Deep Learning Based Driver Yawning Detection

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***ABSTRACT*— Drunk drivers are frequently to blame for accidents. We are seeking to solve this issue in our project by creating a system that will alert the driver if he or she is drowsy or weary. The facial region is first found and tracked in the recorded video stream using computer vision methods. The eye and mouth were removed, and they were examined for symptoms of driving fatigue. It is done by calculating the Mouth Aspect Ratio (MAR) and the Eye Aspect Ratio (EAR). Both EAR and MAR have threshold values; when the mouth is opened to yawn, the MAR value increases and the EAR value decreases. When these figures exceed their cutoff, the buzzer starts to alert the driver.**

***Keywords*— Shape-predictor-68, Open-CV, D-lib, EAR, MAR, Face landmarks.**

1. INTRODUCTION

Driving when fatigued is a serious issue in today's society. Driving when fatigued was a factor in about 12% of serious car accidents. This problem is addressed in this research by designing a system that would warn the driver if it detected sleepiness. To identify sleepiness, our method examines both the mouth and the eyes. As there will be no traffic, the drivers thought that midnight was a fantastic time to drive. As a result of the toll, it takes on their sleep cycles, they are more likely to fall asleep behind the wheel. So if they nodded off while driving, this technology will let them know. Our system can be used in commercial systems because it is not subject-dependent. By examining the eye aspect ratio and the mouth aspect ratio, it is possible to identify the eye closure and yawn (MAR). If there is a shift in these levels, we can identify the first indications of exhaustion. The driver is closing his eyes if the value of EAR keeps dropping, while the driver is yawning if the value of MAR rises. In this project, we use this logic to determine the driver's level of weariness.

1.1 BACKGROUND

Night time driving can be dangerous. The majority of long-distance travellers like night time driving. The lack of traffic is the obvious cause of this. Traffic can indeed be a good excuse, but only in particular cases. It's probable that there won't be much traffic if you drive on the weekends, even at night. Driving at night has a lot of other issues besides traffic. Consider the weather: you never know what it will be like as you travel across the state. Additionally, inclement weather like rain or snow can cause issues. Who knows how effective the headlights on your car are, either. You should have them examined! The most important element that impacts night-time driving is poor visibility. It's critical to understand that not all roads have adequate lighting at night. There can be places when you can only rely on the headlights of your car to keep your eyes on the road. Having said that, it's not unusual to drive in low-light conditions while using your high beams. While there is nothing wrong with that, the glare can reduce your visibility. Avoid staring directly into the headlights of the oncoming car to drive safely. This will not only assist you in maintaining your attention on the road, but it will also keep your vision from becoming blurry. When looking into the high beams, it can eventually be challenging for your eyes to transition from bright to low light. Therefore, when driving, you should pay closer attention to the lane markers or simply look straight ahead. s Additionally, it's crucial to keep your car's windscreen, mirrors, and headlights clean. By doing this, glare and light scattering will be avoided. Our bodies automatically shift into rest mode as night falls. It can be nearly impossible for you to drive at night when you start your journey after a long day of work. You are so exhausted that your body can no longer support you. It is crucial that you rest well before beginning your lengthy night time travel. You can take a number of actions to achieve this, such as:
Start a little early: Starting early is one approach to become used to the low light circumstances at night. Your body, mind, and eyes, in particular, will be able to acclimatise to the outdoor surroundings if you start your excursion while it's still light outside. So you won't experience any transition issues if it eventually grows dark outside. Get enough rest before driving: Taking a nap before a night trip may not be for everyone. Prior to evening driving, getting enough sleep might help you stay alert and productive for a considerable amount of time. In the modern world, driving when fatigued is a serious issue. Drunk driving accounts for about 12% of major car accidents.

This issue is addressed in the system by creating a mechanism that alerts the driver when they are drowsy. To identify sleepiness, this technique examines both the eyes and the mouth. Because there is no traffic around midnight, it is an ideal time for drive to drive. This interferes with their sleep cycle, resulting in their nodding off behind the wheel. So if they doze off while driving, this technology will let them know. This system can be utilised in commercial systems because it is independent of the subject. Eye aspect ratio analysis can identify eye closure, and mouth aspect ratio analysis can identify yawning (MAR).

1.2 METHODOLOGY

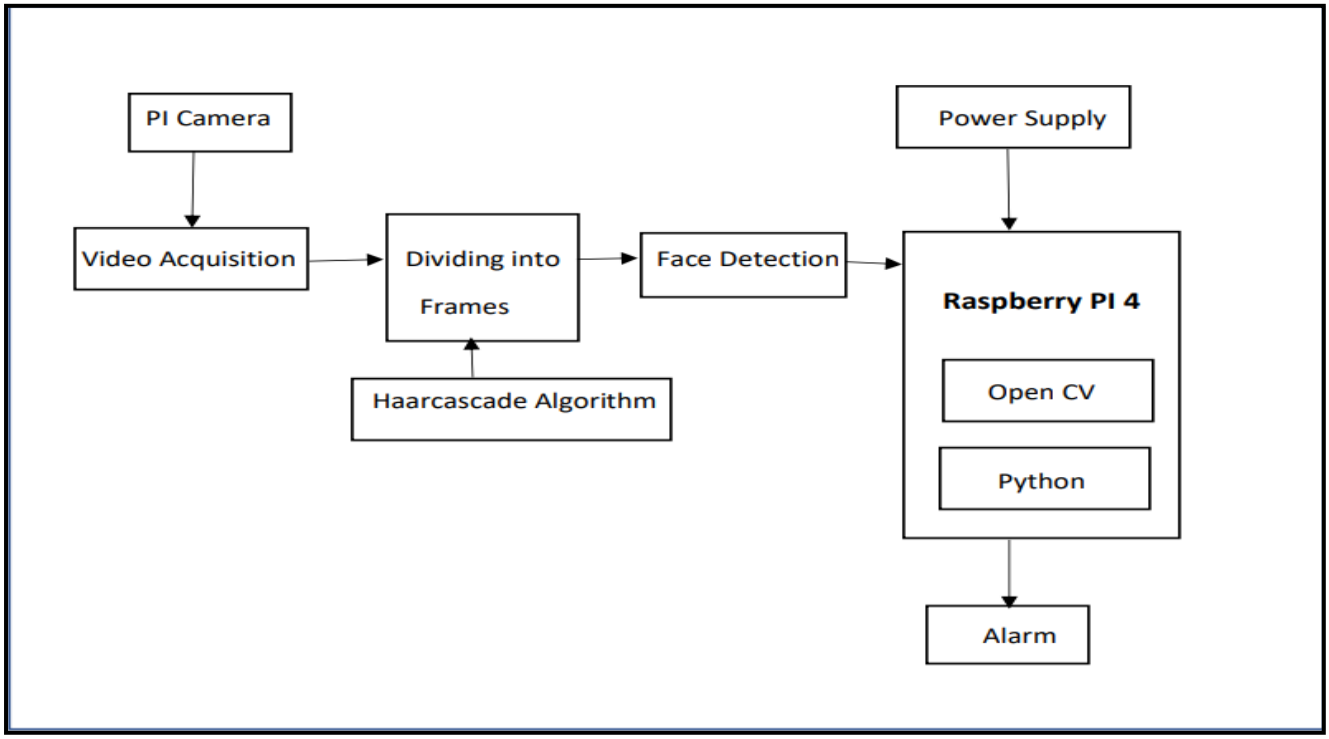

Fig.1: Architecture Diagram for Drowsiness and Yawning Detection System

1.3 BLOCK DIAGRAM DESCRIPTION

1. Video Acquisition

The system is made to enhance the video quality of thermal imaging camera systems and give the cameras the ability to record, broadcast, and analyse footage. Getting the driver's live video feed is the major goal of video acquisition. The acquisition of video is accomplished by using a PI camera.

Face and eye recognition in the context of image processing is a crucial and difficult issue. Additionally, it is a critical phase in facial recognition. The Haar Cascade Classifier is implemented using Open-Source Computer Vision Library Open CV. In this project, a video sensor is needed to identify drivers' faces in order to recognize driver drowsiness. The rate at which the eyes blink can then be used to gauge how sleepy a motorist is. The techniques for implementing face and eye detection, including eye blinks, using the Haar Cascade Classifier and Eye Aspect Ratio, respt. The four major steps in the Haar Cascade Classifier must be completed. Haar Feature, Integral Image, AdaBoost, and Cascade Classifier are the stages. Regarding Eye Aspect Ratio, it uses a formula based on the width and height of the eye to identify eye blinks (eyes open and close).

2. Dividing into Frames:

This module is used to handle live video by taking it as an input and turning it into a collection of frames or images. A frameset is a group of frames in the browser window. Similar to how tables are structured into rows and columns, frames are divided into frames. After identifying the driver's face, the rate at which the eyes blink is used to determine the driver's degree of drowsiness. The eye blink can be recognized using the scalar value by the Eye Aspect Ratio (EAR) formula, which was introduced in.

For instance, if a driver's eyes are blinking more frequently, it indicates that they are drowsy. In order to determine the frequency of eye blinking, it is therefore essential to accurately detect the shape of the eyes. The EAR is used as an estimation of the eye openness condition from the landmarks found in the image with the face. The eye landmarks are identified for each video frame between the computed height and breadth of the eye.

3. Face detection:

Nowadays, facial recognition systems are very common since they can be far more secure than fingerprints and typed passwords. Your smartphone's face unlock feature, which makes everything incredibly simple, may be something you're familiar with. In various locations, including airports, train stations, and streets, face recognition is also utilised for surveillance. Due of the portability and surveillance capabilities of the Raspberry Pi, we will construct a facial recognition system utilising the OpenCV library. I have tested this system, and it will undoubtedly function properly. The frame grabber provides the frames for the face detection function, which takes one frame at a time and attempts to identify the face of the car in each frame.

1.3 FLOWCHART

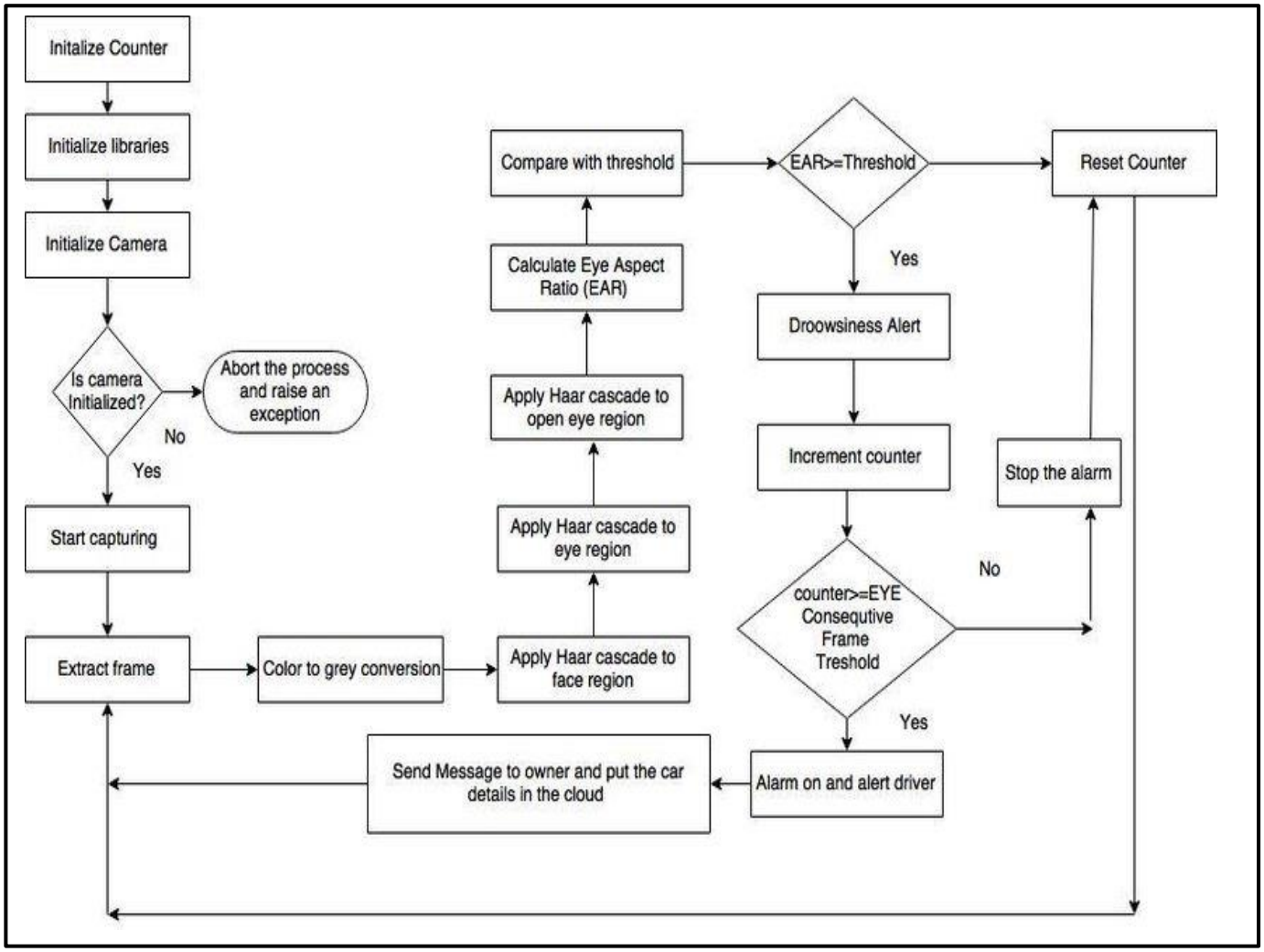

Fig.1: Flowchart For Proposed Methodology

driver fatigue is yawning and eye blinking. To address this issue, we developed an experiment that utilizes a Pi camera, buzzer, LCD, and Raspberry Pi to detect and alert the driver when they are yawning or blinking excessively. The purpose of this experiment is to create a system that can accurately detect signs of driver fatigue and provide timely alerts to prevent accidents. By utilizing the Pi camera, the system can capture real-time images of the driver's face and analyze them using image processing techniques to detect yawning and eye blinking. The buzzer and LCD are used to provide audio and visual alerts to the driver when signs of fatigue are detected. The system has the potential to improve driver safety by detecting fatigue and alerting the driver to take a break or rest, ultimately reducing the risk of accidents caused by driver fatigue. The experiment is an innovative approach to addressing a critical issue in transportation safety and can serve as a foundation for further research and development in the field.

❖ Steps To Setting The Raspberry Pi :

1. Mount the Pi camera on the dashboard of the vehicle facing towards the driver's face.
2. Connect the Pi camera to the Raspberry Pi using a ribbon cable.
3. Connect a buzzer to the Raspberry Pi through a GPIO pin.
4. Connect an LCD screen to the Raspberry Pi using the HDMI port.
5. Install the necessary software on the Raspberry Pi, such as Python and OpenCV, to process the video feed from the Pi camera.

2. RESULT AND OUTPUT

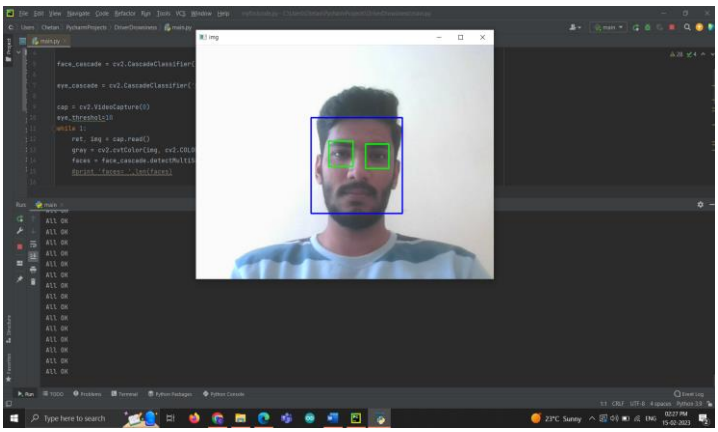

Fig. 2.1 when the subject is awake.

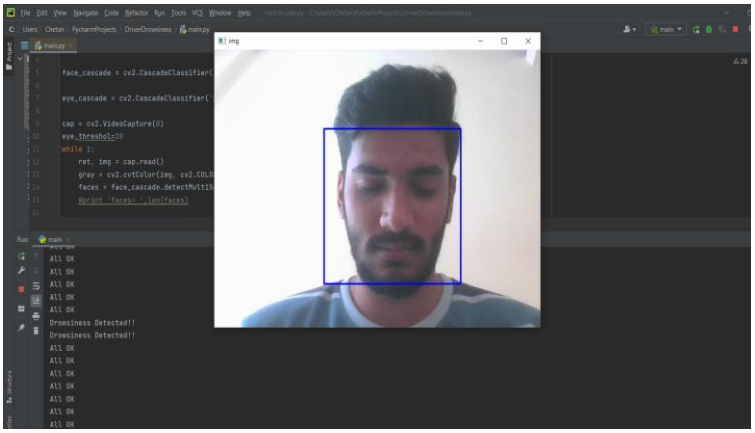

Fig. 2.2 when the subject eyes are closed.

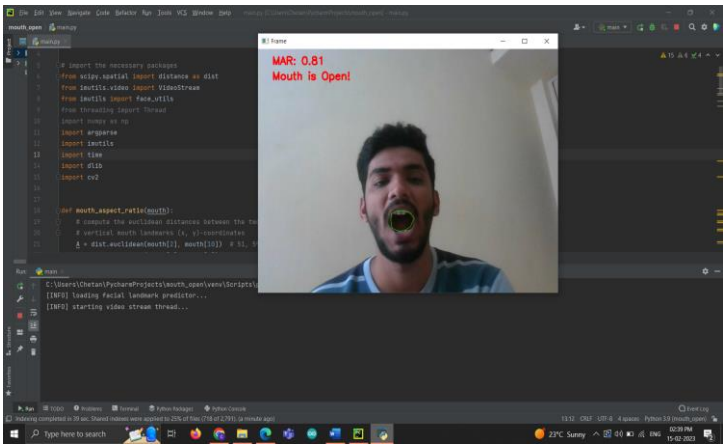

Fig. 2.3 when the subject's mouth is open

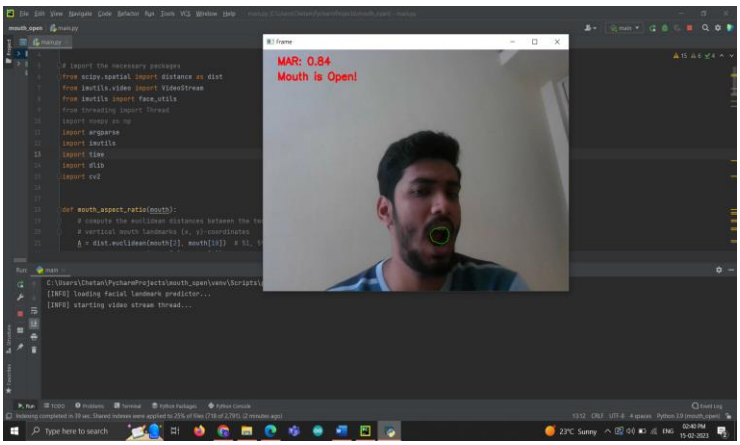

Fig. 2.4 when the subject's mouth is open in different direction.

The Fig. 2.1 is shows that in order to identify symptoms of fatigue or yawning, the system employs a webcam to take real-time pictures of the driver's face. These pictures are then processed using computer vision algorithms. The driver's eye and mouth movements are examined by image processing algorithms, which seek for signs of weariness in their patterns. Let's now concentrate on the image of a motorist who is awake. The driver may be seen in this picture with their lips closed and their eyes open. The driver's eyes seem awake and focused, showing that they are paying attention and that they are not showing any indications of exhaustion or sleepiness. In a similar manner, the system would search for modifications in the driver's mouth movement, such as opening or shutting of the mouth or adjustments in the contour of the lips, to identify yawning. The device will sound an alarm to urge the driver to take a break if they repeatedly yawn, which is a sign that they are getting tired.

Certainly! In the Fig.2.2 The driver's eyelids are closed in the second illustration, suggesting that they could be getting sleepy or drowsy. The driver tiredness and yawning detection system is made to watch the driver's eye movements and recognise when their eyes are closed for a considerable amount of time. The system may play a sound or trigger a buzzer to inform the driver if it is set up to employ an audible alert. If the driver has already started to doze off, this signal should be audible enough to wake them. A message such as "Warning: Driver Drowsiness Detected" could also be shown on a monitor inside the car if the system is set up to employ a visual alert. Please pause for a moment. The intention is to warn the motorist that they need to take a pause or rest if they are getting drowsy in either scenario. The driver can then proceed to take the proper action, such as stopping by the side of the road to take a sleep or exchanging driving duties with another passenger. All things considered, the driver sleepiness and yawning detection system is a crucial safety element that can aid in preventing accidents brought on by driver weariness. The device can assist in ensuring that drivers maintain their alertness and attention while operating a vehicle by watching their eye and mouth movements and warning them when they start to drowse or yawn.

Also in above Fig.2.3 and Fig.2.4 the driver is yawning, as seen by the gaping lips. The purpose of the driver tiredness and yawning detection system is to track the driver's mouth movements and identify instances when their mouth is open for a protracted length of time.

3. CONCLUSION AND FUTURE SCOPE

3.1 CONCLUSION

The suggested system operates quickly and analyses the video sequence in real-time. as it won't employ any sophisticated algorithms. Low lighting doesn't affect how well it functions. The system is quick, and once it begins taking pictures, it keeps finding faces and performing detection until it is stopped. This system can be used in commercial systems because it is not subject-dependent. To determine a worker's level of weariness, it can also be utilized in industries. In the future, a system that would slow the car down and park it on the side of the road could be added. A GSM module attached to an accident detection system that would phone a nearby hospital to request an ambulance can be added. Driving while fatigued is dangerous for the driver, other passengers, and cargo.

3.2 FUTURE SCOPE

- Future research might concentrate on how to measure weariness using external aspects like vehicle states, sleeping patterns, weather, mechanical data, etc.

- Drowsiness detection systems may be added to aircraft in the future to inform pilots.

- In the future, it can be used to establish drowsiness detection systems in colleges and schools, alerting personnel to tired students in the classroom.

4. ACKNOWLEDGMENT

With great pleasure, we deliver the project report for the initial phase, titled "Driver yawning analysis utilising PI Camera and Deep Learning." I'd want to take this opportunity to express my gratitude to Ms. S. M. Ingawale, my internal guide, for providing me with all the support and direction I required. We sincerely appreciate their thoughtful assistance. Their insightful advice was quite beneficial. We also acknowledge the invaluable assistance and advice provided by Dr. S. K. Jagtap, Head of the Electronics and Telecommunication Engineering Department at the Sinhgad Institute of Technology in Pune. The appreciation would be lacking if we did not express our gratitude to our principal, Dr. A.V. Deshpande, who provided us with all the working facilities and the required direction on project.

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