LI-FI ENABLED DRUNK DRIVING DETECTION AND NOTIFICATION SYSTEM

Project Report submitted in partial

fulfillment of the requirement of

Bachelor of Technology

Prepared by

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Under the guidance of

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ECE2035

(SENSORS, ACTUATORS AND SIGNAL CONDITIONING)

VELLORE INSTITUTE OF TECHNOLOGY, CHENNAI

CERTIFICATE

This is to certify that this project entitled "**LI-FI ENABLED DRUNK DRIVING DETECTION AND NOTIFICATION SYSTEM**" submitted in partial fulfilment of the degree of B. Tech to Vellore Institute of Technology, Chennai, done by **ADAVELLI ROHAN REDDY (20BRS1270)** is an authentic work carried out by they/them under my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Adavelli Rohan Reddy

Date: ***16th April 2023***

DECLARATION BY THE STUDENT

I **Adavelli Rohan Reddy,** bearing Reg. No. **20BRS1270** hereby declare that this project report entitled **LI-FI ENABLED DRUNK DRIVING DETECTION AND NOTIFICATION SYSTEM** has been prepared by me towards the partial fulfilment of the requirement for the award of the Bachelor of Technology (B. Tech) Degree under the guidance of **Dr. Biswajit Jena**

I also declare that this project report is my original work and has not been previously submitted for the award of any Degree, Diploma, Fellowship, or other similar titles.

Place: Chennai

Date: 16th April 2023

ADAVELLI ROHAN REDDY (20BRS1270)

ABSTRACT

Drunk driving is a major cause of road accidents, leading to injuries and fatalities. To address this problem, we propose a system that uses an MQ3 alcohol sensor and an ultrasonic sensor to detect drunk driving and alert oncoming drivers using Li-Fi technology.

The system works by using an MQ3 alcohol sensor to detect alcohol levels in a driver's breath. If the alcohol level exceeds a certain threshold, an Arduino Uno board is signalled to activate an ultrasonic sensor that checks if there is a car ahead. If a car is detected, an LED is turned on and modulated using Li-Fi technology to signal to the oncoming driver that the driver in the other car is drunk.

The opposite car contains a solar panel that detects the modulated LED signal using Li-Fi technology. The solar panel converts the light energy from the LED into electrical energy, which is then used to power an alarm system that notifies the opposite driver of the presence of a drunk driver.

The alarm system is comprised of a speaker that produces an audible alert when the modulated LED signal is detected.

Overall, the system provides an effective and efficient way to detect and notify oncoming drivers of the presence of a drunk driver on the road, potentially reducing the number of accidents caused by drunk driving.

ACKNOWLEDGEMENT

I am using this opportunity to express my gratitude to everyone who supported me throughout the course of this project. It is not possible to prepare a project report without the assistance and encouragement of other people. This one is certainly no exception. On the very outset of this report, I would like to extend my sincere & heartfelt obligation towards all the personages who have helped me in this endeavour. Without their active guidance, help, cooperation & encouragement, I would not have made headway in the project. I am ineffably indebted to my faculty Dr. Biswajit Jena for his conscientious guidance and encouragement to accomplish this assignment presently. I extend my gratitude to VIT Chennai for giving me this opportunity. I also acknowledge with a deep sense of reverence, my gratitude towards my parents and members of my family, who have always supported me morally as well as economically.

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CONTENTS

1. INTRODUCTION

Drunk driving is a serious problem that leads to numerous accidents, injuries, and fatalities worldwide. Despite laws and penalties against it, many people continue to drink and drive, putting themselves and others at risk. To address this problem, we propose a system that uses a combination of sensors, LED lights, solar panels, and Li-Fi technology to detect and alert oncoming drivers of the presence of a drunk driver on the road.

The system works by using an MQ3 alcohol sensor to detect the presence of alcohol in a driver's breath. If the alcohol level exceeds a certain threshold, an ultrasonic sensor is activated to check if there is a car ahead. If a car is detected, an LED light is turned on and modulated using Li-Fi technology to signal to the oncoming driver that the driver in the other car is drunk.

The opposite car contains a solar panel that detects the modulated LED signal using Li-Fi technology. The solar panel converts the light energy from the LED into electrical energy, which is then used to power an alarm system that notifies the opposite driver of the presence of a drunk driver. The alarm system consists of a speaker that produces an audible alert when the modulated LED signal is detected.

The use of Li-Fi technology allows for fast and reliable communication between the cars without the need for complex hardware or infrastructure. Li-Fi technology is a Visible Light Communications system that transmits wireless internet communications at very high speeds. It makes an LED light bulb emit pulses of light that are undetectable to the human eye. Within those emitted pulses, data can travel to and from receivers. By modulating the LED light using Li-Fi technology, the system can send a signal to the oncoming driver without the need for a dedicated communication infrastructure.

Overall, this system provides an effective and efficient way to detect and notify oncoming drivers of the presence of a drunk driver on the road. The use of an alcohol sensor and ultrasonic sensor ensures that only drivers who are actually drunk are detected, minimizing false positives. The use of solar panels and Li-Fi technology allows for a simple and reliable communication system that can be easily integrated into existing cars. The alarm system is also simple and easy to use, with only a speaker needed to produce an audible alert.

In conclusion, the proposed system has the potential to save lives and make the roads safer for everyone. By detecting and alerting oncoming drivers of the presence of a drunk driver, the system can help prevent accidents and reduce the number of fatalities caused by drunk driving. With the use of Li-Fi technology, the system is fast, reliable, and easy to implement, making it a promising solution to the problem of drunk driving.

2. REVIEW OF LITERATURE

Various methods have been proposed to detect and prevent drunk driving, including the use of alcohol sensors, breathalysers, and ignition interlock devices. However, these methods are limited in their effectiveness and can be easily bypassed by determined drivers.

Recently, Li-Fi technology has emerged as a promising solution for wireless communication between devices. Li-Fi uses visible light communication (VLC) to transmit data between devices, allowing for faster and more reliable communication compared to traditional wireless communication technologies such as Wi-Fi or Bluetooth. Li-Fi is also more secure than traditional wireless communication as the signals cannot penetrate walls or other obstacles, limiting the potential for interference or hacking.

Several studies have explored the use of Li-Fi technology in different applications, including indoor positioning, high-speed data transfer, and wireless sensor networks. However, there has been limited research on the use of Li-Fi in the context of vehicular communication.

One study by Chen et al. (2020) proposed a Li-Fi based vehicular communication system for autonomous driving. The system used a combination of VLC and radio frequency (RF) communication to enable real-time data exchange between autonomous vehicles. The results showed that the proposed system was able to achieve high-speed data transfer with low latency, making it suitable for use in autonomous driving applications.

Another study by Gao et al. (2020) explored the use of Li-Fi for vehicle-to-vehicle (V2V) communication in a highway scenario. The proposed system used a combination of VLC and RF communication to enable real-time data exchange between vehicles. The results showed that the proposed system was able to achieve high data rate and low latency, making it suitable for V2V communication in a highway scenario.

In the context of drunk driving prevention, a few studies have explored the use of different sensors and technologies to detect alcohol levels in drivers. One study by Singh et al. (2016) proposed a system that used a combination of alcohol sensors, GPS, and GSM to detect and prevent drunk driving. The system was able to detect alcohol levels in a driver's breath and notify the authorities in case of a violation.

However, there has been limited research on the use of Li-Fi technology in the context of drunk driving prevention. The proposed system in this project combines Li-Fi technology with alcohol sensors and ultrasonic sensors to detect drunk driving and notify oncoming drivers of the presence of a drunk driver on the road. The use of solar panels and a simple alarm system makes the proposed system easy to implement and integrate into existing cars. Further research is needed to explore the feasibility and effectiveness of the proposed system in real-world scenarios.

3. PROPOSED MODEL

3.1. Transmitter Part

The MQ3 alcohol sensor is a commonly used gas sensor that is sensitive to ethanol vapor. It can detect the presence of alcohol in a person's breath and convert it into an electrical signal. When the alcohol concentration in the driver's breath exceeds a certain threshold, the MQ3 alcohol sensor would send a high signal to the Arduino Uno microcontroller.
The Arduino Uno microcontroller would then use an ultrasonic sensor to check if there is a car ahead with a certain threshold value. If the ultrasonic sensor detects a car within the threshold value, the microcontroller would turn on an LED. The LED would emit pulses of light that contain data about the presence of a drunk driver on the road.
In this system, the LED and the ultrasonic sensor would be connected to the Arduino Uno microcontroller. The microcontroller would be programmed to control the LED and the ultrasonic sensor based on the input signals from the MQ3 alcohol sensor.
The use of an Arduino Uno microcontroller allows for flexible programming and customization of the system. The microcontroller can be programmed to adjust the threshold values of the alcohol sensor and the ultrasonic sensor, as well as the timing and frequency of the LED pulses.
Overall, the transmitter part of the system in the drunk driver's car would consist of an MQ3 alcohol sensor, ultrasonic sensor, LED and an Arduino Uno microcontroller, which would work together to detect the presence of a drunk driver and emit pulses of light containing data about the presence of the drunk driver on the road.

3.2. Receiver Part

The solar panel would detect the pulses of light emitted by the LED in the transmitter part of the drunk driver's car and convert them into electrical signals. These signals would be processed by the audio circuit, which would trigger the alarm sound from the speaker if the signals indicate the presence of a drunk driver on the road.

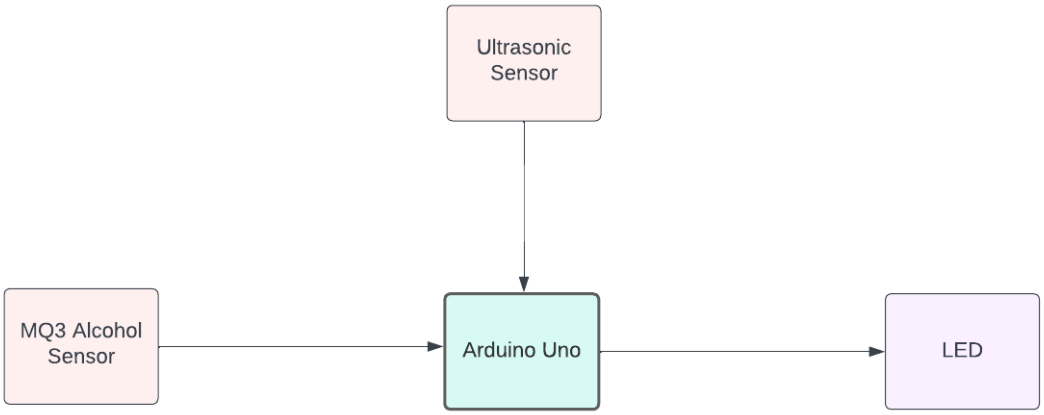
The audio circuit would include a transistor amplifier to amplify the signal from the solar panel, a filter circuit to remove any noise or interference from the signal, and a speaker to produce the alarm sound. The circuit would be designed to be simple and low-cost, making it easy to manufacture and install in vehicles.

It's important to note that the sensitivity of the solar panel and the design of the audio circuit would be critical to the effectiveness of the system. The solar panel would need to be sensitive enough to detect the LED pulses from a significant distance, while the audio circuit would need to be designed to reliably trigger the alarm sound when a drunk driver is detected.

Overall, the receiver part of the system in the other car would consist of a solar panel and a simple audio circuit to trigger the alarm sound, making the system effective in alerting other drivers of the presence of a drunk driver on the road.

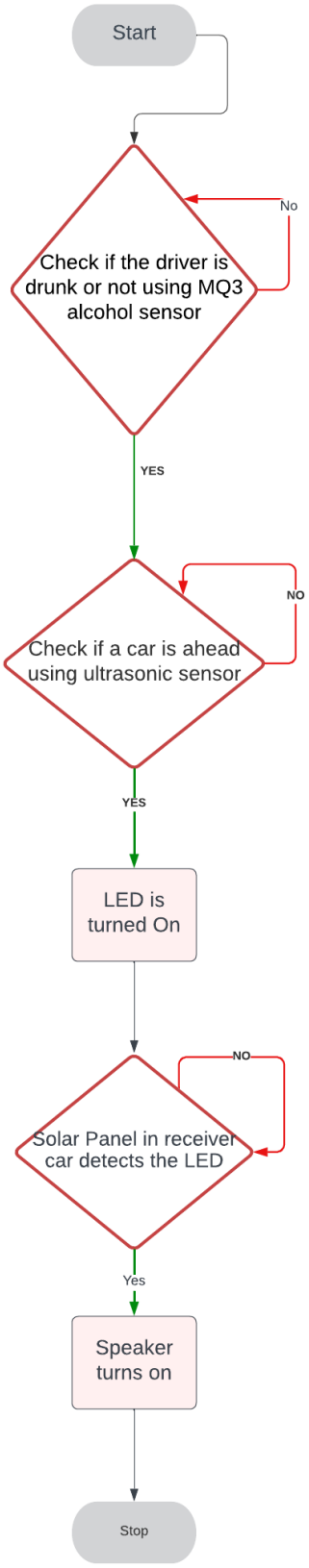
4. SYSTEM ARCHITECTURE

4.1 Transmitter Part



4.2 Receiver Part

4.3 Working


Start
Check if the driver is drunk or not using MQ3 alcohol sensor
No
YES
Check if a car is ahead using ultrasonic sensor
NO
YES
LED is turned On
Solar Panel in receiver car detects the LED
NO
Yes
Speaker turns on
Stop

5. SPECIFICATIONS

5.1 Hardware Specifications

Arduino Uno –
It is an open-source microcontroller board based on the ATmega328P microcontroller. It is one of the most popular microcontroller boards used for creating electronic projects due to its ease of use, low cost, and large community of developers. The board contains a variety of digital and analog input/output pins that can be programmed to interact with different components and sensors, making it an ideal choice for building a wide range of projects.

MQ3 Alcohol Sensor –
It is a gas sensor module that detects the presence of alcohol vapor in the air. It is commonly used in Breathalyzer devices and other applications where detecting alcohol vapor is important. The sensor module contains a small heating element that warms up a tin dioxide sensing element. When alcohol vapor comes in contact with the sensing element, its resistance decreases, which can be measured by an analog-to-digital converter or microcontroller connected to the sensor. The output signal of the sensor is proportional to the alcohol concentration in the air. The sensor has a high sensitivity to alcohol vapor, but it can also detect other gases such as methane and propane, which can affect its accuracy. To minimize the effect of other gases, the sensor is often used in combination with a filter or other gas-specific sensor. The MQ-3 alcohol sensor module is easy to use and widely available, making it a popular choice for many alcohol detection projects.

Ultrasonic Sensor –
It is a device that uses high frequency sound waves to detect the presence and distance of objects. The sensor emits a series of sound waves at a frequency that is beyond the range of human hearing, typically in the range of 20 kHz to 200 kHz. The sound waves bounce off the objects and return to the sensor, which measures the time it takes for the waves to return. By measuring the time, it takes for the sound waves to return, the sensor can calculate the distance to the object. Ultrasonic sensors are commonly used in a variety of applications, such as obstacle detection and distance measurement. They are typically accurate and reliable, and can work in a wide range of environments, including dark or dusty areas. Ultrasonic sensors can be found in different forms, such as a module or a sensor head, and can be interfaced with different types of microcontrollers or other devices.

LED –
It is a semiconductor device that emits light when a current passes through it. LEDs are widely used in various applications, such as lighting, displays, and indicators. Compared to traditional incandescent bulbs, LEDs consume less power, are more durable, and have a longer lifespan. They come in different colours, sizes, and shapes, and can be used in various electronic projects. LEDs are often used as indicators in electronic circuits, such as in a traffic signal, to indicate the status of a device or system. They can also be used in lighting applications, such as in LED strips, light bulbs, or flashlights. LEDs are popular in electronic hobby projects due to their versatility, low cost, and ease of use. They can be driven by a wide range of voltage levels, making them suitable for use with different types of microcontrollers or other devices.

Solar Panel –

A solar panel, also known as a photovoltaic (PV) module, is a device that converts sunlight into electricity using photovoltaic cells. Photovoltaic cells are made of semiconductor materials, such as silicon, which absorb sunlight and release electrons. When the released electrons are captured by the cells, they create an electric current that can be used to power electrical devices or stored in a battery. Solar panels are widely used in various applications, such as residential and commercial power systems, street lights, and mobile devices. They are an environmentally friendly and sustainable source of energy, as they do not produce any harmful emissions or waste products. The efficiency of a solar panel depends on various factors, such as the amount of sunlight it receives, the type of semiconductor material used, and the design of the panel. Solar panels come in different sizes and power ratings, and can be connected in series or parallel to increase the voltage or current output. They are often used in conjunction with a charge controller or inverter to regulate the flow of electricity and make it suitable for use with different types of electrical devices.

Operational Amplifier –

It is an electronic circuit element that amplifies the difference between two input voltages. It has a high gain, meaning that even a small difference in input voltage can result in a large output voltage. Op-amps are commonly used in a wide variety of electronic circuits, such as filters, oscillators, and voltage regulators.

Op-amps have two input terminals, called the inverting and non-inverting inputs, and one output terminal. The inverting input is typically marked with a negative (-) symbol, while the non-inverting input is marked with a positive (+) symbol. The output of an op-amp is the difference between the two input voltages, multiplied by the gain of the amplifier.

Op-amps are available in different configurations, such as single, dual, and quad packages, and with different performance specifications, such as gain bandwidth product, input offset voltage, and input bias current. They can be powered by a wide range of voltage levels, and are often used in conjunction with other electronic components, such as resistors and capacitors, to create various types of circuits. Op-amps are a fundamental building block of analog electronics and are widely used in various applications, such as audio amplifiers, instrumentation amplifiers, and signal processing circuits.

Speaker -

A speaker is an electroacoustic transducer that converts an electrical signal into sound waves. It consists of a vibrating diaphragm or cone that moves back and forth in response to an electrical signal, creating pressure waves that propagate through the air as sound. The diaphragm is typically made of a lightweight material, such as paper or plastic, and is suspended within a magnetic field produced by a permanent magnet or an electromagnet.

When an electrical signal is applied to the speaker, it causes the diaphragm to move back and forth, creating pressure waves that travel through the air as sound. The frequency of the sound waves is determined by the frequency of the electrical signal, and the amplitude or volume of the sound is determined by the amplitude of the electrical signal.

Speakers are used in a wide variety of applications, such as music playback, public address systems, home theater systems, and teleconferencing systems. They come in various sizes and configurations, including cone speakers, dome speakers, and horn speakers, and can be

designed to produce different frequency ranges, such as high-frequency tweeters, midrange drivers, and low-frequency woofers. The performance of a speaker is measured by various parameters, such as frequency response, impedance, sensitivity, and power handling capacity.

9 Volt Battery-
A 9-volt battery is a type of alkaline battery that provides a nominal voltage of 9 volts. It is commonly used in portable electronic devices that require a stable and long-lasting power source. The battery consists of six small 1.5-volt cells stacked together in a compact rectangular case, with two metal terminals at one end. The 9-volt battery has a relatively high energy density and a long shelf life, but its capacity is limited compared to other types of batteries. It can be easily replaced by disconnecting the old battery from the terminals and inserting a new battery with the correct polarity. Used batteries should be disposed of properly through battery recycling programs to prevent harm to the environment.

5.2 Software Specifications

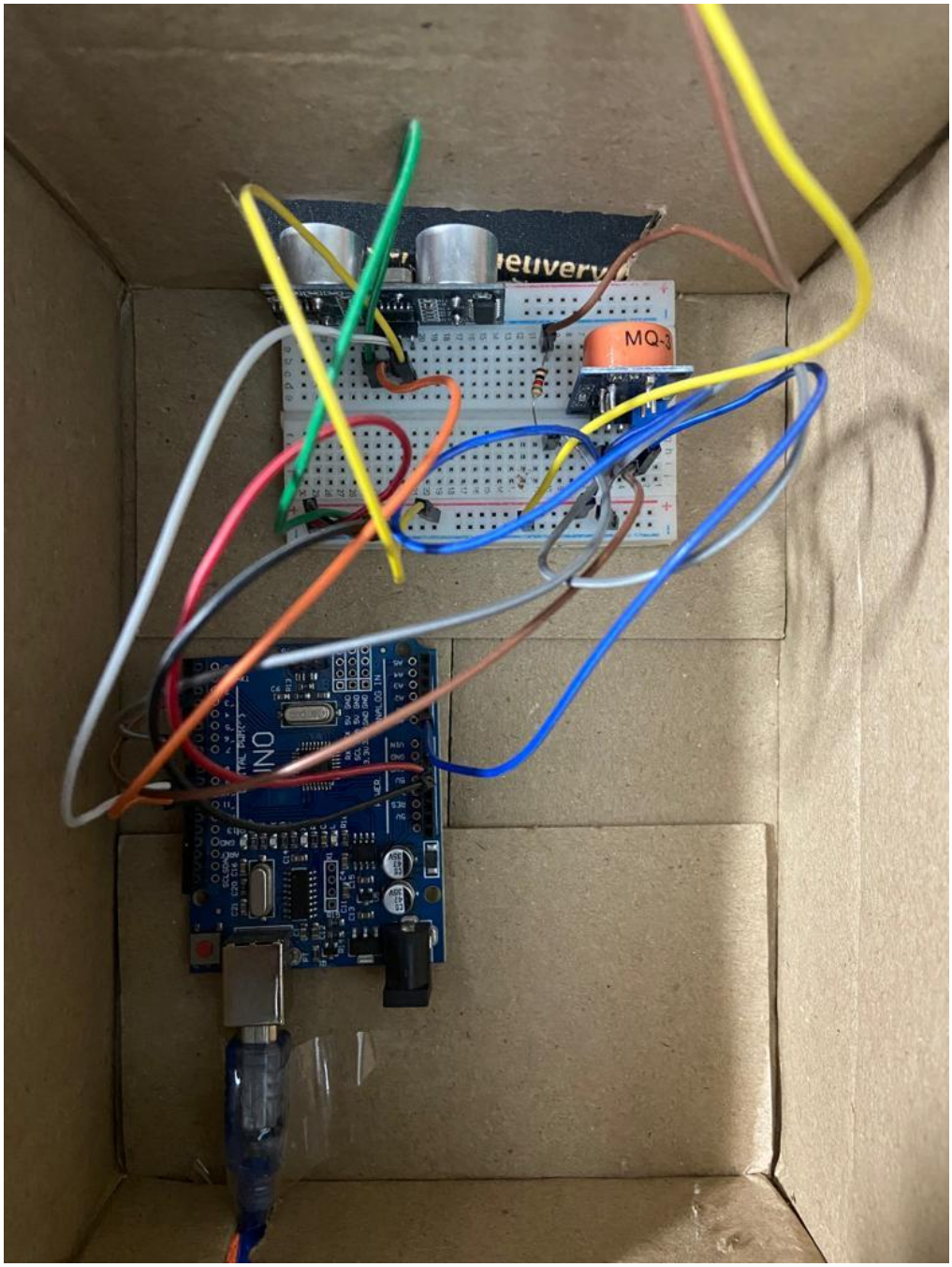
Arduino IDE –
It is a user-friendly integrated development environment, is used to write, upload and debug code on the Arduino Uno. It can be powered through a USB port or external power source, making it easy to use in a variety of applications.

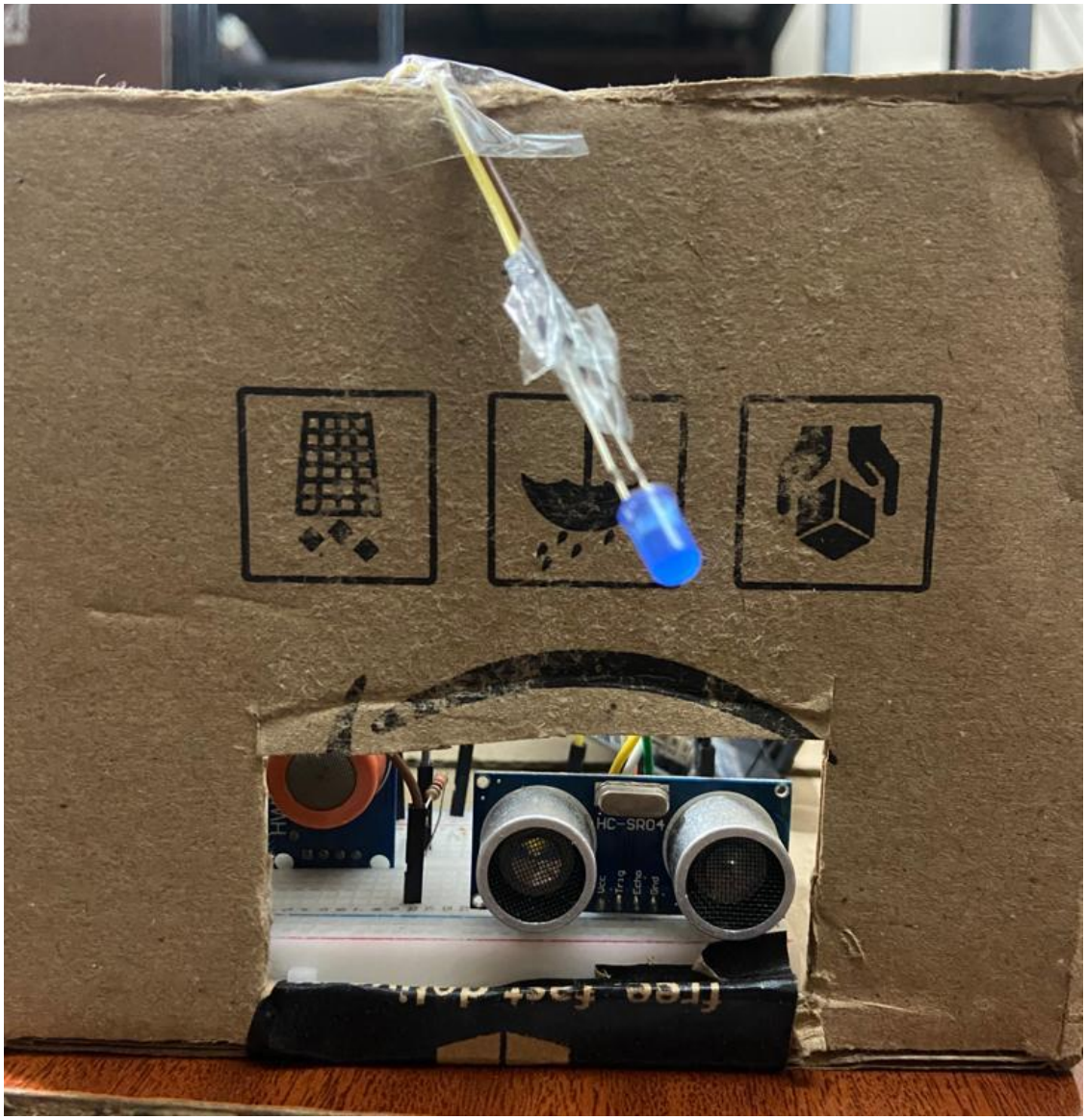
6. CODE

```
#define Drunk 400   // Define min value that we consider drunk
#define MQ3 0

float sensorValue;
int LED = 6;
const int trigPin = 9;
const int echoPin = 10;
long duration = 0;
int distance = 0;
int alcohol = 3;

void setup() {
  pinMode(trigPin , OUTPUT);
  pinMode(echoPin , INPUT);
  pinMode(LED , OUTPUT);
  pinMode(alcohol, INPUT);
  Serial.begin(9600);
}

void loop() {
  digitalWrite(LED, LOW);
  sensorValue = analogRead(MQ3); // read analog input pin 0
  Serial.print("Sensor Value: ");
  Serial.print(sensorValue);
  sensorValue = 402;
  if (sensorValue > Drunk) {
    // Check for vehicle ahead using ultrasonic sensor
    // Clears the trigPin
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);
    // Sets the trigPin on HIGH state for 10 micro seconds
    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
    // Reads the echoPin, returns the sound wave travel time in microseconds
    duration = pulseIn(echoPin, HIGH);
    // Calculating the distance
    distance = duration * 0.034 / 2;
    // Prints the distance on the Serial Monitor
    Serial.print("\nDistance: ");
    Serial.println(distance);
    if(distance<70)
      digitalWrite(LED, HIGH);
  }
  delay(2000); // wait 2s for next reading
}
```

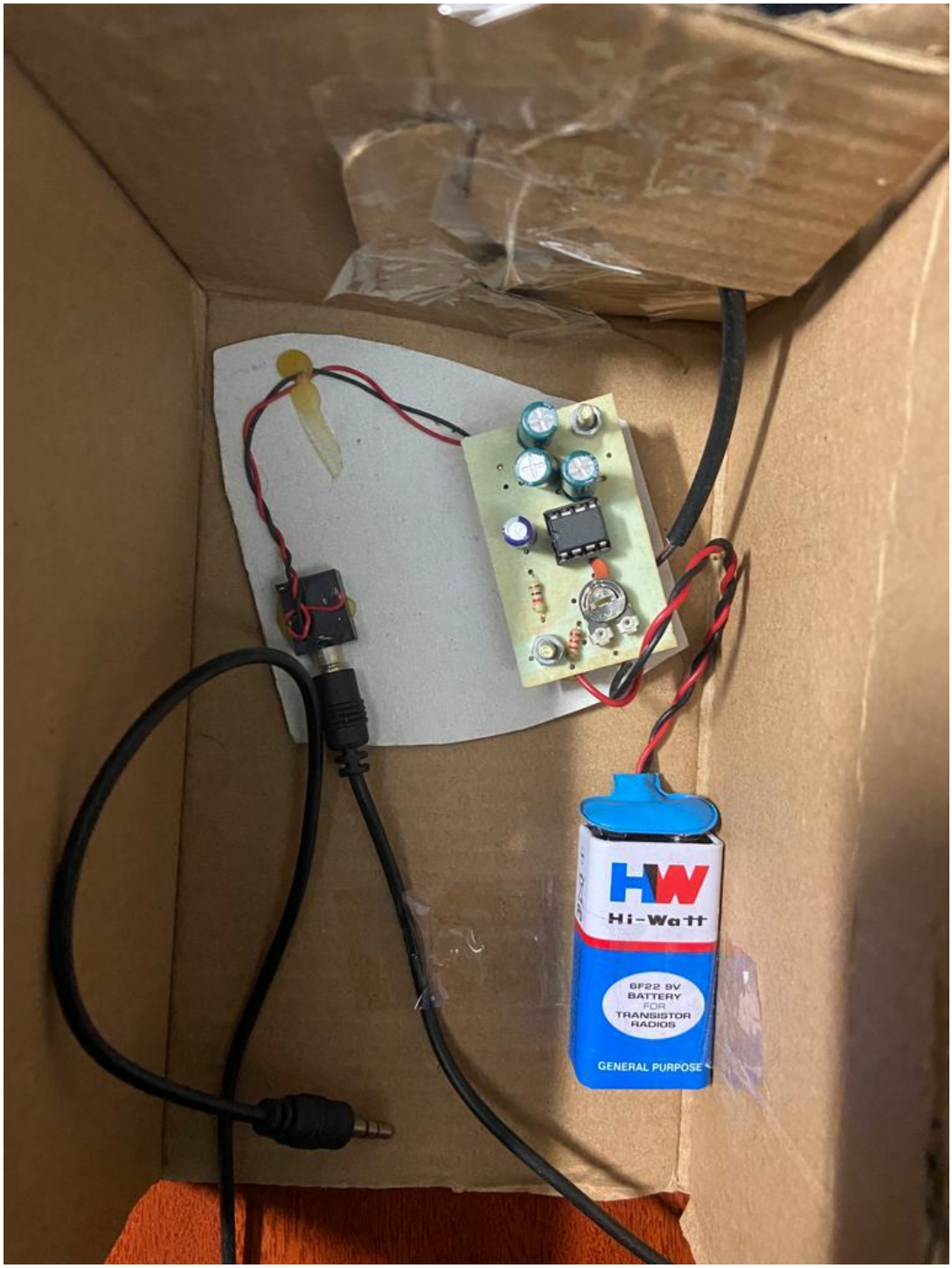
7. CIRCUIT SREENSHOTS

7.1 Transmitter Car




HC-SR04

7.2 Receiver Car



8. CONCLUSION

In conclusion, the proposed project is aimed at developing a system that can help to reduce the incidence of drunk driving and its associated risks. The system is designed to detect when a driver is under the influence of alcohol and alert other drivers on the road to the potential danger.

The system consists of two parts: the transmitter part that is installed in the drunk driver's car and the receiver part that is installed in other cars on the road. The transmitter part uses an MQ3 alcohol sensor and an ultrasonic sensor to detect when the driver is drunk and if there is a car ahead. If both conditions are met, an LED is turned on, emitting pulses of light that are detected by the solar panel in the receiver part of the system.

The receiver part of the system consists of a solar panel and a simple audio circuit that triggers an alarm sound if the LED pulses are detected. The system's sensitivity to light and its ability to convert light into electrical signals are critical to its effectiveness.

In summary, the proposed project has the potential to make our roads safer by reducing the number of accidents caused by drunk driving. By alerting other drivers to the presence of a potentially dangerous situation on the road, the system can help to prevent accidents and save lives. The proposed system is low-cost, easy to manufacture and install, making it a practical solution to a serious problem.

9. FUTURE WORKS

There are several potential future works that can be undertaken to enhance the proposed system and make it more effective in reducing the incidence of drunk driving:

Integration with smart city infrastructure: The proposed system can be integrated with the smart city infrastructure to enhance its functionality. For example, the system can be linked to traffic management systems, enabling authorities to redirect traffic away from areas with a high incidence of drunk driving.

Integration with autonomous driving technology: As autonomous driving technology becomes more prevalent; the proposed system can be integrated with this technology to enable self-driving cars to detect and respond to drunk drivers on the road.

Machine learning-based algorithms: Machine learning-based algorithms can be developed to analyse the data collected by the system and identify patterns that can help to predict when and where drunk driving incidents are likely to occur.

Real-time communication: The system can be enhanced to enable real-time communication between the transmitter and receiver parts. This will allow for more accurate detection of drunk drivers and faster response times.

Integration with law enforcement: The system can be integrated with law enforcement agencies to enable them to respond to drunk driving incidents more effectively.

Development of a mobile application: A mobile application can be developed that will enable drivers to receive alerts about potential drunk drivers in their vicinity, allowing them to take appropriate action to avoid accidents.

These future works have the potential to enhance the proposed system's functionality and make it more effective in reducing the incidence of drunk driving.

10. REFERENCES

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