International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-09, Issue-12, Mar 2024

Drowsiness Detection and Warning System

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Abstract **One of the main causes of car accidents worldwide in recent years has been driver weariness, and the number of incidents resulting from drowsy drivers is sharply rising. The majority of drivers have low energy levels as a result of their overall weariness or fatigue from work. They thus frequently experience drowsiness when driving. These fatigues greatly enhance the likelihood of accidents occurring. Therefore, the goal of this project is to create a model that can recognize when a driver is feeling sleepy or drowsy and will sound an alert if it does. Though there are lots of ways to measure tiredness, this method is totally non-intrusive and has no negative effects on the driver. These models are fitted into the majority of expensive cars, although public transport vehicles do not have this technology. Python is being used as the implementation language for this project. In this research, we're concentrating on developing an inexpensive, readily available, and efficient model for sleepiness recognition. This study primarily focuses on facial detection using the regions of interest (ROI) of both eyes rather than the entire face. Several OpenCV libraries are utilized for system implementation, including Dlib.**

Keywords - Car Accident, Tiredness, public transport vehicles, ROI (Region of Interest), Python, sleep alert, sleepy, Drowsiness, Computer-Vision, Accident, Image Processing,

I. Introduction

The most commonly occurring sort of accident in today's world is one caused by the driver's drowsiness regardless of the time of day or night. The global accident fatality rate has risen to 21% as a result of this. This demonstrates the gravity of the situation. Drowsiness Detection is a safe technique that can help prevent accidents caused by drivers who nod off while driving. The goal of this Python project is to create a Drowsiness Detection Model that detects when a driver's eyelids close for a few seconds. This project's solution makes use of a pre-built model of a facial landmark for quick deployment on the edge of computationally inefficient devices. The project has an immediate use in the automobile industry. The primary objective of this project is to create a Drowsiness Detection Model that makes use of the driver's eyes as the ROI (Region of Interest) and regularly detects (in real-time) the eye lid to determine if the driver is tired or not. If the driver becomes tired, the model will emit a Sound Alarm to bring him or her back to consciousness. This concept is also useful when the driver is wearing glasses. The number of incidents demonstrates how serious this issue is, which is why we opted to establish this initiative aimed at reducing these accidents. Drowsiness is a complex term that signifies a reduction in the driver's alertness and aware situations. action of glaucoma and other disorders from retinal pictures, the optical slice (OD), Fatigue and micro sleep while driving are frequently the causes of catastrophic accidents. The early indicators of weariness, on the other hand, can be noticed before a hazardous scenario emerges.

The Bosch driver drowsiness detection may do this by monitoring drivers eye and alerting drivers when it is time to take a break. Nowadays, an increasing number of career options need long-term focus. People who work in the transportation industry (car and truck drivers, steersmen, airplane pilots) must maintain a vigilant watch on the road

 DOI : 10.35291/2454-9150.2024.0069

ISSN : 2454-9150 Vol-09, Issue-12, Mar 2024

in order to respond quickly to unexpected events (e.g. road accidents, animals on the road, etc.). Long periods of driving produce driver weariness, which affects her/his response time. According to the findings of a research presented at the International Symposium on Sleep Disorders, driver tiredness is responsible for 30% of all traffic accidents. The British magazine "What Car?" published the findings of a driving simulator experiment, concluding that a sleepy driver is far riskier than someone whose blood alcohol level is 25% higher than the legal limit. Driver weariness can result in microsleep (loss of attention, a brief sleep lasting 1 to 30 seconds) and falling asleep behind the wheel. As a result, there is a need to design a system that would identify and inform a driver of her/his poor psychophysical condition, potentially reducing the incidence of fatigue-related automobile accidents. However, the most significant challenges in developing such a system are connected to the rapid and accurate assessment of a driver's tiredness symptoms. Because of the rising number of cars on the road, which immediately translates into road accidents,

II METHODOLOGY

A) PROPOSED METHODOLOGY

The suggested approach is mostly dependent on the driver's eye blinking and yawning, which are both behavioral measurements. The goal of this research is to detect yawning by closing one's eyes or opening one's lips and alerting the driver. This is accomplished by positioning a camera or recording device in front of the driver and continually capturing real-time video with OpenCV and dlib. Python is used to run the programmes, and the camera on the laptop is used to process the images.

The task is often broken into three stages:

1. Recognition of the face and eyes
2. Detection of eye closure

A. Recognition of the face and eye

The usage of the dlib library detects the face in this stage. To detect face landmarks, a shape predictor developed in the dlib package is employed. The equipping a car with a tiredness detection system is necessary. One technological option for implementing such a system is to adopt a vision-based method. With the fast advancement of image analysis.

provides 68 landmark points that may be used to localize facial areas such as the eyes, brows, nose, ears, and mouth. Figure 1 depicts the face landmarks that dlib can detect. As a result, using facial landmark detection, the eyes and mouth may be localized and recognised.

B. Detection of eye closure

As seen in Figure 2, each eye is defined by six coordinates.2. An equation called the Eye Aspect Ratio (EAR) may be constructed to represent the relationship between the width and height of coordinators. The distance between vertical eye landmarks is determined in the numerator, while the distance between horizontal eye landmarks is calculated in the denominator, using the Euclidean distance formula. Each eye is represented by six landmark points, as you can see. The EAR for a single eye is estimated as follows:

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

Fig 1: Measurement eye lid distance

B) SOFTWARE REQUIREMENTS SPECIFICATION

The performance of the proposed model will be determined by the quality of the camera. The Graphical User Interface is provided so that the user may easily interact with the model by just clicking on the offered interface. The front end is designed to be user-friendly and not overly complicated for non-technical users. As its fundamental element, the model requires a webcam (camera) and a speaker. The entire model is written in Python and includes all of the essential auxiliary devices.

III DESIGN OF DROWSY DETECTION

A. Architecture of the System

This concept employs a webcam to capture live video feed while driving a large vehicle (like an automobile). This stream will be utilized as an input for detecting driver sleepiness. The OpenCV module will process the stream, and with the aid of Dlib, landmarks, in this instance eyeballs, will be constructed. The eye aspect ratio is determined using the Euclidean distance formula, which is used to assess eye closure and trigger a warning if the value falls below the given threshold value, at which point the alarm will sound.

 DOI : 10.35291/2454-9150.2024.0069

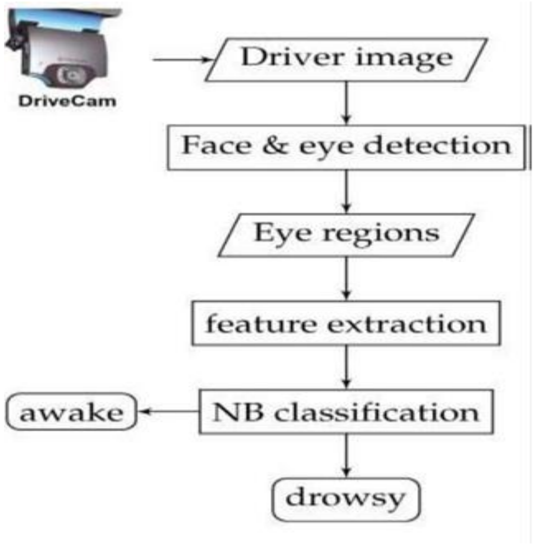

Fig 2; Flow chart of the proposed idea

Design in Depth

➳ Take an Image as Input from a Camera: We will take pictures as input from a webcam. We employ the cv2 technique offered by OpenCV. Capture the access camera with Video Capture (0) and set the capture object cap. read () reads each frame and saves the picture to a frame variable.

➳ Detect Face in the Image and Create a Region of Interest (ROI): OpenCV technique for object detection uses gray photos as the input. The function face_utils. FACIAL_LANDMARKS_68_IDXS ["EYE_L/ R"] is used to define eyes from the Model.

➳Detect and feed the eyeballs from the ROI to the classifier: The same method that is used to detect faces is utilized to detect eyes. To retrieve the face bounding box, we may use an OpenCV Cascade Classifier to detect a face and eye.

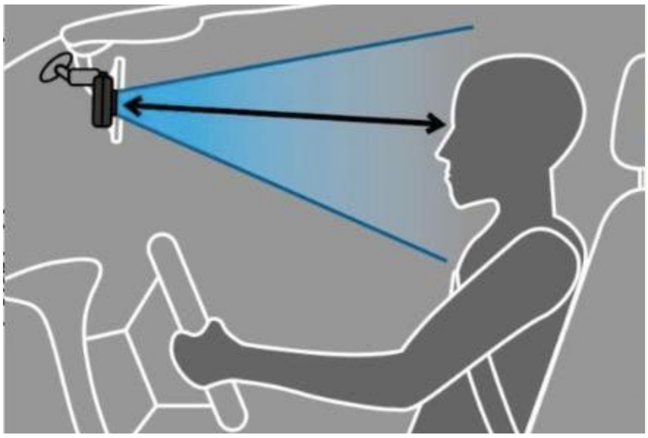

Fig 3: Proposed idea implementation area

C)Region of Interest (ROI) & Euclidean Distance

The model's methodology states that if the eyelids are closed for more than the predefined threshold value, the model will create an alert message with an alarm. When one of the several instances occurs, the outcome will be created as shown in the table above.

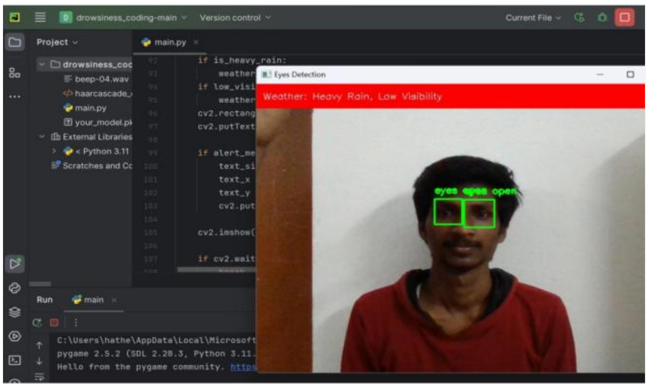

Fig 4: Proposed idea output with open eye position

The picture above depicts the optimal placement of the face and eyes. It specifies the situation in which the Eye Status is Detected and the Eyelid Position is Open. The counter value is created sideways to the image frame, and when the eyes reclosed for more than 20 seconds (the model's threshold value), the alert message and alarm are generated. The above *figure* mentioned alert generating instance is depicted

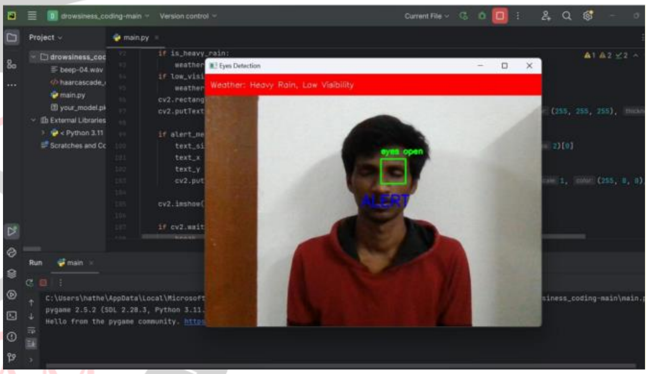

Fig 5: Proposed idea output with closed eye position

Table I: Model Testing

Test Case	Eye Status	Eye-lid Position	Result
Case 1	Not detected	Open	No Alarm
Case 2	Detected	Open	No Alarm
Case 3	Not detected	Close	No Alarm
Case 4	Detected	Close	Alarm

II. Conclusion

The Drowsiness Detection Model is capable of detecting tiredness by monitoring the driver's eye movement. The facial detection algorithm, which has been pre-trained by the Dlib model of facial recognition, provides the inputs. To detect the region of interest, the model uses the aspect ratio of the eye. The EAR function is used to compute the aspect ratio of the eye. If the detection

 DOI : 10.35291/2454-9150.2024.0069

counter value exceeds the threshold value defined in the driver code, an alarm is produced. The primary goal of establishing this initiative is to minimize the amount of accidents caused by sleepy drivers.

The accuracy of this model is highly dependent on the camera's quality. If the driver's eyes are not readily visible for detection, the detection quality suffers. It can occur as a result of light reflecting sunglasses or spectacles, or any other type of obstruction between the eyes and the camera. Furthermore, precision is hampered if the driver is

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 DOI : 10.35291/2454-9150.2024.0069