will have energy harvesting function to solve one aspect of the problem regarding power supply, since only small batteries may be mounted. With the additional function of GPS tracking and Mobile Application as a tracker, the Life Box can really be a breakthrough in times of disaster.

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# CHAPTER III

# RESEARCH DESIGN AND METHODOLOGY

This chapter presents the research methodology on how the data gathered will be analyzed and how the concepts will be related to the project. These includes the Research Design, Research Methodology, Locale of the Study, Sample and Sampling Techniques, Description of the Respondents, Research Instruments, Data Gathering Procedure and Statistical Treatment.

### RESEARCH DESIGN

The researchers will be utilizing the descriptive and developmental research. The methods of research stated above are applicable for this study given that the researchers will be integrating different kinds of major functions onto our prototype. The descriptive research will be implemented in the research in such case that we will also be conducting the study to analyze and determine the effectiveness of the Life box. By gathering all the needed modules and materials, we will be making Life box.

### LOCALE OF THE STUDY

The study will be conducted on specific barangays of CAMANAVA area. The four cities in CAMANAVA are commonly affected by interconnected rivers, one of which is the Tullahan River. At the times that typhoons visit the country, there are barangays which are submerged in floodwaters, mainly Barangay 100-125 Grace Park East at Caloocan, Barangay Niugan at Malabon, North Bay Boulevard, North at Navotas and Barangay Marulas at Valenzuela.

### DESCRIPTION OF RESPONDENTS

The respondents of the research will be focusing on the residents living near or on the said barangays that are usually submerged by floodwater due to heavy rainfall. The respondents must be residing long enough to have experienced several incidents of floods.

### RESEARCH INSTRUMENT

The researchers will use survey questionnaires for data gathering and collecting. Each item in the questionnaire corresponds to how the Help Watch will be in terms of reliability and effectiveness. The researchers will use tally, checklist scales, and computation for quantitative observation of the research while in the qualitative side, the proponents will use observational and stoichiometric device.

### DATA GATHERING PROCEDURE

The researchers will be utilizing necessary steps to gather the data needed for the study.

* A request letter will be presented to the respective target population of the researchers
* The data will be collected from the respondents using the researcher’s questionnaire and it will be tallied.
* The proponents will gather additional data through references like books, journals, thesis, articles, dissertations, etc. from different libraries like UP Diliman College of Engineering Library, PUP college of Engineering Library, Online Public Access Catalogs of different schools. Aside from that, the researchers gathered electronic references from the internet.

### STATISTICAL TREATMENT

The proponents used the formula for sample size in determining the total number of respondents in areas of CAMANAVA. Since the total population is too large To determine the sample size to be used on the study, we will use the formula:

s =

Where Ss stands for the sample size; N for the total number of population, V for the standard value (2.58) of one percent level of probability with 0.99 reliability, Se for sampling error (0.01) and p, largest possible proportion (0.50).

Weighted Mean is used in computation in the pre-test or in computing the result in the survey part of the research study. This is a kind of average instead of each data point contributing equally to the final mean. This type of getting the mean is done due to some data points contribute more “weight” than the others. If the weights are equal, then the weighted mean is equal to the arithmetic mean or regular mean of the data.

### SAMPLE AND SAMPLING TECHNIQUES

The sampling technique that will be used is Judgement Sampling in which the researchers will select the respondents considered to be in the best position, or most knowledgeable to give the needed information. Since Life Box will be specially designed for residents of the areas that are usually submerged in floodwaters, the respondents must be knowledgeable and have enough experience when the said phenomena occurs.

The main source of the data for this study will come from chosen respondents or participants. The sample size is determined by the formula below:

s =

Where Ss stands for the sample size; N for the total number of population, V for the standard value (2.58) of one percent level of probability with 0.99 reliability, Se for sampling error (0.01) and p, largest possible proportion (0.50).

For Caloocan Area:

s =

s =

For Malabon Area:

s =

s =

For Navotas Area:

s =

s =

For Valenzuela Area:

s =

s =

The proponents will randomly choose 256 respondents from Barangay Grace Park East at Caloocan, 255 from Barangay Niugan at Malabon, 256 from North Bay Boulevard at Navotas and 257 from Barangay Marulas at Valenzuela.

# COSTING

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| QUANTITY | ITEM NAME/PARTS/COMPONENT | UNIT PRICE | AMOUNT | ITEM DESCRIPTION |
| 1 | Lithium-Ion Polymer  Battery | ₱1500 | ₱1500 | Power Source |
| 1 | Atmega328p | ₱450 | ₱450 | Microcontroller |
| 1 | GSM/GPS Module | ₱3050 | ₱3050 | Signal Transmitter |
| 1 | 2.4 GHz Transmitter | ₱350 | ₱350 | Signal Transmitter |
| 1 | Gasket and Sealant | ₱1000 | ₱1000 | Waterproofing |
| 1 | Metals, Polymers, Ceramics, and Composites | ₱2000 | ₱2000 | Casing |
| 1 | BQ2970 Current Protection Integrated  Circuit | ₱100 | ₱100 | Overcharge Protection Circuit |
| Asstd. | Electrical Components | - | ₱500 | Components |
| Total: ₱8950.00 | | | | |

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# INSTRUMENTS

The proponents used the Internet and some books from different libraries as instruments used to research and gather information and data.

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