

AN IMPERATIVE IoT BASED VEHICLE ACCIDENT DETECTION AND REPORTING SYSTEM

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

by

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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade “A++” by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of
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ACCIDENT DETECTION AND REPORTING SYSTEM**" under our supervision from
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We **BAKIYALAKSHMI V** (Reg. No. 40140005) and **SWETHA P** (Reg. No. 40140036) hereby declare that the Project Report entitled "**AN IMPERATIVE IoT BASED VEHICLE ACCIDENT DETECTION AND REPORTING SYSTEM**" done by us under the guidance of **Dr. C. BHUVANESWARI** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering.

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ABSTRACT

An accident is an unexpected and unwanted event. One of the primary causes of car accidents is speed. Many lives could be saved if rescue services received accident information and responds to it quickly. The advancement of technology has also resulted in an increase in traffic dangers and road accidents which result in huge loss of life and property due to inadequate emergency services .With an increasing number of vehicles, the number of accidents is also increasing at an unprecedented rate. Each year, among the total number of deaths 1.5 million deaths occurred due to the vehicle accident. In India, the root causes of these accidents are due to the drunken driver, drowsiness, and badly designed speed breakers. There is no effective mechanism to prevent these root causes. Our proposed system provides an efficient, cost-effective and real-time solution to prevent vehicle accident. Since, after an accident every second counts and immediate action is required to avoid the death of a person. One of the most effective technologies is accident detection systems so that the rate of death in road accidents can be decreased by treating the victims as soon as possible. This article is based on computer vision which is an emergency alert system built on python which uses object tracking techniques to detect the occurrence of an accident. An efficient automatic accident detection system featuring automated reporting of the accident site to emergency responders is critical for saving valuable human life. This system intends to identify accidents beforehand and communicate the information to emergency responders in order to give rapid aid to the wounded individual. The research work purpose is to determine the severity of an accident and to warn the rescue crew in time.

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO
	ABSTRACT	V
	LIST OF FIGURES	VIII
1	INTRODUCTION	
	1.1 GENERAL	1
	1.2 MOTIVATION FOR THE SELECTION OF PROBLEM	2
	1.3 OVERVIEW	3
2	LITERATURE SURVEY	
	2.1 MAJOR FINDINGS FROM LITERATURE SURVEY	4
	2.2 EXISTING SYSTEM BLOCK DIAGRAM	7
	2.3 DISADVANTAGES	8
	2.4 CONSTRAINTS	8
	2.5 TRADE OFF	9
3	AIM AND SCOPE OF THE PRESENT INVESTIGATION	
	3.1 PROBLEM STATEMENT	11
	3.2 AIM OF THE PROJECT	11
	3.3 SCOPE OF THE PROJECT	12

3.4	BLOCK DIAGRAM & OBJECTIVES	12
3.5	ADVANTAGES	13
3.6	IEEE STANDARDS FOLLOWED	14
4	HARDWARE AND PROCESS FLOWCHART	
4.1	HARDWARE COMPONENTS	
4.1.1	ARDUINO UNO	16
4.1.2	ALCOHOL SENSOR	19
4.1.3	EYE BLINK SENSOR	20
4.1.4	VIBRATION SENSOR	21
4.1.5	RASPBERRY PI CAMERA	21
4.1.6	BUZZER	22
4.1.7	GPS	23
4.2	PROCESS FLOWCHART	
4.2.1	FLOWCHART OF ALCOHOLDTECTION AND ENGINE LOCKING SYSTEM	24
4.2.2	FLOWCHART OF COLLISION DETECTION	25
4.3	IEEE STANDARDS FOLLOWED	27
5	RESULTS AND DISCUSSIONS	
5.1	HARDWARE PART	29
5.2	SIMULATION OUTPUT	32
6	SUMMARY AND CONCLUSION	
6.1	SUMMARY	36
6.2	CONCLUSION	37
	REFERENCES	38

LIST OF FIGURES

FIGURE NO	TITLE	PAGE NO
1.1	ROAD ACCIDENTS AND PERSON DIED IN INDIA	2
2.1	EXISTING SYSTEM BLOCK DIAGRAM	7
3.1	BLOCK DIAGRAM OF THE PROPOSED SYSTEM	12
4.1	ARDUINO UNO	17
4.2	PIN DIAGRAM	19
4.3	ALCOHOL SENSOR	19
4.4	EYE BLINK SENSOR	20
4.5	VIBRATION SENSOR	21
4.6	RASPBERRY PI CAMERA	22
4.7	BUZZER	22
4.8	GPS	23
4.9	FLOWCHART OF ALCOHOL DETECTION	24
4.10	FLOWCHART OF COLLISION DETECTION	25
5.1	HARDWARE PICTURE	29
5.2	ALCOHOL DETECTION	30
5.3	SLEEP DETECTION	30

LIST OF FIGURES

FIGURE NO	TITLE	PAGE NO
5.4	VIBRATION DETECTION AND MESSAGE SENDING	31
5.5	OUTPUT MAIL ALERT	31
5.6	SIMULATION OUTPUT – SLEEP NOT DETECTED	32
5.7	SIMULATION OUTPUT – ALCOHOL NOT DETECTED	33
5.8	SIMULATION OUTPUT – SLEEP DETECTED	33
5.9	SIMULATION OUTPUT – ALCOHOL DETECTED	34
5.10	SIMULATION OUTPUT – VIBRATION DETECTED AND SENDING MESSAGE	35

CHAPTER 1

INTRODUCTION

1.1 GENERAL

Accidents pose a significant threat to human lives, property, and the environment. In both industrial and everyday settings, the prevention, detection, and reporting of accidents are paramount to ensuring safety and minimizing the associated risks. This project report introduces a comprehensive "Accident Prevention, Detection, and Reporting System" aimed at addressing these critical concerns.

Traditional methods of accident management often fall short in terms of response time and effectiveness. Hence, the need for an integrated system that not only proactively works towards preventing accidents but also swiftly detects them when they occur and facilitates accurate reporting.

Our project focuses on a multifaceted approach to accident management, beginning with the prevention of accidents through proactive measures and culminating in the swift detection and accurate reporting of any untoward incidents. We believe that a comprehensive system that leverages cutting-edge technology can significantly reduce the frequency and severity of accidents, ultimately saving lives and minimizing damage.

The system incorporates eye blink sensors to monitor the alertness of drivers, alcohol sensors to prevent drunk driving, and vibration sensors to detect unusual vehicle or equipment behavior. GPS and GSM technologies provide real-time tracking and communication capabilities, while the Raspberry Pi camera captures vital visual data in case of accidents. These components work seamlessly together to create a comprehensive safety net.

This report will delve into the intricate details of each component, explaining their functionality and integration into the system. Furthermore, we will explore the potential applications, benefits, and real-world impact of our Advanced Accident Prevention, Detection, and Reporting System. By embracing this innovative approach, we aim to revolutionize safety management and contribute to a safer, more secure world for all.

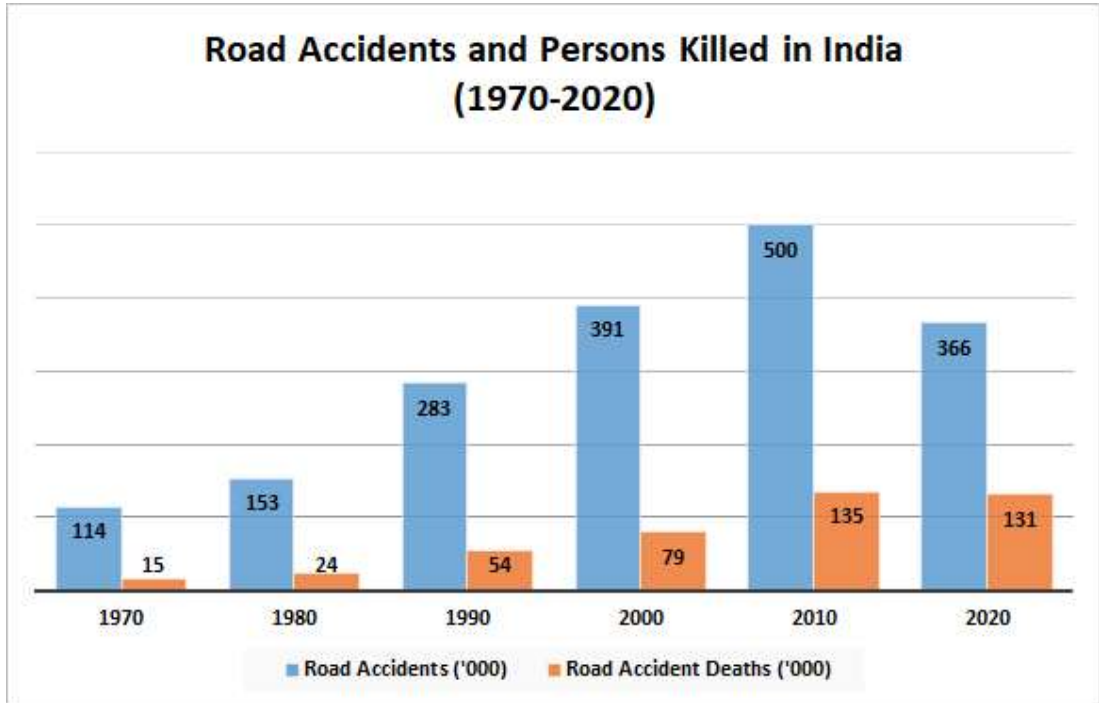


Fig 1.1: Road Accidents and Persons died in India

1.2 MOTIVATION FOR THE SELECTION OF PROBLEM

Currently there is no technology for accident detection. As it is done manually there is loss of life in golden hours .The accident victim is dependent on the mercy of others to rush him to hospital. Many times an accident goes unnoticed for hours before help comes .Due to all these factors there is a high rate of mortality of the accident victims .In addition to this there is delay in the ambulance reaching the hospital to the traffic congestion between accident location and hospital which increases the chances of the death of victim

Although automobiles save our lots of travelling time, the risk increases in travelling because of the accidents. For the prevention from such accidents, we can use

modern additional technologies. In the context of our project, we have used some sensors, electronic modules and microcontroller unit which helps us in providing prevention from accidents, detects the accident if it occurs even after the preventive measures and reports the ambulance service.

1.3 OVERVIEW

The system consists of eye blink sensor, temperature sensor, alcohol sensor, accelerometer, GPS module, GSM module, motor, buzzer, led, Raspberry pi camera etc. And all these devices are interfaced with the central micro controller unit.

We are going to use eye blink sensor for detecting sleep by setting the certain time limit, if the driver gets sleepy, we can warn him. Temperature sensor helps us in detecting the heat of the engine and if the engine is overheated then that of a normal condition, we can warn the driver.

Alcohol sensor helps us in detecting if the driver is drunk or not. If he/she is over drunk the vehicle provides warning and the engine stops functioning. Accelerometer detects the occurrence of accident and sends signal to the micro controller for further functioning.

GPS module provides us the location, speed, time and date of the certain place where the vehicle is in the real time. And the image is taken by the raspberry camera, and the taken image is compared with the already available image with the help of deep learning methodology.

If accident occurs, the location of accident that we get from the GPS is send to the ambulance service and police by the help of GSM module.

CHAPTER 2

LITERATURE SURVEY

2.1 MAJOR FINDINGS FROM LITERATURE SURVEY

S. Aishwarya and B. U. Maheswari, 2022 suggest that Road accidents are caused by driver's poor decisions or actions while driving... Automobiles may be equipped with driver/passenger health monitoring systems with sensors to help prevent accidents. The proposed work suggests a sensor-based prototype for autonomous vehicles with smart seat belts, and road rules such as speed control, stopping the vehicle when the traffic signal shows red light, parking/no parking control, and horn/no horn control systems using Radio Frequency (RF) communication.

G. T. Selvi, S. R. K. V, S. A and J. R, 2022 suggest that the major cause for deaths is the time it takes for informing about the accidents to ambulance, hospitals and to police. In the Accident Detection System, the accident is detected automatically by the use of different sensors and it is informed to the ambulance and various other services through a Mobile Application along with the accident's GPS Location. The system is thus useful as a quick response to the accidents and may considerably reduce the death rates.

P. D. R. Dewmin, P. S. H. Yapa, S. D. Lokuge, M. G. N. M. Pemadasa and N. Amarasena, 2022 suggest that by analyzing the data, smart license detection and accident prevention system was proposed to identify and validate driver's license using RFID. The proposed system also facilitates sub-systems to check driver's drowsiness, fatigue, alcohol level and driver distracted or not using Raspberry Pi camera module based on computer vision using Tensor Flow Lite. While these sub systems reduce the probability of occurring an accident, airbag detection sub system reduce the fatality rate of an accident by detecting the deployment of airbags and informing the nearest police station and hospital about an accident using GSM module and SMS Gateway API.

S. Sarker, M. S. Rahman and M. N. Sakib, 2019 suggest that develop intelligent accident detection, location tracking a notification system that detects an accident

immediately when it takes place. Global Positioning System (GPS) device finds the exact location of accident. So that they can visit the link, find out the shortest route of the accident spot and take initiatives to speed up the rescue process.

R. Rishi, S. Yede, K. Kunal and N. V. Bansode, 2020 suggest that to develop such a system which can notify the concerned people about the mishap, GPS module, GSM module, accelerometer is interfaced with Arduino uno which acts as the controller. The accelerometer detects the accident by a change in preset value of the vehicle orientation and sends the location through GPS module to registered sim card via GSM module without any indulgence of the driver or passengers. The planned system aims to cut back deaths in road accidents by quite nine p.c.

G. Pradeepkumar, G. Praveen Santhoshkumar, C. Rohith Bhat, M. Jeyalakshmi, T. Muthukumar and N. S. Kumar, 2023 suggest that curved roads have significantly more fatalities than straight roads. This occurs mainly on U-turns, hairpin turns, and narrow mountain roads. Place the ultrasonic range detection sensor on one side of the road before the bend and the light indicator system on the opposite side after the bend. When a vehicle approaches from afar, an ultrasonic sensor on one side of the road sends a signal to the other side of the road via a light system.

P. Kulkarni and V. P. Baligar, 2020 suggest that traffic flow is monitored by using computer vision paradigm, where images or sequence of images provides betterment on the road view. In order to detect vehicles, monitor and estimate traffic flow using low cost electronic devices, this research work utilizes camera module of raspberry pi. S. Rana, M. R. H. Faysal, S. C. Saha, A. A. Noman and K. Shikder, 2021 suggest that 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 implemented system uses Artificial Intelligence-based advanced algorithms to detect the expressions of the driver and can calculate the rate of the driver's drowsiness. The system detects drowsiness by extracting the 'Eye Aspect Ratio' (EAR) calculation of facial landmark localization and the authentication is verified by incorporating with the facial recognition technology.

M. A. Rakhonde, S. A. Khoje and R. D. Komati, 2018 suggest that to detect the accident and monitor the increasing pollution. This paper is based on enhancement in the smart vehicle system. The main objective is to detect accidents in real time and minimize the response time of medical help. For accident avoidance, tire pressure is measured whereas in accident detection is implemented with the help of node MCU.MQ7 is used in order to monitor the pollution.

A. Rodrigo, L. Rai, C. Samadhi and P. D. Welgama, 2018 suggest that to detect vehicle distance up to 1 km based on the signal strength to prevent road traffic accidents Overtaking of a vehicle is clearly identified by measuring the current position of over-taker within the distance range of 15 m to 30 m from the receiver. Graphical User Interface (GUI) is implemented to display the detected vehicle for real-time monitoring to show the exact position of overtaking vehicle.

M. Syedul Amin, J. Jalil and M. B. I. Reaz, 2018 suggest that utilize the capability of a GPS receiver to monitor speed of a vehicle and detect accident basing on monitored speed and send accident location to an Alert Service Center. The GPS will monitor speed of a vehicle and compare with the previous speed in every second through a Microcontroller Unit. Whenever the speed will be below the specified speed, it will assume that an accident has occurred.

D. A. Machhi, A. S. Pillai, S. S. More and P. Thirumalaikumar, 2022 suggest that this paper presents a design and implementation of such a system, that is able to give a set of information from the user to the nearby hospital by sending a mail alert by using technologies such as Convolution Neural Network (CNN) and Tensor Flow which is used to build the model which would help in detecting the accident and thus then sending an email alert to the nearby hospital and helping the victim to get immediate medication.

N. Bhatia, Y. Dixit and K. M. Balamurugan, 2023 suggest that this article is based on computer vision which is an emergency alert system built on python which uses object

tracking techniques to detect the occurrence of an accident. This system intends to identify accidents beforehand and communicate the information to emergency responders in order to give rapid aid to the wounded individual.

N. T. S. A. Wadhahi, S. M. Hussain, K. M. Yosof, S. A. Hussain and A. V. Singh, 2018 suggest that the system has two phases-Accident Detection and Accident Prevention. The detection phase is carried out using IR sensors that could detect and alert the people by sending SMS using GSM module that contains predefined numbers and accident location using GPS module.

2.2 EXISTING SYSTEM BLOCK DIAGRAM

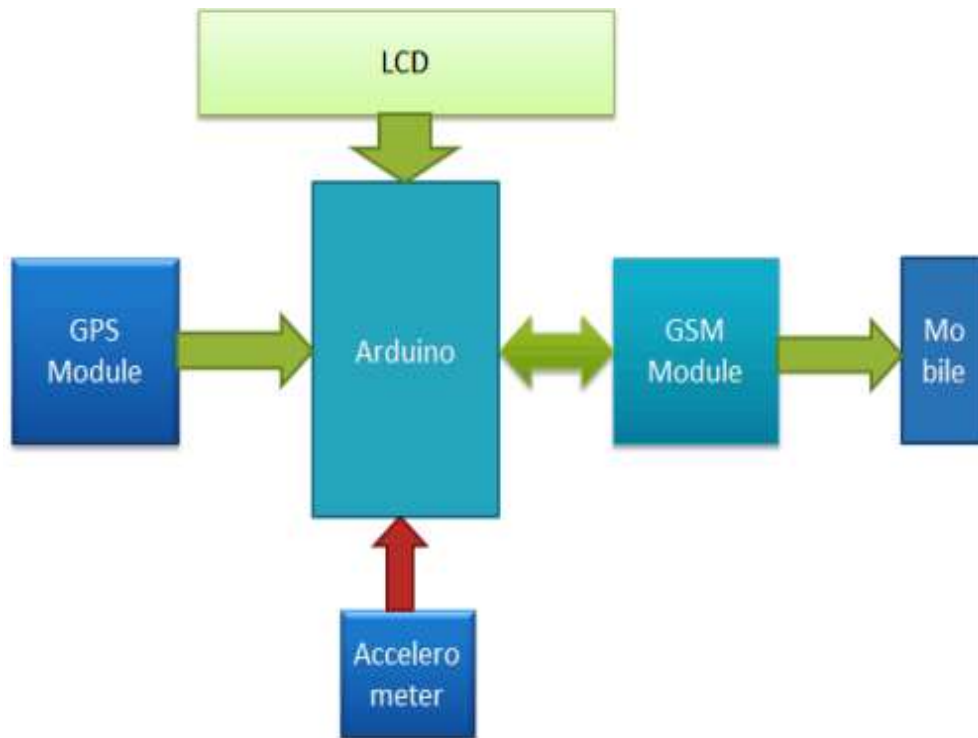


Fig 2.1: Existing system block diagram

2.3 DISADVANTAGES

- Some of this existing system **have only collision sensor** that will help to report to the family members and the hospital. **It can't able to prevent the accidents.**
- **Tracking of accident is crucial process** in the existing system.
- Required **medical attention cannot be given to the needed person** at the right time
- There is a possibility of **false reporting of an accident at low speed.**
- Damage to the sensor cannot be detected.

2.4 CONSTRAINTS

- ❖ **Data Constraints:** Availability of historical accident data for training and testing the system. Data privacy and security concerns when capturing visual evidence.
- ❖ **Regulatory Constraints:** Compliance with local and national laws regarding data privacy and monitoring devices. Certification and approval requirements for safety systems and sensors.
- ❖ **Power Constraints:** Battery life and power consumption for sensors, Raspberry Pi, and other components. Charging and power supply infrastructure for the system.
- ❖ **Network Constraints:** Network coverage and reliability for GSM communication. Bandwidth limitations for data transmission.
- ❖ **Environmental Constraints:** Environmental factors affecting sensor accuracy (e.g., weather, lighting). Durability of components in harsh conditions (e.g., extreme temperatures, humidity).

- ❖ **Cost Constraints:** Budget limitations for procuring and implementing the system. Ongoing maintenance and operational costs.
- ❖ **User Constraints:** User acceptance and training requirements for drivers and emergency response personnel. Accessibility and usability considerations for all potential users.
- ❖ **Testing and Validation Constraints:** Challenges in simulating real accident scenarios for testing. Accuracy of accident detection and response in a variety of road conditions.
- ❖ **Scalability Constraints:** The system's ability to scale to accommodate a large number of vehicles and users. Performance limitations when handling a high volume of data and alerts.
- ❖ **Maintenance and Support Constraints:** Availability of technical support and resources for ongoing maintenance and updates. Handling system failures and malfunctions in a timely manner.

2.5 TRADE OFF

1. Privacy concerns vs. Safety benefits

Implementing driver monitoring sensors may raise privacy concerns as it involves monitoring an individual's behavior. Striking the right balance between safety and privacy is essential.

2. False positives vs. accurate detection

Vibration sensors may sometimes trigger false alarms due to road conditions. Striking a balance between accurate collision detection and avoiding unnecessary alerts is crucial.

3. Privacy vs. Verification

Capturing visual evidence for accident verification is essential, but it can infringe on privacy. Ensuring data privacy and consent while still providing valuable evidence is a challenge.

4. Battery life vs. Real-time accuracy

Constant GPS tracking can drain the battery quickly. Balancing the need for real-time accuracy with the vehicle's power constraints is essential.

5. Data costs vs. Communication reliability

Real-time communication via GSM may incur data costs, and the reliability of the GSM network in remote or low-signal areas could be a concern. Balancing cost-effectiveness and reliability is necessary.

6. System complexity vs. User acceptance

Increasing system complexity with additional features may impact user acceptance and increase the learning curve for users. Balancing safety features with ease of use is crucial.

CHAPTER 3

AIM AND SCOPE OF THE PRESENT INVESTIGATION

3.1 PROBLEM STATEMENT FOR THE PROPOSED SYSTEM

The current accident prevention, detection, and reporting systems suffer from significant limitations. They primarily rely on collision sensors to notify family members and hospitals after an accident have occurred, offering no real accident prevention. Tracking accidents is a critical but inadequate aspect of the existing system, often failing to provide timely medical assistance. False accident reports are possible, especially at low speeds, undermining system reliability. Moreover, sensor damage goes undetected. To address these shortcomings, the proposed problem statement is to develop an advanced accident prevention and reporting system that not only detects accidents but also actively works to prevent them, offers accurate accident tracking, ensures prompt medical attention, and includes robust sensor health monitoring.

3.2 AIM OF THE PROJECT

The aim of the Accident Prevention, Detection, and Reporting System project is to enhance public safety by developing a comprehensive and intelligent system that proactively identifies and mitigates potential accidents across various domains. This system will leverage advanced technologies such as machine learning, computer vision, and sensor networks to detect and predict accidents in real-time. Its primary objectives include reducing accident rates, minimizing injury severity, and expediting emergency response. Additionally, the project aims to establish efficient reporting mechanisms to alert relevant authorities and stakeholders swiftly. By achieving these goals, the project aims to save lives, reduce property damage, and create a safer environment for all members of the community.

3.3 SCOPE OF THE PROJECT

The comprehensive scope of this project aims to address various aspects of accident prevention, detection, and reporting. It focuses on enhancing driver safety by monitoring driver condition, preventing drunk driving, and providing immediate collision detection. Additionally, it ensures accurate location-based reporting and communication with relevant authorities for swift response and assistance in the event of an accident or emergency.

3.4.1 BLOCK DIAGRAM OF THE PROPOSED SYSTEM

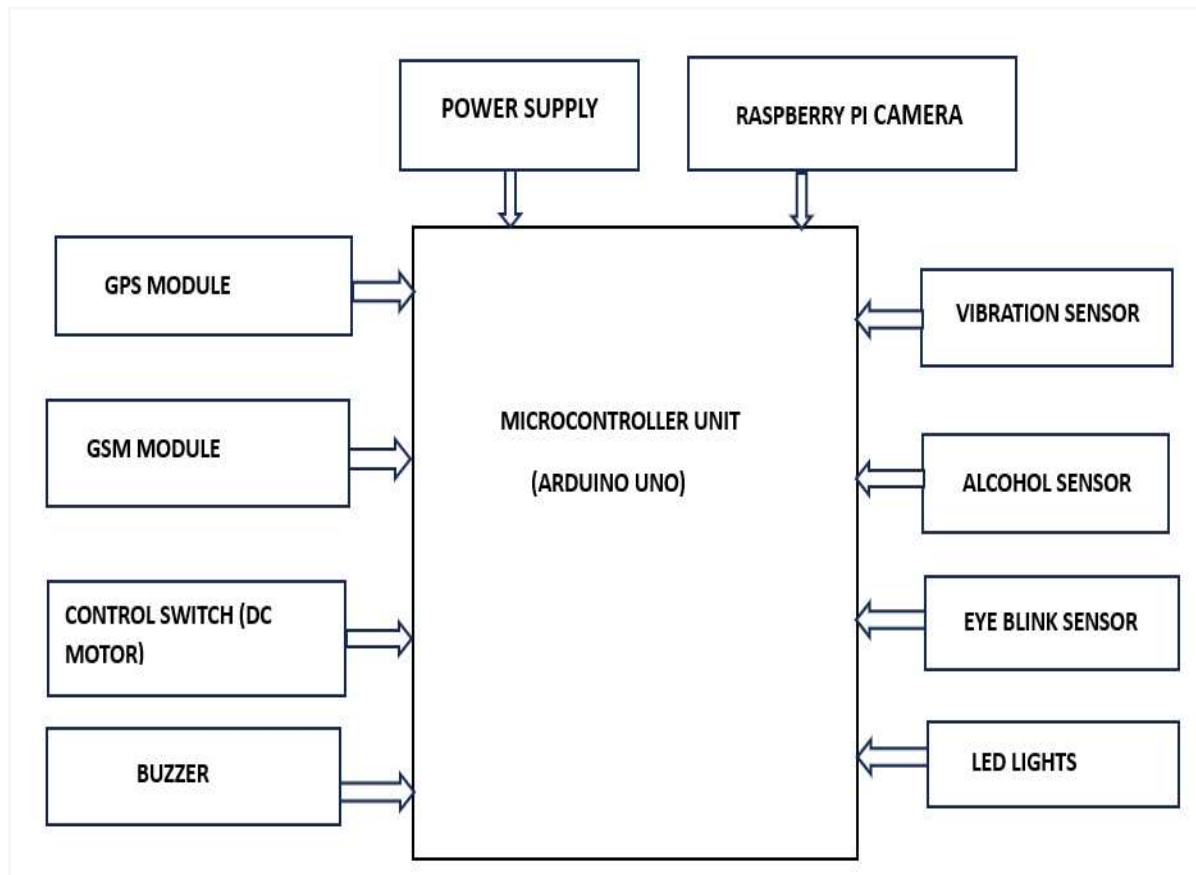


FIG 3.1: Block Diagram of the Proposed System

3.4.2 OBJECTIVES

- Detect and mitigate potential accidents by monitoring driver fatigue (eye blink sensor) and preventing drunk driving (alcohol sensor).
- Identify collisions and impact events (vibration sensor) for immediate response and reporting.
- Capture visual evidence (Raspberry Pi camera) to aid accident verification and insurance claims.
- Ensure accurate real-time tracking (GPS) and location-based reporting for swift emergency response.
- Enable instant communication (GSM) with emergency services and relevant authorities, facilitating efficient accident reporting and response mechanisms.
- The project aims to reduce accidents, minimize their impact, and create a safer environment for all road users.

3.5 ADVANTAGES

- **Enhanced Safety:** The eye blink sensor helps prevent accidents caused by drowsy or fatigued drivers, thereby enhancing road safety. Alcohol sensors deter and prevent drunk driving, a significant contributor to accidents.
- **Accurate Accident Detection:** Vibration sensors can detect accidents, collisions, or sudden impacts with high accuracy. The Raspberry Pi camera provides visual evidence of accidents, aiding in post-accident investigations and insurance claims.
- **Real-time Monitoring and Tracking:** GPS technology enables real-time vehicle tracking, allowing authorities to monitor vehicles' locations and speeds. GSM connectivity facilitates immediate communication in the event of an accident, ensuring rapid response and assistance.

- **Improved safety:** Electricity theft can be dangerous and can result in accidents and fires. By reducing theft, IoT can help improve safety for both consumers and electricity providers.
- **Environmental Impact:** Accurate accident reporting can lead to faster cleanup and containment of hazardous materials in the event of an environmental accident, reducing environmental damage.
- **Timely Reporting:** The system can automatically report accidents to emergency services, reducing response times and potentially saving lives. Accident data can be transmitted to relevant authorities, insurance companies, and fleet managers in real-time, streamlining accident reporting and processing.
- **Overall Societal Benefits:** The system contributes to reducing accidents, injuries, and fatalities, resulting in improved overall societal well-being.

3.6 IEEE STANDARDS FOLLOWED

1. **IEEE 802.11p-2010 - Wireless Access in Vehicular Environments (WAVE):** This standard defines enhancements to 802.11 (the basis for wireless LANs) required to support Intelligent Transportation Systems (ITS) applications. This includes vehicle-to-vehicle and vehicle-to-infrastructure communication, which are critical for accident detection and reporting.
2. **IEEE 1609 Family of Standards for Wireless Access in Vehicular Environments (WAVE):** This suite of standards provides the foundation for vehicular communication systems. It covers aspects such as security (IEEE 1609.2), network services (IEEE 1609.3), and multi-channel operation (IEEE 1609.4), all of which are essential for effective accident detection and communication.

3. **IEEE 1512 Family of Standards - For Emergency Management and Incident Response Activities:** These standards focus on the communication and interoperability among emergency management and incident response entities, including the reporting and management of accidents.
4. **ISO 39001:2012 - Road traffic safety (RTS) management systems:** While not an IEEE standard, this International Organization for Standardization (ISO) standard specifies requirements for a road traffic safety (RTS) management system to enable an organization that interacts with the road traffic system to reduce death and serious injuries related to road traffic crashes.
5. **IEEE 802.22-2011 - Wireless Regional Area Networks (WRANs):** This standard utilizes the unused TV broadcast channels to provide communication. It can support applications such as traffic management and accident reporting in rural areas.
6. **ISO 21448:2019 - Road vehicles — Safety of the intended functionality (SOTIF):** Another ISO standard, which is not directly an IEEE standard but is highly relevant for accident detection systems, especially in the context of autonomous vehicles and advanced driver-assistance systems (ADAS).
7. **IEEE 2030.5™/SunSpec Alliance - Standard for Smart Energy Application Protocol:** Relevant for the integration of emergency and disaster response mechanisms with smart grid and smart city infrastructure, which can be crucial for coordinating responses to accidents.

CHAPTER 4

HARDWARE AND PROCESS FLOWCHART

4.1 HARDWARE COMPONENTS

The list of hardware components that are required are:

- Arduino Uno
- Power Supply
- Alcohol Sensor
- Eye blink Sensor
- Vibration Sensor
- Raspberry Pi Camera
- Buzzer
- GPS Module

4.1.1 ARDUINO UNO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

4.3.1.1 Input and Output

Arduino - ArduinoBoardUno Each of the 14 digital pins on the Uno can be used as an input or output, using `pinMode()`, `digitalWrite()`, and `digitalRead()` functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms.

The Uno is one of the more popular boards in the Arduino family and a great choice for beginners.

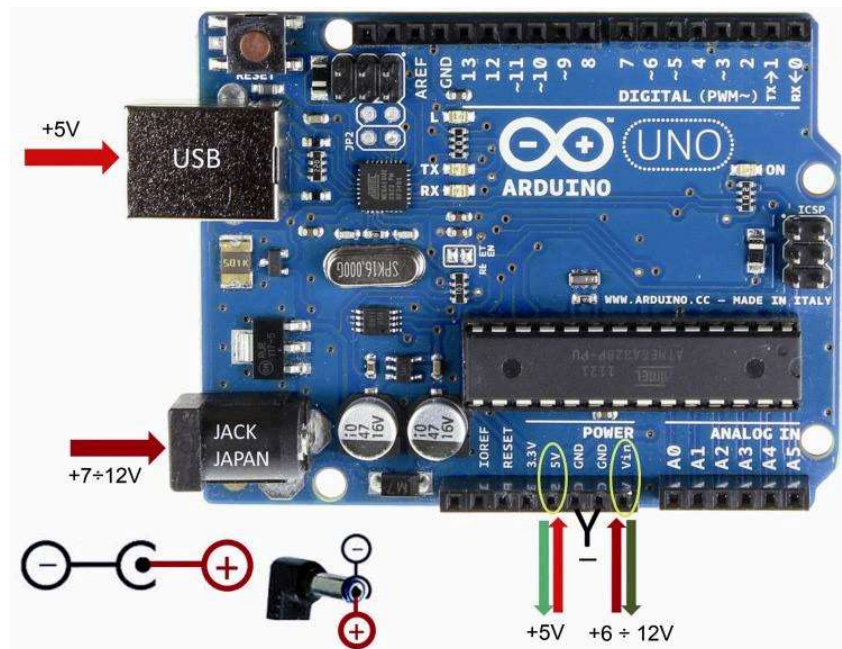


Fig 4.1: Arduino UNO

4.3.1.2 Power (USB / Barrel Jack)

Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply that is terminated in a barrel jack. In the picture above the USB connection is

labelled **(1)** and the barrel jack is labelled **(2)**. The USB connection is also how you will load code onto your Arduino board.

4.3.1.3 Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)

The pins on your Arduino are the places where you connect wires to construct a circuit (probably in conjunction with a breadboard and some wire).

They usually have black plastic 'headers' that allow you to just plug a wire right into the board. The Arduino has several different kinds of pins, each of which is labelled on the board and used for different functions.

GND (3): Short for 'Ground'. There are several GND pins on the Arduino, any of which can be used to ground your circuit.

5V (4) & 3.3V (5): As you might guess, the 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.

Analog (6): The area of pins under the 'Analog In' label (A0 through A5 on the UNO) is Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.

Digital (7): Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).

PWM (8): You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM).

AREF (9): Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

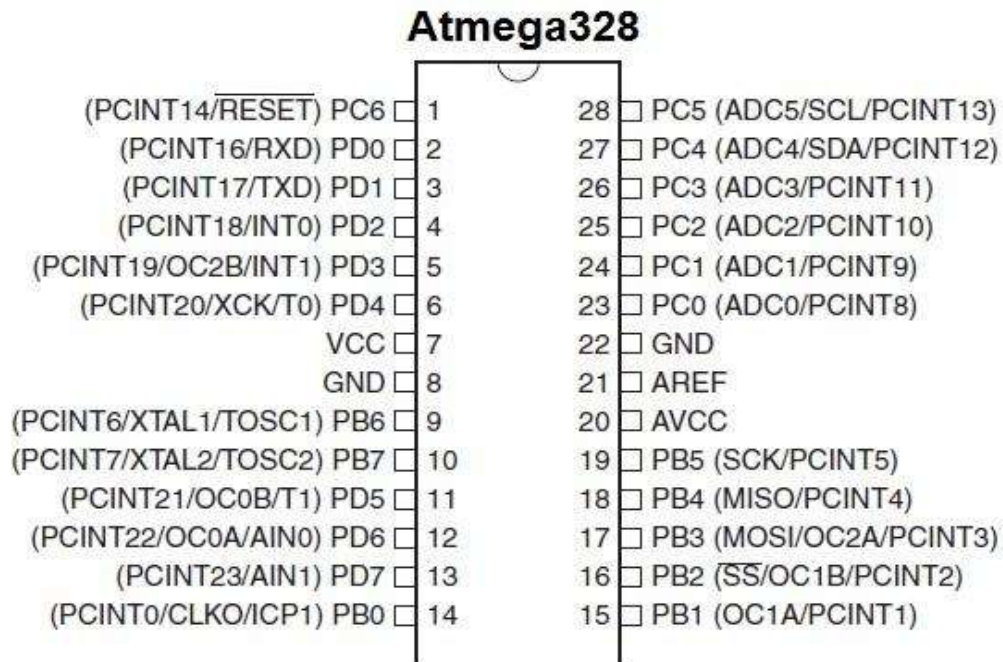


Fig 4.2: Pin diagram

4.1.2 ALCOHOL SENSOR



Fig 4.3: Alcohol Sensor

MQ-3 module is suitable for detecting Alcohol, Benzine, CH₄, Hexane, LPG, CO. Sensitive material of MQ-3 gas sensor is SnO₂, which with lower conductivity in clean air. When the target alcohol gas exists, the sensor's conductivity is higher along with the gas concentration rising. MQ-3 gas sensor has high sensitivity to Alcohol, and has good resistance to disturb of gasoline, smoke and vapor. This sensor provides an analog resistive output based on alcohol concentration. When the alcohol gas exists, the sensor's conductivity gets higher along with the gas concentration rising.

4.1.3 EYE BLINK SENSOR

The eye blinking system can be used for different purposes. First, let's look at the blink sensing system. The eye blink sensor constantly sends infrared waves which are reflected and detected by the receiver. As soon as the eye blinks, the output of the sensor goes high. This output is sent to the Arduino board. Another purpose for which this system can be used is called the driver drowsiness system. This system can be used to check if the driver might sleep during driving. This can be done with some minor changes in the Arduino code. Instead of detecting blinks the Arduino should give the command to buzz when the eyes of the driver are closed for more than 2-3 seconds depending upon your preference.

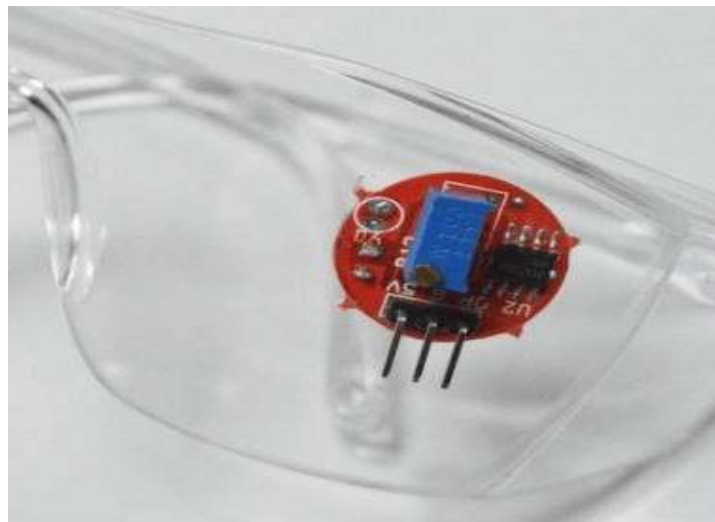


Fig 4.4: Eye blink Sensor

4.1.4 VIBRATION SENSOR

The vibration sensor is also called a piezoelectric sensor. These sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. This sensor is also used for deciding fragrances within the air by immediately measuring capacitance as well as quality. The sensitivity of these sensors normally ranges from 10 m V/g to 100 m V/g, and there are lower and higher sensitivities are also accessible.

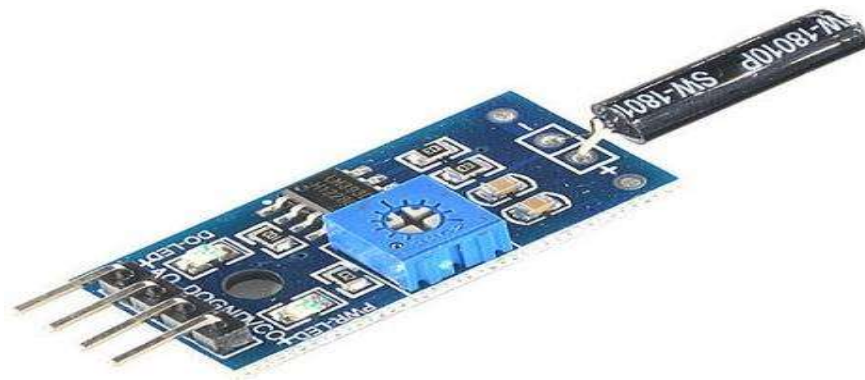


Fig 4.5: Vibration Sensor

4.1.5 RASPBERRY PI CAMERA

The camera board attaches to the Raspberry Pi via a ribbon cable. One end of the ribbon cable goes to the camera PCB and the other end attached to Raspberry Pi hardware itself. You need to get the ribbon cable connections the right way, or the camera will not work. On the camera PCB, the blue backing on the cable should be facing away from the PCB, and on the Raspberry Pi hardware it should be facing towards the Ethernet connection.



Fig 4.6: Raspberry Pi Camera

4.1.6 BUZZER

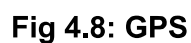
A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications. There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it.



Fig 4.7: Buzzer

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

A GPS navigation device, GPS receiver, or simply GPS is a device that is capable of receiving information from GPS satellites and then to calculate the device's geographical position. Using suitable software, the device may display the position on a map, and it may offer directions. The Global Positioning System (GPS) is a global navigation satellite system (GNSS) made up of a network of a minimum of 24, but currently 30, satellites placed into orbit by the U.S. Department of Defense.



4.2 PROCESS FLOWCHARTS

4.2.1 Flowchart of alcohol detection and engine locking system

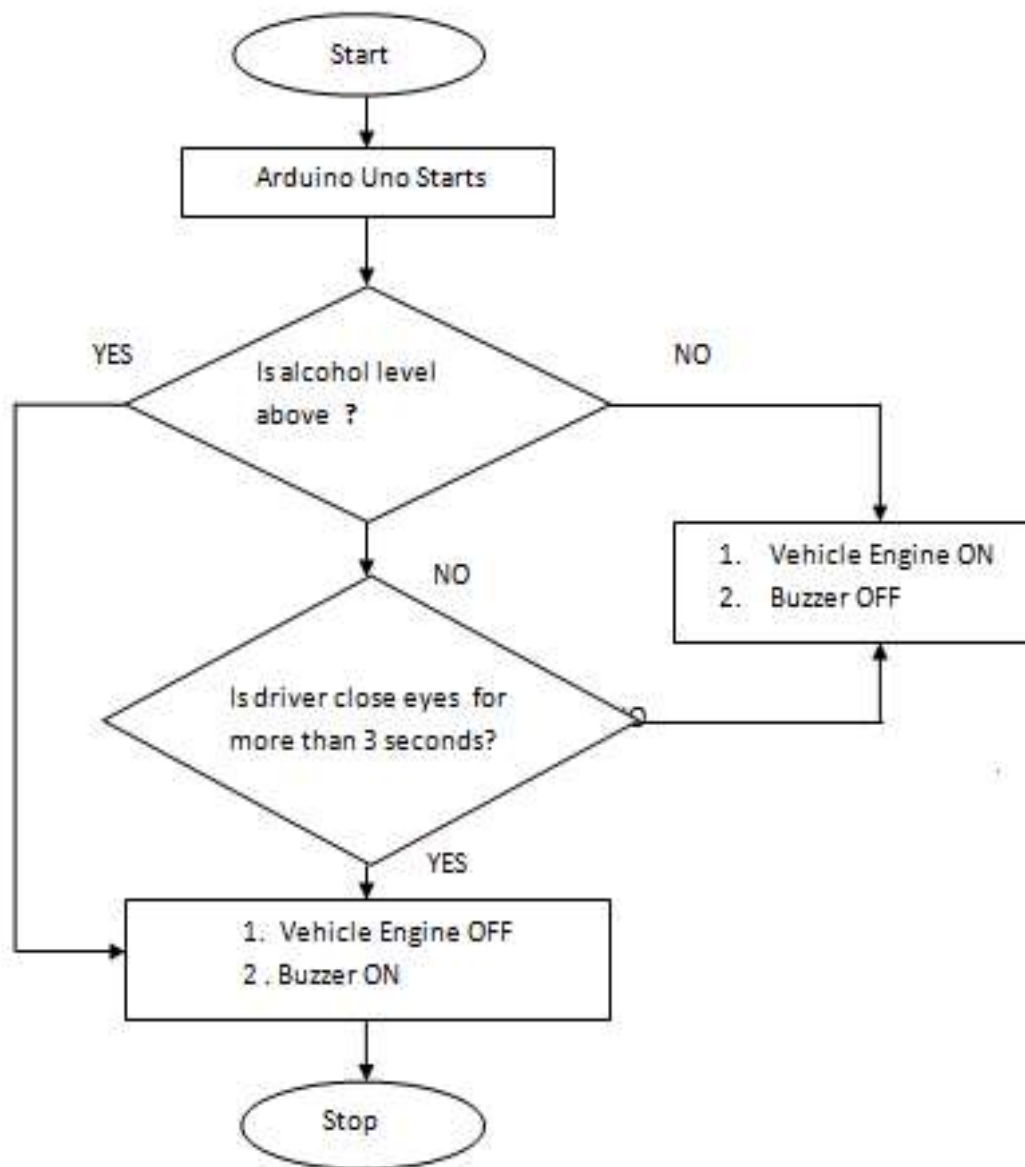


Fig 4.9: Alcohol detection

4.2.2 Flowchart of collision detection system

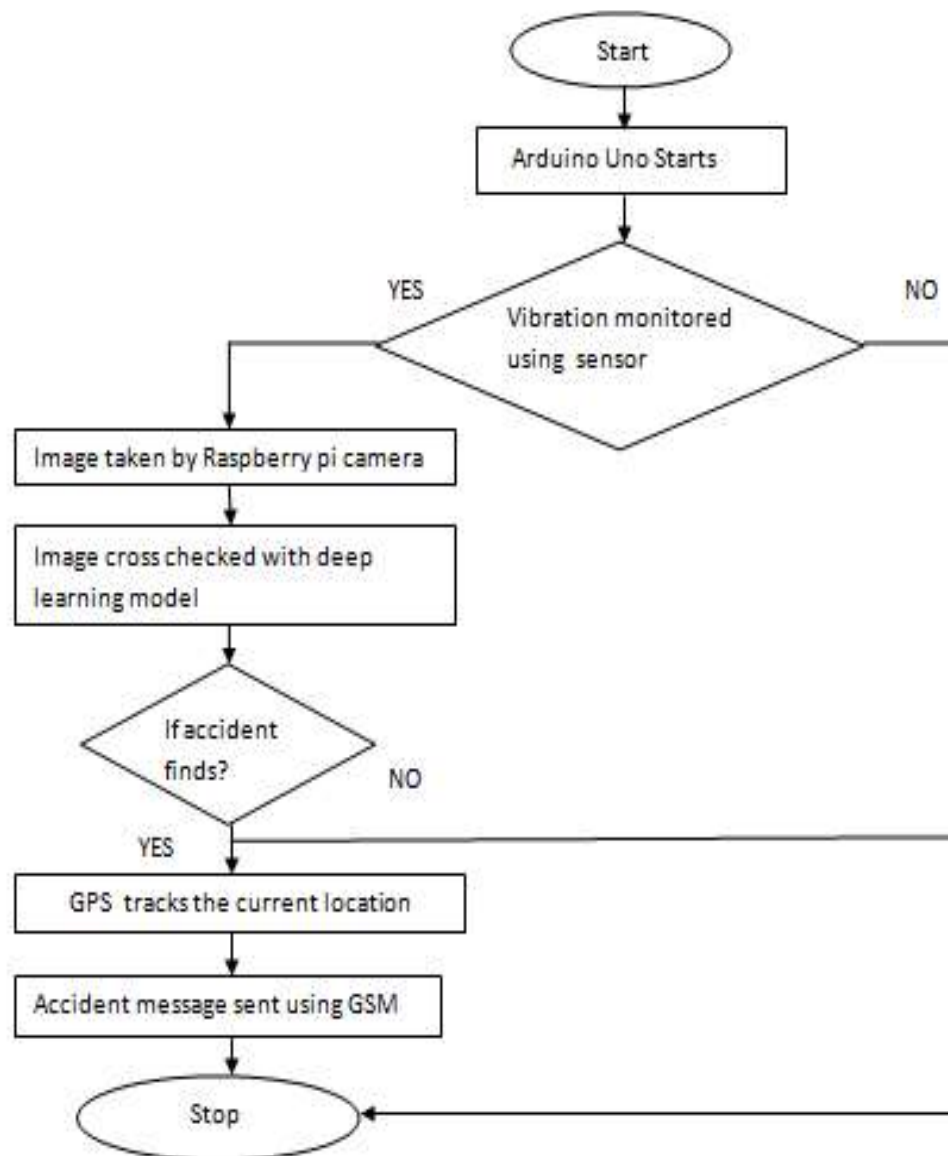


Fig 4.10: Collision detection

4.3 WORKING PROCESS OF THE PROPOSED SYSTEM

The project comprises two phases to ensure the maximum safety of passengers while driving. The first phase is that of prevention of accidents, and the second is that of detection if an accident occurs. Many accidents occur due to drink and drive cases and the lack of concentration resulting from it. The prevention phase thus includes features for alcohol detection and automatic engine locking.

Whenever the driver starts the engine, an alcohol sensing unit (MQ3 Gas Sensor) analyses the breath of the driver and measures the alcohol content. Consequently, an LED blinks red if the measured amount is higher than the threshold value. In India, the permissible Blood Alcohol Content (BAC) is 0.03% per 100 ml of blood. An automatic engine locking system ensures that the engine does not start unless the alcohol content is within permissible limits. An L293D motor driver is used to demonstrate the locking system for the prototype.

However, an accident may still occur due to reasons that were not taken care of, in the prevention phase. Therefore, the proposed work also includes a detection phase to ensure that the passengers get the required medical help when an accident occurs. The detection phase consists of a vibration sensor (SW420) that constantly monitors the system for any abnormal jerk or vibration. In case of a vibration, a photograph of the scene is taken and it is compared with the image dataset that is fed into a pre-trained Keras deep learning model. If the images match, the accident is confirmed and is reported to the nearest emergency center using GPS and GSM.

4.3.1 Alcohol & sleep detection and engine locking

The MQ3 alcohol sensor can detect ethanol in the air. When a driver breathes, the sensor output is connected to two LEDs that blink red when the concentration of alcohol goes above the threshold limit which is set equal to the legal alcohol limit in the respective country, and blinks green when sensed content is normal. The vehicle

engine will be off in the former case. The L293D motor works only while the green LED is ON, thereby demonstrating the engine locking mechanism.

4.3.2 Collision detection

Whenever a vibration that is above the set threshold is sensed by the SW-420 sensor, an alarm is raised which remains ON for the next 10 seconds. This time delay is provided so that the driver, if safe and does not require any medical assistance, can choose to manually switch off the buzzer. If the buzzer is not switched off in time, it is assumed that the passengers are injured and the scene is captured using an in-built camera and further processed by the deep learning model, which when confirms the accident, activates the GSM module which sends SMS to the nearby emergency center through location tracking. For the prototype created, the output of the vibration sensor is sent to the raspberry pi module using serial communication between the Arduino and raspberry pi, and as this input is received, the pi camera module gets activated to capture the scene. Fig 3 depicts the process flow for the same.

4.4 IEEE STANDARDS FOLLOWED

1. **IEEE 802.15.4-2020** - This standard specifies the operation of low-rate wireless personal area networks (LR-WPANs). It's pivotal for IoT (Internet of Things) applications, including sensors for accident detection systems. These sensors can be deployed in various environments (e.g., on roads, within vehicles, or in wearable devices) to detect accidents or hazardous conditions promptly.
2. **IEEE 1609.11-2010** - Over-the-Air Data Exchange Protocol for Intelligent Transportation Systems (ITS): Part of the WAVE (Wireless Access in Vehicular Environments) set, this standard defines secure message formats and processing for data exchange between vehicles and between vehicles and roadside infrastructure. It's crucial for the communication aspect of accident

detection systems, ensuring that detected incidents are reported securely and reliably.

3. **IEEE 21451-7-2011** - Information technology - Smart transducer interface for sensors and actuators - Part 7: Transducers to Radio Frequency Identification (RFID) Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats: This standard facilitates the integration of RFID technology with sensors and actuators for smart transducer communications. In the context of accident prevention and detection, RFID can be used for identifying and tracking assets (e.g., vehicles, equipment), which is vital for real-time monitoring and incident response.
4. **IEEE 802.21-2008** - Media Independent Handover Services: This standard facilitates seamless handover between different network types (e.g., Wi-Fi, WiMAX, cellular) to maintain continuous communication for mobile devices. For accident prevention and detection systems, especially in vehicular networks, this ensures uninterrupted data transmission for emergency calls, accident notifications, and real-time monitoring, even as vehicles move across different network coverage areas.
5. **IEEE 2700-2014** - Standard for Sensor Performance Parameter Definitions: This standard provides a common framework for specifying performance parameters for sensors. In accident detection systems, sensors play a critical role in monitoring conditions and detecting incidents. A standardized approach to defining sensor performance ensures reliability and interoperability of sensor data, which is critical for accurate detection and reporting of accidents.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 HARDWARE PART

5.1.1 HARDWARE PICTURE

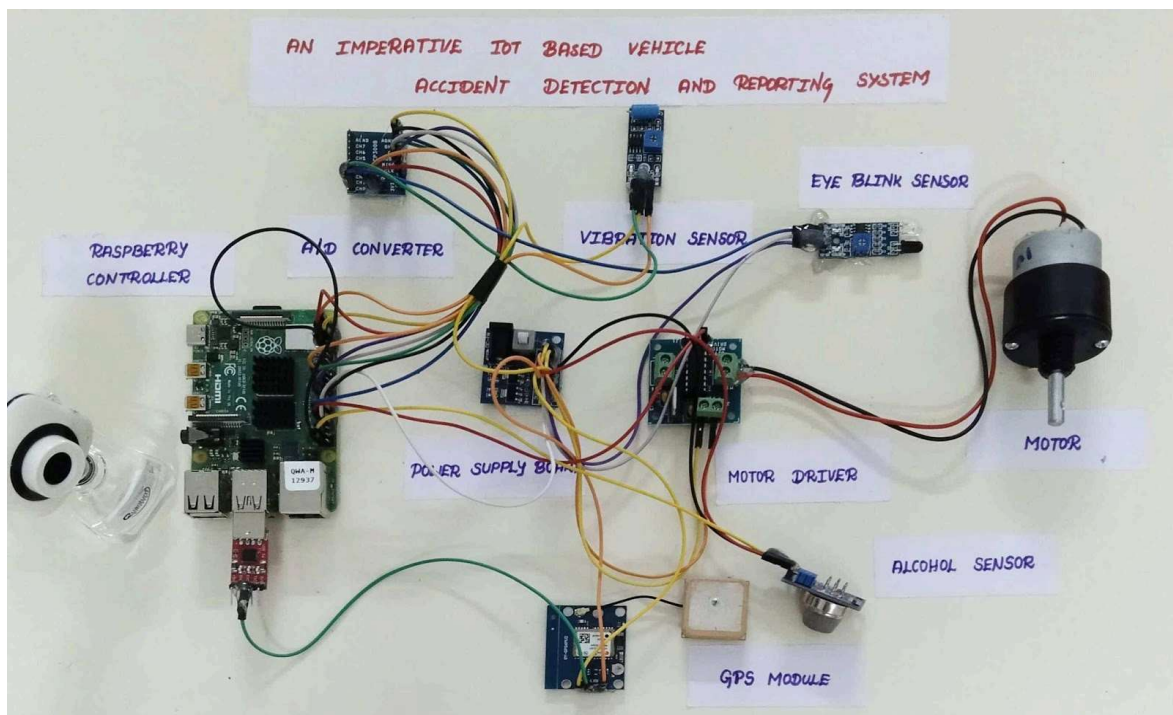


Fig 5.1:Hardware Picture

5.1.2 HARDWARE OUTPUT

This system has three major parts, those are,

- Accident prevention

- Accident detection
- Reporting system

5.1.2.1 ALCOHOL DETECTION

After giving the power supply to the microcontroller board, the motor will start rotate. If the persons has drunken and driving the vehicle then the alcohol level of the person will be detected by the alcohol sensor. In order to detect the alcohol , we are using alcohol sensor with the alcohol based sanitizer, once it detects the alcohol the green light will glow in the sensor and after the motor will get stopped.

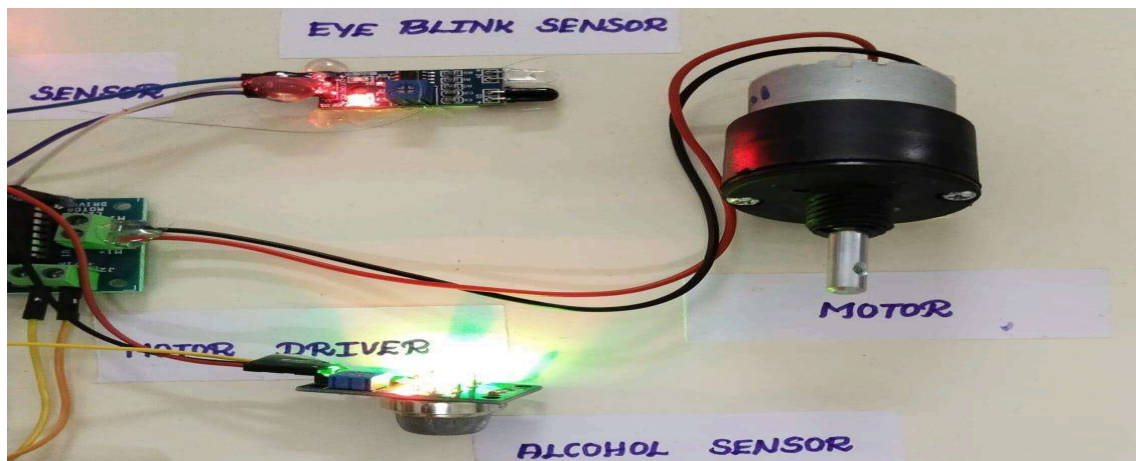


Fig 5.2:Alcohol detection

5.1.2.2 SLEEP DETECTION

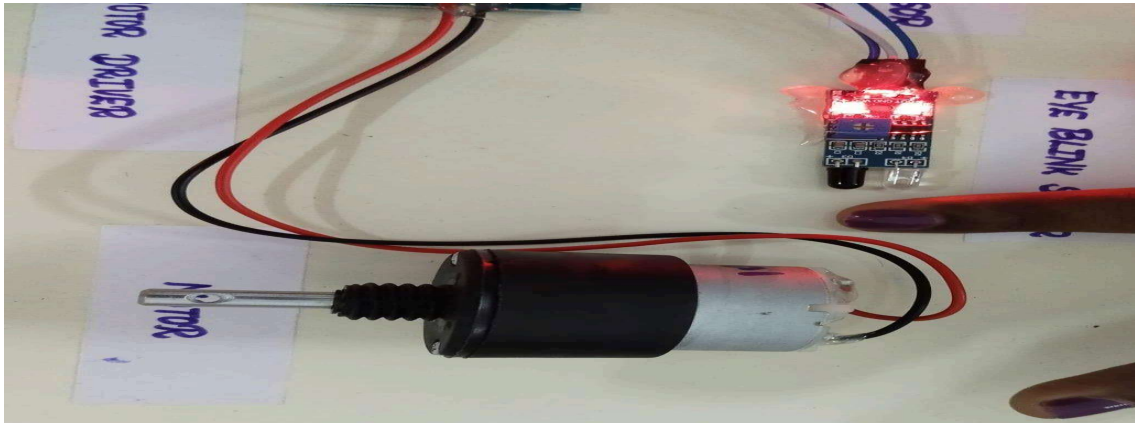


Fig 5.3: Sleep detection

In the sleep detection part, in order to detect the sleepiness of the driver we are using the eye blink sensor, for that we have already set some 15 seconds in the program. Once the sensor reaches the 15 seconds automatically the another one red light will glow in the sensor and the motor will get stopped.

5.1.2.3 ACCIDENT DETECTION AND REPORTING

Coming to the accident detection and reporting part, once the accidents has happened then the vibration sensor will detect the accident and after that GPS will track the location and send the mail alert to the emergency contact.

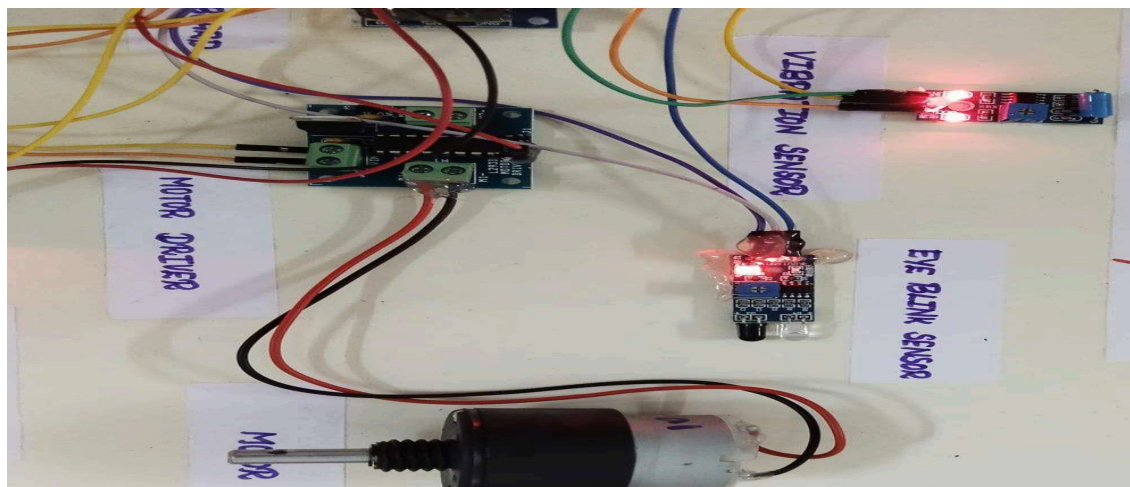


Fig 5.4 : Vibration detection and message sending



Fig 5.5 : Output mail alert

5.2 SIMULATION OUTPUT

We have implemented the simulation part in Proteus software and the desired results are shown in the below figures.

5.2.1 Sleep not detected

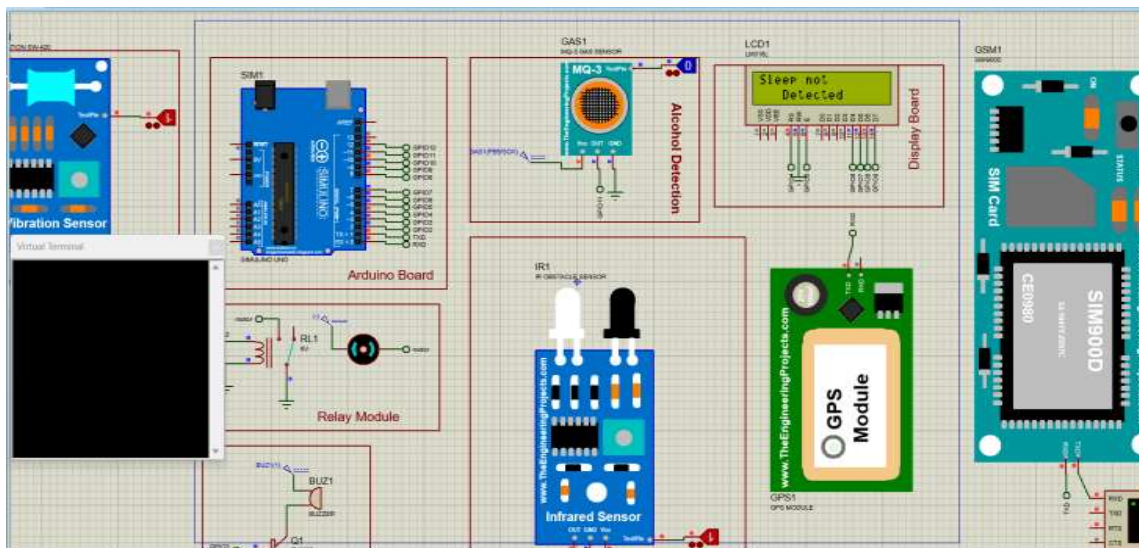


Fig 5.6 : Simulation Output – Sleep not detected

The above figure shows the sleep not detected signal. Once the arduino has started the eye blink sensor will start. If the person is not sleeping and he is in the good condition to drive the vehicle then the output of the eye blink sensor will be logic low that is shown in the figure 3.

5.2.2. Alcohol not detected

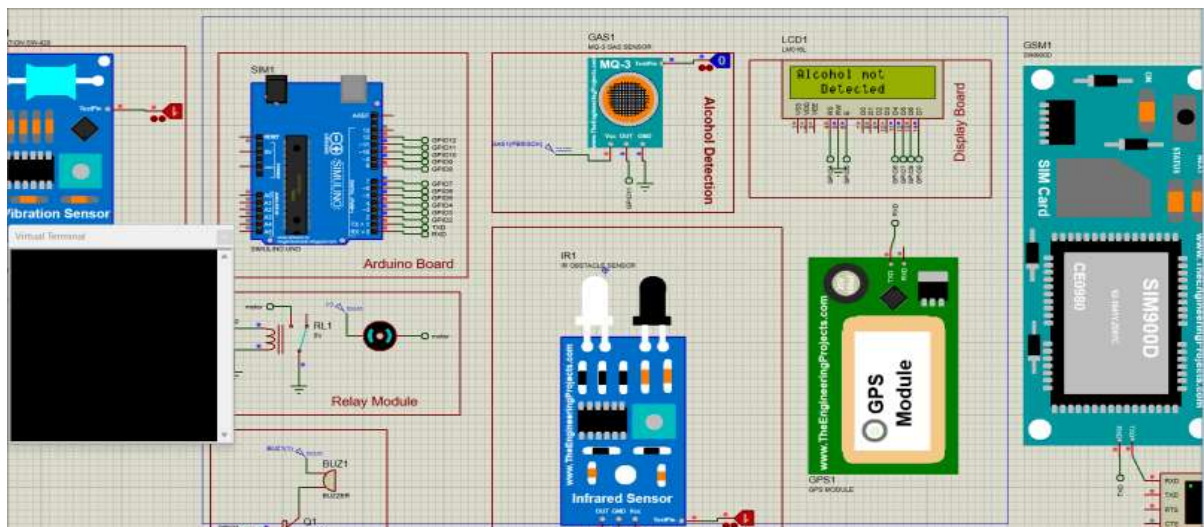


Fig 5.7 : Simulation Output –Alcohol not detected

After checking the person sleepiness then the arduino sends the control to the alchocol sensor and it checks for the alchocol level of the driver,if the person has not

drunken and he is good to carry the driving then its sends the logic low signal to arduino that is shown in the figure 4.

5.2.3. Sleep Detected

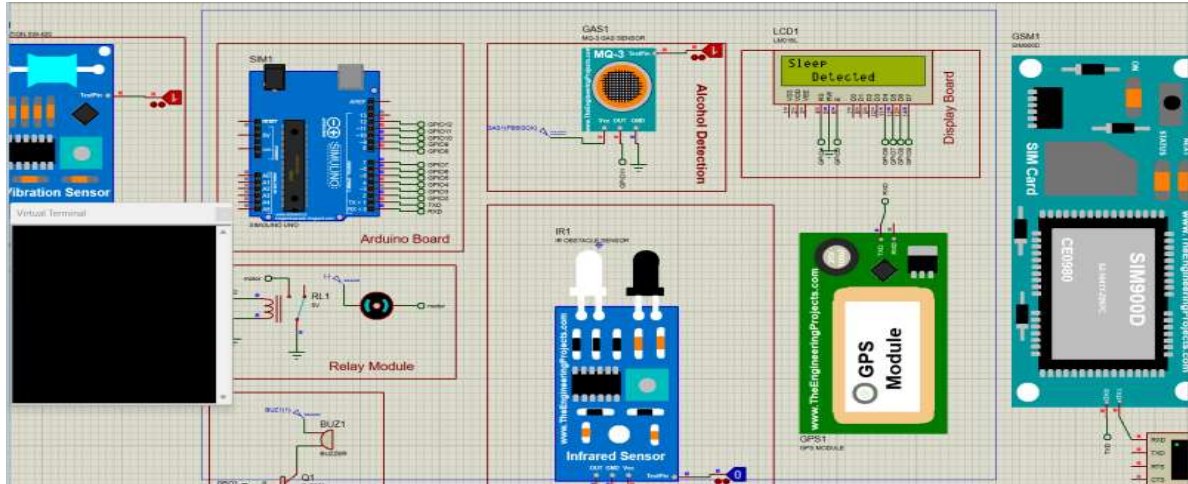


Fig 5.8 : Simulation Output – Sleep detected

The above figure shows the sleep detected signal. Once the arduino has started the eye blink sensor will start. If the person closes his eyes for more than 3 seconds then it's confirm that the person is sleeping or he is feeling sleepy. So it sends the logic high signal to the arduino and the arduino will stop the motor and switch on the buzzer.

5.2.4. Alcohol detected

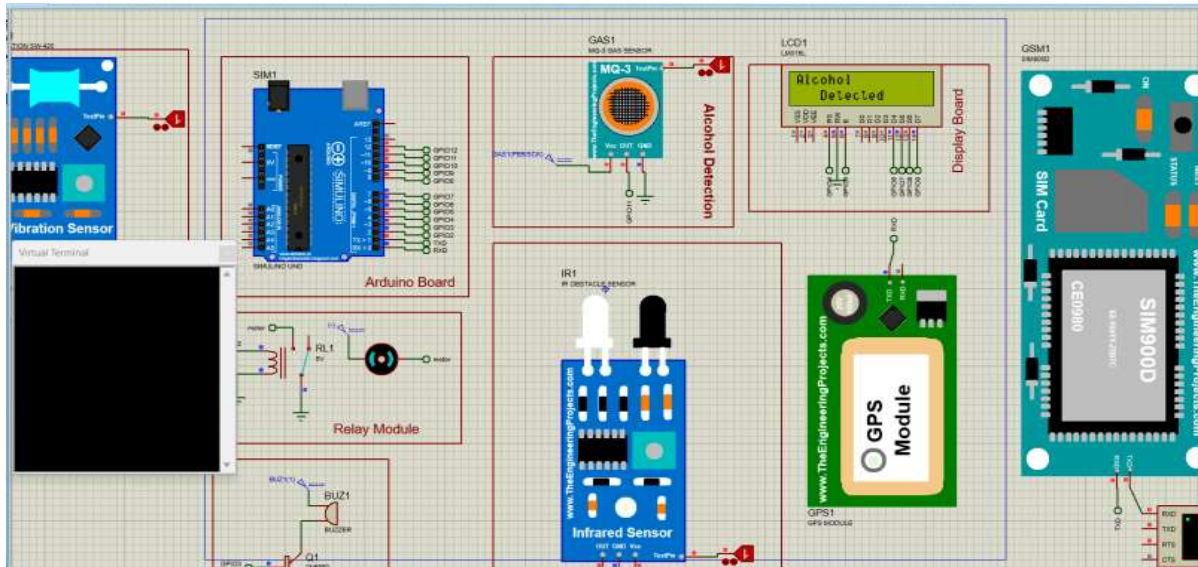


Fig 5.9 : Simulation Output –Alcohol detected

After checking the driver sleepiness arduino sends the control to the alchocol sensor, and it's search for the alcohol level of the driver if the alcohol level of the person is more than the preset value it comes to know that the person has druken and driving the vehicle so it's sends the logic high output to the arduino and the arduino stops the motor and switch on the buzzer. This process has been shown in the above figure 6.

5.2.5. Vibration detected and sending message

After completing the prevention section and the controller known that the pesron is in the good condtion to drive its starts the vehicle motor.After the motor has been started the vibration sensor continuosly check for the vibration if it finds the vibration then its sends the logic high output to the arduino . After that the GPS tracks the location and sends the message to the emergencycontacts it is shown in the above figure 7.

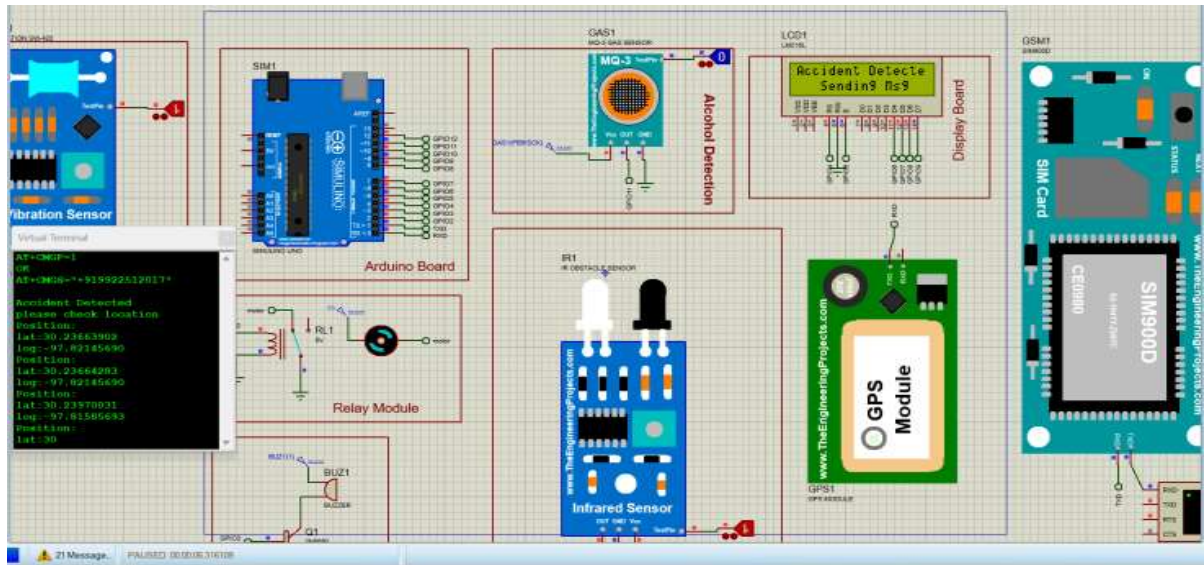


Fig 5.10 : Simulation Output –Vibration detected and sending message

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 SUMMARY

The project focuses on enhancing road safety through the implementation of a comprehensive system designed to detect and mitigate potential accidents. It employs various sensors and technologies to achieve this goal. An eye blink sensor monitor's driver fatigue, while an alcohol sensor prevents drunk driving, thereby reducing the risk of accidents caused by impaired drivers. A vibration sensor identifies collisions and impact events, enabling immediate response and reporting. A Raspberry Pi camera captures visual evidence, which can be crucial for accident verification and insurance claims. Real-time tracking via GPS ensures accurate location-based reporting for swift emergency response. The system also facilitates instant communication with emergency services and relevant authorities through GSM technology, streamlining accident reporting and response mechanisms. Ultimately, the project aims to minimize accidents, reduce their impact, and create a safer environment for all road users, promoting road safety and saving lives.

6.2 CONCLUSION

The present work provides an efficient solution to the rising concern about the large number of road accidents occurring per day, per year. One major cause of accidents, excessive use of alcohol while driving has been addressed here. Using alcohol detection sensors, the driver is made aware of how fit he is to drive. Lack of awareness often leads to irrecoverable losses. Even expert drivers can make mistakes when not fully in their senses. Apart from alcohol, there could still be unattended causes that may lead to an accident, such as drowsiness or over speed. To take care of such situations, in this work, a detection phase is also included to ensure that the driver and passengers get the required medical assistance as quickly as possible. Collisions that result in abnormal vibrations of the vehicle are detected using vibration sensors. Along with vibration detection, the most recent technology in development - deep learning has also been included to finally confirm accidents and report to the concerned centers. By including both prevention and detection phases a better safety can be assured. These technological advancements that ensure safe driving are the new features incorporated in this work that make it superior to the models reported so far.

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