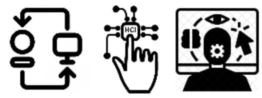
CSE 4015

HUMAN COMPUTER INTERACTION



Digital Assignment – 1

G2+TG2 | SJT222
Dr. Jenicka S

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by

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1. MODULES

While doing our regular brainstorming session (before proposing the problem statement), we'd come up with 5 different modules to undertake in this project.

Now since exactly dividing the number wasn't possible, we shared it as 2 and 3, respectively. We'll balance this individual portion in other parts of the project, while implementing it.

Sl. No.	Modules	Team member
1.	M1: Eye Detection M2: Eye Aspect Ratio (EAR)	Sharadindu Adhikari
2.	M3: Eye State Detection M4: Yawn Detection M5: Drowsiness Detection	Soumyadip Mondal

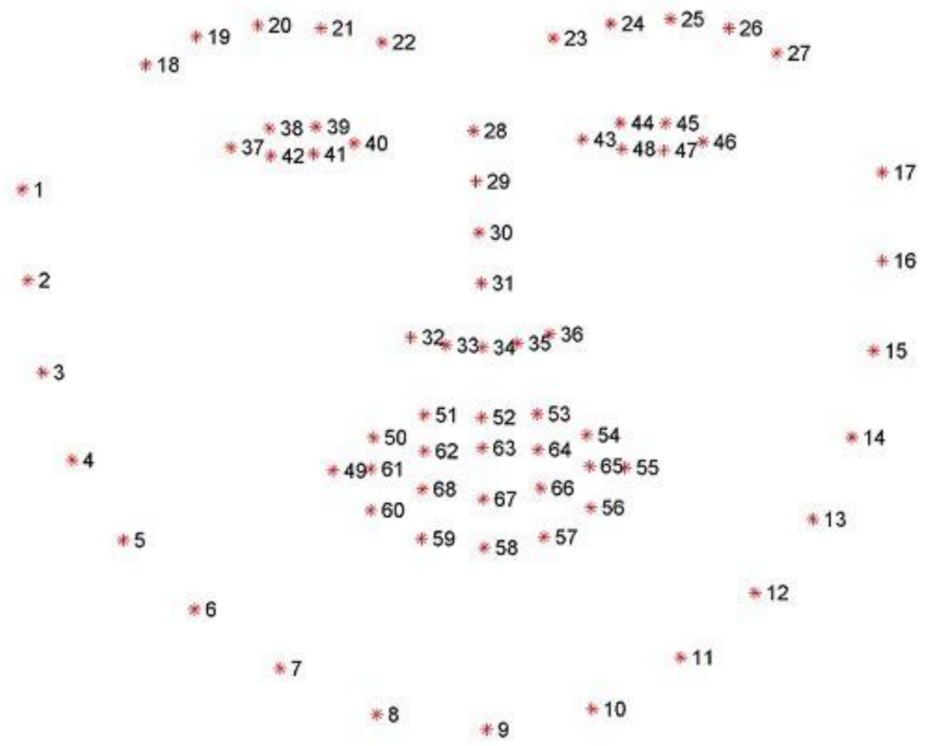
<u>Module 1</u>: Eye Detection

In the system we are going to use facial landmark prediction for eye detection.

The facial landmark detector included in the dlib library is an implementation of the One Millisecond Face Alignment with an Ensemble of Regression Trees paper by Kazemi and Sullivan (2014).

• This method starts by using:

1. A training set of labelled facial landmarks on an image. These images are manually labelled, specifying specific (x, y)-coordinates of regions surrounding each facial structure.



2. Priors, of more specifically, the probability on distance between pairs of input pixels.

• 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.

• We can detect and access both the eye region by the following facial landmark index shown below:

1. The right eye using [36, 42].

2. The left eye with [42, 48].

• These annotations are part of the 68 point iBUG 300-W dataset which the dlib facial landmark predictor was trained on.

• Regardless of which dataset is used, the same dlib framework can be leveraged to train a shape predictor on the input training data.

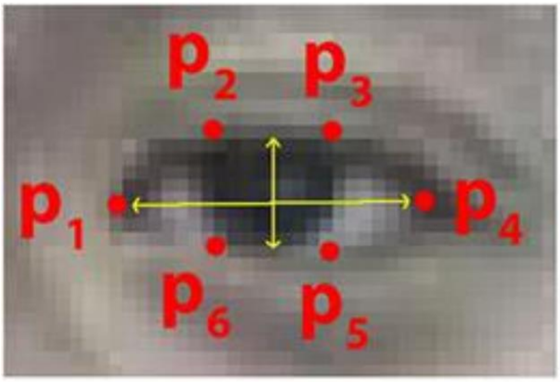
<u>Module 2</u>: Eye Aspect Ratio (EAR)

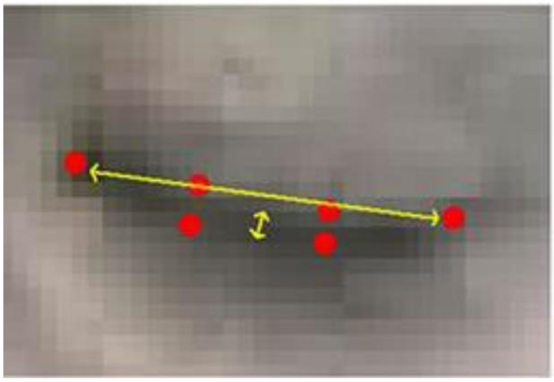
• For every video frame, the eye landmarks will be detected.

• The eye aspect ratio (EAR) between height and width of the eye will be computed.

EAR = ||p2 − p6|| + ||p3 − p5|| • 2||p1 − p4||

where p1, . . ., p6 are the 2D landmark locations.





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

• Aspect ratio of the open eye has a small variance among individuals, and it is fully invariant to a uniform scaling of the image and in-plane rotation of the face.

• Since eye blinking is performed by both eyes synchronously, the EAR of both eyes is averaged.

2. Driver Drowsiness Detection System and Human Computer Interaction

The main reason for motor vehicular accidents in India and most developing countries is the driver drowsiness. Keeping this in mind, we are working towards developing a surveillance system to detect and alert the vehicle driver about the presence of drowsiness. Our app will do the exact job, thereby implementing a practical Human Computer Interaction System.

For the detection of drowsiness, the most relevant visual indicators that reflect the driver's condition are the behaviour of the eyes, the lateral and frontal assent of the head and the yawn. The system works adequately under natural lighting conditions and no matter the use of driver accessories like glasses, hearing aids or a cap.

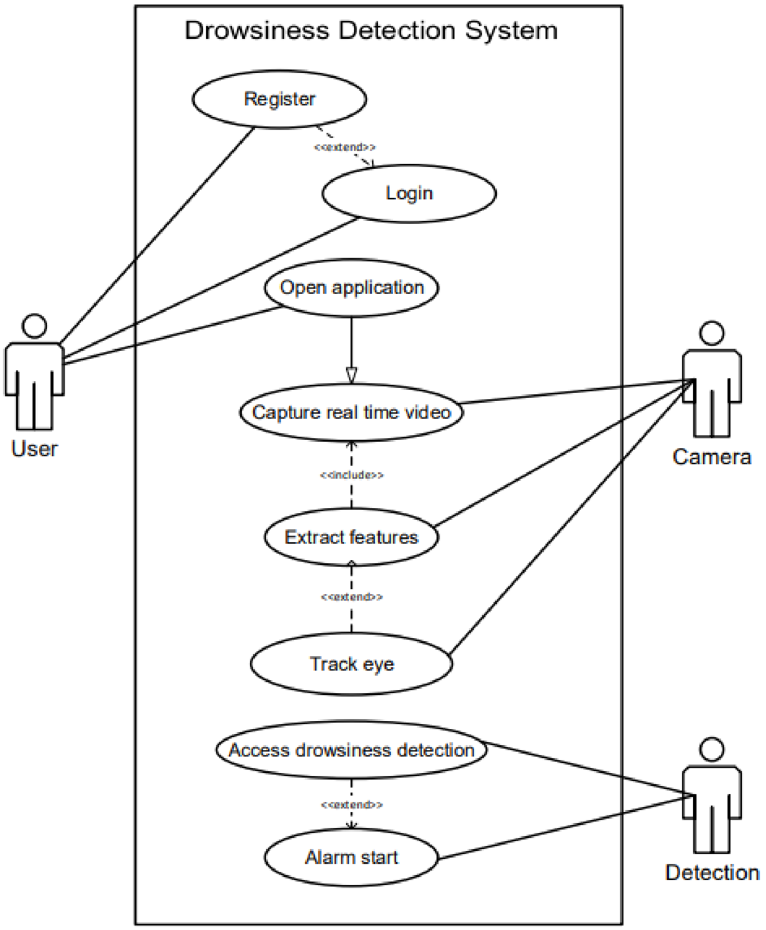
Due to a large number of traffic accidents when driver has fallen asleep, we'll try our best to develop this proposal in order to prevent them by providing a non-invasive system, easy to use and without the necessity of purchasing specialized devices. The method should get more than 90% of drowsiness detections.

Details of our proposed approach, which validate the coincidence of our topic with HCI domain:

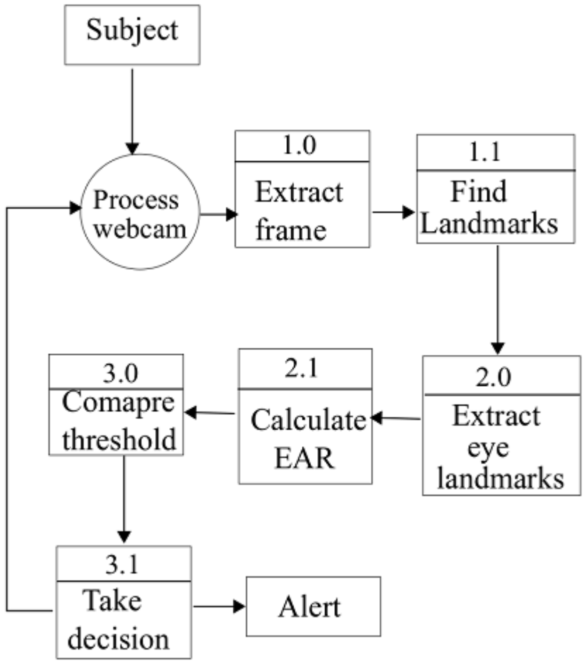
- First of all, we will capture video from the camera and detect face from the video frames.
- From the extracted frames, we will derive the eyes from the face. This will be used in calculating the time for which eyes are closed.
- After that we will calculate Eyes Aspect Ratio (EAR) and compare that to threshold ratio. If the EAR is less than the threshold then an alert message will be displayed upon the screen.
- Along with Eye detection, the program will also detect mouth and keep a counter for number of yawns in a fixed interval of time. Yawn will be detected in a similar manner to blink detection.
- We will thereafter calculate Mouth Aspect Ratio (MAR) and compare that to threshold ratio. If the MAR is greater than the threshold, then it will be counted as a yawn and the yawn counter will increase. If the yawn counter crosses the threshold value, then an alert message will be displayed upon the screen.
- Also, apart from the message upon the screen, we will be sending a message on the phone of the emergency contact of driver along with the location of the driver.

3. DIAGRAMS

3.1. Use Case Diagram



3.2. Data Flow Diagram



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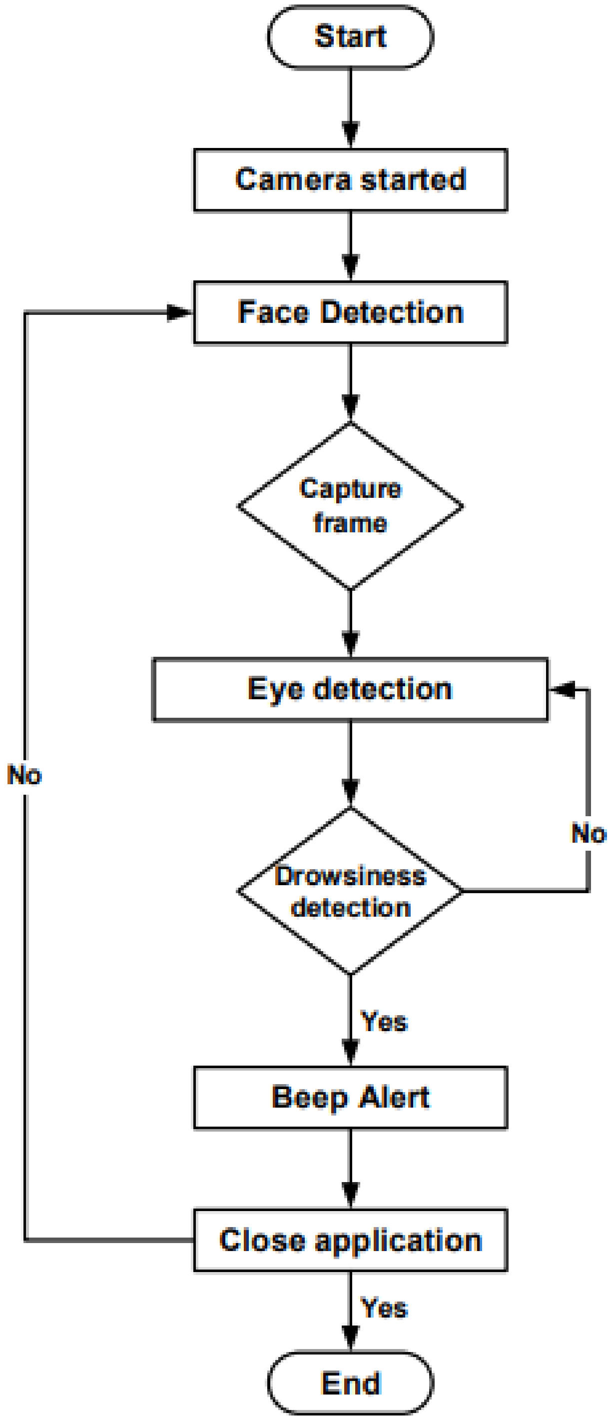
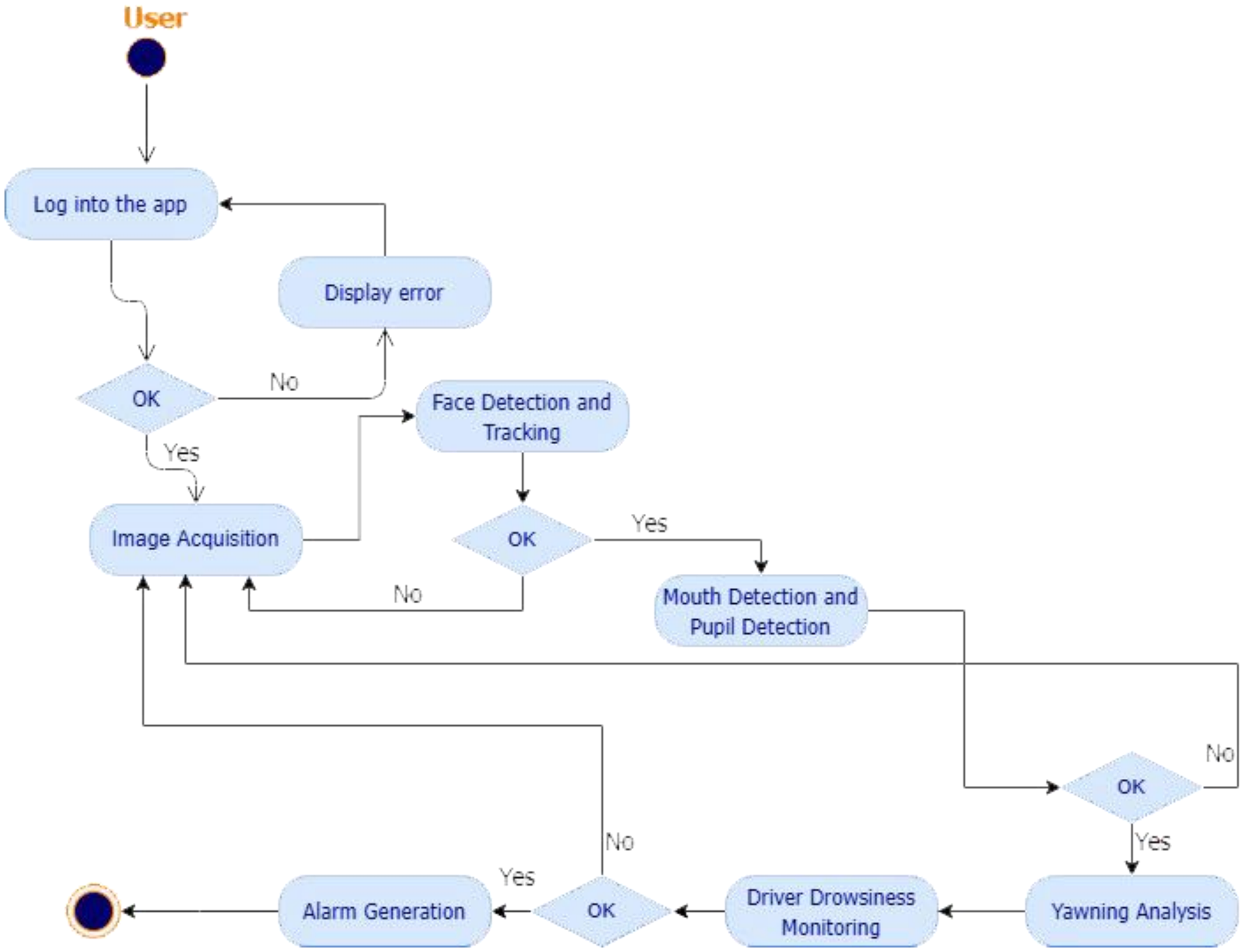
3.3. Flowchart



3.4. Activity Chart



3.5. Timeline Chart