Driver Drowsiness Detection system

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Content

Driver Drowsiness detection System

Objective :

The need to prevent road accidents caused by drowsy drivers has become critical in modern times. To address this issue, we have developed a system capable of detecting driver drowsiness and alerting the driver accordingly. The system can also detect yawning as a sign of drowsiness and issue warnings. While the system can be implemented on a computer, we have chosen to use a Raspberry Pi for its portability and convenience. The algorithms used in this system are highly optimized, ensuring real-time detection and response, which is a critical feature for this application.

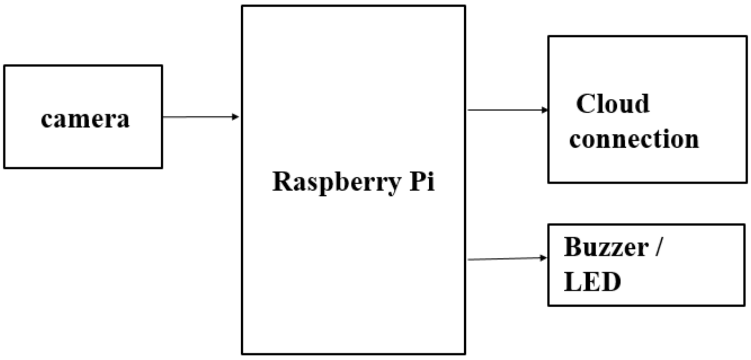
Hardware Requirement:

- Raspberry PI
- Raspberry PI Camera
- Breadboard
- Jumper Wire
- Resistors
- LEDs
- Buzzer

Software Requirement :

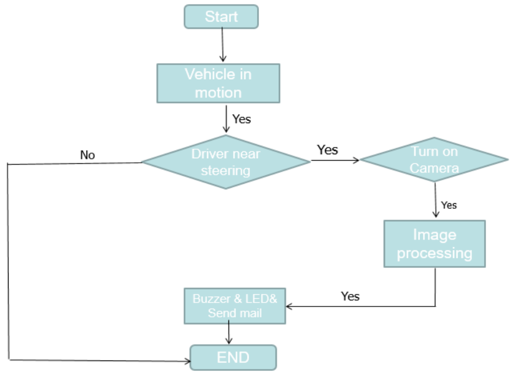
- Python
- OpenCV
- Dlib
- Imutils
- Scripy
- Numpy
- Argparse

System Architecture :



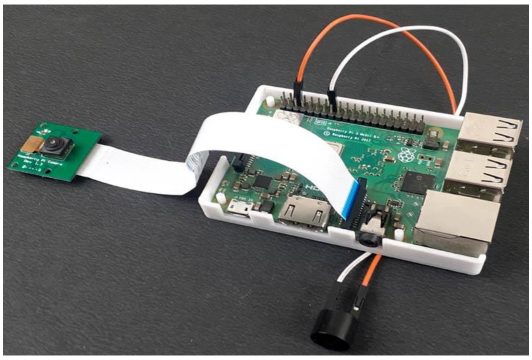
[Figure 1. System Architecture]

Flow Chart :



[Figure 2. Flowchart of the system]

Hardware setup:



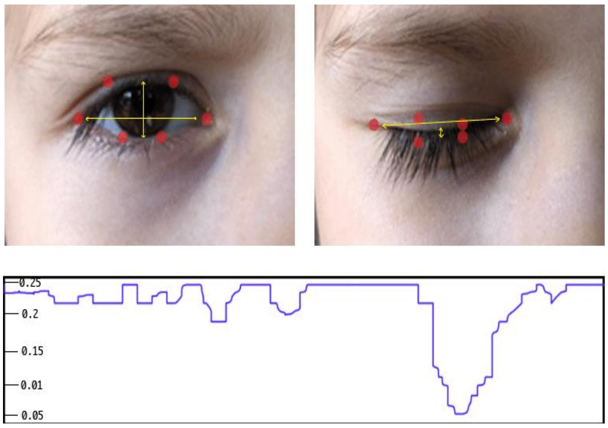
[Figure 3. Hardware setup of the system]

The proposed system comprises of three phases

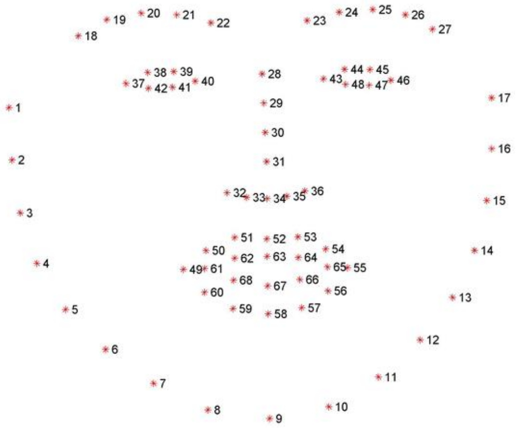
Face Detection :

To detect if a user is drowsy, we first need to detect their face. We require an algorithm that is accurate, fast, and requires minimal processing power to work on Raspberry Pi. Therefore, the Viola-Jones algorithm for face detection has been chosen. Although there are more accurate deep learning-based algorithms available, they are not suitable for real-time usage on a Raspberry Pi or even on a PC without a powerful GPU.

Eye Detection :



[5][Figure 4.1.1 Eye aspect ratio]



[Figure 4.1.2 Face Landmark recognition]

To detect if the user is sleeping, we will use the Eye-Aspect-Ratio (EAR) which measures the ratio of the distance between certain points on the eye to the distance between other points. An average EAR of 0.339 indicates that the eyes are open, while an average EAR of 0.141 indicates that the eyes are closed. To calculate the EAR, we will use *Dlib's 68 facial landmark* model to estimate the location of 68 coordinates on a person's face. Using these coordinates, we can calculate the EAR using the formula **EAR = (|(P2-P6)| + |(P3-P5)|) / (2* |(P1 - P4)|)** where P1-P6 represents the location of certain points on the eye. The system will continuously check the EAR and if it is below a threshold set by the user, it will alert the user until they open their eyes.

Yawn Detection :

To detect yawns, the system will measure the distance between the user's upper and lower lips. During normal talking, this distance remains within a certain limit, but during a yawn, the distance increases significantly beyond the threshold. Using DLIB's facial landmark model, the system will identify the landmarks of the lips and calculate the distance between the midpoint of the upper and lower lip. If this distance exceeds the predetermined threshold, the system will alert the user of a yawn.

Application:

Avoid various road accident

Reduce the number of crashes related to drowsy driving

Future Scope :

Anti-drowsiness alarm

Make driving easy

Detection system in aircraft in order to alert pilot

Alcoholic sensor can be used for drunk drivers.

Conclusion

- Thus, We developed a system for detecting drowsiness and yawn, with the help of image processing technique. If Driver is detected drowsy inside camera (Video) Buzzer will make a beep sound and alert the driver. In the above cases, email and notification send to the driver via IFTTT cloud service.
- Although, one can enhance the face detection algorithm, but it needs to be optimized to work in real-time on devices like Raspberry Pi.

References

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- https://github.com/infoaryan/Driver-Drowsiness-Detection/blob/master/driver_drowsiness.py [3]
- https://www.youtube.com/watch?v=ksi42rwGyas&t=1s [4]
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