Driver Drowsiness Detection and Accident Preventition

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Abstract- Due to tiredness, many accidents happen. It is currently one of the major causes of traffic accidents. According to recent statistics, intoxication plays a major role in many accidents. Numerous people are killed each year in sleepy driving-related car accidents. Drunk driving is a factor in more than 30 percent of accidents. There is need for a technology that can identify tiredness and alert the life-saving driver to prevent this. The proposed system introduces a driver drowsiness programme in this project. In this instance, a webcam is continually watching the driver. The driver's face and eyes are the main subjects of this model's image processing methods. The algorithm isolates the driver's face and forecasts an eyeblink in the eye region. To check if driver is drowsy the system tracks and analyses the faces and eyes of drivers using an algorithm. The device sounds an alert to the driver when the blinking intensity is high.

1. Introduction

Drowsiness of drivers is an important factor in many road accidents. Drowsiness endangers road safety and can lead to serious injuries, resulting in the death of the victim and financial loss. Drowsiness means drowsiness, lethargy, and tired eyes for drivers while using cars. Many accidents in India are caused by the negligence of the driver. Driver performance is deteriorating due to fatigue. To avert this occurrence, we created a system that can detect the driver's tiredness and inform him promptly. This system uses a camera to capture images as just a video feed, recognises faces, and locates eyes. The Perclos algorithm[4] is then used to analyse the eyes for sleepiness detection. An alarm system alerts the motorist for drowsiness based on the results.

Drowsiness is an autonomic nervous system-controlled activity in humans. Drowsiness is defined by Webster's Dictionary as the sensation of being tired and lethargic. Drowsiness detection has been used in disciplines such as individual behaviour analysis, tiredness detection, alertness level measurement, and so on since it is closely related to human focus and activity. Many different approaches for detecting drowsiness have been proposed. These methods are almost classified as insufficient and non-disruptive methods. Inadequate methods involve the installation of body sculpting equipment, while non-invasive methods do not involve the placement of any abrasions that touch the skin immediately.

There are various methods for detecting the driver's tiredness. They are grouped into three groups[3]:

1. Behavioural Parameters-Based Techniques: Driver sleepiness can be measured in this category without the use of non-invasive tools. Analysing a driver's behaviour based on the degree of blindness, frequent blinking, yawning, head position, and facial expressions[2]. The driver's eye blind rate is the current variable used in this system. A vision-based driver tiredness solution is suggested to prevent traffic accidents.

2. Vehicular Parameters-Based Techniques: This category includes, estimating driver fatigue using driving habits. These features include route change behaviour, steering wheel orientation, steering column strength, vehicle velocity variation, along with variety of other features[2].

3. Physiological Parameters-Based Techniques - Depending on the driver's physical condition, this category addresses monitoring driver weariness. These variables include pulse rate, temperature, and many others. These biological traits, among many others, produce extremely trustworthy results because they rely on the driver's biological traits[3].

Each of the techniques has benefits and drawbacks. Depending on the precision of the desired outcome, any approach can be employed. Life involves wearing a device on the body of the driver. The electrodes in this device can detect a driver's heart rate, which could make them uneasy while driving. Additionally, there is no assurance that the driver will utilise these items while always driving, which could produce unsatisfactory results. The style of life is therefore challenging. A car-based approach always focuses on adapting to the driver's circumstances. Additionally, there are restrictions like those caused by the type of vehicle and the ever-changing road conditions. Therefore, it is advisable to utilise a behavioural-based strategy that includes camera-based visual inspection of the driver[5]. The finest alternative that can be used to any car without modification is thus always this technique. Typically, digital image processing refers to the use of a digital computer to process a two-dimensional image. It broadly refers to any two-dimensional data processing carried out by a computer. A set of real numbers characterized by a set of bits make up a digital image[7]. The flexibility, duplication, and preservation of original input accuracy are the key benefits of image processing technology. A pixel is a very tiny piece of the image. Any single value can be associated with each pixel. The pixel value in an 8-bit grayscale picture ranges from 0 to 255. The intensity of the bright light photons at any given time is represented by the pixel values at that location.

Methods such as the conditions for abnormal sleep patterns, while methods such as these are examples of non-disruptive sleep patterns[9]. Most of these solutions, however, face numerous problems. Attacking procedures often require equipment to measure contact with the human body, as well as other hardware. Reliable high-resolution cameras are required to take photographs in a non-disruptive way. Even though many methods produce very accurate findings in controlled laboratory environments, their performance becomes difficult when used in real world conditions in an unrestricted environment.

2. Related Works

Computer theory is the use of computer models to create computer simulations in computer science images. Image processing, such as a paragraph or instruction for digital signal processing, has more important benefits than analogue image processing. It enables the use of a wide variety of algorithms in the input data and can avoid problems such as noise accumulation and signal distortion during processing[10]. Because images are defined in two dimensions, digital image processing can be performed as a multidimensional system.

The driver's face can be in the region of interest (ROI)[11]. An intriguing region can be spotted in the blue rectangle. Finding a green rectangular area in the first frame of the Haar Cascade Classifier that includes length and breadth is the first step in creating a ROI area. After that, a larger rectangle is used to define an area of interest. There are a few processes involved in calculating the ROI, and we should do so for every area of interest. The binary patterns of the local histograms are used in this approach to obtain the face . Making intermediate pictures that describe the actual image in binary format is the first stage in calculating in lbph. The image is transformed into a matrix form, and the limit value must be the average value of the matrix[9]. This value designates adjacent values that can be set to either 0 or 1. The remaining values in the matrix form are not considered and only one value is. Pixels are represented by numbers. This area of the face is accessible.

A vision-based driver tiredness solution is suggested to prevent traffic accidents. The HSI colour model is used to identify the driver's face in the supplied photographs first. Second, as a versatile eye tracking template, the Sobel edge generator is utilized to find eye areas and detect eye images[15]. The eyes' openness or closeness is then determined using an HSI colour model on the detected images to estimate the level of drowsiness of the driver. For the exam's eye tracking and face recognition, four test videos are used. The suggested system is contrasted with expert-labelled data. The accuracy of the suggested system is 88.90%, whereas the standard standard is 99.01 percent.

Road accidents frequently result from driver fatigue. Sarada Devi and Bajaj suggest a driver fatigue programme based on aural analysis and yawn to solve the problem. First, the system uses a cascade of phase training and oral recognition on the input photos to recognise and trace the driver's mouth. Then, using SVM, oral pictures and yawning are learned. Finally, yawning and alertness fatigue are detected by separating the oral regions using SVM[50]. The authors gather certain movies for testing, choosing 20 snaps and much more than 100 normal videos to use as a database. The outcomes demonstrate that the suggested system outperforms a system that makes use of geometric aspects. The suggested method recognises yawning, alerts to early signs of weariness, and improves driver safety.

Finite Element Analysis, a sophisticated system that makes use of a facial database as a pattern and identifies drowsiness based on data from the database, is the current state of the lab. Assari and Rahmati also unveiled a handset Accident-Avoidance system that uses face cues[1]. The physical system uses infrared energy because it has various advantages, including simplicity of usage and the absence of ambient lighting. The system first extracts the position of the facial features from the input photos using the background output method. Following that, the shape of the face is ascertained using horizontal guessing and a matching template. The elements are then tracked using model simulations in the subsequent follow-up phase, and the sleep phenomena is explored utilising the identification of face features from variations in facial characteristics. The device generates a warning when one of the three primary criteria, such as drooping eyelids, yawning, or prolonged eye closure, changes. Tests are done under actual driving circumstances. A webcam is used to take pictures of various persons and varied lighting situations for testing. The findings look on whether the system responds appropriately when the driver's face is reflected in a beard or moustache mirror.

Based on non-disruptive computer concepts, Ahmad and Borolie suggested a Driver Sleep Program. A front-mounted webcam for the driver serves as the program's main component. Both saved simulated target videos and online videos are considered. The camera begins by capturing the driver's head motions and facial expressions. After then, the video is split up into frames, and each frame is handled separately. Using the Viola-Jones algorithm, the face may be extracted from the frame. Then, using a cascade classifier, the essential features—such as eyes, mouth, and head—are eliminated. On the face, a rectangle denotes the area of interest. The primary contributor to tiredness in this situation is eye blinking, which can occur anywhere between 12 and 19 times per minute and typically suggests fatigue when the regularity is less than normal. To determine moderate tiredness, one does not just count eye blinks. Non-zero values are displayed as partially or completely open eyes, and the acquired eye is equivalent to zero (closed eye). The system will alarm the driver if the value goes above the threshold value. Additionally, yawning is regarded as a warning indicator. Videos from both online and offline sources were used in testing on two different platforms. The outcomes demonstrate that the system is up to 90% efficient[33].

Every year more people die because of road accidents related to fatigue. According to a study, about 20% of accidents occur every year with 90 deaths a day due to drowsiness. Drivers who drive continuously will have a chance of fatigue. So, finding drivers' drowsiness and its symptoms can greatly reduce the number of accidents. To reduce this type of risk other image processing methods such as viola jones, Adabooshaar cascade, gobar features, global face recognition. The following are some ways to experience sleepiness

Every year, large numbers of people die in traffic accidents caused by fatigue. According to one study, about 20 percent of all accidents occur annually, with an average death rate of 0.85% each day from fatigue. People who drive too often are more likely to get tired. As a result, detecting and showing driver drowsiness can significantly reduce the number of accidents. Other image processing techniques, such as viola jones, Adaboost, haar cascade, gobar features, and facial recognition, can help reduce these types of errors. Below are some tips to detect fatigue. We classify related work into three categories in this category: those linked to the object recognition algorithm, those related to the facial features identification algorithm, and those linked to driver drowsiness detection methods.

M.A. Assari and M. Rahmati [1] developed a system for detecting driver fatigue by detecting the face using lateral projection in the image and monitoring facial features in the form of a template, which includes nails, eyes, and lips. The algorithm presented was used in the MATLAB (Simulink) simulation area. The addition of IR light as light sources assisted in visual acuity in this system.

Tianyi Hong [2] described a system using a face-based Cascade algorithm trained by Adaboost class dividers. In this program, the development is done using the central representation of the main image to create canny lens processing chains and improve performance. For faster and better calculation results, primitive performance primitives (IPP) were used. The GENE-8310 embedded platform is used to validate this system.

B. Warwick [3] introduced a physical-based system in which the pilot wears a portable biosensor. It is a small device process for obtaining body composition data and transferring it to a smartphone. This data is then processed using FFT and PSD, which reveals the appropriate vectored input of the Neural Network. Researchers are applying this technique to a smartphone app that gets drowsy.

K. Dwivedi [4] created a system that detects driver drowsiness using representative reading. The Haar-like visual system sends images to a deep 2-layer neural network to extract features, which are used to train indirect activation layer separator to determine if the driver is tired or not. This technology has achieved 78% sensible accuracy in detecting fatigue and alerting the driver.

J.J. Yan [5] created a system in which the collected images are converted into greyscale and edge detection is done using Sobel operator. Matching template is used to determine the position of the eyes. Binarization and fast filtering algorithms are used to detect eye conditions, which also ensures the distribution of black pixels on the grey scale. The P80 is used as an important driver body process in this investigation. If the number of black squares is below this level, the driver is considered drowsy.

Visual tracking is an important challenge for computer visibility. It has many uses, including human computer interaction, behaviour detection, robots, and surveillance. Considering the previous state of the object in the frame bar, object detection predicts the location of the object in each frame of the video frame. Lucas [6] said that motion detection can be done by using pixel connections between consecutive video sequencing frames and pixel transitions. This process, however, can only detect medium-sized object moving between two consecutive frames.

With the recent development of computer vision [7], Bolme has introduced the MOSSE filter, which can create strong integrated filters for object monitoring. MOSSE has excellent computer performance, but its accuracy is limited, and it can analyze gray information from a single channel. Li used a link filter, HoG, color-coding features, and a scale conversion technique to improve object tracking. Danelljan tracked an object using HOG and a non-binding filter. When the target targets rotate, SAMF and DSST face the problem of distortion or change of scale. In addition, they face the tracker's inability to track objects fluently and its slow operating speed.

Some researchers have combined machine learning and filtering with the development of an in-depth reading model to monitor cell objectives [8]. Although these methods are more accurate than link-based tracking algorithms, they require more training time. As a result, in the real-world situation, these algorithms cannot monitor an object in real time. The system can monitor a person's face in real time using this method. Identifying facial features. The purpose of identifying an important facial point is to obtain important information about the eyebrows, eye, nose, and lips on the face.

3. Methodology

3.1 System Architecture

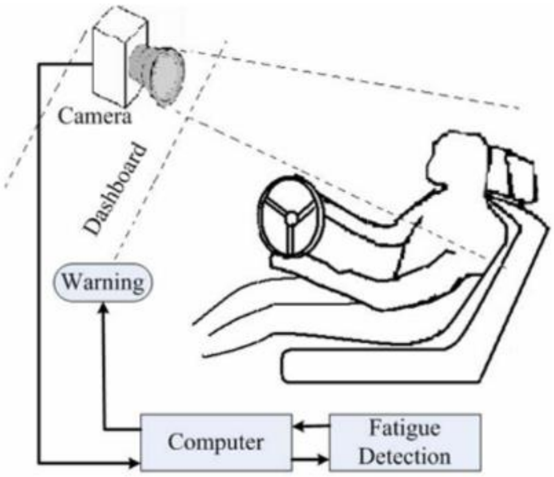

Figure 3.1 : Block Diagram

The system is built so that the driver's face, and thus his eyes and lips, are constantly monitored as shown in Figure 4.1, and if the established levels of attentiveness are detected to be violated, an adequate alarm is triggered, and suitable action is being taken to avoid any fatalities. In Figure 4.2, the system architecture of the designed system is being shown. The camera, Sensors, GPS module and the SIM module are being connected to the raspberry pi. The image from the camera is being sent to raspberry pi and it processes the image. An alert is given if any drowsiness is detected and an SMS is sent if there is any accident or alcohol detected.

3.2 Algorithm used

1. Capture the image of the driver from the camera.

2. Send the captured image to haarcascade file for face detection.

3. If the face is detected then crop the image consisting of the face only. If the driver is distracted then a face might not be detected, so play the buzzer.

4. Send the face image to haarcascade file for eye detection.

5. If the eyes are detected then crop only the eyes and extract the left and right eye from that image. If both eyes are not found, then the driver is looking sideways, so sound the buzzer.

6. The cropped eye images are sent to the hough transformations for detecting pupils which will determine whether they are open or closed.

7. If they are found to be closed for five continuous frames, then the driver should be alerted by playing the buzzer.

8. Cut the 3/4th portion of the face image and send it to haarcascade file for mouth detection.

9. If the mouth is not detected, it indicates a yawn and so, the driver needs to be alerted by playing the buzzer.

10. Repeat the above procedure continuously in a rapid loop if the car is moving.

4. Implementation

This section outlines how to implement the program. That is a system that can detect when a driver is drowsy and prevent accidents by spotting alcohol. Implementation is a process of transforming a new system design

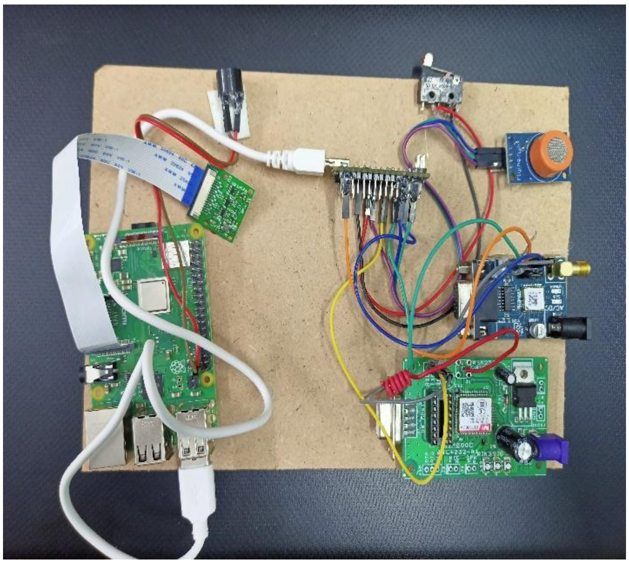

Figure 4.1 : Proposed System Hardware connection

into a function. It is an important step in achieving a successful new system. It should therefore be well planned and controlled. System implementation is done after the completion of the upgrade attempt.

The hardware connections for the driver drowsiness detection and accident prevention system is as shown in the Figure 4.1. The camera is being connected to the raspberry pi, which continuously monitors the drivers face and sends the video to the raspberry pi. The Raspberry pi identifies the eyes and mouth of the driver and runs the program to detect if the driver is drowsy or not. If the driver is drowsy it send the signal to the buzzer so that the buzzer rings and alert the driver.

The GPS system is also being connected to the raspberry pi along with the pressure sensor and alcohol sensor. When the pressure sensor detects some pressure, it means that there is some accident occurred and it immediately sends the SMS alert to the registered mobile number. The same procedure happens if there is alcohol detected.

4. Results and Discussions

The code was used and the following results were recorded in a convenient location for most people and the detection of fatigue was tested positively. According to the stepwise algorithm, the images of the pilot were taken and processed continuously as it appears.

4.1 Results

1. Image has been captured by camera and saved to memory.

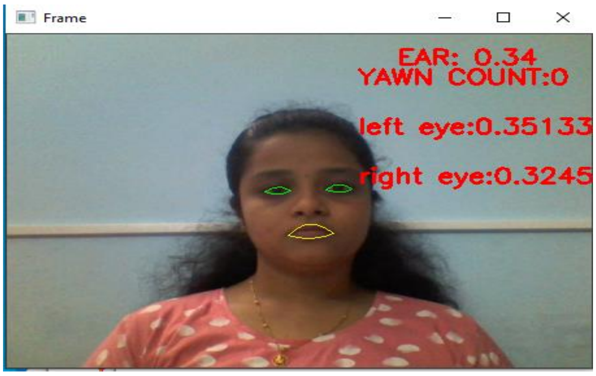

Figure 4.2 : Face detection

2. Face Detection is performed and it is checked whether face is detected or not. This is done by passing the image through Haar Cascade. If face is not detected, it means the driver is not looking in the right direction and hence it is considered as a condition of fatigue and needs to be alarmed about.

3. As the next step, if the face has been detected in the earlier step, then the image is processed to check for eye detection using Haar classifier. Thus, the pair of eyes are detected for being the input for the next step.

5. Once the eyes have been detected, the part of the face that contains the eyes is cut so that only

this large image is re-processed using Houg's transformation to determine if the eyes are found open or closed. For this purpose, each eye is examined independently. The efficiency of the system can reach up to 90 percent in normal light conditions. However, the system may give erroneous results when the lighting level drops. Therefore, when the system was tested on different people as drivers for different lighting conditions and 100 samples, the accuracy was higher in better light and when one had no spectacles and other visible obstacles associated with the acquisition of the face, eyes. and mouth.

6. After the eye and mouth is being detected the number of yawns will be counted. As a when the driver yawns it will be counted. As we can see in Figure 4.2, the yawn count is 0 but in Figure 4.3 the yawn count is 3

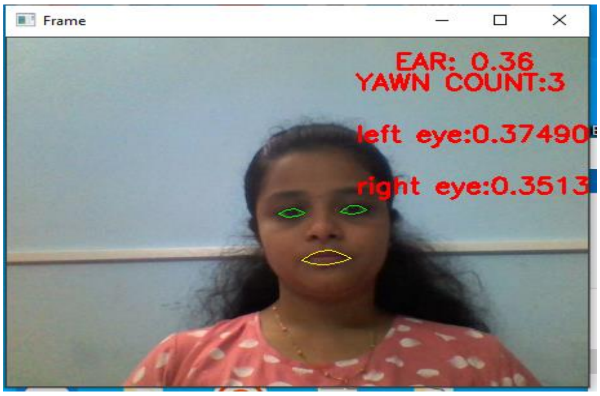

Figure 4.3: Yawn count

7. When the driver is drowsy, the system gives an audio alert message stating that “You are drowsy, please wakeup”

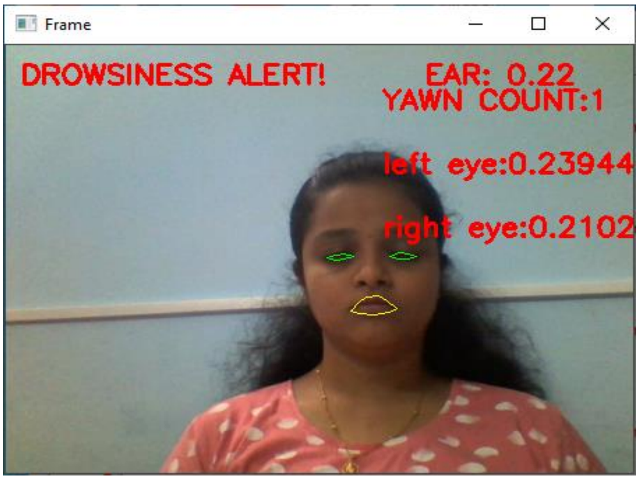

Figure 4.4: Audio Alert Message when drowsiness detected

7. If any accident is being detected then the system sends a message to the registered mobile number along with the location where the accident has occurred as shown in Figure 4.5

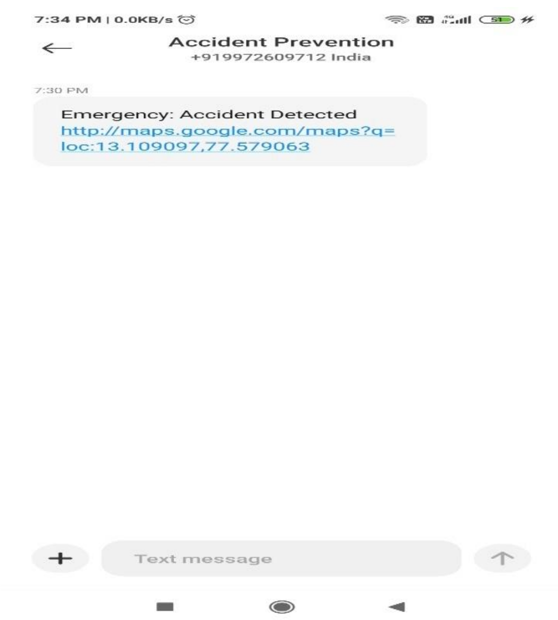

Figure 4.5: SMS alert when accident detected.

8. If the driver is drunken, and there is any alcohol identified in he surroundings then there is an intimation given to the vehicle owner as an SMS alert (Figure 4.6)

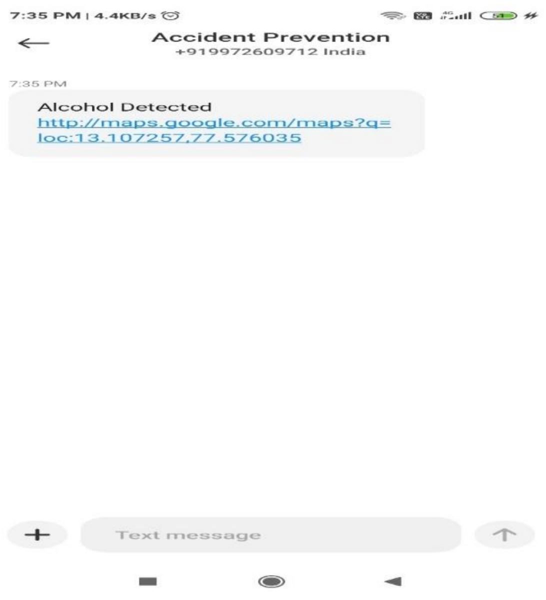

Figure 4.6: SMS alert when alcohol detected

4.2 Future Enhancement

In the future, this system will focus on accelerating the operating system to improve accuracy. This idea can also be developed to offer a cost-effective answer for large trucks. Driving at night can be challenging owing to poor lighting, which is a significant issue that requires addressing. This rule should also be applicable to bearded men who wear sunglasses. The scope of the future requires that this regression be modified. The adaptability and functionality of the vehicle when the buzzer is off may also require more effort. When used extremely cautiously, this can aid in lowering the number of traffic accidents. The offsite terminal may be informed of the driver's weariness or the vehicle speed may be lowered.

5. Conclusion

Driving a drowsy person can be as deadly as driving under the influence of alcohol. Drowsiness of the drivers not only puts them at risk, but it is dangerous for everyone on the road. Drivers who were sleepy and fatigued delayed their responses and made worse choices. In this article, we discuss the creation and application of an innovative driver diagnostic tool that alerts the driver when they are drowsy. we believe that drowsiness can adversely affect people in the workplace and in the classroom. Although sleep deprivation and college go hand in hand, drowsiness at work especially when working with heavy machinery can cause serious injuries like what happens when you drive while drowsy. Our solution to this problem is to build a recovery system that identifies key sleep factors and triggers a warning if someone is drowsy before it is too late. The results of this work can lead to the development of real products that can save many lives and avoid many road accidents. In addition, our results can be widely used in any situation where people should not sleep: from applying to the most important areas of equipment to everyday use.

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