International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 04 | Apr 2022 www.irjet.net p-ISSN: 2395-0072

DROWSINESS DETECTION MODEL USING PYTHON

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Abstract: *In today's time, the accidents due to the sleepiness of the driver are increasing heavily. Due the tiredness or fatigue of all the work, most of the drivers feel low in terms of energy. As a result, they tend to feel sleepy during the drive time. Because of these fatigues, the chances of accidents to happen increase immensely. So, the aim of this project is to design a model such that it detects the drowsiness of the driver and generate alarm whenever the driver feels drowsy or sleepy. In most of the high-end cars, these models are integrated within itself but for the cars which are used by general public lacks this technology. In this project, we are using Python as an implementation language. This project we are focusing on creating an affordable model for the drowsiness detection which will be efficient as well as cheap in terms of cost and availability. The focus of this project is heavily based on the facial detection with the ROI of both eyes instead of the whole face.*

Key words: Drowsiness, Python, ROI (Region of Interest).

INTRODUCTION

The most common type accident in today's world is the accident occurring due to the sleepiness of the driver irrespective of day and night. The death rate of accidents due to this has spiked to 21% over the world. This shows how serious this problem is. The Drowsiness Detection is a safe technology that can prevent accidents that are caused by drivers who fall asleep while driving. The objective of this python project is to build a Drowsiness Detection Model which will detect that a driver's eyes are closed for a few seconds. The implementation of this project uses a pre-built model of face landmark for easy deployment on edge of computationally less efficient devices. The project has a direct application in the automotive sector. This paper is aimed at designing a Drowsiness Detection Model, which takes the driver's eyes as ROI (Region of Interest) and continuously senses (in real-time) the eye lid to detect whether the driver is feeling sleepy or not. If the driver feels sleepy, the model will generate *Sound Alarm* to bring the driver back to his/her conscious state. This model is also effective even when the driver is wearing a spectacle. The number of accidents show just how much grave this matter is and that's why we chose to develop this project that is intended to reduce these accidents.

LITERATURE REVIEW

The survey has been done which consists of present research and technologies on this Drowsiness Detection. The idea of this survey is to understand the field of study, and also to understand where we should be putting our efforts while designing this project. [1]*Driver Drowsiness Detection System Using Computer Vision (2021),* this paper includes to detect a driver's drowsiness based on eyelid movement and yawning and is reliable to give appropriate voice alerts in real-time. [2]*The Detection of Drowsiness using a Driver Monitoring System (2019),* research has established the ability to detect drowsiness with various kind of sensors. The author studied drowsy driving in a high-fidelity driving simulator and evaluated the ability of an automotive production ready Driver Monitoring System to detect drowsy driving. Additionally, this feature was compared to and combined with signals from vehicles-based sensors. *[3]Real-time Driver Drowsiness Detection based on Driver's Face Image Behavior using a System of Computer Interaction Implemented in a Smartphone (2018),* this study has shown promising result in applying the vehicular driver surveillance based on Artificial Vision Techniques and implemented in a smart-phone. The implemented system allows an efficient detection of the indicators that appear in drowsiness, as long as the measurements are carried out under the established conditions. The correct functioning of the system depends on these conditions.

PROJECT OBJECTIVES

- The principal objective is to design or develop a Drowsiness Detection Model which detects the

eye movements of the driver to acknowledge the sleepy pattern and generate the Sound Alarm whenever the driver feels drowsy.

- The secondary objective of this project is to make the model platform independent, computationally less efficient devices and cheap for the low-end spec platform. Also, to make detection algorithm accurate in terms of sensing the face.

RESEARCH METHODOLOGY

In the past, the facial detection was not prominent and if it was carried out, it was not accurate. So, the previous model of drowsiness detection was of average performance. At that time multiple problems were loaded these systems, one of the most important was the accuracy of the facial detection algorithm. Because of which the performance of the system was heavily compromised.

So now in this model, the facial detection process is carried out by the facial detection algorithm, [4]***shape_predictor_68_face_landmarks.dat*** which is pre-trained by the *Dlib* model for face landmark detection. Dlib has excellent Face Detection and Face Landmarks algorithms built in. Also, it provides pre-trained model for facial landmark detection. The ROI (Region of Interest), that is the eyes of driver is created using the face_utils of the *imutils* module of Python. The *Euclidean distance* for eye ratio is calculated using the distance of the *scipy.spatial* module. The alarm sound is carried out by the *pygame* module which is initiated when driver is detected to be drowsy or sleepy.

SOFTWARE REQUIREMENTS SPECIFICATION

The presented model's performance will be based on quality of the camera. The Graphical User Interface is provided so the user can easily interact with model by just clicking on the interface provided. The front end is made user-friendly so that it isn't too complex for the non-technical user. The model requires a web-cam (camera) & a speaker as its basic entity. The complete model is built on Python 3 and is implemented along with the necessary peripheral devices.

DROWSINESS DETECTION DESIGN

System Architecture

During the driving of heavy vehicle (including car), this model uses web-cam to take live video feed as input. This feed will be used as an input for the detection of drowsiness in the driver. The feed will be processed by the OpenCV module and with the help of Dlib the landmarks are established, which in this case are eyes. The calculation of eye aspect ratio is calculated by the Euclidean distance formula which is used to measure the eye closure and generate warning if the value is decreased than the defined threshold value and ultimately the alarm will set off.

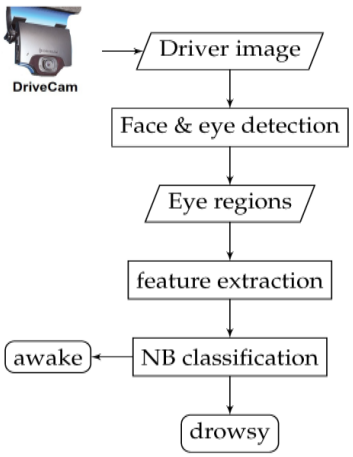

Figure 1. Flow chart of DDM.

Detailed Design

➢ Take Image as Input from a Camera: With a webcam, we will take images as input. We use the method provided by OpenCV, cv2.VideoCapture(0) to access the camera and set the capture object cap.read() will read each frame and we store the image in a frame variable.

➢ Detect Face in the Image and Create a Region of Interest (ROI):OpenCV algorithm for object detection takes grey images in the input. face_utils.FACIAL_LANDMARKS_68_IDXS["EYE_L/R"] is used to define eyes from the Model itself.

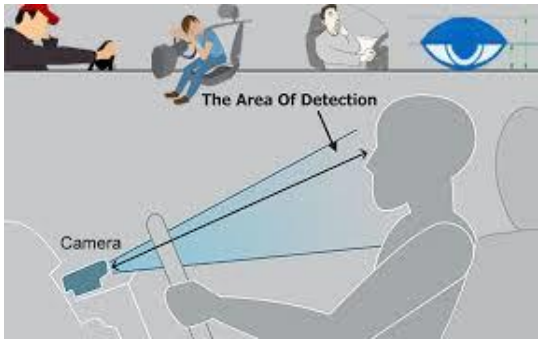

Figure 2. Eye Detection.

➢ Detect the eyes from ROI and feed it to the classifier: The same procedure to detect faces is used to detect eyes. We can use an OpenCV Cascade Classifier to detect a face and eye and use it to get the face bounding box.

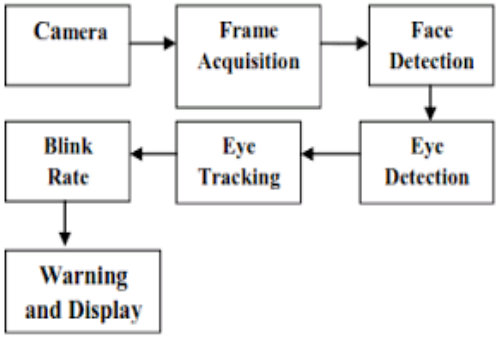

Figure 3. Flow of Detection Process.

- Classifier will Categorize whether Eyes are Open or Closed: The Classifier will detect the eye aspect ratio to whether the eyes are open or not. This is done by a simple Euclidean formula. Calculate Score to Check whether Person is Drowsy: The score is basically a value we will use to determine how long the person has closed his eyes. We are drawing the result on the screen using cv2.putText() function which will display real time status of the person.

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

RESULT AND DISCUSSION

In this project, there is no dataset training as the model used for facial recognition is pre trained. The [4]**shape_predictor_68_face_landmarks.dat** is used to detect the face in a frame or image. The output is based on status of the object created for the algorithm (i.e., driver's eyes). The following result is generated as per the positioning of the eyes:

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

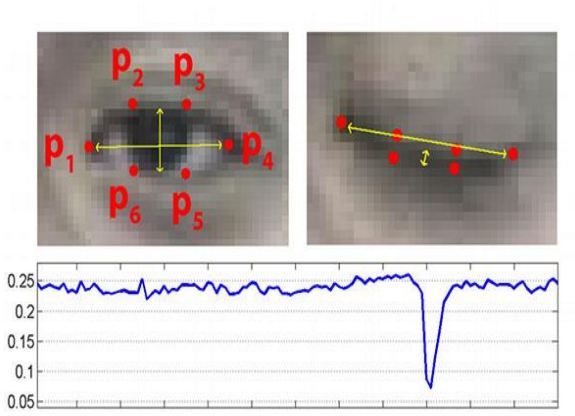

Figure 4. Region of Interest (ROI) & Euclidean Distance

According to the approach of the model, if the eye-lids are closed for more than the pre-defined threshold value, the model will start to generate alert message with alarm. Subsequently, one of the different cases arises, the result will be generated as per the above table.

The live testing of the model has shown the following results:

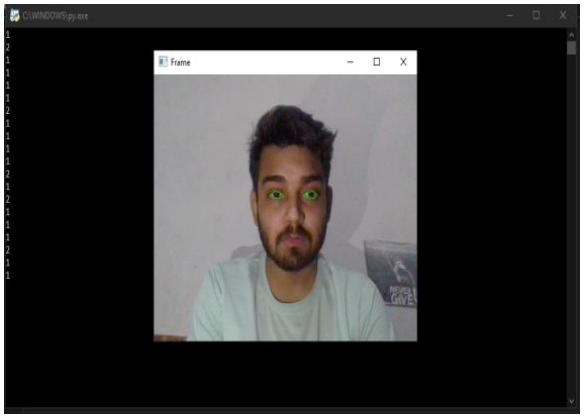

Figure 5. Ideal detection of eye.

The above image shows the ideal positioning of the face as well as the eyes. It defines the case in which the Eye Status is Detected and the Eye-lid Position is Open. The counter value is generated sidewise to the image frame and when the eyes are closed for more than 20 (i.e., the threshold value defined in the model), the alert message along with the alarm. The Fig. 2 shows the alert generation case as stated above.

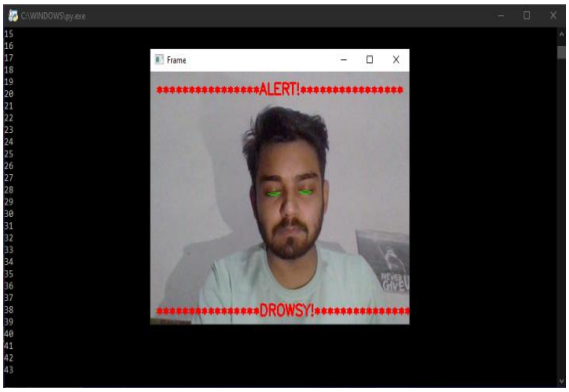

Figure 6. Detection and Alert Generation.

CONCLUSION

The Drowsiness Detection Model is competent of detecting the sleepiness by keeping track of the eye's movement of the driver. The inputs are obtained from the facial detection algorithm which is pre trained by the Dlib model of facial recognition. The model deals with the eye's aspect ratio to detect the region of interest. The eye's aspect ratio is calculated using the EAR function. The alert is generated if the value of the detection counter exceeds the threshold value defines inside the driver code. The main focus for developing this project is to reduce the number of accidents which occur due to the sleepiness of the drivers.

FUTURE SCOPE

The correctness of this model is hugely dependent on the quality of camera. The quality of detection degrades if the driver's eyes are not clearly visible for the detection. It can happen because of the Sunglasses or spectacles having light reflection or any other kind of obstacles between the eyes and the camera. Also, if the driver is not facing the camera properly, the accuracy is compromised.

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[4]. Shape_predictor_68_face_landmarks.dat, is a tool that takes in an image containing some object and outputs a set of points location that define the pose of the object. It is also used in detecting the face in a frame or image.

BIOGRAPHIES

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