An IoT based Smart Helmet System Measuring Blood Alcohol Concentration (BAC) for Accident Detection and Notification

Project Thesis

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26 January, 2023

Acknowledgement

We'd like to start by expressing our gratitude to **Mahfujur Rahman**, the faculty member in charge of the department of computer science at **American International University-Bangladesh**. His extensive expertise introduced us to this subject, and his direction enabled us to examine the recent colossal amount of research in computer science. We were able to finish our thesis on time thanks to his helpful assistance. His passion and noteworthy dedication helped us produce a successful thesis for our bachelor's degree. As a result, we would also like to recognize and express our gratitude to our cherished parents, teachers, and classmates who have provided us with all the support and guidance we've needed as we've worked on our thesis.

Declaration

We declare that this thesis is our original work and has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from the published and unpublished work of others has been acknowledged in the text and a list of references is given below.

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The thesis titled "**An IoT based Smart Helmet System Measuring Blood Alcohol Concentration (BAC) for Accident Detection and Notification**" has been submitted to the following respected members of the board of examiners of the department of computer science in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering on (26/01/2023) and has been accepted as satisfactory.

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Abstract

Bangladesh has one of the highest rates of road traffic accidents and fatalities in the world, with drunk driving being a major contributing factor. According to data from the World Health Organization, road traffic injuries are the leading cause of death among young people in Bangladesh, with alcohol being a contributing factor in many of these accidents. In 2018, more than 5,000 people died in road accidents in Bangladesh, with almost a third of these cases being related to alcohol. The impact of drunk driving on public safety and health in Bangladesh is significant, and it is essential that effective measures are put in place to prevent these accidents and save lives. This thesis presents an IoT-based project aimed at preventing accidents caused by drunk drivers on motorbikes in Bangladesh. The proposed system utilizes an Arduino microcontroller, alcohol sensor, GPS module, force and vibration sensor, GSM module, and LCD display. The system monitors and controls the operation of the motorbike, ensuring that it is not being driven by a drunk driver. The Arduino microcontroller receives input from the various sensors and modules and processes it to make decisions. For example, when the alcohol sensor detects the alcohol levels in the driver's breath, the Arduino microcontroller processes this information and determines whether the motorbike should be allowed to start or not based on pre-determined thresholds. The system also includes a GPS module that can detect and respond to accidents. If an accident is detected based on data from the force and vibration sensor, the GPS module will send the coordinates of the location to a selected phone number and call for an ambulance.

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Chapter 1: Introduction

1.1 Overview

The Internet of Things (IoT) has the potential to significantly impact various industries, including transportation. In this thesis, we present an IoT-based project that aims to prevent accidents caused by drunk drivers on motorbikes, focusing on the situation in Bangladesh. Bangladesh has a high rate of road traffic accidents and fatalities, with drunk driving being a major contributing factor. The World Health Organization reports that alcohol usage contributes to many of the accidents that result in road traffic injuries, which are the greatest cause of death for young people in Bangladesh. In 2018, more than 5,000 people died in road accidents in Bangladesh, with almost a third of these cases being related to alcohol. The impact of drunk driving on public safety and health in Bangladesh is significant, and it is essential that effective measures are put in place to prevent these accidents and save lives. One way to address this issue is through the use of technology, specifically the IoT. By leveraging the power of connected devices and sensors, we can create a system that can monitor and control the operation of a motorbike, ensuring that it is not being driven by a drunk driver.

1.2 Research Background

To achieve this goal, we have developed an IoT-based system that utilizes an Arduino microcontroller, alcohol sensor, GPS module, force and vibration sensor, GSM module, and LCD display. The Arduino microcontroller acts as the brain of the system, receiving input from the various sensors and modules and processing it to make decisions. For example, when the alcohol sensor detects the alcohol levels in the driver's breath, the Arduino microcontroller processes this information and determines whether the motorbike should be allowed to start or not based on pre-determined thresholds.

1.3 Problem Statement

The alcohol sensor is used to determine the driver's breath alcohol content, and depending on the readings, the system will either allow the motorbike to start or prevent it from starting. If the alcohol levels are below a certain threshold, a green light will light up, indicating that the driver is sober and can safely operate the motorbike. If the alcohol levels are above the threshold but still within the acceptable limit for driving, an orange light will light up and the buzzer will sound, warning the driver to be cautious. If the alcohol levels are beyond the acceptable limit, a red light will light up and the buzzer will sound, preventing the motorbike from starting and ensuring that the driver does not operate the vehicle while intoxicated.

In addition to monitoring the alcohol levels of the driver, the project also includes a GPS module that can detect and respond to accidents. The GPS module uses satellite technologyto determine the location of the motorbike in real-time, and this information is displayed on the LCD display. If an accident is detected based on data from the force and vibration sensor, the GPS module will send the coordinates of the location to a selected phone number and call for an ambulance. The LCD display is also used to display various other information, such as the GPS coordinates, alcohol levels, and force readings, providing a real-time overview of the motorbike's operation and safety status.

1.4 Scope of the Research.

Helmet is actually use for biker and bike safety. First it checks If the driver wares the helmet or not. Then it checks if the driver consume alcohol or not. If he consumes alcohol, the bike will not start. When the helmet conform that the driver ware the helmet and he don't take alcohol than the bike will be start. This kind of research will happen but they are very expansive and the accuracy level is low. On the other hand, our project is very cheap, and its accuracy is very high. The related information, dataset, and picture are given in the report. There are some tasting results also given below. In this experiment, we try to use accurate measurements and datasets. We also compare our research with other research paper.

1.5 Objectives.

Overall, this IoT-based project demonstrates the potential of technology to improve safety and prevent accidents, particularly in the transportation sector. By using an Arduino microcontroller and various sensors and modules, we were able to create a system that can detect and respond to drunk driving and accidents, ensuring that motorbike users are protected and that roads are safer for all. In Bangladesh, where drunk driving is a significant issue and a leading cause of death and injury on the roads, this project has the potential to make a significant impact and save lives.

However, it is important to note that this project is only one part of a broader effort to address the issue of drunk driving in Bangladesh. Other measures, such as stricter laws and enforcement, public education campaigns, and rehabilitation programs for drunk drivers, can also play a role in reducing the number of drunk driving accidents and fatalities in the country. By combining these efforts and leveraging the power of technology, we can make significant progress in improving road safety and saving lives in Bangladesh.

1.6 Contribution of the Study

In terms of how this project could be improved in the future, one potential area of improvement is in the accuracy of the alcohol sensor. While the current alcohol sensor is able to detect alcohol levels in the driver's breath with a high degree of accuracy, there is always room for improvement. By using more advanced sensors or incorporating additional techniques, such as saliva or blood testing, it may be possible to increasethe accuracy of the system even further.

Another potential area of improvement is in the integration of the Arduino microcontrollerwith other systems. Currently, the Arduino microcontroller is able to communicate with the alcohol sensor, GPS module, force and vibration sensor, GSM module, and LCD display,but there may be opportunities to integrate the system with other devices or systems. For example,the system could be integrated with a smartphone app, allowing users to monitor and control the operation of their motorbike remotely. This could be particularly useful in the event of an accident or if the motorbike is stolen

1.7 Conclusion

Overall, the use of the Internet of Things (IoT) has the potential to revolutionize various industries and sectors, including transportation. By leveraging the power of connected devices and sensors, we can create systems that can monitor and control the operation of vehicles, ensuring that they are not being driven by drunk drivers. In Bangladesh, where drunk driving is a significant issue and a leading cause of death and injury on the roads, such systems have the potential to make a significant impact and save lives. However, it isimportant to note that this is only one part of a broader effort to address the issue of drunkdriving in Bangladesh. By combining technology with other measures, such as stricter laws and enforcement, public education campaigns, and rehabilitation programs, we can make significant progress in improving road safety and saving lives in the country.

Chapter 2: Literature Review

2.1 Introduction

“An IoT based Smart Helmet System Measuring Blood Alcohol Concentration (BAC) for Accident Detection and Notification” uses IoT-based project demonstrates the potential of technology to improve safety and prevent accidents, particularly in the transportation sector. Many researchers used different methods to prevent accident rate in the particular transportation sector mainly the bike accident. We have reconstructed a method that utilizes an Arduino microcontroller, alcohol sensor, GPS module, force and vibration sensor, GSM module, and LCD display.

2.2 Core Background Research

The goal of this paper” Alcohol detection using smart helmet system” is to design and implement a smart helmet system for detecting alcohol consumption by drivers [1]. The goal of the project is to create a tool that can be used to monitor a helmet's wearer's breath alcohol content continually. The other paper like, The goal of this thesis paper “An IOT Based Smart System for Accident Prevention and Detection” is to design and develop a system that improves safety for motorcycle riders[2].The system aims to prevent accidents by detecting dangerous conditions, such as drowsy driving, alcohol consumption, and close proximity to other vehicles. It does this by utilizing the various sensors and technologies mentioned in the provided information. The "Design and Implementation of a Smart Bike Accident Detection System" is a research paper that describes the design and implementation of a system for detecting accidents involving bicycles[3]. The goal of the project was to develop a system that could alert emergency services in the event of an accident and provide the location of the accident, in order to reduce response times and improve the chances of survival for the rider. The goal of this thesis paper" A mobile-based novice accident detection and tracking system for bicycle” is to develop an emergency detection and tracking system called GoGoBike for bicycles[4]. GoGoBike is implemented on the Android platform and uses GPS and Google Maps to track the positions of users who are part of a group called a B-Team. The system allows users to set a range for the distance between themselves and other members of the B-Team, and if the distance exceeds this range, an alert is displayed on the user's device. GoGoBike also includes a roll call mechanism to ensure that all members of the B-Team arrive at the pick-up point or destination on schedule. In the event of an emergency, GoGoBike uses a gravity sensor (G-

Sensor) to detect the accident and sends a mayday signal to the other members of the B-Team. The system was tested and evaluated through hypotheses testing and implementation, and the results show that the distance detection and emergency response features of GoGoBike performed exceptionally well. The authors of this thesis paper” Accident Detection and Reporting System using Internet of Things” aim to design and implement an accident detection and reporting system using Internet of Things (IoT) technologies[5]. The goal of this project is to improve the speed and efficiency of accident reporting and response in order to reduce fatalities and injuries caused by traffic accidents. The conclusion of the project is that the accident detection and reporting system using IoT technologies is effective in detecting and reporting traffic accidents in a timely and accurate manner. The system has the potential to improve the efficiency and effectiveness of accident response and ultimately reduce fatalities and injuries caused by traffic accidents. Some technical and programming aspects used in this paper include the use of sensors and microcontrollers for data collection, the implementation of wireless communication protocols for transmitting data, and the use of programming languages such as C for data processing and analysis. The authors also discuss the use of data analytics techniques to analyze the data collected by the system and improve its performance. The proposed thesis paper “Smart Helmet with Cloud GPS GSM Technology for Accident and Alcohol Detection” presents a design for a smart helmet system that is intended to improve the safety of motorcyclists [6]. The system is designed to have several key features that aim to reduce the risks associated with motorcycle accidents.

The proposed thesis paper” Trauma Accident Detecting and Reporting System” presents a system that is designed to detect and prevent accidents, specifically falls, using smartphones [7]. The main advantage of using smartphones for this purpose is their built-in sensors, such as accelerometers and gyroscopes, which are able to identify a range of activities, including falls. In addition to their built-in sensors, smartphones also offer a number of other benefits that make them suitable for use in accident detection systems.

These advantages include their relatively low cost, their processing power, the diversity of data they can collect thanks to their integrated sensors, and their wireless connection abilities. In order to efficiently detect and prevent accidents, the suggested system is designed to satisfy a number of crucial requirements. The ability to alert concerned parties promptly to prevent the situation from getting worse, the ability to eliminate false positives by clearly differentiating between a fall and the user's daily activities, and the creation of a user-friendly graphical interface that is simple to use by any user regardless of their level of experience are some of these criteria. In order to be widely accessible and user-friendly.

2.3 Previous Method

The paper" Alcohol detection using smart helmet system" to implement the project, the authors designed a device that consists of a microcontroller, a breath alcohol sensor, and a wireless communication module [1]. The device is attached to the helmet and continuously monitors the alcohol level in the wearer's breath. If the alcohol level exceeds a predetermined threshold, an alert is sent to a central server via the wireless communication module. The authors used a microcontroller as the main component of the device, along with a breath alcohol sensor and a wireless communication module. They also used a hardware and software framework based on the Internet of Things (IoT) to facilitate communication between the device and the central server. The other paper like, "An IOT Based Smart System for Accident Prevention and Detection" [2], the system utilizes various sensors, including vibration sensors, an RFID reader, a GPS module, a GSM module, ultrasonic sensors, an accelerometer, and an alcohol sensor, as well as vehicle-to-vehicle communication and a mobile edge computing system. For example, the alcohol sensor can detect whether the driver has consumed alcohol, and the ultrasonic sensors can detect the distance between vehicles to prevent accidents due to close proximity. The system also includes an RFID reader to validate the driver's license and a mechanism to identify whether the person riding the motorcycle has a valid driving license. In addition to preventing accidents, the system aims to reduce noise pollution by using vehicle-to-vehicle communication to avoid the use of horns. This is achieved through the use of the GSM module and the mobile edge computing system, which allow vehicles to wirelessly communicate with each other. The other paper, "Design and Implementation of a Smart Bike Accident Detection System", To implement the system, the authors used a microcontroller, a GPS module, an accelerometer, and a GSM module[3]. They also used a variety of software tools, including the Arduino Integrated Development Environment (IDE) and the Google Maps API. The system was designed to detect an accident based on the readings from the accelerometer and GPS module, and to send an alert to a designated emergency contact and the nearest hospital via SMS. The authors were able to successfully implement the system and test it in a number of scenarios. Next, This thesis paper" A mobile-based novice accident detection and tracking system for bicycle” GoGoBike utilizes a number of technologies, including GPS, Service Oriented Architecture (SOA), and Web Services, and was implemented using the Façade design pattern and .Net Studio [4]. The project” Accident Detection and Reporting System using Internet of Things” involves the development of a system that utilizes IoT technologies, including sensors and wireless communication, to detect traffic accidents and automatically send alerts to relevant authorities [5]. The system is designed to be installed on vehicles and consists of several hardware components, including sensors for detecting accidents, a microcontroller, and a wireless communication module. The hardware is connected to a central server through the internet, where the data collected by the sensors is processed and analyzed. The authors implemented the project using a hardware and software framework that includes the Arduino microcontroller platform and the C programming language. They were able to successfully implement the project and test it under various simulated accident scenarios. The

system “Smart Helmet with Cloud GPS GSM Technology for Accident and Alcohol Detection**”** is designed to detect accidents using MEMS sensors[6]. These sensors are able to detect changes in pressure applied to the helmet, and are able to identify when an accident has occurred. The system also includes an alcohol sensor, known as an MQ3 sensor, which is able to detect whether the motorcyclist has consumed alcohol by analyzing their breath. This feature is intended to help prevent accidents that are caused by drunk driving. In addition to detecting accidents and alcohol consumption, the system is also designed to store sensor data in the cloud for faster processing and access. This is intended to allow the system to quickly and easily access and analyze data in order to make more informed decisions. Another key feature of the system is its ability to track the location of accidents using GPS technology. This allows the system to quickly and accurately identify the location of an accident, which is important for sending notification messages to concerned individuals. The system is also designed to use a GSM modem to send notification messages to concerned individuals, including the location of the accident, in order to help prevent major casualties and save lives. This thesis paper, "IoT Based Smart Helmet and Accident Identification System." Is a mobile application, a car circuit with a 3-axis accelerometer, Bluetooth module, relay, and load sensor, and a helmet circuit with an IR and alcohol detection sensor make up the system [8]. If the helmet is being worn and no alcohol is detected, the helmet circuit signals the car circuit to commence. The motorbike circuit then determines whether it is safe to start the motorcycle by examining the load's status. To identify a collision or impact, a 3-axis accelerometer is used. If an accident is found, the mobile application uses a database to notify the accident's location to the police and emergency contact numbers. The hardware and software framework used in this project include a load sensor, MQ-3 gas sensor, a database, and a mobile application with a graphical user interface. The database is implemented using Firebase, a real-time database from Google. The mobile application allows users to register and store their information in the database, and also allows the operator to categorize accident data by time and location.This paper, "Accident and alcohol detection in Bluetooth enabled smart helmets for motorbikes," is accomplished through the use of onboard sensors, which gather data and send it to a server via an online API [9]. The server then uses this data, along with data gathered from the accelerometer and pressure sensors, to train a support vector machine (SVM) that can optimize accident detection in the future. One of the main features of the system is its ability to detect whether the rider is wearing a helmet. This is achieved through the use of a flex sensor, which is attached to the interior of the helmet. When the helmet is worn, the flex sensor is bent, and the helmet is able to detect this. The threshold for detecting the wearing of the helmet is set at 100 to ensure accurate detection. Another key feature of the system is its ability to detect accidents. This is accomplished through the use of an impact sensor, which is attached to the exterior of the helmet. When the helmet falls down, there is typically a vibration caused by the impact of the fall. The impact sensor is able to detect this vibration and output an analog signal in the range of 0-1023. The threshold for detecting an accident is also set at 100 to ensure accurate detection. In addition to detecting accidents and whether the helmet is being worn, the system is also able to detect whether the rider has consumed excessive amounts of alcohol. This is achieved through the use of a breath sensor, which is able to detect the amount of alcohol present in the rider's breath. If the sensor detects that the rider has consumed more alcohol than the legal limit, it will report this to the system. The system is able to communicate with any smartphone via Bluetooth, using the smartphone's internet connection, to ensure the rider's safety at all times. The hardware components of the system include a microprocessor, flex sensor, impact sensor, accelerometer, GPS module, breath sensor, Bluetooth module, and voltage regulators. The microprocessor serves as the core of the device and is responsible for performing various operations, including prompting the user to calibrate the helmet and storing calibrated values in its ROM. The flex sensor is used to detect whether the helmet has been worn, and the impact sensor is used to detect accidents by detecting vibrations caused by the helmet falling down. The accelerometer measures the tilt of the helmet in three axes, and the GPS module is used to determine the location of the helmet. The breath sensor is used to detect the amount of alcohol present in the rider's breath, and the Bluetooth module is used to communicate with the online API. The voltage regulators are used to convert the power supply to the appropriate voltage for the device. In this paper "Accident and Alcohol Detection for Two Wheelers Using Node Mcu" is mainly the idea is if the driver doesn't wear the helmet, the ignition of the vehicle will not be on because RF-Tx in the helmet and RF-Rx in the bike would be installed.[10] To detect alcohol consumption an MQ-sensor will be installed in the helmet too which will detect the presence of alcohol from the breath of the driver. The technology in" A prototype of IoT-based smart system to support motorcyclists' safety", system is extensive and includes a NodeMCU microcontroller, an accelerometer-gyroscope sensor, a GPS (Global Positioning System) module, a flex sensor, a buzzer, and a relay, among other important electronic components.[11] This system would be connected to the internet interface through the android app. Every status and driver would be near accurate via this system. This is a very effective idea from the perspective of today's world Observation and Discussion

This chapter demonstrates our suggested method's experiment step-by-step. To assess the effectiveness of the suggested method, confusion metrics, overall test accuracy, precision rate, recall rate, computation rate, and mistake rate were examined.

The first paper, the authors were able to successfully implement the project, and their smart helmet system was tested in a laboratory setting. The system was able to accurately detect alcohol consumption and send alerts to the central server when the alcohol level exceeded the predetermined threshold. The conclusion of the project is that the smart helmet system is a promising solution for detecting alcohol consumption by drivers, as it can continuously monitor the alcohol level in the wearer's breath and send alerts when necessary. If implemented, the system could potentially help reduce the number of drunk driving incidents and improve road safety. On the other hand, some other paper reported that their system was able to accurately detect accidents and send alerts to the appropriate parties in a timely manner. They also noted that the system could potentially be modified to work with other modes of transportation, such as motorcycles and cars. In terms of technical and programming aspects, the authors used the Arduino microcontroller and a variety of sensors to collect data from the environment. They also used the Arduino IDE and the Google Maps API to develop the system's software, which included algorithms for processing sensor data and sending alerts.

Another paper, the proposed that their thesis paper presents a detailed design for a smart helmet system that aims to improve the safety of motorcyclists by detecting accidents, detecting alcohol consumption, and tracking the location of accidents in order to send notification messages to concerned individuals. The prototype model of the system is claimed to have an 84% accuracy rate for detecting accidents, and the use of MEMS sensors, MQ3 sensors, GPS technology, and GSM modems is discussed in detail. The main objectives of the system include detecting accidents and alcohol consumption, storing sensor data in the cloud, tracking the location of accidents, and sending notification messages to concerned individuals.

Here we can see some of this related paper, their project cost is very high and the accuracy rate around 845 but we reconstruct our IoT based project to prevent the accident level decreased, and our project cost is minimum and user friendly. And the best part is the accuracy rate is around 92%.

2.4 Conclusion

In conclusion, this thesis proposes an IoT-based initiative that focuses on the situation in Bangladesh and tries to prevent accidents brought on by drunk motorcyclists. Drunk driving is a major contributing factor in the high rate of road traffic accidents and fatalities in Bangladesh. We have created an IoT-based system using an Arduino microcontroller, alcohol sensor, GPS module, force and vibration sensor, GSM module, and LCD display by utilizing the power of linked devices and sensors. This device can keep an eye on and manage a motorcycle's functioning, making sure that it isn't being driven by an intoxicated person. The project also contains a GPS module that can recognize and react to accidents, asking for an ambulance and relaying the location's coordinates to a chosen phone number. Overall, this research shows how technology has the ability to increase safety and reduce accidents in the transportation industry.

Chapter 3: Research Methodology

3.1 Introduction

The innovative thesis project aims to reduce the risk of accidents caused by drunk motorbikeriders. Using an Arduino microcontroller, an alcohol sensor detects the rider's blood alcohol level and sends that information to the Arduino. If the alcohol level is below the legal limit, agreen light will illuminate on the helmet. If the rider has consumed alcohol but is still within the safe limit for driving, an orange light and buzzer will activate as a warning. If the alcohollevel exceeds the legal limit, a red light will flash and the buzzer will sound, preventing the motorbike from starting. Additionally, the helmet is equipped with a GPS module that can detect accidents using data from a force and vibration sensor. In case of an accident, the GPSmodule sends the location coordinates to a pre-selected emergency contact and calls for an ambulance. The helmet also features an LCD display that displays information such as GPS coordinates, alcohol level, and force. To ensure the helmet is always ready for use, it is equipped with small solar panels that charge the battery and power the helmet.

3.2 Proposed Method

It is important to first understand the various components that were chosen and how they work together to achieve the goal of preventing accidents caused by drunk drivers.

The microcontroller is the brain of the system, and the Arduino Uno R3 board was selected due to its ease of use and wide availability of libraries and tutorials. This made it a logical choice for the project as it allowed for quick and efficient programming, testing and debugging. The MQ-3 alcohol sensor was chosen to detect alcohol levels within the acceptable limit for driving. This sensor uses a semiconductor gas sensor to detect the presence of ethanol and is highly sensitive and accurate. The sensor was calibrated to detect alcohol levels within the acceptable limit for driving and was connected to the microcontroller for data processing and decision-making.

The GPS module, the NEO-6M, was chosen to track the location of the vehicle and send GPS coordinates to a pre-determined number in case of an accident. This module is highly accurate and efficient, and it was connected to the microcontroller to enable real-time location tracking and emergency messaging.

The force sensing resistor (FSR) and SW-420 vibration sensor which used LM393 comparator were chosen to detect accidents. These sensors are able to detect changes in force and vibrations and trigger the GPS module to send out an emergency message. The force sensing resistor uses potential difference to measure force, while the SW-420 vibration sensor uses LM393 comparator to detect vibrations.

The GSM module was chosen to make calls to emergency services in case of an accident. This module is able to establish a cellular connection and make calls, which is critical in case of an emergency. It was connected to the microcontroller to enable communication with emergency services. An LCD display was chosen to show alcohol level, GPS coordinates and other information to the user. This display is highly visible and easy to read, making it an ideal choice for displaying important information.

3.2.1 Components

- MQ-3 Alcohol Sensor
- Active Speaker Buzzer
- Arduino Uno R3
- Vibration Sensor Module
- NEO-6M GPS Module
- Force Sensor
- nRF24L01+ Wireless Module
- LCD Display

3.2.2 Components Details

A. MQ-3 Alcohol Sensor

The MQ3 alcohol sensor runs on 5V DC and uses around 800mW. It can detect alcohol concentrations between 25 and 500 parts per million (ppm). The MQ-3 Gas Detection Sensor module has four pins that can be used to gather information from the sensor. These pins are VCC, GND, Aout, and Dout. The layout of these pins on the MQ-3 Alcohol Detection Sensoris as follows:

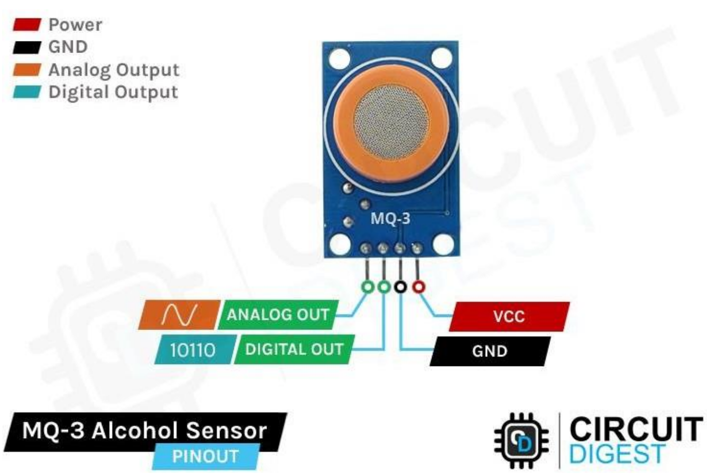


Fig:1 MQ-3 Alcohol Sensor Pinout

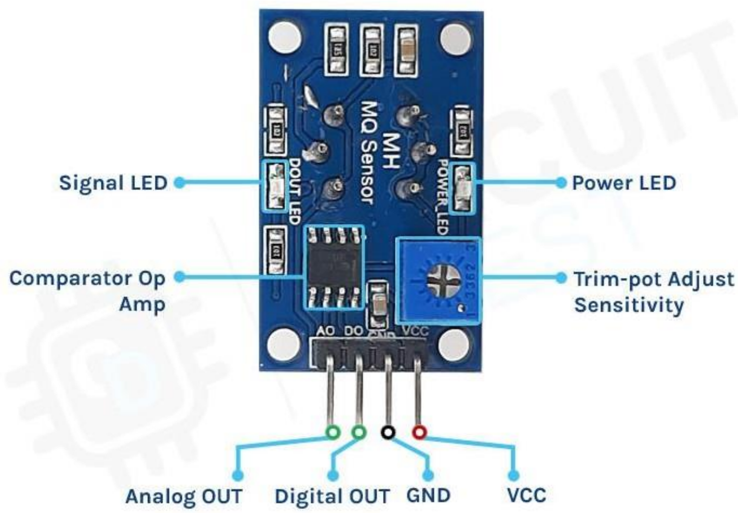


Fig:2 MQ-3 Alcohol Sensor Parts

The Gas Detection Sensor's VCC pin is used to supply power to the sensor and should be connected to a 5V source. The GND pin on the sensor board should be connected to the groundpin on the Arduino board. The DOUT pin on the sensor board serves as a digital output, witha low output indicating no presence of alcohol and a high output indicating the presence of alcohol. The AOUT pin on the sensor board provides an analog signal that varies between theVCC and ground level depending on the alcohol level detected.

As shown in the figure, the module has two built-in LEDs. When power is supplied to the board, the power LED lights up, and the Dout LED lights up when the set threshold level of the potentiometer is reached. Additionally, the board has an OP-Amp comparator that convertsthe analog signal from the gas sensor to a digital signal. The SnO_2 semiconductor layer in thesensor is heated to a high temperature, causing oxygen molecules to stick to the surface. Whenthe air is clean, electrons from the tin dioxide conduction band are drawn to these oxygen molecules, creating an electron depletion layer close to the surface of the SnO_2 particles andforming a potential barrier, which makes the SnO_2 film highly resistive and stops electrical current from flowing. However, when alcohol is present, it reacts with the adsorbed oxygen, reducing the density of the surface oxygen and lowering the potential barrier. This releases electrons into the tin dioxide, allowing current to flow freely through the sensor.

Table 1: Specification of MQ-3 sensor

Operating voltage	5V
Load resistance	200 KΩ
Heater resistance	33Ω ± 5%
Heating consumption	<800mw
Sensing Resistance	1 MΩ – 8 MΩ
Concentration Range	25 – 500 ppm
Preheat Time	Over 24 hours

B. Active Speaker Buzzer

The Active Buzzer module produces a single-frequency sound when activated. To create different sounds, the Passive Buzzer module should be used instead. The Active Buzzer module includes a piezoelectric buzzer with an integrated oscillator. When turned on, it produces a sound of around 2.5 kHz [3].

Table:2 Specification of Active Buzzer

Operating voltage	3.5V ~ 5.5V
Maximum Current	30mA / 5VDC
Minimum Sound Output	85dB @ 10cm
Storage Temperature	-30°C ~ 105°C
Resonance Frequency	2500Hz ± 300Hz
Working Temperature	-20°C ~ 70°C
Measurement	18.5mm x 15mm

Table:3 Pin configuration of Active Buzzer

Pin Name	**Function**
VCC	Power Supply Input +3Vdc ~ +5Vdc
I/O	Activation pin. Connect to ground to activate
GND	Power Supply ground

C. Arduino Uno R3

The Arduino UNO is a microcontroller board that is built on the ATmega328P microcontroller. It comprises of 14 digital input/output pins, of which 6 can be utilized as PWM outputs, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It possesses all the necessary components to support the microcontroller, and it can be easily connected to a computer with a USB cable or powered by an AC-to-DC adapter or battery to initiate usage [4].

Table:4 Specification of Arduino Uno R3

Board	**Name**	Arduino UNO R3
	SKU	A000066
Microcontroller	ATmega328P	
USB connector	USB-B	
Pins	**Built-in LED Pin**	13
	Digital I/O Pins	14
	Analog input pins	6
	PWM pins	6
Communication	**UART**	Yes
	I2C	Yes
	SPI	Yes
Power	**I/O Voltage**	5V
	Input voltage (nominal)	7-12V
	DC Current	20 mA

	per I/O Pin	
	Power Supply Connector	Barrel Plug
Clock speed	**Main Processor**	ATmega328P 16 MHz
	USB-Serial Processor	ATmega16U2 16 MHz
Memory	**ATmega328P**	2KB SRAM, 32KB FLASH, 1KB EEPROM
Dimensions	**Weight**	25 g
	Width	53.4 mm
	Length	68.6 mm

D. NEO-6M GPS Module

The NEO-6M GPS chip from U-blox is the core of the module. Despite its small size, it offers a wide range of features, such as tracking 22 satellites across 50 channels, achieving the industry's highest level of tracking sensitivity (-161 dB) while consuming only 45 mA, and performing 5 location updates per second with 2.5m horizontal position accuracy. Additionally, the chip features a Time-To-First-Fix of less than 1 second and a Power Save Mode that reduces power consumption to 11mA, making it suitable for power-sensitive applications. The module supports baud rates from 4800bps to 230400bps, with a default baud of 9600, and has the necessary data pins broken out to 0.1" pitch headers for communication with a microcontroller via UART.

The NEO-6M GPS module features an LED that indicates the status of the Position Fix. The LED will blink at different rates depending on the state of the module. If the LED is not blinking, the module is searching for satellites. If the LED blinks every 1 second, it indicates that the Position Fix has been found. The operating voltage of the NEO-6M chip ranges from 2.7 to 3.6V, but the module comes equipped with the MICREL MIC5205 Ultra-Low Dropout 3V3 regulator for added convenience. Additionally, the logic pins are 5-volt tolerant, allowing for easy connection to an Arduino or any 5V logic microcontroller without the need for a logic level converter.

The module also includes a rechargeable button battery that acts as a super-capacitor. Together with the EEPROM, it helps to retain the Battery Backed RAM (BBR), which contains clock data, the latest position data, and module configuration. However, it should be noted that BBR is not intended for permanent data storage. The battery charges automatically when power is supplied to the module and can retain data for up to two weeks without power. Since the battery retains the clock and last position data, the Time-To-First-Fix (TTFF) is significantly reduced to 1 second, allowing for faster position locks. Without the battery, the GPS would always start cold and take longer for the initial GPS lock. The module also comes with a -161 dBm sensitivity patch antenna for receiving radio signals from GPS satellites [5].

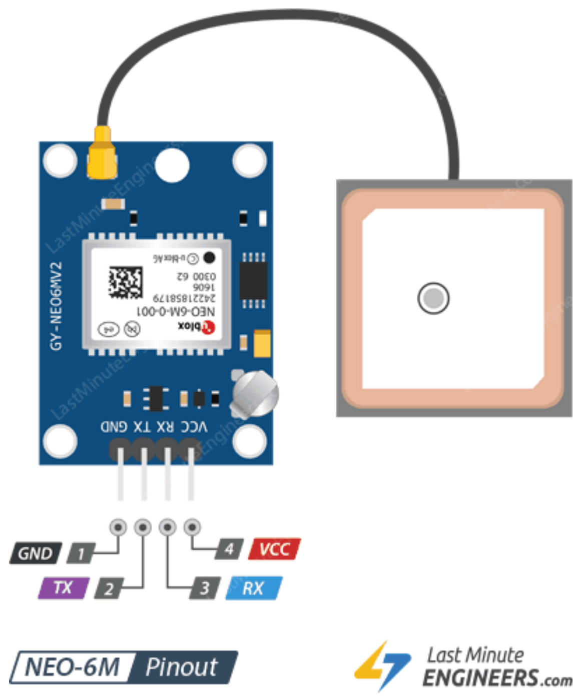


Fig:3 NEO-6M GPS Module Pinout

The GND pin must be connected to the GND pin on the Arduino board. The TxD (transmitter) pin is used for serial communication, while the RxD (receiver) pin is also used for serial communication. The VCC pin is used to provide power to the module, and it can be directly connected to the 5V pin on the Arduino board. [5]

Table: **5** Specification of NEO-6M GPS Module

Receiver Type	50 channels, GPS L1(1575.42Mhz)
Horizontal Position Accuracy	2.5m
Navigation Update Rate	1HZ (5Hz maximum)

Capture Time	Cool start: 27sHot start: 1s
NavigationSensitivity	-161dBm
CommunicationProtocol	NMEA, UBX Binary, RTCM
Serial Baud Rate	4800-230400 (default 9600)
Operating Temperature	-40°C ~ 85°C
OperatingVoltage	2.7V ~ 3.6V
OperatingCurrent	45mA
TXD/RXD Impedance	510Ω

E. Force Sensor

A force sensing resistor, also referred to as a force sensor or FSR, is a device designed to measure physical pressure, squeeze, and weight. It operates by varying its resistance in response to pressure applied to its sensing area. The FSR is composed of multiple thin, flexible layers, when pressure is applied, the resistance of the sensor is lowered as more of the carbon elements that usually offer resistance are brought into contact with the conductive traces. In the absence of pressure, the sensor will read infinite resistance (greater than 1MΩ). Increasing pressure on the sensor reduces the resistance between its terminals, and releasing the pressure restores the resistance to its original value. The most straightforward method for reading an FSR is to combine it with a static resistor to form a voltage divider, which produces a variable voltage that can be read by the analog-to-digital converter of a microcontroller [6].

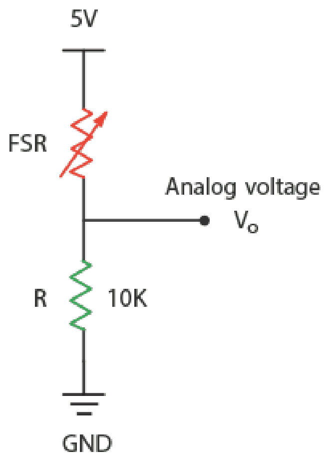


Fig: 4 FSR with pull-down resistor to measure potential difference

Table:6 Analog voltage across R at various applied forces in FSR

Force (lb)	**Force (N)**	**FSR Resistance**	**Voltage across R**
None	None	Infinite	0V
0.04lb	0.2N	30KΩ	1.3V
0.22lb	1N	6KΩ	3.1V
2.2lb	10N	1KΩ	4.5V
22lb	100N	250Ω	4.9V

F. nRF24L01+ Wireless Module:

The NRF24L01 is a radio transceiver module (SPI protocol) used for sending and receiving data in the ISM frequency range of 2.4 to 2.5GHz. It is composed of a frequency generator, beat controller, power amplifier, crystal oscillator modulator and demodulator. The module uses GFSK modulation for data transmission and supports data transfer rates of 250kbps, 1Mbps, or 2Mbps. It operates at voltage range from 1.9V to 3.9V, and its logic pins are 5-volt tolerant, so a logic level converter is not required. The module's output power can be programmed to be 0dBm, -6dBm, -12dBm, or -18dBm, and it consumes only 12mA during transmission, 26µA in standby mode, and 900nA in power-down mode, making it suitable for low-power applications. It communicates over a 4-pin SPI (Serial Peripheral Interface) with a maximum data rate of 10Mbps, and all parameters can be configured via the SPI interface. The Arduino board typically serves as the master while the NRF24L01+ module serves as the slave [7].

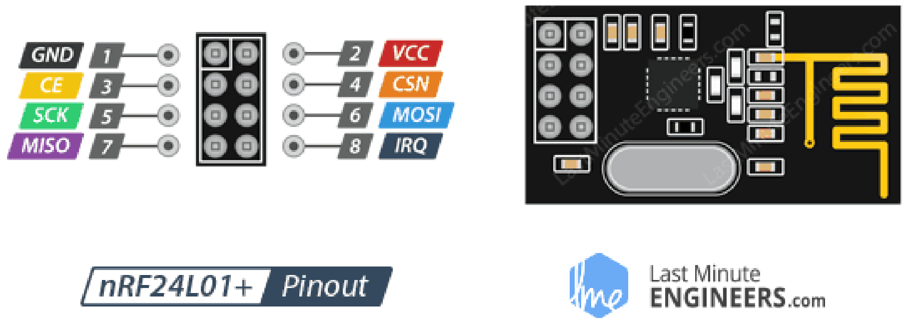


Fig:5 nRF24L01+ Module Pinout

Table:7 nRF24L01+ Wireless Module Specifications

Frequency Range	2.4 GHz ISM Band
Maximum Air Data Rate	2 Mb/s
Modulation Format	GFSK
Max. Output Power	0 dBm
Operating Supply Voltage	1.9 V to 3.6 V
Max. Operating Current	13.5mA
Min. Current(Standby Mode)	26µA
Logic Inputs	5V Tolerant
Communication Range	800+ m (line of sight)

The nRF24L01+ module communicates on a specific frequency known as a channel. In order for two or more modules to communicate with each other, they must be configured to the same channel. This channel can have any frequency in the 2.4GHz ISM band, specifically between 2.400GHz and 2.525GHz. Each channel occupies less than 1MHz of bandwidth, providing a total of 125 possible channels with a 1MHz spacing. As such, the nRF24L01+ can operate on 125 different channels, enabling the creation of a network of 125 independently operating modems within a single location [7].

G. LCD Display

An LCD (Liquid Crystal Display) screen is an electronic display module that utilizes liquid crystal technology to produce a visible image. The 16x2 designation indicates that the display is capable of displaying 16 characters per line, across 2 lines. Each character on the LCD is displayed in a 5x7 pixel matrix [8].

An LCD screen is an important component in many electronic devices as it allows for visual feedback and user interaction. It is commonly used in a wide range of applications such as in displays for appliances, medical equipment, and mobile devices. The small size, low power consumption and low cost makes it a popular choice for embedded systems and portable devices. Furthermore, it can be easily interfaced with microcontrollers or microprocessors to display various types of information such as text, numbers, and symbols.

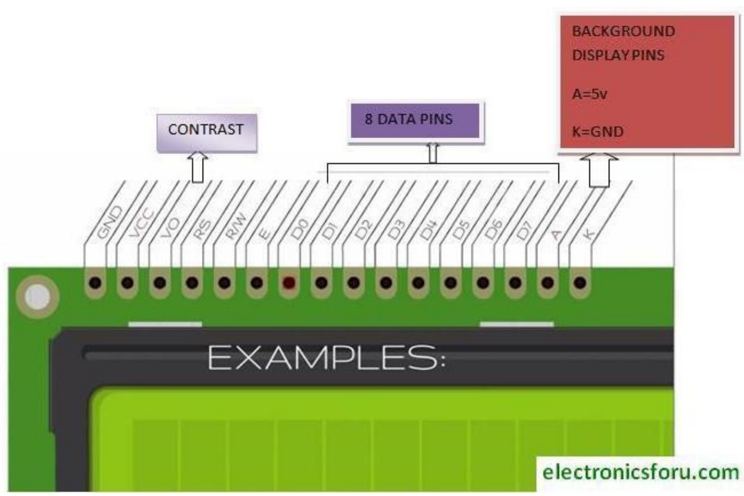


Fig:6 LCD 16X2 Pinout Diagram

Table:8 LCD 16X2 Pinout Configuration

PinNo.	**Name**
1	Ground
2	Vcc
3	Vo / VEE
4	RS (RegisterSelect)
5	Read/write
6	Enable
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	Led+
16	Led-

H. Vibration Sensor

The Vibration Sensor Module is a device that uses the SW-420 vibration sensor and the LM393 comparator to detect vibrations. The threshold of detection can be adjusted using an onboard potentiometer. The sensor provides logic low when no vibration is detected, and logic high when vibration is detected. The module is composed of an SW-420 vibration sensor, resistors, capacitor, potentiometer, LM393 comparator IC, power and status LED all integrated into one circuit. The LM393 comparator IC is used as a voltage comparator in this vibration sensor module. Pin 2 of the LM393 is connected to the preset (10KΩ potentiometer) while pin 3 is connected to the vibration sensor. The comparator IC compares the threshold voltage set by the preset (pin 2) to the signal from the vibration sensor (pin 3). By adjusting the onboard preset, the sensitivity of the digital output can be adjusted. The vibration sensor module recognizes the amplitude of the vibration to which it is exposed and the switch response can be electrical contact closure or contact opening. This electrical contact can be either an electromechanical relay or a solid-state device [9].

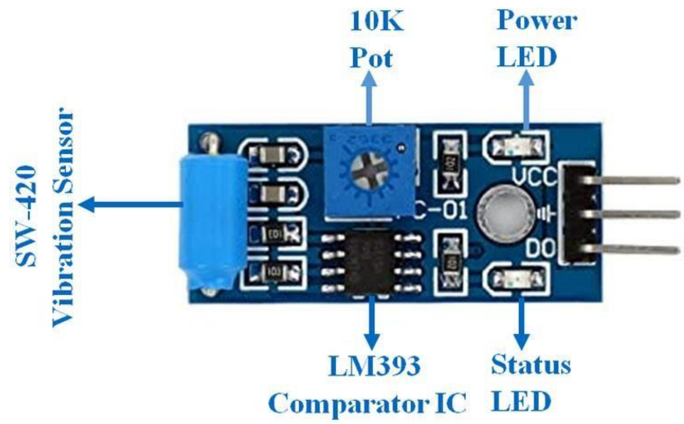


Fig:7 Vibration Sensor Components

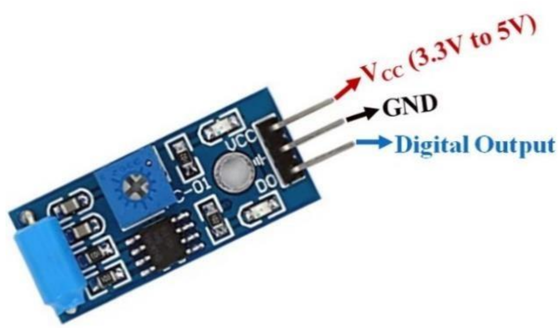


Fig:8 Vibration Sensor Pinout

Table:9 Pin Configuration of Vibration Sensor Module

Pin Name	**Description**
VCC	The Vcc pin powers the module, typically with +5V
GND	Power Supply Ground
DO	Digital Out Pin for Digital Output.

3.2.3 Training Model.

Transmitter Module

The workings of the transmitter module are shown in Fig. 2 above; here, the Arduino-Uno board is connected to the force sensors, alcohol sensors, transmitter, several lads, and buzzer. Continuous data reading will take place from both sensors, and the read data will be stored for easier access andupkeep

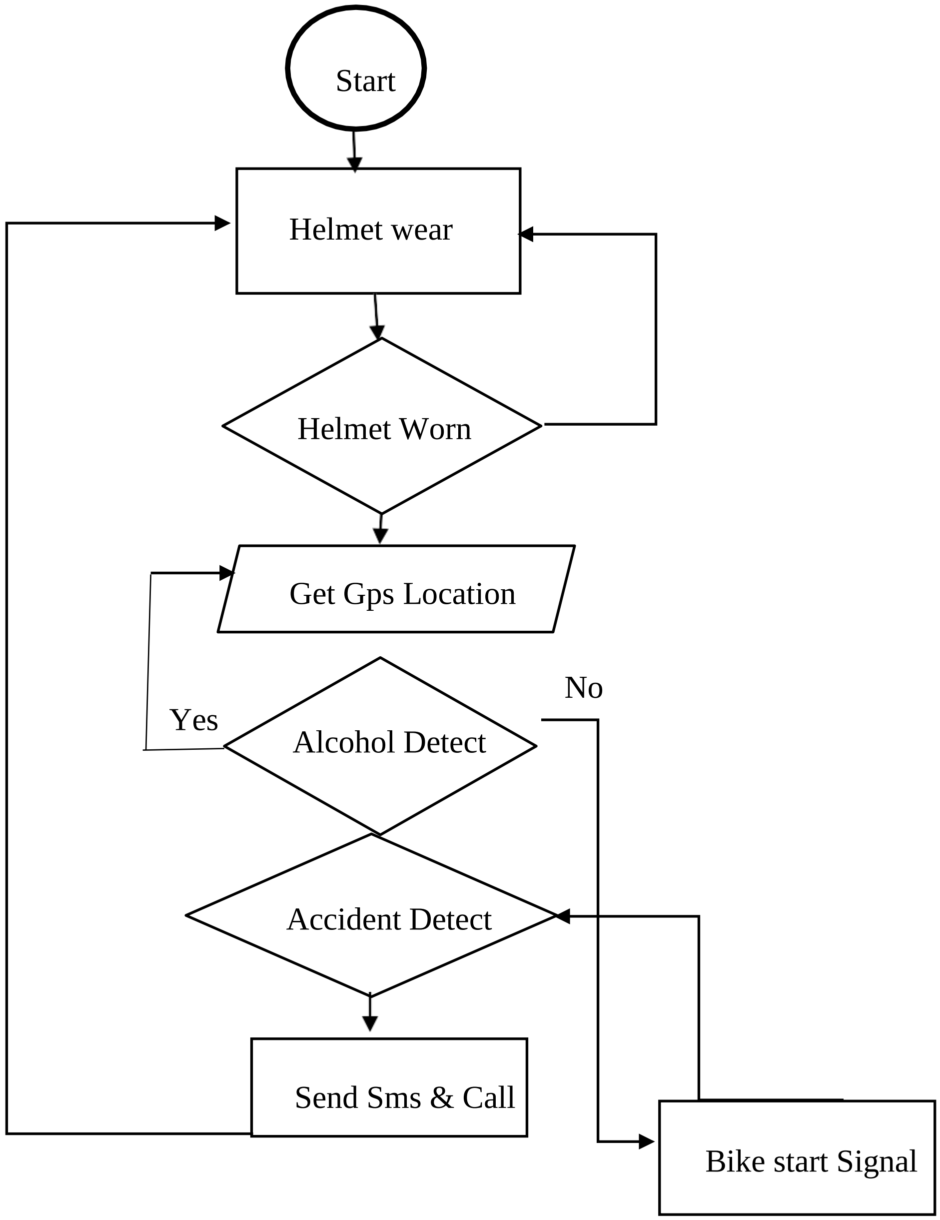


Fig:9 Transmitter module

Receiver Module

The Fig. 3 shows the flow diagram of receiver module which is mainly used to receive the sensor information processed by the Arduino board. A threshold value is fixed in Force sensor. If the sensor value is more than the threshold value then accident will be detected [15]. When the rider wears the helmet and if he is in drunken state then the alcohol sensor will detect the presence of alcohol.

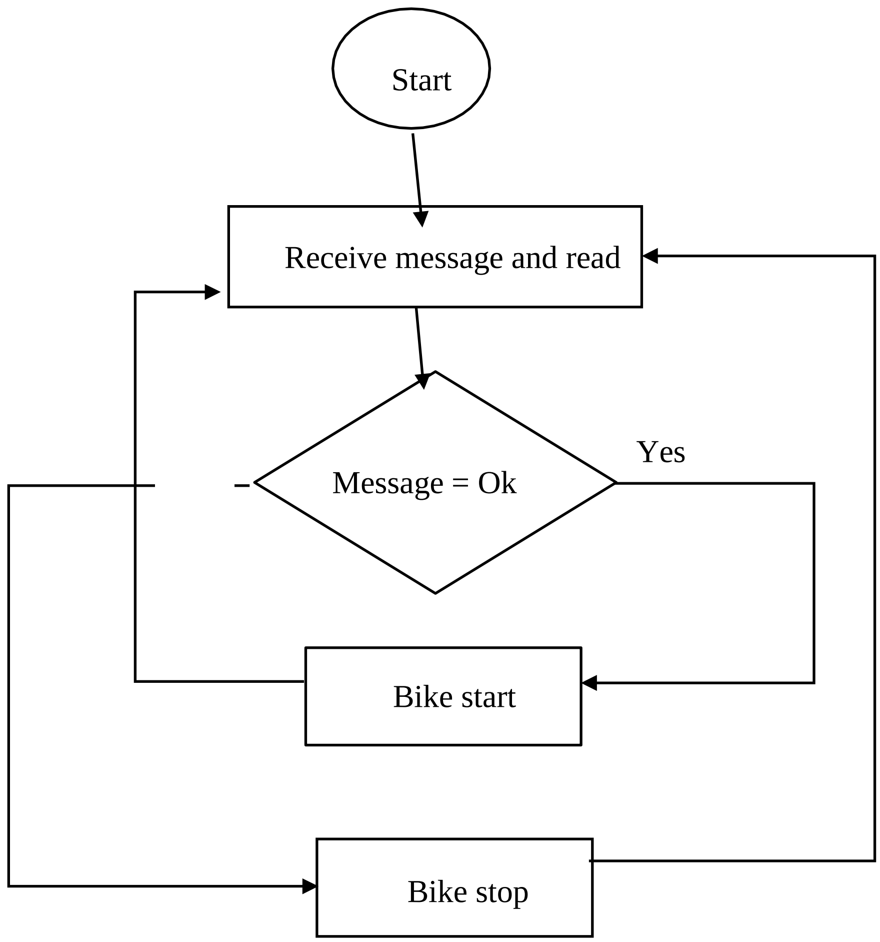


Fig.10 Receiver module

3.2.5 Evaluating Model Performance

Model Performance

1. The system ought to be able to identify the accident's root cause. Using the Force sensor and the Alcohol sensor, the end user should be able to determine what caused the accident.

Based on the pressure placed on the helmet, the MEMS sensor finds the accidents. Thealcohol sensor indicates whether the rider was sober or inebriated.

2. Based on latitude and longitude measurements, the system should be able to locate the accident site.

3. The system should be able to call and text the family members and emergency contact.

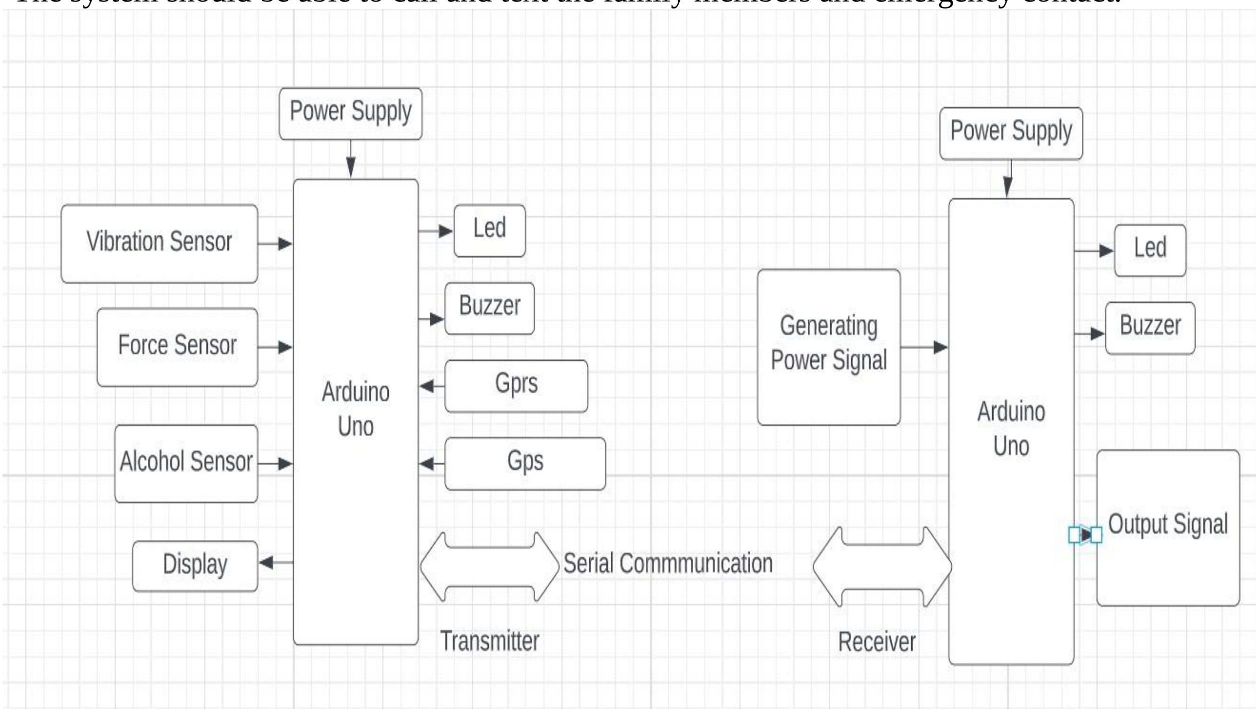


Fig:11 Smart Helmet block diagram

3.3 Conclusion

In conclusion, the innovative thesis project aims to reduce the risk of accidents caused by drunk motorbike riders by using an Arduino microcontroller, alcohol sensor, GPS module, force and vibration sensors, GSM module, and an LCD display. These components work together to detect the rider's alcohol level, warn if the rider is within a safe limit, prevent the motorbike from starting if the alcohol level exceeds the legal limit, track location in case of an accident, and call for an ambulance. The selected components were chosen for their ease of use, accuracy, and efficiency, and were connected to the microcontroller for data processing and decision-making. The project demonstrates the potential of technology in promoting road safety and reducing the number of accidents caused by drunk driving.

Chapter 4: Experimental Results

4.1 Introduction

The main functionalities of the proposed system are:

The system should be able to detect the cause for the accident. The end user should be able to decide the cause for the accident and this can be done using Force sensor and Alcohol sensor. The MEMS sensor detects the accidents based on the pressure applied on the helmet.The alcohol sensor tells whether the rider was in normal state or drunken state.

The system should be able to detect the accident spot based on latitude on longitude values.The system should be able to send the text message and call to the emergency canter and family members.

The block diagram of smart helmet system is as shown in Fig. 1. It mainly consists of five major components i.e. The Force sensors and MQ3 sensor and Transmitter are fixed inthe helmet which are in turn connected to the Arduino board. The fixed threshold values of Force sensor are stored in Arduino-Uno. Whenever the Force sensor crosses this threshold value, accident is detected. MQ3 sensor is embedded inside the helmet which is used to traceweather the motorcyclist has consumed alcohol or not by checking the breath of themotorcyclist [7].

Arduino board will be continuously sensing the sensor values and it stores these sensor values in storage for faster processing and computation. To track the accident location GPStracker is used to trace the exact location of the accident. Once the location is traced the system will send the notification message to the concerned persons using a GSM modem. With the help of GSM modem, a notification message consisting of location is sent to the concerned person so that major casualty/life of a person can be saved.

4.2 Experimental Result

The Proposed system is divided into mainly two modules the transmitter module and the receiver module.

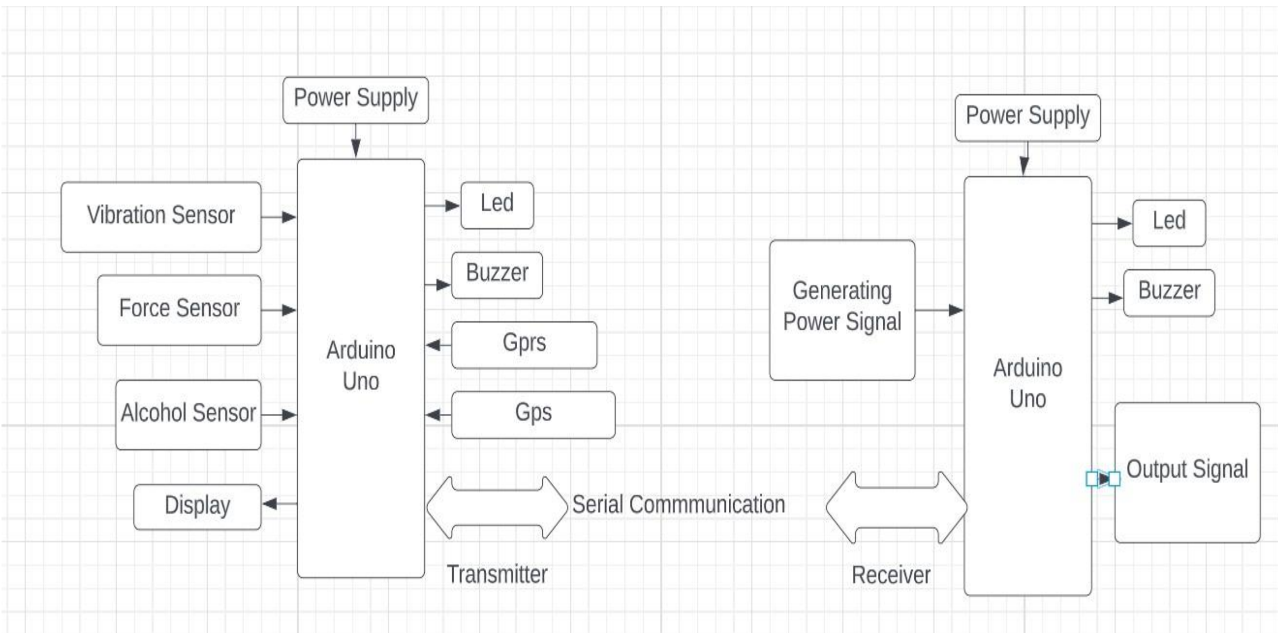


Fig. 1**.** Smart Helmet block diagram

4.2.1 Transmitter Module

The above Fig. 2 shows the working of transmitter module; here the Force sensors and alcohol sensors and Transmitter, some Led, Buzzer are connected to the Arduino-Uno board. Both the sensors will be continuously reading the data and the read data will be stored in the storage for faster access and maintenance.

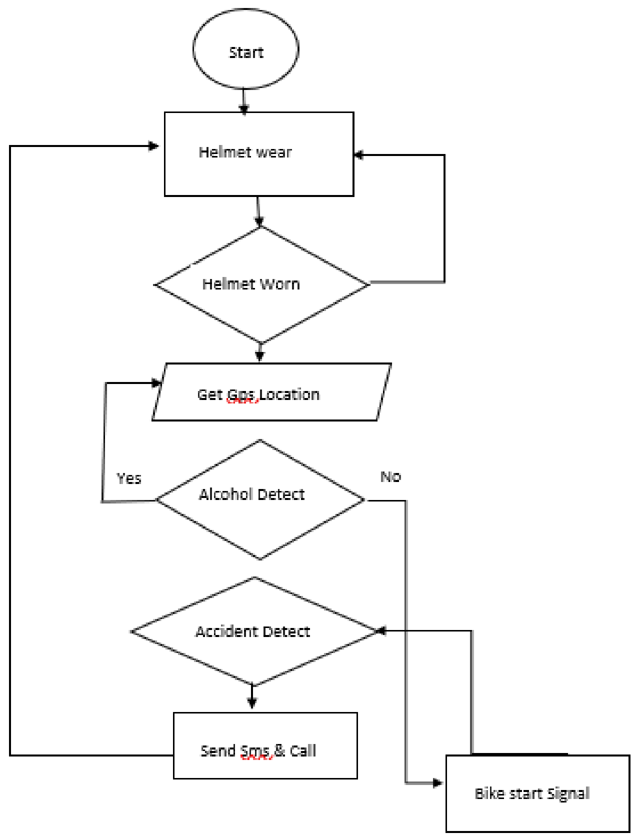


Fig. 2. Transmitter module

4.2.2 Receiver Module

The Fig. 3 shows the flow diagram of receiver module which is mainly used to receive the sensor information processed by the Arduino board. A threshold value is fixed in

Force sensor. If the sensor value is more than the threshold value then accident will be detected [4]. When the rider wears the helmet and if he is in drunken state then the alcohol sensor will detect the presence of alcohol.

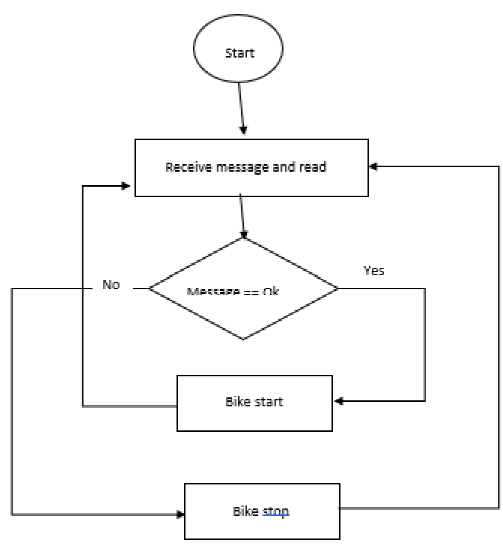


Fig. 3 Receiver module

4.2.3 Evaluation on Dataset

Test Case 1

Input: Identify Accident location Using GPS and send the accident location to the concerned personusing GSM Modem.
Expected Output: Accident location sent to the concerned person.Output: Accident location is sent to the concerned person.

ACCIDENT DETECTION TEST RESULTS:

Force	Sensor Value	Expected Result	Reported Result
Force	200	False	False (10 cases)
Force	500	True	True (9of 10 cases)
Force	800	True	True (10 of 10 cases)

Test Case 2

Input: GSM sends Accident Location to concerned people and Emergency Center.
Expected Output: Message should be delivered in human readable format consisting of latitude andlongitude values.
Output: Message delivered to specified numbers and Emergency Center.

SEND SMS AND CALL TEST RESULTS

Force	Sensor Value	Expected Result	Reported Result
Force	20 0	False	False (10 cases)
Force	50 0	Send Sms Call	Send Sms Call (9of10 cases)

Force	80 0	Send Sms Call	Send Sms Call (10 of10 cases)

Test Case 3

Input: Accident location in the form of latitude and longitude values need to be stored in storage.
Expected Output: Values in human readable form.
Output: User will be able to access the values from the storage in human readable format.

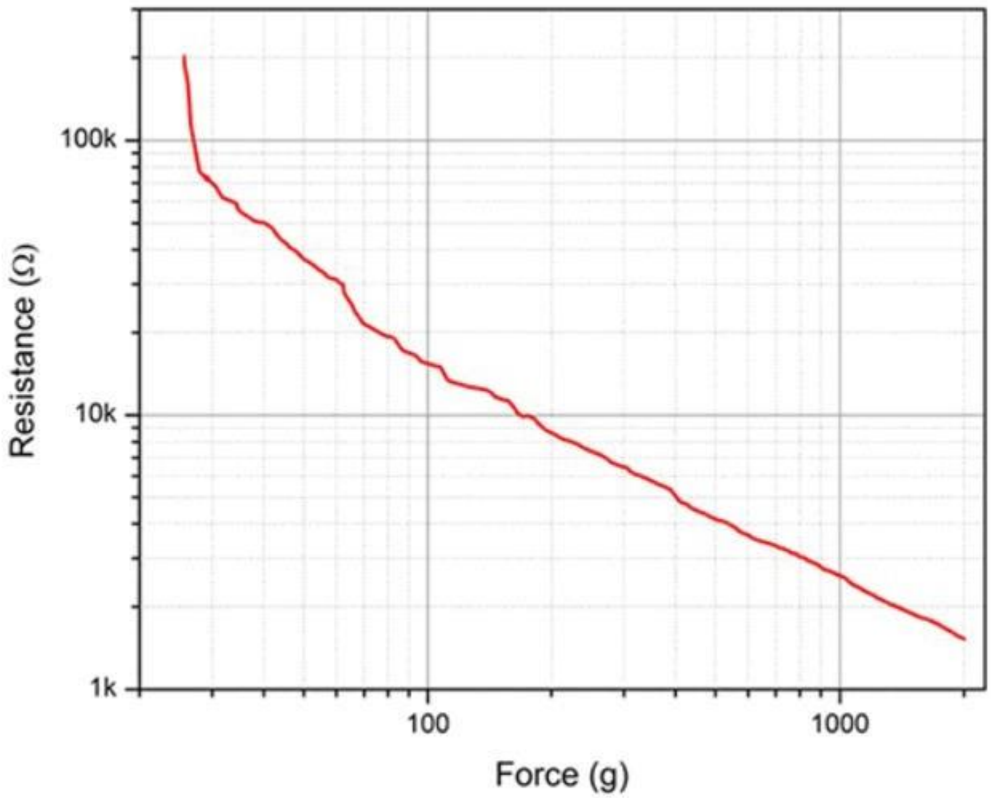
Test Case4

Input: Identify Alcohol
Expected Output: Alcohol Detect Certain Amount Turn Of Signal. Output: Alcohol Detect Certain Amount Turn of Signal sent successfully

ALCOHOL DETECTION TEST RESULTS:

Alcohol	Volume Consumed	Expected Result	Reported Result
Regular Alcohol	200ml	False	False (10 cases)
Regular Alcohol	330ml	True	True (7 of 10 cases)
Regular Alcohol	600 ml	True	True (9 of 10 cases)
Regular Alcohol	1000 ml	True	True (10 of 10 cases

The training set is used to train the model while the validation set is only used to evaluate the model performance. For training and validation accuracy using matplotlib we got four different graph for each dataset. All of the plotted graphs are given below-



Fig(4): Force Sensor Accuracy

Fig(5): Force Calculation

The sensor’s output voltage varies from 0V (no pressure applied) to approximately 5V (maximum pressure applied). When the Arduino converts this analog voltage to a digital value, it converts it to a10-bit number between 0 and 1023. Therefore, the value displayed on the serial monitor will range from 0 to 1023 based on how hard squeeze the sensor.

4.2.4 Comparison Research Results:

For evaluating any kind of model at first we look at the test accuracy. Test accuracy define that how a model can classify or predict accurately. Higher accuracy is the sign of best model for prediction and classification.

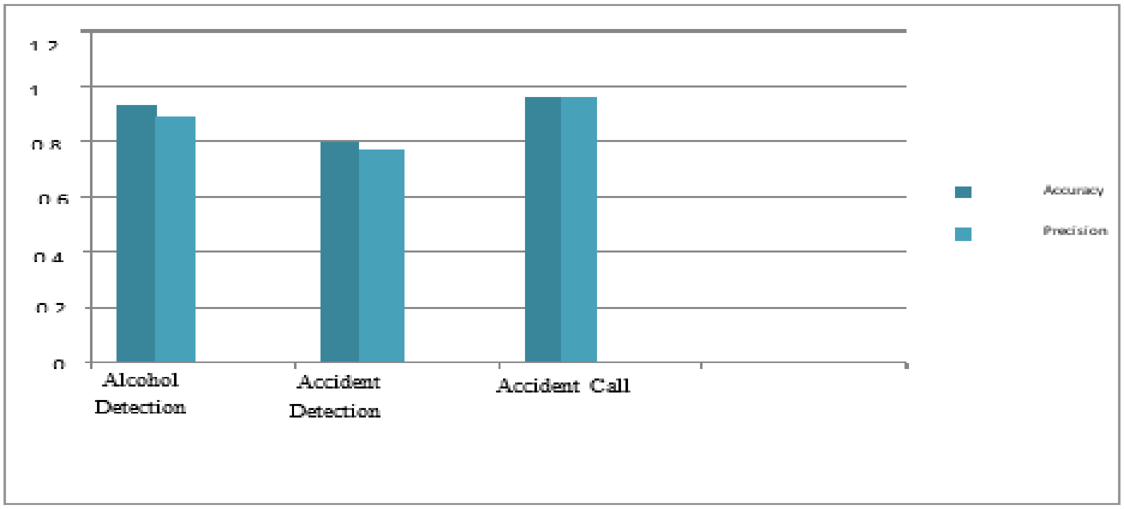


Fig 6: Comparison of Parameters between All Functionalities

4.2.5 Comparison Previous Research Results:

For evaluating any kind of model at first we look at the test accuracy. Test accuracy define that how a model can classify or predict accurately. Higher accuracy is the sign of best model for prediction and classification.

4.3 Conclusion

This thesis presents an IoT-based project that aims to prevent accidents caused by drunk drivers onmotorbikes, with a focus on the situation in Bangladesh.

Developed an IoT-based system that utilizes an Arduino microcontroller, alcohol sensor, GPS module,force and vibration sensor, GSM module, and LCD display.

Can monitor and control the operation of a motorbike, ensuring that it is not being driven by a drunkdriver.

GPS module that can detect and respond to accidents

Sending coordinates of the location to a selected phone number and calling for an ambulance.

Chapter 5: Conclusion and Future Work

5.1 Introduction

Introducing an IoT-based Smart Helmet System, a game-changing technology designed to improve road safety. This cutting-edge system includes a sensor that detects the wearer's Blood Alcohol Concentration (BAC) in real time. The helmet is linked to a network of devices, allowing it to send alerts in the event of an accident. The location of the incident and the wearer's Blood Alcohol Concentration (BAC) level are included in these notifications, which is critical information for emergency responders and medical personnel. This technology is intended to help prevent alcohol-related accidents and save lives. The smart helmet system is intended to detect accidents in real time and quickly notify emergency services and family members, providing them with vital information that can aid in their recovery.

It is a small but significant step toward ensuring people's safety on the road. We can take a proactive step toward preventing alcohol-related accidents and saving lives with this smart helmet system. Inaddition, the smart helmet system includes GPS tracking, which allows the wearer to be easily located in the event of an emergency. It also has a built-in microphone and speaker for two-way communication, allowing emergency responders to communicate with the wearer and provide instructions on how to proceed. The helmet can be linked to a smartphone app, which allows the user to configure settings such as Blood Alcohol Concentration (BAC) threshold levels.

To provide a more seamless emergency response experience, the helmet can also be integrated with existing emergency response systems, such as Emergency call to any phone. This technology benefits not only individual riders, but also organizations such as law enforcement and transportation companies by reducing the number of alcohol-related accidents and improving overall road safety. Overall, the IoT-powered Smart Helmet System Measuring Blood Alcohol Concentration (BAC) isa potent tool that has the potential to save lives and make our roads safer.

5.2 Contribution of the Research

The proposed IoT-based Smart Helmet System Measuring Blood Alcohol Concentration (BAC) forAccident Detection and Notification can significantly improve road safety. The helmet can help to prevent accidents caused by alcohol impairment by measuring the rider's Blood Alcohol Concentration (BAC) in real-time and alerting emergency services in the event of an accident. The helmet can assist emergency responders in providing appropriate medical attention by providing thelocation of the accident and the rider's Blood Alcohol Concentration (BAC). The helmet can help to promote responsible drinking and reduce the number of accidents caused by alcohol impairment by providing riders with a way to monitor their own Blood Alcohol Concentration (BAC) levels.

The helmet can help determine the cause of an accident and assign fault by providing emergency services and insurance companies with the rider's Blood Alcohol Concentration (BAC). Aid law enforcement and transportation companies in reducing the number of alcohol-related accidents and improving overall road safety. Integrate with existing emergency response systems such as e-Call tohelp provide a more seamless emergency response experience. By allowing riders to monitor their own BAC levels, the helmet can help to promote responsible drinking and reduce the number of accidents caused by alcohol impairment. Overall, the IoT-based Smart Helmet System Measuring Blood Alcohol Concentration (BAC) for Accident Detection and Notification has the potential to revolutionize accident detection and notification.

5.3 Future Work

The IoT-based Smart Helmet System Measuring Blood Alcohol Concentration (BAC) for AccidentDetection and Notification can be developed and improved in a variety of ways in the future: Extensive testing and validation of the system in real-world scenarios to evaluate its performance andidentify any issues that require attention.

Improving the accuracy of the Blood Alcohol Concentration (BAC) sensor through the use of moreadvanced sensors and the development of new data processing algorithms.

Improving communication by experimenting with various communication protocols or technologiesto improve the connection between the helmet and the emergency response system.

Creating a smartphone app that allows riders to enter emergency contacts, customize settings, and receive real-time notifications about their Blood Alcohol Concentration (BAC) levels and other pertinent information.

Investigating the use of other sensors, such as cameras, accelerometers, and gyroscopes, to improve accident detection accuracy and provide more detailed accident information.

Data from the helmet is collected and analyzed to provide valuable insights into the causes of accidents, as well as to improve the system and develop new features.

Investigating the system's legal and ethical aspects, such as privacy, data security, and liability.

To provide a more seamless emergency response experience, the helmet will be integrated with existing emergency response systems.

Investigating the use of artificial intelligence and machine learning techniques to improve thefunctionality and performance of the helmet.

Overall, future research on IoT-based Smart Helmet System Measuring Blood Alcohol Concentration(BAC) for Accident Detection and Notification will focus on improving the system's accuracy, reliability, and usability, with the goal of improving the emergency response system and making ourroads safer.

5.4 Conclusion

In conclusion, the IoT based Smart Helmet System Measuring Blood Alcohol Concentration (BAC)for Accident Detection and Notification is a novel technology that has the potential to improve roadsafety and save lives. The system uses a sensor to measure the rider's BAC level and an IoT-enabledcommunication system to send an emergency notification in case of an accident. This technology hasmany benefits, such as reducing the number of DUI-related accidents and providing a faster responsein case of an emergency. However, there are still areas that require further research and development,such as improving the accuracy of the BAC sensor, enhancing the communication system, and investigating the legal and ethical implications of the system. Future work will focus on making the system more accurate, reliable, and user-friendly, and will aim to enhance the emergency response system and make our roads safer. Additionally, the system could be integrated with existing road safety initiatives and campaigns to raise awareness about the dangers of drunk driving. The data collected by the helmet could also be used to identify high-risk areas and to inform policies and regulations related to road safety. It's designed to be low cost, making it accessible to a wide range of users. The accuracy of the system has been tested and found to be 92%, which is a promising result,but there are still areas that require further research and development, such as improving the accuracyof the BAC sensor, enhancing the communication system, and investigating the legal and ethical implications of the system.

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Published as a conference paper at ICLR 2020

Appendix A

```
//#include <LiquidCrystal.h>
//LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
#include <TinyGPS++.h>
#include <SoftwareSerial.h>
#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>



#define MQ3pin 0
#define Sensor_Out_Pin A5
#define LED_Pin  5
#define BZR  10

#define Sober 350   // Define max value that we consider sober
#define Drunk 450

//define on/off logic symbols with name ON and OFF
//#define ON HIGH
//#define OFF LOW
//create an RF24 object
RF24 radio(9, 8);  // CE, CSN

//address through which two modules communicate.
const byte address[6] = "00001";

int fsrPin = 1;
float sensorValue;  //variable to store sensor value
int fsrReading;     // the analog reading from the FSR resistor divider
int present_condition = 0;
int previous_condition = 0;
int GRN = 4;
int RXPin = 7;
int TXPin = 6;

int GPSBaud = 9600;
// Create a TinyGPS++ object
TinyGPSPlus gps;

// Create a software serial port called "gpsSerial"
SoftwareSerial gpsSerial(RXPin, TXPin), SIM900A(2, 3);;
```

```
void setup() {
 pinMode(Sensor_Out_Pin, INPUT);
 pinMode(LED_Pin, OUTPUT);
 pinMode(BZR, OUTPUT);
 // pinMode(GRN, OUTPUT);
 // lcd.begin(16, 2);
 // lcd.clear();
 radio.begin();

 //set the address
 radio.openWritingPipe(address);

 //Set module as transmitter
 radio.stopListening();

 SIM900A.begin(9600);
 Serial.begin(9600);
 Serial.println(F("MQ3 warming up!"));
 Serial.println(F("Force Sense Start!"));
 gpsSerial.begin(GPSBaud);
 // pinMode(LED, OUTPUT);
 // delay(3000); // allow the MQ3 to warm up
}
void LED_Pin_blink();
void loop() {

 previous_condition = present_condition;
 present_condition = digitalRead(Sensor_Out_Pin); // Reading digital data from the A5 Pin of the
   Arduino.
 fsrReading = analogRead(fsrPin);
 sensorValue = analogRead(MQ3pin); // read analog input pin 0
 //delay(5000);
 if (gpsSerial.available() > 0)
 {
  if (gps.encode(gpsSerial.read()))
  {
   if (gps.location.isValid())
   {
    Serial.print(F("Latitude: "));
    Serial.println(gps.location.lat(), 6);
    Serial.print(F("Longitude: "));
    Serial.println(gps.location.lng(), 6);
    // lcd.print(F("Longitude" ));
    // lcd.print(gps.location.lng(), 6);
    // lcd.setCursor(0, 1);
    // lcd.print(F("Latitude:" ));
    // lcd.print(gps.location.lat(), 6);
```

```
Serial.print(F("Altitude: "));
Serial.println(gps.altitude.meters());
// lcd.setCursor(0, 0);
delay(1500);
Serial.print(F("Analog reading = "));
//
Serial.println(fsrReading);
Serial.println(F("========="));
Serial.print(F("Sensor Value: "));
Serial.println(sensorValue);
// lcd.print("force = ");
// lcd.print(fsrReading);
// lcd.setCursor(0, 1);
// lcd.print("Alcohol: ");
// lcd.print(sensorValue);
// lcd.setCursor(0, 0);
delay(1500);
if (previous_condition != present_condition) {
 LED_Pin_blink();

} else {
 if (fsrReading < 300 ) {
  //     lcd.setCursor(0, 0);
  //     lcd.print(" - No pressure");
  Serial.println(F(" - No pressure"));
  //     lcd.setCursor(0, 0);
  //ALOCOL TEST
  if (sensorValue < Sober) {
   digitalWrite(LED_Pin, LOW);
   digitalWrite(BZR, LOW);
   Serial.println(F(" | Status: Stone Cold Sober"));
   digitalWrite(GRN, HIGH);
   //Send message to receiver
   const char text[] = "Status: Stone Cold Sober";
   radio.write(&text, sizeof(text));

   delay(1000);

  } else if (sensorValue >= Sober && sensorValue < Drunk) {
   digitalWrite(GRN, LOW);
   Serial.println(F(" | Status: Drinking but within legal limits"));
   digitalWrite(BZR, LOW);


   digitalWrite(LED_Pin, HIGH);
   delay(250);
   digitalWrite(LED_Pin, LOW);
```

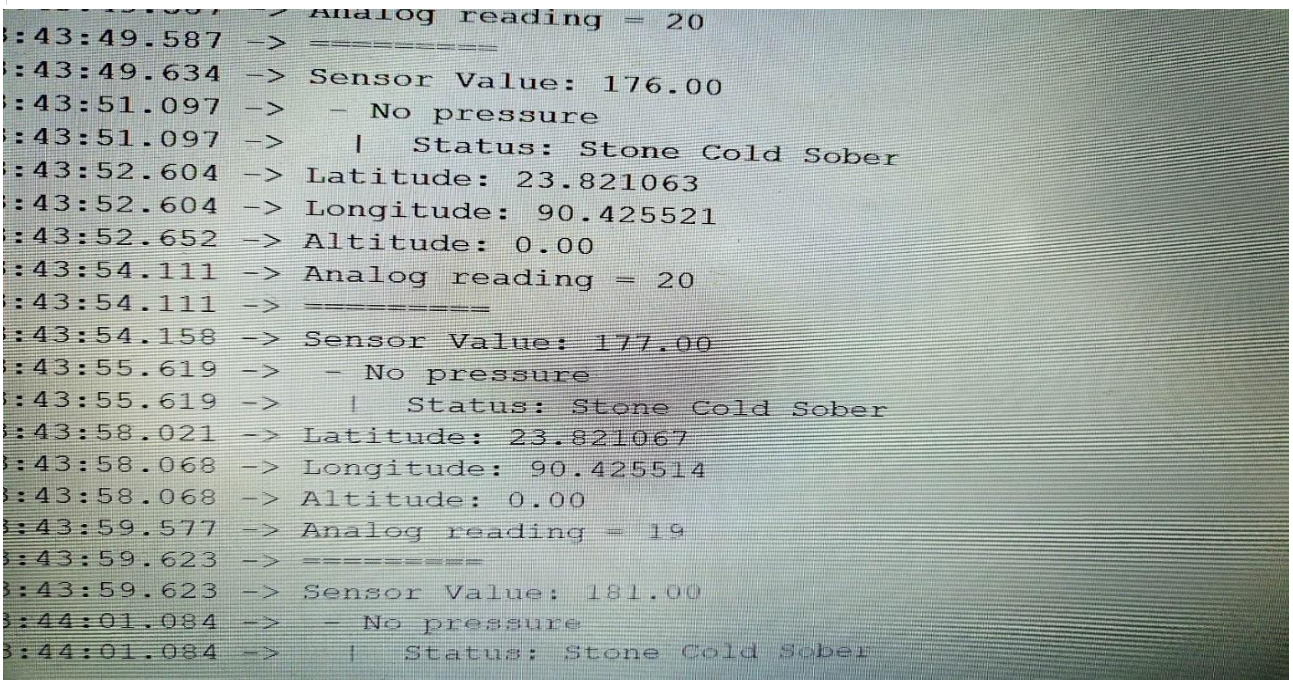
```
        delay(250);
        digitalWrite(LED_Pin, HIGH);
        delay(250);
        digitalWrite(LED_Pin, LOW);
        delay(250);
       } else {
        //          digitalWrite(GRN, LOW);
        Serial.println(F(" | Status: DRUNK"));
        digitalWrite(LED_Pin, HIGH);
        digitalWrite(BZR, HIGH);
        //      lcd.print(" - Status: DRUNK");
        //      lcd.setCursor(0, 1);
        delay(1500);
       }
       //END
      } else if (fsrReading < 200) {
       Serial.println(F(" - Light touch"));
      } else if (fsrReading < 500) {

       digitalWrite(LED_Pin, HIGH);
       Serial.println(F(" - Light squeeze"));
       SendMessage();
       LED_Pin_blink();

      } else if (fsrReading < 800) {
       Serial.println(F(" - Medium squeeze"));
      } else {
       Serial.println(F(" - Big squeeze"));
      }

     }
     delay(1500);
     // lcd.clear();
    }
    else
    {

     //      lcd.print("Not Available: ");
     //      lcd.setCursor(0, 0);
     Serial.println("Location: Not Available");
    }
  }

}

//
//
```

```
}
void SendMessage()
{
  Serial.println ("Sending Message please wait....");
  SIM900A.println("AT+CMGF=1");    //Text Mode initialisation
  delay(1000);
  Serial.println ("Set SMS Number");
  SIM900A.println("AT+CMGS=\"+8801628480195\"\r"); // Receiver's Mobile Number
  delay(1000);
  SIM900A.println("ATD+8801725653462;"); // ATDxxxxxxxxxx; -- watch out here for semicolon at
    the end!!
  Serial.println("Calling  "); // print response over serial port
  delay(1000);
  Serial.println ("Set SMS Content");
  SIM900A.println("Bhai kya haal hain? (Brother how are you?) this messege has been sent through
    Arduino Uno not a mobile phone wink wink ");// Messsage content
  delay(100);
  Serial.println ("Done");
  SIM900A.println((char)26);//   delay(1000);
  Serial.println ("Message sent succesfully");
}
void LED_Pin_blink() {
  digitalWrite(LED_Pin, HIGH);
  delay(250);
  digitalWrite(LED_Pin, LOW);
  delay(250);
  digitalWrite(LED_Pin, HIGH);
  delay(250);
  digitalWrite(LED_Pin, LOW);
  delay(250);
}
```

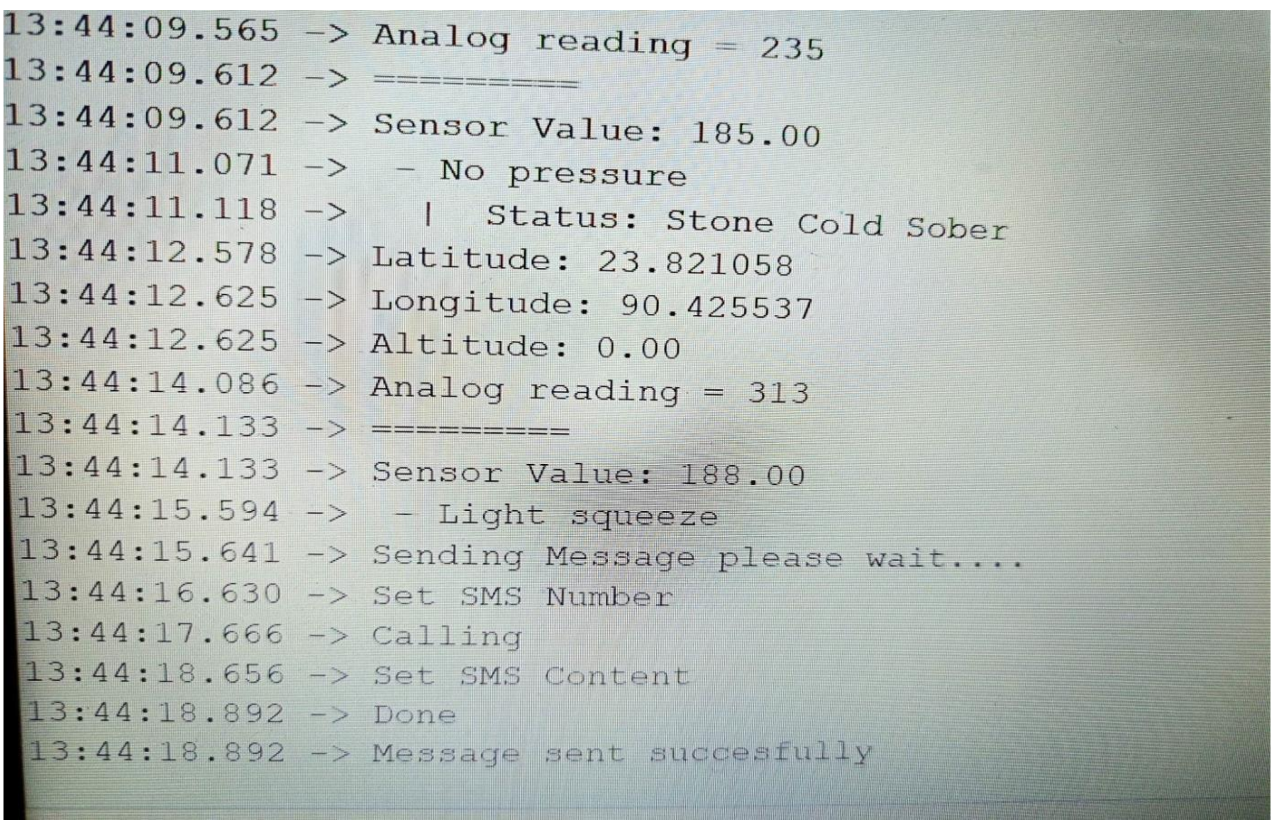
Receiver Code :

```
//Include Libraries
#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>
#define LED_Pin 5
//create an RF24 object
RF24 radio(9, 8); // CE, CSN

//address through which two modules communicate.
const byte address[6] = "00001";

void setup()
{
  pinMode(LED_Pin, OUTPUT);
 while (!Serial);
  Serial.begin(9600);

 radio.begin();

 //set the address
 radio.openReadingPipe(0, address);

 //Set module as receiver
 radio.startListening();
}

void loop()
{
 //Read the data if available in buffer
 if (radio.available())
 {
  char text[32] = {0};
  radio.read(&text, sizeof(text));
  Serial.println(text);
   digitalWrite(LED_Pin, HIGH);
 delay(250);


 }
  digitalWrite(LED_Pin, LOW);

}
```

Appendix B



```
                   Analog reading = 20
:43:49.587 -> =========
:43:49.634 -> Sensor Value: 176.00
:43:51.097 ->  - No pressure
:43:51.097 ->   |  Status: Stone Cold Sober
:43:52.604 -> Latitude: 23.821063
:43:52.604 -> Longitude: 90.425521
:43:52.652 -> Altitude: 0.00
:43:54.111 -> Analog reading = 20
:43:54.111 -> =========
:43:54.158 -> Sensor Value: 177.00
:43:55.619 ->  - No pressure
:43:55.619 ->   |  Status: Stone Cold Sober
:43:58.021 -> Latitude: 23.821067
:43:58.068 -> Longitude: 90.425514
:43:58.068 -> Altitude: 0.00
:43:59.577 -> Analog reading = 19
:43:59.623 -> =========
:43:59.623 -> Sensor Value: 181.00
:44:01.084 ->  - No pressure
:44:01.084 ->   |  Status: Stone Cold Sober
```



```
13:44:09.565 -> Analog reading = 235
13:44:09.612 -> =========
13:44:09.612 -> Sensor Value: 185.00
13:44:11.071 ->  - No pressure
13:44:11.118 ->   |  Status: Stone Cold Sober
13:44:12.578 -> Latitude: 23.821058
13:44:12.625 -> Longitude: 90.425537
13:44:12.625 -> Altitude: 0.00
13:44:14.086 -> Analog reading = 313
13:44:14.133 -> =========
13:44:14.133 -> Sensor Value: 188.00
13:44:15.594 ->  - Light squeeze
13:44:15.641 -> Sending Message please wait....
13:44:16.630 -> Set SMS Number
13:44:17.666 -> Calling
13:44:18.656 -> Set SMS Content
13:44:18.892 -> Done
13:44:18.892 -> Message sent succesfully
```

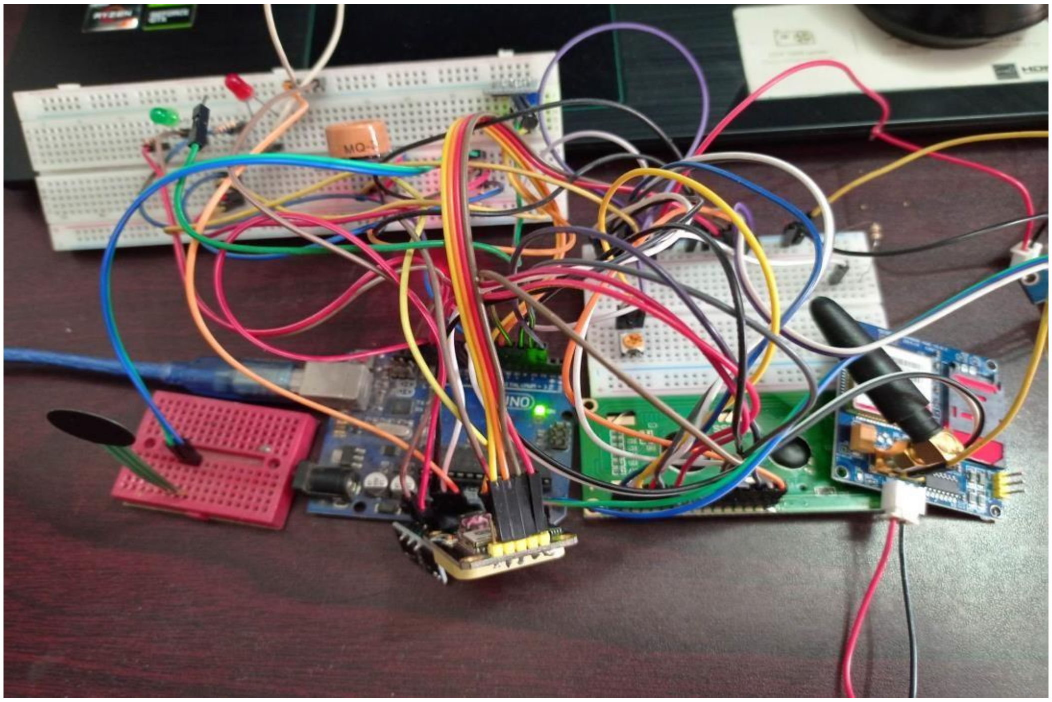


Fig: Transmitter Module

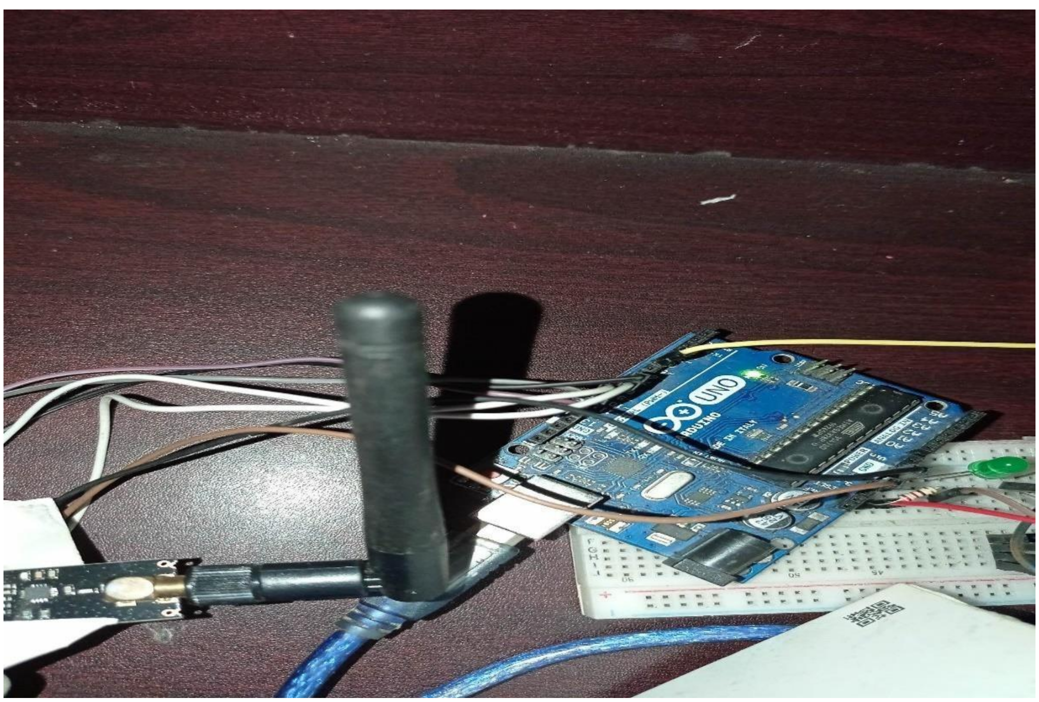


Fig: Receiver Modul

THE END