Real time driver drowsiness detection with alert system and location tracking

Gangadhara Reddy Velagala
Department of Computer Science
Vellore Institue Of
*Technology,*TamilNadu,India

Niwedita Kumari
Department of Computer Science
Vellore Institue Of
*Technology,*TamilNadu,India

Vaibhav raj goel
Department of Computer Science
Vellore Institue Of
*Technology,*TamilNadu,India

Ibin M Biju
Department of Computer Science
Vellore Institue Of
*Technology,*TamilNadu,India

M.Sai Kaushal
Department of Computer Science
Vellore Institue Of
*Technology,*TamilNadu,India

Pramod Kumar Maurya
Assistant Professor Sr.Grade1
Department of Computer Science
Vellore Institue Of
*Technology,*TamilNadu,India

***Abstract*—** Road accidents in India and all over the world have been a major problem for a very long time. Thousands lose their lives and millions of people lose a livelihood annually because of road accidents. Fatigue, which causes drowsiness among other factors, is a key contributor to road accidents.
This paper would like to throw some light on how we could use computer vision for detecting drowsiness and present accidents by alerting drivers at an early stage, and also sending out messages to authorities and family member to receive a response as soon as possible resulting in decreasing fatality rate even if an accident happens which could be due to the malfunction of the vehicle of the alert system. This paper will try to provide with a system which would be cost effective and scalable, making vehicles safer to operate.

***Keywords*—** *Euclidean distances, image processing, Eye aspect ratio, alarm system, location detection.*

I. INTRODUCTION

In the 21st century, driver drowsiness has continued to be a significant challenge contributing to a considerable number of accidents on roads. In India, driver drowsiness, especially among long-distance truck drivers who are public service vehicle drivers and private vehicle drivers, is a significant concern. Despite taking several measures, the Government had failed to rectify the problem. Steps like checking whether the driver is drunk and many other actions are considered but are unable to acknowledge the problem. A few systems are available in the market; however; their cost making is high, making the driver lost his hope to purchase these systems. Therefore, we are needed to come up with affordable solution for lower middle class keeping in mind to also address the accidents associated with drowsiness in public service vehicles.

II. MOTIVATION

A. Technical

Manual approaches seem difficult and cannot be accurate measures to prevent traffic road accidents. Manuals approaches are based highly on the human perception of the situation, but this will not be that useful. The police use this manual technique to check and limit the numerous people who are drunk and driving. Several characteristics including no alcohol in the blood of the driver during an accident, vehicle run off the road or at the back of another, no signs of breaking, car have no mechanical defects, pleasant

weather with clear visibility and even the police officer at the ground suspects drowsiness to be the cause can be the pointers of sleepiness related accidents. The above techniques, however, cannot be used in traffic road accident prevention. Instead of all the manual process, technical solutions will be highly useful, and it makes the work is easy and effective. Hence, to prevent an accident resulting from drowsiness a method for detecting and measuring sleepiness need to be developed. It will make it possible to warn the driver, slow the vehicle or even halt the car if the driving situation demands.

B. Economical

A few systems are available in the market; however; their cost making is high, making the driver lost his hope to purchase these systems. Hence, there is a great need to provide a drowsiness detection system that is affordable to the many who are low-income earners and also public service vehicles to help address the many accidents associated with drowsiness. Hence, automatic detection of the driver's drowsiness is critical for all this to be achieved.

C. Demographic feasibility

The National Highway Traffic Safety Administration estimates that drowsy driving was responsible for around 72,000 crashes, 44,000 injuries, and 800 deaths in 2013. However, these numbers are underestimated and up to 6,000 fatal crashes are caused by drowsy drivers every year. Secondly, according to the National Highway Traffic Safety Administration, every year, about 100,000 police-reported crashes involve drowsy driving. These crashes result in more than 1,550 fatalities and 71,000 injuries. The real number may be much higher, however, as it is difficult to determine whether a driver was drowsy at the time of a crash. Thirdly, exhausted drivers who doze off at the wheel are responsible for about 40% of road accidents, says a study by the Central Road Research Institute (CRRI) on the 300-km Agra-Lucknow Expressway.

III. LITERATURE SURVEY

[1] This paper purposes to address the issue by creating an experiment to calculate the level of drowsiness. A requirement for this paper was the utilisation of a Raspberry Pi Camera and Raspberry Pi 3 module to calculate the level of drowsiness. The frequency of head tilting and blinking of the eyes was used to determine whether the driver felt drowsy or not. With an evaluation of ten volunteers.

Drawbacks:
Since the raspberry pi costs more, the poor people cannot afford to pay the cost for this equipment.

[2] This paper raises that some drivers might have imbalanced eye blinking rate due to medical issues and from the other side, some drivers may have high yawning rate while they have fully driving attention. In this paper, an online face monitoring system was installed and a large list of eyes area features was extracted in spatial and frequency domain including two new features which are circularity and black ratio. For support vector, machine classification models were developed based on combinations of the relevant features.

Drawbacks:
Since this is based on the machine learning, it takes a lot of time for the existing dataset to load and high processing time.

[3] Paper proposes a driver drowsiness detection algorithm based on the state of eyes of the driver which is determined by his iris visibility has been implemented. If eyes remain in one state either open or closed longer than expected time as well as if the driver is not looking straight front, it is an indication that driver is drowsy and then the system warns the driver. The system is capable of detecting the state

of eyes with or without the regular glasses. Matlab with image processing tools has been used to process the image provided by a camera. Matlab creates System Object using the Viola-Jones algorithm to detect the objects such as nose, mouth or upper body. After capturing an image, rectangular eyes area was adjusted to reduce the noise. RGB to Grayscale and finally to Binary image conversion is with a suitable threshold value. A median filter was used to reduce the noise and then the image was smoothened. The drowsiness detection is done based on the conditions like Black to White pixels ratio, several pixels in the column greater than the threshold value and eye's shape. Light and position of the driver play an important role. The system can be set to self-learn at start-up to set up threshold values.

Drawbacks:
This just detects the driver and issues a signal but it do not indicate their family members in case of any tragedy.

[4] This paper proposes drowsiness detection based on driving behavior. It talks about the method that is used in simulated driving environment with help of eye tracking mechanism and analyzing brain patterns using EEG (electroencephalogram), but as this method would be impractical to implement. So, this paper discusses a quite unique way of detecting driver behaviors by tracking changes in various input parameters, which is consisted of longitudinal acceleration, steering angles, lateral acceleration and many more.

Drawback:
Here since we are using different parameters to detect drowsiness, like, combination of accelerations in lateral and longitudinal directions, steering angles combined with lateral and longitudinal acceleration, steering angles only, longitudinal acceleration only, and lateral acceleration only, we attain varying accuracy level that seems to be distributed. We can say so because the sensors that are deployed will provide little preview information. Without sufficient preview information, , the vehicle cannot improve its tracking performance when it travels at high speeds in particular. Also, using a small dataset is not considered a good option as the result can differ majorly since huge dataset delivers better results.

IV. PROPOSED METHODOLOGY

Drowsiness is one of the underlying causes of driving accidents, which contribute, too many road fatalities annually. We have n number of methods to detect the level of drowsiness which are mainly based on image processing which is fast and carries more precision in terms of the resulting output when compared to other methods. In this paper, we are inclined to use image-processing techniques in order to detect the drowsiness in a driving simulator.

From the perspective of a user, the user or the stakeholder needs an active and prolonged working device in the form of an alarm or simulator by his side that can help in accidents prevention. For example, in this case, we have our stakeholder as truck drivers. What they need is a kind of alarm that helps him to be awake while driving and hence avoid unforeseen situations like road accidents.

This setup includes a camera which takes an image of eyes as an input. It is meant to capture the frame of the eye and the facial expressions using Eye Aspect Ratio based on the Euclidean distances obtained from the indexes of the eye indexes obtained from the face landmarks. The system takes a basic look of processing the images and hence detection of eyes and complete face recognition that leads to the detection of drowsiness. Now after getting the frame of the image, processing of the images is done using converting to Grayscale from the image obtained.

When the image has detected features like the proper eye being either closed or opened or a number of eyes detected, then we check the standby status of the eye image detected. If it is in the standby status, the loop of this eye image detection is done again. But if the image detected in not in the standby mode, we check the eye state. If the eye status is normal, as well as the frequency of the eye detected closed is less than that of opened eyes, then again we carry out the normal loop of eye image capture. But if it's

not, that is, the frequency of the eye detected closed is more than that of open eyes, this results in a conclusion that the driver is in a tired state and is fatigued. Hence the driver is in a drowsiness state.

Also, there may be a situation that the driver may not be excessive tired and is able to drive the vehicle properly. This is considered to be a normal state here and hence we can again get back to the loop of taking eye images again. But if the driver is in a high state of fatigue and is trying to drive the vehicle in an inappropriate manner that can generally lead to accidents, then a warning sign in the form of an alarm is introduced.

The alarm continues to pop up until and unless the truck is not stopped, that is, the engine is made to a halted/stopped state. This determines that the driver has stopped the vehicle and that he is aware of his senses and hence the alarm stops ringing. Then this application is closed. The application starts functioning as soon as the engine is switched on and continues to aid in the further journey of the driver. Also, adding to this setup, we have also made an implementation that is meant to notify atleast 3 family members if the drowsiness takes place along with the location of the driver, if the drowsiness takes place for a longer time.

The innovation or novelty of this methodology lies in the using the feature of vibration or sound of the engine that triggers the functioning of the alarm based detection of driver drowsiness. Besides this, we have the feature of image extraction basically the eye image captured during the ride of the vehicle. Also, the calculation of the aspect ratio of eyes opened to eyes closed can aid in making this paper to be novel and also notifying the family members regarding the drowsiness is also been novel.

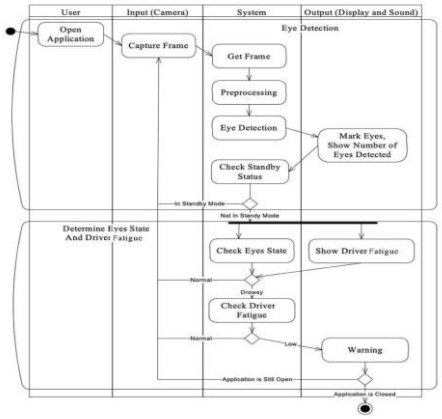

Fig 1. Activity Diagram

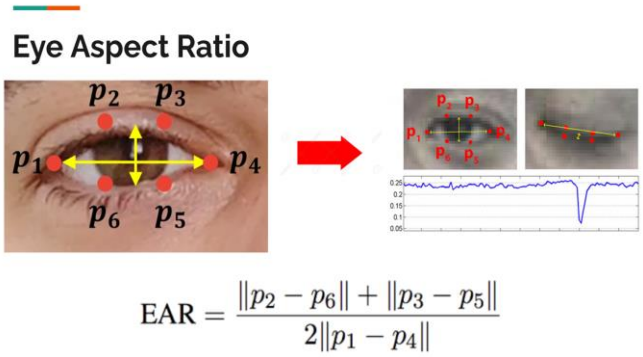

Fig 2. Eye Aspet Ratio

V. RESULTS

Fig 3.1 Frame capture for active driver

Fig 3.2 Frame capture for drowsy driver

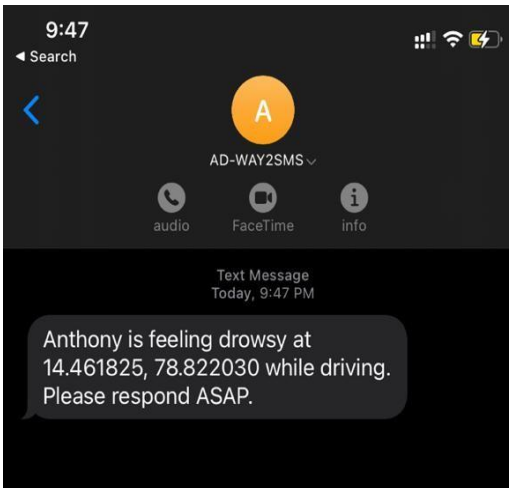

Fig 3.3 Message received to registered contacted on drowsiness detection

We obtain the latitude and longitude values such that if someone copy pastes in Google then we will get the map location of the driver.

VI. CONCLUSION

In this paper, a low cost, real time driver drowsiness monitoring system has been proposed. Here, visual behaviour feature like eye aspect ratio is computed from the image captured by a webcam. This model uses the feature of vibration or sound of the engine that triggers the functioning of the alarm based detection of driver drowsiness. This model also notifies the family members if the drowsiness takes place for a longer time. The short training phase makes the system robust and adaptive. In other words, the proposed system is also used efficiently for various individuals with different face and eyelid

behaviors. Experiments show that the accuracy of the proposed method for extracting the symptoms of driver fatigue and distraction is incredibly good. Additionally, the system can estimate the person/driver fatigue and distraction fine by subjective evaluation.

VII. FUTURE SCOPE

This model can be improved with the use of various other parameters like blink rate, state of the vehicle and yawning etc., If all these parameters are used then the accuracy will improve a lot. This same model and the techniques can be utilized in many other uses like Netflix or prime video or any other streaming service can detect if the user is asleep and stop playing the video accordingly. It can also be used in other applications which prevents the user from sleeping.

REFERENCES

[1] Khunpisuth, O., Chotchinasri, T., Koschakosai, V., & Hnoohom, N. (2018). Driver Drowsiness Detection Using Eye-Closeness Detection. 2018 12th International Conference on Signal-Image Technology & Internet-Based Systems (SITIS). https://ieeexplore.ieee.org/document/7907537

[2] Hussein, W., & El-Seoud, M. S. A. (2017). Improved Driver Drowsiness Detection Model Using Relevant Eye Image's Features. 2017 European Conference on Electrical Engineering and Computer Science (EECS). https://ieeexplore.ieee.org/document/8412031

[3] Kahlon, M., & Ganesan, S. (2018). Driver Drowsiness Detection System Based on Binary Eyes Image Data. 2018 IEEE International Conference on Electro/Information Technology (EIT). https://ieeexplore.ieee.org/document/8500272

[4] CharlotteJacobé de Naurois ChristopheBourdin "Detection and prediction of driver drowsiness using artificial neural network models" Accident Analysis & Prevention Volume 126, May 2019, Pages 95-104

[5] Lukas Bier Michael Emele Kaja Gut Jasna Kulenovic David Rzany Max Peter Bettina Abendroth "Preventing the risks of monotony related fatigue while driving through gamification" European Transport Research Review December 2019

[6] Rateb Jabbara*, Khalifa Al-Khalifaa, Mohamed Kharbeche "Real-time Driver Drowsiness Detection for Android Application Using Deep Neural Networks Techniques" The 9th International Conference on Ambient Systems, Networks, and Technologies (ANT 2018)

[7] Vibin Varghese1, Amritha Shenoy1, Sreeram Ks1, Remya K P "Ear Based Driver Drowsiness Detection System" IOSR Journal of Engineering (IOSRJEN) www.iosrjen.orgISSN (e): 2250-3021, ISSN (p): 2278-8719PP 93-96Emerging Research Trends in Electrical Engineering-2018 (ERTEE'18)

[8] Ch Venkata RamiReddy, U. Srinivasulu Reddy, D Mahesh Babu "An Automatic Driver Drowsiness Detection System using DWT and RBFNN" International Journal of Recent Technology and Engineering (IJRTE)ISSN: 2277-3878, Volume-7, Issue-5S4, February 2019

[9] ARUN D PANICKER and MADHU S NAIR "Open-eye detection using iris–sclera pattern analysis for driver drowsiness detection" Sa¯dhana¯Vol. 42, No. 11, November 2017, pp. 1835– 1849

[10] Singh Himani Parmar, 2Mehul Jajal, 3Yadav Priyanka Brijbhan "Drowsy Driver Warning SystemUsing Image Processing" INTERNATIONAL JOURNAL OF ENGINEERING DEVELOPMENT AND RESEARCH"

[11] Ameen Aliu Bamidele, Kamilia Kamardin, Nur Syazarin Natasha Abd Aziz, Suriani Mohd Sam, Irfanuddin Shafi Ahmed, Azizul Azizan, Nurul Aini Bani, Hazilah Mad Kaidi(2019) Non-intrusive Driver Drowsiness Detection based on Face and Eye Tracking (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 10, No. 7, 2019

[12] Anna Liza A. Ramos, Jomar Christian Erandio, Dean Hur T. Mangilaya, Nathaniel Del Carmen, Erika May Enteria, Leonilo Jean Enriquez (2019) Driver Drowsiness Detection Based on Eye

Movement and Yawning Using Facial Landmark Analysis International Journal of Simulation: Systems, Science and Technology DOI 10.5013/IJSSST.a.20.S2.37

[13] CHAO ZHANG, XIAOPEI WU, XI ZHENG, AND SHUI YU Driver Drowsiness Detection Using Multi-Channel Second Order Blind Identifications(2019)2019 IEEE Digital Object Identifier 10.1109/ACCESS.2019.2891971

[14] MUHAMMAD RAMZAN, HIKMAT ULLAH KHAN, SHAHID MAHMOOD AWAN, AMINA ISMAIL, MAHWISH ILYAS, AND AHSAN MAHMOOD4 A Survey on State-of-the-Art Drowsiness Detection Techniques 2019 IEEE Digital Object Identifier 10.1109/ACCESS.2019.2914373

[15] WANGHUA DENG AND RUOXUE WU Real-Time Driver-Drowsiness Detection System Using Facial Features 2019 IEEE Digital Object Identifier 10.1109/ACCESS.2019.2936663

[16] Anis-Ul-Islam Rafid, Amit Raha Niloy, Atiqul Islam Chowdhury and Dr Nusrat Sharmin, A Brief Review on Different Driver's Drowsiness Detection Techniques, I.J. Image, Graphics and Signal Processing, 2020, 3, 41-50 Published Online June 2020 in MECS (http://www.mecs-press.org/) DOI: 10.5815/ijigsp.2020.03.05

[17] Hanojhan Rajahrajasingh, DRIVER DROWSINESS DETECTION USING MATLAB, International Journal of Engineering Applied Sciences and Technology, 2019 Vol. 4, Issue 7, ISSN No. 2455-2143, Pages 80-87 Published Online November 2019 in IJEAST (http://www.ijeast.com)

[18] K Adi, A P Widodo, C E Widodo, A B Putranto, S Naqiyah and H N Aristia, Detecting driver drowsiness using total pixel algorithm, OP Conf. Series: Journal of Physics: Conf. Series 1217 (2019) 012036

[19] R. Prem Kumar, M. Sangeeth, K.S. Vaidhyanathan, Mr A. PandiaN, TRAFFIC SIGN AND DROWSINESS DETECTION USING OPEN-CV, International Research Journal of Engineering and Technology (IRJET).Volume: 06 Issue: 03 | Mar 2019

[20] Sukrit Mehta, Sharad Dadhich, Sahil Gumber, Arpita Jadhav Bhatt, Real-Time Driver Drowsiness Detection System Using Eye Aspect Ratio and Eye Closure Ratio,2019, SUSCOM.

[21] Thomas Kundinger, Nikoletta Sofra and Andreas Riener, Assessment of the Potential of Wrist-Worn Wearable Sensors for Driver Drowsiness Detection, MDPI, Sensors 2020, 20, 1029; DOI:10.3390/s20041029

[22] Pramodini A. Punde; Mukti E. Jadhav; Ramesh R. Manza(2017) A study of eye-tracking technology and its applications. 2017 1st International Conference on Intelligent Systems and Information Management (ICISIM) https://ieeexplore.ieee.org/document/8122153