ISSN: 2454-9940

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

E-Mail :
editor.ijasem@gmail.com
editor@ijasem.org

www.ijasem.org

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT
ISSN 2454-9940
www.ijasem.org
Vol 19, Issue 1, 2025

A NOVEL AND EFFICIENT REAL TIME DRIVER FATIGUE AND YAWN DETECTION-ALERT SYSTEM

Mrs. L. GAVIRAMMA[1],CH. SUDHA MOUNIKA [2], A. GEETHA AKSHITHA[3], P. HAZZ[4], T. LAVANYA[5], M. SRINIVAS[6]

[1]Assistant Professor, Dept. Of ECE, PRAGATI ENGINEERING COLLEGE

[23456]UG Students, Dept. Of ECE, PRAGATI ENGINEERING COLLEGE

ABSTRACT

Fatigue among drivers is a major cause of road accidents in India each year. One of the primary reasons behind this fatigue is the lack of adequate sleep, typically six to eight hours. Sleep deprivation significantly impacts a driver's reaction time and decision-making abilities, increasing the likelihood of accidents. Such accidents are particularly dangerous as they often occur at high speeds, and since the driver has fallen asleep, they are unable to apply the brakes or steer to minimize the impact, resulting in severe injuries or fatalities.

Given these risks, it is crucial to develop a smart system capable of detecting and alerting drivers about their fatigue levels. Although several solutions have been proposed in this area, many remain theoretical or have not been successfully implemented in real-world conditions. In this research paper, we propose an efficient driver fatigue detection and alert system using open-source technologies. We implement and test this system in real-time, and the results demonstrate significant improvements over many existing solutions, making it a promising approach to reducing fatigue-related accidents.

INTRODUCTION

Driver fatigue is a leading cause of road accidents worldwide, posing significant risks to both drivers and pedestrians. The primary cause of fatigue-related accidents is insufficient sleep, which impairs reaction time, cognitive abilities, and decision-making while driving. Unlike other types of accidents, fatigue-related incidents often occur at high speeds, making them more severe and potentially fatal. Due to the lack of immediate response from drowsy drivers, these accidents tend to result in more severe injuries and fatalities.

To mitigate these risks, there is a growing need for smart systems that can detect driver fatigue and provide timely alerts. While several solutions have been proposed, many remain theoretical or lack practical implementation. The need for a real-time, efficient, and cost-effective driver fatigue detection and alert system is crucial for reducing road accidents and enhancing transportation safety. This research focuses on developing a real-time fatigue detection system using advanced image processing and machine learning techniques.

LITERATURE SURVEY

Several studies have explored various approaches to driver fatigue detection, ranging from physiological-based methods to behavioral and hybrid systems.

- **Physiological Methods:** Some systems use biosensors to measure heart rate, brain activity (EEG), and skin conductance to detect fatigue. While these methods provide high accuracy, they require wearable sensors, which can be uncomfortable for drivers.
- **Behavioral Methods:** Many researchers have focused on using computer vision techniques to analyze facial features and detect signs of drowsiness. Methods such as the Percentage of Eyelid Closure (PERCLOS) and yawning detection have been widely used.
- **Hybrid Systems:** Combining physiological and behavioral approaches, hybrid systems leverage multiple sensors and AI-based models to improve accuracy. These systems offer better performance but often come with increased complexity and cost.

Despite advancements in driver fatigue detection, existing methods have limitations, such as sensitivity to lighting conditions and the need for high computational power. The proposed system addresses these challenges by optimizing image processing algorithms and leveraging machine learning techniques for real-time detection.

PROPOSED SYSTEM

The proposed driver fatigue detection system is designed to identify signs of drowsiness and alert the driver in real time. This system integrates advanced image processing techniques with machine learning models to accurately analyze facial expressions and eye movements. The key components of the proposed system include:

1. **Real-Time Monitoring:** The system continuously captures and analyzes the driver's facial expressions using a camera mounted on the vehicle's dashboard.
2. **Eye State Detection**: Using image processing algorithms, the system detects whether the driver's eyes are open or closed. Prolonged eye closure is a strong indicator of drowsiness.
3. **Facial Landmark Tracking:** The system tracks facial landmarks such as blinking rate, yawning frequency, and head movements to assess fatigue levels.
4. **Alert Mechanism:** If the system detects signs of drowsiness, it triggers an alert through a buzzer or vibration to wake up the driver.
5. **Adaptive Learning:** The system improves its accuracy over time by learning from the driver's unique facial patterns and behaviors.

The implementation of this system aims to enhance road safety by preventing accidents caused by driver fatigue. The use of non-intrusive image processing techniques ensures comfort for the driver while maintaining high detection accuracy.

While the results of a standard histogram equalization filtering over the whole image give promising results, we wanted to see whether the results could be further improved. Many well-known enhancement algorithms such as histogram equalization and homomorphic filtering are global in nature and are intended to enhance an image and deal with it as a whole. We tried to split the original image in sub-images and filter each sub-image individually. First we decided to try and split the image into two halves vertically (thus obtaining two sub-

images of the original image) and then apply the filter to each half individually. Second idea wasto split the image horizontally and again apply the filter to each half individually. Encouraged by the good results obtained with both these methods (see Section 5.2.3 for details), further tried to combine the filtering results into a joint representation. Let $I_{HEV}(x, y)$ be the image split vertically and each half filtered with histogram equalization filter individually and let $I_{HEH}(x, y)$ be the same for horizontally split images and let $I_{HEMOD}(x, y)$ be our proposed modification:

$$I_{HEMOD}(x, y) = 0.5[\ I_{HEV}(x, y) + .70\ I_{HEH}(x,y)]$$

Since I_{HEV} scored higher results than I_{HEH} in our tests, we decided to keep the whole I_{HEV} and multiply I_{HEH} with a constant of 0.70 (chosen based on experimental results), to lower its influence on the final representation. This combination produced highest results in our experiments and was kept as a final representation. We will show in the following section that our method yields superior results, and therefore justifies further research of the histogram equalization filtering variations as a means of simple yet efficient image preprocessing

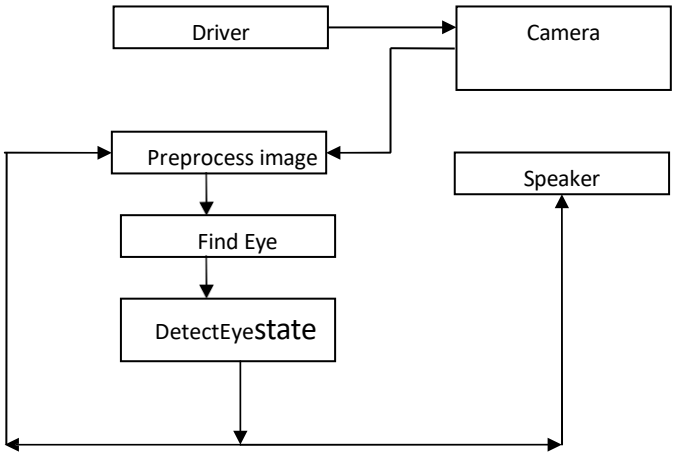

Figure.1 Flow diagram

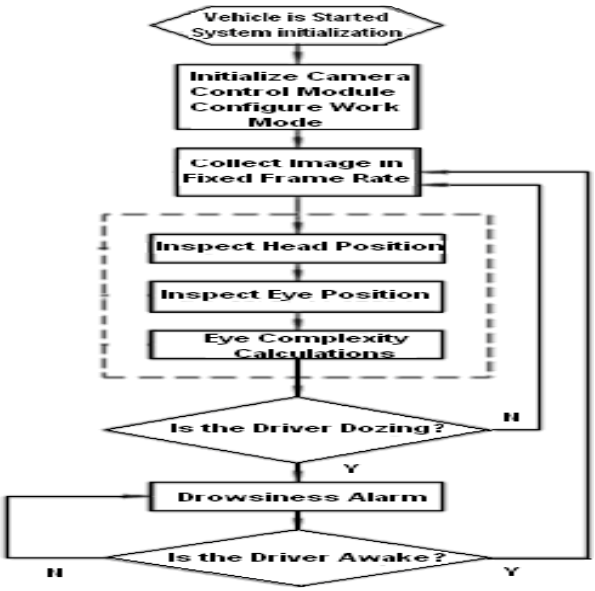

Figure.2 Execution Process

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT
ISSN 2454-9940
www.ijasem.org
Vol 19, Issue 1, 2025

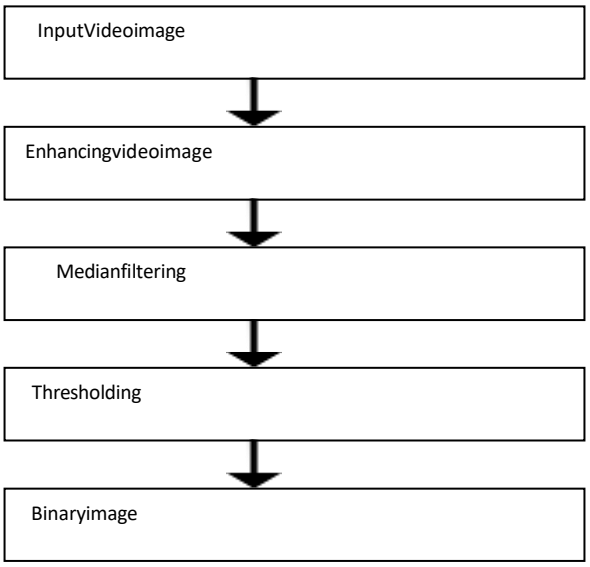

Figure.3 Flow Chart

STIMULATION RESULTS

The proposed method was tested on the real driver images. The video image [480 x 640 pixels] of 75 different test persons has been recorded during several sessions at different places. The eye pair can be selected successfully in most cases, no matter whether face patterns are on different scales, expressions, and illumination conditions. The proposed system is compared with color cues and projection function method. This projection method achieves eye in three stages. sequentially. It is followed by a connected component analysis to quantify spatially connected region and further reduce the search space to determine the contending eye pair windows. Finally the mean and variance projection functions are employed in each eye pair window to validate the presence of the eye. The eye location rate is 82.67% whereas the proposed system rate is 90.67%. Typical results of eye detection with the proposed approach .

An efficient and effective method for detecting eyes in video images in unconstrained backgrounds is presented. The images are subjected to thefirst stage of preprocessing. The second stage of Homomorphic filtering is then applied to enhance the contrast of dark regions; therefore facial images with poor contrast are enhanced. Finally eye pairs are extracted by using binary template matching method with eyeball detection.

Face locating

Detecting the locations of human face in a scene is the first step in the recognition system. In this step the region of the face candidate is roughly estimated using histogram thresholding technique. To simplify the segmentation, we assume that there is only one face in the image and is to be located. The binary image B (x, y) consists of all active pixels which include eye features. Histogram smoothing and automatic thresholding techniques are employed in this stage to eliminate the noises in the image and select the threshold.

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT
ISSN 2454-9940
www.ijasem.org
Vol 19, Issue 1, 2025

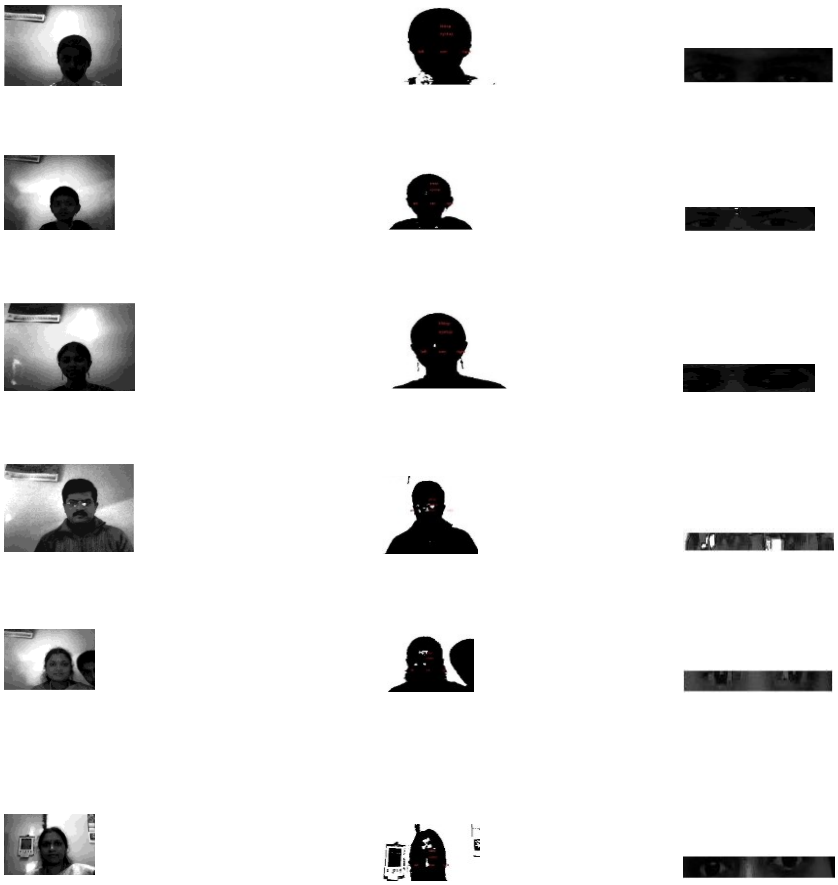

Figure.4 Real Image capture from video using BTMED &Original Image. Binary image after preprocess &both eyes

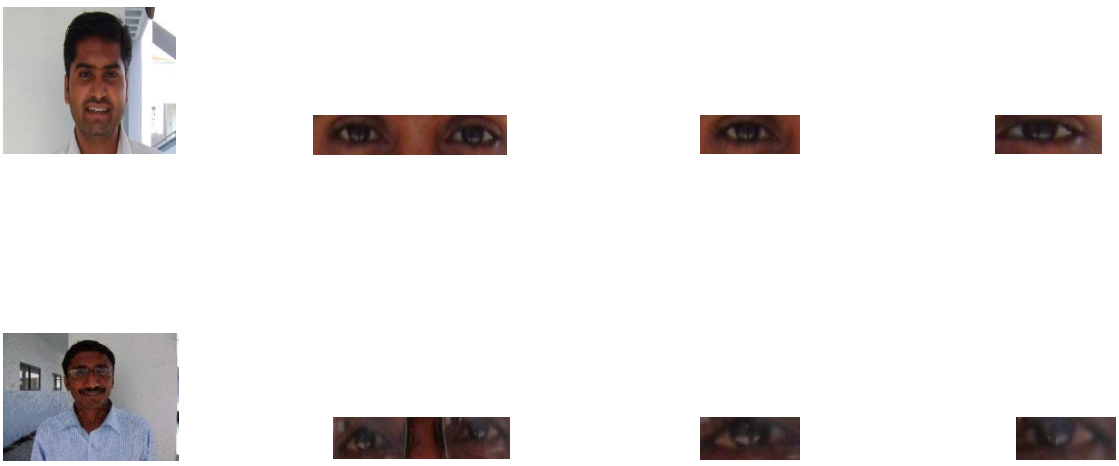

Figure.5 Eye captured using digital camera & Original Image &Both eyes &Left eye &Right eye

ISSN 2454-9940
www.ijasem.org
Vol 19, Issue 1, 2025

CONCLUSION

This paper presented the design and analysis of an efficient and smart driver fatigue detection system. The proposed system is used to avoid road accidents created by human factors such as drowsy driving. It also helps the driver to stay awake during driving by generating an alert as soon as the driver is feeling sleepy. The Raspberry Pi module along with Camera is used to monitor the drowsiness of the driver in real time. Fatigue is detected with face, eye and mouth using Haar Cascade Classifier, and also with the use of facial landmarks and Eye Aspect Ratio by estimating the Euclidean Distance between the eyes and mouth. During the monitoring, the system is able to detect if the eyes are closed or open. When the eyes have been closed for a specified period of time, the system issues an alarm. Our system also implements the detection of yawn. If the yawn count has crossed a predefined number, the system sends an alert message to the owner of the car indicating the chances of the driver falling asleep. The system implemented in real time gave highly accurate results and promises a reliable fatigue detection.

FUTURESCOPE

Automotive Industry:

- Driver Fatigue Monitoring Systems: In cars and trucks, a fatigue detection system could be integrated into autonomous or semi-autonomous vehicles to monitor drivers' alertness and provide timely alerts to prevent accidents caused by drowsiness.
- Self-Driving Cars: Autonomous vehicles could benefit from these systems to assess when human intervention is needed, improving the interaction between human drivers and self-driving cars.

Aviation Industry:

- Pilot Fatigue Detection: Pilots often experience fatigue due to long flight hours. A system that detects fatigue and yawning could significantly improve aviation safety by alerting pilots and ground control about the need for rest or a change in personnel.
- Air Traffic Control: Controllers, like pilots, work in shifts and could benefit from similar fatigue detection to prevent errors that result from tiredness.

Healthcare Sector:

- Monitoring Healthcare Workers: Fatigue detection in doctors and nurses is essential in high-pressure environments like hospitals and emergency rooms. An alert system could prevent mistakes due to tiredness, ensuring better care for patients.
- Remote Patient Monitoring: Fatigue and yawning detection can also be extended to monitor elderly patients, ensuring they get proper rest and alerting caregivers when necessary.

REFERENCES

1. Hong Su and Gang tie Zheng, "A Partial Least Squares Regression-Based Fusion Model for Predicting the Trend in Drowsiness", IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans, vol. 38, no. 5, pp. 1085-1092, 2008.
2. M. Flores, J. Armingol and A. de la Escalera, "Driver drowsiness detection system under infrared illumination for an intelligent vehicle", IET Intelligent Transport Systems, vol. 5, no. 4, pp. 241-251, 2011.
3. A Subhashini Spurjeon and A Yogesh Bahindwar, “A Dedicated System for Monitoring of Drivers Fatigue”, International Journal of Innovative Research in Science, Engineering and Technology, 2013.
4. J. Alzubi, S. Jacob, V. G. Menon, S. Joseph and P. G. Vinoj, "A Top-Up Design for PAL to VGA Conversion in Real Time Video Processing System," 2018 International Symposium on Advanced Electrical and Communication Technologies (ISAECT), Morocco, 2018, pp. 1-5.
5. S. Abtahi, B. Hariri and S. Shi Mohammadi, "Driver drowsiness monitoring based on yawning detection," 2011 IEEE International Instrumentation and Measurement Technology Conference, Binjiang, 2011, pp. 1-4.
6. G. A. Peláez C., F. García, A. de la Escalera and J. M. Armingol, "Driver Monitoring Based on Low-Cost 3-D Sensors," in IEEE Transactions on Intelligent Transportation Systems, vol. 15, no. 4, pp. 1855-1860, Aug. 2014. W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld. 2003. Face recognition: A literature survey. ACM Comput. Surv. 35, 4 (December 2003), 399-458
7. C. Scharfenberger, S. Chakraborty, J. Zelek and D. Clausi, "Anti-trap protection for an intelligent smart car door system," 2012 15th International IEEE Conference on Intelligent Transportation Systems, Anchorage, AK, 2012, pp. 1734-1740.
8. Nan-Ning Zheng, Shuming Tang, Hong Cheng, Qing Li, G. Lai and F. -. Wang, "Toward intelligent driver-assistance and safety warning system," in IEEE Intelligent Systems, vol. 19, no. 2, pp. 8-11, March-April 2004.
9. Sukanesh, R & Vijayprasath, S. (2013). Certain Investigations on Drowsiness Alert system based on Heart Rate Variability using LabVIEW. Transactions on Information Science and Applications. 10. 368-379.
10. M. Malla, P. R. Davidson, P. J. Bones, R. Green and R. D. Jones, "Automated video-based measurement of eye closure for detecting behavioral microsleep," 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology, Buenos Aires, 2010, pp. 6741-6744.
11. Philip V, Suman VK, Menon VG, Dhanya KA. A Review on latest Internet of Things based Healthcare Applications. International Journal of Computer Science and Information Security. 2017;15(1):248.
12. Rajesh S, Paul V, Menon VG, Khosravi MR. A Secure and Efficient Lightweight Symmetric Encryption Scheme for Transfer of Text Files between Embedded IoT Devices. Symmetry. 2019 Feb;11(2):293
13. V. G. Menon, “Moving from Vehicular Cloud Computing to Vehicular Fog Computing: Issues and Challenges”, International Journal on Computer Science and Engineering, vol. 9, no. 2, pp. 14-18, 2017.