Smart Alert System for Driver's Drowsiness Detection

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***Abstract*--In recent years, the detection of a sleepy driver has become a necessary procedure in order to prevent any road accidents, possibly globally. The project's purpose is to develop a comprehensive warning system for intelligent cars that can automatically prevent damage caused by a tired driver from occurring. The human body is capable of drowsiness, and it occurs for a variety of causes. In order to avoid the cause of the accident, it is vital to create a powerful warning system.**
Video Stream Processing (VSP) is used in this study to construct a drowsy driver warning system that uses the EAR and Euclidean distance to evaluate video streams in the blink of an eye. Adoption of a facial recognition algorithm can be detected visually as well. Any time the IoT module detects driver fatigue, a warning message is sent out, along with information on the conflicting impact of local knowledge.

Keywords— IoT module, Cloud Server, EAR, Raspberry pi, sensors, GSM module, GPS module, Blink count, Image processing.

I. INTRODUCTION

The mixture of long driving hours, dull road conditions, and inclement weather has contributed significantly to the high number of car accidents caused by exhausted drivers. According to the National Highway Traffic Safety Administration and the World Health Organization, at least 1.35 million people died each year as a result of traffic-related injuries and deaths globally. Inadequate driving is the most common cause of accidents. When the driver is under the effect of alcohol or tiredness, certain circumstances arise. One of the most common causes of driver weariness is an accident. Control of a stolen vehicle occurs when drivers fall asleep behind the wheel. In order to create a smart or intelligent automobile, advanced technologies must be used. An alarm system for drivers is being developed as part of the scope of this work.

In the behavior-based approach, the camera measures the driver's blink, facial recognition, head position, and other factors related to facial significance and Euclidean distance. A voice speaker and an email forwarder assist inform the motorist promptly when he or she is in danger of falling asleep behind the wheel. In order to send an email, an IoT module is used that relies on wireless communication. It is hoped that a computer-sized Raspberry Pi3 and a camera on the Raspberry Pi would be able to detect eye movements during an accident and send an alarm to neighboring emergency wards or owners of hospitals or businesses that are close to the scene of the accident and know its GPS location.

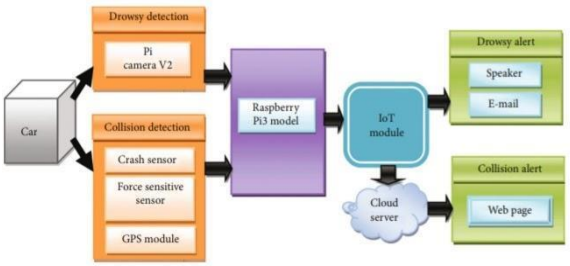

FIGURE 3: The proposed system: drowsy detection to drowsy alert.

Fig. 1. The proposed system

II. LITERATURE REVIEW

Fouzia et al. [1] suggested an eye-blink count-based approach for detecting driver drowsiness. According to this article, tiredness may be identified using the shape prediction algorithm, which catches the eye and also calculates blinking levels in real time, leading to drowsiness detection in real time. An image algorithm is used to analyze image data to acquire eye health data, enabling for non-invasive detection of sleepiness without causing any discomfort or interruption. It may be able to use the same framework to learn more about the driver's drowsiness if they find a driver yawn.

Ratna Kavya M et.al [2] developed an alert system to detect the sleep. An overview of the driver sleepiness problem is presented here in an effort to avoid road accidents. Sleep deprivation and alcohol usage may have contributed to the disaster, as well. The senses and the camera used to continually watch a person help solve these problems. A vibration sensor is attached to the car, which measures and transmits vibrations to the server. Cloud-based storage capacity for driver activities is available on the side. Server-side notification of the driver's location was also provided. Risk of death can be lowered using this method, making it safer for everyone involved. As a preventive precaution, this technique can be utilized to avoid mishaps that could otherwise be avoided due to sleep or

alcohol intoxication. Take safety precautions and put this sort of device in your vehicle for your own safety.

Smart alert systems may be developed using the Eye aspect ratio methodology described by Saravanaraj Sathasivam et al [3]. Based on the results of this study, a system for detecting drowsiness has been proposed. Locating the eyes in a snapshot is the system is an organ system. As a result, the 6 ounces (x, y) local symbols for the new Dlib prediction function are assigned to each eye. A clockwise rotation of the region is followed when the labels are applied, beginning in the lower left corner and working their way outwards. In the meanwhile, there's a correlation between the connections' respective distances from one other. So, the attention ratio, also known as the Eye Aspect Ratio, is the equation in this connection (EAR). As a result, it is most effective during sleep. Use of Sensors like an alcohol sensor and a pulse sensor distinguishing alcohol from heart driver speed can be included in life rate analysis.

Real-time monitoring of the eye's opening and closing rate by S. S. Kulkarni, A. D. Harale, and A. V. Thakur[4] can identify drivers who appear sleepy, which could be due to weariness or drunkenness. Drivers' eyes are detected using the Haar cascade transform here. An embedded device running the Raspbian operating system can collect real images from a digital camera. This embedded system is interfaced serially with microcontroller having RS232 protocol. They have set the alarm threshold to 6 blinks/second. The database which they have considered contains set of eye images which are compared with the real time eye image captured by camera. After a predetermined period, the Raspberry-pi sends an alert to a microcontroller, which either produces a siren or shuts off the relay to prevent the car from moving, depending on the customer's request. Using a GSM module, they were able to send an SMS to the individual whose contact details was already stored in the system.

A method that uses the Eye aspect ratio (EAR) and the Mouth aspect ratio (MAR) to find and evaluate both the eye and the mouth has been proposed for detecting sleepiness in drivers. [5]. The face landmarks have been identified using CV techniques. d-lib, an open-source python package, was used to identify 68 face landmarks. To determine the ocular aspect ratio, real-time EAR was compared to the original EAR. It will alert the driver if the EAR falls below 20% of its original EAR for more than 20 frames. The technique counts the number of yawns to determine the mouth aspect ratio. The aspect ratio of the mouth rises while the mouth is open. The mechanism alerts the driver if the MAR exceeds 20 for more than 20 frames. Here they have used 2 ways of alerting one is via the text message and the another is through the beeping alarm sound. If the driver becomes conscious due alarm beeping, he should give a hand gesture that he is awake. The alarm beeping stops after detecting a hand gesture.

System designed by Praveen Kumar at el.[6] contains three interconnected components. Haar cascade classifier and OpenCV, MQ3 sensor, and piezoelectric sensor are the modules that recognize the driver's weariness and detect alcohol level. Their data collection includes photos of eye samples that have been saved on a Raspberry Pi. Raspberry-pi is attached to the USB port of the camera via which they are recording real time images. These real-time photos are compared to earlier stored images on the Raspberry-pi, which is used to determine a driver's physiological status based on his or her reaction time. If the eye is closed for more than six seconds, a buzzer sounds and the DC motor shuts off, signaling that the vehicle has come to a rest. Using the MQ3 sensor, alcohol can be detected in urine tests. In order to identify alcohol molecules precisely, the sensor is placed in front of the driver's face. Sensors absorb alcohol molecules when they come into touch with them. The buzzer gets louder when there is a greater concentration of alcohol molecules in the air. They have also used a Simple mail transfer protocol (SMTP) which sends an email to the concerned person about the event that has occurred along with the current location.

Mohd Arif Ngasri at el [7]. Developed a video-based micro sleep detection method based on eye aspect ratio. While driving, it is anticipated that this proposed system would be able to detect micro sleep and alert the driver to this. Most typically, the EAR method is used in this proposed study. At any time of day or night, the Haar Cascade face identification algorithm from Open CV is utilized to identify the subject's face in the video. The driver's level of attention may be gauged by glancing at the eye aspect ratio. A driver is deemed drowsy if their eye aspect ratio falls below a certain threshold level.

R Ravi at el [8] in this article, an image processing approach and a cloud-based administration platform are used to construct the suggested system. This system consists of two parts: an alarm system and a rescue system. Image processing is used in the design of the alert system. Using a webcam positioned in front of a driver's face, this suggested system is able to identify tiredness in a car driver by continually photographing their face. In order to make the driver aware, a buzzer is utilized. Even if an accident occurs, the vibration sensor recognizes the accident and the Rescue system is brought into the picture by the vibration sensor. The GPS module sends position data to the Ubidots, which displays that data on a map, so that the ambulance driver may arrive and provide service at the scene of the accident. The MSS app is then utilised by the driver's coworkers to connect.

For the purpose of preventing traffic accidents, Md. Yousuf Hossain [9] has created an IOT-based detecting system. The eye aspect ratio is the primary emphasis of the proposed system. Driver sleepiness may be detected using the EAR, which is a key input parameter for the system. Here, the buzzer serves as a warning to the driver that he or she appears to be falling asleep behind the wheel. The driver's eye is recorded using a pi camera, and the entire system is built using a Raspberry Pi. In terms of developing a smart system that automatically detects sleepy drivers, implemented the technology. Eyelids open, the EAR remains constant, but when the eyelids close, the EAR rapidly approaches zero and then rises again, showing that a blink has actually occurred. In the event that the EAR detects a pattern consistent with a driver's eyes being closed, the drunk driver will be reported for further investigation. Drivers with EAR values greater than or equal to 0.25 are likely to have open eyes. The system has one

fundamental flaw that has to be fixed, and that is its inability to operate correctly at night.

A real-time algorithm developed by Tereza Soukupova and Jan Cech [10] was used to detect eye blinks in a videotape series from a conventional camera shown in the article. When trained on real-world datasets, corner sensors can survive changes in lighting, camera exposure, and face expressions. We demonstrate that the milestones can be identified precisely enough to accurately predict the eye-location. opening's EAR is a single scalar volume that determines the rate at which the eyes open in each frame. The proposed algorithm therefore calculates the corner positions. Short temporal windows of Observance values can be used to identify eye blinks in an SVM classifier. On two typical datasets, the simple algorithm outperforms the state-of-the-art.

Naveen Kumar at el used the proposed framework [11] to continuously assess the driver's eye movement and notify the car driver by cranking the vibrator when they are drowsy. When the eyes have been closed for a lengthy amount of time, this vibration signal is transmitted to the drive. The testing results show that the technology is effective in reducing traffic accidents by spotting drowsy drivers on Open CV terrain with a single camera view. Drowsiness detected using the Proposed System, which uses Image Processing Algorithms to gather information about a person's attention level.

It is easy and adaptable to use a vision-grounded tiredness detection system for the monitoring of machine motorists in motorcars and big trucks. PERCLOS, emulsion, doziness measure likelihood of eyelid check (PERCLOS) assessment, and tiredness position bracket are all components of the system. Bappaditya Mandal, Liyuan Li Gang Sam Wang Jie Lin [12] Researchers were able to demonstrate the system's advantages in terms of delicacy and resilience in stressful driving scenarios by using an oblique camera to examine the driver's face. This system may be able to efficiently cover the attention positions of machine drivers without the need for extra cameras in this system.

Drivers will be alerted when they are drowsy, and the Traffic Division will be able to regulate and avoid any possible incident thanks to Ceerthi Bala U.K. and Sarath TV's proposal [13]. This is a three-tiered framework that is non-obtrusive. It is likely that the core framework will be a sleepiness recognition unit. Driver exhaustion is recognized by the Dashboard unit via the Controller Area Network (CAN). The driver is alerted and frightened by this framework. In order to send a specific demonstration of drowsiness and vehicle location to the IoT stage, the framework uses the third subsystem, the correspondence unit. Using this information, the Road Transport Office (RTO) may determine where the car is. The division can use this information to accomplish its goals.

Gulbadan Sikander at el [14] are the minds of the Driver Fatigue Detection System. This article provides detailed information on tiredness detection studies and current technology. They categorized fatigue as active, passive, and sleep-related exhaustion in this chapter. The term "active fatigue" refers to a state of mental exhaustion that occurs when one is engaged in an activity. Passive exhaustion is brought on by repetitive or boring work. Even if a person isn't weary, a boring activity will take their focus away from what they should be doing. A vehicle's qualities are the basis for the current strategy of recognizing driver weariness, whereas third-party commercial items rely on a driver's physical traits. The suggested paper is broken down into the following five sections. As a starting point, 1.introduces the concept of driver fatigue 2.explains the effects of fatigue on driving performance; 3.demonstrates how the current commercial fatigue detection products are used; and 4.explains the scientific methods used for fatigue detection 5. Each with its own focus: subjective reporting; biochemical properties; physical characteristics; vehicular characteristics; and hybrid characteristics.

Esra Vural, el.al [15] this paper introduces the automatic discovery program for driver drowsiness in the video. The previous methods are fixed speculation about possible drowsiness. The facial expressions of the automatic measuring system were employed to automatically record data behavior during real sleep in this study. In order to better understand the connection between facial emotions and blinking without blinking, have started with this data set. The research also suggests a connection between the driver's drowsiness and headaches caused by their head shifting about as they sleep, according the researchers. It's significant to observe that yawning, a common sign of tiredness, was actually a negative predictor of the 60-second window before an accident. Before going to sleep, it appears that some drivers yawn a bit, but not that much, more frequently. This shows the need of providing instances of tiredness and the situations under which individuals sleep to illustrate a point.

S. E. Viswapriya,Singamsetti el.al [16] An gaze approach of diagnosing drowsiness has been developed in this study. When the eye is sleepy or drowsy, this detects it and sounds an alarm to make you aware of the issues. The Predict and Detection method was used to locate the patient's face and eye area. In order to extract features and apply them in the learning process, a deep neural network of neural convolution is constructed. Drivers are assigned an EAR number based on whether they are up or sleeping. If the model forecasts a continuous state of sleep deprivation, the suggested system correctly recognizes the driver status and alarm alert and alarm notification at Application. Transfer learning will be used in the future to enhance the system's performance. Many accidents will be avoided and the safety of both the driver and the vehicle will be ensured as a result of this. Only in the most costly automobiles can you see the car safety and driver safety systems in action. Driver safety may be applied in regular cars using a drowsy detecting system.

III. CONCLUSION

This study relies upon a variety of papers to create a comprehensive sleepiness-ready framework. While sleepiness discovery generally focuses on the first location, the delayed effect is rarely considered. The proposed framework attempts

to beat this limitation. In addition, a framework for alerting drivers when they are getting fatigued has been devised using the Eye aspect ratio (EAR). When a message alarm sounds, the driver is alerted. The seriousness of the crash is determined independently, yet such a procedure is profoundly disruptive as well as transforms the actual setting. Thus, the proposed framework is utilized to develop a non-intruding strategy for estimating the drowsiness of the driver with the seriousness of crash due to slowing down or disaster. To compute EAR, a Raspberry Pi and a Pi camera module are utilized in this present architecture to collect face tourist places constrained by facial milestone restrictions and then to compute EAR. In contrast, if the value of the calculated EAR esteem rises above a predetermined level, then the eyes remain open and the status of the framework is adversely influenced by this. It will also notify you via email and loud speaker if your EAR value is outside of the acceptable limits. So that the driver is fully informed of any changes, this is done to guarantee that they are fully informed. In addition, sensors with GPS modules are employed to correctly monitor the position of a mishap, therefore alerting the neighboring clinical benefit community to provide crisis finding.

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