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Driver Fatigue Detection Using Image Processing

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ABSTRACT-- *The quantity of street mishaps that happen every day is rising and greater parts of them are credited to being the driver's deficiency. In many of these cases, a fault in their driving is attributed to fatigue-lack of attention, drowsiness or outright dozing off while driving. This work proposes an observing framework that alarms the driver when he capitulates to sleep. The proposed calculation provides the live video feed concentrated on the driver's face and tracks his eye and mouth movements to identify eye closure and also the yawning rates using Haar Cascade classifiers. The driver is determined to be drowsy in two cases. The first is if the driver is found to be sleeping. The second is if the driver is found to be on the verge of sleeping which is determined if the driver yawns continuously. A buzzer is sounded if the driver is sluggish or effectively sleeping. The primary target of this work is to find a proficient methodology for distinguishing whether the driver is distracting from various objectives like drowsiness, etc. Specifically, the proposed method takes input as video using webcam present in the car. Using that it binarizes the picture and identifies whether a person is distracting or not. The proposed method gives an alarm when it detects the driver's distraction.*

Keywords-- *Drowsiness, Eye Gaze, Yawning, Distraction, Haar Cascade.*

I. INTRODUCTION

Traffic accidents are one of the main reasons that cause extreme/ultimate deaths. Reasons for these mishaps run from a blameless second of mindlessness to purposeful driving of a vehicle when the driver is incapacitated or intoxicated. In the previous situation, the co-traveler would caution the driver of his/her slip by of consideration and the driver would return measures to go to the necessary condition of sharpness. In any case, imagine a scenario in which the driver is distant from everyone else or is driving in the night where quite possibly the kindred travelers are sleeping. Normally people try to stay awake by listening to music or with the help of caffeine. But sleep has a way of creeping up on you when you are fatigued. These calls for a driving companion that could continuously monitor the driver's state. In the recent years, an unprecedented amount of research attention has been paid to safety, especially in the transport sector. Increasing the safety levels for drivers and pedestrians alike has been paramount to the research carried out by the transport sector. It primarily aims at reducing multitudes of traffic accidents. Both physical and mental attentiveness is demanded to perform a task as complex as this effectively. Commonly, the term laziness alludes to a condition of lack of concern and sluggishness that prompts the propensity to nod off. It is not a state that is preferable for a driver to be in. It

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reported that one of the principal factors underwriting traffic accidents, among others like over speed and drinking. In addition, the probability of accidents is reports to be higher on lengthy straight roads which bring the dangers of sluggishness into light.. The traffic accident reports are the consequences to detect the drowsiness, which lead us to further understand the concept of drowsiness and its causes. Researchers have classified the human rest cycle is arranged into three classifications

- Drowsiness
- Non-rapid eye movement
- Rapid eye movement .

Drowsiness is a condition of awareness wherein an individual is totally caution and can perform physical and mental undertakings while looking after consideration. This is the normal state we are in on any given regular day and preferable while doing any tasks of import. NREM, the second state mentioned above, is divided into three stages- sluggishness, light rest state and profound rest state, separately. Tiredness is a middle of the road state among sluggishness and attentiveness. It is a condition of diminished consideration and carefulness towards playing out any conscious undertakings. In the case of driving, this could mean gross inattention towards the ongoing traffic and much slower reflexes in case of unexpected events. In a driving situation, a drowsy person is a hazard to everyone on the road as a driver's loss of consideration and expanded reaction time causes road accidents and leads to terrible casualties. Long hours of work, absence of rest and continual driving or any medical condition contribute to drowsiness on the road. Recognizing the need for such systems, many techniques have been developed. There are systems that monitor the driver’s state by analyzing physiological responses.

II. MOTIVATION

The related work to implement the effective system was discussed in this segment

Literature Survey:

Shigeyuki Tateno et al. builds up a framework dependent on pulse observing, which ascertains driver's breath by identifying electro vehicle chart, and afterward gathers the driver's tiredness degree from the breath changes. In spite of the fact that the framework has the hindrances that is legitimately reached with skin and is impacted by the driver's activities, it increases high exactness than the framework that utilizing pulse straightforwardly. Consequently, the framework has commitment to take care of the driver weariness issues.

Jang Woon Baek et al. proposed a calculation which utilizes an AdaBoost classifier dependent on the Modified Census Transform highlights. What's more, the proposed calculation utilizes relapsing Local Binary Features for face milestone location. Eye states (shut, open) are controlled by the estimation of Eye Aspect Ratio which is effortlessly determined by the tourist spots in eye district. The proposed calculation gives ongoing execution that can be run on the installed gadget. We acquired the dataset utilizing video records from the infrared camera which is utilized the genuine field. The proposed calculation tried in the objective board (i.mx6q). The outcome shows that the proposed calculation outflanked in the speed and precision.

Menchie Miranda et al. utilize the innovation of web of things with the goal that the vehicle proprietor can screen the driver's tiredness wherever during work hours. The examination centers at the eyelid development that isn't yet referenced to the past investigation. This proposed framework consistently filters the eyelid

developments of the driver and once laziness is recognized the gadget consequently cautions him utilizing an arbitrary composed alert. It naturally advances the report to the vehicle proprietor from the web application through web get to.

Melissa Yauri-Machaca et al. exhibited the system where it will take the handling of pictures through a camera which will concentrate on the driver. In that, it will investigate the progressions that occur in the face and afterward will be prepared through a program so as to identify the drowsiness to send an alarm to the driver. Bagus G. Pratama et al. proposed different characteristics, for example, visual, non-visual, and vehicular. Visual characteristics are removed from driver's face and recorded by camera. Non-visual characteristics are signals risen up out of driver's body and to secure those signs, they utilize uncommon sensor joined to driver's body. Vehicular characteristics are gotten by watching the conduct of driver during driving. From those highlights which are proposed by analysts, we talked about 3 thoughts that can be considered as direction to lead scientist in creating tiredness identification. The main thought is making the dataset of tiredness outward appearance since it can anticipate laziness and weariness. Second thought is to join visual, non-visual, and vehicular highlights into one for better location. Furthermore, last one is creating wearable durable goods, for example, smart watch for sleepiness discovery which are anything but difficult to utilize and easy to understand.

Natalia I. Vargas-Cuentas et al. built up an instrument dependent on procedures of man-made reasoning and picture handling that can distinguish conditions of tiredness in individuals whose work needs the best consideration - to keep away from mishaps and furthermore built up a calculation that can be executed on a PC and through a webcam can record the essence of the individual or specialist to dissect the video and through facial acknowledgment methods can recognize the eyes of the individual, and in this way distinguish eyelashes that would be a pointer of languor. It is relied upon to have a calculation created in MATLAB to distinguish tiredness and give some warning notification.

Mr. S. S. Kulkarni et.al. exhibited a technique to identify driver's wellbeing and vehicle control utilizing Raspberry Pi and Webcam. As per overview made by government, 22% mishaps are because of laziness and 33% mishaps are because of liquor drinking. In reality, to grow such a procedure in vehicle which can recognize the sluggishness of driver is a major errand. To finish this errand picture preparing method can be increasingly valuable. The camera is bolstered by embedded system in which Raspbian OS is utilized. This installed framework is sequentially interfaced with another miniaturized scale controller with RS232 convention by means of sequential correspondence, which will identify the continuous circumstance of the driver and switch on the alert when tiredness is distinguished the framework turns off the vehicle start power source by microcontroller-based sign. A GSM module is presented in the framework which sends SMS to the individual whose contact is spared in the framework.

III. THEORETICAL ANALYSIS

This project is used to build up a framework for checking, caution, and announcing levels of laziness for individuals.

Estimating drowsiness using Yawing and Eye Gaze:

1) Mouth Aspect Ratio(MAR)

- Ratio of height over width of mouth

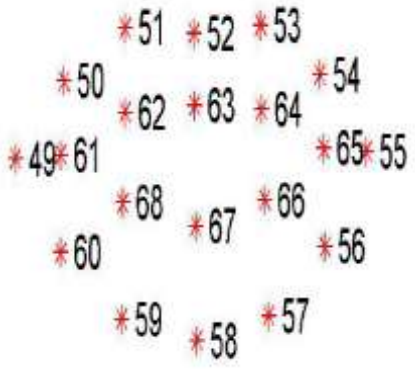

Figure 1: Landmarks of mouth

Estimate Distraction with Eye Gaze

$$MAR = \frac{mean(\|p63-p67\|,\|p52-p58\|)}{mean(\|p61-p65\|,\|p49-p55\|)}$$

- Use of left and right scalars.
- Determine Distraction Over time.

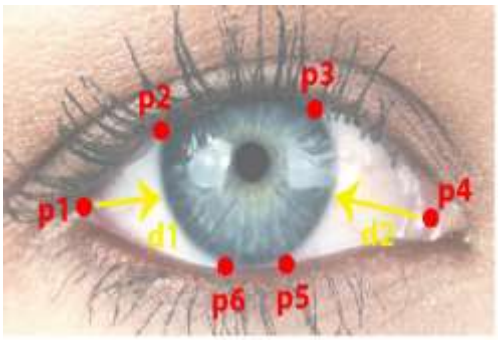

Figure 2: Landmarks of open eye

$$d1 = \|(p2 - p6 / 2) - p1\|$$
$$d2 = \|(p3 - p5 / 2) - p4\|$$

2) Eye Aspect Ratio

Eye perspective proportion is a gauge of the eye state-to make sense of in the event that it is open or shut. It very well may be determined utilizing facial tourist spots plotted by the 68 facial milestone point plot gave by python's dlib library. It utilizes the focuses in the locale important to figure.

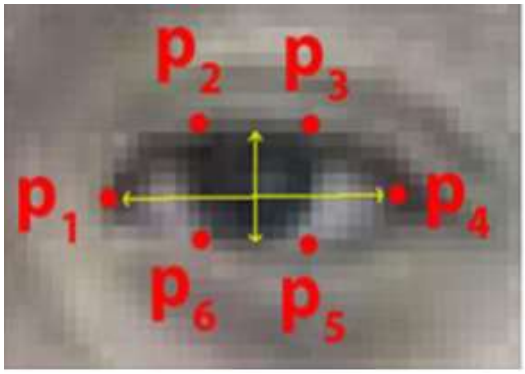

Figure 3: Eye Aspect Ratio of an open eye

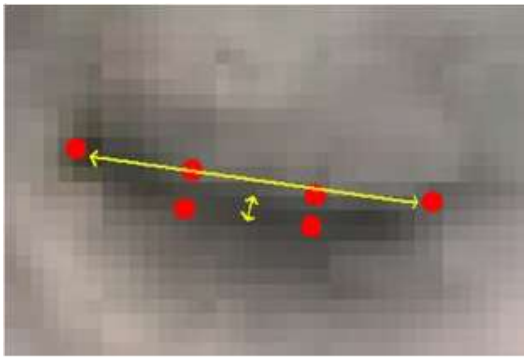

Figure 4: Eye Aspect Ratio of closed eye

$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Here p1; p2; p3; p4; p5; p6 are landmarks of ROI. Threshold: 0.25

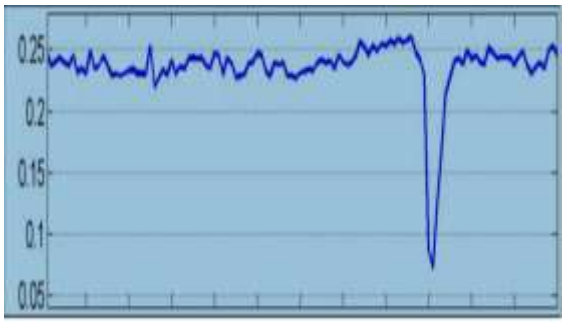

Figure 5: Eye blink threshold value

The proposed algorithm occurs in the following stages.

- Video acquisition
- Processing frames
- Face detection
- Eye closure detection
- Yawning detection

Block diagram:

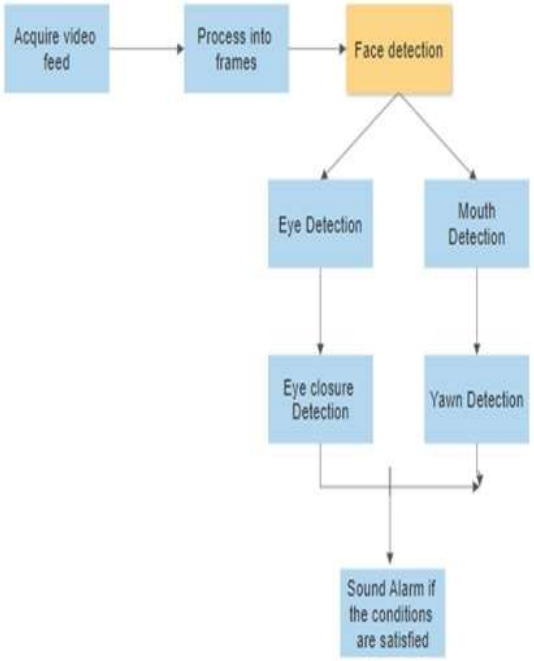

Figure 6: Block Diagram of Driver Distraction

IV. PROPOSED MODEL

The system we propose determines the driver's state based on the video acquired from the camera placed inside the car in front of the driver . Web camera is placed in such a way to provide optimal coverage of the subject's face and facial features.

1) Yawning detection

Yawning is generally an opened mouth. Like the eye conclusion location, it utilizes the facial landmarks to identify an open mouth. Lip separation is the parameter used to decide whether the person mouth is open or not. On the off chance that the lip separation determined from the casing is over 25, the subject is resolved to be yawning. An alert is raised if the subject has yawned in excess of multiple times consecutively. Continuous yawning is an indicator for impending sleep. This could impair driver's attention. In addition to the alarm, a message is also displayed on the run window saying, "You are drowsy". To reduce the case of false positives, small openings of mouth and activities such as talking, smiling, laughing are ignored.

2) Eye closure detection:

The successful detection of the subject's eyes is indicated by the boundaries drawn lining the eyes in the run window of the system. The state of the subject's consciousness is determined using the Eye Aspect Ratio. The Eye Aspect Ratio is computed using landmark facial points in the region of the interest. Eye viewpoint proportion an incentive underneath the edge esteem is demonstrative of shut eyes. The threshold value considered in our experiment is 0.3. This leads us to the conclusion that the person is sleeping or has closed eyes. An alert message is displayed on the screen saying, "You are drowsy" and an alarm is raised. But if the person has closed eyes for an insignificant period of time or has done it on purpose, the alarm could be a nuisance. To prevent this, the alarm is triggered only if fifty consecutive frames are found to have the eye aspect ratio below the threshold. This introduces a delay of about 10 to 15 second in raising the alarm. This is to avoid the issue of false positives.

V. EXPERIMENTAL RESULTS

The following are the screenshots captured when the program drowsiness detection is run

Flow chart:

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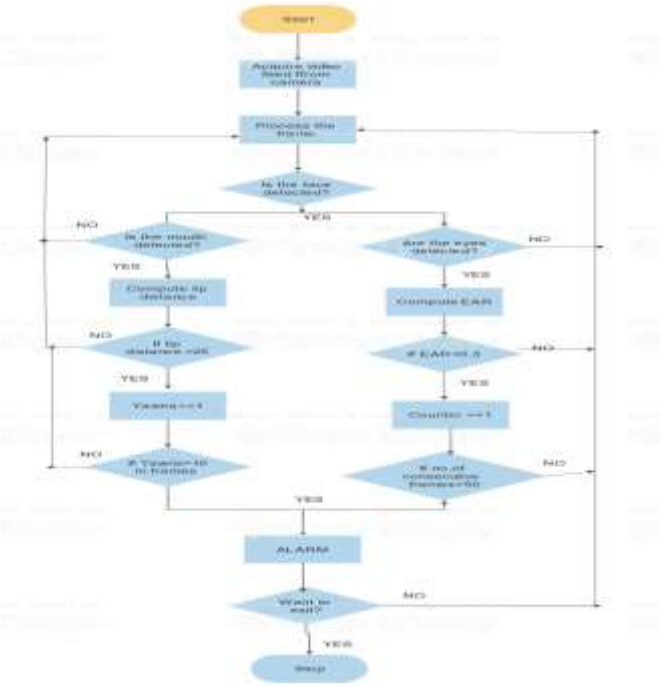

Figure 7: Working model of the proposed system

Figure 8: Yawn Detection when driver open's mouth

Figure 9: Drowsiness Detected when driver closes eye

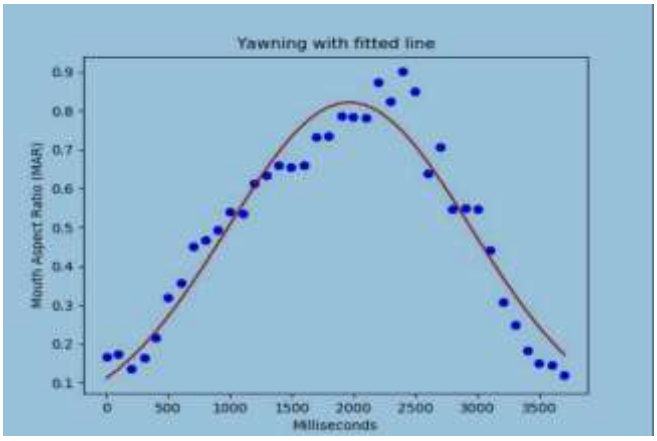

Figure 10: Plot representing yawn detected in milliseconds

VI. CONCLUSION

The number of road accident cases is piling up every day. The numbers gathered through various surveys indicate that one of the main reasons for this is drowsiness or inattention on the driver's part. This is a problem that has been researched in various fields. The state of a driver's alertness can be determined by studying several of the driver's characteristics. With the help of the Haar based classifiers, we detect the face and the required facial features- eyes and mouth. The system raises alarm in two cases. The first is when the driver is found to be sleeping which is recognized by closed eyes. The second is when the driver is found to be drowsy which is characterized by a series of consequent yawns (wide- open mouths). This project is tested with various testcases. It precisely distinguishes faces and the necessary facial highlights in 85 % of the cases. In all the instances of positive component location, tiredness is instantly recognized. The system recognizes facial features accurately under all optimal conditions but fails to do so under bad illumination. This is can be overcome using an infrared camera. The system also fails to detect accurately if the region of interest is covered by an obstruction like a hand. A person can be determined to be drowsy or incapable by monitoring his facial features, behavioral features, and physiological features. Physiological factors like heart rate, respiration rate… can be used. But this also involves a lot of wires connected to the subject and is deemed to be intrusive.

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