CHAPTER I

The Problem and Its Background

1.1 Introduction

According to the WHO (World Health Organization) regarding an article posted on December 2018, there is approximately 1.35 million people died each year as a result of road traffic accidents and crashes. Road traffic injuries cause considerable economic losses to individuals, their families, and to nations as a whole. These losses arise from the cost of treatment as well as lost productivity for those killed or disabled by their injuries, and for family members who need to take time off work or school to care for the injured. One of the reasons for this is the inadequate post- crash care. Most of traffic accidents are time sensitive. The delay of authorities and medics to the accident can make a difference between life and death.

The proposed project entitled: Vehicle Accident Reporting Device (V.A.R.D.) provides a solution to improve traffic accidents. Medical response team can be deployed immediately to the scene with fast and clear location prepared by the device. It can help prevent traffic accidents and save lives. Since most people have access to mobile phones, commuters can incorporate the device to detect whether the vehicle had an accident and take actions regarding the emergency at hand.

1.2 Background of the Study

A car accident, also referred to as a “traffic collision,” occurs when a motor vehicle strikes or collides another vehicle, a stationary object, a pedestrian, or an animal. Car accidents have serious consequences including property damage, injury and death, all of which are likely to cost someone a lot of money.

As technology has been leading the change in our daily lives making it easier, many of the problems faced by people can be solved by technology. It can locate missing persons and items using GPS. GPS began to revolutionized daily lives. GPS or Global Positioning System provides satellite- tracking services that are useful in a variety of commercial and personal applications.

With the help of GPS, commuters can have easy access to Emergency Road Side Support and immediately and know the location of an accident happened. The GPS (Global Positioning System) is a "constellation" of approximately 30 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy is anywhere from 100 to 10 meters for most equipment. Incorporating this with a sensor for accidents such as accelerometer and a message sender to authorities (GSM Module), can create a device suitable to detect accidents at hand.

1.3 Purpose and Description

The sole purpose of this project entitled Vehicle Accident Reporting Device (V.A.R.D) is to take advantage of the technology, improve the response time of authorized persons during crisis and help reduce tragic events from happening. Since prevention is not possible as accidents happen when they happen, it is better to improve the services that cater to those that is affected by certain accidents. This project is designed to notify authorities and family members immediately when it involves a four-wheeled vehicle accidents.

Since there are some cases where reporting an accident using a mobile phone is not possible, this project is much faster way of identifying the location of an accident and can create a more effective ways of saving lives.

Vehicle Accident Reporting Device Features:

- Proximity based sensor
- Buzzer and LED lights
- Accelerometer sensor
- Microcontroller
- GPS
- GSM

If the person is involved with a small accident or if there is no serious threat to the driver, the user can terminate the alert message before it is sent by a switch provided before it creates unnecessary use of time, effort and resources of other people.

1.4 Conceptual Framework

1.4.1 Existing Process

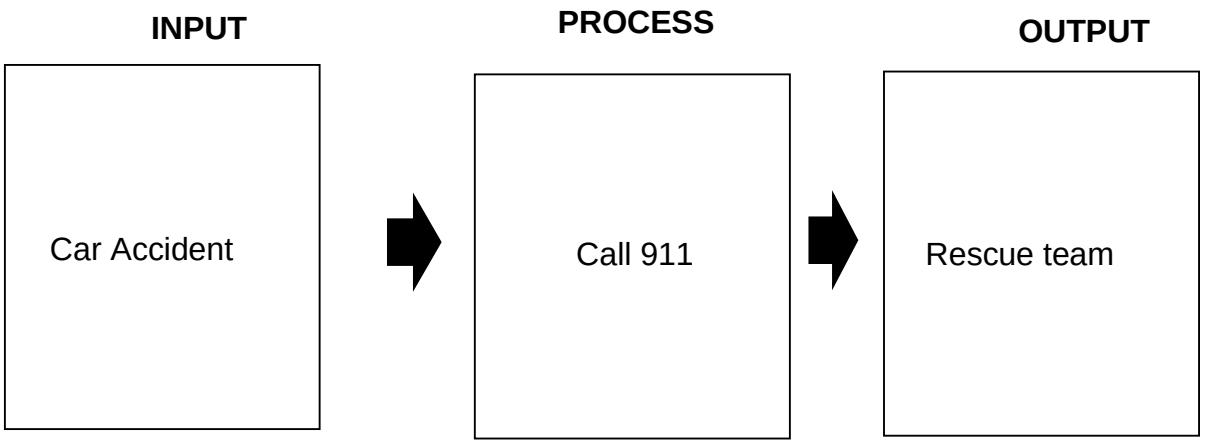

Figure 1.4.1.1 –Existing Process

Figure 1.4.1.1 The input is when the car accident happens. The process is either the driver calls the authorities or the concerned citizen will do the call to report the incident. The operator called will then search for the location of the accident and send it to the nearest authorities in the area. The rescue team will arrive on the area immediately as an output of the testing process of the study.

According to Officer PSMS Jiffrey B. Saguran from Philippine National Police Taguig Traffic Enforcement Unit 30-40, traffic accidents happen every day around Taguig City. Four out of ten of these accidents resulted in death due to various reasons with the accident being not reported immediately. According to Officer FO3 Belinda Ambrosio from the Bureau of Fire Protection (BFP) Response Team, all hotlines and numbers that are posted all around the City of Taguig are manned 24/7. Authorities respond to all reported accidents immediately and deploy nearest authorities as soon as possible.

1.4.2 Knowledge Process

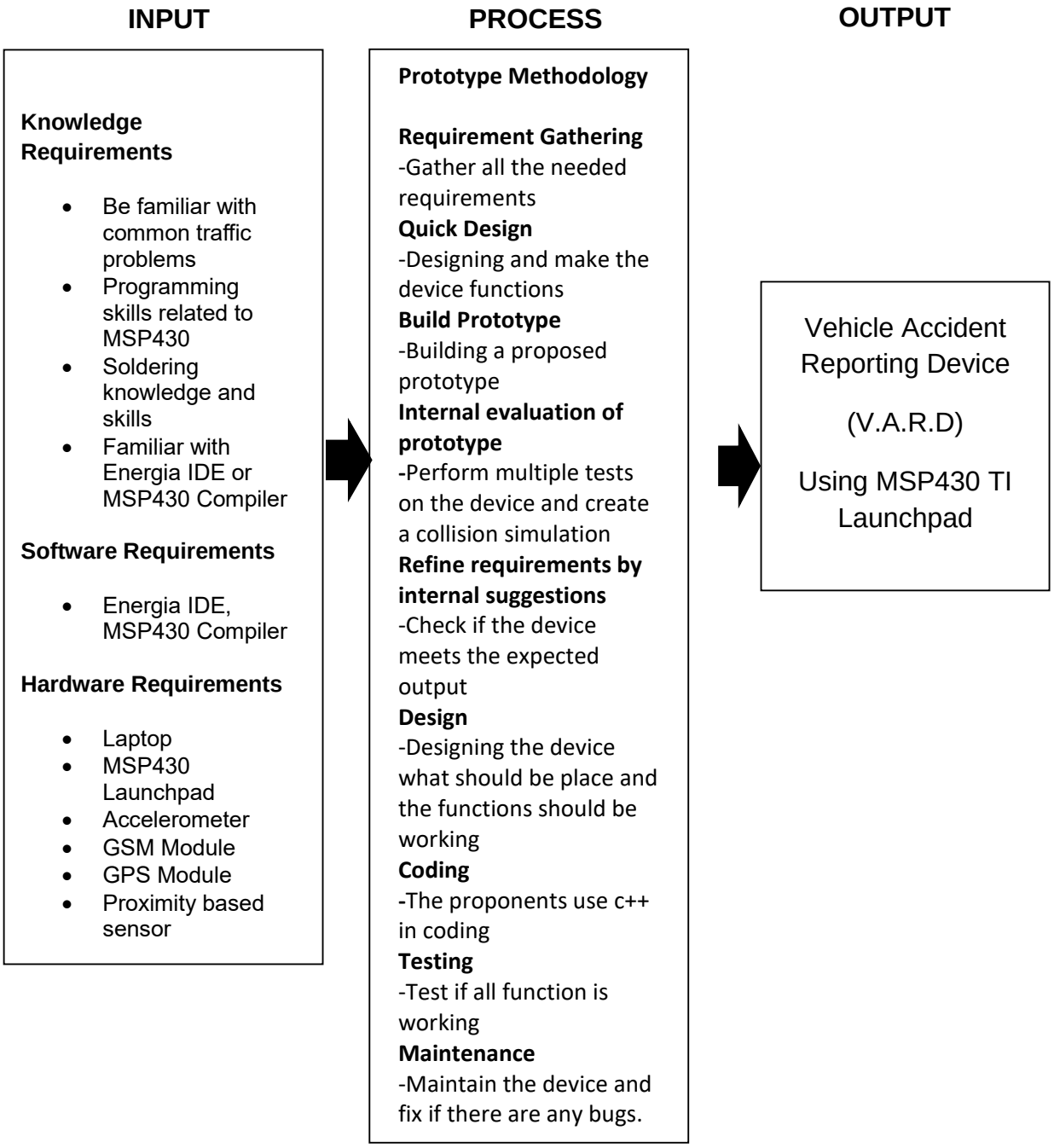

Figure 1.4.2.1 – Knowledge Process

Figure 1.4.2.1 is the knowledge process for the proposed project entitled “Vehicle Accident Reporting Device (V.A.R.D) using MSP430 TI Launchpad”. The proponents need various skills and knowledge in order to achieve the output’s main functions. The proponents need to be aware of common traffic problems and collisions, the programming language used to develop this project is Visual C and C++. The MSP430 Launchpad which is the microcontroller is used for the proposed project. Also, it has its own compiler. The proponents have to familiarize the following in order to avoid problems during the project development.

The process of the proposed project entitled: Vehicle Accident Reporting Device will go through several stages. First the proponents need to plan for the projects and research about the device requirements, the equipment needed in order for the project to be completed. The proponents need to build hardware first and assemble all sensors and modules to the microcontroller to implement the code. In order to ensure that the device is working accurately, the proponents need to conduct multiple test runs simulations to test the device and errors. After checking the errors, the proponents continue to monitor the device to check if there are still room for improvement in the future.

1.4.3 Proposed Process

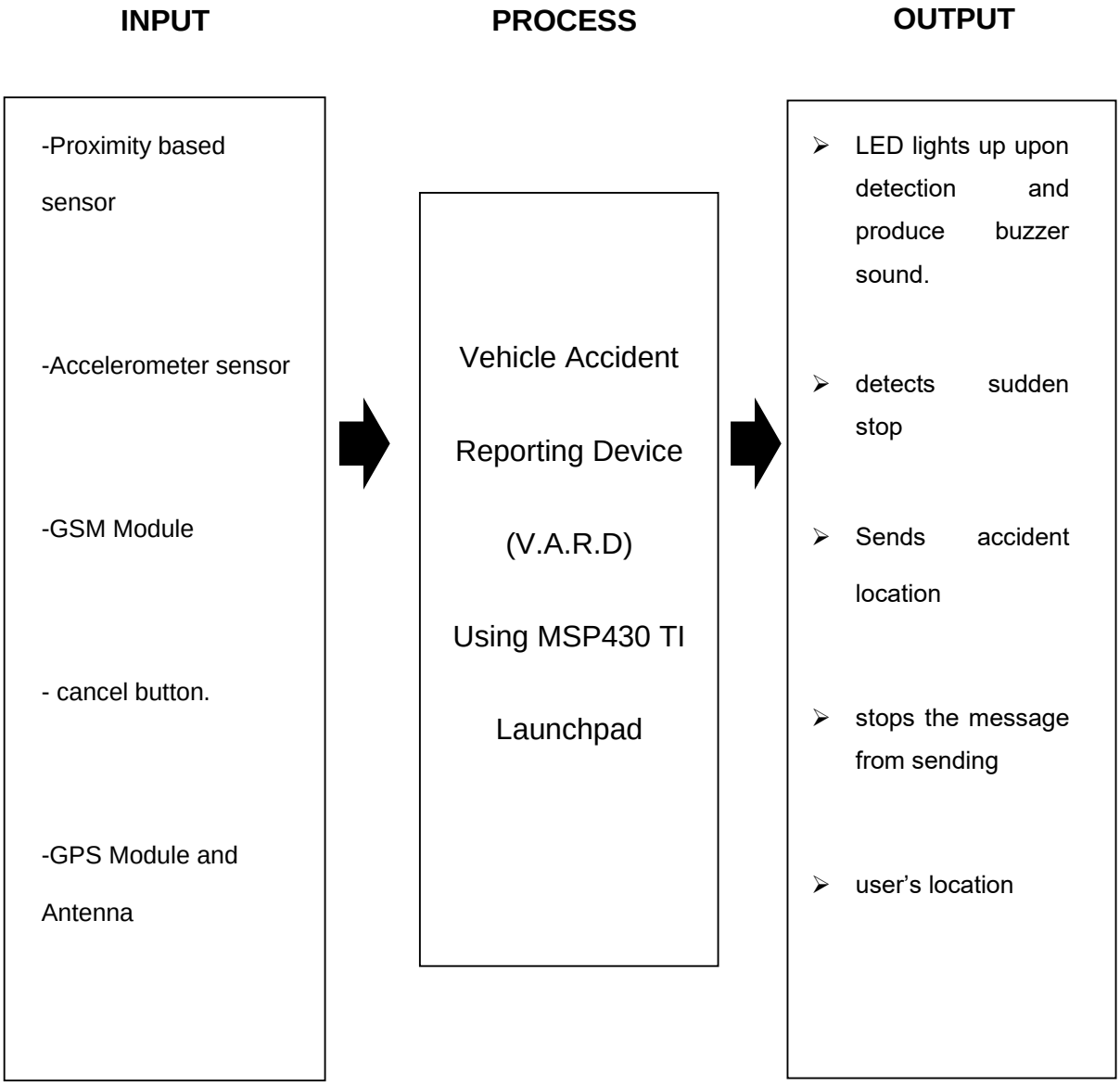

Figure 1.4.3.1 – Proposed Process

Figure 1.4.2.1 is the proposed process for the project entitled “Vehicle Accident Reporting Device (V.A.R.D) using MSP430 TI Launchpad”. In order to prevent collisions from happening, the proponents also added Proximity based sensors on the back and at the front of a vehicle, a buzzer and a LED light to inform the driver when he or she is in danger. The Proximity based sensor is connected on the accelerometer, if ever the vehicle is on a halt, then the Proximity based sensors will stop working.

The idea that the proponents would want to achieve is for the device to successfully detect when the vehicle undergoes a sudden stop or a sudden drop of speed using the accelerometer, the MSP430 will identify the accident encountered, collision after sometime and will perform a countdown. The driver can cancel the message intended to alert authorities. The message can be sent using the GSM Module included in the device to determine the location of the vehicle. The proponents used GPS Module and Antenna.

1.5 Statement of the Problem

1.5.1 General Problem

The main problem of the project is how to successfully implement technology into detecting vehicle collisions to avoid tragic events from happening. To develop a device that is as accurate as possible and be able to relay important message to authorities.

1.5.2 Specific Problem

- How to create a device that accurately sends a message and can be cancelled within a given time?
- How to create a device that is capable of detecting a collision?
- How to be able to send an alert to the driver if it detects a nearby object?
- How to develop a device that is compact and easy to use?
- How to be able to create a dependable device that can report a collision that happened even without the use of manual effort?

1.6 Objectives of the Study

1.6.1 General Objectives

The general objective of the proposed project entitled, “Vehicle Accident Reporting Device (V.A.R.D) using MSP430 TI Launchpad” is to develop a device that will provide accurate and reliable knowledge to authorities. It detects a collision and make people aware that the device can be useful and relevant to the current situation of traffic in the Philippines.

1.6.2 Specific Objectives

- To create a device that accurately send a message and can be cancelled within a given time.
- To be able create a device that is capable of detecting a collision
- To be able to send an alert message to the driver if it detects a nearby object.
- To develop a device that is compact and user-friendly.
- To be able to create a dependable device that can report a collision that happened even without the use of manual effort

1.7 Scope and Delimitation

1.7.1 Scope of the Study

- The device includes a cancel button to stop sending message within five seconds.
- The device comes with LED lights and buzzer to alert the driver or car owner.
- The device can provide the location of the collision with the use of GPS.
- The device includes a proximity-based sensor which can help prevent a collision.
- One-year subscription of the device for the customers

1.7.2 Delimitation of the Study

- The device cannot take or make the calls to the authorities and family members
- The device does not guarantee that the location provided is exact and depends on the coordinates detected by the GPS Antenna and Satellites.
- The device does not guarantee the safety of the passengers and drivers
- The device cannot send additional details to authorities after sending the report
- The ERT that receives the message must have an internet connection to be able to view and set the fastest route possible to the accident.

1.8 Significance of the study

The findings and result of this study are highly significant and beneficial specifically to the following:

- **Vehicle owner or driver.** This project will be a big help in case of emergency and to prevent vehicle accidents.
- **Future Researchers.** This project will be a good reference for other upcoming collision detector device developers.
- **Proponents.** This will help the proponents expand their skills and knowledge.

1.9 Definition of Terms

- **Accelerometer sensor** - An accelerometer is an electromechanical device used to measure acceleration forces. Such forces may be static, like the continuous force of gravity or, as is the case with many mobile devices, dynamic to sense movement or vibrations.
- **GPS Module** – A GPS navigation device, GPS receiver, or simply GPS is a device that is capable of receiving information from GPS satellites and then to calculate the device's geographical position**.**
- **GSM module** - A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system.
- **Proximity based sensors** - Detect the presence or absence of objects using electromagnetic fields, light, and sound
- **Microcontroller** - is a IC chip that executes programs for controlling other devices or machines, used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems.
- **ERT -** An incident response team (IRT) or emergency response team (ERT) is a group of people who prepare for and respond to any emergency incident, such as a natural disaster or an interruption of business operations. Incident response teams are common in public service organizations as well as in organizations. This team is

generally composed of specific members designated before an incident occurs, although under certain circumstances the team may be an ad hoc group of willing volunteers.

- **Vibration -** Vibration is the movement or mechanical oscillation about an equilibrium position of a machine or component. It can be periodic, such as the motion of a pendulum, or random, such as the movement of a tire on a gravel road. Vibration can be expressed in metric units (m/s2) or **units of gravitational constant "g,"** where 1 g = 9.81 m/s2. An object can vibrate in two ways: free vibration and forced vibration.

CHAPTER II

Review of Related Literature and Studies

The literature and studies cited in this chapter tackle the different concepts, understandings and ideas related to study from the past up to the present and serves as the proponent's guide in developing the project. Those that were included in this chapter helps in familiarizing information that are relevant and similar to the present study.

2.1 Foreign Related Literature

The literatures mentioned in this section are written works from foreign country that is related to the study.

Title: Method and system for detecting vehicle collision using global positioning system

Author: Rodric C. Fan, Carey B. Fan and David Mleczko

Year: October 1, 2015

According to the article of Rodric C. Fan, Carey B. Fan and David Mleczko last October 1, 2015 entitled "Method and system for detecting vehicle collision using global positioning system" A method and a System using the Global Positioning

System (GPS) to detect and report vehicle accidents are presented. GPS, which is currently used primarily for vehicle positioning, can be combined with wireless technology to automatically report accidents to third parties.

A mobile unit placed or installed in a vehicle receives code Sequences from the GPS Satellites, converts the code Sequences to positional information, and transmits the positional information to a server. The server derives the acceleration of the mobile unit from the positional information and compares the acceleration with a threshold value. In one embodiment, a microprocessor included in the mobile unit derives the acceleration and compares the acceleration with a threshold value. The threshold value represents acceleration that can be achieved only with an external force Such as a collision. If the acceleration exceeds the threshold value, the Server or the microprocessor automatically sends notification to third parties through the data network.

.**Reference:**

https://patentimages.storage.googleapis.com/2b/ec/25/c949f33f2aac91/US6459988.pdf

The proponents decided to choose this literature since it is similar to the proposed project where GPS detects the location of the accident and the microprocessor automatically sends a notification to third parties through the data network if the accident occurred.

Title: Smart Alert System for Vehicles

Author: R.Ramkumar, S.Dinesh, S.Naveen Kumar and Mrs. G.Prathipa

Year: 2016

According to R.Ramkumar, S.Dinesh, S.Naveen Kumar and Mrs. G.Prathipa (2016) entitled “Smart Alert System for Vehicles” The Rapid growth of technology and infrastructure has made our lives easier. The advent of technology has also increased the traffic hazards and the road accidents take place frequently which causes huge loss of life and property because of the poor emergency facilities. Road accidents are one of the major causes of mortality around the world and over 1,300,000 people are killed annually in the road accidents.

Most of fatal accidents occur on the roads outside the city. Some of the casualties are killed in the crash moment and the others after the accident, mostly due to late arrival of rescue groups. The late arrival of rescue groups is mostly because of the lack of rapid and timely notice from accident. The aim of our work is to find the vehicle accident location by means of sending a message using a system which is placed inside of vehicle system.

So in this work we are using the Arduino microcontroller ATMEGA 2560 for cost effective and also for easy understanding. Here we used embedded C programming for better accuracy and GPS and GSM modules which helps to trace the vehicle anywhere on the globe. The exact location of the vehicle is sent to our remote devices

(mobile phones) using GSM modem. Proposed system contains single-board embedded system that is equipped with GPS and ZigBee, along with microcontroller that is installed in the SAS vehicle.

Reference:

https://pdfs.semanticscholar.org/62ac/c3db46d63a158f755e369d516795293b46e1.pdf

The device that is discussed on the article is the same device that the proponents used. GPS can determine the exact location and send the details to the third party with the use of GSM modem.

Title: Accident Detection and Intelligent Navigation System for Emergency vehicles in Urban Areas using IoT

Author: Harish Kumar N and Dr. Deepak

Date: 2017

According to Harish Kumar N and Dr. Deepak (International Journal of Engineering and Techniques - Volume 3 Issue 6, Nov - Dec 2017) entitled “Accident Detection and Intelligent Navigation System for Emergency vehicles in Urban Areas using IoT” With the current mechanical and populace blast, the utilization of vehicles has quickly accumulated and in the meantime the frequencies of accidents have likewise expanded. Nobody can turn away the accidents, yet can spare their life by pushing the ambulances to the doctor's facilities in time. In this paper accidents discovery and route of crisis vehicle utilizing IoT is proposed. The target of this plan is to limit the delay caused for movement of emergency vehicles. This approach additionally plans to give the accident spot to emergency vehicle utilizing GPS which is accessible in rescue vehicle.

Reference: *https://s3.amazonaws.com/academia.edu.documents/56616077/IJET-V3I6P50.pdf?responsecontentdisposition=inline%3B%20filename%3DAccident_Detection_and_Intelligent_Navig.pdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWOWYYGZ2Y53UL3A%2F20191211%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Date=20191211T175146Z&X-Amz-Expires=3600&X-AmzSignedHeaders=host&XAmzSignature=9b7f932564cf9f77d8123bcdfab1f3a20d5b992a8fb86db4f65383a2e736533d*

In relation, the proposed project will be a big help to the authorities because the device will send the location of the accident. It can send the details quickly as long as there is a signal, but it can assure the respond time of the authorities that the device itself will inform the contact person that is saved on it.

2.2 Local Related Literature

Title: Kalman filtered GPS accelerometer-based accident detection and location system: a low-cost approach

Author: Md. Syedul Amin, Mamun Bin Ibne Reaz, Mohammad Arif Sobhan Bhuiyan and Salwa Sheikh Nasir

Date: 2014

A low-cost accident detection system utilizing cheap ADXL345 accelerometers and GPS receiver is proposed in this communication. The accident detection algorithm was developed based on sudden deceleration. The double integration of the acceleration and heading from the tilt angles of accelerometers were used to determine the location. Kalman filter was utilized to correct the accumulated double integration errors with the trusted GPS data. The field tests demonstrated the correct functioning of the accident detection algorithm and location. The proposed low-cost system can save many lives by the automated accident detection and accurate location even during GPS outage.

Reference:

https://www.jstor.org/stable/24102459?readnow=1&seq=1#page_scan_tab_contents

In relation, the proposed project will be a big help in accident detection where the ultrasonic sensor detects the distance of the vehicle from the object and give a signal through LED lights to catch the attention of the driver before the collision happens.

Title: Microcontroller-based Vehicle Security System with Tracking Capability using GSM and GPS Technologies

Author: Orven F. Mendoza

Date: March 28, 2017

According to Orven F. Mendoza (MSc) (Asia Pacific Journal of Multidisciplinary Research May 28, 2017) The security of vehicles is extremely essential for vehicle owners especially to those whose hard-earned income was used to avail of one or simply, its loss would mean inconveniences to family and work. With these, it becomes the major problem of every vehicle owner. This thesis, Microcontroller based Vehicle Security System with Tracking Capability using GSM and GPS Technologies, is a system that can be used to increase vehicle security, as it can track location of missing vehicle, and help authorities have credible evidence that the vehicle is stolen. The project uses the Global System for Mobile (GSM) and the Global Positioning System (GPS) technology, which includes the use of GPS receiver module, GSM module, and microcontroller as its primary components. It also uses a vibration sensor that senses vehicle movement and a buzzer that sends an alarm when sensors are triggered. A confirmation message is sent to the vehicle owner of the vehicle by the device. The system also features capability of tracking the location of the vehicle with the help of the GPS receiver which gives data to the location of the vehicle by way of coordinates. These coordinates provide exact location of the motor vehicle. The SMS message that the vehicle owner will send to the device attached to the vehicle should follow correct format of limitation for successful use and the use of

the four-character password followed by the command. The command is for power switching or activating automatically the key switch, engine and alarm. If not observed, the device would not work. The project is deemed to provide vehicle owners the security of their vehicle. The system will not only ensure vehicle security but also lessen the threats on vehicles.

Reference: *http://www.apjmr.com/wp-content/uploads/2017/06/APJMR-2017.5.2.2.15.pdf*

GSM Module and Microcontroller in this article is similar to the proposed project where it uses GPS to locate the accident while the GSM module will be the one that sends the location to the authorities.

Title: Advanced Vehicle Tracking System on Google Earth Using GPS and GSM

Author: Sowjanya Kotte and Hima Bindhu Yanamadala

Date: December 3, 2013

According to International Journal of Computer Trends and Technology (IJCTT) December 3, 2013 Vehicle navigation is one of the most important applications in the era of navigation which is mostly used by drivers. Therefore, the efficiency of the maps given to the drivers has a great importance in the navigation system. In this paper we proposed a very efficient system which uses the GPS and earth maps to help the driver in navigation by robust display of the current position of the vehicle on a displayed map. The main aim of this project is designing a system which is capable of continuous monitoring of path of the vehicle on PC with Google Earth Application. Here the important issue is displaying the map on several various scales which are adopted by the users. The heart elements in the implementation of this project are GPS, GSM and MCU. The GPS-GSM integrated structure is designed to track the vehicles by using Google earth application. The micro controller is used to receive data from GPS and to transfer the latitude and longitude to the PC to map by using the VB.Net language and this map is generated using Google Earth information.

Reference: *http://ijcttjournal.org/Volume6/number-3/IJCTT-V6N3P121.pdf*

The proponents decided to choose this literature because it which might be related to our proposed project entitled "Vehicle Accident Reporting Device " we relate our project because giving the exact location is one of our major objectives so, we use google map.

2.3 Foreign Related Studies

The studies mentioned in this section are works from foreign country that is related to our study.

Title: Vehicle Accident Automatic Detection and Remote Alarm Device

Author: Dr.V.Padmaja and Varsha Goud

Date: July 2012

According to Dr.V.Padmaja and Varsha Goud (July 2012) in their thesis entitled “Vehicle Accident Automatic Detection and Remote Alarm Device” The Rapid growth of technology and infrastructure has made our lives more easy . The advent of technology has also increased the traffic hazards and the road accident take place frequently which causes huge loss of life and property because of the poor emergency facilities. Our project will provide an optimum solution to this draw back. An accelerometer can be used in a car alarm application so that dangerous driving can be detected. It can be used as a crash or rollover detector of the vehicle during and after a crash. With signals from an accelerometer, a severe accident can be recognized.

According to this project when a vehicle meets with an accident immediately Vibration sensor will detect the signal or if a car rolls over, a Micro electro mechanical system (MEMS) sensor will detects the signal and sends it to ARM controller.

Microcontroller sends the alert message through the GSM MODEM including the location to police control room or a rescue team. So, the police can immediately trace the location through the GPS MODEM, after receiving the information. Then after conforming the location necessary action will be taken. If the person meets with a small accident or if there is no serious threat to anyone`s life, then the alert message can be terminated by the driver by a switch provided in order to avoid wasting the valuable time of the medical rescue team. This paper is useful in detecting the accident precisely by means of both vibration sensor and Micro electro Mechanical system (MEMS) or accelerometer. As there is a scope for improvement and as a future implementation, we can add a wireless webcam for capturing the images which will help in providing driver`s assistance. Keywords - Accident, Automatic Detection, Micro electro Mechanical system, Remote Alarm Device, Vehicle.

Reference:

https://www.researchgate.net/publication/277848807_Vehicle_Accident_Automatic_Detection_and_Remote_Alarm_Device

In relation to this study to the proposed project entitled Vehicle Accident Report Device, it has a microcontroller that sends the alert message through the GSM module including the location to the authorities and contact person that is saved to the device.

Title: Automatic RF Alert system to Avoid Vehicle Accident and Rescue using Wireless Control Techniques

Author: Munaf Syed, Malathi Lakshmanan and Jayanthi A.N

Date: February 2017

According to Munaf Syed, Malathi Lakshmanan and Jayanthi A.N. in their thesis entitled "Automatic RF Alert system to Avoid Vehicle Accident and Rescue using Wireless Control Techniques" Traffic overcrowding and in an urban areas traffic flow management were familiar as major problems, which have caused much thwarting for the ambulance. Moreover, road accidents in the city have been continuous process, the more crucial process is protecting the loss of life due to the accidents. The main theme behind this scheme is to provide a smooth flow for the ambulance to reach the hospitals in time and thus minifying the expiration. After the accident occurrence there will be intimation to the vehicles which around the accident spot. The ambulance is controlled by the central unit which provide short and traffic-controlled route to reaching the hospital as early as based on the accident location.

Reference:

https://www.researchgate.net/publication/312624847_Automatic_RF_Alert_system_to_Avoid_Vehicle_Accident_and_Rescue_using_Wireless_Control_Techniques.

The proposed project is similar to this study where sending location to the authorities will lessen the time of the rescue team in searching where the accident happened. In this study, it used vibration to get the attention of the driver before the collision happen, instead the proponent used led light and buzzer.

Title: Real Time Vehicle Accident Detection and Tracking Using GPS and GSM

Author: Namrata H. Sane, Damini S. Patil and Snehal D. Thakare

Date: April 2016

According to Namrata H. Sane, Damini S. Patil and Snehal D. Thakare last April 2016 entitled “Real Time Vehicle Accident Detection and Tracking Using GPS and GSM” This paper presents review on the accident detection techniques and some future possibilities in this field. Now-a-days lots of accidents happen on highways due to increase in traffic and also due to rash driving of the drivers. And in many situations the family members or the ambulance and police authority is not informed in time. This result in delaying the help reached to the person suffered due to accident. Road accidents constitute the major part of the accident .

The purpose of the project is to find the vehicle where it is and locate the vehicle by means of sending a message using a system which is placed inside of vehicle system Most of the times we may not be able to find accident location because we don’t know where accident will happen. Our project Real Time Vehicle Tracking and Accident Detection with GPS is designed to avoid such situations

Reference:

https://pdfs.semanticscholar.org/26d9/4732e35310e06b8dd66454000853bbbd267f.pdf

In relation to the proposed project, it can give the exact location where the accident happened with the use of GPS and google map. The microcontroller sends the location through GSM Module and the message contains a link where the location of the accident is.

2.4 Local Related Studies

The studies mentioned in this sector are works from our country that is related to our study.

Title: Distress Signal Tracker Using GPS And SMS Technology

Author: Ralph H. Balingasa, Maria Tricia Camille R. Bilog, Jonnelle Klenn D. Castillo, Jerome M. Perez, Agnes F. Terrible and Rionel B. Caldo

Date: September 2015

According to Ralph H. Balingasa, Maria Tricia Camille R. Bilog, Jonnelle Klenn D. Castillo, Jerome M. Perez, Agnes F. Terrible and Rionel B. Caldo (September 2015) on their thesis entitle “Distress signal tracker using gps and sms technology” There is no time in history that tracking has become a part and parcel of almost everyone‟s lives than it is today. Due to the need of a device that enables easy access in locating a particular person, thing or vehicle, the proponents aim to develop a study which comprises of the communication between a distress signal tracker incorporated in a server through mobile communication (SMS) that contributes to public safety, delivers accurate location of the user to the corresponding recipients and provides a real-time monitoring system using VB.Net and MySQL. The method of research used in this study was experimental method which involves the identification of response time and availability of the network signal. A series of testing was performed in 30 different locations in Calamba, Laguna demonstrating the versatility and accuracy of

the device and server under various circumstances. Based from the evaluation of the data gathered, the results are proved to satisfy the required objectives and specifications of the study.

Reference:

http://lpulaguna.edu.ph/wp-content/uploads/2016/08/1.-DISTRESS-SIGNAL-TRACKER-USING-GPS-AND-SMS-TECHNOLOGY.pdf

In relation to the proposed project, the target is the owner of the vehicle for their safety while driving. The proponents want to alert the driver and be aware on the road with the use of the buzzer instead.

Title: Development of Multi-Home Alarm System Based on GSM Technology

Author: Crystalynne D. Cortez, Jennifer L. Santos, Ken M. Alberto, Patrick O.Kua, Reynan C. Muncada, and Kevin R. Pontiveros

Date: August 2016

According to Crystalynne D. Cortez, Jennifer L. Santos, Ken M. Alberto, Patrick O. Kua, Reynan C. Muncada, and Kevin R. Pontiveros on their thesis (August 2016) entitled “Development of Multi-Home Alarm System Based on GSM Technology” The paper presents the development of a cost-effective microcontroller-based multi-home alarm system that can detect smoke and home intrusion. Acquisition of local materials was taken into consideration. The developed prototype can send notification text message whenever smoke or intrusion was detected. Developmental research design was used to come up with a working prototype of the design. To test the smoke alarm, the system was exposed to different burning materials such as paper, wood, plastic, cloth and rubber; and to test the intrusion alarm, the system was placed at different distances. Based from the findings of the study, all materials acquired locally were able to function properly. The system was found to be consistent and efficient with data transmission, processing and reception. Response time of less than 20 seconds for smoke alarm and less than 2 seconds for lock mechanism were recorded. The system instantly sent notification messages to the user after fire and proximity sensors were triggered.

Reference: *http://www.ijeee.net/uploadfile/2016/0831/20160831074553244.pdf*

In relation to the proposed project, the proponents used microcontroller and GSM. If the accident occurred, a text message will be sent and if the accident is not that serious the driver or user can cancel the message before it sends.

Title: GPS and GSM Based Advanced Vehicle Monitoring and Information System

Author: Muhammad Anas and Usman Saleem

Date: February 2014

According to Muhammad Anas and Usman Saleem in their research last February 2014 entitled “GPS and GSM Based Advanced Vehicle Monitoring and Information System” This paper presents an insight into a cost-effective advanced vehicle system which is used for monitoring and information purpose without third par-ties' involvement using GPS (Global Positioning System) and GSM (Global System for Mobile Communications). The proposed system monitors the geographical position and speed of the vehicle through GPS module and sends its information to the owner on his mobile phone as a short message (SMS) through GSM module at his request or after a predefined time period. The system is composed of a GPS module, a microcontroller and a GSM module.

Additionally, the system also consists of certain salient features that include accident identification via Inertia sensor, date and time via RTC (Real Time Clock), parking system via Ultrasonic sonar sensors (measurement of the distance between vehicle and obstacles for automatic parking) and data logging in SD card by which we can determine the path of vehicle and visualize the movement at Google maps.

Reference:

https://www.researchgate.net/publication/274313688_GPS_and_GSM_Based_Advanced_Vehicle_Monitoring_and_Information_System

In relation to the proposed project, this research used GPS, GSM Module and ultrasonic sensor. The objective of the study is to lessen the car accidents on the road using the device that will give a signal through LED light and buzzer to the driver every time the ultrasonic sensor detects an object.

CHAPTER III

The Problem and Its Background

This chapter discusses the method of research that will be employed by the proponents to gather the necessary data. It also presents the research design and instruments used. The techniques and data gathering procedure and the software development model that would be helpful for the proponents in the course of the research are also tackled.

3.1 Research Design

This research proposal will use a quantitative approach and survey to collect the data. The quantitative approach in gathering information focuses on describing a trend phenomenon across a larger number of participants thereby providing the possibility of summarizing characteristics across groups or relationship. This approach surveys a large number of individuals and applies statistical techniques to recognize overall patterns in the relations of process.

This research is designed to lessen the car accident on the road and improve the alert system for the driver. It also helps the rescue team to detect the exact location of the accident

3.2 System Methodology

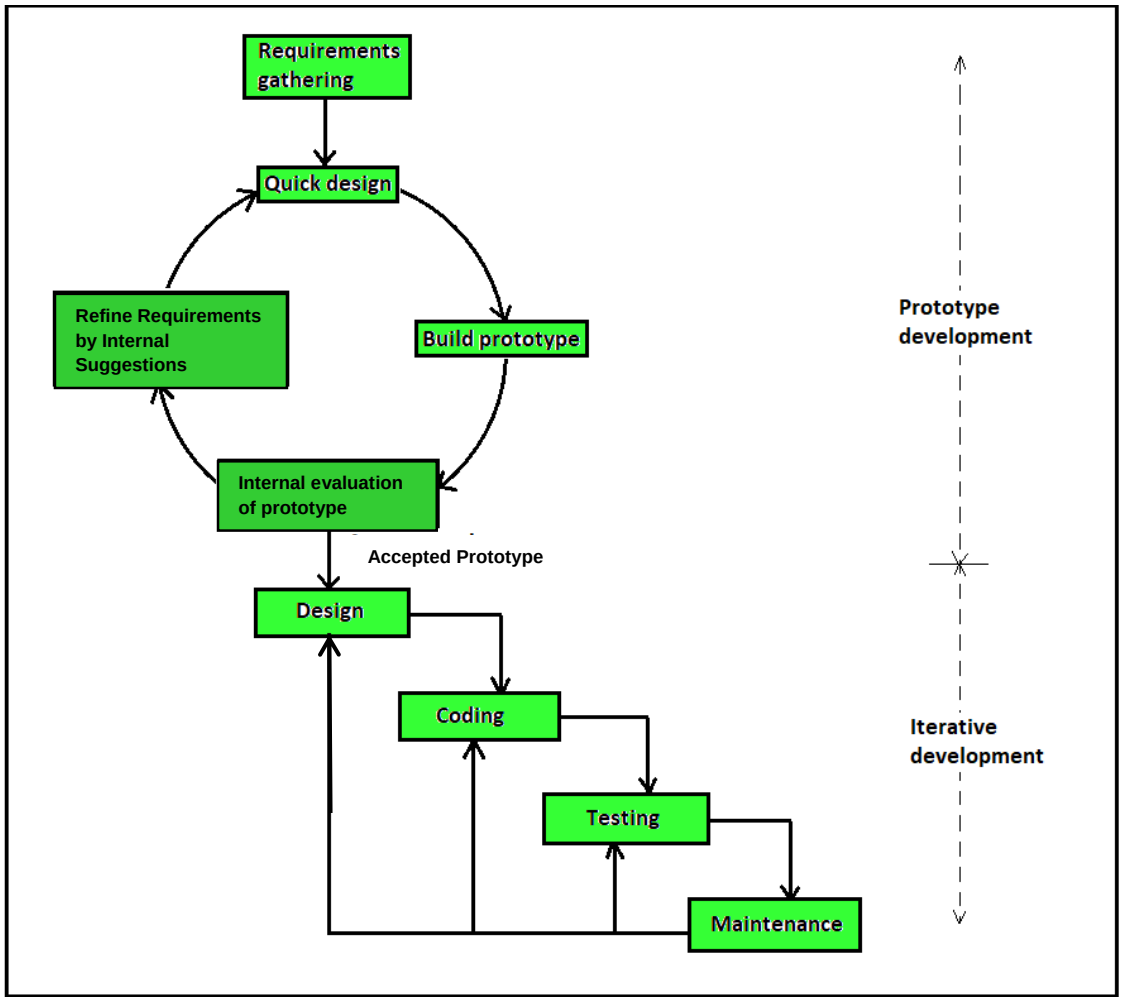

Figure 3.2.1 –Prototype Model Methodology

This part of the research contains the method used in developing the Vehicle Accident Report Device (V.A.R.D). Methodology is the process of how an application is developed. The proponents chose the Prototype Model.

Figure 3.2.1 The Prototyping model is one of the popular software development life cycle model. The prototyping model can be considered to be an extension of the Iterative Waterfall model. This model suggests building a working Prototype of the system, before the development of the actual software.

Requirements Gathering

The proponents conducted research regarding the proposed title (Vehicle Accident Reporting Device or V.A.R.D powered by MSP430), it is all about the kind of sensor/s and modules needed in order to fulfill the features the proponents planned to do in the early stages of development. First, the proponents focused on the main device, which is the MSP430 Launchpad. The Launchpad is a low cost & low powered microcontroller capable of handling the voltage requirements for other peripherals needed.

Next, the proponents canvassed and bought from multiple sources like online and local shops for the modules and sensors used in making the device, breadboards, jumper wires, GPS module, GSM Module(s), Multiple Ultrasonic Sensors, Accelerometer, and GPS Antenna.

Quick Design

The next step in this method is a quick design wherein the proponents visualized how the device is going to look like and where certain sensors and modules should be placed. The Ultrasonic Sensor goes to the front and back of a vehicle, while the Microcontroller and other devices are to be stored in a compact box or case to be put inside the vehicle near the driver. The cancel button should be within the reach of the driver at all times. The proponents also planned to put the GPS antenna in the window of the car in order to detect the satellites above for accurate location data.

Build Prototype

In this phase, the proponents start to build the planned prototype. The requirements gathered in the earlier phases are then connected to the microcontroller one by one. The proponents then check if the GPIO pin connections are correct and will be functional once the Iterative Development begins.

Internal Evaluation of Prototype

This activity refers to the phase wherein the proponents check if the devices and the prototype are enough in order to fulfill the features or if there are any more required parts and other alternative for other devices. The problem the proponents encountered in this phase is the GSM Module, where in the proponents was able to get the required GPIO connections.

Refine Requirements by Internal Suggestions

In this phase the proponents suggest other alternative methods in order to reduce cost and unnecessary effort while the device is functioning.

Like the problem encountered by the proponents with the GSM Module, the programmer suggested to find other ways in order to lessen the needed GPIO connections. The proponents decided on a different GSM Module with the least required GPIO connection.

Design

When the prototype is completed and suggestions are heard and made adjustments, the final design is decided by the proponents. The proponents concluded that the quick design that was planned earlier on is going to be used. The

proponents are planning to use waterproof plastic case in order for the microcontroller for another layer of protection. Also, the modules and sensors are also going to be inside a compact box with a USB Connection slot for the power supply. The outer design (like paint and other protective cases) is one of the considerations of the proponents.

Coding

The language used for this project to run is Visual C/C++, the main programmer used a combination of Energia IDE, and Code Composer Studio. First, the programmer checked if the modules and sensors used are working perfectly.

The first device the proponents worked on is the Ultrasonic Sensor, the proponents analyzed if the Ultrasonic Sensor works properly. The proponents incorporate LED Light and the Piezo Buzzer for safety purposes and indicating purposes.

The programmer adds the code for accelerometer. In this phase, there were limited open source codes found on the internet. In order to get a more accurate response the accelerometer gets tilted beyond the constant values set by the program, the proponents combined the formula for getting the gravitational (g) units and an if or else statement that if the sensitivity set by the proponents are met then

the GSM should send a text message to authorities together with the latitude and longitude data provided by the GPS module.

Testing

The proponents will test the device if all functions that are set on work properly and ready for implementation, for the testing of proposed project, a toy car/ bumpcar is used in order to prove if the device works properly in the real world.

Maintenance

Once the testing is done, the “Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430” can now be implemented. Buyers/Customers are required to sign a memorandum of agreement in order to make sure that the device can function at full capacity for the longest time. The Memorandum of Agreement states that the user agrees to a yearly subscription for the device, in which during every renewal of the device on a designated service center can the user check the status of his/her device (*and replace parts if ever a situation arises*), renew SIM Card requirements, and add additional family member’s details to the device’s system in order to have an updated notification process. The proponents will then monitor all devices regularly, check for further improvement and create solutions for bugs that may arise and be able to update customer’s information anytime the users deem fit.

3.3 Variables and Measurement

VARIABLES	MEASUREMENT
Ultrasonic Sensor	-Measures the distance of obstacles, vehicles, and other objects -checks whether the LED should light up or not
GSM Module	-part of the device that is responsible to send messages
GPS Module	-Gets the NMEA Sentences and converts them to longitude and latitude data to be sent using GSM Module
Accelerometer	-Gets the g units in order to be compared to the constant sensitivity for the system to think that the car crashed
Launchpad MSP430	-the code for all the modules and sensors used are embedded in the chip -responsible for getting all the inputs and producing outputs for the device

Table 3.3.1 – Variables and Measurements

3.4 RESEARCH SUBJECT

This part of the research contains the subjects whom the proponents have conducted the research.

Vehicle owners - The main target of the proposed study for safety purposes

Philippine Government Agencies – The device will be a big help in locating the accident since the device will send the exact location of the collision.

3.5 SAMPLING TECHNIQUE

In this study, the proponents will make use of stratified random sampling. A stratified random sampling procedure was used for selecting the participants in this study. To stratify the researchers would randomly select proportional amounts of people from each group. This is an effective sampling technique for studying how the issue might differ across subgroups.

In this study, respondents were randomly selected for evaluation and survey and classified them by Groups (Vehicle owner and Philippine Government Agency). The proponents used this kind of sampling technique to utilize the data gathered.

3.6 DATA GATHERING PROCEDURE

- **Internet Research**

  At the beginning of the proposed project, the proponents used the internet in researching and gathering data. The proponents watched tutorials related to the proposed project as guide on how to start the project properly.

- **Library Research**

  The proponents used past capstone document as a guideline in making the proposed project.

- **Interview**

  The proponents interviewed Officer FO3 Belenda Ambrucio from Bureau of Fire Protection (BFP) and Officer PSMS Jiffrey B. Saguran from Philippine National Police Taguig Traffic Enforcement Unit regarding on how they response on emergencies. Also some professors, car owners and students regarding this project are interviewed. The devices or language used and tips to lessen the future problems of the proposed device.

- **Survey**

  The proponents surveyed (50) respondents. 20 for the car owners, 10 for the authorities and 20 for the students to help develop the proposed project and to achieve the objectives.

- **Evaluation**

  The proponents evaluated (50) respondents to see if the proposed project is helpful and useful to the user.

3.7 DATA ANALYSIS

The proponents will use *qualitative research* in conducting surveys with the use of questionnaires. This part of the research shows the scales used in rating the proposed project entitled" Vehicle Accident Reporting Device (V.A.R.D) powered by launchpad MSP430. It contains two kinds of scales; the Likert Scale and 5 Point Scale:

Likert Scale: Psychological measurement device that is used to gauge attitudes, values, and opinions. It functions by having a person complete a questionnaire that requires them to indicate the extent to which they agree or disagree with a series of statement.

Verbal Interpretation	Numerical Equipment
Excellent	4.21 – 5.00
Very Satisfactory	3.41 – 4.20
Satisfactory	2.61 – 3.40
Fair	1.81 – 2.60
Poor	1.00 – 1.80

Table 3.7.1 – Likert Scale

Table 3.7.1 shows the Verbal interpretation and its Numerical equivalent value that the proponents' used for rating the application during the evaluation period. The Likert scale is where the computed results of evaluation are interpreted.

The Likert scale determines if the value of a result falls inside a specific range, its verbal interpretation is equivalent to the rating range where the result belongs.

Five Point Scale Rating: The following are the verbal interpretation of the Likert Scale. Five –Point rating scale and its interval used in evaluating the proposed application.

Rating	Verbal Interpretation
5	Excellent
4	Very Satisfactory
3	Satisfactory
2	Fair
1	Poor

Table 3.7.2 – Five Point Scale

Table 3.7.2 shows the Verbal interpretation and its Numerical equivalent value. The five-point scale is where the respondents of the evaluation will base their answer. Every rating has an equivalent verbal interpretation; the highest rating is 5 which is equivalent to “Excellent”, 4 which is equivalent to “Very Satisfactory”, 3 which is equivalent to “Satisfactory”, 2 which is equivalent to “Fair” and the lowest rating is 1 which is equivalent to “Poor”.

The proponents used the five-point scale rating because it makes the respondents easily understand what opinion he or she should choose for his or her answer. Five-point scales is the most recommended scale by the researchers for it reduces the frustration level of the respondent.

3.8 Statistical Treatment of Data

The following statistical tools were used in the analysis and interpretation of the collected data.

Frequency - it is the actual response to a specific item/question in the questionnaire where the respondent ticks her choice.

Legend $\Sigma F = N$

Σ = Summation of

F = Frequency

N = Total number of respondents

- **Weighted mean** – this was used to describe the perception of the respondents on each indicator. Weighted mean is for determining the average of each criteria and their verbal interpretation.

The weighted mean formula is:

$$WM = \Sigma w*f / n$$

Where:

WM = summation of computed weighted mean

w = weight of the scale value

f = frequency of response

n = total number of respondents

- **Percentage** – This was the used as descriptive statistics or something that describe a part of the whole.

The percentage formula is:

$$P = (f/n)*100$$

Where:

P = Percentage

f= Frequency, Sum of respondent

n = Total number of respondents

3.9 System Requirements

This part of the research contains the requirements needed in developing the proposed project entitled" Vehicle Accident Reporting Device (V.A.R.D) powered by launchpad MSP430. System requirements have two parts, the hardware requirements and software requirements.

3.9.1 Hardware Requirements

3.10 Project Cost and Benefit

Hardware Costs	QTY.	Total
MSP430 Launchpad	2	3,100.00
Header Pins	2	405.00
GPS Module	2	1,000.00
USB Hub	1	300.00
Heat Shrink Seal	1	270.00
GPS Antenna	2	700.00
GSM Module	1	650.00
Breadboard, Jumper Cables, Power Supply	n/a	1,800.00
SIM	1	60.00
FTDI Cable	1	500.00
Enclosure Case	1	550.00
Total		9,335.00

Table 3.10.1 Hardware Costs

Table 3.10.1 shows the hardware costs used by the researchers.

Software Costs	
Item	Cost
1. Windows10	Free
2. Energia IDE	Free
TOTAL	0

Table 3.10.2 Software Costs

Table 3.10.2 shows the costs of the software that is used by the researchers in developing the proposed project entitled ”Vehicle Accident Reporting Device (V.A.R.D) powered by launchpad MSP430.

Stationary and Supply Costs		
Item	Quantity	Cost
1. Hard Copy	9	₱ 900.00
2. Folder	9	₱ 72.00
3. Bondpaper	2	₱ 500.00
TOTAL		₱ 2,208.00

Table 3.10.3 Stationary and Supply Costs

Table 3.10.3 shows the stationary and supply costs used by the researchers.

Personal Costs		
Item	Quantity	Cost
1. Food		₱ 2,000.00
2. Internet	Per month(1)	₱ 1500.00
3. Transportation	2	₱ 1,000.00
4. Testing Costs(Bump Car)	n/a	n/a
TOTAL	7	₱ 4,500.00

Table 3.10.4 Personal Costs

Table 3.10.4 shows the personal costs used by the researchers during the

Summary of Costs	
1. Hardware Cost	₱ 9,335.00
2. Personal Cost	₱ 4500.00
3. Software Cost	₱ 0.00
3. Stationary and Supply Cost	₱2,208.00
TOTAL	₱ 16,043.00

Table 3.10.5 Summary of Costs

Table 3.10.5 shows the overall expenses used by the researchers.

3.11 Data Process and Modeling

This part of the research contains complex software system design. The use of text and symbols represent the way data flow of the proposed project entitled" Vehicle Accident Reporting Device (V.A.R.D) powered by launchpad MSP430.

3.11.1 System Flowchart

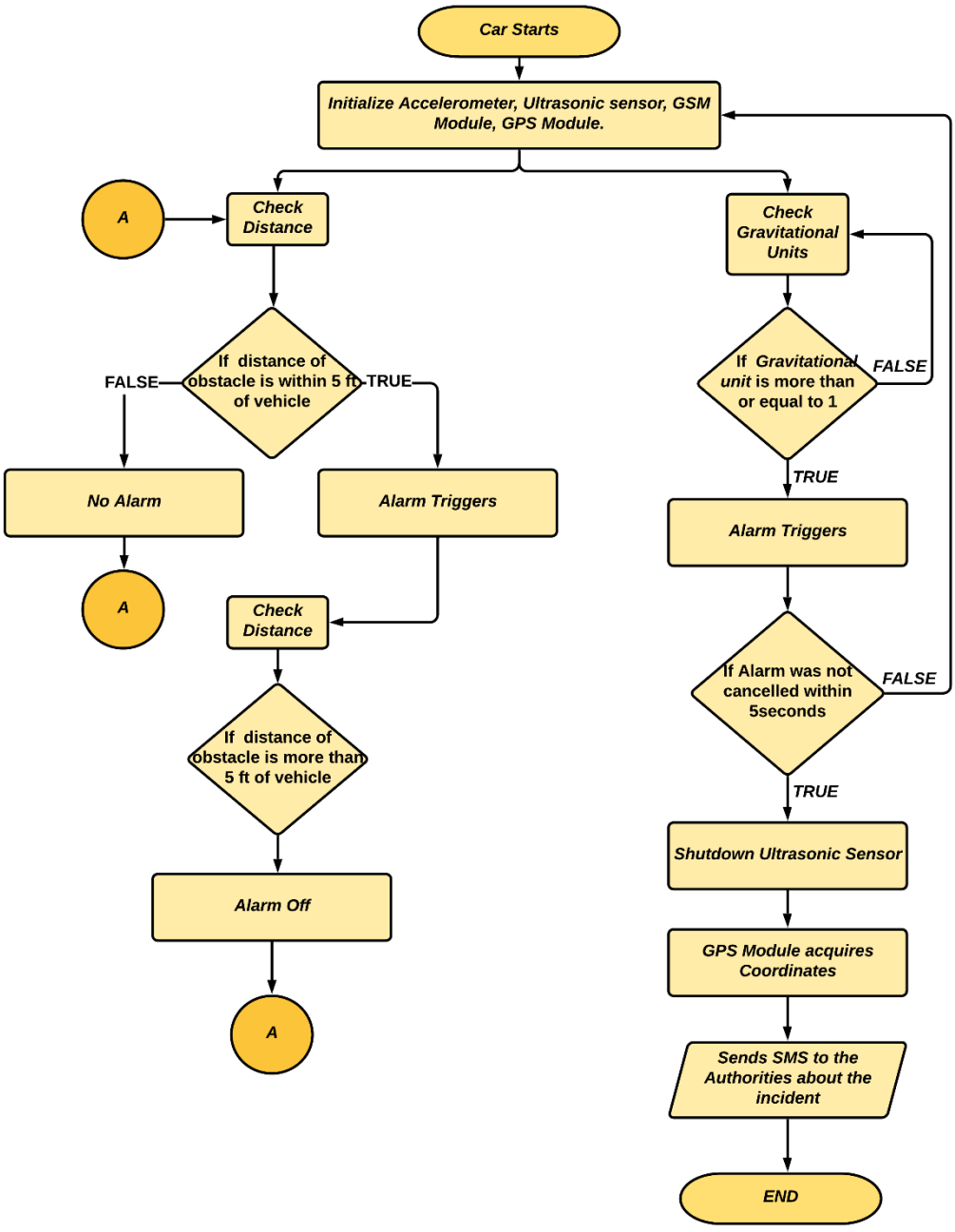

Figure 3.11.1.1 System Flowchart

3.11.2 Context Diagram

This part shows the software system using text and symbols to represent the flow of the data.

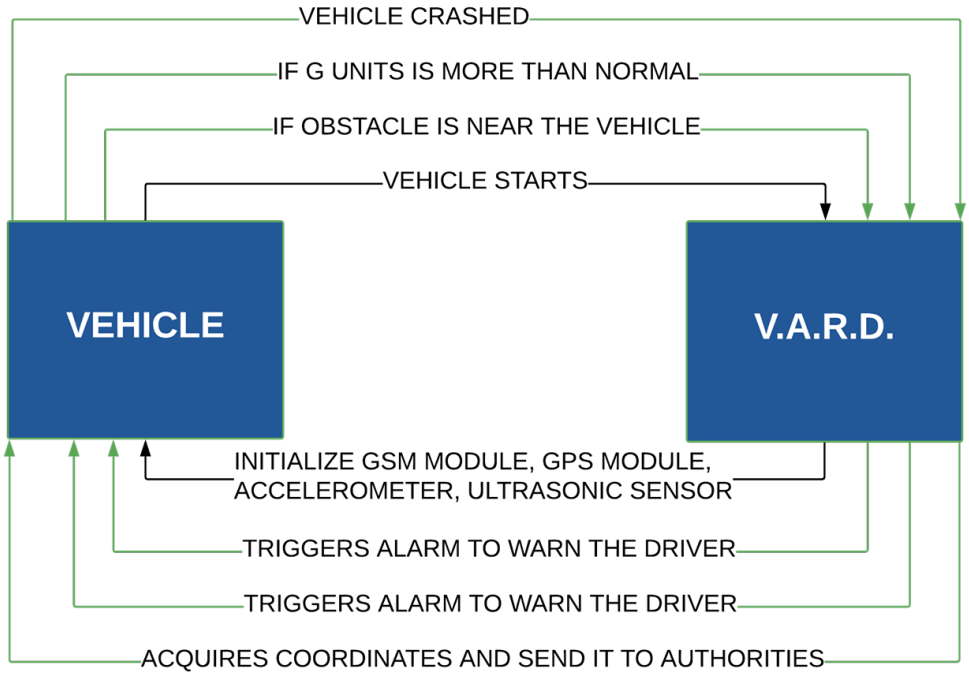

Figure 3.11.2.1 Context Diagram

Figure 3.11.2.1 shows the flow of the proposed entitled ”Vehicle Accident Reporting Device (V.A.R.D) powered by launchpad MSP430. The user starts the engine of the car and the device will turn on automatically. Since the source of the power of the device is inside the car, the device will detect the location and sense the object near the car. The device will send the message if accident occur. However, the authorities will not receive the message in case the button is pressed in 5 seconds.

3.11.3 Schematic Diagram

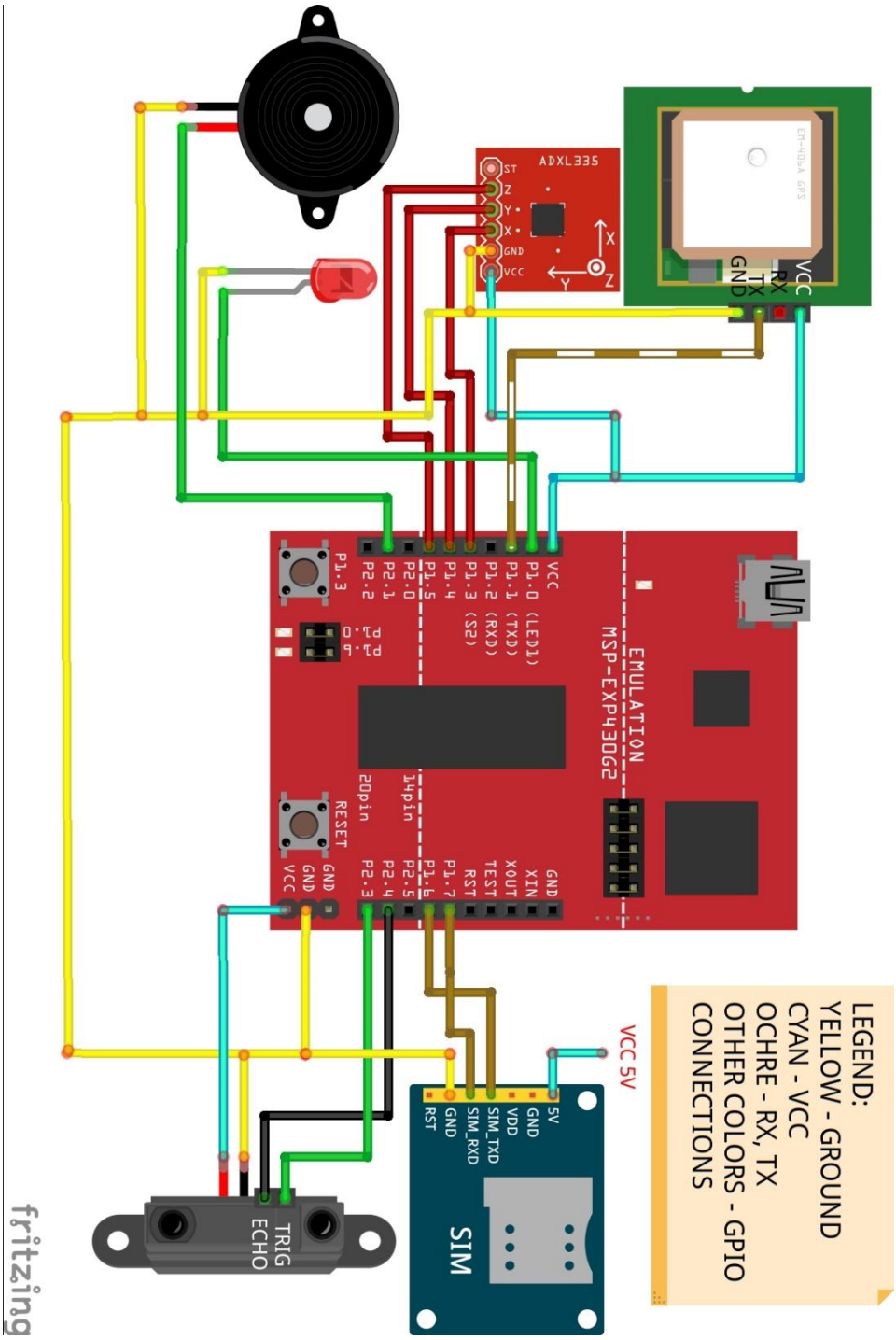

Figure 3.11.3.1 Schematic Diagram

CHAPTER IV

Presentation, Analysis and Interpretation of Data

4.1 Survey Presentation

This part of the study presents the result of the survey conducted by the proponents. The respondents' perceptions have been the source of information in gathering ideas and developing the proposed application.

The proponents conducted a survey by giving the questionnaire to fifty (50) respondents that is composed of students, authorities and drivers as well.

4.1.1 Classification of Survey Respondents

Respondents	Frequency	Percentage
Students	20	40%
Drivers	20	40%
Authorities	10	20%
TOTAL	50	100%

Table 4.1.1.1 Classification of Respondents

Table 4.1.1.1 shows the frequency and percentage of the respondents who answered the survey questionnaires.

Survey Questionnaire for Students

Name: _____ Date: _____

Year & Section: _____ Age: _____ Gender: _____

Instruction: This is a survey questionnaire for the project entitled **"Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430"**. Please choose the answer that best corresponds to your opinion by answering YES or No. Put ✓ for each question below.

Questions	YES	NO
1. Are you using devices such as smartphones?		
2. Do you think reporting car collisions/accidents are important?		
3. Have you encountered being or witnessing a car crash/accident?		
4. As a student do you think computer technology(such as sensors and proximity based tech.) can be more helpful in terms of emergency situations?		
5. Do you have an idea of what a microcontroller is?		
6. Do you think the automation of filing a car accident report can be useful?		
7. Do you think a device with proximity based sensors can be useful if used to detect nearby obstacles and accident threats to a car?		
8. Do you think having a device that can notify the victim's family if accidents do happen can be helpful to the authorities and car owners?		
9. Would you consider Vehicle Accident Reporting Device (V.A.R.D) as a tool for ensuring precautionary measures, reporting of vehicle crash and notification of accident to family members?		
10. Would you recommend Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430 to your family, friends and relatives?		

_____

Signature

4.2 Survey Result

Below is the survey questionnaire and its corresponding frequency answered by the respondents.

Tally of Survey for Students

Questions	YES	NO
1. Are you using devices such as smartphones?	20	0
2. Do you think reporting car collisions/accidents are important?	20	0
3. Have you encountered being or witnessing a car crash/accident?	19	1
4. As a student do you think computer technology(such as sensors and proximity based tech.) can be more helpful in terms of emergency situations?	19	1
5. Do you have an idea of what a microcontroller is?	18	2
6. Do you think the automation of filing a car accident report can be useful?	19	1
7. Do you think a device with proximity based sensors can be useful if used to detect nearby obstacles and accident threats to a car?	19	1
8. Do you think having a device that can notify the victim's family if accidents do happen can be helpful to the authorities and car owners?	19	1
9. Would you consider Vehicle Accident Reporting Device (V.A.R.D) as a tool for ensuring precautionary measures, reporting of vehicle crash and notification of accident to family members?	20	0
10. Would you recommend Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430 to your family, friends and relatives?	20	0

Table 4.2.1 Tally of Survey for Students

Table 4.1.2.1 shows the result of the survey questionnaires given to 20 student respondents who answered YES and NO in 10 questions presented.

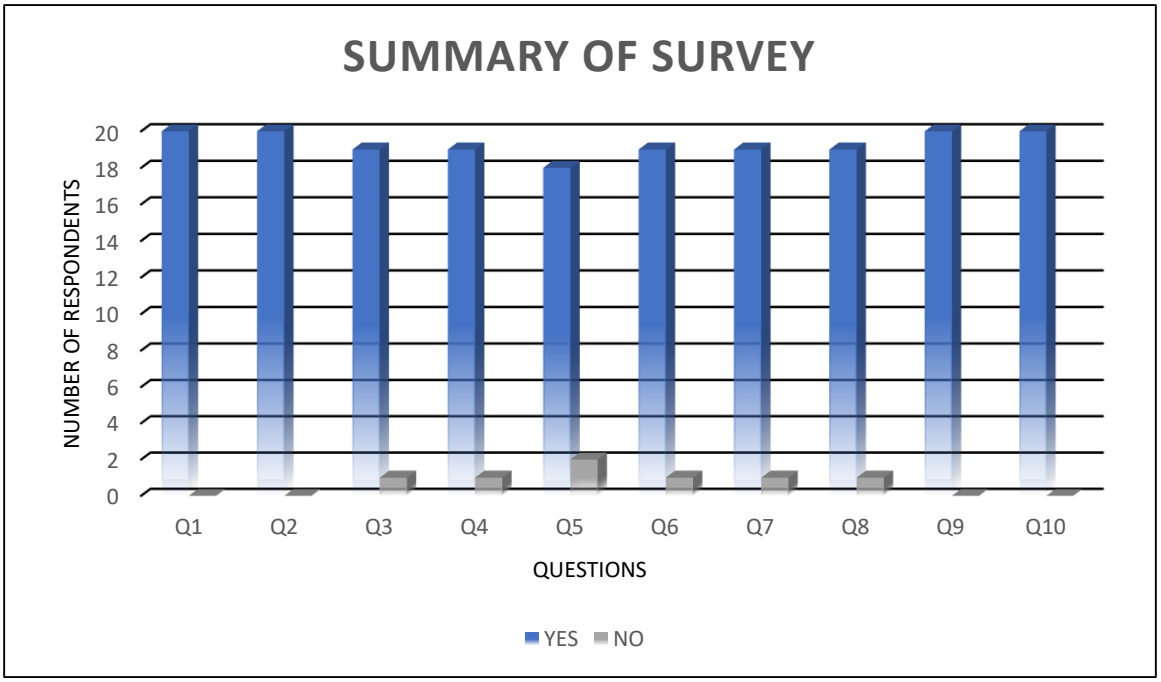

Figure 4.2.1 Summary Survey Result of the Proposed Application for Students

Figure 4.2.1 shows the tally summary result of the survey for students using bar graph. The tally shows that most of them think that reporting of these collisions on time or as soon as possible is important as most of them have experience or has seen such collisions. Most of the student respondents agree that the “Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430” can be a useful tool to notify family members and authorities whenever there are collisions while driving. They also believe that as students, the use of technology in order to improve traditional reporting methods can be more accurate, fast and precise. Therefore the proposed project is a good tool for ensuring precautionary measures, reporting of vehicle crash and notification of accident to family members.

Survey Questionnaire for Drivers

Name: _____ Date: _____

Car Type: _____ Age: _____ Gender: _____

Instruction: This is a survey questionnaire for the project entitled **"Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430"**. Please choose the answer that best corresponds to your opinion by answering YES or No. Put ✓ for each question below.

Questions	YES	NO
1. Are you aware of the dangers of every day transportation specially driving and riding vehicles?		
2. Do you think being involved in a car accident can have a huge impact on your life?		
3. Have you encountered being or witnessing a traffic collision?		
4. Do you think that with the help of technology(such as proximity based and accelerometer sensors), many accidents can be reported in a more faster and organized way?		
5. Do you acknowledge that nowadays, many car entrepreneurs and car owners invest in proximity based and accelerometer technology to improve the safety and productivity of their vehicles?		
6. Do you think the automation of filing a vehicle accident/crash report can be implemented and be of use?		
7. Do you think having a device that can notify authorities when you encounter a life threatening vehicle accident can be useful?		
8. Do you think that being able to let your loved ones/guardians know when you encounter a vehicular accident can be useful?		
9. Would you consider Vehicle Accident Reporting Device (V.A.R.D) as a tool for ensuring precautionary measures, reporting of vehicle crash and notification of accident to family members?		
10. Would you recommend Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430 to your family, friends and relatives?		

_____

Signature

Below is the survey questionnaire and its corresponding frequency answered by the respondents.

Tally of Survey for Drivers

Questions	YES	NO
1. Are you aware of the dangers of every day transportation specially driving and riding vehicles?	20	0
2. Do you think being involved in a car accident can have a huge impact on your life?	20	0
3. Have you encountered being or witnessing a traffic collision?	4	16
4. Do you think that with the help of technology(such as proximity based and accelerometer sensors), many accidents can be reported in a more faster and organized way?	18	2
5. Do you acknowledge that nowadays, many car entrepreneurs and car owners invest in proximity based and accelerometer technology to improve the safety and productivity of their vehicles?	18	2
6. Do you think the automation of filing a vehicle accident/crash report can be implemented and be of use?	20	0
7. Do you think having a device that can notify authorities when you encounter a life threatening vehicle accident can be useful?	17	3
8. Do you think that being able to let your loved ones/guardians know when you encounter a vehicular accident can be useful?	18	2
9. Would you consider Vehicle Accident Reporting Device (V.A.R.D) as a tool for ensuring precautionary measures, reporting of vehicle crash and notification of accident to family members?	18	2
10. Would you recommend Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430 to your family, friends and relatives?	20	0

Table 4.2.2 Tally of Survey for Drivers

Table 4.2.2 shows the result of the survey questionnaires given to 20 driver respondents who answered YES and NO in 10 questions presented.

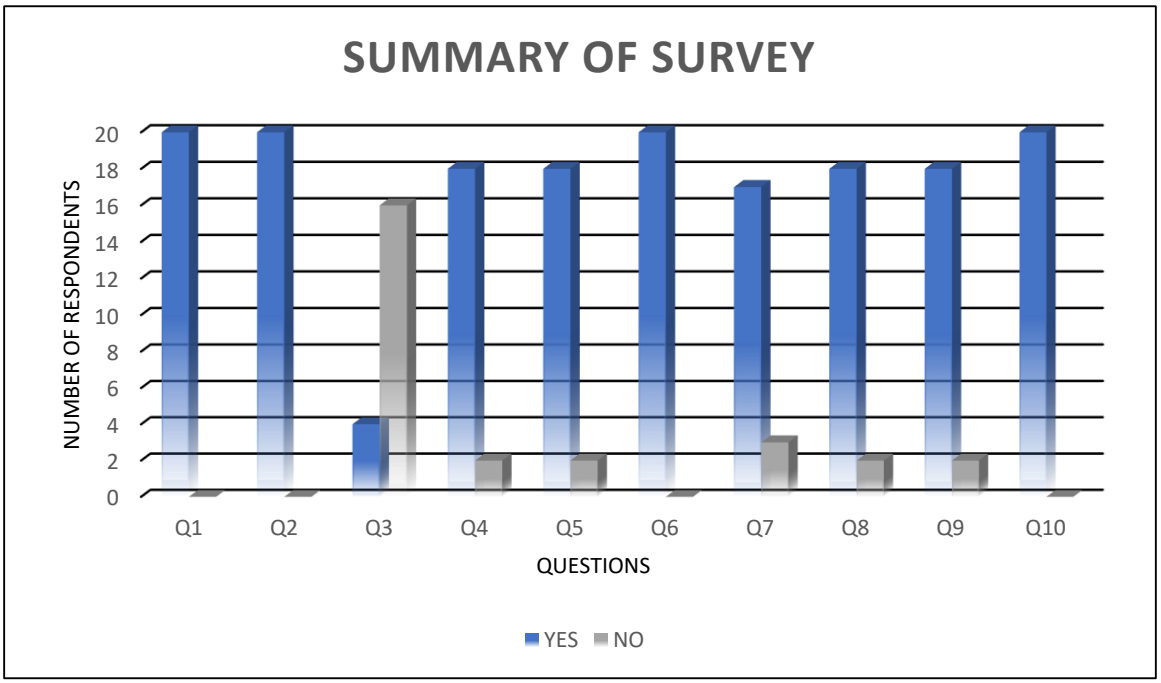

Figure 4.2.2 Summary Survey Result of the Proposed Application for Drivers

Figure 4.2.2 shows the tally summary result of the survey for drivers using bar graph. The tally shows that all of them think that there dangers of every day transportation. Most of the driver respondents agree that there is a big impact in terms of financial, physical, emotional and psychological loss when involved in these types of accidents. They also believe that as drivers, having a device that can help them report when they have a collision automatically can be helpful. Therefore, the proposed project “Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430” can be a good tool to automate the of filing a vehicle accident/crash report.

Survey Questionnaire for Authorities

Name: _____ Date: _____

Position: _____ Age: _____ Gender: _____

Instruction: This is a survey questionnaire for the project entitled **"Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430"**. Please choose the answer that best corresponds to your opinion by answering YES or No. Put ✓ for each question below.

Questions	YES	NO
1. Are you aware of the dangers of every day transportation? (vehicles)		
2. Have you encountered/responded in an emergency matter?		
3. Do you think accidents should be reported immediately and without much delay?		
4. As accidents happen anytime of the day, are the hotlines posted all around the city manned 24/7?		
5. Do you think the automation of filing a vehicle accident/crash report can be useful?		
6. Do you think sending the exact location of the collision through Google Map will be big help?		
7. Do you think having a device that can alert the authorities if accidents happen can prevent more losses to the victims?		
8. Do you think having a device that can notify the victim's family if accidents do happen can be helpful to the authorities and car owners?		
9. Would you consider Vehicle Accident Reporting Device (V.A.R.D) as a tool for ensuring precautionary measures, reporting of vehicle crash and notification of accident to family members?		
10. Would you recommend Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430 to your family, friends and relatives?		

_____

Signature

Below is the survey questionnaire and its corresponding frequency answered by the respondents.

Tally of Survey for Authorities

Questions	YES	NO
1. Are you aware of the dangers of every day transportation? (vehicles)	10	0
2. Have you encountered/responded in an emergency matter?	7	3
3. Do you think accidents should be reported immediately and without much delay?	10	0
4. As accidents happen anytime of the day, are the hotlines posted all around the city manned 24/7?	10	0
5. Do you think the automation of filing a vehicle accident/crash report can be useful?	10	0
6. Do you think sending the exact location of the collision through Google Map will be big help?	10	0
7. Do you think having a device that can alert the authorities if accidents happen can prevent more losses to the victims?	10	0
8. Do you think having a device that can notify the victim's family if accidents do happen can be helpful to the authorities and car owners?	10	0
9. Would you consider Vehicle Accident Reporting Device (V.A.R.D) as a tool for ensuring precautionary measures, reporting of vehicle crash and notification of accident to family members?	10	0
10. Would you recommend Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430 to your family, friends and relatives?	10	0

Table 4.2.3 Tally of Survey for Authorities

Table 4.2.3. shows the result of the survey questionnaires given to 20 authority respondents who answered YES and NO in 10 questions presented.

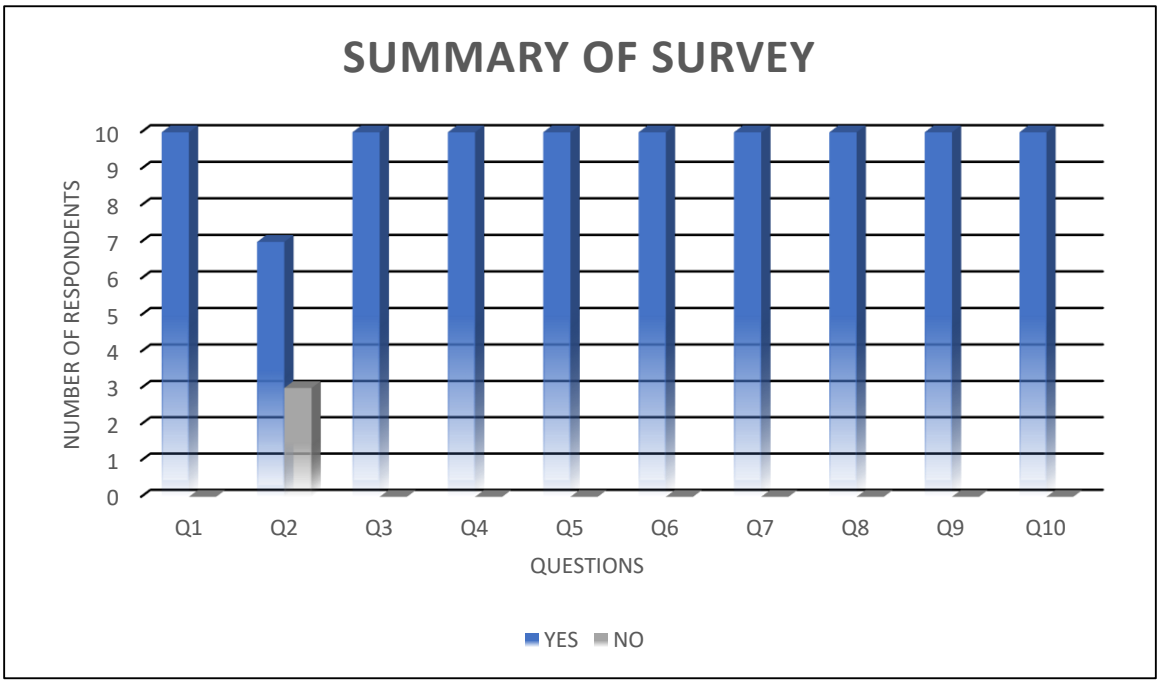

Figure 4.2.2 Summary Survey Result of the Proposed Application for Authorities

Figure 4.2.3 shows the tally summary result of the survey for authorities using bar graph. The tally shows that all of them think that mmost of them has responded to an emergency matter. All of the respondents think that reporting accidents are important, and they are aware that accidents happen anywhere and anytime. They also believe that as authorities, having a device that pinpoint the accurate location of the accident can help them greatly especially in emergency situations. Therefore, the respondents agree that the proposed project “Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430” is a good device that can alert the authorities if accidents happen can prevent more losses to the victims and can be helpful in emergency situations.

Proponents-Made Evaluation
"Vehicle Accident Reporting Device (V.A.R.D)"

Name: _____ Date: _____

Age: _____ Gender: _____ Signature: _____

The proponents would like to ask for your evaluation of the proposed system entitled "**Vehicle Accident Reporting Device (V.A.R.D) - *A Vehicle Tracking Device with Accident Detection and Alert System***"

Instructions: Below are the criteria for evaluating the system. Please check the appropriate rating for each criterion.

Critera		5	4	3	2	1
Efficiency	The capabilities of the device to produce effectively with minimum amount of resources wasted.					
Availability	The capability of the device that should be usable upon demand to perform its required function.					
Functionality	The ability of the system to perform its task and to provide useful functions.					
Usability	The degree in which the device is to be used and understand. It also includes the aesthetic, design and user-friendliness.					
Accuracy	The degree of the system to produce accurate data, result and other features.					

Rating	Verbal Interpretation
5	Excellent
4	Very Satisfactory
3	Satisfactory
2	Fair
1	Poor

Comments and Suggestions:

_____

_____

_____

4.3.1 Evaluation of the Respondents

The proponents conducted an evaluation of the proposed application through the distribution of questionnaires. By using the questionnaires, the proponents can use an evaluation to obtain a clear defined result of the proposed application.

The respondents who evaluated the proposed application are the parents, teachers and students. The proponents showed the proposed application to the respondent, and guide them to navigate while explaining the ability and functionality of the proposed application.

Respondents	Frequency	Percentage
Students	20	40%
Drivers	20	40%
Authorities	10	20%
TOTAL	50	100%

Table 4.3.1 Respondents of the Evaluation

Table 4.3.1 shows the frequency and percentage of the respondents who evaluated the proposed application.

4.3.2 Evaluation Result

The proponents organized the response of the respondents and used descriptive statistics to provide summaries and description of data. Graphical tools and charts are also utilized to support the data gathered.

The fifty (50) respondents rated the evaluation tool provided by the proponents.

The following criteria are:

1. **Efficiency** - The capabilities of the device to produce effectively with minimum amount of resources wasted.

2. **Availability** - The capability of the device that should be usable upon demand to perform its required function.

3. **Functionality** - The ability of the system to perform its task and to provide useful functions.

4. **Usability** - The degree in which the device is to be used and understand. It also includes the aesthetic, design and user-friendliness.

5. **Accuracy** - The degree of the system to produce accurate data, result and other features.

The proponents used two (2) kinds of scales in rating the proposed project:

The Five Point Scale and the Likert Scale. The Five Point Scale was used by the respondents to rate the evaluation of the application while Likert Scale was used to

interpret the computed analysis of the evaluation.

Rating	Verbal Interpretation
5	Excellent
4	Very Satisfactory
3	Satisfactory
2	Fair
1	Poor

Table 4.3.2.1 Five Point Scale

Table 4.3.2.1 shows the Five Point scaling that has been used in the evaluation. The respondents rated the application based on their perspective with the criterion of 5 as excellent, 4 as very satisfactory, 3 as satisfactory, 2 as fair and 1 as poor.

Verbal Interpretation	Numerical Equipment
Excellent	4.21 – 5.00
Very Satisfactory	3.41 – 4.20
Satisfactory	2.61 – 3.40
Fair	1.81 – 2.60
Poor	1.00 – 1.80

Table 4.3.2.2 Likert Scale

Table 4.3.2.2 shows the Likert Scale which has been used for rating the application during the evaluation period. It shows the verbal interpretation and its corresponding rating range.

4.4 Proposed Application Evaluation Result

This section explains and shows the computation of the data gathered by the proponents in evaluating the proposed application.

Efficiency - The capabilities of the device to produce effectively with minimum amount of resources wasted.

Criterion	5	4	3	2	1	Total
Efficiency	24	21	5	0	0	50

Table 4.4.1 Assessment in Criterion of Efficiency

Table 4.4.1 shows the assessment in criterion of efficiency. The acquired tally result in the proposed study rating is 24 for excellent, 21 for very satisfactory, 5 for satisfactory, 0 for fair and 0 for poor.

Total Number of Respondent: 50

The weighted mean formula is:

$$WM = \Sigma w*f / n$$

Where:

WM = summation of computed weighted mean

w = weight of the scale value

f = frequency of response

n = total number of respondents

Efficiency = (24*5)/50 + (21*4)/50 + (5*3)/50 + (0x2)/50 + (0x1)/50 = **4.44 (Excellent)**

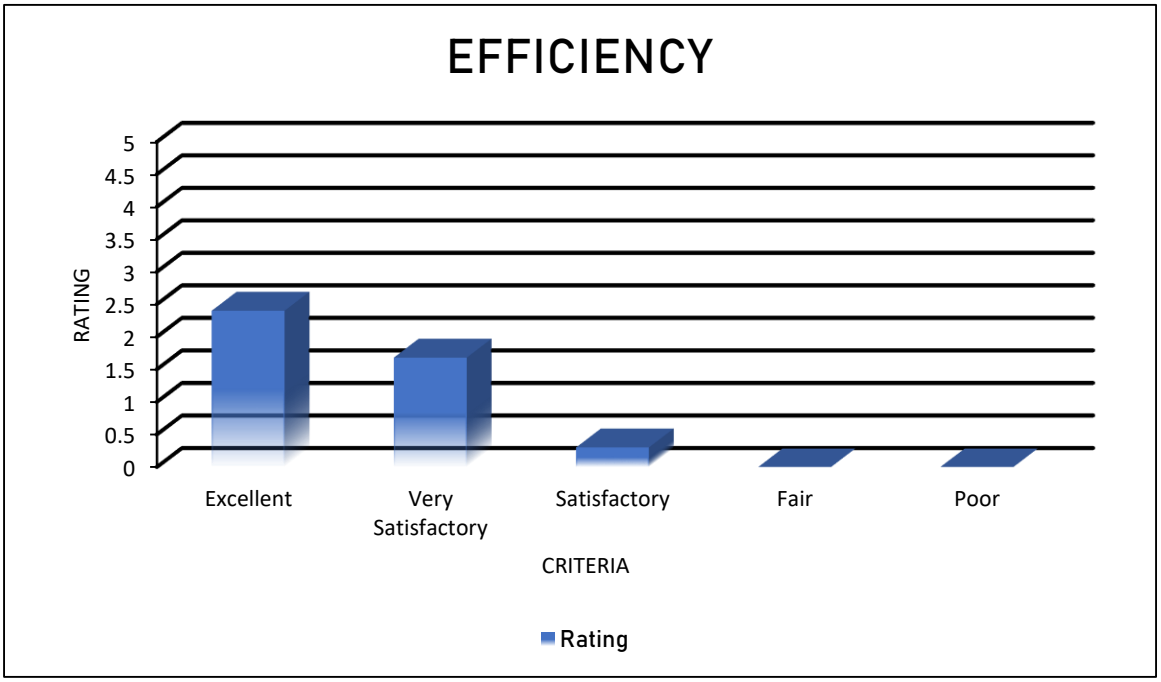

Figure 4.4.1 Bar Graph Representation of the Assessment in Criterion of Efficiency

Figure 4.4.1 shows that the majority of the respondents (which corresponds to 48% of the total respondents) evaluated the application excellent, 42% very satisfactory and 10% satisfactory in ability to produced expected and consistent result.

The rating average for excellent is 2.4, while the rating average for very satisfactory is 1.68, followed by 0.3 for the rating average of satisfactory, then 0 rating average for both fair and poor.

Above all the total weighted mean percentage for the criterion of Efficiency is **4.44** which is interpreted as **Excellent** in the Likert Scale table.

Availability - The capability of the device that should be usable upon demand to perform its required function.

Criterion	5	4	3	2	1	Total
Availability	28	21	1	0	0	50

Table 4.4.2 Assessment in Criterion of Availability

Table 4.4.2 shows the assessment in criterion of availability. The acquired tally result in the proposed study rating is 28 for excellent, 21 for very satisfactory, 1 for satisfactory, 0 for fair and 0 for poor.

Total Number of Respondent: 50

The weighted mean formula is:

$$WM = \Sigma w*f / n$$

Where:

WM = summation of computed weighted mean

w = weight of the scale value

f = frequency of response

n = total number of respondents

Availability = (28*5)/50 + (21*4)/50 + (1*3)/50 + (0x2)/50 + (0x1)/50

= 2.8 + 1.68 + 0.06 + 0 + 0

= **4.6 (Excellent)**

Figure 4.4.2 Bar Graph Representation of the Assessment in Criterion of Availability

Figure 4.4.2 shows that the majority of the respondents (which corresponds to 56% of the total respondents) evaluated the application excellent, 42% very satisfactory and 2% satisfactory in ability to produced expected and consistent result.

The rating average for excellent is 2.8, while the rating average for very satisfactory is 1.68, followed by 0.06 for the rating average of satisfactory, then 0 rating average for both fair and poor.

Above all the total weighted mean percentage for the criterion of Availability is **4.6** which is interpreted as **Excellent** in the Likert Scale table.

Functionality - The ability of the system to perform its task and to provide useful functions.

Criterion	5	4	3	2	1	Total
Functionality	19	29	2	0	0	50

Table 4.4.3 Assessment in Criterion of Functionality

Table 4.4.3 shows the assessment in criterion of functionality. The acquired tally result in the proposed study rating is 19 for excellent, 29 for very satisfactory, 2 for satisfactory, 0 for fair and 0 for poor.

Total Number of Respondent: 50

The weighted mean formula is:

$$WM = \Sigma w*f / n$$

Where:

WM = summation of computed weighted mean

w = weight of the scale value

f = frequency of response

n = total number of respondents

Functionality = (19*5)/50 + (29*4)/50 + (2*3)/50 + (0x2)/50 + (0x1)/50

= 1.9 + 2.32 + 0.12 + 0 + 0

= **4.4 (Excellent)**

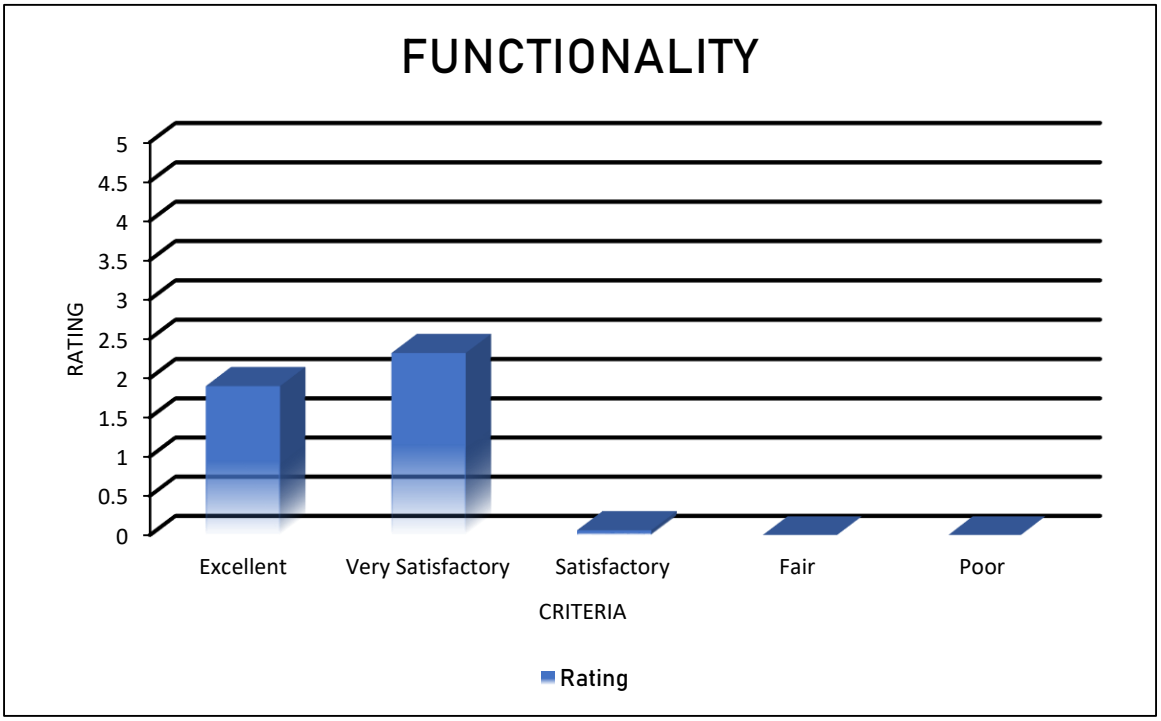

Figure 4.4.3 Bar Graph Representation of the Assessment in Criterion of Functionality

Figure 4.4.3 shows that the majority of the respondents (which corresponds to 38% of the total respondents) evaluated the application excellent, 58% very satisfactory and 4% satisfactory in ability to produced expected and consistent result.

The rating average for excellent is 1.9, while the rating average for very satisfactory is 2.32, followed by 0.12 for the rating average of satisfactory, then 0 rating average for both fair and poor.

Above all the total weighted mean percentage for the criterion of Functionality is **4.4** which is interpreted as **Excellent** in the Likert Scale table.

Usability - The degree in which the device is to be used and understand. It also includes the aesthetic, design and user-friendliness.

Criterion	5	4	3	2	1	Total
Usability	29	16	5	0	0	50

Table 4.4.4 Assessment in Criterion of Usability

Table 4.4.3 shows the assessment in criterion of usability. The acquired tally result in the proposed study rating is 29 for excellent, 16 for very satisfactory, 5 for satisfactory, 0 for fair and 0 for poor.

Total Number of Respondent: 50

The weighted mean formula is:

$$WM = \Sigma w*f / n$$

Where:

WM = summation of computed weighted mean

w = weight of the scale value

f = frequency of response

n = total number of respondents

Usability = (29*5)/50 + (16*4)/50 + (5*3)/50 + (0x2)/50 + (0x1)/50

= 2.9 + 1.28 + 0.3 + 0 + 0

= **4.54 (Excellent)**

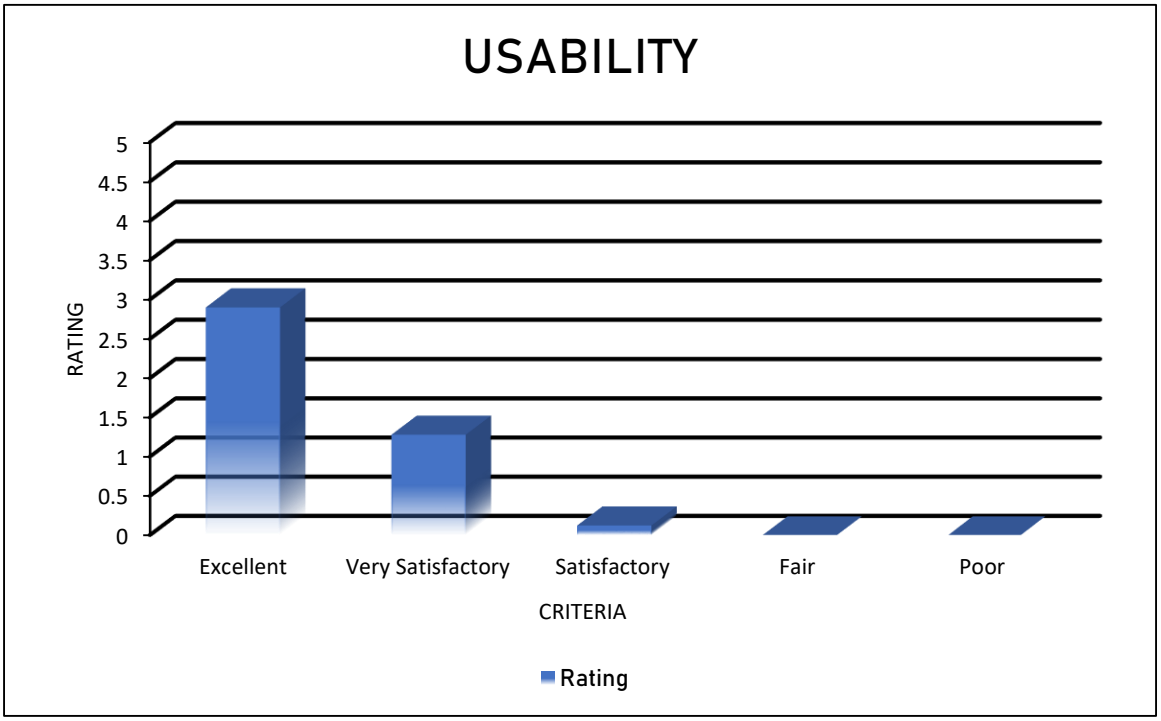

Figure 4.4.4 Bar Graph Representation of the Assessment in Criterion of Functionality

Figure 4.4.4 shows that the majority of the respondents (which corresponds to 58% of the total respondents) evaluated the application excellent, 32% very satisfactory and 10% satisfactory in ability to produced expected and consistent result.

The rating average for excellent is 2.9, while the rating average for very satisfactory is 1.28, followed by 0.3 for the rating average of satisfactory, then 0 rating average for both fair and poor.

Above all the total weighted mean percentage for the criterion of Usability is **4.54** which is interpreted as **Excellent** in the Likert Scale table.

Accuracy - The degree of the system to produce accurate data, result and other features.

Criterion	5	4	3	2	1	Total
Accuracy	29	18	3	0	0	50

Table 4.4.5 Assessment in Criterion of Accuracy

Table 4.4.5 shows the assessment in criterion of accuracy. The acquired tally result in the proposed study rating is 29 for excellent, 18 for very satisfactory, 3 for satisfactory, 0 for fair and 0 for poor.

Total Number of Respondent: 50

The weighted mean formula is:

$$WM = \Sigma w*f / n$$

Where:

WM = summation of computed weighted mean

w = weight of the scale value

f = frequency of response

n = total number of respondents

Accuracy = (29*5)/50 + (18*4)/50 + (3*3)/50 + (0x2)/50 + (0x1)/50

= 2.9 + 1.44 + 0.18 + 0 + 0

= **4.58 (Excellent)**

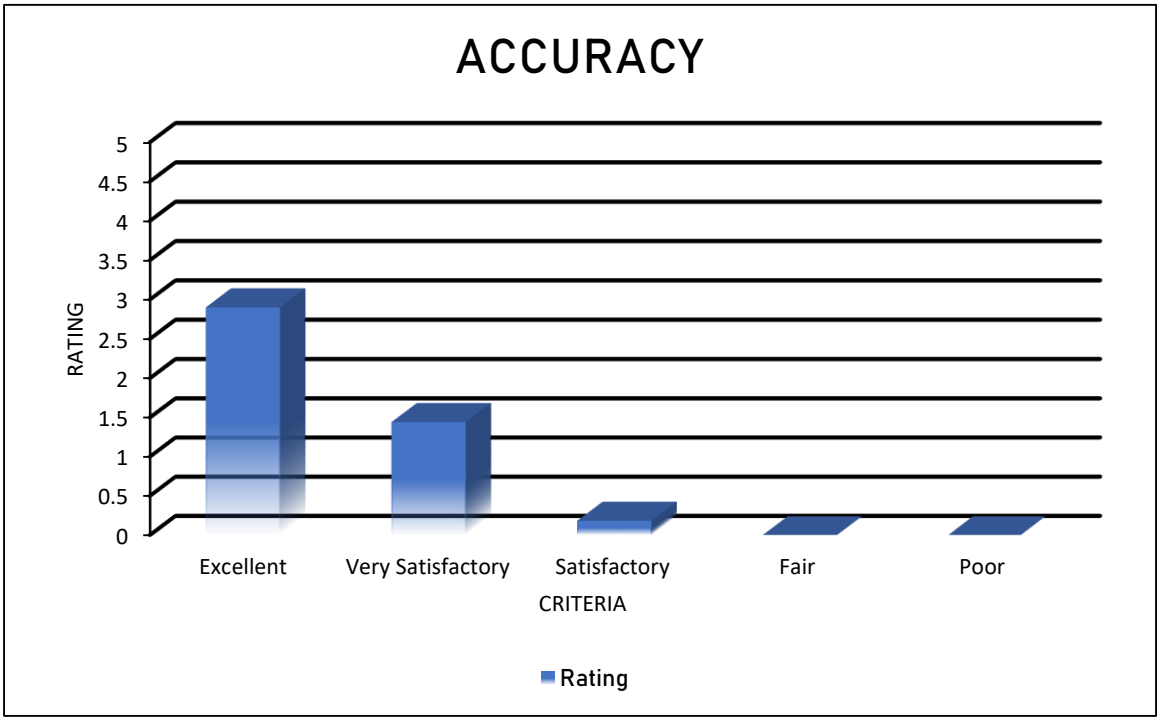

Figure 4.4.5 Bar Graph Representation of the Assessment in Criterion of Accuracy

Figure 4.4.5 shows that the majority of the respondents (which corresponds to 58% of the total respondents) evaluated the application excellent, 36% very satisfactory and 6% satisfactory in ability to produced expected and consistent result.

The rating average for excellent is 2.9, while the rating average for very satisfactory is 1.44, followed by 0.18 for the rating average of satisfactory, then 0 rating average for both fair and poor.

Above all the total weighted mean percentage for the criterion of Accuracy is **4.58** which is interpreted as **Excellent** in the Likert Scale table.

Criteria	Proposed Average	Verbal Interpretation	Rating
Efficiency	4.44	Excellent	5
Availability	4.6	Excellent	5
Functionality	4.4	Excellent	5
Usability	4.54	Excellent	5
Accuracy	4.58	Excellent	5
Total	**4.51**	**Excellent**	**5**

Table 4.4.6 Summary Result of the Evaluation

Table 4.4.6 shows each criterion with their corresponding averages computed by the proponents and their equivalent verbal interpretation. It can be seen that the grand total weighted mean is 4.51 which has an interpretation of excellent.

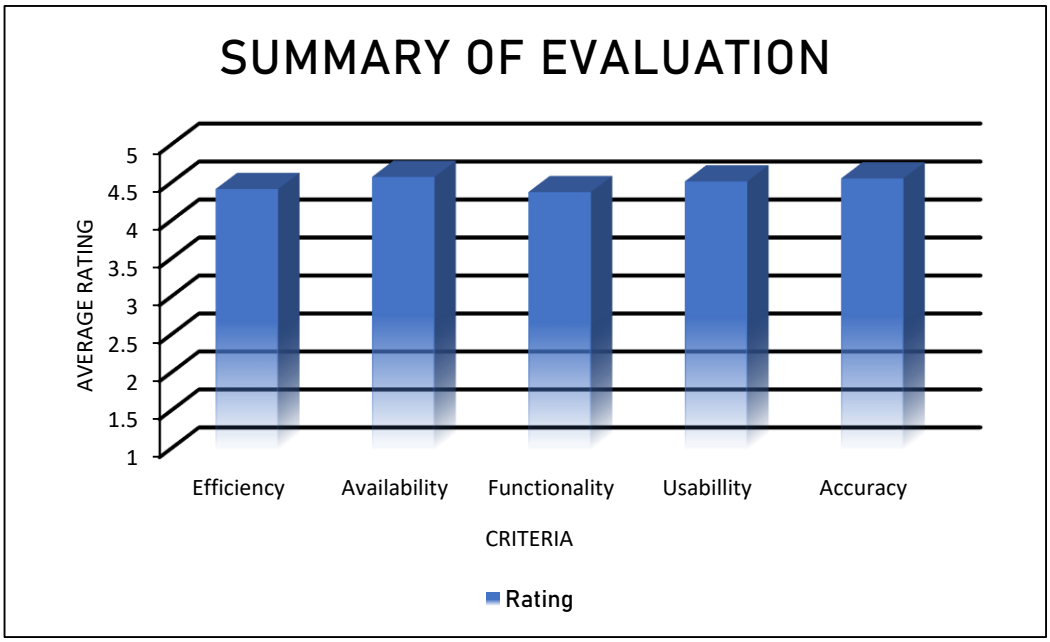

Figure 4.4.6 Summary of Evaluation in Bar Graph

Figure 4.4.6 shows the bar graph of all criteria such as Efficiency, Availability, Functionality, Usability and Accuracy.

4.5 Evaluation of the Proposed Application

Table 4.4.6 and Figure 4.4.6 shows the overall result of the proposed application in terms of the following below:

- Efficiency with the weighted mean of 4.44
- Availability with a weighted mean 4.6
- Functionality with a weighted mean of 4.4
- Usability with a weighted mean of 4.54
- Accuracy with a weighted mean of 4.58

As stated in the table, it reveals that all the criteria are rated “Excellent” But they vary in the weighted means. Overall the proposed project entitled: “Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430” is ranked 5 with the weighted mean of 4.51 therefore, the proponents conclude that the outcome of this study is successful.

CHAPTER V

Summary, Conclusion and Recommendation

5.1 Summary

The proposed project entitled: Vehicle Accident Reporting Device (V.A.R.D.) provides a solution to improve traffic accidents. Medical response team can be deployed immediately to the scene with fast and clear location prepared by the device. It can help prevent traffic accidents and save lives. It is a device that can automatically notify family members and authorities whenever the car is involved in a collision.

Since there are some cases where reporting an accident using a mobile phone is not possible, this proposed project is a much faster way of identifying the location of an accident and can create a more effective ways of saving lives. Most people have access to mobile phones, commuters can incorporate the device to detect whether the vehicle had an accident and take actions regarding the emergency at hand.

If the person is involved with a small accident or if there is no serious threat to the driver, the user can terminate the alert message before it is sent by a switch provided before it creates unnecessary use of time, effort and resources of other people. The aim of the proponents is to develop a device that will provide accurate and reliable knowledge to authorities and become a device that is useful and relevant to the current situation of traffic in the Philippines.

5.2 Conclusion

After months of hard work and strenuous long nights, the proponents arrived with utmost succeeding conclusions together. The proponents, through the different data gathering procedures, have concluded that most people view these accidents as a serious matter, automating and using technology in order to modernize the traditional methods of reporting collisions will help lessen the financial, psychological, physical and other losses to the victims.

The possibility of this device actually being implemented (and improved) in the real world can be a big help to every day transportation, not just in the Philippines, but also in many other parts of the world. Authorities, Drivers, Family Members and Students can benefit greatly from this proposed project, this is further proven by the proponents-made evaluation questionnaire provided to multiple people which provided great results.

5.3 Recommendation

The proponents' development of this project resulted to better understanding of the many types of microcontrollers, and the language that are used and integrated in order to make multiple peripherals connected to the microcontroller work together. Through the proposed project entitled "Vehicle Accident Reporting Device (V.A.R.D) powered by Launchpad MSP430" the proponents were able to learn different technical methods that is relevant to the device and the language used.

Although the project is finished, it is still open for improvements and expansions which leads the proponents to multiple recommendation below:

- Create a better design for the enclosure
- Create a system in order to register new users when they buy the device
- Add another feature for the device, like a help button for when the driver is stranded in an unfamiliar area
- Create an online updating system for the family members' information with scheduling reminders when it is time to renew their subscription to the device
- Add an LCD Screen in order to provide more information to the driver
- Add a voice command feature