FATIQUE DETECTION SYSTEM BASED ON BEHAVIOURAL CHARACTERISTICS OF DRIVER

BY TEAM NUMBER - 4

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Abstract

- Drowsiness while driving is common problem in the world. Especially, during long distance drives when a person is alone. A number of commercial solutions are available in the industry. In this small project, an attempt has been made to develop an efficient solution in this regard. We can use this application to detect drowsiness while driving; it can help us to avoid crashes caused by fatigue by alarming drivers to take a break in time. In this project, we measure physical activities like eye blinking (open/close state of eyes), duration in which eye remained close, sagging posture, and leaning of head. We can set a threshold value for each posture and when the threshold value crosses the limit, an alert (in this case a siren) blows out.

INTRODUCTION:

Drowsiness Detection

- Drowsiness refers to feeling abnormally sleepy during the day. People who are drowsy may fall asleep in inappropriate situations or at inappropriate times.

- Driver drowsiness detection is a car safety technology which helps prevent accidents caused by the driver getting drowsy.
- The driver behavior is noticed in many conditions such as wearing spectacles and also dark condition inside the vehicle
- The system will continuously monitoring the retina of the driver and sent to the micro-controller

Problem Definition:

- Drowsy driving increases the risk of accidents leading to a troubling number of injuries and deaths every year
- Current drowsiness detection systems monitoring the drivers conditions requires complex computation and expensive equipment , not comfortable to wear during driving and is not suitable for driving conditions

Literature Survey:

- Drowsiness Detection of a driver using Conventional computer vision application(2020)- In this paper pre-existing features for facial landmark detection is used
- A Real-Time driver drowsiness detection using Hybrid features and transfer learning (2020) – A multilayer based transfer learning approach by using a CNN convolutional Neural Network and DBN Deep –Belief –Network
- Design of Real Time Drowsiness detection System using Dlib(2019) –The model is trained to identify 64 facial landmarks .
- Driver's Drowsinees using image processing , 2019 International conference on vision towards Emerging Trends in Communication and Networking , vellore India , march 2019.
- Hitendra Garg Drowsinees Detection of a Driver using Conventional Computer vision Application, 2020 international conference on power electronics & IOT Application.

Requirement Analysis:

- **Existing System :**
- vehicles has large front glass window to have a Broadview for safe driving if we place a camera on the window of front glass the camera blocks the frontal view of driver so it is not practical .
- The OpenCV detector detects only 40% of face of driver in normal driving position .In order to conquer the problem of existing system new detection system is developed in this project

Requirement Analysis:

- **Proposed System: In** order to overcome this eye blink sensor is used.
- A spectacle with eye blink sensor is used to detect the driver drowsiness and alerts the driver with buzzer with new components like Tilt-sensor, eyeblink sensor ,alcohol-senser

System Requirements:

operating system : Windows 10/8/7 (incl. 64- bit), Mac OS, Linux

Language :python 3

IDE : python ide

Hardware Requirements:

- **processor** : 64 – bit , quad-core , 2.5 GHz minimum per core
- **RAM** : 4 GB or more
- **HDD** :20 GB of available space or more
- **Display** : Dual XGA (1024 x 768) or higher resolution monitors.
- **Camera** : A detachable webcam.
- **Keyboard** : A Standard key board.

Modules :

- **Haar Cascade frontal face Algorithm** ->it is an Object Detection Algorithm used to identify faces in an image developed by Haar wavelets
- a new and faster method of processing images and detecting faces using rectangular features The rectangular features which are used to detect different features of the face like eyes and notes .

Modular Division :

The entire architecture is divided into 6 modules :

- **Face Detection**
- **Face Detection**
- **Face Tracking**
- **Eye Tracking**
- **Drowsiness Detection**
- **Distraction Detection**

Face Detection:

This module takes input from the camera and tries to detect a face in the video input. The detection of the face is achieved through the Haar classifiers mainly, the Frontal face cascade classifier. The face is detected in a rectangle format and converted to grayscale image and stored in the memory which can be used for training the model.

Eye Detection :

Since the model works on building a detection system for drowsiness, we need to focus on the eyes to detect drowsiness. The eyes are detected through the video input by implementing a haar classifier namely Haar Cascade Eye Classifier. The eyes are detected in rectangular formats Face Tracking:

Due to the real-time nature of the project, we need to track the faces continuously for any form of distraction. Hence the faces are continuously detected during the entire time

Drowsiness Detection :

In the previous module the frequency is calculated and if it remains 0 for a longer period then the driver is alerted for the drowsiness through an alert from the system

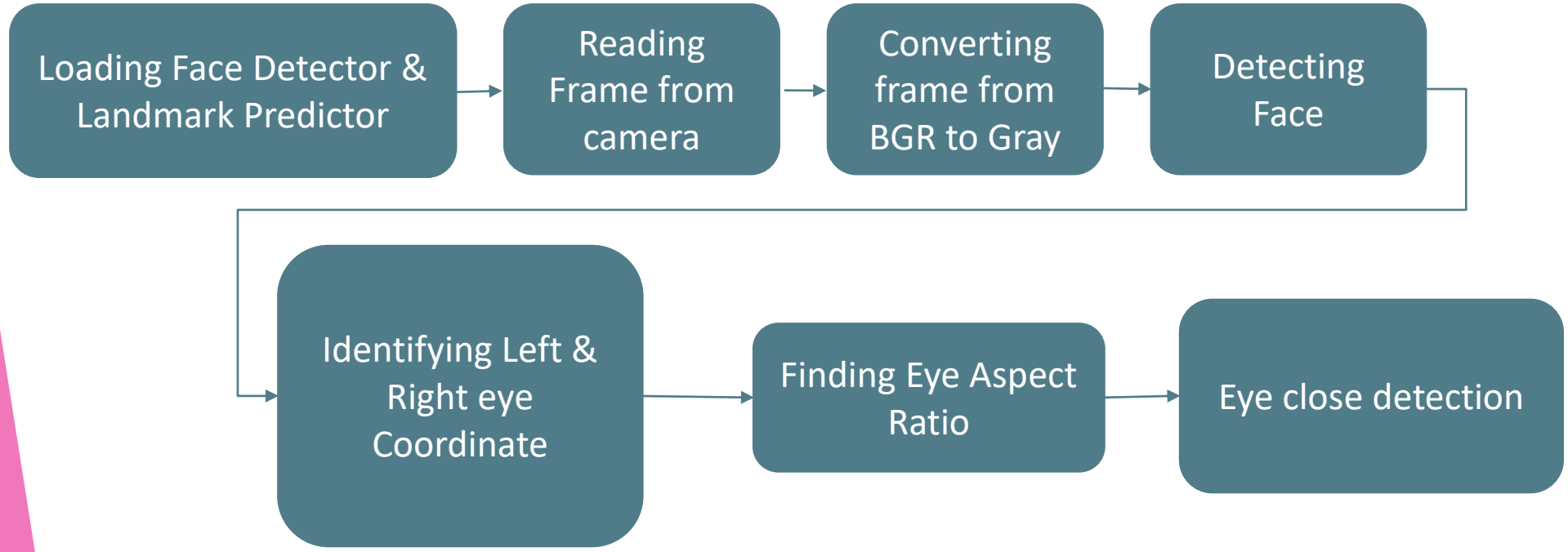
Distraction detection:

In the face tracking module, the face of the driver is continuously

monitored for any frequent movements or the long gaze of the eyes without any blinks which can be treated as lack of concentration of the driver and is alerted by the system for distraction.

Architecture:

- WORK FLOW



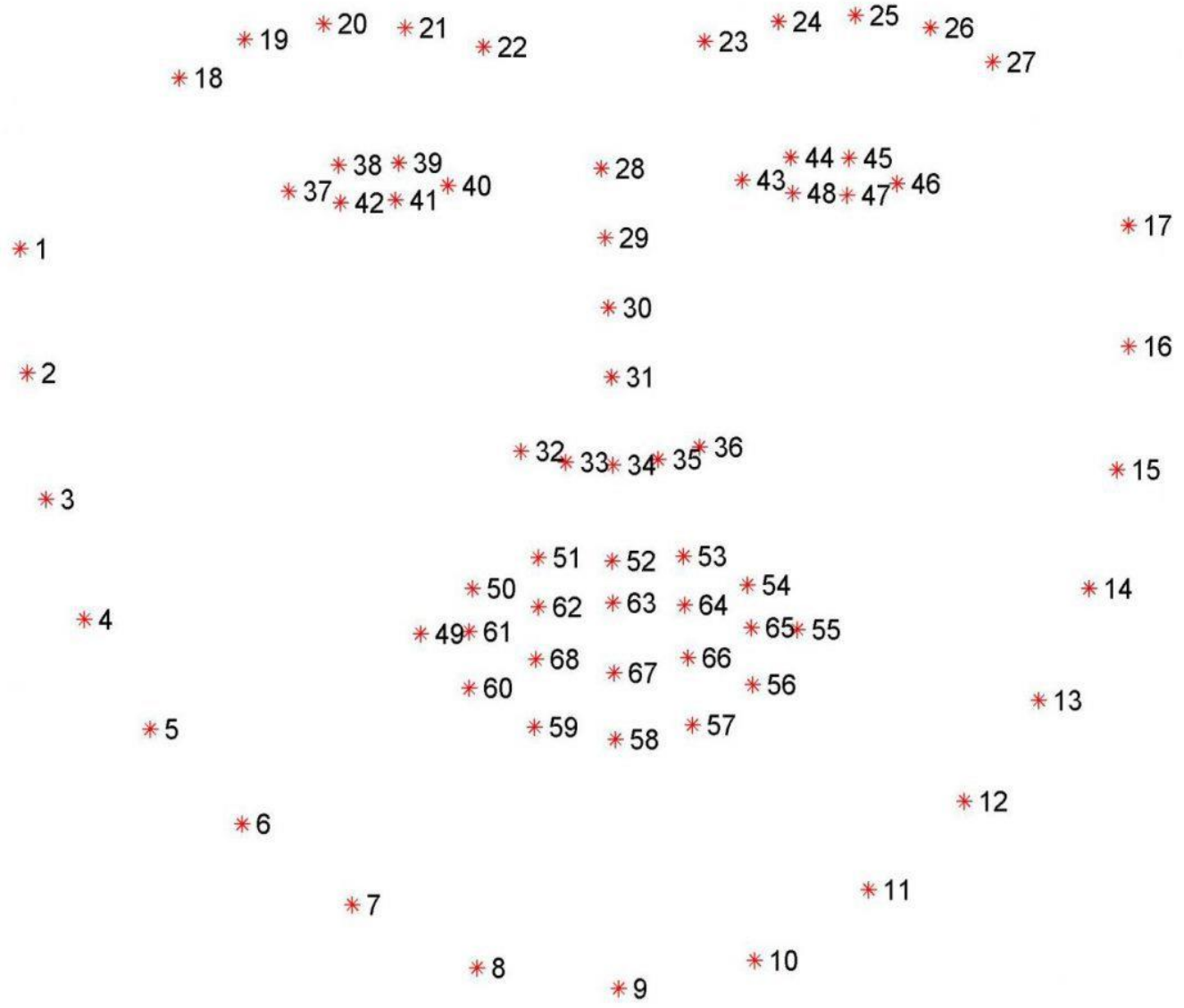
Dlib’s facial landmark detection

- 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 . Facial landmarks are used for localizing and representing salient regions or facial parts of the person’s face, such as:
- Nose
- Jaws
- Left eye
- Right eye
- Left eyebrow
- Mouth
- Right eyebrow

Dlib’s facial landmark detector

- The Locations of the Facial Parts are as follows:
- The left eye is accessed with points [42, 47].
- The mouth is accessed through points [48, 67].
- The left eyebrow is accessed through points [22, 26].
- The nose is accessed using points [27, 34].
- The right eyebrow is accessed through points [17, 21].
- The right eye is accessed using points [36, 41].
- And the jaw is accessed via points [0, 16].

Dilib’s facial landmarks



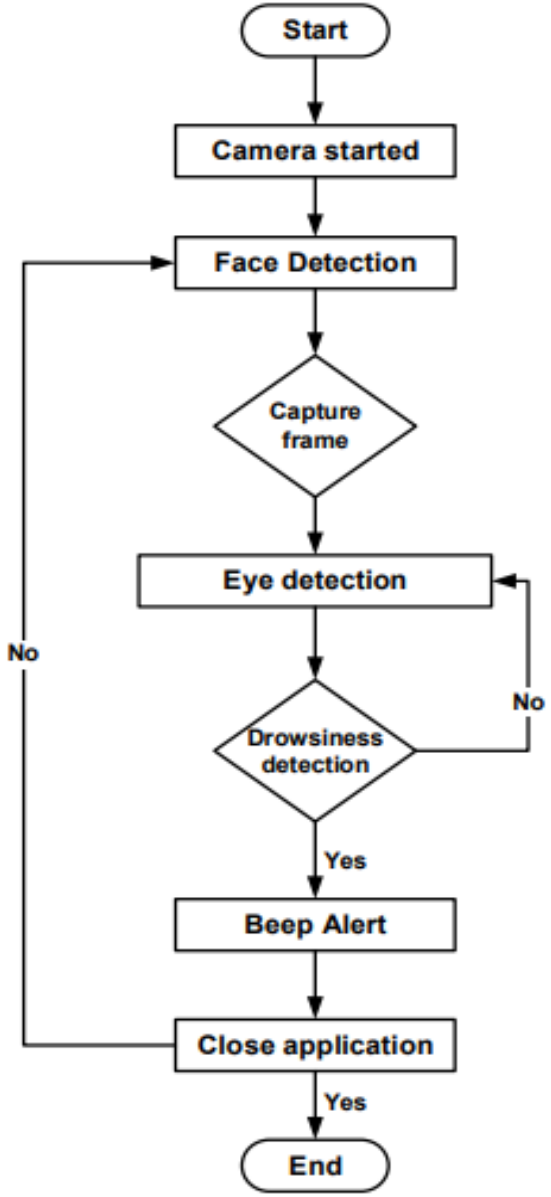
Work flow :

Based on the paper, ***Real-Time Eye Blink Detection using Facial Landmarks***,[5] we can then derive an equation that reflects this relation called the *eye aspect ratio* (EAR):

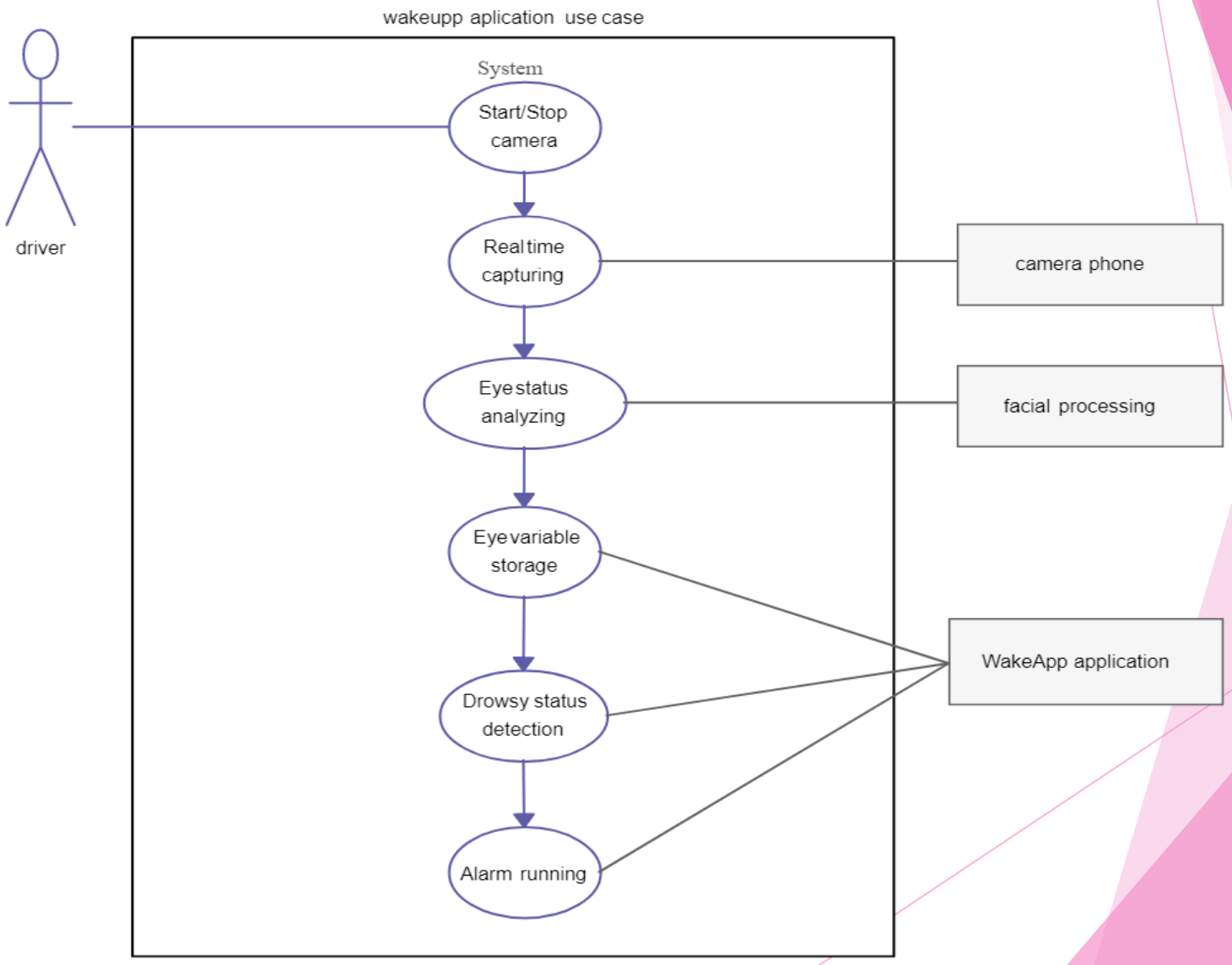
$$\text{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Eye Aspect Ratio(EAR) Equation.

Uml diagrams:



Use case Diagram:



Conclusion

- A drowsiness detection system developed around the principle of image processing judges the drivers alertness level on the basis of continuous eye closures.
- it can help us to avoid crashes caused by fatigue by alarming drivers to take a break in time
- Image processing achieves highly accurate and reliable detection of drowsiness.
- Image processing offers a non-invasive approach to detecting drowsiness without the annoyance and interference