Driver Drowsiness Detection system based on IoT-powered technologies and Machine Learning.

Team Members

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Introduction

- Road accidents are one of the leading causes of fatal accidents indiscriminate of roadway and time. This is intensified by the increase in the number of vehicles around the world.
- According to a research conducted by the Central Road Research Institute (CRRI) on the 300-km Agra-Lucknow Expressway, sleepy or fatigued drivers cause 40% of traffic accidents.
- Fatigue can easily set in during long journeys, particularly when drivers take inadequate rest periods or pause to help break up the monotony.
- The proposed system contributes to preventing fatal accidents due to driver drowsiness or fatigue. Although it is not possible to control sleepiness, it is possible to detect it and alert the driver using
- An alarm/buzzer which will prevent the risk of fatal accidents.

CONTRIBUTION OF EACH PROJECT MEMBER

THEJESH KUMAR H MUTT	BAPU D PUNEETH KUMAR
▪ CODING ▪ CAMERA MODULE ▪ HARDWARE INTEGRATION ▪ HUM-ANTENNA	▪ IDEA OF PROJECT ▪ CODING ▪ CAMERA MODULE ▪ HEART RATE MODULE
DIVYA M • HEART RATE MODULE • CODING • REPORT	ANNAPOORNA • MESSAGE MODULE • REPORT • PPT

System Design

The system is designed on a combined method approach and has three layers as shown in the figure.

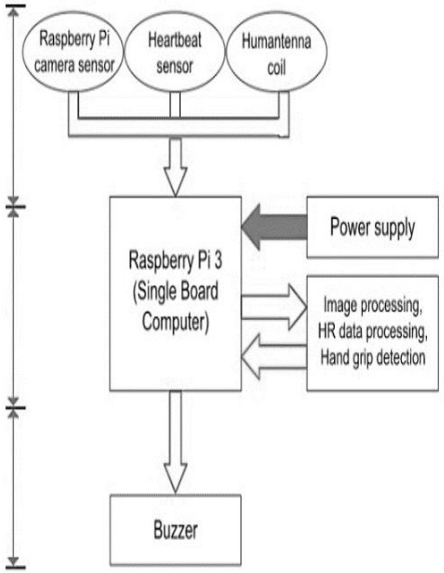


Fig. 2.1: System design

As depicted the raw data from input components is fed to the Raspberry Pi 3 board for data analysis and processing. To analyze and process data means to identify the features of data and process them to identify drowsiness in drivers.

Methodology

- There are three stages in the proposed system as follows:

A. Data collection

- Image acquisition
- Heartbeat rate
- Touch sensing

B. Data processing

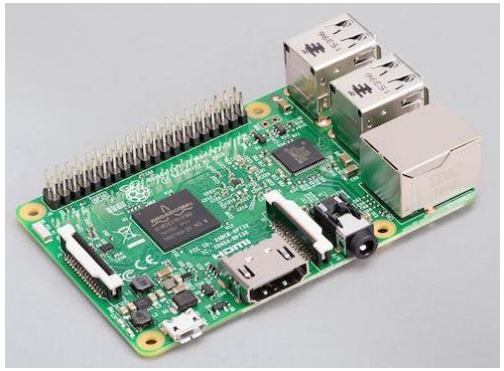
Once the data is collected it is processed using the Raspberry Pi 3 interface. The raw data obtained by the sensors must be analyzed for Region of Interest(RoI), threshold comparision and must be processed for drowsiness detection.

C. Alert

A buzzer is used to alert the driver if drowsiness is identified by data processing.

Components

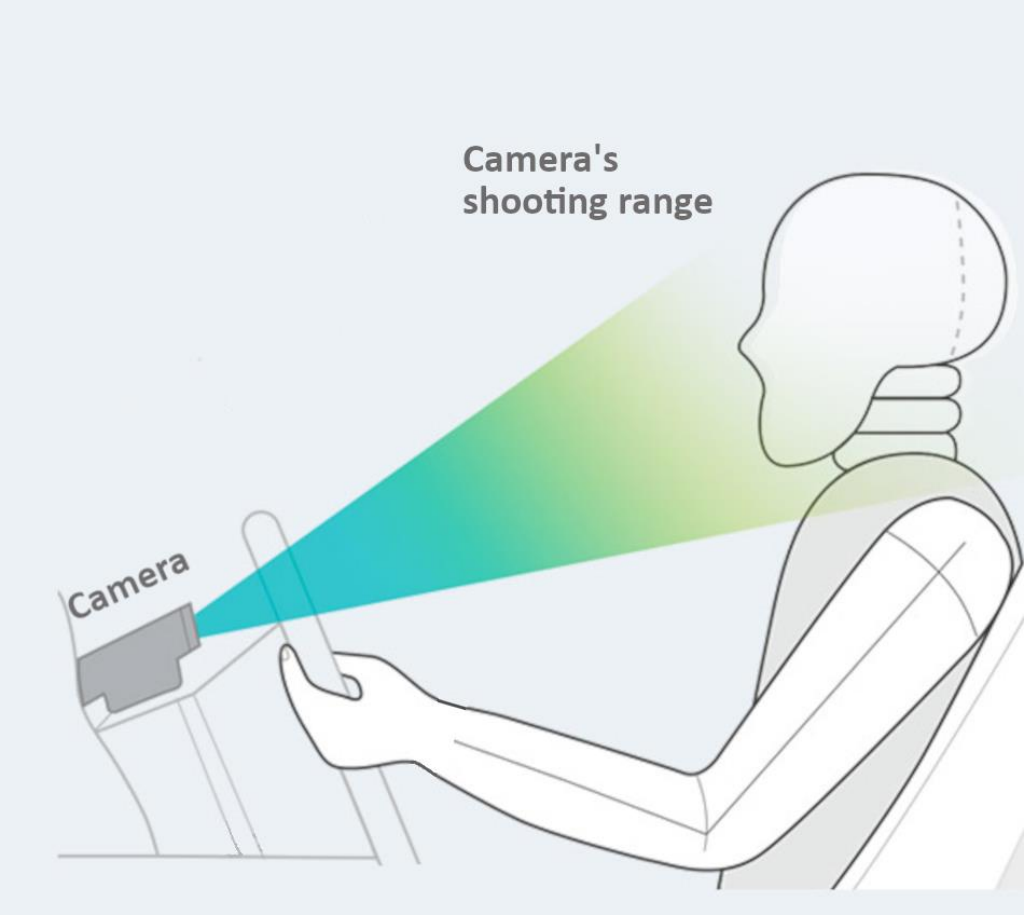
Processing



Input

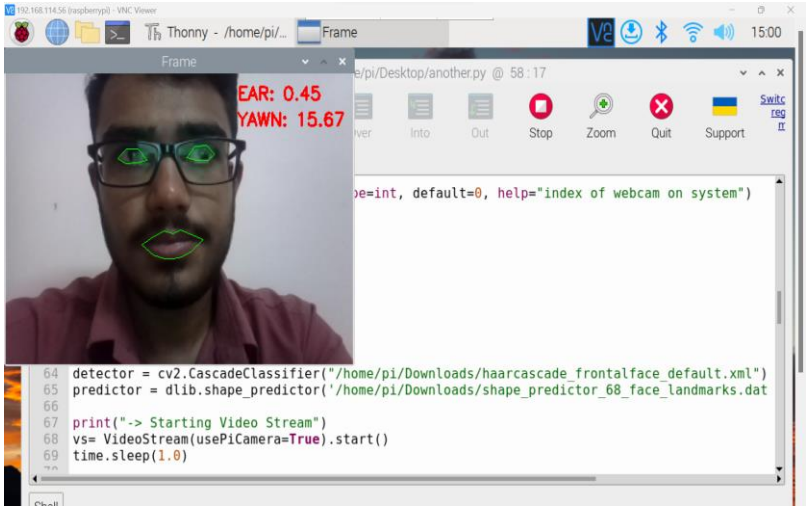
Output

Camera sensor



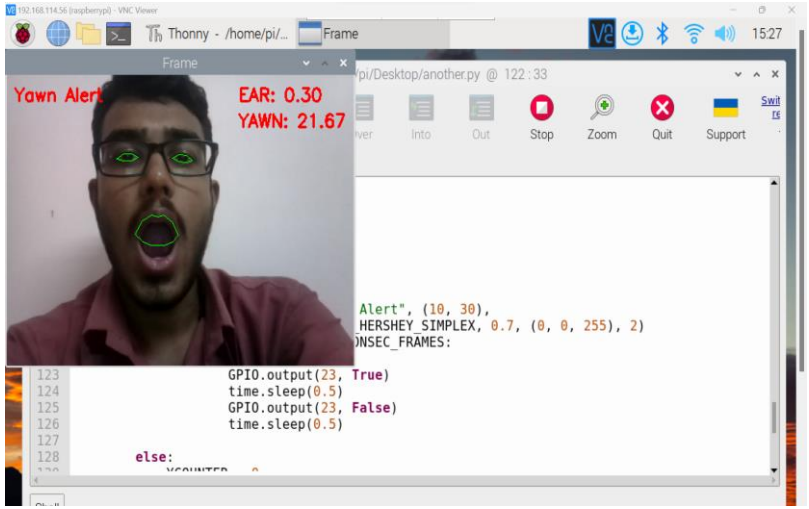
- Haar Cascade algorithm
- Dlib's facial landmarks
- Eye Aspect Ratio

Camera sensor



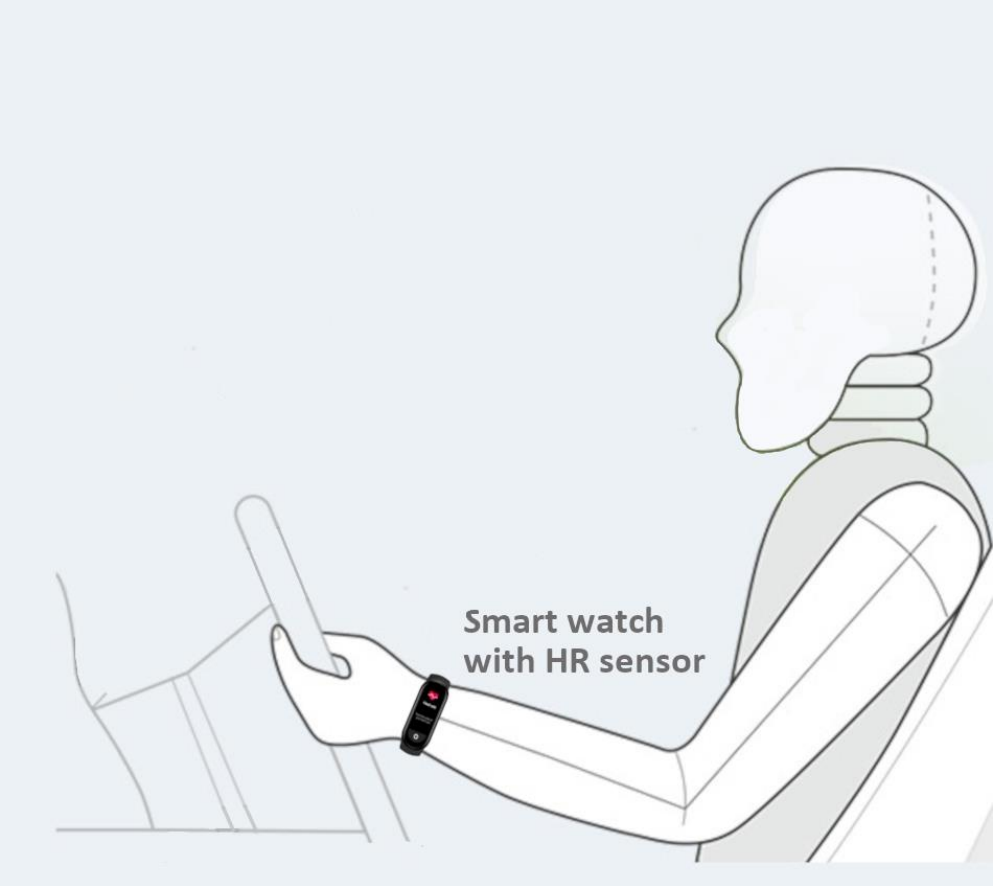
Normal State

Drowsy state: Eye closure



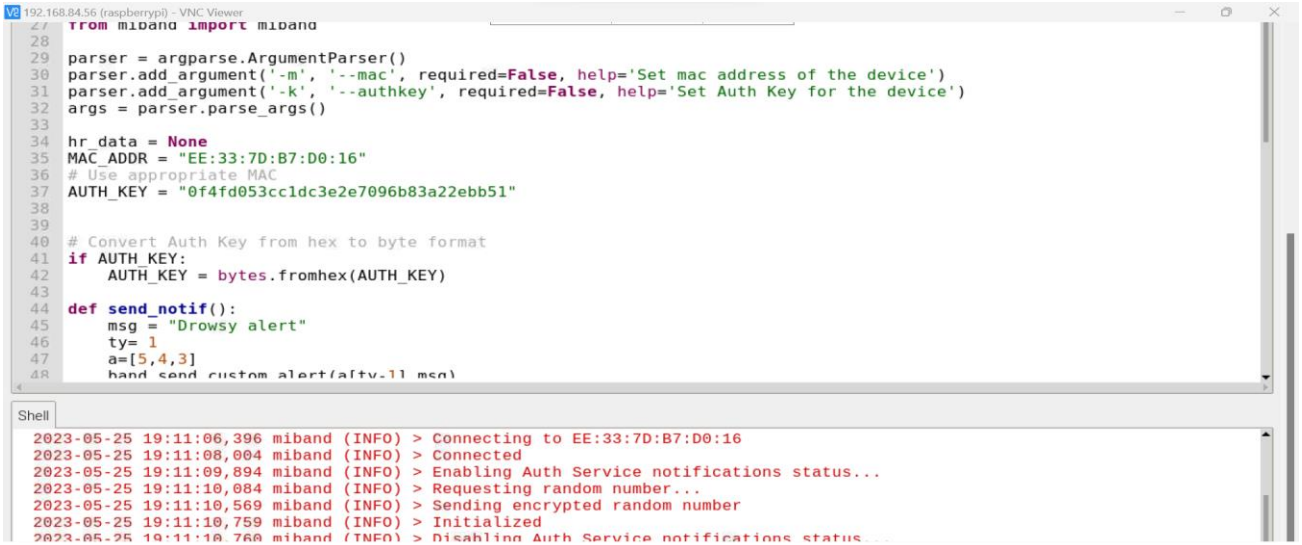
Drowsy state: Yawn detection

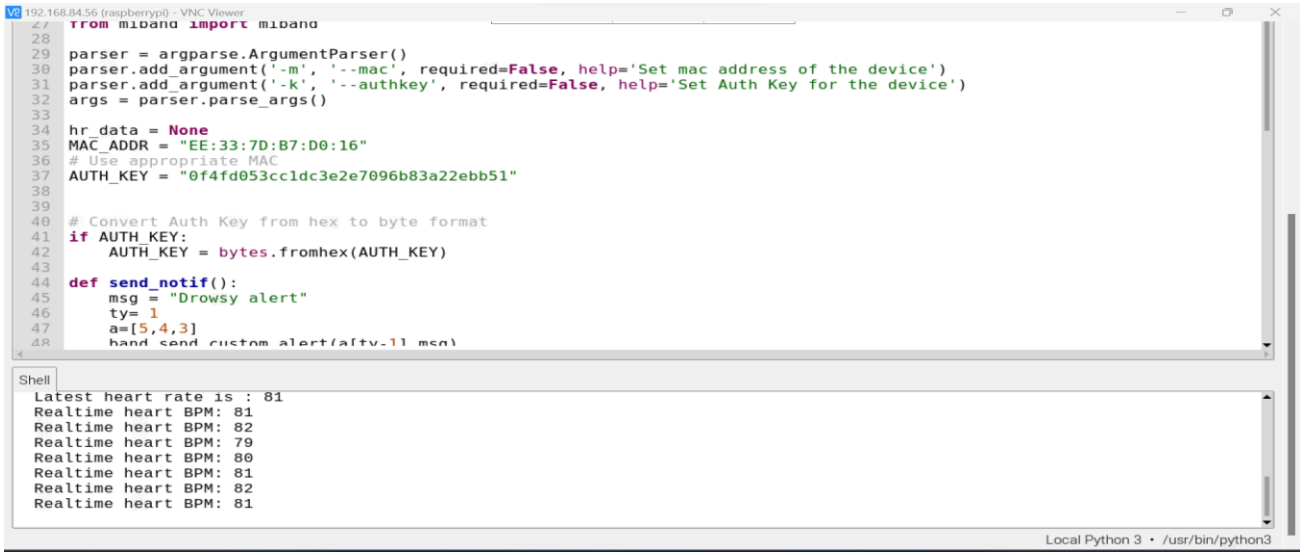
Heart-rate sensor



- Heart rate sensor embedded smart watch or a heart rate sensor

Heart-rate sensor

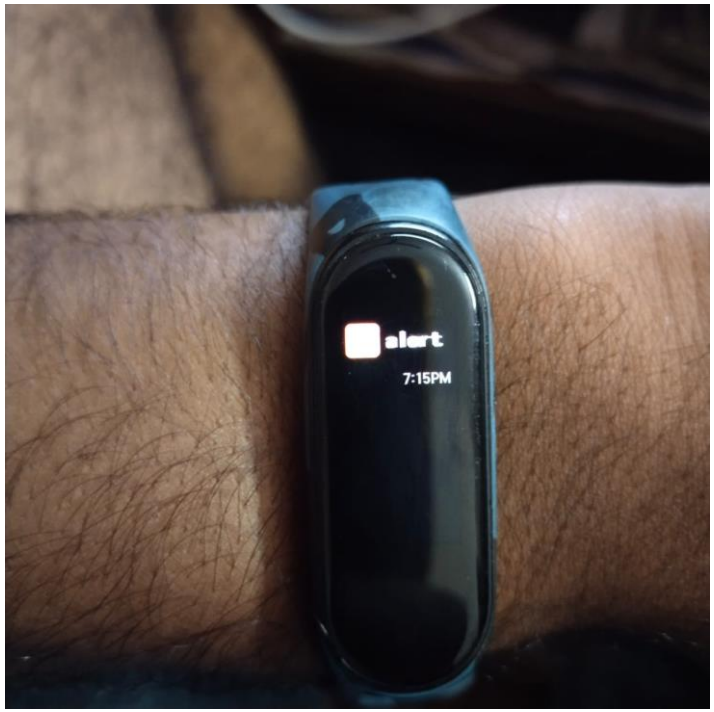




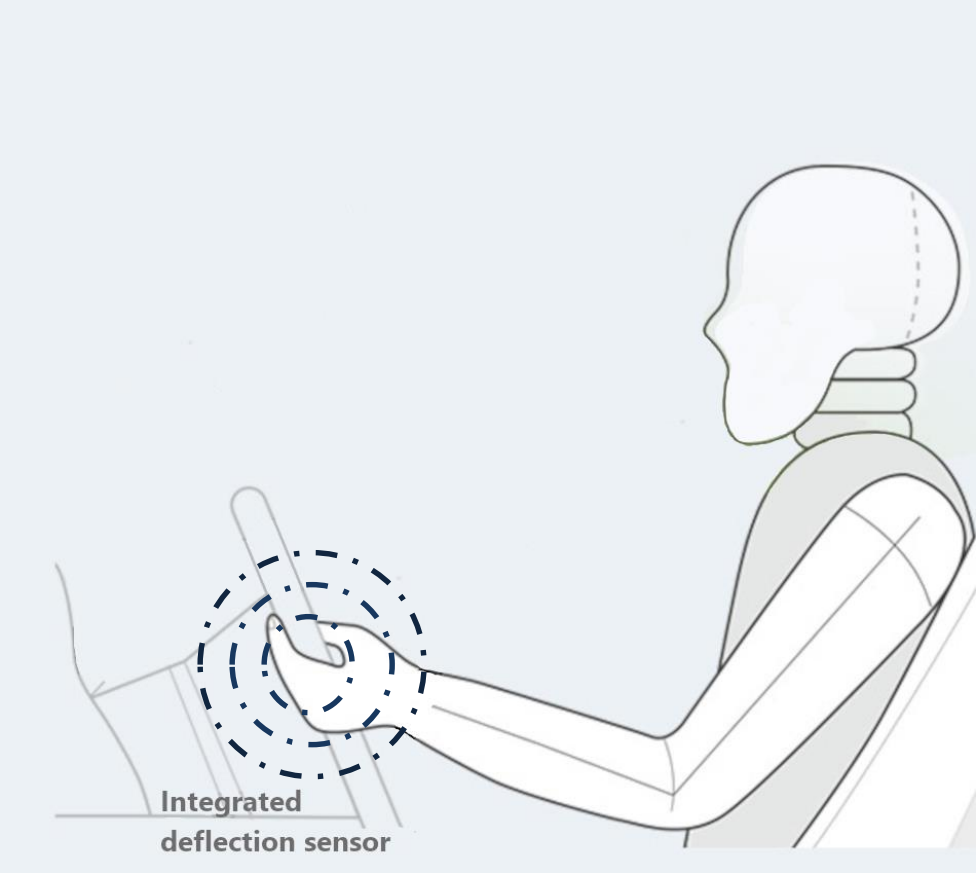
Heart-rate sensor

Mi Band 4

Drowsy Alert

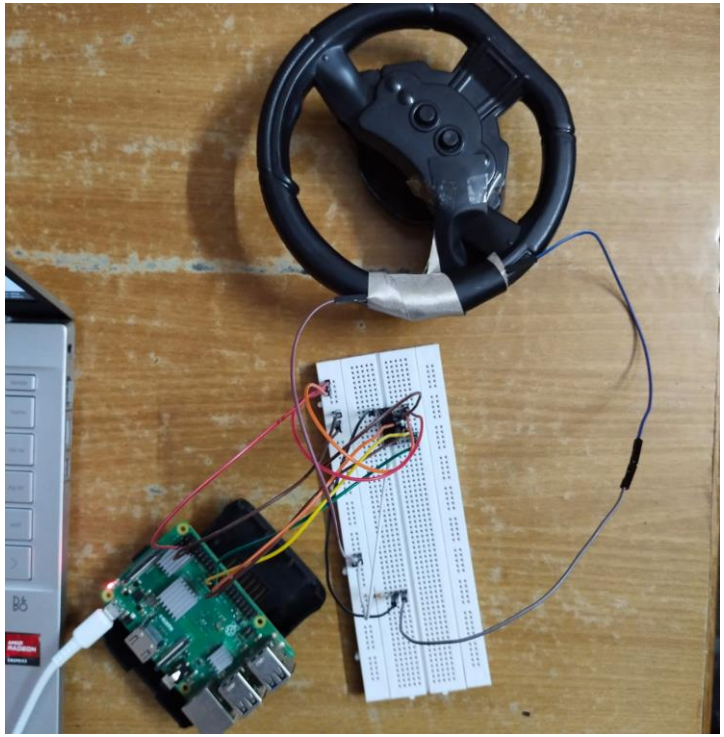


Velostat pressure sensor



- Velostat sensor
- Woven Conductive sheet
- Hum-antenna technique

Velostat pressure sensor



Velostat pressure sensor setup

Velostat pressure sensor

192.168.84.56 (raspberrypi) - VNC Viewer

```
#Create SPI
spi = spidev.SpiDev()
spi.open(0, 0)
spi.max_speed_hz=1000000

def readadc(adcnum):
    # read SPI data from the MCP3008, 8 channels in total
    if adcnum > 7 or adcnum < 0:
        return -1
    r = spi.xfer2([1, 8 + adcnum << 4, 0])
    data = ((r[1] & 3) << 8) + r[2]
    return data

try:
    while True:
        pad_value = readadc(pad_channel)
        print("----------------------------------------")
        print("Pressure Pad Value: %d" % pad_value)
        time.sleep(delay)
except KeyboardInterrupt:
    pass
```

Shell

```
----------------------------------------
Pressure Pad Value: 3
----------------------------------------
Pressure Pad Value: 5
----------------------------------------
Pressure Pad Value: 4
----------------------------------------
Pressure Pad Value: 0
```

Local Python 3 • /usr/bin/python3

192.168.84.56 (raspberrypi) - VNC Viewer

```
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except KeyboardInterrupt:
    pass
```
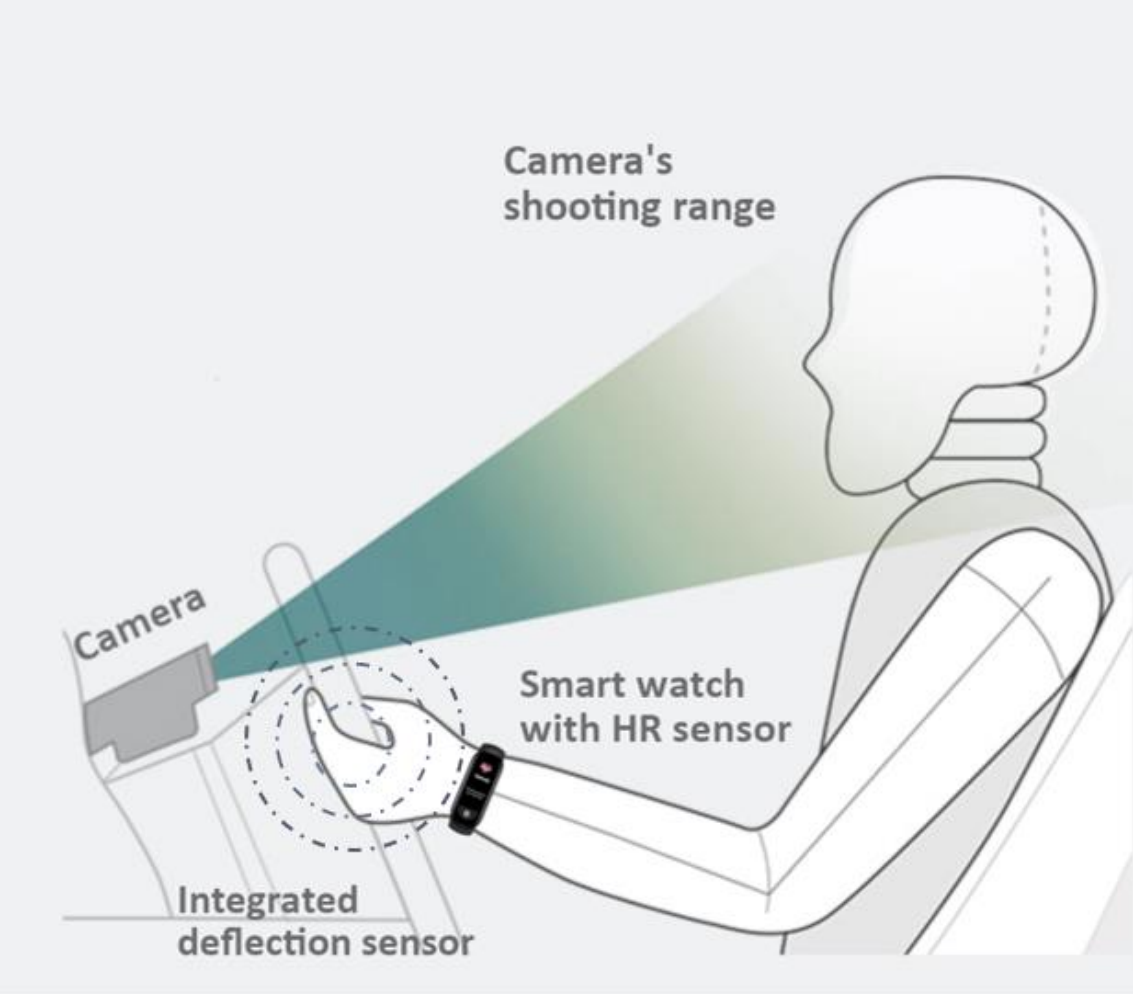

Shell

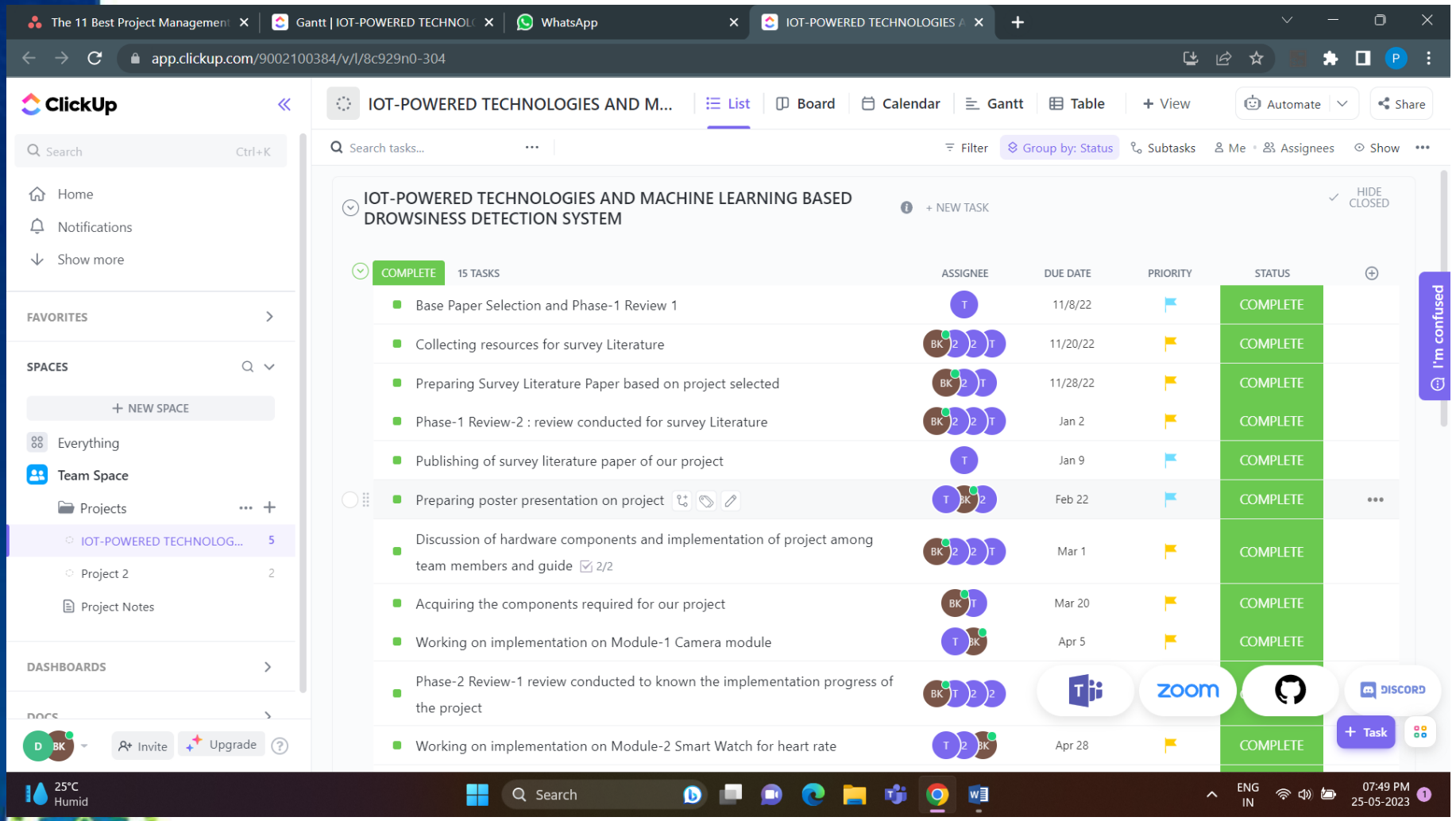
```
----------------------------------------
Pressure Pad Value: 119
----------------------------------------
Pressure Pad Value: 0
----------------------------------------
Pressure Pad Value: 73
----------------------------------------
Pressure Pad Value: 0
```

Local Python 3 • /usr/bin/python3

Combined system



PROJECT TOOL SNAPSHOT



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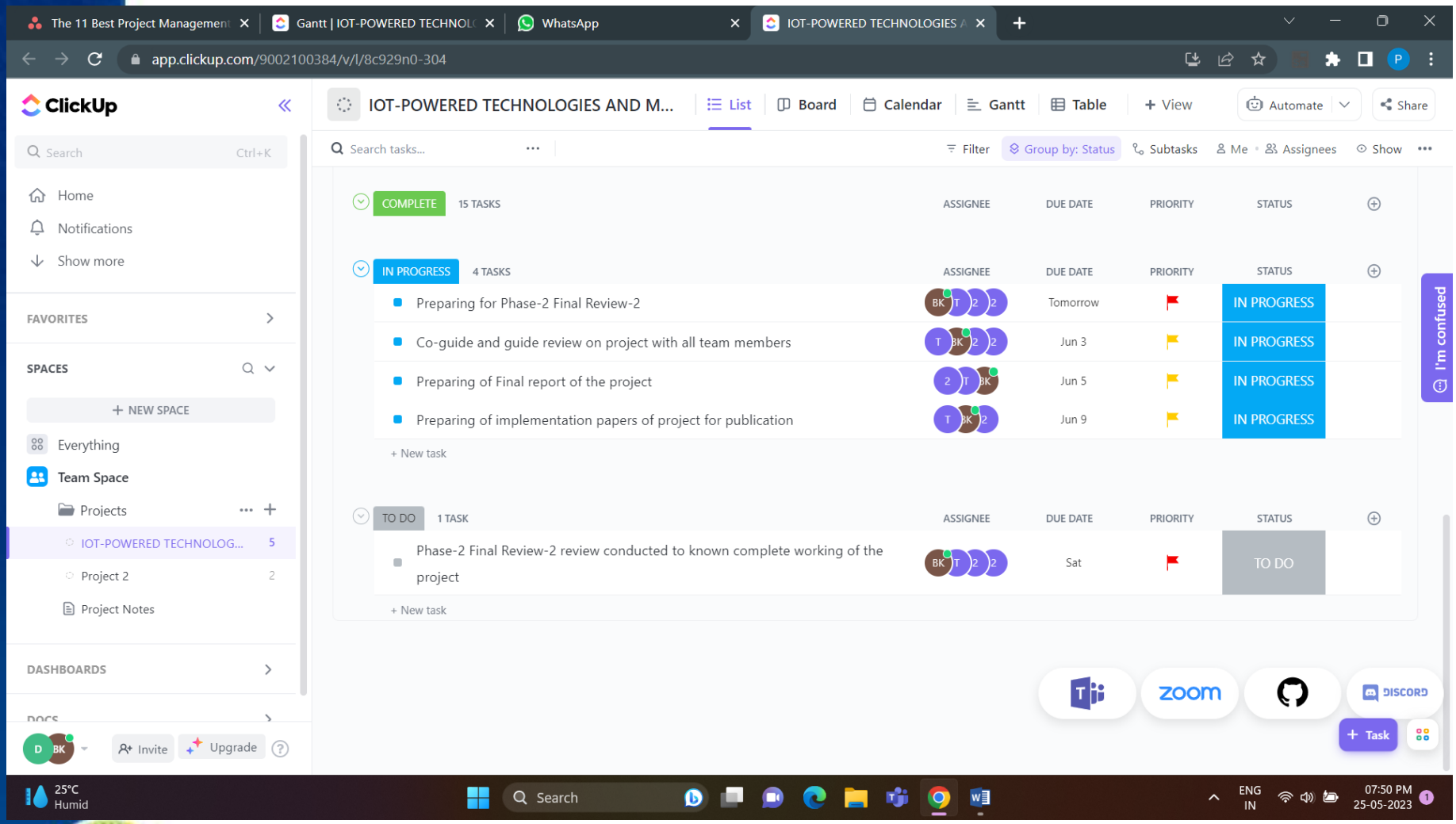

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Conclusion

The real-time video stream from raspberry pi night vision camera is used to detect driver drowsy while driving in long distance, the system is successful in classifying blinking from sleeping and it works fine in both Day and Night times.

Touch sensor are called as tactile sensors and are sensitive to touch, force or pressure.it can be implemented on steering while the driver losses the hand grip the buzzer get ring to alert driver.

This project is based on multiple-approach integration technique for driver drowsiness detection i.e., camera module, smart watch and pressure-sensitive conductive sheet.

The alert is given by vibrator incorporated in the mi band 4 which will be activated in case of drowsiness detection, Bluetooth speaker is used to provide a voice alert with the specific aspect where drowsiness is detected and a third-party messaging site is used to send an alert message to emergency contact.

Scope for future work

The increase in the population of vehicles all over the world acts as a fuel for the proposed system.

The system uses major approach such as facial analysis, heart rate analysis, and steering grip analysis for drowsiness detection. This can be considered as crucial aspects through which drowsiness can be detected. Although some other aspects like vehicular based techniques: (1) Driving Lane technique: In which the vehicle driving lane is analyzed for any faulty driving through which driver drowsiness can be predicted, (2) Steering wheel technique: In which the steering wheel handling is analyzed for any sudden pull or faulty handling of the steering through which driver drowsiness is predicted.

The system is successful in classifying blinking from sleeping by providing frame length to ignore blinking. The system detects drowsiness when the yawn threshold is met however it does not classify talking from yawning which can be implemented using audio detection which can be used to classify talking from capturing real-time audio.

THANK YOU