A Report on

Improving Driver Safety by Detecting and Reducing health Risks in Vehicles using Sensors

Submitted in the partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

in

ELECTRONICS AND COMMUNICATION ENGINEERING

by

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2024-2025

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CERTIFICATE

This is to certify that the report entitled**" Improving driver safety by detecting and reducing health risks in vehicles using sensors**" that is being submitted by

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We hereby declare that the work entitled "Improving Driver Safety by Detecting Risks in Vehicles Using Sensors." Is being submitted to

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ABSTRACT

In today's fast-paced world, weariness, drunk driving, and drowsiness are the main factors leading to auto accidents and the deaths that result from them. The car's acceleration may be reduced to avoid an accident if the driver is still asleep or fatigued more than two seconds after the warning system sounds. These days, drivers' well- being is paramount, given the challenges they face on the road, including health emergencies and drowsiness. Our proposed abstract, "Improving Driver Safety by Detecting and Reducing Health Risks in Vehicles Using Sensors", introduces innovative sensor technology to monitor these issues. It includes a heart rate sensor in the seat belt and an eye blinking sensor above the driver's eyes, ensuring continuous vital sign monitoring. The intelligent alarm system, with internal and external buzzers, alerts the driver to potential danger. In case of worsening conditions, an automated emergency call is initiated to nearby services for timely intervention. The system also enables gradual deceleration of the vehicle, prioritizing driver safety enhancement, reducing accidents due to health emergencies or drowsiness, and providing prompt assistance on the road. This system presents a comprehensive driver safety solution, combining real-time health monitoring, early warning alerts, emergency assistance, and vehicle intervention. By proactively detecting and addressing health-related risks, this technology has the potential to significantly reduce accidents caused by fatigue, drowsiness, and medical emergencies. As advancements in automotive safety continue to evolve, integrating intelligent sensor-based monitoring systems in vehicles will play a crucial role in enhancing driver well-being and saving lives on the road.

Keywords: Driver safety enhancement, Driver well-being, Eye blinking sensor, Heartbeat sensor, Intelligent Alarm System, Gradual deceleration.

Software used: Arduino IDE

Hardware used: eye blink sensor (QRD1114), heartbeat sensor (AD 8232), Arduino Uno board, piezo buzzer, GSM SIM900A module, DC motors.

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CHAPTER-1

INTRODUCTION

1.1 INTRODUCTION TO IOT

The **Internet of Things (IoT)** is a revolutionary technology that connects everyday objects to the internet, enabling them to collect, share, and exchange data without human intervention. This network of smart devices includes everything from household appliances like refrigerators and thermostats to industrial machines, wearable health trackers, smart cars, and even connected cities. At its core, IoT allows objects to be embedded with sensors, software, and other technologies to gather and transmit data in real time. This data-driven connectivity enhances efficiency, automation, and convenience across various sectors, including healthcare, transportation, agriculture, smart homes, and industries.

The power of IoT lies in its ability to create a seamless digital ecosystem where devices communicate with each other, making informed decisions without the need for direct human input. As IoT continues to evolve, it plays a crucial role in shaping a smarter, more connected world, driving innovations in automation, energy management, and data analytics. The Internet of Things (IOT) is a rapidly growing technology that connects everyday objects and devices to the internet, enabling them to collect, exchange, and analyze data without human intervention. It involves the integration of sensors, software, and other technologies into physical objects, allowing them to interact with each other and with centralized systems. From smart homes to healthcare and industrial applications, IoT is transforming how we live, work, and interact with our environment. With the proliferation of connected devices, the **IoT ecosystem** spans a wide range of industries, including transportation, agriculture, energy, manufacturing, healthcare, smart homes, and urban infrastructure. This vast network of interconnected devices collects and exchanges **real-time data**, enabling more informed decision-making, improved operational efficiency, and enhanced convenience across various sectors. For instance, in **smart agriculture**, IoT devices monitor soil moisture, weather conditions, and crop health, allowing farmers to optimize irrigation and improve yields.

In **healthcare**, wearable track vital signs, enabling remote patient monitoring and early detection of potential health issues.

As IoT devices become more intelligent through advancements in artificial intelligence (AI) and machine learning (ML), autonomous systems are emerging, promising even greater advancements in automation and resource management. In smart citie**s**, IoT solutions manage traffic flow, reduce energy consumption, and optimize waste management, making urban living more sustainable and efficient. In the energy sector, smart grids monitor and manage electricity distribution in real time, reducing waste and supporting renewable energy integration.

However, the rapid growth of this interconnected world also presents significant challenges. **Security** remains a major concern, as the vast amount of data exchanged can be vulnerable to cyber-attacks if not properly protected. Privacy issues arise from the collection of personal data by IoT devices, raising questions about data ownership and consent. Additionally, the management of such large volumes of data requires robust infrastructure and advanced analytics capabilities to ensure accuracy and reliability.

Despite these challenges, IoT continues to evolve at an unprecedented pace. Innovations in 5G technology, edge computing, and blockchain are expected to address some of these issues, enhancing the security, speed, and scalability of IoT networks. The future of IoT promises a world that is smarter, more connected, and more efficient than ever before, transforming how we live, work, and interact with our environment. As industries and consumers increasingly adopt IoT solutions, it will continue to shape the future of technology and our daily lives.

The Internet of Things (IOT) represents a paradigm shift where every day physical objects are imbued with sensors, software, and network connectivity, enabling them to collect and exchange data. This interconnected web of "things" facilitates communication between devices and systems, fostering a dynamic exchange of information that empowers automation and intelligent decision-making.

Embedded sensors, IoT devices capture real-time data from their surroundings, while actuators perform actions based on processed information, leading to diverse applications across various sectors. From smart homes that optimize energy consumption to industrial settings that enhance manufacturing efficiency, IOT is revolutionizing how we interact with our environment. The core of IOT lies in its ability to connect devices through diverse network technologies, process and analyze collected data, and provide valuable insights that drive innovation and improve our daily lives.

1.2 Introduction to Arduino:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's designed to be accessible to anyone, from hobbyists and artists to engineers and educators, who want to create interactive projects. At its core, an Arduino board is a small microcontroller that can be programmed to sense and control the physical world. These boards can read inputs from sensors—like light, temperature, or motion—and turn those inputs into outputs—like activating motors, turning on LEDs, or displaying information on a screen. The simplicity of the Arduino platform lies in its user-friendly Integrated Development Environment (IDE), which provides a straightforward way to write and upload code to the micro controller.

The strength of Arduino lies in its vibrant community and extensive resources. The open-source nature of the platform means that countless examples, libraries, and tutorials are readily available online, making it easy for beginners to learn and for experienced users to find solutions to complex problems. This collaborative environment fosters innovation and allows users to build upon the work of others, accelerating the development process. Furthermore, the affordability and versatility of Arduino boards make them ideal for a wide range of applications, from simple DIY projects to sophisticated prototypes. Whether you're interested in building a robotic arm, automating your home, or creating interactive art installations, Arduino provides a powerful and accessible tool set for bringing your ideas to life.

1.3 Heart beat sensors:

Heartbeat sensors are devices designed to detect and measure the rate of a person's heartbeat. They play a crucial role in various applications, from personal fitness tracking to medical monitoring. These sensors typically work by detecting the changes in blood volume in a finger or earlobe, which occur with each heartbeat.

There are two primary types of heartbeat sensors: optical sensors and electrical sensors.

Optical sensors, often used in wearable devices like fitness trackers, utilize light to detect changes in blood volume. They shine a light into the tissue and measure the amount of light reflected back, which varies depending on the blood flow. Electrical sensors, like those used in electrocardiograms (ECGS), measure the electrical activity of the heart. These sensors provide a more accurate and detailed representation of the heart's rhythm, but they are generally more complex and require closer contact with the body.

Heartbeat sensors have a wide range of applications. In fitness, they help individuals track their heart rate during exercise, allowing them to optimize their workouts and monitor their cardiovascular health. In healthcare, they can monitor patients with heart conditions, detect arrhythmia, and provide early warning signs of potential problems. They also find applications in research, gaming, and even stress monitoring. As technology advances, heartbeat sensors are becoming smaller, more accurate, and more integrated into everyday devices, making them a valuable tool for monitoring and understanding human physiology.

1.4 Eye Blinking Sensor:

Eye blinking sensors are devices designed to detect and measure the frequency and characteristics of human eye blinks. These sensors play a critical role in various applications, ranging from medical diagnostics and human-computer interaction to fatigue monitoring and assistive technologies.

The core principle behind these sensors often involves detecting changes in the electrical potential around the eyes or the physical movement of the eyelids. Electrooculography (EOG) is a common technique used in medical settings, where electrodes placed around the eyes measure the electrical potential changes caused by eye movements and blinks. Optical sensors, on the other hand, utilize infrared light or other optical methods to detect the physical movement of the eyelids, offering a non- invasive alternative for applications like user interface control and drowsiness detection. These sensors can differentiate between voluntary and involuntary blinks, providing valuable data about a person's cognitive state, alertness, and potential neurological conditions.

The applications of eye blinking sensors are diverse and impactful. In medical diagnostics, they aid in the assessment of neurological disorders such as Parkinson's disease, multiple sclerosis, and amyotrophic lateral sclerosis (ALS), where eye blink abnormalities can serve as crucial indicators. In human-computer interaction, these sensors enable hands-free control of devices, offering accessibility for individuals with motor impairments. In fields like transportation and industrial safety, they are used to monitor driver or operator fatigue, preventing accidents caused by drowsiness. Furthermore, eye blinking sensors are integrated into virtual reality and augmented reality systems to enhance user interaction and create more immersive experiences. In assistive technologies, they empower individuals with severe disabilities to communicate and control their environment. As technology advances, these sensors are becoming more accurate, compact, and less intrusive, paving the way for wider adoption and innovative applications in various domains.

1.5 Relay Module:

A relay module serves as an electrically controlled switch, bridging the gap between low-power control circuits and high-power load circuits. This crucial component allows a small electrical signal, typically from a microcontroller like an Arduino, to activate a larger current or voltage circuit, effectively controlling devices like motors, lights, or appliances.

The core functionality revolves around an electromagnet that, when energized by the control signal, physically moves a switch, either closing or opening the load circuit. The inherent electrical isolation between the control and load circuits is a vital safety feature, protecting sensitive electronics from potentially damaging high voltages or currents. Available in various configurations, such as SPST, SPDT, and DPDT, relay modules offer flexibility in controlling diverse electrical systems. In essence, they provide a reliable and safe method for microcontrollers and other low-power devices to manage and automate high-power electrical loads.

1.6 DC Motor:

A DC motor, or direct current motor, is an electromechanical device that converts electrical energy into mechanical energy. Its operation relies on the fundamental principle of electromagnetism: when a current-carrying conductor is placed in a magnetic field, it experiences a force. In a DC motor, this force is harnessed to produce rotational motion. The core components include a stator, which provides a stationary magnetic field, and a rotor (armature), which carries the electrical current and rotates within the magnetic field. The stator can consist of permanent magnets or electromagnets, while the rotor typically comprises coils of wire wound around an iron core. A commutator and brushes are essential for reversing the current direction in the rotor coils, ensuring continuous rotation. The commutator is a segmented ring connected to the rotor windings, and the brushes are stationary contacts that transfer current from an external circuit to the commutator. As the rotor turns, the commutator segments switch contact with the brushes, reversing the current flow and maintaining the torque in a consistent direction.

DC motors are prevalent in a wide array of applications due to their simplicity and ease of control. They are found in everything from small electronic devices and toys to large industrial machinery and electric vehicles. The speed of a DC motor can be easily controlled by varying the applied voltage, and its direction can be reversed by changing the polarity of the voltage. This versatility makes DC motors a fundamental component in many automation and robotics systems, where precise motion control is essential.

Furthermore, different types of DC motors, such as brushed and brushless, offer varying performance characteristics, allowing for optimization in specific applications. Brushed DC motors, while simpler and less expensive, require regular maintenance due to brush wear, whereas brushless DC motors offer higher efficiency, longer lifespan, and quieter operation, making them ideal for high-performance and demanding applications.

1.7 Battery:

A battery is an electrochemical energy storage device that converts chemical energy into electrical energy through a series of redox reactions. At its core, a battery comprises one or more electrochemical cells, each consisting of a positive electrode (cathode), a negative electrode (anode), and an electrolyte. The electrolyte, a substance that conducts ions, facilitates the movement of charged particles between the electrodes, enabling the flow of electrical current. When a battery is connected to an external circuit, chemical reactions occur at the electrodes, releasing electrons that flow from the anode to the cathode, creating an electrical current. The type of materials used for the electrodes and electrolyte determines the battery's voltage, capacity, and overall performance characteristics. Primary batteries, such as alkaline and lithium-ion coin cells, are designed for single use and are discarded once their chemical reactants are depleted. Secondary batteries, like lithium-ion and lead-acid batteries, are rechargeable, allowing for multiple charge-discharge cycles. These rechargeable batteries rely on reversible chemical reactions, enabling the restoration of the active materials through an external power source. Battery technology continues to evolve, driven by the increasing demand for portable electronics, electric vehicles, and renewable energy storage. Advancements in materials science and electro chemistry are leading to the development of batteries with higher energy densities, longer lifespans, and improved safety profiles. From powering small electronic devices to enabling large-scale energy storage for grid stabilization, batteries play a crucial role in modern technology and sustainable energy solutions.

1.8 GSM Module:

A GSM (Global System for Mobile Communications) module is a type of hardware device that enables wireless communication using cellular networks. These modules are essentially miniaturized mobile phones that can be embedded into various electronic systems, allowing them to send and receive data, voice calls, and SMS messages over cellular networks. They operate by connecting to a mobile network operator's infrastructure, using SIM cards to authenticate and identify themselves on the network.

Key features of GSM modules include their ability to establish connections using various cellular technologies, such as 2G, 3G, and sometimes even 4G/LTE, depending on the specific module. They typically support a range of communication protocols, including AT commands, which allow micro controllers and other embedded systems to control the module's functions. These commands enable tasks such as making calls, sending and receiving SMS messages, and establishing data connections over GPRS (General Packet Radio Service) or other data networks. GSM modules are widely used in applications that require remote monitoring and control, such as asset tracking, security systems, and remote data logging. They are also integral to IOT (Internet of Things) devices that need to transmit data over cellular networks. The reliability and widespread availability of GSM networks make these modules a versatile solution for connecting devices in remote or challenging environments.

1.9 Mini Bread Board:

A breadboard, also known as a protoboard, is an essential tool in prototyping electronics, designed to facilitate the construction and testing of electronic circuits without the need for soldering. It's a rectangular plastic board with a grid of holes, where electronic components can be inserted and interconnected using jumper wire. The internal structure of a breadboard consists of interconnected metal strips that run horizontally and vertically, providing a convenient way to create electrical connections. Typically, the center section of the breadboard features rows of holes connected horizontally, while the outer rows, known as power rails, run vertically along the edges, providing easy access to power and ground connections. This arrangement allows for the quick and easy assembly of circuits, making it ideal for experimenting with different component combinations and circuit designs. The primary advantage of using a breadboard is its reusability and flexibility. Components can be easily inserted and removed, allowing for rapid modifications and adjustments to the circuit.

This makes breadboards invaluable for educational purposes, hobbyist projects, and professional prototyping, where experimentation and iteration are crucial. Furthermore, the absence of soldering eliminates the risk of damaging sensitive electronic components due to excessive heat, and it simplifies the process of troubleshooting and debugging circuits. Breadboards come in various sizes and configurations, catering to different project requirements. Larger breadboards provide more space for complex circuits, while smaller ones are suitable for compact projects. The ease of use and versatility of breadboards have made them a staple in the electronics world, empowering creators to bring their ideas to life quickly and efficiently.

1.10 Wires and jumper Wires:

Electrical wires are fundamental components in any electronic or electrical system, serving as the conduits through which electrical current flows. They come in a vast array of types, sizes, and materials, each suited for specific applications and operating conditions. Copper is favored for its excellent conductivity and flexibility, while aluminum is used in high-voltage transmission lines due to its lighter weight and lower cost. The insulating material, often made of plastic, rubber, or Teflon, prevents current leakage and protects against short circuits and environmental factors.

The size of a wire, typically measured in gauge (AWG - American Wire Gauge), dictates its current-carrying capacity. Smaller gauge numbers correspond to thicker wires, which can handle higher currents, while larger gauge numbers indicate thinner wires, suitable for lower current applications. Additionally, specialized wires like coaxial cables for high-frequency signals, shielded wires for noise reduction, and high-temperature wires for extreme environments are designed to meet specific performance requirements. Proper wire selection and installation are crucial for ensuring the safety and reliability of electrical systems, preventing overheating, short circuits, and other potential hazards. Jumper wires are essential tools for prototyping and experimenting with electronic circuits on breadboards or other prototyping platforms. They are flexible wires with connectors at each end, designed to establish temporary connections between components without the need for soldering. These wires come in various types, each suited for different applications and connection styles.

The most common types include solid-core jumper wires, stranded jumper wires, and ribbon jumper wires. Solid-core jumper wires are rigid and ideal for making clean and precise connections on breadboards, as their solid core maintains its shape and easily inserts into the breadboard holes. Stranded jumper wires, on the other hand, are more flexible and durable, making them suitable for connections that may involve movement or frequent adjustments. Ribbon jumper wires consist of multiple insulated wires bundled together in a flat ribbon, allowing for organized and efficient connections between multiple points.

Jumper wires also vary in their connector types, with male-to-male, male-to-female, and female-to-female configurations. Male connectors have exposed pins, while female connectors have receptacles. This variety allows for versatile connections between different components and boards. For example, male-to-male jumpers are commonly used to connect components on a breadboard, while male-to-female jumpers are used to connect components to microcontroller boards like Arduino or Raspberry Pi. The color-coding of jumper wires help organize and identify connections, simplifying circuit debugging and troubleshooting. Overall, jumper wires are indispensable for rapid prototyping, allowing for quick and easy experimentation with electronic circuits.

1.11 Buzzer:

A buzzer, also known as a sounder or beeper, is an audio signaling device that produces a distinct buzzing or beeping sound. Buzzers are broadly categorized into two main types: electromagnetic buzzers and piezoelectric buzzers. Electromagnetic buzzers, also called magnetic buzzers, operate based on the principle of electromagnetism. They consist of an electromagnet, a diaphragm, and a coil. When an electrical current is applied to the coil, it generates a magnetic field that attracts the diaphragm, causing it to vibrate and produce sound. Piezoelectric buzzers, on the other hand, utilize the piezoelectric effect, where certain materials generate an electrical charge when subjected to mechanical stress, or conversely, deform when an electrical field is applied. They consist of a piezoelectric crystal sandwiched between two conductive plates.

When an alternating voltage is applied to the plates, the crystal vibrates, producing sound. Piezoelectric buzzers are often simpler to drive, as they can sometimes be activated directly with a square wave signal from a microcontroller. They generally consume less power than electromagnetic buzzers. Buzzers find applications in various devices and systems, including alarm clocks, timers, electronic toys, household appliances, and industrial control panels. They are used to signal alarms, notifications, warnings, and user feedback. Their simplicity, low cost, and reliable operation make buzzers a common and effective solution for audible signaling in electronic circuits.

Goggles and Toy cars are used. Goggles are used to connect the Eye Blinking Sensor. With the help of this eye blinking sensor, when the patient blinks, it starts buzzing, and with the help of this, the patient wakes up. The toy car is used to connect the motor. We insert the motor inside the car. With the help of the battery, the motor runs.

CHAPTER-2

LITERATURE SURVEY

We began to search our base paper in https://ieeexplorer.ieee.org/ based on our problem statement, which consists of the best research.

2.1.1 Drowsy Driving

This approach addresses the issue of drowsy driving, specifically targeting healthcare workers, such as nurses, who often work long hours. It aims to educate individuals about the dangers of driving while fatigue, highlighting the impact on safety and health. Through this training, it seeks to raise awareness of how drowsiness can impair driving abilities. It provides strategies to prevent fatigue-related accidents and encourages proper rest. The resource helps mitigate risks for workers who drive after extended shifts. Ultimately, the project promotes safer driving habits and overall well- being. This approach is very useful to nurses. It educates on how to drive in a safe manner.

2.1.2 Advanced driver assistance systems: Changes in prevalence, use, and perceptions over 3 years.

This approach examines how older drivers' use of Advanced Driver Assistance Systems (ADAS) has changed over three years. It focuses on the prevalence of ADAS technologies in vehicles used by older adults. The research tracks how the adoption and usage of these systems evolve over time within this demographic. It also explores older drivers' perceptions of ADAS, including their attitudes and confidence levels. The study aims to understand the impact of these technologies on driving safety and behavior. It sheds light on how older drivers adapt to new automotive technologies. Ultimately, the research provides insights into improving vehicle safety features for aging drivers.

2.1.3 Fatigued driving

This approach focuses on understanding the risks associated with fatigued driving, which occurs when a driver is too tired to operate a vehicle safely. It highlights the dangers of driving while drowsy, including slower reaction times and impaired decision-making. This project mainly aims to raise awareness about impact of fatigue on driving performance and safety. It provides strategies to prevent accidents caused by tiredness, such as taking breaks or ensuring adequate rest. The project may also explore factors contributing to driver fatigue, like long work hours or poor sleep. Its goal is to promote safer driving habits and reduce fatigue-related crashes. Ultimately, the project seeks to improve public awareness and encourage healthier driving practices.

2.1.4 A texture-aware U-Net for identifying incomplete blinking from eye videography.

This approach introduces a texture-aware U-Net, a deep learning model designed to detect incomplete blinking in eye videography. It focuses on analyzing video footage of eyes to identify instances where blinking is not fully completed. The U-Net model is texture-aware, meaning it can recognize subtle variations in eye features that indicate incomplete blinks. It uses advanced image segmentation techniques to isolate these details from video frames. The goal is to improve the accuracy of blink detection, which has applications in areas like driver monitoring and healthcare. The project enhances the ability to track and understand eye movements. Ultimately, it aims to provide better insights into fatigue or focus-related issues.

2.1.5 Real-time classification for autonomous drowsiness detection using eye aspect ratio.

This project focuses on real-time drowsiness detection for autonomous systems using the eye aspect ratio (EAR).It involves monitoring the changes in the eye's shape to identify signs of fatigue or drowsiness. By analyzing the EAR, which measures the distance between key points on the eye, the system can detect if a person's eyes are closing too frequently or for extended periods. The project aims to provide continuous monitoring to enhance safety in applications like self-driving cars or driver-assist systems. The system operates in real-time, making it suitable for immediate action when drowsiness is detected. It is designed to help prevent accidents caused by fatigued drivers. Ultimately, the project seeks to integrate drowsiness detection into autonomous driving technologies for safer roads.

2.1.6 Face Mesh

This Face mesh approach refers to a 3D representation of a human face, created by mapping key facial landmarks onto a mesh of connected points. It uses advanced computer vision techniques to track and model the facial structure in real-time. The face mesh consists of a network of vertices that define the contours, eyes, nose, mouth, and other facial features. It is commonly used in applications like facial recognition, augmented reality (AR), and emotion detection. Technology can capture subtle movements and expressions, enhancing user interaction with devices. By tracking facial landmarks, it provides detailed data for analyzing facial gestures. Overall, face mesh enables accurate, dynamic facial modeling for various digital experiences

CHAPTER-3

EXISTING DESIGN

3.1 Existing System: Improving driver safety by detecting and reducing health risks in vehicles using sensors

The Design for Improving driver safety by detecting and reducing health risks in vehicles using sensors. In this case, there was an Arduino. The Arduino input pins are connected to the relay module and GSM module. In this project, the inputs are Heartbeat Sensors and Eye Blink sensors. Two Buzzers are present in this project. If the person is not responding to the sound of the first Buzzer, then the Second Buzzer starts Buzzing. When a sleepy condition is detected, the vehicle gradually reduces its speed every 4 seconds until it comes to a complete stop at 0 km/h. This controlled deceleration prevents sudden braking, which could cause dangerous collisions. It also alerts nearby drivers, giving them enough time to react and avoid potential accidents by maintaining situational awareness.

For the experimental Setup, we need a GSM MODULE and GPS to trace and send that the person is in danger to the emergency contact. SIM900A is used in it. For the toy car, we need to set up a motor that is connected to the relay module, and it is powered by a 12V battery supply. We will connect Arduino input pins to the relay module and GSM module and connect to the Ground in the breadboard. In the Arduino Board, we will connect pin 2 and pin 3 to the GSM module. Pin 6 as relay module input, Pin 8 as Eye Blinking Sensor output. Pin 9,Pin 10 to the Heart Beat Sensors. The Analog pins A0, A1, and A2 are connected to the Heart Sensor, Buzzer 1, and Buzzer 2. In this, all the connections are connected.

In summary, Improving Driver safety by detecting and reducing health risks in vehicles using sensor controls the accidents with the help of GPS, GSM module, Buzzers, heartbeat sensors, and Eye Blinking Sensors.

3.2 Disadvantages of the Existing System:

- **False Positives/Negatives**: Drowsiness detection systems may incorrectly identify a person as drowsy when they are not (false positive) or fail to detect genuine drowsiness (false negative). This can reduce the effectiveness of the system and create false alarms or missed safety risks.
- **Limited Scope**: Many systems are designed to monitor physical signs such as blinking or head movement. However, these indicators may not always reliably correlate with drowsiness.
- **Driver Discomfort or Distraction**: Some systems use cameras or sensors that can be intrusive or distracting, causing discomfort to drivers. Constant monitoring may also create a sense of surveillance, which can be unsettling for users.
- **Over-reliance on Technology**: There's a risk that drivers or operators might become overly reliant on the detection system, potentially ignoring other signs of drowsiness or fatigue, assuming the system will always alert them in time.
- **Environmental Factors**: Poor lighting, weather conditions, or certain movements may interfere with the detection system's ability to accurately assess drowsiness.
- **Privacy Concerns**: Some drowsiness detection systems require cameras or sensors that monitor individuals closely. This raises concerns about privacy, particularly if the data is collected or used for other purposes.
- **High Cost**: Advanced drowsiness detection technology can be expensive to implement, particularly in vehicles. This can limit its availability or affordability for widespread use.
- **Adaptation and Calibration**: Some systems may require calibration to individual users, and not all systems adapt well to different driving styles, making them less effective in diverse situations.
- **Behavioral Changes**: Users might alter their behavior to avoid triggering the drowsiness system (e.g., deliberately making unnecessary movements or changing their posture), which could impact the system's reliability.
- **Adaptation and Calibration**: Some systems may require calibration to individual users, and not all systems adapt well to different driving styles, making them less effective in diverse situations.

CHAPTER-4

PROPOSED DESIGN

4.1 BLOCK DIAGRAM

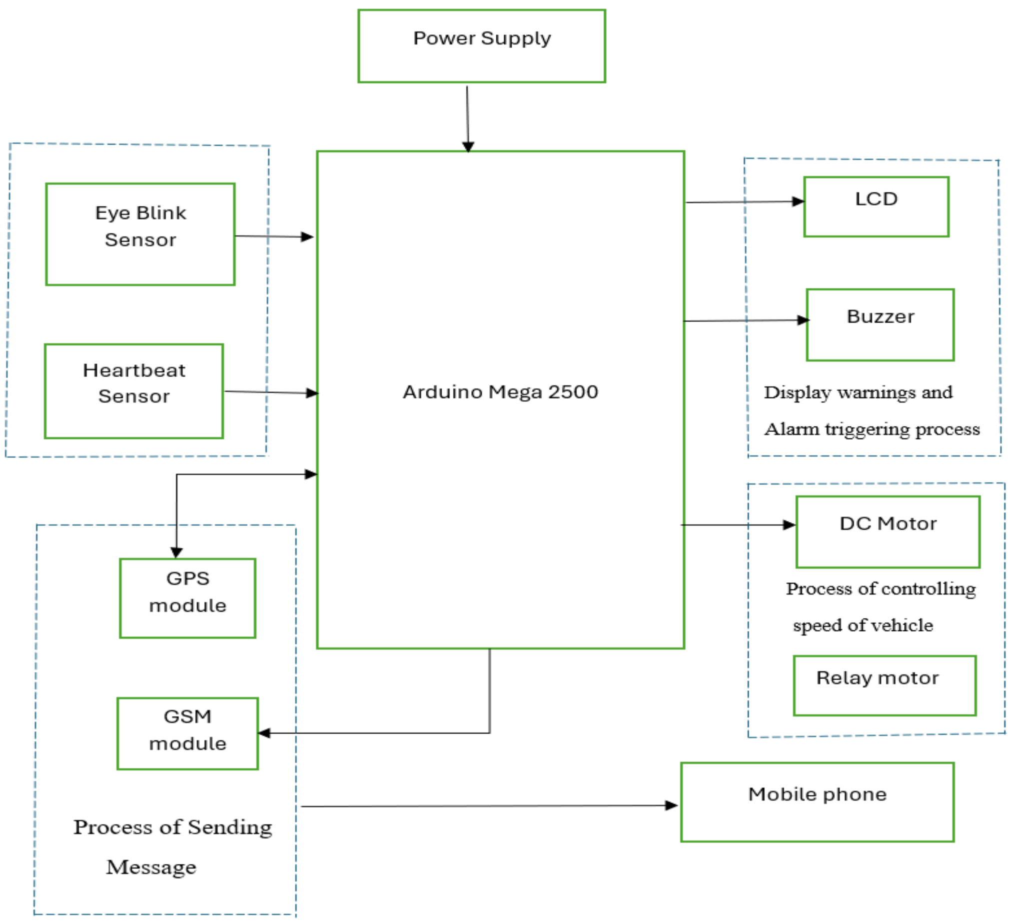

Fig:4.11 Block diagram

The above block diagram shows the inputs and outputs. It consists of the following components:

A) Arduino Uno: The **Arduino Uno** is one of the most popular microcontroller boards used in electronics and programming. It is a part of the Arduino family of open-source hardware and software. It is widely used for DIY projects, prototyping, and learning about embedded systems .

The Arduino Uno is one of the most popular microcontroller boards used for building digital devices and interactive projects. It's based on the ATmega328P microcontroller and features 14 digital input/output pins (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button.

It's widely used for prototyping because it's easy to program using the Arduino IDE, which supports C and C++ languages. The Uno can control LEDs, motors, sensors, and other electronic components, making it perfect for beginners and advanced users alike.

Applications of Arduino Uno:

1) **Basic Electronics Projects**: The Arduino Uno is ideal for learning basic electronics concepts like reading sensors, controlling outputs like motors or LEDs, and interfacing with other components

2) **Automation Systems:** Arduino can be used to create home automation systems, controlling lights, fans, or other devices based on sensors or time-based logic.

3) **Robotics**: The Arduino Uno can control the motors of a robot, handle sensors like ultrasonic distance sensors or cameras, and provide the logic for movement.

4) **Environmental Monitoring:** You can use Arduino Uno with sensors to measure environmental data like temperature, humidity, or air quality and log the data for analysis or display it on a screen.

IoT Projects: Although Arduino Uno doesn't have built-in Wi-Fi or Bluetooth, it can easily be paired with external modules like the **ESP8266** or **HC-05 Bluetooth module** to create Internet of Things (IoT) devices.

Arduino Uno can be used as the core of wearable devices that monitor health data or track user movement, though for smaller wearable projects, a smaller Arduino variant like the **Arduino Nano** is often preferred.

Pros of Arduino Uno:

1. **Beginner-Friendly**: The simplicity of the Arduino environment and vast online resources make it easy for beginners to get started.
2. **Large Community**: There is a huge online community of Arduino users who share tutorials, projects, and support.
3. **Affordability**: Arduino Uno is relatively inexpensive compared to other development boards.
4. **Compatibility**: It is compatible with a wide range of shields and modules (e.g., sensors, displays, motor controllers).
5. **Ease of Use**: The Arduino IDE is beginner-friendly, with simple programming in C/C++. Extensive community support makes troubleshooting easier.
6. **Open Source**: Both the hardware and software are open source, allowing anyone to modify and improve them. This fosters a large, active community of makers and developers.
7. **Affordable**: It's cost-effective, especially for hobby projects, educational purposes, and prototypes.
8. **Wide Range of Shields and Modules**: The Uno is compatible with numerous Arduino shields and external modules (like Wi-Fi, Bluetooth, motor drivers), making it versatile for different applications.
9. **Cross-Platform**: The Arduino IDE works on Windows, macOS, and Linux, ensuring compatibility across different operating systems.
10. **Compact Size**: Its small form factor makes it easy to integrate into various projects without taking up much space.
11. **Reliable and Stable**: Once programmed, the Uno runs code reliably, making it suitable for long-term projects.
12. **Extensive Documentation and Tutorials**: There are countless guides, tutorials, and examples available online, which helps in learning and troubleshooting.
13. **Great for Prototyping**: The Uno is ideal for quick prototyping, allowing you to test and modify circuits easily before finalizing designs.

Cons of Arduino Uno:

1. **Limited Processing Power**: With a 16 MHz clock speed and 32 KB of memory, the Arduino Uno is limited in its computational power, making it unsuitable for complex applications.
2. **Limited I/O Pins**: The board has only a limited number of digital and analog I/O pins, which may be restrictive for more complex projects.

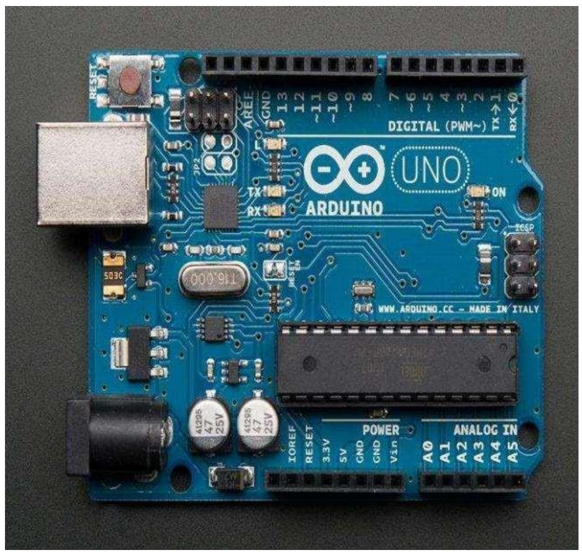

Fig 4.12:Aurduino UNO

B) Heartbeat Sensors : Heartbeat sensors are devices designed to monitor and measure a person's heart rate. They are used in various applications, including healthcare, fitness, and drowsiness detection, among others. These sensors typically detect the electrical activity of the heart or the physical motion of blood as it circulates through the body.

There are several types of heartbeat sensors, each with its unique characteristics and uses:

Applications for Heartbeat Sensors Health Monitoring:

Heartbeat sensors are essential in monitoring heart health, detecting arrhythmias, and assessing overall cardiovascular function. They are commonly used in hospitals, clinics, and by individuals for preventive health measures.

Fitness and Exercise:

Fitness trackers and smartwatches use heartbeat sensors to track physical activity and monitor exercise intensity. Heart rate data is valuable for users to gauge their fitness levels, optimize workouts, and track recovery.

Drowsiness Detection:

In some drowsiness detection systems, heartbeat sensors can track changes in heart rate patterns, as drowsiness can affect heart rate variability. This is often combined with other sensors, such as PPG or motion sensors.

Sleep Monitoring:

Heartbeat sensors can be used in devices like smart mattresses or wearable devices to monitor sleep patterns, heart rate variability, and overall sleep quality.

Fig 4.13: Heart Beat Sensor

Advantages of Heartbeat Sensors:

- **Non-invasive**: Many modern sensors, such as PPG and BCG sensors, are non-invasive and comfortable, enabling users to track heart health.
- **Continuous Monitoring**: Heartbeat sensors allow for real-time and continuous heart rate monitoring, which is useful for both medical and fitness purposes.
- **Portable**: Many heartbeat sensors are integrated into wearable devices, making it easy to monitor heart health on the go.

Disadvantages of Heartbeat Sensors:

- **Accuracy**: Some sensors, particularly PPG, can be less accurate, especially in environments with motion or poor skin contact.
- **Interference**: External factors such as ambient light, skin tone, or even tight-fitting clothes can interfere with sensor readings, reducing accuracy.
- **Battery Life**: Wearable devices with heartbeat sensors often need to be recharged regularly, especially when monitoring continuously.
- **Cost**: High-quality sensors, like ECG-based systems, can be expensive and require specialized equipment or professional medical oversight.

C) Eye Blinking Sensor: An **eye blinking sensor** is a device designed to detect when a person blinks their eyes. These sensors are often used in applications where detecting eye movement is important, such as in drowsiness detection systems, eye-controlled interfaces, or assistive technologies for individuals with disabilities.

There are a few different types of sensors that can be used to detect eye blinking:

1. Infrared (IR) Sensors:

- **How it works**: Infrared sensors use an infrared light emitter and detector to monitor changes in the amount of reflected infrared light. When a person blinks, the distance or intensity of reflected infrared light changes, and this can be detected by the sensor.
- **Applications**: Commonly used in low-cost eye-tracking systems and drowsiness detection, where detecting blinking is crucial to assess alertness.

2. Electromyography (EMG):

- **How it works**: This method involves detecting electrical signals generated by the muscles around the eyes. When a person blinks, the muscles contract, and these electrical signals can be picked up by electrodes placed near the eyes.

- **Applications**: Used for more advanced and precise detection of eye blinking, such as in medical devices or custom-made assistive technologies.

3. Camera-Based Systems (Computer Vision):

- **How it works**: A camera (typically a regular webcam or an infrared camera) is used to capture images or videos of the face. Computer vision algorithms analyze the shape and movement of the eyes to detect when a blink occurs. Blink detection is usually based on recognizing the changes in the position of the eyelids.
- **Applications**: Used in systems where precise tracking of eye movements is necessary, such as in research or human-computer interaction interfaces (e.g., controlling a device with blinks).

4. Capacitive or Resistive Sensors:

- **How it works**: These sensors detect changes in capacitance or resistance when a person blinks. The eye acts as a conductive element, and when it blinks, the change in resistance or capacitance is recorded.
- **Applications**: These sensors are often used in wearables or headsets to detect eye blinks for controlling devices like video games or as a method for people with physical impairments to interact with electronics.

5. Blinking Sensors:

- **Non-invasive**: Many blinking sensors, especially camera-based or IR-based ones, are non-invasive and can be used for continuous monitoring without discomfort.
- **Real-Time Monitoring**: These sensors allow for real-time detection of eye blinks, which is useful in applications like drowsiness detection or assistive technology.
- **Low Power Consumption**: IR-based sensors and some capacitive sensors consume relatively low power, making them suitable for portable and wearable applications.

Applications for Eye Blinking Sensors:

1. **Drowsiness Detection**: Used in vehicles to detect when a driver is blinking frequently, which may indicate fatigue or drowsiness.
2. **Assistive Technology**: People with limited mobility can use blink detection to control devices (e.g., turning on lights or operating a wheelchair).
3. **Human-Computer Interaction**: Eye blinking can be used as an input method, such

as in eye-controlled interfaces or games.

4. **Sleep Monitoring**: Eye blinking sensors can be part of a sleep study to monitor sleep patterns or diagnosed conditions like sleep apnea.


Fig 4.14:Eye blink Sensor

Advantages of Eye Blinking Sensors:

- **Non-invasive**: Many blinking sensors, especially camera-based or IR-based ones, are non-invasive and can be used for continuous monitoring without discomfort.
- **Real-Time Monitoring**: These sensors allow for real-time detection of eye blinks, which is useful in applications like drowsiness detection or assistive technology.
- **Low Power Consumption**: IR-based sensors and some capacitive sensors consume relatively low power, making them suitable for portable and wearable applications.

Disadvantages of Eye Blinking Sensors:

- **Accuracy Issues**: Factors like lighting, skin tone, or sensor positioning can affect the reliability of blink detection, especially in IR or camera-based systems.
- **Environmental Interference**: IR sensors may be influenced by external light sources or reflections, which can cause false positives or negatives.
- **Limited Range**: Some sensor types may have a limited range or sensitivity, which may require precise positioning or calibration for reliable results.
- **Privacy Concerns (for camera-based systems)**: Some users may feel uncomfortable with the use of cameras, especially if the data is not being processes locally or securely.

D) GPS Module & GSM Module: A **GPS module** is a device that receives signals from satellites in the Global Positioning System (GPS) and uses those signals to determine the module's position on Earth. GPS modules are widely used in applications like navigation, tracking systems, and location-based services.

How GPS &GSM Works

- **Satellites**: The GPS system consists of a network of satellites orbiting the Earth. These satellites transmit signals that contain the satellite's location and the time the signal was sent.
- **Receiver**: A GPS module acts as the receiver, collecting the signals from multiple satellites. By calculating the time delay between when a signal was transmitted and when it was received, the GPS module can determine the distance to each satellite.
- **Triangulation**: Using signals from at least four satellites, the GPS module can triangulate its position (latitude, longitude, and altitude). This allows the system to provide the exact geographical location of the module.

Components of a GPS & GSM Module

1. **GPS Antenna**: Collects signals from GPS satellites. Some modules have integrated antennas, while others allow you to connect an external one.
2. **GPS Receiver**: This component receives the signals from the satellites and decodes the data to determine the position.
3. **Processor**: It processes the data and performs the calculations needed for location determination.
4. **Serial Communication Interface**: Most GPS modules communicate with other devices (e.g., Arduino, Raspberry Pi, etc.) through UART, SPI, or I2C.

Key Features of GPS & GSM Modules:

1. **Accuracy**: Modern GPS modules can provide position accuracy within a few meters, with high-end models achieving accuracy within centimeters under optimal conditions.

2. **Update Rate**: The update rate of GPS modules (the frequency with which they update position data) can range from 1 Hz (once per second) to higher frequencies, depending on the model and intended application.
3. **Accuracy**: Modern GPS modules can provide position accuracy within a few meters, with high-end models achieving accuracy within centimeters under optimal conditions.
4. **Update Rate**: The update rate of GPS modules (the frequency with which they update position data) can range from 1 Hz (once per second) to higher frequencies, depending on the model and intended application.
5. **Altitude and Speed**: In addition to providing geographic coordinates (latitude and longitude), GPS modules can also provide altitude and speed information.
6. **Time**: GPS modules can provide highly accurate time, synchronized with GPS atomic clocks, which is used for time-stamping applications or synchronization.
7. **Low Power Consumption**: Many GPS modules are designed to consume low power, making them suitable for battery-powered projects.

Applications of GPS & GSM Modules:

1. **Navigation Systems**: GPS modules are widely used in personal navigation devices (PNDs) and automotive navigation systems.

2. **Vehicle Tracking**: GPS modules are used in tracking systems to monitor the location of vehicles in real time.

3. **Drones**: Many drones use GPS modules for autonomous flight and navigation, ensuring precise location control.

4. **Mapping and Surveying**: GPS modules are commonly used in surveying and mapping applications for accuracy and precision in land measurement.

5. **Outdoor Activities**: Hikers, cyclists, and runners use GPS to track their routes and location.

Fig 4.15:GPS Module

Advantages of GPS Modules:

1. **High Accuracy**: Modern GPS modules can provide precise location data with meter-level accuracy.
2. **Ease of Use**: GPS modules are easy to integrate into various projects, especially with open-source platforms like Arduino and Raspberry Pi.
3. **Global Coverage**: GPS works anywhere on Earth, providing reliable location data as long as there is a clear view of the sky.
4. **Time Synchronization**: GPS modules provide very accurate time, based on atomic clocks in the satellites.

Disadvantages of GPS & GSM Modules:

1. **Signal Dependency**: GPS modules require a clear line of sight to the sky to receive signals, making them unreliable indoors or in dense urban areas (where signals may be blocked by buildings).

2. **Power Consumption**: GPS modules can consume significant power, especially when operating continuously, which may be a concern for battery-powered projects.

E) LCD: An **LCD (Liquid Crystal Display)** is a flat-panel display technology that is commonly used to display text, numbers, and simple graphics in electronic devices. It is a popular choice due to its relatively low power consumption, compact size, and ability to display information clearly in a variety of devices, including handheld gadgets, computers, watches, and more.

Types of LCDs:

1. Character LCDs: These displays show text or numbers in a grid of fixed character sizes, typically 16x2 or 20x4 (16 characters on 2 lines, 20 characters on 4 lines). These displays are commonly used in simple applications like clocks, meters, or status displays.

2. Graphical LCDs: These displays allow the display of full graphics and more complex information, such as images, custom characters, and detailed graphical interfaces. They typically have higher resolution compared to character-based LCDs

3. TFT LCD (Thin-Film Transistor): TFT LCDs are a type of active-matrix LCD that offers better image quality, higher resolution, and faster refresh rates. These are commonly used in smartphones, tablets, and other multimedia devices.

4. OLED (Organic Light Emitting Diode): OLED displays are sometimes considered part of the LCD family, but they are a different technology that does not rely on backlighting. OLEDs emit light themselves and can provide deeper blacks and more vibrant colors.

Applications of LCDs:

1. **Display Text**: LCDs are often used to display messages, readings from sensors, or status updates in embedded projects.
2. **Simple User Interfaces**: Used in Arduino or Raspberry Pi projects to create simple control panels with buttons or sensors.
3. **Data Logging**: LCDs are useful for showing real-time data in projects like weather stations, sensors, and monitoring systems.

Advantages of LCDS:

1. **Low Power Consumption:** LCDs consume less power compared to other display types like LEDs or OLEDs.
2. **Cost-Effective:** LCD modules are relatively cheap and widely available.
3. **Clear Display**: LCDs can display text and numbers clearly, making them suitable for

a wide range of applications.

4 **Compact Size**: LCD modules are compact and can be easily integrated into small devices or portable projects.

Fig 4.16:LCD

Disadvantages of LCDs:

1. **Limited Color**: Most character-based LCDs only display monochrome text, though graphical LCDs can display some basic colors.
2. **Requires Backlight**: Since LCDs don't emit their own light, they need an external light source (backlight), which can increase power consumption
3. **Relatively Slow Response Time**: LCDs are slower than OLEDs or LEDs in terms of refresh rates and response times, which might be an issue for high- speed applications.

F) Buzzer:

A **buzzer** is a simple electronic component used to produce sound, typically to alert or signal the user about an event or condition in a system. It is commonly used in a wide range of applications, from alarms to user interface feedback in electronic projects.

Types of Buzzers:

1. **Active Buzzer**:
   1. An active buzzer has a built-in oscillator that generates the sound when powered.
   2. It only needs a DC voltage to make a sound, and once powered, it produces a tone continuously.
2. **Passive Buzzer**:
   1. A passive buzzer does not have an internal oscillator. Instead, it requires an external signal to create sound, such as a square wave signal from a microcontroller.
   2. The pitch and frequency of the sound can be varied depending on the signal input.

Applications of Buzzers:

1. **Alarms**: Used in smoke detectors, security systems, or any device where a warning or alert is needed.
2. **User Interface Feedback**: Provides auditory feedback in devices such as microwaves, washing machines, or computers (e.g., key press feedback or error signals).
3. **Timer Indicators**: Often used to signal the end of a timer or countdown.
4. **Signal Indicators:** Used in traffic systems, doorbells, or any scenario where a sound-based indicator is needed.

Fig 4.17 Buzzer

Advantages of Buzzers:

1. **Simple and Cost-Effective**: Buzzers are inexpensive and easy to integrate into electronic systems.
2. **Low Power Consumption**: Especially active buzzers, which use very little power when on.
3. **Effective Communication**: They provide immediate attention through sound, making them ideal for signaling events.

Disadvantages of Buzzers:

1. **Noise**: Buzzers can be loud, which could be disruptive in certain environments.
2. **Limited Sound Quality**: Unlike speakers, buzzers can only produce simple tones or sounds and cannot generate complex audio like music.
3. **Overuse**: Repeated use of buzzers in an environment might lead to auditory fatigue or annoyance.

DC Motor: A **DC motor (Direct Current motor)** is an electrical machine that converts electrical energy into mechanical energy through the interaction of magnetic fields. DC Motors are widely used in many applications, from robotics to household appliances, because they are simple, efficient, and easy to control.

Types of DC Motors:

Brushed DC Motors:

1. The most common type of DC motors, using brushes and a commutator to switch the direction of the current in the motor windings, which produces continuous rotation.
2. They are simple, inexpensive, and widely used in low-power applications like toys, fans, and small robotics.

Brushless DC Motors (BLDC):

Unlike brushed DC motors, BLDC motors do not have brushes or a commutator. Instead, they use electronic controllers to switch the current in the windings, resulting in higher efficiency and less maintenance. These motors are more durable and commonly found in applications like drones, electric vehicles, and computer cooling fans.

Permanent Magnet DC Motors:

These motors use permanent magnets to create the magnetic field, which simplifies the construction and makes them more compact and efficient. They are commonly used in low-power applications.

Series-wound DC Motors:

In these motors, the armature and field windings are connected in series, which provides high starting torque. These motors are typically used in applications that require high torque, such as in lifting equipment.

Shunt-wound DC Motors:

In shunt-wound motors, the armature and field windings are connected in parallel (shunt). These provide constant speed and are commonly used in precision applications.

Fig 4.18:DC Motor

Advantages of DC Motors:

1. **Simple Speed Control**: DC motors are easy to control with a microcontroller or other electronics, making them ideal for applications requiring speed adjustments.
2. **High Starting Torque**: DC motors can provide high torque at low speeds, which makes them suitable for applications where the motor needs to start under load (e.g., in electric vehicles or winches).
3. **Compact and Cost-Effective**: They are relatively inexpensive and come in a wide range of sizes, from small motors for toys to larger motors for industrial applications.

Disadvantages of DC Motors:

1. **Wear and Tear**: Brushed DC motors have brushes and a commutator that wear out over time, requiring regular maintenance or replacement.
2. **Limited Efficiency**: Although generally efficient, brushed DC motors are less efficient than brushless DC motors, particularly at higher speeds.
3. **Electromagnetic Interference (EMI)**: The brushes and commutators in DC motors can create electrical noise that may interfere with sensitive electronic equipment.

Applications for DC Motors:

1. **Robotics**: DC motors are commonly used in robotics for driving wheels, actuators, and other moving parts due to their simple control and high starting torque.
2. **Electric Vehicles (EVs)**: DC motors are used in electric vehicles (e.g., e-bikes, electric cars) for their efficient speed and torque control.
3. **Fans and Pumps**: Many household fans, blowers, and water pumps use DC motors for their smooth operation and variable speed control.

4. **Electric Tools**: DC motors are used in electric drills, screwdrivers, and other power tools for variable speed and torque control.

4.2 Algorithm:

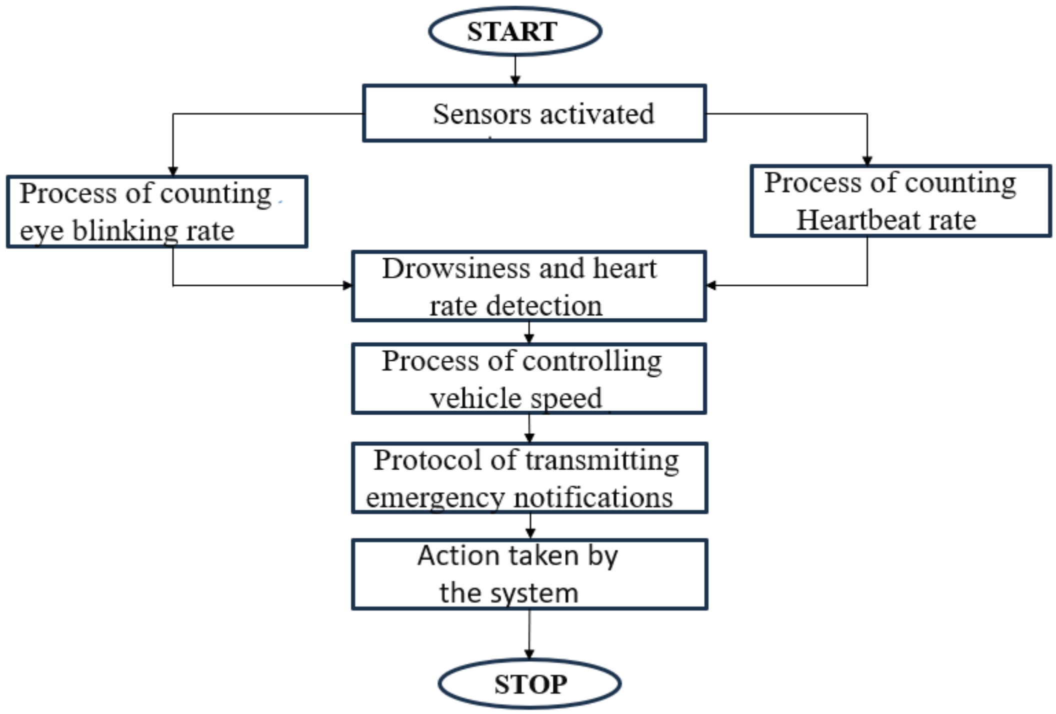

Fig 4.19 Algorithm

This flowchart depicts the algorithm for **drowsiness and heart rate monitoring system** designed to enhance road safety. Let's break down the meaning of each step:

1. **START:** This is the beginning of the system's operation.
2. **Sensors Activated:** The system initiates by activating various sensors. These are likely Eye Tracking Sensors: To monitor eye blinking rate. Heart Rate Sensor: To measure the driver's heart rate.
3. **Process of Counting Eye Blinking Rate:** The eye tracking sensors capture images of the driver's eyes and an algorithm analyzes these images to count the number of blinks within a specific time period.
4. **Process of Counting Heartbeat Rate:** The heart rate sensor measures the driver's pulse and calculates the heart rate (beats per minute).

5. **Drowsiness and Heart Rate Detection:** The system analyzes the data collected from the previous two steps.

1. Drowsiness Detection: A decrease in blinking rate below a certain threshold is interpreted as a sign of drowsiness.
2. Heart Rate Analysis: Significant deviations from the normal heart rate range can also indicate stress or fatigue, contributing to drowsiness.

6. **Process of Controlling Vehicle Speed**: If drowsiness or abnormal heart rate is detected, the system takes action to mitigate the risk. This step likely involves:

1. Alerting the Driver: visual warnings to alert the driver about their condition
2. Speed Reduction: Gradually reducing the vehicle's speed to a safer level.

7. **Protocol of Transmitting Emergency Notifications:** In critical situations, the system can automatically send emergency notifications to designated contacts or emergency services. This could be triggered by:

1. Prolonged Drowsiness: If the driver doesn't respond to warnings and continues to show signs of severe drowsiness.
2. Sudden Heart Rate Irregularities: If the heart rate indicates a potential medical emergency.

8.**Action Taken by the System:** This is a general step indicating the execution of the actions determined in the previous steps

9**.STOP:** The system's operation is completed, or it has been manually deactivated.

4.3 SOFTWARE IMPLEMENTATION

4.3.1 Introduction to Arduino IDE:

The Arduino IDE, or Integrated Development Environment, serves as the cornerstone for programming Arduino boards. It's a user-friendly software application that simplifies the process of writing, compiling, and uploading code to these microcontrollers. Designed with accessibility in mind, the IDE boasts a clean interface that's welcoming to beginners, yet powerful enough for experienced users. Functioning as a cross-platform tool, it's compatible with Windows, macOS, and Linux, ensuring broad accessibility. At its core, the IDE features a text editor for crafting Arduino sketches, which are essentially programs written in a simplified version of C/C++. It also includes a compiler that translates these sketches into machine-readable code, and an uploader that transmits this code to the Arduino board via USB. Furthermore, the Arduino IDE streamlines library management, allowing users to easily incorporate pre-written code to enhance their projects. This combination of features makes the Arduino IDE an essential tool for anyone looking to explore the world of physical computing and electronics.

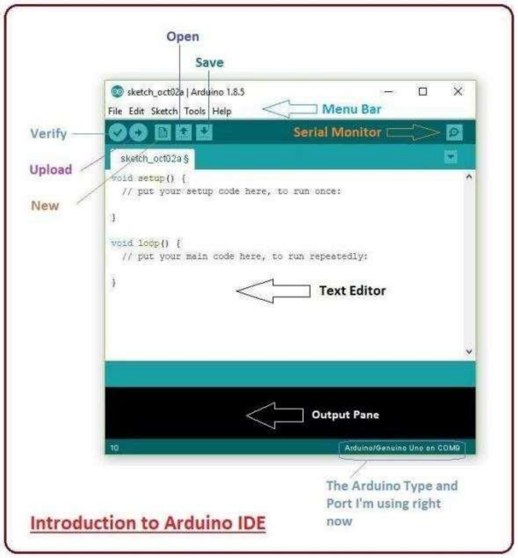

Fig 4.31 Arduino IDE

The Arduino Integrated Development Environment (IDE) is a software platform used to write, compile, and upload code to Arduino microcontroller boards. It provides an easy- to-use interface for programming, especially for beginners. The IDE supports multiple programming languages, primarily C and C++, and allows users to interact with the Arduino hardware to control sensors, motors, lights, and other components. It includes features like syntax highlighting, code completion, and built-in libraries that simplify complex tasks. With a wide community of makers, hobbyists, and engineers, the Arduino IDE has become a popular tool for developing a variety of electronic projects, from simple LEDs to sophisticated robotic systems.

4.3.2 How to Download Arduino IDE:

To download the Arduino IDE, first visit the official Arduino website at www.arduino.cc. On the homepage, navigate to the "Software" section in the top menu and select "Downloads." The website will automatically detect your operating system (Windows, macOS, or Linux) and provide a download link tailored to your system. If it doesn't detect your OS correctly, you can manually choose the right version. Once the download is complete, run the installer and follow the instructions to install the IDE on your computer. After installation, you can launch the Arduino IDE and begin programming. The process is simple and provides all the tools needed to start creating with Arduino.

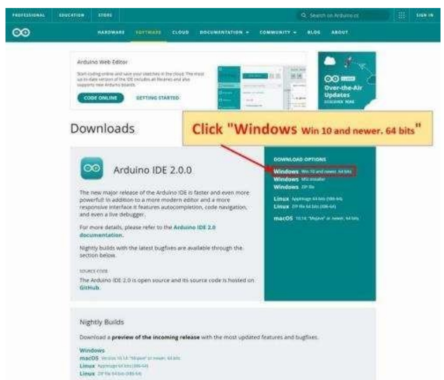

Fig 4.32 Download of arduino ide

The Arduino IDE isn't just a basic text editor; it's a carefully crafted environment that lowers the barrier to entry for electronics programming. Its strength lies in its **abstraction of complexity**. Instead of requiring users to grapple with intricate microcontroller details, it presents a simplified interface and language, allowing them to focus on the logic and functionality of their projects.

Key aspects that elevate the Arduino IDE beyond a simple code editor:

- **Hardware Abstraction Layer:** The IDE and its associated libraries provide a layer of abstraction between the user's code and the underlying hardware. This means you don't need to know the specific register settings of the microcontroller to control a digital pin or read an analog value. You can use simple functions like digitalWrite() and analogRead().

- **Simplified C/C++:** Arduino uses a simplified version of C/C++, making it easier to learn for beginners. The IDE handles many of the complexities of C/C++, such as memory management and compiler settings.
- **Bootloader Integration:** The Arduino boards come pre-programmed with a bootloader, a small piece of software that allows the IDE to upload code via USB without the need for a separate programmer. The IDE seamlessly integrates with this bootloader, simplifying the upload process.
- **Community-Driven Development:** The Arduino IDE is open-source and benefits from a large and active community. This means that it's constantly being improved and expanded with new features and libraries.
- **Serial Communication and Debugging:** The built-in Serial Monitor allows for easy communication between the Arduino board and the computer. This is invaluable for debugging and monitoring the behavior of your code.
- **Library Manager:** The Library Manager simplifies the process of installing and managing libraries, which are collections of pre-written code that extended.
- **Board Manager:** The Board Manager allows you to install support for different Arduino boards and compatible third-party boards. This expands the range of hardware that can be programmed using the Arduino IDE.

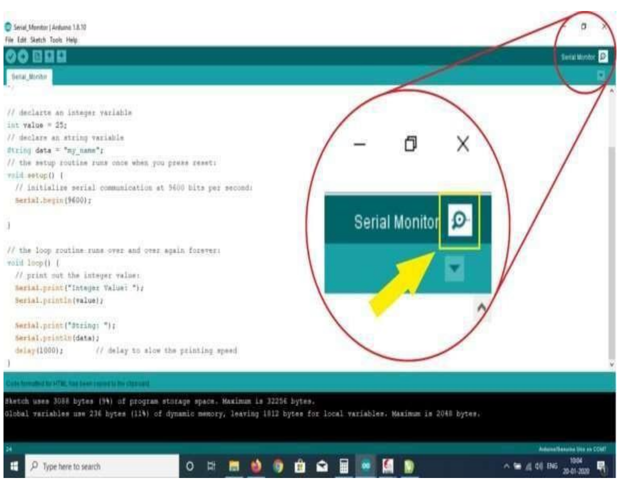

Fig 4.33 Serial Monitoring

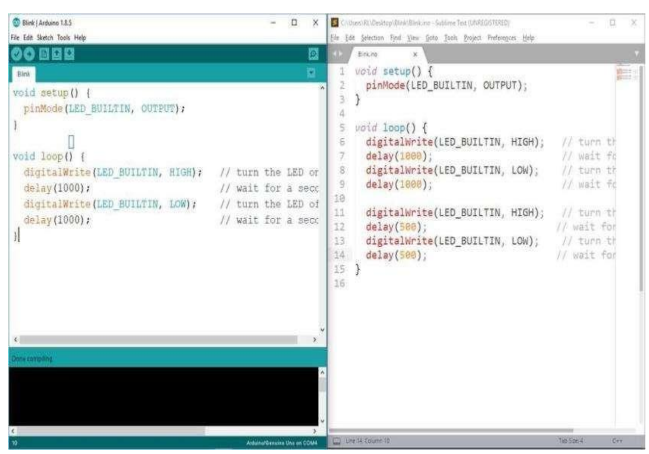

Fig 4.34 Text Editor in Programming

A text editor in programming is a software tool that allows developers to write and edit code.

It is a basic but essential part of the software development process, as it provides a platform for writing source code in various programming languages such as Python, JavaScript, C++, and more. Text editors are designed to handle plain text, without the overhead formatting that word processors use. Some text editors are lightweight and simple, focusing solely on providing a fast, distraction-free environment for coding, while others come with advanced features like syntax highlighting, code completion, and debugging tools.

4.3.3 How to select Board

To select a board in the Arduino IDE, first open the software and navigate to the "Tools" menu at the top of the window. From the dropdown menu, hover over the "Board" option, which will display a list of available Arduino boards. Scroll through the list and select the board that corresponds to your hardware, such as Arduino Uno, Arduino Mega, or Arduino Nano. Once selected, the IDE will be set to upload code to the chosen board. It's important to ensure that you pick the correct board model to ensure proper functionality when uploading and running your code.

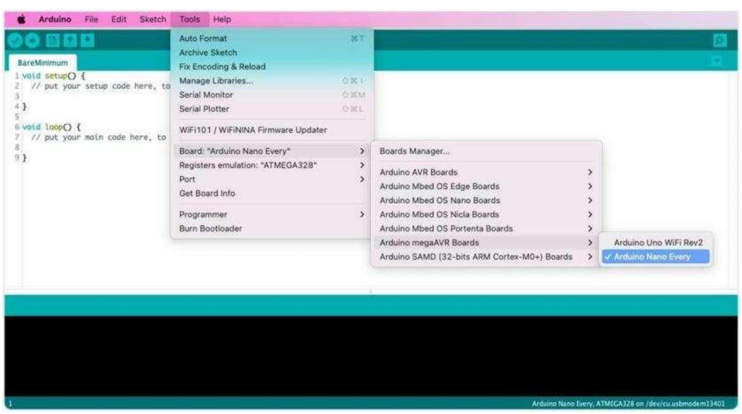

Fig 4.35 Select in Arduino Board

4.4 Libraries

In the Arduino IDE, libraries are re-written code collections that make it easier to interact with hardware components, such as sensors, motors, and displays, without having to write complex code from scratch. Libraries contain functions and definitions that simplify common tasks, saving time and effort for developers.

For example, a library might provide easy-to-use functions for controlling an LCD screen, reading sensor values, or communicating via Bluetooth. To use a library in the Arduino IDE, you can either install it from the built-in Library Manager or manually download and import it. To install a library through the Library Manager, go to the "Sketch" menu, select "Include Library," and then "Manage Libraries." From there, you can search for a specific library and install it with just a few clicks. Once installed, you can include the library in your sketches by selecting "Include Library" again and choosing the desired library from the list. Using libraries enhances the functionality of your projects and allows you to build complex applications with minimal coding.

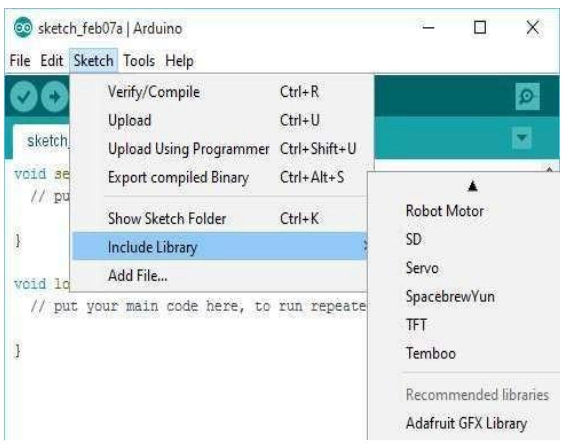

Fig 4.41 Adding Libraries

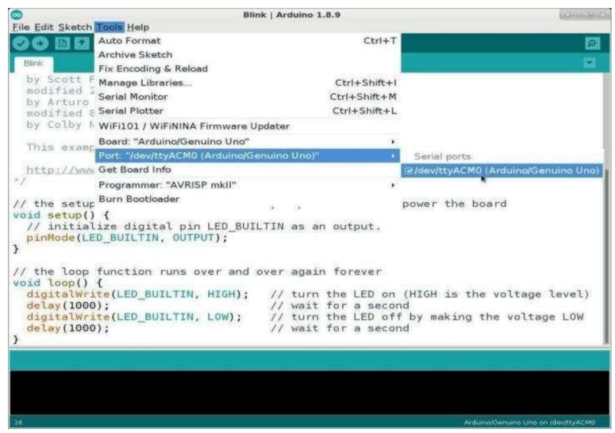

Fig 4.42 Selecting Com port Bootloader

A boot-loader in the context of micro controllers like Arduino is a small program embedded in the micro controller's memory that enables the device to load new firmware or code onto the chip. Essentially, it acts as a bridge between the micro controller's hardware and the Arduino IDE, allowing the board to receive and run new code via a serial connection. When you upload a sketch from the Arduino IDE, the boot loader is responsible for receiving the compiled code and placing it into the appropriate memory locations on the micro controller.

The boot loader runs automatically when the Arduino is powered on or reset. It waits for new code to be uploaded and, if it detects a new sketch being sent, it accepts the data and writes it to the micro controller's flash memory.

If no new code is detected, the boot loader simply hands over control to the program already stored in memory. Most Arduino boards come with a pre- installed boot loader, which makes programming them simple. However, if the boot loader is accidentally erased or corrupted, it may need to be reinstalled using a programmer.

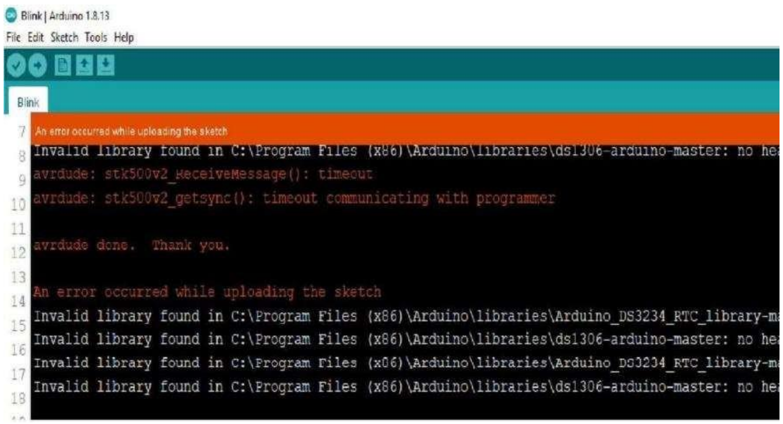

Fig:4.43 boot loader

CHAPTER-5

RESULT AND DISCUSSION

5.1 RESULT ANALYSIS:

The implementation of a driver health monitoring system using sensors has proven to be a significant advancement in improving road safety by proactively identifying and mitigating health risks in real-time. This system integrates a variety of advanced sensors, including heart rate monitors, eye-tracking cameras, and motion detectors**,** to continuously assess the driver's physical and cognitive condition.

By monitoring vital signs such as heart rate variability and analyzing eye movement patterns, the system can detect early warning signs of fatigue, drowsiness, or even medical emergencies like heart attacks or strokes. This continuous health assessment enables immediate action, significantly reducing the likelihood of accidents caused by undetected health issues that may impair driving ability.

The system is specifically designed to detect drowsy drivers using a combination of eye blink sensors and heart rate monitors. It works by analyzing the frequency and duration of eye blinks, as well as monitoring heart rate patterns. When early signs of drowsiness are detected, such as prolonged eye closures or irregular heart rates, the system activates an audible buzzer to alert the driver.

The drowsiness detection mechanism is based on proximity levels, where a buzzer is triggered when the driver's drowsiness is in the range of Proximity 3.00 to 4.00, indicating early signs of fatigue. If the driver's sleepiness level increases to the most critical range, Proximity 0.00 to 1.59, the buzzer sounds continuously to signal an immediate risk.In response to severe drowsiness, the system gradually slows down the vehicle and eventually brings it to a complete stop if the driver does not respond to alerts. This automated action ensures the safety of the driver, passengers, and other road users by preventing accidents caused by falling asleep at the wheel.

The system also employs light analysis on the eye blink sensor to distinguish between closed and wide-open eyes, using different buzzer frequencies to indicate varying levels of drowsiness. A higher frequency alerts the driver to mild drowsiness, while a lower frequency signals more severe fatigue. Additionally, pulse rate monitoring plays a crucial role in enhancing driver safety. It continuously tracks the driver's heart rate to detect low or abnormal heart rates, which can be indicative of potential health emergencies. If an abnormal pulse is detected, the system triggers visual and auditory warnings to prompt the driver to take immediate action. In conclusion, this advanced health monitoring system not only identifies signs of drowsiness but also provides critical alerts for other health-related risks. By combining real-time health data with automated vehicle control responses, it significantly improves road safety, reduces accident risks, and ensures a safer driving environment for everyone on the road.

The implementation phase involves translating the conceptual design into a functional system using various hardware components. Key components include the eye blink sensor **(QRD1114)** for detecting drowsiness through eye movement analysis. The heartbeat sensor **(AD8232)** monitors the driver's heart rate to identify abnormal patterns. An Arduino Uno board acts as the central controller, processing sensor data and triggering responses. A piezo buzzer provides auditory alerts for drowsiness or health risks. LED indicators visually signal the system's status to the driver. The GSM SIM900A module enables real-time communication, sending alerts in case of emergencies. **DC motors c**ontrol the vehicle's movement, while the GPS module (GY-NEO6MV2) tracks the vehicle's location. Together, these components create an integrated health monitoring and safety system for drivers.

The fig illustrates the project's prototype and device connections. The eye blink sensor is placed on glasses (Fig. 5) for monitoring driver alertness, and the heart rate sensor (Fig. 4) measures the driver's heartbeat on the seat belt or hand. Software programs enable real-time monitoring and data processing.

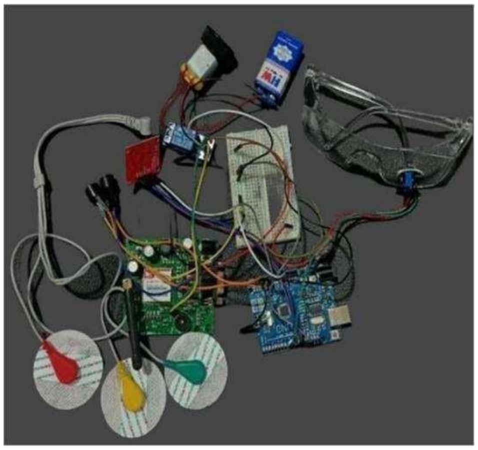

Fig 5.1 working prototype

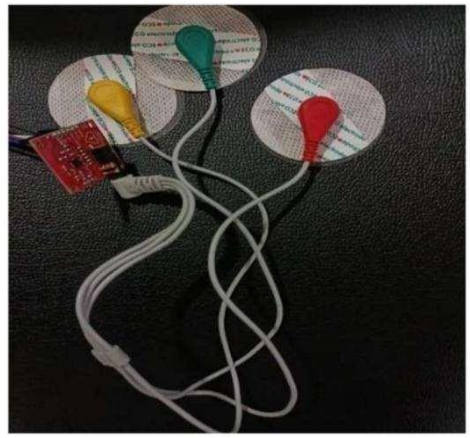

Fig 5.2 Heartbeat sensors

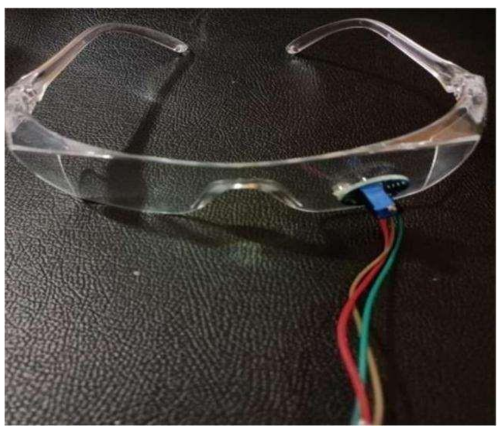

Fig 5.3 Eye blink sensor placed on goggles

When a potential health risk is detected, the system responds with a combination of auditory alerts, visual warnings, and tactile feedback (like steering wheel vibrations) to grab the driver's attention.

In more advanced models, the system can go beyond alerts and take autonomous safety actions such as adjusting the vehicle's speed, activating emergency braking, or steering the vehicle safely to the side of the road if the driver becomes unresponsive. This quick response can be crucial in preventing accidents, especially in high-speed driving scenarios where reaction times are critical.

Beyond immediate intervention, the system also plays a vital role in driver behavior improvement. By providing real-time feedback, drivers become more aware of their physical and mental condition, encouraging healthier driving habits such as regular breaks and proper posture. This proactive approach not only reduces accident rates but also contributes to long- term health benefits for drivers, making driving a less stressful and more secure activity.

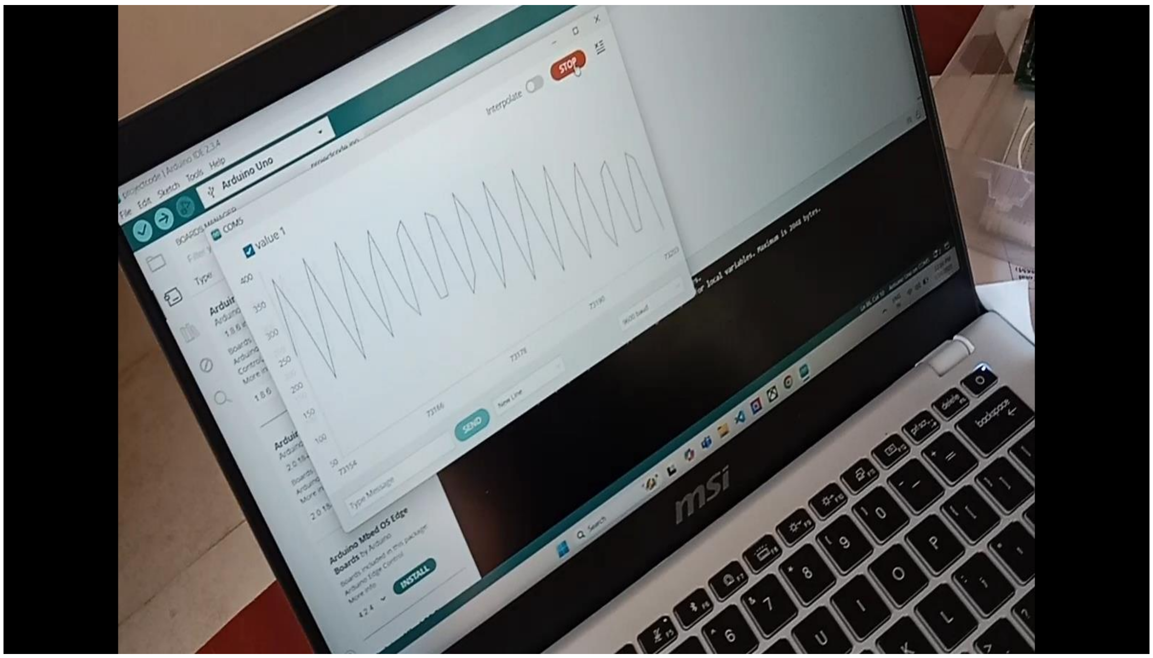

Fig 5.4 pulse waveforms

In conclusion, the total result of implementing a driver health monitoring system using sensors is a safer, smarter, and more responsive driving environment. It represents a shift from traditional reactive safety measures to proactive health management, ensuring that drivers are not only aware of their health status but also receive immediate assistance when needed. This innovative approach significantly reduces accident rates, saves lives, and enhances the overall driving experience, marking a transformative step in automotive safety technology.

In conclusion, the total result of improving driver safety by detecting and reducing health risks in vehicles using sensors is a **comprehensive, proactive safety ecosystem**. This system shifts traditional vehicle safety from reactive measures to real-time health management, focusing on the driver's well-being.

By continuously monitoring vital signs such as heart rate, body temperature, and signs of fatigue, the system can detect potential health risks before they become critical. This proactive approach helps identify issues like drowsiness, stress, dehydration, or even medical emergencies such as heart attacks.

When a health risk is detected, the system triggers immediate safety protocols, including audible alarms, visual warnings, and tactile feedback like steering wheel vibrations. In advanced models, the vehicle can automatically engage emergency braking, adjust speed, or steer to safety if the driver becomes unresponsive.

These interventions significantly reduce accident rates by addressing health-related issues promptly, preventing them from leading to dangerous driving conditions. Moreover, the system improves the overall driving experience, providing drivers with peace of mind knowing their health is actively monitored.

Technology also promotes healthier driving habits, encouraging regular breaks, hydration, and stress management. Data collected from these systems can be used for post-incident analysis, helping improve vehicle safety features and develop predictive models.

As this technology continues to evolve, it will play a pivotal role in shaping the future of **intelligent, health-conscious vehicles**. It will set new road safety standards worldwide, ensuring that drivers are protected not just from external hazards but also from internal health risks that could impair their ability to drive safely.

Ultimately, this system represents a significant step toward a safer, smarter, and healthier driving environment for everyone on the road.

CHAPTER-6

CONCLUSION & FUTURE SCOPE

6.1 Conclusion

The integration of advanced sensors in vehicles to detect and reduce health risks offers a promising solution for enhancing driver safety. These sensors continuously monitor vital health parameters like heart rate, body temperature, and eye movement, identifying early signs of fatigue, stress, or medical emergencies. Real-time data analysis allows the system to trigger immediate alerts and interventions, such as audible warnings, visual signals, or even automated vehicle control actions. This proactive approach helps prevent accidents caused by health- related issues, such as heart attacks, drowsiness, or sudden medical conditions. Additionally, the system improves driver awareness of their health status, encouraging safer driving habits. By combining real-time monitoring with automated responses, this technology significantly reduces road risks and enhances overall safety.

This technology not only ensures a safer driving experience but also promotes a proactive approach to driver well-being. By continuously monitoring vital health parameters, it reduces the risk of sudden medical events, such as heart attacks or drowsiness-related accidents. This proactive detection significantly decreases the likelihood of accidents, enhancing overall road safety. Additionally, integrating health data with vehicle performance insights allows for the development of personalized safety features tailored to individual drivers. These features can adjust vehicle settings based on the driver's health status, creating a more optimized, health- conscious driving environment. Over time, such systems can adapt to drivers' unique patterns, improving safety measures even further. Ultimately, this technology not only protects drivers from immediate health risks but also supports long-term well-being on the road.

The use of sensors in vehicles to detect and mitigate health risks is a groundbreaking advancement in automotive safety. These sensors continuously monitor vital signs like heart rate, eye movement, and body temperature, identifying early signs of fatigue, stress, or medical emergencies. As sensor technology rapidly evolves, the integration of health-monitoring features within vehicles becomes increasingly sophisticated. This proactive approach helps detect health issues before they escalate, reducing the risk of accidents caused by sudden medical conditions. By providing real-time alerts and automated responses, these systems enhance driver awareness and safety. Additionally, the combination of health data with vehicle control systems allows for personalized safety measures. This technology not only prevents accidents but also promotes long- term well-being for drivers. Overall, it represents a significant leap forward in making roads safer for everyone.

Additionally, the data collected from health-monitoring sensors can be used to create personalized driving experiences, enhancing both safety and comfort. For instance, based on the driver's current health status, the system could adjust critical vehicle settings, such as vehicle speed, seat position, climate control, or steering sensitivity, to optimize comfort and reduce stress. This personalized approach not only improves the driving experience but also helps prevent health-related incidents by minimizing physical strain on the driver.

Moreover, the inclusion of these sensors supports the broader goal of creating smart and autonomous vehicles. As self-driving technology continues to evolve, health-monitoring systems will play a vital role in ensuring that drivers remain in optimal health, even when they are not actively controlling the vehicle. In the event of an emergency, these systems can detect signs of medical distress and automatically alert emergency services or even take over control of the vehicle to safely stop it.

These systems are also crucial for semi-autonomous vehicles, where drivers may need to resume manual control at any moment. The real-time monitoring of vital signs ensures that drivers are physically capable of taking over if necessary, reducing the risk of accidents due to sudden health issues. Additionally, health data can be used to improve vehicle safety protocols, such as adjusting driver assistance features .

In the long term, this integration of health-monitoring systems with advanced vehicle technologies will lead to safer, more intelligent transportation ecosystems. It will create vehicles that not only respond to external driving conditions but also actively support and protect the driver's health, enhancing road safety and driving comfort on a global scale.

However, challenges remain in terms of privacy, data security, and the accuracy of the sensors. Ensuring that the collected health data is protected from misuse and that sensors are consistently accurate will be essential to the widespread adoption of these systems. By integrating real-time health assessments into the driving experience, we can create a safer, more responsive transportation environment. This technology holds great promise, and with continued innovation, it could become a standard feature in future vehicles, ultimately saving lives and enhancing the overall safety of roadways around the world.

In conclusion, the successful deployment of health-monitoring sensors in vehicles is a crucial step toward mitigating health-related risks, improving the overall safety of drivers and passengers, and contributing to the advancement of autonomous and smart vehicle technologies. Future developments in sensor technology and data analysis will likely further enhance these systems, paving the way for even safer driving environments in the coming years.

6.2 FUTURE SCOPE

Future Scope of Improving Driver Safety by Detecting and Reducing Health Risks in Vehicles Using Sensors

The future of driver safety through health-risk detection using sensors holds immense potential. As technology continues to evolve rapidly, the capabilities of these systems will expand, offering a wide range of advancements that could reshape the automotive industry and revolutionize road safety. Below are some key areas where this technology could expand:

1) **Advanced Health Monitoring Systems:**

Future vehicles will integrate more sophisticated sensors capable of monitoring a broader spectrum of health metrics. These may include **oxygen saturation, blood sugar levels, stress indicators, neural activity, and even hormonal fluctuations**. With advanced sensors, real- time data collection will provide a deeper understanding of the driver's health, enabling more accurate predictions of health-related issues. This proactive approach could reduce the likelihood of medical emergencies while driving, significantly enhancing safety.

2) **Personalized Driver Assistance:**

As sensor technology becomes more refined, it will enable personalized driver assistance tailored to individual health conditions. For example, a driver with a history of heart disease might receive specific alerts if their heart rate shows irregularities. Additionally, vehicles could adjust cabin environments like temperature, seat adjustments, and steering sensitivity based on the driver’s health. Systems may even suggest breaks when fatigue levels are detected, promoting healthier driving habits.

3) **Integration with Autonomous Vehicles:**

In the future, health-monitoring systems will be vital for the safe operation of **autonomous vehicles**. If a driver becomes incapacitated due to a health issue, the system can not only send emergency alerts but also take over control, guiding the vehicle safely to a stop or even to the nearest medical facility. This combination of **health detection and autonomous driving** will create a seamless, safer driving environment, reducing human error caused by health impairments.

4) **Real-Time Emergency Response Integration:**

Future systems could instantly communicate with emergency services when critical health risks are detected. For instance, if a driver experiences a heart attack or stroke, the vehicle can automatically notify **nearby hospitals, dispatch ambulances,** and provide real-time data about the driver's condition. This immediate response can lead to quicker medical intervention, significantly improving treatment outcomes and saving lives.

5) Wearable Technology Integration:

A promising future direction is the integration of **wearable health devices** such as smartwatches, fitness trackers, and specialized medical monitors with vehicle systems. These wearables can continuously track health data, syncing with the car to provide a comprehensive view of the driver’s health both on and off the road.

6) Improved Driver Fatigue and Distraction Detection:

Future sensor systems will likely combine **physiological data** (like eye movement, facial expressions, heart rate, and brain activity) with **behavioral data** (such as steering patterns and reaction times) to detect signs of fatigue, drowsiness, or distraction. The vehicle can respond proactively, adjusting driving speed, suggesting breaks, or even activating semi-autonomous features when the driver’s alertness declines, minimizing the risk of accidents due to impaired focus.

7) Data Analytics and Predictive Modeling:

With the accumulation of vast amounts of health data over time, **machine learning algorithms and AI** will become increasingly effective at predicting health risks before they occur. Predictive models will analyze patterns in the driver’s health and driving behavior, offering early warnings for potential health emergencies. This capability enables vehicles to take preventive actions well in advance, ensuring the highest level of safety.

8) Collaboration with Healthcare Providers:

Future health-monitoring systems in vehicles could involve deeper collaborations with **healthcare providers**. With the driver’s consent, vehicle data could be shared with medical professionals for continuous monitoring. For example, a driver with diabetes could have their glucose levels tracked in real-time, with alerts sent automatically to both the driver and their healthcare provider if dangerous fluctuations are detected. This system could bridge the gap between on-the-road safety and ongoing medical care.

9) Global Standards and Regulatory Frameworks:

As health-monitoring technologies evolve, the need for **international standards and regulations** will become critical. Legal frameworks will be established to ensure ethical use of health data, prioritize data privacy, and enforce stringent safety protocols. These standards will guide the development, testing, and deployment of health-monitoring systems, ensuring accuracy, reliability, and user trust across different regions.

10) Integration with Smart City Infrastructure:

In the long term, vehicles equipped with health-monitoring sensors could connect with **smart city infrastructure**. For example, traffic lights and road signage could adapt based on a driver's health status, directing them to safer routes or providing real-time assistance if an emergency is detected. This integration would create a more interconnected ecosystem where vehicles, infrastructure, and health systems collaborate for enhanced road safety.

11) Global Standards and Regulatory Frameworks:

As health-monitoring technologies evolve, the need for **international standards and regulations** will become critical. Legal frameworks will be established to ensure ethical use of health data, prioritize data privacy, and enforce stringent safety protocols. These standards will guide the development, testing, and deployment of health-monitoring systems, ensuring accuracy, reliability, and user trust across different regions.

12) Integration with Smart City Infrastructure:

In the long term, vehicles equipped with health-monitoring sensors could connect with **smart city infrastructure**. For example, traffic lights and road signage could adapt based on a driver's health status, directing them to safer routes or providing real-time assistance if an emergency is detected.

Conclusion:

The future of improving driver safety through health-risk detection using sensors is filled with transformative possibilities. From advanced health monitoring and autonomous vehicle integration to cloud-based analytics and ethical data management, this technology will continue to evolve, shaping safer, smarter, and more connected transportation ecosystems. As we move forward, the synergy between health monitoring, AI, smart infrastructure, and vehicle automation will redefine what it means to drive safely in the 21st century.

APPENDIX

```
#include <SoftwareSerial.h>
int sensor = 8;
int buzzer = A1;
int motor = 6;
int buzzer2=A2;
SoftwareSerial gsmSerial(2,3); // RX, TX.
void setup()
{
     gsmSerial.begin(9600);
  delay(1000);
 Serial.begin(9600);
  pinMode(buzzer, OUTPUT);
  pinMode(sensor,INPUT);
  pinMode(motor,OUTPUT);
  pinMode(10, INPUT); // Setup for leads off detection LO +
pinMode(11, INPUT); // Setup for leads off detection LO -

  digitalWrite(motor,HIGH);
}
void sendSMS() {


  Serial.println("Initializing...");

  gsmSerial.println("AT"); // Check if the module is responding
  delay(1000);

  gsmSerial.println("AT+CMGF=1"); // Set SMS mode to text
  delay(1000);

  gsmSerial.print("AT+CMGS=\"+917671915207\"\r"); // Replace with the recipient's
phone number
  delay(1000);

  gsmSerial.print("Alert driver is in problem driver phone: +917032587337"); // Your
SMS message
  delay(100);

  gsmSerial.write(26); // Send Ctrl+Z to end the message
  delay(1000);

  Serial.println("Message sent.");
}

// the loop function runs over and over again forever
```

```
void loop() {
  if(digitalRead(sensor)==1)
  {
    analogWrite(buzzer,100);
    digitalWrite(motor,LOW);
analogWrite(buzzer2,100);
  }
  else
  {
    analogWrite(buzzer,1000);
    digitalWrite(motor,HIGH);

          delay(5000);
    while(digitalRead(sensor)==0){
      analogWrite(buzzer2,1000);
      sendSMS();
      delay(5000);
      }

      delay(1000);

  }
while((digitalRead(10) == 1)||(digitalRead(11) == 1)){
  Serial.println('!');

 analogWrite(buzzer,1000);


      analogWrite(buzzer2,1000);
       digitalWrite(motor,HIGH);


      sendSMS();
       delay(5000);
}

// send the value of analog input 0:
Serial.println(analogRead(A0));
analogWrite(buzzer2,100);
analogWrite(buzzer,100);

//Wait for a bit to keep serial data from saturating
delay(1);
}
```

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CO-PO MAPPING TABLE

Project title: Improving Driver Safety by Detecting and Reducing Health Risks in Vehicles using Sensors.

Batch No: C9
STUDENT NAMES
1. S.CHARISHMA 21NM1A04D3
2. S MEGHANA 21NM1A04E0
3. T.SRK TEJA SREE 21NM1A04E7
4. M. PREETHI 22NM5A0427

Project course outcomes:

CO1:Formulate and apply mathematical, Engineering, and IoT Principles for Drowsiness detection.

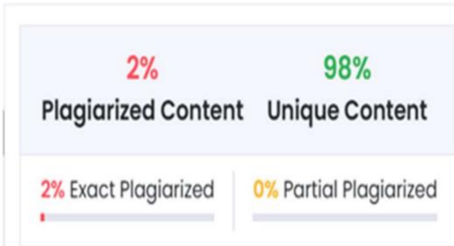
CO2: Utilize Arduino IDE software for testing and uploading.

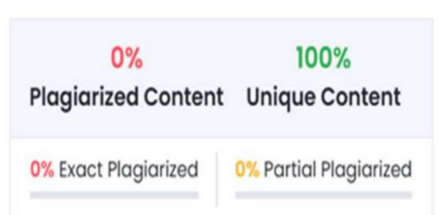
CO3: Validate the results to contemporary issues related to eye blinking count.

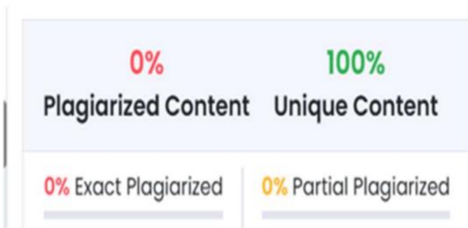
CO4: Demonstrate effective engineering principles used in methods individually and as a team, including simulation and real-time implementation.

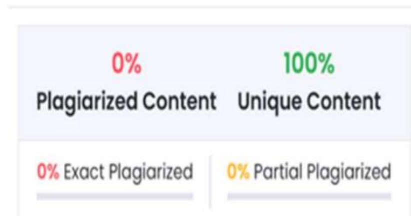
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	1	2
CO 1	2	3	2	-	-	2	-	-	2	-	2	-	2	-
CO 2	-	3	3	-	3	-	3	-	-	3	-	-	3	-
CO 3	-	2	-	2	-	2	-	3	2	-	2	-	3	2
CO 4	-	-	2	-	-	2	-	-	2	3	3	-	-	3

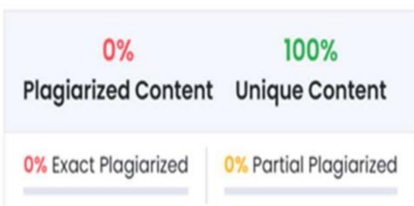
Team Leader Signature

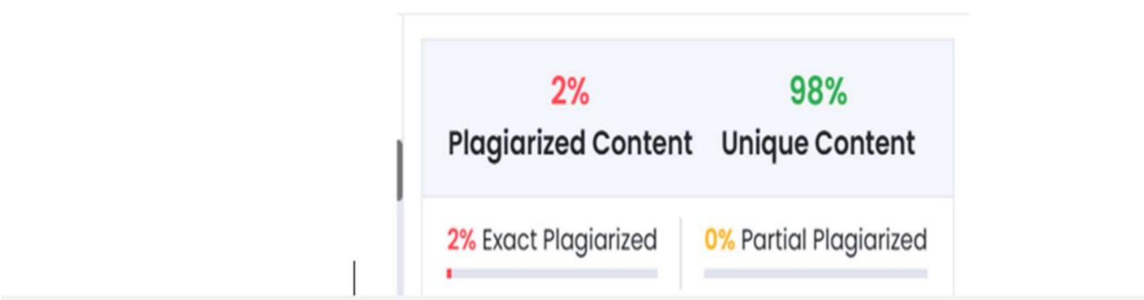












Total Plagiarism : 1 %