Journal of Information Systems Engineering and Management
2025, 10(47s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

A Novel IoT-Driven Smart Detection of Driver Drowsiness and Alcohol Impairment

Mr. Ranjith M S [1*], Dr. S. Raja Mohamed [2*]
[1] *Master of Computer Science and Engineering, KIT – Kalaignarkarunanidhi Institute of Technology, Coimbatore, India*
[2] *Associate Professor, Head of Department, Department of Computer Science and Engineering, KIT – Kalaignarkarunanidhi Institute of Technology, Coimbatore, India*
* Corresponding Authors: ranjithbhatmesh@gmail.com, rajamohameds@kitcbe.ac.in

ARTICLE INFO

Received: 31 Dec 2024

Revised: 20 Feb 2025

Accepted: 28 Feb 2025

ABSTRACT

Driver drowsiness and alcohol consumption are significant contributors to road accidents, posing a serious risk to passengers, pedestrians, and other motorists. This project introduces an advanced IoT based system that integrates behavioral and vehicle based approaches to detect driver fatigue and alcohol impairment in real time. Utilizing a Convolutional Neural Network (CNN) algorithm, the system captures and analyzes facial expressions through a camera to identify signs of drowsiness, while an alcohol sensor detects intoxication levels. Additionally, an LED display on the windshield and rear of the vehicle alerts nearby drivers with messages. A built-in SOS button enables passengers to send emergency alerts to the cab organization, ensuring swift action. By continuously monitoring the driver's condition, issuing timely warnings, and facilitating emergency responses, this system enhances road safety and provides a robust real time solution for preventing drowsiness and drunk driving-related accidents.

Keywords: Driver drowsiness detection, Alcohol level detection, Convolutional Neural Network (CNN) Algorithm, Driver behavior analysis Data collection and analysis, Predictive analytics.

INTRODUCTION

Road safety remains one of the most critical challenges in modern transportation, with driver drowsiness and alcohol consumption being leading causes of accidents worldwide. The lack of awareness, delayed reaction times, and impaired judgment caused by fatigue and intoxication significantly increase the risk of collisions, often resulting in severe injuries and fatalities. Despite stringent traffic regulations and awareness campaigns, incidents related to drowsy and drunk driving continue to rise, necessitating the development of an advanced, real-time monitoring system to ensure safer roads. This project proposes an IoT-based smart detection system designed to identify driver drowsiness and alcohol impairment through a combination of behavioral and vehicle-based methods. The system integrates a Convolutional Neural Network (CNN) algorithm for facial recognition and eye movement analysis using a camera, effectively detecting early signs of fatigue. Additionally, an alcohol sensor is employed to monitor the driver's breath and determine intoxication levels. By implementing these technologies, the system aims to proactively reduce the risks associated with impaired driving. A unique feature of this project is its real-time alert system, which includes LED displays on both the front windshield and rear of the vehicle. These displays provide critical warnings to surrounding drivers, such as "Driver may be drowsy, maintain distance" or "Passenger needs help." This feature ensures that other motorists are made aware of potential hazards, allowing them to take precautionary measures. Moreover, the system is equipped with an SOS emergency button, enabling passengers to send an immediate distress signal to the cab organization or relevant authorities. Upon activation, an alert message is transmitted, prompting a swift response to assist the affected passengers. This function not only enhances passenger safety but also encourages prompt intervention in critical situations. The integration of IoT technology, sensor-based detection, and real-time data processing makes this system an efficient solution for preventing road accidents caused by drowsiness

Journal of Information Systems Engineering and Management
2025, 10(47s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

and alcohol consumption. The system continuously monitors the driver's condition and provides automated alerts, ensuring a proactive approach to accident prevention. Furthermore, its application extends beyond personal vehicles to public transportation and commercial fleets, making it a valuable tool in enhancing road safety on a larger scale. In conclusion, this project addresses a crucial gap in road safety by combining AI-driven facial recognition, alcohol detection, and an intelligent alert system. By incorporating real-time monitoring, automated warnings, and emergency response mechanisms, this IoT-based solution effectively reduces the risk of accidents, thereby saving lives. Future enhancements could include machine learning-based predictive analytics to further improve the accuracy and efficiency of the system. With its innovative approach, this project contributes to a safer and more responsible driving environment, reinforcing the importance of technological advancements in transportation safety.

LITERATURE REVIEW

Numerous studies have explored the detection of driver drowsiness and alcohol impairment using IoT and deep learning-based approaches. Sapthami et al. [1] proposed an IoT-based alcohol detection and vehicle control system that effectively prevents drunk driving by disabling the ignition when alcohol is detected. However, the system lacks real-time drowsiness monitoring, limiting its applicability to fatigue-related incidents. Similarly, Raja et al. [2] introduced an alcohol detection and emergency alert system using IoT, which ensures timely notifications to authorities. Nevertheless, the system primarily focuses on alcohol impairment and does not incorporate behavioral-based drowsiness detection, making it less comprehensive in accident prevention. Kalisetti et al. [3] analyzed various driver drowsiness detection methods, highlighting the effectiveness of vehicle-based, behavioral, and physiological approaches. However, their study indicated that behavioral-based detection methods, such as facial recognition, can be affected by external lighting conditions, reducing system accuracy. Baby Shamini et al. [4] developed a driver drowsiness detection system based on eye-blink monitoring, utilizing an infrared sensor to track eye movement. Although effective, this approach may produce false positives due to natural blinking patterns, leading to unnecessary alerts. Varshitha et al. [5] and Buddhi et al. [6] focused on deep learning techniques for driver drowsiness detection, utilizing Convolutional Neural Networks (CNNs) for improved accuracy. While CNN-based systems provide robust results in controlled environments, they require extensive datasets for training and struggle with real-time performance in complex driving conditions. Additionally, Gill et al. [7] developed a real-time eye state identification system using CNN, achieving high detection accuracy. However, the system does not integrate alcohol detection, limiting its scope in addressing impaired driving comprehensively. Ch et al. [8] and Ahmed et al. [9] enhanced driver drowsiness detection using automatic deep learning systems, refining accuracy by integrating multiple detection parameters. Despite their effectiveness, these studies do not incorporate an alert system for nearby drivers, which is crucial for accident prevention. Manu et al. [10] introduced a novel approach using the Haar algorithm and Raspberry Pi for both drowsiness and alcohol detection. While innovative, the system lacks a robust real-time notification mechanism to alert surrounding vehicles and emergency services. Additional studies, such as those by Chacon-Murguia and Prieto-Resendiz [11], reviewed various system designs for drowsiness detection, identifying technological gaps in implementation, including processing delays in real-time scenarios. The National Highway Traffic Safety Administration (NHTSA) [12] reported that drowsy driving remains a critical issue despite advancements in detection technology, emphasizing the need for integrated solutions. Rajneesh [13] and Fuletra [14] highlighted real time drowsiness detection techniques but noted that most methods suffer from high computational requirements, making deployment on embedded systems challenging. Yu [15] explored nonintrusive approaches for detecting drowsiness but found them less reliable under varying environmental conditions. Kline et al. [16] developed a detection system using Arduino Uno, which provided a cost-effective solution but lacked deep learning capabilities for improved accuracy. In conclusion, while existing studies have made significant advancements in detecting driver drowsiness and alcohol impairment, they often focus on either aspect individually rather than integrating both. Many methods suffer from limitations such as environmental dependency, false positives, and computational constraints. The proposed IoT-based system addresses these gaps by combining CNN-based facial recognition, alcohol sensors, and real time LED alerts, ensuring a more comprehensive and reliable solution for preventing road accidents.

Journal of Information Systems Engineering and Management
2025, 10(47s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

MODULES

A. FACE DETECTION MODULE (DROWSINESS DETECTION)

The Face Detection Module plays a crucial role in identifying signs of driver drowsiness in real-time. Utilizing a Convolutional Neural Network (CNN) algorithm, this module analyzes facial features such as eye closure, yawning frequency, and head position using an in vehicle camera. The CNN algorithm is trained to recognize patterns of drowsiness by detecting slow eyelid movement (microsleeps) and prolonged eye closure. If drowsiness is detected, an alert system is triggered, which includes audible warnings, LED display alerts, and haptic feedback (vibrations on the steering wheel) to immediately wake the driver. This module ensures proactive monitoring and intervention, reducing the likelihood of accidents due to fatigue. Additionally, the real-time image processing and IoT integration enable continuous tracking of the driver's alertness, making it a reliable and efficient solution for preventing drowsy driving incidents.

B. ALCOHOL DETECTION MODULE

The Alcohol Detection Module is designed to identify drivers under the influence of alcohol using a gas sensor (MQ-3 alcohol sensor). This sensor detects alcohol concentration in the driver's breath and provides real-time data to assess impairment levels. If the detected alcohol level exceeds the predefined threshold, the system triggers an immediate alert through visual and auditory warnings. Additionally, the vehicle's LED display will notify nearby drivers with messages such as "Driver under influence, maintain distance." For added safety, the system can also restrict vehicle ignition if the alcohol level is dangerously high, preventing intoxicated individuals from operating the vehicle. Furthermore, if intoxication is detected while the vehicle is in motion, an emergency alert is sent to the cab organization or relevant authorities for immediate intervention. This module enhances road safety by preventing impaired driving and ensuring quick response mechanisms are in place. The integration of IoT technology and cloud-based monitoring ensures real-time data transmission, making this an effective and reliable alcohol detection system.

C. ALERT AND NOTIFICATION MODULE

The Alert and Notification Module is a crucial component of the system, ensuring timely warnings and emergency notifications. When the system detects drowsiness or alcohol impairment, it triggers multiple alert mechanisms, including visual, auditory, and haptic feedback. A buzzer and voice alerts inside the vehicle notify the driver, while the LED display on the windshield WORKFLOW and rear of the vehicle informs nearby motorists with messages like "Driver may be drowsy, maintain distance." In addition to driver alerts, the system sends real-time notifications to the cab organization or emergency contacts via IoT-based communication. If the SOS button is pressed, an immediate distress signal is transmitted, prompting swift intervention. These alerts can also be integrated with cloud-based platforms for centralized monitoring. The multi-tiered notification system enhances safety by ensuring that both the driver and external parties are aware of potential dangers, enabling prompt actions to prevent accidents.

D. SOS EMERGENCY MODULE

The SOS Emergency Module is designed to provide immediate assistance in critical situations. If a passenger or driver experiences an emergency, they can press the SOS button, which triggers an instant alert to the cab organization, emergency contacts, or law enforcement authorities. The system sends a real-time location update along with the distress signal, enabling quick intervention. Additionally, the LED display on the vehicle shows messages like "Passenger needs help", alerting nearby drivers to assist or report the situation. This feature ensures that help is sought not only from designated responders but also from nearby motorists. The SOS Emergency Module enhances safety by ensuring rapid action in emergencies, making transportation more secure for passengers and drivers alike.

Journal of Information Systems Engineering and Management
2025, 10(47s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

SYSTEM ARCHITECTURE

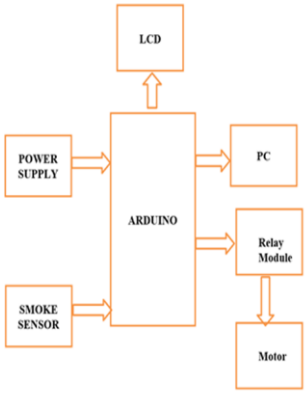

Fig 1.System Architecture

WORKFLOW

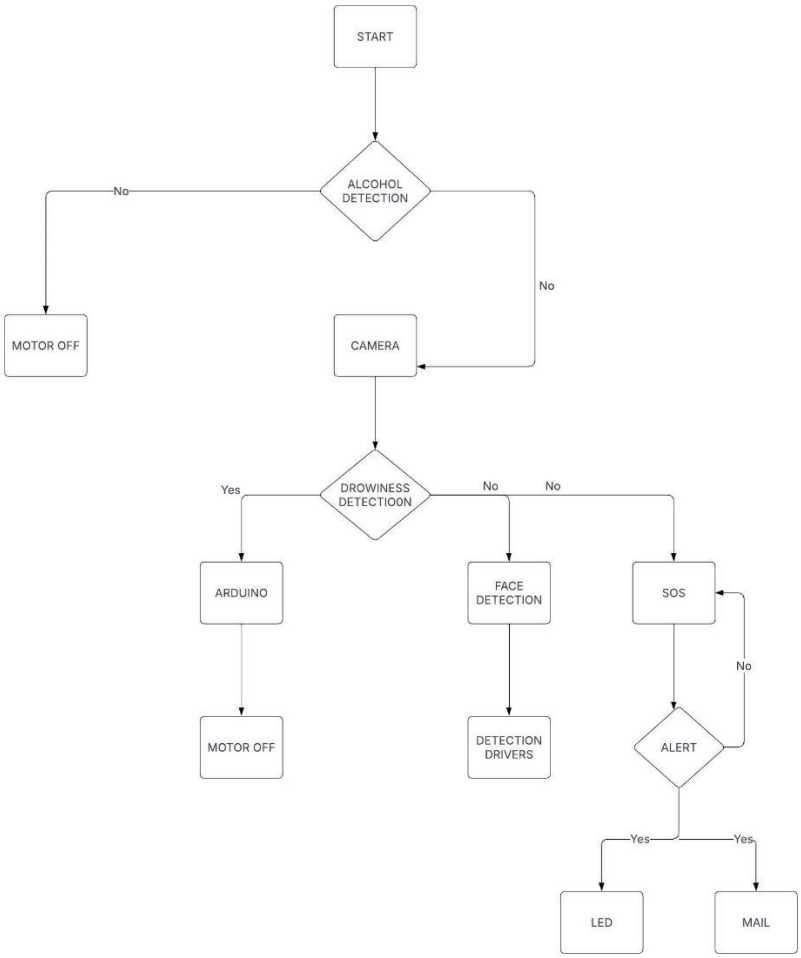

Fig 2. Workflow Diagram

Journal of Information Systems Engineering and Management
2025, 10(47s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

CONCLUSION

The proposed IoT-based driver monitoring system effectively enhances road safety by detecting drowsiness and alcohol impairment in real time. By integrating CNN based facial recognition, alcohol sensors, and automated alert systems, it provides timely warnings and emergency responses. The LED display notifications and SOS emergency feature ensure that passengers and surrounding drivers remain informed, facilitating quick interventions. This system significantly reduces the risk of accidents and promotes responsible driving. Future enhancements could include AI-driven predictive analytics for even more precise monitoring. The project presents a scalable, efficient, and life-saving solution for road safety.

REFERENCES

[1] I. Sapthami, V. V. Narasimha Raju, V. Vaithianathan, P. Chinnasamy, G. Kumaran and R. K. Ayyasamy, "IoT Based Alcohol Detection and Vehicle Control System," 2024 5th International Conference on Data Intelligence and Cognitive Informatics (ICDICI), Tirunelveli, India, 2024, pp. 262-266, doi: 10.1109/ICDICI62993.2024.10810851.

[2] D. P. Raja, G. Barkavi, S. Aishwarya, K. Keerthana and V. Vasudevan, "Alcohol Detection and Emergency Alert System using IoT," 2022 6th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2022, pp. 10.1109/ICICCS53718.2022.9788419.

[3] V. Kalisetti, V. S. C. Vasarla, S. B. Kolli, R. Varaparla, V. Enireddy and M. Mohammed, "Analysis of Driver Drowsiness Detection Methods," 2023 Second International Conference on Electronics and Renewable Systems (ICEARS), Tuticorin, India, 2023, pp. 1481 1485, doi: 10.1109/ICEARS56392.2023.10084986.

[4] P. Baby Shamini, M. Vinodhini, B. Keerthana, S. Lakshna and K. R. Meenatchi, "Driver Drowsiness Detection based on Monitoring of Eye Blink Rate," 2022 4th International Conference on Smart Systems and Inventive Technology (ICSSIT), Tirunelveli, India, 2022, pp. 1595-1599, doi: 10.1109/ICSSIT53264.2022.9716304.

[5] V. S. Varshitha, M. M. Iqbal, V. Amrutha and P. Pujitha, "Driver Drowsiness Detection Using Deep Learning," 2023 International Conference on Computing, Communication, and Intelligent Systems (ICCCIS), Greater Noida, India, 2023, pp. 584-588, doi: 10.1109/ICCCIS60361.2023.10425361.

[6] D. Buddhi and P. Negi, "Deep Learning based Driver Drowsiness Detection," Interdisciplinary 2022 Humanitarian International Conference for Sustainability (IIHC), Bengaluru, India, 2022, pp. 874 879, doi: 10.1109/IIHC55949.2022.10059778.

[7] K. S. Gill, V. Anand, R. Chauhan, S. Thapliyal and R. Gupta, "A Convolutional Neural Network-Based Method for Real- Time Eye State Identification in Driver Drowsiness Detection," 2023 3rd International Conference on Smart Generation Computing, Communication and Networking (SMART GENCON), Bangalore, India, 2023, pp. 1-5, doi: 10.1109/SMARTGENCON60755.2023.10442238.

[8] S. P. Ch, S. Guduru, V. Ronagala, H. Kuresan and S. Dhanalakshmi, "Automatic System for Driver Drowsiness Detection System using Deep Learning," 2023 International Conference for Advancement in Technology (ICONAT), Goa, India, 2023, pp. 1-4, doi: 10.1109/ICONAT57137.2023.10080067.

[9] T. Ahmed, O. Jyoti and T. H. Mou, "Drivers' Drowsiness Detection System Enhancement Using Deep Learning: CNN-based Approach," 2023 26th International Conference on Computer and Information Technology (ICCIT), Cox's Bazar, Bangladesh, 2023, pp. 1-6, doi: 10.1109/ICCIT60459.2023.10441229.

[10] Manu, M. & Jaijan, Dayana & Nissa, S. & Jesna, S. & Shukoor, Abin & Shamna, A.. (2020). A Novel Approach to Detect Driver Drowsiness and Alcohol Intoxication using Haar Algorithm with Raspberry Pi. International Journal of Research in Engineering, Science and Management. 3. 48-51. 10.47607/ijresm.2020.284.

[11] Mario I Chacon-Murguia Claudia Prieto-Resendiz, "Detecting Driver Drowsiness-A survey of system designs and technology," IEEE Consumer Electronics Magazine, pp. 107-108, October 2015.

[12] "Drowsy Driving," National Highway Traffic Safety Administration (NHTSA), 2018.

[13] Rajneesh, "Real Time Drivers Drowsiness Detection and alert System by Measuring EAR," International Journal of Computer Applications (0975 – 8887) Volume 181 – No. 25, November- 2018 .

[14] Jay D. Fuletra., "A Survey on Driver's Drowsiness Detection Techniques" International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 1 Issue: 11, 2013.

[15] Integrated Approach for Nonintrusive Detection of Driver Drowsiness. Yu, Xun. Duluth : s.n., 2012.

Journal of Information Systems Engineering and Management
2025, 10(47s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

[16] Kline, George & Bolivar, Francis & Nacar, Caeyla & Domingo, Azilanna & Baldonado, Ariane & Sunga, Ashlhey & Bautista, Josephine & Galay- Limos, Jenny. (2024). Drowsiness and alcohol detection system using Arduino Uno. International Journal of Research Studies in Educational Technology. 8. 10.5861/ijrset.2024.8010.