JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Driver Alertness Detection On Real Time Face And Eye Recognition

[1]Dr. Sulaiman Syed Mohammed, Dilip Kumar M[2], Gagana G[3], Galla Gireesh[4], EarannaRaju C[5], DhurWahidQuadri[6],

[1]Associate Professor, [23456]Student, Department of Computer Science and Engineering, Presidency University (Deemed to be University), Karnataka. Bengaluru, India.

Abstract: This paper is an overview of research that was done in the field of computer engineering to create a system for detecting driver drowsiness in order to avoid accidents caused by fatigued or sleepy drivers. A restricted implementation of the numerous strategies that are discussed in the thesis-es on the subject was addressed in the novel along with results and solutions. In the current state of traffic, the document addresses the many methods for detecting weariness and their effectiveness in averting accidents. The report also summarises the authors' observations in order to support further optimisation in the concerned area and produce the utility with greater effectiveness for a safer road.

Key words: Driver weariness; eye detection; yawn recognition; blink frequency; and fatigue while driving.

1.INTRODUCTION

Humans have always created tools and devised methods to make life easier and safer, whether for routine tasks like getting to and from work or for more intriguing ones like aviation. Our dependence on transportation increased tremendously as technology continued to progress. Our lives as we know them have been significantly impacted by it. Even our grandparents couldn't have imagined how quickly we can now travel. Today, practically everyone uses some kind of transportation every day. While some people are wealthy enough to buy a car, others go by public transportation. Regardless of their socioeconomic standing, drivers are nevertheless subject to certain laws and codes of behavior. One of them is continuing to be active and awake while driving.

Every year, thousands of fatalities are linked to this magnificent innovation because we neglected our obligations to promote safer travel. To most people, it can seem insignificant, yet adhering to traffic laws and regulations is crucial.

The most powerful object on the road is an automobile. When used carelessly, it can be harmful and occasionally endanger the lives of other road users as well. Not acknowledging when we are too sleepy to operate a vehicle is one form of irresponsibility. Numerous scholars have written research papers on driver neglect to track and stop a catastrophic effect from such carelessness. Not acknowledging when we are too sleepy to operate a vehicle is one form of irresponsibility. Plenty of researchers have written research papers on driver sleepiness detection systems in an effort to monitor and stop a disastrous outcome from such irresponsibility. However, sometimes the system's observations and points are not precise enough. Therefore, this review is being produced to provide information and a different viewpoint on the research conducted, in order to improve their implementations and further optimise the solution.

Our most recent numbers show that 148,707 persons perished in car-related incidents in India alone in 2015 [1]. At least 21% of these accidents were brought on by tired drivers making mistakes [1, 2, 3]. This number may even be lower given that, among the several factors that can cause an accident, weariness is sometimes severely underrated as a contributing factor. In developing nations like India, fatigue paired with poor infrastructure is a prescription for disaster.

Due to the nature of fatigue as a safety issue, no nation in the world has yet made significant progress in addressing it. Contrary to alcohol and drugs, which have obvious key signs and tests that are simple to obtain, fatigue is typically exceedingly difficult to measure or detect. The most effective ways to address this issue are likely to be raising awareness of incidents linked to driver drowsiness and encouraging them to admit it when necessary. Since the latter is impossible without the former due to the former's difficulty and higher cost, as well as due to the former's high financial benefit, long hours behind the wheel. The earnings associated with a job rise as the need for it rises, which encourages an increase in the number of individuals who take the position. In operating a vehicle at night, this is true. Money induces reckless behavior in drivers, such as night time driving despite exhaustion. This is primarily a result of the drivers themselves being unaware of the enormous risk involved with driving while fatigued. Although several nations have placed limits on how long a driver can operate a vehicle

2. LITERATURE SURVEY

A survey done by National Highway Traffic Safety Administration estimated that there were 56,000 sleep related road crashes in the U.S.A in 1996. Another survey done in 2007 says that 18% of accidents involved fatigue as the main factor. In Britain up to 20% of serious road accidents were caused due to fatigue. Similarly, survey done by the Road and Traffic Authority states that in the year 2007, fatigue contributed to 20% of accidents caused on road. Accidents due to drowsy was prevented and controlled when the vehicle is out of control. Also, the drunken driving is detected by using alcohol detector in the vehicle. The term used here for the identification that the driver is drowsy is by using eye blink of the driver.

These types of accidents occurred due to drowsy and driver could not be able to control the vehicle, when the driver wakes. The drowsiness was identified by the eye blink closure rate through infrared sensor worn by driver by means of spectacles frame. If the driver is in drowsy state, then the system will give buzzer signal and the speed of the vehicle was reduced and the obstacle sensor is used to sense the adjacent vehicle to avoid collision with that, and if there is no vehicle in left adjacent side then the vehicle move to the left side of the road by auto steering and controlling and vehicle was parked with prior indications. In the recent years, many researchers worked on these devices and few approaches have been reported .

One of the suggested methods is to monitor the movement of the vehicle to detect drowsiness of the driver. However this method has limitations as the results are influenced by the type of vehicle and the condition of road. Another method is to process the electrocardiogram (ECG) signals of driver. This approach also has limitations as ECG probes shall always be connected to the driver‘s body. That would disturb the driver. Few researches tried to assess the fatigue factor by monitoring the eye blink rate of the driver. Successful detection of eye blink rate has been the interest of many researchers proposed methods based on combination of projection and the geometry feature of iris and pupil. T.D Orazio and Z.Zhang use the fact that the iris and pupil are darker than skin and white part of the eye.

Y.Lei proposed an algorithm based on the cascade AdaBoost classifier. T.Hong, a gray level image of an eye is converted to a binary image, using a predetermined threshold. Then, based on the number of black and white pixels of this binary image, state of the eye is determined.

The algorithm presented by Ms. Devi used the Hough Transform to detect the iris and to determine openness of the eye. Some researchers are based on the projection of the image, to determine the state of an eye. Z. Liu the vertical projection of the image of both eyes is used. The horizontal projection image of an eye is used to determine the interval between eyebrows and eyelids and to recognize the state of an eye. The horizontal projection of the image of a face is calculated to determine state of an eye.

Some works also are based on "Support Vector Machine" (SVM) classifier. The SVM classifier is used to detect state of the eye. F Smach used SVM classifier and Gabor filter to extract eye characteristic. In the above methods, the authors used some conditions which make some difficulties in the eye state recognition. The system detects the fatigue symptoms of the driver which consists of an eye blink sensor for driver blink attainment and an adaptive speed controller designed using stepper motor for providing actual positioning of the throttle valve to adjust the speed of vehicle. Advanced technology offers some hope to avoid these up to some extent. This paper involves measure and control of accidents by using both alcohol sensor and IR sensor.

It uses remotely located charge-coupled-device cameras with active infrared illuminators to acquire video images of the driver. Various visual signs that typically characterize the level of alertness of a person were extracted in real-time and systematically combined to infer the fatigue level of the driver. The visual cues employed characterize eyelid, gaze, head movements and facial expressions. A probabilistic model was developed to model human fatigue and to estimate fatigue based on the visual cues. The simultaneous use of visual cues and their systematic combination earns an accurate fatigue characterization. This system was validated under real-life fatigue conditions with the human subjects of different ethnic backgrounds with or without glasses; and beneath different illumination conditions. It was found to be reasonably reliable, and accurate in fatigue characterization.

The computer vision based method of Seshadri determine if a driver is holding a cell phone close of his/her ears using the Supervised Descent Method (SDM) which it tracks some facial landmarks to extract a crop of regions of interest (ROI) (the driver‘s ear region). Features are extracted from the ROIs and the phone usage is detected using previously trained classifiers. The system can be processed in near real time. The approach of Yang send beeps of high frequency through the car sound equipment, network Bluetooth, and use software running on the phone for capturing and processing sound signals. The beeps are used to calculate the position where the cell phone is, and then we know when the driver (or another passenger in the car) is talking on it. The proposal achieved a classification accuracy of more than 90%. This approach works with hands-free usage, but it depends on the operating system and mobile phone brand, and the software has to be continually enabled by the driver.

3. PROPOSED METHODOLOGY

Authors of several study publications have offered a variety of approaches for successfully identifying driver weariness. Accurate face and eye detection for the purpose of detecting weariness can be achieved using the Python OpenCV package. This makes the system very simple to use, but it also makes the face detection process incredibly slow. This method can be made at least twenty times faster using various strategies, such as examining changes in successive frames to recognise face and eyes [6]. The entire drowsiness detection procedure can be made considerably more reliable [7] by using a method for human eye recognition that employs the Circular Hough Transform (CHT) for precise iris detection. The centre and radius of the iris are determined using CHT, which is crucial for determining the distance between the eyelids. Another technology employs video data to analyse the mouth and eyes for mouth monitoring and eye tracking to better gauge driver fatigue. Because only brightness can differentiate faces with varied complexions, the two components of YCbCr are Both luminance (EyeMapL) and chrominance (EyeMapC) can aid in better facial complexion detection because after luminance is removed from the Eye Map, it is much easier to distinguish between faces with various skin tones. To determine whether the eyes are open or closed, colour spaces like the HSV graph are employed. This information is then used to calculate the PERCLOS parameter, which is used to determine tiredness. Structural Similarity Measure SSIM), which performs better than any other standard metrics, can be used to detect eyes. By examining sleepiness levels, detection with this outcome provides information that aids in determining whether the alarm should be set.

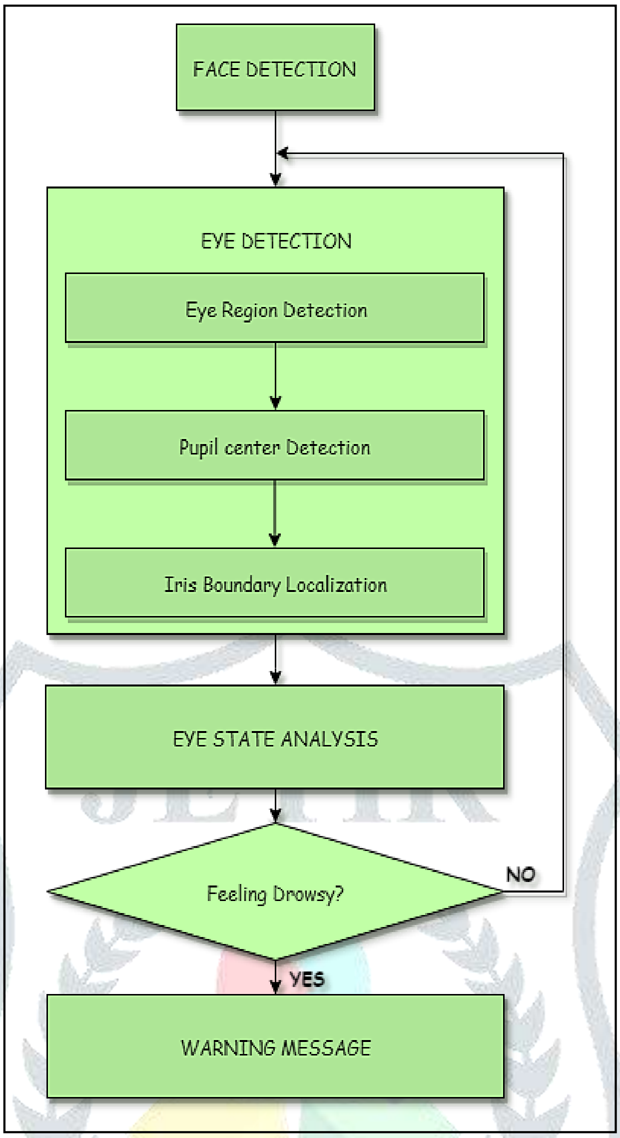


Figure 1: The mentioned system for alertness detection [16].

4. RESULTS

Modern technology must be used in non-intrusive, precise methods for a higher acceptance rate in order to offset the impacts of sleepiness. There is a tonne of research for putting such methods into practise. Many pieces of software, such as TensorFlow and OpenCV, are available that can assist in the recognition of faces and their many components, making the implementation of fatigue detection simpler. To determine drowsiness, there are methods like tracking the space between your eyes over time. Others include things like gaze detection and blinking rate. If a person yawns repeatedly, the next step is to watch their mouth for signs of weariness. Other methods involve tracking vehicle data to identify the driver's sleepiness. It involves erratically moving the steering wheel, sharp turns, abrupt acceleration or slowdown, lateral lane position, etc.

For the purpose of sleepiness detection, the following approaches and findings are explained in detail:

1) A technique based on eyelid movement
2) Analysis on eye state using the Circular Hough Transform (CHT)
3) Yawning and closing of eyes
4) Analysis of Open/Closed Eyes
5) A. Technique based on eyelid movement

Eyelid movement-based techniques can identify faces and eyes more quickly than conventional methods, which speeds up the entire fatigue detection procedure [9]. The process of detecting eyes and faces is twenty times faster when using motion information to trace the face in addition to mask matching and diamond searching techniques. This method focuses on the drivers' eyelid movements to assess their level of weariness. There can only be one of the driver's four eyelid states in two consecutive frames.

The four eyelid states are:

1) Totally closed condition
2) Fully opened condition
3) Partially opened condition
4) State that is partially closed.

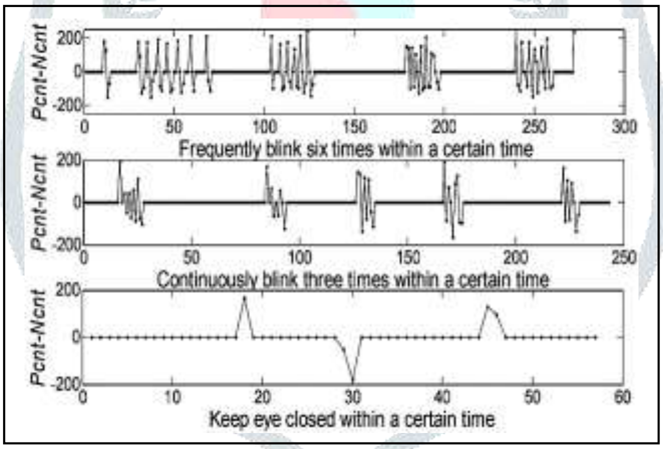
Sclera, iris, and eyelid are the three components that make up an eye. Each of these components may be easily differentiated when two consecutive frames are viewed and the temporal difference image is created. As a result, the latter two states of the eyelids can be distinguished by monitoring the transition of the eyelids from a closed to an opened state or from an opened to a closed state in accordance with the shift in the iris's colour gradient from dark to light (Ncnt) or from light to dark (Pcnt), respectively [6]. If a black peak appears during an eyelid movement before a brilliant peak, it means that the eye's condition altered, first opening from a closed position before closing. The formula below can be utilised to determine the present condition of the eyes.

The state of the eyelids serves as a basis for several metrics used to assess a person's level of sleepiness. These criteria are:

1) The length of time that the eyelids are closed is determined by the various peaks of the Pcnt and Ncnt curves. Following a comparison with a predetermined threshold, it is employed in the calculation.

2) Constant eye blinking groups: These are also determined by the various Pcnt and Ncnt curve peaks. The presence of more than two continuous groups may indicate that the driver is fatigued.

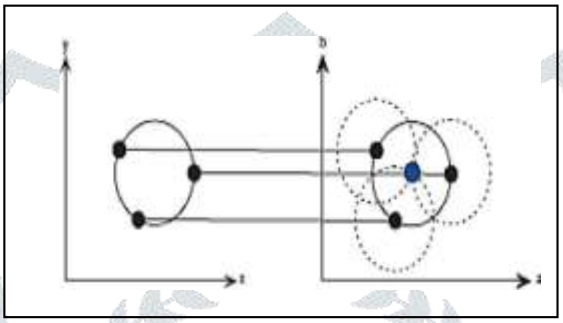
3) The frequency of eyelid closure is a crucial factor because it is one of the main ways a driver shows signs of fatigue. The motorist could try to flutter their eyes faster to awaken if they just started feeling sleepy. The driver may blink less frequently if they are exhausted for a longer amount of time.



Normal human blinking occurs every 6–10 seconds lasting 0.15–0.30 seconds, with a maximum of 2 blinks each moment. A person has a good probability of being drowsy if they disobey any of these rules.

Due to its simplicity and rapidity, this technique can be applied in real-world situations. However, due to the obvious flaws in the thesis itself, accuracy is not mentioned in the study and cannot be evaluated without thorough trials. The driver's mouth movement, which might lead to numerous irregularities, is not taken into consideration by this technique. The precision of the findings will decline with altered head positions. Additionally, any background movement of any kind may bring about erroneous positives. As this method uses a very good algorithm for eye detection but not for face or mouth detection, more research is required to improve drowsiness detection. Work needs to be done to address the aforementioned constraints in order to achieve the goal of a perfect driver sleepiness detection system.

B. Analysis of eye status using the Circular Hough Transform (CHT) The Circular Hough Transform (CHT), which can be used with any video-capturing equipment, including a driver-cam and even a webcam, was designed to do analysis of the status of eyes at various movements. This method suggests using the Circular Hough Transform to more precisely identify eyeballs [10]. In this process, the face is initially retrieved using face detection methods like the SVM algorithm [11], which Blake created and Bakir subsequently improved [12]. Second, the eyes are positioned specifically to prevent any mistake with other facial features that move. This is accomplished by using the gradient image to emphasise the edges. To detect above, lower, left, and right are now detected using horizontal and the eyes and the right edge of the face are now separated [7]. A fresh edge detection method that takes into account the shape of the eye was proposed by Alioua [7]. It recognises the eye by comparing the colour differences between the pupil, iris, and sclera. The iris is exceptionally brilliant and surrounds the extremely dark sclera. This aids in the precise identification of eyes. A threshold pixel value is chosen that is dark enough to be inside the sclera's pixel intensity boundary while yet retaining a significant contrast from the iris' pixel intensity. In order to determine whether or not the pixels to the left and right of the identified sclera pixels are iris-related, they are now tested to see if they are bright or not. The chosen pixel forms if all the requirements are satisfied with the sclera's right or left edge.



The suggested method for eye condition analysis is quite accurate in identifying both eyes and other eye structures. When used to sleepiness detection, this technique can reduce the incidence of false positives. However, because it relies on cameras, this method only works well in well-lit environments or with equipment that has a good low-light camera. Different head positions will further decrease the results' accuracy because the system is camera-based. Additionally, this method demands a lot of computer resources to operate due to its complexity. However, given sufficient lighting and processing capacity, it offers more accuracy than most traditional approaches for recognising eyes, as measured by the Kappa Statistic, Confusion Matrix, and Correct Classification Rate. According to the Confusion Matrix and Kappa statistics, respectively, and [7], the average accuracy is 99%. Although the findings show consistency in face detection, the aforementioned constraints make this algorithm ineffective for preventing accidents caused by fatigue. C. Combining yawning with eye closure In order to accurately determine the driver's level of sleepiness, two elements must be combined in this section. The accuracy in detecting the driver's condition of tiredness is lower because the aforementioned strategies only analyse the components separately. However, it is logical to infer that the driver's state is certain when several elements are combined [8]. By detecting and integrating two parameters, i.e., eye closure rate and yawning rate, in the repeated sequential frames, this technique raises the certainty that the driver is tired. This leads to a more accurate assessment of the drowsy state because yawning and increased eye closure are signs of weariness. A recognition system can use fusion in three different ways:

- Feature recognition system
- Stages 2 and 3 of the decision-making process After the decision-making process is complete, the state alert is either turned ON or off depending on the outcome of the detecting procedure [8]. Making decisions is a part of the process overall. Depending on the outcome of the detection process, the status alert is either turned ON or off after the decision-making process is complete [8]. Decision-making is a part of the entire process.

There are three detection categorization levels used by this technique;

1) Level 1 - ALERT: The eye blinks with the bare minimum frequency rate, and there is no sign of yawning. The eyes close for little more than a second, and the facial features are normal.

2) Level 2 - SEMI-DREAMY: There is some yawning and an increase in the frequency of eye blinked.

3) Level 3 - DROWSY: Closed eyes and rapid yawning are both noted. A high-alert area is this.

Utilizing a variety of parameters, such as eye closure detection and yawning, this method makes use of the subtle movements that the human body makes to detect fatigue. However, the method is difficult to implement due to its complexity, and because it is based on a camera, head rotation and poor lighting may further reduce accuracy. In addition, combining factors may result in the processing of redundant data from the combined input, resulting in even more inconsistent results. However, when compared to the other methods discussed in this paper, it may result in greater accuracy. Although M. Omidyeganeh does not specify the accuracy of the method in light of the various standards, a database containing 450 images of 27 distinct individuals reveals an accuracy of 98%. M. Omidyeganeh did not check the aforementioned limitations because the images used were of people looking straight into the camera. The highly accurate result indicates that, at least for people looking directly into the camera, this method is superior to the majority of techniques currently in use for detecting drowsiness. To have a framework with practically no vulnerability in tiredness location further work should be finished.

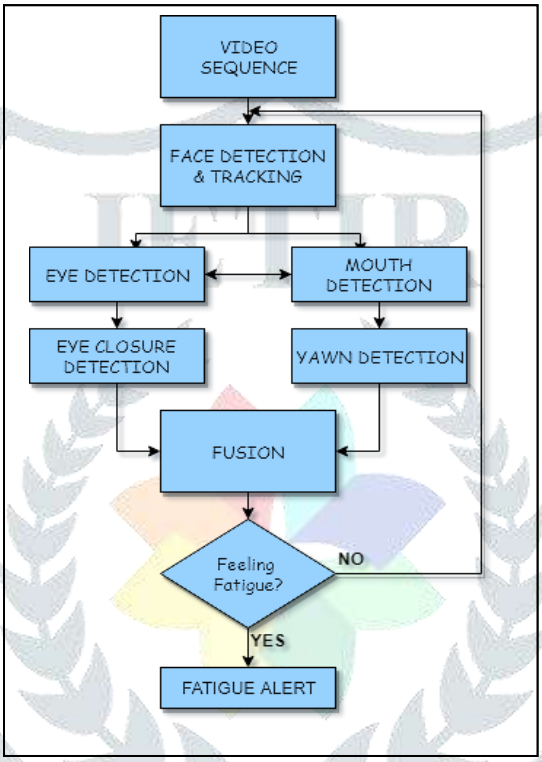


Figure 3: Driver alertness system using yawning and eye closure [8].

Because various skin tones have the same chrominance components and simply differ in brightness, they may represent varied complexity more accurately than RGB. Additionally, it is more difficult to distinguish faces using RGB since it does not support brightness to the same extent as YCbCr. Face analysis is now used to identify eyes, and Eye Map theory is used to localise the pupil centre and iris boundary. All of this is doable with a simple camera. Eye Maps of two different types—EyeMapC for chrominance and EyeMapL for luminosity—are combined to create a single eye map. EyeMapC is created using:

$$EyeMapC = \frac{1}{3}\{C_b^2 + (C)_r^2 (\frac{C_b}{C_r})\}$$

Chrominance Eye Map formula

Here, Cb and Cr represents the chrominance component of the Y$CbCr$ curve. ($\tilde{C}r$) represents 255-Cr and all the different components are reduced to be in the range of [0,255]. The other Eye Map called EyeMapL is of luminance which when multiplied with EyeMapC produces the required Eye Map which is used to detect eyes. This process is not time-consuming as it requires some basic calculations [16]. After the eye region is detected Top Hat filter [17] is applied and then the intensity image is converted into a binary image using N. Otsu's method [18]. Now, the needed EyeMapL can be constructed using:

$$EyeMapL = \frac{Y(x,y) \oplus se(x,y)}{Y(x,y) \ominus se(x,y) + 1}$$

Luminance Eye Map formula

In which if the system detects the drowsiness will be sent through telegram bot so that the driver could analyse at what time he feels drowsiness while driving in the results and conclusion.for the future enhancement we could add a near by hotels beside the roads that he could find easier to get sleep if he feels the symptoms of drowsiness.

5. CONCLUSION

In this study, we investigated various methods that might be used to analyse eye-states in order to detect driver fatigue. All of the unique strategies for identifying eyeballs are briefly described in this study along with a step-by-step explanation of how they work. Based on the accuracy of the results and a real-world scenario, it also discusses the benefits and drawbacks of the various strategies. Since there is currently no dataset available for the various strategies, it is nearly hard to truly compare the outcomes of the various techniques for the real world. This paper discussed the significance of the findings reported by many writers and their relevance to the quest for the ideal sleepiness detection method.

This problem deserves a workable answer since it is a real one, not just one that is thought to exist. There are some methods available to detect driver drowsiness, as the paper has discussed, but each has its own shortcomings. Therefore, research must be conducted in order to develop a better solution for this problem that has a better implementation of a driver drowsiness detector with high accuracy.

In order to find a solution that will help to reduce and ultimately eradicate this problem, we intend to conduct more study in this area in the future. In order to improve road safety, a low-cost device that can detect sleepiness has been developed.

REFERENCES

[1] "TRAFFICACCIDENTS,"2015.[Online].Available:http://ncrb.gov.in/StatPublications/ADSI/ADSI2015/chapter1A%20traffic%20accidents.pdf

[2] M. Ruikar, "National statistics of road traffic accidents in India," J Orthop Traumatol Rehabil 2013, vol. 6, pp. 1–6, 2013. [Online].Available: http://www.jotr.in/text.asp?2013/6/1/1/118718

[3] T. A. Dingus, S. G. Klauer, V. Neale, A. Petersen, and Virginia Tech Transportation Institute, Co-Sponsors: National Highway Traffic Safety Administration and Virginia Department of Transportation, "The 100-car naturalistic driving study," 2006.

[4] Q. Ji, Z. Zhu, and P. Lan, "Real-Time Non-intrusive Monitoring and Pre- diction of Driver Fatigue," IEEE Trans. Vehicular Technology, vol. 53, no. 4, Jul.2004, pp. 1052–1068.

[5] S. Chokroverty, "Overview of sleep & sleep disorders," Indian J Med Res 131, pp. 126–140, 2010. [Online].Available: http://medind.nic.in/iby/t10/i2/ibyt10i2p126.pdf

[6] D. Liu, P. Sun, Y. Xiao, and Y. Yin, "Drowsiness Detection Based on Eyelid Movement," in 2010 Second International Workshop on Education Technology and Computer Science, Wuhan, and others, Ed., Wuhan, 2010, pp. 49–52.

[7] N. Alioua, A. Amine, M. Rziza, and D. Aboutajdine, "Eye state analysis using iris detection based on Circular Hough Transform," in 2011 International Conference on Multimedia Computing and Systems, Ouarzazate, 2011, pp. 1–5.

[8] M. Omidyeganeh, A. Javadtalab, and S. Shirmohammadi, and eye closure," in 2011 IEEE International Conference on Virtual Environments, Human-Computer Interfaces and Measurement Systems Proceedings, Ottawa, ON, 2011, pp. 1–6.

[9] D. Liu, P. Sun, and Y. Yin, "How to Speed-up an Embedded Face Detector?" 2009.

[10] R. Duda and P. E. Hart, "Use of the Hough transformation to detect lines and curves in picture," pp. 11–15, 1972.