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Real Time Prevention of Driver Fatigue and Exhaustion Using Deep Learning

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1. ABSTRACT

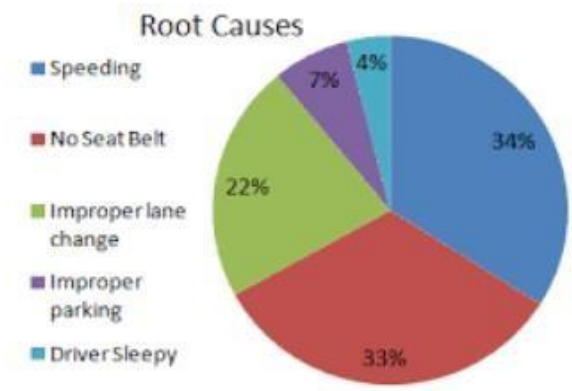
Car accidents are frequently caused due to many reasons like drowsiness, drunkenness or tiredness, which has serious consequences for traffic safety. If advanced warning systems were in place to alert drowsy drivers, it could potentially prevent numerous fatal accidents. There are a number of drowsiness detection technologies that can be used to check for signs of inattention while driving and alert the driver. Self-driving cars must have sensors that can tell if a driver is drowsy, irritated, or going through dramatic swings in their emotions. So far, various additional alert systems have been proposed to help prevent drowsy driving. These systems sound an alarm when they notice a major lane departure, a change in the headway distance, or other symptoms of poor driving performance. Other warning signs include increased head wobble or prolonged eye closure duration. These systems typically identify such behaviour after sleepy driving has started. This piece explores numerous ways in which Driver Drowsiness Detection Systems can be applied in automobiles to address this particular concern.

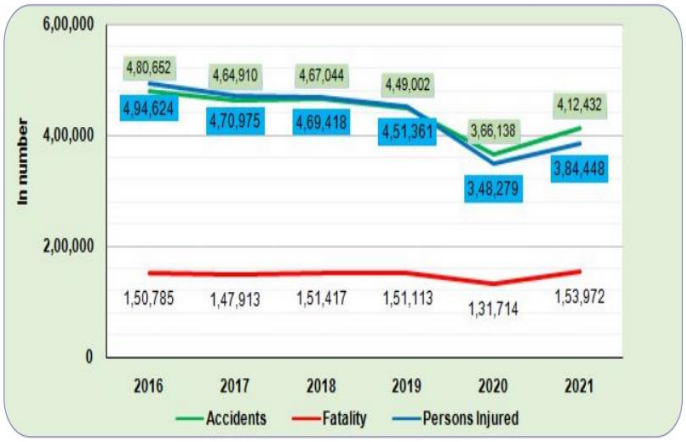
Keywords: Drowsiness-Detection, Driver-Fatigue, Computer Vision, Real Time, Survey

2. INTRODUCTION

In our daily lives, drowsiness is one of the main causes of actual car accidents. According to the news sources 40 % of the accidents in India happen due to driver dozing off. Drowsiness costs consumers 16.4 billion annually in property damage, medical expenses, lost productivity, and time. Drive. The road accidents in India cause a total loss of 3.14% of the total GDP of the country. India's cost per fatality is projected to be ₹ 91.16 lakh, while the cost each critically injured person is ₹ 3.64 lakh, and the cost per minor injured person is ₹ 77,938. Today's drivers are less conscious of their surroundings, which has led to an increase in traffic accidents, which has become a serious concern for society. There are several factors to consider. The physical condition of the driver is another factor in the incidents. We can establish a connection between these incidents and the driver's fatigue. Driver fatigue is one of the factors that is most likely to be significant, particularly in car accidents that occasionally result in fatalities as well as injuries to both drivers and passengers. According to a report, tiredness causes 32.2% of annual traffic accidents on average. This shown that driving is worse when sleepiness levels are high, with a consequent increase of 21.4% in vehicle accidents.

Statistics of Accident Due to Drowsiness in India





Reason for Driver Drowsiness

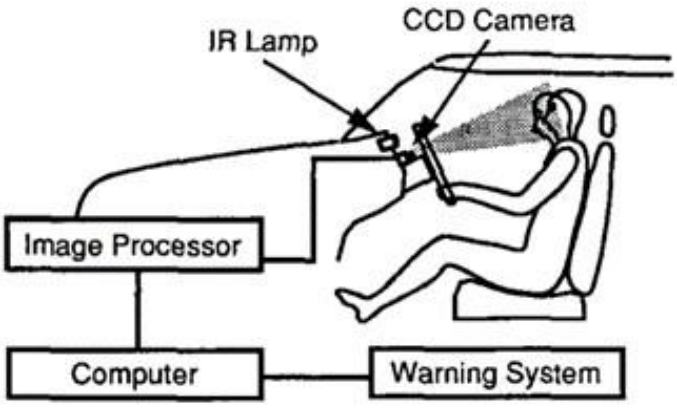
Drowsy driving is a serious issue. The risk, danger, and frequently deadly outcomes of driving when fatigued are worrisome. Driving while sleepy or fatigued is referred to as drowsy driving. The most common cause of this is insufficient sleep, although other causes include untreated sleep problems, drugs, drinking alcohol, or working shifts. The exact moment when slumber envelops someone is elusive and indiscernible. Although it is obviously dangerous to fall asleep while driving, being sleepy still has an impact on your ability to drive safely. Drowsiness:

- Makes it harder for you to focus on the road. Slows down your ability to steer or brake promptly.
- Impedes your ability to make wise decisions

2. LITERATURE SURVEY

Development of Drowsiness Detection System (1994)

In this study, the authors created a system that analyzes video camera photos of the driver's face using image processing technologies. Based on how much the driver's eyes are open or closed, diminished attentiveness is identified. This detection device enables early identification of a reduction in driver awareness while driving and offers a noncontact approach for evaluating various degrees of driver attentiveness. A tiny CCD camera in front of the driver captures photographs of his face. The facial image data are first transformed to binary image data and then transmitted to the image processor's frame memory. Each image is stored in the frame memory in 512x432 format, using eight bits of memory space for each pixel. The image processing process is managed and the processed results are evaluated by a personal computer that is linked to the image processor. The instrument panel has an infrared lamp to make it easier to take face photos when driving at night.



Using Driver's Head Movements Evolution as a Drowsiness Indicator (2003)

The purpose of this research is to provide a collection of indicators relating to driving performance and physiology that may be used to monitor driver sleepiness and are simple to assess. 32 participants participated in a 336 km long simulated highway journey, which was used

to collect performance and physiological data. Two sets of indications are presented by the examination of these data: a group of performance metrics whose changes correspond to those mentioned in the literature. They make sure that during the experiment, sleepiness is detected. Second, a group of physiological indicators: the dispersion of head motions. This has shown to be a fairly accurate indicator since it develops similarly to performance indicators over time while being little affected by the road.

Yawning Detection for Determining Driver Drowsiness (2005)

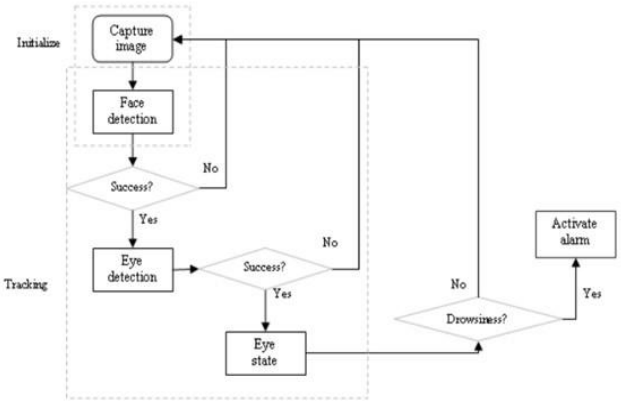
A system based on video analysis is proposed for identifying driver sleepiness or exhaustion. The method of extracting driver yawning is the main topic of this study. The driver's facial area is located using a real-time face detector. The Kalman filter is then used to track the facial region. Additionally, to identify driver yawning in video, the mouth window is targeted within the region of the face, and the degree of mouth openness is retrieved based on mouth features. When obstruction or miss-detection occur, the system will reset. To determine the viability of the suggested approach, experiments are carried out.

The Effects of Specific Musical Stimuli on Driver's Drowsiness (2006)

In this study, the musical style and composition of each piece of music were analyzed to measure its impact on drowsiness. 4 musical patterns were chosen based on the pace and preference (high-low) scales (fast - slow). The experiment lasted for ten minutes. The subjects were exposed to musical stimuli throughout each session. The findings revealed that "high preference - fast tempo" music was preferred. made a positive impact on the subjects' vigilance on the "Low preference - slow tempo" music, on the other hand, promoted as the sedative effect reduces the subject's level of attentiveness. These findings imply that musical preferences and tempo the music were effective stimuli for a driver's arousal level, and thus his/her level of vigilance

Real-Time Drowsiness Detection System for an Intelligent Vehicle (2008)

A new Advanced Driver Assistance System (ADAS) for automatic driver sleepiness detection based on visual input and Artificial Intelligence is provided in this research. This system operates in steps to achieve full automation. Furthermore, the goal of this program is to locate and track the face and eyes in order to compute a sleepiness index. Examples of several driver photos captured over a real vehicle are provided to confirm the real-time technique



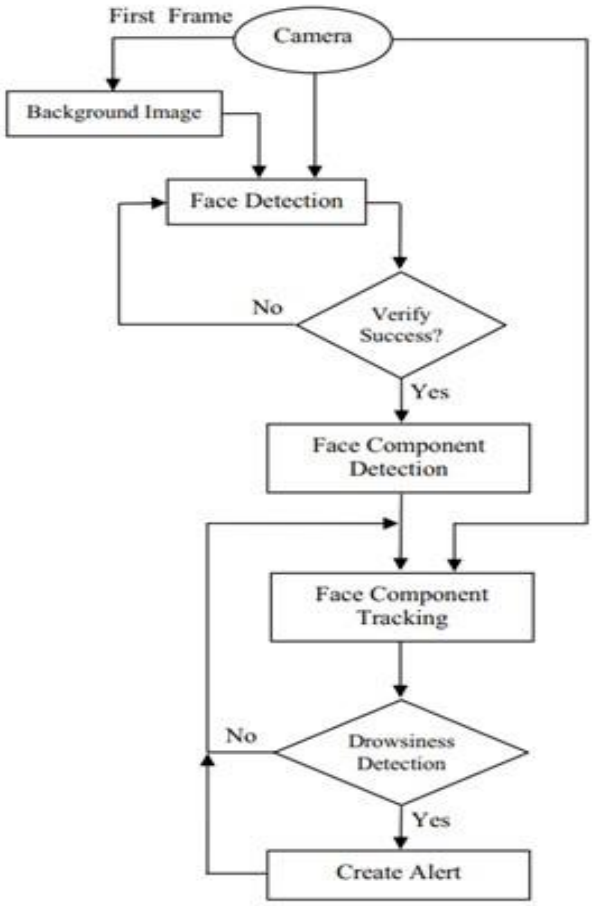
Eye Tracking based Driver Fatigue Monitoring and Warning System (2011)

The technology suggested in this research uses a camera to monitor the driver's eyes and develops an algorithm to detect indications of driver fatigue early enough to avoid an accident. As a result, our technology detects driver drowsiness in advance and provides warning output in the form of sound and seat belt vibration with frequencies ranging from 100 to 300 Hz. Furthermore, rather than being deactivated automatically, the warning will be deactivated manually.

Driver Drowsiness Detection Using Face Expression Recognition (2012)

The proposed hardware in the proposed system is used to acquire the sequence of photos before injecting them into the system as input. Face identification, facial component extraction, facial component tracking, and drowsiness detection are the four phases that make up the system.

- The background image is created first. The facial region in the image is found using the background subtraction technique.
- The facial features detected in the previous step's face are then retrieved, including the eyebrow, eye, and mouth.
- Each of the facial components is tracked using a reference template and a template matching approach in the tracking step.
- Each facial component is monitored independently during the drowsiness detection phase, and if any of the three components deals with a facial expression brought on by weariness or sleepiness, a warning message will be generated.



Implementation of Computer Vision to Detect Driver Fatigue or Drowsiness to Reduce the Chances of Vehicle Accident (2014)

The method uses a video series of a driver's frontal face to first detect the face, then locate the eye from the extracted face, to identify tired drivers. Second, the system determines whether the eye pupil is present in the detected eye and simultaneously measures the blink rate. By examining these characteristics, the system determines the loss of awareness before the driver loses all concentration. The suggested system intends to be more affordable than industrial installations; as a result, all parameters have been examined in a laboratory setting and frames have been recorded using a reasonably priced camera.

Detection of driver drowsiness in driving environment using deep learning methods (2018)

In this work, a deep learning approach was utilized to identify drivers' sleep stages while they were operating a

vehicle. To evaluate if the eyes of some consistent facial photos of drivers are closed, a convolutional neural network (CNN) model has been presented. The suggested model has a broad range of possible applications, including designing human-computer interfaces, identifying facial expressions, and determining driver weariness and sleepiness. The Closed Eyes in The Wild (CEW) database's 4,846 genuine eye photos have been subjected to this approach, which was developed using driver sleepiness data. On the same data, popular CNN models are applied to compare how well the prepared model performs.

Early Identification and Detection of Driver Drowsiness by Hybrid Machine Learning (2021)

The suggested study uses facial expressions to create an emotion recognition algorithm based on Support Vector Machines (SVM). The algorithm performed more accurately than recent research when evaluated under settings of varying brightness. They have successfully detected changes in facial expression at an 83.25% rate.

Driver Safety Development: Real-Time Driver Drowsiness Detection System Based on Convolutional Neural Network (2021)

The difficulty of driver safety on the road is the main topic of this study, which also introduces a cutting-edge technology for drowsy driver detection. Convolutional Neural Networks are used in this system to detect the driver's tiredness by detecting his or her state of falling asleep. With reference to the two real-time application goals of high accuracy and quickness, networks (CNN) are utilized. Three potential networks are presented, one of which is a Fully Designed Neural Network (FD-NN), while the other two use Transfer Learning in VGG16 and VGG19 with additional designed layers (TL-VGG). In the field of eye closure detection, a severe lack of a reliable ocular dataset is felt. Consequently, an entirely new dataset was suggested.

Drivers' attention detection: a systematic literature review (2022)

This article gives a Systematic Literature Review (SLR) of the methods and criteria for detecting drivers' attention while operating a vehicle, with an emphasis on methods that use visual cues. 50 studies were chosen from the body of research on drivers' attention detection as a consequence, and 22 of them have solutions that fit the intended context. The findings of SLR can be a useful tool in planning future studies on detecting drivers' attention.

Driver Drowsiness Prediction Based on Multiple Aspects Using Image Processing Techniques (2022)

An integrated strategy is suggested in this study and is dependent on the PERCLOS (Eye and Mouth Closure Status) as well as the computation of the new proposed vector FAR (Facial Aspect Ratio), which is comparable to EAR and MAR. This helps recognize whether eyes are shut or a mouth is open, like during a yawn, and detects frames where hands are moving, such as nodding or covering an open mouth with the hand, which are instinctive human behaviors used to manage tiredness. The system also combined techniques and gradient patterns based on textural information to locate the driver's face in various angles and recognize sunglasses on the driver's face. Scenarios such as hands covering the driver's eyes or lips while nodding or yawning were also identified and treated.

3. METHODOLOGY

[1] In this study, the authors created a system that analyses video camera photos of the driver's face using image processing technologies. Based on how much the driver's eyes are open or closed, diminished attentiveness is

identified. This detection device enables early identification of a reduction in driver awareness while driving and offers a noncontact approach for evaluating various degrees of driver attentiveness.

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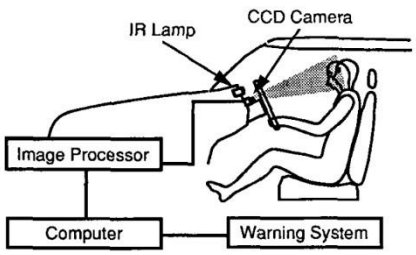

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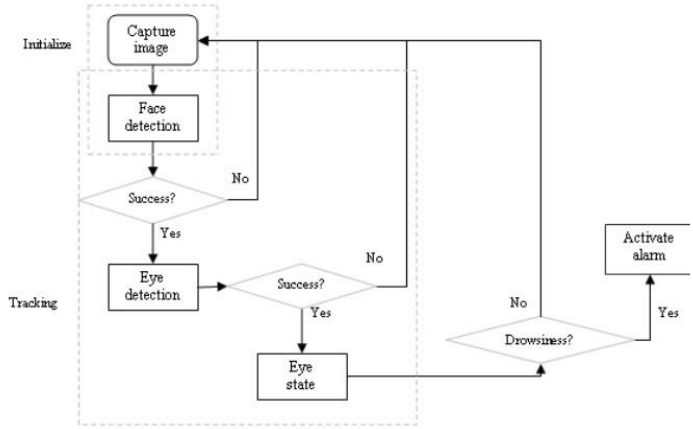

Figure 4: System Architecture [5]

[6] The technology suggested in this research uses a camera to monitor the driver's eyes and develops an algorithm to detect indications of driver fatigue early enough to avoid an accident. As a result, our technology detects driver drowsiness in advance and provides warning output in the form of sound and seat belt vibration with frequencies ranging from 100 to 300 Hz. Furthermore, rather of being deactivated automatically, the warning will be deactivated manually.

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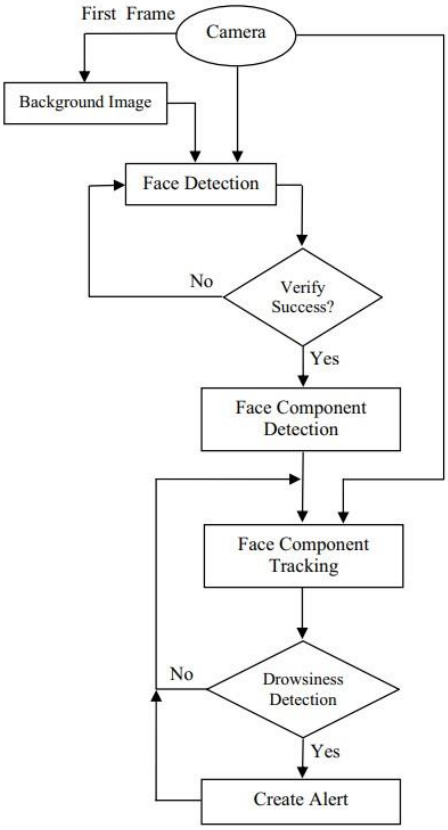

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4. CONCLUSIONS

The main factor in accidents is driver drowsiness when driving. A thorough review of the literature is conducted on the topic of sleepiness detection in driving situations, and the various techniques are compared. This paper provides a study of numerous works on driver weariness. The impact of musical stimuli on drivers as well as several approaches for classifying and detecting fatigue, including PERCLOS, CNN, FD-NN, SVM, ADAS, and CCD cameras, were investigated. It appears that CNN-based monitoring, which will be discussed in the following study, will be the most promising.

5. FUTURE SCOPE

Future work will include improving the existing system. Also we can add music according to the preference of the driver to prevent the drowsiness. In the future, we can also add commands that direct the motor vehicle's ECU to slow down or limit its speed while also turning on its danger lights to alert other traffic

6. ACKNOWLEDGEMENT

Prof. Ankita Kotalwar, our supervisor and adviser, deserves special recognition. Throughout this study's long journey, he was there in every way. He was the one who encouraged and urged to suggest further research in this topic, and he inspired us with his zeal for research, experience, and vibrant personality. Prof. Ankita Kotalwar, our advisor, deserves a heartfelt thank you for his excellent advice, constant support, and encouragement. We are extremely grateful to everyone who contributed to the effective completion of our survey paper.

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