International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 02 | February - 2024 SJIF Rating: 8.176 ISSN: 2582-3930

Driver Safety: Accident Prevention and Detection System

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ABSTRACT
The integrated Accident Prevention and Detection System is a groundbreaking venture poised to elevate vehicular safety with advanced technology. By amalgamating a NodeMCU microcontroller, alcohol detection sensor, eye blink sensor, and GSM module, this system offers a holistic solution. Monitoring alcohol levels and signs of fatigue, the sensors feed data to the NodeMCU, the brain of the system. Real time analysis allows the system to foresee potential collisions and promptly intervene. Beyond collision prevention, the GSM module enables emergency communication, instantly alerting authorities via SMS in case of a looming collision. With remote monitoring capabilities and GPS tracking for accurate location data, this system is tailored for adaptability and user-friendliness. By combining these elements, it not only detects impairment but also proactively mitigates risks, standing as an innovative safeguard for road safety.

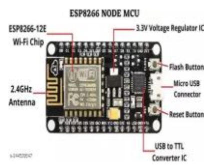
Key Words: NodeMCU microcontroller, Eye Blink Sensor, GSM Module, Alcohol Detection Sensor, SMS Alerts, Vehicle Safety, Remote Monitoring, GPS Tracking.

1.INTRODUCTION

Road accidents remain a leading cause of death and injury worldwide, with human error contributing to a significant portion of these unfortunate events. Distracted driving, drowsiness, and alcohol intoxication are some of the major factors that compromise driver safety and put lives at risk. In response to this critical challenge, this project presents an innovative driver safety system designed to both prevent accidents and improve response in the event of a collision.This integrated system leverages a combination of advanced technologies and sensors to address multiple safety concerns:Drowsiness detection: Employing reliable methods like eye-tracking, physiological monitoring, or breathalyzer sensors, the system accurately identifies driver drowsiness and instigates timely interventions.Alcohol intoxication detection: Utilizing a breathalyzer sensor (MQ3), the system detects alcohol presence and implements immediate measures to prevent intoxicated individuals from driving.Accident detection and emergency response: Utilizing an accelerometer or gyroscope, the system detects sudden impacts indicative of a collision. It then transmits crucial information (location, severity) via a GSM module to alert emergency services promptly.By proactively addressing these crucial aspects of driver safety, this project aims to make a significant impact on reducing road accidents, saving lives, and fostering a culture of responsible driving.Further enhancements:Data logging and analysis: The system can be implemented to log driver behavior data for long-term analysis and system improvement.Privacy-conscious design: Ethical data collection and handling practices ensure user privacy and anonymity.

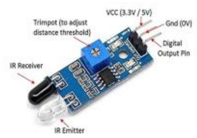
1.1 NodeMCU ESP8266:

Microcontroller runs the algorithm code and processes real-time sensor data feeds to determine driver condition and triggers safety actions accordingly through output signals.



1.2 Eye Blink Sensor:

IR transmitter and receiver placed near driver eyes tracks blinking rate. Gradual decrease indicates drowsiness till unsafe levels to actuate alerts followed by engine cut-off.

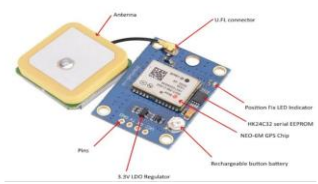


1.3 Alcohol Gas Sensor (MQ3):

Detects alcohol levels from driver's breath. Output voltage mapped to alcohol concentration enables intoxication detection.

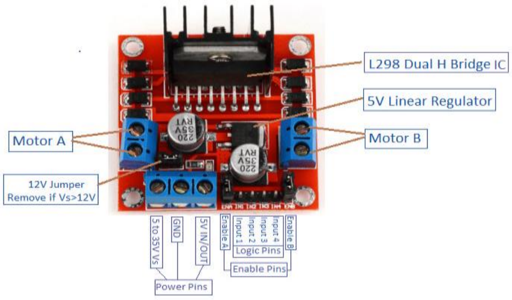
1.4 GPS Module:

NEO-6M GPS module provides real-time vehicle latitude and longitude coordinate data over serial interface which is parsed by NodeMCU and sent over GSM.



1.5 L298N dual H driver(Motor driver):

The L298N is a popular dual H-bridge motor driver integrated circuit (IC) used in robotics, automation, and other electronic projects to control the movement of DC motors. It is designed to provide bidirectional control (forward and reverse) for two DC motors or control one stepper motor.



1.6 Buzzer:

Piezo buzzer beeps to warn driver initially before cutting engine relay during sensed drowsiness/intoxication thereby providing in-sequence multi-level alerts.

1.7 DC Motor:

DC motors can be essential components in accident detection systems, enabling the detection of hazards, activation of safety mechanisms, and implementation of emergency response measures to enhance safety and mitigate the consequences of accidents in various environments, including automotive, industrial, and public safety applications.

1.8 Blynk App:

Blynk is a platform that allows users to build IoT (Internet of Things) applications for controlling and monitoring connected devices remotely. The core of the Blynk platform consists of the Blynk app, a mobile application available for both iOS and Android devices, and the Blynk cloud service.

2. LITERATURE REVIEW

2.1 Drowsiness Monitoring Approaches:

Ooi et al. [3] developed a non-intrusive drowsiness detection system using Microsoft Kinect v2 sensor able to continuously monitor blink duration and facial expressions. Tested under real highway conditions using 10 participants, the computer vision algorithm achieved over 90% accuracy in distinguishing alert versus fatigue states based on PERCLOS metric. However, major hardware requirements pose challenges to integration at scale.Garcia et al. [4] designed a lightweight embedded system using ATmega328 microcontroller and infrared emitter/detector for affordable blink rate monitoring. The prototype device was able to detect drowsiness with reasonable accuracy by tracking abrupt changes and progressive drop-offs in blink frequencies. Such minimal component solutions show promise for integration into commercial vehicles.

2.2 Alcohol Detection Techniques:

Laxman et al. [5] experimentally analyzed various techniques for measuring Blood Alcohol Content (BAC) levels including fuel cell based sensors, infrared spectroscopy, and semiconductor metal oxide detectors. MQ3 gas sensor was found most suitable for automotive grade real-time alcohol detection offering optimal performance trade-offs. Readings could be correlated to legal BAC limits for cutting off ignition control signal relay.

2.3 IoT-enabled Accident Alert Systems:

Pissolato Filho et al. [6] developed a smartphone app paired with Arduino Uno evaluation board and MPU-6050 accelerometer for crash detection and instant GeoSMS alerts to predefined contacts. GPS location extracted from mobile device ensured First Responders could be rapidly deployed to the site. Cloud integration offered opportunity for further analytics. Low cost and minimal custom hardware provided a advantageous starting point.

3. PROPOSED SYSTEM

This system features three key functionalities for driver safety:

3.1 Drowsiness Detection:

IR Sensor tracks blink rate to determine onset of fatigue. Readings processed by NodeMCU and engine cutoff signal triggered if anomalous patterns observed.

3.2 Intoxication Testing:

MQ3 gas sensor estimates BAC levels from driver breath sample. Microcontroller compares reading against 0.08% calibrated threshold - legal limit for intoxication. Immobilizer activated if exceeded to prevent vehicle starting.

3.3 Crash Notification:
ADXL335 accelerometer monitors surge forces along 3 axes suggestive of impact. On crossing set threshold, ESP8266 activates GSM communication protocol to immediately alert predefined emergency contacts and share GPS coordinates. Allows first responders to be rapidly dispatched to accident site.

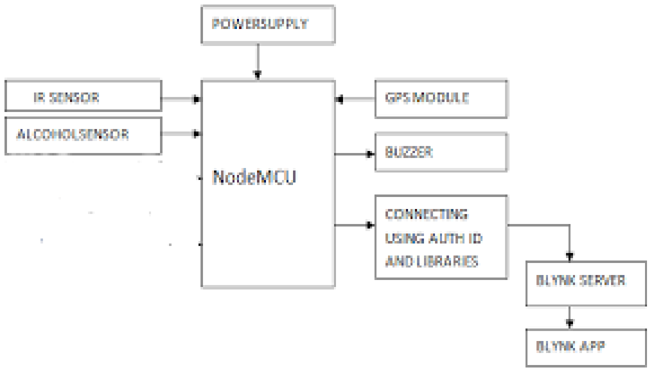


Fig: Block Diagram of Driver Safety System

4.PROCESS FLOW:

Integrating a Blynk app into a driver safety system that utilizes a NodeMCU, GSM module, alcohol sensor, and IR sensor enhances user interaction and control. Here's a detailed process flow for such a system:

4.1 Initialization :
- Power up the NodeMCU and initialize all connected modules (GSM module, alcohol sensor, IR sensor).
- Set up communication interfaces (e.g., UART for GSM module, GPIO for sensors).
- Establish connection with the Blynk server using Wi - Fi.

4.2 Blynk App Configuration :
– Generate a Blynk project Within the Blynk application
- Add appropriate widgets to the Blynk app dashboard, such as buttons, value displays, and notifications.
- Assign virtual pins to the widgets for communication with the NodeMCU.

4.3 Sensor Calibration and Self-Test :
- Calibrate the alcohol sensor to ensure accurate readings.
- Perform self-tests on the IR sensor to verify functionality.

4.4 Data Acquisition and Transmission :
- Continuously monitor the alcohol sensor to detect alcohol levels in the driver's breath.
- Monitor the IR sensor to detect the presence of the driver in the vehicle seat.
- Transmit sensor data to the Blynk app using virtual pins.

4.5 Blynk App Interaction :
- Display real-time sensor data (alcohol levels, seat occupancy) on the Blynk app dashboard.
- Implement controls (buttons, sliders) on the Blynk app to trigger actions based on sensor data.
- Allow the user to set thresholds for alcohol levels and customize alert preferences.

4.6 Safety Measures Activation :
- If the alcohol concentration exceeds the threshold or the driver is not seated:
  - Activate the GSM module to send an alert message containing the GPS location of the vehicle to predefined emergency contacts or authorities.
  - Activate warning signals within the vehicle (e.g., sound alarms, visual alerts) to alert the driver.
  - Optionally, immobilize the vehicle by cutting off the ignition or applying brakes using relays controlled by the NodeMCU.

4.7 Alert Notification :
- Send push notifications or emails to the Blynk app user's mobile device to notify them of safety violations.
- Include relevant information such as the location of the vehicle and the detected safety issue.

4.8 Continuous Monitoring and Feedback :
- Continuously update the Blynk app dashboard with real-time sensor data and status updates.
- Provide feedback to the user through the Blynk app interface to inform them of safety violations and system actions taken.

4.9 Emergency Response :
- Enable the user to manually override safety measures or deactivate alerts through the Blynk app interface in case of false alarms or emergencies.
- Implement fail-safe mechanisms to ensure that the system can be deactivated remotely by authorized personnel if necessary.

4.1.1 Logging and Reporting:
- Log all detected safety events and system actions for future analysis and reporting.
- Generate reports within the Blynk app or provide access to historical data for vehicle owners or fleet managers to review safety incidents and system performance.

By integrating the Blynk app into the driver safety system, users gain remote access to real-time sensor data and control over safety measures, enhancing overall safety and user experience.

5.RESULTS AND ANALYSIS

Implementing a driver safety system using a NodeMCU, GPS location, alcohol sensor, IR sensor, and Blynk app can provide valuable insights into the behavior of drivers and enhance safety measures. Here are some potential results and analysis that can be derived from such a system:

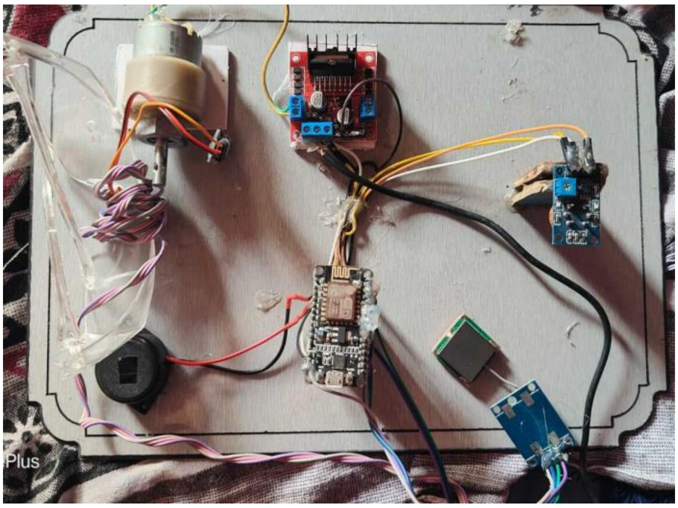


Fig : Snap Shot of Device Connections

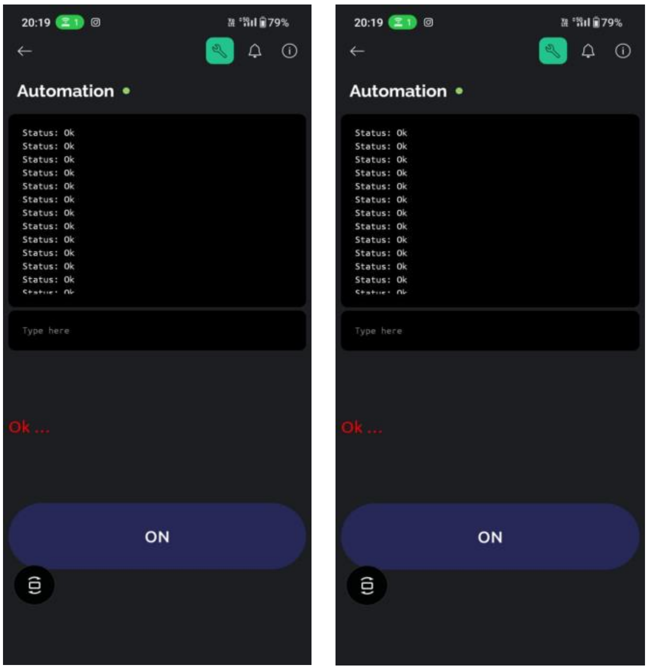


Fig : Android application

6.CONCLUSIONS

According to the research, it can be noted that a diverse range of tasks has been accomplished thus far in this domain. Numerous individuals executed tasks to identify accidents, ascertain the accident location, and dispatch alert messages to the driver, among other actions. In this project, the system “Driver Safety: Accident Prevention and Detection System” is designed by using GSM and GPS. Upon occurrence of an accident, the GPS-derived coordinates of the accident location are transmitted via the GSM network to the designated mobile numbers. This paper provides the work to not only detect an accident but also to prevent that. Integrating the system into the vehicle may result in heightened vehicle expenses on one side, yet simultaneously enhance road safety and mitigate potential mishaps. The suggested system proves immensely advantageous in pinpointing accident locations for prompt rescue of injured individuals.

7.FUTURE SCOPE

Vehicle mishaps are increasing day by day. Hence, it is paramount to discover a method to diminish it. From this paper it can be observed that such a system can spare numerous lives. As of now, the system is using the location based on GPS and employing an alert message by the GSM module. This framework has the potential to broaden in the future through its integration with Google Maps. Another up-gradation could be in the message sending module. Aside from transmitting the message solely to the enrolled numbers, an alarm notification would also be dispatched to the nearest accessible ambulance or medical facilities.

ACKNOWLEDGEMENT

We would like to thank Department of Computer Science and systems Engineering, Lendi Institute of Engineering and Technology, Vizianagaram for helping us carry out the work and supporting us all the time.

REFERENCES

1. Arjun , Prithviraj and Ashwitha, "SENSOR BASED APPLICATION FOR SMARTVEHICLES ", International Journal of Latest Trends in Engineering and Technology, Vol.(8)Issue(1), pp.526-532 DOI: http://dx.doi.org/10.21172/1.81.068 e -ISSN:2278-621X.
2. bb Aishwarya, Ashish Rai, Charitha, Prasanth, Savitha, "An IoT Based Accident Prevention & Tracking System for Night Drivers", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Issue 4, April 2015 .
3. M. Kavya and Shakeel Ahmed , "IOT BASED REAL-TIME AUTONOMOUS VEHICLE TRACKING SYSTEM", International Journal of Modern Trends in Engineering and Research, Scientific Journal Impact Factor (SJIF): 4.364, ISSN (online) 2349 -9745, ISSN (print) 2393 -8161.
4. N.Upendra Yadav, Prof Kamalakannan, "Smart Vehicle Monitoring System using IOT ", IJDCST@March-April-2017,Issue-V-5,I-3,SW-31 ISSN-2320-7884 (Online) ISSN-2321-0257 (Print).

5. Mr.Dinesh Kumar HSDK, Shreya Gupta, Sumeet Kumar, Sonali Srivastava, "Accident Detection and Reporting System Using GPS and GSM Module", JETIR (ISSN-2349-5162), May 2015, Volume 2, Issue 5 4, April 2017
6. M. A. Fikirli, C. P. Uzunoğlu, İ. A. Solmaz and M. Uğur, "Dedection of eye blink movements withsensors," 2015 Medical Technologies National Conference (TIPTEKNO) , Bodrum, 2015, pp. 1-3,doi: 10.1109/TIPTEKNO.2015.7374610.
7. A. Rahman, M. Sirshar and A. Khan, "Real time drowsiness detection using eye blink monitoring," 2015 National Software Engineering Conference (NSEC), Rawalpindi, 2015, pp. 1- 7, doi: 10.1109/NSEC.2015.7396336.
8. Z. Halim, R. Kalsoom, S. Bashir, and G. Abbas, "Artificial intelligence techniques for driving safety and vehicle crash prediction," Artificial Intelligence Review, vol. 46, no. 3, pp. 351–387, 2016.