AAS- Automated Alert System for Driver Drowsiness

Prem P, Pruthvi Nandan DH, SR Sagar, S Rohan, MadhumitaMishra

School of Computer Science and Engineering
REVA University, Bangalore, India

***Abstract*- Drowsiness in a driver is one of the major reasons behind the increase in accident rates. The eyes, an important sense organ of the body, deliver the most information. When an operator is weary, facial expressions such as blinking, yawning rate, and face tilt change from those in a normal state. We propose an efficient alert system for drivers-drowsiness in this effort, we employ video clips to monitor drivers' tiredness status, such as eyes closure duration, yawning, and head tilt position, without having them carry sensors on their bodies. Due to the limitations of previous methodologies, we are using an efficient face-tracking algorithm to improve tracking reliability. 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. By integrating the eyes, mouth, and head, the AAS raises a fatigue alarm alert to the driver.**

Keywords— Drowsy driver, The yawn rate, eye closure length, fatigue alert

1. INTRODUCTION

An automobile is now a necessary form of mobility for most people. As per statistics published by: "Statista Research Department", sales of cars worldwide grew by approximately 3 million units in 2021 as compared to the previous year's sales. Although the use of automobiles like cars, bikes, etc. has altered people's living standards and made day-to-day work so much easy as well as convenient, sadly it is linked to several negativity like road accidents which leads to loss of precious lives & hard-earned money. According to the National Highway Traffic Safety Administration (NHTSA) published data, a total of 72,77,000 road accidents were reported in 2016, with a total of "37,461" precious lives lost and a total of 31,44,000 people injured. Driver driving when they're not fully fresh or are in the Fatigued stage was one of the main reasons responsible for mostly 20% to 30% of the traffic accidents in this research. Thus, driving a vehicle in a fatigued state is a major important risk in traffic causality. The drowsiness-driving-detection technology in the modern world has now become a prominent research area.

Positivist and analytic detection methods are two types of detection procedures. A driver must engage in the subjective recognition method's analysis, that connects to the driver's personalized impressions through procedures such as self- observation, assessment, and filling out an opinion poll. Then, these data help the drivers to pre-plan their work timings based on the data. The objective detection method does not need drivers' feedback because it examines the driver's state of mind and driving-behaviour parameters in actual time. The data is being gathered to find out the level of drowsiness drivers have. In addition, objective detection is divided into 2 different categories: contact and non-contact. Non-contact is cheap and much more suitable than that contact because the method does not need Vision-based technology or a high-level camera, which allows more cars to use the gadget.

The non-contact approach has popularly been applied in fatigue-driving detection because it is easy to install and doesn't cost much. Concentration Technology and Smart Eye, for example, use the motion of the eyes of the driver and the head position of the driver to estimate their fatigue level. The use of the alerting system has made our technique much more unique and future-proof.

EXISTING SYSTEM

In the existing system, distraction can be indicated by changes in eye-steering correlation. Eye movements linked with road examining procedures have a low eye steering connection, which can be shown by autocorrelation and cross- correlation of horizontal eye state and the angle of the steering wheel. On a straight road, the eye steering correlation will regulate the connection. Because of the straight route, the steering motion and eye glances had a low association. This system's goal is to identify driver distraction depending on visual behaviour or conduct; thus, it's used to describe the relationship between vehicle control and visual behaviour for that purpose. This approach assesses the eye-steering association on a normal road, assuming that it shall have a comparative and empirically different connection than a curving road and that it will be susceptible to distraction. On curving roads, a high eye steering connection linked with this process has been discovered in the visual behaviour and vehicle control relationship, which reveals a basic perception- control mechanism that plays a major role in driving.

In technology like computer vision, recognizing objects and tracking is one of the important issues. Human-computer interaction, the nature of a person’s recognition, robotics, and monitoring are just a few of the domains where it can be used. The pixel connection between adjacent frames of the video sequence and movement changes of the pixels, according to Lucas, you can use pixel connections between adjacent frames in a video sample and changes in pixel movement to monitor moving targets. This technique, on the other hand, can only recognize a moderate-sized target that moves in between the frames. Based on recent developments in the correlations filter in CV (Computer vision), Bolme introduced the Minimal Outcome Sum of Squared Error (MOSSE) filter, which may give robust correlation filters for tracking the objects. Despite its high processing efficiency, the MOSSE's algorithm accuracy is restricted, and it studies grey info from one phase [1].In computer vision, tracking visual objects is a key topic. It can be applied in a variety of fields, including behaviour identification, human-computer interlink, robotics, and supervision Visual-based surveillance calculates each frame of the image at the target location based on the early state target of the preceding frame. According to Lucas, the relationship in the pixel between each subsequent frame of a video series can be used to track a moving target. On the other hand, this approach can only detect a moderate target that travels across two frames. [3].

OBJECTIVES

The driver's eye is tracked using a real-time eye-tracking system. When a motorist is tired or preoccupied, he or she has a slower reaction time in different driving circumstances. As a result, the chances of an accident will increase. There are three ways to identify tiredness in a driver. One of the major criteria is physiological changes in the body, which can be pulse rate, cardiac activity, and brain messages, which a wearable wristband system can detect. The suggested eye-tracking system achieves the second method through behavioural metrics such as unexpected nodding, eye movements, yawning, and blinking.

The developed system's goal is to achieve the following five primary points:

A-Affordable: The technologies must be affordable, as the cost is one of the most important considerations during the design phase.

Portable: Solution to be mobile and easy to put in place in any kind of vehicle model.

Secure: The system should be secure by ensuring that components are in a safe area.

Quick: Because an accident occurs in a matter of seconds, the reaction and process time to react in the event of a driver's urgency is among the most important variables.

Accurate: Because the system must be precise, we have chosen the most precise among them.

METHODOLOGY

one of the most important reasons for road accidents in the real world has a solution now. The system is one step towards safeguarding precious lives by avoiding accidents in the real world. The proposed system is based on DLIB & SOLVE PNP Models.

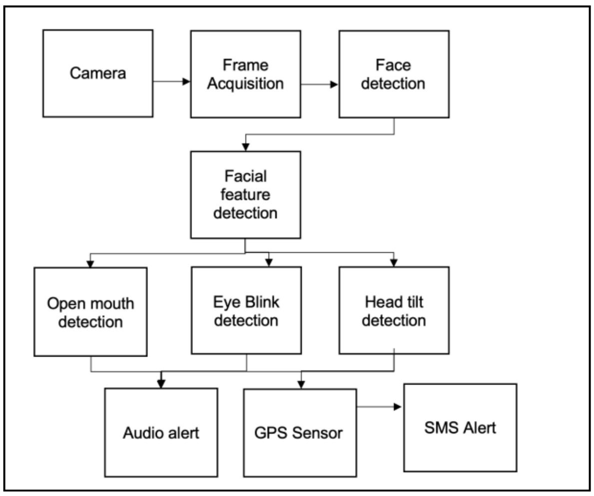

Fig.1 Block Diagram of Proposed System

The camera is initialized at the beginning; frame acquisition is done in the next step by using image classification and object detection. Object detection not only predicts the object (Face) but also finds there location in terms of bounding boxes. After the Frame is acquired, the face is detected in the frame representing bounding boxes. In the next step, we detect facial features, and the eye position, mouth & head is identified by using 68 face point co-ordinates.

Following are the formulae to calculate Eye Aspect Ratio:

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

Following are 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. The Nose Tip: (0.0, 0.0, 0.0)

b. The Jaw: (0.0, -330.0, -65.0)

The left eye's left corner: (-225.0f, 170.0f, -135.0)

The right eye’s right corner: (225.0, 170.0, -135.0)

e. The Mouth’s left corner: (-150.0, -150.0, -125.0)

f. The Mouth’s right corner: (150.0, -150.0, -125.0)

After calculating EAR, MAR & PnP, the system alerts through the speaker if it detects eyes closed for more than 5 secs and measure system also sends an SMS alert to the concerned person including GPS location fetched via GPS sensor.

IMPLEMENTATION

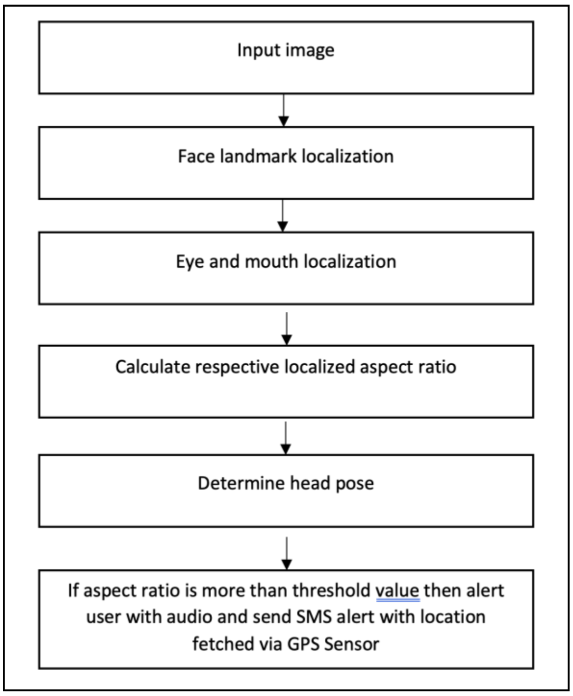

Fig.2 Implementation of the Proposed System

A facial marker is being used to pick out and represent the main facial aspect, such as:

Eye

Eyebrows

Nose

Mouth

Jawline

Alignment of the face, estimation of the head pose, switching

Face prediction problem is a subclass of face landmark detection. In the Given input image, a shape predictor tries to identify significant spots along with a shape of an image. In the field of facial landmarks, we want to employ a shape prediction method for finding important facial structures only by looking at them. Finding facial signs is only two stages:

Step #1: Identify the face.

Step #2: Identify the key facial points on the face Region of interest.

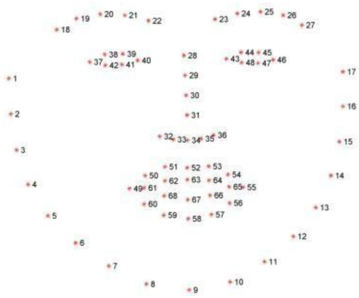

Fig.4 Picture representing the 68 face point coordinates from the iBUG 300- W dataset are visualized.

EYE ASPECT RATIO

Each eye is represented by six (x, y) coordinates that start in the left corner and rotate clockwise around the rest of the area. Eye aspect ratio is a scalar quantity obtained by detecting a face from an image, finding the Euclidean distance of the corresponding eyecoordinates. f the face, detecting blink, and other jobs have all been constructively completed using facial landmarks.

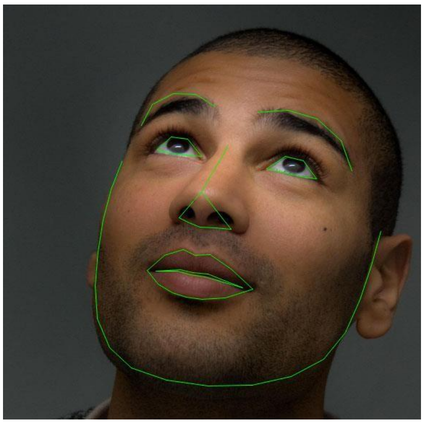

Fig.3 In this image, we used facial landmarks to name and identify essential face features.

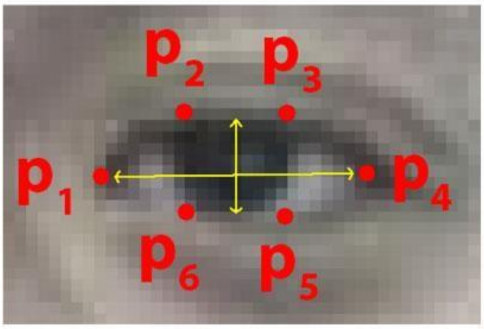

Fig.5 6 facial landmarks related to the eye.

MOUTH ASPECT RATIO

Mouth aspect ratio is a measure to find how wide open the mouth is extended from driver-drowsiness system that detects the yawns.

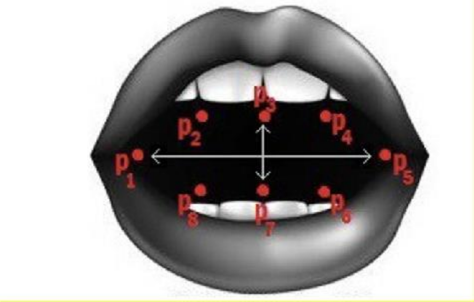

Fig.6 Facial Landmark associated with Mouth

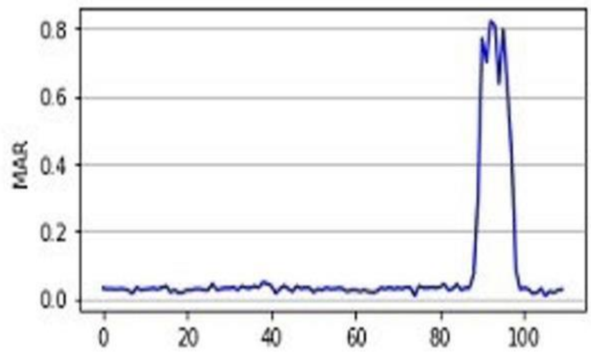

Fig.7 Graphical Representation of yawning

yaw[z]), It is used to express a rotation matrix (3*3), or a rotation direction (axis) and the angle can is used to express it.

VI OUTCOMES

The graph clearly shows that whenever the mouth is closed, the mouth aspect ratio is nearly zero, as in the first 80 frames. The mouth aspect ratio is higher somewhat when the mouth is partly open. However, inform frame 80, the mouth aspect ratio is much higher, indicating that the mouth is completely open, most likely for yawning.

PnP (For Head Tilt Detection)

In computer vision, an object's pose refers to its inclination and location about the camera. You can alter the attitude by shifting the article about the camera or the camera about the item.

A 3D rigid item only has two types of motions regarding a camera.

Translation: Translation is the process of shifting the lens from its present 3 Dimension (X, Y, Z) location to a new 3 Dimension location (X, Y, Z). As you can see, translation has three free points. They can be moved in the X, Y, or Z directions. It is denoted by a vector t which is similar to:

$$(X' - X, Y' - Y, Z' - Z)$$

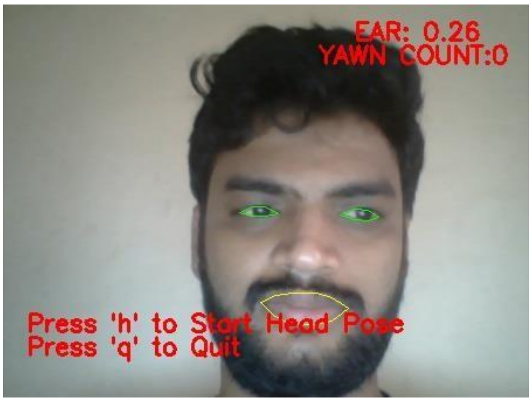

Fig.7 Real-time view through the camera

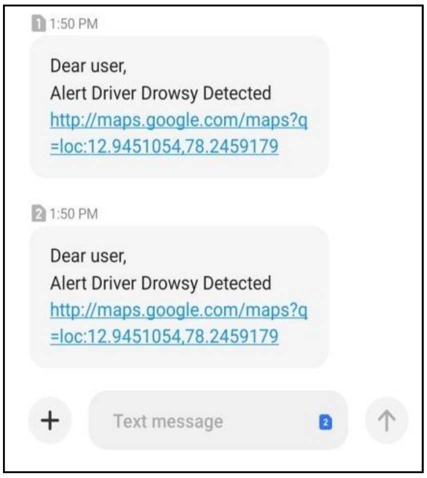

Fig.8 SMS Alert to Concerned Person

5 CONCLUSION

A framework that spreads and monitors the driver's eye Aspect Ratio, mouth Aspect Ratio and head movements is Rotation: The camera can also be rotated around the X, Y, and Z-axis. As a result, there are three rotations in degrees of freedom. Rotation is represented in different ways. Euler angles (roll[x], pitch[y],

designed to detect weariness. The framework utilizes a mixture of layout-based coordinating and highlight-based coordinating to keep the eyes from wandering too far. The framework will certainly determine if the driver's eyes are closed or open and whether he is looking ahead while driving.

A notice indication will be given as a bell or alarm message when the eyes are closed for an extended period. GPS will detect the live location and update. Whenever eyes are closed, continue yawning and the head is tilted will trigger the system to send an SMS alert to provided number ensuring the safety of the driver, people walking on the road, and other fellow drivers.

ACKNOWLEDGMENT

We are grateful to each of the members of the Major Project Committee members of CSE Department REVA who has provided each of us with extensive skilled guidance on research activity.

Finally, we wish to express our deep gratitude to our parents for their constant words of encouragement throughout our studies.

REFERENCES

International Organization of Motor Vehicle Manufacturers, "Provisional registrations or sales of new vehicles," http://www.oica.net/wpcontent/uploads/, 2018.

Wards Intelligence, "World vehicles in operation by country, 2013-2017," http://subscribers.wardsintelligence.com/data-browse-world, 2018.

National Highway Traffic Safety Administration, "Traffic safety facts 2016," https://crashstats.nhtsa.dot.gov., 2018.

Attention Technologies, "S.a.m.g-3-steering attention monitor,"www.zzzzalert.com, 1999.

Smart Eye, "Smarteye," Available online at: https://smarteye.se/, 2018.

Zhang K, Zhang Z, and Li Z et. al, "Joint face detection and alignment using multitask cascaded convolutional networks," IEEE Signal Processing Letters, 2016.

Al-Shammari, N. K., Syed, T. H., & Syed, M. B. (2021). An Edge–IoT framework and prototype based on blockchain for smart healthcare applications. *Engineering, Technology & Applied Science Research*, *11*(4), 7326-7331.

M. Danelljan, G. HÃd'ger, F. S. Khan, and M. Felsberg, "Discriminativescale space tracking," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 39, no. 8, pp. 1561–1575, Aug. 2017.

C. Ma, J. Huang, X. Yang, and M. Yang, "Robust visual tracking via hierarchical convolutional features," IEEE Transactions on Pattern Analysis and Machine Intelligence, p. 1, 2018.

J. Valmadre, L. Bertinetto, J. Henriques, A. Vedaldi, and P. H. S. Torr, "End-to-end representation learning for correlation filter-based tracking," inProc. IEEE Conf. Computer Vision and Pattern Recognition (CVPR), July 2017, pp. 5000–5008.

Y. Wu, T. Hassner, K. Kim, G. Medioni, and P. Natarajan, "Facial landmark detection with tweaked convolutional neural networks," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 40, no. 12, pp.3067–3074, Dec. 2018.

[11] B.D. Parameshachari, H.T. Panduranga, S. liberate Ullo "Analysis and computation of encryption technology to enhance the security of medical. images", IOP Conference Series: Materials Science and Engineering, 925,Article 012028, IOP Publishing (2022)