Intelligent Driver Safety System

An undergraduate project report submitted to the

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in partial fulfillment of the requirements for the module

EE5305 Sensors and Transducers

By

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Preface

This report details the project proposal of the Intelligent Driver Safety System which is done in the completion of continuous assessment of the EE5305 Sensors and Transducers module offered by the Faculty of Engineering University of Ruhuna. The project proposal consists of one section and three sub sections.

In sub section one, a brief introduction to the project will be given including the project background and the problem statement. Next the objectives are detailed, and a scope is provided. Lastly, the methodology and list of components are provided in explaining the implementation procedure of this project.

Acknowledgments

First, we would like to express our sincere gratitude to the module coordinator Mr. Saman De Silva and Lecturer Mr. Hasalanka Nagahawaththa for giving us this valuable opportunity to learn by applying theoretical knowledge to practical applications.

Also, we would like to thank Dr. Chitral Ambawatte the Dean Faculty of Engineering University of Ruhuna and Dr. Rajitha Udawalpola head of the Electrical and Information Engineering Department for providing the necessary resources and support for the conduct of this module. Further, we would like to thank everyone who offered genuine support and guidance for the conduct of this project.

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Chapter 1

1 Introduction

Drowsy driving and alcohol drunken driving are the two major causes of death and injuries from road accidents. Both states impair attention, critical thinking, reaction time, and decision-making of the driver. Drowsy drivers may experience microsleeps, which results in loss of vehicle control and collisions with other road users. In addition to that, alcohol drunken drivers may have problems with vision, which results in reckless driving behaviors that endanger themselves and others. Therefore, the project “Intelligent Driver Safety System” can help to overcome such issues.

Most of the people get killed or injured due to drowsy driving and alcohol impairment. According to statistics 684 crashes occur annually due to drowsy driving and 13,384 crashes occur annually due to alcohol impairment, resulting in 14% of all traffic fatalities and 24% of all traffic injuries. [1] [2] Therefore, it is necessary to find new better ways to keep the drivers safe until to the destination.

The goal of the project, “Intelligent Driver Safety System” is to provide drivers with a safe journey to the destination. With economic development and the great increase in vehicles, accidents due to drowsiness and alcohol consumed drivers are increasing day by day. Therefore, this project will overcome such issues with the help of two sensors, eye blink and alcohol sensor. When these sensors detect a problem, the car will slow down and stop, preventing dangerous driving. The accidents due to drowsy driving can be mitigated by using an eye blink sensor. The driver wears a special frame with this sensor. When the drowsiness of the driver is detected, a warning signal is generated using the buzzer. On the other hand, the accidents due to drunken drivers can be mitigated by using MQ3 sensor. This sensor finds alcohol in a person's breath and generates a signal to stop the vehicle.

Chapter 2

2 Logical Implementation

2.1 Flow chart of the logical implementation

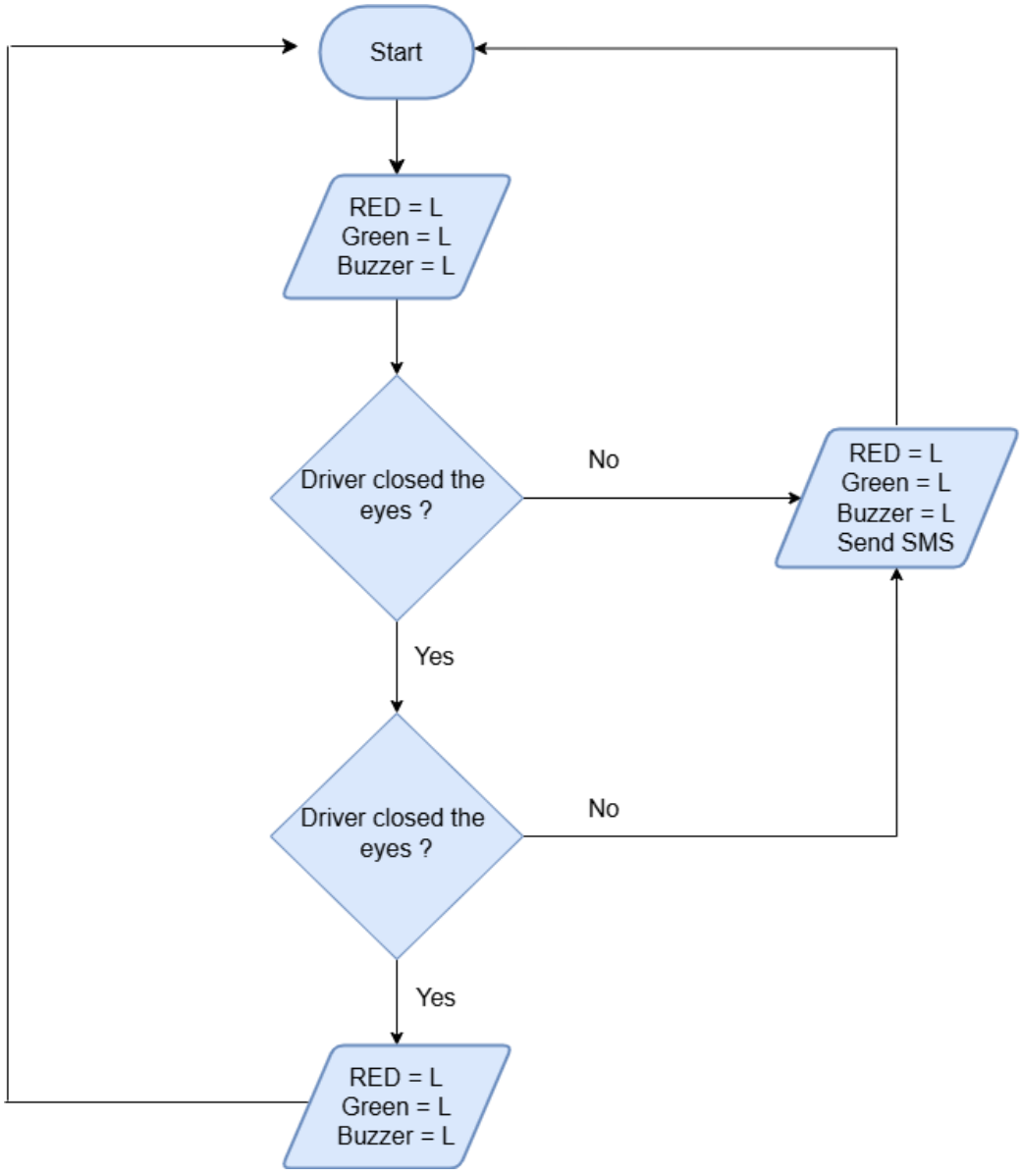

Figure 2.1: Flow Chart of the Logical implementation

2.2 Code and Simulation

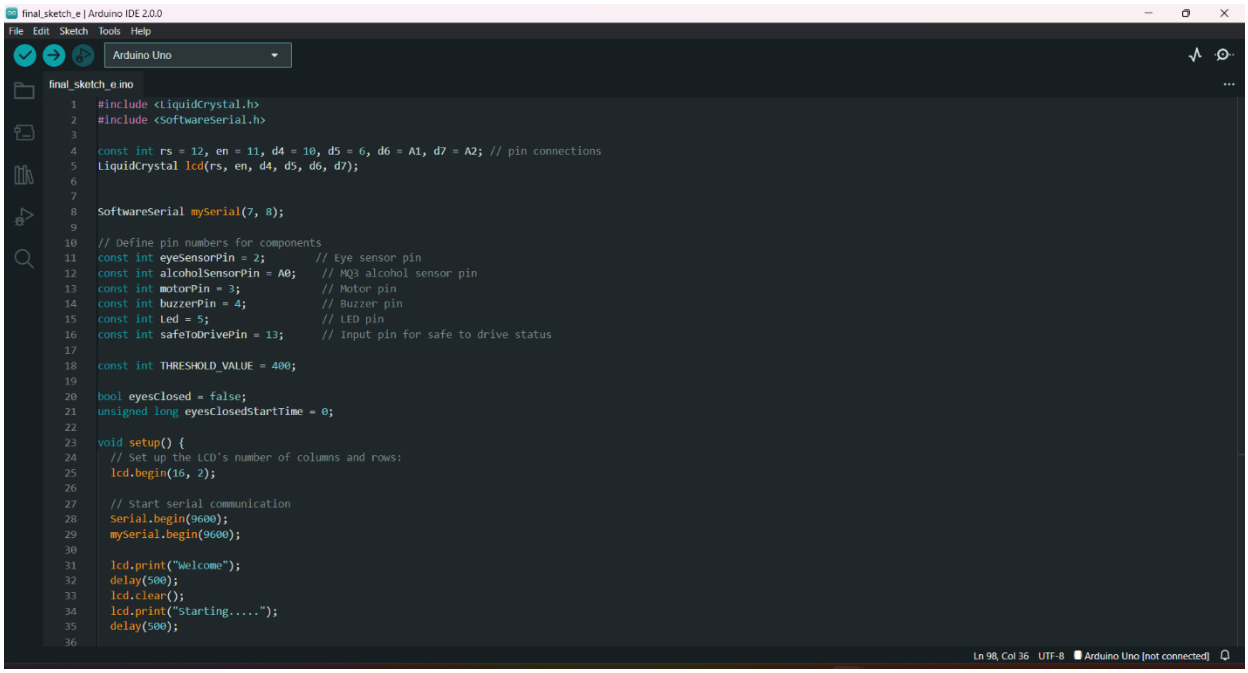

Figure 2.2: Arduino Code Part 1

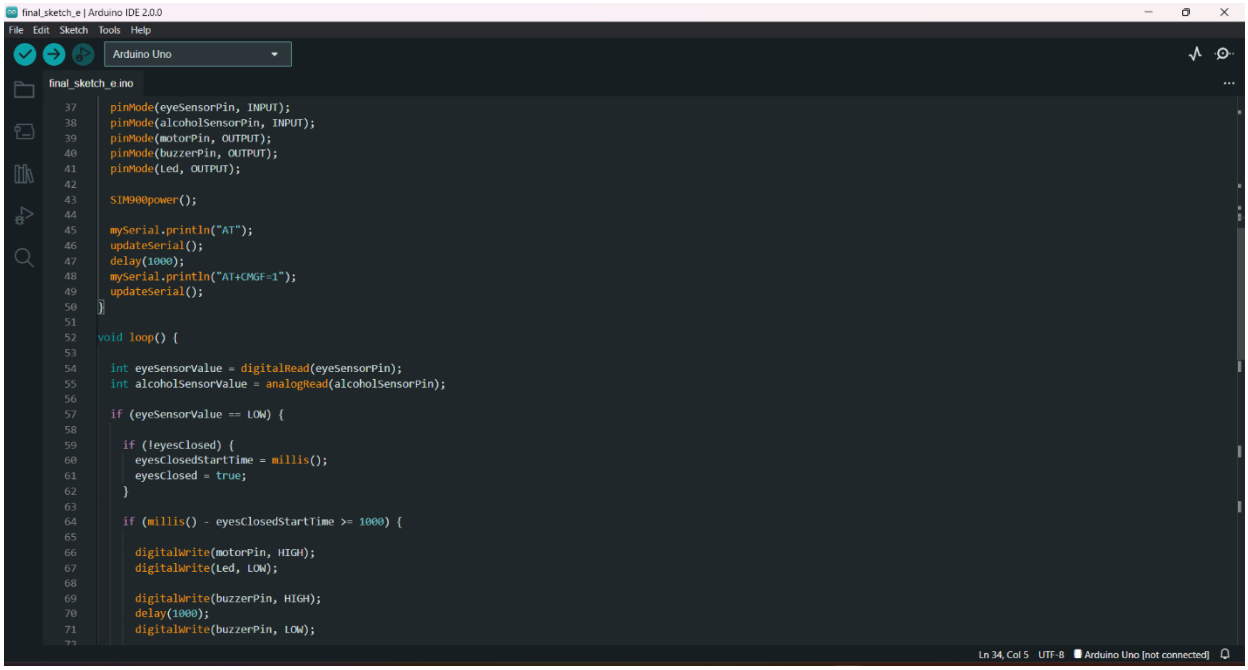

Figure 2.3: Arduino Code Part 2

Figure 2.4: Arduino Code Part 3

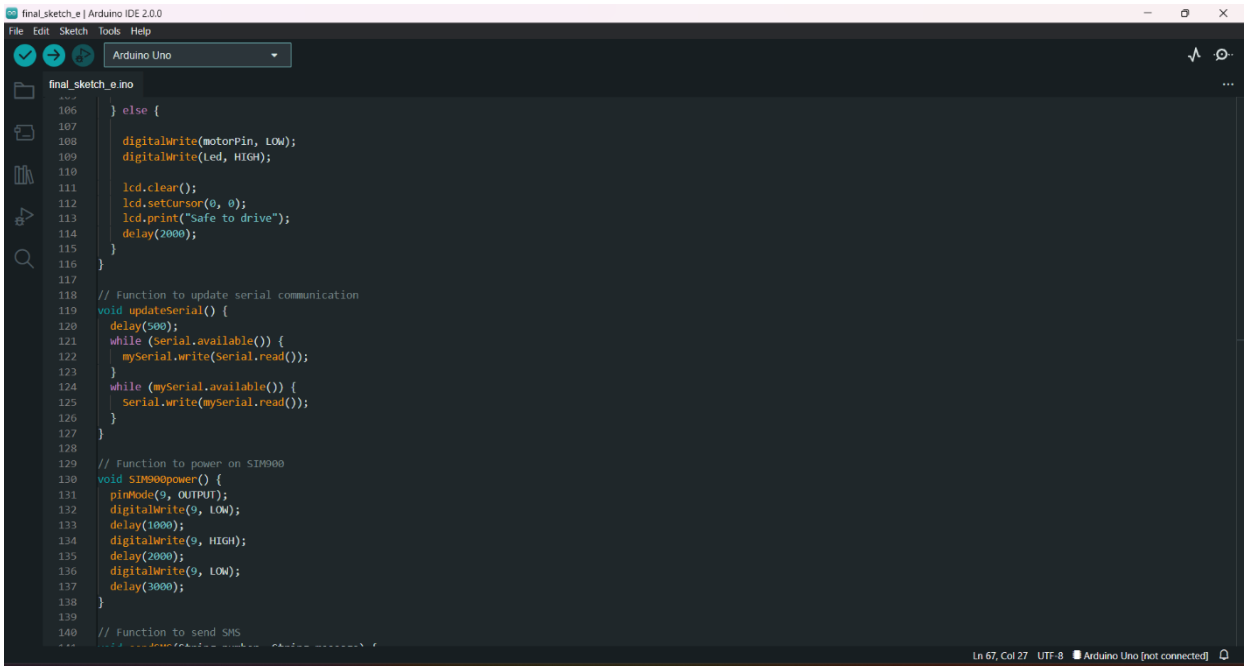

Figure 2.5: Arduino Code Part 4

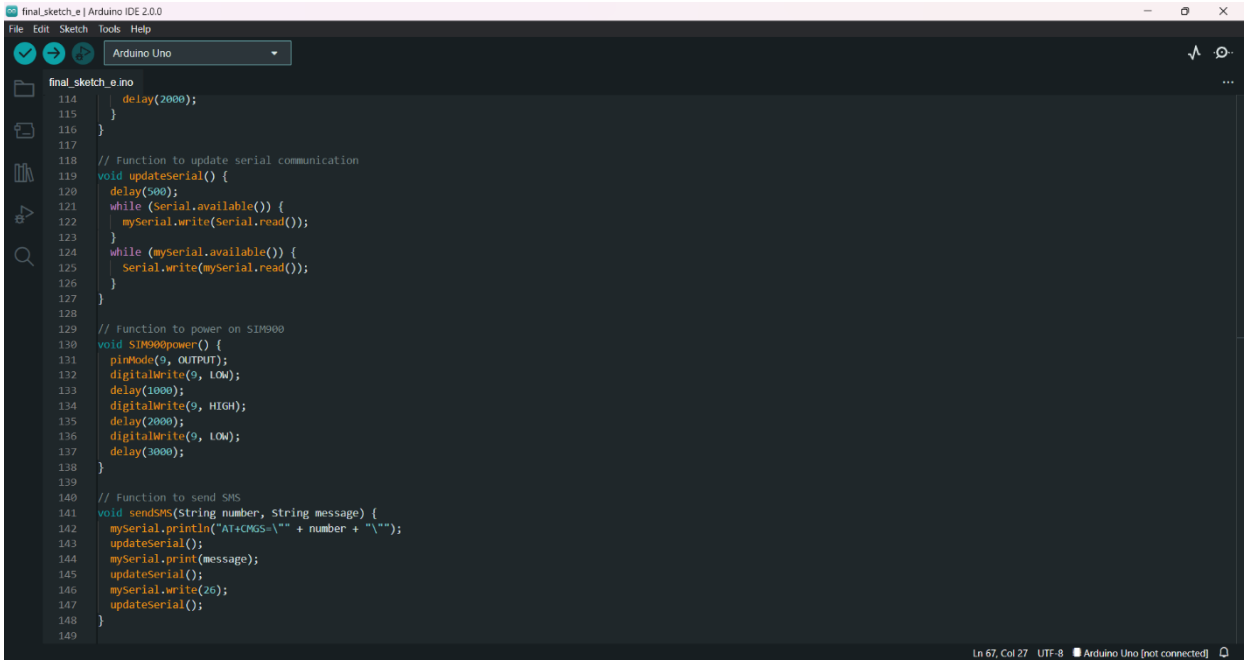

Figure 2.6: Arduino Code Part 5

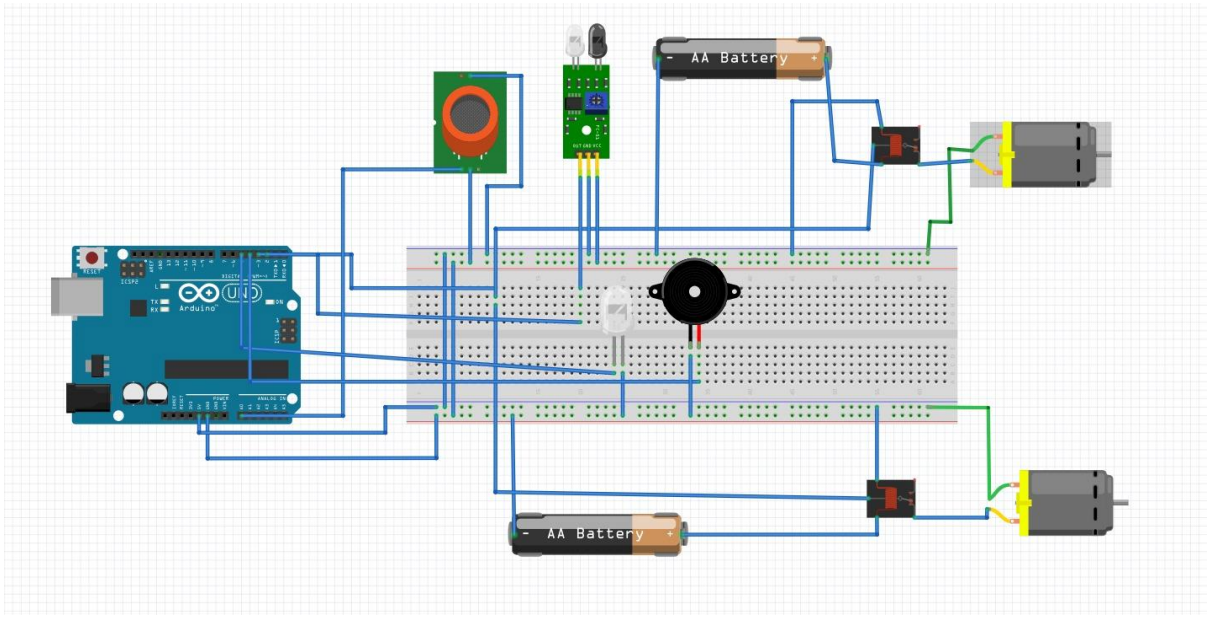

Figure 2.7: Simulation.

Chapter 3

3 Physical Implementation

3.1 Components Used

- Eye Blink Sensor
- MQ3 Sensor
- Arduino UNO Borad
- BO Motor and Wheel
- 5V Buzzer
- Relay
- Switches
- LED

3.1.1 Eye Blink Sensor

An eye blink sensor is a small electronic device designed to detect and measure the blinking of an eye. It typically uses an infrared (IR) emitter and receiver pair placed near the eye. When the eye blinks, the sensor detects the change in reflected IR light, converting it into an electrical signal.

This sensor can be used for various purposes, including health monitoring, human-computer interaction, prosthetics control, and security systems. It provides a non-invasive way to monitor eye movements and use them for controlling devices or interfaces, authentication, and assessing fatigue levels.

3.1.2 MQ3 Sensor

The MQ-3 sensor is a gas sensor primarily used for detecting alcohol vapor in the air. It operates based on the principle of a chemical reaction between the alcohol molecules and the sensing element of the sensor. When alcohol vapor is present, the sensor's resistance changes, and this change is converted into an electrical signal.

This sensor is commonly used in breathalyzers, automotive alcohol detection systems, and industrial safety devices. It provides a cost-effective and reliable way to detect alcohol concentration levels in the surrounding environment.

3.1.3 Arduino UNO Borad

The Arduino Uno board is a popular microcontroller board based on the ATmega328P microcontroller. It's the most widely used board in the Arduino family due to its simplicity, versatility, and affordability.

The Uno board features:

1. Microcontroller: The heart of the board is the ATmega328P microcontroller, which runs at 16 MHz and has 32 KB of flash memory for storing programs.

2. Input/Output Pins: It has 14 digital input/output pins, of which 6 can be used as PWM (Pulse Width Modulation) outputs, and 6 analog input pins. These pins can be used to interface with various sensors, actuators, and other electronic components.

3. USB Interface: It has a USB interface for programming the board and for serial communication with a computer. This allows users to easily upload sketches (programs) and communicate with external devices.

4. Power Supply: The board can be powered via USB connection or an external power supply. It has a built-in voltage regulator, allowing it to accept voltages between 7 and 20 volts.

5. Reset Button: A reset button is available for restarting the microcontroller, useful for debugging and reloading sketches.

6. LEDs: The board includes built-in LEDs for power indication and to indicate the status of digital pins.

The Arduino Uno is widely used by hobbyists, students, and professionals for prototyping and creating various electronic projects, including robotics, home automation, sensor applications,

and more. Its ease of use, large community support, and extensive libraries make it an ideal choice for beginners and experienced users alike.

3.1.4 BO Motor and Wheel

A BO (Brushed DC) motor is a type of electric motor widely used in robotics and hobbyist projects. It consists of a rotor (the rotating part) and a stator (the stationary part) separated by a small air gap. Brushes and a commutator assembly are used to supply current to the rotor windings, creating a rotating magnetic field that drives the motor.

3.1.5 5V Buzzer

A 5V buzzer is a small electronic component that produces sound when powered by a 5-volt DC source. It's commonly used in electronic projects for audible alerts or notifications. Its simplicity and compatibility with microcontrollers like Arduino make it ideal for adding sound feedback to various applications.

3.1.6 Relay

A relay is an electromechanical switch used to control high-power circuits with low-power signals. It consists of a coil that generates a magnetic field when energized, causing a switch (contacts) to open or close. Relays are widely used in automation, automotive, and home appliances for controlling lights, motors, and other devices.

3.1.7 Switches

A switch is a basic electrical component used to interrupt or complete a circuit. It consists of a mechanism that physically opens or closes an electrical pathway. Common types include toggle, push-button, and rocker switches. Switches are fundamental in controlling lights, appliances, and electronic devices in everyday life.

3.1.8 LED

An LED (Light Emitting Diode) is a semiconductor device that emits light when an electric current passes through it. It's energy-efficient, compact, and durable. LEDs come in various colors and sizes, and they're widely used in lighting, displays, indicators, and electronic projects due to their versatility and longevity.

3.2 Operating Principal

The sleep detection system is designed to prevent accidents caused by driver's drowsiness. The eye blink sensor operates by emitting infrared light towards the eye. It contains an Infrared transmitter and Receiver LED which is used to detect eye blink. The working of the simple IR sensor is shown below.

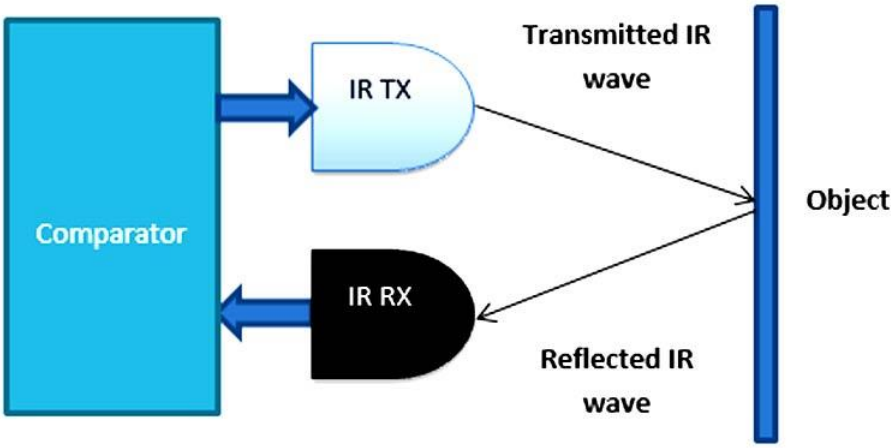

Figure 3.1: Operating Principal Eye Blink Sensor

As shown in Figure 3.1 the infrared transmitter emits energy, which then interacts with objects in its path and is subsequently reflected to the infrared receiver. When the emitted light from the IR LED reaches the receiver, the resistance of the photodiode undergoes a significant reduction.

This photoreceiver is integrated into a circuit alongside a potentiometer, forming a voltage divider configuration. This setup generates a variable analog output signal in response to detected blinking activity. In addition to that, the sensor detects changes in infrared light intensity, translating them into electrical signals indicative of eye blinking.

In addition to that, an alcohol detection system is designed for accidents due to alcohol impairments. An MQ3 sensor is a gas sensor that can detect the presence and concentration of alcohol in the air. This MQ-3 alcohol sensor is used by the system to continually monitor alcohol level and identify the presence of alcohol in a driver's exhale. If the sensors detect alcohol on the driver's breath, it will send the signal to the circuit.

Both sensors are connected to the Arduino UNO board, which is a microcontroller that can process the data and execute commands. This Arduino UNO board is also connected to the buzzer, the LED, and the power source. The buzzer plays a crucial role in driver safety by emitting a loud alert in response to detected signs of drowsiness or consumption of alcohol.

Meanwhile, the LED is used to indicate the system status. To ensure uninterrupted operation, the system is powered by batteries, to provide voltage and current. When eye sensor or alcohol sensor detects, then it will send the data to microcontroller. This microcontroller processes the data and if either drowsiness or alcohol is detected it sends the signal to shut off the engine to prevent the vehicle from rolling. Moreover, this integrated system prioritizes driver safety by promptly detecting and addressing potential risks, thus enhancing overall safety during vehicle operation.

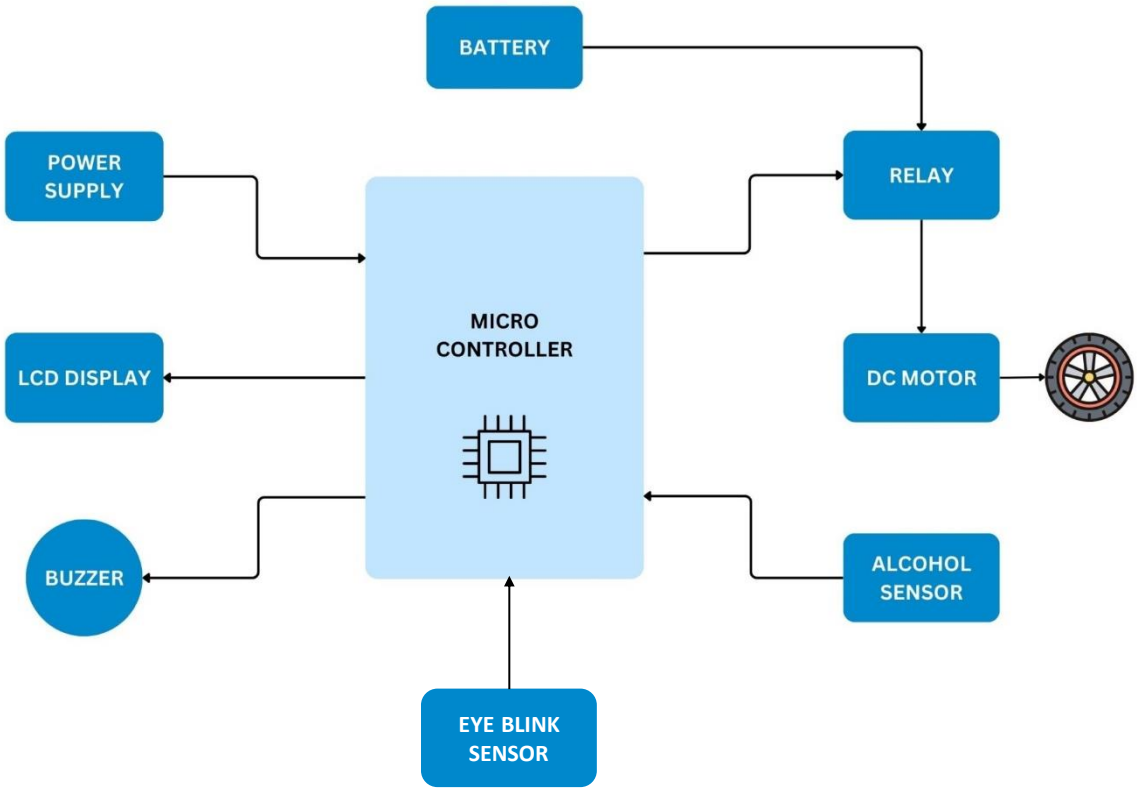

Figure 3.2: Block Diagram of Intelligent Driver Safety System

Chapter 4

4 Project Reflection

After doing this of this project, we have gained valuable hands-on experience and insights.

- We made a working safety system using eye blink and alcohol sensors.
- Even though it was hard to understand everything, we kept going and finished the project.
- We learned a lot about using sensors and Arduino boards.
- In the future, we want to make our system better and work with others to make roads safer.

5 References

[1] "NHTSA," [Online]. Available: https://www.nhtsa.gov/risky-driving/drunk-driving. [Accessed 03 01 2024].

[2] "NHTSA," [Online]. Available: https://www.nhtsa.gov/book/countermeasures-that-work/drowsy-driving. [Accessed 03 01 2024].