A PROJECT REPORT

on

"DRIVER DROWSINESS DETECTION SYSTEM"

Submitted in partial fulfillment of the requirements for the degree of

BACHELOR OF TECHNOLOGY

Session: - Jan-June 2022

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MAY - 2022

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Examiner Certificate

This is to certify that the following student **LOKESH KUMAR SALVI B, RIYA TALREJA,HARSHWARDHAN SINGH BHATI** of final year B.Tech. (Electronics & Communication Engineering), was examined for the project work .

"DRIVER DROWSINESS DETECTION SYSTEM"

during the academic year 2018 – 2022 at Techno India NJR Institute of Technology,Udaipur

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Certificate

This is to certify that project work titled "DRIVER DROWSINESS DETECTION SYSTEM" by LOKESH KUMAR SALVI B, HARSHWARDHAN SINGH BHATI, RIYA TALREJA was successfully carried out in the Department of Electronics and Communication Engineering, TINJRIT and the report is approved for submission in the partial fulfillment of the requirements for award of degree of Bachelor of Technology in Electronics and Communication. The work has been completed in all the respects duringsession 2018-2022.

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Chapter 1

Introduction

PURPOSE

Life is a precious gift but it is full of risk. Therefore, there is a need to take safety precautions in order to avoid accidents. Now- a-days, road accidents have become one of the major cause of insecure life. It is very important to take proper care while driving.
Carelessness for a single minute can cause major problems. Most of the road accidents occur due to carelessness and inactiveness of the driver while driving.
This is the reason, every year the number of road accidents is increasing especially by cars. Due to drowsiness, drivers become inactive while driving. Drowsiness detection could have saved number of lives if it could have been detected earlier.
Development of drowsiness detection is due to the use/help of machine
vision-based concepts. In order to detect fatigue or drowsiness, small camera has been used which points directly towards the driver's face and detects the eye ball movement of the driver. At the very first stage, system detects the face and then detects the eyes and then determines whether the eye detected is open or closed. Changes between the intensity in the eye takes place due to which, it narrows
down area of the eye and further gives information to the system.
Within a time limit, a system gives information that the driver is falling asleep and there is a need to alert him/her.

HUMAN PSYCHOLOGY WITH CURRENT TECHNOLOGY

Humans have always invented machines and devised techniques to ease and protect their lives, for mundane activities like traveling to work, or for more interesting purposes like aircraft travel. With the advancement in technology, modes of transportation kept on advancing and our dependency on it started increasing exponentially. It has greatly affected our lives as we know it. Now, we can travel to places at a pace that even our grandparents wouldn't have thought possible. In modern times, almost everyone in this world uses some sort of transportation every day. Some people are rich enough to have their own vehicles while others use public transportation. However, there are some rules and codes of conduct for those who drive irrespective of their social status. One of them is staying alert and active while driving.

Neglecting our duties towards safer travel has enabled hundreds of thousands of tragedies to get associated with this wonderful invention every year. It may seem like a trivial thing to most folks but following rules and regulations on the road is of utmost importance. While on road, an automobile wields the most power and in irresponsible hands, it can be destructive and sometimes, that carelessness can harm lives even of

the people on the road. One kind of carelessness is not admitting when we are too tired to drive. In order to monitor and prevent a destructive outcome from such negligence, many researchers have written research papers on driver drowsiness detection systems. But at times, some of the points and observations made by the system are not accurate enough. Hence, to provide data and another perspective on the problem at hand, in order to improve their implementations and to further optimize the solution, this project has been done.

FACTS & STATISTICS

Our current statistics reveal that just in 2015 in India alone, 148,707 people died due to car related accidents. Of these, at least 21 percent were caused due to fatigue causing drivers to make mistakes. This can be a relatively smaller number still, as among the multiple causes that can lead to an accident, the involvement of fatigue as a cause is generally grossly underestimated. Fatigue combined with bad infrastructure in developing countries like India is a recipe for disaster. Fatigue, in general, is very difficult to measure or observe unlike alcohol and drugs, which have clear key indicators and tests that are available easily. Probably, the best solutions to this problem are awareness about fatigue-related accidents and promoting drivers to admit fatigue when needed. The former is hard and much more expensive to achieve, and the latter is not possible without the former as driving for long hours is very lucrative. When there is an increased need for a job, the wages associated with it increases leading to more and more people adopting it. Such is the case for driving transport vehicles at night. Money motivates drivers to make unwise decisions like driving all night even with fatigue. This is mainly because the drivers are not themselves aware of the huge risk associated with driving when fatigued. Some countries have imposed restrictions on the number of hours a driver can drive at a stretch, but it is still not enough to solve this problem as its implementation is very difficult and costly.

DOCUMENT CONVENTIONS

Main Heading Font size: 24

(bold fonts) Sub-headings

Font size: 16 (bold fonts)

Sub-headings Content Font size: 14 (normal fonts)

INTENDED AUDIENCE

The intended audience for this document are the development team, the project evaluation jury, and other tech-savvy enthusiasts who wish to further work on the project.

PRODUCT SCOPE

There are many products out there that provide the measure of fatigue level in the drivers which are implemented in many vehicles. The driver drowsiness detection system provides the similar functionality but with better results and additional benefits. Also, it alerts the user on reaching a certain saturation point of the drowsiness measure.

PROBLEM DEFINITION

Fatigue is a safety problem that has not yet been deeply tackled by any country in the world mainly because of its nature. Fatigue, in general, is very difficult to measure or observe unlike alcohol and drugs, which have clear key indicators and tests that are available easily. Probably, the best solutions to this problem are awareness about fatigue-related accidents and promoting drivers to admit fatigue when needed. The former is hard and much more expensive to achieve, and the latter is not possible without theformer as driving for long hours is very lucrative.

Chapter 2

Literature Survey

SYSTEM REVIEW

This survey is done to comprehend the need and prerequisite of the general population, and to do as such, we went through different sites and applications and looked for the fundamental data. Based on these data, we made an audit that helped us get new thoughts and make different arrangements for our task. We reached the decision that there is a need of such application and felt that there is a decent extent of progress in this field too.

TECHNOLOGY USED

MATLAB - The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects, which together represent the state-of-the-art in software for matrix computation.
MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.
MATLAB features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to *learn* and *apply* specialized

technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

The MATLAB system consists of five main parts:

The MATLAB language.
This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented
programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

The MATLAB working environment.

This is the set of tools and facilities that you work with as the MATLAB user or programmer. It includes facilities for managing the variables in your workspace and importing and exporting data. It also includes tools for developing, managing, debugging, and profiling M-files, MATLAB's applications.

Handle Graphics.

This is the MATLAB graphics system. It includes high-level commands for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete Graphical User Interfaces on your MATLAB applications.

The MATLAB mathematical function library.

This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigenvalues, Bessel functions, and fast Fourier transforms.

The MATLAB Application Program Interface (API).
This is a library that allows you to write C and Fortran programs that interact with MATLAB. It include facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

b. IMAGE PROCESSING – Digital processing is the use of computer algorithms to create ,process,communicate and display digital images.
Digital image processing algorithms can be used to :

- Convert signals from an image sensor into digital images.
- Improve clarity and remove noises and other artifacts.
- Extract the size, scale, or number of objects in a scene.
- Prepare images for display or printing.
- Compress images for communication across a network.

Image processing is the technique to convert an image into digital format and perform operations on it to get an enhanced image or extract some useful information from it.

Changes that take place in images are usually performed automatically and rely on carefully designed algorithms.

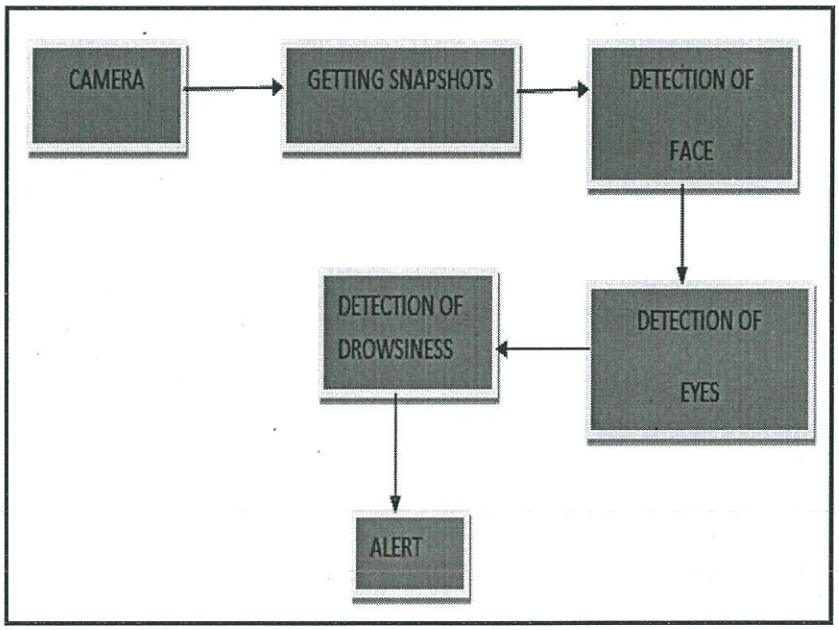
- Image processing is a multidisciplinary field, with contributions from different branches of science including mathematics, physics, optical and electrical engineering. Moreover, it overlaps with other areas such as pattern recognition, machine learning, artificial intelligence and human vision research. Different steps involved in image processing include importing the image with an optical scanner or from a digital camera, analysing and manipulating the image (data compression, image enhancement and filtering), and generating the desired output image.

EXISTING SYSTEM

Some of the existing systems use hardware devices which may affect the body of the
driver and aging of components reduces the function of the system. If the hardware
device gets damaged, it will affect the whole system.

PROPOSED SYSTEM

In the proposed method, an image is taken from a live video. In an image, it detects the face and eyes by using Viola Jones algorithm, and then determines whether the eyes are closed or open to detect drowsiness to alert the driver to open his/her eyes.



The block diagram of the proposed system is shown within the Fig.1.

Chapter 3

Software Requirements Specification

- MALTAB
- C LANGUAGE ALGORITHMS

Hardware Requirements Specification

I. Laptop with basic hardware.
II. Webcam

Chapter 4

Programming Language:

C is a general-purpose programming language that is extremely popular, simple, and flexible to use. It is a structured programming language that is machine-independent and extensively used to write various applications, Operating Systems like Windows, and many other complex programs like Oracle database, Git, Python interpreter, and more

It is said that 'C' is a god's programming language. One can say, C is a base for the programming. If you know 'C,' you can easily grasp the knowledge of the other programming languages that uses the concept of 'C'

It is essential to have a background in computer memory mechanisms because it is an important aspect when dealing with the C programming language.

'C' is a structured programming language in which program is divided into various modules. Each module can be written separately and together it forms a single 'C' program. This structure makes it easy for testing, maintaining and debugging processes.
'C' contains 32 keywords, various data types and a set of powerful built-in functions that make programming very efficient.

Another feature of 'C' programming is that it can extend itself.

A 'C' program contains various functions which are part of a library. We can add our features and functions to the library. We can access and use these functions anytime we want in our program. This feature makes it simple while working with complex programming.
Various compilers are available in the market that can be used for executing programs written in this language.
It is a highly portable language which means programs written in 'C' language can run on other machines. This feature is essential if we wish to use or execute the code on another computer.

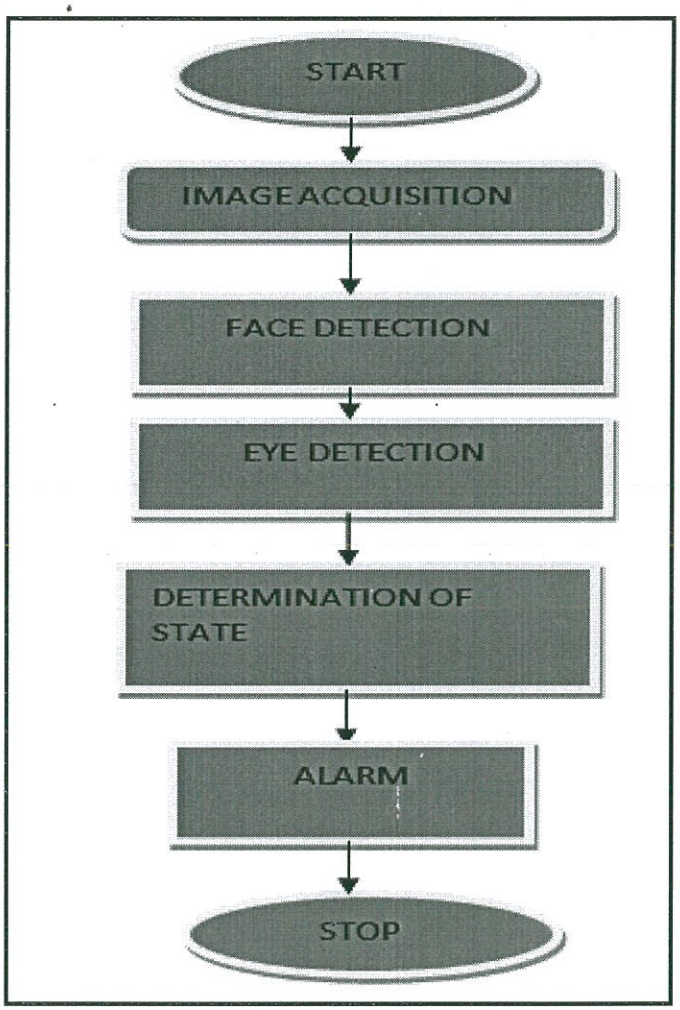
PSUEDO CODE:

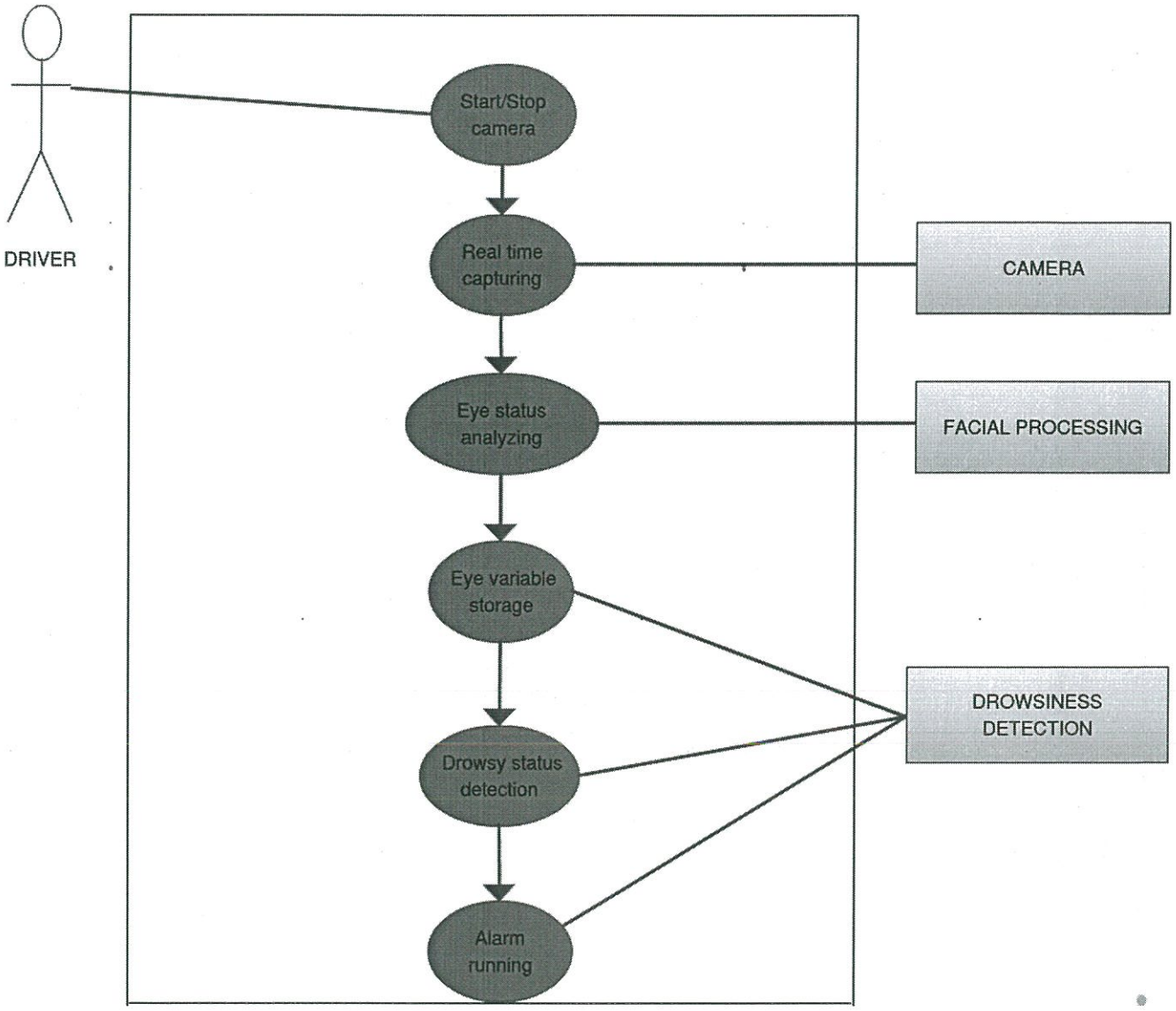
```
clc;
clear all;
close all;
c=webcam;
%preview(c);

while true
    e=snapshot(c);
      FaDetect=vision.CascadeObjectDetector();
      BBf=step(FaDetect,e);
      detFace=insertObjectAnnotation(e,'Rectangle',BBf,'Face');
      imshow(detFace);
      Edet=vision.CascadeObjectDetector('EyePairBig','MergeThreshold',30);
      l=detFace;
      Bbox=step(Edet,l);
      imshow(l);
      if(sum(sum(Bbox))==0)
            hold on;
            title('Eyes Closed');
            [a,fs]=audioread('BeepSound.mp3');
            p=audioplayer(a,fs);
            play(p)
      else
            title('Eyes Open');
            for(i=1:size(Bbox,1))
                  rectangle('Position',Bbox(i,:),'Linewidth',5,'LineStyle','-
','EdgeColor','r');
            end
      end
end
```

Chapter 5

System Design

USE CASE DIAGRAM




DRIVER
Start/Stop camera
Real time capturing
Eye status analyzing
Eye variable storage
Drowsy status detection
Alarm running
CAMERA
FACIAL PROCESSING
DROWSINESS DETECTION

ACTIVITY DIAGRAM

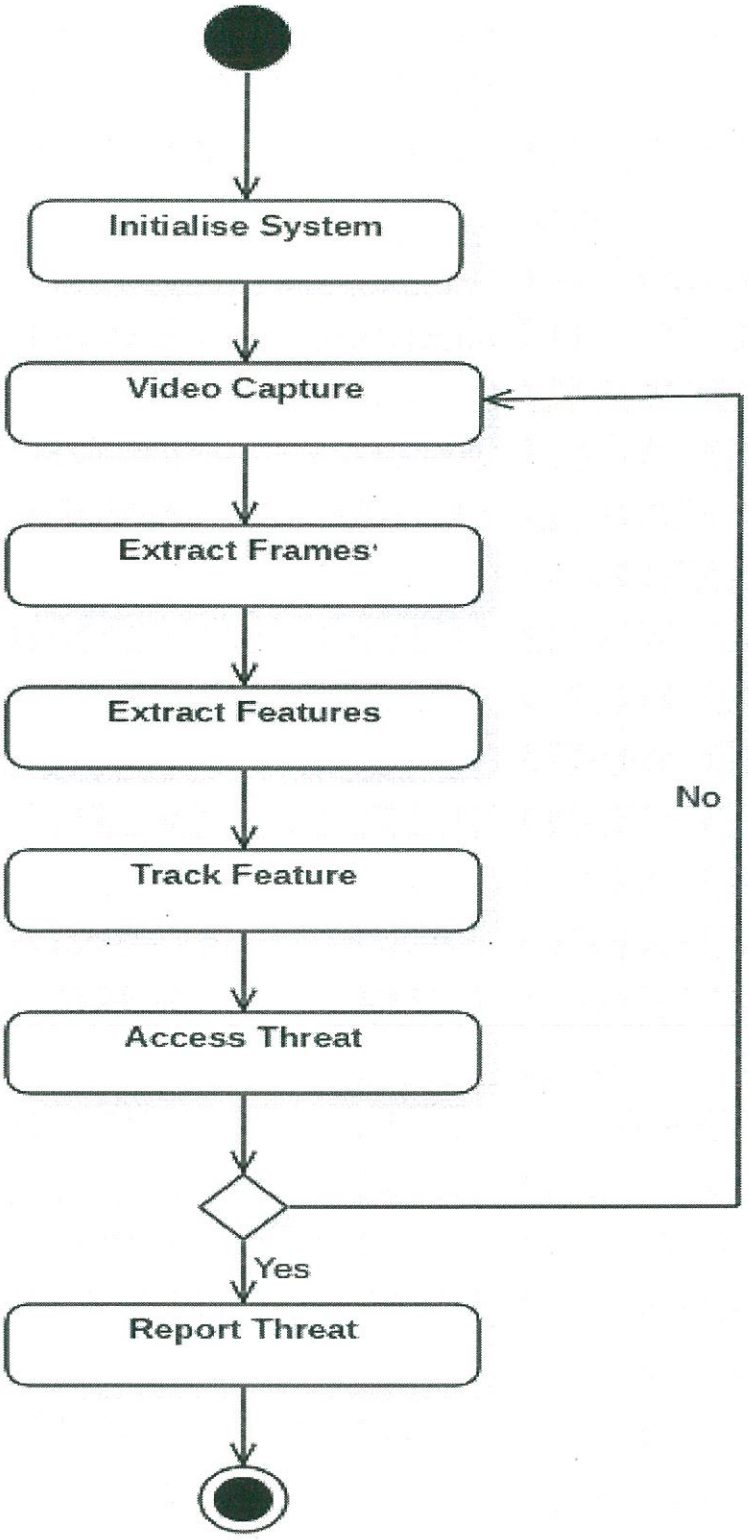


FIGURE 2

CLASS DIAGRAM

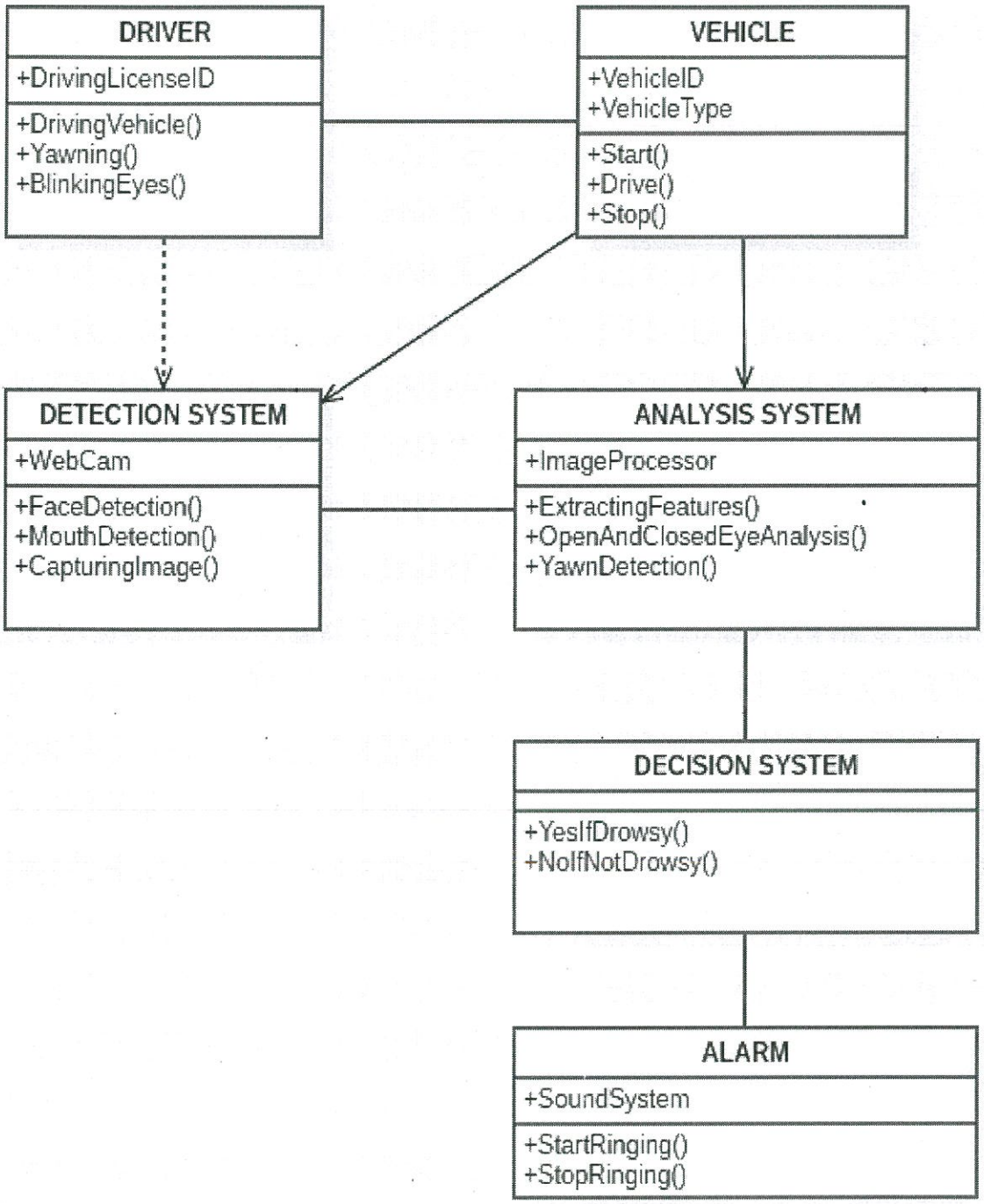


FIGURE 3

Chapter 6

PROPOSED WORK

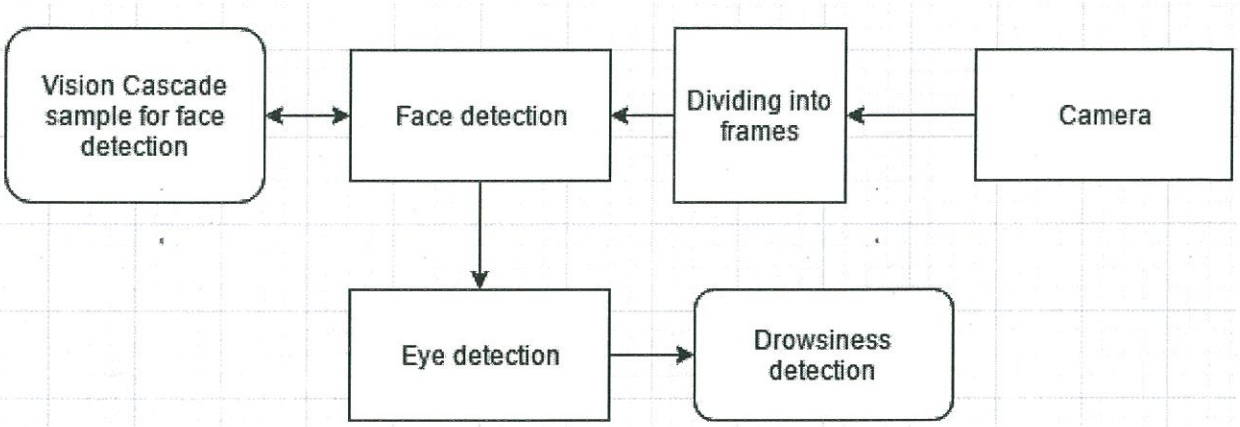


Image Acquisition

It mainly involves obtaining the image of the Automobile driver. It can be acquired with the help of camera with diving into different frames. Live image is taken as its input and then it converts those images into the series of images which are further proceed to make various operations.

Face Detection

Face detection activity takes one of the frame at a time 't' from frame grabber which later tries to detect the face of Automobile driver in every frame. And it can be done with the help of Vision Cascade samples.

Eye Detection

After detecting the face of Automobile driver with the face detection function, the eyes detection can be done with the help of eyes detection function. This can be done with Voila Jones Algorithm.

Drowsiness Detection

Once the eyes of Automobile driver are detected, the drowsi- ness detection function detects whether the driver is drowsy or not, by taking into consideration whether the eyes are open or closed that is the state of the eyes.

System Testing

6.1 Test Cases and Test Results

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

Note: Testing is performed manually

Chapter 7

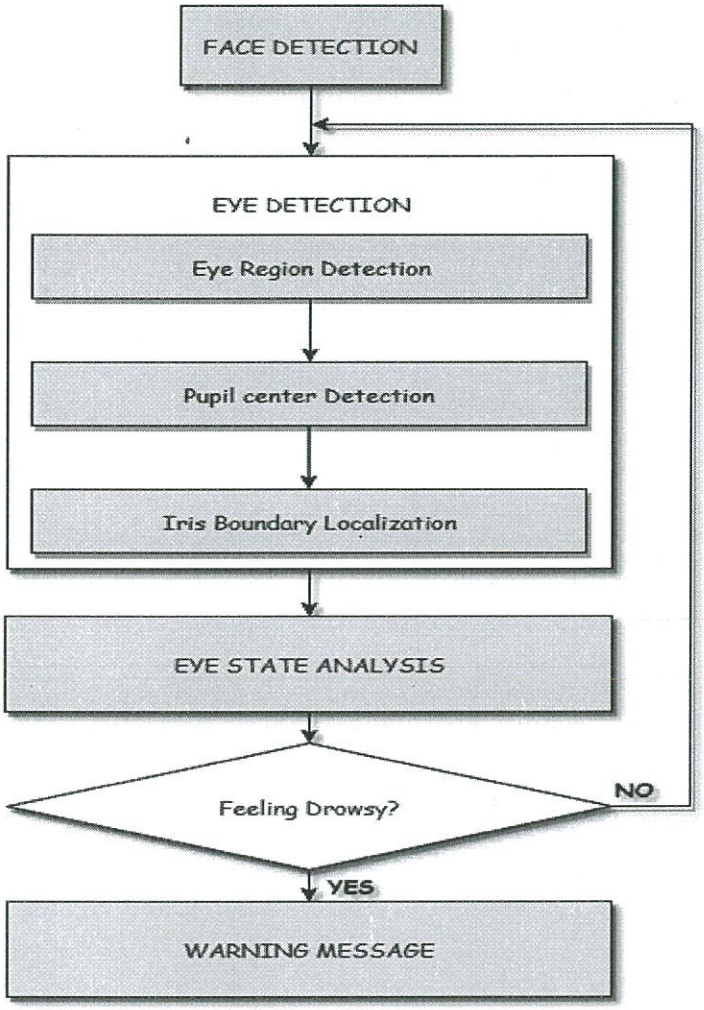
Project Planning

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.

Figure 4: Block diagram



Chapter 8

RESULT AND DISCUSSION

An image is acquired from the camera which is fixed in front of the face of the driver. The image shown in the Fig.2 is of 346*368 pixels.

Fig.2. Image Acquisition

After acquiring image from the camera, it searches for the face of the driver by using Viola-Jones algorithm and the face is annotated by a yellow rectangular box labelled as face as shown in the Fig. 3.

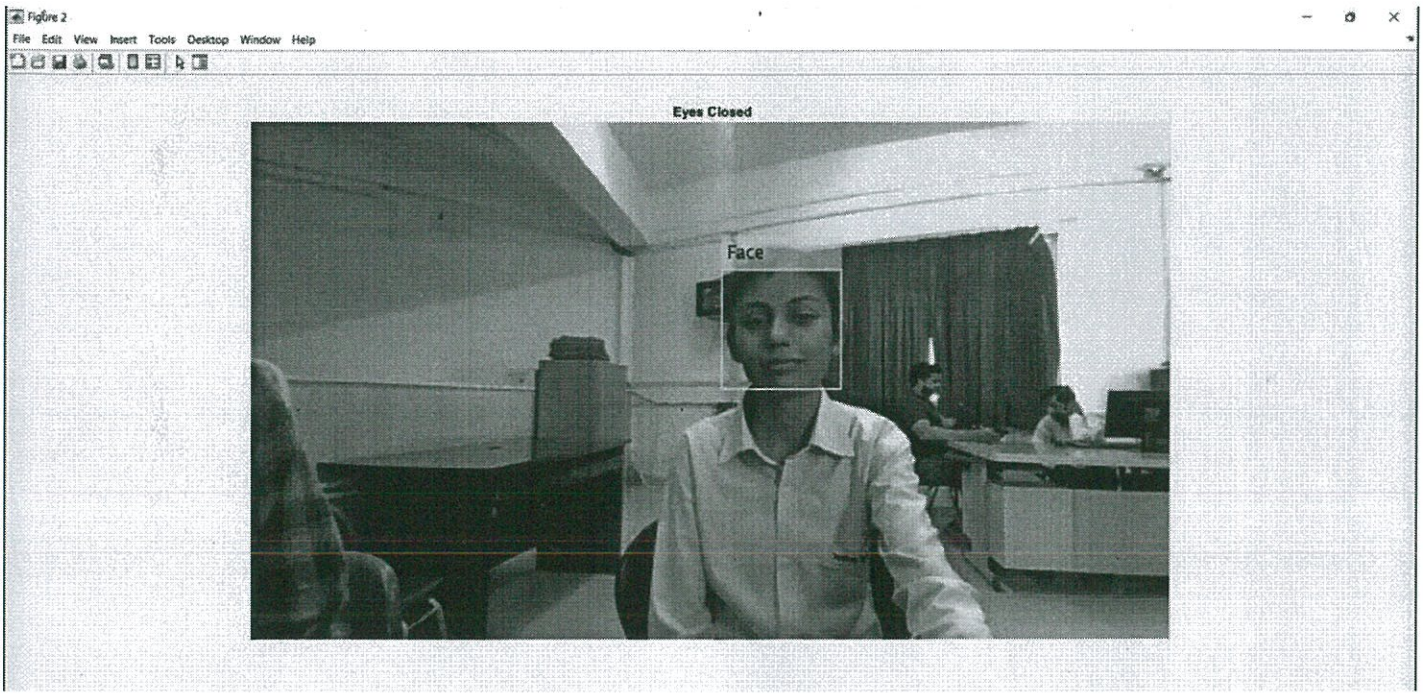


Fig.3. Face Detection

An image is acquired from the camera which is fixed in front of the face of the driver. The image shown in the Fig.4 is of 270*286 pixels

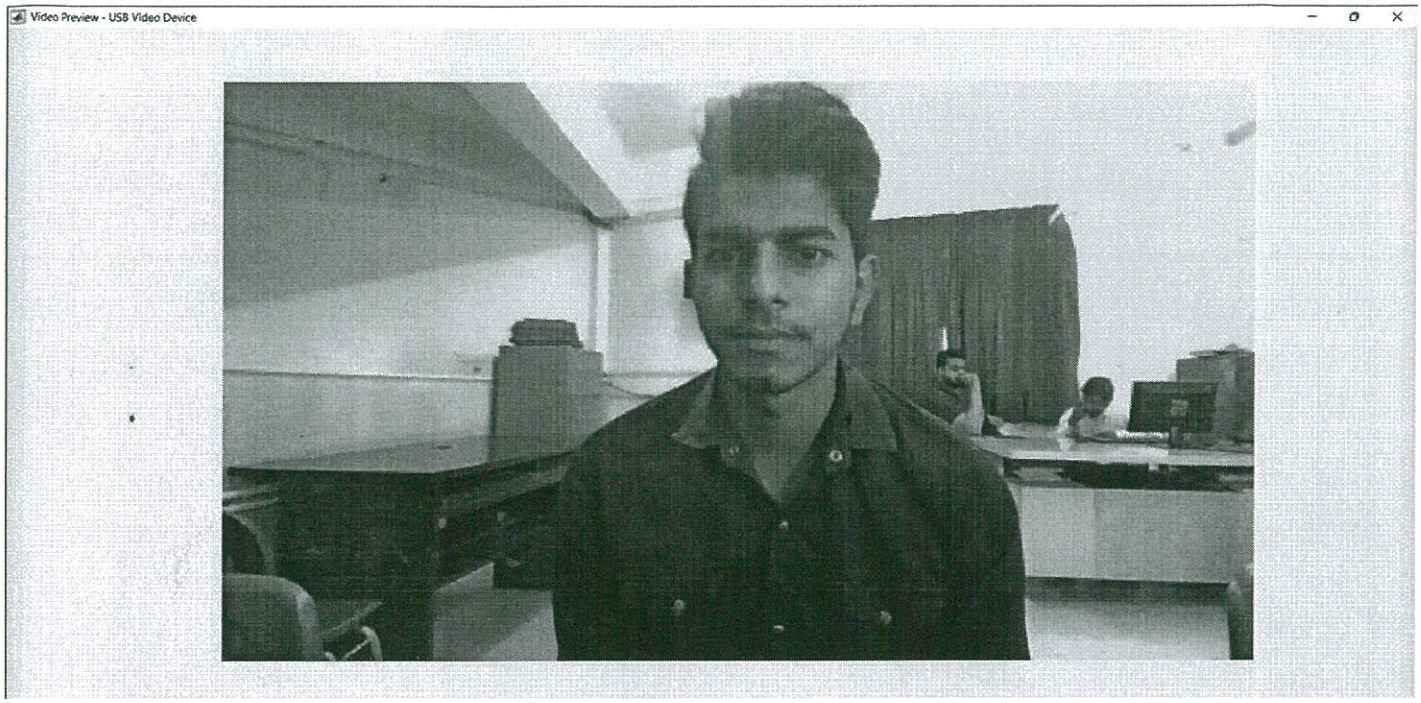


Fig.4. Image Acquisition

After acquiring image from the camera, it searches for the face of the driver by using Viola-Jones algorithm and the face is annotated by a yellow rectangular box labelled as face as shown in the Fig. 5 and then searches for eyes which is annotated by red rectangular box. When the eyes are open, it shows as 'Eyes Open' as shown in the Fig. 5.

Fig.5. Eyes are in open state

In the result of proposed when the eyes are in closed state, it shows as eyes closed as shown in the fig.6, and alerts the driver to open his/her eyes by producing a 'Beep Sound'.

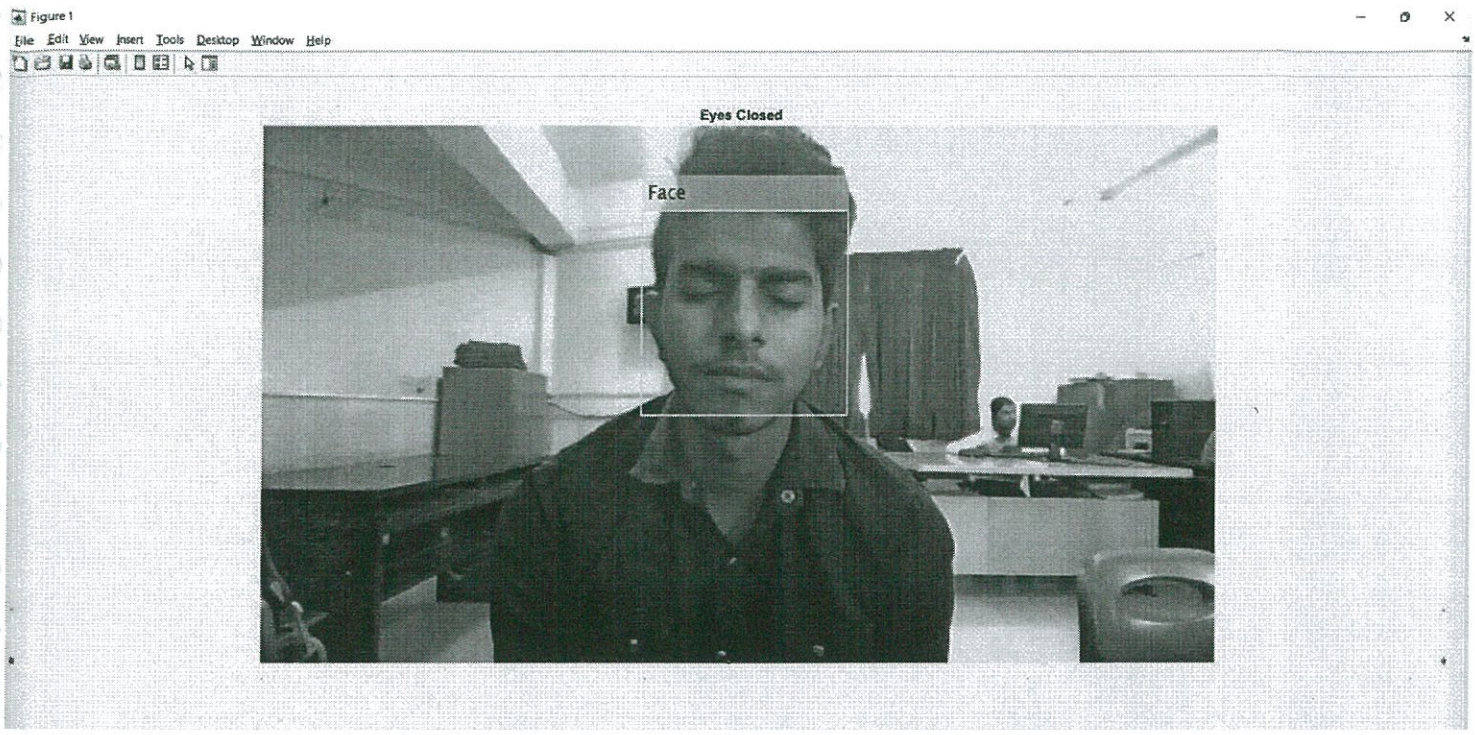


Fig. 6. Eyes are in closed State

When eyes are in closed state, it produces a 'Beep Sound' which is having a sample rate of 44100 Hz and duration of 0.7835 seconds as shown in the Fig. 7. The waveform of Beep Sound is shown in the Fig.8.

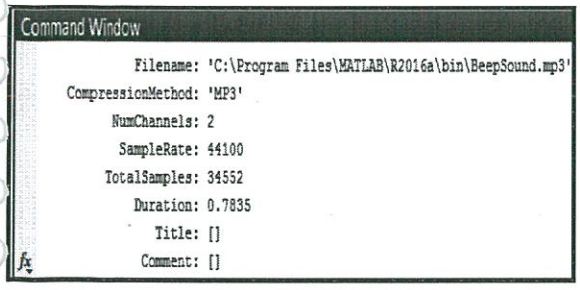


Fig. 7. Properties of Beep Sound

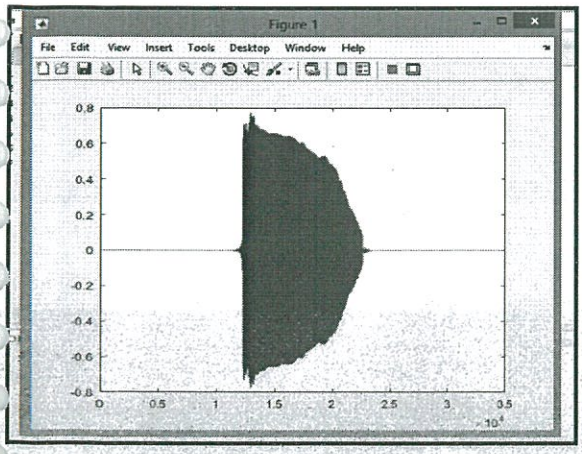


Fig. 8. Waveform of Beep Sound

The equation used to find the correct rate of the proposed system is detection failure

subtracted from the total number of snapshots divided by the total snapshots.

$$\text{Correct Rate} = \frac{\text{Total snapshots} - \text{detection failure}}{\text{Total snapshots}}$$

For the Proposed System, the Average Correct Rate is 84.4 percentage for different

users, both male and female of different ages, and skin color. The Bar chart for Correct Rate is shown in the Fig. 9.

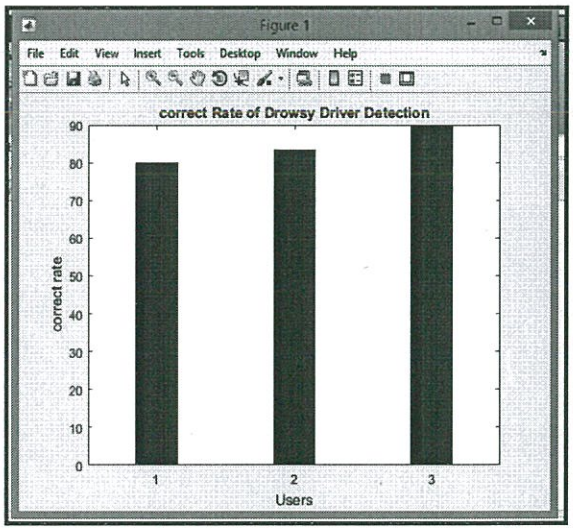


Fig. 9. Correct Rate of the Drowsy Driver Detection

Chapter 9

Conclusion and Future Scope

Conclusion

It completely meets the objectives and requirements of the system. The framework has achieved an unfaltering state where all the bugs have been disposed of. The framework 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.

Therefore, we have successfully implemented drowsy driver detection using Viola Jones Algorithm. The system has been developed successfully, tested and its limitations are identified. Limitations of the proposed system are

If the driver wears any glasses then the computation doesn't work.

If light directly strikes the camera, the system doesn't work.

If the surrounding is dark, the accuracy will reduce.

The applications are

This system helps to reduce the number of crashes occurs due to drowsiness.

In the medical field, it helps to alert the doctor when a

patient is not opening his/her eyes for a long time.
In educational institutions, it is used to detect the drowsy state of students during lectures.
This can be used to detect drowsiness of employees in companies to alert them.

Future Scope

The model can be improved incrementally by using other parameters like blink rate, yawning, state of the car, etc. If all these parameters are used it can improve the accuracy by a lot.

We plan to further work on the project by adding a sensor to track the heart rate in order to prevent accidents caused due to sudden heart attacks to drivers.

Same model and techniques can be used for various other uses like Netflix and other streaming services can detect when the user is asleep and stop the video accordingly. It can also be used in application that prevents user from sleeping.

The future work may be to detect drowsiness by using external
environmental factors such as weather and fatigue measurement
by analyzing neural networks.
In the real time driver fatigue detection system it is required to slow down a vehicle automatically when

fatigue level crosses a certain limit. Instead of threshold drowsiness level it is suggested to design a continuous scale driver fatigue detection system. It monitors the level of drowsiness continuously and when this level exceeds a certain value a signal is generated which controls the hydraulic braking system of the vehicle.

LIMITATIONS

Limitations of the proposed system are as follows:
If the driver is using sunglasses then the computation doesn't work.If there is the striking light directly on the web-camera then the system doesn't work.

The accuracy of the model degrades if the eye frames are not captured clearly due to any kind of obstacles such as goggles or spectacles having reflection). Camera operations such as auto adjustments with respect to zoom and rotation are not considered in conducting experiments. Once the eyes are localized, zooming in automatically will help increase the accuracy. The accuracy of detection of eyes and mouth reduces when the driver is not facing the camera.

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