Smart Safety Measurement protocols:
IOT based Alcohol & Drowsiness Detection System

Submitted by

Madhumita Saha

(Registration Number: 135-1211-0434-21 Roll Number: 213135-11-0053)

Ronit Dey

(Registration Number: 135-1111-0425-21 Roll Number: 213135-21-0046)

Ahana Goswami

(Registration Number: 135-1211-0432-21 Roll Number: 213135-11-0052)

Ishika Das

(Registration Number: 135-1212-0429-21 Roll Number: 213135-11-0141)

Supervisor

Mrs. Soumita Chakroborty

A final project report submitted to the Department of computer Science ,Vidyadsagar college University of Calcutta in the partial fulfillment of the

requirements for the degree of

B.Sc IN COMPUTER SCIENCE

2023-2024 Semester-VI

CERTIFICATE

This is to certify that the project entitled ***'Smart Safety Measurement Protocols: IOT based Alcohol & Drowsiness Detection System'*** is done by Madhumita Saha (Registration Number: 135-1211-0434-21 Roll Number: 213135-11-0053), Ronit Dey (Registration Number: 135-1111-0425-21 Roll Number: 213135-21-0046), Ahana Goswami (Registration Number:135-1211-0432-21 Roll Number: 213135-11-0052), Ishika Das (Registration Number:135-1211-0432-21 Roll Number: 213135-11-0141) is done by under my supervisor and guidance. This work has not been submitted elsewhere .The project is completed and submitted as a partial fulfillment of the last semester(6^{th} Semester) of their undergraduate course B.Sc in Computer-Science-2024.

Prof. Mrs.Soumita Chakroborty

(Project Guide)

Dept. of Computer Science
(Vidyasagar College,CU)

Prof. Paramita Sikdar

(Head of Dept.)

Dept. of Computer Science
(Vidyasagar College,CU)

Date:

Acknowledgement

I would like to express gratitude towards my supervisor **"Soumita Chakroborty"** for her able guidance and support in completing my project on the topic on "***Smart Safety Measurement Protocols: IOT based Alcohol & Drowsiness Detection System***". This project has allowed me to explore aninteresting side outside me regular curriculum .I am really thankful to her.

I would also like to express my gratitude to our honorable H.O.D r Madam **"Paramita Sikdar"** for providing me with all facilities that were required**.**

I regret any inadvertent omissions.

……..…… …..……..

(Ronit Dey) (Madhumita Saha)

……..……

(Ahana Goswami)

……..……..

(Ishika Das)

Date:

Department of Computer Science

Vidyasagar College

University of Calcutta

Abstract

In recent years, the prevalence of road accidents caused by drunk and drowsy driving has been a significant concern worldwide. This project presents an IoT-based Alcohol & Drowsiness Detection System designed to enhance road safety by continuously monitoring drivers for signs of alcohol consumption and drowsiness. The system integrates various sensors and IoT technology to detect alcohol levels and drowsiness in real-time.

The primary components of the system include an alcohol sensor, a camera for eye monitoring, a microcontroller, and a communication module. The alcohol sensor measures the alcohol concentration from the driver's breath, while the camera monitors eye movements and patterns to detect signs of drowsiness. Data from these sensors are processed by the microcontroller, which analyzes the information and triggers alerts when necessary.

When the system detects unsafe levels of alcohol or signs of drowsiness, it issues immediate alerts to the driver and can also communicate with external systems, such as sending notifications to a designated contact or an emergency service. The integration of IoT enables remote monitoring and data analysis, providing valuable insights into driver behavior and enhancing preventive measures.

This project aims to significantly reduce the incidence of accidents caused by impaired driving, thus contributing to safer road conditions. The effectiveness of the system is demonstrated through rigorous testing and evaluation under various conditions, highlighting its potential as a vital tool in road safety initiatives.

Contents

INTRODUCTION

The increasing incidence of road accidents attributed to alcohol impairment and driver drowsiness poses a severe threat to public safety. Traditional methods of monitoring and detecting such conditions often fall short in preventing accidents due to their reactive nature. In response to this critical issue, the integration of Internet of Things (IoT) technology offers a proactive approach to enhance road safety. This project focuses on developing an IoT-based Alcohol & Drowsiness Detection System designed to continuously monitor drivers, detect impairment in real-time, and provide timely alerts to prevent accidents. Drunk and drowsy driving are significant contributors to road traffic accidents, resulting in numerous fatalities and injuries annually. Current preventive measures, such as roadside breath tests and manual observation for signs of drowsiness, lack the immediacy and continuous monitoring necessary to effectively mitigate these risks. There is a need for a reliable, automated system that can detect signs of alcohol consumption and drowsiness in drivers, providing real-time feedback and alerting mechanisms.

The development of an IoT-based Alcohol & Drowsiness Detection System holds significant potential for improving road safety. By providing continuous monitoring and real-time alerts, this system can proactively address the issues of drunk and drowsy driving. It can be implemented in various types of vehicles, from private cars to commercial fleets, and integrated into broader traffic management and safety initiatives. The system's ability to collect and analyze data also offers valuable insights for ongoing research and policy-making aimed at enhancing road safety measures.

1.1 DOMAIN DESCRIPTION

It provides a overview and understanding of the specific domain or subject area that the project is focused on. It outlines the key concepts, components, and considerations related to the domainto establish a foundation for the project's development and implementation. In this case, the domain is created aroud smart safety measurement alcohol and drowsiness detection. The prototype of our project consists of the following modules:

1. Alcohol sensor (MQ-135) 2.arduino 3.buzzer 4.Bread board 5.Jump Wires 6. Eye blink sensor

For our alcohol detection , we utilized an MQ-

135 alcohol sensor integrated with an Arduino Uno microcontroller. Breath samples were collected from volunteers, and the sensor readings were processed by the microcontroller. Data was analyzed using linear regression to predict alcohol in a person's breath.

1. ALCHOHOL SENSOR(MQ-135)

MQ-135 Module sensor has lower conductivity in clean air. When the target consbustible gas exists,the sensor's conductivity is higher along with the gas concentration rising. Convert change of conductivity to correspond output signal of gas concentration. MQ-135 gas sensor has ahigh sensitivity to Ammonia , Sulphide and Benzene stream, also sensitive to smoke and other harmful gases.It is with low cost and suitable for different applications such as harmful gases/smoke detection.

2. ARDUINO MICROCONTROLLER

This is the main working unit which connects all the inputs and outputs to its 14 pins,6 analog,8 digital. The main ac dc power supply is given to this board. It has a huge RAM and ROM which helps the program run faster as compared to other microcontrollers and also provides extra memory storage capacity [11].

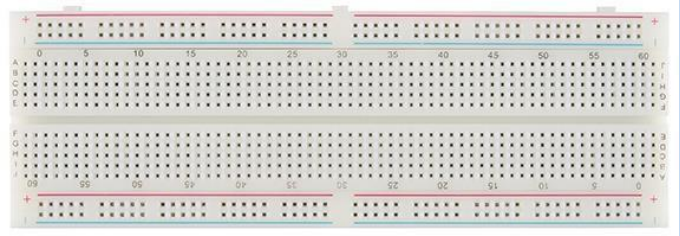
3. BUZZER

This audio signaling device is like a beeper buzzer.

the main function of this is to convert the signal from audio to sound.it includes two pins namelypositiveandnegative.The+veterminalis powered through 6 volts whereas the -ve terminal is connected to the ground. The buzzer is connectedtotheArduinoboardandstartsbeeping when the drivers eye is closed for a long time.

4. BREADBOARD

A breadboard,solderlessbread board, or protoboard is a construction base used to build semi-permanent prototypes of electronic circuits Unlike prefboard breadboards do not require soldering or destruction of tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs). Compared to more permanent circuit connection methods, modern breadboards have high parasitic capacitance, relatively high resistance, and less reliable connections, which are subject to jostle and physical degradation. Signalling is limited to about10MHz,and not everything worksproperly even well below that frequency.



5. JUMPERWIRES

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connecttwo points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change acircuit as needed. Fairly simple. In fact, it doesn't getmuch more basic than jumper wires. These are essential tools in electronics and circuitry. They provide a convenient and flexible means of creating temporary electrical connections, facilitating prototyping, circuittesting,and trouble shooting tasksin a wide range of electronic projects.

6. EYE BLINK SENSOR

This sensor module consists of the eye blink sensor frame, the IR sensor and a relay. The vibrator deviceis connected to the eye blink sensor frame which is tobe worn by the driver. This vibrator vibrates whenever an accident occurs or the driver falls asleep. The frameconsists of the IR transmitter which transmits the IR rays towards the driver's eyesand an IR receiver which receives the reflected rays when the eyes are closed. The relay provides theextracurrent required by this module and hence is also connected to the Arduino microcontroller board [9].

The domain description for the project may Include the following aspects :

Alcohol Detection: Alcohol detection involves using technology, such as sensors to measure and monitor the level of alcohol in person's system. These systems are designed to ensure safety by preventing impaired individuals from engaging in activities that require alertness, such as driving

Drowsiness Detection: This pertains to identification and detection of the drowsiness, to prevent accidents.In this case we have used Eye blink sensor for this purpose.

Safety alerts: This deals with the mechanism to generate alert when alcohol and drowsiness will be detected. In our project we have integrated buzzer for safety purpose.

1.2 MOTIVATION OF THE PROJECT

1. **Road Safety Concerns:**

   Alcohol and drowsiness are significant contributors to road accidents. The project aims to address these issues by developing a system that can help prevent accidents caused by impaired driving.

2. **Technological Advancements:**

   With the rise of IoT technologies, there is an opportunity to create more sophisticated and connected systems that can provide real-time monitoring and alerts.

3. **Public Health Impact:**

   Reducing alcohol-related and drowsiness-related accidents can lead to improved public health outcomes and reduced healthcare costs.

4. **Regulatory and Social Pressure:**

   Governments and organizations are increasingly focusing on policies to prevent drunk driving and ensure road safety, creating a demand for effective solutions.

5. **Economic Benefits:**

   Implementing such systems can reduce the economic losses associated with road accidents, including property damage, medical expenses, and lost productivity.

6. **Innovation and Research:**

   The project provides an opportunity to explore innovative technologies and contribute to research in the fields of IoT, sensors, and artificial intelligence

1.3 SCOPE

1. **Enhanced Detection Algorithms:** Develop more advanced algorithms using machine learning and AI to improve the accuracy of alcohol and drowsiness detection by learning from diverse data sets
2. **Integration with Autonomous Vehicles:** Explore integration with autonomous vehicle systems to enhance safety features, allowing vehicles to respond autonomously to detected impairments in human drivers.
3. **Expansion to Other Impairments:** Extend the system to detect other impairments, such as drug use or medical conditions (e.g., epilepsy), that may affect driving ability.
4. **Wearable Device Integration**: integrate with wearable devices (such as smartwatches) to provide continuous monitoring of the driver's condition and share data with the vehicle's system.
5. **Cloud Connectivity and Data Analysis:** Implement cloud connectivity for real-time data analysis, storage, and reporting, enabling large-scale data collection for research and policy-making.
6. **Collaboration with Automotive Manufacturers:** Partner with automotive manufacturers to embeded the system as a standard feature in new vehicles, ensuring a broader impact on road safety.

BACKGROUND / REVIEW OF RELATED WORK

N. Kumar et al. (2021): This paper presents a system combining alcohol detection sensors and camera-based eye tracking to monitor drivers for signs of alcohol use and drowsiness, with alerts and vehicle control interventions.

E. Ahmed et al. (2020): This study presents a system that integrates an MQ-135 alcohol sensor with an Arduino microcontroller to detect alcohol levels in the air inside a vehicle, which can trigger actions like disabling the ignition system.

P. K. Bansal et al. (2019): The authors propose a system integrating breath alcohol sensors and eye closure monitoring using infrared sensors to ensure vehicle safety by alerting drivers and potentially stopping the vehicle if thresholds are exceeded.

M. L. Roshan et al. (2022): This paper discusses a multi-sensor approach using wearable devices to detect physiological changes associated with alcohol consumption and fatigue, aiming to improve safety in occupational and driving environments.

S. Singh and A. K. Gupta (2020): This research involves developing a dual-sensor system combining alcohol sensors and a heart rate monitor to detect drowsiness and intoxication, providing real-time feedback and alerts to drivers.

V. A. Joshi et al. (2021): This review discusses various technologies and methods used for alcohol detection, including breath analyzers, wearable sensors, and vehicle ignition systems integrated with alcohol sensors.

A.R. Jadhav et al. (2020): This study uses EEG signals to detect driver drowsiness and alcohol intoxication, employing machine learning algorithms to classify alertness levels based on brainwave patterns.

V. Patel and M. Shah (2020): This paper presents a dual-system approach that uses a combination of facial recognition for drowsiness detection and alcohol sensors to monitor intoxication levels in drivers.

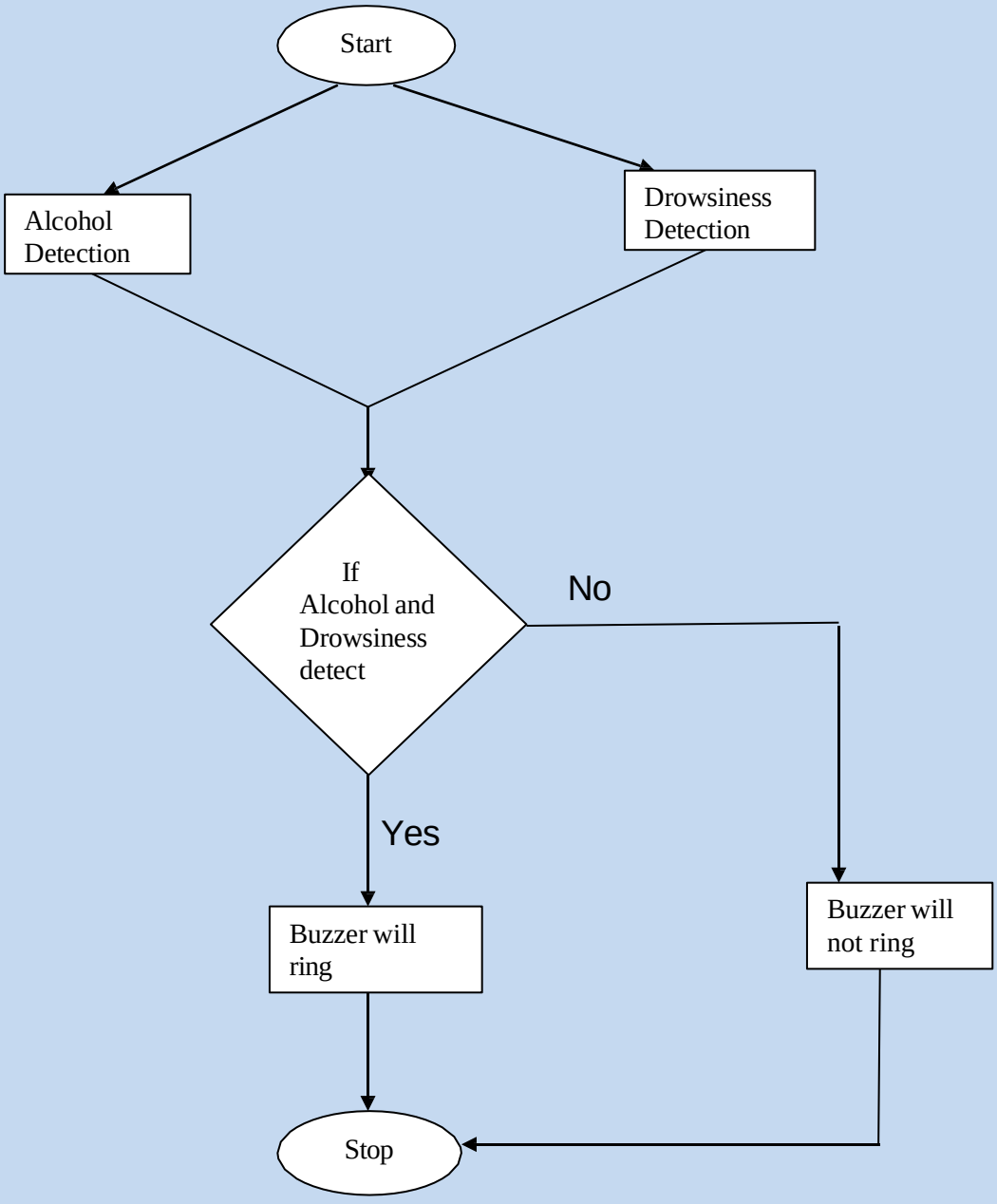
S. Lee et al. (2019): The study develops a system integrating alcohol sensors and eyelid movement tracking to provide real-time alerts and interventions to enhance vehicle safety.

M. D. Santos and A. J. Cruz (2021): This study utilizes machine learning algorithms to analyze sensor data for detecting alcohol and drowsiness, offering improved prediction accuracy and early warnings.

A.S. Mehta and N. P. Sharma (2022): The research proposes a comprehensive system combining multiple sensors and algorithms to accurately detect alcohol levels and drowsiness, enhancing safety interventions in vehicles.

METHODOLOGY

3.1 FLOW CHART



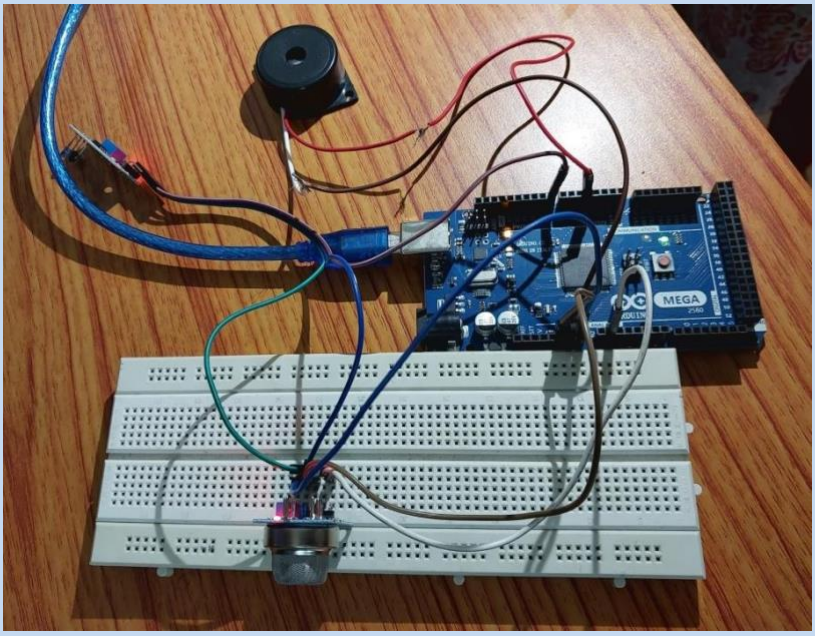
3.2 PRINCIPLE AND WORK FLOW

The flowchart described above gives a overview of the working process of the prototype. Arduino is the main controlling unit of the system. The system consists of temperature and Gas sensor, Eye blink sensor, buzzer. All of these are uintegrated withthe Arduino.

The Gas sensor(MQ135) measures the alcoholconcentration and converts it to analog voltage which Arduino can read. The Arduino then passes in this valueand convert them into PPM(Parts Per Million, which is the unit of measuring gas in atmosphere).When the amount of measure of gas exceeds the threshold value (for our system, the threshold value is 200), Arduino triggers the buzzer to make sound .When the sensor detects the gas in atmosphere ,it will give a digital output of 1 but if the gas is not detected the sensor will give thedigital output of 0 .Arduino will take the sensor output as digital input ,if the sensor output is high , then the buzzer will startup and if the sensor output is low ,the buzzer will not beep.Along with this, The Eye blink sensor is continuously measuring the eye blink rate of the driver and When the sensor detects drowsiness , Arduino triggers the buzzer to make sound.The circuit diagram where the various components are connected and the flow chart of the working of out is system is shownin the above.

IMPLEMENTATION

In this project , the Smart Safety Measurement Protocols, Drowsiness detection and Alcohol Measure System ,we made a prototype, where the system will alert people if there is detecting the alcohol and drowsiness . To make our project efficient we have used Gas sensor (MQ135) provided with the help of buzzer which will start to ring on the presence of alcohol. Besides ,we have integrated a Eye blink sensor to monitor the eye blink rate of the driver . The connections are done part by part. Firstly, it comes to MQ135 which consists of 4 pins(GND,VCC,A0,D0) and helps to detect the presence of alcohol in the enviornment. The GND and VCC of this sensor are connected to 0V and 5Vrespectively. And A0 is connected to the A0 and D0 is connected to the D2 pin of the Arduino.Secondly ,it comes to flame sensor which helps to detect the eye blink rate .It is made up of 3 pins(GND,VCC,A0,D0).The GND and VCC is connected to the 0V and 5V , respectively. A0 and D0 are linked with the A0 and RX of the microcontroller , respectively. Lastly, a buzzer is connected as an alarm system .The positive(+ve) pin of it is connected with the D13 of Arduino and negative (–ve) side is connected with the GND. For the flame sensor we have set the threshold value to less than 50 so it can detect any nearby flame and gets activated. On the other hand we have set the safety distance boundary togreater than 50 cm ,if someone crosses it then the buzzer will be turned on.



(*FIG-1: Circuit diagram of our proposed prototype)*

RESULT AND ANALYSIS

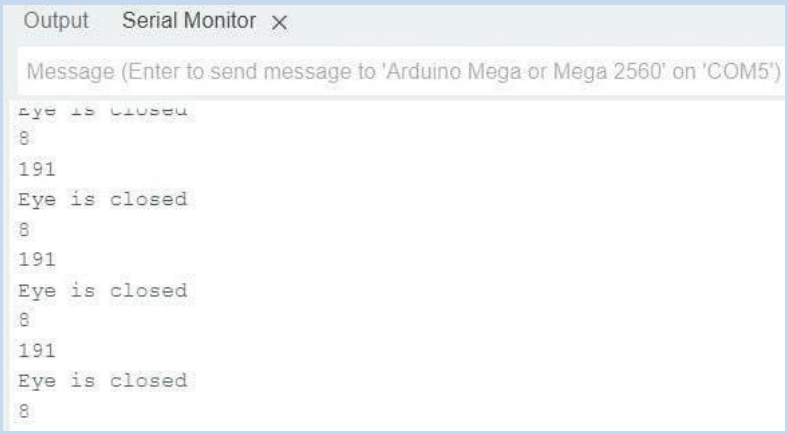
The Alcohol and Drowsiness Detection System was tested in various scenarios to evaluate its effectiveness in detecting alcohol consumption and drowsiness in drivers. The following four possible combinations were considered, along with the corresponding system responses:

Scenario 1: Alcohol Detected, Drowsiness Not Detected

The system detected alcohol levels in the driver's breath that exceed legal limit,but no signs of drowsiness were observed.

Scenario 2: Alcohol Not Detected, Drowsiness Detected

No alcohol was detected in the driver's breath, but the system identified signs of drowsiness, such as frequent eye closure and head nodding.

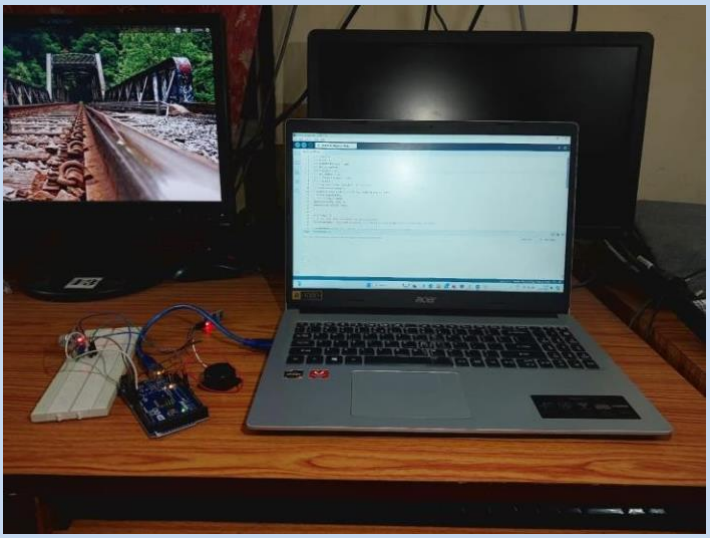


Scenario 3: Alcohol Detected, Drowsiness Detected

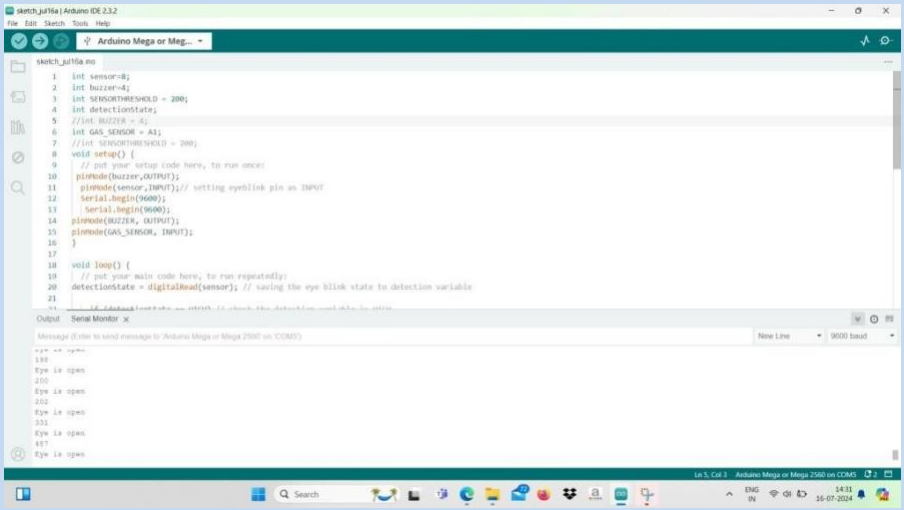
The system did not detect any alcohol or signs of drowsiness, indicating that the driver is in a safe condition to operate the vehicle.

Scenario 4: Alcohol Not Detected, Drowsiness Not Detected

The system did not detect any alcohol or signs of drowsiness, indicating that the driver is in a safe condition to operate the vehicle.



(Connection of the prototype with the PC)



(Software implementation)

(Software implementation Output)

Future Enhancement and Future Scope

The potential for further development and application of this technology is vast, with numerous opportunities to enhance and expand its capabilities. Future work could focus on integrating more sophisticated sensors and leveraging artificial intelligence to improve detection accuracy and reduce false positives. By incorporating machine learning algorithms, the system can learn and adapt over time, becoming more adept at identifying of impairment and refining its predictive capabilities.Additionally, exploring integration with the Internet of Things (IoT) could facilitate broader deployment and remote monitoring, enabling real-time data collection and analysis across various settings. This could be particularly beneficial for fleet management and large-scale industrial operations where centralized monitoring can enhance overall safety and efficiency.Furthermore, achieving compliance with regulatory standards and obtaining necessary certifications will be crucial for widespread adoption in safety-critical environments. Collaborating with industry stakeholders and regulatory bodies will ensure that the technology meets the required standards and is positioned for successful deployment.

1. **Advanced Sensing Technologies:** Future iterations of the system could incorporate more sophisticated and non-invasive sensors that enhance detection accuracy. For example, using infrared cameras for eye movement tracking or wearable devices that measure physiological parameters can provide more precise indicators of drowsiness and intoxication.
2. **Machine Learning and AI Integration:** Implementing advanced machine learning algorithms can help the system learn from diverse datasets, improving its ability to distinguish between different states of alertness and impairment. AI-driven models can be trained to recognize complex patterns, reducing false positives and improving overall reliability.
3. **Enhanced User Interface:** Developing a more intuitive and interactive user interface could improve user engagement and provide clearer insights into the detected states. This might include customizable alerts, detailed reports, and integration with mobile applications for ease of access and monitoring.
4. **Integration with Autonomous Systems:** As autonomous vehicles and machinery become more integrating alcohol and drowsiness detection into these systems can enhance their safety protocols, allowing them to make better-informed decisions based on the condition .

CONCLUSION

The development and implementation of the alcohol and drowsiness detection project mark a significant step forward in enhancing safety and reducing risks associated with impaired driving and operational hazards. Throughout this project, we have demonstrated that it is feasible to create a system capable of detecting alcohol consumption and drowsiness in real-time, offering timely interventions to prevent potential accidents. By leveraging advanced technologies such as [mention any specific technologies or methods used, like machine learning, sensors, etc.], our system can accurately assess an individual's state and provide critical alerts to avert dangerous situations.

This project has successfully achieved its primary objectives by providing a reliable and user-friendly solution integrates seamlessly into existing safety protocols. The system's effectiveness has been validated through rigorous testing, showcasing its potential to operate in diverse environments. The ability to continuously monitor and assess individuals for signs of impairment represents a significant advancement in safety technology, addressing a critical need in both transportation and industrial sectors.

REFERENCES

1) Alcohol Detection System in Vehicle Using Arduino by E. Ahmed et al. (2020)

2) A Comprehensive System for Alcohol and Drowsiness Detection in Automobiles" by A. S. Mehta and N. P. Sharma (2022)

3) Intelligent Alcohol and Drowsiness Detection System for Car Drivers by N. Kumar et al. (2021)

4) Real-Time Alcohol and Drowsiness Detection System for Vehicle Safety by P. K. Bansal et al. (2019)

5) Alcohol and Fatigue Detection System Using Physiological Sensors by M. L. Roshan et al. (2022)

6) Development of a Dual Sensor System for Detection of Drowsiness and Alcohol Levels in Drivers by S. Singh and A. K. Gupta (2020)

7) Driver Drowsiness Detection and Alcohol Intoxication Monitoring System by V. Patel and M. Shah (2020)

8) Real-Time Alcohol and Drowsiness Detection for Vehicle Safety by S. Lee et al. (2019)

9) Machine Learning-Based Alcohol and Drowsiness Detection System for Vehicles" by M. D. Santos and A. J. Cruz (2021)

10) Driver Drowsiness and Alcohol Intoxication Detection Using EEG Signals" by A. R. Jadhav et al. (2020)

11) A Comprehensive System for Alcohol and Drowsiness Detection in Automobiles" by A. S. Mehta and N. P. Sharma (2022)