International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 06 | June - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Driver Drowsiness Detection System

Vikrant Malik, Yashika Sharma, Yash Gupta, Yash Masih, Pradyumn Tripathi
(IT / Noida Institute of Engineering and Technology (NIET) Greater Noida, India)

Abstract: *The paper describes the steps which are involved in the designing and implementing of a driver drowsiness detection system based on visual inputs taken from driver's face and head. It combines the software components for, human skin colour detection, face detection and the eye state (weather open or closed) classification in an efficient way..*

Keywords: Computer vision, Dlib, Facial expression analysis, Image Processing, OpenCV, Real-time Detection

1. Introduction

Drowsy driving is a significant safety problem on the roads, as it contributes to a high number of accidents and fatalities. Drowsy driving can occur due to a variety of reasons, such as lack of sleep, long driving hours, and certain medical conditions. The consequences of drowsy driving can be severe, as it affects the driver's reaction time, attention, and decision-making abilities, making it difficult to avoid an accident. To address this problem, researchers have developed various systems that aim to detect drowsiness in real-time and alarms the driver that he or she must take a break.

One of the most promising methods of driver drowsiness detection is facial expression analysis. The use of facial expressions as a means of detecting drowsiness is based on the assumption that changes in facial muscle activity are correlated with changes in the level of drowsiness. Various computer vision algorithms are used to analyse the driver's facial expressions, such as feature-based methods, appearance-based methods, and deep learning-based methods. These algorithms extract features such as facial landmarks, wrinkles, and eyelid movements, which are utilized in-order analyse the level of driver's drowsiness.

The advantages of using facial expression analysis include the non-intrusive nature of the method and the ability to detect drowsiness in real-time. Additionally, this method can be integrated with other driver monitoring systems such as lane departure warning systems or the adaptive cruise control systems to provide a more comprehensive and accurate drowsiness detection system. Moreover, the use of facial recognition algorithms can also help to personalize the system to the individual driver.

Recent studies have proposed the use of computer vision techniques, such as OpenCV and Dlib, for driver drowsiness detection. OpenCV is a library of computer vision functions and Dlib is a library of machine learning and computer vision. These libraries could be utilized to analyse images and video from a camera, such as a dashboard camera, to detect facial features and eye movements that indicate drowsiness.

The proposed work is to develop a driver drowsiness detection system using OpenCV and Dlib. The system utilizes the computer vision capabilities of the OpenCV library for image processing and the machine

learning capabilities of the Dlib library for facial landmarks recognition. The system can also efficiently utilize the machine learning algorithms in-order to improve its performance with time.

1- Technologies used in this project:

Driver drowsiness detection is a complex task that involves the use of various technologies to accurately detect drowsiness in real-time. Two of the most popular technologies used in driver drowsiness detection are the OpenCV and Dlib libraries.

- **Python:** Python is an high-level, general purpose , interpreted programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Python's object-oriented approach aims at helping programmers write a logical and easy to understand code for small to large sized projects.

- **JUPYTER:** JUPYTER is a non for profit organization which is created in order to develop open-source software and services for providing interactive computing for multiple of programming languages.

- **Machine learning:** Machine learning could be defined as the scientific study of statistical models and algorithms which are used by the computer systems in order to perform an specific task with high efficiency without the use of any explicit instructions, relying primarily on the inference and different patterns. It is seen as a subset of artificial intelligence. Machine learning algorithms build a mathematical model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly told. Image processing is the use of computer algorithms to perform image processing on digital images.

- **OpenCV:** Is basically a library of machine learning algorithms that provides users with array of functionality for video processing and image processing. OpenCVis based on C++ and can be used on various platforms such as Windows, Linux, and MacOS. In the context of driver drowsiness detection, OpenCV could be utilized for capturing and processing video frames with the help of a camera mounted in the vehicle, detect and track the face of the driver, and extract various facial features like landmarks, wrinkles and movements of the eyelids.

- **Dlib:** It is a modern library of C++ that provides an array of machine learning and other computer algorithms. It is also open-source, and can be used on various platforms. One of the features of Dlib library is facial landmark detection. The facial landmark detector implemented inside Dlib is an high level and one of the best deep-learning based method that can detect 68 facial landmarks on the face. These landmarks can then be utilized in-order to classify the level of driver's drowsiness.

2- Working of the Driver Drowsiness Detection System:

The system is designed for detection and classification of drowsiness in real-time, and make the driver alert and notify him or her to take a break when necessary. The proposed system can do the following:

1. Capturing and processing the video frames with the help of a camera mounted in the vehicle.
2. Detection and tracking of the driver's face in the video frames using various computer based vision algorithms.
3. Extract facial features such as landmarks, wrinkles, and eyelid movements that are indicative of drowsiness.
4. Use machine learning algorithms and techniques for classification of the level of the driver's drowsiness based on features extracted from the face.
5. Implement a real-time alert system that can notify the driver to take a break when drowsiness is detected.

The system can also be implemented using a web cam within the vehicle, or can be integrated in a mobile application.

3- Problem Definition for Driver Drowsiness Detection:

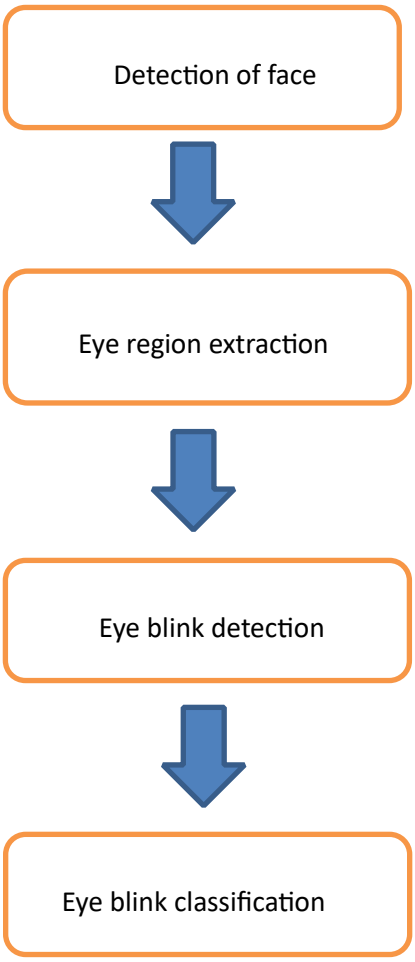
Our System mainly focuses on finding solution on these problems.

- The system will be able to detect drowsiness in a variety of driving scenarios, including both highway and city driving.
- The system would be capable of working with an array of vehicles and would be simple to install and use.
- The system will have minimal false alarms and should not disturb the driver in any way while he/she is driving.

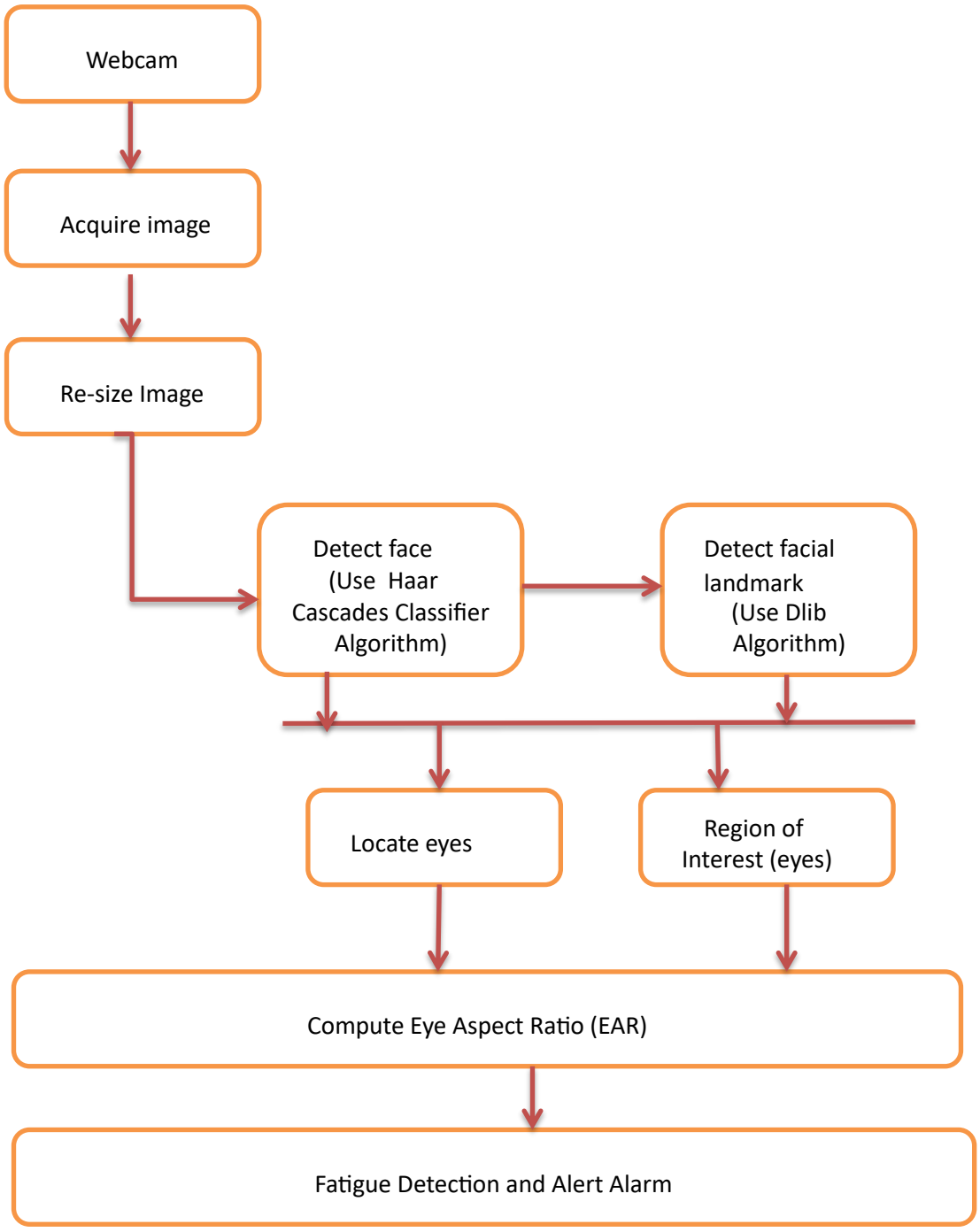
4-Proposed Methodology in brief:

The methodology employed in order to design the System for Driver's Drowsiness Detection is an analytic and research based cycle. The research stage of the proposed system generates the concepts and the selection of the concepts along with analysis of requirements and constraints is done in the analysis stage. The phenomenon is repeated multiple times in order to generate more refined concepts and further analysis of these concepts generate the most appropriate results.

4.1-Flow Chart



4.2-Outline of the Proposed System



4.3-Eye tracking and Plot Generation

- The process of eye tracking involves measuring of either "The point of gaze" ,that is where the person is looking or the relative motion of an eye compared to the head of the person. Eye tracker is an device which is used for analysis of the eye movement and the eye position.
- The eye trackers are utilized in wide range of works which include - visual system research, in psycholinguistic and psychological researches, in product design and in human-computer interactions.
- Eye movement could be measured and analysed in number of ways but the most widely used method or variant uses video images with the analysis of which the position of the eye is extracted. We here are using eye tracking in detecting the drowsiness of the driver. Eye tracking is helping us to detect and sense the state of the driver, whether he is dozing off, getting exhausted while driving etc.
- We are first trying to generate a preview of the driver through the web camera of the laptop. The driver's preview image is being captured simultaneously by the web camera and the camera forms to give us a preview image. The camera now starts to record the video and automatically saves it in the backend so that it can be analysed. The recorded video is in grey, HSV colour and original form. These different types of recording are done because it helps to give us data in all the frames- grey scale or black and white, coloured frame and original frame. After the images, videos, frames are being recorded and saved, the eyes are detected from them and then, the movement is being tracked by using appropriate machine learning algorithm.
- The eye tracking involves calculating the value for the aspect ratio of the eye and give the figures and plotting the detected the data being recorded.

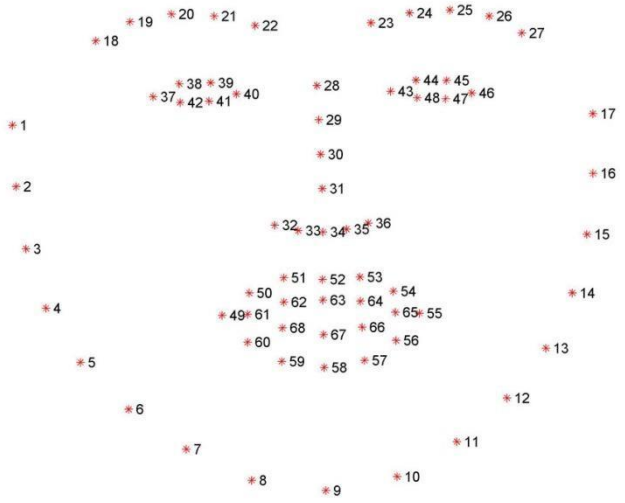


Figure-1: 68 Facial Landmark Model

The above figure marks all the regions on the face and gives the proper outlining of the face to be focused on.
The numbers marked 37,38,39,40,41,42,43,44,45,46,47,48 are the main region of interest for us in this project. Face detection, Eye region being focused, Detect the blinking of the eye, Eye blinking being detected.

4-CONCLUSION:

In conclusion, driver drowsiness detection is an issue that needed to be addressed in-order reduce the number of accidents caused by drowsy driving. Traditional methods of detecting drowsiness have limitations in terms of accuracy and reliability, making it necessary to develop new and improved methods. The use of machine learning and computer vision techniques can be more accurate and reliable in detecting drowsiness. The proposed driver drowsiness detection system utilizes facial landmarks to classify the level of the driver's drowsiness and alert the person who is driving within time. It is designed to be non-intrusive and real-time, and has the potential to be widely adopted in various vehicles and driving scenarios. Furthermore, by using OpenCV and Dlib library for the detection and tracking of the face, and extracting the facial landmarks, as well as for machine learning based classification, the system can be more precise. The development of such systems can make a significant impact on road safety and significantly reduce the accidents which are caused by drowsy driving.

5-ACKNOWLEDGMENT:

This project is done by the supported of Noida Institute of Engineering and Technology, Greater Noida

6-References:

[1] Tereza Soukupova and Jan Cech, Center for Machine Perception, Department of Cybernetics Faculty of Electrical Engineering, Czech Technical University in Prague, ―Real-Time Eye Blink Detection using Facial Landmarks‖, 21st Computer Vision Winter Workshop Luka Cehovin, Rok Mandeljc, Vitomir Struc (eds.) Rimske Toplice, Slovenia, February 3–5, 2016.

[2] Amna Rahman, Department of Software Engineering, Fatima Jinnah Women University, ―Real Time Drowsiness Detection using Eye Blink Monitoring‖ 2015 National Software Engineering Conference (NSEC 2015)https:// ieeexplore.ieee.org/document/7396336

[3] R. Oyini Mbouna, S. G. Kong, and M. Chun, ―Visual analysis of eye state and head pose for drive alertness monitoring,‖ IEEE Transactions on Intelligent Transportation Systems, vol. 14, no. 3, pp. 1462–1469, Sept. 2013.

[4] CISR- Central Road Research Institute, ―https://www.crridom.gov.in/

[5] M. Omidyeganeh, A. Javadtalab, and S. Shirmohammadi, ―Intelligent driver drowsiness detection through fusion of yawning and eye closure,‖ in Proc. IEEE Int. Conf. Virtual Environments HumanComputer Interfaces and Measurement Systems, Sept. 2011, pp. 1–6.

[6] Davis E. King, ―Dlib-ml: A machine learning toolkit,‖ J. Mach. Learn. Res., vol. 10, pp. 1755– 1758, Dec. 2009.