OPERATOR FATIGUE DETECTING AND ANALYSING SYSTEM

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Abstract—Operator fatigue is defined as the mental tiredness occurred due to late night work. This system proposed to detect the mental tiredness of operator. Road accidents are caused by a variety of factors, including driver carelessness, weather conditions, road invisibility, sleepiness, and alcohol intake. In addition, the study provides an outline of the authors' findings in order to aid future optimization in the indicated sector in order to obtain utility at a higher efficiency for a safer road. This gives us the alert notification about the status of operator who is operating the vehicle by calculating the aspect ratio of their eyes and determine them which fixed and calculated ratio. This manually tested experimental results showed that Operator Fatigue Detecting System achieved around 94% accuracy.

INDEX TERM :- Operator fatigue; fatigue detection; eye detection; yawn detection; blink pattern.

1. Introduction

A. What is Operator Fatigue ?

Operator fatigue is defined as the mental tiredness occurred due to late night work. This device was designed to identify the operator's mental fatigue. Monitoring such closures is a useful approach to assess tiredness and avoid an accident since the occurrences of eyes closures drastically rise during the ten second interval preceding an accident. Because the range is 10 seconds, the system must evaluate whether the driver is sleepy in a matter of seconds. The algorithm should not only be quick, but also accurate, with as few false alarms (alerting while the driver is awake) and false finds (mistaking other characteristics in the picture for eyes) as feasible.In this proposed system we also help us to analysis on blinking of eye.[1]

Driver weariness and lack of sleep, particularly among those who operate big vehicles such as trucks and buses, have become increasingly problematic in recent years. Vehicle driving has played a critical role in preventing accidents that have resulted in the deaths of millions of people in the country, whose livelihood is more essential to their children than their own. In the months of October 2008, the life and car value were both high.Accidents are frequently caused by drowsy, Drivers who are inattentive and enraged. Accidents are frequently caused by drowsy, inattentive, and furious drivers. Drowsiness is thought to be a factor in over 1,00,000 crashes each year, resulting in over 1,500 deaths and 40,000 injuries, costing the government and companies an unfathomable amount of money. Many lives, personal miseries, and

enterprises can be saved by automatically detecting drivers' alertness early enough to notify them about their lack of awareness due to drowsiness. Transport systems are becoming an important aspect of human activity. We may all be victims of tiredness while driving, whether it's from a lack of sleep, a change in physical condition, or extended travels. The experience of sleep diminishes the driver's degree of awareness, resulting in potentially risky conditions and increasing the likelihood of an accident that occrued.[2]

There are three types of causes for accidents: adverse weather or faulty infrastructure (rain, potholes on the road), vehicle malfunctions (manufacturing problems or wear and tear), and human factors (physiological or behavioral). While physiological errors such as driver weariness and sleepiness are common, behavioural errors such as distracted driving, intoxicated driving, aggressive driving, road rage, harsh acceleration, hard braking, cornering, and speeding are also common. Aggressive driving and road rage are a priority behaviour that have the potential to result in tragic or non-fatal road accidents, physical violence events, and even murders. Aggressive driving is defined as driving a car in an unsafe and confrontational way without consideration for others, including risky road conduct such as frequent or unsafe lane [3].

Road rage is an aggressive driving behaviour in which the motorist makes disrespectful gestures, makes physical and verbal threats, and uses unsafe driving techniques in an attempt to intimidate or vent displeasure from another vehicle. The frequency of insurance claims filed by policyholders rises in lockstep with the growth in traffic accidents. The fundamental motivation for insurers to use UBI is to introduce some realistic and correct measurability in order to determine the risk to which their clients are exposed and charge a risk-based premium recommended by an actuary. According to the premium charge approach, policyholders who showed more risk while driving must pay a much higher price [4].

Fatigue is difficult to detect or observe in general, unlike alcohol and drugs, which have well-defined key indications and tests that are readily available. The greatest remedies to this problem are probably increased awareness of tiredness-related accidents and encouraging drivers to confess weariness when necessary. The former is difficult and expensive to attain, while the latter is impossible without the former since long-distance driving is enormously lucrative. When there is a greater demand for a job, the salaries connected with it rise, causing an increase in the number of individuals who take it. Driving freight vehicles at night is one example of this. Money incentivizes drivers to make rash actions, such as driving all night despite exhaustion. According to current figures, 148,707 individuals died in India in 2015 as a result of automobile accidents. At least 21% of these were caused by weariness, which prompted drivers to make errors. This may be the case a much lower amount, as there are several circumstances that might lead to this.

2. Reveling Stats about death due to road accident

The global mortality as a result of road accidents from 2013 to 2018 is depicted in

Fig. 1. However, the figures do not reflect the true picture of all incidents since pedestrians and cyclists are not included in the statistics.

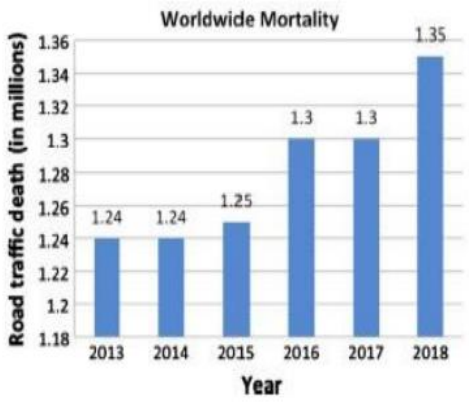

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Fig 1. Worldwide Mortality Rate

If such figures are taken into account, the World Health Organization's total 2018 data show below

• More than half of all road traffic deaths occurred among young adults aged 15–44.

• Road traffic crashes were ranked as the 9th leading cause of death and accounts for 2.2% of all deaths globally.

• Unless some remedial action is initiated, road traffic injuries would likely to become the fifth leading cause of death by 2030.

Accidents can be categorised into three groups based on their causes: Vehicle malfunctioning (manufacturing problems or wear and tear), adverse weather or bad infrastructure (rain, potholes on the road), or human causes (physiological or behavioral). While physiological errors occur as a result of driving weariness and sleepiness, behavioural errors also occur. Distracted driving, intoxicated driving, aggressive driving, road rage, harsh acceleration, hard braking, cornering, and speeding are all examples of faults. Aggressive driving and road rage are a priori behaviours that can result in deadly or non-fatal traffic accidents, physical violence, and even murder [8].

3. KEY TEMINOLOGY

A) OPERATOR FATIGUE DETECTING

Operator There are two sorts of fatigue detection methods: touch and non-contact methods. In contact techniques, drivers wear or touch devices to get physiological characteristics from which to assess their fatigue state. To gather data and quantify sleepiness, Warwick et al. strapped the Bio Harness to the driver's body. Li et al. employed an electroencephalographic (EEG) signal to identify driver sleepiness using a wristwatch. Jung et al. redesigned the steering wheel and included an integrated sensor to track the driver's electrocardiogram (ECG) signal. However, there are significant constraints that cannot be used universally due to the cost of contact techniques and installation [6].

The other technique uses a tag-free approach to detect driver sleepiness, which eliminates the necessity for the measured object to make touch with the driver. For example, Omidyeganeh et al. employed the camera to capture the driver's facial look in order to identify tiredness, although this approach is not real-time. To predict driver weariness, Zhang and Hua employed fatigue facial expression restructuring based on Local Binary Pattern (LBP) features and Support Vector Machines (SVM), however this approach is more sophisticated than ours. Picot et al. also offered an approach that uses Drowsiness is detected using an electro

oculogram (EOG) signal and a blinking feature. For sleepiness detection, Akrout and Mahdi employed a fusion system based on eye state and head position. Unlike these approaches, we utilise simple equations and evaluations, which make the findings easy to assess and are particularly beneficial in detecting the operator's mental fatigue in all aspects [7].

B) IMAGE RECOGNIGATION

Image recognition is a fundamental human ability that is commonly employed in everyday life. With the advancement of computer and electrical technology, computers can now process images in real time, and effective image processing algorithms and picture recognition technologies have become increasingly vital. In a system of intelligent transportation. Artificial intelligence's image recognition technology is a study area. Image recognition technology is based on the image's primary properties. The picture must be preprocessed, the superfluous information eliminated, and the important information (i.e., features) recovered during the image recognition process. After that, categorizing the training samples yields the classifier. Image Recognition is a fundamental human intellect that is commonly employed in everyday life. With the fast advancement of computer and electronic technology, computers can now analyze images in real time, and image processing algorithms and image recognition technologies play a critical role in the intelligent transportation system. Artificial intelligence's image recognition technology is a study area. Image recognition technology is based on the image's primary properties. The picture must be preprocessed, the superfluous information eliminated, and the important information (i.e., features) recovered during the image recognition process. After that, you may get the classifier by categorizing the training samples [10].

4. PROJECT IMPLEMENTATION

We divide the associated work into three sections in this section: the prototype algorithm design version, the facial landmarks recognition algorithm, and the analysis of the person on camera.

A. Prototype algorithm design version

This section explains how the Operator Fatigue Detecting and Analyzing System works. The initial goal of this research was to utilize retinal reflection (alone) to locate the eyes on the face, and then to use the absence of this reflection to determine when the eyes were closed. For two reasons, it was discovered that this approach of eye monitoring might not be the best. First, the quantity of retinal reflection diminishes in reduced illumination circumstances; second, if the individual has tiny eyes, the reflection may not be visible.

The basis of the horizontal intensity adjustments was employed as the project proceeded. One thing that all faces have in common is that the intensity of the eyebrows is considerably different from that of the skin, and that the eyes are the next big shift in intensity in the y-direction. This facial trait is the focal point for locating the eyes on the face, allowing the system to track the eyes and identify lengthy durations of closed eyes. The design of the driver drowsiness detection

system is described in each of the parts below. The flow chart diagram of Operator fatigue detecting and analyzing system are describe below in detailed and pictorial representation.

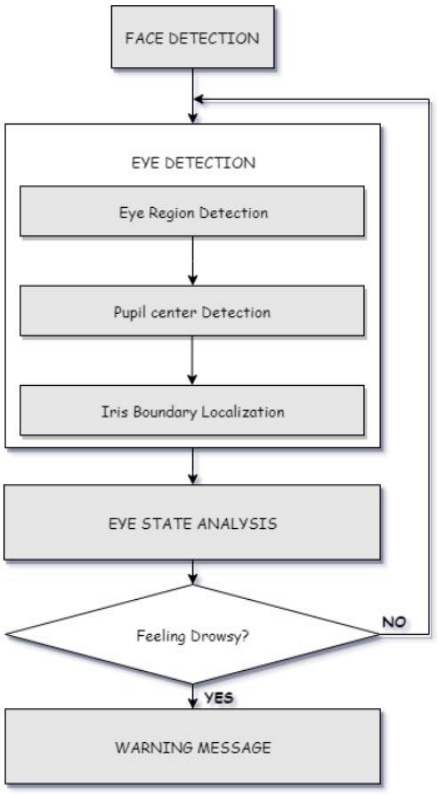

Fig 2. Flow Chart Of OFDS

(B) How Project is Implemented ?

(i) Aspect Ratio

To effectively shift designs, photos, and compress digital video files/content from one media to another without making any arithmetic errors, you must first grasp what aspect ratios are. For the record, an aspect ratio is the proportionate connection between the height and breadth of a rectangle. **"**Aspect ratio calculations matter a lot depending on whether it is an image, design project or a digital video you are working with."

Aspect ratios are generally specified by numbers, as in a mathematical ratio that specifies the number of inches high and wide your video, picture, and design projects should be. While aspect ratios are height and width measurements, they are frequently lowered to the smallest workable ratio to fit properly in any media.

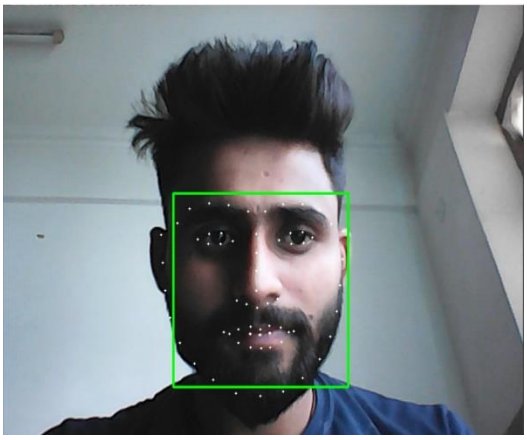

Fig. 3 Output Image 1

Converting the image into aspect ratio

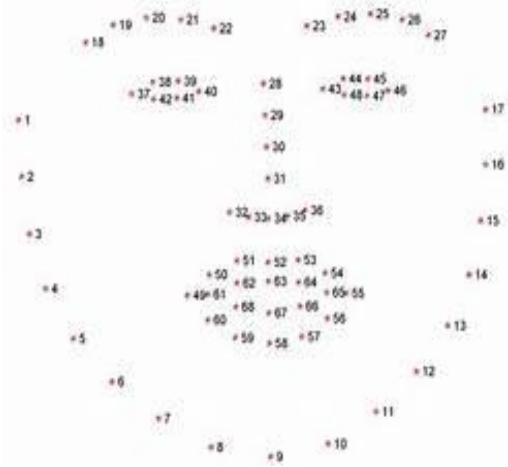

Fig. 4 Output 2

Aspect Ratio Formula

The formula for finding aspect ratio is:

$AR = W / H$

Where:

- *AR* is the aspect ratio
- *W* is the width of the displayed image
- *H* is the height of the displayed image

Note that *W* and *H* are measured in inches or millimeters.

(ii) IMPLEMENTATION

Dlib, a pre-trained algorithm trained on the HELEN dataset to to recognize human faces using the pre-defined 68 landmarks, was employed in our program.

We can detect left and right eycharacteristics of the face after delivering our video stream to the dlib frame by frame.

We then used OpenCV to draw outlines around it.Eyes with horizontal and vertical distances noted for calculating the Eye Aspect Ratio

We determined the total of both eyes' aspect ratio using Scipy's Euclidean function, which is the sum of two unique vertical distances between the eyelids divided by the horizontal distance.

(i) Aspect ratio >= 0.25

Fig. 5 Output 3

Aspect ratio is greater than 0.25 determine the activeness of operator which is operating the vehicle. When operator is in active state while driving the vehicle (aspect ratio is greater than 0.25).

(ii) 0.24<= Aspect ratio <= 0.05

Fig. 6 Output 4

Aspect ratio for operator which lie between 0.05 to 0.25 describe the drowsiness of operator as they are operator is operating the vehicles for longer time.

(iii) Aspect Ratio<0.05

Fig. 7 Output 5

To identify the operator sleeping is very important aspect because if any operator blinking their eyes which might cause accidents. So with aspect ratio less than 0.05 gives us alert notification that our operator is sleeping.

iii). Implementation Table

Test Id	Test Case Title	Test Condition	System Behavior	Expected Result
T01	Case_1	Straight Face, Good Light, With no Glasses	Active	Active
T02	Case_2	Tilted Face, Good Light, No Glasses	Drowsy	Drowsy
T03	Case_3	Tilted Face, Good Light, No Glasses	Sleeping	Sleeping

Conclusion and Future Scope

The suggested approach was put to the test using real-world driver photos. The video picture [480 x 640 pixels] of 75 distinct test subjects was captured in a variety of settings, including day, night, and complicated backgrounds. With the help of alert genration the operator will get notify then they will able to help of themselves as well other who are travelling on the road at that moment of time.The following was accomplished details

about the operator fatigue detecting and analyzing system :

• OFDS detects sleepiness with excellent accuracy and reliability; • OFDS uses a non-intrusive technique to detect1 drowsiness without causing irritation or disturbance.

• Processing determines the driver's degree of awareness based on continuous eye closures. • The suggested technology may be used at any time of day or night.

Some other future scope that might came into came into affect regarding operator fatigue detecting and analyzing system,Some of them are describe in detailed and descriptive manner below:

Other factors like as blink rate, yawning, automobile condition, and so on may be used to enhance the model progressively. If all of these factors are applied, the accuracy can be greatly improved.

We intend to expand on the concept by adding a sensor to monitor heart rate in order to prevent accidents caused by drivers suffering from sudden heart attacks.

The same concept and methodology may be applied to a variety of different applications, such as detecting when a user is sleeping and stopping the movie accordingly. It may also be utilized in an application that keeps the user awake.

This research will be expanded to include the use of a nano camera to monitor the reflect ray from the eye. If there is no reflected ray, the eye is closed; otherwise, the eye is opened. We hope that by doing so, we will be able to identify tiredness more accurately.

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