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College of Science and Technology

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AFRICAN CENTER OF EXCELLENCE IN INTERNET OF THINGS

**Research Thesis Title: IOT BASED FRONT - END COLLISION DETECTION SYSTEM**

*A dissertation submitted in partial fulfilment of the requirements for the award of masters of science degree in internet of things: wireless intelligent sensor network.*

Submitted by:

**Name: DUSHIME Jean Claude (Ref. No: 221000862)**

**November, 2022**



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Submitted By

**DUSHIME Jean Claude (Ref. No: 221000862)**

Supervised by:

Name of Main supervisor: **Dr. Dejan Vukobratovic**

Name of co – supervisor: **Mr. Emmanuel Ndashimye**

**November 2022**

## Declaration

I **Jean Claude DUSHIME**, Master 'student from African Center of Excellence in internet of things, at University of Rwanda. I declare that this research thesis is my own original work and it has never been presented before anywhere in the world.

Jean Claude DUSHIME

Ref: 221000862

Signed:



Date: 23<sup>rd</sup> /11/2022

## Bonafide certificate

This is to certify that this submitted Research Thesis work report is a record of the original work done by **Jean Claude DUSHIME (Ref. No: 221000862)**, MSc. IoT-WISNET Student at the University of Rwanda / College of Science and Technology / African Center of Excellence in Internet of Things, the Academic year 2020-2022.

This work has been submitted under the supervision of **Dr. Dejan Vukobratovic** and **Mr. Emmanuel Ndashimye**

Main Supervisor: **Dr. Dejan Vukobratovic**

Co-Supervisor: **Mr. Emmanuel Ndashimye**

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## Abstract

This project introduces a new technique in automobile technology about how to keep 10 meters distance between one vehicle and another vehicle, so that the vehicle doesn't crash or cause any traffic problem. The aim of the system is to detect accidents mainly due to not knowing the distance between one vehicle and another vehicle. The proposed system comprises an idea of having safety while reversing a vehicle, detects any object within the 10m distance, and displays the distance between one vehicle and another vehicle to the driver using LCD (Aravinda B1, 2016). Ultrasonic sensors will be used to detect any vehicle on both front and back side of our vehicle. If the car reaches 10 meter, green color light will glow. At 8-meter distance yellow color light will glow. Then at 5-meter distance red color light will glow. The distance is also indicated to the vehicle driver. By this proposed system, the safety is maintained on crowded areas and in vehicle reversing process.

In this system we will use the following materials such as Ultrasonic sensors, Arduino, Breadboard, and LCD

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## List of Acronyms

AVADRS: Automatic Vehicle Accident Detection and Rescue System

IOT: Internet of Things

CAR: Central African Republic

DRC: Democratic Republic of Congo

PIC: Peripheral Interface Controller

M2MC: Machine-to-Machine Communications

STP: Sao Tome & Principe.

LCD: liquid crystal display

LED: Light Emitting Diode

ICT: Information Communication Technology

IT: Information Technology

IDE: Integrated Development Environment

UML: Unified Modeling language



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### CHAPTER ONE: GENERAL INTRODUCTION

#### 1.1. Introduction

This chapter explains Background, Problem Statement, Objectives of the project, Scope of the project, Motivation, Interest of Project, Personal Interest, Public Interest, Academic Interest, Techniques and Methodology, Scope of the Study, and Challenges.

#### 1.2 Background

The Internet of Things (IoT) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure. Typically, IoT offers advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is implemented in nearly all fields of automation enabling advanced applications like a Smart Grid. The term things in the IoT refers to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, or field operation devices that assist fire-fighters in search and rescue. Current market examples include thermostat systems and washer/dryers that utilize Wi-Fi for remote monitoring, speed governors technology in transportation etc.

Due to lack of attention, speed and new technology increases the chances of accident. Many countries are having rank in the accident overall world. When road is curvature road at that instant a greater number of accidents occur. On the curvature road driver at one side cannot see the vehicles at other side. Both vehicles may have high speed. Suddenly both vehicles are come in front of each other and at that time they cannot control their vehicles speed and accident happen and valuable life has lost. To overcome this problem existing system, I supposed to developed a new system in which life of human can save using Ultrasonic sensors. These sensors are placed at front sides of the vehicle. Ultrasonic sensors sensors are used with Arduino and WI-FI module interfacing with them. This system also saves the valuable human life.



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Nowadays, information technology (IT) is widely used and rapidly becoming the common fixture of modern social and economic life. These technologies are opening opportunities and new avenues for all. With the technology now advancing at a great pace, our country tries to cope up with this trend by being up to date as far as IT technology is concerned. This is manifested in various fields, where you find even in business IT is depended on for correct and reliable outcome. As accidents continue to increase, the police department of traffic should use technology that can help drivers to reduce accidents easily through automatic vehicle accident detection and rescue system using microcontroller. As this system will be using sensors, drivers will be able to reduce accidents from different places. For this system to run efficiently, it is must that vehicle has sensor that should help to detect front and back sides in order to know the distance between both these vehicles. The ICT development, modern technology based on sensor and automobile has been employed for performing automatic vehicle accident detection and rescue system at low cost, in successful way as well. This leads us to think of the way to avoid the regular accidents that will normally occurring on highways and in city traffic by developing a system that provides solution to the problem of accident.

### 1.3. Problem Statement

Is not always easy to know distance between vehicles and this affects drivers in their day-to-day activities. Unsafe travel to reach our destination-even a small distraction may cause an accident and drowsiness have larger role in accidents. Most of the accidents occur due to driver inattention since they don't have a way to get alert. The number of accidents is ever increasing, but the way to find how they can prevent it is still low due to lack of system they can use for cars accident avoidance. In case of they still do not find the way which can be used for protecting people at real time in order to avoid the accident.

### 1.4. Objectives of the project

In order to carry out this research in organized way, objectives are formulated as follow:



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### 1.4.1. General Objective

The general, objective of this study is to develop and implement a system that will help to prevent accidents mainly due to not knowing the distance between one vehicle and another vehicle front and back sides.

### 1.4.2. Specific Objectives

- Require a prototype of cars accident avoidance system using microcontroller automatically detected by the sensor system
- Design and develop a system where will have safety while reversing a vehicle, detects any object within the 10m distance.
- Test and configure the available device for implementing the IoT based automatic vehicle accident detection and rescue system
- Displays the distance between one vehicle and another vehicle to the driver using LCD.

### 1.5. Scope of the project

According to the time we have, this project called “**IOT BASED FRONT - END COLLISION DETECTION SYSTEM**” will focus on detecting object within 10m and display distance between two vehicles during implementation.

The project will use the following materials such as Ultrasonic sensors, Arduino, Breadboard, and LCD. The Arduino board is used to become the main system that can control or conduct other device for making it function properly that it will be programmed with Arduino software (IDE) by facilitating the definition of device’s coding.

#### 1.5.1 COMPONENTS USED DESCRIPTION:

1. **16x2 LCD Display:** An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is commonly used in various devices and circuits. 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. The 16 x 2 intelligent alphanumeric dot matrix display is capable of



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displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

2. **ULTRASONIC SENSOR MODULE:** ADXL345 Ultrasonic Accelerometer Board is a small, thin, low power, 3-axis accelerometer with high resolution (13-bit) measurement at up to  $\pm 16g$ . Digital output data is format as 16-bit twos complement and is accessible through either an SPI (3- or 4-wire) or I2C digital interface.
3. **DC MOTOR L298N**
4. **LED (RED, GREEN, YELLOW)**
5. **Jumper wires**
6. **Breadboard mini**
7. **Arduino UNO**
- 8.

### 1.5.2. LIST OF USED COMPONENTS:

- In this project we are using a 12V DC to provide a power supply.
- In this project the microcontroller and motor controller to run the operation. When switch is on then Regulated power goes to microcontroller, motor controller etc. though microcontroller attachment with each other.
- (Switch is on – vehicle is on – Accident fallout – Ultrasonic sensor sense – signal to microcontroller – Indicator led is on – message is sent – vehicle is off).
- Detects any object within the 10m distance front and back sides.
- Displays the distance between one vehicle and another vehicle to the driver using LCD.



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- Displays the color lighting as notification depending on the distance between front or backvehicle by using LED.

### 1.6. Motivation

This research finds its motivation from the factor that designing a cheap sensor accident-avoidance system has always been a tonic for further research. This research suggests such a unique and distinguished design which if implemented commercially can prove itself worthy of controlling sudden accidents. This technology will somewhat reduce the road accident-based systems and will be suitable for common people because of its cost reduction.

### 1.7 Interest of Project

My research project will help drivers to know the distance between their vehicles in order to avoid the accident.

#### 1.7.1 Personal Interest

- To improve professional capacity in what we have learnt.
- Increase knowledge on designing and programming in details, this will contribute to the generation of more commands as programming goes on.
- To develop our experience in the development of object-oriented programming.
- Apply the skills gained during the academic study to resolve practical problems.

#### 1.7.2 Public Interest

An attempt has been made in this project to study and comprehend aspects of Ultrasonic sensor. The use of the collision avoidance system will help in saving human lives.

#### 1.7.3 Academic Interest

My project will help future researchers who need to develop their own project by consulting what I have done in my project and what I omitted in order to make best project.

- UR Masters student will have high rate in job competition.
- It will encourage UR lectures because their students make value from what they teach them.



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- When this project is found useful and becomes popular, it will promote university of Rwanda, then attracts student to study in University of Rwanda.

### 1.8 Techniques and Methodology

There is always a technique used in order to achieve all goals during scientific research.

#### 1.8.1 Techniques

Research methodology explains the method by which we may proceed with my research. Research methodology involves the learning of the different techniques that can be used to conduct research with tests, experiments, surveys and analyzing critical studies.

The research methodology may include publication research, interviews, documentation and other research techniques, and could include both present and historical information. So in this project we preferred to use the observation technique, documentation technique, and interview technique.

- **Observation technique:** I have used this technique by going on the field and to see how the current way works where you see the process of how cars are made accident to the different road.
- **Documentation technique:** This technique helps to refer to books, Internet and memoires related to the project.
- **Interviewing technique:** This technique consists of verbal communication between the interviewer and interviewee. It allows us to ask several questions regarding the study that has been conducted at official offices using interviews to gather the necessary data helpful to the realization of our project. The purpose was to understand how the current way system works in order to propose the adequate system.

#### 1.8.2 Methodology

Unified Modeling language (UML) is a standardized modeling language enabling developers to specify, visualize, construct and document artifacts of a software system. Thus, UML makes these artifacts scalable, secure and robust in execution. UML is an important aspect involved in object-



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oriented software development. It uses graphic notation to create visual models of software systems.

### 1.9 Challenges

Although this project is very interesting to develop it, I faced many challenges including getting information I needed. Some of information I needed were from Police stations department of traffic. They are always busy due to work. I had to wait until they get a free time and helped me.

- Some traffic men were not willing to give me information about how they make announcement of different accidents in different places.
- A virus damaged my documents.
- Time and cost problem.

The research will focus on **IOT BASED FRONT - END COLLISION DETECTION SYSTEM**

The design presents a collision avoidance system which can be installed on the moving vehicles. The key idea incorporated in the detection of front and back vehicle of using ultrasonic sensors.

I am confident that in coming year our project if used in proper and in efficient direction will become useful and serve the mankind.

### 1.10 Justification

This project suggested to be done because we need to avoid the regular accidents that will normally occurring on highways and in city traffic since there is no way to determine the exact distance of automobiles travelling behind as that will be responsible for accident.

### 1.11 Organization of the Study

This project is organized into six chapters as follows:

Chapter 1: Relates to the general introduction

Chapter 2: Focuses on the literature review.



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Chapter 3: Deals with the analysis of the existing system.

Chapter 4: Concerns to the analysis and the design of the proposed system.

Chapter 5: Is about the implementation of the new system.

Chapter 6: Deals with conclusion of the project and states some recommendations for future work, and enhancement.



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### CHAPTER TWO: LITERATURE REVIEW

This is a short description of the terms that will be used during the development of this system. It provides definitions, advantages, disadvantages and characteristics of terms used. Theoretical concepts that will be used seem to be complex. It will also include the comparative study with other project done by others and my contribution to the solution.

#### 2.1 General concepts

This research purpose is to bring intelligence into vehicles by providing the ability of determining the exact distance front and back of our vehicles. Thus, an ultrasonic ranging module with microelectronics will be designed and prototyped into vehicles. This project will use Arduino microcontroller, LCD and Breadboard as the main rather than usual Peripheral Interface Controller (PIC) as Arduino provide s flexible, complete, and easy hardware and software platform unlike PIC.

##### 2.1.1 Definitions of the concepts

###### 2.1.1.1 IOT

It describes physical objects with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the internet.

###### 2.1.1.2 Automatic

Device or process working by itself with little or no direct human control.

###### 2.1.1.3 Vehicle

A thing used for transporting people or goods, especially on land.

#### **In this context Accident means:**

Is an event that happens without being planned.

#### 2.2. Vehicle accident: Determining the causes of the accidents (J, 2014)

The most relevant information on the accident that was used to reduce the causes of the accidents were the following:



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- What the driver was doing?
- Damage to the vehicle, e.g., burst type
- Statements by the involved parties and traffic officer/police
- Animals or pedestrians in road
- Sketch (if drawn)

**Accident causes were divided into some categories only to enhance the statistical analyses.**

**They are explained below.** (J, 2014)

- **Negligence:** The accident would not have occurred if the driver were not negligent. Examples are unsafe overtaking, colliding with an oncoming vehicle in the opposite or same direction, and losing control over a vehicle due to speeding or inattention if there is not a vehicle fault.
- **Pedestrian in road:** When a pedestrian crosses the road in an unsafe manner or walking in the road and causing an accident.
- **Alcohol use suspected:** A driver is being suspected of being over the alcohol limit, but this was not tested (only one accident report reported a test having been done).
- **Vehicle problem:** A burst type, faulty lights or any other vehicle faults that caused the accident.
- **Road problem:** This includes an accident scene, oil, water, pothole or rock in the road, poor road markings or road signs and road works obstructing a road.
- **Animal in road:** An animal crossing the road and causing an accident.
- **Unknown:** The cause could not be reduced from the accident report.

The above causes are divided into the three contributing accident risk factors as follows: (J, 2014)

### **Human factors**

- Negligence
- Pedestrian in road



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- Alcohol use suspected

### Vehicle factors

- Vehicle problem

### Road environment factors

- Road problem
- Animal in road

### Unknown factors

- Unknown

## 2.3. Avoidance

Is the action of keeping away from or not doing something. (J, 2014)

### 2.3.1 Determining the avoidance of the accidents

- **Keep your eyes on the road**

**When you are driving, you should be doing just that and nothing else.** Don't let things going on inside the car distract you from the task at hand. The car is not the place for multi-tasking, so you should not be doing things like brushing your hair or shaving (yes, there are people who actually do these things). If you are not concentrating solely on your driving, you are risking an accident, because you will not be prepared for anything that is up ahead.

- **Never use your cell phone**

**There is no good reason to be talking on a cell phone while you are driving.** This is extremely distracting. If you do not have a hands-free model, you will have to look at the phone to dial numbers. Even with a hands-free, you will be talking, which will distract you from your driving. Put the phone away, and make sure it is turned off so you don't have the urge to answer it if it rings. If you do need to make a call, wait until you are parked before doing so.



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### ➤ **Don't change CD's**

It isn't really a good idea to be listening to music while you are driving anyway, but if you are listening to CD's, make sure that you are not changing them while you are driving. Again, this will cause you to look away, and even if you just take your eyes off the road for a second, accidents can happen. Only change CD's while the vehicle is parked. If you must listen to music, which itself is distracting enough, try using the radio instead, on your favorite station which is already preset so you don't have to fiddle with it.

### ➤ **Never, ever drink and drive**

When you are drinking and you drive a car, you do not have the same abilities that you do when you are sober, and that includes the ability to drive safely. Your judgment is impaired, and your vision may not be the greatest either. If you are going to drink, find alternate transportation. Have a designated driver. Take a taxi. Take a bus. Just don't take your car. Remember, this also includes driving while under the influence of any drugs, including narcotics such as marijuana.

### ➤ **Follow speed limits**

When you are driving too fast, you are really risking having accidents. For one thing, if you have to stop suddenly, chances are that you are not going to be able to. What if a child was to run out in front of you and you were going too fast? Would you be able to slow down enough, or even stop, so that you don't hit him? If you are driving within the posted speed limit, you will not have this problem, because you will be driving a speed that makes it easy to stop quickly if necessary. It is not just pedestrians you need to worry about either. Another driver may not be paying attention and run a stop sign, and you need to be going slowly enough to be able to react on time.

### ➤ **Follow the rules of the road**

Just like speed limits, there are other rules of the road that you must follow if you want to avoid having accidents, and getting traffic tickets. If you are approaching a stop sign or a red light, start



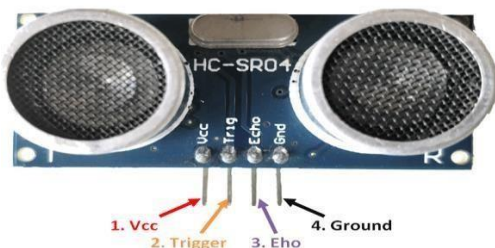
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slowing down long before you get to it, so that you are able to come to a complete stop at the stop line. Obey all traffic signs; they are there for a reason.

### ➤ Ignore aggressive drivers

There are going to be some drivers who do some pretty crazy things, like speed and cut other drivers off, and sooner or later, you are going to be faced with one of these people. The best thing to do in a case like this is to try and get as far out of their way as possible. If they are crawling up behind you, honking their horn, slow down to let them pass. **Don't play games and just make them angrier.** The quicker you can get them away from you, the safer you will be.

### 2.3.1 Ultrasonic sensor



**Figure 1: Ultrasonic sensor (Nedelkovski, 2009)**

The ultrasonic sensor uses sonar to determine distance to an object. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. (Nedelkovski, 2009)

### 2.3.2 Ultrasonic Sensor Pin Configuration

Pin Number	Pin Name	Description
1	VCC	The VCC pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.



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- 3                    Echo                    Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
- 4                    Ground                    This pin is connected to the Ground of the system.

2.3.3 Breadboard

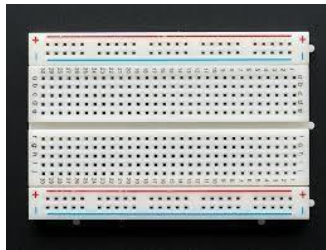


Figure 2 : Breadboard

The breadboard is a solder less device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. (Barragán, 2016)

2.3.4 Arduino Uno



Figure 3 : Arduino Uno

**The Arduino Uno** is a microcontroller board. It has 14 digital input/output pins of which 6 can be used as outputs, 6 analog inputs, a 16 MHz quartz crystal, a USB. (Botlon, 2005)



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### 2.3.5 LCD



**Figure 4: LCD**

The LCD is a commonly used to display data in devices such as electronic devices. (Brayon, 2016)

### 2.4 Related works:

#### 2.4.1 Collision Avoidance System for Vehicle Safety

Automobile safety can be improved by anticipating a crash before it occurs and there by providing additional time to deploy safety technologies. By this project, the goal is to design a collision avoidance system which is reliable for drivers in traffic. The purpose of the automatic collision avoidance system is to keep drivers better informed with the environment surrounding them. Primarily Ultrasonic sensors, Microcontroller, Buzzer, LCD, Motors and a set of LEDS are used to implement the design. The success of the proposed system can reduce human suffering caused by injury and death. The financial burden will be reduced because maintenance and replacements of parts of vehicle are avoided. (NIELIT, Gorakhpur, 2015).

#### 2.4.2 Sensor Based Accident Prevention System

In the mountain roads there will be tight curves and the roads will be narrow. In these kinds of situations, the driver of a vehicle cannot see vehicles coming from opposite side. Thousands of people lose their lives each year because of this problem. Since we are talking about mountain roads here other side might be lead to a cliff. The solution for this problem is alerting the driver about the vehicle coming from opposite side. This is done by keeping an ultrasonic sensor in one side of the road before the curve and keeping a LED light after the curve, so that if vehicle comes from one end of the curve sensor senses and LED light glows at the opposite side. By looking at the LED light on/off criteria driver can become alert and can slow down the speed of the vehicle. (C.C.D.A.K.AravindaB1, 2016)



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### 2.4.3 Similarities of Proposed System and existing

The comparative study allows the comparison between my works with other works done before. Here we focus on showing the similarities and the differences among both projects compared. We do have also to demonstrate their weak points and show the improvement to solve those weaknesses.

#### Project 1

➤ **Scope of study**, I read a final project entitled: “**Sensor Based Accident Prevention System**” written by Chris Macharia Waruguru with the purpose of the award of bachelor ‘s degree in information Technology at University of Nairobi in 2010 According to his project he proposed a system that to allow and help Kenya National Police department of traffic and people to avoid and easily to prevent the accident.

➤ **Weaknesses**

Even if this project consulted “Collision avoidance system” has some positive impact on collision increase, but it is also having some weaknesses due to the fact that police station doesn’t only avoid the accident in different road but they are other accident that are happen around the country. In that case developing system for collision avoidance only in this case it is not enough for them.

➤ **Similarities**

The similarity of his project “Sensor Based Accident Prevention System” and mine “IoT based automatic vehicle accident detection and rescue system”

**“In terms of implementation both are:**

- ✓ All use ultrasonic sensors
- ✓ All have target of detecting object



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### In terms of functionalities

Same purpose of reducing accident in the road.

### Differences

#### In terms of implementation:

Technology I will use, I will use advanced technology of embedded system application where ultrasonic sensor, LCD, LED will be mostly materials

## Project 2

**Scope of study**, I had read another project entitled “Automatic Speed Control and Accident Of vehicle using Multi Sensors” written by *Kevin MAINA* the 21-year-old aeronautical engineering student Kenya, according to his project it was embedded system which has the purpose of controlling the car speed it works like speed governor it controlled the speed of vehicle and it given the alert as a signal.

### Weaknesses

Even if this project consulted “**Automatic Speed Control and Accident of vehicle using Multi Sensors**” has some positive impact in cars avoidance system, but also has some weaknesses because it was only control speed and it gave the alert signal, the driver was only seeing that alert it doesn’t deal with de distance between the vehicles only in this case not enough for them.

### Similarities

The similarity of his project “Automatic Speed Control and Accident of vehicle using Multi Sensors” and mine “IoT based automatic vehicle accident detection and rescue system”

✓ ” Both are embedded system



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- ✓ All use ultrasonic sensors.

### **In terms of functionalities:**

- ✓ Easy to be monitored by police all others who are in charge in traffic road safety

### **Difference**

#### **In terms of implementation:**

- ✓ While others deal only on speed no alert notification to the driver for example speed Governor
- ✓ Deals with only speed management

#### **In terms of functionalities**

- ✓ Low cost implementation and greater functionalities provided such alert notification, self-decision on speed depending on LED notification.

## 2.5 Advantages and Disadvantages

### 2.5.1. Advantages

- Obstacle controlling vehicle
- It protects from accident and given notification.
- Easy and Wireless control from anywhere

Efficient by using ultrasonic sensor.

- Low cost design.
- Low power consumption.

### 2.5.2. Disadvantages

- Only Works on internet.



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### 2.6. FUTURE SCOPE:

- The proposed program deals with detecting incidents and warning paramedics to reach the specific location by taking them to the nearest hospital and providing the medical services to the person affected by the incident.
- This can be extended through providing the victim with medication at the spot of the accident. We can also avoid accidents by increasing the technology and using warning systems that could really stop the vehicle to conquer them

### 2.7. CONCLUSION

The description of the related systems to my project shows how the iot based automatic vehicle accident detection and rescue system technologies are implemented used almost the same materials such that will use during the development of my system, this helps us to get enough ideas of the research I did, as the proposed system may avoid many accidents happened by requiring at low cost components such as ultrasonic sensor, LCD and LED in its implementation.



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### CHAPTER THREE: ANALYSIS OF THE EXISTING SYSTEM

#### 3.1 Introduction

This chapter facilitates us to know and explain briefly the description and how the existing system works. The analysis will help us to explain the current situation and to be compared with the new system we want to develop and finally proposes the solutions to the problems identified.

#### 3.2 Background and related statistics

In 2010, concerned about the very high and increasing burden of road traffic crashes around the world, the United Nations General Assembly adopted Resolution 64/255, which proclaimed 2011–2020 the Decade of Action for Road Safety. The goal of the Decade is to reduce the increasing trend in road traffic deaths, and to save an estimated 5 million lives over the period. The Resolution followed the publication of the first Global status report on road safety, which had showed, among other major findings, that the Region had one of the highest rates of road traffic deaths, along with the Eastern Mediterranean Region. In order to guide national responses to achieve the decade goal, a global Plan of Action was developed. It provides a practical tool to support governments and other national stakeholders in the development of national and local plans of action, as well as a framework for coordination of activities at regional and global levels. It was determined that the improvement of road safety would be hinged on improvement in the following five areas, also termed pillars for the decade: road safety management, safer roads and mobility, safer vehicles, safer road users, and post-crash response. General Assembly Resolution 64/255 also called for regular monitoring of the global progress towards meeting the targets identified in the Plan of Action. The data collection, for each country was based on a standard questionnaire which was filled by a multi-sectorial group of respondents and validated in a consensus meeting. The data were cleaned and analyzed and modeling was used to adjust all reported deaths to the standard thirty day definition. (Oluwagbemi, 2013)

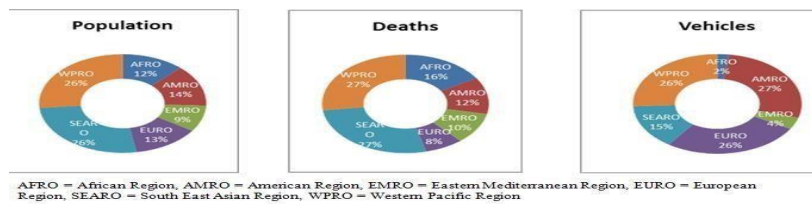


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3.3 Deaths on Africa’s roads

The African Region remains the least motorized of the six world regions, but suffers the highest rates of road traffic fatalities (Figure 1), with 37 of 44 surveyed countries having death rates well above the global average of 18.0 deaths per 100 000 populations (Figure 2). While the regional average is 24.1 deaths per 100 000 populations, for the 19 countries in the middle-income category, covering 44% of the Region’s population, the rate is 27.8 deaths per 100 000 populations. By comparison, the global average for middle-income countries is 20.1 deaths per 100 000 population. (Oluwagbemi, 2013)

Figure 5: A comparison of regional populations, road deaths, and registered vehicles



(Oluwagbemi, 2013)

Regions	Regional Population	Road Deaths	Registered Vehicles
African Region	14%	16%	2%
American Region	14%	12%	27%
Eastern Mediterranean Region	9%	10%	4%
European Region	13%	8%	26%
South East Asian Region	26%	27%	15%
Western Pacific Region	26%	27%	26%

Table 1: Comparison of regional populations



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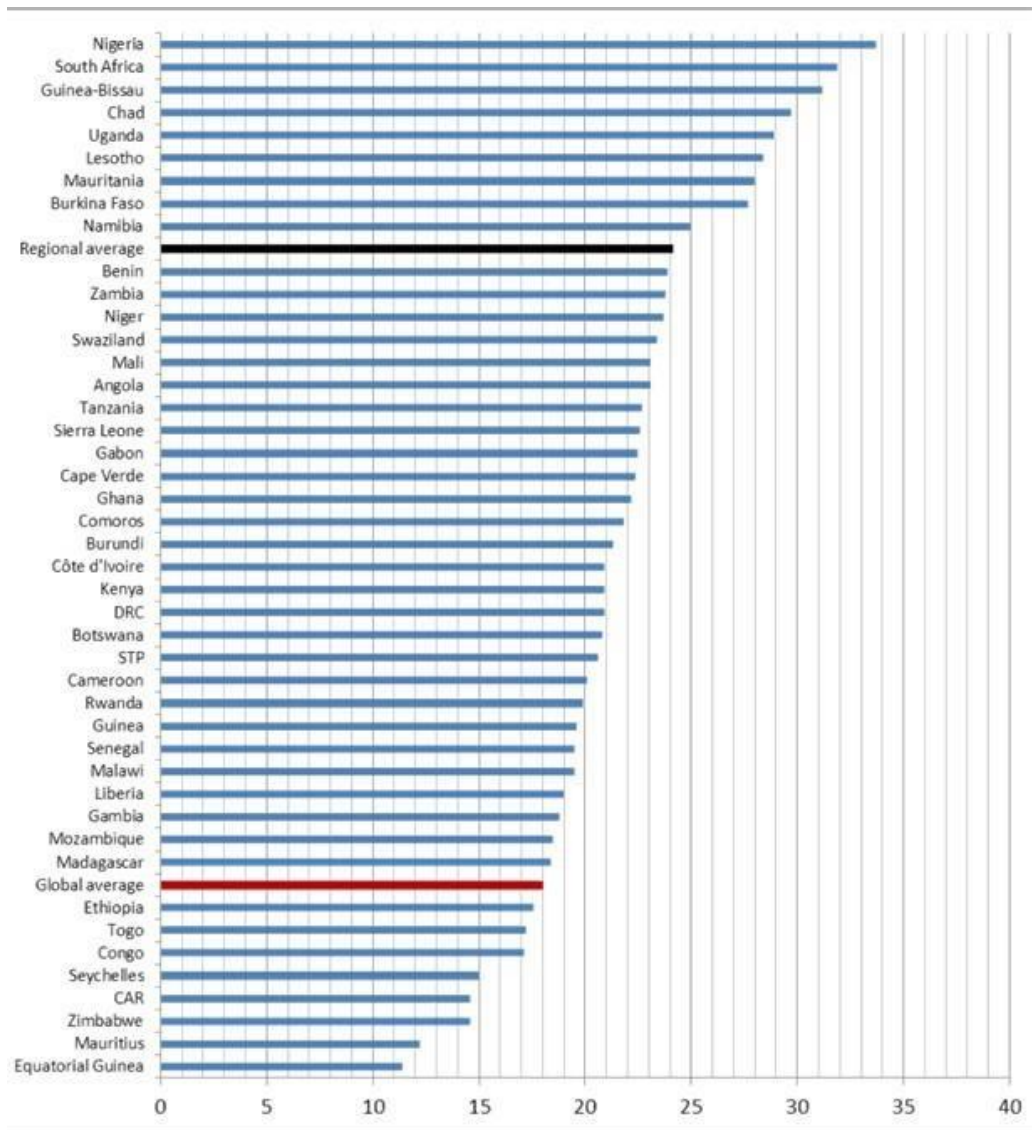
### 3.3.1 African Region accident statistics due to lack of proper system

While the African Region possesses only 2% of the world's vehicles it contributes 16% to the global deaths. Nigeria and South Africa have the highest fatality rates (33.7 and 31.9 deaths per 100000 populations per year, respectively) in the region. More than one in four deaths in the African Region occur on Nigeria's roads, and with six other countries; Democratic Republic of Congo (DRC), Ethiopia, Kenya, South Africa, Tanzania, and Uganda, are responsible for 64% of all road deaths in the region. While Ethiopia, Kenya, and Tanzania have relatively low (for the region) road fatality rates, Nigeria, South Africa, and Uganda combine big populations with very high fatality rates, resulting in large numbers of deaths. These seven countries must reduce their road deaths considerably if the region is to realize a significant reduction in deaths. While statistics clearly point to a high economic cost to the respective countries, only nine countries provided an estimate of the cost in terms of the Gross Domestic Product. This ranged from 1% in six of the countries, to 9% in Angola. (Oluwagbemi, 2013)



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Figure 6: Road death rates 2010



(Oluwagbemi, 2013)

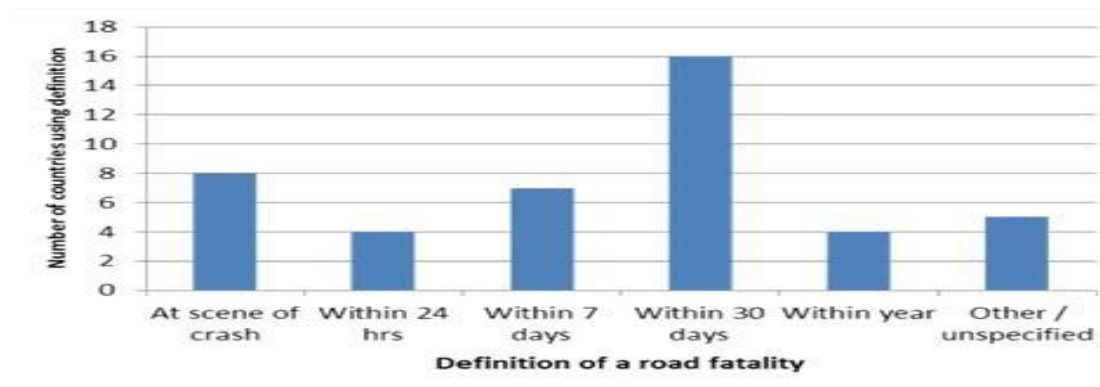


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3.3.2 Fatality data

Definitions and data sources vary widely. Only 16 countries (37%) use the internationally recommended definition of a road death, as that occurring within 30 days of the crash (Figure 3). In 77% of the countries fatality data come exclusively from police records. A further 16% use a combination of police and health facility records.

Figure 7: Definition of road fatality



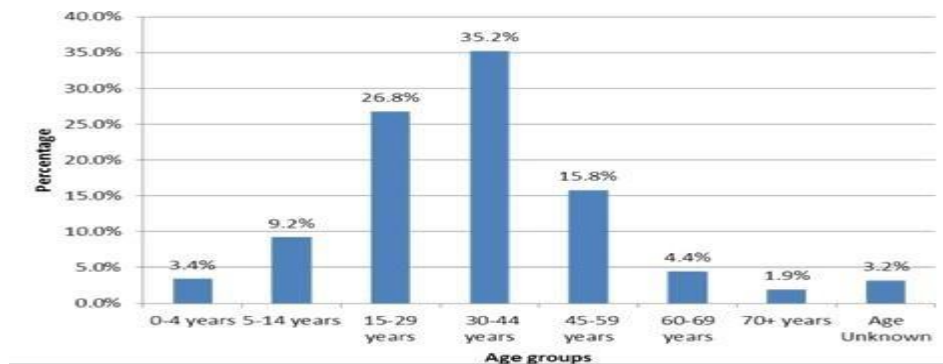
(Oluwagbemi, 2013)

The majority of persons killed on the roads are young adults, with 62% of all deaths aged between 15 and 44 years (Figure 4). In twenty countries (48.4% regional population) where data on sex were available, three out of every four deaths were male. Young men were the most vulnerable of road users in the Region.



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Figure 81: Age of groups



Vulnerable road users pedestrians, cyclists and motorized 2- and 3-wheelers – constitute more than half (52%) of road users killed on the roads, with pedestrians alone being 37%. There are significant variations across countries. For instance, Mozambique and Liberia have 55.5% and 66.3% of road deaths respectively being pedestrians, compared to DRC with only 5% pedestrians.

All these analysis was in these countries listed below:

Botswana, Comoros, Central African Republic, Ethiopia, Ghana, Lesotho, Mauritius, Mozambique, Namibia, Seychelles, South Africa, and Swaziland.



Figure 9: Road safety parameters and indicators



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(Oluwagbemi, 2013)

Only 12 of 44 countries have national policies to separate road users. Buses make up a very small proportion of the fleets. In most urban centers those commuters who cannot afford personal cars have tough choices: mini-buses or commuter vans, two- or three-wheelers, or walking. Mini-buses tend to be out of financial reach of low income earners, and in most countries they have poor safety records.

Road safety management parameter	Number of countries	Countries
Countries with funded national strategy that sets targets	12	Burkina Faso, Central African Republic, Côte d'Ivoire, Equatorial Guinea, Ghana, Kenya, Lesotho, Mauritania Mauritius, Namibia, Rwanda, Zambia

Table 2: Road safety management parameter

3.3.3 Road safety management

Almost all (42) countries surveyed have lead agencies. However, eight of the lead agencies are not government funded, and only three countries have full funding for implementing their road safety strategies this suggests that while more countries created lead agencies, there remain serious challenges with the actual working of these agencies. There can be little progress expected from lead agencies working with neither targets nor funding.

3.4 Traffic Accidents in Europe

Daily traffic in Europe is very dense and requires constant alertness by drivers. This demanding task can be supported by advanced driver assistance systems, which are able to help the driver by applying active steering and braking power in the right situations. Interactive aims not only at



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avoiding traffic accidents, but also at mitigating the impact of collisions that can be avoided. This will lead to fewer road fatalities and less severe injuries. In addition, the support will be provided by my system will decrease the stress level of all traffic participants and lead to a more pleasant overall driving experience because intelligent vehicles being developed by google it will take longer time to come on board.

### 3.4.2 Deaths from accidents, injuries and assault comparison in Europe's roads

In 2014, there were 152 thousand deaths in the European Union-28 resulting from accidents, equivalent to 3.1 % of all deaths. Table 1 shows that the proportion of deaths from accidents in Lithuania, Finland and France, as well as in Iceland, the former Yugoslav Republic of Macedonia and Albania, was equal to or over 4.5 %, while accidents accounted for less than 2.0 % of all deaths in Greece and Bulgaria, as well as in Serbia. A higher share of men (than women) in the European Union-28 died from accidents in 2014 (3.7 % compared with 2.5 %). This pattern was repeated across all of the European Union Member States (Johnson, 2017)



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3.4.3 All deaths caused by accidents, European Union-28, 2014

	Number of deaths (number)	Share of all deaths			Standardised death rate				
		Total	Males	Females	Total	Males	Females	Persons aged < 65 years	Persons aged 65 or over
		Total (%)			Total (per 100 000 inhabitants)				
EU-28	151 561	3.1	3.7	2.5	30.6	42.7	20.5	13.7	100.1
Belgium	4 184	4.0	4.4	3.7	38.8	51.4	29.1	14.2	140.4
Bulgaria	1 901	1.8	2.5	1.0	26.3	41.3	12.8	20.3	50.7
Czech Republic	3 854	3.7	4.6	2.7	42.5	62.3	27.3	20.0	135.5
Denmark	1 361	2.7	3.0	2.3	27.2	35.7	20.0	10.6	95.3
Germany	21 426	2.5	2.7	2.2	25.5	35.0	18.3	8.5	95.3
Estonia	654	4.2	6.7	1.9	50.0	85.7	20.8	46.8	62.9
Ireland	956	3.3	4.2	2.3	26.5	36.8	17.3	14.3	76.7
Greece	2 192	1.9	2.8	1.1	19.3	30.5	9.2	13.4	43.9
Spain	10 122	2.6	2.9	2.2	21.2	29.2	14.5	8.7	73.2
France	25 304	4.5	4.9	4.2	37.4	51.5	26.6	13.7	135.1
Croatia	1 959	3.8	4.2	3.5	53.9	69.4	40.5	17.3	205.4
Italy	17 436	2.9	3.2	2.7	25.4	34.4	18.4	8.2	96.5
Cyprus	217	4.0	4.2	3.7	35.8	42.4	30.1	9.8	142.8
Latvia	1 194	4.2	6.6	2.0	60.0	105.6	24.5	50.4	99.9
Lithuania	1 924	4.8	7.3	2.4	66.0	114.2	28.0	56.2	106.4
Luxembourg	152	4.0	4.4	3.6	34.0	43.4	25.9	12.1	124.4
Hungary	3 582	2.8	3.6	2.1	40.4	61.7	25.3	17.4	135.0
Malta	67	2.0	2.5	1.5	19.6	29.5	12.9	6.0	75.7
Netherlands	4 683	3.4	3.4	3.4	33.2	40.9	27.5	6.3	144.2
Austria	2 515	3.2	3.8	2.7	30.7	42.7	21.6	10.6	113.5
Poland	13 064	3.5	4.7	2.1	38.1	59.5	19.9	24.6	93.8
Portugal	2 366	2.3	2.9	1.6	22.2	34.3	12.5	11.7	65.7
Romania	7 322	2.9	4.2	1.4	37.9	61.9	16.8	30.5	68.6
Slovenia	770	4.1	4.5	3.7	41.9	55.0	30.6	13.4	159.3
Slovakia	1 846	3.6	4.9	2.2	40.8	61.6	23.4	24.6	107.4
Finland	2 455	4.7	6.1	3.4	45.9	68.7	27.8	22.3	143.3
Sweden	3 116	3.5	4.3	2.8	32.3	46.0	21.5	11.9	116.5
United Kingdom	14 940	2.6	3.1	2.2	24.6	32.1	17.9	12.6	74.0
Iceland	3	33.3	40.0	25.0					
Liechtenstein	11	4.2	4.2	4.2	36.2	26.6	35.9	12.5	134.4
Norway	1 495	3.8	4.6	3.1	32.9	45.6	23.1	11.7	120.3
Switzerland	2 501	4.1	4.4	3.8	33.7	43.0	26.1	9.5	133.7
Former Yugoslav Republic of Macedonia	5	10.4	3.1	25.0					
Albania	18	9.9	13.6	3.1					
Serbia	1 472	1.5	2.1	0.8	21.5	33.2	11.2	13.4	55.1
Turkey	15 347	4.1	5.2	2.7	32.9	45.6	21.9	15.3	105.7

Figure 10: All deaths caused by accidents

3.4.3.1 Men more likely than women to die from all types of accidents

The EU-28's standardized death rate for accidents was 30.6 deaths per 100 000 inhabitants in 2014. The death rate for men (42.7 per 100 000 inhabitants) was just over double that for women (20.5 per 100 000 inhabitants) see Table 1. In all EU Member States, the standardized death rate for men was higher than that for women, most notably in the Baltic Member States where the difference was at least 64.9 deaths per 100 000 inhabitants. While accidents were a more common cause of death at advanced ages, the difference between the rates for people aged less than 65 years and those aged 65 and over was relatively narrow compared with other causes of death. The EU-



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28's standardized death rate from accidents for those aged 65 or over was 7.3 times as high as the rate for persons aged less than 65; for all causes of death the standardized death rate for those aged 65 and over was 20.4 times as high as for the younger generations.

A more detailed analysis of causes of death is presented in Table 2 for a selection of accidents as well as assault. Among men and women, the three leading causes of death from accidents were the miscellaneous category of other accidents (including for example burns, electrocution, crushing and overexertion), falls and transport accidents. For each of these causes of death the standardized death rates for men were higher than for women in all EU Member States. (Johnson, 2017)

### 3.4.3.2 Age matters for death from accidents and assaults

The impact of accidents is important both for younger and older people. On the one hand, accidents and injuries may trigger a fatal deterioration in the health of older people: more than three fifths (62.3 %) of all deaths from accidents in the EU-28 in 2014 were among people aged 65 or over. On the other hand, a relatively high proportion of people under the age of 65 die from accidents: the proportion of the total number of deaths that were caused by accidents was 2.8 times as high for people aged less than 65 than it was for people aged 65 or over (Johnson, 2017)

## 3.5 Common Causes of accident both in Africa and Europe

### 1. Over Speeding:

Most of the fatal accidents occur due to over speeding. It is a natural human's soul performs exceptionally well. If given a chance man is sure to achieve infinity in speed. But when we are sharing the road with other users we will always remain behind some or other vehicle. Increase in speed multiplies the risk of accident and severity of injury during accident. Faster vehicles are more prone to accident than the slower one and the severity of accident will also be more in case of faster the severity of accident will also be more in case of faster vehicles. Higher the speed, greater the risk. At high speed the vehicle needs greater distance to stop i.e. braking distance. A slower vehicle comes to halt immediately while faster one takes long way to stop and also skids a



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long distance due to law of notion. A vehicle moving on high speed will have greater impact during the crash and hence will cause more injuries. The ability to judge the forthcoming events also gets reduced while driving at faster speed which causes error in judgment and finally a crash. (Snyman, 2017)

### 2. Difficult to know the exact distance between your vehicle and front and back vehicles

There is no way to determine the exact distance of automobiles traveling behind as that will be responsible for accidents. We are not sure that we will have a safe travel to reach our destination- even a small distraction may lead to an accident and drowsiness have larger role in accidents. Most of the accidents occur due to driven inattention since they don't have a way to get alert.

### 3. Distracted Driving

The number one cause of car accidents is not a criminal that drove drunk, sped or ran a red light. Distracted drivers are the top cause of car accidents in the world today. A distracted driver is a motorist that diverts his or her attention from the road, usually to talk on a cell phone, send a text message or eat food. (Snyman, 2017)

**Here are some common driver distractions:** (Snyman, 2017)

- Talking on a cell phone
- Sending text messages
- Reaching for a moving object inside the vehicle
- Looking at an object or event outside of the vehicle
- Reading a book
- Eating food
- Applying makeup.

### 4. Red Light jumping:



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It is a common sight at road intersections that vehicles cross without caring for the light. The main motive behind Red light jumping is saving time. The common conception is that stopping at red signal is wastage of time and fuel. Studies have shown that traffic signals followed properly by all drivers save time and commuters reach destination safely and timely. A red light jumper not only jeopardizes his life but also the safety of other road users. This act by one driver incites other driver to attempt it and finally causes chaos at crossing. This chaos at intersection is the main cause of traffic jams. Eventually everybody gets late to their destinations. It has also been seen that the red light jumper crosses the intersection with greater speed to avoid crash but it hampers his ability to judge the ongoing traffic and quite often crashes. (MacDonald, 2018)

### 5. Running Stop Signs

Stop signs should never be ignored, but when they are, serious car accidents are often the result. Each year, thousands of car accidents occur because one driver ran a stop sign. Many rollover accidents and side-impact car accidents result from drivers that run stop signs. You should always look both ways when proceeding through a stop sign. (MacDonald, 2018)

### 6. Reckless driving

We see this everyday - accidents caused by drivers who cut into tight spaces at high speeds, or who don't concern themselves with the rules of the road, skipping stop signs and robots. (MacDonald, 2018)

The reason that we have stop lights, turn signals, and lanes designated for moving either right or left as opposed to straight is because when drivers ignore the rules of the road, car accidents are often the result. To prevent a car accident, always look for signs and obey the proper right-of-way before you make a turn. (MacDonald, 2018)

### 3.6 Problem of existing system

- Is not always easily to know distance between vehicles and this affects them in their day-to-day activities,



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- Unsafe travel to reach our destination-even a small distraction may cause an accident and drowsiness have larger role in accidents.
- Most of the accidents occur due to driven inattention since they don't have a way to get alert.
- The number of accident is ever increasing, but the way to find how they can prevent it is still low due to lack of system they can use for cars accident avoidance. In case of they still do not find the way which can be used for protecting people at real time in order to avoid the accident.

### 3.7 Proposed results

- ❖ Detects any object within the 10m distance front and back sides.
- ❖ Displays the distance between one vehicle and another vehicle to the driver using LCD.
- ❖ Displays the color lighting as notification depending the distance between front and back vehicle by using LED.

### 3.8 Gerayo Amahoro and its impact on road security

The Rwandan police realized that there were many accidents caused by excessive speeding of vehicles and established a program called GERAYO AMAHORO.



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**Figure 11: Gerayo Amahoro**

The purpose of the program was to help motorists and passengers in general to avoid accidents on the road, the program led to a minimum reduction in accidents caused by high speed of vehicles. Every year on November 17, the world comes together for the International Day of Remembrance for Road Traffic Victims. According to the 2018 World Health Organization (WHO) report, road accidents are the leading cause of death to children aged between 4 and 15 years. Although developing countries have only one percent of all vehicles in the world, it accounts for a vast majority (13 percent) of the 1.35 million accidents that occur each year, globally.

The report further shows that more than half (54%) of all road traffic deaths are vulnerable road users—pedestrians, cyclists, and riders of motorized two and three wheelers and their passengers.

The World Day of Remembrance for Road Traffic Victims was confirmed in a 60/5 Resolution adopted by the General Assembly on 26 October 2005, which aimed at improving global road safety. In his message on the World Day of Remembrance for Road Traffic Victims, UN Secretary General, António Guterres, urged for strong partnership to reduce road carnage. “Urgent action remains imperative. On this World Day, I call on all to join forces to address the global road safety crisis,” Guterres said. In Rwanda, about 5000 road traffic accidents occurred last year (2018) across the country, claiming about 700 lives, injuring 2000 others. At least Rwf20billion was spent in compensation for the 3000-property destroyed in road accidents during the



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same period. The vast majority of accidents in Rwanda is caused by reckless human behaviors—speeding, distractive driving (use of handset when driving, riding or crossing the road), impaired driving (drunkenness and use of illicit drugs), bad maneuvers and overtaking or speeding in sharp corners, among others. “These are the major challenges to sustainable road safety and security, which Gerayo Amahoro campaign was designed to address,” says Commissioner of Police (CP) John Bosco Kabera, the Rwanda National Police spokesperson.

Gerayo Amahoro, loosely translated as ‘arrive safe’, is a 52-week—all year round—campaign launched in May to raise awareness on standard and safer road usage, and to prevent all reckless human actions on road that lead to road carnage. “The campaign, which is now in its 28th week, targets all categories of road users from all groups of drivers to motorcyclists, cyclists, passengers, different groups of pedestrians (students, people in the market, churches, on roads and in their respective community gatherings),” says CP Kabera. “The human factor exerts a dominant influence on road safety; education, training and enforcing traffic rules and regulations are some of the effective measures to influence positive behaviors of all road users.”

The campaign is designed for all people living in Rwanda, we have interacted with different of road users; we have visited many churches and schools across the country, we have met different sections of drivers—public service vehicles, special hires, truck drivers—motorcyclists, cyclists; met with owners and employees of hospitality facilities and conducted special operations against impaired driving and drunk-driving in particular, and all these are creating impact. Statistics indicate that road accidents reduced by 25 percent between May and October compared to the same period last year. The campaign conducted between August and October targeted 2, 379 primary and 1, 647 secondary schools across the country. At least 652 drivers were arrested in the last eight weeks after they were found driving while drunk while other 588 were arrested in the same period for disconnecting speed governor devices in their vehicles. More than 1200 drivers have been arrested since the beginning of this year after they were found driving while drunk. No one is permitted to go on the wheel or ride while above the maximum 0.08 of body alcohol content.

Compulsory installation of speed governor devices in public service vehicles and trucks, acquisition of more hi-tech gadgets like speed guns and CCTV camera across all highways and compulsory regular vehicle mechanical inspection; all are aimed at ensuring that road safety standards are respected. “This is a cycle and continuous campaign... it’s a gradual process from enforcement, choice to making it a cultural heritage,” says CP Kabera. Gerayo Amahoro also involves erecting more traffic control signposts and pedestrian crosswalks. René-Claude Manzi,



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the operation manager at ATPR, [Association for Transport Companies in Rwanda] says Gerayo Amahoro campaign has created a difference. “When people start talking about something... that’s the beginning of change because they already know it, and this is what we see today, six months after Gerayo Amahoro campaign started. We are also seeing reduction in accidents involving our drivers or vehicles,” says Manzi. Innocent Twahirwa, the operation manager for Rwanda Federation of Transport Cooperatives (RFTC) said that since Gerayo Amahoro started none of their vehicles has been involved in a serious accident. “We are seeing change in attitude of drivers, the way pedestrians use the road, and respect for pedestrian crosswalks. We hope that if this campaign is maintained, which is also our responsibility and, in our benefit, there will be massive change in the way people use the road,” says Twahirwa. According to Daniel Ngarambe, the president of Ferwacotamo, a federation of taxi-moto cooperatives in the country, Gerayo Amahoro is changing the mindset of many motorcyclists. “We are now working closely with the Police and other institutions to educate motorcyclists to obey traffic rules and to reorganize the whole transport sector,” says Ngarambe.

“We have also taken measures which we hope will change the behaviors of our members including owning their motorcycles rather than working on contracts which influences them to break rules as a way of making more money. This is influencing many motorcyclists to join cooperatives, feeling responsible and changing their attitudes.”

All mentioned strategies taken by the Government of Rwanda was reduced the accident to certain percentage estimated to 40%. However, once my system is implemented will reduce further to 80%. The reason why it very important to implement this project carefully in order to save human lives.



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### 3.8 Conclusion

Conclusion this chapter attempts to contribute to the body of knowledge on road safety. It is hoped that it will inspire and facilitate increased cooperation, innovation and commitment to preventing road traffic crashes around the world. Road traffic crashes are predictable and therefore preventable. In order to combat the problem, though, there needs to be close coordination and collaboration, using a holistic and integrated approach, across many sectors and many disciplines. While there are many interventions that can save lives and limbs, political will and commitment are essential and without them little can be achieved. The time to act is now. Road users everywhere deserve better and safer road travel.



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### CHAPTER FOUR: ANALYSIS AND DESIGN OF THE PROPOSED SYSTEM

#### 4.1. Introduction

This chapter developed to solve problems of existing system. The Subject System Analysis and Design mainly deals with the software development activities it should describe the requirements Specifications Use Case Diagrams, Use Case Diagram for system, Functional Decomposition Diagram, data flow diagram, Flow Chart, Sequence Diagram and Class Diagram. After going through this lesson, we should be able to understand a system and understand the different phases of system developments life cycle know the components of System analysis knows the components of system designing. Basically there are three major Components in every system, namely input, processing and output.

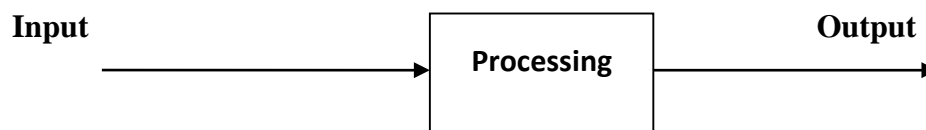
##### 4.1.1 System analysis definition

Systems analysis is the process of studying a procedure or business in order to identify its goals and purposes and create systems and procedures that will achieve them in an efficient way.

##### 4.1.2 System definition

A set of components that interact together to achieve a common goal.

Basically there are three major components in every system. Namely input. Processing and output.



In a system the different components are connected with each other and they are interdependent. The objectives of the system demand that some output is produced a result of processing the suitable inputs.



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### 4.2 Development Methodologies, Models and Tools

#### 4.2.1 Methodology

Unified Modeling language (UML) is a standardized modeling language enabling developers to specify, visualize, construct and document artifacts of a software system. Thus, UML makes these artifacts scalable, secure and robust in execution. UML is an important aspect involved in object-oriented software development. It uses graphic notation to create visual models of software systems.

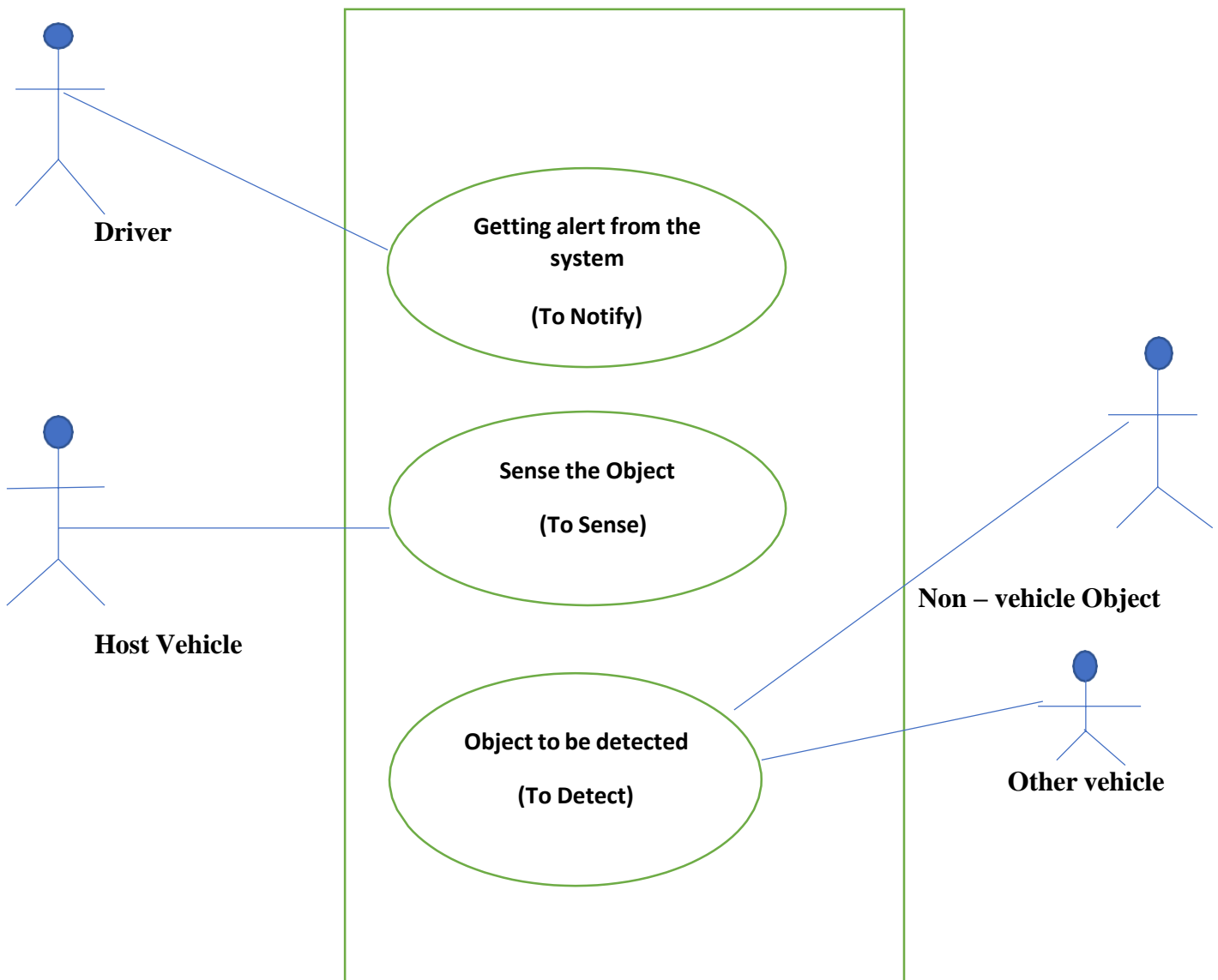
**Some Behavior diagrams represent functionality of software system and emphasize on what must happen in the system being modeled. The different behavior diagrams are:**

- **Use Case Diagram:** describes functionality of a system in terms of actors, goals as use cases and dependencies among the use cases.
- **Activity Diagram:** represents step by step workflow of business and operational components.
- Data flow diagram is a graphical representation of the "flow" of data through an information system, modeling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated
- **Class diagram:** is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application.
- **Sequence Diagram:** represents communication between objects in terms of a sequence of messages.



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4.2. Use Case Diagrams





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4.3 Use Case Diagram for system

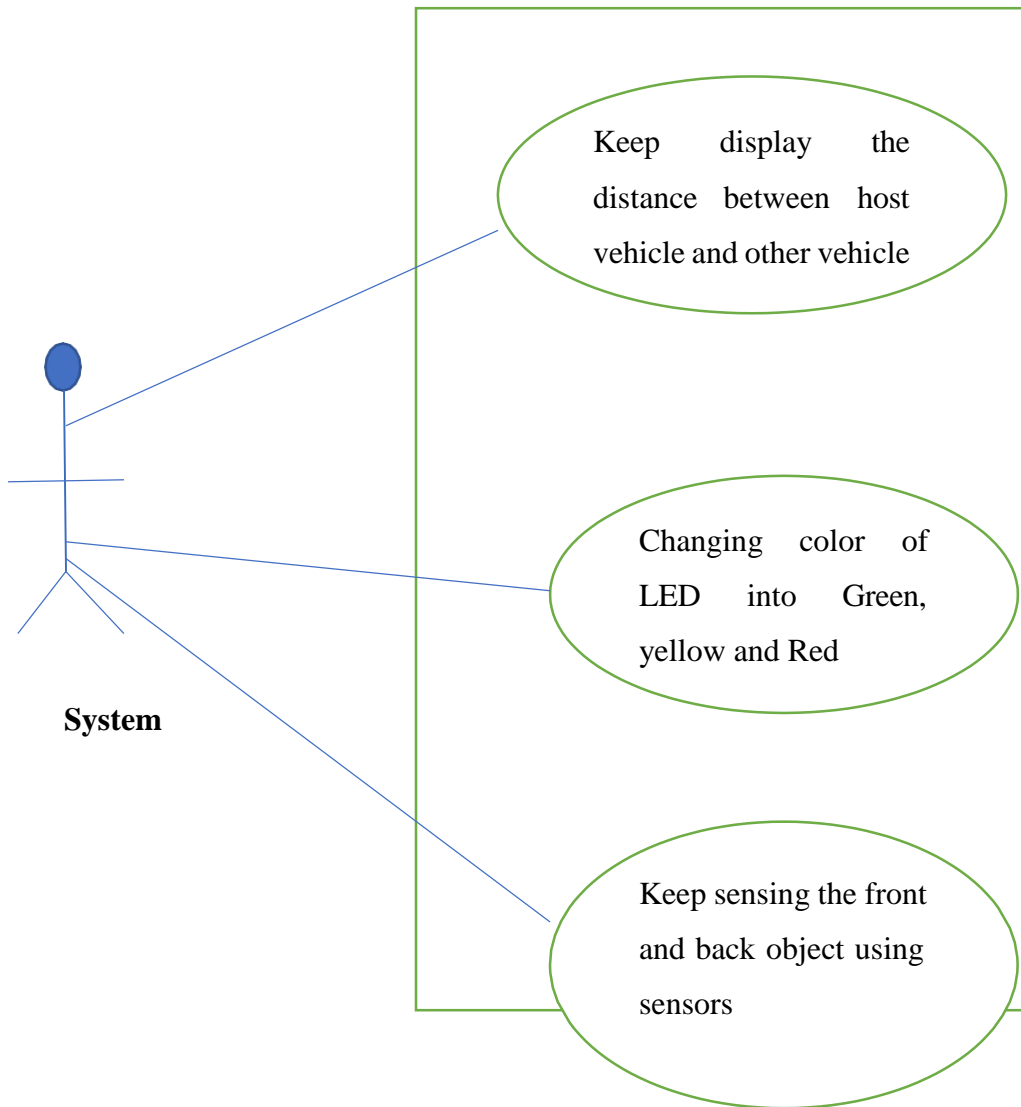


Figure 12: Use Case Diagram for system

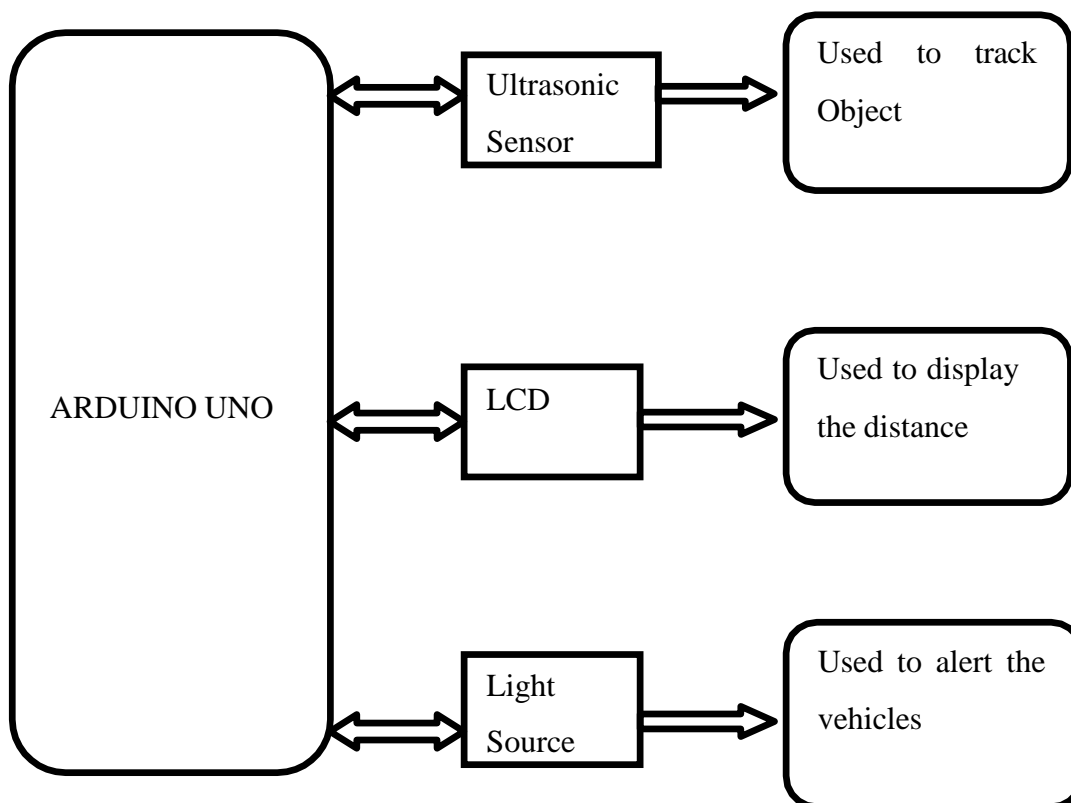


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### 4.3. Activity Diagrams

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control. Diagram can help to describe the flow of control of the target System, such as the exploring complex business rules and operations.

#### 4.3.1. Functional Decomposition Diagram



**Figure 13: Functional Decomposition Diagram**



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4.3.2. Data Flow Diagram

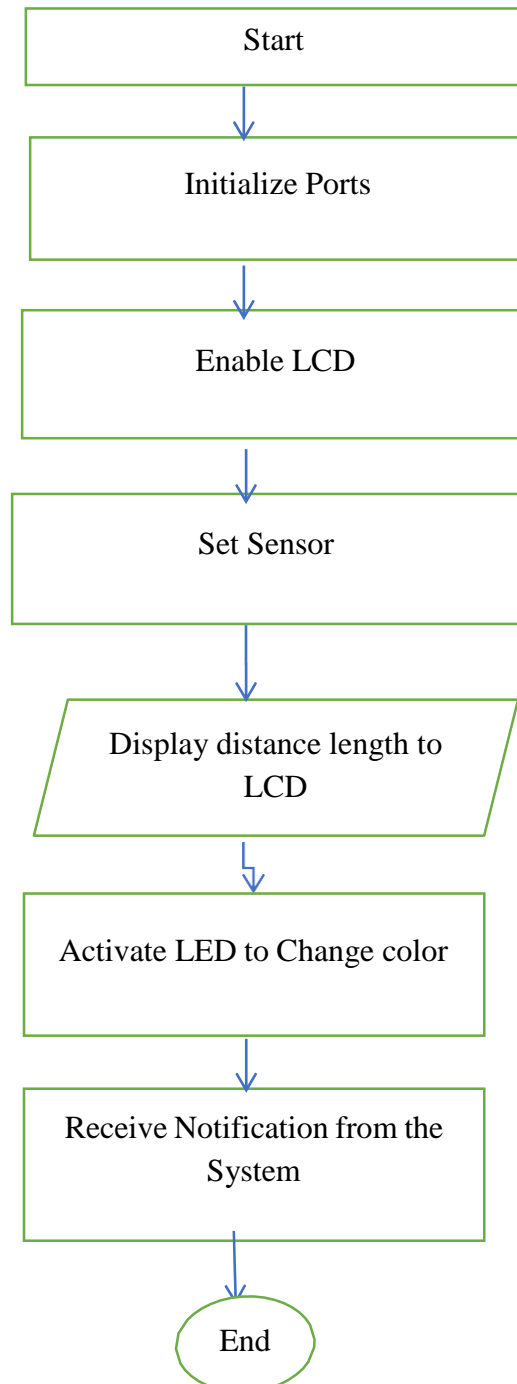


Figure 14 :Data Flow Diagram



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4.3.3. Flow Chart

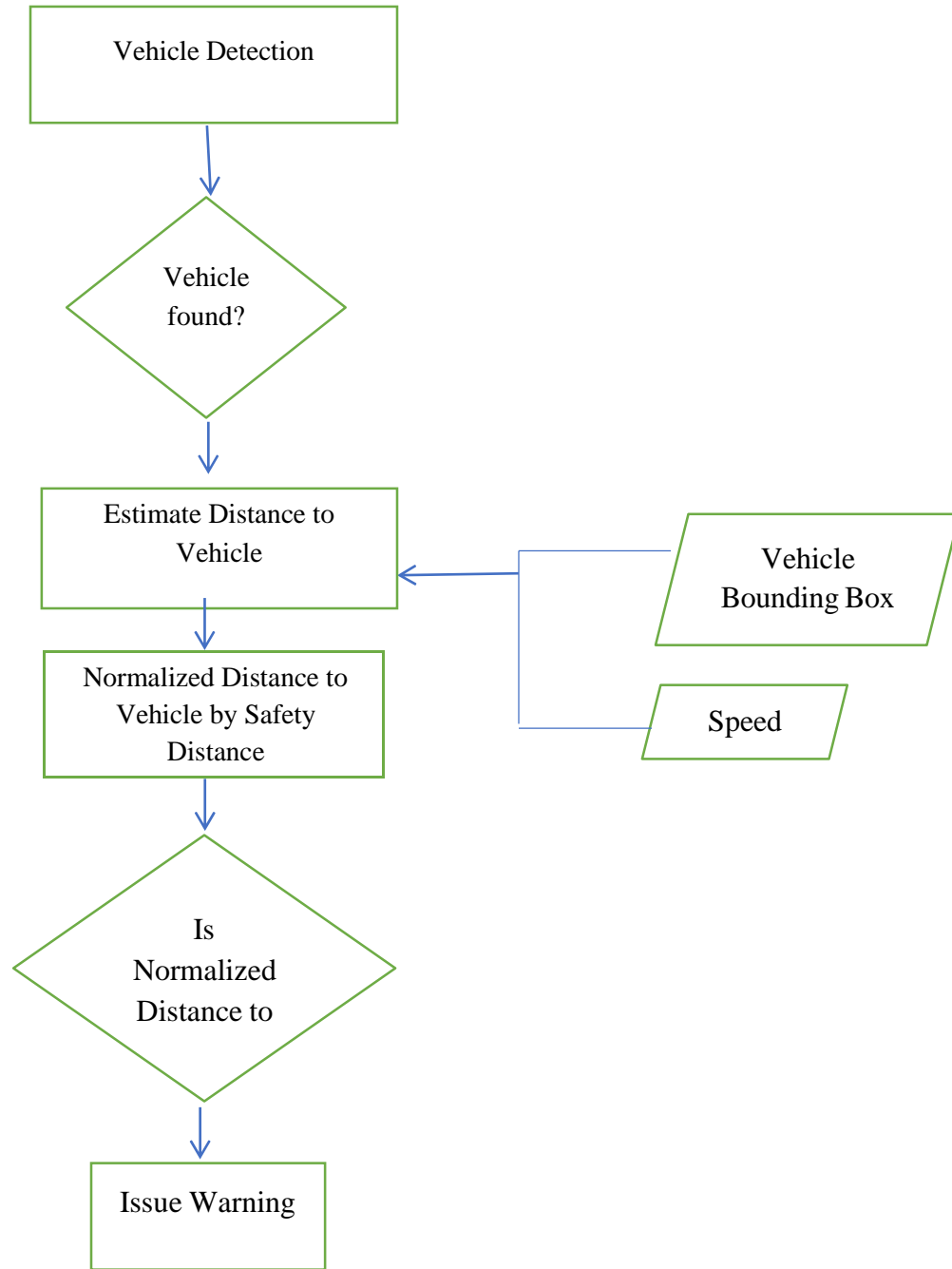


Figure 15 :Flow Chart



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4.4. Sequence Diagram

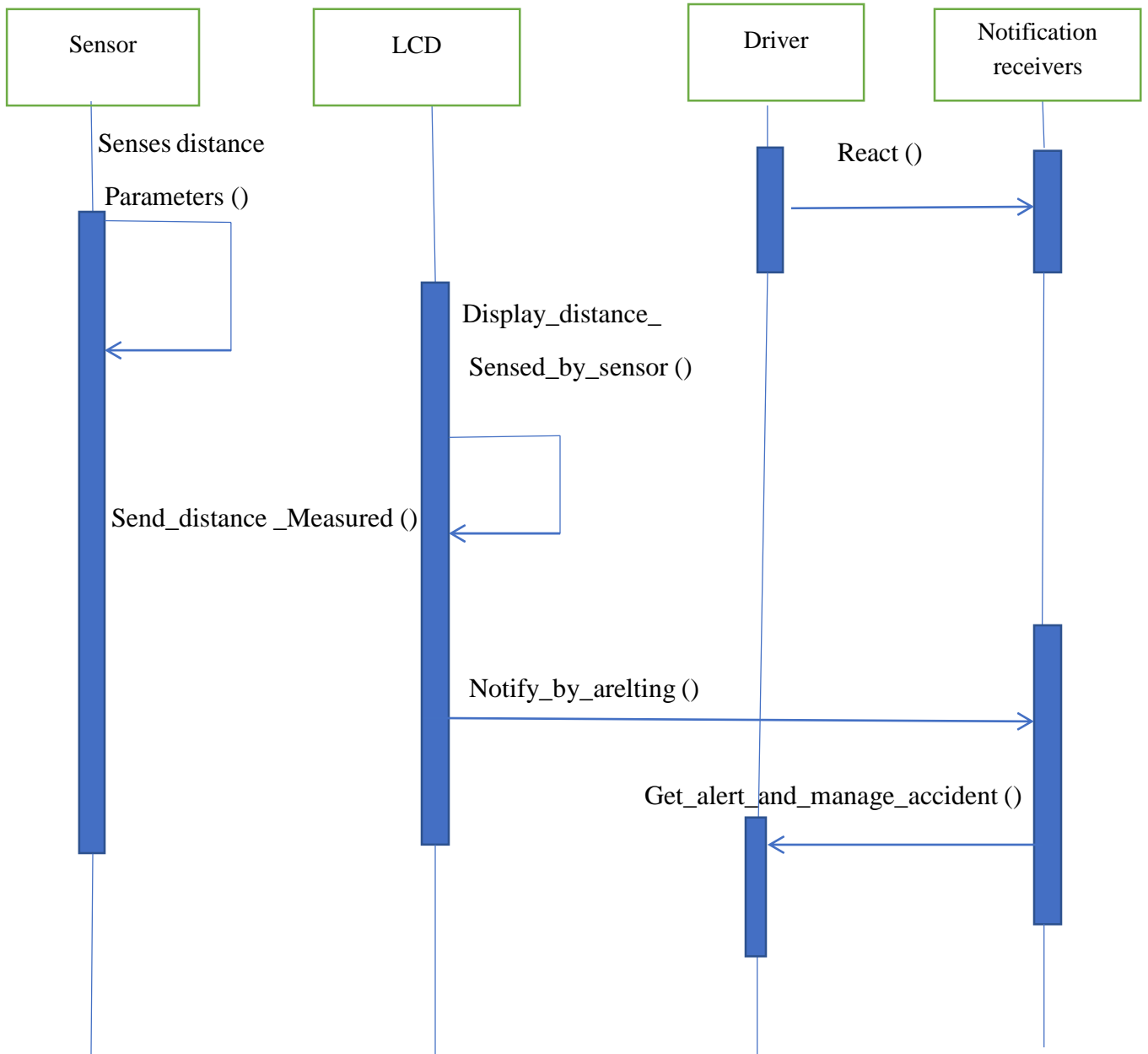


Figure 16 :Sequence Diagram



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4.5. Class Diagram

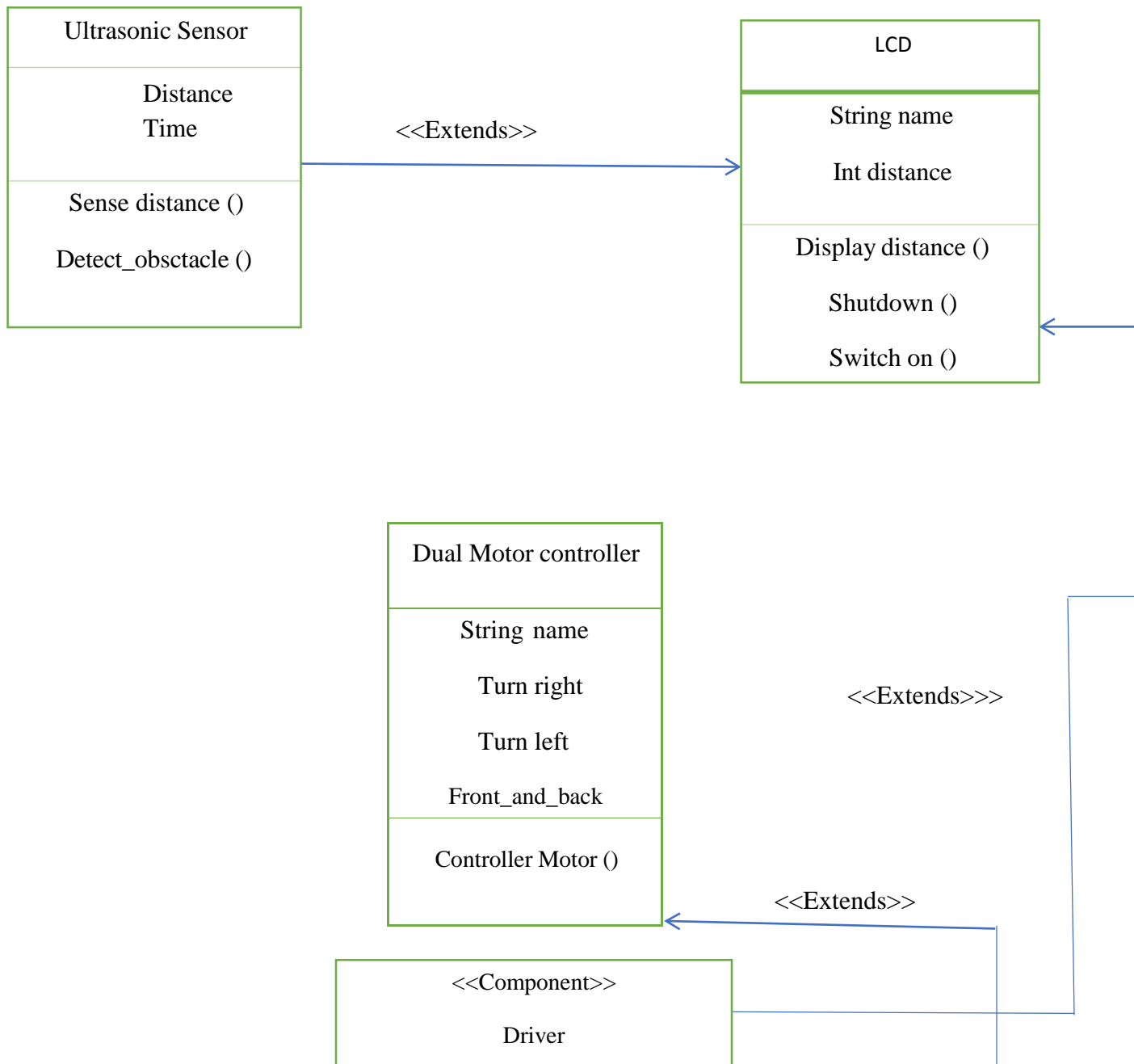


Figure 17 :Class Diagram



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### 4.5.1 How Class Diagram will work

A Class diagram models the static structure of a system. It shows relationships between classes, objects, attributes, and operations.

- Classes represent an abstraction of entities with common characteristics.
- Associations represent the relationships between classes.
- Active classes initiate and control the flow of activity, while passive classes store data and serve other classes.
- We use visibility markers to signify who can access the information contained within a class.
- Associations represent static relationships between classes.

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4.6. Schematic Diagrams of System

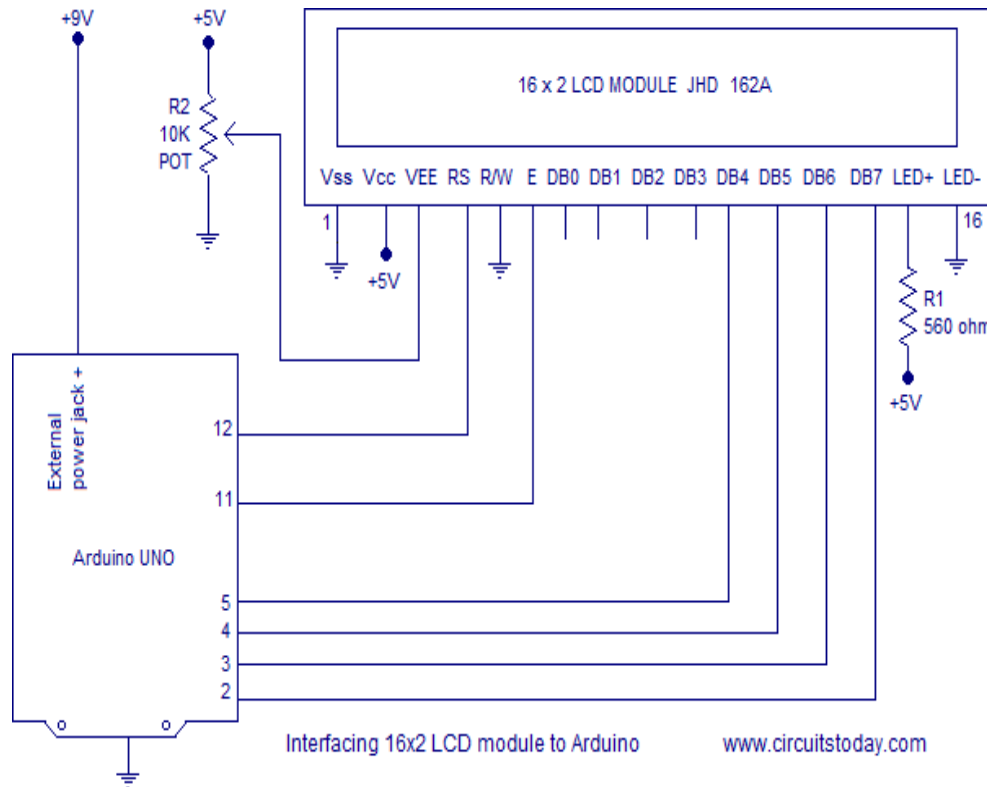


Figure 18 :Schematic Diagrams of System

4.7.2. Conclusion

This chapter addressed the analysis and design of the proposed system of the project. The basic focus of the design stage was to develop the logical model of the system using UML diagrams such as use case and activity diagrams. The system was implemented and tested; we documented the testing process with screen shots of each operation at each step.



## CHAPTER FIVE: IMPLEMENTATION OF THE PROPOSED SYSTEM

### 5.1 Introduction

After complete analysis of the current system and design of the proposed system in the previous chapter, it is time now to implement the system we did and explain some terms used in system implementation. We shall also show and explain the important interfaces of the new system.

### 5.2 Connection between LCD and ARDUINO UNO

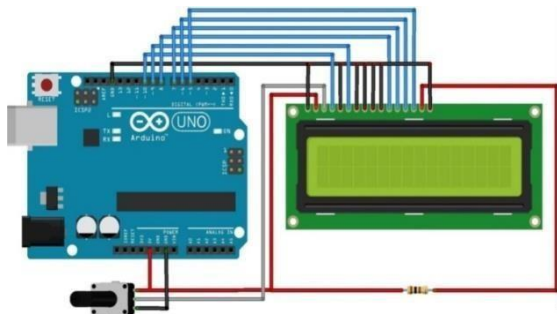


Figure 19: Connection between LCD and ARDUINO UNO

### 5.3 Adding Ultrasonic Sensor

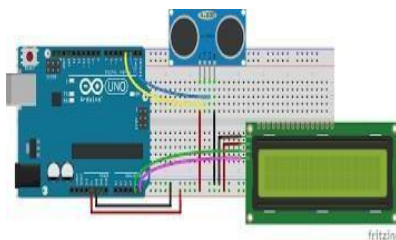


Figure 20: Adding Ultrasonic Sensor



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### 5.4 Adding LED

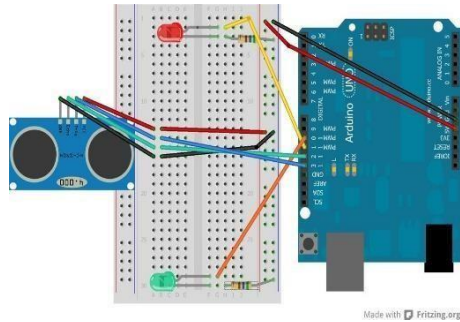


Figure 21: Adding LED

### 5.5. System Implementation

The functionality of **IOT BASED FRONT - END COLLISION DETECTION SYSTEM** is based on twoparts:

Hardware part: allow the connection of all devices by enabling them to communicate each other.

Software part: contain codes uploaded into hardware part.

The following are different figures that demonstrate the implementation of project:



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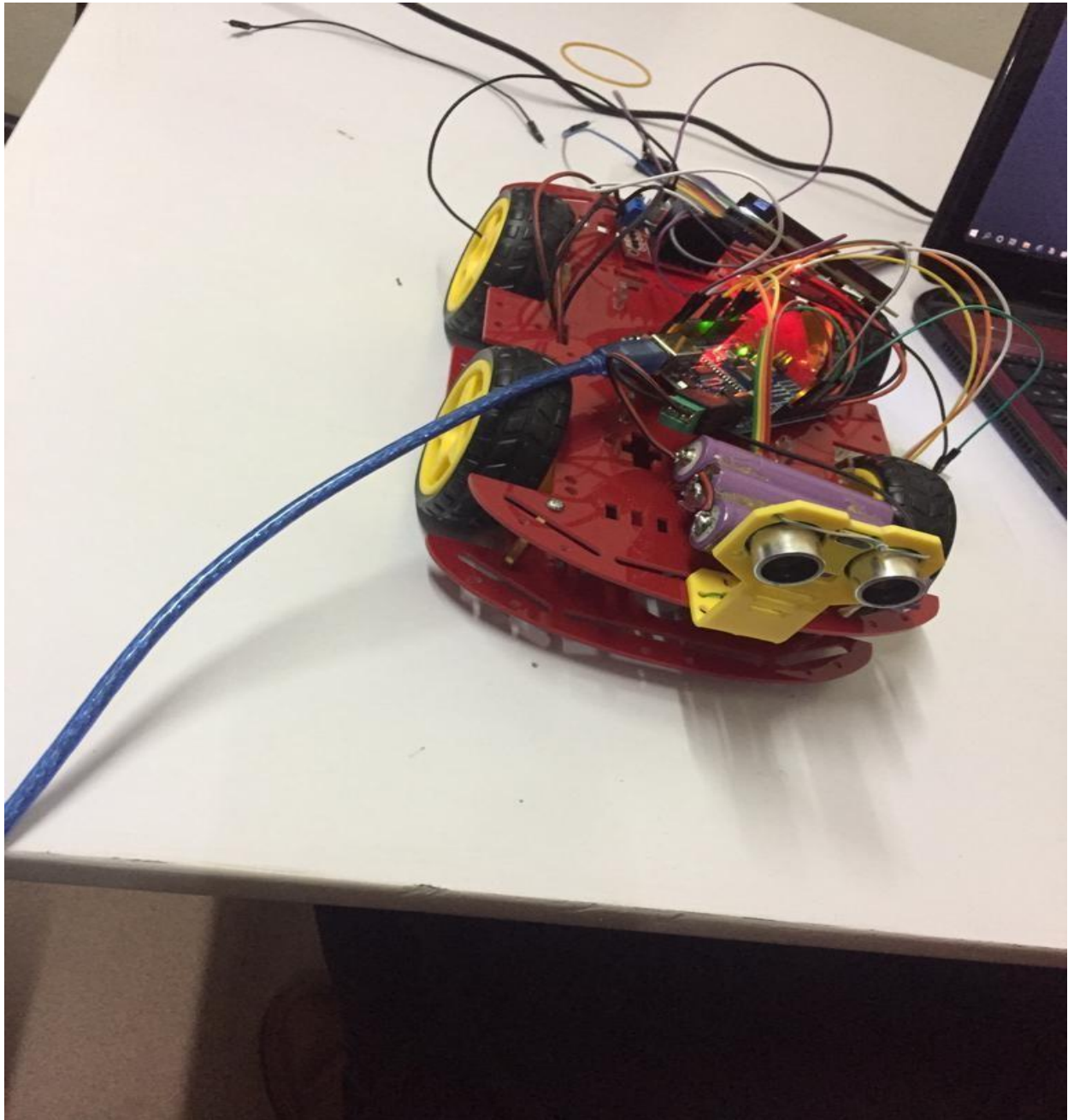


Figure 22: Image showing connection



## 5.7 Conclusion

This chapter addressed the designs and implementation of the project. The basic focus of the design stage was to develop the logical model of the system using UML diagrams such as Use case and activity diagrams. The system was implemented and tested; we documented the testing process with screen shots of each operation at each step.



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### CHAPTER SIX: CONCLUSION AND RECOMMENDATION

#### 6.1. Conclusion

We have carefully designed and implemented the **IOT BASED FRONT - END COLLISION DETECTION SYSTEM**, this project proved to be efficient and cost-effective compared to the existing system. After successful implementation, car detects any object within the 10m distance, and displays the distance between one car and another car to the driver using LCD. We have used ultrasonic sensors to detect any car on both front and back side of our vehicle. If the car reaches 10 meter, green color light will glow. At 8-meter distance yellow color light will glow. When it reaches 5-meter distance red color light will glow. The distance is also indicated to the vehicle driver.

The design was implemented with Ultrasonic sensors, Arduino, Breadboard, LED and LCD. The Implementation fully utilized the features of microcontroller to reduce the size of the design and product a more compact and reliable system.

#### 6.2. Recommendations

- The display unit used in this project is a 16 by 4 LCD screen and LED. For future work of a similar project, a bigger screen should be used so that the display is not limited to the notification.
- Mobile application component should be developed to be integrated with this system in order to track exact location of accident occurrence and provide basic help
- When developing a new car considers cars distance sensor for measuring the distance between the car and another car or any object in front or back of that car.



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- We recommend the UR especially the African Center of Excellence the in IoT department for helping students who want to do advanced embedded system to provide technical skills by bringing IoT professionals who are experienced.



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