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Attention Assist
A Drowsiness Detection System

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Abstract: **Every year the frequency of accidents during drowsy road trips is on the rise. It is well-known that many accidents occur due to driver fatigue and inattention. This study aims to improve efforts to identify driver drowsiness under real driving conditions through the use of driver drowsiness detection systems. Secondary data collected from previous research on drowsiness detection systems has been utilized, which involves various methods to detect drowsiness or inattentive driving. Our project involves creating an interface that automatically detects driver drowsiness and triggers an alert in the event of an accident. This vehicle safety project collects images from a live webcam stream and applies a machine learning algorithm to recognize whether the driver is drowsy or not. If the driver is found to be sleepy, a buzzer alarm will be activated, and the alarm sound will ring until the driver wakes up.The purpose of this system is to identify, monitor, and evaluate the driver's face and eye movements to calculate a drowsiness index. This real-time system operates under different lighting conditions, including both daytime and nighttime driving.**

Keywords: **Eye extraction, Dlib, Facial Extraction, Drowsiness, Machine Learning, EAR, Python, Face Detection**

I. INTRODUCTION

Attention assist is one of the active safety systems that interacts with drivers to help them avoid traffic accidents. The main objective of these systems is to reduce traffic accidents by incorporating new technologies that increase vehicle security and decrease danger during driving caused by human error. Boredom while driving for extended periods. The reduced level of vigilance caused by drowsiness can lead to dangerous situations and increase the likelihood of an accident. Studies suggest that drowsiness causes between 10% to 20% of traffic accidents, resulting in fatalities and injuries. The lack of a standardized tool to measure a driver's vigilance level necessitates observation and analysis of hypervigilance signs.

These signs can be classified into physiological and behavioral indicators such as physical symptoms or abnormal conduct. Driving for extended periods without adequate rest or driving during regular sleep times can result in drowsiness[6]. Fortunately, people in a state of drowsiness produce visual cues that can be detected in the human face, such as yawn frequency, eye-blinking frequency, eye-gaze movement, head movement, and facial expressions. Computer vision technology can leverage these visual characteristics to monitor drivers and measure their level of attention during the driving process

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This study aims to develop an affordable and efficient drowsiness detection system that uses geometric features of the eyes and mouth.Fatigue is a state of physical or mental exhaustion or the unwillingness to continue a task due to extended periods of performing the same task [7] Driver drowsiness is a significant factor in the increasing number of road accidents, but itis often underestimated and difficult to quantify. The transition from fatigue to dozing off is subtle and goes unnoticed by the driver, highlighting the importance of further research in this area to reduce accidents caused by drowsiness. The proposed system seeks to prevent destructive outcomes resulting from driver negligence due to fatigue.

Figure 1

II. LITERATURE SURVEY

TABLE1- Paper Details.

	PAPER NAME	AUTHOR	YEAR	PUBLICATIONS	SEED IDEA
1	Embedded Application for Driver Drowsiness Monitoring System	Susaf NoorAzhar; Igi Ardiyanto;Agus Bejo	2020	IEEE	A thorough examination of recent progress in embedded implementation methods for driver fatigue detection is presented in this comprehensive review. Each section of the review concentrates on distinct approaches to implementation that leverage embedded system
2	Advanced Driver Assistance System for the drowsiness detection using facial landmarks	Luis Darío SincheCueva; Jorge Cordero	2020	IEEE	This paper introduces a real-time solution for detecting driver drowsiness and issuing alerts to prevent potential traffic accidents. The focus is on analyzing computer vision methods, specifically the utilization of facial reference points, for drowsiness detection.
3	Eye tracking based driver Fatigue monitoring and warning system	Hardeep Singh; J. S. Bhatia; Jasbir Kaur	2011	IEEE	The purpose of incorporating a deactivation switch is to provide users with the option to disable the warning system. Additionally, when a driver experiences drowsiness, there may be instances of sudden acceleration or deceleration. This behavior can be detected by plotting a time-domain graph and analyzing the three input variables.
4	Design and Implementation of driver Drowsiness detection system on digitalized driver system	Pranoto Hidaya Rusmin; Andrew B. Osmond; Arief Syaichu-Rohman	2017	IEEE	The system captures images of the driver and subsequently detects the face and eyes. The eye detection results are analyzed on a frame-by-frame basis to determine if the eyes remain closed for a duration of 4 seconds. If the eyes are closed for 4 seconds, the system concludes that the driver is drowsy and triggers an alarm.
5.	A Cost-Effective Driver Drowsiness Recognition System	Sk. Hasibul Alam; Sheikh Shataddru Tahsin; Israt Tarannum; Tanney Chowdhury; Kashfia Sarony	2020	IEEE	This study demonstrates a drowsiness detection system with a remarkably low setup cost of around 31 US$. The findings highlight potential use of heart rate and eye-blink rate as reliable indicators for recognizing drowsiness. As a result, the proposed system represents a highly promising approach for accurately identifying instances of drowsy driving.

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III. PROPOSED SYSTEM

a. OBJECTIVE

The primary aim is to create a reliable system that can accurately eyes detect a driver's drowsiness by monitoring eyelid movement and yawning, and issue timely voice alerts. Other objectives include designing a system that regularly monitors a driver's for signs of drowsiness, alerts the driver when frequent yawning or closed eyes are detected, and is compatiblewith drivers who wear glasses. Additionally, the system should not be affected by poor lightingconditions.

b. METHODOLOGY

To detect drowsiness and yawns in an image, a series of steps are followed. Firstly, the face is detected using pre-trained face detection algorithms from *OpenCV*. Then, a facial landmark detector from the *dlib* library is used to estimate the location of 68 coordinates (x and y) that map to facial structures. The eye aspect ratio (EAR) is calculated using the ratio of distances between the horizontal and vertical eye landmarks. For yawn detection, the distance between the upper and lower lip is calculated and compared to a threshold value. These calculations are used to determine drowsiness and trigger appropriate alerts.

c. TOOLS & IMAGE PROCESSING METHOD

Image obtaining:- The system has an image obtaining module that captures color images from a camera during daytime with natural daylight and near-infrared (NIR) images from a night vision camera during nighttime with artificial NIR illumination. The night vision camera is equipped with an array of small, low-power LEDs that produce NIR light at a specific wavelength, and the working status of the camera is determined by the photoresistor based on the ambient illumination. In a real vehicle, the LEDs are only turned on at night to capture face images.

Face Detection :- The driver's facial expression is the key focus of the active safety detection system under discussion, and the first step in achieving this is to detect thedriver's face. The VJ object detector algorithm is deemed most suitable for this system, as it employs machine learning and can achieve a detection rate of over 98% in real-time. After detecting the driver's face, a rectangle is drawn around it based on the detected coordinates, and the contour gravity of this rectangle is calculated and labelled.

The face detector of the OpenCV library is utilized to successfully detect the face location in each frame, and a Kalman filter is used to track the driver's face image in the subsequent frame. The filter searches for the face within an area of interest around the previous frame's face rectangle size, providing an efficient two-stage recursive estimate of the position and uncertainty of the moving object.

Eye or Pupil Detection:- The main focus of the active safety detection system is to monitor the driver's facial expressions for signs of fatigue. Face detection is the first step in this process, specifically locating the eyes and mouth which are key indicators of drowsiness. The most appropriate face detection algorithm for this system is the VJ object detector, which uses machine learning and has a real-time detection rate of over 98%. Once the driver's face is detected, a rectangle interest region is created around it based on the coordinates from the face detection. The contour gravity of this rectangle is then calculated and labelled in the current frame. The OpenCV library-based face detector is used to locate the face in each frame, assuming that there is always a face present. A Kalman filter is then employed to track the driver's face image in the next video frame, with the search interest region being based on the gravity of the previous frame's face rectangle size. The Kalman filter is a highly efficient recursive two-stage filter that estimates the position and uncertainty of the moving object in the next frame.

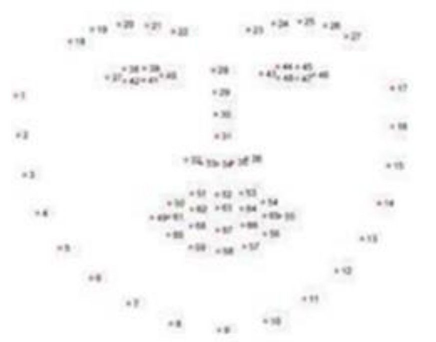

Figure 2 :-**Face landmarks detection by open-cv**
Source:- Py Image search

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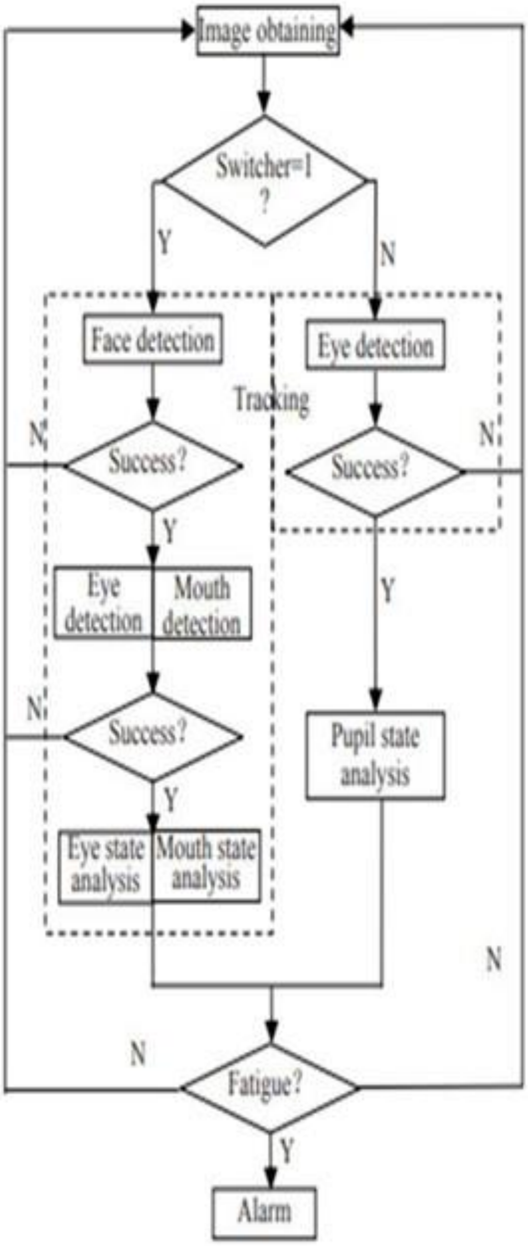

FLOW CHART
Figure. 3

Mouth Detection and Yawning State:- Detecting yawning is a crucial method for detecting driver fatigue. The mouth region is an essential feature for this detection, and it needs to be identified from the face region of interest. By searching for the mouth region from the lower region of the detected face region, the computation cost in image processing can be reduced. Similar to eye detection, we use an ellipse fitting training algorithm, and then apply Gabor wavelet features for texture detection in selecting the mouth features. There are three states of the mouth: closed, open normally, and yawning. Normally, during driving, the driver's mouth remains in a closed state. The mouth opens normally when the driver talks, and it opens widely during yawning. To detect driver fatigue, a threshold is set to match the mouth feature. This threshold is determined by the ratio of the mouth height to the mouth width, based on the fitted ellipse short axis and long axis. With this ratio, we can detect the driver's fatigue state.

Figure 4 **:- Eye aspect ratio (EAR)**

source :- Google

Outcome Screen Shots

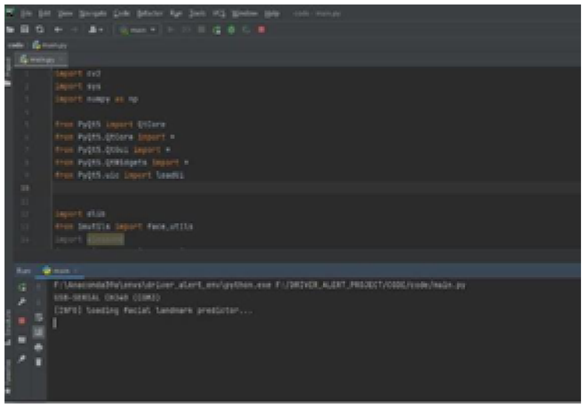

***Figure 5*. On running the program first the screen displays**

***Figure 6.* Face is detected after opening the camera.**

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Figure 7. EAR ratio is calculated of the object.

Figure 8- Closed eyes are detected and alert is displayed on the screen as well as on the hardware

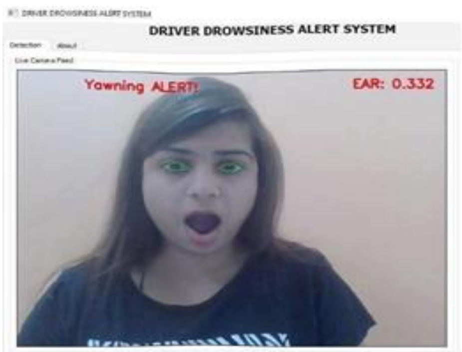

Figure 9. Drowsiness detected by Yawning.

IV. RESULT

The primary method for identifying image features involves extracting facial landmarks.

These landmarks are a specific part of the shape predictor problem and are useful for determining the position of key areas such as the eyes, nose, and mouth, as well as the overall facial shape. The dlib library offers a facial landmark detector capable of identifying 68 sets of coordinates (a, b) that correspond to these landmarks

Open Eye coordinates

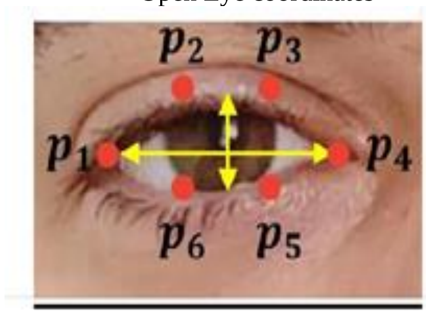

Figure 10 In this eye coordinates a1, a2, a3,a4, a5, and a6 used to measure eye aspect ratio (EAR) for an open eye is approx. 0.24.

Close Eye coordinates

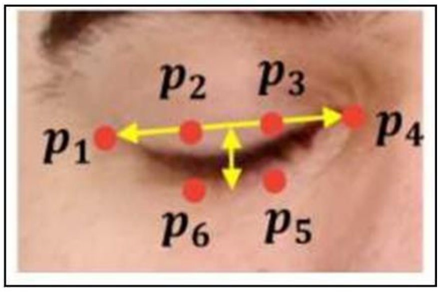

Figure 11 :- Eye aspect ratio (EAR) for a close eye is approx.0.15.

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Table 2-Result Table.

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Individual	Ear Thres hold	Light	REMARKS	DROWSINESS DETECTION ALARM
A	0.2	Bright	Normal	3 out of 3
A	0.2	Dim	Normal	3 out of 3
A	0.2	Bright	Wear	2 out of 3
				sunglasses
B	0.25	Bright	Normal	3 out of 3
B	0.25	Dim	Rainy	3 out of 3
				Weather
B	0.25	Dim	Rainy	2 out of 3
				weather
C	0.22	Bright	Wear	3 out of 3
				Glasses
C	0.22	Dim	Wear	3 out of 3
				Glasses
C	0.22	Dim	Night Drive	1 out of 3
C	0.22	Very Dim	Normal	3 out of 3

The accuracy test for the project was conducted ten times, with various parameters such as different lighting conditions, drivers, and alarm sensitivity. The table below presents the details of the testing parameters. The objective was to assess the overall accuracy of the project using the following formula:

Correct Rate (CR) = (C/A) * 100%

In this formula, CR represents the correct rate, C denotes the number of tests that produced accurate results, and A represents the total number of tests conducted. Out of the ten tests, eight were successful and yielded satisfactory outcomes, while three tests failed due to poor lighting conditions during nighttime. Consequently, the resulting accuracy of the project averaged around 70%. The accuracy and output of the project were influenced by the brightness of the lighting conditions during the experiments. Therefore, the average accuracy of our project is approximately 70%.

V. CONCLUSION AND FUTURE SCOPE

This project aims to reduce the rate of accidents and prevent fatalities caused by road accidents by detecting drowsiness through monitoring the eyes and mouth using facial landmark detection. The EAR function computes the ratio of distances between the horizontal and vertical eye landmarks to detect drowsiness, and a text-to speech synthesizer module is deployed to give appropriate voice alerts when the driver is feeling drowsy or yawning. Future work can focus on incorporating outer factors such as weather conditions, vehicle state, time of sleep, mechanical data to measure fatigue and drowsiness. Continuously observing the driver's drowsiness state and informing them about their condition is crucial in preventing accidents, particularly for commercial motor vehicle operators.

Currently, no adjustments can be made to the camera's zoom or direction during system operation, but in the future, integrating the algorithm into mobile devices, adding an onboard GSM module for SMS alerts, changing the windscreen view according to the driver's state, and automatically turning on the camera when the seat pressure increases to 10 kg can be explored.

VI. ACKNOWLEDGMENT

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