In advance accident alert system & Driver Drowsiness Detection

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Abstract - *The majority of information is relayed by the eyes, which are an important part of the body. An operator's facial expressions, such as blinking, yawning frequency, and face tilt, differ from those in a rested condition when they are tired. We propose a Driver-Drowsiness Detection System in this effort, which employs video clips to monitor drivers' tiredness status, such as yawning, eye closure length, and head tilt position, without having them to carry sensors on their bodies. We are using a face-tracking algorithm to improve tracking reliability due to the limitations of previous methodologies. To distinguish facial areas, we used a technique based on 68 key points. Then we assess the passengers' health using these areas of the head. The Driver-Drowsiness Monitoring Method can use a tiredness alarm to alert the driver by combining the eyes, mouth, and head.*

***Key Words*:** Accident alert, Driver Drowsiness, facial features. Safety, Deep learning.

1.INTRODUCTION

In recent years, faster car park expansion has been required due to rising demand for contemporary mobility. The automobile is now a necessary form of mobility for most people. In 2017, 97 million vehicles were sold worldwide, up 0.3 percent from 2016. According to estimates, there were approximately 1 billion automobiles in operation globally in 2018. Although the vehicle has altered people's lifestyles and made daily tasks more convenient, it is also linked to several negative consequences, such as road accidents. The National Highway road Safety Administration estimates that there were 7,277,000 road accidents in 2016, accounting for 37,461 fatalities and 3,144,000 injuries. Fatigued driving was responsible for roughly 20% to 30% of the traffic accidents in this study. As an outcome, driving while fatigued presents a significant and concealed danger for traffic accidents. The fatigue-driving-detection technology has become a prominent research area in recent years.

Positivist and interpretivist detection methods are the two types of detection procedures. A driver is required to participate in the subjective identification method's evaluation, which is connected to the driver's subjective perceptions through actions including self-questioning, evaluation, and questionnaire filling out. These statistics are then utilized to estimate the number of cars driven by weary drivers, allowing them to better arrange their timetables. The objective detection approach, on the other hand, does not require drivers' feedback because it analyses the driver's physiological condition and driving-behavior parameters in real time. The information gathered is utilized to determine the driver's level of weariness. In addition, objective detection is divided into two categories: contact and non-contact. Non-contact is less expensive and more convenient than contact because the system does not need Vision - based technology or a sophisticated camera, allowing the gadget to be used in more cars.

Due to its low cost and ease of installation, the non-contact method has been used extensively for the detection of fatigued driving. Concentration Technology and Smart Eye, for example, use the motion of the driver's eyes and the position of the driver's head to estimate their fatigue level. One method to improve system reliability in the real world is to alert concerned parties.

2. EXISTING SYSTEM

According to the existing system, changes in the eye-steering correlation can signify distraction. The autocorrelation and cross-correlation of horizontal eye position and steering wheel angle demonstrate the low eye steering relationship associated with eye movements associated with road scanning methods. The eye-steering correlation will control the connection on a straight path. Because of the straight route, the steering motion and eye glances had a low association. This system's goal is to identify driver distraction based on the visual behavior or performance; therefore it's used to describe the relationship between visual behavior and vehicle control for that purpose. This method evaluates the eye-steering correlation on a straight road, presuming that it will have a different relationship than a curved road both subjectively and numerically and that it will be prone to distraction. On curving roads, a high eye steering connection linked with this process has been discovered in the visual behavior and vehicle control relationship, which reveals a basic perception-control mechanism that plays a major role in driving.

Tracking object detection is a crucial problem in computer vision. Human-computer interaction, behavior recognition, robotics, and monitoring are just a few of the disciplines where it can be used. Given the initial state of the target in the previous frame, object recognition tracking predicts the target position in each frame of the image sequence. The pixel connection between adjacent frames of the video sequence and movement changes of the pixels, according to Lucas, can be used to monitor a moving target. Contrarily, this method can only detect a medium-sized target that switches between two frames. Based on recent advancements in the correlations filter in computer vision, Bolme presented the Minimal Outcome Sum of Squared Error (MOSSE) filter, which may give reliable correlation filters to track the object. The MOSSE has excellent processing efficiency, but its algorithm precision is constrained, and it can only analyse the grey information of a single channel [1].

Tracking of visual objects. In computer vision, visual object tracking is a critical issue. Human-computer interaction, behavior recognition, robotics, and surveillance are just a few of the disciplines where it can be used. Given the initial state of the target in the previous frame, vision - based monitoring estimates the target position in each frame of the image sequence. According to Lucas, a moving target can be watched using the pixel relationship between succeeding frames of the video sequence and displacement changes of the pixels. This technique, on the other hand, can only recognize a medium-sized target that moves between two frames [3].

4. OBJECTIVES

Real-time eye tracking technology is used to monitor the driver's eyes. In certain driving situations, a driver's reaction time is slowed down when they are fatigued or distracted. The likelihood of an accident will consequently rise. There are actually three techniques to recognize driver fatigue. The first is physiological changes in the body, such as pulse rate, brain messages, and cardiac activity, which a wearable wristband system can detect. The second technique is accomplished by the suggested eye tracking system using behavioral metrics including surprising nodding, eye movement, yawning, and blinking.

The five main objectives of the created system are as follows:

a. Affordable: Cost is one of the most essential factors throughout the design phase, thus the technologies must be reasonably priced.
b. Portable: The solutions must be adaptable to various car models and simple to install.
c. Secure: By positioning each component in its right location, the security of the system is guaranteed.
d. Quick: The reaction and processing time to react in the case of a driver's urgency is among the most crucial factors because an accident happens in a matter of seconds.
e. Accurate: The most accurate algorithms have in fact been selected because the system needs to be precise.

5. METHODOLOGY

There is now a remedy for one of the main causes of real-world traffic accidents. The system takes us closer to saving lives by preventing mishaps in the real world. DLIB & SOLVE PNP Models are the foundation of the proposed system.

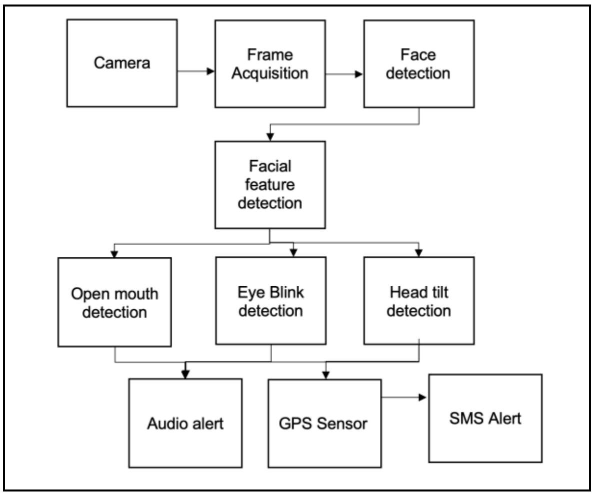

Fig -1: Architecture of proposed system

The first stage is to initialize the camera, and the second is to acquire frames. Face is found in the frame after it has been acquired. The position of the lips, eyes, and head are detected in the subsequent phase.

Following is the formulae to calculate Eye Aspect Ratio:

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

Following is the formulae to calculate Mouth Aspect Ratio:

$$\text{MAR} = \frac{\|p_2 - p_8\| + \|p_3 - p_7\| + \|p_4 - p_6\|}{2\,\|p_1 - p_5\|}$$

We calculate the head Position using PnP i.e. Perspective-end-Point by detecting 3D facial points:

a. Tip of the nose: (0.0, 0.0, 0.0)
b. Chin: (0.0, -330.0, -65.0)
c. Left corner of the left eye: (-225.0f, 170.0f, -135.0)
d. Right corner of the right eye: (225.0, 170.0, -135.0)

e. Left corner of the mouth: (-150.0, -150.0, -125.0)
f. Right corner of the mouth: (150.0, -150.0, -125.0)

After calculating EAR, MAR & PnP, system alerts through speaker if it detects eyes closed for more than 5 secs and yawning so much. System also alerts driver when his head is not straight. As additional security measure system also sends SMS alert to concern person including GPS location fetched via GPS sensor.

6. IMPLEMENTATION

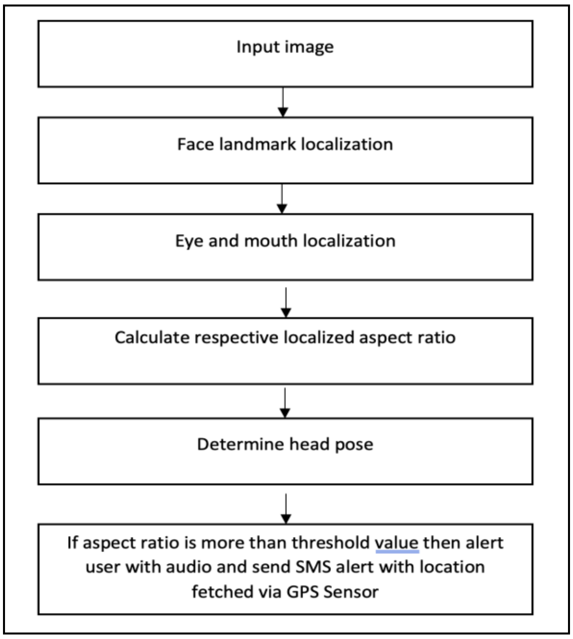

Fig -2: Implementation of proposed system

Face alignment, head pose estimation, face switching, blink detection, and other tasks have all been effectively accomplished using facial landmarks.

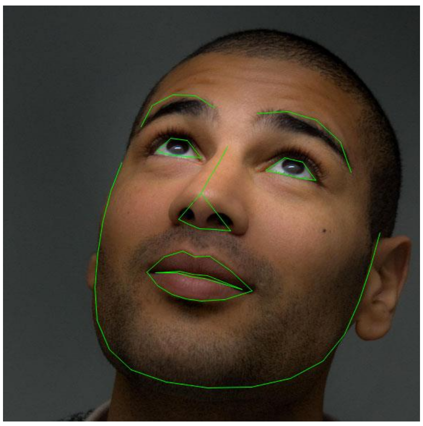

Fig -3: In an image, facial landmarks are used to name and identify essential face features.

Face landmark detection is a subset of the shape predicting issue. Given an input image (and generally a ROI that characterizes the object of interest), a shape predictor tries to identify important points of interest along a shape. In the field of facial landmarks, our aim is to apply shape prediction techniques to identify key facial components merely from the face.

Therefore, identifying face landmarks requires two steps:

Step #1: Localize the face in the image.
Step #2: Detect the key facial structures on the face ROI.

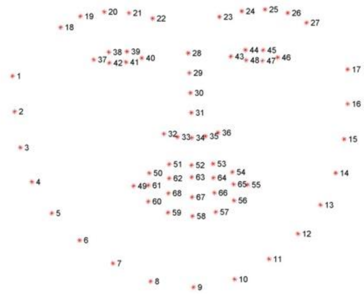

Fig -4: The 68 face landmark coordinates from the iBUG 300-W dataset are visualized.

i. EYE ASPECT RATIO

These annotations are from the 68-point iBUG 300-W dataset, which was used to train the dlib face landmark predictor. Six (x, y)-coordinates are used to symbolize each eye, beginning at the left corner (as if staring at the subject) and moving clockwise around the remainder of the area:

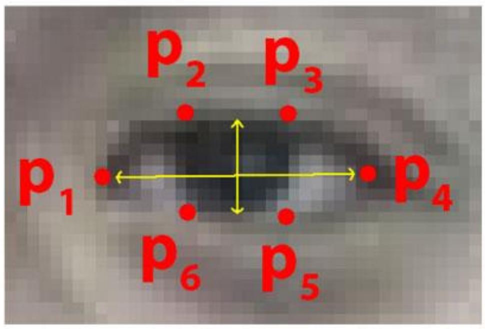

Fig -5: The 6 facial landmarks associated with the eye.

II. MOUTH ASPECT RATIO

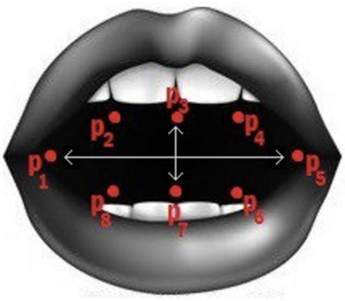

Fig -6: Facial Landmark associated with Mouth

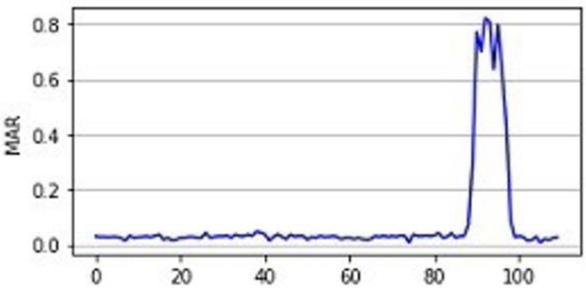

Fig -7: Graphical Representation of yawning

The graph unmistakably demonstrates that, as in the previous 80 frames, the mouth aspect ratio is almost zero whenever the mouth is closed. When the mouth is partially open, the mouth aspect ratio is a little greater. The mouth aspect ratio, however, is substantially higher in form frame 80, indicating that the mouth is open completely, perhaps for yawning.

III. PnP (For Head Tilt Detection)

An object's posture in computer vision relates to its placement and orientation in reference to a camera. You can alter the attitude by moving the object in relation to the camera or the camera in relation to the item.

A 3D rigid object has only two kinds of motions with respect to a camera.

a. Translation: The act of translating involves moving the camera from its present 3D (X, Y, Z) location to a new 3D (X', Y', Z') location. As you can see, there are three possible directions you can go in when translating: X, Y, or Z. A vector t, with the value 1, represents translation and is equal to: $(X' - X, Y' - Y, Z' - Z)$

b. Rotation: The X, Y, and Z axes can also be used to rotate the camera. Thus, there are three degrees of freedom in a rotation. Different graphical representations exist for rotation. It can be expressed using Euler angles (roll, pitch, and yaw), a 3 X 3 rotation matrix, or a rotation direction (i.e. axis) and angle.

7. CONCLUSION

To identify fatigue, a framework that stretches out and keeps track of the driver's mouth, eye, and head motions is used. The framework utilizes a mixture of layout-based coordinating and highlight-based coordinating to keep the eyes from wandering too far. Framework will almost certainly determine if the driver's eyes are open or closed, and whether the driver is looking ahead, while following. When the eyes are closed for a long time, a bell or alarm message will sound as a warning. GPS will detect the live location and update, whenever eyes are closed, continue yawning and head tilted will trigger the system to send SMS alert to provided number ensuring the safety of driver, people walking on the road and other fellow drivers.

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