ICEST-2K24 [International Conference on Engineering, Science and Technology]
In Association with
International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN - 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)

Driver Enervation Detection and Hypnosis Alert System Using OpenCV and Machine Learning

Prof. G. G. Sayyad[1], Omkar Somanath Ghogare[2], Sarthak Popat Jadhav[2], Sahil Samir Pathan[2]
[1]Assistant Professor, S. B. Patil College of Engineering, Maharashtra, India
[2]Department of Computer Engineering, Savitribai Phule Pune University, Maharashtra, India

ABSTRACT

In India, where driver fatigue, enervation, and hypnosis contribute to over 30% of road accidents, the need for effective detection and alert systems is critical. This paper introduces a comprehensive Driver Enervation Detection and Hypnosis Alert System that seamlessly integrates OpenCV and Machine Learning techniques. By leveraging visual assessment methods through live capturing of the Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR), the system promptly detects drowsiness states and incorporates hypnosis alert capabilities. Utilizing OpenCV for image analysis and Python for coding, the system aims to enhance road safety by identifying both drowsiness and hypnosis episodes in real-time.

Furthermore, the system addresses the root causes of driver enervation, emphasizing the significance of adequate sleep and highlighting factors such as untreated sleep disorders, health conditions, alcohol consumption, and smoking. Studies and data from the National Highway Traffic Safety Administration reveal that approximately 40% of accidents are attributed to driver enervation and hypnosis, underscoring the urgency of implementing effective detection systems. This proactive approach aims to mitigate the rising trend of accidents caused by enervation, ultimately contributing to reduced road fatalities and safer driving environments.

Keywords : Machine Learning, Internet of thing, DriverEnervation, Driver Hypnosis, Alert System Sending Email or sms or call.

I. INTRODUCTION

In India, driver fatigue and hypnosis are responsible for over 30% of road accidents. There are primarily three methods to detect driver fatigue: monitoring biomedical signals, visually assessing the driver's face images, and monitoring the driver's performance. The algorithm discussed here is based on real-time capture of the Eye Aspect Ratio (EAR) using image processing techniques. Open-source image processing libraries like OpenCVare used as the primary tool, with Python serving as the main programming language. Highway hypnosis is a common issue that occurs during driving.

Drowsiness is characterized as a reduced state of consciousness marked by sleepiness and difficulty in maintaining alertness. However, the individual can be awakened with simple stimuli. It can be caused by lack of sleep, medication, substance abuse, or a neurological disorder. It is often a result of fatigue, which can be both mental and physical. Physical fatigue or muscle tiredness is the temporary inability of a muscle to perform optimally. Mental fatigue is a temporary inability to maintain optimal cognitive performance. The onset of mental fatigue during any cognitive activity is gradual and depends on an individual's cognitive ability, as well as other factors such as sleep deprivation and overall health. Mental fatigue has also been shown to reduce physical performance.

Initially, the HAAR Cascade algorithm is used to extract only face images from the live camera feed. Then, about 68 facial landmarks are assigned to the face image with the help of the Dlib library. Since our main focus is on calculating the EAR, the Support Vector Machine (SVM) Algorithm assigns 6 landmark points to the eye. With these 6 landmarks, SVM calculates the EAR (Euclidean distance between measured eye coordinates). This EAR is compared with the threshold EAR value, which has been calculated by training a dataset. By comparing this threshold value with the live EAR values, a live graph of blinks and microsleepis drawn using the Pyplot function. Blinks and fatigue levels are displayed on the monitor screen along with an audio warning for microsleep detection. An alert email or sms or call is sent using the SMTP or twilio library available in Python.

II. LITERATURE SURVEY

1. In Paper [1] the writer have covered Discussion of additional features such as providing the driver's location to emergency contacts and detecting accidents.
2. In Paper [2] the writer have covered Functionality of the IoT module in issuing warning messages upon detecting driver fatigue, including collision impact and location information.
3. In Paper [3] the writer have covered Integration of an LDR sensor to adjust headlight intensity and prevent accidents caused by blurry vision.
4. In Paper [4] the writer have covered Implementation of a classification algorithm trained with images of drowsy and non-drowsy faces for drowsiness detection
5. In Paper [5] the writer have covered Identification of insufficient sleep before long drives and various factors such as untreated sleep disorders, medical conditions, alcohol consumption, and smoking as primary causes of driver enervation
6. In Paper [6] the writer have covered Paper Overall aim of the system to mitigate the risk of drowsy driving and enhance road safety through innovative technology and research-based approaches.
7. In Paper [7] the writer have covered Reference to research findings indicating that around 40% of accidents result from driver enervation detection and driver hypnosis.
8. In Paper [8] the writer have covered Highlighting the physiological method as a notable approach for alerting drivers and redirecting attention away from drowsiness.
9. In Paper [9] the writer have covered Emphasis on the crucial need for real-time and accurate detection and warning systems to reduce the rate of fatigue-related driving accidents, including their impacts on trauma, economic losses, injuries, and fatalities.
10. In Paper [10] the writer have covered Proposal of a cost-effective and efficient driver drowsiness detection system utilizing advancements in machine learning and artificial intelligence.
11. For safe, secure and smart transport now a day's IOT based smart technologies are used.

III. LIMITATIONS OF EXISTING WORK

- The system may not always accurately detect signs of driver fatigue or hypnosis. Factors such as lighting conditions, facial expressions, or physical movements could lead to false alarms or missed warnings.
- Individuals display signs of fatigue or drowsiness in varying ways. The system may encounter challenges in adapting to diverse individual characteristics, potentially reducing its effectiveness for certain users.
- The system may sometimes misinterpret typical behavior as signs of drowsiness or fail to detect genuine fatigue indicators. These errors could result in unnecessary alarms or missed warnings.
- The system's monitoring of an individual's physical state raises privacy and ethical considerations.

IV. PROBLEM STATEMENT

Create an innovative Driver Fatigue Detection and Hypnosis Alert System that utilizes cutting-edge biometric sensors and AI algorithms. This system continuously monitors physiological indicators, identifies signs of driver fatigue, and promptly issues real-time alerts. By doing so, it ensures timely intervention to prevent accidents and enhance road safety.

V. PROPOSED SYSTEM

ARCHITECTURE

Following Figure represents Architecture of our proposed system

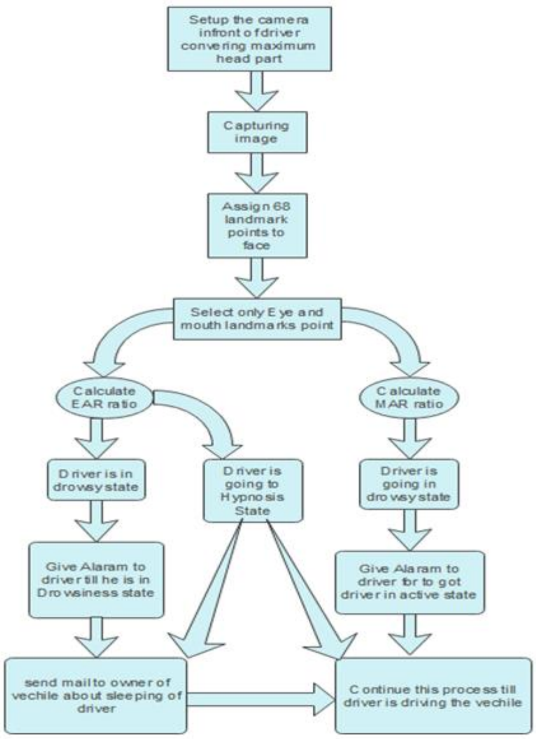


Fig.1. Architecture of Driver Enervation and Hypnosis Alert System

ARCHITECTURE DESCRIPTION

The system utilizes a camera mounted inside the vehicle, facing the driver, to capture their facial features at regular intervals. This data is then processed through several stages to assess the driver's state and identify potential signs of drowsiness or hypnosis.

1. **Facial Landmark Detection:** Specialized software analyzes the captured images to identify and mark 68 specific points on the driver's face. These points correspond to key facial features like eyes, nose, mouth, and jawline.
2. **Feature Selection:** From the 68 points, only those related to the eyes and mouth are selected for further analysis.
3. **Ratio Calculations:** Two key ratios are calculated based on the selected landmarks:
   - **Eye Aspect Ratio (EAR):** This ratio compares the distance between specific points on the eye's outer corners to the distance between the eye's center and the midpoint between its inner corners. Generally, a lower EAR indicates drowsiness as fatigued eyes tend to partially close.
   - **Mouth Aspect Ratio (MAR):** This ratio compares the distance between the mouth's corners to the distance between its top and bottom. Significant changes in MAR may suggest potential hypnosis or yawning, which can be a sign of drowsiness.
4. **Driver State Determination:** Based on the calculated EAR and MAR values, the system categorizes the driver's state:
   - **Drowsy:** If the EAR falls below a predefined threshold, the system identifies the driver as drowsy.
   - **Hypnosis:** If the MAR deviates significantly from a baseline, the system may classify the driver as potentially entering a hypnotic state.
   - **Impending Drowsiness:** The system might issue an alert if it detects the EAR approaching the drowsiness threshold, indicating potential fatigue.
5. **Alerting and Notification:**
   - **Drowsiness:** Upon detecting drowsiness, the system triggers an alarm to alert the driver. This alarm might persist until the EAR value rises above the threshold, signifying the driver's alertness.
   - **Hypnosis:** If hypnosis is detected, the system raises an alarm to warn the driver.
   - **Vehicle Owner Notification (Optional):** The system can be configured to send an email notification to the vehicle owner if the driver is found to be drowsy or potentially entering a hypnotic state.
6. **Continuous Monitoring:** The system operates continuously, capturing images, analyzing facial features, and issuing alerts as necessary, ensuring ongoing monitoring of the driver's state while they are behind the wheel.

OBJECTIVE

In our project objective is follows

- Enhance roadsafety.
- Preventingaccident.
- Protect occupant and other road users.
- Increasedriverawareness.
- Reduce fatigue related road accidents in specific sector.

HARDWAREAND SOFTWARE REQUIREMENTS

In our project hardware and software requirements are given below

A. Operating System : Windows 7/8/10/11, Linux
B. RAM : Minimum 4 GB
C. Hard Disk : up to 1 TB
D. Network Connection
E. Python
F. Webcam
G. Sensors

ALGORITHM

Algorithm of our project are follows

1. The NTHU CVlab Dataset is a valuable resource for calculating the threshold EAR (Eye Aspect Ratio) value. This dataset includes recordings of different individuals under various conditions, such as wearing glasses, sunglasses, and bareface scenarios. The simulated driving environment captures actions like normal blinking, yawning, falling asleep, and laughter. Recordings were conducted during both day and night conditions, with subjects seated in a chair and interacting with a simulated driving wheel and pedals. Additionally, participants were instructed to exhibit different facial expressions while driving. The dataset spans a total of 9.5 hours and covers scenarios related to drowsiness (e.g., yawning, slow blink rate) as well as non-drowsiness actions (e.g., talking, laughing, looking in different directions). By training on this diverse dataset, the system can effectively recognize various driving-related scenarios.

2. The HAAR Cascade Algorithm is a machine learning technique used for face detection in images or live video. It operates based on the concept of positive and negative images. Positive images represent the target objects we want to process—in this case, we focus on detecting faces, making them our positive images. Negative images, on the other hand, are those we can disregard. In the context of face detection, any image that is not a face serves as a negative image.

3. DLIB Library for landmarks detection As HAAR algorithm returns the faces from the given image or recording. For finding drowsiness we need to consider different landmarks for face which is given by DLIB library, it identifies the nodal points on face and give about 68 landmarks to face including 6 landmarks to eye. This landmarks are displayed as light green dots. This landmarks are easy to recognize distinct human face.
   Below is code for Landmark Detection
   ```
   Face_Detector=dilb.get_frontial_face_detector1()
   Landmark_Finder1=dilb.shape.predictor(FACIAL_LANDMARK_PREDICTOR)
   Webcam_Feed1=cv2.VideoCapture1(0)
   ```

4. Hidden Markov Model(HMM) based dynamic modeling to detect drowsiness Hidden Markov models(HMMs) are sequence models. That is, given a sequence of inputs, such as words , an HMM will compute a sequence of outputs of the same length. An HMM model is graph where nodes are probability distributions over labels and edges give the probability of transitioning from one node to the other. Together, these can be used to computer the probability of a label sequence given the input sequence. A good HMM accurately models the real world source of the observed real data and has the ability to simulate the source. A lot of Machine learning techniques are based on HMMs have been successfully applied to problems including speech recognition, optical character recognition, computational biology and they have become a fundamental tool in bioinformatics. For their robust statistical foundation, conceptual simplicity and malleability, they are adapted fit diverse classification problems.

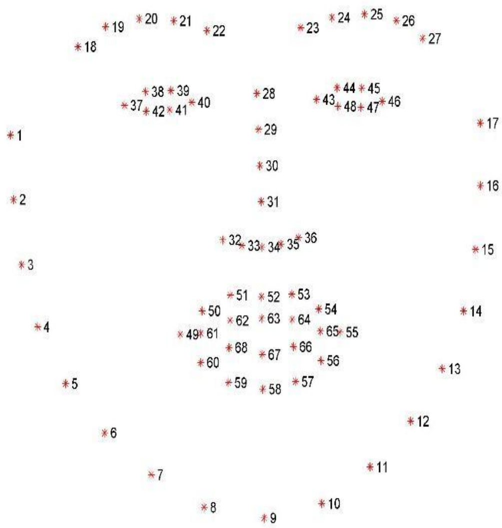


Fig. 2. Facial Landmarks

5. Support Vector Machine (SVM) is a classification algorithm used for separating data items. Proposed by Vladimir N. Vapnik, SVM is based on statistical learning theory and is commonly applied in pattern recognition. Its primary objective is to find decision boundaries that divide or distinguish data into two or more classes. In the context of drowsiness detection, SVM assigns label 0 to indicate that the driver is experiencing drowsiness, while label 2 signifies that the driver is not tired. The 68 facial landmarks provided by the DLIB library are processed using SVM. Specifically, only the landmarks associated with the eyes are considered. SVM identifies 6 eye landmarks, which are then used to calculate the EAR (Eye Aspect Ratio) using OpenCV functions. By comparing this EAR value with a predefined threshold, the system determines whether the driver is drowsy. The EAR ratio is computed from the geometric coordinates of the eyes, calculated using the Euclidean distance formula(EAR).

EAR(Eye Aspect Ratio)= $\frac{|p2-p6|+|p3-p5|}{2|p1-p4|}$

APPLICATIONS

Application of the our project are following

a) PreventingAccident
b) Longdistancetraveling
c) Commercialvehicle
d) FleetManagement
e) AlertMessage

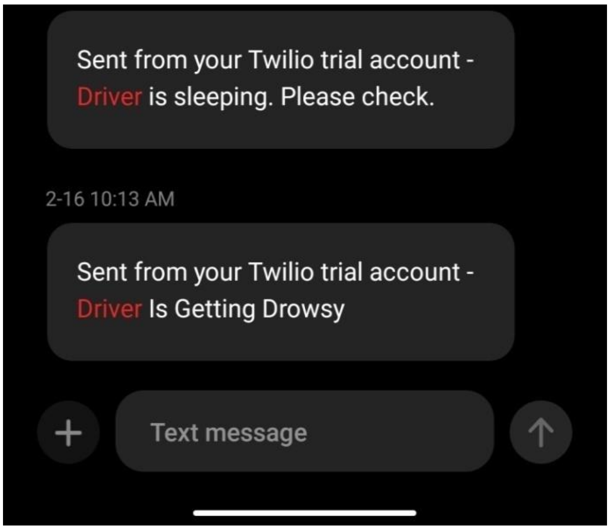
VI. RESULT DISCUSSION

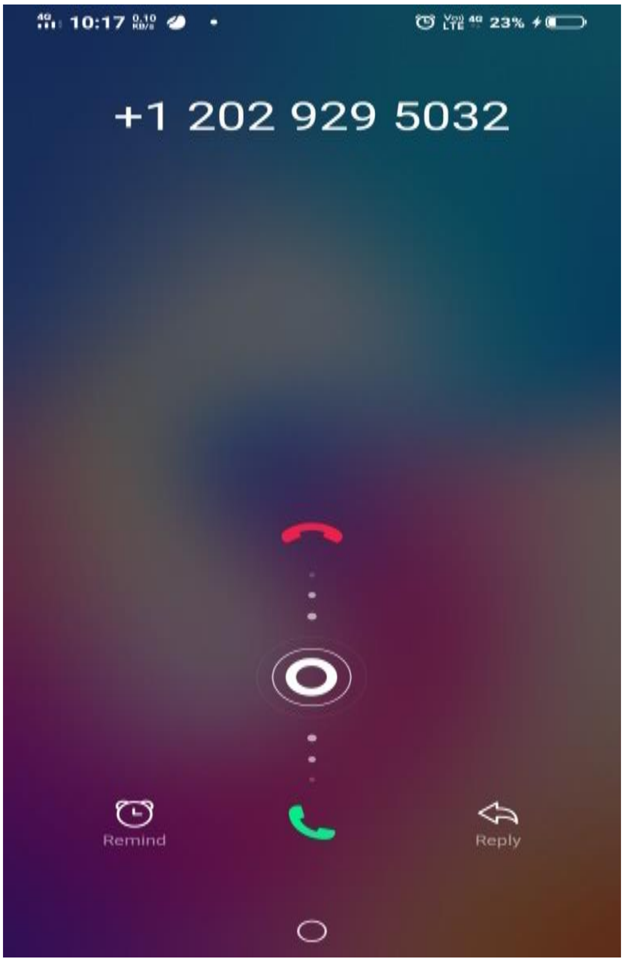
The “Driver Enervation Detection and Hypnosis Alert System” project is designed to address the critical issue of driver fatigue and hypnosis while driving. It incorporates advanced sensor technologies and possibly machine learning algorithms to accurately detect signs of fatigue or drowsiness while maintaining user privacy. By analyzing various driver behavior indicators such as eye movement and steering patterns, the system generates alerts to prevent accidents caused by impaired driving. Its user-friendly interface allows for seamless interaction, making it accessible to drivers and enhancing road safety. The system has diverse applications, including use in individual vehicles, commercial fleets, and transportation infrastructure, thereby significantly improving road safety and saving lives. In conclusion, the Driver Enervation Detection And Hypnosis Alert System offers a crucial solution to a pressing safety concern, promoting safer driving practices and safeguarding lives.

VII. RESULT SCREENSHOTS AND ITS DESCRIPTION

Here are the result screenshots of our project


ACTIVE
HYPNOSIS ALERT!
HYPNOSIS ALERT!


Sent from your Twilio trial account - Driver is sleeping. Please check.
2-16 10:13 AM
Sent from your Twilio trial account - Driver Is Getting Drowsy
Text message


10:17
23%
+1 202 929 5032
Remind
Reply

OVERVIEW

Implemented a system for the detection of drowsiness of driver & its alertness to the driver as well as to the vehicle's owner through email or message by providing the name of driver and at what time the driver was sleepy. The system will respond only if the driver's eyes pass the threshold value of EAR ratio for a specific time and for more accuracy, the author had also used yawn detection techniques to minimize the number of false positives.

KEY FEATURES

Driver Enervation Detection Hypnosis Alert System:
Enhanced Safety: Continuous monitoring of the driver's physiological signals detects signs of fatigue or drowsiness, allowing timely intervention to prevent accidents.
Reduced Accidents: Early detection of driver fatigue reduces the likelihood of accidents caused by impaired driving due to exhaustion.
Customized Alerts: Personalized visual or auditory warnings prompt corrective actions or rest breaks, ensuring safety.
Integration with Vehicle Systems: Seamless integration with existing safety systems ehances overall road safety.
Improved Driver Experience: Customizable alert preferences prioritize safety while providing a secure driving experience.
Prevention of Hypnosis-Induced Accidents: By monitoring driver behaviour, the system detects signs of hypnotic induction, preventing accidents caused by trance-like states or distractions.
Enhanced Driver Awareness: Alerts prompt heightened vigilance, reducing the risk of accidents due to hypnosis.

VIII. CONCLUSION

We proposed an approach to generate driver enervationdetection system with EAR ratio calculation. This has a lot of application as accidents due to driver drowsiness are major issues causing deaths or serious injuries. The techniques used previously have been studied like drowsiness detection by visual assessment, biomedical signals and monitoring vehicle behaviour. Out of which visual assessment to detect enervation is more accurate and convenient approach. We have studied this existing system and find some changes that can lead to increase in accuracy of system such as using dataset to train our SVM algorithm so it can give accurate result in case if driver is wearing glasses or there is low intensity light in car. The only drawback of this system is that it increases the cost as we are using infrared camera, so it can work in any weather condition. For sending the alert system the TWILIO is used to send the alert call as well as ringing the alarm when the person is detected in drowsiness state.

IX. REFERENCES

[1]. Manisha Samant, Keval Mahajan, Chirag Panchal, Ameya Kulkarni, SaloniMathure, "Drowsy Driver Alert System with Accident Detection" on 2022.

[2]. Anil Kumar Biswal, Debabrata Singh, Binod Kumar Pattanayak, " IoT-Based Smart Alert System For Drowsy Driver Detection" on 2021.

[3]. Gowtham B, Nagajothi V, Karthi G, " Real Time Alert System For Slumberous And Fatigue Driver" 2023.

[4]. DevarakondaSruthi, AvanagantiAmulya Reddy, G. Sai Siddaharth Reddy, Mrs. ShilpaShesham "Driver Drowsiness Detection System Using Deep Learning" on 2023.

[5]. Mr Shankar, E SankerChavali "Driver Drowsiness Detection And Alarming System"on 2023.

[6]. AlumonaTheophilus Leonard, NnaemekaUchennaEzeony "Drowsy Driver Detection and Alert System using Pulse Sensor" on 2021.

[7]. Aspreet Singh Bajaj, Naveen Kumar, Rajesh Kumar "System And Method For Driver Drowsiness Using Behavioral And Sensor- Based Physiological Measure" on 2023.

[8]. Rama Moorthy, RohithChinthalachervu, ImmaneniTeja, M. Ajay Kumar "Driver Drowsiness Detection And Monitoring System Using Machine Learning" on 2022.

[9]. HafeezSidd, Adil Ali Saleem, Robert Brown "Non-Invasive Driver Drowsiness Detection System" on 2021.

[10]. Musa Hajara, Muhammad AbubakarSadiq, Ali Ahmad Aminu "Android-Based Real- Time Driver Drowsiness Detection And Alert System" on 2022.

[11]. Jadhav, Ajit, et al. "RFID based secure smart school bus system." Department of CSE, IAETSD J, March (2018).

[12]. Patil, D. S., Gavali, A. B., & Gavali, S. B. (2014, February). Review on indexing methods in location based services. In 2014 IEEE International Advance Computing Conference (IACC) (pp. 930-936). IEEE.

[13]. Karve, S. M. ., Kakad , S. ., Swapnaja Amol, Gavali, A. B. ., Gavali , S. B. ., & Shirkande, S. T. . (2024). An Identification and Analysis of Harmful URLs through the Application of Machine Learning Techniques. International Journal of Intelligent Systems and Applications in Engineering, 12(17s), 456–468. Retrieved from https://www.ijisae.org/index.php/IJISAE/article/view/4905

[14]. Kale, R. ., Shirkande, S. T. ., Pawar, R. ., Chitre, A. ., Deokate, S. T. ., Rajput, S. D. ., & Kumar, J. R. R. . (2023). CR System with Efficient Spectrum Sensing and Optimized Handoff Latency to Get Best Quality of Service. International Journal of Intelligent Systems and Applications in Engineering, 11(10s), 829–839.

[15]. S. T. Shirkande, Rutuja. B. Bhosale, Shweta. S. More, Suyash. S. Awate Predicting Driving Behaviour Using Deep Learning https://doi.org/10.46610/JoAAT.2023.v08i01.002, Vol. 8 No. 1 (2023).