Driver Drowsiness Detection Using AI & ML

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***Abstract*— In recent years, driving has become an important part of our day-to-day life. Due to busy life in urban areas people may feel drowsy while driving, due to that there is a chance of meeting with an accident. Road accidents are apparently one of the major hazards in our country. After the accidents caused by the drunk and drive, the next main issue to be addressed is drowsiness due to which it leads to severe physical injuries or damage to the asset and even loss of human life. We are addressing this by detecting the drowsiness of the driver and warning him. Eye aspect ratio (EAR) is used to detect the drowsiness of the driver.**

I. INTRODUCTION

Based on the survey of the *National Crime Record Bureau (NCRB)* approximately 135000 site visitors-related dying manifest every year in india. Based on the survey of the National Crime Records Bureau (NCRB) approximately 135000 site visitors related dying manifest every year in India. If the accident caused by drowsiness of the driver, it can be prevented by placing drowsiness detecting system within the vehicle. Tiredness can be caused by several phenomena like psychosocial factors, health factors, and physiological factors. Based on the survey of National Highway Traffic Safety Administration of the United States of America (USA), police studied around 1 00000 crashes occurred due to the drowsiness of the drivers, it reasons a primary losses like 71000 wounds, $12.5 billion budgetary mishap and 1550 passing detector. The issues can be overcome by implementing several methods which include Support Vector Machines (SVM), fuzzy-based system, neuron-fuzzy approach and Artificial Neural Networks (ANN) for detecting the drowsiness. It is troublesome to accurately say around a correct number of sleep-related mischance's, but activity inquire about appears up to 20% of accidents happen due to drowsiness of the driver. Detection of drowsiness can be carried out by two strategies. The primary procedure is intrusive and second one is non-intrusive. The intrusive method includes computation of mind wave monitoring, heart-beat rate etc. Non intrusive methods are appropriate in finding facial appearance for tiredness detection. Mouth expanding and eye closure are the well known side effects of the tiredness discovery. The non-intrusive technique involves head pose, eye blinking rate, yawn detection, eye closure, etc. Another non-intrusive way to detect drowsiness can have three scenarios: visual cues, physiological measurements, driving performance. Physiological and visual includes direct computation, while driving execution involves indirect computation.

II. LITREATURE SRUVEY

The already existing systems are:

[1]: "Automated video-based measurements of eye closure for detecting behavioral micro sleep" was proposed by A.Malla, P. Davidson, P. Bones, R. Green and R. Jones. A device capable of continuously monitoring an individual's levels of alertness in real-time is highly desirable for preventing drowsiness and microsleep related accidents. The developed system uses a remotely placed camera with a near-infrared illumination to acquire the video. The computer-vision methods are then applied to sequentially localize face, eyes, and eyelids positions to measure ratio of eye closure.

[2]. "Rapid Object Detection using a Boosted Cascade of Simple Features" was proposed by P. Viola and M. Jones. In this paper it describes a machine learning approach for visual object detection which is capable of processing images extremely rapidly and achieving high detection rates. The cascade can be viewed as an object specific focus-of-

attention mechanism which unlike previous approaches provides statistical guarantees that discarded regions are unlikely to contain the object of interest. In the domain of face detection the system yields detection rates comparable to the best previous systems.

[3]. "An Extended Set of Haar-like Features for Rapid Object Detection" was proposed by R. Lienhart and J. Maydt Recently Viola et al. [2001] have introduced a rapid object detection. Scheme based on a boosted cascade of simple feature classifiers. In this paper we introduce a novel set of rotated Haar-like features. These novel features significantly enrich the simple features of Violaetal and can also be calculated efficiently.

[4]."Bright Pupil Detection in an Embedded, Real-time Drowsiness Monitoring System" was proposed by S. Vitabile, A. Paola and F. Sorbello. The paper presents the design and the implementation of a system able to find and evidence the drowsiness level of a driver in an ordinary motor vehicle, in order to prevent car accidents. The system, made up of a car installed infrared video camera connected to the Celoxica RC203E FPGA based board, is able to perform a real time video stream processing. The system exploits the “bright pupil” phenomenon produced by the retina that reflects the 90% of the incident light when a radiation of 850 nm wavelength hit the retina itself. While acquiring the video, a processing chain is executed to detect driver's eyes and to compute a PERCLOS (Percentage of Eye Closure) function linked to the drowsiness level of a driver

III. METHODOLOGY

The main aim is to distinguish tiredness of driver, it can be done in diverse ways like identifying facial expression of the driver and measuring Eye Aspect Ratio (EAR). Blinking pattern is different for each and every individual it depends on the person eye sizes. The design gets varied in terms of degree of eye, squint length and speed of closing and opening the eye. IT includes the following strategies such as Haar Cascade Classifiers, Shape Predictor_68_facial point of interest discovery, Eye Aspect Ratio (EAR). *OS* used in this project is ***ubuntu*.**

IV. HAARCASCADE CLASSIFIERS

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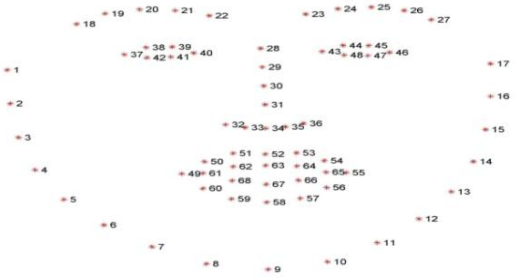
V. SHAPE PREDICTOR-68 FACIAL LANDMARK DETECTION

Shape predictor is used in order to predict the face and eye region within the live video stream. The drowsiness is measured by calculating the eye aspect ratio (Euclidean distance between the eyes are calculated), the arguments are passed to the predefined dataset and facial landmark detection is carried out. The 68 facial landmark is shown in fig 1. In 68 face landmark model shows how we can access the face features like eyes, eyebrows, nose, lips etc.



VI. EYE ASPECT RATIO

The drowsiness which is measured by calculating the eye aspect ratio (Euclidean distance between the eyes are calculated). The aspect ratio between width and height of the eye is calculated. Eye Aspect Ratio is calculated by using the formula give below.

$$EAR = \frac{\left|\left|\mathrm{p2} - \mathrm{p6}\right|\right| + \left|\left|\mathrm{p3} - \mathrm{p5}\right|\right|}{2\left|\left|\mathrm{p1} - \mathrm{p4}\right|\right|}$$

EYE ASPECT RATIO

Where p1,.., p6 are the two-dimensional landmark location as shown in fig 2.

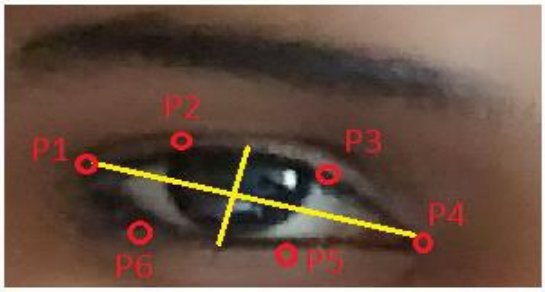


Fig 2: open eyes with landmark detected.

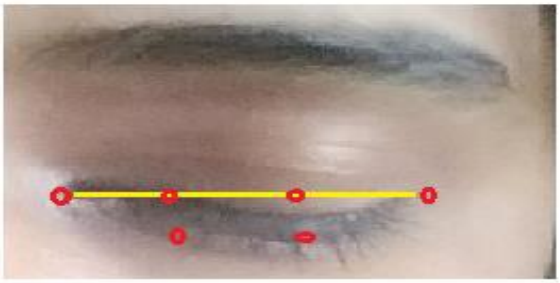


Fig2.1: close eyes with landmark detected.

The EAR is mostly stable when an eye is open and is getting close to zero while the eye is not in open state (as shown in figure 2&2.1). If the person viewing the camera continuously, the Eye Aspect Ratio (EAR) is found to be ordinary and it comes to low value when he/she closing the eye for a longer time. When the lower value is reached, then drowsiness is detected.

VII. REQUIREMENTS

Requirements	Explanation
Ubuntu	It a Linux-based operating system.
argparse	Python argparse is a command-line parsing module that is recommended to work with the command line argument.
pyttsx3	Pyttsx3 is a text-to-speech conversion library in Python.
numpy	NumPy is a Python library. NumPy is used for working with arrays. NumPy is short for "Numerical Python".
time	An easy-use module to operate date-time by string.
dlib	A toolkit for making real world machine learning and data analysis applications.
cv2	A package that provides various functions to assist the OpenCV workflow.
opencv	Wrapper package for OpenCV python bindings.
os	Python OS module provides the facility to establish the interaction between the user and the operating system.
imutils	A series of convenience functions to make basic image processing function such as translation, rotation, resizing, etc.

VII. RESULTS

The driver laziness can be measured utilizing Eye Aspect Ratio(EAR). The proportion of the eye can change for each and every individual. The following case is tested for ten different set of people with two conditions. One is calculated for eye-opening condition and another one for eye closing condition. Eye closing rate is measured after every 0.5 seconds as shown in fig 3

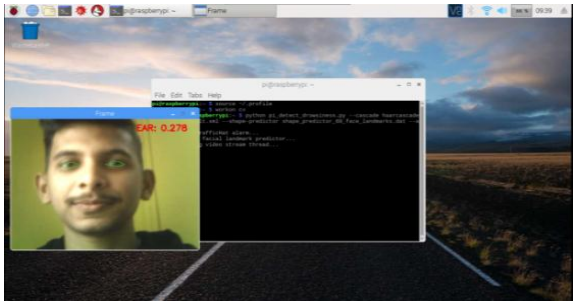


Fig3: Eye aspect ratio

If the value cross already existed threshold value, that means, when the person is closing his eyes for more than fixed threshold range then the drowsiness is detected as shown in fig 3.1.

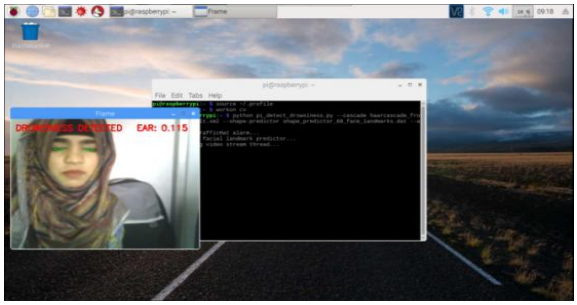


Fig3.1: Drowsiness is detected

After the drowsiness is detected then the alert signal is generated to wake up the driver from sleepy state.

IX. CONCLUSION

The system proposed here provides the accurate detection of driver drowsiness in which it will help to reduce the number of accidents caused due to drowsiness. This application will assist the driver to be awake by giving the alert messages. Adaptive EAR will help in detecting drowsiness in driver with different shapes and sizes of the eyes. This general purpose algorithm is to detect the drowsiness and it

can be used in any different situation where the drowsiness needs to be detected.

X. FUTURE WORK

The yawn detection parameter can also be added to detect the yawing. In future the motion of car can also be detected and alert the driver only when the car in the motion state.

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