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Drive Safe Alert System

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Abstract

Today, access to transportation is a need for daily life. Any of us could experience an accident while driving, which could be brought on by inadequate sleep, physical ineptitude, or extended travel. An increased likelihood of accidents deviates from insufficient sleep or any unfair circumstances. One of themain reasons for car accidents is lethargy or sluggishness. Driving becomes quite perilous when one is sleep deprived. Therefore, it is crucial to identify the driver's state of weariness in order to ensure both his survival and that of others. The primary focus of this study is the Driver Drowsiness Detection System. This device continuously records photos of the driver without pausing, and it uses specific algorithms to gauge the condition of the eyes. Although there are other ways to accomplish the same objective, this one is totally unrelated to the driver because it has no impact on it in any way. The stoppingscore of the eyes is used to detect somnolence; if it exceeds a certain score, one is deemed to be asleep, and the device quickly raises an alarm. In this project we are going to use DLIB library is basically a deep learning library which has algorithm which is used to predict the eye motion which help to detect whether the driver is in drawsing or not.

Introduction

In today's fast-paced world, road safety remains a paramount concern, with driver attention being a critical factor in preventing accidents. The National Highway Traffic Safety Administration reports that a significant number of car crashes are attributed to driver drowsiness, highlighting the pressing need for effective solutions to mitigate this risk. Various factors can divert a driver's attention, including mobile phone usage, adjusting radio stations, eating or drinking, and daydreaming. Moreover, fatigue and stress-induced sleepiness can impair a driver's reaction time, further increasing the likelihood of accidents. Recognizing the gravity of these challenges, researchers have been exploring innovative technologies to address driver distraction and drowsiness. One promising approach involves the integration of an eye-tracking system into wearable bracelets designed to monitor drivers' physiological parameters. By leveraging computer vision technologies such as the OpenCV library in Python, these systems can analyse facial

features and eye movements to detect signs of distraction or drowsiness in real-time. Positioned discreetly on the dashboard, the camera-based eye-tracking system operates unobtrusively, allowing drivers to maintain focus on the road while still benefiting from enhanced safety features. The proposed system utilizes sophisticated algorithms to detect subtle changes in the driver's eye movements, which serve as reliable indicators of cognitive state. By continuously monitoring eye activity, the system can accurately identify signs of drowsiness or distraction and issue timely alerts to the driver, thereby preventing potential accidents. Additionally, the integration of Visual Average Speed Computer and Recorder (VASCAR) technology further enhances the system's capabilities by providing accurate speed calculations, facilitating safer driving practices. Central to the system's effectiveness is the implementation of the blob algorithm, which enables the detection of driver motion patterns. By analysing these motion cues, the system can anticipate potential hazards and intervene proactively to mitigate risks. This proactive approach to safety aligns with modern advancements in intelligent transportation systems, where technology plays a pivotal role in safeguarding road users. In summary, the integration of an eye-tracking system into wearable bracelets represents a significant advancement in road safety technology. By leveraging computer vision and machine learning algorithms, these systems offer real-time monitoring of driver attention and alertness, helping to prevent accidents caused by distraction and drowsiness. With continuous innovation and refinement, such technologies hold the potential to revolutionize road safety practices, making our highways safer for all users.

Fundamental

The fundamentals of the proposed system revolve around detecting signs of driver sleepiness or distraction, with particular emphasis on monitoring the driver's eyes as a key indicator. By focusing on the eyes, the system aims to mitigate the occurrence of accidents caused by drowsiness or distraction, as these factors significantly contribute to road safety hazards. Additionally, the system incorporates functionality to calculate the speed of vehicles, thereby addressing the issue of overspeeding, which is another common cause of accidents on the road. Overall, the system's core objectives include enhancing driver alertness, reducing accident rates due to drowsiness and speeding, and ultimately improving road safety for all users.

• Help detect sleepiness or distraction of the driver, the main symptom is the eyes of the driver.

• Helps to reduce the ratio of accident happen due to drowsy of the driver and the overspeed.

• calculate the speed of vehicles

Objectives

The objective of this intermediate project is to build a drowsiness detection system that will detectthat a person’s eyes are closed for a few seconds.

• It Detects whether the person is drowsy or not.

• It helps in prevention of accident passenger and commercial vehicle.

• We will use VASCAR-ESQUE approach with OpenCV to detect vehicle’s over speed(BLOB detection algorithm).

The objective of the designed system aims the following five points:

• Affordable: The systems must be affordable as the price is one of the main factors that kept on mind during design phase.

• Portable: The systems to be portable and easy to install in different vehicles models.

• Safe: The safety of the system is achieved by choosing the appropriate location for eachcomponent.

• Fast: The response and processing time to react in case of driver's emergency is one of thekeys factors since the accident happens in few seconds.

• Accurate: The system must be accurate; therefore, the most accurate algorithms have beenchosen.

Scope

• The proposed system helps the driver to drive vehicle in a limited speed.

• It avoids the major accident that happen due to drivers drowsiness.

• An another main reason of accident is over speeding so we will use algorithm i.e blob whichwill help the driver in limited speed.

• We will add a system which show the over speeding cameras on highways to avoid the fine.

• We all know that system can't detect during night due to the lack of camera vision. So we aregoing to add thermal object detection using PyTorch and VOLOv5.

Outline

The research paper give us drowsy driver monitoring and accident prevention system. The rest of the paper is divided into 4 sections. Section 2 covers Literature Review. Section 3 includes the methodology for the work done in the paper in which the dataset used along with the analysis techniques used to detect factors affecting crime most are discussed This section also includes the details of testing the model on validation database. In section 4 concludes work done is concluded along with the discussion of the future work to create a standard model which can be applied to all datasets.

Literature Survey

Drowsiness of driver can be determined with different aspects using vehicle-based, psychological, and behavioral measurements implemented through different predictive algorithms as discussed in the following sections.

Technique Category One

A Machine Learning Technique

Technique One

Jabbar et al. [5] proposed Convolutional Neural Network (CNN) technique of the ML algorithm to detectmicrosleep and drowsiness. In this paper, detection of driver's facial landmarks can be achieved througha camera that is then

passed to this CNN algorithm to properly identify drowsiness. Here, the experimental classification of eye detection is performed through various data sets like without glasses and with glasses in day or night vision. So, it works for effective drowsiness detection with high precisionwith android modules.

Technique TWO

The algorithm of Deep CNN was used to detect eye blink and its state recognition as provided by Sanyal and Chakrabarty [6]. Saleh et al. [7] developed an algorithm of LSTM and Recurrent Neural Networks (RNN) to classify driver's behaviors through sensors. Ed-Doughmi et al. analyzed the driver's behaviors through the RNN algorithm. It specially focuses on construction of real-time fatigue detection to prevent roadside accidents. This system formulates a number of drivers' faces, which works on multilayered 3D CNN models to identify drowsy drivers and provide 92 percentage acceptance rate.

Technique Category Two

K means clustering Technique

Arefnezhad et al. [8] proposed a noninterfering drowsy detection system based on vehicle steering data using neurofuzzy system with support vector machine and particle swarm optimization algorithm. Mutya et al. [9] established a system to resolve the problem of drowsiness using steering wheel algorithm. It is basically based on image-formed or pictorial-based steering movement and the CNN algorithm for proper classification of drowsiness, which can also reduce false drowsy detection rates.

Proposed Technique

The DriveSafe Alert system is a system that focuses on abnormal behavior of the driver using microcontroller, the raspberry pi single board computer. In the proposed system a non-instructive driver drowsiness monitoring system has been developed using computer vison technique. The blob algorithm helps to detect the motion of the driver that help to reduce the accident of the vehicle. This algorithm helps to reduce the ratio of accident happen due to drowsy of the driver and the overspeed.

Hybrid Approach One

In the proposed model, The device has a camera module integrated with raspberry pi. The camera continuously monitors the eye moments of the driver and detects the sleeping stage andonset of the sleep period to alert the driver. Visual Average Speed Computer and Recorder (VASCAR) is a method for calculating the speed of vehicles. OpenCV library in python is a computer vision library that is widely used for image analysis, image processing, detection, recognition, etc. The blob algorithm helps to detect the motion of the driver that help to reducethe accident of the vehicle.

Methodology

Collect images of drivers' faces and eyes:

You can use a camera to capture images of drivers' faces and eyes. Make sure to capture images under different lighting conditions and with different drivers.

Label the images:

Use an image annotation tool such as LabelImg to label the images as either drowsy or not drowsy. You can draw a bounding box around the eyes and label them accordingly. Make sure to have a good numberof labeled images for training the classifier.

Use the DLIB library's facial landmark detector to extract the features of the eyes:

Once you have the labeled images, use the DLIB library's facial landmark detector to extract the featuresof the eyes. The facial landmark detector will give you the coordinates of the eyes in the images.

Preprocess the data:

Preprocess the data by resizing the images, normalizing the pixel values, and converting the labels to binary (0 for not drowsy and 1 for drowsy). You can also augment the data by adding noise, rotating theimages, or flipping the images horizontally.

Split the data into training and testing sets:

Split the data into training and testing sets. Use 80% of the data for training the classifier and 20% for testing the classifier.

Train the classifier:

Train a binary classifier such as SVM or a deep learning algorithm such as a CNN using the extracted eye features and labels. Use the training set for training the classifier and the testing set for evaluating the classifier's performance.

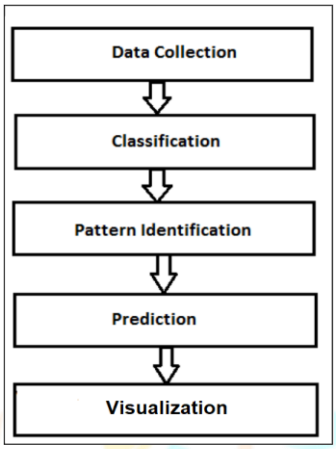
Evaluate the classifier:

Evaluate the classifier's performance using metrics such as accuracy, precision, recall, and F1 score. If the performance is not satisfactory, fine-tune the classifier by adjusting the hyperparameters or using different algorithms.

Use the classifier to detect drowsiness in real-time:

Once you have a satisfactory classifier, use it to detect drowsiness in real-time by applying it to the eye features extracted from a video feed. If the classifier detects drowsiness, sound an alarm or alert the driverto take a break.

Figure3.1 Proposed System



Existing System Architecture

The existing system of driver drowsiness detection system has following disadvantages.

• Mainly, using of two cameras in the system one for monitoring the head movement and the other one for facial expressions.

• The other disadvantage is aging of sensors and all these sensors are attached to thedriver's body which may affect the driver.

So to overcome all these disadvantages we designed a system in which a live camera is used for monitoring the driver drowsiness condition and alert the driver which reduces the road accidents.

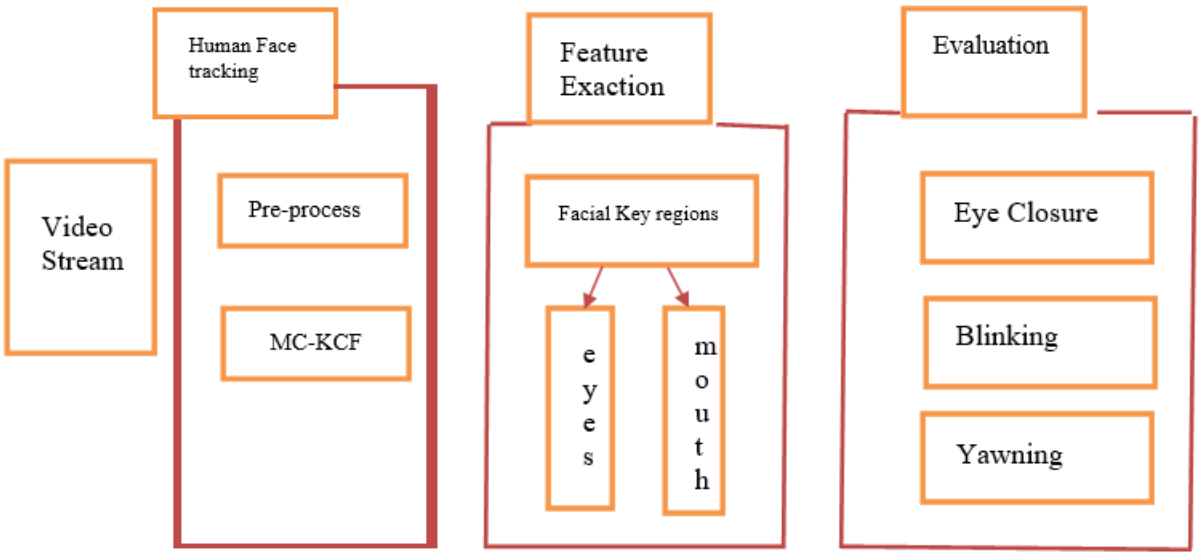


Figure3.1 Proposed System

Proposed System Architecture

The previous sections discussed the strengths and weaknesses of exiting system. In order to achieve better domain results, researchers combined both techniques to build Hybrid domain systems, which seek to inherit vantages and eliminate disadvantages.

In general, hybrid recommenders are systems that combine multiple recommendation techniques together to achieve a synergy between them. Although there exist a number of recommendation approaches that are practical to merge (i.e. Collaborative, Content-based, Demographic and Knowledge-based Recommender), our work will mainly focus on the combination of CF and CBF techniques. The proposed architecture is shown in Figure 3.3

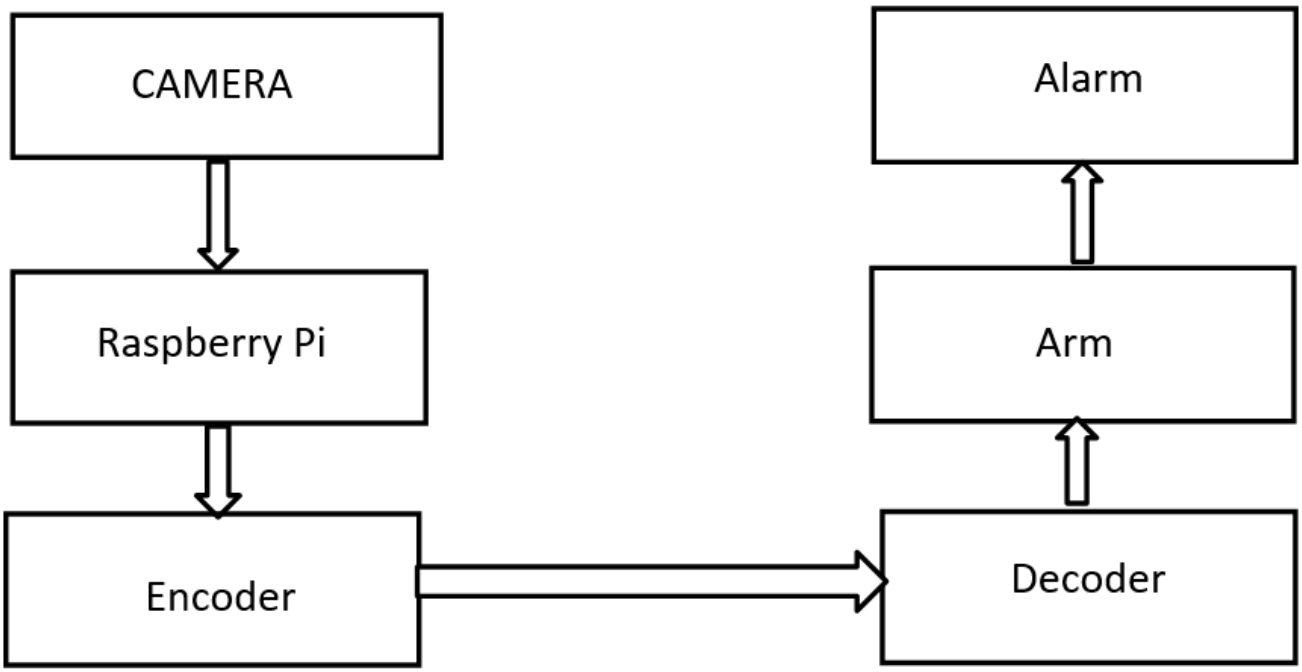


Fig. 3.3 Proposed system architecture

Architecture Diagram :

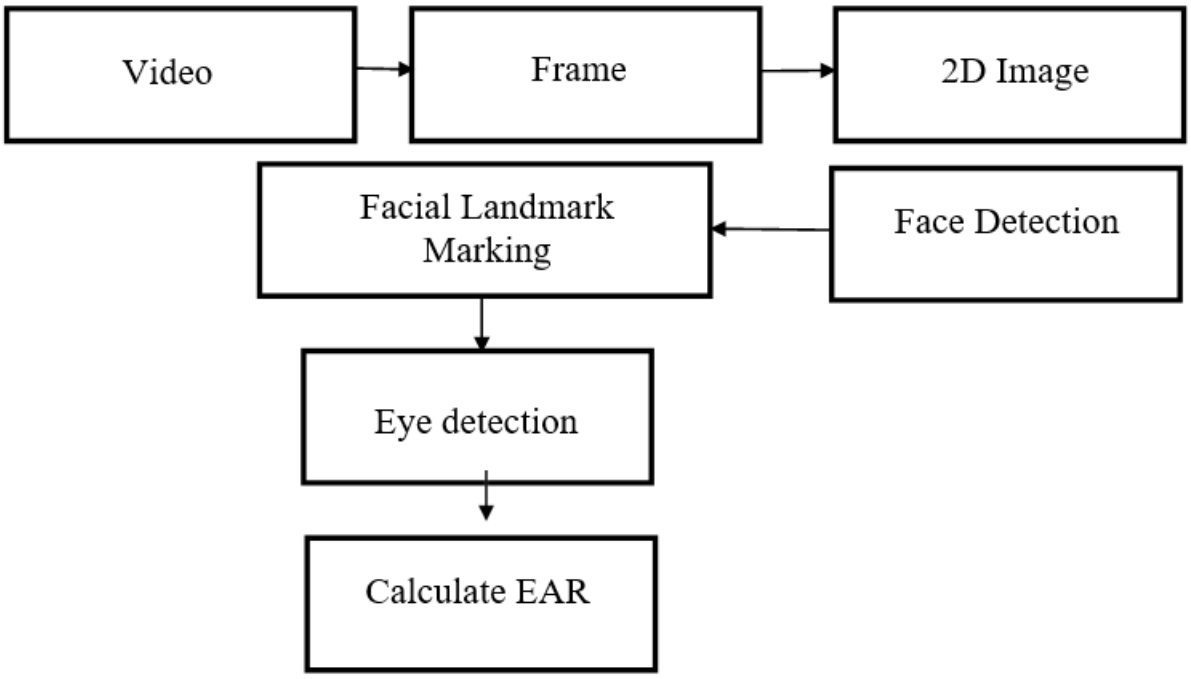


Fig: 3.4 Architecture Diagram

Implementation Details

Data Collection:

The first step in implementing a driver drowsiness project is to collect data from various sources. This data can include video footage of drivers, sensor data from vehicles, and physiological data fromthe drivers.

Data Preprocessing:

Once the data is collected, it needs to be preprocessed to extract relevant features. This may include filtering out irrelevant data, normalization, and feature extraction.

Model Selection:

The next step is to select a suitable model for the driver drowsiness detection. The model can be based on machine learning algorithms, deep learning, or a combination of both.

Training the Model:

The selected model needs to be trained on the preprocessed data. This involves feeding the datato the model and adjusting the model parameters until it can accurately predict driver drowsiness.

Testing and Validation:

After the model is trained, it needs to be tested on new data to evaluate its performance. The performance can be evaluated using various metrics such as accuracy, precision, and recall.

Deployment:

Once the model is tested and validated, it can be deployed for real-time driver drowsiness detection. This may involve integrating the model into a vehicle or driver monitoring system.

Continuous Improvement:

The driver drowsiness detection system should be continuously improved by collecting new data, retraining the model, and updating the system based on new research and technological advancements.

In this project, for collecting images from webcam we will be using OpenCV and feed these images to our Deep learning model which will classify that the person's eyes is 'Open' or 'Closed'. So we will follow these steps:

- We will take image input from the camera
- Detect face and eyes in the image.
- Create a Region of Interest(ROI), for both detected face and eyes.
- Feed this to our classifier(model), which will categorize whether eyes are open or closed.
- At last, we will calculate the time to check if the person is drowsy or not.

Use Case Diagram

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 factors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to showwhat system functions are performed for which actor. Roles of the actors in the system can be depicted.

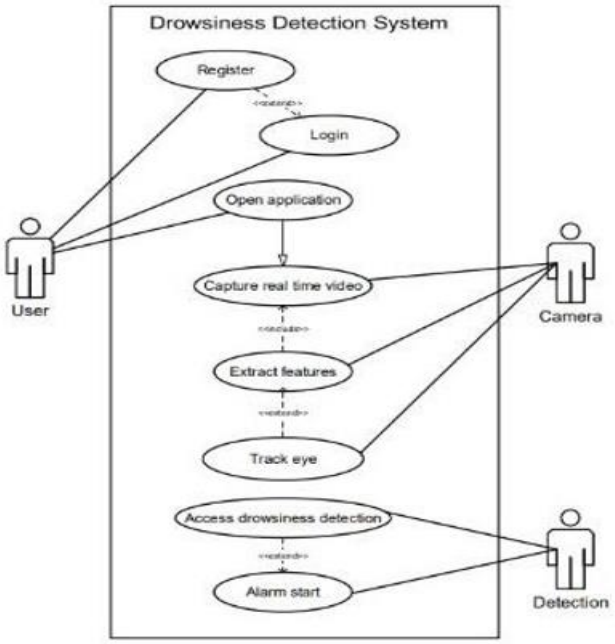


Fig: Use Case Diagram

Activity Diagram

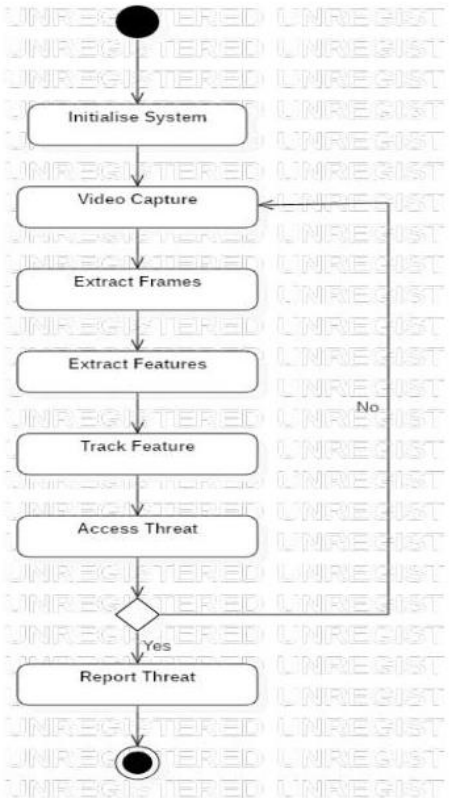


Fig:

Activity Diagram

Sample Dataset Used

So firstly , we need dataset to train our model, the dataset we will be using in this is yawn-eye-dataset. In this dataset you will see the train and test folder in which there are subfolders (closed, open, yawn,no_yawn) which

consist of 726 images of each closed eyes, open eyes, etc.

Hardware and Software Specifications

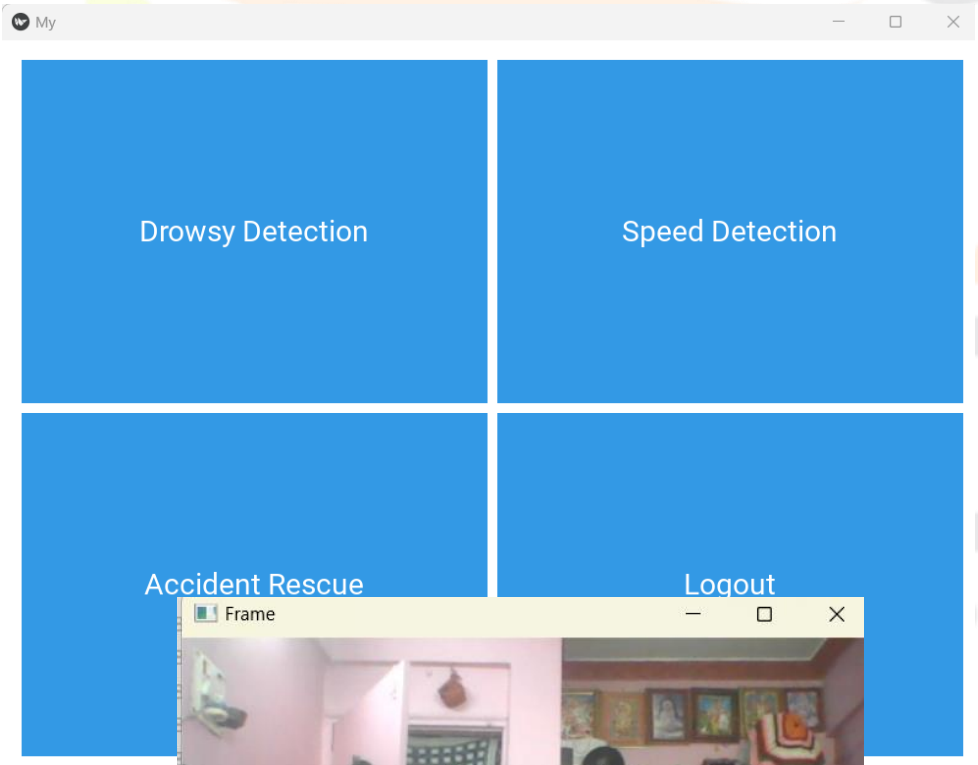
Table 3.2 Hardware details

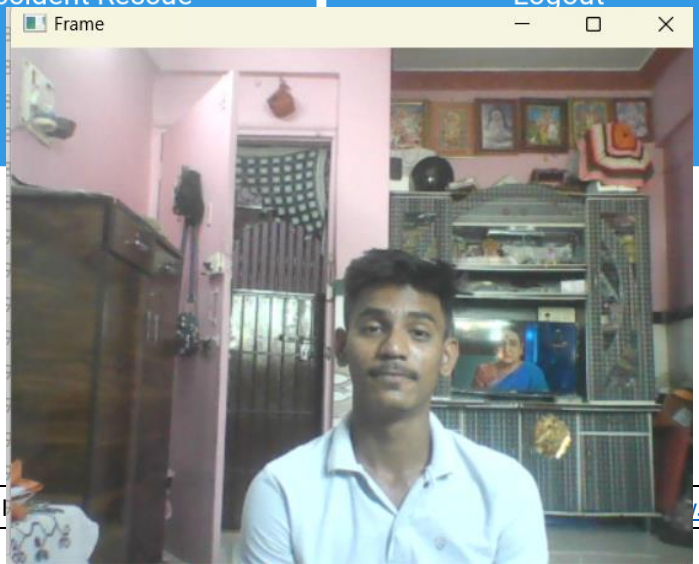
Processor	2 GHz Intel
HDD	180 GB
RAM	2 GB

Table 3.3 Software details

Operating System	Windows XP Professional With Service pack 2
Programming Language	python
Database	Oracle 9

Results:





Applications

The driver drowsiness project has several applications, including:

Automotive Industry:

The automotive industry can use driver drowsiness detection systems to improve vehicle safety by alerting drivers when they are drowsy or fatigued. This can help prevent accidents caused by drowsy driving.

Transportation Industry:

The transportation industry, including commercial trucking and public transportation, canuse driver drowsiness detection systems to monitor the alertness of their drivers and prevent accidents caused by driver fatigue.

Military:

The military can use driver drowsiness detection systems to monitor the alertness of soldiers driving military vehicles and prevent accidents caused by fatigue.

Aviation Industry:

The aviation industry can use driver drowsiness detection systems to monitor the alertnessof pilots and prevent accidents caused by pilot fatigue.

Healthcare Industry:

The healthcare industry can use driver drowsiness detection systems to monitor patients with sleep disorders or other conditions that affect their alertness while driving.

Overall, drive safe alert systems have the potential to improve road safety and reduce accidents caused by driver fatigue.

Summary:

Drivesafe Alert adds an eye-tracking system that uses a camera to detect sleepiness due to stress, fatigueor any distraction. The blob algorithm helps to detect the motion of the driver that help to reduce the accident of the vehicle. In existing system two cameras in the system one for monitoring the head movement and the other one for facial expressions. So to overcome these disadvantage we proposed a system in which a live camera is used for monitoring the driver drowsiness condition and alert the driver which reduces the road accidents. We

proposed these system which helps in prevention of accident passenger and commercial vehicle.

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