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A FACIAL RECOGNITION APPROACH TO PREVENTING DRIVER DROWSINESS AND YAWNING

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ABSTRACT

In today's fast-paced world, the risk of accidents due to driver drowsiness remains a significant concern. To address this issue, we propose a novel approach that integrates face recognition technology with real-time drowsiness and yawn detection for enhancing road safety. Our system utilizes computer vision techniques to continuously monitor the driver's facial features and analyze patterns indicative of drowsiness, such as eye closure duration and yawning frequency. By employing a convolutional neural network (CNN) trained on a large dataset of labeled facial images, we achieve high accuracy in recognizing signs of fatigue and alertness. The system operates seamlessly in various lighting conditions and is capable of providing timely alerts to drivers, thereby preventing potential accidents caused by impaired vigilance. Through experimental validation on diverse driving scenarios, we demonstrate the effectiveness and reliability of our approach in mitigating the risks associated with drowsy driving. Our solution represents a promising step towards leveraging advanced technology to safeguard lives on the road and promote safer driving behaviors.

I. INTRODUCTION

The escalation in the number of motor vehicles, particularly in developing countries, over the past decade has brought transportation safety to the forefront of global concerns. Official investigations into traffic accidents consistently identify dangerous driving behaviors, such as drunk and drowsy driving, as significant contributors to road accidents. Alarmingly, a substantial portion of these incidents occur during specific time frames, notably between 2:00-6:00 A.M. and 14:00-16:00 P.M., with night shifts exacerbating the vulnerability of drivers. The staggering toll of road accidents worldwide, claiming 1.3 million lives annually and causing 50 million disabilities, underscores the urgent need for effective preventive measures.

Driver drowsiness emerges as a particularly insidious hazard, implicated as a direct or contributing cause in a majority of road accidents. The deleterious effects of drowsiness on driver reaction time, awareness, and judgment are well-documented, emphasizing the criticality of proactive intervention. The development of a driver monitoring system capable of issuing warnings upon detecting signs of drowsiness holds the potential to avert road accidents and save countless lives.

Simultaneously, advancements in image processing within the realm of computer science engineering have opened avenues for multidimensional impact. Harnessing image processing techniques for drowsiness detection presents a promising avenue for mitigating road accidents. By utilizing image processing algorithms to analyze factors such as eye blink frequency, a proactive scheme for detecting driver drowsiness can be implemented.

In this context, facial recognition technology emerges as a potent tool for enhancing drowsiness detection systems. Facial recognition systems, propelled by advancements in computer vision and machine learning, offer the capability to discern subtle facial cues indicative of drowsiness. By monitoring facial expressions, eyelid movements, and head positions, facial recognition systems can provide real-time assessments of driver alertness levels. Integrating facial recognition into drowsiness detection systems not only enhances accuracy but also enables a non-intrusive and seamless monitoring experience for drivers.

This paper presents a novel approach that synergizes image processing techniques, specifically facial recognition, with drowsiness detection algorithms to develop a robust driver monitoring system. Our proposed

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scheme aims to leverage the power of facial recognition to enhance the efficacy of drowsiness detection, thereby contributing to the overarching goal of reducing road accidents and promoting transportation safety.

II. LITERATURE REVIEW

Bandpass channels and thresholding were used by Li and Chung [1] to remove disturbance from low and high-frequency ECG information. It is necessary to eliminate important highlights for grouping after preprocessing in which the yield information is broken up in recurrence space using Fast Fourier Transforms (FFT).

Li et al. [2] performed comparative examinations on EEG information to decide the drowsiness of a driver. They utilized Independent Component Analysis (ICA) to isolate and limit blended EEG information to speci_c mental exercises. From the preprocessed information, highlights are separated in the recurrence area.

Sunagawa et al. [3] discussed the actualized drowsiness location framework by utilizing EOG information. The first distinguished the eye squinted from the recorded EOG information It removed the eye top development parameters as highlights to be characterized using Support Vector Machines(SVM). The fundamental characteristic of physiological estimating systems is that they can decide the reduction in dimension of sharpness early before the genuine drowsiness scene begins. People do not usually get sleepy in a moment, and there is progressive decline accordingly or action of the different body parts which in the long run lead to drowsiness. For instance, in the EEG investigation, the adjustment in flag control at the alpha range (8 _ 12Hz) shows early tiredness. Physiological estimating procedures can quantify such changes at the beginning times. The individual can be cautioned, or the best possible well-being measure can be taken before mishaps could happen. The deliberate signs are likewise dependable to distinguish drowsiness as their connection with the driver's readiness is very precise. They are generally free of external factors, for example, the nature of the street, the sort of vehicle, or the traffic. Subsequently, they have more specifc drowsiness location ability than vehicle-based and conduct estimating methods.

Dasgupta et al. [4] used progressive image sifting systems such as picture subtraction, morphologically closed activities, and binarization. Lastly, I checked the number of pixels around the eyes distract to distinguish the eye conclusion.

Ramzan et al. [5] removed essential highlights from the fleeting contrast of sequential picture outlines. They utilized them to investigate the standards of eyelid development amid drowsiness.

Kaplan et al. [6] have additionally displayed a non-meddlesome way to deal with drowsiness discovery. They utilized an R.I.R brightening framework and a high goal camera to acknowledge a surge of pictures and perform face and eye location. They connected channels on the eyes district and performed flat and vertical projections of the pixel estimations of the identi_ed eye territory. The vertical forecast compares to the eye tallness, which is utilized to assess the PERCLOS.

You et al. [7] performed face and eye recognition. They followed the eye understudies utilizing non-straight Kalman and mean-move following. They likewise performed vertical and flat projections of the pixels around the eyes district. Since the eyeball shading is a lot darker than the encompassing, they determined the pixel esteems in the vertical projection to decide the level of eyelid conclusion.

III. EXISTING SYSTEM

IR(Infrared rays) sensor An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion.

These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation.

These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

Drawbacks

1. Cost is heavy to perform.
2. Before execution we have to check hardware connection properly otherwise we lost.

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IV. PROPOSED SYSTEM AND ADVANTAGES

In Proposed System, a low-cost, Real time Driver's drowsiness detection system developed with acceptable accuracy.A webcam based system is used to detect Driver's Fatigue from the face image using image processing and machine learning techniques. The Major parts of the system are:-

1. Driver assistance system with camera.
2. No hardware using web camera.
3. Human detection based attention.
4. Eye blink
5. EAR values
6. Facial Recognition

Advantages:-

This method will detect a problem before any problem accord and inform the driver and other passengers by raising an alert, In this Open CV based machine learning techniques are used for automatic detection of drowsiness., Detect if the Driver is feeling sleepy, Security of vehicle, Record driving data, collision data and position data.

V. DIGITAL IMAGE PROCESSING

The identification of objects in an image would probably start with image processing techniques such as noise removal, followed by (low-level) feature extraction to locate lines, regions and possibly areas with certain textures.

The clever bit is to interpret collections of these shapes as single objects, e.g. cars on a road, boxes on a conveyor belt or cancerous cells on a microscope slide. One reason this is an AI problem is that an object can appear very different when viewed from different angles or under different lighting. Another problem is deciding what features belong to what object and which are background or shadows etc.

The human visual system performs these tasks mostly unconsciously but a computer requires skillful programming and lots of processing power to approach human performance. Manipulating data in the form of an image through several possible techniques. An image is usually interpreted as a two-dimensional array of brightness values, and is most familiarly represented by such patterns as those of a photographic print, slide, television screen, or movie screen. An image can be processed optically or digitally with a computer.

Classifcation Of Image:-

There are 3 types of images used in Digital Image Processing. They are :-

1. Binary Image
2. Gray Scale Image
3. Color Image

VI. SYSTEM DESIGN

Video streaming technology is one way to deliver video over the Internet. Using streaming technologies, the delivery of audio and video over the Internet can reach many millions of customer using their personal computers, PDAs, mobile smartphones or other streaming devices.

The reasons for video streaming technology growth are:-

1. broadband networks are being deployed
2. video and audio compression techniques are more efficient
3. quality and variety of audio and video services over internet are increasing

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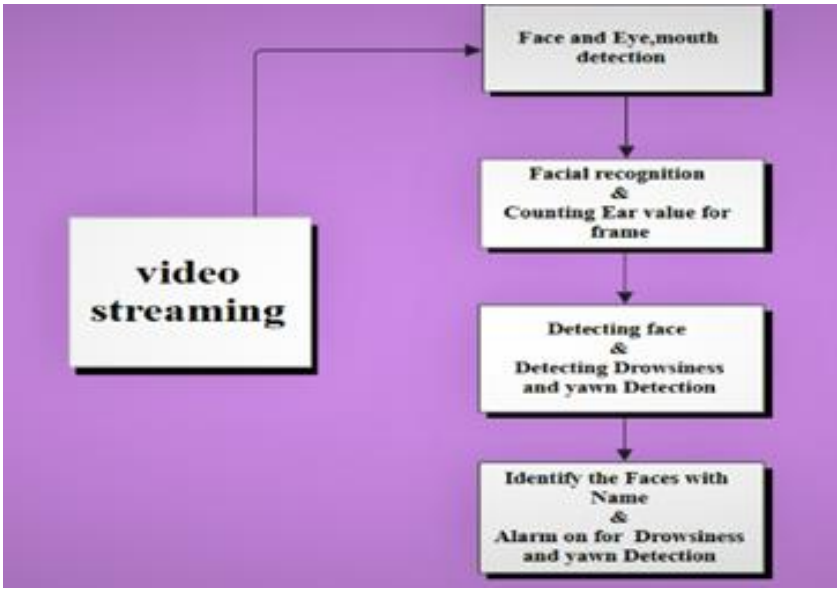

Fig 1: Block Diagram

VII. FACE DETECTION

As face detection is one of popular research areas, many algorithms have been proposed for it. Most of them are based on the same idea considering the face detection as a binary classification task. That is, given a part of image, the task is to decide whether it is a face or not. This is achieved by first transforming the given region into features and then using classifier trained on example images to decide if these features represent a human face.As faces can appear in various locations and can also show themselves in various sizes, often, a window-sliding technique is also employed.

Fig 2: Facial landmark detector

The idea is to have the classifier classifying the portions of an image, at all location and scales, as face or non-face.It is process to extract face regions from input image which has normalized intensity and uniform in size.The appearance features are extracted from detected face part which describes changes of face such as furrows and wrinkles (skin texture).In this system model, an executable (.dll- dynamic link library) file is utilized to extract face region.It is used for face detection process is based on haar like features and adaptive boosting method.

The Drowsiness Detector Algorithm:

First, we'll setup a camera that monitors a stream for faces.If a face is found, we apply facial landmark detection and extract the eye regions.

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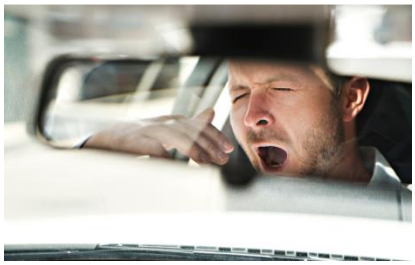

Fig 3: Drowsiness detection

We will be using "haar cascade Frontal face default" classifier and "dlib's shape predictor 68 face landmarks". Understanding dlib's facia landmark detector:-

The pre-trained facial landmark detector inside the dlib library is used to estimate the location of 68 (x, y)-coordinates that map to facial structures on the face.

VIII. EYE DETECTION

The eyes are detected for further processing to detect whether the driver is in drowsiness or not. In this, we are specially characterizing the eyes from the face.

A real time algorithm to detect eye blinks in a video sequence from a camera is used in this proposed system. Recent landmarks detectors exhibit excellent robustness against a head orientation with respect to a camera, varying illumination and facial expressions.

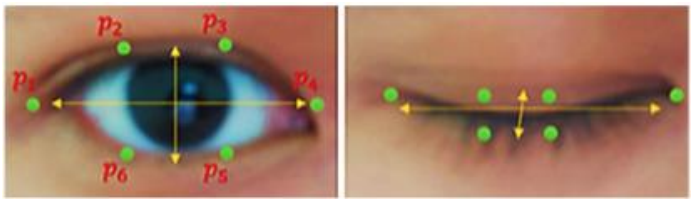

Fig 4: Six ocular landmarks

In this project, the landmarks are detected precisely enough to estimate the level of the eye opening. The proposed algorithm therefore estimates the landmark positions, extracts a quantity which is known as the eye aspect ratio (EAR) for characterizing the eye opening in each frame

In this technique, we are using different landmarks to detect the opening and closing of eye. This landmark detectors that capture most of the characteristic points on a human face image. The eye blink is a fast closing and reopening of a human eye. Each individual person has a little bit different pattern of blinks.

The pattern differs in the speed of closing and opening of the eye, a degree of squeezing the eye and in a blink duration. The eye blink lasts approximately 100-400ms. From the landmarks detected in the image, we derive the eye aspect ratio (EAR) that is used as an estimate of the eye opening state. For every video frame, the eye landmarks are detected. The eye aspect ratio between height and width of the eye is computed. From the fig. 2 P1,P2,...,P6 are the landmarks on the eye.

The EAR is mostly constant when an eye is open and is getting close to zero while closing an eye.

Since eye blinking is performed by both eyes synchronously, the EAR of both eyes are taken and it is averaged. After getting the EAR value, if the value is less than the limit for 2 or 3 seconds the driver is said to be drowsy. In terms of blink detection, we are only interested in two sets of facial structures the eyes.

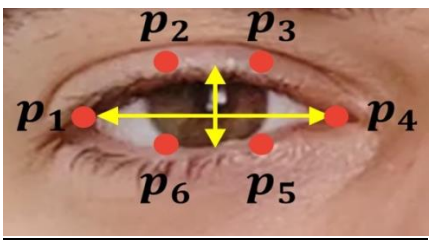

Fig 5: Detection of Eyes

Based on this image, we should take away on key point:

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1. There is a relation between the width and the height of these coordinates.
2. We can then derive an equation that reflects this relation called the eye aspect ratio (EAR) (for drowsiness detection)

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

Fig 6: Function to calculate EAR

To improve our blink detector:-

Computing the eye aspect ratio for the N-th frame, along with the eye aspect ratios for

N – 6 and N + 6 frames, then concatenating these eye aspect ratios to form a 13 dimensional feature vector.

Training a HaarCaascade on these feature vectors.

IX. RESULT

9.1 Open Visual studio code:

Visual Studio Code is a free source code editor that fully supports Python and useful features such as real-time collaboration. It's highly customizable to support your classroom the way you like to teach.

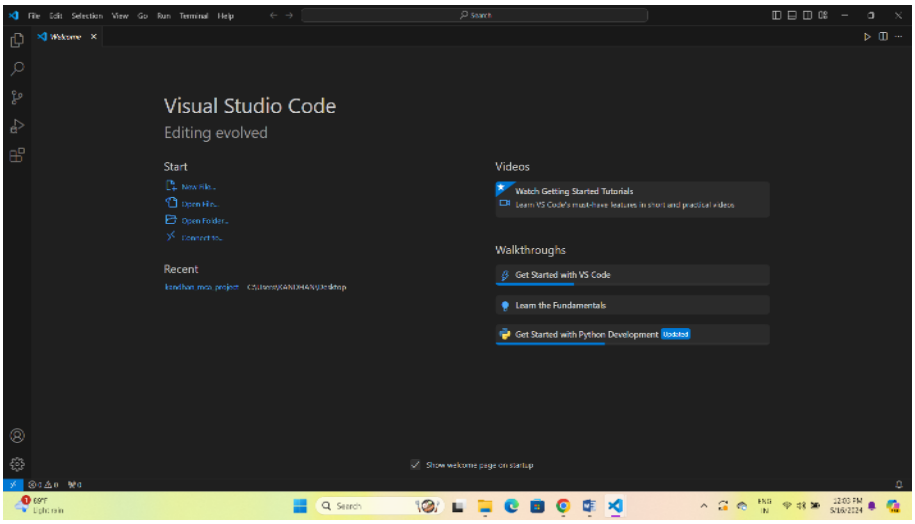

Fig 7: Open Visual studio code

9.2 Execute a program:-

Execute a Python code to run a project

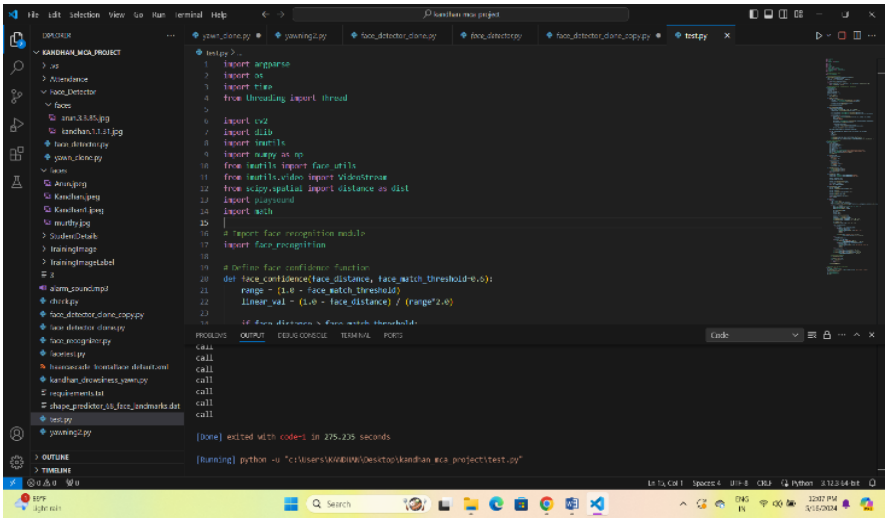

Fig 8: Execute a program in python

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9.3 Final Output:-

1. Facial recognition process

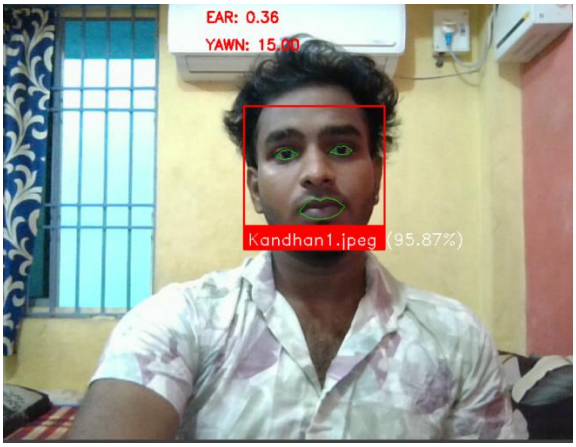

Fig 9: Facial recognition

2. Drowsiness Detection and alarm sound

Fig 10: Drowsiness Detection

3. Yawning detection and alarm system

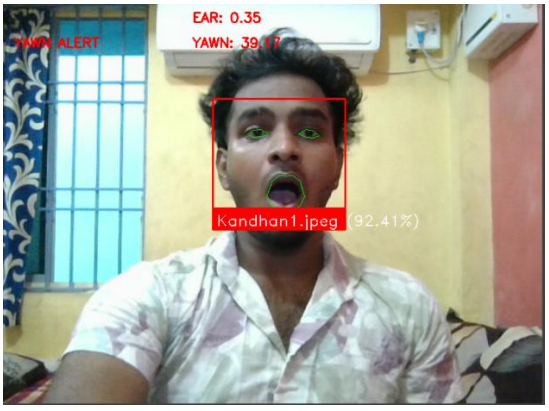

Fig 11: Yawning detection

X. CONCLUSION

This project introduces a drowsiness detection framework based on shape predictor algorithm, that detects the eyes, and also counts the eye blink rate followed by drowsiness detection at real time. In the proposed system, the details about the eye status is obtained through image processing algorithms, which offer a non-invasive approach to detect drowsiness without any annoyance and interference. In future, the detection of yawning of the driver can be also be implemented using same frame work for detecting further details about the drowsiness of driver.

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XI. FUTURE ENHANCEMENT

In this process detection of drowsiness 1obtained by using video streaming based on the driver position at the time of driving. Here detection starts when vehicle starts.at the time of driving only it detects. For the future purpose we can use this detection for the rest of position also. That means we have to add another features for this purpose.

Detection can also be applied for sleeping at the time of vehicle and human rest position also. For the next generation we can detect the other living things position also.

By using this process accidents will be avoided. Here we can implement detection for the different type of applications.

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