

Real-time Driver Drowsiness detection using Embedded system

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AGENDA:

Objective of project work



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graph TD; A[Objective of project work] --> B[Existing system]; B --> C[Proposed system]; C --> D[Expected outcome];
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Existing system

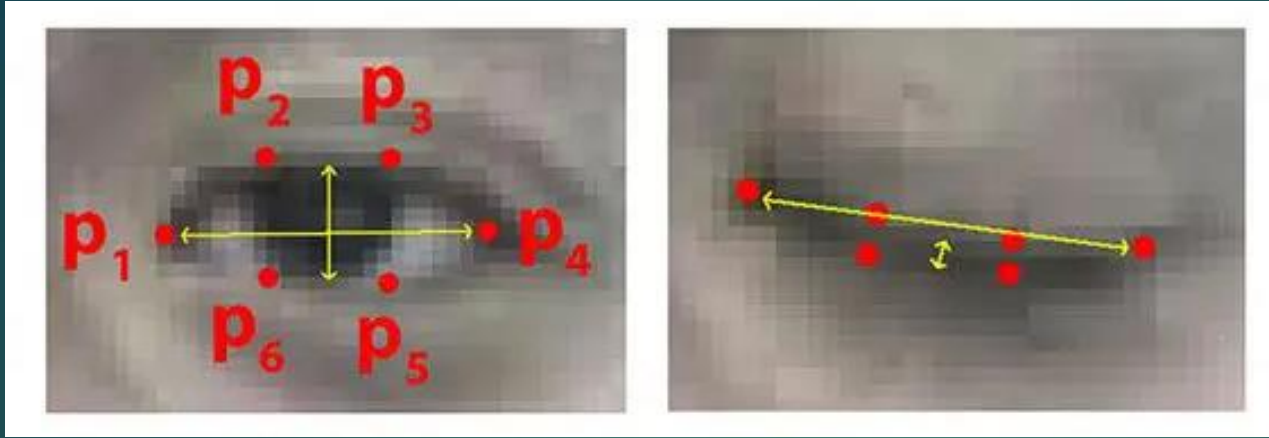
Proposed system

Expected outcome

INTRODUCTION:

- ▶ Vehicles accidents due to driver drowsiness –40% of highway accidents.
- ▶ Drowsiness- fatigueness, lack of sleep.
- ▶ Existing methods for drowsiness detection are not efficient.

AIM: To design a real time embedded system for drowsiness detection using Eye aspect ratio metric.



Eye landmarks used by EAR

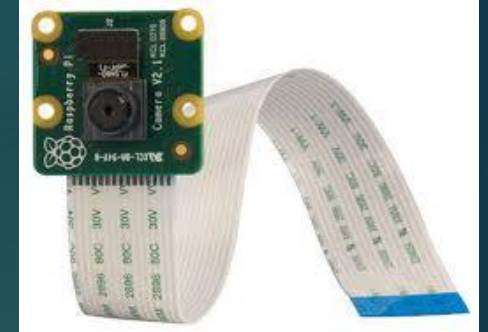
EYE ASPECT RATIO:

An eye blink detection method.

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

Designed prototype :

1. Performs facial landmark detection
2. Detects eye blink in video streams



Picamera: to capture real time video



Buzzer: to alert drowsy driver



Raspberry pi 4 board

BACKGROUND AND RELATED WORK

➤ 2016

Tereza Soukupova et al in 2016 used the eye-aspect ratio to detect the drowsiness of the driver

➤ 2018

Rateb et al in 2018 detected drowsiness of a driver using neural networks

➤ 2019

- In paper "The detection of drowsiness using a driver monitoring system" drowsiness system classified drivers' into drowsiness into low, moderate, and severe levels of drowsiness.

Limitations - could not classify drowsiness into moderate and severe levels of drowsiness.

- In paper “Drowsiness Detection Based on Eye Closure and Yawning Detection” driver's eye movements and mouth movements are tracked using Haar cascade classifiers.

Results detected accurately in 85% of cases

HAAR Cascade : Machine learning approach where a lot of positive and negative images are used to train the classifier

Limitation :High false positive detection, Less accurate, Training custom object is hard

➤ 2020

In paper “Driver Drowsiness Detection System Using Computer Vision.” analyzing the eye blinks of humans using facial landmark detection by calculating eye aspect ratio

Results showed that system effectively detected level of eye openness.

Performance cost is low

PROBLEM STATEMENT

FROM PREVIOUS WORK


To detect drowsiness of driver fingerprint, behavioral and physiological measures are used which need physical contact and are costly

☐ **We need an approach which is :**

- Has no human intervention
- Process which is simpler and faster
- Reliable
- Accurate
- Can be widely used
- Low performance cost

☐ Eye blinking detection is key to drowsiness detection

☐ Here comes dlib library for face detection and facial landmarks detection - more accurate than OpenCV.

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- ❑ Use eye aspect ratio to determine eye openness
 - ❑ Music has a huge affect on mood and mental state

OUR DROWSINESS DETECTION SYSTEM

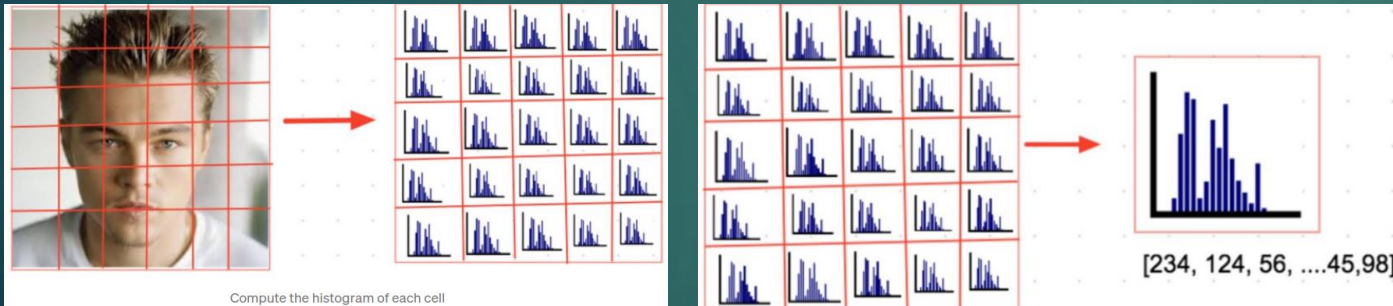
- Detect drowsiness – EAR in every frame in real time
- Buzzer sound
- Music starts playing

WORK COMPLETED:

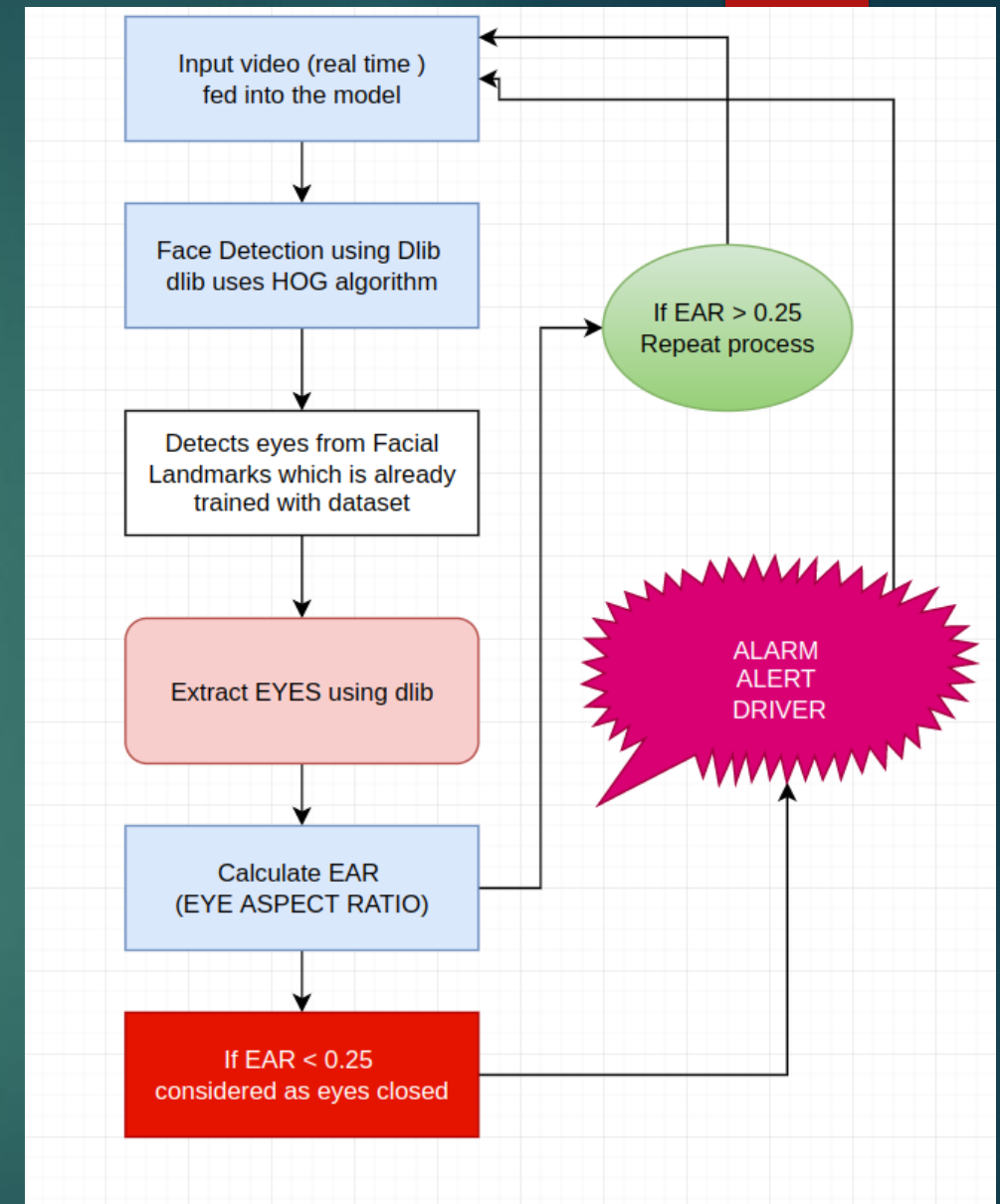
For Detecting drowsiness in the driver we have used OpenCv and python.

The dlib library is used to detect and isolate the facial landmarks using dlib pre-trained facial landmark detector

Dlib uses HOG algorithm which divides the image into small connected cells and computes histogram for each cell .At last makes a unique vector out of all histograms



We used Shape_predictor_68_landmarks.dat model to train dlib.



Basic proposed method

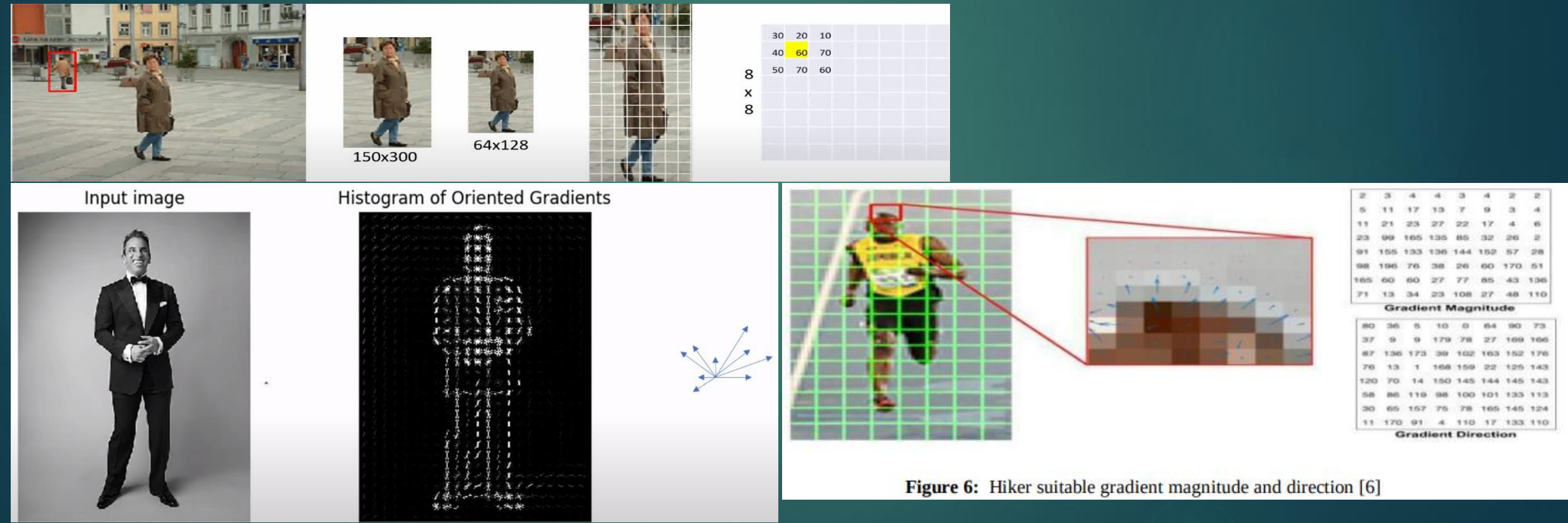
HOG (Histogram of Oriented Gradients)ALGORITHM :

Method of face recognition based on gradient direction histogram features extraction from image data.

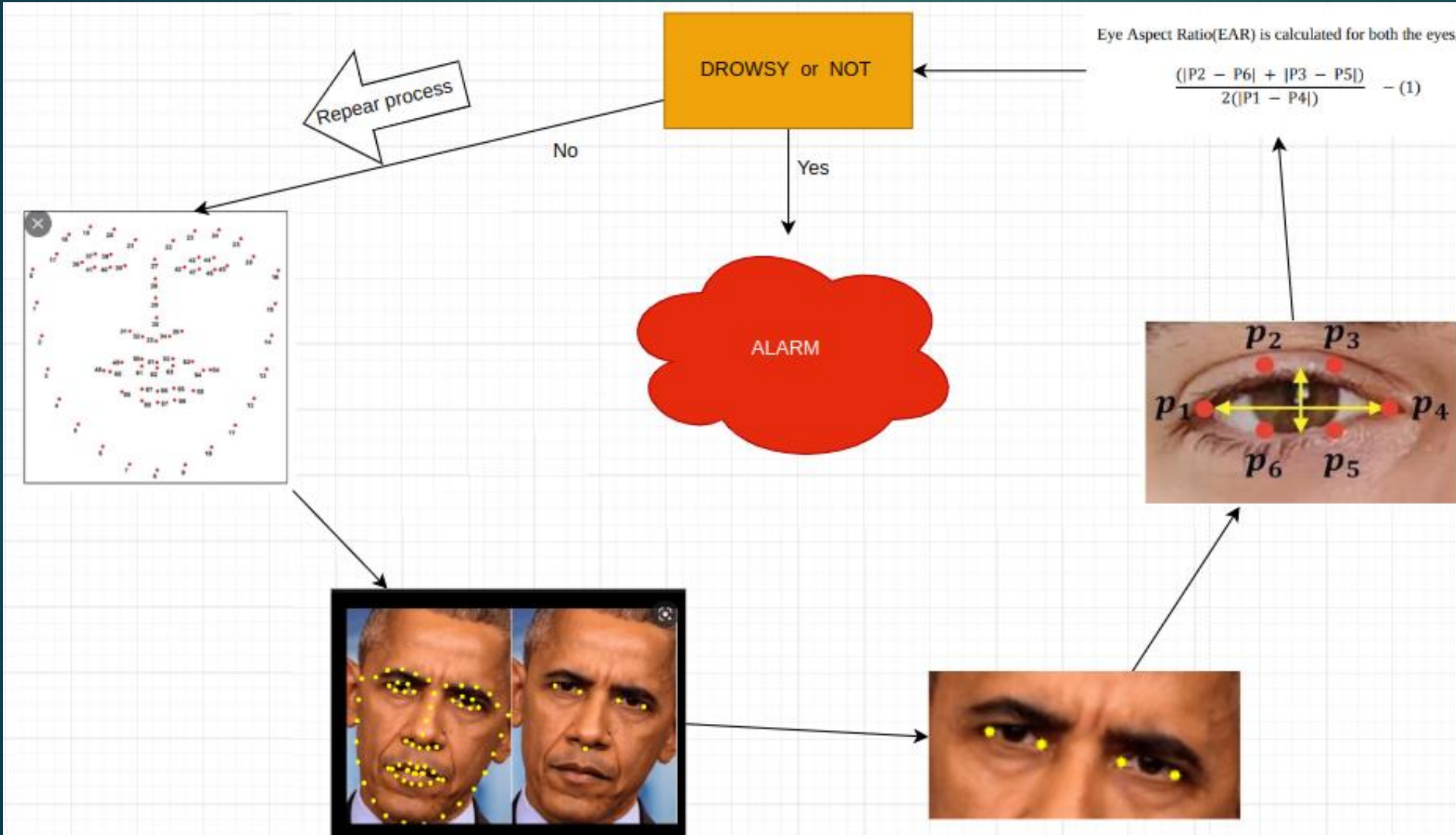
implementing HOG using tools like OpenCv is extremely simple using a predefined function

The complete image is broken down into smaller regions and for each region ,the HOG is calculated

Finally ,the HOG would generate a Histogram for each of his regions separately.



Complex to simple process:



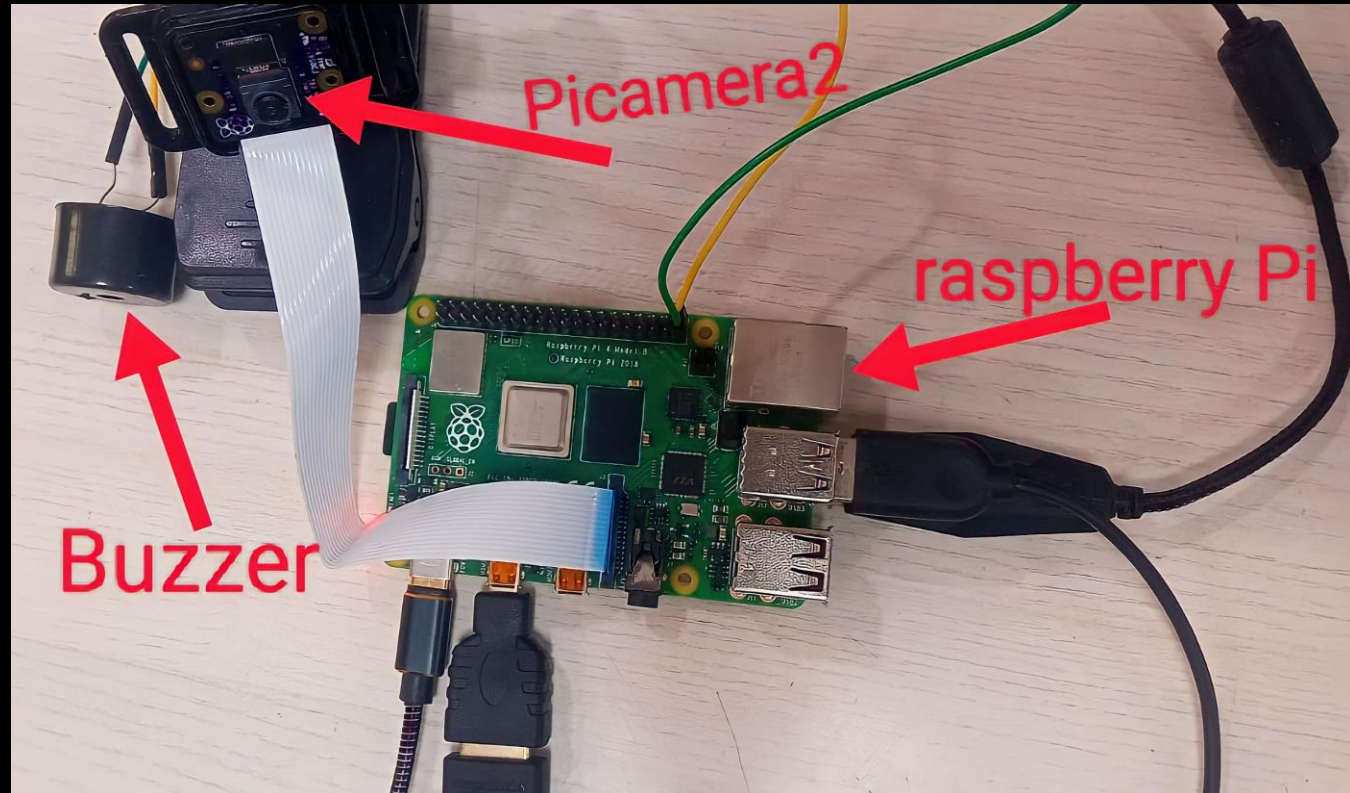
Working models :

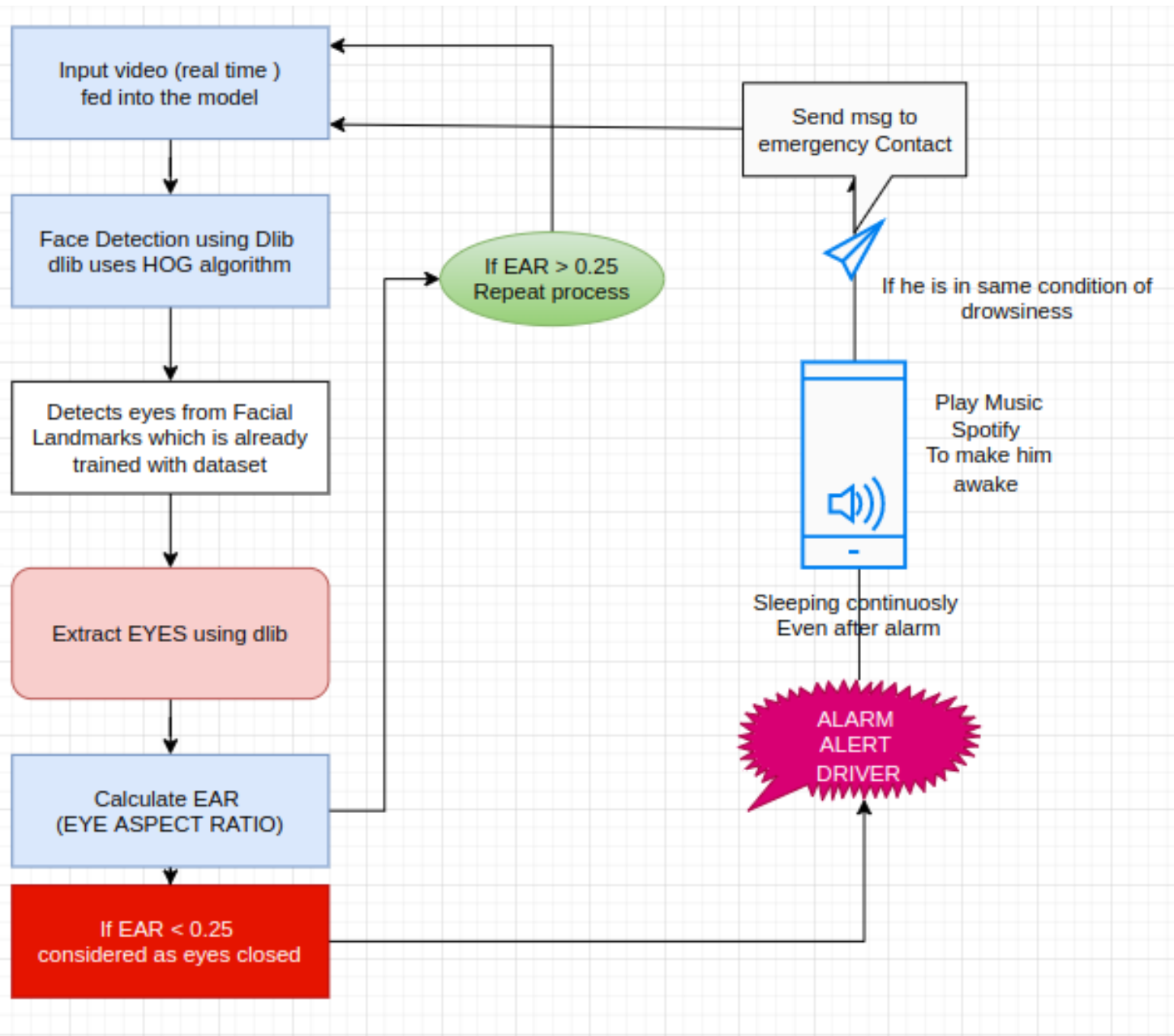


Basic position of camera

```
pi@raspberrypi: ~ $ cd Desktop/Driver-Drowsiness-System/
pi@raspberrypi:~/Desktop/Driver-Drowsiness-System$ python3 face_eye_detection_for_drowsiness.py
[0:38:01.516846471] [2138] INFO Camera camera_manager.cpp:203 libcamera v0.0.1-21-7c855784
[0:38:01.547528564] [2145] WARN RPI raspberrypi.cpp:1287 Mismatch between Unicam and CamHelper for embedded data use
[0:38:01.548836490] [2145] INFO RPI raspberrypi.cpp:1414 Registered camera /base/soc/i2c0mux/i2c@1/1mx219@10 to Unic
[0:38:01.553394841] [2138] INFO Camera camera.cpp:1026 configuring streams: (0) 640x480-XPGB8888
[0:38:01.553885934] [2145] INFO RPI raspberrypi.cpp:888 Sensor: /base/soc/i2c0mux/i2c@1/1mx219@10 - Selected sensor f
0.39
0.36
0.35
0.33
0.38
0.34
0.35
0.31
0.28
0.28
0.28
0.39
0.32
0.36
0.3
[]
```

Terminal of working code
in raspberry Pi OS





FUTURE WORK :

References:

- 1 . Aditya Ranjan, Karan Vyas, Sujay Ghadge, Siddharth Patel, Suvarna Sanjay Pawar, "Driver Drowsiness Detection System Using Computer Vision.", in International Research Journal of Engineering and Technology(IRJET), 2020
- 2 . Chris Schwarz, John Gaspar, Thomas Miller & Reza Yousefian, "The detection of drowsiness using a driver monitoring system" , in Journal of Traffic Injury Prevention (Taylor and Francis Online), 2019.
- 3 . Rahul Atul Bhope, "Computer Vision based drowsiness detection for motorized vehicles with Web Push Notifications", IEEE 4th International Conference on Internet of Things, IEEE, Ghaziabad, India, 2019.
- 4. B.Mohana, C.M.Sheela Rani, "Drowsiness Detection Based on Eye Closure and Yawning Detection", in International Research Journal of Engineering and Technology(IRJET), 2019.
- 5. T. Danisman, I.M. Bilasco, C. Djeraba and N. Ihaddadene, "Drowsy driver detection system using eye blink patterns," Universite Lille 1 & Telecom Lille 1, Marconi, France, 2010

THANK YOU