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Project Report

On

OPERATOR FATIGUE DETECTING & ANALYZING SYSTEM

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By

Shivansh Tiwari (1829010143)

Shivshankar Jaiswal (1829010144)

Under the Supervision

of

Mrs. Divya Tyagi

Assistant Professor

Department of Computer Science and Engineering

ABES INSTITUTE OF TECHNOLOGY, GHAZIABAD

AFFILIATED TO

Dr A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH, LUCKNOW

JUNE-2022

DECLARATION

I hereby declare that the work presented in this report entitled "**Operator Fatigue Detecting and Analyzing System** ", was carried out by me. I have not submitted the matter embodied in this report for the award of any other degree or diploma of any other University or Institute.

I have given due credit to the original authors/sources for all the words, ideas, diagrams, graphics, computer programs, experiments, results, that are not my original contribution. I have used quotation marks to identify verbatim sentences and given credit to the original authors/sources.

I affirm that no portion of my work is plagiarized, and the experiments and results reported in the report are not manipulated. In the event of a complaint of plagiarism and the manipulation of the experiments and results, I shall be fully responsible and answerable.

Name : Shivansh Tiwari

Roll. No. : 1829010143

Branch : Computer Science and Engineering

(Candidate Signature)

Name : Shivshankar Jaiswal

Roll. No. : 1829010144

Branch : Computer Science and Engineering

(Candidate Signature)

CERTIFICATE

Certified that **Shivansh Tiwari (**Roll no. 1829010143) and **Shivshankar Jaiswal** (Roll no. 1829010144) has carried out the research work presented in this thesis entitled **"Operator Fatigue Detecting and Analyzing System"** for the award of **Bachelor of Technology** from Dr. APJ Abdul Kalam Technical University, Lucknow under my supervision. The report embodies results of original work, and studies are carried out by the student himself and the contents of the thesis do not form the basis for the award of any other degree to the candidate or to anybody else from this or any other University/Institution.

Supervisor Signature	Signature
Mrs. Divya Tyagi	Dr. Rizwan Khan
Assistant Professor	Head of Department (CSE)
ABES Institute of Technology, Ghaziabad	ABES Institute of Technology, Ghaziabad

Date: Date:

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 Operator 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.

ACKNOWLEDGEMENT

With deep gratitude I express my earnest thanks to my esteemed supervisor Mrs. Divya Tyagi of supervisor, Assistant Professor, Department of Computer Science &Engineering for his constant involvement, energetic efforts and proficient guidance, which gave me direction and body to work, respond here. Without his counsel and encouragement, it would have been impossible to complete the thesis work in this manner.

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Shivansh Tiwari
B.Tech (Final Year)
Roll No: 1829010143
Shivshankar Jaiswal
B.Tech(Final Year)
Roll No. 1829010144
Computer Science &Engineering
ABES Institute of Technology, Ghaziabad

Date:
Place: Ghaziabad

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List of Abbreviation

PCA	Principal Component Analysis
LDA	Linear Discriminate Analysis
EM	Elastic matching
HMM	Hidden Markov Model
EEG	Electro Encephalo Graphic
HRV	Heart Rate Variability
PERCLOS	Percent Eye Closure
SMI	Sensor Motoric Instruments
SVM	Support Vector Machine
OFDS	Operator Fatigue Detecting

CHAPTER I

INTRODUCTION

1.1 What is Operator Fatigue detecting System?

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. As the range is 10 seconds, the system must evaluate whether the Operator 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 Operator is awake) and false finds (mistaking other characteristics in the picture for eyes) as feasible.[1].

Operator 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, Operators who are inattentive and enraged. Accidents are frequently caused by drowsy, inattentive, and furious Operators. 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 Operators' 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 Operator's degree of awareness, resulting in potentially risky conditions and increasing the likelihood of an accident that occurred.[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 Operator weariness and sleepiness are common, behavioral 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 behavior 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 behavior 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.

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 Operators 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 Operators 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 Operators to make errors. This may be the case a much lower amount, as there are several circumstances that might lead to this.

1.2 Reveling Stats about death due to road accident

According to current figures, 148,707 individuals died in India in 2015 as a result of car accidents. At least 21% of these were caused by weariness, which caused Operators to make mistakes. This number could be even lower, as the role of exhaustion as a cause of an accident is often grossly underestimated among the many factors that can lead to an accident. In underdeveloped countries like India, fatigue paired with poor infrastructure is a prescription for disaster.

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 fatigue-related accidents and encouraging Operators to confess weariness when necessary.

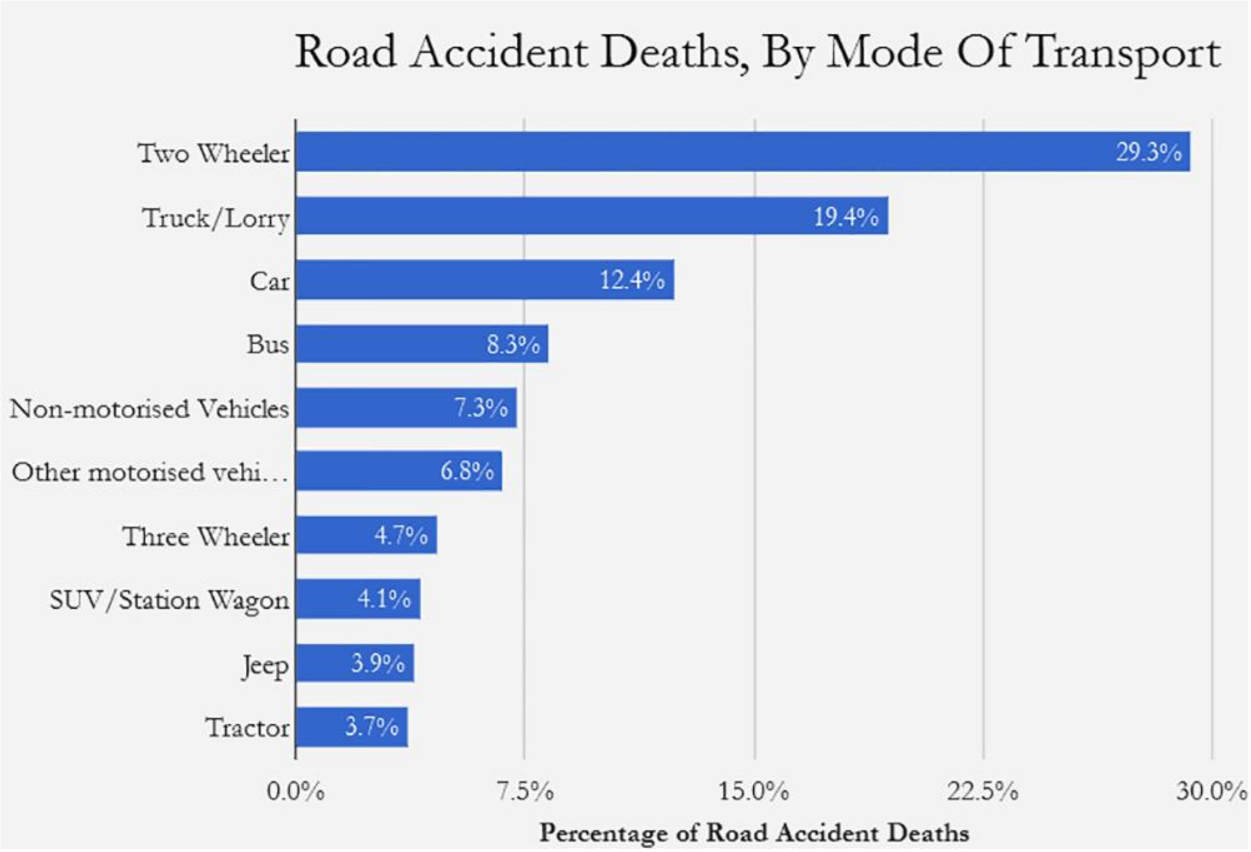

Fig 1. Percentage of Road Accident Deaths

The former is difficult and expensive to achieve, while the latter is impossible without the former because 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 an example of this. Money incentivizes Operators to make rash actions, such as driving all night despite exhaustion. This is primarily due to the fact that the Operators are unaware of the significant dangers of driving while fatigued. Some countries have put limits on how many hours a Operator can drive in a row, but this isn't enough to fix the problem, as its execution is still lacking.

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.

CHAPTER – II

LITERATURE SURVEY

2.1. Facial Recognition

Some facial recognition algorithms take landmarks or features from an image to identify faces. The relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw, for example, may be analyzed by an algorithm. These features are then utilized to find other photos that have similar features. Other approaches compress the face data after normalizing a gallery of face photos, saving only the info in the image that is important for face detection. The facial data is then compared to a probing image. One of the first effective systems is based on template matching techniques applied to a set of important facial traits, resulting in a compressed representation of the face.

2.1.1. Facial Recognition methods

There are two types of algorithms for recognition:

i. Geometric, which is concerned with differentiating characteristics (feature based).
ii. Photometric, a statistical approach that reduces an image to values and compares them to templates to remove variations (view based).

Recognition algorithms that are commonly used the geometric technique is used in both Principal Component Analysis and Linear Discriminate Analysis. The statistical method is used in Elastic Bunch Graph Matching and the Hidden Markov Model.

2.1.1.1 Principal Component Analysis (PCA)

PCA is a mathematical process that reduces a large number of potentially associated variables to a smaller number of unrelated variables known as primary components. The first principal component accounts for as much variety as feasible in the data, and each subsequent component accounts for as much variability as possible.

PCA is mostly used for exploratory data analysis and the creation of prediction models. The eigen value decomposition of a data covariance matrix or the singular value decomposition of a data matrix is calculated in PCA.

PCA is the most basic eigenvector-based multivariate analysis method. Its operation is often described as revealing the data's fundamental structure in a way that best explains the variation in the information.When a multivariate dataset is displayed as a set of coordinates in a high-dimensional data space (one axis per variable), PCA provides a lower-dimensional representation, or "shadow," of the item when viewed from its (in some ways) most relevant viewpoint.

2.1.1.2 Linear Discriminate Analysis (LDA)

LDA is a technique for determining a linear combination of features that distinguishes or distinguishes two or more classes of objects or occurrences. The final product can be used as a linear classifier. Each face is represented by a huge number of pixel values in computerized face recognition. Before classification, linear discriminant analysis is performed to reduce the number of features to a more manageable quantity. Each of the additional dimensions is a template made up of a linear combination of pixel values.

2.1.1.3 Elastic bunch graph mapping

In computer science, elastic matching (EM) is one of the pattern recognition approaches. It's also known as nonlinear template matching, flexible template matching, or deformable template matching. Elastic matching is a two-dimensional warping optimization problem that specifies corresponding pixels between subjected images.

2.1.1.4 Hidden Markov Model (HMM)

A hidden Markov model (HMM) is a statistical model that assumes the system being modelled is a Markov process with an unobserved state. An HMM is the most basic type of dynamic Bayesian network.

Hidden Markov models are widely used in temporal pattern recognition applications like as voice, handwriting, gesture identification, part-of-speech tagging, partial discharges, and bioinformatics.

2.1.2. Three Dimension face Recognition

Three-dimensional facial recognition is a new trend that claims to attain previously unmatched accuracy. This method captures information on the geometry of a face using 3-D sensors. The contour of the eye sockets, nose, and chin are among the characteristic features on the surface of a face that are identified using this information.

Even the most precise 3D matching algorithm could be affected by facial emotions. To do this, tools from metric geometry are used to treat expressions as isometrics.

2.1.3 Skin texture analysis

Skin texture analysis, which employs the visual features of the skin obtained in conventional digital or scanned photographs, is another rising trend. This technology converts a person's skin's distinct lines, patterns, and spots into a mathematical space.

Operator Drowsy Detection System

2.2.1 Method for detecting drowsiness

Drowsy detection systems can be divided into two types: incursion and non-intrusion.Approaches that are intrusive Sensors are used to detect tiredness and activate an alarm system. Invasive instrumentation devices or temperature sensing electrodes are used in such systems. Other intrusive methods include monitoring brain waves, heart rate, and eye blinking, as well as drooping posture, head leaning, and the open/closed states of the eyes.

Operators are said to be both physically and mentally disturbed by these devices. This is the most accurate description, yet it is not realistic. Because the sensing electrodes would have to be affixed to the Operator's body directly. It irritates and distracts the motorist.Furthermore, long periods of driving cause perspiration on the sensors, reducing their ability to monitor precisely.

Drowsiness is detected using non-intrusive approaches that do not disturb the Operator's body. Sensing arterial blood supply, Operator response regularly, lane departure, yawn rate computation, optical sensor, LED, video camera, head motion, eyelid movement, and Doppler component such as velocities and angle are all crucial non-intrusive methods. These devices are lifelike, but they aren't always correct.

In individuals driving a car, there is no defined protocol for monitoring tiredness or quantifying automatic sleep. There are, however, five recording techniques that are widely utilized. The recording of electroencephalographic (EEG) brain waves is one method.

An EEG is a device that records brain wave activity. Sensors on both sides of the head are connected to a polygraph machine, which shows brain activity. Electro-oculogram (EOG) is employed in the majority of cases. The EOG uses a voltage differential between the cornea and the retina to capture eye movements. The vector of this electric field changes with regard to a reference electrode when the eye moves. The problem with this technology is that while recording eye movements, at least two channels are required to help separate eye movement potentials from other signal anomalies.

Electromyography is used to quantify muscle tension (EMG). Under the chin and on the legs are two common locations for EMG electrodes. It is frequently ruled out since it interferes with the Operator's (job) task. Camera-based eye movement recordings are another prominent approach that has gained a lot of attention in relation to Operator tiredness. Because it is contactless, unobtrusive, and suited for online analysis, this technology is more viable in many driving experiments. Cameras are used to record the Operator's gaze in order to obtain video images. Blink frequency, blink duration, extended closure time, pupil diameter (response), and gaze are all visual indicators that indicate tiredness.

Behavioral signals of tiredness, such as body motions, gestures, face tone, and head movements, fall under a third technical category. Cameras are used to measure the head, and the records are then subjected to video image analysis or observer ratings. A drowsy and expressionless facial tone, yawning, nodding (head tilts), and a sagging body posture are all signs of tiredness.

A fourth category refers to driving metrics linked to tired driving performance impairment. Increased lateral position fluctuation and specific steering wheel characteristics (e.g., lack of micro adjustments) are example.Operator tiredness is often indicated by significant steering wheel reversals and occasional large steering wheel reversals.

Subjective tiredness ratings are the sixth category. The simplest technique to measure Operator tiredness is by ratings; nevertheless, it's also interesting to learn more about how Operators perceive sleepiness and whether their perception correlates with objective sleepiness indices. Let's take a look at each metric individually.

2.2.2 Brain waves

The electroencephalographic (EEG) gadget is a head tracker. EEG detects brain activity directly and can thus assess a person's state of alertness. EEG is a valid and reliable measure of tiredness in many applications because it can discriminate between someone who is fully awake and aware and someone who is drowsy and at risk of falling asleep at the wheel. EEG is commonly used to research sleep in people who are trying to sleep. An EEG method for identifying weariness and drowsiness under simulated conditions was shown to have significant connections in a study by [14].

The difficulty in collecting recordings under genuine driving settings is the most significant disadvantage of EEG as an on-road tiredness monitoring equipment, making it a relatively unrealistic alternative. Fatigue detection is an option. The quantification of EEG data is relatively difficult, so an off-line analysis is frequently the best option.

2.2.3 Signal rate of heartbeats

The heart rate variability (HRV) may be calculated using the heart beat pulse signal, which might reflect the amount of effort that individual expends fighting sleep and could be a useful metric in this type of study. HRV contains three primary frequency bands, according to the frequency domain spectrum analysis: high frequency band (HF) of 0.15–0.4 Hz, low frequency band (LF) of 0.04–0.15 Hz, and very low frequency (VLF) of 0.0033–0.04 Hz. The LF/HF ratio is the ratio of LF to HF power spectral density. When a person transitions from waking to drowsiness/sleep, the HF power falls, while the HF power increases. As a result, HRV analysis could be a useful tool for detecting Operator drowsiness. The HRV method's key downside is that it is heavily influenced by stress.

2.2.4 Gestural tracking

The current method for detecting tiredness focuses solely on changes in the eye. Infrared light and appearance-based object recognition are used in the eye detection and tracking method. Another way involves using infrared light to produce corneal glints that are picked up by the camera to determine pupil-glint vectors while maintaining the pupil central. In another form, the eye is tracked using the colour features of human skin. Another difference is that video cameras collect images of the Operator's face, and a variety of indicators, including eye gaze direction, are utilised to infer driving states like fatigue [7].

Almost all of these approaches were either created in the lab or have little on-road application. Many of these methods have shown to be effective. In low-light situations or when head movements are frequent, it can be difficult to distinguish the eye.

2.2.5 Blink Behavior

Blink Behavior is a type of blinking behavior that occurs when a person blinks another way is to use video monitoring techniques to analyze Operators' eye blinking rate. When the Operator is wearing spectacles, the system has a hard time calculating the value. Image processing based on a Operator's facial expression is possible, but the processing power is significant, and the lighting inside the car is a crucial component for obtaining valid data, and the technology may raise privacy concerns. The financial cost is enormous, and it also compromises the Operator's privacy.

The other variation is one that uses motion image processing to measure a Operator's blink rate in real time and infer Operator states [11].

2.2.6 Eye Closure

The PERCLOS (Percent Eye Closure) approach stands out as potentially useful in the actual world. It's a video-based technique for determining ocular closure. One of the advantages of PERCLOS is that it has been tested for validity as a fatigue detection device. A variety of performance indicators were used to assess the system. Eye closure and gaps in attention were found to have satisfactory connections, offering some convergent evidence when one measure corresponds with other tests thought to evaluate the same construct of the system's ability to identify the Operator's current state. Furthermore, when compared to a number of other prospective sleepiness detection systems, PERCLOS exhibited the clearest association with driving simulator performance.

Other variation is that automated detection of eye closure by using video imaging of the face then computation methods for locating the eyes and changes in intensity to determine whether eyes are opened or closed. If eye is closed for five consecutive frames or more, alarm is given to the Operator.

2.2.7 Facial Tracking

The original PERCLOS methodology involved video recording of the Operator’s eyes to be later scored by trained observers. The approach used by Seeing Machines, called face LAB, is different from most other measures of eye closure and gaze direction. This method has the apparent advantage of being able to cope with low light conditions, head movement and tracking of gaze direction while the Operator is wearing sunglasses. The face LAB methodology has been validated, in PERCLOS approach was used to mimic driving situations.

Another method locates pupils and detects head movements using infrared light. After that, Kalman filtering is utilized to estimate the positions of facial features. To deal with facial occlusion difficulties, this strategy employs predictive analysis .

2.2.8 Arterial Blood Supply Sensing

Non-intrusive systems, such as the detection of arterial blood supply in various parts of the Operator's body, can be used to determine the Operator's status.

The disadvantage of this technique is that it is difficult to measure cranial blood flow, which necessitates a tailored device with contact sensors that only detect cranial blood flow.

Method of Operator Reaction

Some non-intrusive approaches detect the Operator's response by asking the motorist to provide a response to the system every five seconds to demonstrate awareness. The difficulty with this method is that the motorist will ultimately use of it and become irritated.

2.3.1 Calculate your yawn rate

The process of detecting yawning is divided into two parts: The yawn component in the face is identified, regardless of the mouth location. This part is essentially a hole in the mouth caused by a broad mouth opening. The mouth location is used to confirm the identified component's validity. The greatest hole inside the face is chosen as the contender for a yawning mouth after skin segmentation. This crater is connected to a Inside the face, there is a non-skin area that can be associated to the eyes, mouth, or open mouth. In a yawning state, it's safe to infer that the open mouth will be the largest of the three. In this method, a yawning mouth candidate can be found. The identified mouth's information is then used to confirm the observed yawning mouth. The number of pixels in the yawning mouth in relation to the number of mouth pixels, as well as the relative placement of the open mouth in relation to the lips, are used as verification criteria.

The distance between the midpoint of the nostrils i.e. the nose passage and the chin, is another approach for detecting yawns. The chin is segmented, and the face is segmented. The midpoint of the nostrils is then found using the directional integral projection approach. The Operators' yawn can be identified by estimating the vertical distance between the midpoints of their noses and their chin.

Using geometric aspects of the mouth to identify yawning has some drawbacks. First, the left and right mouth corners are clear distinguishing features, but the hole in the mouth is more difficult to spot. Second, geometric traits are more likely to pose and differ from person to person.

2.3.2 Operator State Monitor

Delphi Electronics is working on an automotive-grade, real-time, vision-based Operator status monitoring system that will help Operators avoid falling asleep or being distracted. The system combines the Fore Warn Drowsy Operator Alert and the Fore Warn Operator Distraction Alert into a single Operator State Monitor (DSM). The DSM is a computer vision system that uses two IR illumination sources and a single camera installed on the dashboard immediately in front of the Operator. The technology evaluates eye closures and head attitude to infer fatigue or distraction level after identifying and tracking the Operator's facial features.

2.3.3 Video-based Sensor

Face LAB from Seeing Machines tracks the head and face, as well as the eye, eyelid, and gaze. without the need of cables or magnets, including head position, gaze direction, and eyelid closure in real time under real-world situations. As a result, it's a promising technique for studying Operator behavior in simulators and test vehicles. Face LAB's complete blink analysis and PERCLOS assessment, which includes delivery of raw data on the specifics of eyelid behavior, may detect drowsiness in real time. The location of the eyelids is measured rather than the brightness of the pupil or the blockage of the cornea. Face LAB also allows each human image to be automatically calibrated, and the data can be reused in other research. The difficulty in locating eyelid location is a major drawback of this procedure, which necessitates numerous measurements.

2.3.4 Smart Eye

Smart Eye AB is a company that provides general services Computer vision software enables computers and machines to identify human face/head movement, eye movement, and gaze direction in the public, private, and academic sectors. Smart Eye Pro 3.0, a remote and unobtrusive sensor that detects facial and eye movement for a number of applications, including transportation safety research (drowsiness, alertness) and simulators, has been created and tested by Smart Eye. Smart Eye Pro 3.0 is a machine vision system that uses a simple and reliable method based on tracking individual face features and a three-dimensional (3D) head model to estimate head posture. The first head model is generic and can be customized for the user. The 3D feature locations are determined using their prior locations and a motion model once the device is in tracking mode. If you're looking for a way to keep. When the probe face is unexpectedly lost, the system uses a fast face identification algorithm to swiftly re-acquire the probe face and resume tracking. While the face is being tracked, picture edge information is combined with 3D models of the eye and eyelids to calculate gaze direction and eyelid positions. The issue with this strategy is that it does not build a sleepiness monitoring algorithm.

2.3.5 Sensor Motoric Instruments (SMI)

SMI, based in Berlin, Germany, is currently working on Insight, a cutting-edge, noninvasive operator monitoring system that measures head position and orientation, gaze direction, eyelid opening, and pupil location and diameter using computer vision. It's a high-speed device that measures head posture and gaze at 120 Hz, as well as eyelid closure and blinking at 120 Hz. for combined gaze, head pose, and eyelid measurement, and 60 Hz for combined gaze, head pose, and eyelid measurement. Insight TM calculates PERCLOS to determine a Operator's level of awareness. According to the manufacturer, the system uses automatic and robust tracking algorithms that enable for precise Operator state monitoring in all lighting conditions, from sunlight to darkness.

2.4. Eye Detection Research

For skin color extraction, Sobattka et al. employ HSV color space thresholding. This approach, however, is sensitive to variations in lighting and racing. Huang et al. use optimum wavelet packets for eye representation and radial basis functions for later categorization of facial areas into eye and non-eye regions to accomplish eye detection. Sirohey et al. employ filters that are based on this eye detection Research. [12]

Gabor wavelets are used to identify eyes in grayscale photographs. Sobattka et al. use the vertical and horizontal reliefs to detect the eye pair that requires posture normalization in a similar way. Feng et al. use the variance projection method to detect eyes on grey images utilizing several signals. The variance projection function, on the other hand and the consistency of an eye window is variable. [13]

2.5. Negative aspects

Variable lighting and changing backgrounds provide issues that are difficult to solve in a moving vehicle. Changes and movements in the eyes have been utilized to detect sleepiness effects and the current state of the Operator. This notion is used by a variety of technologies to assess changes in the Operator's gaze direction, blink rate, and actual eye closure. Almost many of these approaches have only seen limited use on the road or have only been created in the lab and not put into practice.

The Percent Eye Closure (PERCLOS) methodology and electroencephalographic (EEG) for measuring tiredness are two prominent methodologies. The issue with the PERCLOS is determining when the Operator is in danger and when a warning should be issued. The difficulties in getting recordings under real-world driving conditions makes EEG a relatively impractical alternative for fatigue monitoring. This old approach has some flaws due to lighting variations. As a result, the proposed system employs newly developed preprocessing and eye detection approaches, as detailed in Chapters 4 and 5. The existing systems have a number of major flaws.

- IR lighting can be hampered by sunlight.
- Some gadgets store the frame in external memory.
- The current gadget has a higher percentage of false alarms.
- Current approaches, such as PERCLOSURE and AVGCLOSURE, are unreliable.
- Many existing systems employ intrusive techniques.
- Traditional technologies are unreliable when travelling at night or throughout the day.

2.6 Description table

Author	**Publisher**	**Tittle**	**Work**
1. Vishnu Yarlagadda, Shashidhar G. Koolagudi, Manoj Kumar M V, Swapna Donepudi	IEEE (December 2020)	Driver Drowsiness Detection Using Facial Parameters and RNNs with LSTM	In this project we detect the state of drowsiness using facial parameters obtained using facial points with the help of RNNS and LSTM with accuracy of 97.25%.
2. WANGHUA DENG AND RUOXUE WU	IEEE (21st August 2019)	Real-Time Driver Drowsiness Detection System Using Facial Features	In this paper, we propose a system called “DriCare”, which detects the drivers’ fatigue status, such as yawning, blinking, and duration of eye closure, with accuracy of 90%.
3. Subramanian Arumugam* and R. Bhargavi	Springer (2019)	A survey on driving behavior analysis in usage based insurance using big. data.	In this research paper, PayHow-You-Drive (PHYD) model is developed in which

			the premium is charged for the personal auto insurance depending on the post-trip analysis.
4. Jun Wang, Xiaoping Yu*, Qiang Liu,and Zhou Yang	Springer (2019)	Research on key technologies of intelligent transpotation based on image recoznigation and anti fatigue.	This paper focuses on the traffic safety caused by fatigue driving based on image recognition of key technologies for research and analysis. It uses KNN algorithm with accuracy of 87.82%.
5. Felipe Jiménez José Eugenio Naranjo , José Javier Anaya , Fernando García b	ScienceDirect (18 April 2016)	Advanced Driver Assistance System for road environments to improve safety and efficiency	In this project, advanced driver assistance system (ADAS) for rural and intercity environments is proposed. The system focuses mainly on compared to motorways and the high number of severe and fatal accidents on them.

Table. 01 Description about Literature Servey

CHAPTER – III

PROBLEM DISCRIPTION & PROPOSED WORK

3.1. Problem statement

Fatigue is a safety issue that has yet to be fully addressed by any government in the world, owing to its nature. 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 fatigue-related accidents and encouraging Operators to confess weariness when necessary. The former is difficult and expensive to achieve, while the latter is impossible without the former, as long-distance driving is extremely lucrative.

Problem: A new system to monitor the operator fatigue and analyze them.

3.2. Feasibility Study

This survey is being conducted to better understand the needs and requirements of the general public, and in order to do so, we combed through several websites and applications for the necessary information. We created an audit based on this data, which allowed us generate fresh ideas and build alternate arrangements for our assignment. We came to the conclusion that such an application is required and that there has been some advancement in this field.

3.3 Proposed Research Work

3.3.1 Key Terminology

A) Operator Fatigue Detecting

Operator There are two sorts of fatigue detection methods: touch and non-contact methods. In contact techniques, Operators 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 Operator's body. Li et al. employed an electroencephalographic (EEG) signal to identify Operator sleepiness using a wristwatch. Jung et al. redesigned the steering wheel and included an integrated sensor to track the Operator'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 Operator sleepiness, which eliminates the necessity for the measured object to make touch with the Operator. For example, Omidyeganeh et al. employed the camera to capture the Operator's facial look in order to identify tiredness, although this approach is not real-time.

To predict Operator 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 utilize 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].

3.4 Software Requirements and Hardware Requirement

3.4.1 Software Requirement Specification

3.4.1.1 Python:

i) Python

3.4.1.2 Libraries

i) Numpy
ii) Scipy
iii) Playsound
iv) Dlib
v) Imutils
vi) opencv, etc.

3.4.1.3 Operating System

i) Windows or Ubuntu

3.4.2 Hardware Requirements Specification

a) Laptop with basic hardware.
b) Webcam

3.4.3 Requirement Analysis

(A) Python:

Python is the basis of the program that we wrote. It utilizes many of the python libraries.Python is a programming language. Python is a high-level, interpreted programming language that may be used for a variety of tasks. Python's design philosophy priorities code readability, as evidenced by its extensive use of whitespace.

(B) Libraries:

a) **Numpy**: Pre-requisite for Dlib. NumPy is a Python module that allows you to interact with arrays. It also provides functions for working with matrices, fourier transforms, and linear algebra. Travis Oliphant invented NumPy in 2005. It is an open source project that you are free to use.

b) Scipy:
Used for calculating Euclidean distance between the eyelids. SciPy is a scientific computation package built on top of NumPy.Scientific Python (SciPy) is a Python programming language.It has greater optimization, statistics, and signal processing functions.SciPy, like NumPy, is open source, which means we can use it without restriction.Functions that are regularly used in NumPy and Data Science have been improved and added to SciPy.

c) Dlib:
This program is used to find the frontal human face and estimate its pose using 68 face landmarks. Dlib is a modern python toolkit that includes machine learning techniques and tools for writing complicated python software that solves real-world problems.

d) **Imutils:**
A set of convenience functions for OpenCV and Python 2.7 and Python 3 that make fundamental image processing functions like translation, rotation, scaling, skeletonization, and presenting Matplotlib pictures easier.

e) **Opencv:**
Computer vision that is open source. It is one of the most extensively used tools for image processing and computer vision. It's utilized in a variety of applications, including face identification, video recording, tracking moving objects, object disclosure, and, more recently, Covid applications like face mask detection and social distancing. If you want to learn more about OpenCV which is used to get the video stream from the webcam, etc.

3.4.4 Operating System:

Program is tested on Windows 10 build 1903 and PopOS 19.04 4.3 Laptop: Used to run our code. 4.4 Webcam: Used to get the video feed.

CHAPTER – IV

IMPLEMENTATION AND RESULT DESCRIPTION

4.1 TOOLS REQURIED FOR IMPLEMENTATION

4.1.1 Python

Python is a programming language. Python is a high-level, interpreted programming language that may be used for a variety of tasks. Python's design philosophy priorities code readability, as evidenced by its extensive use of whitespace. Its language elements and object-oriented approach are designed to assist programmers in writing clear, logical code for both small and big projects. Python is dynamically typed and supports procedural, object-oriented, and functional programming paradigms.

Fig 2. Python

4.1.2 Visual Studio Code

Visual Studio Code is a source-code editor that supports Java, JavaScript, Go, Node.js, and Python, among other programming languages. It's built on the Electron framework, which is used to create

Node.js Web apps that leverage the Blink layout engine. The same editor component (codenamed "Monaco") that is used in Azure DevOps is used in Visual Studio Code (formerly called Visual Studio Online and Visual Studio Team Services). Visual Studio Code comes with rudimentary support for the majority of programming languages out of the box. Syntax highlighting, bracket matching, code folding, and customizable snippets are all included in this basic package

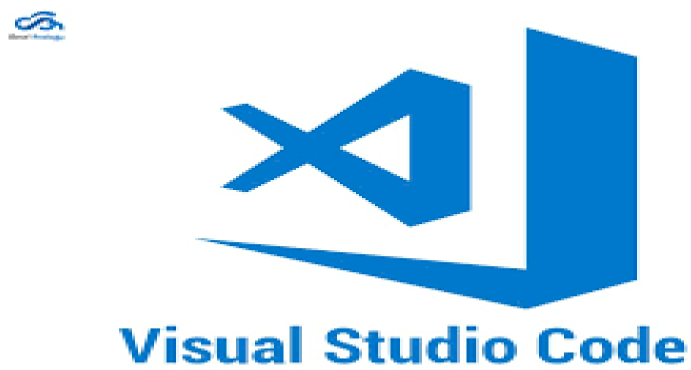

Fig 3. Visual Studio Code

4.1.3 Image Processing

Image processing is the process of converting a physical image to a digital representation and then conducting operations on it to extract valuable information. When implementing specific specified signal processing algorithms, the image processing system normally treats all images as 2D signals.

Image processing can be divided into five categories:

- Visualization - Look for objects in the image that aren't visible.
- Identifying or detecting things in an image is referred to as recognition.
- Sharpening and restoration - From the original image, create an upgraded image.
- Recognize the many patterns that surround the things in the image.

- Search and browse through a big library of digital photos that are comparable to the original image.

Fig. 4. Image Processing

4.1.4 MACHINE LEARNING

Machine learning is the scientific study of algorithms and statistical models that computer systems utilize to effectively accomplish a certain task without explicit instructions, relying instead on patterns and inference. Artificial intelligence is seen as a subset of it. In order to make predictions or judgments without being explicitly taught, machine learning algorithms create a mathematical model based on sample data, known as "training data."

Machine learning can be defined as the science of teaching computers to learn on their own. It's a type of artificial intelligence (AI) that allows computers to behave like people and learn more as they encounter more data.

Machine learning is becoming more and more popular. It's a buzzword that appears in science and technology headlines alongside terms like deep learning and artificial intelligence. But, first and foremost, what is machine learning? What is it used for, exactly? We examine everything there is to know about the fundamentals of this interesting technology.

We'll look at some of the main forms of machine learning now in use, as well as their applications, in addition to analyzing a machine learning definition. We'll also go through some of the machine-learning-related jobs and the abilities you'll need to get started.

Computers can learn to make judgements and predictions without being explicitly trained to do so using machine learning. The method use algorithms to create models that can subsequently be used for a variety of applications.

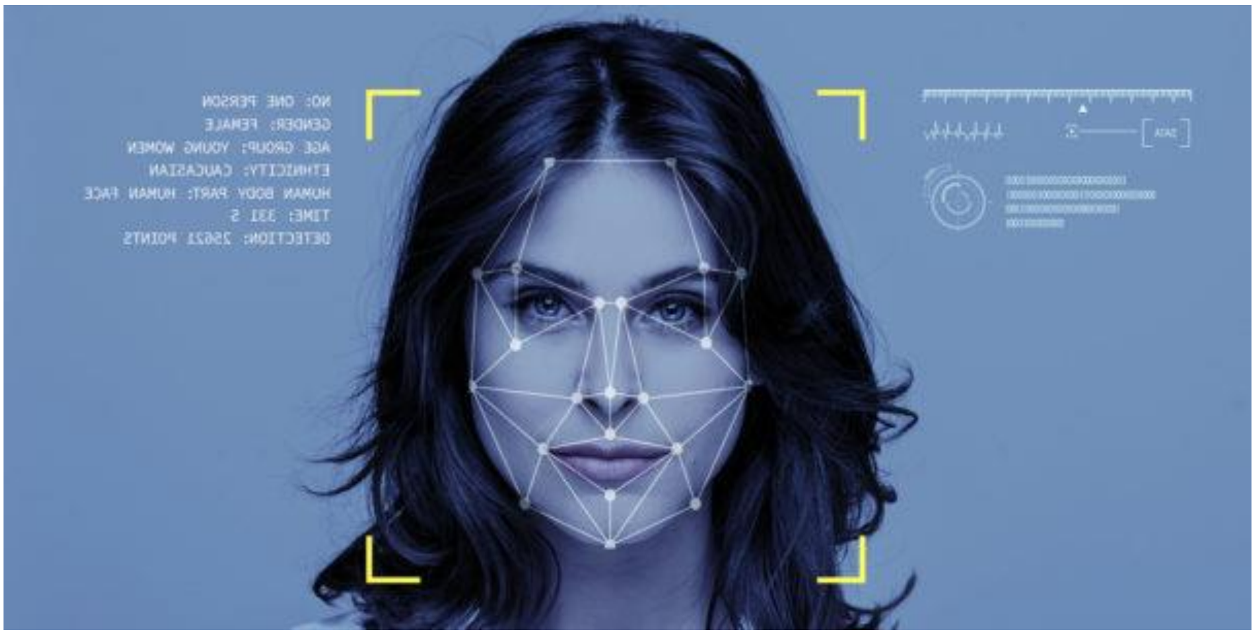

Fig 5. Machine Learning

4.1.5 OpenCv

Computer vision that is open source. It is one of the most extensively used tools for image processing and computer vision. It's utilised in a variety of applications, including face identification, video recording, tracking moving objects, object disclosure, and, more recently, Covid applications like face mask detection and social distancing. If you want to learn more about OpenCV.

OpenCV is an image recognition library that is free to use .It's utilized for image processing, computer vision, and machine learning. When you combine OpenCV with sophisticated libraries like Numpy and Pandas, you can get the most out of it.

Fig. 6. OpenCv

4.1.6 Dlib

Dlib is a modern python toolkit that includes machine learning techniques and tools for writing complicated python software that solves real-world problems. It is employed in a wide number of fields, including robots, embedded devices, mobile phones, and massive high-performance computing systems, in both industry and academics.

Fig 7. Dlib

4.2 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.

4.2.1. 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 Operator 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.

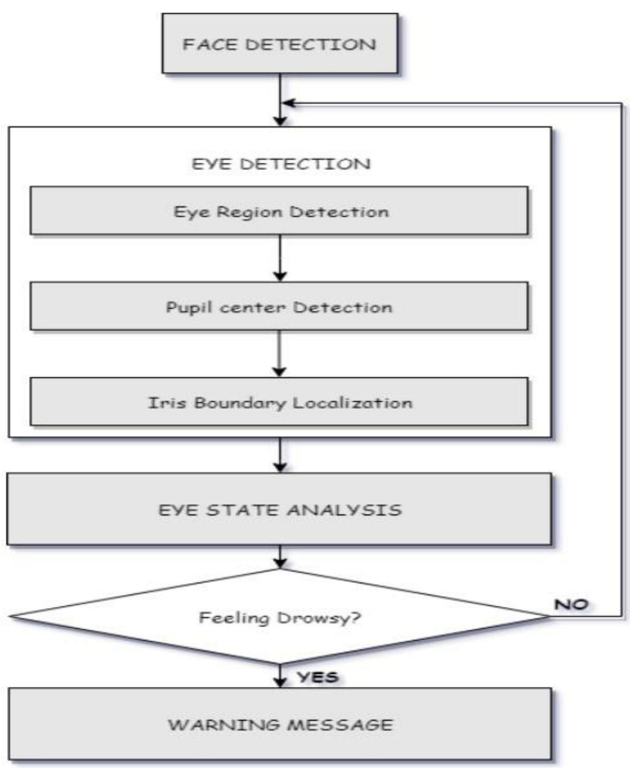

Fig 8. OFDS

4.2.2 User Case Diagram

User Case diagram is the pictorial representation of how the functioning of the project is going to implement their respective process. In this user case diagram we explain the process from starting the operator to how the alert notification message is going to be printed on the screen as well the notification of analyzing which is done with the help of aspect ratio and the blinking of the eye how this all gone happen with the operator.

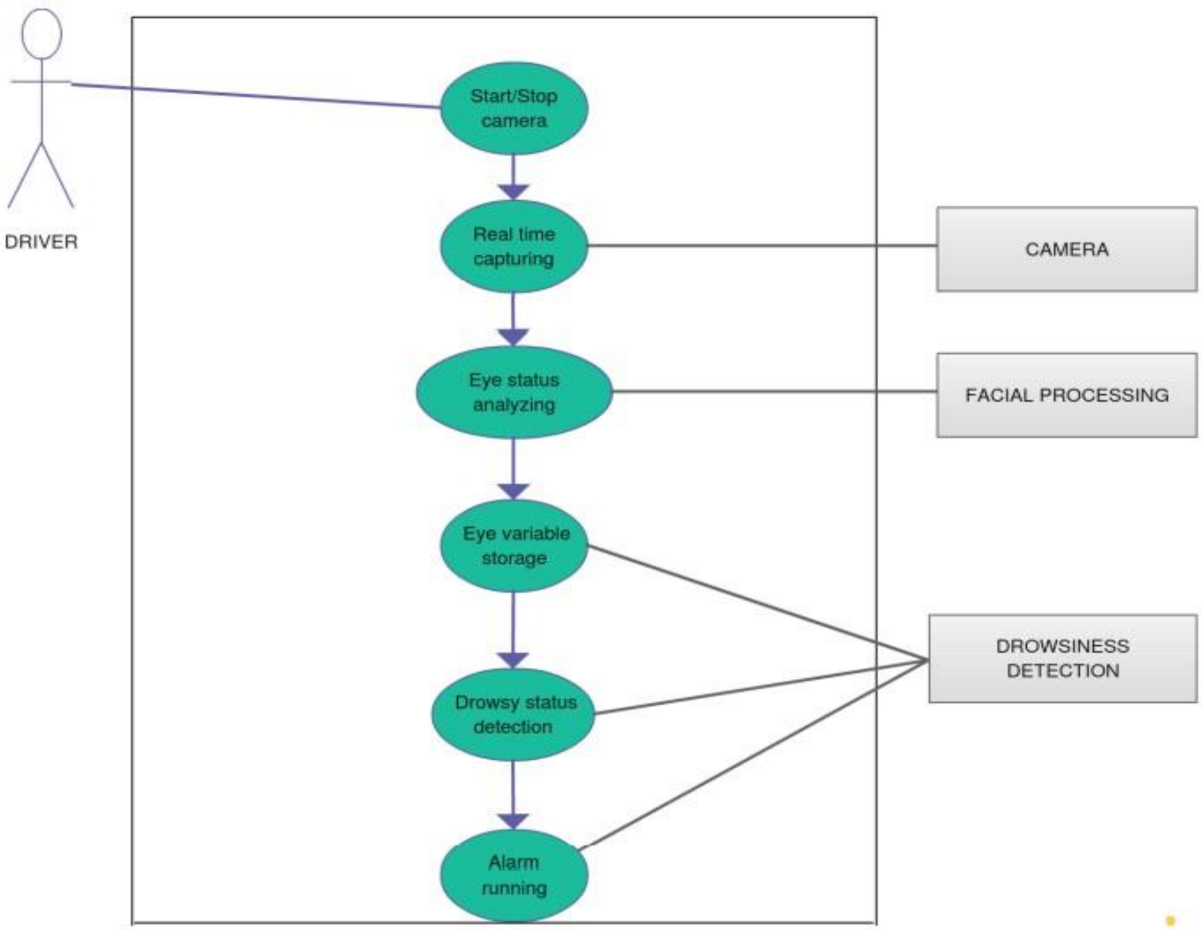

Fig 9. User Case Diagram

4.2.3 CODE EXPLAINTION

Our main oblective in this segment is to calculate the aspect ratio of operator’s eyes so that after cakculating the aspect ratio we will able to find out that the blinking ratio as well as apect ratio of the person who is operating the vehicle.So first of all let’s dicuss what is aspect ratio.

(i) Aspect ratio :-

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.

phase3.py > {} cv2

```
#Importing OpenCV Library for basic image processing functions
import cv2
# Numpy for array related functions
import numpy as np
# Dlib for deep learning based Modules and face landmark detection
import dlib
#face_utils for basic operations of conversion
from imutils import face_utils


#Initializing the camera and taking the instance
cap = cv2.VideoCapture(0)

#Initializing the face detector and landmark detector
detector = dlib.get_frontal_face_detector()
predictor = dlib.shape_predictor("shape_predictor_68_face_landmarks.dat")

#status marking for current state
sleep = 0
drowsy = 0
active = 0
status=""
color=(0,0,0)

```

Fig. 10 Code Implementatin Phase 1

phase3.py > {} cv2

```python
def compute(ptA,ptB):
    dist = np.linalg.norm(ptA - ptB)
    return dist

def blinked(a,b,c,d,e,f):
    up = compute(b,d) + compute(c,e)
    down = compute(a,f)
    ratio = up/(2.0*down)

    #Checking if it is blinked
    if(ratio>0.25):
        return 2
    elif(ratio>0.21 and ratio<=0.25):
        return 1
    else:
        return 0


while True:
    _, frame = cap.read()
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)

    faces = detector(gray)
    #detected face in faces array
```

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Fig. 11 Code Implementatin Phase 2

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".

IMPLEMENTING PROCESS:-

- In our program we used Dlib, a pre-trained program trained on the HELEN dataset to detect human faces using the pre-defined 68 landmarks.
- After passing our video feed to the dlib frame by frame, we are able to detect left eye and right eye features of the face.
- Now, we drew contours around it using OpenCV.
- Using Scipy's Euclidean function, we calculated sum of both eyes' aspect ratio which is the sum of 2 distinct vertical distances between the eyelids divided by its horizontal distance.

- Now we check if the aspect ratio value is less than 0.25 (0.25 was chosen as a base case after some tests). If it is less an alarm is sounded and user is warned

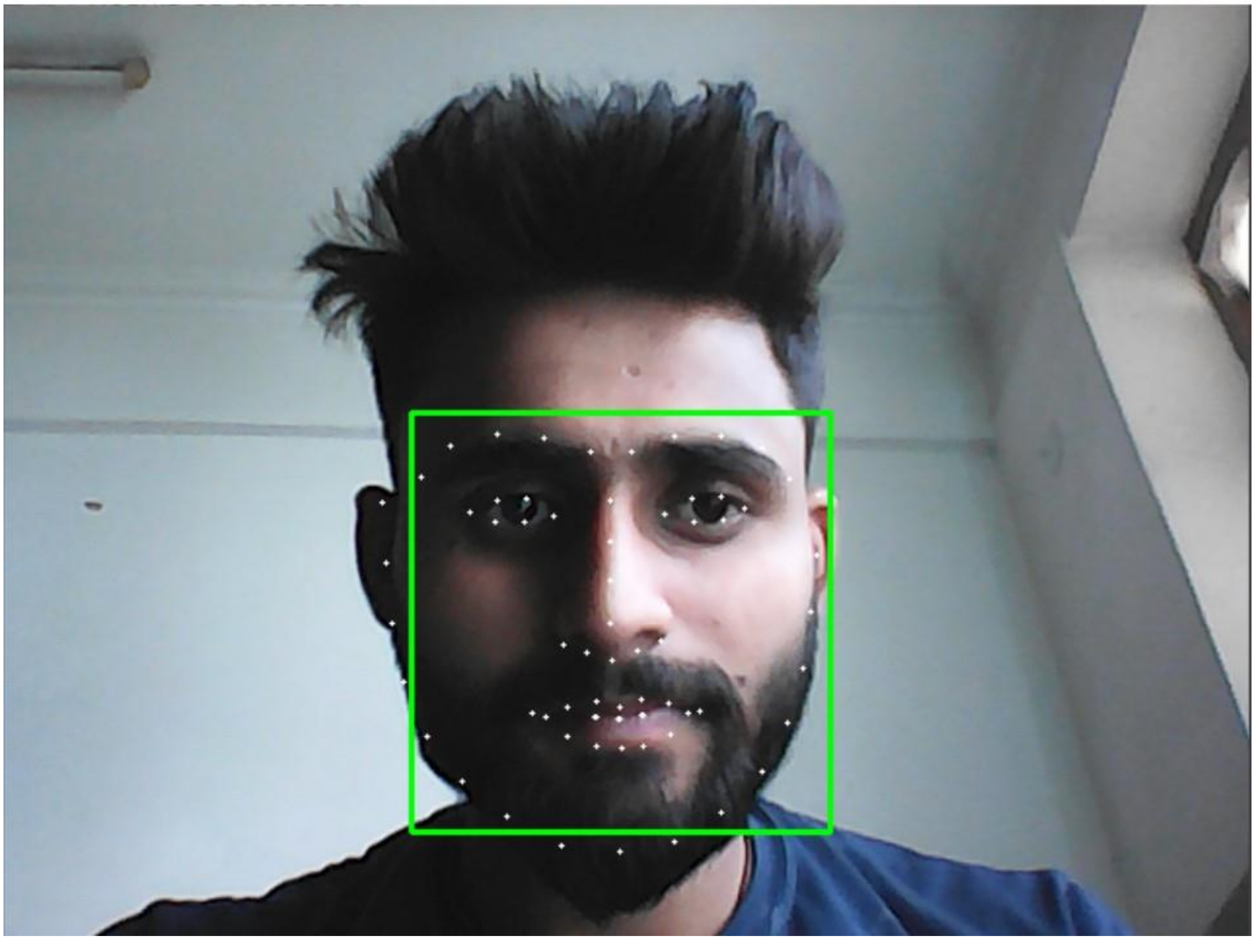

Fig. 12 Output Image 1.

phase3.py > {} cv2

```python
    for face in faces:
        x1 = face.left()
        y1 = face.top()
        x2 = face.right()
        y2 = face.bottom()

        face_frame = frame.copy()
        cv2.rectangle(face_frame, (x1, y1), (x2, y2), (0, 255, 0), 2)

        landmarks = predictor(gray, face)
        landmarks = face_utils.shape_to_np(landmarks)

        #The numbers are actually the landmarks which will show eye
        left_blink = blinked(landmarks[36],landmarks[37],
            landmarks[38], landmarks[41], landmarks[40], landmarks[39])
        right_blink = blinked(landmarks[42],landmarks[43],
            landmarks[44], landmarks[47], landmarks[46], landmarks[45])

        #Now judge what to do for the eye blinks
        if(left_blink==0 or right_blink==0):
            sleep+=1
            drowsy=0
            active=0
```

Loading...

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Fig. 13 Code Implementatin Phase 3

The above code convert the face landmark into dotted image structure and covert into image processing as shown below

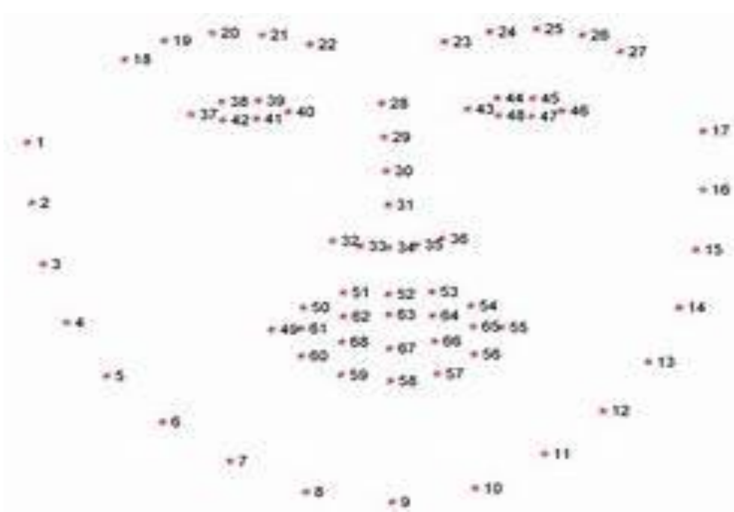

Fig. 14 Output Image 2.

(ii) Aspect ratio >= 0.25

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).

Fig. 15 Output Image 3.

(ii) 0.24<= Aspect ratio <= 0.05

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.

Fig. 16 Output Image 4.

(iii) Aspect Ratio<0.05

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.

Fig. 17 Output Image 5.

4.2.4 System Testing

Test Cases and Test Results

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

Table 02. Test Case & Results

CHAPTER V

CONCLUSION AND FUTURE SCOPE

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 of the ten-second time frame, the system must decide if the Operator is sleepy in only a few seconds. The algorithm should not only be quick, but also accurate, with as few false alarms (alerting while the Operator is awake) and false finds (mistaking other characteristics in the picture for eyes) as feasible.

It totally fulfils the system's aims and criteria. The framework has reached a stable state in which all defects have been eliminated. Clients who are familiar with the framework and understand its features, as well as the fact that it alleviates stress for those who suffer from fatigue-related disorders by informing them of their sleepiness level while driving.

5.1 Conclusion

It totally fulfils the system's aims and criteria. The framework has reached a stable state in which all defects have been eliminated. Clients who are familiar with the framework and understand its features, as well as the fact that it addresses the issue of stressing out for people with fatigue-related issues by informing them of their sleepiness level while driving. With the help of alert generation and 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 Operator'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.

5.2 Future Scope

Some future scope of them are describe in detailed and descriptive manner below:

(1). 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.

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

(3) Other parameters such as blink rate, yawning, automobile condition, and so on can be used to improve the model incrementally. If all of these factors are applied, the accuracy can be greatly improved.

(4).We intend to expand on the project by adding a sensor to monitor heart rate in order to prevent accidents caused by Operators suffering from sudden heart attacks.

(5).The same model and techniques can be applied to a variety of other applications, such as detecting when a user is sleeping and stopping the video accordingly. It can also be utilised in an application that warns users about their level of tiredness while driving.

REFERENCES

[1] Operator Drowsiness Detection Using Facial Parameters and RNNs with LSTM, Vishnu Yarlagadda, Shashidhar G. Koolagudi, Manoj Kumar M V,Swapna Donepudi in IEEE(December 2020).

[2] Real-Time Operator-Drowsiness Detection System Using Facial Features WANGHUA DENG1 AND RUOXUE WU in IEEE (21 August 2019).

[3] A survey on driving behavior analysis in usage based insurance using big data, Subramanian Arumugam* and R. Bhargavi in Springer (2019).

[4] Research on key technologies of intelligent transportation based on image recognition and antifatigue driving Jun Wang, Xiaoping Yu, Qiang Liu and Zhou Yang in Springer (2019).

[5] Advanced Operator Assistance System for road environments to improve safety and efficiency Felipe Jiménez a,*, José Eugenio Naranjo a, José Javier Anaya a, Fernando García b, Aurelio Ponz b, José María Armingol in ScienceDirect (18 April 2016).

[6] International Organization of motor vehicle Manufacturers (2018). Pro-visonal Registration or sales of New Vehicles [2018]. http://www.oica.net/wp-content/uploads

[7] Belhumeur 1 P. 1 and 1 Kriegman 1 D., "What is the set of images of an object under all possible lighting conditions", 1 Int. J. of 1Computer 1 Vision, Vol. 28, 1 pp. 245- 260, 1 2014.

[8] Fletcher L., Apostoloff N., Petersson 1 L. and Zelinsky A., "Vision in and out of1 Vehicles",In Broggi, A. (Ed.), Intelligent Transportation 1Systems.1 IEEE 1 Computer Society, 1 pp. 1 12-17, 1 2013.

[9] G. Borghini, L. Astolfi, G. Vecchiato, D. Mattia, and F. Babiloni, ''Measuring neurophysiological signals in aircraft pilots and car Operators for the assessment of mental workload, fatigue and drowsiness,'' Neurosci. Biobehav. Rev., vol. 44, pp. 58–75, Jul. 2014.

[10] Smart Eye. (2018). Smarteye. [Online]. Available: https://smarteye.se/

[11] J. F. Henriques, R. Caseiro, P. Martins, and J. Batista, ''High-speed tracking with kernelized correlation filters,'' IEEE Trans. Pattern Anal. Mach. Intell., vol. 37, no. 3, pp. 583–596, Mar. 2015.

[12] P. F. Felzenszwalb, R. B. Girshick, D. McAllester, and D. Ramanan, ''Object detection with discriminatively trained partbased models,'' IEEE Trans. Pattern Anal. Mach. Intell., vol. 32, no. 9, pp. 1627–1645, Sep. 2010.

[13] Y. Sun, X. Wang, and X. Tang, ‘‘Deep convolutional network cascade for facial point detection,’’ in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2013, pp. 3476–3483.

[14] S. Ren, X. Cao, Y. Wei, and J. Sun, ‘‘Face alignment at 3000 FPS via regressing local binary features,’’ in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2014, pp. 1685–1692.

[15] E. Zhou, H. Fan, Z. Cao, Y. Jiang, and Q.Yin,‘‘Extensive facial landmark localization with coarse-to-fine. IEEE Int. Conf. Computer. Vis. Workshops, Dec. 2013, pp. 386–391.

[16] Moorthi M., Arthanari and Sivakumar M.,“Preprocessing of Video Image with Unconstrained Background for Drowsy Operator Detection”, International Journal of Computer Science and Network Security (IJCSNS), USA, ISSN 1947-5500 Vol. 8 No.2,pp.145-151, May 2011.

[17] Bassem, H., Berssenbrugge, J., Al Qaisi, I., Stocklein, J., 2013. Reconfigurable driving simulator for testing and training of advanced driver assistance systems. IEEE International Symposium on Assembly and Manufacturing, pp. 337–339. Bifulcoa, G., Pariotaa, L.,

[18] Brackstioneb, M., Mcdonald, M., 2013. Driving behaviour models enabling the simulation of Advanced Driving Assistance Systems: revisiting the Action Point paradigm. Transportation Research Part C: Emerging Technologies, v. 36, pp. 352–366.

[19] Cho, H., Rybski, P.E., Zhang, W. 2011. Vision-based 3D bicycle tracking using deformable part model and Interacting Multiple Model filter”. IEEE ICRA, pp. 4391–4398.

[20] García, F., de la Escalera, A., Armingol, J.M., Jimenez, F., 2012. Context aided fusion procedure for road safety application, IEEE Conference on Multisensor Fusion and Integration for Intelligent Systems, pp. 407–412.

[21] García, F., Jiménez, F., Naranjo, J.E., Zato, J.G., Aparicio, F., Armingol, J.M., de la Escalera, A. 2012. Environment perception based on LIDAR sensors for real road applications,” Robotica, v.30(2), pp. 185–193.

[22] Statista. Number of passenger cars and commercial vehicles in use worldwide. 2019. https://www.statista.com/stati stics/281134/number-of-vehicles-in-use-worldwide/.

[24] World Health Organization. Global status report on road safety 2015. 2015. https://www.who.int/violence_injur y_prevention/road_safety_status/2015/en/.

[25] Xie Shuyun, Ran Jie, Yang Cedar. Research on intelligent urban transportation system based on group intelligence perception [J]. Electron. Des. Eng., 2014, 22 (20): 49 –51

[26] Wang Shaohua, Lu Hao, Huang Qian, et al. Research on key technologies of intelligent transportation system [J]. Surveying and Spatial Geogr. Inf., 2013 (s1): 88 –91

[27] Ganasindu K S, Smithashekar B, Harish G. An approach for intelligent traffic splitting for sudden changes of traffic, dynamics[J]. Iran. J. Clin. Infect. Dis., 2011, 20(2):167 –169

List of Publication

1. **“**Operator Fatigue Detecting & Analyzing System"- 4th IEEE International Conference on Advances in Computing, Communication Control and Networking (ICAC3N-22), IEEE scopus indexed proceedings (Accepted). www.icac3n.in

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to me

Dear Author,

Greetings from Galgotias College of Engineering and Technology!!!

On behalf of the 4th ICAC3N-22 Program Committee, I am delighted to inform you that the submission of “Paper ID- 97 “ titled “ Operator Fatigue Detecting and Analyzing System “ has been accepted for presentation at the ICAC3N- 22 and will be sent for the submission in the conference proceedings to be published by the IEEE.

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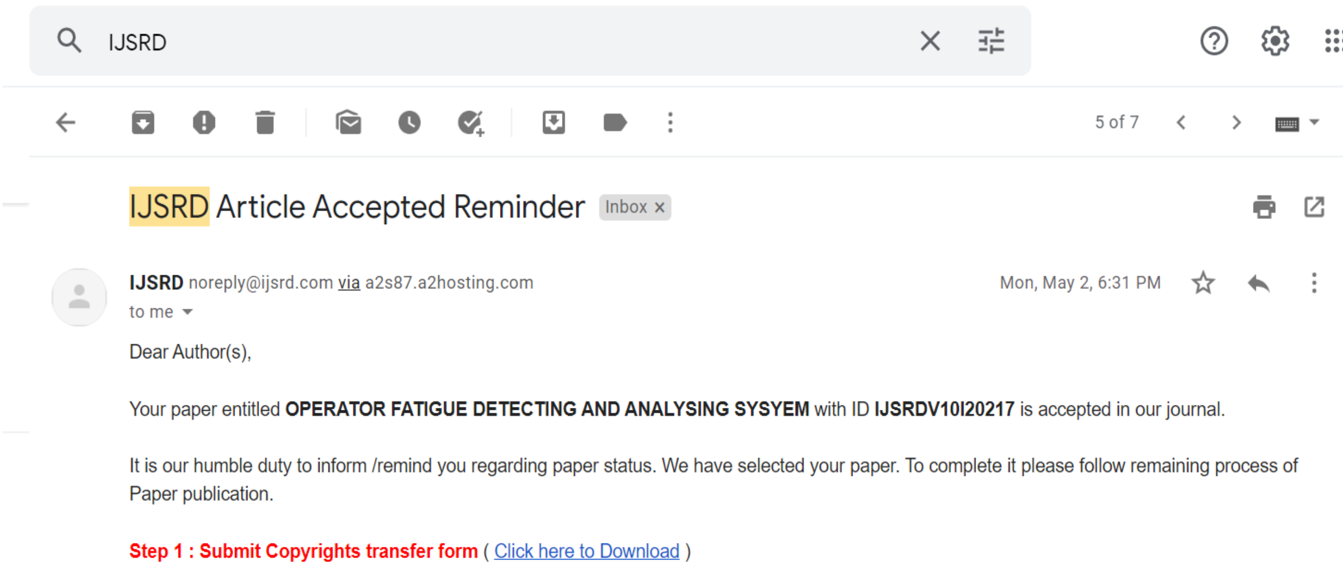
2. “Operator Fatigue Detecting & Analyzing System"-International Journal for Scientific Research and Development (IJSRD) (Accepted). www.ijsrd.in



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Research Paper

OPERATOR FATIGUE DETECTING AND ANALYSING SYSTEM

Shivansh Tiwari, Shivshankar Jaiswal, Divya Tyagi

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.

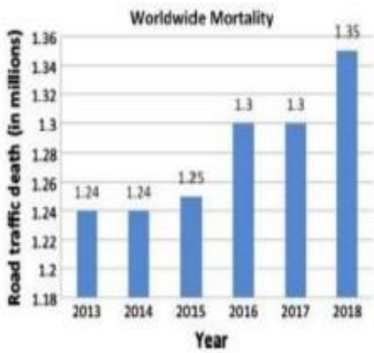

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Fig 1. Worldwide Mortality Rate

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.

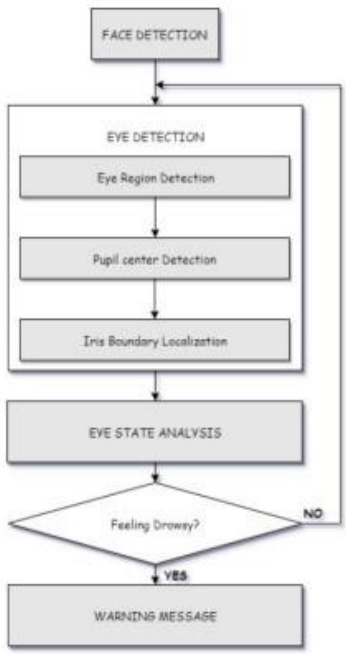

Fig 2. Flow Chart Of OFDS

(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.

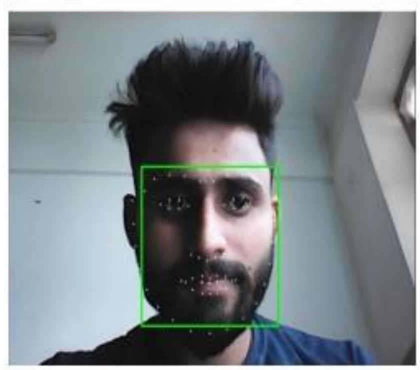

Fig. 3 Output Image 1

Converting the image into aspect ratio

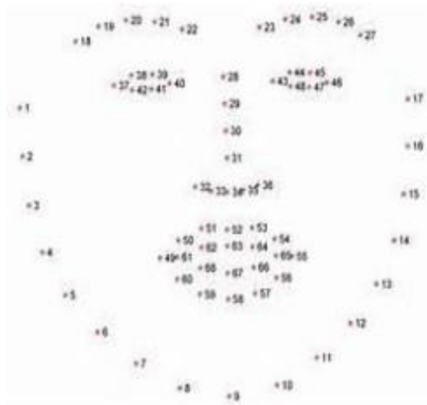

Fig. 4 Output 2

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

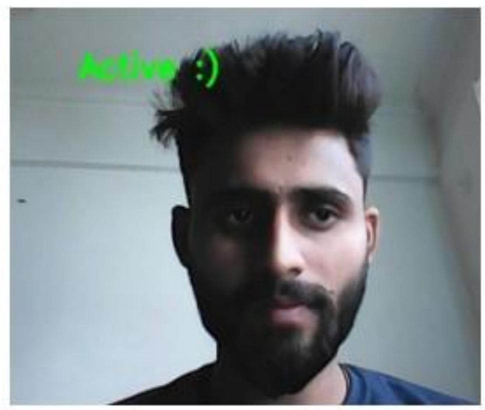

Fig. 5 Output 3

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.

REFERENCES

[1] Driver Drowsiness Detection Using Facial Parameters and RNNs with LSTM, Vishnu Yarlagadda,Shashidhar G. Koolagudi, Manoj Kumar M V,Swapna Donepudi in IEEE(December 2020).

[2] Real-Time Driver-Drowsiness Detection System Using Facial Features WANGHUA DENG1 AND RUOXUE WU in IEEE(21 August 2019).

[3] A survey on driving behavior analysis in usage based insurance using big data, Subramanian Arumugam* and R. Bhargavi in Springer(2019).

[4] Research on key technologies of intelligent transportation based on image recognition and antifatigue driving Jun Wang, Xiaoping Yu, Qiang Liu and Zhou Yang in Springer (2019).

[5] Advanced Driver Assistance System for road environments to improve safety and efficiency Felipe Jiménez a,*, José Eugenio Naranjo a, José Javier Anaya a, Fernando García b, Aurelio Ponz b, José María Armingol in ScienceDirect (18 April 2016).

[6] International Organization of motor vehicle Manufacturers (2018). Pro-visonal Registration or sales of New Vehicles [2018]. http://www.oica.net/wp-content/uploads

[7] Belhumeur P. and Kriegman D., "What is the set of images of an object under all possible lighting conditions", Int. J. of Computer Vision, Vol. 28, pp. 245-260, 2014.

[8] Fletcher L., Apostoloff N., Petersson L. and Zelinsky A., "Vision in and out of

Vehicles",In Broggi, A. (Ed.), Intelligent Transportation Systems. IEEE Computer Society, pp. 12-17, 2013.

[9] G. Borghini, L. Astolfi, G. Vecchiato, D. Mattia, and F. Babiloni, ''Measuring neurophysiological signals in aircraft pilots and car drivers for the assessment of mental workload, fatigue and drowsiness,'' Neurosci. Biobehav. Rev., vol. 44, pp. 58–75, Jul. 2014.

[10] Smart Eye. (2018). Smarteye. [Online]. Available: https://smarteye.se/

[11] J. F. Henriques, R. Caseiro, P. Martins, and J. Batista, ''High-speed tracking with kernelized correlation filters,'' IEEE Trans. Pattern Anal. Mach. Intell., vol. 37, no. 3, pp. 583–596, Mar. 2015.

[12] P. F. Felzenszwalb, R. B. Girshick, D. McAllester, and D. Ramanan, ''Object detection with discriminatively trained part-based models,'' IEEE Trans. Pattern Anal. Mach. Intell., vol. 32, no. 9, pp. 1627–1645, Sep. 2010.

[13] Y. Sun, X. Wang, and X. Tang, ''Deep convolutional network cascade for facial point detection,'' in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2013, pp. 3476–3483.

[14] S. Ren, X. Cao, Y. Wei, and J. Sun, ''Face alignment at 3000 FPS via regressing local binary features,'' in Proc. IEEE Conf. Comput. Vis. Pattern Recognit., Jun. 2014, pp. 1685–1692. [

[15] E. Zhou, H. Fan, Z. Cao, Y. Jiang, and Q.Yin,''Extensive facial landmark localization with coarse-to-fine. IEEE Int. Conf. Computer. Vis. Workshops, Dec. 2013, pp. 386–391.

[16] Moorthi M., Arthanari and Sivakumar M.,"Preprocessing of Video Image with Unconstrained Background for Drowsy Operator Detection", International Journal of Computer Science and Network Security (IJCSNS), USA, ISSN 1947-5500 Vol. 8 No.2,pp.145-151, May 2011.

[17] Bassem, H., Berssenbrugge, J., Al Qaisi, I., Stocklein, J., 2013. Reconfigurable driving simulator for testing and training of advanced driver assistance systems. IEEE International Symposium on Assembly and Manufacturing, pp. 337–339. Bifulcoa, G., Pariotaa, L.,

[18] Brackstioneb, M., Mcdonald, M., 2013. Driving behaviour models enabling the simulation of Advanced Driving Assistance Systems: revisiting the Action Point paradigm. Transportation Research Part C: Emerging Technologies, v. 36, pp. 352 366.

[19] Cho, H., Rybski, P.E., Zhang, W. 2011. Vision-based 3D bicycle tracking using deformable part model and Interacting Multiple Model filter". IEEE ICRA, pp. 4391–4398.

[20] García, F., de la Escalera, A., Armingol, J.M., Jimenez, F., 2012. Context aided fusion procedure for road safety application, IEEE Conference on Multisensor Fusion and Integration for Intelligent Systems, pp. 407–412.

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