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Driving Assistance using Computer Vision

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***Abstract*—-The primary concept behind this project is to implement and develop a system that can detect a driver diving a car's drowsy actions and can issue an alert in time. Drivers who do not take timely breaks when driving long distances are at high risk of being tired, a disorder that they frequently fail to notice early enough. According to expert reports, about one-quarter of all serious road accidents are associated with tired drivers in need of rest, which suggests that sleepiness causes a lot more road accidents than drink-driving. This paper suggests a Computer Vision-based assistance device for motor vehicles to warn the driver before an accident happens in order to prevent such accidents. A real-time video camera captures the driver's face, and from that real-time video stream, a pre-trained machine learning model detects the mouth and eye boundaries. Then, starting from the left corner of the eye and then working clockwise around the eye, each eye is represented by 6 coordinates (x, y). The EAR (Ear Aspect Ratio) and MAR (Mouth Aspect Ratio) are measured and the warning system is activated if the value is less than the threshold.**

1. Introduction

Traffic collisions cause millions of individuals to lose their lives every year, according to estimates from the World Health Organization (WHO). Much of the fatal accidents are due to driver fatigue and carelessness, statistics claim.

21 percent of all fatal accidents are due to drowsy driving, according to the Ministry of Road Transport and High-Ways, 2018. In the past year, 60% of adult passengers, or around 168 million individuals, have driven a vehicle while feeling drowsy. Every year, 100,000 collisions are the direct product of driver exhaustion, the National Highway Traffic Safety Administration reports. Drowsy driving is a problem that for years has plagued various countries, and parts of India are facing compounding.

Risks due to the geography and driving style of the region. The only category that drowsy conduct could fall into in India is the responsibility of the driver, which is divided into two categories: speeding and alcohol or drug consumption.

A gradual event is the process of falling asleep in the vehicle. The driver may turn from normal to drowsiness due to monotonous driving conditions and other environmental factors. Therefore, the first crucial problem to be found in the fatigue detection system is how to reliably and early recognize drowsiness. In this paper, the use of a behavioural model on drivers is recommended to track driver fatigue in real-time. Without disrupting the driver, a Behavioural fatigue monitoring system can be implemented and can capture this incremental transition.

2. Literature Survey

1. Driver accident warning system that uses face recognition [1]. In order to ensure the safety of the driver, this paper recommends strategies to keep track of the driver's visual features. The sensor is used for night vision and the data is sent to the control system. Then, the speed is decreased by the control mechanism.

2.Computer Vision-based identification of drowsiness with Web Push Alerts for motorized vehicles [2]. This paper suggests a novel method in which the machine notifies the location of the latest coffee shop when the driver is found drowsy.

3.A Deep Learning Approach for Real Time Detecting Drowsy Drivers [3]. This paper proposes CNN systems that compare their efficiency with current technology. With the support of current technologies with fresh add-ons, this paper focuses on improving accuracy.

4. Drowsy Driving Real-Time Detection via Acoustic Sensing on smartphones(IEEE 2020) [4]. This paper is based on a Doppler shift that takes 3 parameters under it, i.e.

nodding, yawning and steering wheel operation. The sound The signals are obtained from the smartphone's microphone and then transformed via FFT into a Doppler profile.

5. Real-time Drowsiness Monitoring Device Architecture using Dlib [5]. In this paper, Dlib's shape de-ector is used to map the coordinates of the input video's facial landmarks and somnolence identified by monitoring eye and mouth aspect ratios.

6. Detection of Real Time Drowsiness using Viola Jones KLT [6]. They suggested a technique in this paper that helps to detect whether or not the driver is drowsy. Various algorithms, such as Viola Jones, Kanade Lucas Tomasi, and Hough Transform, are used. If the conditions are met, the device activates the warning. Two conditions are used to verify the drowsiness.

7. Visual Behaviour and Machine Learning Driver Drowsiness Control System [7]. This paper provides strategies for detecting drowsy drivers identified as behavioural and physiological based vehicle-based drivers. Centered on visual behaviour and machine learning, a low cost, real-time driver drowsiness monitoring system has been suggested.

8. Detection of inattentive and violent driving behaviour by human drivers using deep learning [8]. Because of driving patterns, this paper proposes various driving styles, perceptions and emotions. Driver Distraction (DD), Driver Exhaustion (DF) or Drowsi-ness led to them (DFD). By providing a systematic comparative review of all recent techniques, they attempt to achieve a thorough understanding of HIADB (Human Inattentive and Violent Driving Behaviour) identification.

3. Proposed System

3.1. Flow Chart

The flow chart of our proposed system is shown in the Figure 1.

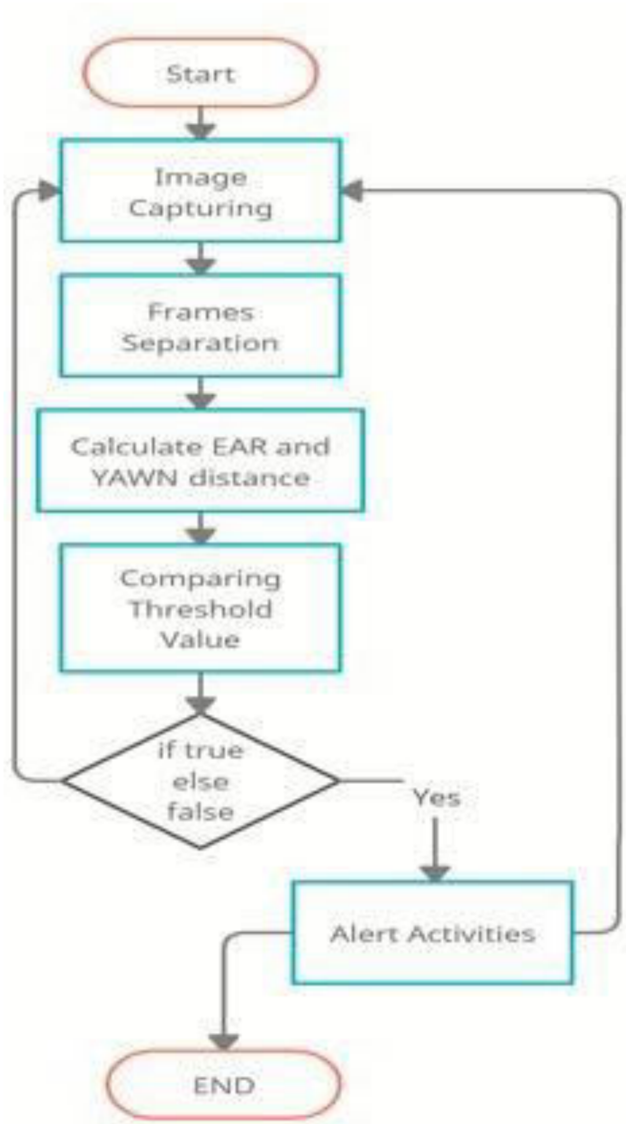

Figure 1. Flow chart for the system.

3.2. Video Input

In Python, to get the driver's live video stream, the Open CV library is used. In real time, Open CV is directly aimed at Computer Vision and was introduced by Intel, then by Willow Garage, then by Itseez. It is a cross-platform open-source library that offers excellent processing of images, computer vision and functionality for predictive machine learning. A laptop's default web camera is used to capture the video feed.

3.3. Face and Coordinate detection

The first step is to remove the face region from the video stream in real-time for which the algorithm Viola-Jones is used. The algorithm proposed by Paul Viola and Mike Jones was the first real-time face detector of its kind. The algorithm includes 4 HAAR Feature Selection steps, Integral Image Formation, Adaboost Training, and Cascading Classifiers. AdaBoost is an algorithm that, using a weak learning algorithm, finds a single rectangle element. The goal of the lessons is to find the best classification of the threshold for the given function. Most of the field is a non-face region in a picture. The non-face area is thus rejected and only the face region is processed. The concept of the Cascade of Classifiers was only introduced by Viola and Jones for this reason. Each attribute is introduced one by one instead of all at once. If the first feature does not pass the test, the remaining features are rejected. The second stage is added to the window if the first feature passes, and the process continues. As a face area, the window that passes through all these phases successfully is selected. The Dlib library is used, as shown in Figure 2, to obtain 68 facial landmark points. Dlib library is used for getting 68 facial landmark points as shown in Figure 2.

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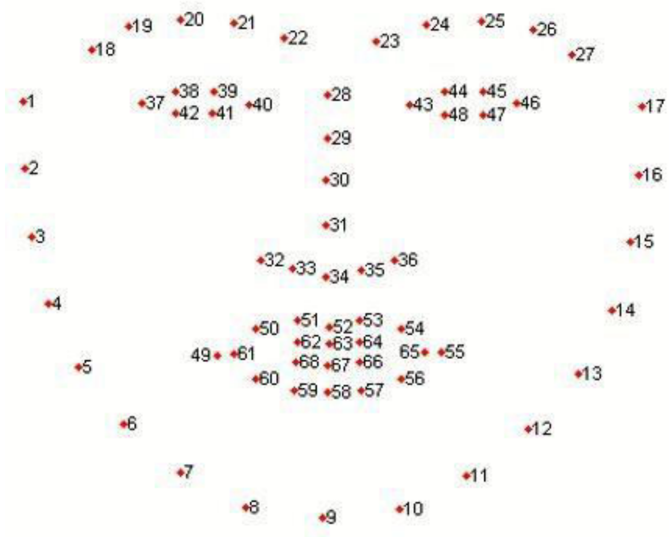

Figure 2. 68 facial landmarks used for face detection.

3.4. Eye Detection

After face detection the area of the face is defined, now we can search for eyes in this defined area. Again the Viola-Jones Cascade classifier is applied to detect eyes. The cascade classifier is applied on 20 frames per second to detect the face and the eyes.

3.5. EAR

The EAR(Eye Aspect Ratio) is used for determining whether the eye is opened or closed. The EAR is a constant value which rapidly falls to zero when the eye is found closed.

$$EAR = \frac{||p2 - p6|| + ||p3 - p5||}{2||p1 - p4||}$$

As shown in Figure 3, the 2D eye's hallmark locations are p1, p2, p3, p4, p5, and p6. The EAR is calculated for 20 consecutive frames, and when the average EAR is less than the threshold value of 0.25, the alarm is produced. A constant threshold is obtained from the EAR measurement when the eye is closed and the p2 and p3 points are very similar to the p5 and p6 points, or the p1, p2, p3, p4, p5 and p6 points on the same side, i.e. the x-axis, as shown in Figure 4.

3.6. MAR

Mouth aspect ratio is used to detect whether the driver is yawning or not. MAR helps is calculating the distance of opened mouth and thereby concluding yawning or not.

$$MAR = \frac{|CD| + |EF| + |GH|}{3 * |AB|}$$

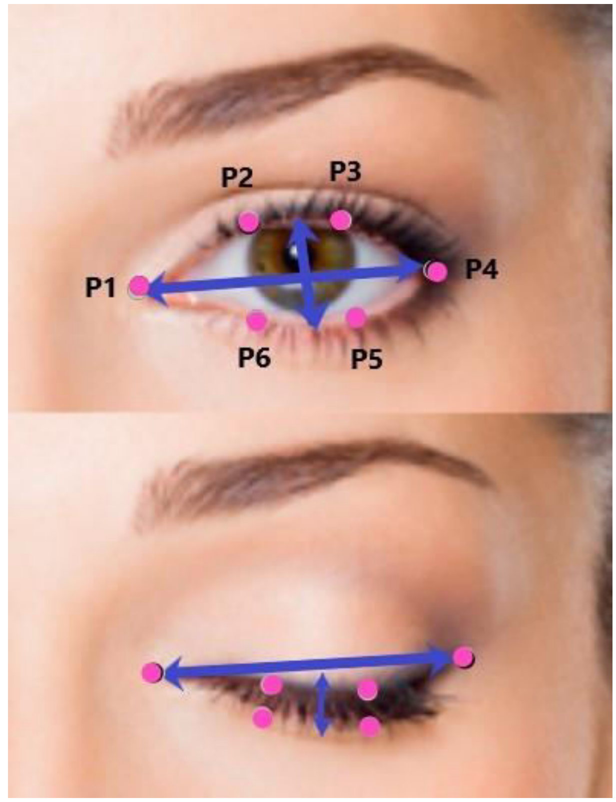

Figure 3. Top: A visualization of eye landmarks when then the eye is open. Bottom: Eye landmarks when the eye is closed.

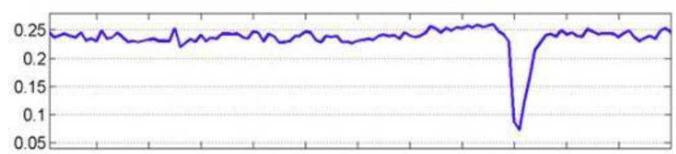

Figure 4. Plotting the eye aspect ratio over time. The dip in the eye aspect ratio indicates a blink.

3.7. Driver Detective Mechanism

Intelligent Driver alertness mechanisms decides the success of drowsy driver assistance system. This mechanism helps in waking up the sleepy driver and reduce the probability of road accidents. In this mechanism, the user will interact with front-end where the system will take input image and send image to the back-end. At the back-end implementation of our model will process the image and analyse whether the person is drowsy or not. If found drowsy a quiz will appear. So, the person can become concious again. For example: Which color is displayed on the screen ? If the driver unable to answer quiz within a specified limit then alert sound volume increases. This process will continue.

4. Conclusion

Hence a Computer Vision-based drowsiness detection system for motorized vehicles has been developed. The EAR or the Eye Aspect Ratio is used to detect a closed eye state ,The MAR or the Mouth Aspect Ratio is used to detect open state of mouth and Driver Detective Mechanism check the conciousness of the driver. The system performed successfully in its trial run and was able to detect the driver's drowsiness.

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