International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 06 | June 2019 www.irjet.net p-ISSN: 2395-0072

Driver Drowsiness Monitoring System

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Abstract - *In recent years driver weakness is one of the significant reasons for vehicle mishaps. A direct method for estimating driver weakness is estimating the condition of the driver for example drowsiness. So it is essential to identify the drowsiness of the driver to spare life and property. This task is pointed towards building up a model of drowsiness identification framework. In this framework it collects the picture persistently and measures the condition of the eye, mouth ratio and head node rate as per the predetermined calculation and gives cautioning whenever required. For actualizing this framework a few OpenCv libraries are utilized including Haar-cascade.*

Key Words*: *OpenCV, Haar- cascade, Machine learning Libraries

1. INTRODUCTION

Driver drowsiness location is a vehicle security innovation which counteracts mishaps when the driver is getting tired. Different examinations have proposed that around 20% of all street mishaps are weakness related, up to half on specific streets. Driver exhaustion is a critical factor in an expansive number of vehicle mishaps. Ongoing insights gauge that yearly 1,200 passing and 76,000 wounds can be ascribed to weakness related accidents. The improvement of innovations for distinguishing or anticipating languor in the driver's seat is a noteworthy test in the field of mishap shirking frameworks. Due to the danger that sluggishness introduces out and about, techniques should be created for neutralizing its effects.

1.1 Drowsiness

Drowsiness is defined as a decreased level of awareness portrayed by sleepiness and trouble in staying alarm but the person awakes with simple excitement by stimuli. It might be caused by an absence of rest, medicine, substance misuse, or a cerebral issue. It is mostly the result of fatigue which can be both mental and physical. Physical fatigue, or muscle weariness, is the temporary physical failure of a muscle to perform ideally. Mental fatigue is a temporary failure to keep up ideal psychological execution.

The aim is collect the drowsiness symptoms from the driver's face through analysis of the driver's eye state, Head node and yawning (Mouth Aspect ratio). This will be achieved through processing video images by OpenCV. The outcome of the video will be used to determine the drowsiness levels and then provide a warning to the driver if he/she is drowsy.

2. LITERATURE SURVEY

Drowsiness detection poses a big challenge to researchers. In both manual and automatic approaches, researchers highly depend on the symptoms of drowsiness in order to predict a drowsy driver. Manual approaches are however very difficult and totally undependable to prevent traffic road accidents. Manuals approaches are based on the human perception of the situation.

2.1 Existing System

Exhaustion driving is alludes to the driver in quite a while nonstop driving or physical weakness condition, and after that appear physiological and mental capacity issue, prompted a decrease in driving capacity. Gone for the necessities of observing on the weakness driving, this article planned a driver weariness screen framework based STM32F407 of ARM as a controller, it used to decide the driver's exhaustion and diminish the auto collision.

The upside of PC vision techniques is that they are non-meddlesome, and along these lines are logically sensible to use by the general populace. There are some enormous past examinations about tiredness acknowledgment using PC vision strategies. A huge segment of the circulated research on PC vision approaches to manage disclosure of sluggishness has focused on the examination of squints and head improvements. It has been considered that these drivers demonstrates certain physiological models that are typical and detectible. The standard "head weaving" improvement, where the driver's head drops and after that rapidly pulls back upward is one of the models that is frequently indicated when an individual is getting the chance to be tired while arranged in an upstanding position.

2.2 Proposed System

Research has recognized a few signs or side effects which help in deciding the tired condition of the driver. These signs or side effects are the accompanying:

- Daydreaming and absence of concentrating.
- Blinking every now and again and incompletely shut eye.
- Not ready to recollect the voyaged way.
- Yawning after each little period.
- Drifting or perhaps move out from the path.
- Head gesturing.
- Poor Concentration

- Slow responses.

3. ARCHITECTURE

The system design process builds up the new framework is drowsiness discovery framework for the vehicle.. Through investigation of the eye expresses, yawning and head node in the framework will probably tell a sleepy driver from a typical driver. A video stream will be consistently acquired from the driver's appearances and feed into a micro controller for preparing. Classifiers will at that point be utilized to group the condition of the driver's eye, mouth and head. In the event that a lazy driver is recognized a caution will be raised, until the framework sees the driver is alert.

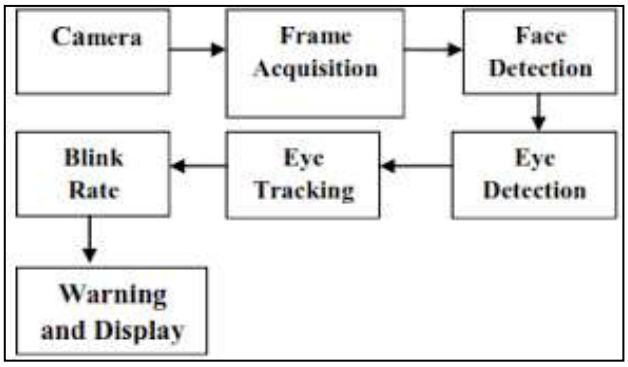

Fig - 1 : Block diagram of the system

The process involves the following steps:

- **Image Capture**

Utilizing a web camera exhibited inside the vehicle we can get the picture of the driver. Not withstanding the manner in which that the camera makes a video cut, we have to apply the calculation on each edge of the video stream to get the edges for the further procedure.

- **Partitioning into Frames**

It is figured out how to get the consistent situation where video is recorded and should be readied. Be that as it may, the video isn't which is utilized simultaneously so it is changed over into picture. Hereafter the video must be partitioned into edges for exploring.

- **Face Recognition**

In this stage it is recognized that the region containing the quintessence of the driver. A predefined count is for area of face in each packaging. By face acknowledgment we infers that finding the face in an edge or by the day's end finding zone of facial characters through a kind of advancement with the use of PC. The packaging may be any subjective packaging. Simply facial related structures or features are recognized and all others sorts of articles like structures, tree, bodies are ignored.

- **Eye Detection**

After acknowledgment of face eye ought to be distinguished for further taking care of. In the methodology eye is the decision parameter for finding the state of driver. Notwithstanding the way that recognizable proof of eye may be less complex to discover, anyway it's in reality tangled. Presently it plays out the area of eye in the required explicit region with the use of acknowledgment of a couple of features. All things considered Eigen approach is used for this methodology.

Eye aspect ratio (EAR): From the eye corner points, the eye aspect ratio is calculated as the ratio of height and width of the eye as given by

$$EAR = \frac{(P2 - P6) + (P3 - P5)}{2(P4 - P1)}$$

Likewise the measures are taken from the Mouth that is by using Mouth Opening Ratio (MOR), and also the head nodding is calculated. After detecting the facial landmarks, Mouth opening ratio (MOR): Mouth opening ratio is a parameter to detect yawning during drowsiness. Similar to EAR, it is calculated as

$$MOR = \frac{(P15 - P23) + (P16 - P22) + (P17 - P2)}{3(P19 - P15)}$$

Due to drowsiness, usually driver's head tilts (forward or backward) with respect to vertical axis. So, from the head bending angle, driver drowsiness can be detected.. In normal condition, our nose makes an acute angle with respect to focal plane of the camera. This angle increases as the head moves vertically up and decreases on moving down. Therefore, the ratio of nose length to an average nose length while awake is a measure of head bending and if the value is greater or less than a particular range, it indicates head bending as well as drowsiness. From the facial landmarks, the nose length is calculated and it is defined as

$$NLR = \frac{Nose\ Length(P28 - P25)}{Average\ Nose\ Length}$$

4. METHODOLOGY

Generally, the methods to detect drowsy drivers are classified in three types; vehicle based, behavioral based and physiological based. In vehicle based method, a number of metrics like steering wheel movement, accelerator or brake pattern, vehicle speed, lateral acceleration, deviations from lane position etc. are monitored continuously. Detection of any abnormal change in these values is considered as driver drowsiness.

4.1 Pseudocode

Pseudocode is a simplied programming language which gives the information of each step as shown below

Step1: Start

Step2: Sense the data using OpenCV

Step3: Process the sensed data

Step4: Check the form of a person

Step5: Normal mode or sleeping mode

Step6: if Normal mode

Step7: Engine on

Step8: Else if sleeping mode

Step9: Buzzer on

Step10: Engine off

Step11: Stop

4.2 Algorithm used

- **Eigen Face Approach**

Eigen face approach for face affirmation is gainful and steady because of its speed of movement ease in using and limit of learning. In PC vision face recognizable proof is finished by use of eigen face which are basically set of eigen vectors. This strategy is on a very basic level an appearance based procedure which faces affirmation by getting the assortment in a lot of face pictures and this information is used for connection and encoding of each individual faces in proper manner. What we mean by eigen faces is that they are Principal portions of circled faces which are addressed as covariance system of set of appearances. In this system a face picture is addressed as one dimensional structure. We understand we can address a face in two dimensional sort of pixels as N x N structure in N2 estimation space.

- **Viola-jones Algorithm**

Viola-jones approach is an exceptionally basic methodology for object recognition. The calculation is a AI approach for article discovery that underlines on quick outcome age and high object location rates with figures of up to 99% discovery being enrolled by various scientists, the technique utilizes necessary pictures as the picture recognition structure that ensures speed in recognition. The highlights are determined by taking the total of pixels inside various rectangular regions.

Viola jones algorithm has four stages:

- Haar Features
- Create an Integral Image
- Adaboost Training
- Cascading Classifiers

- **Euclidean Algorithm**

It is only a distance measure between a couple of tests p and q in a n-dimensional element space:

$$\sqrt{\sum_{i=1}^{n}(q_i - p_i)^2}.$$

Concerning Euclidean geometry, an estimation is created in one estimation by fixing two on a line, and picking one to be the root. The length of the line part between these focuses depicts the unit of parcel and the heading from the motivation to the second point is portrayed as the positive bearing. This line segment might be made a clarification of along the line to fabricate longer portions whose lengths relate to aftereffects of the unit segregated. The second point is then astoundingly picked as the point on hold that is at a unit of one positive unit from the earliest starting point organize. The division between any two on the genuine line is the hard and fast estimation of the numerical contrast of their orientation. It is totally expected to see the name of a point with its Cartesian support.

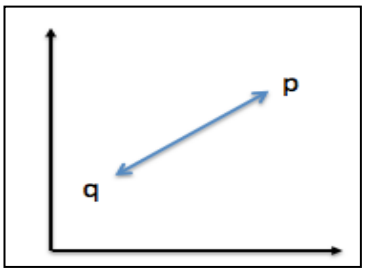

Fig - 2 : Euclidean Distance

5. IMPLEMENTATION AND RESULTS

This Chapter contains the detailed design and implementation of the project including the result

5.1 Software platform

- **OpenCV**

OpenCV (Open Source Computer Vision) is a library of programming limits for the most part went for continuous PC vision. In clear language it is library used for Image Processing. It is generally used to do all the undertaking related to Images.

OpenCV bolsters the profound learning structures TensorFlow, Torch/PyTorch and Caffe.Fundamentally there are four modules.

- **Python 2.7**

Python 2.7 is scheduled to be the last significant form in the 2.x series before it moves into an all-encompassing support period.. One should now have an IDLE session open

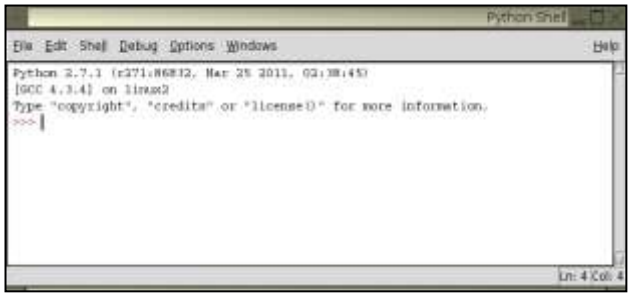

Fig - 3: IDLE session Open

This is where we'll pick up the workshop. If you're feeling ambitious, try creating a Python script by clicking File -> New Window, which will open a text editor window.

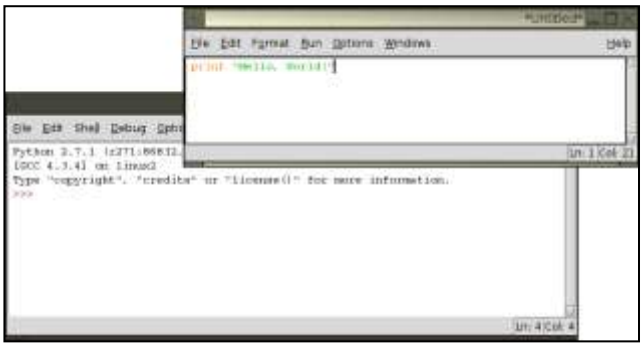

Fig - 4: IDLE will take to the workshop

Click File -> Save and enter hw.py for the filename. Then click Run -> Run Module to run the script. IDLE that runs the program will open the separate workshop

Fig - 5: IDLE run the program

5.2 Results

Model of Drowsiness recognition framework was organized utilizing code in python language. It was endeavored with various subjects and grouped condition like straight and twist head and photograph copy of the yield was displayed as seeks after.

Fig - 6: Drowsiness Alert when Eye Closed

Fig - 7: Drowsiness Alert when Yawning

Fig - 8: Drowsiness Alert when Head bend

6. CONCLUSIONS

The framework is created which dispenses and tracks the eye Aspect Ratio, Mouth Aspect Ratio and head developments of the driver so as to identify tiredness. The framework utilizes a mix of layout – based coordinating and highlight based coordinating so as to restrict the eyes. During following, framework will most likely choose if the eyes are open or shut and whether the driver is looking in front. At the point when the eyes will be shut for a really long time, a notice sign will be given as bell or alarm message.

ACKNOWLEDGEMENT

I would like to thank Dr. Sathish S Kumar (Asst Prof, Dept of CSE, RNSIT, Bangalore) for his valuable suggestions and comments that helped improving this works, this support is greatly appreciated.

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BIOGRAPHY

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