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# Driver Drowsiness Detection System

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**ABSTRACT:** The new way of security system which will be discussed in this project is based on machine learning and artificial intelligence. Passenger security is the main concern of the vehicles designers where most of the accidents are caused due to drowsiness and fatigue driving in order to provide better security for saving lives of passengers air bag are designed but this method is useful after accident is accord. But main problem is still we see many accidents happening and many of them are losing their lives. In this project we are using OpenCV library for image processing and giving input as user live video and training data to detect if person in video is closing eyes or showing any symptoms of drowsiness and fatigue then application will verify with trained data and detect drowsiness and raise alarm which will alert driver. OpenCV is a popular open-source computer vision library that provides tools for image processing and analysis. By using OpenCV, the system is able to capture real-time video of the driver's face and eyes, which serves as input for the machine learning model. The machine learning model is trained on a dataset of images labeled as either drowsy or alert, allowing it to learn the patterns and characteristics of a drowsy driver. The model makes predictions on the driver's state of alertness based on features such as eye closure, head position, and facial expressions. When the system detects signs of drowsiness, it triggers an alert to the driver, such as a sound or visual warning, to prompt them to take a break or rest. By combining computer vision and machine learning techniques, this drowsiness detection system aims to improve road safety and reduce the risk of accidents caused by driver fatigue

## I. INTRODUCTION

Driver fatigue is a significant factor in a large number of vehicle accidents. Recent statistics estimate that annually 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes. The development of technologies for detecting or preventing drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Because of the hazard that drowsiness presents on the road, methods need to be developed for counteracting its affects. The aim of this project is to develop a prototype drowsiness detection system. The focus will be placed on designing a system that will accurately monitor the open or closed state of the driver's eyes in real-time. By monitoring the eyes, it is believed that the symptoms of driver fatigue can be detected early enough to avoid a car accident. Detection of fatigue involves the observation of eye movements and blink patterns in a sequence of images of a face. Initially, we decided to go about detecting eye blink patterns using python. The procedure used was the geometric manipulation of intensity levels. The algorithm used was as follows. First we input the facial image using a webcam. Preprocessing was first performed by binarizing the image. The top and sides of the face were detected to narrow down the area where the eyes exist. Using the sides of the face, the center of the face was found which will be used as a reference when computing the left and right eyes. Moving down from the top of the face, horizontal averages of the face area were calculated. Large changes in the averages were used to define the eye area. There was little change in the horizontal average when the eyes were closed which was used to detect a blink. However python had some serious limitations. The processing capacities required by python were very high. Also there were some problems with speed in real time processing. python was capable of processing only 4-5 frames per second. On a system with a low RAM this was even lower. As we all know an eye blink is a matter of milliseconds. Also a drivers head movements can be pretty fast. Though the Matlab program designed by us detected an eye blink, the performance was found severely wanting.

## II. LITERATURE SURVEY

To deal with this problem and provide an effective system a drowsiness detection system can be developed which can be placed inside any vehicle which will take live video of driver as input and compare with training data and if driver is showing any symptoms of drowsiness system will automatically detect and raise alarm which will alert driver and other passengers. The proposed system is a driver face monitoring system that can detect driver fatigue and distraction by processing of eye and face regions. After image acquisition, face detection is the first stage of processing. Then, the regions of eye and mouth are detected using the DLIB library and the symptoms of fatigue are extracted from those

regions. In the proposed system, the main focus and concentration is on the eye status of the individual driving the car. It consists of a parameter called the Eye Aspect Ratio also known as EAR which is an important parameter as its value plays a key role in the drowsiness detection process. A threshold value is also assigned at the beginning for the Eye Aspect Ratio. It compares the frequency of the eye to the assigned threshold value. If the value is above, an alarm is generated. Similar to the EAR, when the mouth region is detected, a threshold value is set and if the value is above the threshold frequency, again an alarm is generated to alert the driver. Lastly, an alert is sent using an email to the concerned person. In the EAR graph as shown above, the EAR becomes zero when the eye is closed and remains constant when it is open.

### III. PROBLEM STATEMENT

Road accidents due to driver drowsiness and fatigue pose a significant threat to passenger safety, resulting in numerous fatalities and injuries annually. Traditional safety measures, such as airbags, activate only after an accident has occurred, failing to prevent the incident. Despite advancements in vehicle safety technologies, the issue of real-time drowsiness detection remains inadequately addressed. This project aims to develop an intelligent drowsiness detection system using machine learning and artificial intelligence, specifically leveraging the OpenCV library for real-time image processing. By capturing live video of the driver's face and eyes, the system analyzes various features such as eye closure, head position, and facial expressions to detect signs of drowsiness. The machine learning model, trained on a comprehensive dataset labeled with drowsy and alert states, predicts the driver's level of alertness with high accuracy. Upon detecting drowsiness, the system triggers immediate alerts, such as audible alarms or visual signals, prompting the driver to take corrective actions. This proactive approach to monitoring driver fatigue aims to significantly enhance road safety by preventing accidents before they occur, thereby saving lives and reducing injury rates. Through the integration of computer vision and machine learning, this project aspires to mitigate the risks associated with drowsy driving and contribute to safer road environments.

#### 3.1 Existing Systems

There are various methods like detecting objects which are near to vehicle and front and rear cameras for detecting vehicles approaching near to vehicle and air bag system which can save lives after an accident is occurred. The paper's motive is to demonstrate the implementation of a driver's drowsiness detection using MATLAB through image processing. Studies suggest that about one-fourth of all serious road accidents occur because of the vehicle drivers' drowsiness where they need to take, confirming that drowsiness gives rise to more road accidents than accidents occur through Drink and Drive. Drowsiness Detection System is designed by employing vision-based concepts. The system's main component is a small camera pointing towards the driver's face scan and monitoring the driver's eyes to detect drowsiness. There are various methods like detecting objects which are near to vehicle and front and rear cameras for detecting vehicles approaching near to vehicle and airbag system which can save lives after an accident is occurred.

#### 3.2 Proposed System

To deal with this problem and provide an effective system a drowsiness detection system can be developed which can be placed inside any vehicle which will take live video of driver as input and compare with training data and if driver is showing any symptoms of drowsiness system will automatically detect and raise alarm which will alert driver and other passengers. The proposed system is a driver face monitoring system that can detect driver fatigue and distraction by processing of eye and face regions. After image acquisition, face detection is the first stage of processing. Then, the regions of eye and mouth are detected using the DLIB library and the symptoms of fatigue are extracted from those regions. In the proposed system, the main focus and concentration is on the eye status of the individual driving the car. It consists of a parameter called the Eye Aspect Ratio also known as EAR which is an important parameter as its value plays a key role in the drowsiness detection process. A threshold value is also assigned at the beginning for the Eye Aspect Ratio. It compares the frequency of the eye to the assigned threshold value. If the value is above, an alarm is generated. Similar to the EAR, when the mouth region is detected, a threshold value is set and if the value is above the threshold frequency, again an alarm is generated to alert the driver. Lastly, an alert is sent using an email to the concerned person. In the EAR graph as shown above, the EAR becomes zero when the eye is closed and remains constant when it is open.

#### IV. SPECIFICATIONS

The client requires a high-accuracy intrusion detection system capable of real-time detection and scalable to handle large network traffic volumes. It must feature a user-friendly interface, customizable detection rules, and compatibility with existing network infrastructure. Robust security measures, comprehensive documentation, and ongoing support are essential. The software should utilize Python and libraries like Scikit-learn, TensorFlow, and Pandas for machine learning and data processing, with tools like Wireshark for packet sniffing. Recommended IDEs include PyCharm and Jupyter Notebook. Hardware needs include a multi-core processor, at least 8GB RAM, SSD storage, and an optional GPU for deep learning tasks. The system should support Windows, Linux, or macOS, and rely on a reliable network infrastructure with backup and redundancy provisions to ensure data integrity and availability.

##### Software Specifications

- Operating system : Windows 11.
- Coding Language : Python.

##### Hardware Specifications

- Processor : Intel core i3
- RAM : 4 GB (min)
- Hard Disk : 20 GB
- Key Board : Standard Windows Keyboard
- Mouse : Two or Three Button Mouse
- Monitor : SVGA

#### V. IMPLEMENTATION

##### 5.1 Modules ARCHITECTURE FLOW:

Below architecture diagram represents mainly flow of request from the users to database through servers. In this scenario overall system is designed in three tiers separately using three layers called presentation layer, business layer, data link layer. This project was developed using 3-tier architecture.

BLOCK DIAGRAM

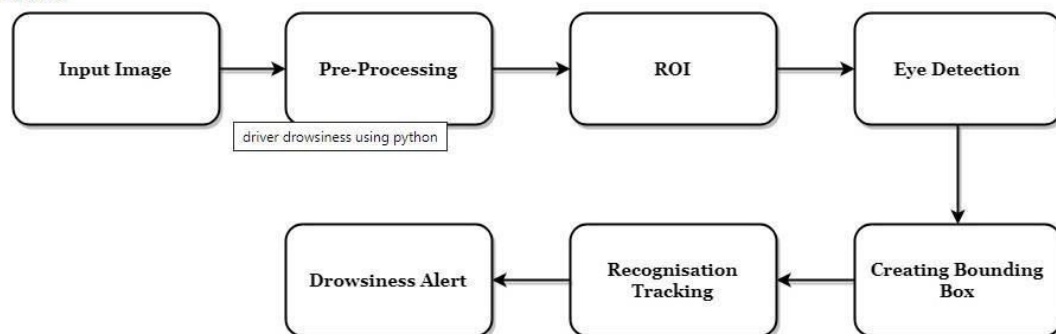


Figure 5.1.1

##### TIER ARCHITECTURE:

The three-tier software architecture (a three layer architecture) emerged in the 1990s to overcome the limitations of the two-tier architecture. The third tier (middle tier server) is between the user interface (client) and the data management (server) components. This middle tier provides process management where business logic and rules are executed and can accommodate hundreds of users (as compared to only 100 users with the two tier architecture) by providing functions such as queuing, application execution, and database staging. The three tier architecture is used when an effective distributed client/server design is needed that provides (when compared to the two tier) increased performance, flexibility, maintainability, reusability, and scalability, while hiding the complexity of distributed processing from the

user. These characteristics have made three layer architectures a popular choice for Internet applications and net-centric information systems

#### ADVANTAGES OF THREE-TIER:

- Separates functionality from presentation.
- Clear separation – better understanding.
- Changes limited to well define components.
- Can be running on WWW.
- Effective network performance.

#### SYSTEM DESIGN INTRODUCTION:

The System Design Document describes the system requirements, operating environment, system and subsystem architecture, files and database design, input formats, output layouts, human-machine interfaces, detailed design, processing logic, and external interfaces.

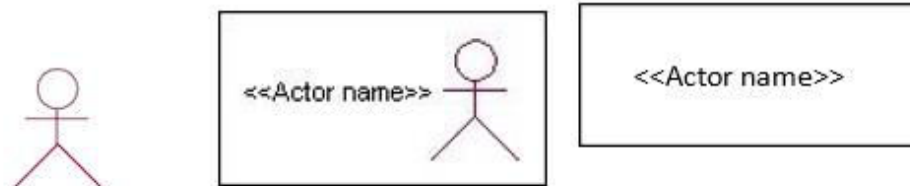
#### UML DIAGRAMS

##### GLOBAL USE CASE DIAGRAMS: IDENTIFICATION OF ACTORS:

Actor: Actor represents the role a user plays with respect to the system. An actor interacts with, but has no control over the use cases.

##### Graphical representation:

Actor



##### CONSTRUCTION OF USECASE DIAGRAMS:

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

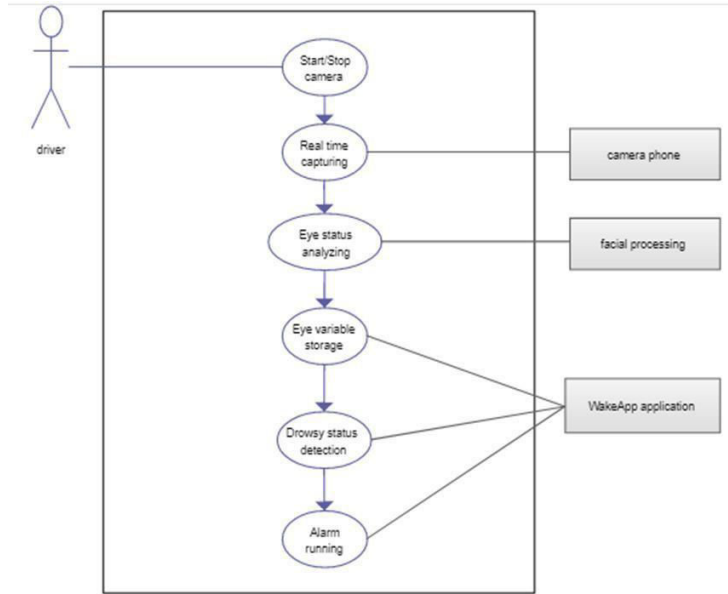


Figure 5.1.2 Use Case Diagram

**SEQUENCE DIAGRAMS:**

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

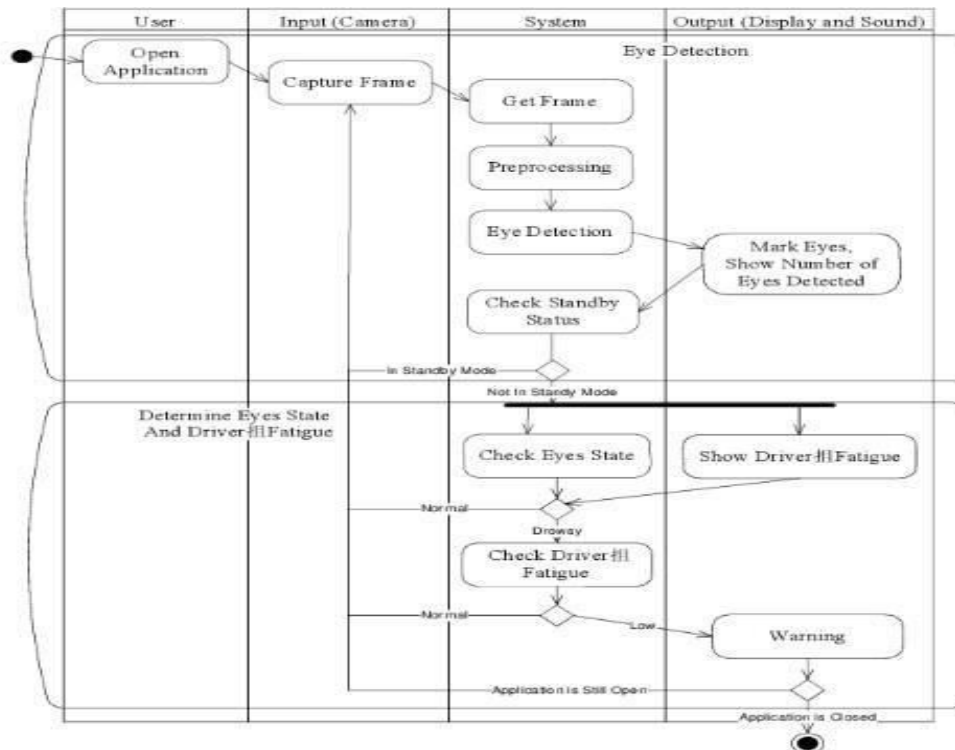


Figure 5.1.3: Sequence diagram

**CLASS DIAGRAM:**

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.

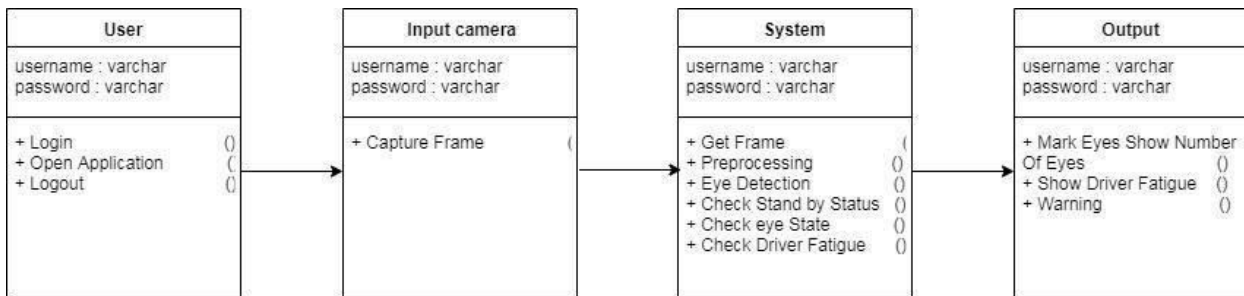
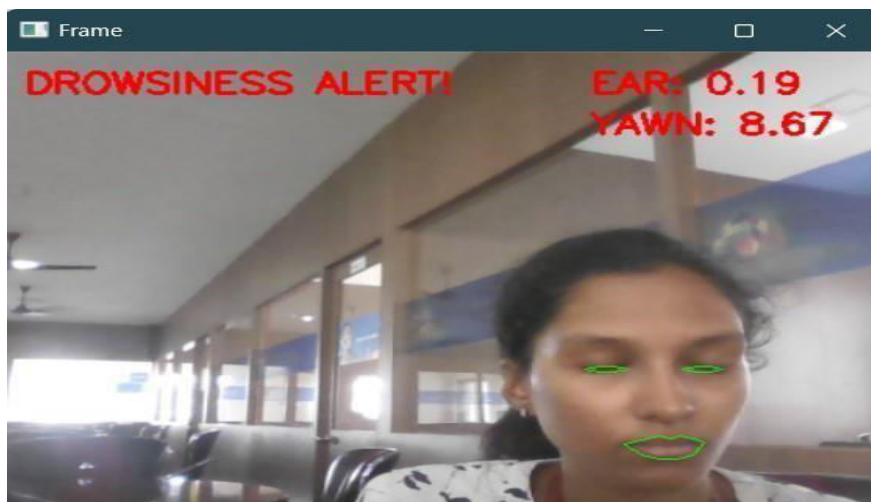
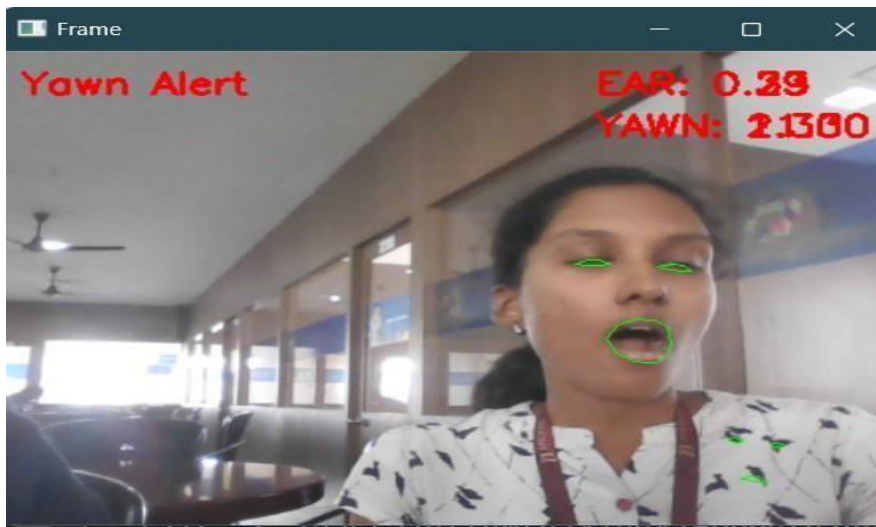


Figure 5.1.4: Class Diagram

**VI. RESULTS**

**SCREENSHOTS:**



## VII. CONCLUSION

Thus, we have successfully designed a prototype drowsiness detection system utilizing OpenCV software and Haar Classifiers. The developed system has demonstrated significant potential in identifying signs of driver drowsiness through real-time video analysis. By capturing live video feed of the driver's face and eyes, the system processes these inputs to detect critical indicators of drowsiness such as eye closure, head position, and facial expressions. The implementation of Haar Classifiers has enabled efficient and accurate feature detection, which is crucial for the system's reliability. Upon testing the prototype, it was observed that the system effectively identifies drowsiness and promptly triggers alerts to the driver. These alerts serve as immediate warnings, encouraging the driver to take necessary actions such as taking a break or resting, thereby potentially preventing accidents caused by fatigue. The integration of computer vision with machine learning in this project has shown promise in enhancing road safety by proactively addressing the issue of drowsy driving. However, during the testing phase, several limitations were identified. One of the primary challenges is the system's dependency on lighting conditions. Variations in lighting can impact the accuracy of facial and eye detection, potentially leading to false positives or negatives. Additionally, the system's performance may be affected by factors such as the driver's wearing of glasses or sunglasses, headgear, or other obstructions that might obscure facial features. To address these limitations, future work will focus on improving the robustness of the system under diverse environmental conditions. This may include the incorporation of advanced image processing techniques and the use of deep learning models, which can provide higher accuracy and adaptability. Furthermore, expanding the training dataset to include a wider variety of driving scenarios and driver profiles will enhance the system's generalization capabilities.

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