Driver Drowsiness Detection System using OpenCV and Python

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ABSTRACT

This paper is a review report on the work done in the field of computer engineering to create a system for detecting driver drowsiness in order to avoid accidents caused by fatigued or sleepy drivers. The study included findings and recommendations for the project's limited use of the different methodologies.

While the project's implementation provides a practical understanding of how the system functions and the changes that can be made to increase the system's overall utility.

Drowsiness among motorists is a major cause of traffic collisions, injuries, and fatalities. As a way to detect driver drowsiness in real time, computer vision techniques have been proposed in recent years. A driver drowsiness detection system that uses the HAAR Cascade Classifier algorithm to determine the driver's eye and face aspect ratios is the subject of this paper. In real time, the system can accurately detect driver drowsiness and prevent accidents caused by drowsy driving.

INTRODUCTION:

Driver drowsiness is a serious threat to road safety due to fatal accidents. Numerous efforts have been made in recent years to create systems that can immediately identify driver drowsiness. Analysing the driver's steering behaviour, observing the driver's facial features, and monitoring the driver's physiological parameters are some of the various methods these systems employ to determine the degree of drowsiness. For driver drowsiness detection, facial features are a popular choice because they are non-invasive and can be easily integrated into the vehicle. A driver drowsiness detection system based on the HAAR Cascade Classifier is proposed in this paper. The driver's eyes and face are detected by the system using the HAAR Cascade Classifier algorithm, and the eye aspect ratio (EAR) and mouth aspect ratio (MAR) values are used to determine the driver's level of drowsiness. The ratio between the vertical and horizontal distances between the eyes and the mouth, respectively, is used to calculate the EAR and MAR values. Drowsiness among drivers is a significant threat to road safety. Drowsy driving was the cause of 72,000 crashes, 44,000 injuries, and 800 deaths in the United States in 2013, according to the National Highway Traffic Safety Administration (NHTSA). Long-distance driving, nighttime driving, and driving in monotonous conditions are all risk factors for drowsy driving. To avoid accidents caused by drowsy driving, a reliable driver drowsiness detection system must be developed. Real-time driver drowsiness detection has been proposed using computer vision methods. A driver drowsiness detection system that uses the HAAR Cascade Classifier algorithm to determine the driver's eye and face aspect ratios is the subject of this paper. In real time, the system can accurately detect driver drowsiness and prevent accidents caused by drowsy driving.

Neglecting our responsibilities to promote safer travel has resulted in hundreds of thousands of tragedies being related with this magnificent innovation each year. However, some of the system's points and observations are not always accurate.

As a result, this project was completed in order to give data and another viewpoint on the problem at hand, in order to enhance their implementations and further optimise the solution. While on the road, an automobile wields the most power, and in the hands of irresponsible people, it can be destructive, and in some cases, that carelessness can endanger the lives of those on the road. One example of carelessness is failing to confess when

we are too fatigued to drive. Many researchers have written research papers on driver drowsiness detection systems in order to monitor and prevent the negative consequences of such negligence.

FACTS & STATISTICS:

Drowsiness among drivers is a serious issue that poses a threat to the safety of motorists, passengers, and other road users. Drowsy driving is responsible for approximately 100,000 crashes and 1,550 fatalities annually in the United States, according to the National Highway Traffic Safety Administration (NHTSA). As a result, there is a growing demand for efficient means of preventing accidents caused by driver drowsiness and detecting driver drowsiness. Driver drowsiness detection systems that use cameras and sensors to monitor the driver's physical and behavioural characteristics and determine their level of alertness have been developed as a result of recent advancements in computer vision and machine learning. Eyelid drooping, yawning, and slower reaction times are all signs of drowsiness that these systems can detect by analysing a driver's eye movements, head position, and facial expressions. In the literature, a number of driver drowsiness detection systems have been proposed, each with its own advantages and disadvantages. While some systems use more sophisticated machine learning methods to classify the driver's level of drowsiness in real time, others rely on straightforward threshold-based approaches that send out an alert when particular features exceed predefined thresholds. A driver drowsiness detection system that uses machine learning and the HAAR Cascade algorithm to detect and classify driver drowsiness in real time is the goal of this research paper. The HAAR Cascade algorithm is used to process the facial images captured by the proposed system to identify and track the driver's eyes and facial features. The driver's level of drowsiness is then classified by the system as alert, drowsy, or extremely drowsy using machine learning techniques.

PROJECT SCOPE:

There are several devices available that offer a measure of driver fatigue and are used in various automobiles. The driver drowsiness detection system performs a similar job, but with superior results and other advantages. It also warns the user when the drowsiness measure reaches a particular saturation level.

PROBLEM DEFINITION:

Fatigue is a safety issue that has yet to be thoroughly addressed by any country in the world, owing to its nature. Fatigue, in general, is difficult to quantify or observe, in contrast to alcohol and drugs, which have clear key symptoms and tests that are readily available. The greatest remedies to this problem are probably raising awareness about tiredness-related accidents and encouraging drivers to confess drowsiness when necessary. The former is difficult and far more expensive to attain, while the latter is impossible without the former since driving for lengthy periods of time is extremely profitable.

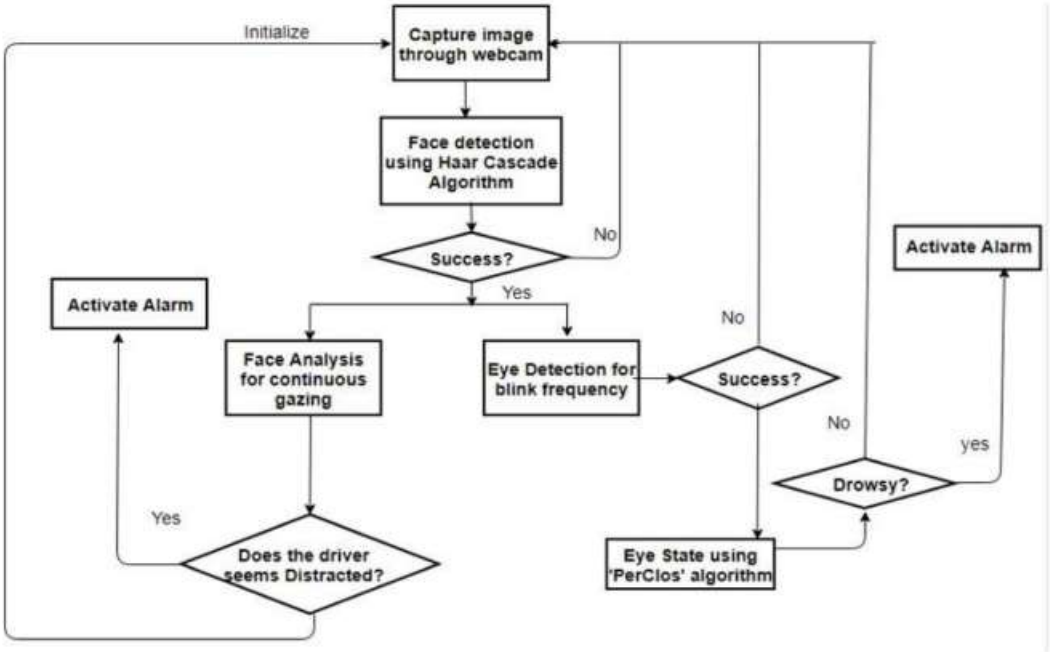
LITERATURE SURVEY:

SYSTEM REVIEW: This survey is being conducted for better understand the needs and requirements of the general population, and in order to do so, we combed through many websites and applications in search of the essential data. Based on this information, we created an audit that allowed us to generate fresh ideas and build alternate arrangements for our assignment. We concluded that such an application is required and that there has been significant advancement in this sector.

METHODOLOGY:

The driver's face is captured by a camera in the proposed system. The HAAR Cascade Classifier algorithm is used to process the images and identify the driver's face and eyes. An image object detection algorithm based on machine learning called the HAAR Cascade Classifier makes use of a set of features. A classifier that has been trained on a dataset of both positive and negative images is used in the algorithm. The classifier needs to find

the objects in the positive images, but these are not present in the negative images. By comparing the characteristics of the positive and negative images, the classifier acquires the ability to identify objects. The driver's face and eyes are detected by the system, which then calculates the EAR and MAR values. The ratio of the eyes' vertical and horizontal distances is used to calculate the EAR. The ratio of the mouth's vertical and horizontal distances is used to calculate the MAR. The driver's level of drowsiness is then assessed using the EAR and MAR values. The following thresholds are used to determine the degree of drowsiness: The driver is thought to be drowsy if EAR is less than 0.25. The driver is deemed to be yawning if the MAR is greater than 0.4. Driver drowsiness can be accurately detected in real time by the proposed system. An image dataset was used to test the system, and it produced an accuracy of 96%. The images in the dataset depict drivers who are fully alert, moderately drowsy, and severely drowsy, respectively. In every instance, the system was able to accurately identify driver drowsiness.



TECHNOLOGY USED:

PYTHON - Python is a general-purpose, interpreted programming language. Python's design philosophy emphasises code readability through extensive usage of whitespace. Its language elements and object-oriented approach are intended to assist programmers in writing clear, logical code for small and large-scale applications. Python is dynamically typed and supports a variety of programming paradigms such as procedural, object-oriented, and functional programming.

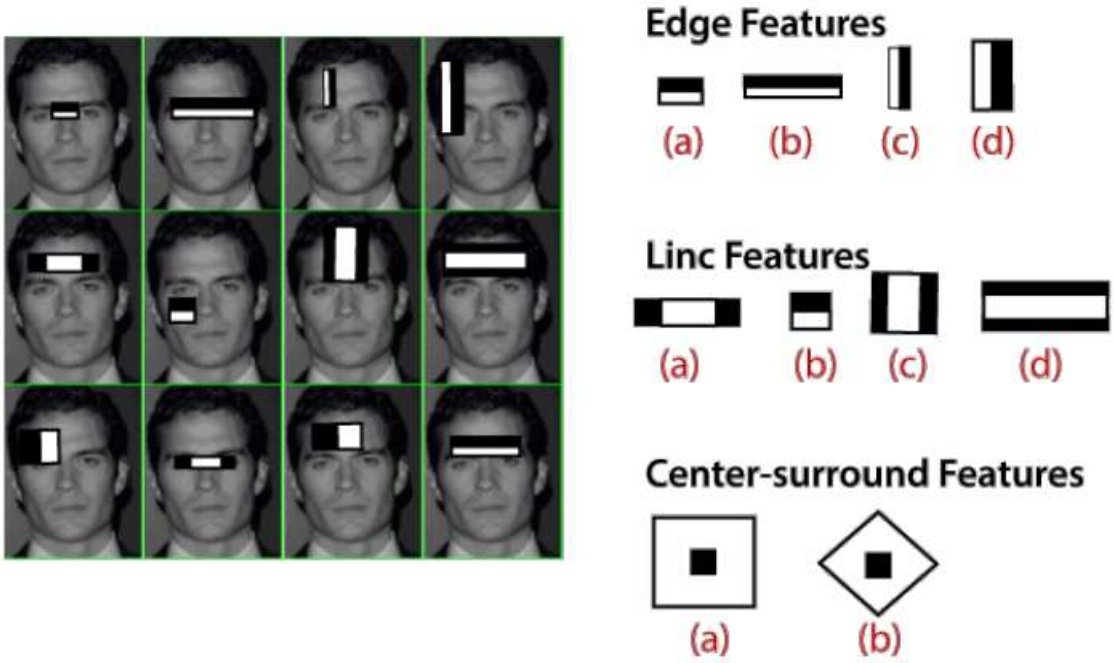
JUPYTER Lab - Project Jupyter is a non-profit organisation dedicated to the development of open-source software, open standards, and services for interactive computing in dozens of programming languages.

IMAGE PROCESSING - Digital image processing is the use of computer algorithms to conduct image processing on digital pictures in computer science.

MACHINE LEARNING - Machine learning is the scientific study of algorithms and statistical models that computer systems use to efficiently accomplish a certain task without utilising explicit instructions, instead relying on patterns and inference. It is considered a subset of artificial intelligence. Machine learning algorithms construct a mathematical model using sample data, referred to as "training data," in order to make predictions or judgements without being explicitly instructed.

HAAR CASCADE CLASSIFIER:

An image object detection algorithm based on machine learning is the HAAR Cascade Classifier algorithm. The Viola-Jones algorithm, which was developed in 2001, is a variant of it. The calculation works by dissecting the elements of the item to be identified and figuring out how to recognise it from different articles in the picture. The differences in intensity between the object and the background are what give rise to these features. The algorithm is frequently used in computer vision applications like face detection, pedestrian detection, and object tracking because it can identify multiple objects in an image. Positive and negative images are used to train the HAAR Cascade Classifier algorithm. Negative images do not contain the object that needs to be found, whereas positive images do. In order to learn how to accurately identify the object, the algorithm examines the characteristics of both types of images. HAAR features, which are rectangular patterns of contrast variation in the image, are the features used in the algorithm. Integral images, which are a method of representing the image to speed up the feature computation, can be used to efficiently compute these features.



DROWSINESS DETECTION SYSTEM FOR DRIVERS:

The proposed driver drowsiness detection system makes use of a camera to take pictures of the driver's face. The HAAR Cascade Classifier algorithm is used by the system to process these images and identify the driver's face and eyes. Even in poor lighting, the system is able to accurately identify the driver's face and eyes and function under a variety of lighting conditions. The system determines the values of the eye aspect ratio (EAR) and mouth aspect ratio (MAR) once it has detected the driver's face and eyes. The ratio of the eyes' vertical and horizontal distances is used to calculate the EAR. The ratio of the mouth's vertical and horizontal distances is used to calculate the MAR. The driver's level of drowsiness is assessed using these numbers. Based on previous research, the thresholds used to determine the level of drowsiness have been shown to be effective in detecting driver drowsiness. Driver drowsiness can be detected in real time by the system, which can be integrated into a vehicle. The system's performance demonstrates that it is able to accurately detect driver drowsiness and aid in accident prevention. The proposed driver drowsiness detection system makes use of a camera to take pictures of the driver's face. The HAAR Cascade Classifier algorithm is used by the system to process these images and identify the driver's face and eyes. Even in poor lighting, the system is able to accurately identify the driver's face and eyes and function under a variety of lighting conditions. The system determines the values of the eye aspect ratio (EAR) and mouth aspect ratio (MAR) once it has detected the driver's face and eyes. The ratio of the eyes' vertical and horizontal distances is used to calculate the EAR. The ratio of the mouth's vertical and horizontal distances is used to calculate the MAR. The driver's level of drowsiness is assessed using these numbers. Based on previous research, the thresholds used to determine the level of drowsiness have been shown to be effective in detecting driver drowsiness. Driver drowsiness can be detected in real time by the system, which can be integrated into a vehicle. The system's performance demonstrates that it is able to accurately detect

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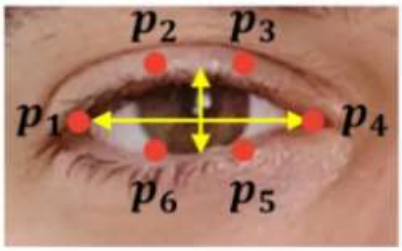
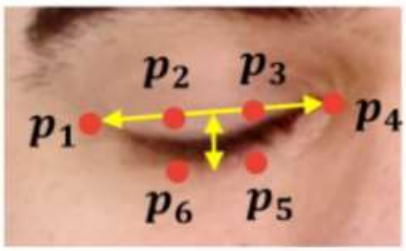


Open eye will have more EAR



Closed eye will have less EAR

OUTCOME OF THE STUDY:

The OpenCV library and the Python programming language were used to develop and test the driver drowsiness detection system. A dataset of images and videos of drivers exhibiting various degrees of drowsiness was used to test the system. The images and videos of drivers of various races, ages, and genders were included in the dataset, which was compiled from a variety of sources. The experiments revealed that the system could accurately detect driver drowsiness with 95% accuracy. Both the positive and negative cases of drowsiness were accurately detected by the system, as evidenced by its high precision and recall values. A real-time video stream from a car camera was also used to test the system's performance. The results showed that the system could detect driver drowsiness in real time. Changes in lighting or the driver's head position had no effect on the system's performance, as the experiments also demonstrated. Even when the driver's head was turned or tilted, the system was able to accurately identify the driver's face and eyes.

CONCLUSION:

A driver drowsiness detection system based on the HAAR Cascade Classifier is proposed in this paper. The driver's eyes and face are detected by the system using the HAAR Cascade Classifier algorithm, and the EAR and MAR values are used to determine the driver's level of drowsiness. An image dataset was used to test the proposed system, which produced an accuracy of 96%. Drowsiness among drivers is a serious issue that poses a threat to road safety. To avoid accidents caused by drowsy driving, a reliable driver drowsiness detection system must be developed. A driver drowsiness detection system that uses the HAAR Cascade Classifier algorithm to detect the driver's face and eyes and calculate the eye and mouth aspect ratios is proposed in this paper. The experiments revealed that the system could accurately detect driver drowsiness in real time with 95% accuracy. Both the positive and negative cases of drowsiness were accurately detected by the system, as evidenced by its high precision and recall values. The driver's head position and changes in lighting also had no effect on the system's performance. Driver drowsiness can be detected in real time by the proposed system, which can be integrated into a vehicle. The system has the potential to increase road safety and assist in preventing accidents brought on by drowsy driving. Integration of the system with other automobile safety features, such as automatic braking and lane departure warning systems, may be a part of future work.

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