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Abstract

This project aims to develop a drowsiness detector using OpenCV, python library. The detector will analyze facial expressions and eye movements to detect signs of drowsiness in a driver, and trigger an alert to prevent accidents caused by driver fatigue. The algorithm uses computer vision techniques to track the eyes and measure the blink rate and frequency of head movements.

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Abstract

The system will also monitor changes in facial expression and use machine learning algorithms to detect signs of fatigue. The proposed drowsiness detector has the potential to improve road safety and reduce the number of accidents caused by driver fatigue.

By using this drowsiness detector, drivers can be alerted before they become too drowsy to drive safely, allowing them to take a break, switch drivers, or take other corrective actions to prevent accidents.

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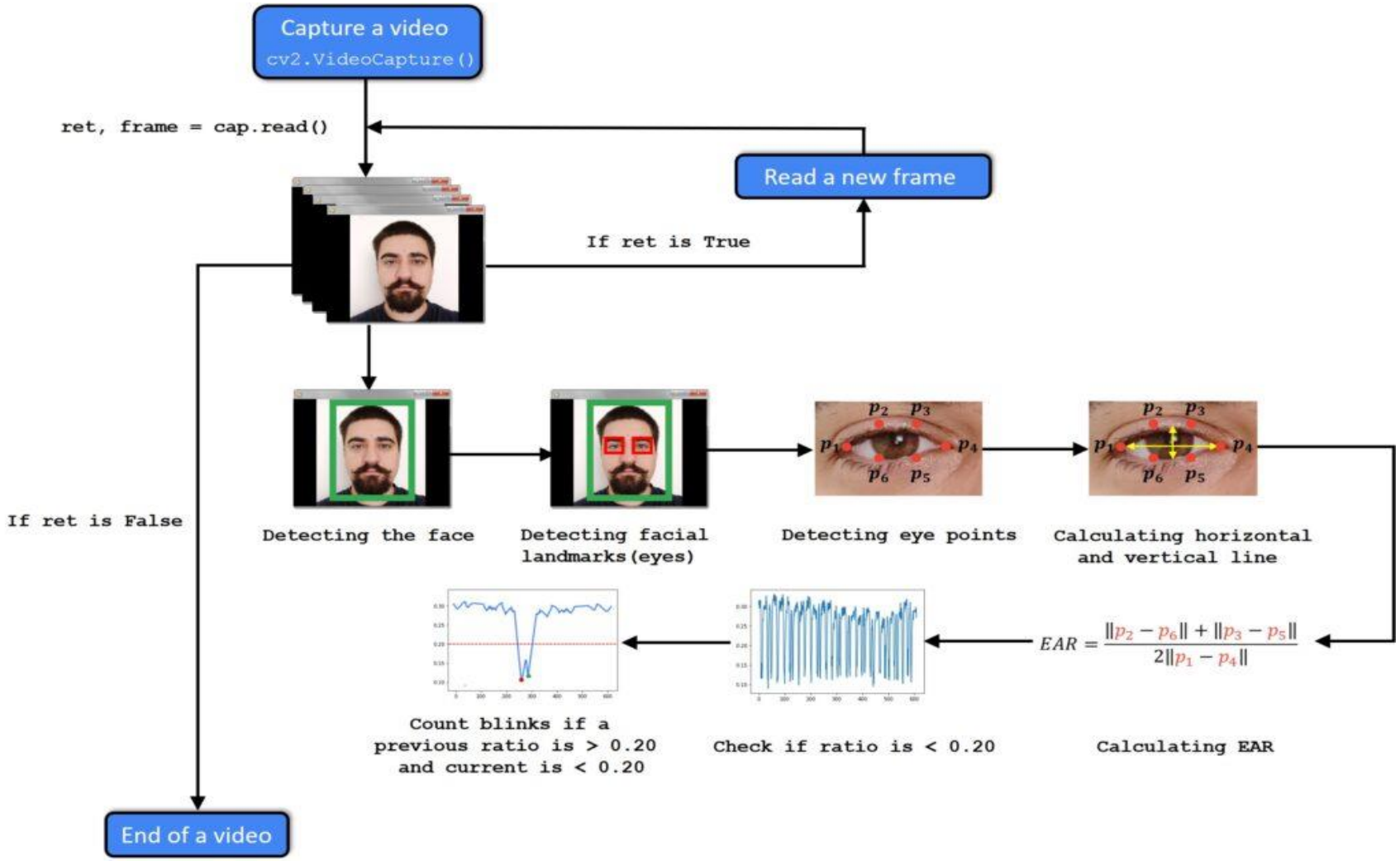
Objective

- To use computer vision and machine learning techniques to analyze the facial features of a person and determine whether they are becoming drowsy.
- To provide an accurate and reliable system that can work in real-time and can detect drowsiness with a high degree of accuracy.
- To reduce the number of accidents caused by drowsiness, which is a major cause of accidents in many industries, including transportation, healthcare, and manufacturing.

Flow diagram/Block Diagram/Use case Diagram



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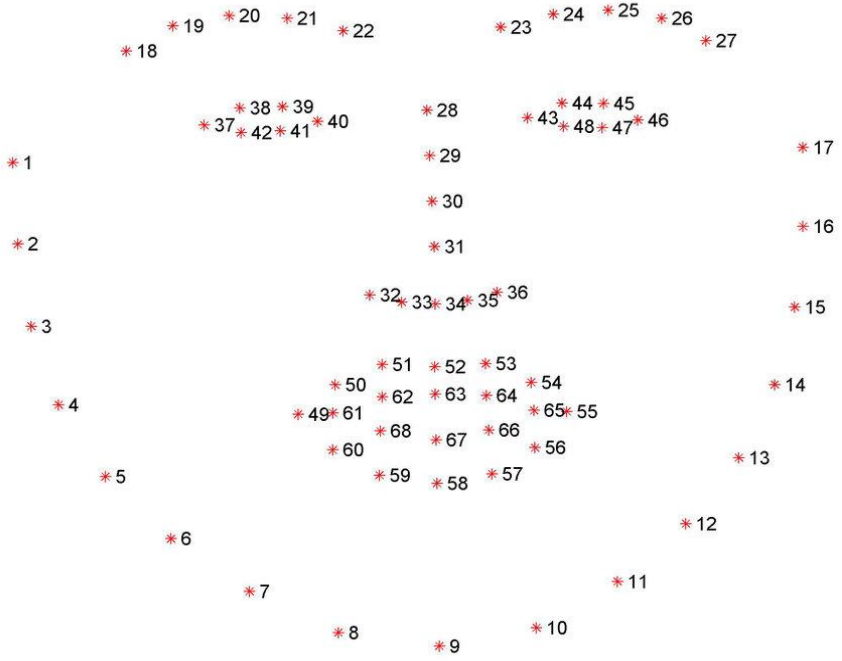
Methodology

- Receiving live Video feed from user
  - The live video feed is obtained by the VideoCapture method of OpenCV.
  - The frame rate is set to 30fps for maximum efficiency.
  - We use cv2.VideoCapture() to get a video capture object for the camera.
  - We set up an infinite while loop and use the read() method to read the frames using the above created object.
  - We use cv2.imshow() method to show the frames in the video.
  - Breaks the loop when the user clicks a specific key.(Here we use esc key)

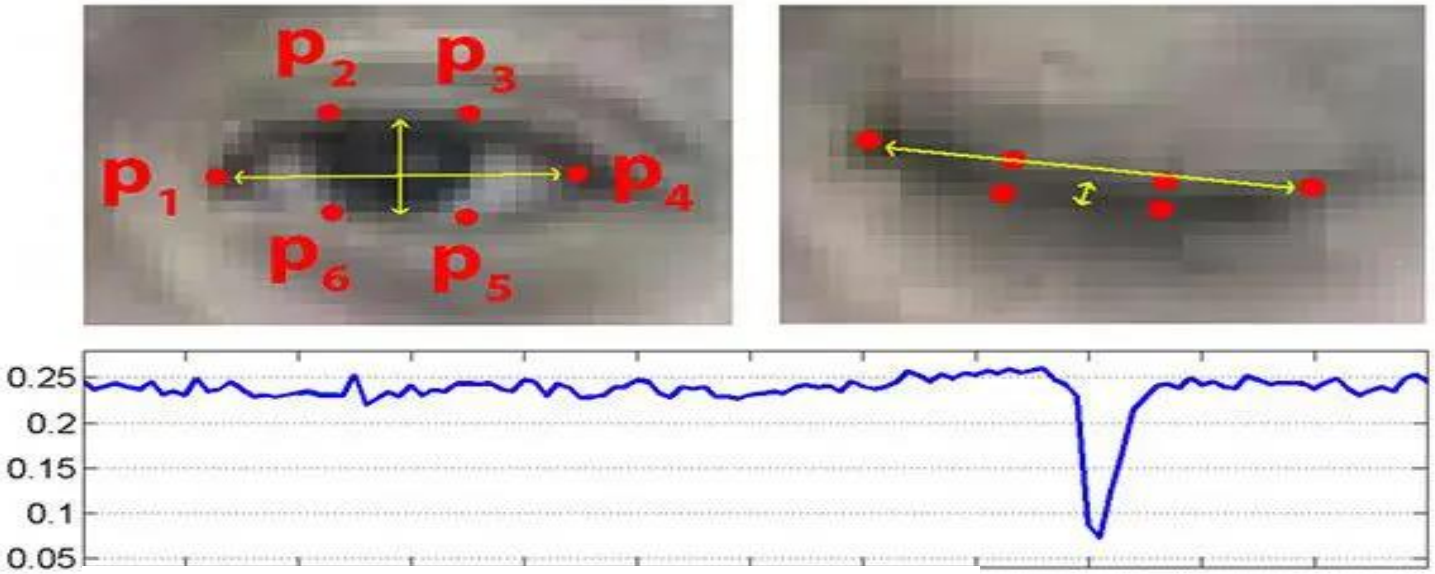
Methodology

- Face landmarks detection
  - The DLib library is used to extract the 68 facial landmarks from the user.



Methodology

- Eyes detection and Eye Aspect Ratio



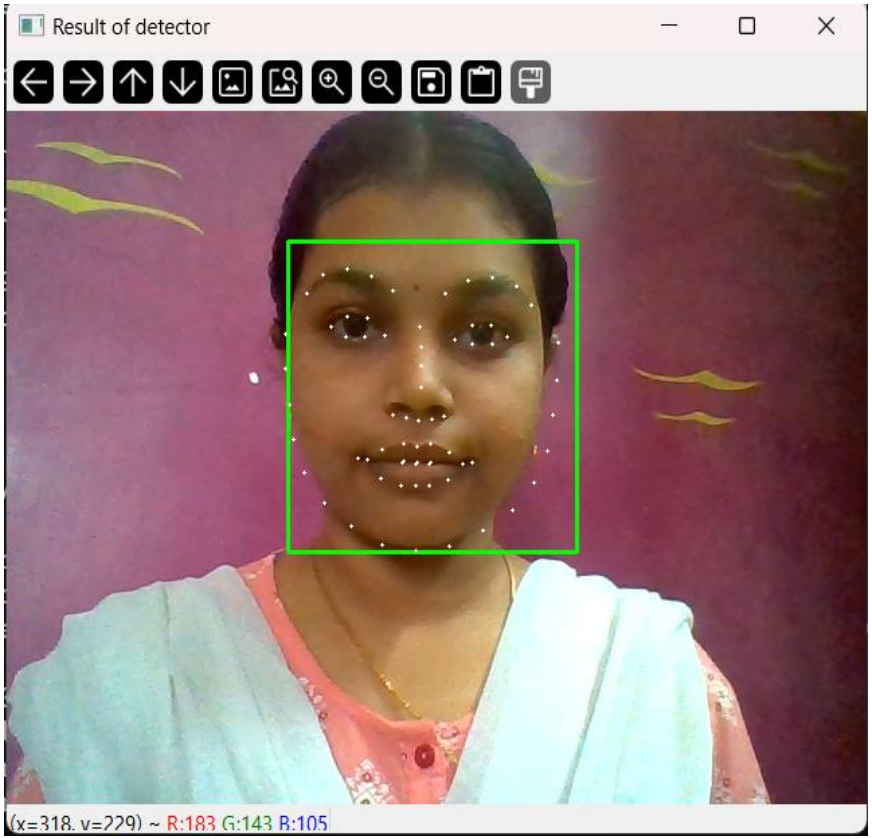
$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Where P1,P2,…,P6 are 2D facial landmarks location.

Methodology

- Drowsiness Detection:
  - User is Active:
    - The EAR is in the range of 0.25 and above and remains constant.
  - User is Drowsy:
    - The EAR is in the range of 0.21 to 0.25.
  - User is Sleeping:
    - The EAR drops to the range of 0.05 and less.

Output

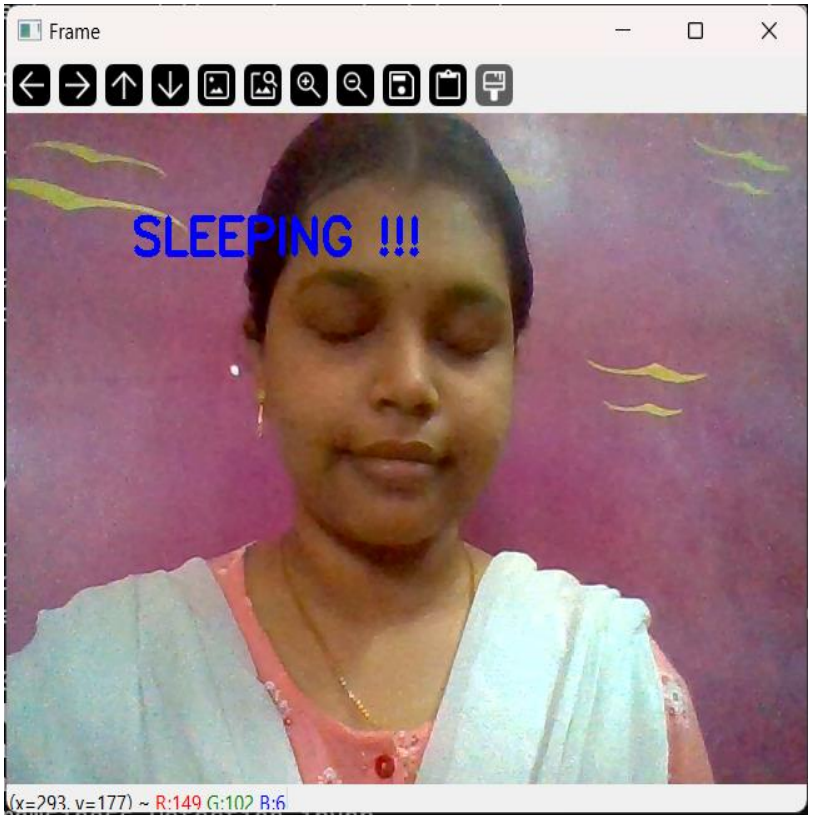


1. Face Landmarks detection

2. Active

Output

3. Drowsy



4. Sleeping

Future Work and Conclusion

- Drowsiness detection can be expanded by uses with diversion detector which can be used to maintain the concentration of students during online classes.
- Drowsiness detection for driver safety can be improved by utilization of outer factors such as vehicle states, sleeping hours, weather conditions, mechanical data, etc.

Reference

Articles studied

- "Real-time driver drowsiness detection using OpenCV and random forest classifier" by Das and Gupta in 2021.
- "Real-time drowsiness detection using OpenCV and machine learning" by Patel and Patel in 2021.
- "Real-time driver drowsiness detection based on OpenCV and HOG features" by Zhang et al. in 2021.