**TABLE OF CONTENTS**

[CHAPTER I 1](#_gjdgxs)

[THE PROBLEM AND ITS BACKGROUND 1](#_30j0zll)

[1.1 Introduction 1](#_1fob9te)

[1.2 Background of the Study 2](#_3znysh7)

[1.3 Statement of the Problem 3](#_2et92p0)

[1.4 Significance of the Study 4](#_tyjcwt)

[1.5 Theoretical Framework 5](#_3dy6vkm)

[1.6 Conceptual Framework 11](#_1t3h5sf)

[1.7 Scope and Limitation 12](#_4d34og8)

[1.8 Definition of Terms 14](#_2s8eyo1)

[CHAPTER II 17](#_17dp8vu)

[REVIEW OF RELATED LITERATURE AND STUDIES 17](#_3rdcrjn)

[2.1 Foreign Literature 17](#_26in1rg)

[2.2 Local Literature 19](#_lnxbz9)

[2.3 Foreign Study 21](#_35nkun2)

[2.4 Local Study 25](#_1ksv4uv)

[2.5 Synthesis and Relevance of the Study 27](#_44sinio)

[CHAPTER III 28](#_z337ya)

[RESEARCH DESIGN AND METHODOLOGY 28](#_3j2qqm3)

[3.1 Research Design 28](#_1y810tw)

[3.2 Locale of the Study 28](#_4i7ojhp)

[3.3 Description of Respondents 29](#_2xcytpi)

[3.4 Research Instrument 29](#_1ci93xb)

[3.5 Data Gathering Procedure 29](#_3whwml4)

[3.6 Statistical Treatment 30](#_2bn6wsx)

[3.7 Sample and Sampling Techniques 30](#_qsh70q)

[COSTING 32](#_3as4poj)

[BIBLIOGRAPHY 33](#_1pxezwc)

[INSTRUMENTS 34](#_49x2ik5)

[PROTOTYPE DESIGN 35](#_2p2csry)

# CHAPTER I

# THE PROBLEM AND ITS BACKGROUND

### 1.1 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.

### 1.2 Background of the Study

The geographic location of the Philippines is rather unfortunate; there are plenty of storms that can hit the country and there are also the storms from other countries that end up also hitting Philippines. It is also included in the Pacific Ring of fire, where 81% of volcanic activities in the world can be found. Therefore, the researchers came up with the study Help Box: A Life and Body Locator System through a Designed TV Box for Post-Disaster Rescue Mission in a City. 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 Help 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 or Headquarters 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. The researchers conclude that the system created will help the target location into solving their problems.

### 1.3 Statement of the Problem

Adisaster is a sudden event that seriously affects the community or society and causes both human and environmental losses that exceed the community’s ability to cope using its own resources. Disasters are often caused by nature, like tsunami and earthquake, but sometimes it can have human origins, like house fire. Like any other disasters, flooding caused by several occurrences, like typhoon and tsunami, is a lethal hit to the community. Earthquakes are also very dangerous since it is the most unpredictable one. Several approaches were done to reduce the casualties caused by disasters. Earthquake and fire drills are being conducted by different schools and organizations to help citizens on how to act in times of emergency. In disasters, the most efficient way of reducing casualties is rescuing the stranded victims. Because disasters are very sudden, civilians are usually left in panic, and many people get stranded in their respective locations before a disaster wreaks havoc. In this case, the speed of rescuing is crucial so every second counts. The thing is, the rescuers do not know the exact location of these victims, so they tend to search the whole area which is very impractical. For example, NDRRMC also relies on the information given to them by the people present at the disaster area. When a person, for example a civilian, relays information to NDRRMC, the accuracy of information is questionable.

Gathering data for the study can be challenging since natural disasters are mostly unpredictable, except typhoons which has early signs. Due to this fact, the researchers chose to gather data where the effect of typhoon is immediate and has a greater effect. Based from these statements, Malabon City matches the criteria.

### 1.4 Significance of the Study

First of all, the study will be beneficial to the following, (1) The residents residing in flood-prone areas, (2) Rescue-Oriented Organizations; primarily public, (3) the University where the study will be archived, and (4) the future researchers.

The research 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 household. 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.

### 1.5 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)

When referring to a *signal* in relation to wireless communications, it is an electromagnetic field with specific characteristics, being its oscillation frequency. When working with computer data, copper wires are used to send electrical signals; fiber-optic cables can send optical signals. If you want to send wireless signals, you use light waves for line-of-sight technologies (such as IrDA) or RF for non-line-of-sight technologies (such as Bluetooth). When you listen to a radio station in your local area, this radio station broadcasts its content over a radio-wave signal that operates at a base waveform or wave of a specific set of dimensions consisting of an amplitude, period, and phase. This wave can be modified through one of the modulation techniques to change its form, and thereby transmit information. (Edward Tetz, Dummies.com)

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### 1.6 Conceptual Framework









*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.

### 1.7 Scope and Limitation

Because of its diversity, Help Box can be used in almost any situations that needs immediate action, especially disasters. Given that 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, typhoons and other disasters. Upon using the device, it can transmit its location through GPS. The GPS signal will be stronger at open areas, so the signal will be greatly boosted outside. The 2.4 GHz transmitter will be used to send data to the rescuer’s app made by the researchers. Each Help Box has an ID registered to the Command Center, and will also be transmitted when Help Box has been activated. 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. Help Box has GPS to locate the victim. Even without internet, Help Box will be able to communicate to the GPS satellite. Also, the study has a 2.4 GHz Transmitter that will serve as a hotspot for additional functionality, adding more accuracy to the rescue operation. It will be focused on areas with high risk of disasters, like earthquakes, tsunamis and storms. Help Box has a compact size that will be able to fit anywhere, and it also has its own battery, making the device mobile. It is easy to operate; one push of a button will immediately send a distress signal to the Command Center. Help Box has a compact size that will be able to fit anywhere. It also has a battery, making it portable. It is also water resistant and shockproof, an essential feature of a device if it is expected to survive in a disaster.

The scope of the study will include the following:

* Help Box has GPS to locate the Life Box. Even without internet, Help Box will be able to communicate to the GPS satellite.
* Help Box also has a 2.4 GHz Transmitter that will serve as a hotspot for additional functionality, adding more accuracy to the rescue operation.
* Help Box has a compact size that will be able to fit anywhere, and it also has its own battery, making the device mobile.
* Help Box is easy to operate; one push of a button will immediately send a distress signal to the Command Center.
* Help Box is water resistant and shockproof.

However, the study has limitations. Help Box cannot detect the state of consciousness of a victim. The 2.4 GHz Transmitter and GPS Functionality has its own limitations. The 2.4 GHz is susceptible to horizontal obstacle, and the GPS is susceptible to vertical blockage. Also, Help Box relies on 2G signal to send any data to the Command Center. It will also not detect the location of the victim if they wouldn’t bring the device with them.

The limitations of the study are the following:

* Help Box cannot detect the state of consciousness of a victim.
* The 2.4 GHz Transmitter has a range of approximately 8 meters.
* GPS Receivers can only receive data from satellites, and cannot transmit data back to the satellites.
* In times of disaster, Help Box must be carried by the user upon activation in order for the device to update the Command Center of its latest location.
* Because Natural

### 1.8 Definition of Terms

1. **2G –** It is short for second-generation cellular technology. It is used for wireless communication mostly on phone devices.

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

**3. COMMAND CENTER –** The Command Center mentioned in the study several times is the headquarters of the system. This is where Help Box will first send the data, and then the Command Center will be the one to relay this information to the rescuers.

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

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

**6. 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.

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

**8.** **HELP BOX –** Help Box is a life and body locator system through a designed TV Box for post-disaster rescue mission in a city. Upon pressing a button installed in the device, it will send a signal to the Command Center. It also has a 2.4 GHz Transmitter that will be used as a hotspot for additional accuracy of the victim’s location.

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

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

**11. 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.

**12. SIGNAL** - it is 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*)

**13. 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)*

**14. 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)*

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

**16. TV BOX –** TV Box is a commonly-known device that is used to connect the Television to different TV Networks. It is usually a small black box placed near the TV.

# CHAPTER II

# REVIEW OF RELATED LITERATURE AND STUDIES

This chapter will be discussing some literature and studies, both foreign and local, 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.

### 2.1 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 Help 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 Help 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.

### 2.2 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.

### 2.3 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.

### 2.4 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.

### 2.5 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 Help 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 Help Box can really be a breakthrough in times of disaster.

# 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.

### 3.1 Research Design

The researchers will be utilizing the experimental 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 Help Box. By gathering all the needed modules and materials, we will be making Help Box.

### 3.2 Locale of the Study

The researchers chose CaMaNaVa as their target area since this is where the disasters are often congested. Out of the four areas, the researchers chose Malabon because of its small area and geographically, it is near Manila Bay. The city of Malabon recorded a total population of 365, 525 as of August 1, 2015 based on the 2015 Census of the city. The researchers will be conducting the research on every barangay at Malabon.

### 3.3 Description of Respondents

The respondents of the research focuses on the residents of Malabon. The respondents must be residing long enough to have experience several disasters that have occurred so that the researchers will be able to gather precise data for the study.

### 3.4 Research Instrument

The researchers will use survey questionnaires for data gathering and collecting. Each item in the questionnaire corresponds to how the Help Box 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.

### 3.5 Data Gathering Procedure

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

* 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.
* The researchers coordinated with NDRRMC, a Local Government Unit (LGU) to be able to gather data regarding the information of the Locale of the researcher’s 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 questionnaires made by the respondents. The data will be collected from the respondents using the researcher’s questionnaire and it will be tallied.

### 3.6 Statistical Treatment

The researchers will be utilizing Likert scaling in the survey. In terms of computing results or the data in the survey part of the study, the researchers will be using Weighted mean. Weighted mean will be applied and shall be computed by summarizing the product of frequency, multiplied by the weight assigned to it and then divided by the total number of respondents.

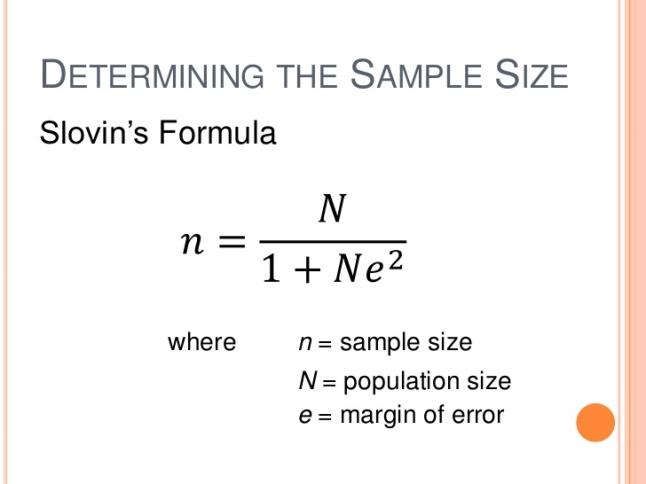
∑x = W1x1 + W2x2 + ….Wnxn

W1 + W2 + … + Wn

Where ∑x is the weighted mean, W for the weighted frequency of respondents and x for the value of the scale.

### 3.7 Sample and Sampling Techniques

The sampling technique that will be used is Judgment 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 Help Box will be designed for disasters, the respondents must be knowledgeable and have enough experience when said phenomena occur. The main source of the data for this study will come from chosen respondents or participants. As of the 2015 Census, Malabon currently has a recorded population of 365, 525 residents. The sample size of the respondents will be determined through Slovin’s formula:



Where N stands for population size, n for the sample size, e for the margin of error (0.05)

For the computation to determine the sample size of the respondents:

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The proponents will randomly choose 400 respondents from the municipality of Malabon.

# COSTING

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| QUANTITY | ITEM NAME/PARTS/COMPONENT | UNIT PRICE | AMOUNT | ITEM DESCRIPTION |
| 1 | **Adafruit FONA 808 Mini Cellular GPS GSM Breakout** | ₱2,609.00 | ₱2,609 | GSM and GPS Module |
| 1 | **Lithium Polymer Battery 2200mAh** | ₱650.00 | ₱650 | Power Source |
| 1 | **GSM and GPS Antenna** | ₱494.00 | ₱494 | Component |
| - | **Electric Components** | - | ₱500 | Circuit Component |
| 1 | **Raspberry Pi 3B + Case and Fan** | ₱2500 | ₱2500 | Server |
| 1 | **GSM Module** | ₱525.00 | ₱525 | GSM Module for Server |
| - | **Aluminum Casing** | ₱3000 | ₱3000 | Casing |
| 1 | **Adafruit Huzzah ESP8266 WiFi Module** | ₱450 | ₱450 | WiFi Transmitter |
| 1 | **Arduino Uno** | ₱400 | ₱400 | Microcontroller |
| Total: ₱11128.00 | | | | |

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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.

# PROTOTYPE DESIGNC:\Users\Zale Carter Vraem\Downloads\LifeBox-Design\Life Box with Button.JPG

