IoT BASED ROAD ACCIDENT DETECTION AND PREVENTION SYSTEM USING SENSORS

A PROJECT REPORT

Submitted by

SHRIMEENATCHI K (913119104097)
SONAL L R (913119104099)
SRINITHI M (913119104104)
SWATHEKA R (913119104111)

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY, MADURAI

ANNA UNIVERSITY :: CHENNAI 600 025

MAY 2023

ANNA UNIVERSITY : CHENNAI 600 025

BONAFIDE CERTIFICATE

Certified that this project report "**IoT BASED ROAD ACCIDENT DETECTION AND PREVENTION SYSTEM"** is the bonafide work of **"SHRIMEENATCHI K (913119104097)", "SONAL L R (913119104099)", "SRINITHI M (913119104104)"** and **"SWATHEKA R (913119104111)"** who carried out the project work under my supervision.

SIGNATURE
Dr. R. DEEPALAKSHMI,
B.E., M.E., Ph.D.

HEAD OF THE DEPARTMENT
PROFESSOR AND HEAD,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING,
VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY,
MADURAI-9

SIGNATURE
Mr. KR. SENTHIL MURUGAN,
B.E., M.E., M.B.A.,(Ph.D)

SUPERVISOR
ASSISTANT PROFESSOR II,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING,
VELAMMAL COLLEGE OF ENGINEERING AND TECHNOLOGY,
MADURAI-9

Submitted for the university viva - voce held on _____
at Velammal College of Engineering and Technology.

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ABSTRACT

According to the risk investigations of being involved in an accident, alcohol-impaired driving is one of the major causes of motor vehicle accidents. Preventing highly intoxicated persons from driving could potentially save many lives. This paper proposes a lightweight in-vehicle alcohol detection that processes the data generated from six alcohol sensors (MQ-3 alcohol sensors) using an optimizable shallow neural network (O-SNN). The experimental evaluation results exhibit a high-performance detection system, scoring a 99.8% detection accuracy. Hence, the proposed model can be efficiently deployed and used to discover in-vehicle alcohol with high accuracy and low inference overhead as a part of the driver alcohol detection system for safety (DADSS) system aiming at the massive deployment of alcohol-sensing systems that could potentially save thousands of lives annually.

Our project is to develop and review a fire alarm navigation system and application that uses the internet of things. Fire alarm systems are designed to warn people about fires in advance so that they can evacuate the fire-affected area and take immediate action to control the fire. There will be a temperature sensor, microcontroller (Arduino UNO R3), DC motor (control), switch, buzzers, LEDs, and a GSM module, Arduino IDE will be utilised as the software operations for the accident forestalment, discovery, and reporting system to ensure early notification to authorities and fire stations.

TABLE OF CONTENTS

LIST OF ABBREVATIONS

MQ3	Metal Oxide Semiconductor
O-SNN	Optimizable-Shallow Neural Network
DADSS	Driver Alcohol Detection System for Safety
DIP	Dual Inline Package
DC	Direct Current
LED	Light Emitting Diode
GSM	Global System for Mobile communication
GPS	Global Positioning System
IDE	Integrated Development Environment
UNO	One in Italian
WHO	World Health Organization
IoT	Internet of Things
LM35	Linear Monolithic
ADC	Analog to Digital Converter
I/O	Input Output
API	Application Programming Interface
DHT	Distributed Hash Table
IIot	Industrial Internet of Things
V2I	Vehicle to Infrastructure
IP	Internet Protocol

LIST OF FIGURES

1. INTRODUCTION

1.1 OVERVIEW

Road safety is still a significant development issue, a public health issue, and a major global cause of death and injury. According to the World Health Organisation, at least one out of every ten individuals killed on roads around the world is an Indian. In addition to the victims and their families, the economy as a whole, bears the cost of road accidents in terms of premature deaths, injuries, disabilities, and lost potential income. The fact that we haven't made much progress on this front despite the government's ongoing efforts in this area and our goals to halving deaths is, in fact, extremely concerning.

Fig 1. Road Accident

One of the largest national public health concerns right now is "Road Safety". The death toll from traffic accidents is in the thousands each year, and the clock is always running. If we want to accomplish the goals of sustainable development, wealth, and progress, we cannot compromise on road safety. Road safety is essential for a person's and the country's ability to live happy, healthy, and prosperous lives.

The problem affects all categories of road users, including walkers, bikers, and drivers, as well as unauthorised roadside sellers and other intruders. Travel

dangers and traffic exposure increase significantly more quickly with increasing motorization and a growing road network since the number of registered vehicles constantly grows faster than the population and more roads are built. Road traffic accidents are one of the top causes of deaths, disability, and hospitalisations today, and they have a significant socioeconomic impact worldwide.

1.2 INTRODUCTION OF IoT

The internet of things, or IoT, is a network of connected computing devices, mechanical and digital machines, objects, animals, or people that can exchange data over a network without requiring human-to-human or human-to-computer interaction. The term "thing" refers to any natural or artificial object that can be given an Internet Protocol (IP) address and has the ability to transfer data over a network, including people with implanted heart monitors, farm animals with biochip transponders, cars with built-in tyre pressure monitors, and other examples.

1.2.1 WORKING OF IoT

The Internet of Things (IoT) ecosystem is made up of web-enabled smart devices that use embedded systems, such as processors, sensors, and communication hardware, to gather, send, and act on the data they gather from their surroundings. By connecting to an IoT gateway or other edge device, which either sends data to the cloud for analysis or analyses it locally, IoT devices share the sensor data they collect. Sometimes, these gadgets communicate with other connected devices and act on the information they acquire from one another. Although people can interact with the devices to set them up, give them instructions, or access the data, the devices do the majority of the work without their help.

1.2.2 APPLICATIONS OF IoT

There are numerous real-world applications of the internet of things, ranging from consumer IoT and enterprise IoT to manufacturing and industrial IoT (IIoT). IoT applications span numerous verticals, including automotive, telecom and energy. In the consumer segment, for example, smart homes that are equipped with smart thermostats, smart appliances and connected heating, lighting and electronic devices can be controlled remotely via computers and smartphones.

In order to make users' life easier and more comfortable, wearable technologies with sensors and software may gather and analyse user data. They can also convey messages to other technologies concerning the users. In order to improve first responders' response times during emergencies, wearable gadgets are also employed in public safety. For instance, they can provide optimised routes to a location or monitor the vital signs of firemen or construction workers at potentially fatal work sites.

Fig 2. IoT in Location Tracking

IoT in healthcare has several advantages, one of which is the capacity to track patients more closely by analysing the data produced. IoT devices are frequently used in hospitals to carry out activities like managing the inventory of drugs and medical equipment.

Fig 3. IoT in Healthcare

Utilising sensors that determine the number of inhabitants in a room, smart buildings can, for example, lower energy expenditures. Automatic temperature adjustments can be made, such as turning on the air conditioner if sensors detect that a conference room is full or reducing the heat if everyone has left the workplace.

Fig 4. IoT in Buildings

IoT-based smart farming systems in agriculture can support the monitoring of crop fields' light, temperature, humidity, and soil moisture via connected sensors. Irrigation system automation benefits from IoT as well.

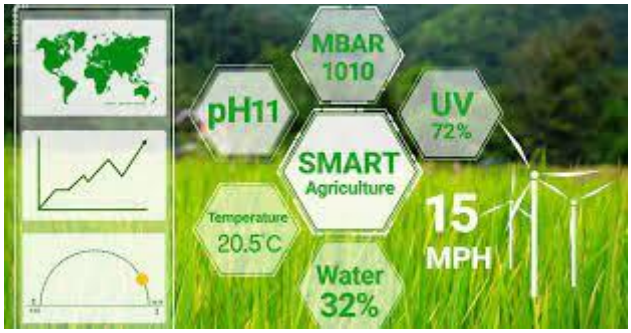

Fig 5. IoT in Agriculture

IoT sensors and deployments, such smart metres and lamps, can reduce traffic, save energy, monitor and handle environmental issues, and enhance sanitation in a smart city.

Fig 6. IoT in Smart City

1.3 PROBLEM DEFINITION

According to statistics conducted by the WHO (World Health Organization), road traffic injuries claim the lives of more than 50% of people each year. Furthermore, according to WHO, the likelihood of driving while intoxicated is increasing globally, which increases the risk of a serious traffic collision. Despite the fact that a number of awareness campaigns have been launched and laws have been enacted in the interests of the populace, people continue to break the law, including those prohibiting driving while intoxicated. Therefore, a problem-solving strategy is to design an original and prose project of Use of safety

equipment is required for detecting alcohol and battery fires with an embedded system.

1.4 OBJECTIVE

The main goal of the project is to ensure the safety of the people preventing them from accidents.

1. To develop a technology that will improve driving safety
2. To check whether he/she has consumed alcohol or not, alcohol sensor will detect whether the person has consumed alcohol or not
3. To ensure that the driver does not gets distracted
4. To detect the heat of the battery before the vehicle meets any fire accidents due to over-heat of the battery

2. LITERATURE SURVEY

In our survey we researched for multiple sites for smart accident prevention system and came across few which were similar to what we needed. By using this survey, we have been able to add and make changes to our project step by step. The project has been equally divided and completed by all four members of the group.

Below is the details of the sites of road accident detection and prevention system:

2.1 VEHICLE ACCIDENT DETECTION AND PREVENTION USING IoT AND DEEP LEARNING

Authors: Lakshmy S; Renjith Gopan; Meenakshi M L; Adithya V; Mariya R Elizabeth

Year: 2022

Link: https://ieeexplore.ieee.org/document/9774089

Objective: To present an accident prevention mechanism developed through alcohol detection using an MQ3 alcohol sensor followed by automatic engine locking.

2.2 COST EFFECTIVE ACCIDENT PREVENTION SYSTEM FOR VEHICLES

Authors: Luqman Shahzad; Kumeel Rasheed; Imran Ahmad; Syed Waseem Haider; Syed Saad; Ejaz Ahmed

Year: 2021

Link: https://ieeexplore.ieee.org/document/9682266

Objective: To provide an attractive, low in price and intelligent environment with precise measurements to avoid accidents on roads.

2.3 ROAD ACCIDENT PREVENTION BY DETECTING DROWSINESS AND ENSURE SAFETY ISSUES

Authors: Sohel Rana; Md. Rabbi Hasan Faysal; Sajal Chandra Saha; Abdullah All Noman; Kawshik Shikder

Year: 2022

Link: https://ieeexplore.ieee.org/document/9331043

Objective: The design of a system that can alert the drivers and stopping them from driving while being in a drowsy state to mitigate road accidents have been presented. The system is also focused on ensuring safety issues like fastening the seatbelt, preventing unauthorized access, preventing driving while being in a drunk state, etc.

2.4 IoT BASED V2I FRAMEWORK FOR ACCIDENT PREVENTION

Authors: Hitesh Mohapatra; Asish Kumar Dalai

Year: 2022

Link: https://ieeexplore.ieee.org/document/9760623

Objective: To presented an IoT-based vehicle to infrastructure (V2I) model for better predictability about road behaviours. This V2I model helps to avoid accidents or collisions at cross-sections of the road. The implementation part of the proposed model has considered the speed of the vehicle and creates an advanced alert mechanism based on the speed.

2.5 ACCIDENT DETECTION AND PREVENTION SYSTEM USING IoT INTEGRATED IN AN ELECTRIC POLE

Authors: Minal S. Patil; Harshal Dharmik; Nikita Borate; Ritikesh Gokhe; Abhishek A. Madankar; Roshan Umate

Year: 2022

Link: https://ieeexplore.ieee.org/abstract/document/9885559

Objective: In the proposed system when a vehicle comes from opposite direction and it may lead to accident so it providing the accident prevention before it's occurring. An indicator lights up if it detects a moving vehicle coming from the other side of the road.

2.6 AN IoT BASED SMART SYSTEM FOR ACCIDENT PREVENTION AND DETECTION

Authors: Sayanee Nanda; Harshada Joshi; Smita Khairnar

Year: 2018

Link: https://ieeexplore.ieee.org/document/8697663

Objective: To propose a system which can effectively help in preventing any kind of mishaps and if such conditions occur then how it detects and informs the concerned authorities and people, so that the situation can be taken care of immediately.

2.7 INTELLIGENT ACCIDENT PREVENTION AND DETECTION FOR FOUR-WHEELER

Authors: KR. Senthil Murugan; R. Roshni

Year: 2018

Link: https://ieeexplore.ieee.org/document/9489046

Objective: To locate the exact site of accidents and send the ambulance to the correct location, as well as to reduce traffic so that the ambulance arrives on time at the hospitals.

3. ABOUT THE SYSTEM

3.1 EXISTING SYSTEM

Nowadays, the number of accidents has increased rapidly. About 17 accidents take place every hour. Bike accidents constitute a major chunk of all accidents; this is because two-wheelers do not have as many safety parameters which are included in four-wheelers. Reasons causing it can be due to not wearing a helmet, feeling drowsy while driving, alcohol consumption, two vehicles coming into closer proximity without both drivers' notice, breaking of traffic signals, driving without a valid or no driving license, careless driving, unintended triggering of the acceleration pedal, etc

The main objective of this paper is to propose a system which can effectively help in preventing any kind of mishaps and if such conditions occur then how it detects and informs the concerned authorities and people, so that the situation can be taken care of immediately. This system detects accidents by vibration sensors, accelerometers. For detection, we use GPS and GSM module which locates the site of the accident and correspondingly informs the person's near ones and nearby hospitals through a text message. Only sending a text message to nearby hospitals won't be enough because it cannot avoid secondary accidents and hence, this system caters this requirement too.

Previously, there was no technology to lock the engine of the vehicle after sensing the alcohol consumption by the driver which was considered to the main cause of the accidents. There was manual checking after particular distance on the roads or the highways but still these checks were not sufficient to stop the happening of the misshapes. To avoid these problems, this project vehicle detection and alcohol sensing alert with engine locking system is developed. Till date, there has been a

lot of study about predicting a detecting the vehicle accident but there has not been pre-intimation to the drivers about the accident. In this project, we propose to overcome the accident.

DISADVANTAGES OF THE EXISTING SYSTEM:

- Requires some extra amount to implement
- Costlier System
- Implementation is difficult, but it can be implemented in inbuilt
- Cost of the system increases due to use of the additional sensor
- Use of additional modules like GSM makes the system costlier

3.2 NEED FOR NEW SYSTEM

The current scenario shows that the most of the road accidents are occurring due to drunk-driving. The restricted ability of enforcement agents undermines each manual effort geared toward edge drink-driving. There is therefore the need for an alcohol detection system that can function without the restriction of space and time. This project presents the design and implementation of an Alcohol Detection with Engine Locking for cars using the Ultrasonic Sensor and Arduino UNO. The system will continuously monitor level of alcohol concentration in alcohol detection sensor and thus turn off the engine of vehicle if the alcohol concentration is above the threshold level.

The project provides an efficient solution to control accidents due to drunk driving. Because of the increasing number of fire incidents, this study paves way to mitigate some risks on this kind of catastrophic event. Fire safety systems are important means of prevention and are designed primarily to provide building occupants prompt warning and instruction to safely evacuate the premises if a fire

occurs. When correctly maintained, operating fire safety systems are proven to be life saving devices that can get you out of a situation that would potentially turn into a tragedy.

3.3 PROPOSED SYSTEM

In the proposed system, we are going to identify whether the person driving the car has consumed alcohol or not. Alcohol sensors assist us in determining whether or not a driver is intoxicated. The car warns the driver if they are too intoxicated and the motor shuts off. Use the GSM module to send an alarm if you smell alcohol. The system includes a temperature sensor, an alcohol sensor, an accelerometer, a GSM module, a motor, a buzzer, a led, etc., all of which are connected to the main microcontroller unit. With a temperature sensor, we can monitor the engine's temperature and alert the driver if it rises above normal levels.

The main advantages of the proposed system are:

- Avoiding the count of accidents
- Ensuring the safety of the drivers
- Faster and quick process
- Reliable system
- Simple system

4. REQUIREMENT ANALYSIS

4.1 SOFTWARE SPECIFICATION

The system is specified in the software requirements paper. Both a definition and a list of prerequisites should be included. It is a list of what the system ought to accomplish as opposed to how it ought to do it. The software requirements specification is built on top of the software requirements. It helps with cost estimation, task planning, task execution, team tracking, and team progress monitoring throughout the development activity.

4.1.1 SOFTWARE REQUIREMENTS

- Arduino IDE
- Google Maps
- Messaging Apps
- Processor: intel core i3 10^{th}
- Speed: 1.20 GHz
- RAM: 12 GB
- System Type: 64-bit OS
- Version: 22H2

4.2 HARDWARE SPECIFICATION

The hardware requirements may serve as the basis for a contract for the implementation of the system and should therefore be a complete and consistent specification of the whole system. They are used by software engineers as the starting point for the system design. The hardware and operating system settings

for the computers in your deployment are described in a computer hardware and operating system specification.

4.2.1 HARDWARE REQUIREMENTS

- Arduino UNO
- Temperature Sensor (LM35)
- Alcohol Sensor (MQ3)
- Buzzer
- DC Motor (Control Switch)
- Microcontroller (Arduino UNO R3)
- Micro Sim Card Board
- Temperature Detection LED
- Connecting Wires
- Mobile Phone
- Keyboard: Standard Windows Keyboard
- Mouse: Two or Three Button Mouse

5. SYSTEM ARCHITECTURE

5.1 BLOCK DIAGRAM

The automobile unit features temperature and alcohol sensors, as well as a buzzer and red-light LEDs for warning, as accident prevention techniques. The blood alcohol content of the driver is initially determined by an alcohol sensor the motor turns and the vehicle is ready for use if it falls below a certain threshold. The engine shuts off once alcohol is found. Similar to this, the eye blink sensor detects when the driver feels tired and alerts him or her with a buzzer and red LED lights. The technology will also constantly check the engine temperature and keep you informed if it rises beyond a certain level. An accelerometer is also a part of the vehicle unit, and it continuously updates the microcontroller with the coordinates of the car's position. If it is discovered at random, the GPS location tracker monitors it and notifies the emergency number with values for latitude, longitude, and position on Google Maps.

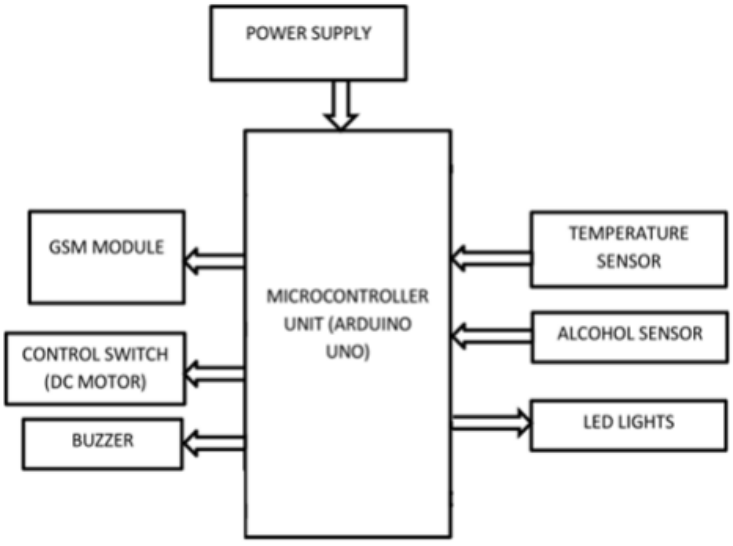

Fig 7. Block Diagram

5.2 DATA FLOW DIAGRAM

A data flow diagram (DFD) maps out the flow of information for any process or system. It is a way of representing the flow of data through a process or a system. The DFD also provides information about the outputs and inputs of each entity and the process itself.

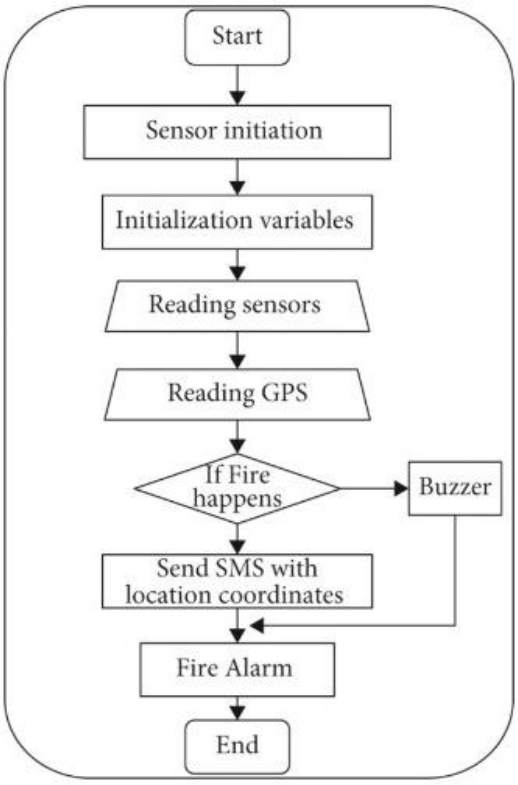

Fig 8. Data Flow Diagram

5.3 USE CASE DIAGRAM

The purpose of the use-case diagram is to describe the high-level functions and scope of a system. These diagrams also identify the interactions between the system and its actors. The use cases and actors in use-case diagrams describe what the system does and how the actors use it, but not how the system operates internally.

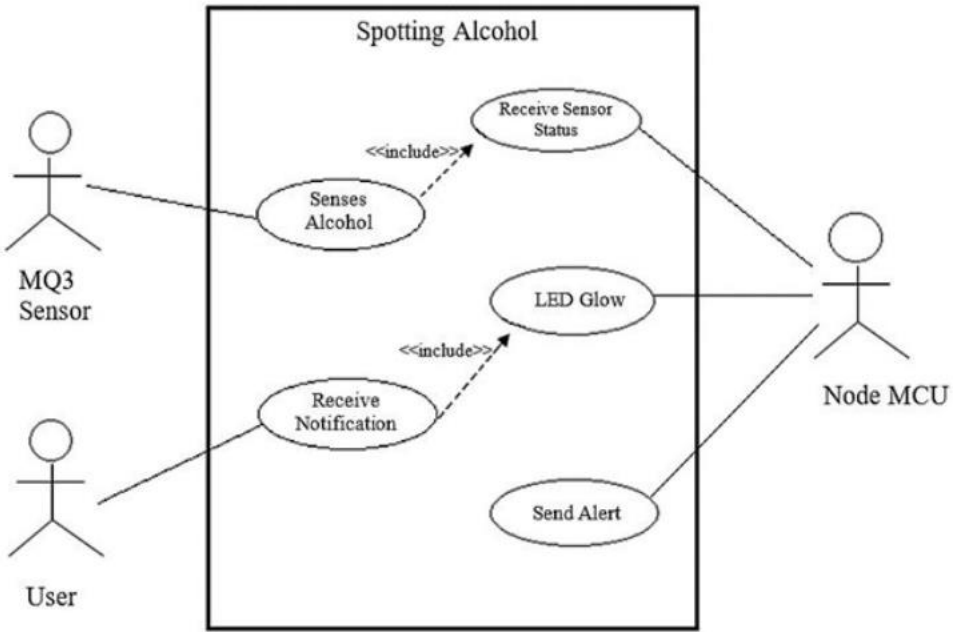

Fig 9. Use Case Diagram

5.4 COMPONENT DIAGRAM

A component diagram, also known as a UML component diagram, describes the organization and wiring of the physical components in a system. Component diagrams are often drawn to help model implementation details and double-check that every aspect of the system's required functions are covered by planned development.

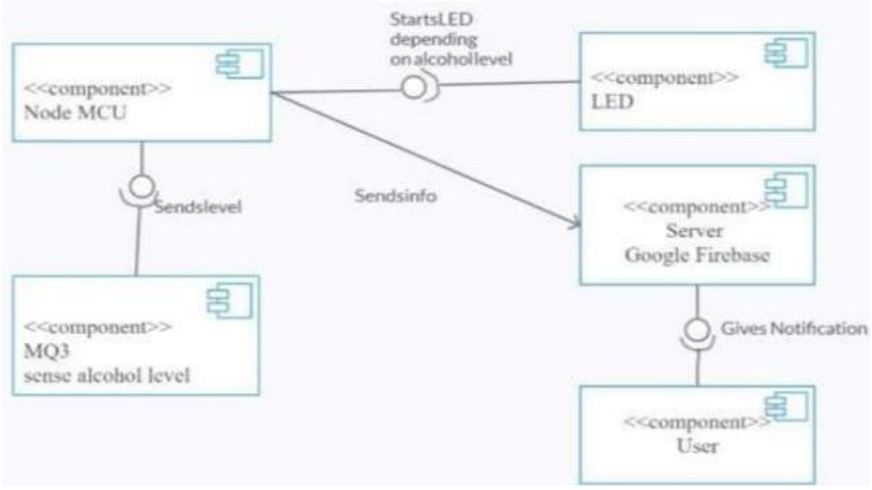

Fig 10. Component Diagram

5.5 DEPLOYMENT DIAGRAM

The purpose of deployment diagram is to visualize the topology of the physical components of a system, where the software components are deployed. Deployment diagrams are used to describe the static deployment view of a system. Deployment diagrams consist of nodes and their relationships.

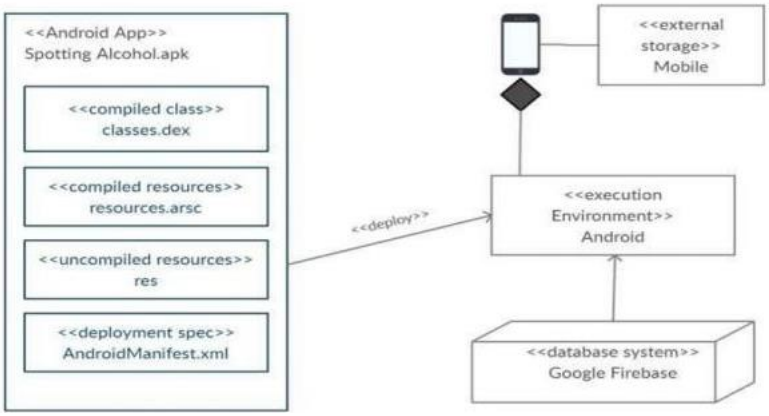

Fig 11. Deployment Diagram

5.6 SEQUENCE DIAGRAM

A sequence diagram is a type of interaction diagram because it describes how—and in what order—a group of objects works together. These diagrams are used by software developers and business professionals to understand requirements for a new system or to document an existing process.

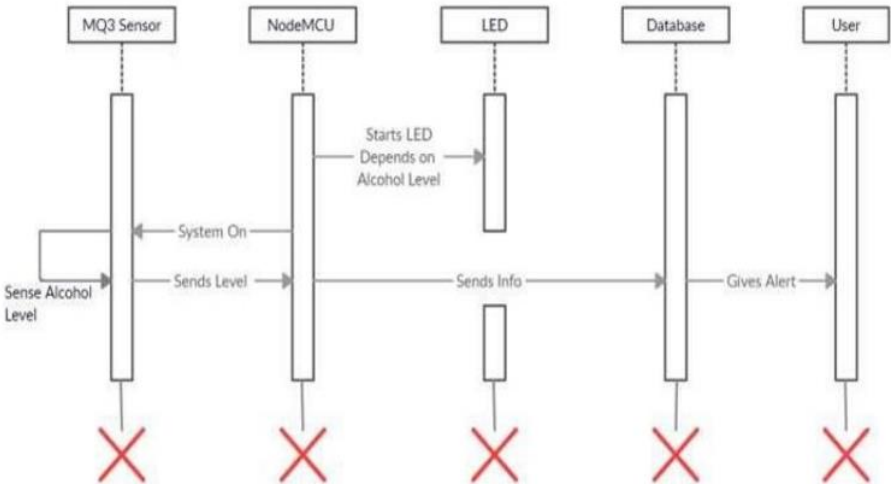

Fig 12. Sequence Diagram

6. WORKING ENVIRONMENT

In our system, we initially focused on preventing car accidents, and even after all the precautions have been taken, if an accident does happen, the system still recognises it. The technology alerts the owner automatically after a vehicle collision is detected. The system is set up in the vehicles. The MQ-3 alcohol sensor and the LM35 temperature sensor are employed as preventative measures for auto accidents. Accelerometer is placed and a GSM module is utilised to detect car accidents. Engine control is handled by a motor (control switch), and warning measures like buzzers and LED lights are employed.

These gadgets connect to the main microcontroller (Arduino Uno) unit. Alcohol sensors assist us in determining whether or not a driver is intoxicated. If the driver is excessively drunk, a warning will be given and the engine will be turned off. A motorist is alerted if he or she begins to nod off using an eye blink sensor. Temperature sensors assist us in determining the engine's temperature, and if the engine becomes warmer than it should, a red Light will alert the driver.

6.1 ARDUINO UNO

Arduino is an easy-to-use open platform to create electronics projects. Arduino boards play a vital role in creating different projects. It makes electronics accessible to non-engineers, hobbyists, etc. The various components present on the Arduino boards are Microcontroller, Digital Input/output pins, USB Interface and Connector, Analog Pins, Reset Button, Power button, LED's, Crystal Oscillator, and Voltage Regulator. Some components may differ depending on the type of board.

The most standard and popular board used over time is Arduino UNO. The ATmega328 Microcontroller present on the UNO board makes it rather powerful

than other boards. There are various types of Arduino boards used for different purposes and projects. The Arduino Boards are organized using the Arduino (IDE), which can run on various platforms. Here, IDE stands for Integrated Development Environment.

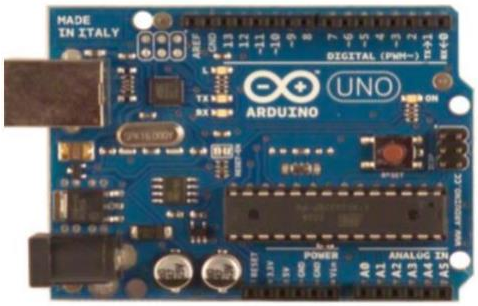

Fig 13. Arduino Board

6.2 TEMPERATURE SENSOR (LM35)

A detailed temperature sensor, the LM35 string's output voltage can be exactly proportional to temperature in Celsius (centigrade). The ambient temperature affects the precession integrated circuit temperature sensor LM35's output voltage fluctuations. It is a tiny, inexpensive IC that may be used to measure temperatures between -55°C and 150°C. Any Microcontroller with an ADC function and any programming platform like Arduino can be readily interfaced with it.

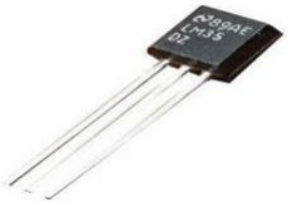

Fig 14. Temperature Sensor (LM35)

6.3 ALCOHOL SENSOR (MQ3)

It is easily interfaced to any Microcontroller with an ADC function and any development environment, such Arduino. When the target alcohol gas is present, the conductivity of the sensor rises along with the increase in gas concentration. The MQ-3 gas sensor is very sensitive to alcohol. It is well tolerant of the disruption caused by fuel, smoke, and mist. This sensor has a resistive analogue output. depending on the amount of alcohol consumed. The conductivity of the sensor increases as the concentration of alcohol gas increases when it is present.

Fig 15. Alcohol Sensor (MQ3)

6.4 BUZZER

A buzzer or beeper is a mechanical or electronic auditory signalling device. In electronic applications, piezoelectric and magnetic buzzers are most frequently utilized. The buzzers are made to be utilised in any circuit as a transducer or indicator. Buzzers and beepers are made to function in electronic circuits as either a transducer or an indication. Alarm clocks, timers, and other electronic devices are common uses for buzzers as well as verification of user input like a mouse click or keyboard. A magnetic field is created in a magnetic buzzer by driving current through a coil of wire. While the current is there, a flexible ferromagnetic disc is drawn to the coil; when the current is absent, the disc returns to its "rest" position. The potential differences between the circuit's source and sink cause the buzzer, an electrical device, to produce audible sound. After the circuit is complete, vibrations start to build in the device's diaphragm, which produces the buzzing or beeping sound.

Fig 16. Buzzer

6.5 DC MOTOR (CONTROL SWITCH)

Any of a class of electrical machines that rotate known as DC motors convert electrical energy from direct current into mechanical energy. The majority of kinds rely on the magnetic field's forces. Almost all DC motor types contain an internal mechanism. To sporadically switch the direction of current flow in a motor component, either electromechanically or electronically. A DC motor controller is able to quickly reverse, causing the DC motor driving current to flow in the other direction, and it can change the position, speed, or torque of a DC powered motor. Reverse, quick starting and stopping, stronger starting torque, changing speeds with voltage input, and more are all available.

Fig 17. DC Motor

6.6 MICROCONTROLLER (ARDUINO UNO R3)

The Arduino Uno R3 microcontroller board is built on a detachable, dual-inline package. The board includes a variety of extension boards (shields), extra circuits, and digital and analog input/output (I/O) pin sets for interface. The board has 6

analog I/O pins, 6 digital I/O pins, and 14 digital I/O pins, six of which can be used for PWM output. It can be programmed using the Arduino IDE (Integrated Development Environment) using a type B USB cable. It has a 3.3 volt and a 5 volt output pin. Three ground pins are also included. An open source hardware computer platform is the Arduino Uno R3. The ATmega328 microcontroller is used. The ATmega16u2 is also included on the board to serve as an onboard USB to serial converter. Applications that work either alone or in conjunction with other devices can be created using the Arduino Uno R3.

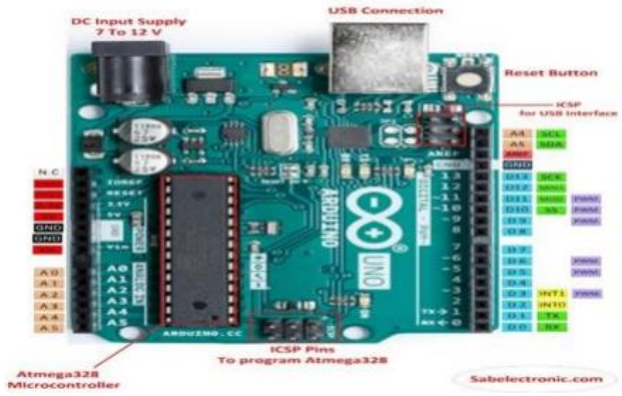

Fig 18. Microcontroller

6.7 MICRO SIMCARD BOARD

Sim800L is a low-cost, small-footmark GSM route board that has all the same functionality as the larger SIM900 GSM module and securities. Located in the middle of the lowest SIM800L GPRS GSM module is a quadrangle-band TTL periodical harbourage of the micro SIM card. This is a SIMCom SIM800L grounded GPRS GSM module which is a GSM GRPS Quad-Band module. microSIM card. This is a SIMCom SIM800L based GPRS GSM module which is a GSM GRPS Quad-Band module.

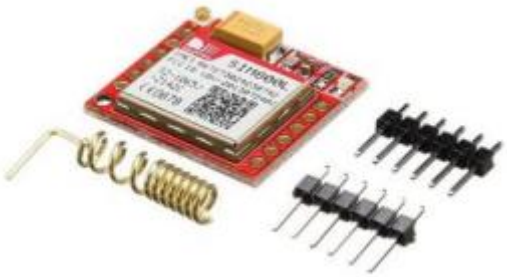

Fig 19. Micro Simcard Board

Algorithm for the working of the system:

1. Start the system by turning on the switch.
2. The system is supplied with an adequate level of electricity.
3. Upon system activation, an alcohol sensor determines whether or not the motorist is intoxicated. If the driver is too inebriated, the system warns them and the car's engine slows down.
4. If no alcohol is found, the car will either start right up or continue to run.
5. Constant temperature monitoring aids in determining how hot the engine is, and if it gets too hot, the driver receives a red-light alarm; otherwise, the vehicle continues to go.
6. A sensor that detects accidents delivers a signal to the microcontroller for continued operation if temperature rises.
7. GSM modules relay messages to police and ambulance emergency numbers.
8. All of the sensors are continuously monitored as soon as the system is switched on using an Arduino Uno microcontroller to do all preventive, detecting, and reporting activities.

7. SYSTEM IMPLEMENTATION

To create an alcohol indicator, we interfaced the blood alcohol level detector with an Arduino board, LEDs, and a MQ-3 alcohol sensor. Although there are other MQ-X sensors on the market for a variety of applications, we will pick MQ-3 in this instance because it is the most effective at detecting alcohol. The majority of MQ sensors operate in the same way. All of them have a heating element that uses a layer of conducting material whose resistance is continuously monitored to heat up. The MQ-3 sensor's resistance changes when alcohol vapours or odours come into touch with it. Both digital and analogue output are provided by the sensor. The difference between the two is very straightforward: with digital output, only high or low values—either 1 or 0—are transmitted to a microcontroller, whereas with an analogue signal, a wide range of values— from 0 to 1023—are transmitted to the microcontroller, which reflects the level of alcohol in the immediate environment.

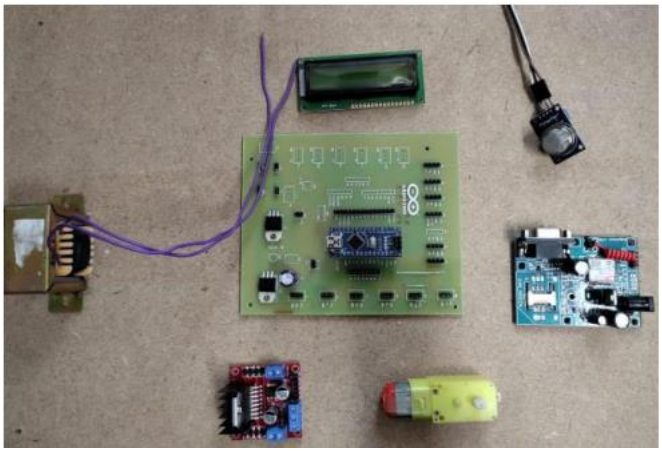

Fig 20. IoT Based Smoke Detector

Initializing the pin to which the sensor delivers its data as soon as the code runs. Finally, during setup, we specify the kind of function such as input or output—

we wish to perform on the initialised pins. Following that, we read the data present on pin 3 and print that value on the monitor using the loop.
We also determine whether the sensor data is high or low, and depending on the result, the led glows or goes out.

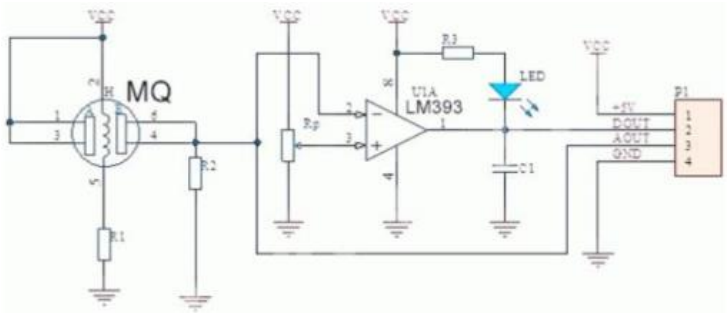

Fig 21. Schematic Diagram

We initialise the buzzer pin to pin 13 and change the pin mode in the setup part of the buzzer code to OUTPUT. We switch the buzzer's high and low settings in the loop part along with the led. With this step finished, a straightforward Homemade alcohol detector is ready for use. In this project, we connected an Arduino board to an LM35 temperature sensor to create a digital thermometer. The sensor's output voltage is inversely proportional to the temperature in degrees Celsius. LM35 has an accuracy of +/- 0.75°C and operates in the temperature range of -55°C to +150°C.

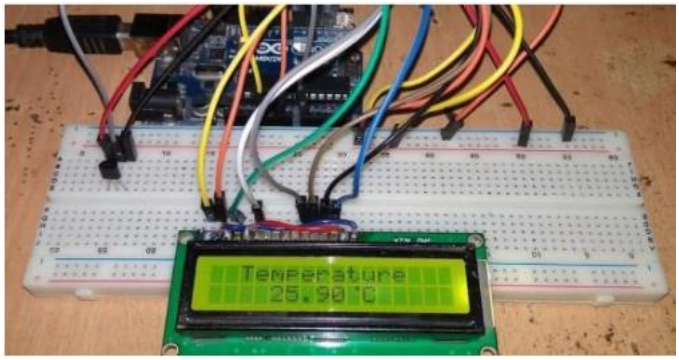

Fig 22. Temperature Detection LED

8. SYSTEM TESTING

8.1 IMPORTANCE OF TESTING

Testing has many benefits and one of the most important ones is cost effectiveness. Having testing in your project can save money in the long run. Software development consists of many stages and if bugs are caught in the earlier stages it costs much less to fix them. That is why it's important to get testing done as soon as possible.

It is a challenging process, especially when you have to test the IoT application with several devices at the same time. This makes it more complex to find out which device causes the problem or if there are other problems in your system. You will have to use different approaches and IoT testing tools when testing your application. For example, you can use manual testing by yourself or with help from other people if necessary. Or maybe you want to use automation tools. There are many different options available for testing IoT applications, but it all comes down to what works best for your business needs.

How testing can help your product security:

- The user gets a trustworthy product.
- Keeps user's personal information and data safe.
- Vulnerability free products.
- Problems and risks are eliminated beforehand.
- Saves a lot of troubles later on.

The ultimate goal for a product owner is to give the best customer satisfaction. Reasons why apps and software should be tested is to bring the best user experience possible.

There are some areas that should be taken into consideration when we talk about IoT testing.

- interoperability testing;
- testing the Internet of Things ecosystem under limited connection;
- techniques for standardization of platforms and possibility of configuration;

Another important step that should be explored will be automation of integration testing, but is hardly to be possible until IoT will reach its maturity.

8.2 TYPES OF TESTING

- Unit testing
- Functional testing
- Connectivity testing
- Performance testing
- Compatibility testing
- Security testing
- Regularity testing

8.2.1 UNIT TESTING

Unit testing is testing that each part, even the smallest unit will correspond with the defined documentation and APIs. Having the certainty that all it is running and correspond after the unit testing, we can go further and validate the software.

As is unit testing is actually testing an application, a function or a class. Usually unit testing is automated from our perspective when we talk about IoT devices, unit testing should start at the level of interconnecting of different objects / devices.

When we talk about IoT unit testing these should be the areas that a tester should cover for each device in the ecosystem. The software engineering it will always be covered by the manufacturers, so the ‘unit’ from the IoT perspectives is the device / object itself that should be tested, but in the corresponding architecture that will be part of.

8.2.2 FUNCTIONAL TESTING

Functionality testing includes end-to-end testing of the IoT ecosystem to ensure that the system generates the desired results and behaviours according to business requirements.

The purpose of these tests is to verify the application's functions to see if they meet all the functional requirements. It analyzes customer requirements and how the consumer wants the output, based on IoT application-specific inputs.

8.2.3 CONNECTIVITY TESTING

The main objective of connectivity testing is to ensure the connection between the objects and the communication infrastructure. Seamless connectivity is an element of critical importance in an IoT network.

As for the information exchanged between users and devices, IoT products implement APIs (Application Program Interfaces). These interfaces are programs

responsible for receiving a message and for replying to it through a new message. There are currently several tools available for testing APIs. These tools can simulate a message sent / received by a device, which helps validate information accuracy.

8.2.4 PERFORMANCE TESTING

Performance testing aims to test the behaviour of IoT devices along the network, to test internal capabilities of embedded systems and network communication. The primary objective of this type of test is to determine the relationship between the object and the software with which it interacts and to standardize the association between them. Performance testing validates the hardware and software components of a device based on multiple test cases.

8.2.5 COMPATIBILITY TESTING

It is an essential step in IoT testing that evaluates the interaction between IoT software and various intelligent devices, platforms, network layers and operating systems. It aims to guarantee the scalability and security of data exchanges and ensure the compatibility of communications protocols.

This type of testing must always be done in the real world and not in the virtual environment. Because IoT systems include a multitude of devices, sensors, protocols and platforms that are constantly updated, the number of possible combinations is extremely high.

Testing compatibility verifies whether the functions are working correctly in different configurations, combinations of device versions, protocols versions, mobile devices, and mobile operating system versions.

8.2.6 SECURITY TESTING

IoT is data centric where all the devices/system connected operate based on the data that is available. When it comes to the data flow between devices, there is always a chance that the data can be accessed or read when getting transferred. From a testing standpoint, we need to check if the data is protected/encrypted when getting transferred from one device to the other. Wherever, there is an UI, we need to make sure there is a password protection on it.

8.2.7 REGULARITY TESTING

This being a healthcare system needs to pass through multiple regulatory/compliance checkpoints. Think of a scenario where the product passes through all the testing steps but fails in the final compliance checklist [testing performed by regulatory body]. It is a better practice to get the regulatory requirements in the starting of the development cycle itself. The same should be made part of the testing checklist. By doing that, we make sure the product is certified for the regulatory checklist as well.

9. FEASIBILITY STUDY

A feasibility study is a preliminary assessment of a project's practicality, which involves analysing various aspects of the project to determine whether it can be successfully implemented within the desired constraints. The feasibility of the project is analysed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

The four key considerations involved in the feasibility analysis are,

- ECONOMICAL FEASIBILITY
- TECHNICAL FEASIBILITY
- SOCIAL FEASIBILITY
- LEGAL FEASIBILITY

9.1 ECONOMIC FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus, the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

9.2 TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

9.3 SOCIAL FEASIBILITY

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

9.4 LEGAL FEASIBILITY

The legal feasibility of the project can be determined by assessing whether the project complies with the legal and regulatory requirements of the country or region where it will be implemented. In this project, data privacy laws and regulations must be considered since sensitive employee health data will be collected and stored.

10. SAMPLE CODING

Code to detect the alcohol:

```
#include "DHT.h"
#define DHTPIN A1
#define DHTTYPE DHT11
DHT dht (DHTPIN, DHTTYP E);

#include <SoftwareSerial.h>
SoftwareSerial mySerial (6,7);

#include <LiquidCrystal.h>
const int rs = 13, en = 12, d4 = 11, d5 = 10, d6 = 9, d7 = 8;
LiquidCrystal lcd (rs, en, d4, d5, d6, d7);

float t;
int val, val1;
void setup() {
Serial.begin(9600);
mySerial.begin(9600);
lcd.begin(16, 2);
pinMode(2, OUTPUT);
pinMode(A0, INPUT);

dht.begin();
analogWrite(6,255);
}
```

```
void loop() {
  t = dht.readTemperature();
  float h = dht.readHumidity();
  //Serial.print(F("%  Temperature: "));
  //Serial.println(t);
      lcd.setCursor(0,0);
      lcd.print("T:");
      lcd.print(t);
      lcd.print(" ");

  if(t > 36)  {
    digitalWrite(4,HIGH);
    digitalWrite(7,HIGH);
    delay(200);
    lcd.print("HT");
    lcd.print(" ");
  }
  else  {
        digitalWrite(4,LOW);
        digitalWrite(7,LOW);
        lcd.print("  ");
        lcd.print(" ");
  }

val1 = digitalRead(A0);
Serial.println(val1);
if(val1 ==  LOW)  {
  digitalWrite(4,HIGH);
  lcd.setCursor(0,1);
```

```
  lcd.print("AL detected.....");
  analogWrite(6,100);
  sms1();
}
else  {
  digitalWrite(4,LOW);
}
delay(500);
}

void sms1()  {
  lcd.setCursor(0, 1);
  lcd.print("SENDING SMS.............");
  mySerial.println("AT\r");
  delay(1000);
  mySerial.println("AT+CMGF=1\r");
  delay(1000);
  mySerial.println("AT+CMGS=\"+919487392030\"\r");
  delay(1000);
  mySerial.println("Alcohol detected..");
  delay(1000);
  mySerial.println((char)26);
  delay(1000);
  lcd.setCursor(0, 1);
  lcd.print("SMS SENT.............");
  d:goto d;
}
```

11. RESULT

The system receives a sufficient amount of electricity. An alcohol sensor detects whether the driver is drunken when the device is enabled. The technology alerts the driver and turns off the car's engine if they are operating it while alcoholic. The car will either start right up or keep running if no alcohol is present. The engine's temperature is continuously monitored to help identify how hot it is; if it rises too high, the driver is alerted with a red light, but if not, the car continues to move. If the temperature rises, a sensor that detects accidents sends a signal for the microcontroller to keep running. GSM modules provide messages to emergency phone numbers for the police and paramedics. As soon as the system is turned on, all of the sensors are monitored regularly. All prevention, detection, and reporting tasks are carried out utilising an Arduino Uno microcontroller.

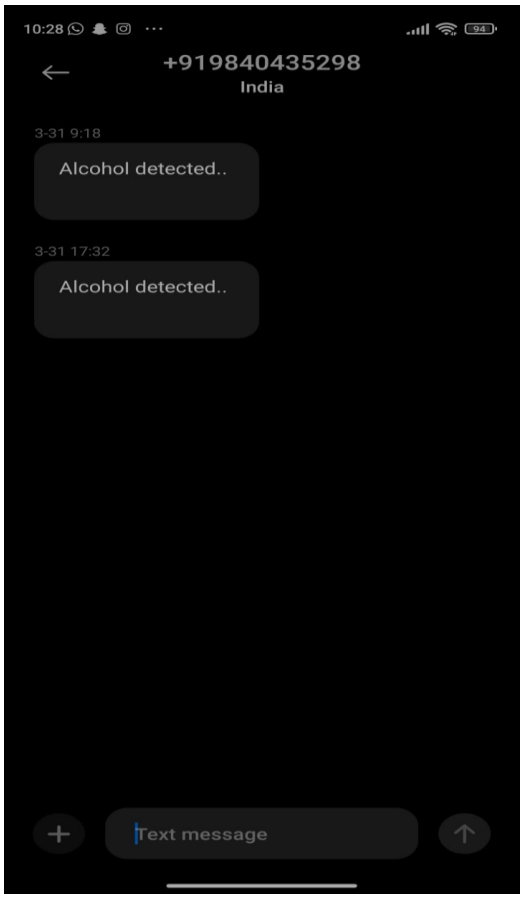

Fig 23. Message for alcohol detection by driver

12. CONCLUSION

By requiring the usage of safety equipment, the system verifies the safety of the drivers. Also, it guarantees that no alcohol will be absorbed during the voyage. Driver is warned of fire hazards by the fire alarm system. Also, the reporting system aids in alerting family members via SMS when a fire mishap occurs so they can receive emergency care.

The cumulative of these systems comes with the advantage of

- Avoiding the count of accidents
- Ensuring the safety of the drivers
- Faster and quick process

13. REFERENCES

[1] N. Mandal, A. Sainkar, O. Rane and M. Vibhute, "Vehicle Tracking with Alcohol Detection & Seat Belt Control System," 2020 International Conference for Emerging Technology (INCET), Belgaum, India, 2020, pp. 1-5, doi: 10.1109/INCET49848.2020.9154093.

[2] R. Patnaik, K. S. Krishna, S. Patnaik, P. Singh and N. Padhy, "Drowsiness Alert, Alcohol Detect and Collision Control for Vehicle Acceleration," 2020 International Conference on Computer Science, Engineering and Applications (ICCSEA), Gunupur, India, 2020, pp. 1-5, doi: 10.1109/ICCSEA49143.2020.9132932.

[3] S. Al-Youif, M. A. M. Ali and M. N. Mohammed, "Alcohol detection for car locking system," 2018 IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE), Penang, Malaysia, 2018, pp. 230-233, doi: 10.1109/ISCAIE.2018.8405475.

[4] M. Malathi, R. Sujitha and M. R. Revathy, "Alcohol detection and seat belt control system using Arduino," 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), Coimbatore, India, 2017, pp. 1-3, doi: 10.1109/ICIIECS.2017.8275841.

[5] M. M S, A. R, S. T, S. M S and C. A. S, "Advanced Wireless techniques to avoid accidents on roads through wearing Smart helmet," 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2021, pp. 258-264, doi: 10.1109/ICICCS51141.2021.9432193.

[6] R. Mounika, S. Hussian.Sk and L. Venkateshwara Kiran, "A Novel Approach for Accident Prevention Using IOT," 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN), Vellore, India, 2019, pp. 1- 5, doi: 10.1109/ViTECoN.2019.8899717.

[7] M. H. Islam, A. A. Khandoker, T. M. Safi Sami, T. I. Talukder, M. I. Rahman and P. K. Sarkar, "Car Accident Prevention And Health Monitoring System For Drivers," 2021 IEEE Region 10 Symposium (TENSYMP), Jeju, Korea, Republic of, 2021, pp. 1-6, doi: 10.1109/TENSYMP52854.2021.9551006.

[8] V. Satish and S. Gowri, "Advanced Internet of Things (IoT) Based Technique for Prevention of Road Accidents," 2021 5th International Conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, 2021, pp. 433-439, doi: 10.1109/ICECA52323.2021.9675863.

[9] L. Rachakonda, S. P. Mohanty, E. Kougianos and M. A. Sayeed, "Smart-Steering: An IoMT-Device to Monitor Blood Alcohol Concentration using Physiological Signals," 2020 IEEE International Conference on Consumer Electronics (ICCE), Las Vegas, NV, USA, 2020, pp. 1-6, doi: 10.1109/ICCE46568.2020.9043045.

[10] S. Johnpaul, C. T. Selvan and P. J. Raguraman, "IoT based Smart Helmet System for Accident Prevention," 2022 International Conference on Edge Computing and Applications (ICECAA), Tamilnadu, India, 2022, pp. 599-602, doi: 10.1109/ICECAA55415.2022.9936313.

[11] D. Selvathi, P. Pavithra and T. Preethi, "Intelligent transportation system for accident prevention and detection," 2017 International Conference on Intelligent

Computing and Control Systems (ICICCS), Madurai, India, 2017, pp. 442- 446, doi: 10.1109/ICCONS.2017.8250761.

[12] S. S. Tippannavar, E. A. Madappa and R. S. B, "Automatic Accident Alert System – Early Accident Prediction and Warning for the consumers," 2022 IEEE 2nd Mysore Sub Section International Conference (MysuruCon), Mysuru, India, 2022, pp. 1-6, doi: 10.1109/MysuruCon55714.2022.9972367.

[13] M. Ismail, A. Marwanto, J. P. Hapsari and M. Haddin, "Embedded Alcohol Sensing Design And Analysis For Air Samples," 2021 8th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI), Semarang, Indonesia, 2021, pp. 85-89, doi: 10.23919/EECSI53397.2021.9624305.

[14] Jesudoss, R. Vybhavi and B. Anusha, "Design of Smart Helmet for Accident Avoidance," 2019 International Conference on Communication and Signal Processing (ICCSP), Chennai, India, 2019, pp. 0774-0778, doi: 10.1109/ICCSP.2019.8698000.

[15] P. Upender, G. N. Reddy and G. Santoshini, "Arduino based Accident Prevention System with Eye Twitch and Alcohol sensor," 2020 12th International Conference on Computational Intelligence and Communication Networks (CICN), Bhimtal, India, 2020, pp. 130-134, doi: 10.1109/CICN49253.2020.9242577.

[16] M. Mizan, A. Z. M. Tahmidul Kabir, N. Zinnurayen, T. Abrar, A. J. Ta-sin and Mahfuzar, "The Smart Vehicle Management System for Accident Prevention by Using Drowsiness, Alcohol, and Overload Detection," 2020 10th Electrical Power, Electronics, Communications, Controls and Informatics Seminar

(EECCIS), Malang, Indonesia, 2020, pp. 173-177, doi: 10.1109/EECCIS49483.2020.9263429.

[17] D. H. Patel, P. Sadatiya, D. K. Patel and P. Barot, "IoT based Obligatory usage of Safety Equipment for Alcohol and Accident Detection," 2019 3rd International conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, 2019, pp. 71-74, doi: 10.1109/ICECA.2019.8822104.