ACCIDENT DETECTION SYSTEM PROJECT REPORT

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Abstract

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ON

ACCIDENT DETECTION SYSTEM

PROJECT

BY

KAMAL ACHARYA

(Tribhuvan University)

Date: 2022/03/25

ABSTRACT

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. Many lives could have been saved if emergency service could get accident information and reach in time. Our project will provide an optimum solution to this draw back. A piezo electric sensor can be used as a crash or rollover detector of the vehicle during and after a crash. With signals from a piezo electric sensor, a severe accident can be recognized. According to this project when a vehicle meets with an accident immediately piezo electric sensor will detect the signal or if a car rolls over. Then with the help of GSM module and GPS module, the location will be sent to the emergency contact. 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.

ACKNOWLEDGEMENT

The success and final outcome of our project “ACCIDENT DETECTION SYSTEM ” required a lot of guidance and assistance from many people and we are extremely privileged to have got this all along the completion of our project. All that we have done is only due to such supervision and assistance and we would not forget to thank them.

Firstly, we are very thankful to our guide Prof. MAITREYI JOGLEKAR for guiding us to do the project work on time and giving us all support and guidance which made us complete the project duly. We are extremely thankful to her for providing such a nice support and guidance.

We are also thankful to and fortunate enough to get constant encouragement, support and guidance from the teachers of Information Technology who helped us in successfully completing our project work.

DECLARATION

I hereby declare that the project entitled, "**ACCIDENT DETECTION SYSTEM**" done at Tribhuvan University Information Technology, has not been in any case duplicated to submit to any other universities for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirements for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Name and Signature of the Student

Kamal Acharya

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INTRODUCTION

1.1: Background:

Road accident is most unwanted thing to happen to a road user, though they happen quite often. A number of factors contribute to the risk of collision, including vehicle design, speed of operation, road design, road environment, and driver skill, impairment due to alcohol or drugs, and behaviour, notably speed and street racing. Worldwide, motor vehicle collisions lead to death and disability as well as financial costs to both society and the individuals involved. Main cause of accidents and crashes are due to human errors. However in this project we are designing a system which can certainly help to minimize the deaths which occur due to such road accidents.

1.2: Objectives:

a) The main intension of this project is to find the accident spot at any place and intimating it to the emergency contacts through the GPS and GSM networks.

b) To save precious lives.

c) To provide good emergency medical facilities.

d) To decrease the count of accidental deaths.

1.3: Purpose, Scope and Applicability:

1.3.1 : Purpose:

This system is based on new technology, its main purpose is to detect an accident and send an alert to the emergency contacts, so the victim can find some help. It can detect accident without presence of any person.

1.3.2 : Scope:

The high demand of automobiles has also increased the traffic hazards and the road accidents, life of the people is under high risk. This is because of the lack of best emergency facilities available in our country. An automatic accident detection system for vehicle accidents is introduced in this project. This design is a system which can detect accidents in significantly less time and sends the basic information to the emergency contacts within a few seconds covering geographical coordinates. This alert message is sent to the emergency contacts in a short time, which will help in saving the valuable lives.

1.3.2: Applicability:

Applicability of the project accident detection system is the automobile industry. As many road accidents happen around the world and many people loose the lives in it, this system can certainly help to decrease the number of deaths that happen because of a road accident.

Chapter 2 Survey of Technologies

A **microcontroller** (MCU for microcontroller unit, or UC for μ-controller) is a small computer on a single integrated circuit. In modern terminology, it is similar to, but less sophisticated than, a system on a chip (SoC); an SoC may include a microcontroller as one of its components. A microcontroller contains one or more CPUs (processor cores) along with memory and programmable input/output peripherals.

Fig. 2.1: Microcontroller

Limitations of microcontroller:

- The microcontroller cannot interface high power devices directly.
- It has more complex structure as compared to microprocessor.
- It only performed limited number of executions simultaneously.
- It is generally used in micro equipment.
- Typically, micro-controller programs must fit in the available on-chip memory, since it would be costly to provide a system with external, expandable memory.

Arduino:

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Fig. 2.2: Arduino UNO

Advantages of Arduino over microcontroller:

- When you need more control and are actually thinking on converting your prototype into a real product, then yes, you need to get deep down into the microcontroller and get rid of all the excess fat, trim the circuit to just the bare bones, optimize the code, etc.
- For prototyping, the Arduino platform gives you a lot of pre-wiring and free code libraries that will let you concentrate on testing your idea instead of spending your time building supporting circuitry or writing tons of low level code.
- Nearly instantaneous start (plug in a USB cord and load an example program and you can see something work).
- A huge community of people working in the same environment.
- A large assortment of included libraries for interfacing to a wide range of hardware.
- Ease of use. The Arduino Uno has built in pinouts for providing you with 5v, 3.3V, ground, analog input, digital output, SPI, I2C which comes in handy.
- The whole point of the "Arduino Platform" is to allow for easy and fast prototyping. Being able to just hook up an LCD and be able to display messages on it in a matter of minutes, instead of hours, is just amazingly powerful and convenient when you have an idea in your head and just want to see if it works.

SENSORS:

- **VIBRATION MODULE:**

Vibration sensor module alarm Motion sensor module vibration switch SW-420 module based on the vibration sensor SW-420 and Comparator LM393 to detect if there is any vibration that beyond the threshold. The threshold can adjust using an onboard potentiometer. When this no vibration, this module output logic LOW the signal indicates LED light, and vice versa.

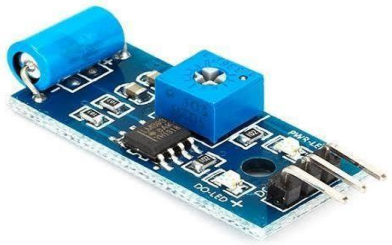


Fig. 2.3: Vibration Module

- **LIMITATIONS:**

1. Not calibrated for unknown metal materials.
2. High sensitivity.
3. Relatively small conversation factor.
4. Error in operation due to the load.
5. Tendency electro iron under the action of pulse discharges.

- **ACCELEROMETER SENSOR:**

An accelerometer is a device that measures proper acceleration.Proper acceleration, being the acceleration (or rate of change of velocity) of a body in its own instantaneous rest frame, is not the same as coordinate acceleration, being the acceleration in a fixed coordinate system. For example, an accelerometer at rest on the surface of the Earth will measure an acceleration due to Earth's gravity, straight upwards (by definition) of $g \approx 9.81$ m/s^2. By contrast, accelerometers in free fall (falling toward the center of the Earth at a rate of about 9.81 m/s^2) will measure zero.

Single- and multi-axis models of accelerometer are available to detect magnitude and direction of the proper acceleration, as a vector quantity, and can be used to sense orientation (because direction of weight changes), coordinate acceleration, vibration, shock, and falling in a resistive medium (a case where the proper acceleration changes, since it starts at zero, then increases). Micromachined microelectromechanical systems (MEMS) accelerometers are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input.

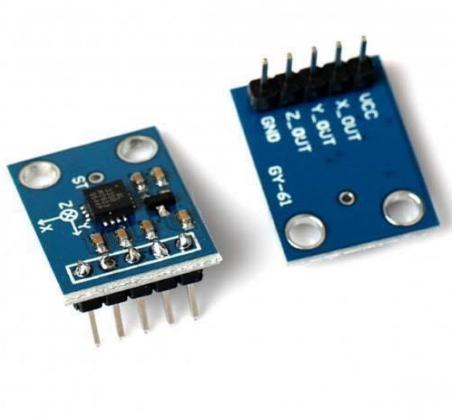


Fig. 2.4: Accelerometer Sensor

• **LIMITATIONS:**

1. Low resonant frequency and phase shift.
2. Cross noise.
3. Big and heavy.
4. Require electronic integration for displacement.

• **PIEZOELECTRIC SENSOR:**

A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, strain, or force by converting them to an electrical charge.

Based on piezoelectric technology various physical quantities can be measured, the most common are pressure and acceleration. For pressure sensors, a thin membrane and a massive base is used, ensuring that an applied pressure specifically loads the elements in one direction. For accelerometers, a seismic mass is attached to the crystal elements. When the accelerometer experiences a motion, the invariant seismic mass loads the elements according to Newton's second law of motion F=ma.

The main difference in working principle between these two cases is the way they apply forces to the sensing elements. In a pressure sensor, a thin membrane transfers the force to the elements, while in accelerometers an attached seismic mass applies the forces.

Sensors often tend to be sensitive to more than one physical quantity. Pressure sensors show false signal when they are exposed to vibrations. Sophisticated pressure sensors therefore use acceleration compensation elements in addition to the pressure sensing elements. By carefully matching those elements, the acceleration signal (released

from the compensation element) is subtracted from the combined signal of pressure and acceleration to derive the true pressure information.

Vibration sensors can also harvest otherwise wasted energy from mechanical vibrations. This is accomplished by using piezoelectric materials to convert mechanical strain into usable electrical energy.

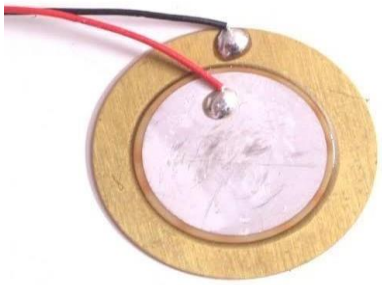


Fig. 2.5: Piezoelectric Sensor

• **ADVANTAGES:**

1. The piezoelectric transducer is available in desired shape.
2. It has rugged construction.
3. It is small in size.
4. It has good frequency response.
5. It has negligible phase shift.

Chapter 3 Requirements and Analysis

3.1 Problem Definition:

A number of technological and sociological improvements have helped reduce traffic fatalities during the past decade, e.g., each 1% increase in seatbelt usage is estimated to save 136 lives.

The road accidents lead to loss of human life and/or incapacitation. It was noted, with deep concern that most of these details occurs as a result of late response by emergency services especially for accident occurring in remote areas or at night where there is no witness or means of alerting the responsible authorities such as police, emergency services responders or relatives. Moreover, each minute that an injured crash victim does not receive emergency medical care can make a large difference in their survival rate, i.e., Analysis shows that reducing accident response time by one-minute correlates to a six percent difference in the number of lives saved. This project seeks to reduce the time taken between accident time and notifying the emergency responders of the accident occurrence.

3.2 Requirement Specification:

Micro-Controller(ATMEGA 328) / Arduino Uno

GSM Module(SIM 900a)

GPS Module(NEO-6M)

Piezoelectric Disc Sensor

16x2 LCD Module

3.3 Planning and Scheduling:

Prototyping Model:

We are using Prototyping Model:

- The Prototyping Model is a systems development method (SDM) in which a prototype (an early approximation of a final system or product) is build, tested, and then reworked as necessary until an acceptable prototype is finally achieved from which the complete system or product can now be developed.
- This model works best in scenarios where not all of the project requirements are known in detail ahead of time. It is an interactive, trail-and-error process that takes place between the developers and the users.

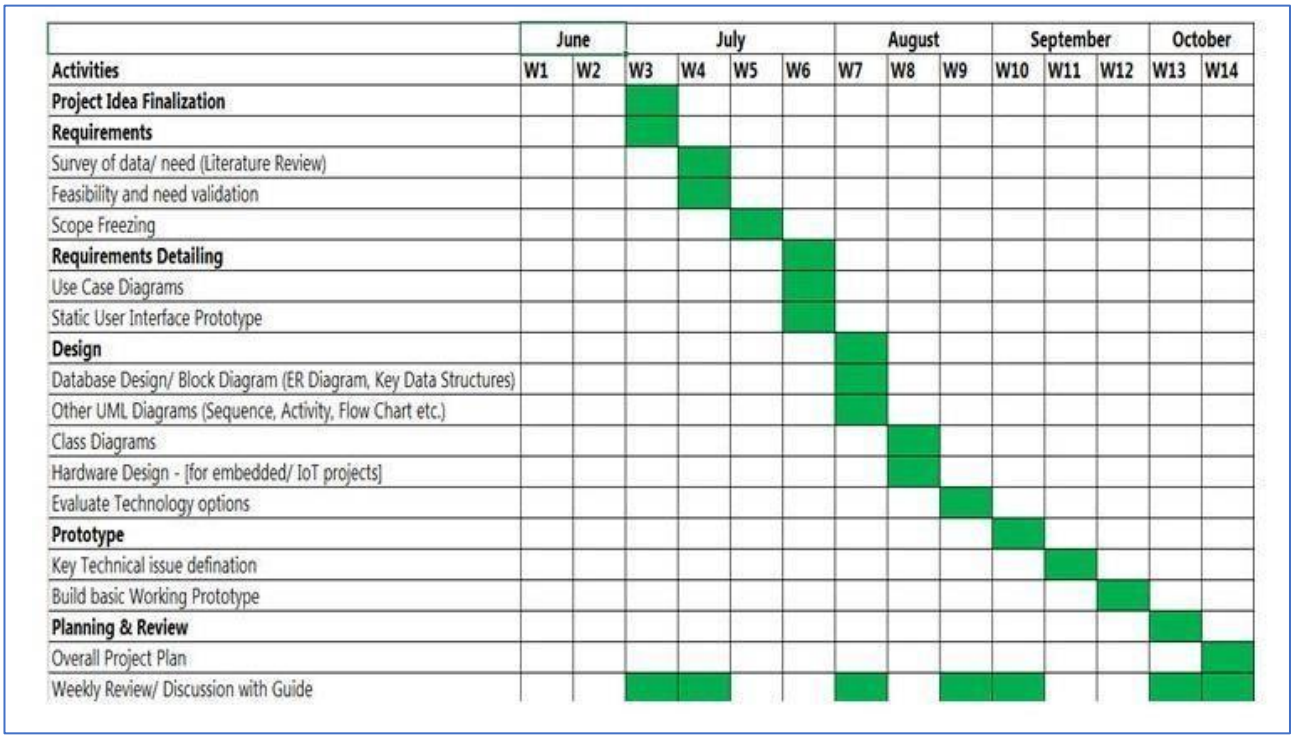


Fig.: 3.3.1: Gantt Chart

3.4 Software and Hardware Requirement:

- **Software Requirements:**

  - **Arduino Software (IDE) :**

    Arduino IDE is used to upload the Arduino sketch.

- **Hardware Requirements:**

  - **Arduino UNO microcontroller board :**

    Arduino UNO microcontroller board is used for connecting all the components.

  - **GSM Module (SIM 900 a):**

    GSM Module(SIM 900 a) is used to send an alert message to the emergency contacts when an accident is detected through the sensor.

  - **GPS Module (NEO-6M):**

    GPS Module (NEO-6M) is used to detect the location where the accident has happened.

- **Piezoelectric Disk Sensor:**

Piezoelectric Disk Sensor is used to detect the accident.

- **16x2 LCD Module:**

16x2 LCD Module is used to display the information which is acquired from GSM (SIM 900 a) Module and GPS(NEO-6M) Module.

- **Male to Female Jumper wire:**

Male to Female Jumper wires are used for connecting all the components to the Arduino UNO Microcontoller Board.

- **Battery:**

  Batter is used to give the power to the Arduino UNO Microcontroller Board.

3.5 Preliminary Product Description:

ARDUINO IDE SOFTWARE:

A program for Arduino may be written in any programming language with compilers that produce binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio. The Arduino project provides the Arduino integrated development environment (IDE), which is a crossplatform application written in the programming language Java. A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension.ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension.pde.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution.

Program structure :

A minimal Arduino C/C++ program consist of only two functions:

- **setup():** This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.
- **loop():** After setup() has been called, function loop() is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

HARDWARE:

- **Arduino Uno**

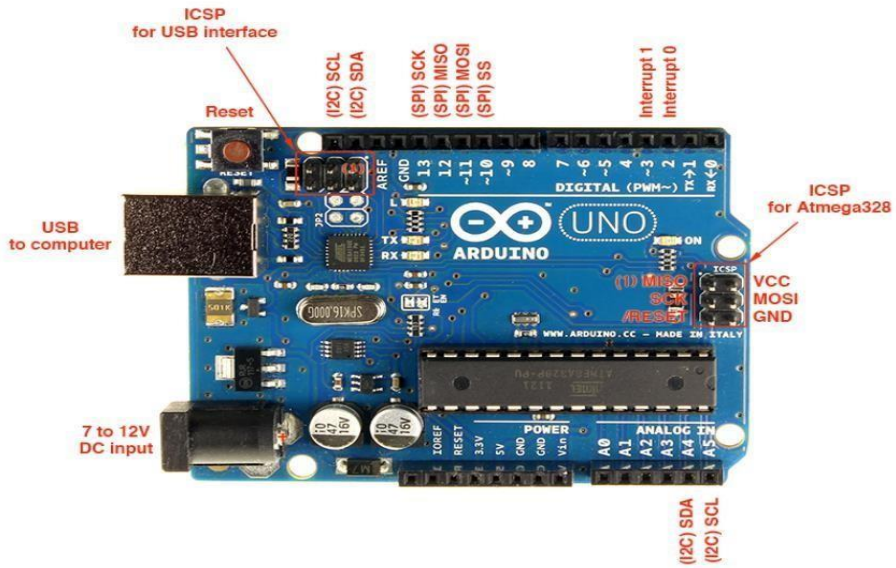


Fig- 3.5.1 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

We can tell the board what to do by sending a set of instructions to the microcontroller on the board. To do so we use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross – platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring . It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and provides simple one – click mechanism to compile and load programs to an Arduino board. A program written with the IDE for Arduino is called a "sketch".

GPS Module:

Fig. 3.5.2 GPS Module

The Global Positioning System (GPS) is a satellite-based navigation system made up of at least 24 satellites. GPS works in any weather conditions, anywhere in the world, 24 hours a day, with no subscription fees or setup charges.

The module only uses 4 pins: VCC, GND, RX, and TX: this is because these modules communicate over a simple serial RS232 connection.

GSM Module:

A GSM Module is basically a GSM Modem (like SIM 900) connected to a PCB with different types of output taken from the board. The board will also have pins or provisions to attach mic and speaker, to take out +5V or other values of power and ground connections.

These type of provisions vary with different modules.

- SIM900 GSM Module supports communication in 900MHz band in India and most of the mobile network providers in this country operate in the 900Mhz band.
- United States mobile networks operate in 850Mhz band (the band is either 850Mhz or 1900Mhz).

  Canada operates primarily on 1900 Mhz band.

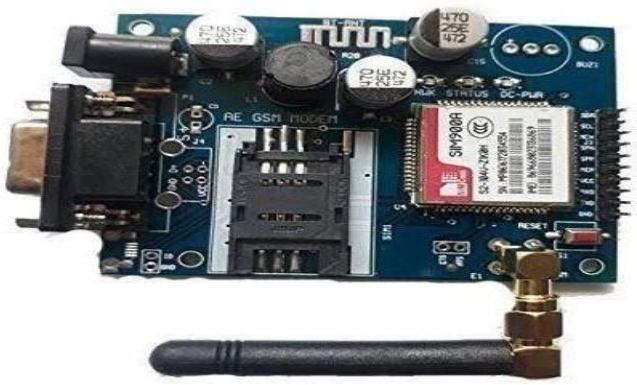


Fig. 3.5.3 GSM Module

Piezoelectric Sensor:

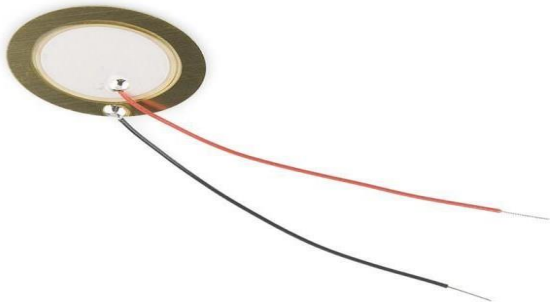


Fig. 3.5.4 Piezoelectric Sensor

A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, strain, or force by converting them to an electrical charge.

The piezoelectric material on ceramic piezo discs is so efficient that even a moderately strong force on the disc will produce in excess of 5 or 10 volts. Piezoelectric discs also make great capacitors.

The piezo sensor has 2 leads, a positive lead and a negative lead. It is a polarized electronic component, so polarity must be observed in order for the sensor to work correctly in a circuit. The red lead is the positive lead and the black lead is the negative lead.

LCD:

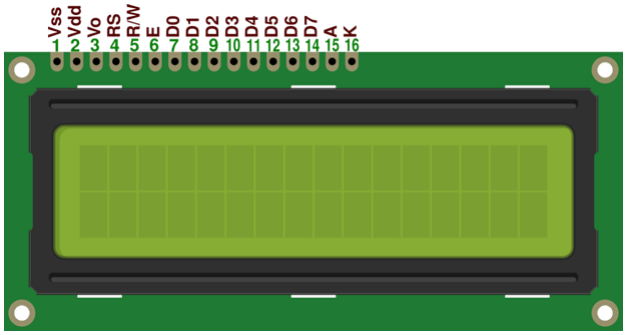


Fig. 3.5.5 LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

- **USB Cable:**

USB cable is used to insert the code written in Arduino IDE in the Arduino board.

Fig. 3.5.6 Cable

- **Male to Female wires, Wires, Male to Male wires:**

Male to female jumper wires

Jumper wire male to female, used in connecting female header pin of any development board (like Arduino) to other development board having male connector. In this one end of the wire is male connector and other one is female. The length of the wire is 20 cm approx.

Fig. 3.5.7 Male to female jumper wires

Male to male jumper wires

In male to male both the ends have male connectors. They are multipurpose use and very handy. Generally used for connecting FRC pins, Header pins, Berg pins etc. Male connector at both the ends. It's Length id about 18cm (approx.).

Fig. 3.5.8 Male to Male jumper wires

• **Wires :**

A wire is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate.

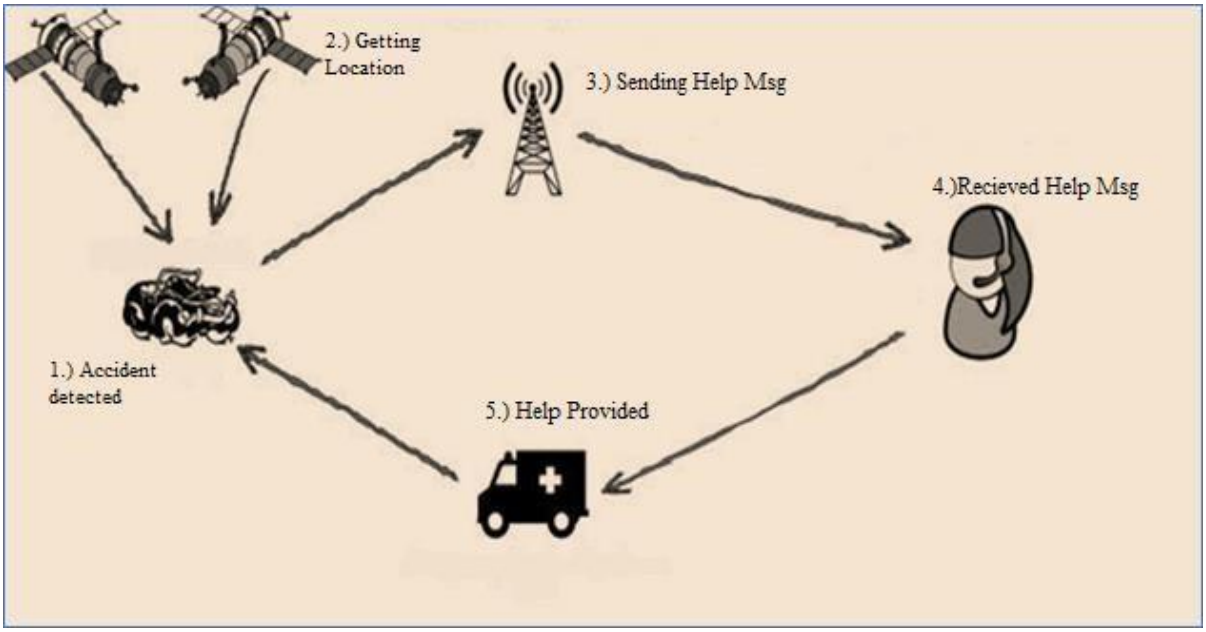
Fig. 3.5.9 Wires

• **Resistor:**

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits, resistors are used to limit current flow, to adjust signal levels, bias active elements, and terminate transmission lines among other uses.

Fig. 3.5.10 Resistor

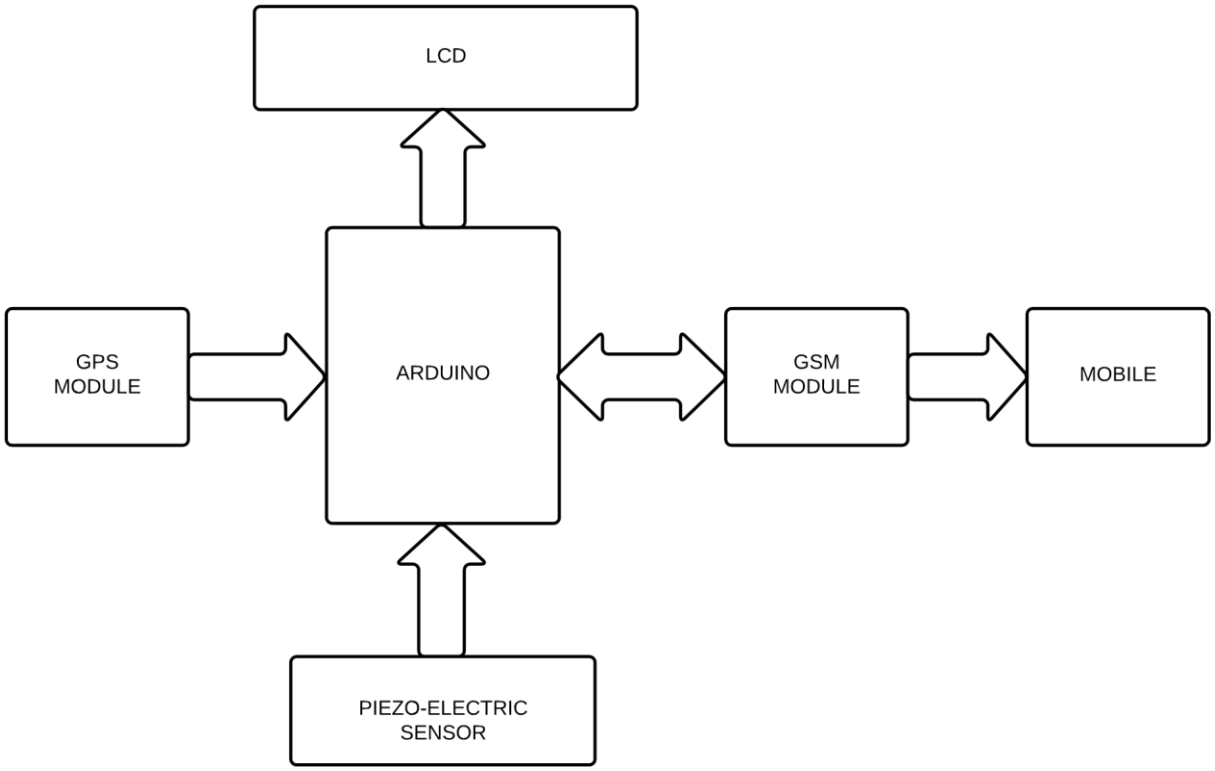
3.6 Conceptual Model:



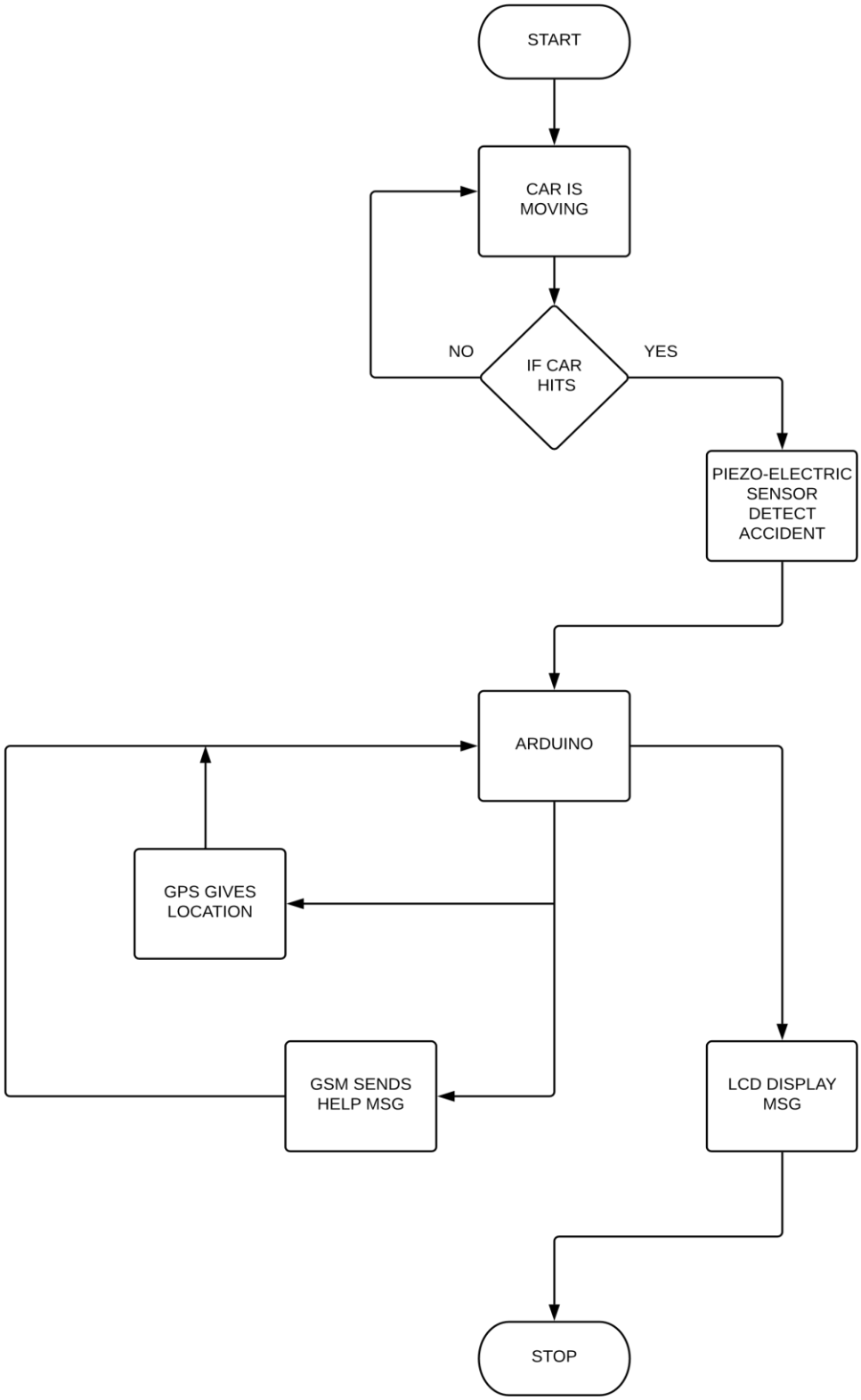
Chapter 4
System Designs

4.1: BASIC MODULES:

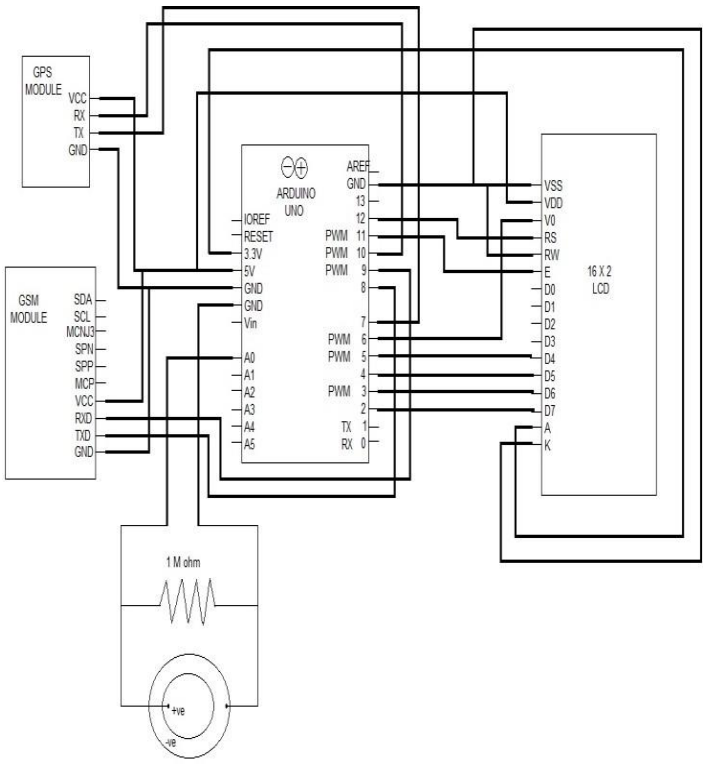
BLOCK DIAGRAM:



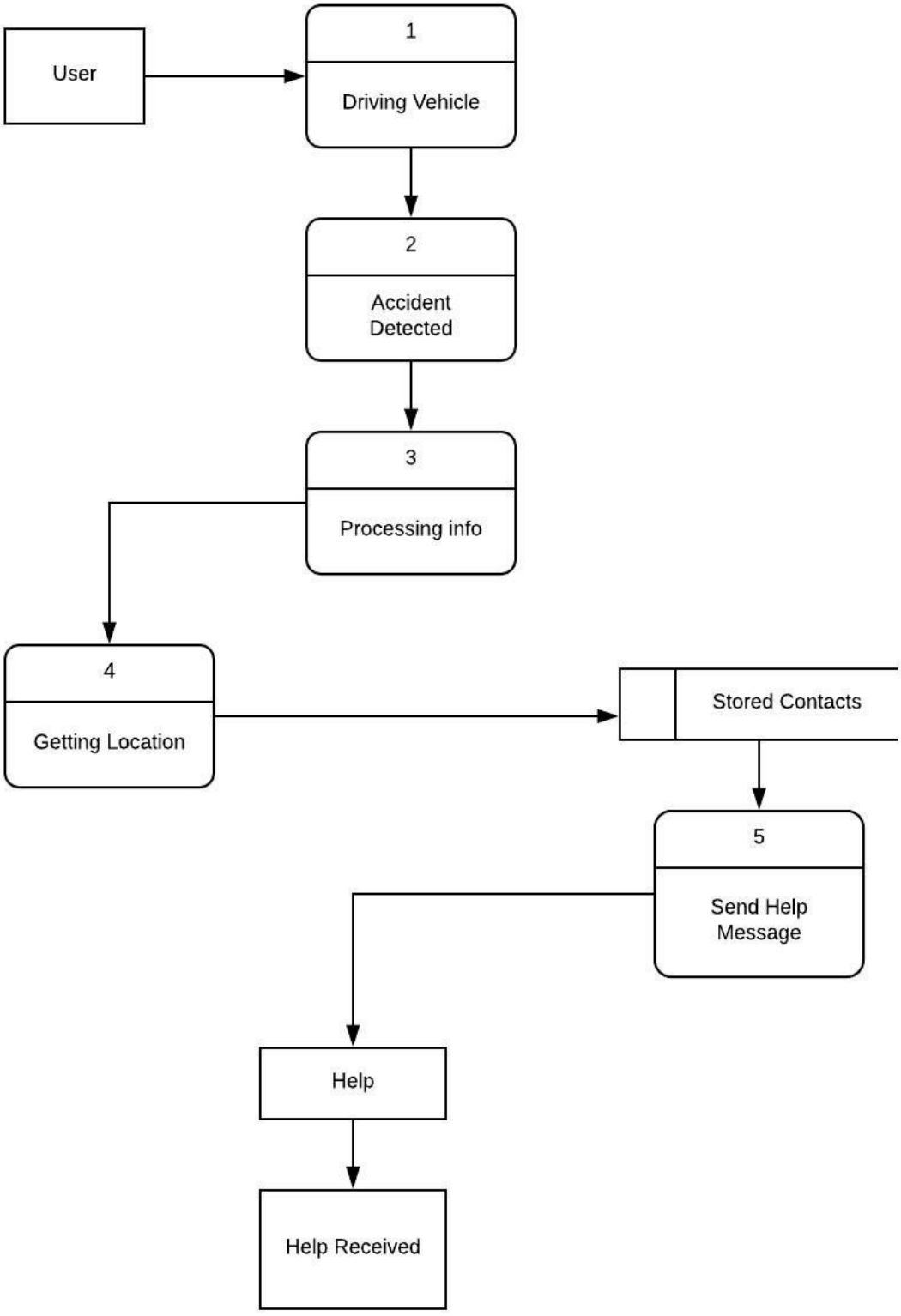
LOGIC DIAGRAM:



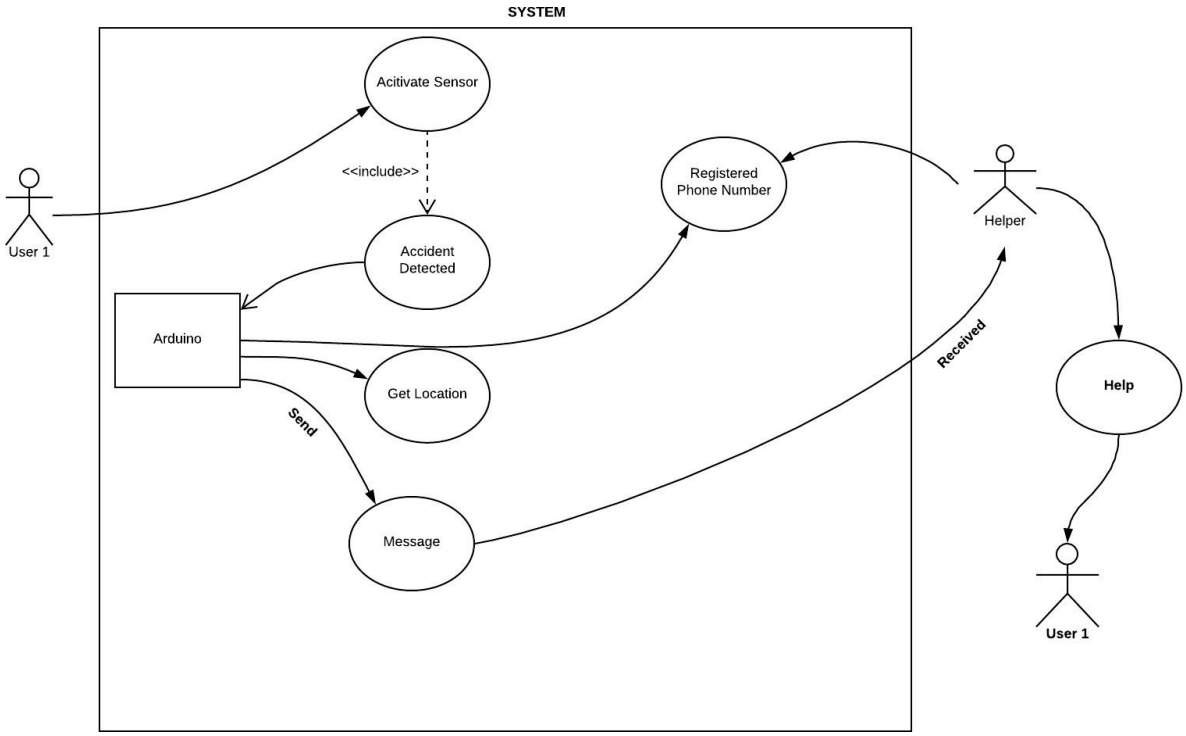
CIRCUIT DIAGRAM:



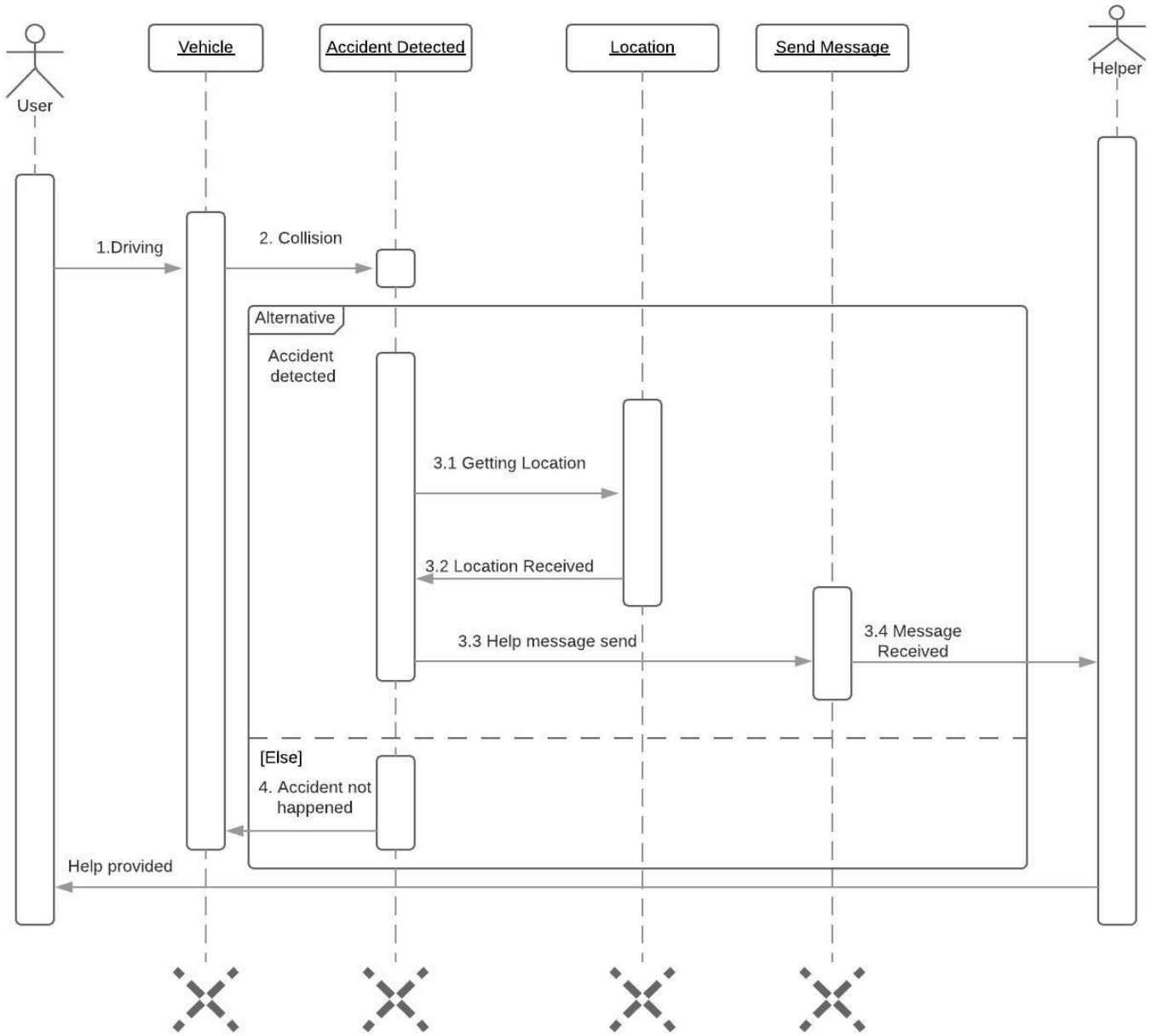
DATA FLOW DIAGRAM:



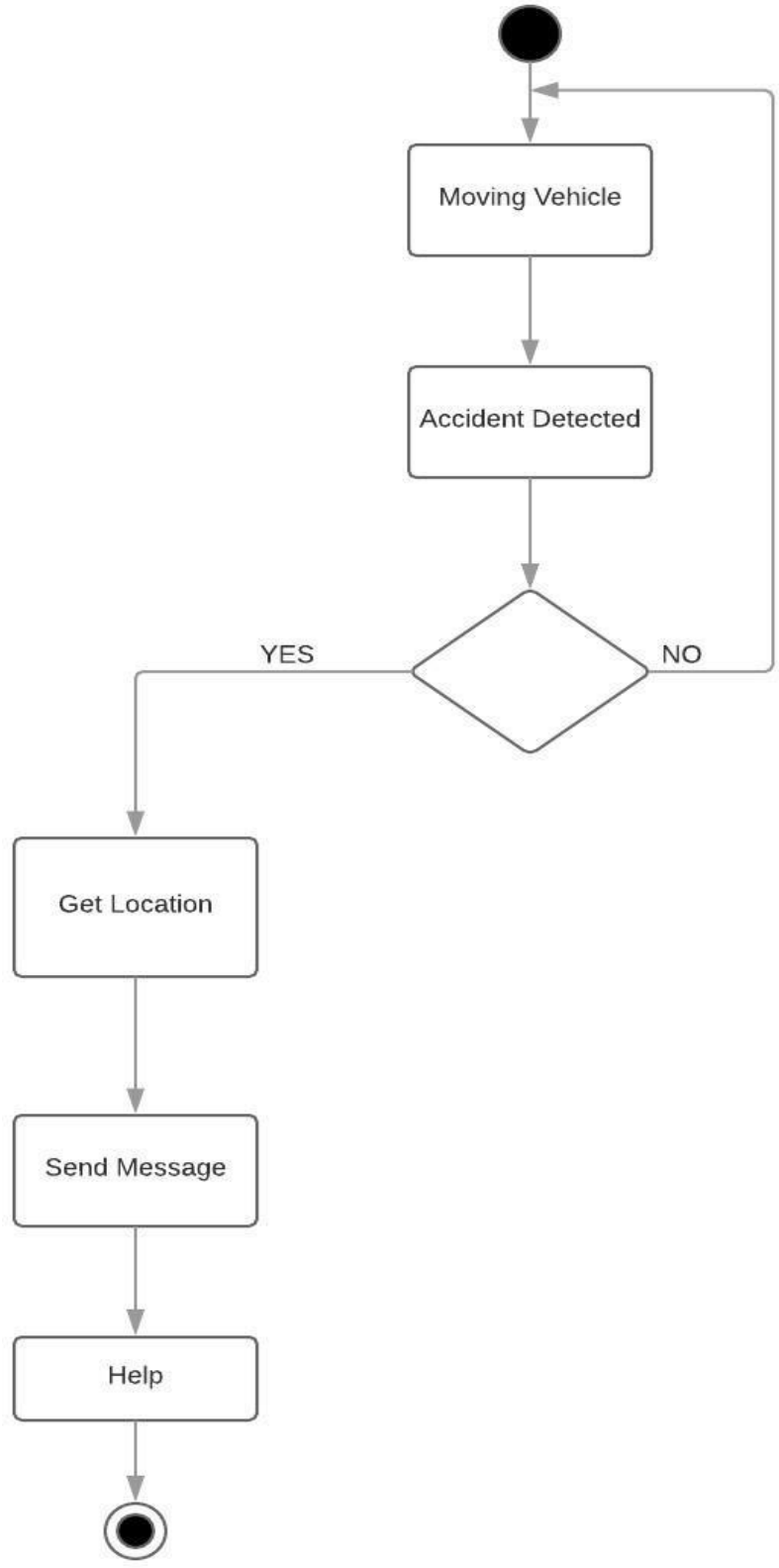
USE CASE DIAGRAM:



SEQUENCE DIAGRAM:



ACTIVITY DIAGRAM:



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