DRIVER'S DROWSINESS DETECTION SYSTEM

A DESIGN PROJECT REPORT

Submitted by

DIVYA.C

MIRDULA.S

SWETHA.S

SRI ASHIKA.M

in partial fulfilment for the award of the degree of

BACHELOR OF TECHNOLOGY

in

ARTIFICIAL INTELLIGENGE AND DATA SCIENCE

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

SAMAYAPURAM–621112

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BONAFIDE CERTIFICATE

Certified that this design project report titled **“DRIVER DROWSINESS DETECTION”** is the bonafide work of **DIVYA.C (REG NO:811721243015), MIRDULA.S (REG NO: 811721243028), SWETHA.S (REG NO:811721243056), SRI ASHIKA.M (REG NO: 811721243304)** who carried out the project under my supervision.

SIGNATURE	**SIGNATURE**
Dr.T.Avudaiappan M.E., Ph.D.,	Mr. A. JOSHUA ISAAC M.E.,
HEAD OF THE DEPARTMENT	**SUPERVISOR**
Associate Professor	Assistant Professor
Department of Artificial Intelligence	Department of Artificial Intelligence
K.Ramakrishnan College of Technology	K.Ramakrishnan College of Technology
(Autonomous)	(Autonomous)
Samayapuram – 621 112	Samayapuram – 621 112

Submitted for the viva-voice examination held on ………………

INTERNAL EXAMINER **EXTERNAL EXAMINER**

DECLARATION

We jointly declare that the project report on **"DRIVER DROWSINESS DETECTION"** is the result of original work done by us and best of our knowledge, similar work has not been submitted to **"ANNA UNIVERSITY CHENNAI"** for the requirement of Degree of **BACHELOR OF TECHNOLOGY**. This design project report is submitted on the partial fulfilment of the requirement of the award of Degree of **BACHELOR OF TECHNOLOGY**.

SIGNATURE

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DIVYA.C

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MIRDULA.S

____

SWETHA.S

____

SRI ASHIKA.M

PLACE **:** SAMAYAPURAM

DATE **:**

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ABSTRACT

Drowsiness while driving poses a significant risk to road safety, leading to numerous accidents worldwide. To mitigate this risk, advanced driver assistance systems incorporating drowsiness detection technologies have been developed. It proposes driver’s drowsiness detection and indication system designed to enhance driver safety and prevent accidents caused by drowsy driving. The system utilizes a combination of deep learning algorithms and physiological sensors to accurately detect signs of driver drowsiness and alarm indication to alert other vehicles. These sensors may include eye-tracking cameras, electroencephalography sensors, and steering wheel sensors. Deep learning models are trained on large datasets to recognize patterns associated with drowsiness, such as eye closure duration, blink frequency. The effectiveness of the proposed system is evaluated through extensive simulations Results demonstrate the system's ability to accurately detect drowsiness with high sensitivity and specificity, while also minimizing false alarms.

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CHAPTER 1

INTRODUCTION

A driver drowsiness detection and indication system is a safety feature designed to monitor a driver's alertness and prevent accidents caused by fatigue. It uses sensors and cameras to analyse the driver's behaviour and facial expressions. When signs of drowsiness are detected, the system alerts the driver with visual, auditory, or haptic signals. Advanced systems may even take corrective action, such as suggesting a break. This technology enhances road safety by reducing the risk of drowsiness-related accidents.

1.1 BACKGROUND

A Driver Drowsiness Detection and Indication System is designed to monitor a driver's alertness and provide warnings when signs of drowsiness are detected. This system uses various sensors and technologies such as camera-based facial recognition to analyse the driver's eye movements, blink rates, and head position. Advanced systems may also monitor steering wheel movements and vehicle lane positioning. If the system detects signs of fatigue, it can issue visual, auditory, or haptic alerts to wake the driver and encourage a break. Some systems may offer recommendations for nearby rest stops. The primary goal of such a system is to prevent accidents caused by driver fatigue and improve road safety for all road users.

1.2 PROBLEM STATEMENT

- Many road accidents are caused by drivers experiencing fatigue or drowsiness while operating vehicles.
- This poses a significant risk not only to the driver but also to passengers and other road users.
- A reliable method to monitor driver alertness and detect early signs of drowsiness is necessary to prevent these accidents and improve road safety.
- The challenge is to design a system that can accurately identify drowsiness in real-time using sensor data and provide timely warnings to the driver, prompting them to take appropriate action such as taking a break or pulling over safely.
- The system must be user-friendly, non-intrusive, and compatible with various types of vehicles to ensure wide adoption and effectiveness in reducing fatigue-related accidents.

1.3 OBJECTIVES

Reduce the risk of accidents caused by driver fatigue by monitoring driver alertness.Issue immediate warnings to the driver when signs of drowsiness or inattention are detected.Make the driver more aware of their state of alertness and the potential dangers of drowsy driving.To alert other vehicles using alarm indicator.

- Continuously monitor the driver's alertness levels using various sensors such as cameras and motion detectors.
- Identify signs of drowsiness, such as slow eye movements, frequent blinking, and head nodding, to assess the driver's state of alertness.
- Provide timely alerts (visual, auditory, or haptic) to notify the driver when signs of drowsiness are detected.

- Suggest the driver take a break or find a rest stop if necessary to avoid fatigue-induced accidents.
- Allow the driver to customize alert settings and sensitivity based on individual preferences.
- Reduce the occurrence of false alarms through advanced algorithms that accurately differentiate between fatigue and other behaviors.
- Offer an easy-to-understand interface for the driver to interact with the system and receive alerts.
- Meet regulatory requirements and standards for safety systems in vehicles.

CHAPTER 2

LITERATURE SURVEY

2.1 PRIVACY PRESERVING FEDERATED TRANSFER LEARNING FOR DRIVER DROWSINESS DETECTION.

Author: Linlin Zhang, Hideo Saito , (Senior Member, Ieee),

Year Of Publication: 20 July 2022

Algorithm Used: Transfer Learning, Federated Learning

Abstract : Drowsiness affects the drivers' sensory, cognitive, and psychomotor abilities, which are necessary for safe driving. Drowsiness detection is a critical technique to avoid traffic accidents. Federated learning (FL) can solve the problem of insufficient driver facial data by utilizing different industrial entities data. However, in the FL system, the privacy information of the drivers might be leaked. In addition, reducing the communication costs and maintaining the model performance are also challenges in industrial scenarios. Furthermore, a CKKS-based privacy-preserving protocol is applied to preserve the drivers' privacy data by encrypting the exchanged parameters. The experimental results show that the PFTL-DDD method is superior in terms of accuracy and efficiency compared to the conventional federated learning on the NTHU-DDD and YAWDD datasets. The theoretical analysis demonstrates that the proposed transfer learning method can reduce the communication cost of the system, and the CKKS-based security protocol can protect personal privacy.

Merits: Privacy Preservation, Improved Generalization, Resource Efficiency.

Demerits: Communication Overhead, Security Concerns, Heterogeneous Data.

2.2 DRIVER DROWSINESS DETECTION USING MULTI-CHANNEL SECOND ORDER BLIND IDENTIFICATIONS

Author: Chao Zhang, Xiaopei Wu

Year Of Publication: January 10, 2019

Algorithm Used: Blood Volume Pulse (BVP), Drowsiness Detection, Second-Order Blind Identification (SOBI).

Abstract : It is well known that blink, yawn, and heart rate changes give clue about a human's mental state, such as drowsiness and fatigue. In this paper, image sequences, as the raw data, are captured from smart phones which serve as non-contact optical sensors. Video streams containing subject's facial region are analysed to identify the physiological sources that are mixed in each image. We then propose a method to extract blood volume pulse and eye blink and yawn signals as multiple independent sources simultaneously.By multi-channel second-order blind identification (SOBI) without any other sophisticated processing, such as eye and mouth localizations. An overall decision is made by analysing the separated source signals in parallel to determine the driver's driving state. The robustness of the proposed method is tested under various illumination contexts and a variety of head motion modes. Experiments on 15 subjects show that the multi-channel SOBI presents a promising framework to accurately detect drowsiness by merging multi-physiological information in a less complex way.

Merits: High Accuracy, Robustness, Non-intrusive.

Demerits: Complexity, Data Collection challenges, Generalization

2.3 EARLY IDENTIFICATION AND DETECTION OF DRIVER DROWSINESS BY HYBRID MACHINE LEARNING

Author: Ayman Alta Meem , Ankit Kumar , Ramesh Chandra Poonia.

Year Of Publication: November 30, 2021

Algorithm Used: Driver drowsiness, machine learning, facial expression.

Abstract : Drunkenness or exhaustion is a leading cause of car accidents, with severe implications for road safety. More fatal accidents could be avoided if fatigued drivers were warned ahead of time. Several drowsiness detection technologies to monitor for signs of inattention while driving and notifying the driver can be adopted. Sensors in self-driving cars must detect if a driver is sleepy, angry, or experiencing extreme changes in their emotions, such as anger. These sensors must constantly monitor the driver's facial expressions and detect facial landmarks in order to extract the driver's state of expression presentation and determine whether they are driving safely. As soon as the system detects such changes, it takes control of the vehicle, immediately slows it down, and alerts the driver by sounding an alarm to make them aware of the situation. In the proposed work, an emotion detection method based on Support Vector Machines (SVM) has been implemented using facial expressions. The algorithm was tested under variable luminance conditions and outperformed current research in terms of accuracy. We have achieved 83.25 % to detect the facial expression change.

Merits: Hybrid Machine Learning Approach, Early Identification.

Demerits: Data Privacy Concerns, Resource intensive, Ethical Considerations

2.4 REAL-TIME DRIVER-DROWSINESS DETECTION SYSTEM USING FACIAL FEATURES

Author: Wanghua Deng1 And Ruoxue Wu

Year Of Publication: August 21,2019

Algorithm Used: CNN, Fatigue Detection, Feature Location, Face Tracking.

Abstract : The face, an important part of the body, conveys a lot of information. When a driver is in a state of fatigue, the facial expressions, e.g., the frequency of blinking and yawning, are different from those in the normal state. In this paper, we propose a system called DriCare, which detects the drivers' fatigue status, such as yawning, blinking, and duration of eye closure, using video images, without equipping their bodies with devices. Owing to the shortcomings of previous algorithms, we introduce a new face-tracking algorithm to improve the tracking accuracy. Further, we designed a new detection method for facial regions based on 68 key points. Then we use these facial regions to evaluate the drivers' state. By combining the features of the eyes and mouth, DriCare can alert the driver using a fatigue warning. The experimental results showed that DriCare achieved around 92% accuracy.

Merits: Real-Time Detection, Facial Feature Analysis, Safety enhancement

Demerits: Accuracy and Reliability, Privacy concerns, Environmental Factors

CHAPTER 3

SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Drowsy driving is a prevalent and serious public health issue that deserves attention. Recent studies estimate that around 20% of car crashes have been caused by drowsy drivers. Nowadays, one of the main goals in the development of new advanced driver assistance systems is trustworthy drowsiness detection. In this paper, a drowsiness detection method based on changes in the respiratory signal is proposed. The respiratory signal, which has been obtained using an inductive plethysmography belt, has been processed in real time in order to classify the driver's state of alertness as drowsy or awake.

3.1.1 Algorithm Used

Respiratory Rate Variability (RRV)

It refers to the fluctuations in the rate and pattern of a person's breathing. In the context of driver drowsiness detection, RRV can provide insight into a driver's level of alertness.

Advanced Driver Assistance Systems (ADAS)

This technologies designed to improve vehicle safety and assist drivers with various tasks. ADAS can also incorporate driver drowsiness detection systems to monitor the driver's state and issue alerts if drowsiness is detected.

Respiratory signal

This algorithm in the context of driver drowsiness detection is a method that uses data from respiratory sensors to monitor a driver's breathing patterns.

3.1.2 Drawbacks

- Sensitivity to Noise and Interference
- Limited Scope of Analysis
- False Positives
- Integration Challenges

3.2 PROPOSED SYSTEM

A proposed driver drowsiness detection and indication system uses deep learning to monitor a driver's state and alert others on the road. The system employs cameras and sensors to track the driver's facial features, eye movements, and head position. Deep learning algorithms process this data in real-time to detect signs of drowsiness with high accuracy. When drowsiness is identified, the system activates an internal alarm to alert the driver and prevent accidents. Additionally, the system triggers an external indication light on the vehicle to alert other drivers on the road. This light serves as a warning signal, making surrounding vehicles aware of the potentially impaired driver. The system can integrate with other vehicle safety features such as adaptive cruise control and collision avoidance systems. Continuous learning and data collection allow the system to improve its accuracy over time and adapt to different drivers' behaviors and patterns.

3.2.1 Algorithm Used

Data Acquisition

Sensors such as cameras and physiological monitors collect data from the driver, such as eye movements, facial expressions, and head position.

Feature Extraction and Processing

The acquired data is processed and features relevant to driver drowsiness, such as blinking rate, yawning, and gaze direction, are extracted.

Deep Learning Model

A deep learning model, such as a convolutional neural network (CNN) or a recurrent neural network (RNN), is trained on labeled datasets to learn patterns indicative of driver drowsiness. The model uses the extracted features to classify the driver's state.

Drowsiness Detection

The model continuously analyses incoming data to detect signs of drowsiness in real time.

Alarm and Indication Light

If drowsiness is detected, the system triggers an alarm (auditory, visual, or tactile) to alert the driver. Additionally, an indication light can be activated on the vehicle to warn other vehicles of the potential risk.

Neural Networks

Neural networks, such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Long Short-Term Memory (LSTM) networks, are employed for end-to-end learning of complex patterns in speech data.

3.2.2 Advantages

- Real time drowsiness of driver’s causing accidents and deaths.
- Alert indicator to other vehicles.
- Detects heart attacks.

CHAPTER 4

SYSTEM SPECIFICATION

4.1 HARDWARE SPECIFICATION

- Computer - minimum of 4GB RAM & dual-core processor.
- Webcam - at least 720p & high frame rate of at least 30fps.
- Stable internet connection.
- Storage

4.2 SOFTWARE SPECIFICATION

- Python programming language - Python serves as the primary programming language.
- Operating system - Windows, macOS, Linux distributions
- Python libraries - OpenCV, D lib, TensorFlow
- HTML/CSS or JavaScript - for UI design.

4.3 SOFTWARE DESCRIPTION

It analyse real-time data from sensors and cameras also it identifies patterns indicative of drowsiness, such as slow eye movements, frequent blinks, and head tilting. When drowsiness is detected, the software triggers alerts to the driver via audio, visual, or haptic feedback.

CHAPTER 5

ARCHITECTURAL DESIGN

A system architecture is the Drowsiness Detection and Indication System combines sophisticated hardware sensors, advanced software algorithms, and intuitive indication mechanisms to effectively monitor, detect, and alert users to prevent drowsiness-related incidents. Additionally, robust data logging and reporting capabilities enhance the system's utility for performance evaluation and trend analysis.

5.1 ARCHITETURAL DIAGRAM

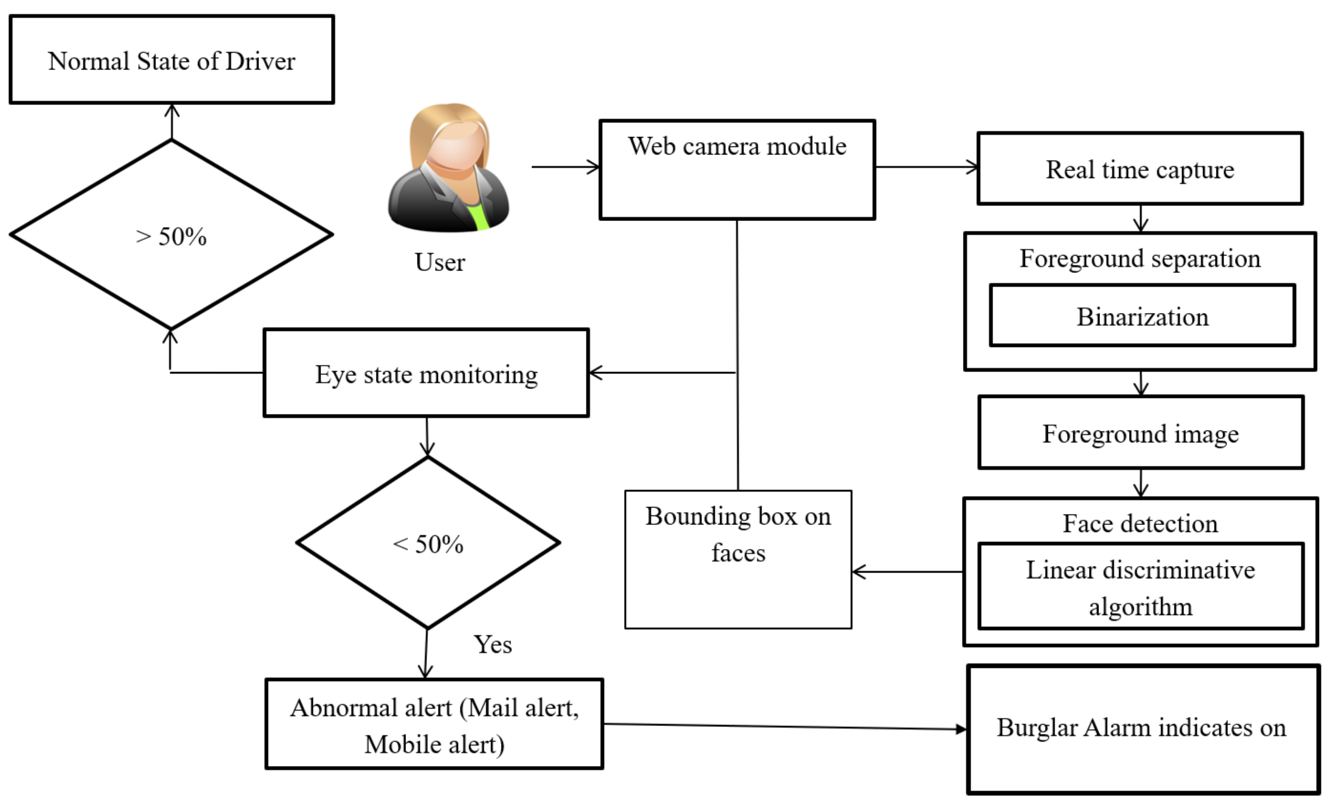


Figure No.5.1.Architectural Diagram

5.2 DATA FLOW DIAGRAM

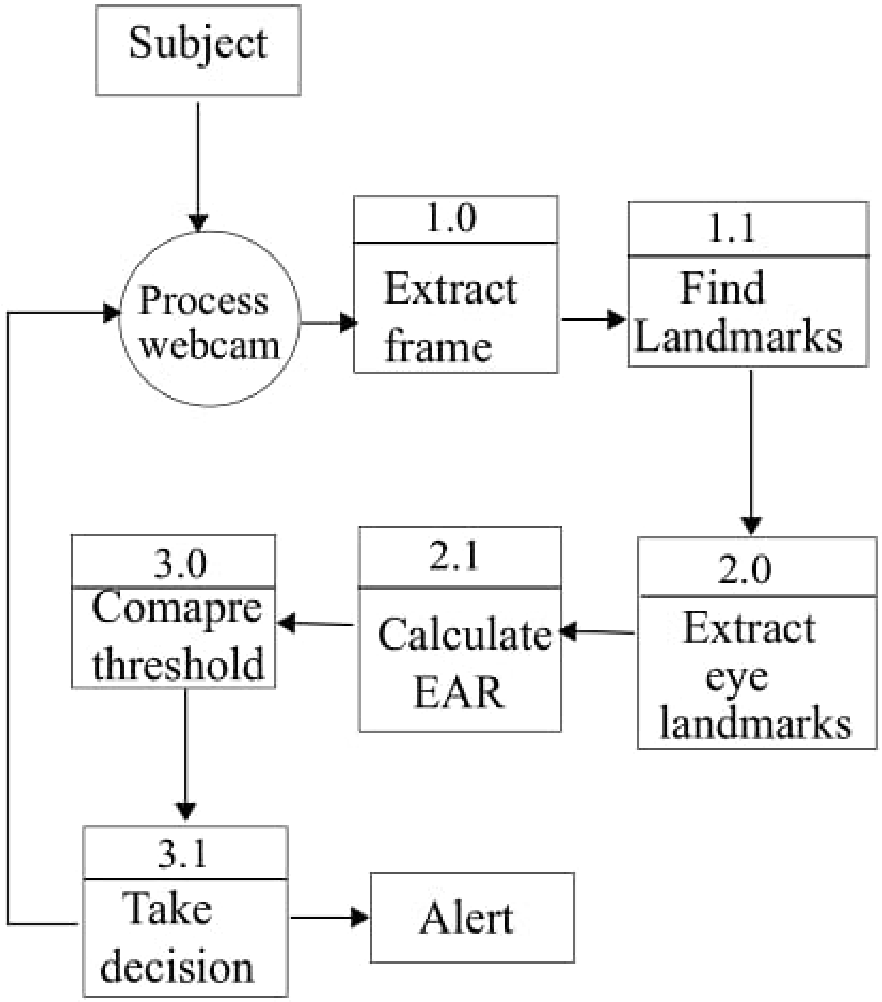


Figure No : 5.2 Data Flow Diagram

5.3 USECASE DIAGRAM

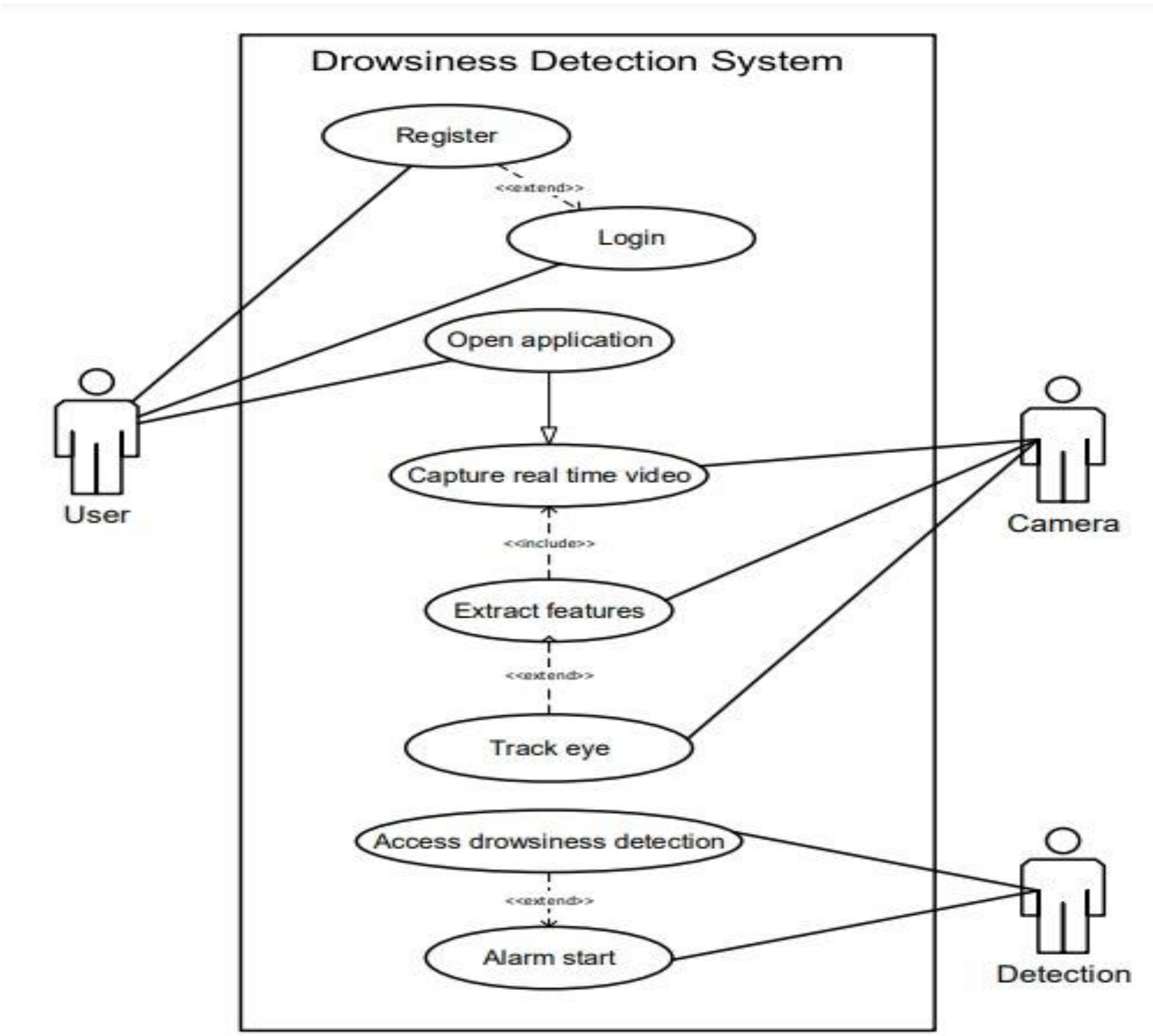


Figure No.5.3 Usecase Diagram

5.4 ACTIVITY DIAGRAM

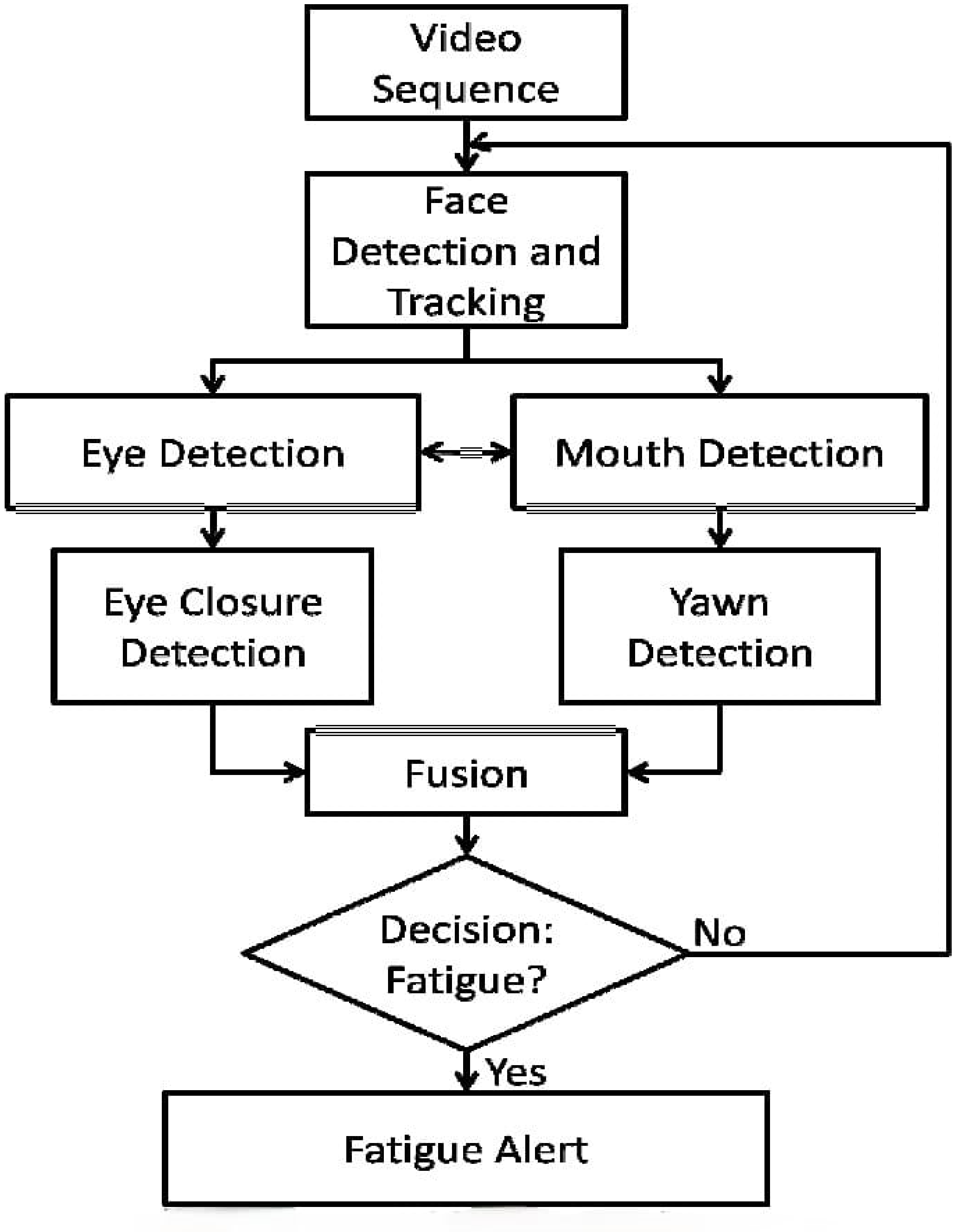


Figure No:5.4 Activity Diagram

5.5 SEQUENCE DIAGRAM

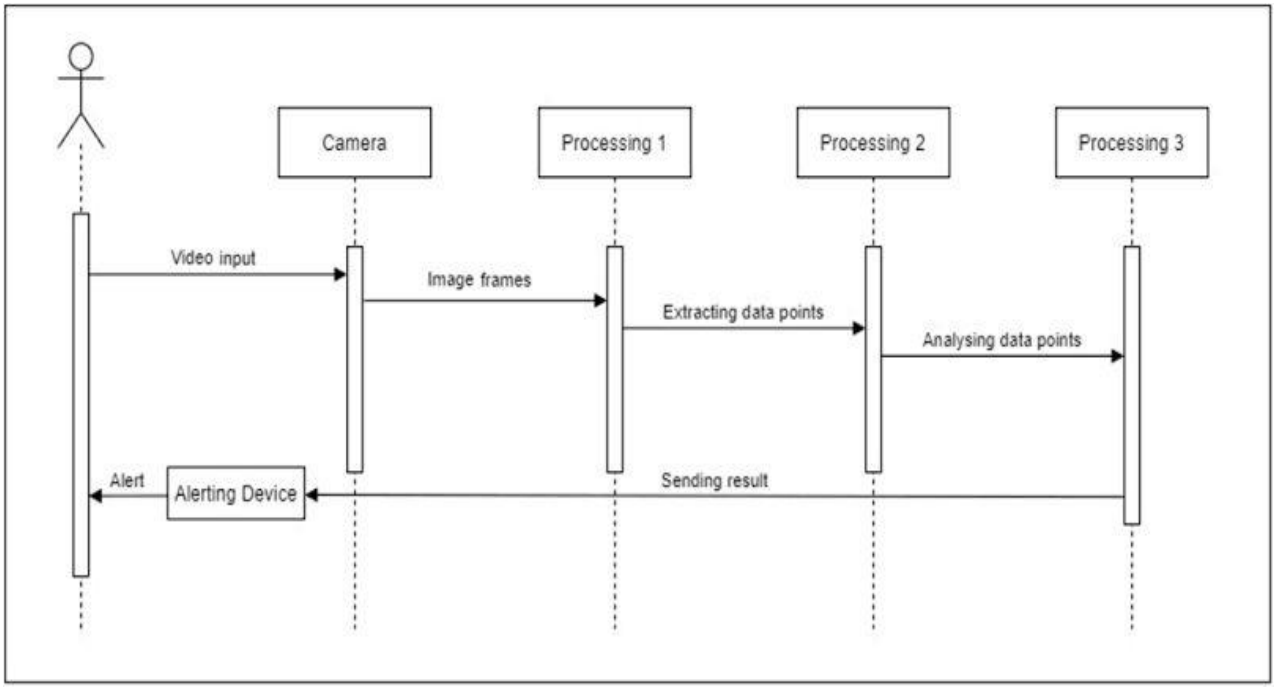


Figure No.5.5 Sequential Diagram

CHAPTER 6

MODULE DESCRIPTION

6.1 MODULES

- Image Processing Module
- Drowsiness Detection Module
- Alerting Module
- Vehicle Control Module
- Decision-Making Module

6.1.1 Image Processing Module

In a Drowsiness Detection and Identification System, the Image Processing Module plays a critical role in analysing visual data to identify signs of drowsiness.

Facial Feature Extraction

The module extracts facial features such as eye movements, blinking patterns, and head pose from video or image data

Eye State Classification

It analyses the extracted eye features to classify the state of the eyes (open, closed, or partially closed). Machine learning algorithms, such as convolutional neural networks (CNNs), are commonly used to classify eye states based on extracted features.

Drowsiness Assessment

Based on the classification of eye states and other facial features, the module assesses the level of drowsiness

6.1.2 Drowsiness Detection Module

In a Drowsiness Detection and Identification System, the Drowsiness Detection Module plays a crucial role in identifying signs of fatigue or drowsiness in users.

Data Acquisition and Processing

The module collects data from various sensors such as infrared cameras, EEG sensors, and accelerometers, capturing vital signs like eye movements, head position, and heart rate variability.

Pattern Recognition and Classification

Using machine learning algorithms,particularly supervised learning technique such as deep neural networks, the module analyses the processed data to recognize patterns associated with drowsiness.

Alert Generation and User Notification

Once drowsiness is detected, the module triggers an alert mechanism to notify the user and/or relevant stakeholders

6.1.3 Alerting Module

In a drowsiness detection and identification system, the alerting module plays a critical role in notifying users or relevant stakeholders about potential drowsiness-related risks.

Real-time Detection Trigger

The alerting module continuously monitors the output from sensors and processing algorithms to identify signs of drowsiness in real-time.

Alert Generation and Delivery

Upon detection of drowsiness, the alerting module generates alerts through various sensory channels such as visual, auditory, and haptic cues.

Adaptive Alerting Strategies

The alerting module employs adaptive strategies to tailor the intensity and frequency of alerts based on contextual factors such as the severity of drowsiness, environmental conditions, and user preferences.

6.1.4 Vehicle Control Module

In a Drowsiness Detection and Identification System integrated with a Vehicle Control Module

Real-time Monitoring

The module continuously monitors driver behaviour and physiological signals using sensors such as cameras, infrared sensors, or EEG devices.

Risk Assessment

Based on the collected data, the module assesses the level of drowsiness and evaluates the risk of potential accidents or lapses in attention.

Intervention and Alerting

When drowsiness is detected, the module triggers appropriate interventions to alert the driver and mitigate the risk.

6.1.5 Decision-Making Module

In a Drowsiness Detection and Identification System, the Decision-Making Module plays a crucial role in processing data from various sensors and determining appropriate actions based on the detected level of drowsiness

Data Fusion and Analysis

The decision-making module in a drowsiness detection system aggregates data from various sensors and sources, such as eye movement trackers, EEG sensors, and vehicle speed sensors.

Risk Assessment and Alert Generation

Once the data is analysed, the decision making module assesses the level of risk posed by the detected drowsiness. It considers factors such as the severity of drowsiness.

Adaptive Response and Intervention

The decision-making module continuously adapts its responses based on real-time feedback and contextual changes.

CHAPTER 7

CONCLUSION AND FUTURE ENHANCEMENT

7.1 CONCLUSION

- In conclusion, the implementation of a driver drowsiness detection system, incorporating indication lights and alarms, stands as a crucial stride towards enhancing road safety and preventing accidents.
- By employing advanced technology to monitor driver alertness, this system acts as a vigilant companion, intervening when fatigue jeopardizes concentration.
- The combination of indication lights and alarms serves as both a visual and auditory cue, promptly alerting drivers to their compromised state and urging them to take necessary breaks or corrective actions.
- Through such proactive measures, the incidence of accidents stemming from driver drowsiness can be significantly reduced, safeguarding lives and fostering a safer transportation environment for all road users.

7.2 FUTURE ENHANCEMENT

- In the realm of driver safety, the future holds promising advancements in drowsiness detection systems designed to prevent accidents and save lives on the road.
- These systems, equipped with sophisticated sensors and AI algorithms, will continuously monitor drivers' behaviour and physiological signals to detect signs of drowsiness or distraction.
- Integrated with intuitive indication lights and alarm mechanisms, they will provide timely alerts to drivers, prompting them to take necessary breaks or corrective actions.

- As technology evolves, these systems may become even more seamless, perhaps integrating with vehicle control mechanisms or wearable devices for enhanced effectiveness.
- With such innovations, the future of road safety is poised to witness a significant reduction in accidents caused by driver fatigue or inattentiveness.
- And also use several potential avenues for further development and improvement.

Here are some future directions for enhancing the system

- Advanced Sensor Integration
- Customizable Alert Systems
- Integration with Vehicle Systems
- Integration with Navigation Systems
- Machine Learning Algorithms
- Moreover, addressing standards, ethical guidelines, and developing cost- effective hardware solutions will contribute to responsible and widespread deployment The project’s future lies in creating a versatile ,user friendly drivers drowsiness detection system that significantly contributes to public safety and prevent from accidents.

APPENDIX 1 SORCE CODE

```
import argparse
import imutils
import time
import cv2
import dlib
import numpy as np
from scipy.spatial import distance
from imutils.video import VideoStream
from imutils import face_utils
import playsound
# construct the argument parse and parse the arguments
ap = argparse.ArgumentParser()
ap.add_argument("-p", "--shape-predictor", required=True,
help="path to facial landmark predictor")
ap.add_argument("-a", "--alarm", type=str, default="",
help="path alarm.WAV file")
ap.add_argument("-w", "--webcam", type=int, default=0,
help="index of webcam on system")
args = vars(ap.parse_args())
# define two constants, one for the eye aspect ratio to indicate
# blink and then a second constant for the number of consecutive
# frames the eye must be below the threshold for to set off the
# alarm
```

```
EYE_AR_THRESH = 0.3
EYE_AR_CONSEC_FRAMES = 48
# initialize the frame counter as well as a boolean used to
# indicate if the alarm is going off
COUNTER = 0
ALARM_ON = False
# initialize dlib's face detector (HOG-based) and then create
# the facial landmark predictor
print("[INFO] loading facial landmark predictor...")
detector = dlib.get_frontal_face_detector()
predictor = dlib.shape_predictor(args["shape_predictor"
# define a function to sound the alarm
def sound_alarm(path):
# play an alarm sound
playsound.playsound(path)
# define a function to compute the eye aspect ratio
def eye_aspect_ratio(eye):
# compute the euclidean distances between the two sets of
# vertical eye landmarks (x, y)-coordinates
A = distance.euclidean(eye[1], eye[5])
B = distance.euclidean(eye[2], eye[4])
# compute the euclidean distance between the horizontal
# eye landmark (x, y)-coordinates
C = distance.euclidean(eye[0], eye[3])
```

```
# compute the eye aspect ratio
ear = (A + B) / (2.0 * C)
# return the eye aspect ratio
return ear
# grab the indexes of the facial landmarks for the left and
# right eye, respectively
(lStart, lEnd) = face_utils.FACIAL_LANDMARKS_IDXS["left_eye"]
(rStart, rEnd) = face_utils.FACIAL_LANDMARKS_IDXS["right_eye"]
# start the video stream thread
print("[INFO] starting video stream thread...")
vs = VideoStream(src=args["webcam"]).start()
time.sleep(1.0)
# loop over frames from the video stream
while True:
# grab the frame from the threaded video file stream, resize
# it, and convert it to grayscale
frame = vs.read()
frame = imutils.resize(frame, width=450)
gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
# detect faces in the grayscale frame
rects = detector(gray, 0)
# loop over the detected face rectangles
for rect in rects:
# determine the facial landmarks for the face region
shape = predictor(gray, rect)
```

```
# extract the left and right eye coordinates, then use the
# coordinates to compute the eye aspect ratio for both eyes
shape = face_utils.shape_to_np(shape)
leftEye = shape[lStart:lEnd]
rightEye = shape[rStart:rEnd]
leftEAR = eye_aspect_ratio(leftEye)
rightEAR = eye_aspect_ratio(rightEye)
# average the eye aspect ratio together for both eyes
ear = (leftEAR + rightEAR) / 2.0
if ear < EYE_AR_THRESH:
COUNTER += 1
# if the eyes were closed for a sufficient number of
# frames, then sound the alarm
if COUNTER >= EYE_AR_CONSEC_FRAMES:
# if the alarm is not on, turn it on
if not ALARM_ON:
ALARM_ON = True
if args["alarm"]!= "":
sound_alarm(args["alarm"])
else:
COUNTER = 0
ALARM_ON = False
# draw the computed eye aspect ratio on the frame to help
# with debugging and setting the correct eye aspect ratio
# thresholds and frame counters
cv2.putText(frame)
```

APPENDIX 2 SCREENSHOTS

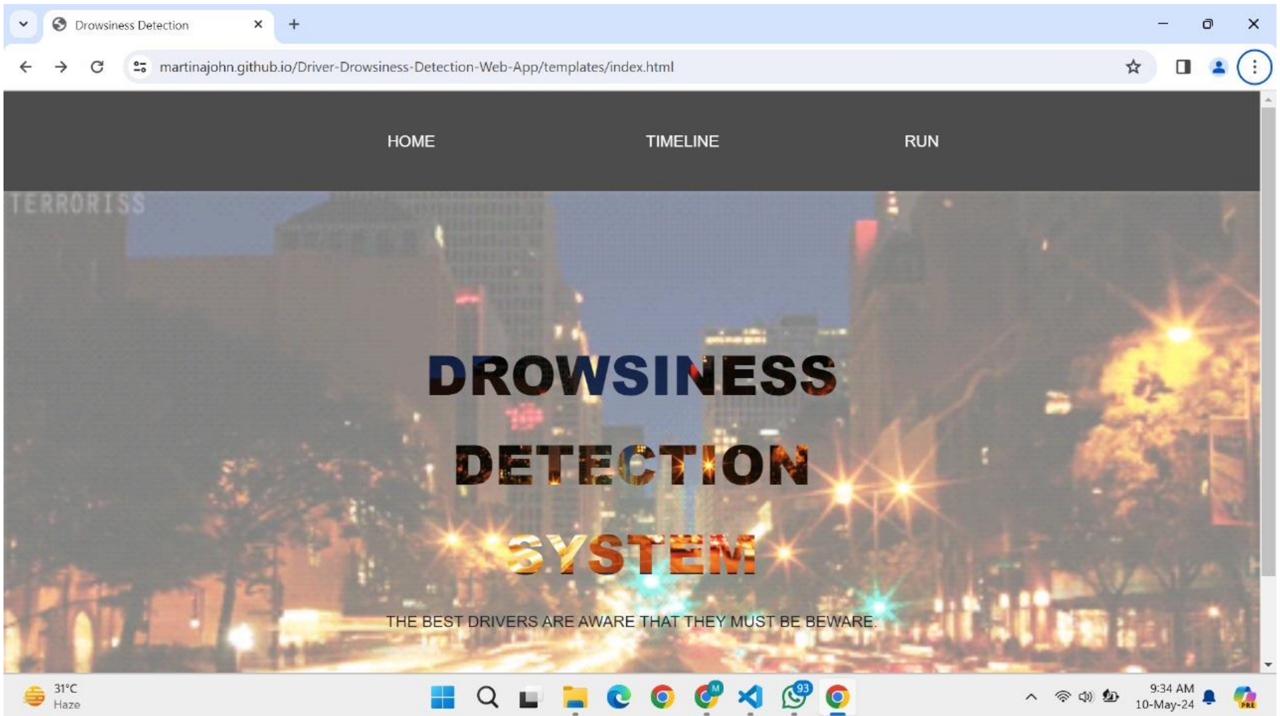


Figure No.A.2.1 Home Page

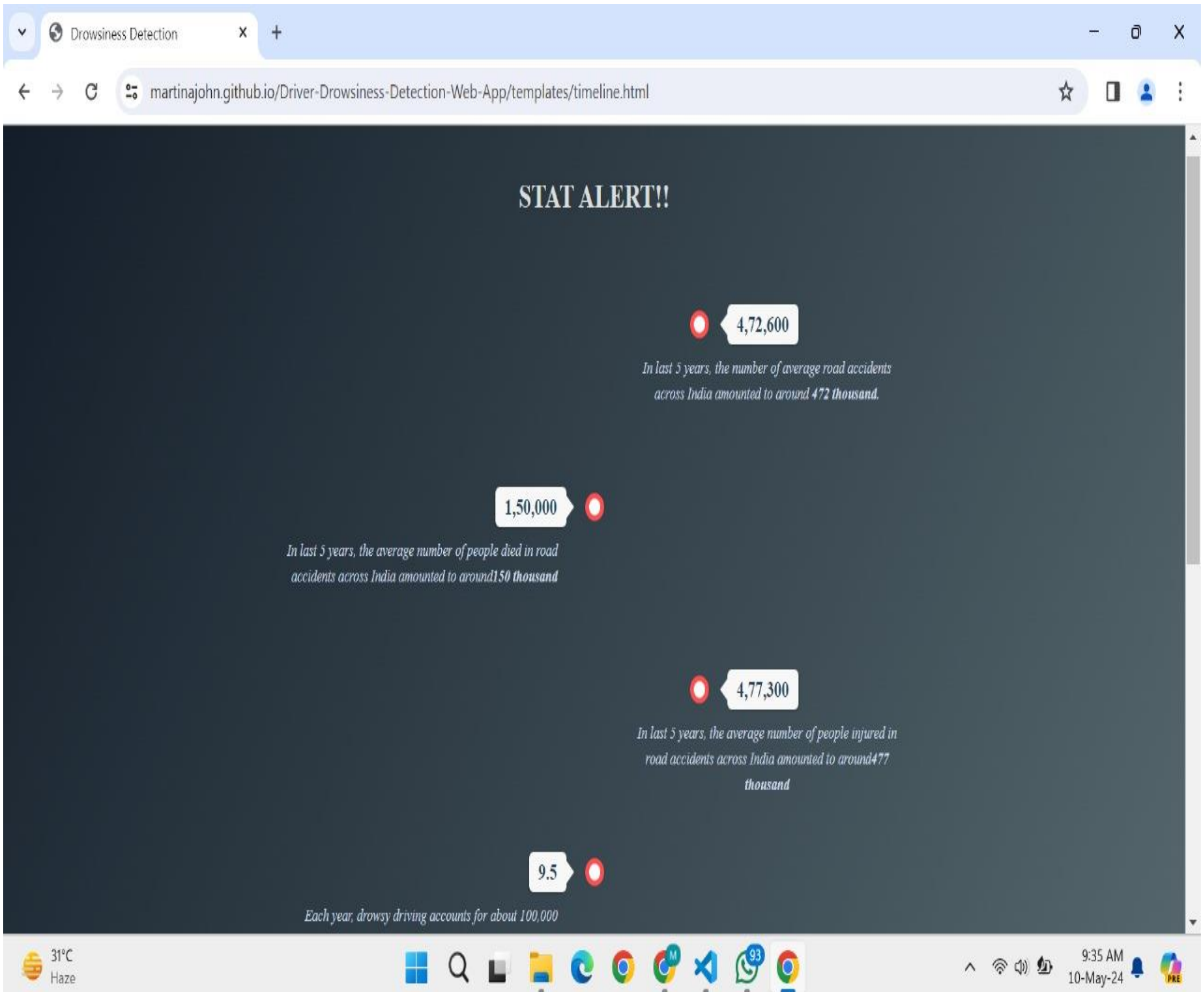
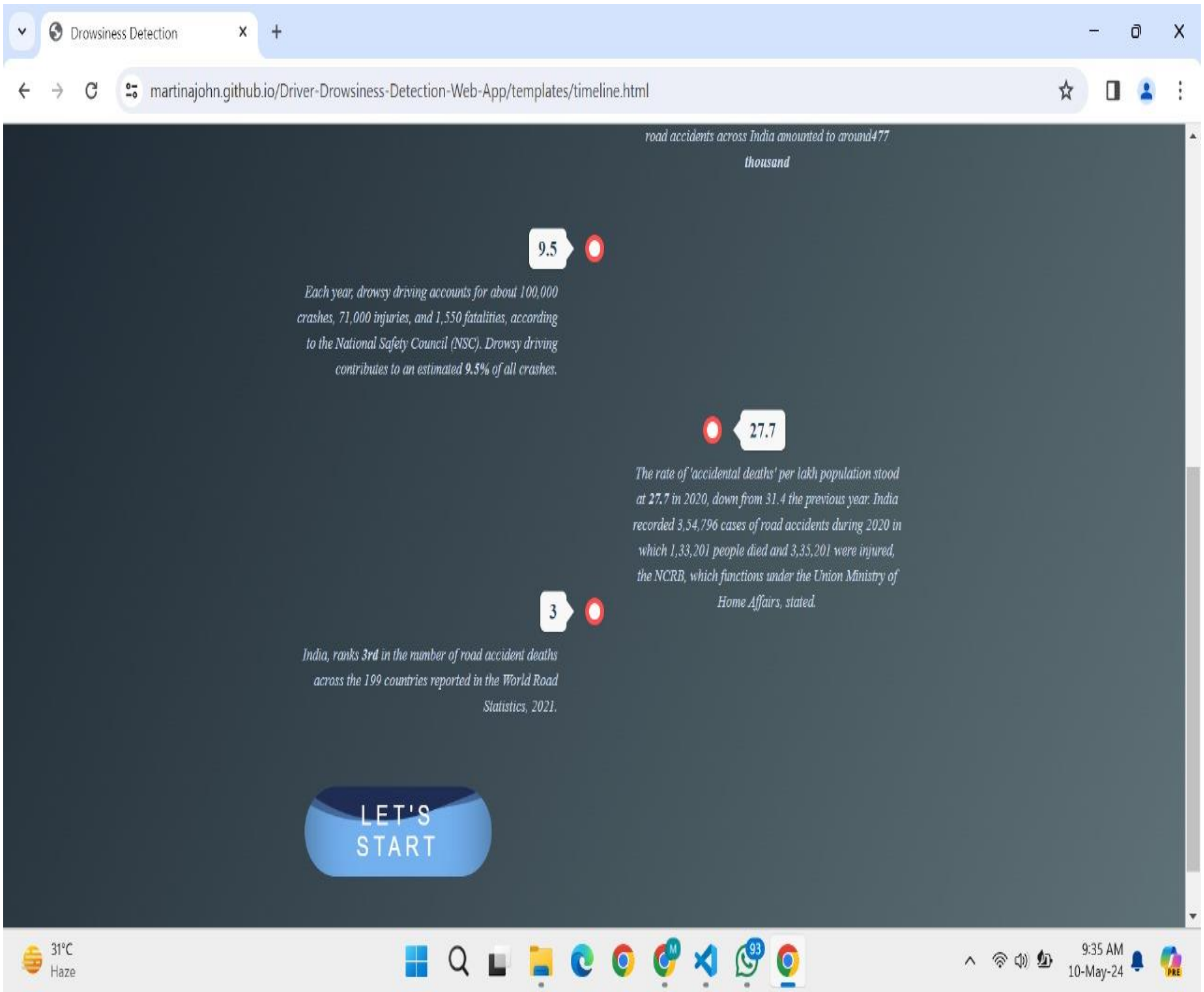


Figure No.A.2.2 Information Page



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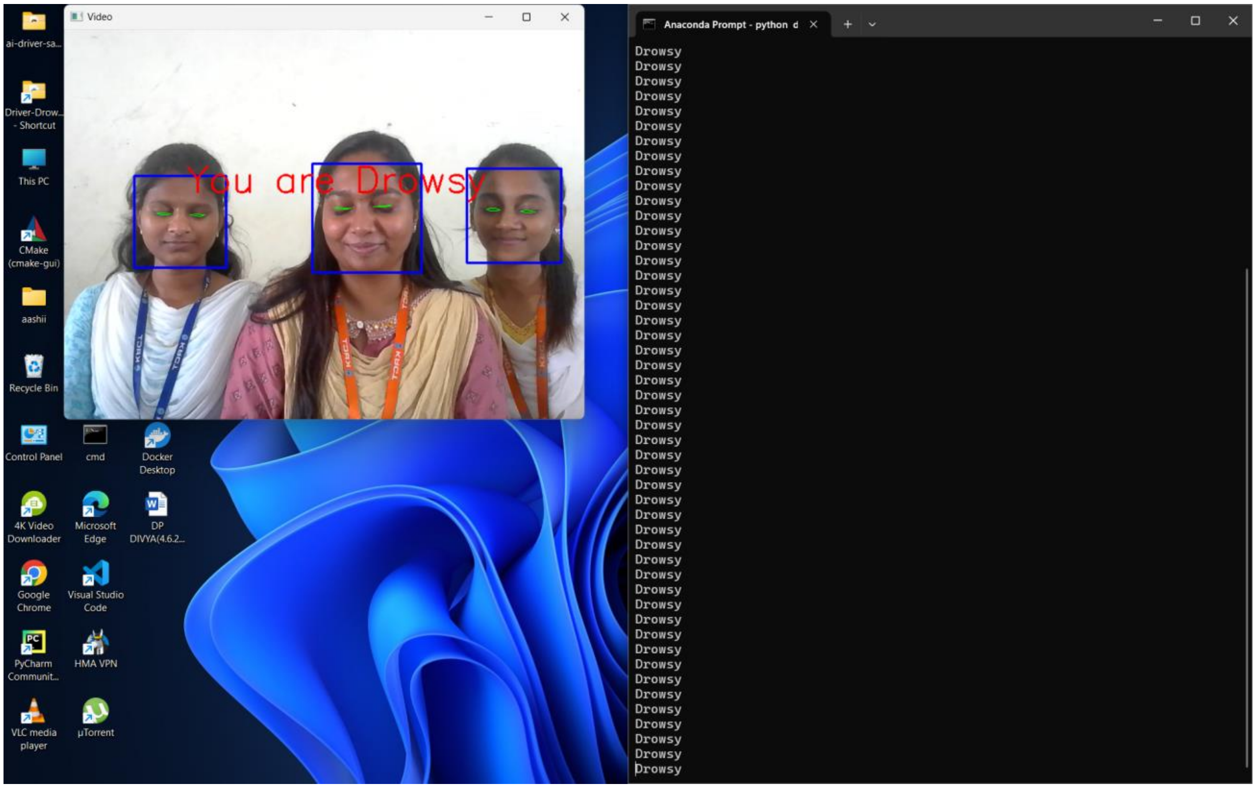

Figure No.A.2.4.Drowsiness Detected

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