SMART CAR ANTI-THEFT SYSTEM WITH DRIVER ASSISTANCE

By

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2023

Faculty of Engineering Sciences and Technology
Hamdard University, Karachi – Islamabad Campus, Pakistan

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Under the supervision of
Engr. Abdullah Umar

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A project presented to the
Faculty of Engineering Sciences and Technology
In partial fulfillment of the requirements
for the degree of

Bachelors of Engineering
In
Electrical Engineering

Faculty of Engineering Sciences and Technology
Hamdard University-Islamabad Campus, Pakistan

Faculty of Engineering Sciences and Technology

Hamdard University–Islamabad Campus Pakistan

CERTIFICATE

This project **"SMART CAR ANTI-THEFT SYSTEM WITH DRIVER ASSISTANCE"** presented by **Ali Tarique, Anas Mukhtar, Javad Hussain Bijarani, Saad Abdullah** under the direction of their project advisor's and approved by the project examination committee, has been presented to and accepted by the Hamdard Institute of Engineering and Technology, in partial fulfillment of the requirements for Bachelor of Engineering (Electrical).

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(Project Supervisor)

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Engr. Talha Riaz
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ABSTRACT

This project is a demonstration of a Smart Car Anti-Theft system with integrated Driver Assistance features. The antitheft and driver assistance features are realized by using fingerprint sensors, flex sensors, GSM modules, and Raspberry Pi controller. The system aims to strengthen the vehicle security against theft attempts while enhancing driver safety and convenience. The experiments involved the seamless integration of hardware components and the development of complex software algorithms to manage anti-theft mechanisms and driver assistance functionalities. The algorithm used for face detection is HAAR CASCADE CLASSIFIERS that identify real-time video or an image. Hardware testing and debugging, optimization, and data analysis will confirm the system's effectiveness in preventing theft and providing real-time driver support. This innovative fusion of anti-theft and driver assistance technologies holds promise for a safer and smarter automotive future.

Final Year Design Project as a Complex Engineering Problem

It is to certify here that the final year design project (FYDP) entitled,

Smart car anti-theft system with driver assistance is categorized as a complex engineering problem (CEP) based on the preamble (in-depth engineering knowledge) and involvement of the following attributes.

1. Preamble - In-depth engineering knowledge
2. Range of conflicting requirements
3. Depth of analysis required
4. Depth of knowledge required
5. Familiarity of issues
6. Extent of applicable codes
7. Extent of stakeholder involvement and level of conflicting requirement
8. Consequence
9. Interdependence

The above listed attributes are thoroughly assessed after conducting meeting on 3rd November 2022, with the following final year students, who proposed the idea of the titled FYDP.

1. Name: Saad Abdullah
   Reg No : ECI-IT-19-028
2. Name: Javad Hussain Bijarani
   Reg No: ECI-IT-19-074
3. Name: Anas Mukhtar
   Reg No: ECI-IT-19-075
4. Name: Ali Tarique
   Reg No: ECI-IT-19-038

This project is going to be conducted in Fall semester 2022 and spring semester 2023. Further, it is submitted that the proposed idea is worthy, and the required efforts are up to the level of a final year design project.

FYDP Advisor: FYDP Co-Advisor:

Engr. M. Abdullah Umar **Engr. Talha Riaz**

Sustainable Development Goals

This section presents a brief overview of all the SDGs and mainly justifies the contribution of the project to the sustainable development goals (SDGs). Detailed justification of the mentioned points is presented in Table 1.

Table 1 SGD Table of the Project

Sr. No	Title	Compliance (Y/N)	Remarks/Justification
1	No poverty	No	Not applicable
2	Zero hunger	No	Not applicable
3	Good health/wellbeing	No	Driver Assist features will help driver in drowsy condition and risk of accidents will be reduced
4	Quality education	No	Not applicable
5	Gender equality	No	Not applicable
6	Clean water and sanitation	No	Not applicable
7	Affordable and clean energy	Yes	Not applicable
8	Decent work and economic Growth	Yes	Not applicable
9	Industry, innovation and Infrastructure	Yes	Project contributes to the safety of vehicles through anti-theft features by incorporating state-of-the-art techniques
10	Reduced Inequalities	No	Not applicable
11	Sustainable Cities and Communities	No	The anti-theft features are an effort towards safety of vehicles, that are a public property
12	Responsible consumption and Production	Yes	Not applicable
13	Climate action	No	Not applicable
14	Life below water	No	Not applicable
15	Life on land	No	Not applicable
16	Peace, Justice and strong Institutions	No	Not applicable
17	Partnerships for the goals	No	Not applicable

1.7 Complex Engineering Problem

This project satisfies the attributes of the complex engineering problem, in the given context, this section presents the justification that how the presented work addresses different attributes of the complex engineering problem. The details are presented below:

Mapping

Sr. No	Attribute	Justification
1	Preamble - In-depth engineering knowledge	The project requires in depth knowledge of microcontrollers, sensors, cameras, computer vision, and embedded systems.
2	Range of conflicting requirements	Performance, range of operation and cost are the balancing factors involved
3	Depth of analysis required	The project requires in depth analysis of vehicle vulnerability conditions and driver drowsiness
4	Depth of knowledge required	The knowledge of Computer vision techniques, Python and embedded systems is critical in development of this project
5	Familiarity of issues	Familiarity of financial and human resource loss associated with vehicle theft and drowsiness induced accidents is required
6	Extent of applicable codes	Safety and legal compliance must be considered
7	Extent of stakeholder involvement and level of conflicting requirement	The project involves coordination with law enforcement agencies and highways authority
8	Consequences	Reduced risk of road accidents and safety of vehicles
9	Interdependence	Cameras, embedded control and computer vision models are interdependent

ACKNOWLEDGMENTS

We must give credit to **Hamdard Institute of Engineering and Technology** for their assistance with this project, which was a major accomplishment for our undergraduate team.

We would like to thank the **Engr Abdullah Umar** for being our supervisor. We would like to express our profound gratitude for their astute advice, generous assistance, and warm demeanor, which motivates us to succeed in the project and brings it to fruition.

We appreciate the assistance of our co-supervisor, **Engr M. Talha Riaz**. We want to express our sincere appreciation for their astute advice and help in maintaining my progress on schedule.

Several people, particularly classmates and team members, provided insightful remarks and recommendations on this project, which inspired us to enhance the undertaking. We express our gratitude to everyone who contributed directly or indirectly to the project's completion.

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ABBREVIATIONS

I/O	Input/output
GND	Ground
V	Voltage
A	Ampere
PLC	Programmable Logic Controller
SCADA	Supervisory Control and Data Acquisition
IoT	Internet of Things
DC	Direct Current
AC	Alternating Current
PC	Personal Computer
TIA	Totally Integrated Automation
ProfNet	Process Field Network
IP	Internet Protocol
CAD	Computer-Aided Design
VFD	Variable Frequency Drive
RPM	Rotation Per Minute
LED	Light Emitting Diode
DVM	Digital Volt Meter
OB	Organizational Block
FC	Function Coil
TCP	Transmission Control Process
V	Version

CHAPTER 1

INTRODUCTION

The risk of car or vehicle theft is a major concern in modern cities around the world. The limited availability of vehicle monitoring and surveillance facilities makes them vulnerable and exposed to criminals. The design and development of efficient and cost- effective car anti-theft systems is required to reduce the risk of financial loss associated with car theft. The proposed anti-theft system will ensure the safety of car by using the owner's identity through his or her fingerprint. The system will accept the fingerprints of car owner or his authorized person e.g. some family member or driver to avoid the use of vehicle by some unauthorized person.

Pakistan has reported the highest number of deaths in road accidents in Asia. Pakistan ranked at 48th number in the World in terms of road accident deaths. Road accidents kill nearly 1.35 million people worldwide each year, while 20-50 million suffer non-fatal injuries and according to the reports, the Anti-Vehicle Lifting Staff (AVLS) has found 125 vehicles in different parts of Pakistan. In accordance with a press release, the department recovered 32 vehicles, 93 motorbikes, weapons, jammers, and more tools that had been taken a few days earlier.

Due to the threat of car theft and accidents we have designed a system which will helps in increasing the driver safety and the biometric authentication system is difficult to hack or bypass which will make car door lock more secure due to this theft of vehicles became difficult. This system will be helpful in future.

1.1 Motivation

Our project's motivation is to provide car owners with a single, integrated solution that keeps their vehicles safe from theft while also making driving more secure and convenient. By combining anti-theft technology with driver assistance features, we aim to offer a comprehensive and user-friendly solution that enhances both car security and the driving experience.

1.2 Problem Statement

The design of car safety and driver assist systems is a recent trend in electronic automotive industry. The project aims to satisfy the demand for an integrated driver assistance and anti-theft car lock system. Current solutions either only concentrate on preventing theft or supporting drivers, which results in a fragmented user experience, exposes vehicles to theft, and deprives drivers of necessary safety features. The difficulty lies in creating a single system that seamlessly integrates anti-theft measures with driver assistance features, assuring both increased driver convenience and vehicle security. The proposed project is realized by using computer vision techniques with state-of-the-art electronic components.

1.3 Significance and Proposed solution

Car lock systems are of a considerable importance as they provide a crucial layer of protection against car theft and unauthorized access. These systems safeguard valuable assets and enhance vehicle security, giving owners peace of mind. Proposed solutions for car lock systems include central locking systems that enable simultaneous locking/unlocking of doors and windows, keyless entry systems that utilize electronic key fobs or/ proximity sensors for convenient access, smart locks that allow remote locking/unlocking using smartphones, and biometric locks that use advanced authentication methods like fingerprints or facial recognition.

On the other hand, camera drowsiness detection holds great significance in promoting driver safety on the roads. Drowsy driving is a major cause of accidents, posing risks to both the driver and others on the road. Computer vision-based drowsiness detection systems can monitor driver behavior and promptly detect signs of drowsiness, helping to prevent accidents. By utilizing techniques like eye-tracking and facial recognition, these systems can identify indicators of drowsiness, such as drooping eyelids or yawning, and alert the driver through audio or visual prompts. This assists in reducing the occurrence of accidents caused by drowsy driving, ultimately enhancing overall road safety.

1.4 Aims and Objectives

- To design a cost-effective anti-theft security and driver assistance system
- To identify efficient anti-theft methodology and driver assist algorithm by review of literature
- To implement anti-theft features
- To implement driver, assist features
- To integrate driver assistance and anti-theft features into complete system and develop the prototype

1.5 Sustainable Development Goals

This section presents a brief overview of all the SDGs and mainly justifies the contribution of the project to the sustainable development goals (SDGs). Detailed justification of the mentioned points is presented in Table 1.

Table 2: SGD Table of the Project

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1.6 Complex Engineering Problem

This project satisfies the attributes of the complex engineering problem, in the given context, this section presents the justification that how the presented work addresses different attributes of the complex engineering problem. The details are presented in Table 2.

Table 3: CEP Attributes Mapping

Sr. No	Attribute	Justification
1	Preamble - In-depth engineering knowledge	The project requires in depth knowledge of microcontrollers, sensors, cameras, computer vision, and embedded systems.
2	Range of conflicting requirements	Performance, range of operation and cost are the balancing factors involved
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1.7 Report organizations

This report expresses the full progress and the implementation of how car lock system and its driver assistance system work. The report is divided into the many stages of development. The upcoming chapters are going to provide further details about anti-theft system. Chapter 2 covers the literature review. Chapter 3 expresses the experimental setup and procedure of the project. Chapter 4 describes material and components used in the project. Chapter 5 covers the software and hardware implementation of the project. Chapter 6 explains the results and discussion of the project and chapter 7 covers the conclusion and future recommendation.

CHAPTER 2

LITERATURE REVIEW

2.1 Related Research

This system generally includes advanced keyless access systems with vehicle immobilizers, GPS automobile monitoring capabilities, and clever vehicle security functions. Moreover, it may incorporate driving force assistance functionalities together with collision detection, lane departure warnings, and blind spot monitoring. These included structures provide complete protection in opposition to robbery whilst imparting extra protection blessings on the road. Connected automobile structures and clever security systems are well worth exploring for an extensive variety of options on this category.

In today's fast-paced technological landscape, where innovations are occurring across all sectors, technology's pervasive influence is unmistakable. It finds extensive application in various domains, including security systems, which are crucial for deterring car theft and minimizing the risk of accidents. Improving vehicle security systems can greatly benefit customers by ensuring the safety of both drivers and their families. Simultaneously, the mounting incidence of daily road accidents underscores the need for enhanced safety measures. In this paper, we introduce an Integrated Vehicle Security System (IVSS) that amalgamates multiple applications to bolster safety. The IVSS includes a fingerprint recognition system at the vehicle's entrance to thwart theft and utilizes indoor face recognition to activate the vehicle's engine. Additionally, it integrates a driver alcohol detection system to prevent intoxicated individuals from driving, thus averting potential accidents. All these applications are seamlessly connected to a GSM module, serving the dual purpose of notifying the owner in the event of recognition failure—whether from the fingerprint or face recognition systems—and providing essential information. Furthermore, the IVSS interfaces with a GPS module for real-time tracking of the vehicle's location in cases of theft. [1]

This research introduces an advanced anti-theft vehicle security system, incorporating GPS, GSM, and fingerprint biometrics. Its purpose is to combat vehicle theft by identifying and tracking remote vehicles. Key components include GPS, GSM, and fingerprint modules, enabling precise vehicle location and authorized user authentication. The system also allows user-vehicle communication via SMS commands for added security. [2]

Compact cars have spread in popularity as people's economic circumstances get better, becoming essential pieces of daily transportation equipment. Car safety is of the utmost importance because of their value as personal assets. In this article, a design that fuses a single-chip microprocessor with a mobile application is shown. The central detection and control unit for the anti-theft system in new vehicles uses a 52 single-chip microcontroller and provides two unlocking options: fingerprint and password. An Internet of Things (IoT) approach to car safety is mainly created by fingerprint unlocking, which is renowned for its speed and security. By integrating with communication modules, customers can obtain exact real-time car security updates through the app. [3]

This paper presents the use of fingerprint-based biometric access control to enhance the safety and security of Electric Vehicles (EVs), which play a crucial role in reducing carbon emissions. Researchers are increasingly focusing on improving EV safety measures due to the rising population and its correlation with road accidents. Negligence, drunk driving, and vehicle theft are common concerns. This paper proposes an advanced safety and security system for EVs that incorporates fingerprint recognition to prevent unauthorized access and theft. The system was successfully implemented and tested in an E-Bike, demonstrating its effectiveness in ensuring vehicle security. As the electric vehicle market continues to grow, robust security systems become increasingly vital. [4]

Face recognition is a trustworthy biometric technique. Because it is based on data about the features of a human face and can work in a range of scenarios, it can be used for both car security and alarm systems. This survey research recommends the development of a car guard and alarm system that uses biometric security based on facial recognition systems. Additionally, expand the framework to include tiredness prediction based on monitoring ocular attributes. It is frequently a problem that different eye monitoring systems that have been introduced up to this point are sensitive to shifting lighting conditions. For merging face recognition with drowsiness detection, we can use a hybrid system. A security mechanism that can be used is the Driver Face Recognition-Anti Theft System in the context of driving. The driver's face is first registered, and after that, facial recognition is used to identify the person. Moreover, to track the states of the eyes using the more accurate Convolutional Neural Network technology and to recognize faces using the HAAR Cascade algorithm. Use the Python Framework to test this survey while driving if a driver is seen acting oddly while keeping their eyes closed, an automatic alarm may sound, warning the neighboring residents. [5]

In recent years, globally, a critical measure to prevent traffic accidents has been the identification of drowsy drivers. With over 350 daily fatalities and nearly 1,000 injuries resulting from accidents, recent technological advancements hold the potential to reduce this trend by 40%. This study introduces an intelligent alerting system intended to stop accidents brought on by driver weariness, despite major obstacles. This approach, which can be integrated into smart cars, can prevent impaired driving caused by tired drivers. The method uses eye distance measurements and eye aspect ratio (EAR) analysis of live video streams of drivers to spot sleepiness cues. Its usefulness in lowering dangerous accidents and injuries from traffic shows in experimental findings. [6]

In the past decade, advancements in computing technology and artificial intelligence have led to notable improvements in driver monitoring systems. This paper offers an updated review of driver drowsiness detection systems developed during this period. It categorizes these systems based on the information they utilize, provides details on features, classification algorithms, and datasets used. The evaluation includes final classification accuracy, sensitivity, and precision. The paper also discusses current challenges, practicality, reliability, and future trends in driver drowsiness detection. [7]

2.1.1 Road Accidents Statistics

Except for the bearers, road accidents in Pakistan are of no consequence. Governments' responsibility to reduce traffic accidents by formulating stringent rules. A total of 104,105 accidents, including 44,959 fatal and 59,146 non-fatal accidents, have been reported in Pakistan from 2009 to 2020, according to the data that is currently available. These mishaps resulted in 55,141 fatalities and 126,144 injuries. These incidents included a whopping 120,501 automobiles and resulted in enormous material loss. It can be speculatively assumed that these incidents, deaths, and injury totals are simply the tip of the iceberg and that the actual statistics would be considerably more heartbreaking due to a paucity of follow-up reporting culture. [8]

In addition to technology's rapid advancement (particularly in the area of information technology), the number of vehicles on the highways and roads has grown significantly in recent years. Road traffic accidents (RTAs) have been reported in substantial numbers in developing nations due to the growth in the number of automobiles. The absence of adequate management (including RTAs data) and consumer guidance are the main causes of RTAs in these nations. In the first half of 2017, a research was done on the M-9 Motorway segment between Hyderabad and Karachi. The statistics showed that a total of 17 accidents occurred during the stated time, resulting in the reported loss of 15 lives and 54 injuries. 30 other vehicles also sustained damage. Considering such causes and motivations for RTAs, this study has concentrated on reviewing the reported RTAs in the literature that is currently available. The data analysis shows that careless driving, poor road conditions, and poor vehicle maintenance are the main contributors to accidents. [9]

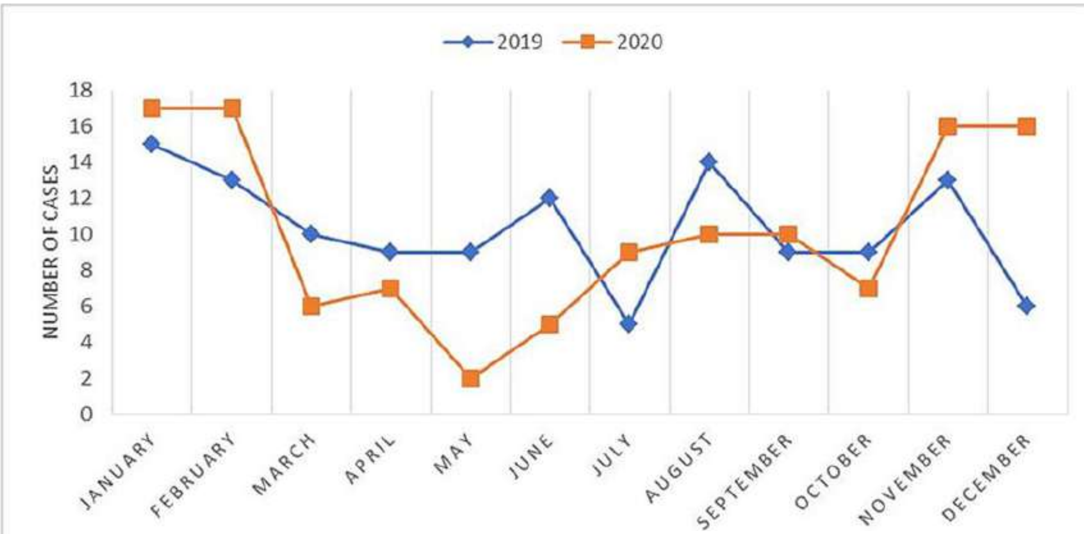
2.1.2 Causes of Road Accidents

According to data published by the World Health Organization on avoiding traffic-related injuries and deaths (WHO, 2004), up to 50 million people are injured and 1.2 million people worldwide are predicted to die in road accidents each year. Forecasts show that if no additional commitment to prevention is made within the next 20 years, their numbers will rise by almost 65%.

It is commonly known that many African and Asian countries currently have a significant problem with traffic accidents (Jacobs & Cutting, 1986). Despite the fact that conditions are normally civilized in Europe and North America, casualty rates (per certified vehicle) are much greater in poor nations than in industrialized ones, according to Jacobs (1995). For instance, across 12 European countries, the number of people who lost loved ones in automobile accidents decreased by almost 20% between 1969 and 1986. In eight Asian nations during the same era, the number of deaths increased by about 150 percent.

Road accidents claim up to 90,000 lives annually in addition to causing significant human misery, and they are swiftly emerging as a serious concern in the majority of the world's largest cities. Accident causes can be precisely determined with the aid of accident data analysis, which can offer guidance on a variety of road accident challenges. Many scholars, notably Smeed (1968), have concentrated their research on the subject of traffic collisions and assert to have produced ground-breaking advances in the field. Smeed (1968) investigated the differences in accident rate models among countries as well as their reasons. [10]

The total number of accident cases report in our entire World. The blue line represents the cases of 2019 and the orange line shows the cases of 2020 and it was more than 2019 as shown in the figure 2.1.



Road Traffic Accidents in Karachi (monthly Trend)

Figure 2.1: Car accidents statistics [11]

2.1.3 Vehicle Theft Statistics

The data from the Citizens Police Liaison Committee reveals that, out of the 188 automobiles reported stolen from various parts of the city last month, 14 were recovered, and 174 remain missing. Furthermore, during the first three months of this year, 14,080 motorbikes and 593 automobiles were reported stolen. With 5,057 motorcycles reported stolen last month, it is evident that motorcycles continue to be the most targeted vehicles for theft in the first three months of the year 2023. [12]

2.1.4 GSM Technology in Anti-Theft car lock System

The biometric authentication plays a significant part in the high security offered by the car door locking system that is based on biometric authentication. Today, security is crucial to protecting our data from unauthorized parties and ensuring its confidentiality. The major goal of this article is to use finger print authentication as a unique id to safeguard the car from unauthorized individuals. The standard door locking system is replaced with a finger print scanner at the location of the car's door locking system, providing the car owner with greater security. The other signal system is also created by utilizing a GSM module to convey the message to the mobile device of the car owner. The Raspberry Pi is used to operate the entire system. [13]

This figure 2.2 shows the Global system of mobile phone (GSM) connected with the microcontroller (Arduino). With the help of GSM, we will send the message to the mobile phone by inserting sim in it.

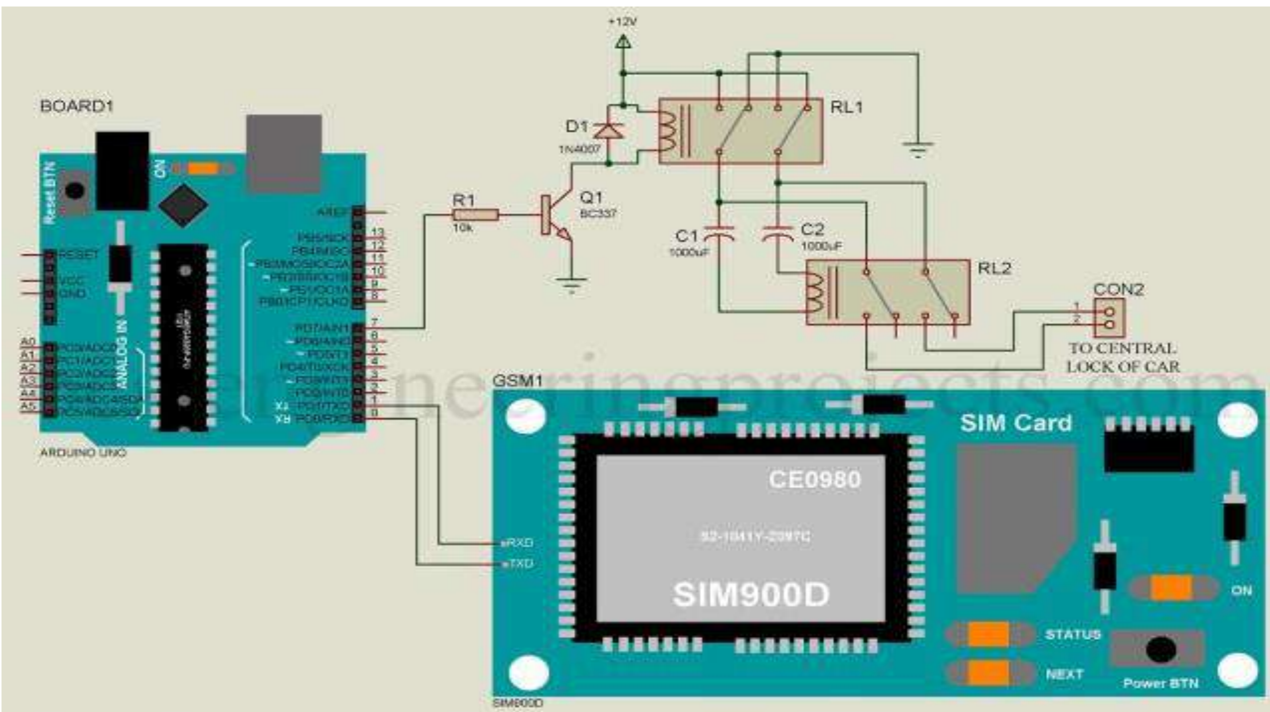


Figure 1: Circuit Diagram of Arduino and GSM 900 Based Car Lock System

Figure 2.2: GSM Module connected with controller [14]

2.1.5 Steering wheel detection by Flex Sensor Glove

Each finger on the flex sensor glove has a flex sensor affixed above it that measures how much the finger bends. A Microcontroller (Arduino) reads these sensors, and then sends the results over serial communication to Unity.

2.1.6 Accident Prevention by drowsiness detection by camera

The world's leading contributor to accidents is driver weariness. The most accurate technique to gauge driver weariness is by observing the driver's level of drowsiness. The development of a sleepiness detection system is the goal of this paper. This technology works by analyzing the driver's eye movement and notifying them when they are asleep by sounding the buzzer. A non-intrusive real-time monitoring system for eye detection has been put into place with this technology. The technology has the ability to determine whether the eyes were open or closed while being monitored. A signal was sent to the driver to warn them if their eyes were closed for an extended period of time. Additionally, the system has the choice to vibrate when drowsiness is detected. Without being intrusive, the goal is to increase the driver's safety. Using a webcam, visual cues were collected from eye blink rates, which normally indicate a person's level of attention. To determine the driver's state of weariness, these were systematically combined and extracted in real-time. The technology can keep an eye on the driver's eyes to spot brief naps of three to four seconds. This approach's system operates at 8–15 frames per second. A single camera view and Open CV were used to develop the application on a Raspberry Pi. This technology was supposed to prevent accidents on the road by identifying the driver's tiredness. [15]

This figure 2.3 shows the step by step performance of drowsiness detection by the help of camera. When the driver feels little bit dizzy the camera detects the drowsiness and generates an alarm.

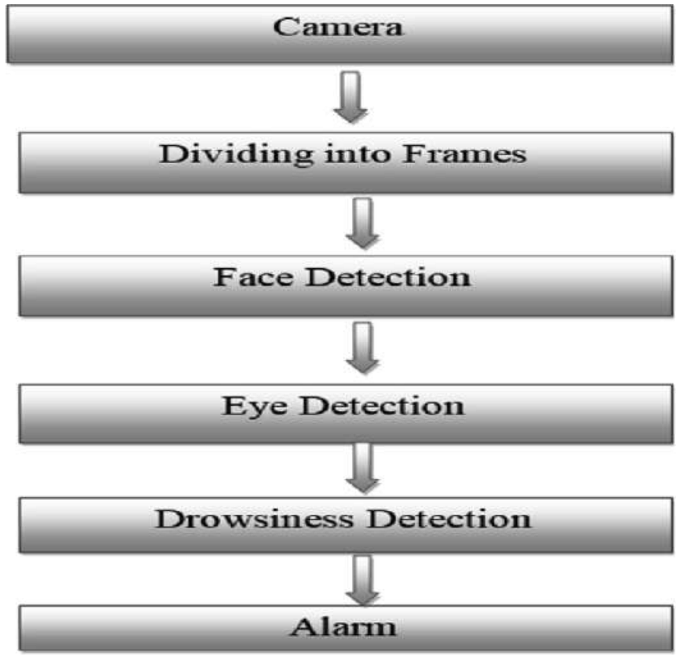


Figure 2.3: Drowsiness detection performance [16]

CHAPTER 3

EXPERIMENTAL SETUP AND PROCEDURE

3.1 Introduction

This FYP project aims to develop a smart car anti-theft system with driver assistance features. The project involves integrating advanced technologies into a vehicle to enhance security and provide additional safety and convenience to the driver. The experimental setup contains selecting and integrating hardware components, developing software code to control functionalities, and testing the system's performance. Through comprehensive testing, calibration, and data analysis, the project aims to validate the effectiveness of the anti-theft system and driver assistance features. User trials and feedback evaluation will further contribute to refining the output. The project will be document and presented to showcase the outcomes and achievements of these innovative smart car solutions.

3.2 Phases of Project

The project is divided into two phases.

- Project hardware.
- Project software system

3.2.1 Project Hardware

Making the project's hardware framework is the initial stage of the project. A list of the hardware, tools, and supplies needed to finish the project is created in this step.
Project hardware includes all components that will be used in the project, including materials, supplies, tools, machinery, and equipment.

3.2.2 Rectangle box of plastic

This figure 3.1 shows a plastic box in which we have adjusted our all the components. The box cut in rectangular shape first and placed all the parts inside it carefully.

Figure 3.1: Rectangular box for adjustments of project components

3.2.3 After fitting components

After cutting the box in right manner we will place and adjust the components in the box. In this figure camera, flex sensor and fingerprint sensor these main components are connected by Raspberry pi 3b+ and all are controlled by the software. As shown in figure 3.2

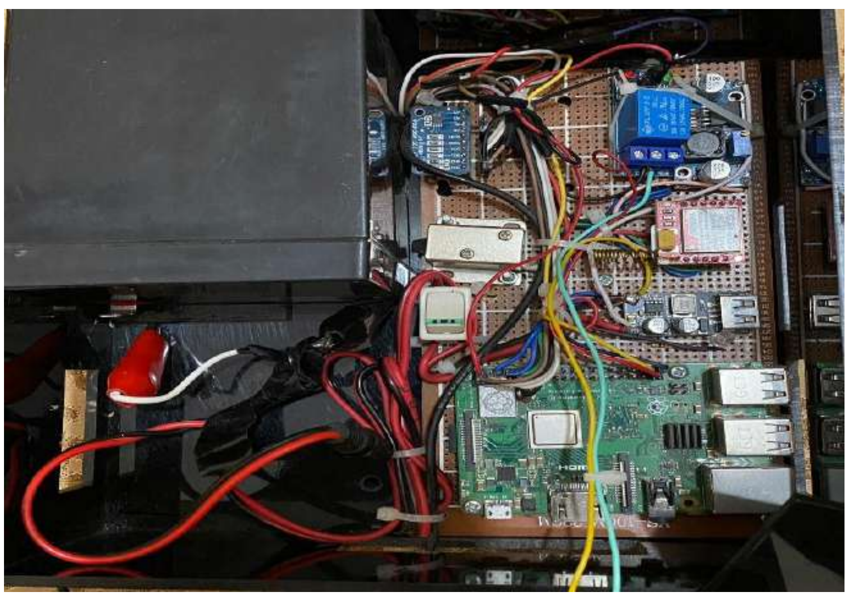


Figure 3.2: Project connections

3.2.4 Fingerprint Sensor

Fingerprint scanner integrated into our cutting-edge car security system offer an unparalleled level of protection for vehicle owner's. Designed to ensure only authorized individuals gain access, the technology provide a seamless and secure experience. With just a touch the scanner swiftly identifies the owner's unique finger fingerprint. This figure 3.3 shows the fingerprint sensor which is connected with the controller. This fingerprint sensor will use for car unlocking when the owners' fingerprint after the correct matching.

Figure 3.3: Finger print sensor

3.2.5 Flex Sensor

The flex sensor, a critical component in our driver's assist system, serves as the bridge between human control and advanced vehicle technology. This innovative sensor precisely detects subtle changes in the driver's grip on the steering wheel, translating these inputs into real-time data that enhances safety and convenience. The flex sensor plays a pivotal role in making driving safer and more comfortable. It's the seamless connection between human intuition and cutting-edge automotive intelligence, ensuring a smoother and smarter ride for drivers everywhere. In this figure 3.4 a flex sensor is installed on one of the fingers and it is connected with the controller. When the finger is on steering wheel and it is not in bend position while driving it start beeping.

Figure 3.4: Flex sensor on glove

3.2.6 Camera for Drowsiness detection

The drowsiness detection camera is a compact and vital component within modern vehicle safety systems. It continuously monitors the driver’s face and eye movements, swiftly detecting signs of fatigue and drowsiness. When these indicators are detected, it triggers alarms or prompts alerts to ensure the driver remains attentive, reducing the risk of accidents caused by drowsy driving. This figure 3.5 shows the camera which is installed on the top our project with a plastic strip. The camera will detect the drowsiness while driving the car.

Figure 3.5: Camera

3.2.7 Complete Project Hardware

This is the project after putting all the components in it and connected with each other through wire carefully. All the components are separately attached from each other there is much space for the components. This figure 3.6 shows the complete project in which camera, fingerprint sensor and flex are connected with it. The other components are inside the box. The sensors are controlled with the help of controller which is raspberry pi 3b+.

Figure 3.6: Complete project

3.3 Raspberry pi programming

For this raspberry pi 3b+ programming two software's have been used one is IP scanner and the other one is Real VNC viewer

3.3.1 IP Scanner

The IP scanner scans the IP of the raspberry pi as shown in the photo. This IP is used for the wirelessly connection of raspberry pi. Then this IP is put in other software for raspberry pi connection. This figure 3.7 shows the desktop window of IP scanner which is one of the software used in the project. The IP scanner will help to find the correct IP which is then used in other software.

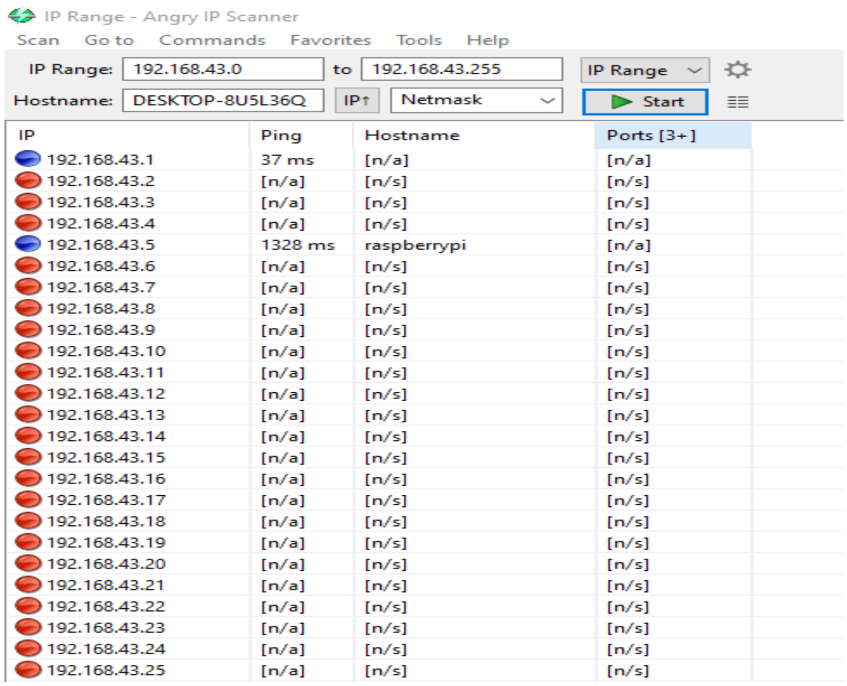


Figure 3.7: IP scanner desktop

3.3.2 Real VNC Viewer desktop for programming

After putting the IP of raspberry pi in the Real VNC viewer a desktop screen appears in front of you. From this software we will do the programming for our project. This is the screen of raspberry pi connected by the software in which we will perform the function of Fingerprint and detection of eyes and hand on steering wheel through programming which will perform in this desktop screen. This figure 3.8 shows the desktop window of Real VNC viewer which is the main software used for raspberry pi 3b+ working. We have used Python language for raspberry pi 3b+.

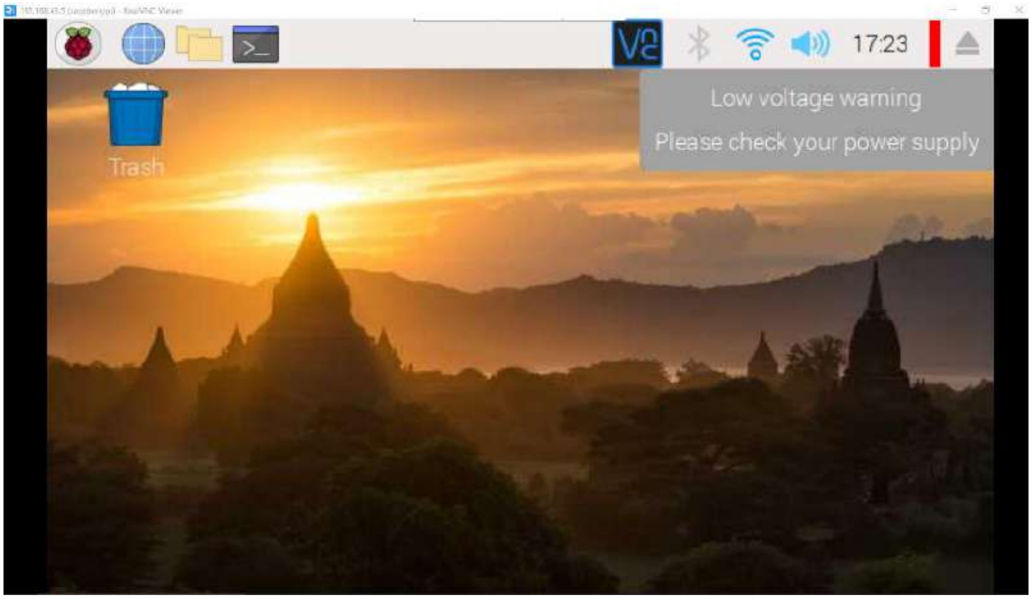


Figure 3.8: Real VNC viewer desktop

3.3.3 Select Programming

Select the programming on left top corner and then we will select the python 3 for our coding from which we will perform all our project fuctions. In this figure 3.9 it shows Real VNC viewer desktop for raspberry pi coding.

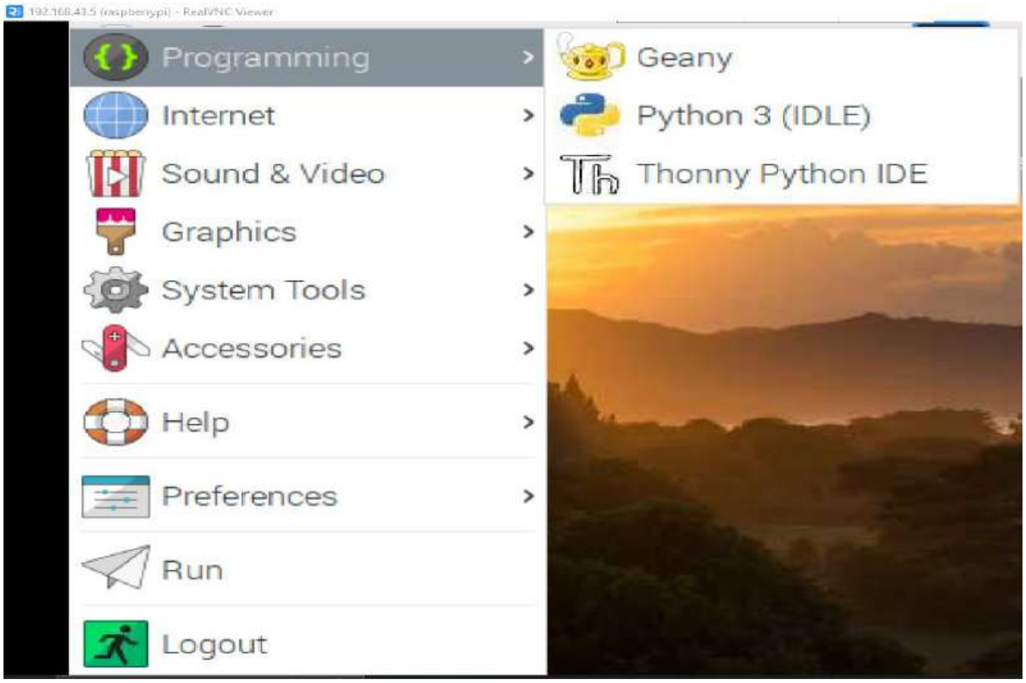


Figure 3.9: Programming Screen

3.3.4 Open new file

This figure 3.10 shows how to open the new file of different coding of related project. This will perform in Real VNC viewer desktop.

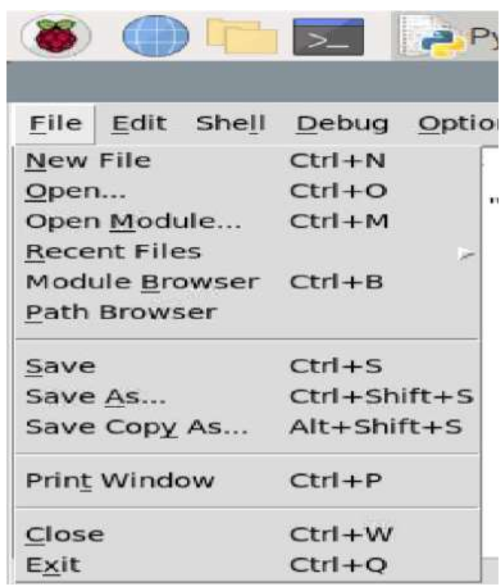


Figure 3.10: VNC viewer file selection

3.3.5 Selecting file

In this figure 3.11 we will select the project drowsiness file which is then open in the Real VNC viewer desktop. After opening the file, we will than perform different functions related to our project.

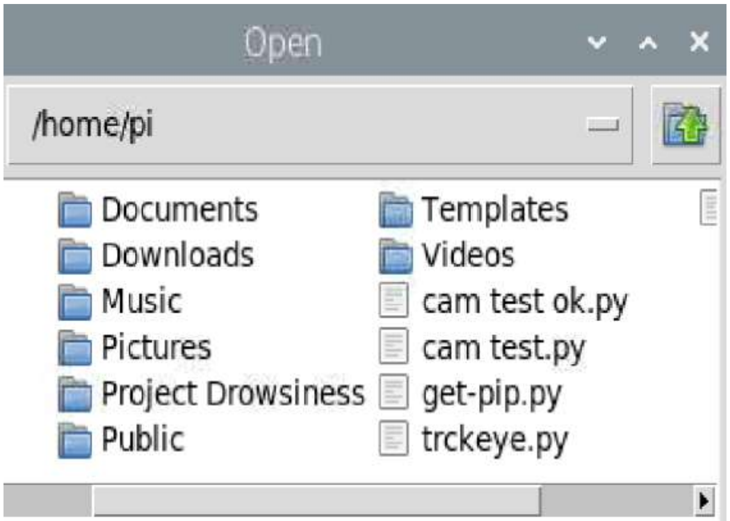


Figure 3.11: Project drowsiness detection by software

3.3.6 Fingerprint Testing

The code will appear in Real VNC viewer when we will perform fingerprint function. From this code you will enroll your fingerprint, save or remove your fingerprint depend on our choice. In this figure 3.12 a screen is shown from which we can perform fingerprint testing.

```
Python 3.7.3 (default, Oct 31 2022, 14:04:00)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license()" for more information.
>>>
=========== RESTART: /home/pi/Project Drowsiness/finger test ok.py =====
----------------
Fingerprint templates:  [0, 1, 2, 3, 5, 6, 7, 8, 12, 15]
Number of templates found:  10
Size of template library:  1000
e) enroll print
f) find print
d) delete print
s) save fingerprint image
r) reset library
q) quit
----------------
> |
```

Figure 3.12: Fingerprint checking on software

3.3.7 Drowsiness Testing

This screen will appear when your fingerprint will be approved by sensor and then another screen will appear from that your drowsiness will be detected. In this figure 3.13 we will see that if your eyes are closed during camera testing a beeping will start and drowsiness detected will start showing on your screen.

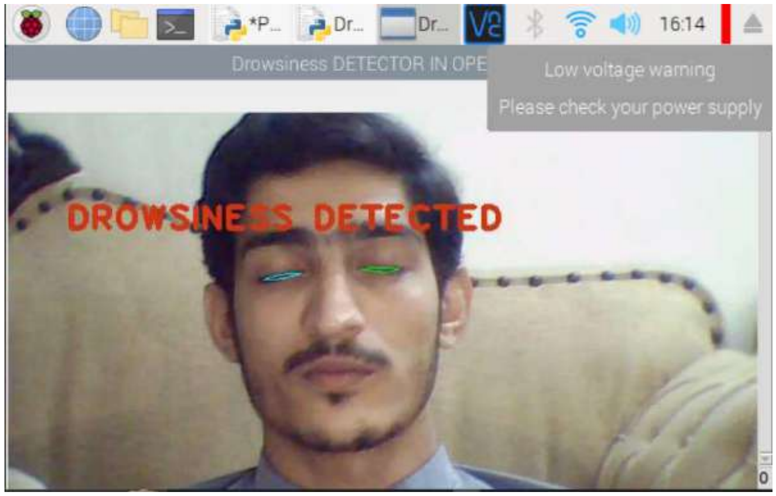


Figure 3.13: Drowsiness detection on Real vnc viewer desktop

CHAPTER 4

MATERIALS AND COMPONENTS

4.1 Raspberry Pi 3b+

On the open-source Raspberry Pi platform, you may find a variety of related documents. so that you can modify the system in accordance with the demands. It is a board for advancement in the PI collection. It may be regarded as a single-board laptop with a LINUX operating system. The board is suitable for advanced applications because it not only offers a ton of features but also has excellent processing speed. This figure 4.1 shows the internal structure of controller.

Figure 4.1: Raspberry pi 3b+ [17]

4.1.1 Raspberry Pi 3 Pin Mapping

The Raspberry Pi Foundation created the single-board computer known as the Raspberry Pi 3 Model B+. An improved version of the Raspberry Pi 3 Model B was released in March 2018. With a 1.4 GHz quad-core ARM Cortex-A53 CPU, 1GB of RAM, and integrated wireless connectivity—both Wi-Fi and Bluetooth—this little and reasonably priced computer has it all. In addition, it features four USB 2.0 connections, a 3.5mm audio socket, an HDMI output, a Gigabit Ethernet port, and a microSD card slot for storage. The Raspberry Pi 3B+ is a versatile and user-friendly board that is extensively used for a wide range of projects, from educational to DIY electronics. It is a well-liked option for enthusiasts and tinkerers because it strikes a mix between performance and power efficiency. The figure 4.2 shows the internal structure of raspberry pi 3b+ model.

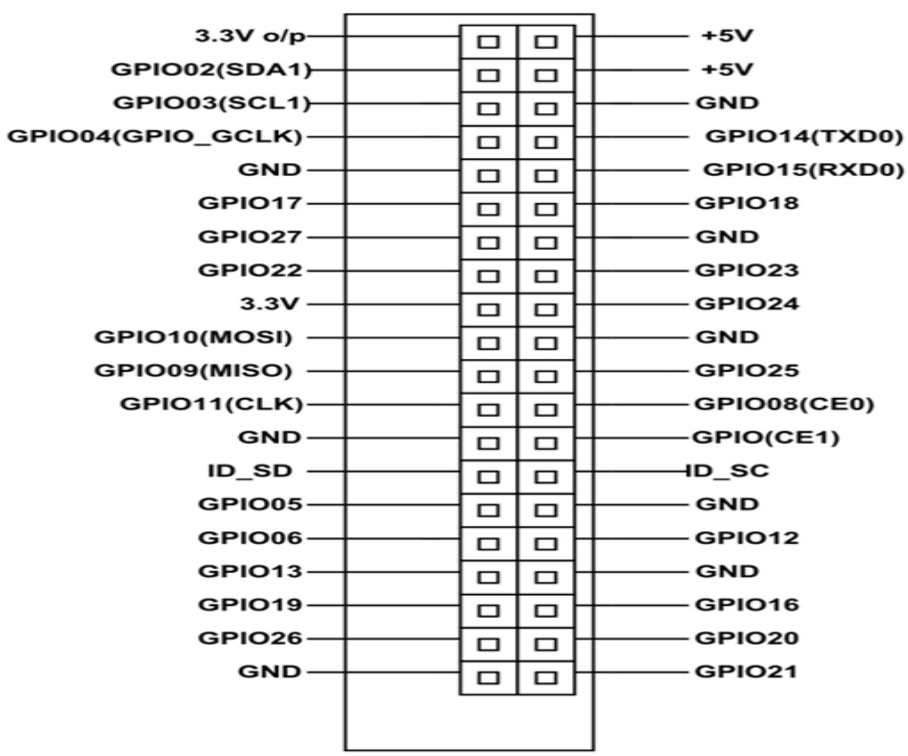


Figure 4.2: Mapping of raspberry pi 3b+

4.2 Camera

The Driver Drowsiness Detection System is being tested. After roughly 10 seconds, a window displaying the live stream from your Raspberry Pi camera will emerge. As soon as the tool recognizes a face, it will print your call on the picture and begin tracing your eyes. To test the alarm, now close your eyes for 7 to 8 seconds. This figure 4.3 shows the camera connection with the controller.

Figure 4.3: Camera for drowsiness detection

This figure 4.4 shows the drowsiness detection of a person while driving.

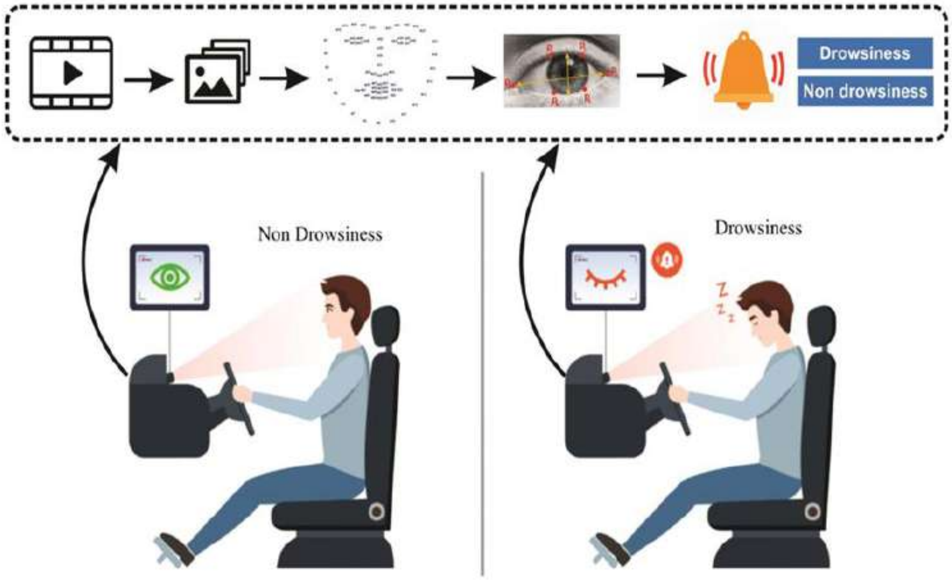


Figure 4.4: Pictorial view of face detection by camera [18]

4.2.1 EXPERIMENT AND RESULT

This figure 4.5 shows the result of drowsiness detection from the project.

- Result no. 1 of the figure when eyes are closed.

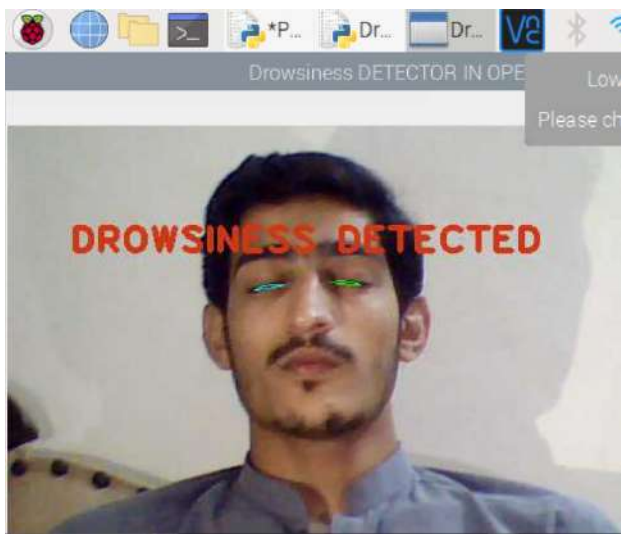


Figure 4.5: Closed eyes

This is the Experimental end result while eyes and mouth are Detected the use of photo processing. The attention component ratio gets Calculated and displayed, that is the precise nation wherein the Peer does no longer sense Drowsiness and it isn't always Yawing, So the ear Is 0.30 so, there's no any alert signal generated. Yawn component Is the space between the upper lip and lower lip at the? Best kingdom it is eight.00 and if Yawning takes place the cost of the Yawn element get exceeds 8.00

This figure 4.6 shows the result when the eyes are opened. This is also from the project.

- Result no: 2 of the figure when eyes are opened

Figure 4.6: Open eyes

This is Experimental end result wherein Eyes were closed for Greater than 10 secs so, there was a notification on the screen "Drowsiness Alert" and an alert signal become generated and Was being handed to alert structures together with track player and Vibration Motor. The attention component Ratio is calculated at every Frame in keeping with second so if the price of EAR is less than 20 in 10 Consecutive frames its consequences in Drowsiness or Fatigue, which Means the peer is feeling drowsy

4.3 Flex sensor

Flex sensors are a type of variable resistor, and as they are bent, their resistance rises. I utilized a 26 k, 2.2" flex sensor for this project. Trial and error were used to determine where the glove's flex sensors should be located. I placed my 2.2" flex sensors, which are relatively short, in a way that would allow me to capture the second knuckle's bending. Since we are more interested in the overall bending of the finger than in the individual knuckles, it is less important to capture the bending of the alternate knuckles. This figure 4.7 shows the flex sensor fixed on the glove.

Figure 4.7: Flex sensor

4.3.1 Flex Sensor Features and Specifications

- Running voltage of FLEX SENSOR: zero-5V.
- Can operate on LOW voltages.
- Energy rating: 0.5Watt (non-stop), 1 Watt (peak)
- Existence: 1 million.
- Operating temperature: -45ºC to +eighty ºC.
- Flat Resistance: 25K Ω
- Resistance Tolerance: ±30%
- Bend Resistance variety: 45K to 125K Ohms (relying on bend)

4.4 Fingerprint Sensor Module

Fingerprint reputation became more accessible and simpler to incorporate into your tasks thanks to fingerprint sensor modules like the one in the following figure. This indicates that making fingerprint series, registering them, comparing them, and looking for them is extraordinarily smooth. These modules have FLASH memory to store artwork and fingerprints for use with any microcontroller or TTL serial device. These modules can be used with time attendance systems, door locks, security systems, and many other things. As shown in figure 4.8.

Figure 4.8: Fingerprint sensor [19]

4.4.1 Specification

Right here are the specifications of the fingerprint sensor module we're using:

- Voltage supply: DC 3.6 to 6.0V
- Modern supply: <120mA
- Backlight coloration: green
- Interface: UART
- Terrible fee: 9600
- Protection level: 5 (from low to high: 1,2,3, four, five)
- fake take delivery of rate (a ways): <zero.001% (safety degree three)
- fake Reject price (FRR): <1.0% (protection level three)
- Able to store 127 unique fingerprints

4.4.2 Sensor Pin out

Sensor has six pin outs that are labeled in the figure 4.9.

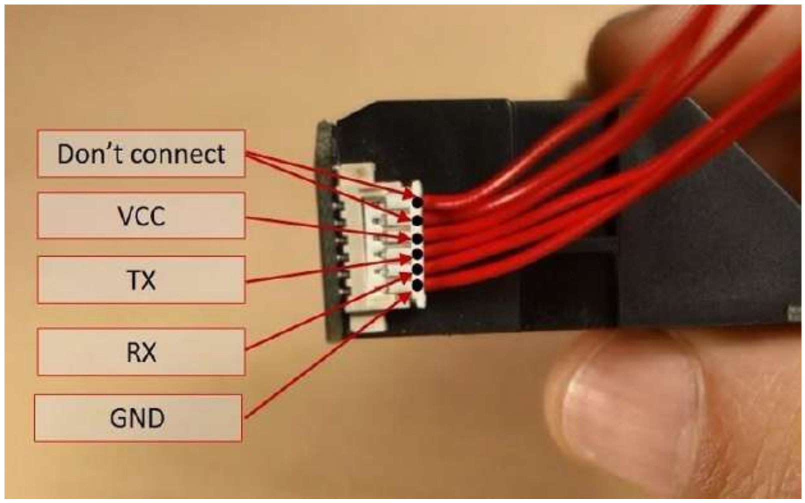


Figure 4.9: Finger print sensor pin out [20]

The fingerprint sensor module is used in the project, and it came with incredibly small wires, so it was necessary to solder breadboard-friendly wires. We suggested using distinctive colors in line with the pin's design. For instance: As shown in figure 4.10.

- DNC – white wires
- VCC – pink twine
- TX – blue wire
- RX – green cord
- GND – black cord

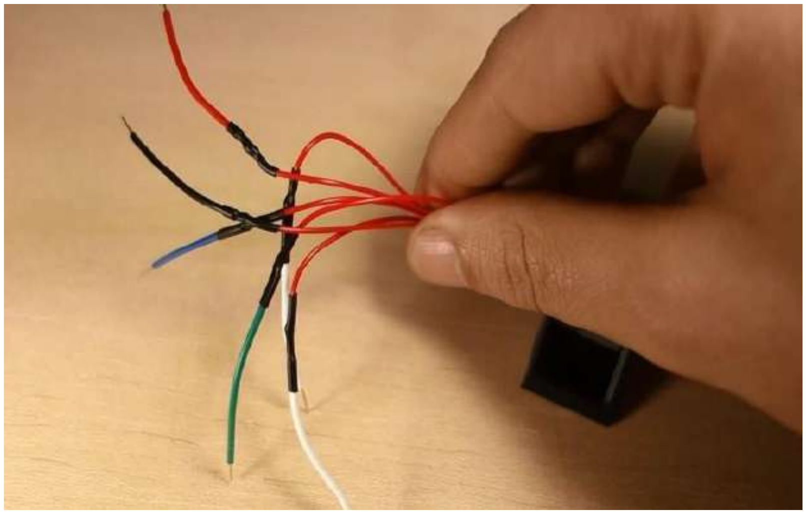


Figure 4.10: Wires of fingerprint sensor

4.5 GSM module

A GSM module is a device that enables communication between electrical devices over the GSM network. GSM is a popular technology for virtual cellular communications, providing a foundation for wireless communication between mobile devices. The figure 4.11 shows the different pins of GSM module. 12 pins are present in this module.

Figure 4.11: GSM module [21]

4.6 Dc to dc buck converter

A DC-to-DC converter is an electrical circuit or electromechanical device that changes the voltage level of a supply of direct current to any other. It is an electric energy converter of some sort. Energy levels might be either low or extremely high. The figure 4.12 shows the internal structure of buck converter.

Figure 4.12: DC to DC buck converter [22]

4.7 Relay Module

A relay module has been established on a board with different additives to offer isolation and protection. This makes them less difficult to apply in a spread of programs. The usage of Relay module gadgets gives a simple and handy way to manipulate the electrical equipment systems remotely. Figure 4.13 shows the internal structure of Relay module.

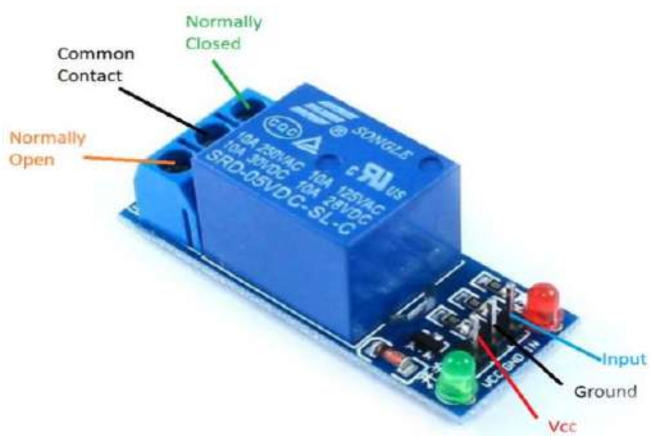


Figure 4.13: Relay module [23]

4.8 Analog to digital converter

An analog-to-virtual converter (ADC) is used to convert an analog signal together with Voltage to a digital shape in order that it is able to be study and processed by way of a microcontroller. Maximum of the microcontrollers these days have integrated ADC converters. Figure 4.14 shows the pins on analog to digital converter.

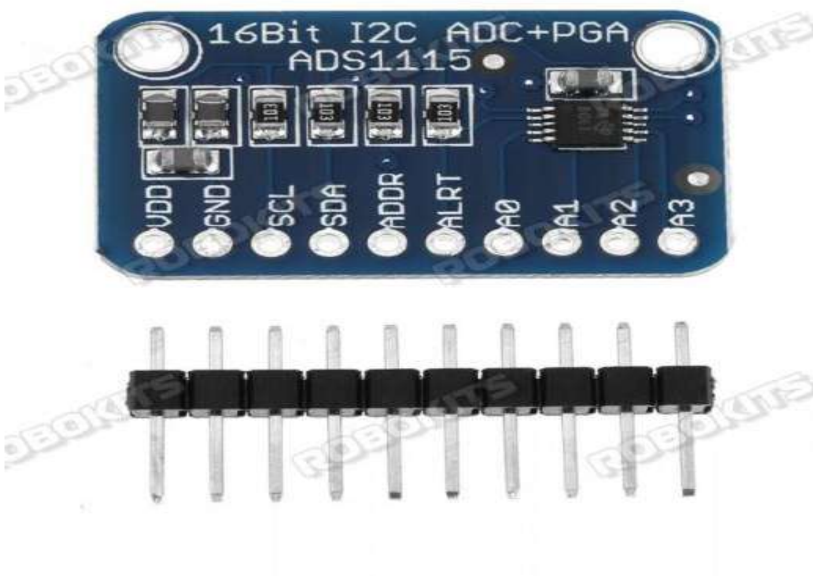


Figure 4.14: Analog to digital converter [24]

CHAPTER 5

METHODOLOGY AND BLOCK DIAGRAM

5.1 Proposed Methodology

The methodology for creating an anti-theft car lock system with drowsiness detection and a detection glove involves several key steps. First, the project's objectives are defined, aiming to combine vehicle security and driver safety. A review of existing literature informs the design by examining anti-theft mechanisms, drowsiness detection techniques, and wearable sensors. Specific requirements are outlined, encompassing drowsiness detection accuracy, sensor types, and communication protocols. The system's architecture is planned, integrating anti-theft measures, drowsiness algorithms, and glove interaction. Sensors are carefully chosen and integrated into the car's structure and detection glove. Algorithms for drowsiness detection and glove interaction are developed, followed by rigorous testing to ensure accuracy and effectiveness. A user-friendly interface is designed, considering ethical and safety concerns. After deployment, continuous refinement is pursued based on user feedback, ensuring a comprehensive anti-theft solution with drowsiness detection and detection glove capabilities. Block Diagram is shown in figure 5.1.

5.2 Block Diagram

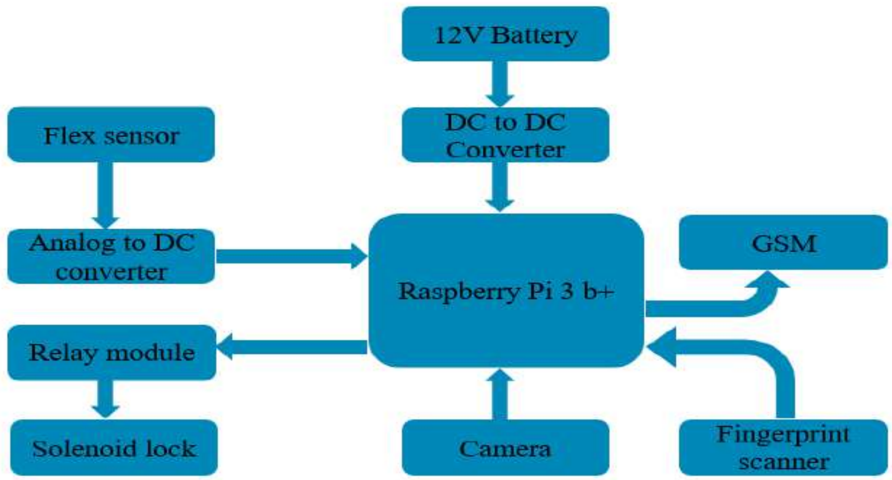


Figure 5.1: Block Diagram

5.3 Explanation of Block diagram

The project process starts by connecting hardware to the power supply. The hardware is connected wirelessly to a laptop, in which software is installed for the Raspberry Pi. Firstly, the first software, which is Angry IP, starts the process of finding the right IP for the Raspberry Pi, which is connected to the hardware. After finding the IP of the Raspberry Pi, now put this IP and paste it into the other software, which is Real VNC Viewer, in which we can start our project process through Python coding.

The real VNC viewer starts after finding the right IP for the Raspberry Pi. A screen will appear on which you can run different Python codes regarding your project. Now run the coding files according to the requirements. First check the fingerprint code, which is for the anti-theft car lock system. Save your fingerprint in it, and then check it two to three times. When you put your fingerprint on the fingerprint sensor, if it matches the lock of the vehicle, the door will unlock, and it will send you a message of door unlock on your mobile phone with the help of the GSM module.

Then run the code for camera drowsiness and check the drowsiness detection of your eyes through the camera with the help of a laptop, which shows the detection of drowsiness.

Flex sensor code for steering wheel detection will also run in the real VNC viewer and check the detection of the steering wheel with the help of a glove, on which a flex sensor is connected. Its setting is adjusted through the coding.

In order to provide an extra layer of security, the system is built to detect driver fatigue and to sound an audio alert (a beep) if the glove is not securely positioned on the steering wheel. The purpose of this audible signal is to keep the driver awake and avoid any potential collisions. In conclusion, the project uses a variety of techniques, including biometric authentication, drowsiness detection, and steering wheel control methods, to improve vehicle security and driver safety. Flow Chart is shown in figure 5.2.

5.4 Flow Chart

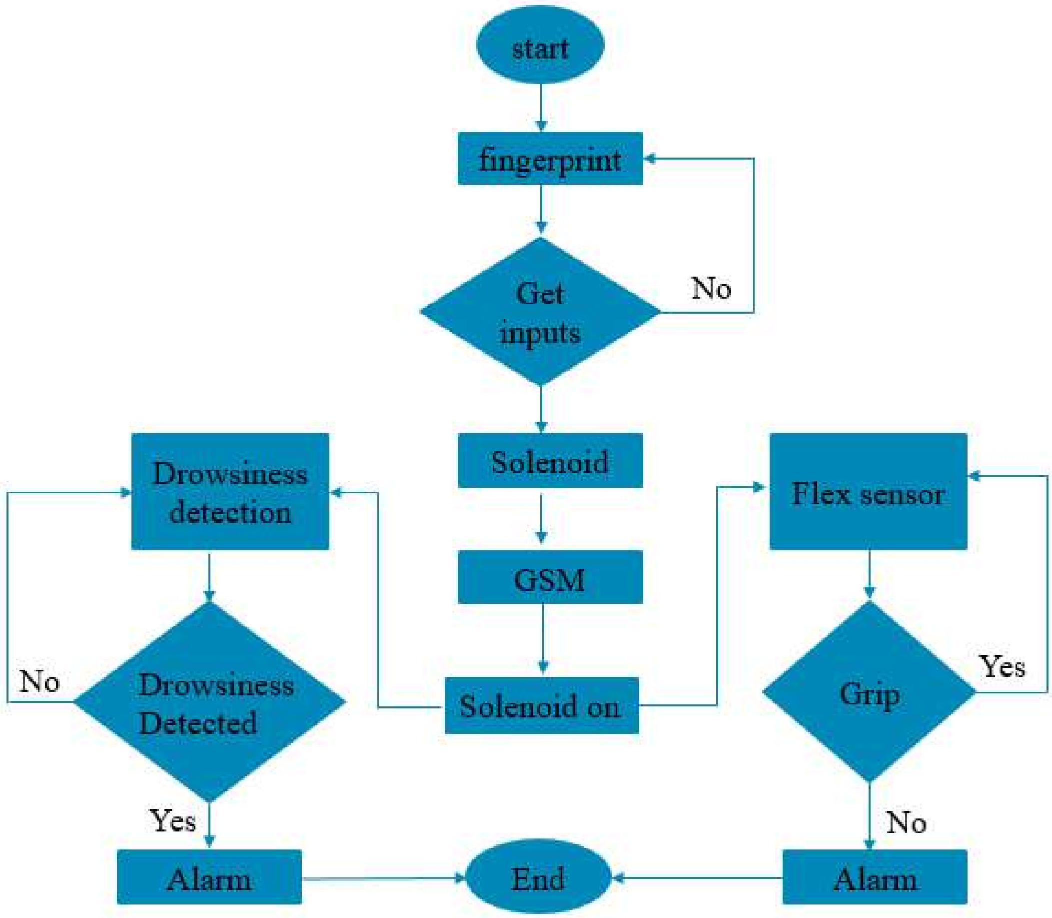


Figure 5.2: Flow Chart

5.6 Explanation of flow chart

The fingerprint module will receive a variety of inputs, including enrolls, deletes, resets, quits, and finds when it is available. The message "Print not Found" will appear if the fingerprint module could not locate any type of saved fingerprint. After identifying the fingerprint, it will send the car's owner an SMS that matches the fingerprint.

After the appropriate fingerprint is identified, the face recognition and the flex sensor will function. A warning beep will sound if the flex sensor on the glove is unfastened or if face sleepiness is detected. All of this will be done using the software REAL VNC VIEWER.

CHAPTER 6

RESULTS AND DISCUSSION

6.1 Final project hardware

The main goal of this project is to secure your vehicle from stolen. We also introduce two features in the form of camera and glove. The camera detects the drowsiness of the driver during driving. If he feels drowsy a beep will start and it will alert the driver, this will save him from a big incident. A glove with flex sensor is also available in the car that a driver will use during driving. It will also start beeping if the driver loses his grip on steering wheel. These are the things that will secure vehicle from stolen and other features will help in reduce the accidents that are increasing day by day. Figure 6.1 shows the complete hardware.

Figure 6.1: Complete project

6.2 Fingerprint result

This code represents the output of a fingerprint sensor integrated into a car's door unlocking system. In the software, pressing the "f" key initiates the process of finding the fingerprint of a registered member, and if it matches, the car door is unlocked. If a match is found, the system sends an SMS notification to the owner, and the message "authentication matched" is displayed. Figure 6.2 shows the various fingerprint functions, and Figure 6.3 displays the message alert.

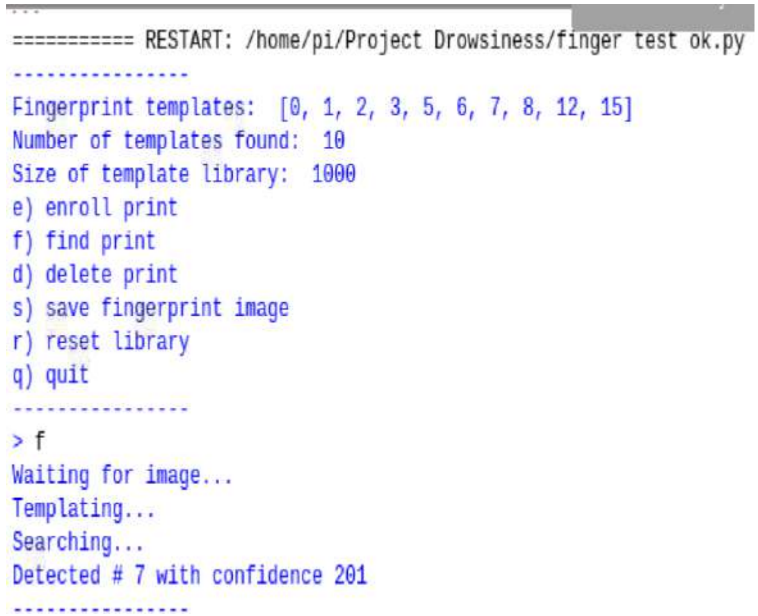


Figure 6.2: Finding fingerprint

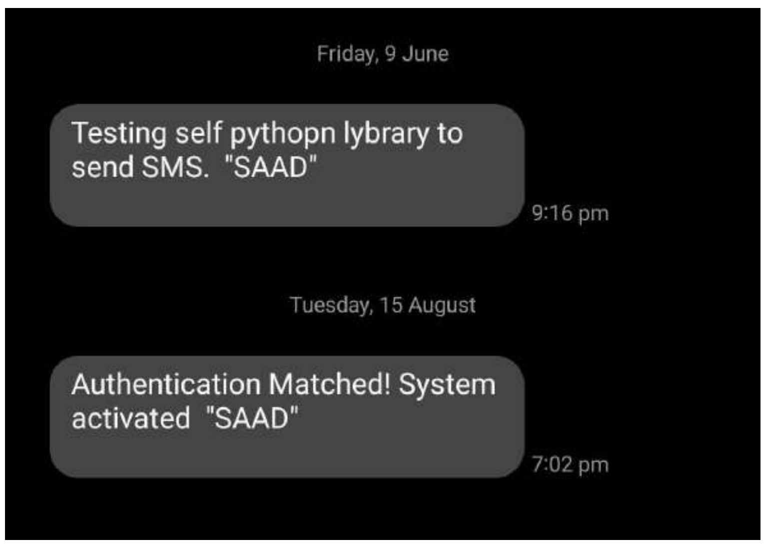


Figure 6.3: Verification Message Alert

6.3 Project result

This figure 6.4 shows the voltage your project is taking and showing the different channels. Figure shows the active channel.

```
----------------
> f
Waiting for image...
Templating...
Searching...
Detected # 7 with confidence 52
CPU:AT
GSM:OK
CPU:AT+CMGF=1
GSM:OK
CPU:AT+CMGS="+923009600011"
GSM:>
CPU:Authentication Matched! System activated _"SAAD"
GSM:>
GSM:
flag=1
Channel 1: 15686
voltage=
```

Figure 6.4: After access, now system is ready to drowsiness detection

6.4 Drowsiness Detection

In the end it shows the detection of drowsiness of the eyes as shown in the figure. When the eyes are closed it shows “drowsiness detected “It will perform all the other functions first check the finger print of the registered member if it matches it send the SMS to the owner, then it starts detecting the drowsiness of the driver. Figure 6.5 shows when drowsiness is detected.

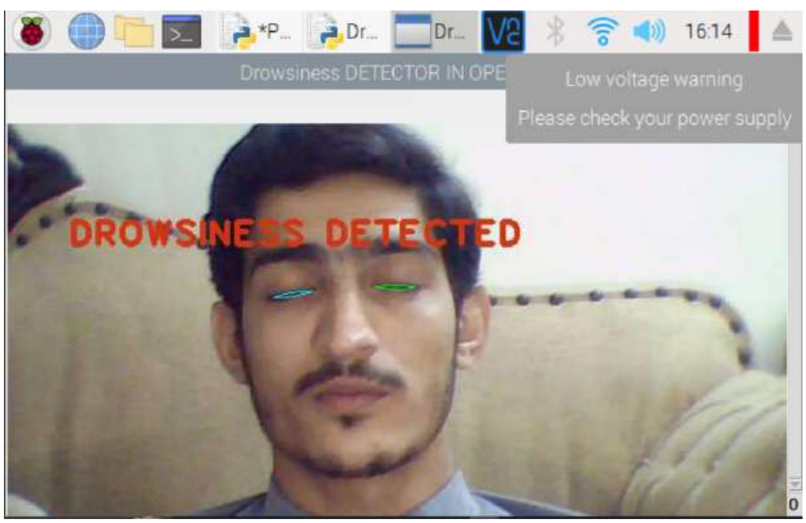


Figure 6.5: Eyes close and drowsiness detected

CHAPTER 7

CONCLUSIONS AND FUTURE SUGGESTIONS

7.1 Conclusion

In conclusion, the culmination of this Final Year Project marks a significant step towards advancing both vehicle security and driver safety through the integration of cutting-edge technologies. The successful development of an anti-theft car lock system accompanied by drowsiness detection capabilities and flex sensor detection mechanism for the steering wheel showcases a comprehensive and innovative solution. By cooperatively combining these features, this project contributes to a complete approach that addresses critical concerns in modern-day driving.

The anti-theft car lock system offers robust security measures, ensuring the protection of valuable assets. Simultaneously, the integration of drowsiness detection technology acts as a crucial safeguard against driver fatigue and lapses in attention, help a safer driving environment for all road users. The inclusion of the flex sensor for steering wheel detection system further enhances user interaction with the vehicle's control interface, promoting intuitive and distraction-free operation.

The journey undertaken throughout this project involved thorough research, meticulous sensor selection, algorithm development, rigorous testing, and user-centric interface design. By successfully aligning these elements, the project demonstrates the feasibility of combining multiple functionalities seamlessly, ultimately contributing to an enriched driving experience.

As we look to the future, the implications of this project extend beyond the academic realm, potentially influencing advancements in automotive technology and driver safety standards. The collaborative effort of various disciplines, from engineering to human-computer interaction, underscores the interdisciplinary nature of this achievement.

In essence, this Final Year Project stands as a testament to innovation, determination, and the pursuit of excellence. As the automotive landscape continues to evolve, the contributions made by this project provide a solid foundation for further exploration and development in the domains of vehicle security, driver alertness, and intuitive human-machine interaction.

7.2 Future suggestion

In future we can work on following things like:

In the future, our plan involves installing a GPS device in the vehicle, which will enable us to remotely track its location at anytime from anywhere. This will be especially helpful in the event of vehicle theft.

We also are planning to growth the safety of the car via cutting off the battery supply to the automobile e, hence adding to its safety. In order to prevent car accidents, our system is currently operated manually using a Bluetooth control. In the future, however, we intend to turn it into a fully automated device that can automatically detect vehicles in its path, change the road lane accordingly, and control its speed accordingly.

Extend the capabilities of the flex sensor for steering wheel detection system to recognize a wider range of gestures. This could include gestures for controlling in-car features, communication, and entertainment, creating a more immersive and intuitive driving experience.

Research the integration of biometric data, such as heart rate and facial expressions, into the drowsiness detection system. This could potentially enhance the accuracy of drowsiness detection.

REFERENCES

[1] Ghanem, S., & Ghanim, S. (2022). Design and Implementation of an Integrated Vehicle Security System (IVSS). International Journal of Industry and Sustainable Development, 3(1), 87-97.

[2] Bukola, A. (2020). Development of an anti-theft vehicle security system using gps and gsm technology with biometric authentication. Int. J. Innov. Sci. Res. Technol.

[3] Shuai, L. V., Wu, L., Li, Z., Xu, Q., & Zhou, X. (2021, September). Intelligent Car Security System Based on Fingerprint Identification and Internet of Things. In 2021 13th International Conference on Computational Intelligence and Communication Networks (CICN) (pp. 183-187). IEEE.

[4] Raj, M. J., Gadde, S., & Jayaraman, R. (2021, October). Implementation of Biometric Access Control Using Fingerprint for Safety and Security System of Electric Vehicle. In 2021 2nd International Conference on Smart Electronics and Communication (ICOSEC) (pp. 1684-1689). IEEE.

[5] Santhiya, S., Divyabharathi, T., Jeno, J., & Kawin, D. (2023, March). Improved Authentication and Drowsiness Detection from Facial Features using Deep Learning Framework in Real Time Environments. In 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS) (Vol. 1, pp. 1638-1642). IEEE.

[6] Guria, M., & Bhowmik, B. (2022, November). Iot-enabled driver drowsiness detection using machine learning. In 2022 Seventh International Conference on Parallel, Distributed and Grid Computing (PDGC) (pp. 519-524). IEEE.

[7] Albadawi, Y., Takruri, M., & Awad, M. (2022). A review of recent developments in driver drowsiness detection systems. Sensors, 22(5), 2069.

[8] Amjad Mehmood " Alaming figure of traffic accidents need attention" THE NEWS international published on NOV 21,2021.

[9] Shah, K. S., Mithal Jiskani, I., Shahani, N. M., Rehman, H. U., Khan, N. M., & Hussain, S. (2020). Analysis and forecast of mining accidents in Pakistan. Journal of Mining and Environment, 11(4), 967-976.

[10] Gulzar, S., Yahya, F., Mir, Z., & Zafar, R. (2012). Provincial analysis of traffic accidents in Pakistan. Academic Research International, 3(3), 365.

[11] Khurshid A, Sohail A, Khurshid M, et al. (April 13, 2021) Analysis of Road Traffic Accident Fatalities in Karachi, Pakistan: An Autopsy-Based Study. Cureus 13(4): e14459. doi:10.7759/cureus.14459

[12] PUBLISHED IN THE EXPRESS TRIBUNE, APRIL 11TH, 2023. "CAR THEFT STATISTICS" https://tribune.com.pk/story/2411256/over-2500-phones-188-vehicles-reported-stolen-in-march-cplc\

[13] N. N. Nagamma, M. V. Lakshmaiah and T. Narmada, "Raspberry Pi based biometric authentication vehicle door locking system," 2017 IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI), Chennai, India, 2017, pp. 2348-2351, doi: 10.1109/ICPCSI.2017.8392138.

[14] https://www.quora.com/How-do-I-interface-GSM-GPRS-modem-RS232-SIM800-with-Arduino-and-upload-sensor-data-to-webpage-via-GPRS-connection

[15] K. U. Anjali, A. K. Thampi, A. Vijayaraman, M. F. Francis, N. J. James and B. K. Rajan, "Real-time nonintrusive monitoring and detection of eye blinking in view of accident prevention due to drowsiness," 2016 International Conference on Circuit, Power and Computing Technologies (ICCPCT), Nagercoil, India, 2016, pp. 1-6, doi: 10.1109/ICCPCT.2016.7530224.

[16] Drowsiness detection performance- https://www.researchgate.net/figure/Flowchart-of-the-drowsiness-detection-system_fig5_356678757

[17] Raspberry pi 3b+- https://www.raspberrypi.com/products/raspberry-pi-3-model-b-plus/

[18] Phan, A. C., Nguyen, N. H. Q., Trieu, T. N., & Phan, T. C. (2021). An efficient approach for detecting driver drowsiness based on deep learning. Applied Sciences, 11(18), 8441.

[19] fingerprint sensor -https://randomnerdtutorials.com/fingerprint-sensor-module-with-arduino/

[20] Finger print sensor pin out -https://randomnerdtutorials.com/fingerprint-sensor-module-with-arduino/

[21] GSM module -https://www.electroduino.com/sim800l-gsm-module/

[22] dc to dc buck converter -https://digilog.pk/products/dc-to-dc-buck-converter-5a-xl4015-in-pakistan

[23] Relay module -https://cityelectronics.pk/product/12v-dc-single-ch-relay-module/

[24] Analog to digital converter -https://fluxworkshop.com/products/biaa100199-16-bit-adc-i2c-ads1115-module-rounded?variant=32458601562172

APPENDIX

Source code

```
import time
import serial
import RPi.GPIO as GPIO
import adafruit_fingerprint
#
import Adafruit_ADS1x15
from time import sleep
##
uart = serial.Serial("/dev/ttyUSB0", baudrate=57600, timeout=1)
finger = adafruit_fingerprint.Adafruit_Fingerprint(uart)
##
GPIO.setwarnings(False) # Ignore warning for now
GPIO.setmode(GPIO.BOARD) # Use physical pin numbering 1-40 not gpio numbers
GPIO.setup(40, GPIO.OUT, initial=GPIO.LOW) # Set pin 18 to be an output pin and
set initial value to low (off)
GPIO.setup(37, GPIO.OUT, initial=GPIO.LOW)
GPIO.setup(38, GPIO.OUT, initial=GPIO.LOW) # LocK
######2
adc = Adafruit_ADS1x15.ADS1115()
GAIN = 1
adc.start_adc_comparator(1,  # Channel number 0=A0,1=A1
                         20000, 5000,  # High threshold value, low threshold
value
                         active_low=True, traditional=True, latching=False,
                         num_readings=1, gain=GAIN)
print('Reading ADS1x15 channel 1 for 5 seconds with comparator...')
start = time.time()
global flag
flag=0
###3
ser = serial.Serial('/dev/ttyS0', 9600, timeout = 1)
def getResponse(cmd,reply,timeout):
    cmd = cmd + '\r'
    print('CPU'+':'+cmd)
    ser.write(bytes(cmd,'utf-8'))
    time.sleep(0.01)
    for i in range (0,timeout):
        in_msg=ser.readline()
        in_msg = in_msg.decode('utf-8').strip()
```

```
        time.sleep(0.01)
        ans=in_msg.find(reply)
        if(ans!=-1):
            i=timeout
    print('GSM'+':'+in_msg)
    time.sleep(0.5)

def gsmPrint(cmd,timeout):
    cmd = cmd + '\r'
    print('CPU'+':'+cmd)
    ser.write(bytes(cmd,'utf-8'))
    time.sleep(0.01)
    for i in range (0,timeout):
        in_msg=ser.readline()
        in_msg = in_msg.decode('utf-8').strip()
        time.sleep(0.01)
        if(len(in_msg)>0): #someting on reply
            i=timeout
    print('GSM'+':'+in_msg)
    time.sleep(0.5)
def gsmEndcommand():
    ser.write(bytes(chr(26),'utf-8'))
    time.sleep(1)
    in_msg=ser.readline()
    in_msg = in_msg.decode('utf-8').strip()
    print('GSM'+':'+in_msg)
    time.sleep(1)
###3 end
####4
import cv2
import dlib
import pyttsx3
from scipy.spatial import distance
engine = pyttsx3.init()
cap = cv2.VideoCapture(0)
face_detector = dlib.get_frontal_face_detector()
dlib_facelandmark = dlib.shape_predictor(
    "/home/pi/Project Drowsiness/shape_predictor_68_face_landmarks.dat")
#/home/pi/Project Drowsiness
def Detect_Eye(eye):
    poi_A = distance.euclidean(eye[1], eye[5])
    poi_B = distance.euclidean(eye[2], eye[4])
    poi_C = distance.euclidean(eye[0], eye[3])
```

```
    aspect_ratio_Eye = (poi_A+poi_B)/(2*poi_C)
    return aspect_ratio_Eye
####4End
##################################################
def get_fingerprint():
    """Get a finger print image, template it, and see if it matches!"""
    print("Waiting for image...")
    while finger.get_image() != adafruit_fingerprint.OK:
        pass
    print("Templating...")
    if finger.image_2_tz(1) != adafruit_fingerprint.OK:
        return False
    print("Searching...")
    if finger.finger_search() != adafruit_fingerprint.OK:
        return False
    return True
# pylint: disable=too-many-branches
def get_fingerprint_detail():
    """Get a finger print image, template it, and see if it matches!
    This time, print out each error instead of just returning on failure"""
    print("Getting image...", end="", flush=True)
    i = finger.get_image()
    if i == adafruit_fingerprint.OK:
        print("Image taken")
    else:
        if i == adafruit_fingerprint.NOFINGER:
            print("No finger detected")
        elif i == adafruit_fingerprint.IMAGEFAIL:
            print("Imaging error")
        else:
            print("Other error")
        return False
    print("Templating...", end="", flush=True)
    i = finger.image_2_tz(1)
    if i == adafruit_fingerprint.OK:
        print("Templated")
    else:
        if i == adafruit_fingerprint.IMAGEMESS:
            print("Image too messy")
        elif i == adafruit_fingerprint.FEATUREFAIL:
            print("Could not identify features")
        elif i == adafruit_fingerprint.INVALIDIMAGE:
            print("Image invalid")
```

```
        else:
            print("Other error")
        return False
    print("Searching...", end="", flush=True)
    i = finger.finger_fast_search()
    # pylint: disable=no-else-return
    # This block needs to be refactored when it can be tested.
    if i == adafruit_fingerprint.OK:
        print("Found fingerprint!")
        return True
    else:
        if i == adafruit_fingerprint.NOTFOUND:
            print("No match found")
        else:
            print("Other error")
        return False
# pylint: disable=too-many-statements
def enroll_finger(location):
    """Take a 2 finger images and template it, then store in 'location'"""
    for fingerimg in range(1, 3):
        if fingerimg == 1:
            print("Place finger on sensor...", end="", flush=True)
        else:
            print("Place same finger again...", end="", flush=True)
        while True:
            i = finger.get_image()
            if i == adafruit_fingerprint.OK:
                print("Image taken")
                break
            if i == adafruit_fingerprint.NOFINGER:
                print(".", end="", flush=True)
            elif i == adafruit_fingerprint.IMAGEFAIL:
                print("Imaging error")
                return False
            else:
                print("Other error")
                return False
        print("Templating...", end="", flush=True)
        i = finger.image_2_tz(fingerimg)
        if i == adafruit_fingerprint.OK:
            print("Templated")
        else:
            if i == adafruit_fingerprint.IMAGEMESS:
```

```
                print("Image too messy")
            elif i == adafruit_fingerprint.FEATUREFAIL:
                print("Could not identify features")
            elif i == adafruit_fingerprint.INVALIDIMAGE:
                print("Image invalid")
            else:
                print("Other error")
            return False
        if fingerimg == 1:
            print("Remove finger")
            time.sleep(1)
            while i != adafruit_fingerprint.NOFINGER:
                i = finger.get_image()
    print("Creating model...", end="", flush=True)
    i = finger.create_model()
    if i == adafruit_fingerprint.OK:
        print("Created")
    else:
        if i == adafruit_fingerprint.ENROLLMISMATCH:
            print("Prints did not match")
        else:
            print("Other error")
        return False
    print("Storing model #%d..." % location, end="", flush=True)
    i = finger.store_model(location)
    if i == adafruit_fingerprint.OK:
        print("Stored")
    else:
        if i == adafruit_fingerprint.BADLOCATION:
            print("Bad storage location")
        elif i == adafruit_fingerprint.FLASHERR:
            print("Flash storage error")
        else:
            print("Other error")
        return False
    return True
def save_fingerprint_image(filename):
    """Scan fingerprint then save image to filename."""
    while finger.get_image():
        pass
    # let PIL take care of the image headers and file structure
    from PIL import Image  # pylint: disable=import-outside-toplevel
    img = Image.new("L", (256, 288), "white")
```

```
    pixeldata = img.load()
    mask = 0b00001111
    result = finger.get_fpdata(sensorbuffer="image")
    # this block "unpacks" the data received from the fingerprint
    #   module then copies the image data to the image placeholder "img"
    #   pixel by pixel.  please refer to section 4.2.1 of the manual for
    #   more details.  thanks to Bastian Raschke and Danylo Esterman.
    # pylint: disable=invalid-name
    x = 0
    # pylint: disable=invalid-name
    y = 0
    # pylint: disable=consider-using-enumerate
    for i in range(len(result)):
        pixeldata[x, y] = (int(result[i]) >> 4) * 17
        x += 1
        pixeldata[x, y] = (int(result[i]) & mask) * 17
        if x == 255:
            x = 0
            y += 1
        else:
            x += 1
    if not img.save(filename):
        return True
    return False
##################################################
def get_num(max_number):
    """Use input() to get a valid number from 0 to the maximum size
    of the library. Retry till success!"""
    i = -1
    while (i > max_number - 1) or (i < 0):
        try:
            i = int(input("Enter ID # from 0-{}: ".format(max_number - 1)))
        except ValueError:
            pass
    return i
while True:
    print("----------------")
    if finger.read_templates() != adafruit_fingerprint.OK:
        raise RuntimeError("Failed to read templates")
    print("Fingerprint templates: ", finger.templates)
    if finger.count_templates() != adafruit_fingerprint.OK:
        raise RuntimeError("Failed to read templates")
    print("Number of templates found: ", finger.template_count)
```

```
    if finger.read_sysparam() != adafruit_fingerprint.OK:
        raise RuntimeError("Failed to get system parameters")
    print("Size of template library: ", finger.library_size)
    print("e) enroll print")
    print("f) find print")
    print("d) delete print")
    print("s) save fingerprint image")
    print("r) reset library")
    print("q) quit")
    print("----------------")
    c = input("> ")
    if c == "e":
        enroll_finger(get_num(finger.library_size))
    if c == "f":
    #while c == "f":
        if get_fingerprint():
            print("Detected #", finger.finger_id, "with confidence",
finger.confidence)
            GPIO.output(40, GPIO.HIGH) # Turn on
            GPIO.output(37, GPIO.HIGH)
            GPIO.output(38, GPIO.HIGH) # Turn on
            sleep(2) # Sleep for 1 second
            GPIO.output(40, GPIO.LOW) # Turn off
            GPIO.output(37, GPIO.LOW)
            GPIO.output(38, GPIO.LOW) # Turn on
            sleep(2) # Sleep for 1 second
            ##
            #global flag
            ###3
            getResponse('AT','OK',2)
            getResponse('AT+CMGF=1','OK',2)
            getResponse('AT+CMGS=\"+923415355125\"','OK',2) #put your number
replacing 'xxxxxxxxxxxxx'
            #for number can use 0341..... it is also ok
            gsmPrint('Authentication Matched! System activated _"Saki Projects
Solutions"',2)
            gsmEndcommand()
            ###3 End
            flag=1
            ##
        else:
            print("Finger not found")
    if c == "d":
```

```
        if finger.delete_model(get_num(finger.library_size)) ==
adafruit_fingerprint.OK:
            print("Deleted!")
        else:
            print("Failed to delete")
    if c == "s":
        if save_fingerprint_image("fingerprint.png"):
            print("Fingerprint image saved")
        else:
            print("Failed to save fingerprint image")
    if c == "r":
        if finger.empty_library() == adafruit_fingerprint.OK:
            print("Library empty!")
        else:
            print("Failed to empty library")
    if c == "q":
        print("Exiting fingerprint example program")
        raise SystemExit
    while flag == 1:
         print("flag=1")
         #sleep(2)
         #flag==0;
         #print("still flag=1")
         value = adc.get_last_result()
         Volt = (value * 3.3 )/ 18000 #26000 value come by using pot of 10K atA0
and it ismaximum value
         #with flex sensor Res min=25K, max=100K and % resistor at 3.3v=25K so
read valuues are min=15000 max=18000
         print('Channel 1: {0}'.format(value))
         print('voltage= ')
         rounded = round(Volt, 2)
         print(rounded)
         if rounded>3:
             print('You are Active ')
         else:
             print('You are in-Active ')
             GPIO.output(40, GPIO.HIGH) # Turn on
             GPIO.output(37, GPIO.HIGH)
             sleep(3) # Sleep for 1 second
             GPIO.output(40, GPIO.LOW) # Turn off
             GPIO.output(37, GPIO.LOW)
             sleep(1) # Sleep for 1 second
```

```
        #finger straight=2.85v,    half bend=3.10 to 3.15      full bend=3.25
and above
        #print(Volt)
        # Sleep for half a second.
        time.sleep(0.5)
        null, frame = cap.read()
        gray_scale = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
        faces = face_detector(gray_scale)
        for face in faces:
            face_landmarks = dlib_facelandmark(gray_scale, face)
            leftEye = []
            rightEye = []
            for n in range(42, 48):
                    x = face_landmarks.part(n).x
                    y = face_landmarks.part(n).y
                    rightEye.append((x, y))
                    next_point = n+1
                    if n == 47:
                        next_point = 42
                    x2 = face_landmarks.part(next_point).x
                    y2 = face_landmarks.part(next_point).y
                    cv2.line(frame, (x, y), (x2, y2), (0, 255, 0), 1)
            for n in range(36, 42):
                    x = face_landmarks.part(n).x
                    y = face_landmarks.part(n).y
                    leftEye.append((x, y))
                    next_point = n+1
                    if n == 41:
                            next_point = 36
                    x2 = face_landmarks.part(next_point).x
                    y2 = face_landmarks.part(next_point).y
                    cv2.line(frame, (x, y), (x2, y2), (255, 255, 0), 1)
            right_Eye = Detect_Eye(rightEye)
            left_Eye = Detect_Eye(leftEye)
            Eye_Rat = (left_Eye+right_Eye)/2
            Eye_Rat = round(Eye_Rat, 2)
            if Eye_Rat < 0.25:
                    cv2.putText(frame, "DROWSINESS DETECTED", (50, 100),
                                                cv2.FONT_HERSHEY_PLAIN, 2, (21,
56, 210), 3)
                    cv2.putText(frame, "Alert!!!! WAKE UP DUDE", (50, 450),
                                                cv2.FONT_HERSHEY_PLAIN, 2, (21,
56, 212), 3)
```

```
                    GPIO.output(40, GPIO.HIGH) # Turn on
                    GPIO.output(37, GPIO.HIGH)
                    sleep(4) # Sleep for 1 second
                    GPIO.output(40, GPIO.LOW) # Turn off
                    GPIO.output(37, GPIO.LOW)
                    sleep(1) # Sleep for 1 second'''
                    engine.say("Alert!!!! WAKE UP DUDE")
                    engine.runAndWait()
        cv2.imshow("Drowsiness DETECTOR IN OPENCV2", frame)
        key = cv2.waitKey(9)
        if key == 20:
            break
cap.release()
cv2.destroyAllWindows()
'''if rounded>3:
            print('You are Active ')
        else:
            print('You are in-Active ')
            GPIO.output(40, GPIO.HIGH) # Turn on
            GPIO.output(37, GPIO.HIGH)
            sleep(3) # Sleep for 1 second
            GPIO.output(40, GPIO.LOW) # Turn off
            GPIO.output(37, GPIO.LOW)
            sleep(1) # Sleep for 1 second'''
```

DATA SHEET OF RASPBERRY PI 3B+

Table 4**:** Data sheet of raspberry pi 3b+

Chip	Broadcom BCM2835 SoC
Core architecture	ARM11
CPU	700 MHz Low Power ARM1176JZFS core
GPU	Dual Core VideoCore IV
	Open GL ES 2.0, hardware-accelerated OpenVG, 1080p30 H.264 high-profile decode
	Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure
Memory	512MB SDRAM
Operating System	Boots from Micro SD card, running a version of the Linux operating system
	Supports Debian GNU/Linux, Fedora, Arch Linux, RISC OS and More
Power	Micro USB socket 5V, 2A
Ethernet	10/100 BaseT Ethernet socket
Video Output	HDMI (rev 1.3 & 1.4)
	Composite RCA (PAL and NTSC)
Audio Output	3.5mm jack, HDMI
USB	4 x USB2.0 Ports with up to 1.2A output
GPIO Interface	40-pin 2.54 mm (100 mil) expansion header: 2x20 strip Providing 27 GPIO pins as well as +3.3 V, +5 V and GND supply lines
Camera Interface	15-pin MIPI Camera Serial Interface (CSI-2)
JTAG	Not populated
Display Interface	Display Serial Interface (DSI) 15 way flat flex cable connector with two data lanes and a clock lane
Memory Card Slot	SDIO

DATA SHEET OF FLEX SENSOR

Table 5: Data sheet of flex sensor

Product	BendShort sensor	
Version	2.0 (2009)	
Sensing parameter	flex angle multiplied by flex radius	
Sensing method	piezo-resistive	
Range	-180° to +180° (larger flex angle possible)	
Active area	61 x 1.7 mm (2.4 x 0.67 inch)	
Minimum flex radius	5 mm (0.2 inch)	
Output impedance	13 KOhm (at 0° flex angle) to 150 KOhm (at 180° flex angle)	
Calibration (using minimum flex radius)		
Degrees	Voltage (use 5 V power supply)	7-bit MIDI value (use 'no processing' editor preset)
-180	0.07	2
0	2.47	63
+180	4.64	118
Power supply	1.0 to 10 V DC, 0.1 mA at 5 V	
Sensor dimensions	96 x 6.0 x 0.1 mm (3.8 x 0.24 x 0.004 inch)	
Weight	9 g (0.3 oz), incl. cable	
Cable	1.0 m (39 inch), shielded, red wire = power, black wire = ground, white wire = sensor output, maximum extension 30 m (98 ft)	
Connector	male plug with a row of 3 pins spaced 2.54 mm (0.100 inch)	
Application notes	The sensor output is determined by both the angle between the ends of the sensor as well as the flex radius; bending the sensor sharply will result in a more value change than bending the sensor smoothly, when keeping the ends in the same position. Shorter versions available as BendMicro and BendMini.	

DATA SHEET OF FINGERPRINT

Table 6: Data sheet of fingerprint

Power	DC 3.6V-6.0V	**Interface**	UART(TTL logical level)/ USB 1.1
Working current	Typical: 100mA Peak: 150mA	**Matching Mode**	1:1 and 1:N
Baud rate	(9600*N)bps, N=1～12 (default N=6)	**Character file size**	256 bytes
Image acquiring time	<0.5s	**Template size**	512 bytes
Storage capacity	120/ 375/ 880	**Security level**	5 (1, 2, 3, 4, 5(highest))
FAR	<0.001%	**FRR**	<0.1%
Average searching time	< 0.8s (1:880)	**Window dimension**	18mm*22mm
Working environment	Temp: -10℃- +40℃	**Storage environment**	Temp: -40℃- +85℃
	RH: 40%-85%		RH: <85%
Outline Dimention	Split type	Module: 42*38*7mm Sensor:56*20*21.5mm	
	Integral type	54.5*20.6*23.8mm	