PROJECT REPORT on Intelligent Driver Monitoring System

Submitted to

Ch. Brahm Prakash Government Engineering College, New Delhi

BY

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Under the guidance of

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CERTIFICATE

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This is to certify that the project entitled

Intelligent Driver Monitoring System

submitted by

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is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Technology (Information Technology) at Ch.Brahm Prakash Government Engineering College, New Delhi. This work is done during the year 2020-21, under our guidance.

Date: 19/06/2021

Project Mentor: Prof. Athar Hussain

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Acknowledgements

We are profoundly grateful to Prof. Athar Hussain for his expert guidance and continuous encouragement throughout to see that this project rights its target since its commencement to its completion.

ABSTRACT

This document is a review report on the research conducted and the project made in the field of computer engineering to develop a system for driver drowsiness detection to prevent accidents from happening because of driver fatigue and sleepiness.

The report proposed the results and solutions on the limited implementation of the various techniques that are introduced in the project. Whereas the implementation of the project gives the real world idea of how the system works and what changes can be done in order to improve the utility of the overall system.

Road accidents are very common all over the world. It is due to the lack of attention of drivers.

Facts on traffic accidents state that driver's mistake is the major reason for loss and harm on roads all over the world every day.
Research And Study Of Ministry of Road Transport and Highways shows upto 45% of Car Accidents are due to Distracted Driving or Fatigue Related.

Drowsiness, stress and lack of concentration caused by a variety of different factors is a serious problem in traffic. Many traffic accidents are due to these risky behaviors of the drivers.
A system which recognizes the state of the driver and suggests breaks when stress level is too high or driver is too tired would enable large savings and reduce accidents.

Furthermore, the paper states the overview of the observations made by the authors in order to help further optimization in the mentioned field to achieve the utility at a better efficiency for a safer road.

INTRODUCTION

According to the data information, more than 1.2 million people die every year due to road accidents and more than 20 million people experienced non-serious injuries due to road accidents. For this purpose, the development of driver monitoring systems has become very important. This system mostly identifies the driver's distraction level by the interval of head movement, eye blinking, yawning and head swing etc.

The proposed system will solve this problem by using a mobile phone camera; the phone will be put on a stand in the car to make the driver feel comfortable. The proposed system has hardware and software components such as mobile camera and Android SDK. Both components are integrated together to record real video for the driver, and then processing it for real-time eye tracking.
The system can automatically detect the driver's distractions like drowsiness, sleepy eyes, yawning.

This system has reserve all advantages like fast and real-time face and eye tracking, external illumination interference is limited, more robustness and accuracy allowance for fast head/face movement. The Main goals of this system are to ensure that the driver is staying awake during his drive, make the driver feel comfortable and to help decrease the number of accidents.

The development of drowsiness detection technologies is both an industrial and academic challenge. In the automotive industry, Volvo developed the Driver Alert Control which warns drivers suspected of drowsy driving.

Following a similar vein, an Attention Assist System has been developed and introduced by Mercedes-Benz that collects data drawn from a driver's driving patterns incessantly ascertains if the obtained information correlates with the steering movement and the driving circumstance at hand.

The driver drowsiness detection system, supplied by Bosch, makes decisions based on data derived from the sensor stationed at the steering, the vehicles' driving velocity, turn signal use, and the lane assist camera mounted at the front of the car. Notably, the use of these safety systems which detect drowsiness is not widespread and is uncommon among drivers because they are usually available in luxury vehicles. An increased embedding and connecting of smart devices equipped with sensors and mobile operating systems like Android, which has the largest installed operating system in cars, was shown by surveys in 20152 . In addition, machine learning has made groundbreaking advances in recent years, especially in the area of deep learning. Thus, the use of these new technologies and methodologies can be an effective way to not only increase the efficiencies of the existing real-time driver drowsiness detection system but also provide a tool that can be widely used by drivers

In a bid to increase accurateness and accelerate drowsiness detection, several approaches have been proposed. This section attempts to summarize previous methods and approaches to drowsiness detection. The first previously-used approach is based on driving patterns, and it is highly dependent on vehicle characteristics, road conditions, and driving skills. To calculate driving pattern, deviation from a lateral or lane position or steering wheel movement should be calculated 3,4. While driving, it is necessary to perform micro adjustments to the steering wheel to keep the car in a lane. Krajewski et al.4 detected drowsiness with 86% accuracy on the basis of correlations between micro adjustments and drowsiness. Also, it is possible to use deviation in a lane position to identify a driving pattern. In this case, the car's position respective to a given lane is monitored, and the deviation is analyzed5 . Nevertheless, techniques based on the driving pattern are highly dependent on vehicle characteristics, road conditions, and driving skills. The second class of techniques employs data acquired from physiological sensors, such as Electrooculography (EOG), Electrocardiogram (ECG) and

Electroencephalogram (EEG) data. EEG signals provide information about the brain’s activity. The three primary signals to measure driver’s drowsiness are theta, delta, and alpha signals. Theta and delta signals spike when a driver is drowsy, while alpha signals rise slightly. According to Mardi et al.6 , this technique is the most accurate method, with an accuracy rate of over 90%. Nevertheless, the main disadvantage of this method is its intrusiveness. It requires many sensors to be attached to the driver's body, which could be uncomfortable. On the other hand, non-intrusive methods for bio-signals are much less precise. The last technique is Computer Vision, based on facial feature extraction. It uses behaviors such as gaze or facial expression, yawning duration, head movement, and eye closure. Danisman et al.7 measured drowsiness of three levels through the distance between eyelids. This calculation considers the number of blinks per minute, assuming that it increases as the driver becomes drowsier. In Hariri et al.8 , the drowsiness measurements are the behaviors of the mouth and yawning. The modified Viola-Jones object detection algorithm was employed for face and mouth detection.

BACKGROUND AND LITERATURE REVIEW

Android is an operating system (OS) based on the Linux kernel and currently developed by Google.
It is designed primarily for touchscreen mobile devices such as smartphones and tablet computers. These devices are becoming popular nowadays and most of them are equipped with many useful sensors. The list of sensors includes: accelerometer, gyroscope, magnetometer, proximity sensor, light sensor and GPS sensor. Android has the largest installed base of all operating systems as surveys of 2015 showed [7]. Android Apps are developed in Java programming language using the Android software development kit (SDK)

Researchers and developers are recently using android devices for powerful controlling applications. Many platforms are designed to be run on Android devices. These platforms ease the accessibility to the smartphone built-in sensors and the communication with other devices and sensors.

In this paper we propose a smart driver monitoring system using android smartphones.
This system guarantees a comprehensive monitoring for driver performance during work and a full privacy protection. The system uses an Android App.

METHODS

One solution to this serious problem is the development of an intelligent vehicle that can predict driver drowsiness and prevent drowsy driving. The percentage of eyelid closure over the pupil over time (PERCLOS) is one of the major methods for the detection of the driver's drowsiness. Physiological measurements like electrocardiogram (ECG) ,capturing eye closure, facial features or driving performance (such as steering characteristics, lane departure, etc.) are used for drowsiness detection. When drowsiness is detected while driving, audible sound vibrations or warning messages on a

display are generally used to warn the driver to concentrate on driving or to take a rest. These methods help the drowsy driver to prevent drowsiness-related crashes in a moment, but it is hard to get rid of drowsiness by just being aware of it. As we found in the literature review, most of the methods need a lot of equipment which is not possible in real life implementations. Also most of the methods which rely on camera input for detection of opening and closing eyelids are not to be tested like they can be implemented in real time as most of the scholars take images as the camera is fixed in front of the driver's road view. As for clear view, it is not possible to put the camera on the front mirror. Secondly most papers have drawbacks when there is high luminance caused by sunlight as well as during dim light conditions like bad weathers. We decided to explore this topic further according to the climate of our country and decided to propose a noble method which can eradicate the above written shortcomings of the literature survey.

FACE TRACKING

Face tracking systems as shown, must be robust to head movement, rotation, pose variation and illumination changes.
To achieve this goal we propose a method to use face detection and object tracking systems simultaneously. This combination gives us the opportunity to utilize the advantages of two programs together.

EYE DETECTION

Locating the position of the eye is a difficult task due to many factors such as lighting condition, expression, facial shadowing, etc. Using eye features, different measures can be calculated with percentage of eyelid closure, maximum closure duration, blink frequency, average opening level of the eyes, opening velocity of the eyes, and closing velocity of the eye and an effective driver drowsiness detection model can be created which can work under varying unconstrained and luminance conditions. After the position of face has been obtained, locating the eye can be done with better accuracy.

We will present the method to detecting eyes using L*a*b color space which can easily differentiate the face and non-face areas. As what was said before this method is not robust to pose variation. However we use this disability as an advantage in distraction detection systems. If an eye could not be detected we can assume that the driver wouldn't look forward. So this situation can be categorized in a distraction state and must alarm the driver.

Software Requirements Specification

1. Android SDK
2. Android NDK (for OpenCV)
3. OpenCV
4. CameraX
5. Visual Studio / IntelliJ Idea
6. Android Studio
7. Firebase
8. Adobe XD
9. Photoshop

Hardware Requirements Specification

1. Android Smartphone
2. Phone Holder

Requirement Analysis

1. Android Studio

2. Java and Kotlin for developing the mobile application

3. Github

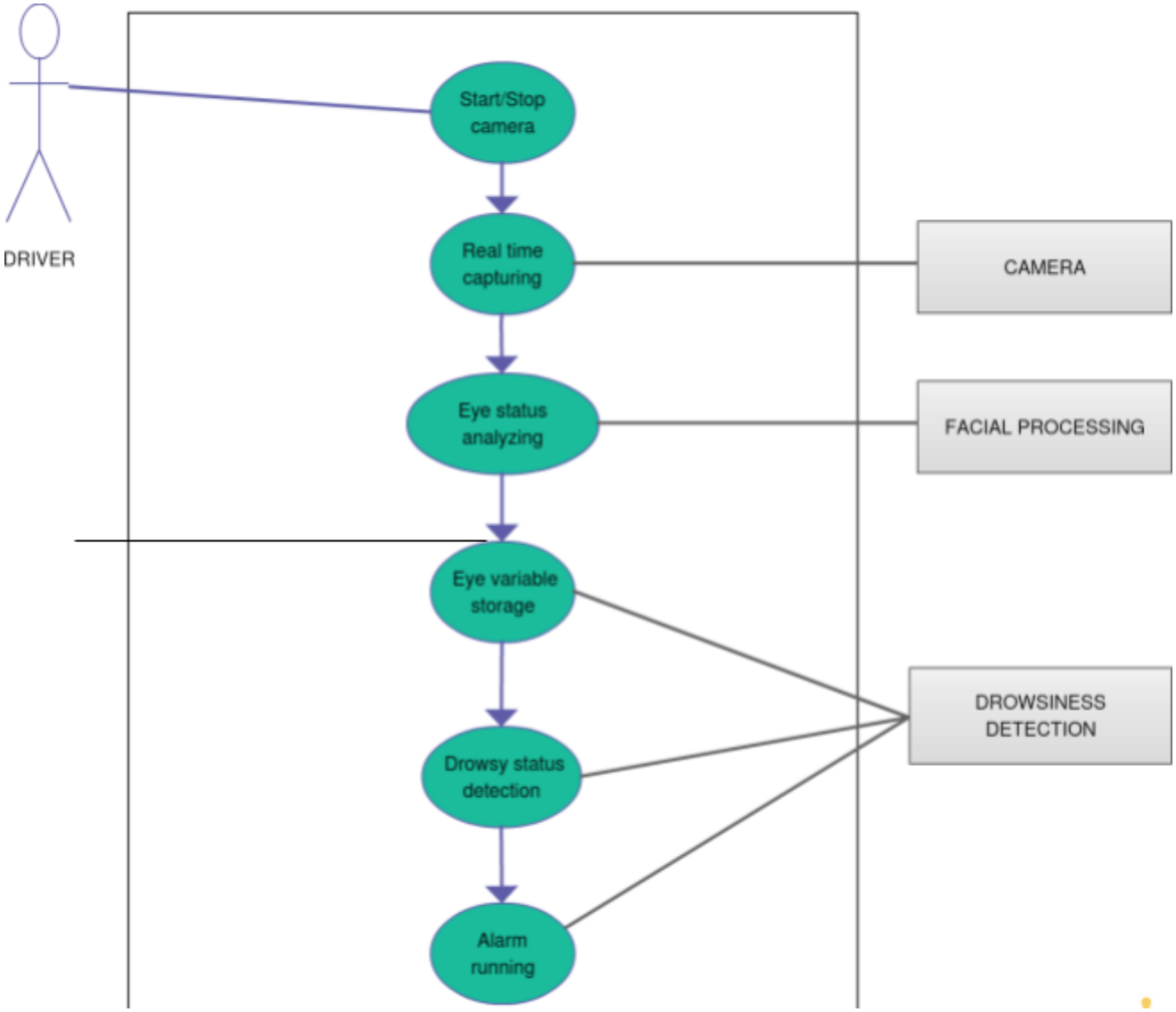
4. Libraries:

- CameraX
- Picasso
- Opencv

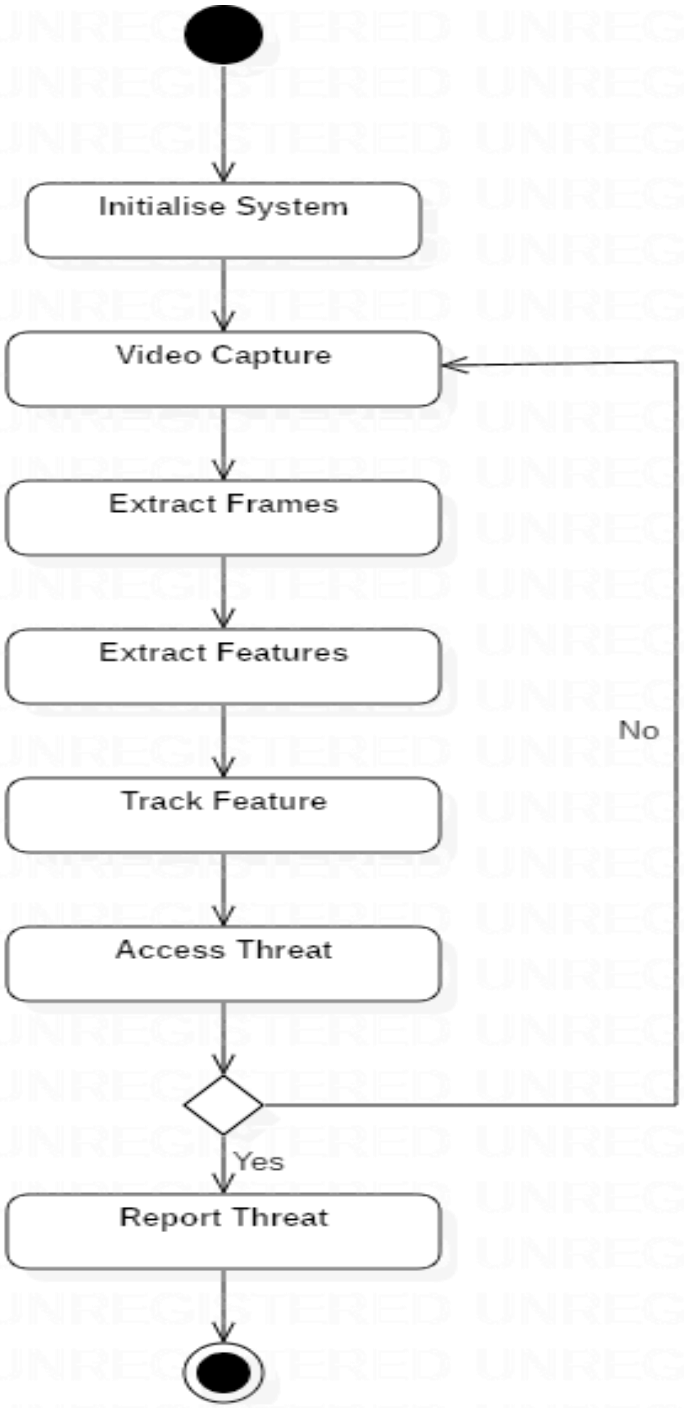
OS: Windows or Mac or Linux

SYSTEM DESIGNING

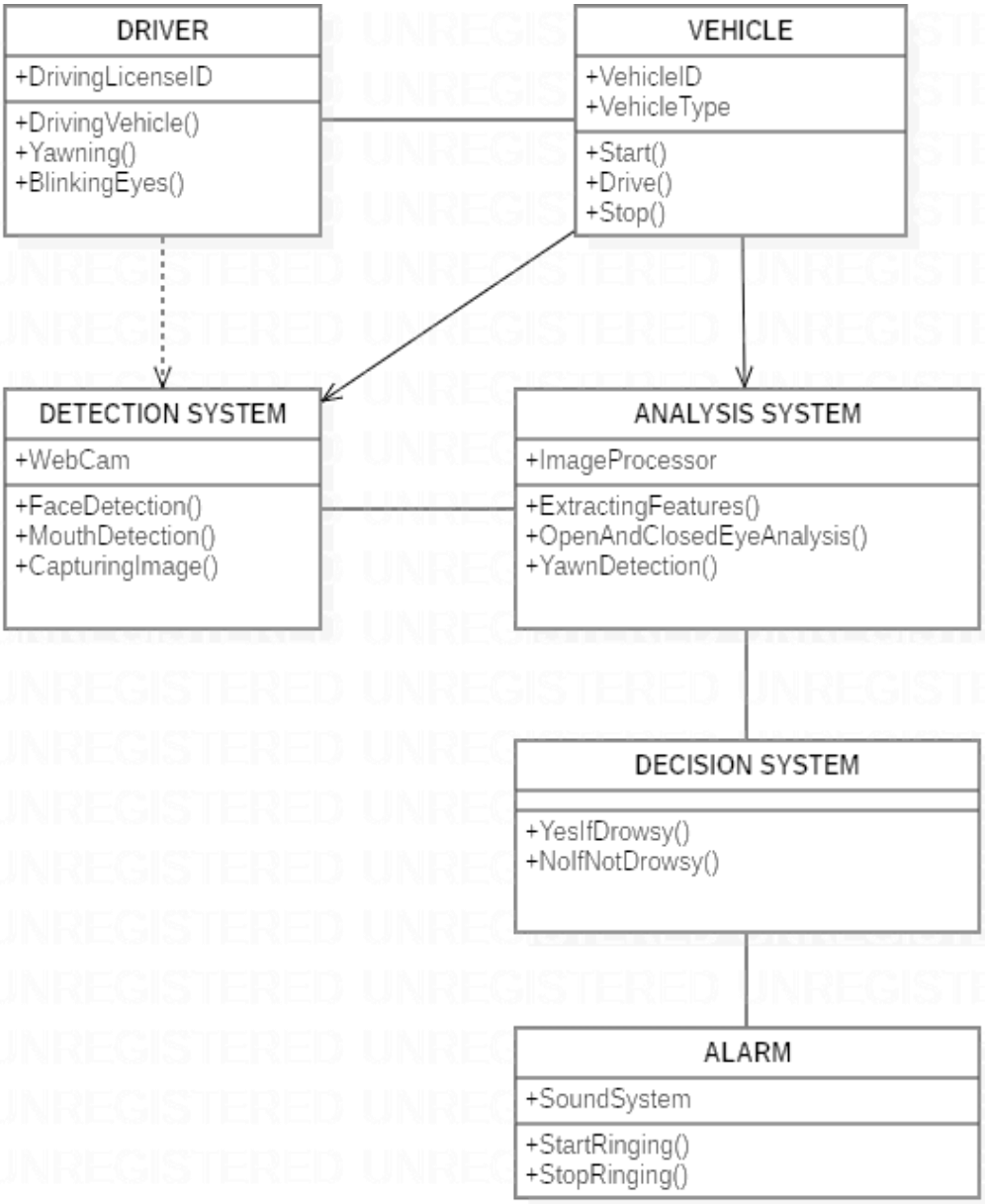
USE CASE DIAGRAM



ACTIVITY DIAGRAM



Class Diagram

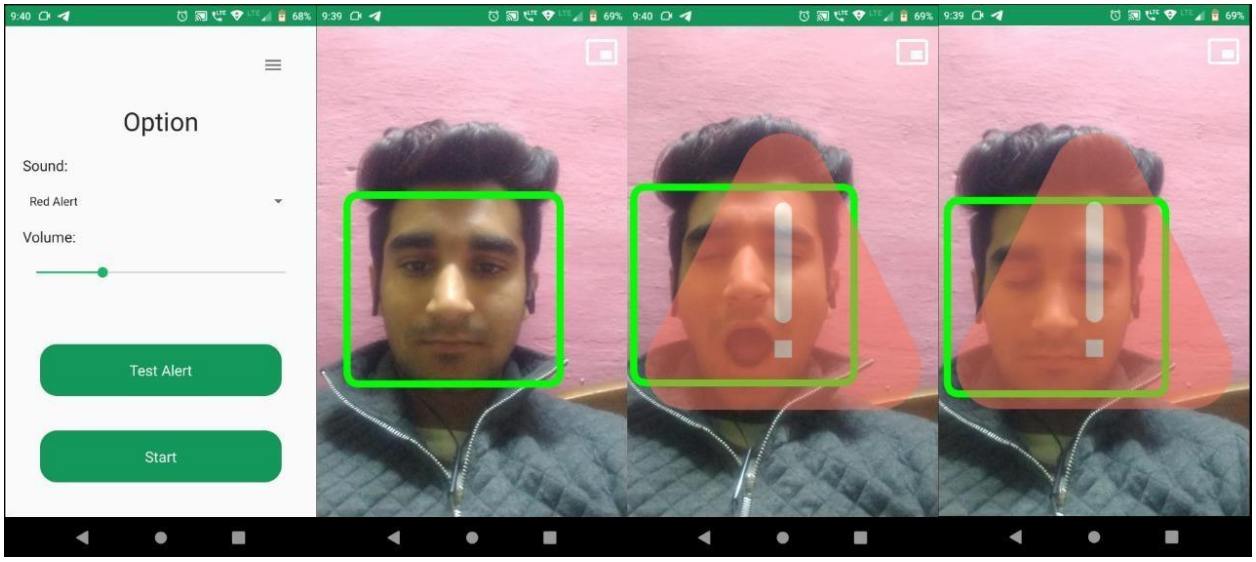


System Testing

Test Cases and Test Results

Test ID	Test Condition	System Behavior	Expected Result
T01	Straight Face, Good Light, With Glasses	Non Drowsy	Non Drowsy
T02	Tilted Face, Good Light, No Glasses	Drowsy	Drowsy
T03	Tilted Face, Good Light, With Glasses	Drowsy	Drowsy

Note: Testing is performed manually

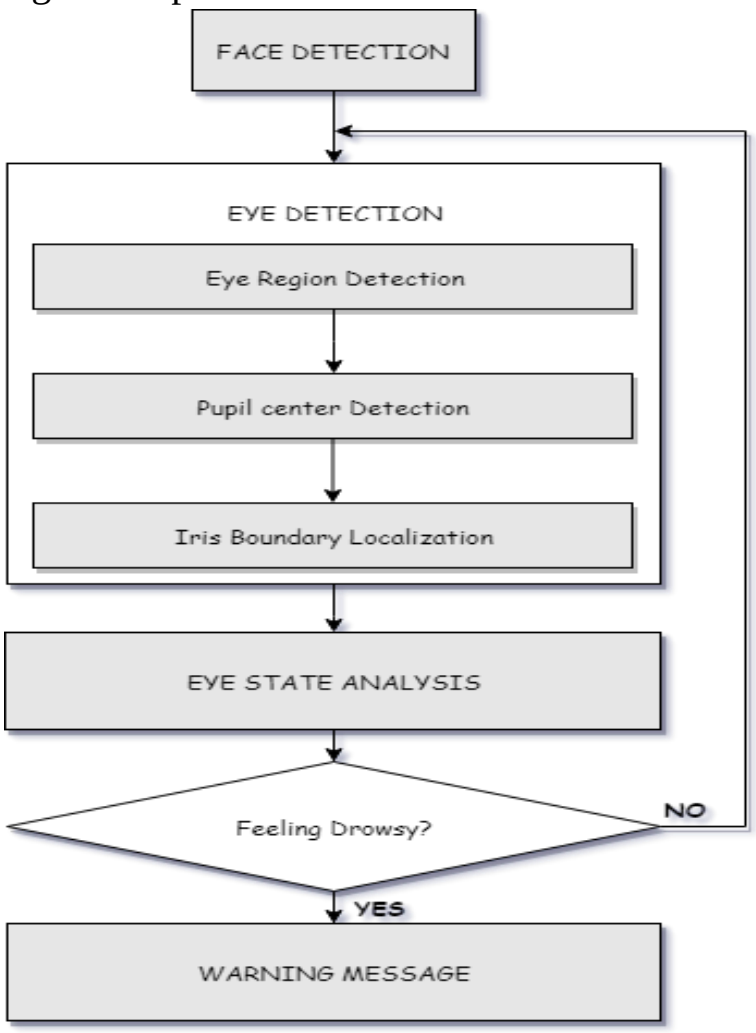


Project Planning

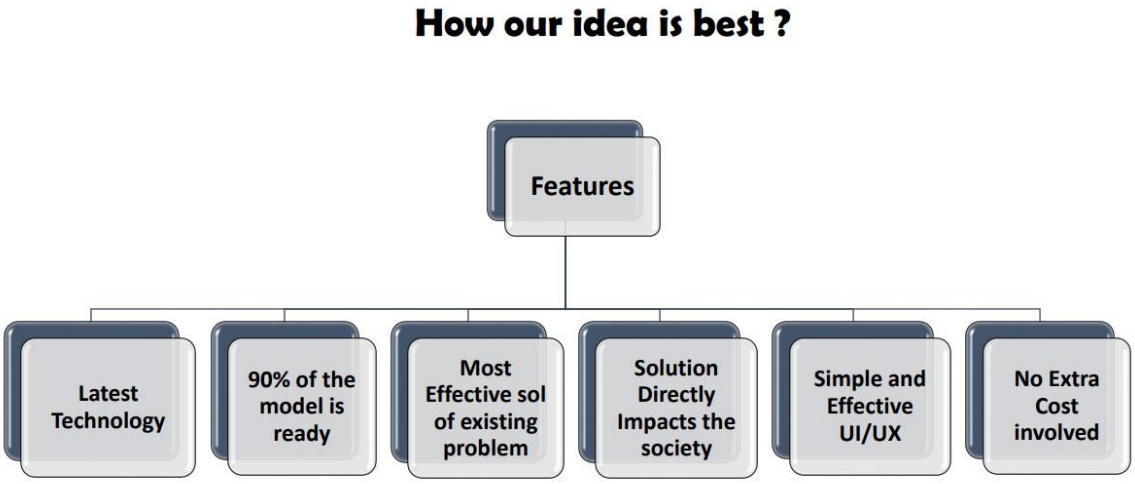
System Model

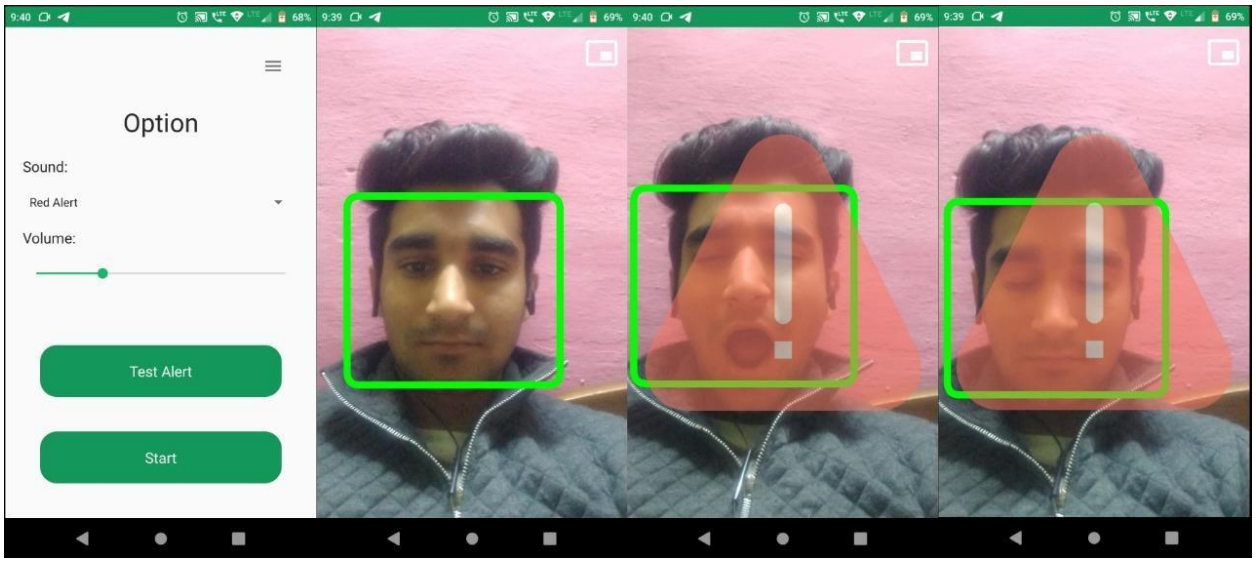
The framework is created utilizing the incremental model. The center model of the framework is first created and afterwards augmented in this way in the wake of testing at each turn. The underlying undertaking skeleton was refined into expanding levels of ability.

At the following incremental level, it might incorporate new execution backing and improvement.



Screenshots of Project





Conclusion

It completely meets the objectives and requirements of the system. The project has achieved an unfaltering state where all the bugs have been disposed of. The project cognizant clients who are familiar with the framework and comprehend it's focal points and the fact that it takes care of the issue of stressing out for

individuals having fatigue-related issues to inform them about the drowsiness level while driving.

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3. Open CV Library