EYE BLINK MONITORING FOR DROWSINESS DETECTION

A Mini - Project Report submitted in partial fulfilment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

Submitted by

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GITAM INSTITUTE OF TECHNOLOGY

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DECLARATION

We, hereby declare that the Project review entitled "**EYE BLINK MONITORING FOR DROWSINESS DETECTION**" is an original work done in the Department of Computer Science and Engineering, GITAM Institute of Technology, GITAM (Deemed to be University) submitted in partial fulfilment of the requirements for the award of the degree of B.Tech. in Computer Science and Engineering. The work has not been submitted to any other college or University for the award of any degree or diploma.

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BONAFIDE CERTIFICATE

This is to certify that the project report entitled **"EYE BLINK MONITORING FOR DROWSINESS DETECTION"** is a bonafide record of work carried out by **HARSHAL PATEL (121710313019), M KIRAN MAI (121710313032), B RAHUL (121710313005) and J PRUDVI RAJ (121710313021)** submitted in partial fulfilment of requirement for the award of degree of Bachelors of Technology in Computer Science and Engineering.

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TABLE OF CONTENTS

LIST OF FIGURES

1. ABSTRACT

Our safety is the first priority while travelling or driving. One mistake of the driver can lead to severe physical injuries, deaths and significant economic losses. Every year, many people lose their lives due to avenue accidents worldwide, and drowsiness is one of the fundamental motives of avenue accidents. Driver drowsiness is one of the major causes of traffic accidents. It is a serious highway safety problem. If drivers could be warned before they became too drowsy to drive safely, some of these crashes could be prevented. To reliably detect the drowsiness, it depends on the presentation of timely warnings of drowsiness. To date, the effectiveness of drowsiness detection methods has been limited by their failure to consider individual differences. And demise fatigue and microsleep at the user controls are frequently the root purpose of serious accidents. Again, preliminary signs and symptoms of fatigue can be detected before a critical scenario arises. Consequently, detection of driver's fatigue and its indication is ongoing research subject most of the ordinary strategies to become aware of drowsiness are primarily based on behavioural factors. Faces contain information that can be used to interpret levels of drowsiness. Many facial features can be extracted from the face to infer the level of drowsiness. These include eye blinks, head movements and yawning. However, developing a drowsiness detection system that yields reliable and accurate results is a challenging task as it requires accurate and robust algorithms. A wide range of techniques has been examined to detect driver drowsiness in the past. The recent rise of deep learning requires that these algorithms be revisited to evaluate their accuracy in detecting drowsiness. By employing photo processing techniques, the machine is successful of detecting facial landmarks computes EAR (Eye Aspect Ratio) and eye closure ratio ECR to realize driver's drowsiness primarily based on adaptive threshold computer mastering algorithms have been employed to take a look at the efficacy of the proposed strategy empirical effects reveal that the proposed model is capable of achieving accuracy of 84% using the random woodland classifier.

2. INTRODUCTION

2.1 Drowsiness

Drowsiness is an aspect of fatigue which is perhaps easiest to define. Drowsiness can be defined as the neurobiological need to sleep, resulting from the physiological wake and sleep drives. The average person needs 8 hours of sleep every 24-hour cycle. Sleep before work is the most prominent factor influencing the waking state and the driver's level of alertness. Knowledge of the causes of driver fatigue is important for deciding on appropriate counter-measures. Brown (1994) identified 5 general causes of fatigue in general and driver fatigue in particular:

- Lack of sleep or poor sleep
- Internal body clock
- Time-on-task
- Monotonous tasks
- Individual characteristics including medical conditions

Besides the quantity, the quality of sleep is also of great importance. If sleep is regularly interrupted, it leads to daytime fatigue, as is the case of too little sleep. The quality of sleep is influenced by, among other things, sleeping disorders, e.g., sleep apnoea (a temporary breathing stoppage while sleeping) and narcolepsy (the tendency to suddenly fall asleep).

According to experts in sleep disorders, drivers, who do not sleep for at least 5 hours a day, are 15 instances extra in all likelihood to motive avenue accidents than these with a wholesome sleep pattern. Many current AP and Telangana accidents have been linked to the driver feeling drowsy just earlier than the dawn. A majority of road mishaps manifest between 3 am, and 5 am.

10% of road accidents are due to lack of sufficient sleep or fatigue. About 2.3 lakh of the 23 lakh road mishaps every year are linked to feeling sleepy.

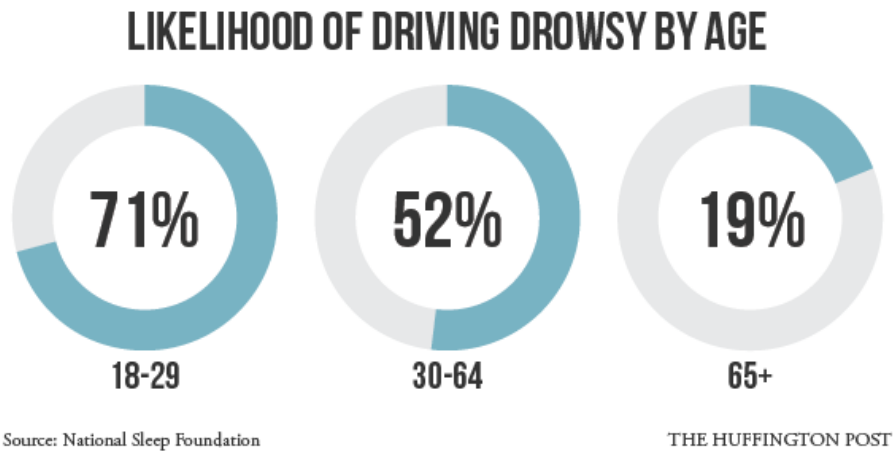
How can drowsiness be prevented?

A regular amount of sleep each night can often prevent drowsiness. Most adults require about eight hours of sleep to feel fully refreshed. Some people may need more, especially those with medical conditions or a particularly active lifestyle.

Talk to your doctor as soon as possible if you experience any changes in your mood, signs of depression, or uncontrollable feelings of stress and anxiety.

2.2 Accidents due to drowsiness

- 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.
- The finding rings the alarm bell on how Indian highway motorists ignore the importance of taking adequate rest and end up endangering lives.
- In a country where road accidents claim nearly three lives every minute, the report related to sleepy drivers has underlined the need for educating highway motorists about the importance of taking frequent breaks and proper sleep for safety.
- Head of CRRI's traffic engineering and safety division Subhash Chand Kaushal said, "While analyzing the reasons behind accidents on the Agra-Lucknow Expressway, we found that 40% of the incidents can be attributed to drivers dozing off at the wheel."
- A bulk of the accidents that we studied took place between midnight and 4 am and in the post-lunch period of between 3 pm and 6 pm," he added.



3. LITERATURE SURVEY

The Author Jayasenan J. S and Mrs Smitha P. S in their paper, explained four methods to detect drowsiness:
(1) sensing of physiological characteristics,
(2) sensing of driver operation,
(3) sensing of vehicle response,
(4) monitoring the response of the driver.
The first two methods are accurate but expensive and need many sensors like a brainwave sensor, which cannot be used. Whereas, methods like sensing vehicle responses and monitoring the driver responses is a good method and implementable.
Author Mrs S. Dhanalakshmi, J. Jasmine Rosepet, G. Leema Rosy, M. Philominal said that machine is an important part of detecting the face localizing the eyes. Still, it is more important to train the machine efficiently to detect the eyes and drowsiness effectively.
Non-intrusive machine vision-based drowsy driver detection system in which images are used to detect eye position and eye blinking and eye blink frequency to calculate drowsiness detection can work perfectly and save the lives of many people. Various papers show that using SVM can make the system robust but increases the complexity of the system.
An identical existing system uses the adaptive driver for the detection of the drowsiness. Truck drivers, company car drivers and shift workers are the foremost in danger of falling asleep while driving. Majority of the accidents occur thanks to the drunkenness of the driving force. The burden of which lies on the corporate owner as they're made liable. It can cause economic loss. during this presentation we present an adaptive driver and company owner alert system and an application that gives driving behaviour to the corporate owner.
A Computer vision machine that can robotically notice driver drowsiness in a real-time video stream and then play an alarm if the driver seems to be drowsy. By using Real time eye blink detection landmarks.
They are two important techniques in computer vision machine:

- Facial landmark detection
- Eye aspect ratio

If the eye aspect ratio indicates that the eyes have been closed for a sufficiently long enough amount of time, we'll sound an alarm to wake up the driver or the student.

4. PROBLEM IDENTIFICATION AND OBJECTIVES

Driver drowsiness is one of the main causes of road accidents around the world. Even though many road safety products and protocols are designed to prevent road accidents due to driver drowsiness. Most of them are either very expensive or produce false alarms or are not available easily in India.

4.1: Aim

- The aim is to design a system that will detect drowsiness and take necessary steps to avoid accidents or warn about the fatigue. The drowsiness detection system, being implemented in this project, aims at being easily available and feasible, and can be implemented in different types of vehicles or meetings.
- In this eye blinking rate and eye closure duration is measured to detect drowsiness.
- This challenge is to enhance a driver drowsiness detection laptop computer through the utilization of histogram analysis. It is viewed that a driver is below drowsiness influences thruway of attainable of looking out at the eyelid. Based on the preceding research, there is none used histogram for analysis.
- The cease result can be no longer right due to the reality histogram assessment analysed the entire image.

4.1: Objectives

This project's sole purpose is to detect fatigue through eye blink monitoring and warn the person about the same. In the case of a drowsy driver, we can alert him/her to take the necessary precautions.

- Warn drivers to avoid road accidents drowsy driving is dangerous, causing accidents that kill or injure thousands of people every year.
- Determine a person's behaviour in the meeting.

APPLICATIONS

IN CARS TO DETECT FATIGUE

- Drowsiness can be defined as the neurobiological need to sleep, resulting from physiological wake and sleep drives.

IN OFFICE MEETING /ZOOM MEETING:

- Stress at work or personal life
- Lack of interest in topics being discussed
- Environment: too cold/warm meeting rooms, lack of fresh air.

5. SYSTEM METHODOLOGY

5.1.1 FLOWCHART

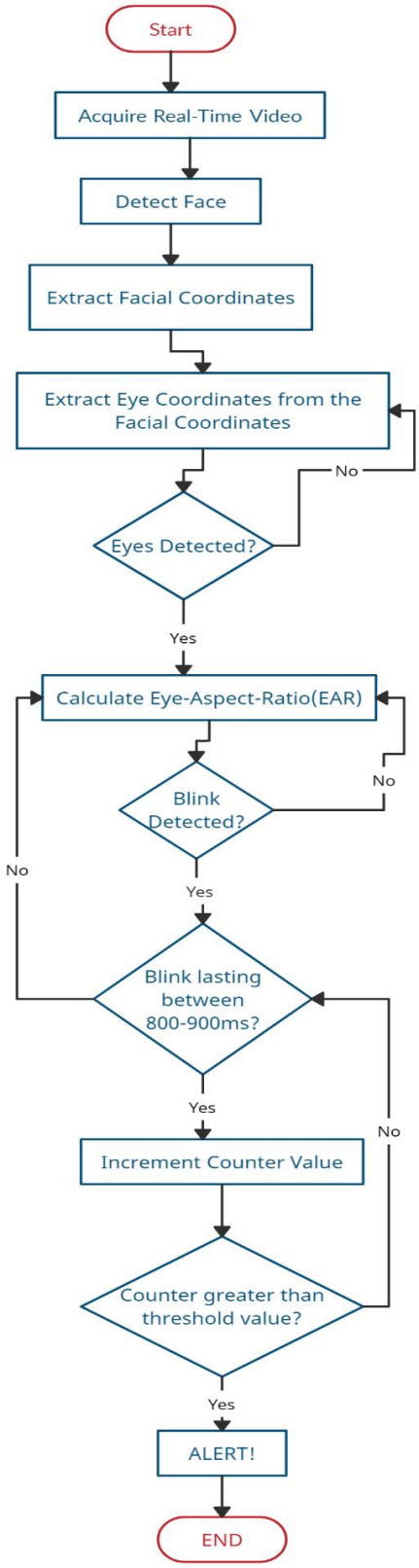


FIGURE: EYE BLINK MONITORING TO DETECT DROWSINESS FLOWCHART

5.2. SOLUTION TO THE PROBLEM

1) Video capturing:

This is the stage where video frames from a fixed camera or a smartphone are broken down into a series of images. The video frames are taken in such a manner that only the face of the driver is captured.

2) Facial Landmark Detection:

Facial landmarks are used to Localize And represent Salient reasons of the face. Such as

Eyes

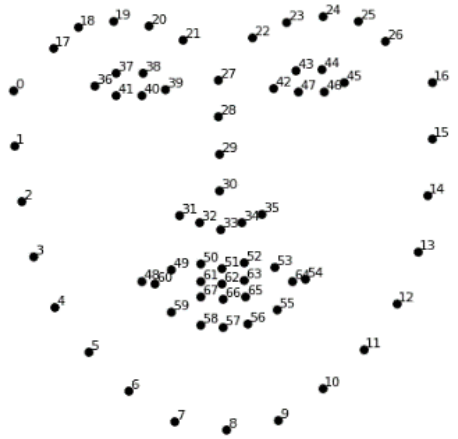
Eyebrows

Nose

Mouth

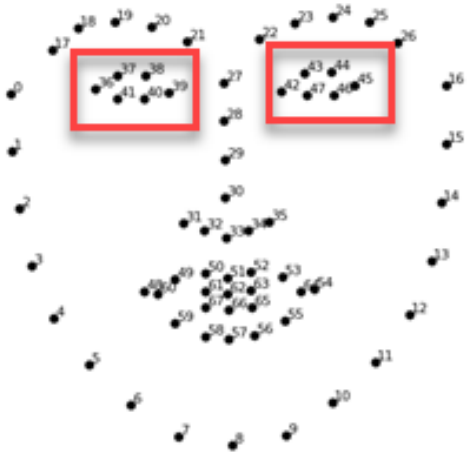
Jawline

The first step is to extract a frame from a camera, in our case web came. Once We have the frame. We use a python library called dlib where a facial landmark detector is included; the result is a collection of X's, Y's coordinates, which indicate where the facial landmark is.



3) Extract Eyes Structure:

Even when we get a collection of points, we are only interested in the position of the eyes, so we are going to keep only the twelve points that belong to the eyes. Now we have the facial landmarks of a single frame. Nevertheless, we want to give our system the sense of the sequence, and to do so, we are not considering single frames to make our final prediction, we take a group of them.

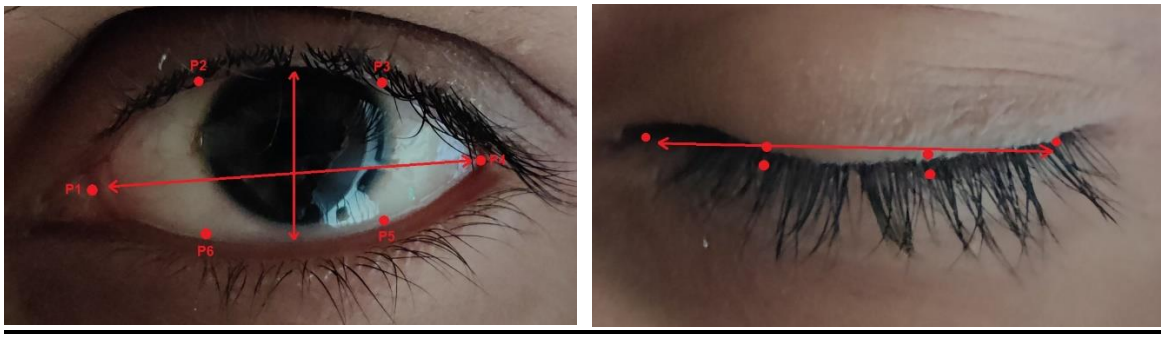


4) Determine the Eye-Aspect-Ratio (EAR):

EAR is the ratio between the height and width of the eye and was introduced by Soukupova and Cech in 2016. EAR classifies the ratio of the eye as it decreases. The formula to calculate the same is given by:

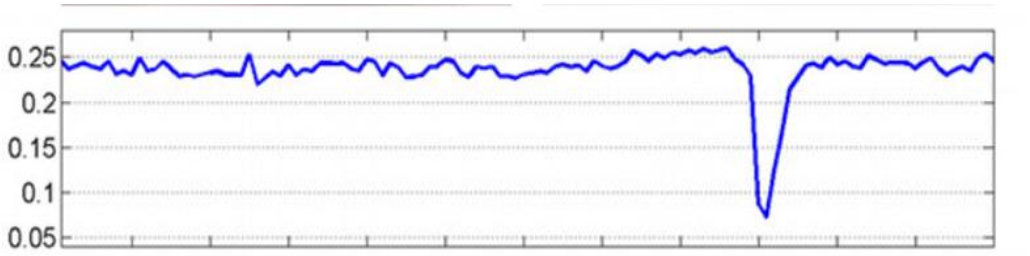
$$\text{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Figure 4: The eye aspect ratio equation.



5) Identify the Blinks:

When the EAR value drops below 0.1, it is considered as a blink.



The downward hill in the graph represents the blink. The width of the hill represents the duration of each blink.

6) Differentiate A Normal Blink from A Drowsy Eye Blink:

- A normal blink lasts between 300-400ms.
- A drowsy blink lasts between 800-900ms.
- An awake person blinks around 15-20times a minute.
- When a person is drowsy, the blink rate drops to 10 or below.

7) Alert:

After reaching a threshold value, the user will be warned that he is drowsy by an alarm sound.

Drowsy Label	Indicators
Alert	* fully alert individual * no indicators of drowsiness * attentive and engaged in driving * normal headpose, eyelid droop, blinks etc.
Slightly Drowsy	* clear signs of drowsiness but otherwise alert and attentive in driving * one or more indicators of drowsiness e.g. increased blink rate and/or repeated yawning * despite being drowsy, active in operating the vehicle: looking around, engaging with passengers etc.
Moderately Drowsy	* signs of reduced alertness due to fatigue * actively engaged in driving, but at a reduced capacity * e.g. not sufficiently alert to anticipate sudden events * fixating on single points * reduced engagement with the in-car environment * attempts to keep themselves awake: shifting positions, rubbing eyes etc. * slow and frequent blinks * drooping eyelids
Extremely Drowsy	* fails to operate a vehicle safely due to fatigue * resting eyes, eyes closed for extended periods, or starting to fall asleep and reawaken * e.g. rapid jerking of head upright, or rapid opening of eyelids * on the verge of falling asleep, and no longer fit to operate a vehicle safely

5.3. SOFTWARE REQUIREMENTS:

- **Python:**

Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

Benefits that make Python the best fit for machine learning and AI-based projects include simplicity and consistency, access to great libraries and frameworks for AI and machine learning (ML), flexibility, platform independence, and a wide community. These add to the overall popularity of the language.

- **OpenCV:**

OpenCV is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing, video capture and analysis including features like face detection and object detection.

- **imutils** For Image Processing Functions
- **dlib** For Facial Landmark Detection
- **SciPy** For Calculations

9. CONCLUSION

The eye blink monitoring system developed is capable of detecting drowsiness in a rapid manner. The system which can differentiate normal eye blink and drowsiness which can prevent the driver from entering the state of sleepiness while driving or warn the host regarding the person's behaviour. The system works well even in case of a user wearing spectacles and under low light conditions also. During the monitoring, the system is able to decide if the eyes are opened or closed. By doing this many accidents will be reduced and provide safe life to the driver and vehicle safety.

Information about the head and eyes position is obtained through various self-developed image processing algorithms. During the monitoring, the system is able to decide if the eyes are opened or closed. When the eyes have been closed for too long, an alarm is triggered to alert the user. This is a cost-effective method that requires minimal investment.

10. REFERENCES

- Jayasenan J. S., Mrs. Smitha P. S., “Driver Drowsiness Detection System,” in IOSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 4, Issue 1, Ver. I (Jan. 2014), PP 34-37 e-ISSN: 2319 – 4200, p-ISSN No.: 2319 – 4197
- Mr. Raees Ahmad, Prof. J.N. Borole, “Drowsy Driver Identification Using Eye Blink Detection,” in (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (1) , 2015, 270-274,
- Hrishikesh B. Juvale, Anant S. Mahajan, Ashwin A Bhagwat, Vishal T Badiger, “Drowsy Detection and Alarming System (DroDeASys)”, in Proceedings of the World Congress on Engineering and Computer Science 2007, WCECS 2007, October 24-26, 2007, San Francisco, USA
- Mrs.S. Dhanalakshmi, J.Jasmine Rosepet, G.Leema Rosy, M.Philominal, “Drowsy Driver Identification Using MATLAB Video Processing”, in International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 4 Issue IV, April 2016 IC Value: 13.98 ISSN: 2321-9653
- J. Batista, “A drowsiness and point of attention monitoring system for driver vigilance,” in Proc. Intell. Transp. Syst. Conf., 2007, pp. 702–708.
- V. Starovoitov, D. Samal, “A Geometric Approach To Face Recognition”, Institute Of Engineering Cybertronics.
- Robert Gabriel Lupu, Florina Ungrurianu, “A Survey Of Eye Tracking Methods And Application”, University Technica,
- 2013.
- Murata and Y. Hiramatsu, “Evaluation of drowsiness by HRV measures—Basic study for drowsy driver detection,” in Proc. 4th Int. Workshop Comput. Intell. Appl., 2008, pp. 99–102