Smart Web App for Business Premises

By

Muneeb Shahzad

Muhammad Zeeshan

Sher Muhammad Hamza

Obaid Ur Rehman

Supervised by:

Prof Hammad Afzal, PhD

Co-Supervised by:

Lt Col Khawir Mehmood

Submitted to the faculty of Department of Computer Software Engineering,
Military College of Signals, National University of Sciences and Technology, Islamabad,
in partial fulfillment for the requirements of B.E Degree in Software Engineering.

June 2024

In the name of ALLAH, the Most benevolent, the Most Courteous

CERTIFICATE OF CORRECTNESS AND APPROVAL

This is to officially state that the thesis work contained in this report

"Smart Web App for Business Premises**"**

is carried out by

Muneeb Shahzad

Muhammad Zeeshan

Sher Muhammad Hamza

Obaid Ur Rehman

under my supervision and that in my judgement, it is fully ample, in scope and excellence, for the degree of Bachelor of Software Engineering in Military College of Signals, National University of Sciences and Technology (NUST), Islamabad.

Approved by

Supervisor

Prof Hammad Afzal, PhD

Date: _____

DECLARATION OF ORIGINALITY

We hereby declare that no portion of work presented in this thesis has been submitted in support of another award or qualification in either this institute or anywhere else.

ACKNOWLEDGEMENTS

Allah Subhan'Wa'Tala is the sole guidance in all domains.

Our parents, colleagues and most of all supervisor, Prof. Hammad Afzal without your guidance.

The group members, who through all adversities worked steadfastly.

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Muneeb Shahzad

348022

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M Zeeshan

337553

_____

Sher M Hamza

341195

_____

Obaid ur Rehman

347779

_____

Signature of Supervisor

ABSTRACT

This multifaceted project is meticulously crafted to cater to the needs of workplace employers, office workers, security personnel, and management staff. Its overarching goal is to introduce a sophisticated camera system that empowers project managers to oversee team activities with precision and efficacy.

By leveraging this innovative system, the project endeavors to cultivate a workplace environment characterized by heightened productivity and a culture of innovation and efficiency. Central to its operation is the integration of a robust database with an extensive network of cameras strategically deployed throughout the building. This integration enables the system to detect various employee behaviors, facilitating essential functions such as clocking in and out, while also serving as a deterrent against detrimental habits like smoking, which can adversely impact office productivity.

Moreover, the system equips managers with the tools to track employee progress and promptly address any workplace offenses captured by the cameras. Leveraging cutting-edge machine learning algorithms, the system analyses images to identify specific behaviors, flagging them within the database for further review and action. With its ability to consider multiple behaviors and synchronize data across numerous cameras in real-time, the project provides managers with comprehensive insights into employee performance, facilitating informed decision-making and driving continuous improvement across the organization.

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Chapter 1: Introduction

This chapter introduces Smart Progressive Web App for Business Premises, the problem statement, our proposed solution, our aims and objectives, scope of the project, working principle, some basic definitions, deliverables, and our relevant sustainable development goal (SDG).

1.1 Overview

The Smart Progressive Web App for Business Premises is designed to maximize the safety and efficiency of business premises using state-of-the-art technologies. This document covers the entire system in detail and includes facial recognition-based attendance, smoking behavior analysis, behavior analysis and car tracking among other features. It sets out the software requirements for the complete system to ensure a consistent and thorough implementation.

1.2 Problem Statement

The problem that this Final Year Project (FYP) seeks to solve is that there is no' smart devices that help in the efficiency of operation and security enhancement in business places. Car tracking, behavior analytics, attendance keeping, and smoke detection are done manually using traditional methods.

1. **Non-effective Operations:** The systems that are currently used require people to enter their attendance manually which is time consuming and can easily have mistaken made during the process this affects their productivity levels due to administrative overheads caused by correcting these errors.
2. **Inadequate Security:** Traditional security measures do not offer proper monitoring or analysis on individuals' movements within the business premise nor vehicles entering - and leaving it thus making them prone areas for infiltration since there is lack of situational awareness here.
3. **Lack Of Instant Information:** Real-time data analytics should be applied whenever decisions are being made. These technologies involve machine learning coupled with

facial recognition, but such facilities have not been integrated into any system so far thereby denying decision makers timely action points based on current scenarios.

4. **Behavior Analysis:** It is important to keep track of what people generally do especially when they are at work because sometimes some might smoke around places where it is prohibited thus posing health hazards.

1.3 Proposed Solution

The Smart Progressive Web App for Business Premises is a complex software solution created to improve the efficiency of work and safety within business facilities. The product has several goals in the use of advanced technologies such as facial recognition, machine learning or real-time data analytics.

For instance, this program tracks attendance automatically using facial recognition algorithms which makes it possible for companies to manage their staff and visitor's entry without any hindrances. Moreover, it can detect smoking events inside the building thereby helping create an environment where people can work in good health conditions as well as reducing accidents related to fires caused by cigarettes.

Machine learning algorithms are used to analyze behavior patterns in a building, which helps to ensure better security measures are put in place. Additionally, these systems have the capability of tracking and analyzing vehicle movements within the premises thus ensuring efficient parking management and overall security by monitoring all activities done by cars.

There are simple counters for managing workers' time worked daily or even part time employees who are on leave due to illness. In addition, they provide alerts if someone has not arrived at work when expected which may mean they have been involved in an accident or are in trouble somewhere else. Automatic reports can be generated showing all employees present or absent during any given period, thereby helping businesses keep track of attendance records.

Secure user-friendly portals are developed for different categories of users including visitors' management system should allow employees view their own attendance history through an online platform where this can be done at any time without necessarily having log into company servers physically each day.

1.4 Working Principle

Business premises need the Smart Progressive Web App. It's designed for, off-line facial recognition for attendance, crowd activity analysis, entry and parking management of cars within the business premises. It performs its activities separately while respecting the current system, hence improving the security and efficiency of the premises. The program gets its data input from the local network cameras, it stores its data in Firebase, the front end uses React and the back end uses Python. Despite being a stand-alone system, it is a step towards businesses embracing intelligent solutions that will enhance the security and operations within their environment.

1.4.1 Product Functions

The Smart Progressive Web App for Business Premises will encompass the following functionalities:

1. **Attendance using Face Recognition:**
   Implementing cutting-edge machine learning algorithms to ensure precise facial recognition for smart attendance tracking within business premises.

2. **Smoking Analysis:**
   Employing sophisticated machine learning algorithms to analyze images captured by local network cameras, specifically targeting smoking behavior within business premises.

3. **Behavior Analysis:**
   Incorporating advanced machine learning algorithms to discern and analyze behavior patterns exhibited within the business premises.

4. **Cars Tracking:**
   Utilizing either machine learning or image processing algorithms to track and analyze vehicle movements with precision.

1.5 Objectives

1.5.1 General Objectives:

The Smart Progressive Web App for Business Premises addresses the unmet need for advanced, integrated solutions to enhance operational efficiency and security in business environments. By leveraging facial recognition, machine learning, and real-time data analytics, the project aims to revolutionize attendance tracking, behavior analysis, smoking detection, and car tracking within business premises. The significance lies in its potential to significantly improve workplace security, automate attendance processes, and provide valuable insights for informed decision-making. This solution responds to the growing demand for intelligent, user-friendly technologies in business settings, contributing to a more secure and efficient work environment.

1.5.2 Academic Objectives:

- Development of a smart and intelligent premises operational management System
- To implement Machine Learning techniques and simulate the results.
- To increase productivity by working in a team
- To design a project that contributes to the welfare of society.

1.6 Scope

The Smart Progressive Web App for Business Premises is a sophisticated software solution aimed at enhancing operational efficiency and security in business environments by leveraging advanced technologies like facial recognition, machine learning, and real-time data analytics. It automates attendance tracking using facial recognition and monitors smoking activities to promote a healthier workplace. Machine learning algorithms analyze behavior patterns and track vehicle movements, contributing to security and parking management. Intuitive dashboards provide administrators with real-time insights and historical data for informed decision-making, while secure portals allow users to access attendance records. Aligned with corporate objectives, the app aims to revolutionize premises management by delivering a comprehensive solution that enhances security, automates processes, and provides valuable insights.

1.7 Deliverables

Deliverables include:

1. Software Requirement Specifications (SRS) Document containing the complete requirements for Smart Progressive Web App for Business Premises.
2. Software Design Document (SDD) Document containing the architectural diagram and all other relevant UML Diagrams to understand the design Smart Progressive Web App for Business Premises.
3. Smart Progressive Web App for Business Premises uses models for smart attendance, user behavior monitoring and smart car parking management.
4. Dashboard to demonstrate the working of software.
5. User Manual is a guide to use Smart Progressive Web App for Business Premises.

1.8 Relevant Sustainable Development Goals

The Smart Progressive Web App for Business Premises aligns with Sustainable Development Goal 9: Industry, Innovation, and Infrastructure. By integrating cutting-edge technologies such as facial recognition, machine learning algorithms, and real-time data analytics, the project aims to revolutionize how businesses manage their premises. This initiative not only enhances the operational efficiency and security protocols within business environments but also contributes to the global goal of fostering inclusive and sustainable industrialization. The focus on innovation in attendance tracking, behavior analysis, and car tracking exemplifies a commitment to resilient infrastructure and technological advancements, echoing the principles of SDG 9 and promoting a more sustainable and secure future for businesses.

1.9 Structure of Thesis

In summary, the thesis breakdown is as follows:

- Chapter 2: Literature Review discusses the popular existing system. Their comparisons and architectural models existing.
- Chapter 3: Proposed Scheme.
- Chapter 4: Overall System Description discusses the product features and functions. It also discusses our target market, Operating environment and some constraints, assumptions and dependencies.
- Chapter 5: System Features presents all the process functionality of the system in detail.

- Chapter 6: System Design presents system architectural design and other relevant UML diagrams to explain the design of the system.
- Chapter 7: System Implementation discusses how the system is implemented.
- Chapter 8: System Analysis.
- Chapter 9: Implementation and Testing
- Chapter 10: Requirement Matrix
- Chapter 11: Conclusion concludes the Thesis with the summary of overall system.
- Chapter 12: Future Direction disuses the possible directions available to grow.

Chapter 2: Literature Review

A new product is launched by modifying and enhancing the features of previously launched similar products. Literature review is an important step for development of an idea to a new product. Likewise, for the development of a product, and for its replacement, related to Smart Progressive Web App for Business Premises, a detailed study regarding all similar projects is compulsory. Our research is divided into the following points.

- Industrial Background
- Existing solutions and their drawbacks

2.1 Industrial background

In contemporary business circumstance, effective control of business property is vital to operational performance as well as security. Classic methods of property management are frequently not able to meet the changing needs of businesses thereby causing inefficiencies and susceptibilities in safety aspects. Businesses are demanding intelligent solutions for managing their premises due to heavy reliance on technology in running their activities. Cloud computing, Internet of Things (IoT) and artificial intelligence (AI) are some of the key technologies that have made it possible to come up with better ways through which property management processes can be optimized. These systems help companies collect data in real time, automate routine operations and beef up security measures among others. In light of this, there arises the need for developing a smart web application for business premises.

2.2 Existing solutions and their drawbacks

Different solutions are previously being provided for the smart and intelligent premises operational management system, but every product has some pros and cons. The following are some solutions which are already being prepared and being implemented.

- TrueIn

- We360.ai
- England Highway Smart System

2.2.1 TrueIn

Truein is a time and attendance solution for the next generation created by Ankit Tanna and Jigar Pujara. It is designed specifically for organizations that have contract or remote staff. Truein solves the common problems of manual recording of attendance and calculation of timesheets. To make the process of taking attendance more transparent and controlled, it uses face recognition and AI technology. The main aim of Truein is to ensure that employees are used optimally, and that income is not lost through a centralized foolproof system of managing attendance for lower to middle level skilled workforces.

Our app offers a full solution for business premises compared to Truein's focus on managing attendance. We've got four main modules in our smart web application besides registering who came in when. These include smoking detection feature behavioral analysis tool and car tracking facility so that the administrator can have an overview of every aspect within the organization.

2.2.2 We360.ai

We360.ai platform created to help employees be more efficient and autonomous. Here they can check attendance records, work schedules, monitor time spent on different websites/apps thereby improving their productivity. This promotes honesty among staff as it provides them with accurate information which they can rely on to judge if they are doing well or poorly. Moreover, it should provide individuals with rightful knowledge concerning their effectiveness at work hence should be used for this purpose. In addition, at we360.ai we believe in doing the right thing even when nobody is watching therefore our teams have exhibited high levels of ethics while offering service delivery which has seen us gain trust among clients across different industries worldwide thus ensuring quality remains uncompromised despite any challenges encountered along way towards achieving organizational objectives.

While we360.ai emphasizes behavior detection, our smart business premises web app has four main modules: attendance tracking; behavior analysis; smoking detection; and car tracking which serve different purposes of improving operational efficiency as well as security in commercial setups. Unlike we360.ai, that focuses on how an individual can be more productive or monitor themselves only- ; with our system you get everything done about managing buildings thus making sure they are safe too (Transparent). These diverse modules offering between one platform another indicate varied needs meted out by them with ours trying much broader such functional optimization towards work environments operationalization together with safeguarding measures implementation

2.2.3 England Highway Smart System

The England Smart Highway is a technology-driven program that aims to increase safety on highways through efficient traffic control and law enforcement. The system allows authorities to keep a close watch on vehicles by identifying their number plates. By making use of sophisticated tracking methods, England Smart Highway will also work towards improving traffic flow, putting more safety measures in place and ensuring that all rules are followed. Real-time monitoring as well as enforcement capabilities are some of the things it seeks to provide so as to deal with congestion problems among others which may arise while using these roads overall making them secure places for drivers all the time. Moreover, this platform represents a giant step forward in terms of managing these spaces where different cars move at high speeds from one point or another which can be very dangerous if not properly handled; therefore through its application such organizations would be able to save many lives alongside optimizing efficiency

England Smart Highway focuses mainly on number plate tracking as its main module, while our smart web app for business premises provides a complete solution with four main modules: attendance tracking, behavior analysis, smoking detection, and car tracking. England Smart Highway is designed for managing traffic on highways through number plate tracking, but our smart web app serves businesses by managing their properties' security and efficiency among others. The fact that different features are

available in each system shows that they have different aims and objectives – England Smart Highway concentrates on issues related with traffic only whereas ours caters for all areas concerned with premises management and safety.

Chapter 3: Proposed Scheme

3.1 User Interfaces

3.1.1 Login Screen

- Both admin and users can login from this screen.
- User id and password is required to login to the dashboard.

3.1.2 Admin Screens

1. Dashboard Screen

- Has a navigation to visit different pages.
- Has Realtime activity of different modules.
- Has Realtime data of any suspicious activity inside the premises.

2. Attendance Screen

- Has Realtime activity of which user is present or not.
- Has Realtime alert of unrecognized person in the premises.
- Has different filters to check data.

3. Car Tracking Screen

- Has Realtime data of cars with their number plate entering the premises.
- Has Realtime data of cars leaving the premises.

4. User Management

- Can add new users.
- Can update existing users.
- Can delete existing users.

5. Crowd Activity Screens

a. Smoking Screen

- Has Realtime activity of which person is smoking.
- Has dedicated buttons to give alerts/warnings to the person.

b. Behavior Screen

- Has Realtime activity of any person misbehaving inside the premises.
- Can give alerts/warnings to the person.

- Has Realtime data of any suspicious behavior.

3.1.3 User Screens

1. **Dashboard Screen**
    - Has Realtime activity of his/her activity.
    - Has Realtime notification of any alert given to that user.
    - Has Realtime data of alert in case of any misbehaving activity in the premises.

2. **Attendance Screen**
    - Can view his/her daily attendance.
    - Can view his/her attendance performance.

3.2 Hardware Interfaces

This system needs following hardware requirements:

- A server PC to operate all Artificial intelligence model.
- Cameras to monitor different locations.
- Internet to enter Realtime data to Firebase Database.
- Laptop or pc to run client web application.
- Server and cameras relate to each other using local area network.

3.3 Software Interfaces

This system has following software interfaces:

- Python server connected to cameras for videos/images feed processing.
- Python server connected to firebase Realtime database with its admin SDK to retrieve and insert data in the database.
- Web Interface (JavaScript) connected to Firebase Realtime Database with its SDK to retrieve data from it.

3.4 Communication Interfaces

This system has following communication interfaces:

- Server and cameras communicate with each other using local area network.
- Server and firebase database communicate using Admin SDK of firebase and internet.
- Web Application will be served over https and used client server communication structure with Firebase and Firebase SDK works as server between the web app and database.

Chapter 4: Overall System Description

This chapter presents the overall description of Smart Web App. It presents the product perspective, product features and product functions of the system. Furthermore, it elaborates the targeted audience, working environment, business rules and some assumptions, dependencies and constraints of the system.

4.1 Product Perspective

Businesses in the digital age encounter a lot of problems concerning security and facilities management. Our software intends to mitigate these issues by presenting companies with an all-around answer for managing their premises effectively and heightening security measures. Our target market spans across various sectors such as retailing industry; corporate offices; educational institutions like schools or colleges among others but not limited to them so basically any place where learning takes place can use it if they want too. What makes our product unique is that it takes into account different areas around buildings along with inside floors which means even hospitals too can benefit from this solution since they have many buildings within one compound. The facial recognition system, machine learning machinery as well as live data analysis tools are used by our site so that people can be able to know who is entering what room at any given time among other things. Furthermore, these technologies also allow users to control access permissions thereby enabling them to monitor onsite activities effectively. It also involves providing a means through which privacy of individuals would not be violated when dealing with such sensitive matters hence fostering confidence levels towards cloud storage platforms that handle critical information.

4.2 Product Features

- Our web app has a simple and easy to use interface that can be integrated with other systems and platforms seamlessly.
- Users are able to access a wide variety of functions such as intelligent attendance recording, behavior analysis, car tracking as well as receiving immediate notifications.

- Using our app coupled with face recognition technology will ensure accurate identification of persons entering or leaving the building thereby saving time for security guards.
- These machine learning algorithms which track behavioral patterns offer insights which may guide security measures among other decisions made by management teams.
- Businesses can customize licenses agreements so that they only pay for what they need thus making it more affordable for them in general terms.
- Our product allows searching through encrypted information even when stored on untrusted clouds thus guaranteeing privacy while at the same time providing access to important data.

4.3 Product Functions

4.3.1 Facial Recognition-based Attendance Module:

This module utilizes cutting-edge machine learning algorithms to enable precise facial recognition for attendance tracking within business premises. As individuals pass by local network cameras, the system captures facial features, matches them with the database, and marks attendance in real-time. Administrators can effortlessly monitor attendance records through intuitive dashboards, promoting seamless and secure attendance management.

4.3.2 Smoking Analysis Module:

Leveraging sophisticated machine learning algorithms, this module analyzes images captured by local network cameras to identify instances of smoking within the premises. When a person is detected smoking, the system generates warnings and alerts administrators in real-time. This functionality contributes to creating a healthier and safer working environment by actively discouraging smoking activities.

4.3.3 Behavior Analysis Module:

The behavior analysis module employs advanced machine learning algorithms to discern and analyze behavior patterns exhibited within the business premises. This insightful

analysis provides administrators with valuable information for enhanced security and management decisions. Real-time data on behavior patterns contributes to proactive measures in maintaining a secure and conducive working environment.

4.3.4 Car Tracking Module:

This module employing either machine learning algorithms, tracks and analyzes vehicle movements within the premises. It plays a crucial role in efficient parking management and overall security by monitoring and recording vehicle activities. Administrators can access real-time data on cars entering and leaving the premises through dedicated dashboards, ensuring streamlined parking facilities.

4.3.5 User Interface Modules:

The user interface modules cater to both administrators and regular users (employees or visitors). Administrators access comprehensive data and analytics through user-friendly dashboards, enabling real-time monitoring and decision-making. Regular users can view their attendance records, receive alerts, and access relevant information through personalized interfaces. The intuitive design ensures a seamless and user-friendly experience for all stakeholders.

4.3.6 Security and Networking Module:

This module ensures the security and seamless communication of the system. It operates within the local network of the business premises, restricting access to authorized users. Data, including user and event information, is stored securely in Firebase, ensuring efficient management. The system is designed for 24/7 availability, meeting the continuous operational needs of business premises.

4.4 User Classes and Characteristics

The Smart Progressive Web App for Business Premises is designed to cater to various user classes based on their roles and responsibilities within the business environment:

1. **Administrators:**

- **Characteristics:** High authority users, such as business owners, managers, or administrators.
- **Functions:** Monitor the premises, access real-time data, generate warnings, create rules, and make announcements. They have complete control and authority over the system.

2. **Employees and Visitors:**

- **Characteristics:** Regular users, including employees and visitors within the business premises.
- **Functions:** Access their attendance records, view warnings issued against them, and receive announcements relevant to their presence within the premises.

These user classes are distinguished based on their roles, responsibilities, and the level of access they have within the Smart Progressive Web App. Administrators have the highest authority, followed by security personnel responsible for continuous monitoring and response, while employees and visitors have limited access focused on their individual information and announcements relevant to them.

4.5 Operating Environment

The Smart Progressive Web App for Business Premises operates in the following environment:

- Client/server system
- Operating systems: Chrome OS, Safari, Opera, Windows (Server)
- Database: Firebase
- Platform: React/Python

4.6 Business Rules

Access Control: The smart web app must only let people who are allowed to and have permission to do so, view or change any stored information.

Data Integrity: Users should check that what they type into our system is right, especially if they're uploading details on attendance, behavior analysis, smoking recognition, or car tracking.

Compliance with Regulations: While working with data in this program users need to follow all laws about keeping it private and following any rules set by authorities when getting it from people.

Secure Key Management: People using modules that work with encrypting things should keep access keys safe but easy enough for them to find again later; this is particularly important for records which show who was at school or other places where lots of individuals might not want anyone else knowing where they have been.

Clear Image Upload: Users should upload clear images when using modules that process pictures so that results of detection and identification are accurate.

Usage Restrictions: People can only use the app for what it was made for in relation to managing property; they are not allowed to do anything illegal with it or look at things they're not supposed to see.

English Dictionary Requirement: For text inputted into our system through keyboards etc., we require conformity with English language dictionaries so as not create any discrepancies during analytical processes carried out by computers.

Compliance with Policies: All persons using these apps must follow organizational policies concerning their usage inclusive but not limited data management methods, protection measures etcetera.

Violations Notification: User must report to the relevant authority immediately if he notices any violation or discrepancy while using the application such as unauthorized access trials among others for necessary action to be taken.

Upgrading Of the System on A Regular Basis: In order to reduce potential weaknesses that can cause harm to the entire organization the latest patches should be used to update what is known as the smart web app by users as well as reliability and high performance should be kept

4.7 Design and Implementation Constraints

In developing the "Smart Progressive Web App for Business Premises," specific constraints guide the project:

- Data, including user and event information, must be stored in Firebase for efficient management.

- Firebase is the designated database engine to ensure seamless integration with the web application.
- The system is designed for 24/7 availability to meet the continuous operational needs of business premises.
- Access to the system is restricted to the local network of the business premises for enhanced security.

Users need to register with the system before each operational period, aligning with business cycles for accurate data.

4.8 Product Design Specifications Assumptions and Dependencies

The product relies on a locally set up machine learning algorithm for the specified features, without the need for external third-party services. Firebase is used for data storage, and the development platform includes React and Python.

Chapter 5: System Features

5.1 Login

1. Description and Priority

- Users (admin & others) can access the web interface by using this feature and it has high priority.

2. Stimulus/Response Sequences

- Users enter their unique id and password and then click login button.
- System will verify the credentials.
- On Correct credentials system will move to dashboard of respective user.
- On Failure system will give an alert.

3. Functional Requirement

Use Case Name	Login Admin/User
Actor	Admin/User
Trigger	User visits the login page
Precondition	User must be present in database.
Basic Path	• User enters his/her id and password and press login button. • System verifies the credentials in database. • The system will redirect the user to his/her dashboard on success.
Alternative Path	If either field is empty, user get an alert by the system.
Post Condition	User will move to his/her respective dashboard.
Others	User Credentials include email and password.

5.2 Real time Attendance

1. Description and Priority

- This feature will mark the person attendance in real time which is inside the premises of building and this feature has high priority.

2. Stimulus/Response Sequences

- Server will try to recognize the person entering the premises with the cameras and database.
- If recognized by the server, the person attendance is marked in the database.
- If not recognized, the system adds an alert to the database.
- Users then can view their attendance and alerts using the web interface.

3. Functional Requirement

- **Mark Attendance**

Use Case Name	Mark Attendance
Actor	Python Server
Trigger	Person passes by the camera
Precondition	Server must be trained to run attendance module.
Basic Path	• When a person passes by the cameras, the server with the help of video/image will start searching for the person in the database. • If available in database, server mark his/her attendance in the database.
Alternative Path	If a person is not present in database, server add an alert in the database.
Post Condition	Attendance has been marked and alerts has been given.

- **Admin Panel**

Use Case Name	Record viewed by Admin
Actor	Admin
Trigger	Admin is on his/her Dashboard
Precondition	Admin must login to his/her dashboard
Basic Path	• When admin redirects to his dashboard after successful login, then he/she can see the attendance of which person is marked. • Can also see alerts of unrecognized person in the premises.
Alternative Path	Admin can also view attendance by using different filters.
Post Condition	Attendance and alerts have been viewed by admin.

- **User Panel**

Use Case Name	Attendance viewed by User
Actor	User
Trigger	User is on his/her dashboard
Precondition	User must log in to his/her dashboard
Basic Path	• User redirects to his/her interface after successful login. • User can see his/her attendance.
Alternative Path	User can see his attendance according to different filters.
Post Condition	Attendance has been viewed by respective user.

5.3Smoking Analysis

1. Description and Priority

- This feature will analyze which person is smoking inside the building premises and add a warning in the database and its priority is high.

2. Stimulus/Response Sequences

- Server will detect if any person is smoking in the premises of building or not.
- If a person is smoking, the server will try to recognize that person.
- Server then adds a warning in the database with location and person identity.
- Admin on his terminal can generate an alert to that person and take necessary actions against that person.
- User can see the alerts against him/her from his/her terminal.

3. Functional Requirement

- **Generate Warnings**

Use Case Name	Generate Warnings By Server
Actor	Python Server
Trigger	Person detected smoking in the cameras
Precondition	Server must be trained to run smoking analysis module.
Basic Path	• When a person is smoking and is caught by cameras, server analysis it and start searching for person in database. • If person is detected in database, then a warning will be added to database with person name and location.

Alternative Path	If a person is not present in database, server adds a warning in database that an unrecognized person is smoking at this location.
Post Condition	Warning added to database.

- **Warning in Admin Panel**

Use Case Name	Warning viewed by Admin
Actor	Admin
Trigger	Admin is on his/her Dashboard
Precondition	Admin must login to his/her dashboard
Basic Path	• When admin redirects to his dashboard after successful login, then he/she can see the warning of which person is smoking at which location. • Can also generate alerts to the specific person.
Post Condition	Alerts have been sent to person.

- **Alert at User Panel**

Use Case Name	Alerts viewed by user
Actor	User
Trigger	User is on his/her Dashboard
Precondition	User must login to his/her dashboard
Basic Path	• When admin redirects to his dashboard after successful login, then he/she can see the alerts of smoking against him/her.
Post Condition	Alerts have been viewed by the user.

5.4Behavior Analysis

1. Description and Priority

- This feature will analyze the behavior of people in the premises and generate warnings in database. This feature has high priority.

2. Stimulus/Response Sequences

- When an undesirable behavior, such as fight is detected, the server triggers to address the situation.
- Server employs facial recognition or other techniques to recognize the individual involved.
- Server then adds a warning in the database with the identities of individuals, their behavior, and the location.
- Admin on his terminal can generate an alert to the individuals and take necessary actions against them.
- User can see the alerts against him/her from his/her terminal.

3. Functional Requirement

- **Generate Warnings**

Use Case Name	Generate Warnings by Server
Actor	Python Server
Trigger	Undesirable behavior detected in the Cameras
Precondition	Server must be trained to run behavior analysis module.
Basic Path	• When a person is behaving in a way that is against the rules and is caught by cameras, server analysis it and start searching for person in database. • If person is detected in database, then a warning will be added to database with person name and location.
Alternative Path	If a person is not present in database, server adds a warning in database that an unrecognized person is behaving undesirably at this location.
Post Condition	Warning added to database.

- **Warnings at Admin Panel**

Use Case Name	Warning viewed by Admin
Actor	Admin
Trigger	Admin is on his/her Dashboard
Precondition	Admin must login to his/her dashboard

Basic Path	• When admin redirects to his dashboard after successful login, then he/she can see the warning of which person behaving wrong at which place. • Can also generate alerts to the specific person.
Post Condition	Alerts have been sent to person.

- **Alert at User Panel**

Use Case Name	Alerts viewed by user
Actor	User
Trigger	User is on his/her Dashboard
Precondition	User must login to his/her dashboard
Basic Path	• When admin redirects to his dashboard after successful login, then he/she can see the alerts of their bahviour.
Post Condition	Alerts have been viewed by the user.

5.5 Car Tracking

1. Description and Priority

- This feature will analyze which car is entering and leaving the premises and this feature has medium priority.

2. Stimulus/Response Sequences

- When a car enters or leaves the building premises the server triggers to address this situation.
- Server detects the car number plate by the help of cameras.
- Server then add a record of car entering and leaving in the database with its number etc.
- Admin can view these records in their web terminal.

3. Functional Requirements

- **Generate Records**

Use Case Name	Generate Warnings By Server
Actor	Python Server
Trigger	Car enters or leaves building premises.
Precondition	Server must be trained to run car tracking module.
Basic Path	• When a car enters or leaves the premises, server with the help of cameras detect the car number plate. • Server then enters the record in database.
Post Condition	Record of car entering/leaving has been added to database.

- **Record in Admin Panel**

Use Case Name	Car Record viewed by Admin
Actor	Admin
Trigger	Admin is on his/her Dashboard
Precondition	Admin must login to his/her dashboard
Basic Path	• When admin redirects to his dashboard after successful login, then he/she can see which car with which number entered or left the premises.
Post Condition	Admin has viewed the records.

Chapter 6: System design

This chapter describes the architecture and system design of the project. It covers the detailed system architecture along with other UML diagrams to explain the design of the system.

6.1 Architecture Design

System architecture refers to the high-level structure and organization of a complex software or hardware system. It defines the components or modules, their relationships, and the principles governing their design, ensuring a blueprint for the system's functionality, scalability, and maintainability.

6.1.1 Facial Recognition-based Attendance Module

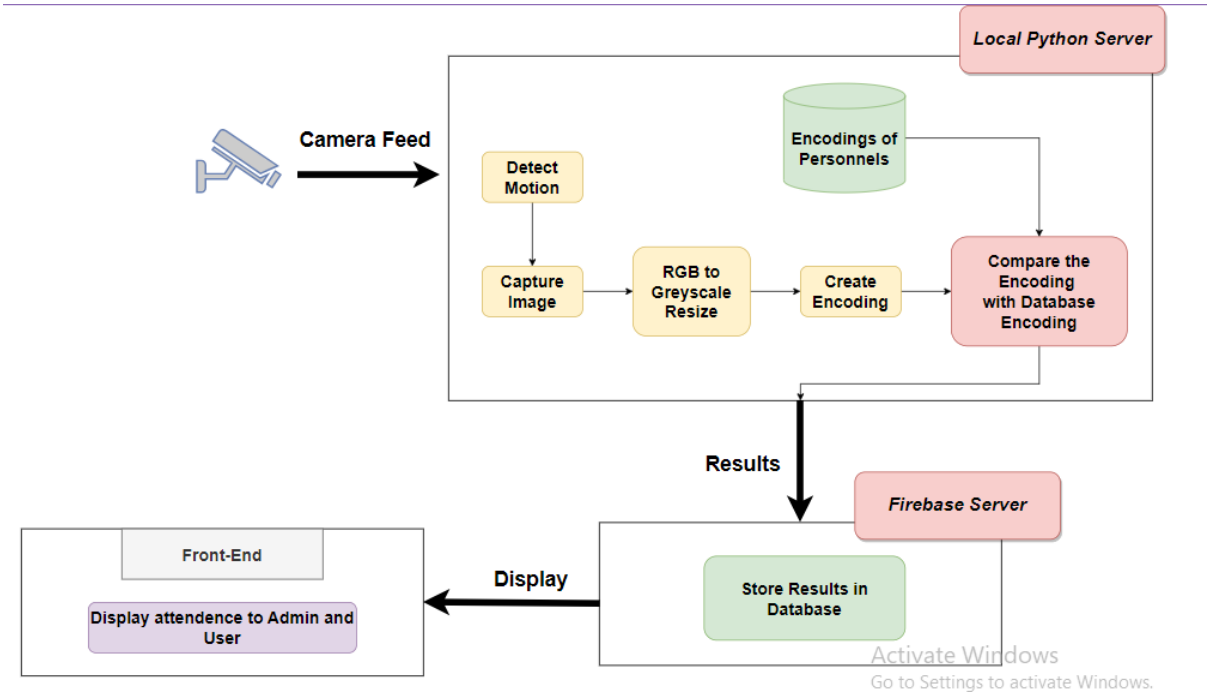

Figure 1:Block Diagram For Attendance Module

The block diagram represents a system for processing and managing attendance through image recognition, specifically using a camera feed. Here's the detailed workflow:

1. **Camera Feed:** The process begins with a camera capturing live feed.
2. **Detect Motion:** The system is designed to detect motion in the live feed to initiate the attendance marking process.
3. **Capture Image:** Upon detecting motion, an image is captured for processing.
4. **Local Python Server:** This server performs several tasks:
    - RGB to Grayscale & Resize: The captured image is converted from RGB to grayscale and resized to standard dimensions for efficient processing.
    - Create Encoding: The grayscale resized image is then encoded for comparison purposes.
    - Encodings of Personnels: A database of encoded images of personnel (like students or employees) is stored on this server.
    - Compare the Encoding with Database Encoding: It compares the encoding of the captured image with those in its database to identify the person.
    - Results: These are derived after comparing encodings and are sent forward for further actions.
5. **Firebase Server:** This server has two primary functions:
    - Store Results in Database: It stores the results received after comparison into a database.
    - Display: It sends data to be displayed on the front-end interface.
6. **Front-End:** This interface displays attendance data to admin and user, providing real-time information access.

6.1.2 Smoking Analysis Module

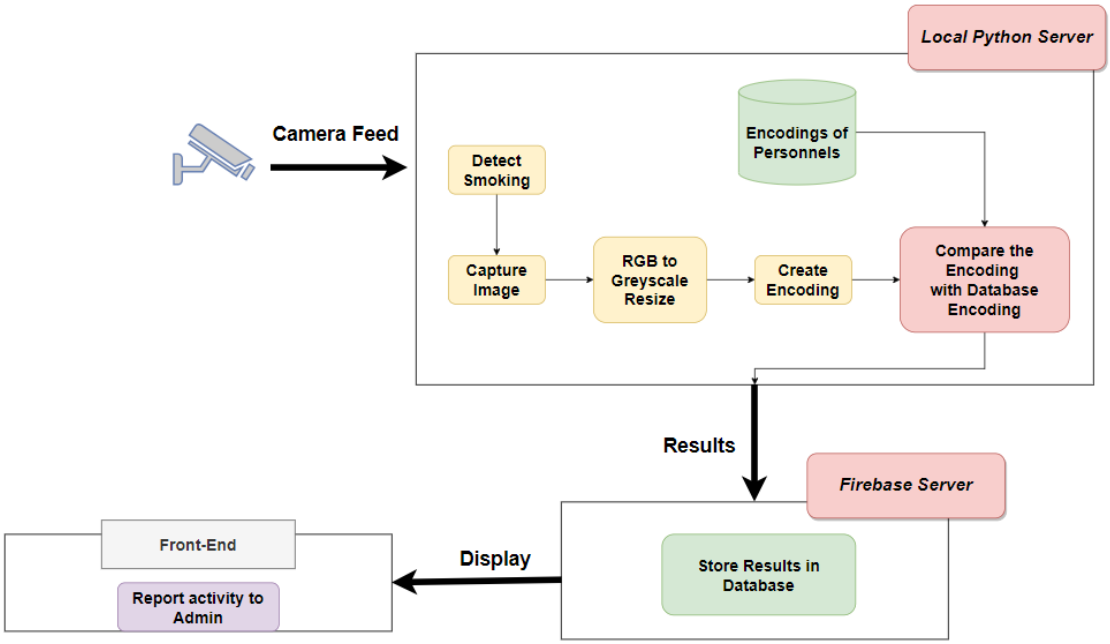

Figure 2:Block Diagram for Smoking Analysis Module

The block diagram represents a system designed to detect smoking activity from a camera feed, process the images, and report the activity to an admin. Here's a detailed breakdown:

1. **Camera Feed:** The system initiates by capturing live feed from a camera.
2. **Detect Smoking:** It has an in-built mechanism to detect smoking activities within the captured images.
3. **Capture Image:** If smoking is detected, it captures the image for further processing.
4. **RGB to Greyscale Resize:** The captured colored image is then converted into greyscale and resized for efficient processing.
5. **Create Encoding:** An encoding of the processed image is created. This could involve generating a unique data signature of the image for identification purposes.
6. **Encodings of Personnels on Local Python Server:** There's a local server that stores pre-existing encodings of personnel who are authorized or recognized by the system.

- Compare the Encoding with Database Encoding: The newly created encoding from the captured image is compared with those in the database to identify if the person caught smoking is recognized or not.
- Results are derived from this comparison and sent forward for storage and display purposes.
- If there's a match, it might imply that an identified individual was caught smoking; otherwise, it was someone unidentified by the system.
- These results can be used for various purposes like security, monitoring adherence to rules etc., depending on where this system is implemented (like offices, public places).

7. **Store Results in Database on Firebase Server:** The results are stored in a database hosted on Firebase server for record-keeping and analytics.

8. **Display:** The results are also displayed probably through an interface or dashboard where real-time data can be monitored. This could be useful for immediate actions or responses whenever smoking activity is detected.

6.1.3 Car Tracking Module

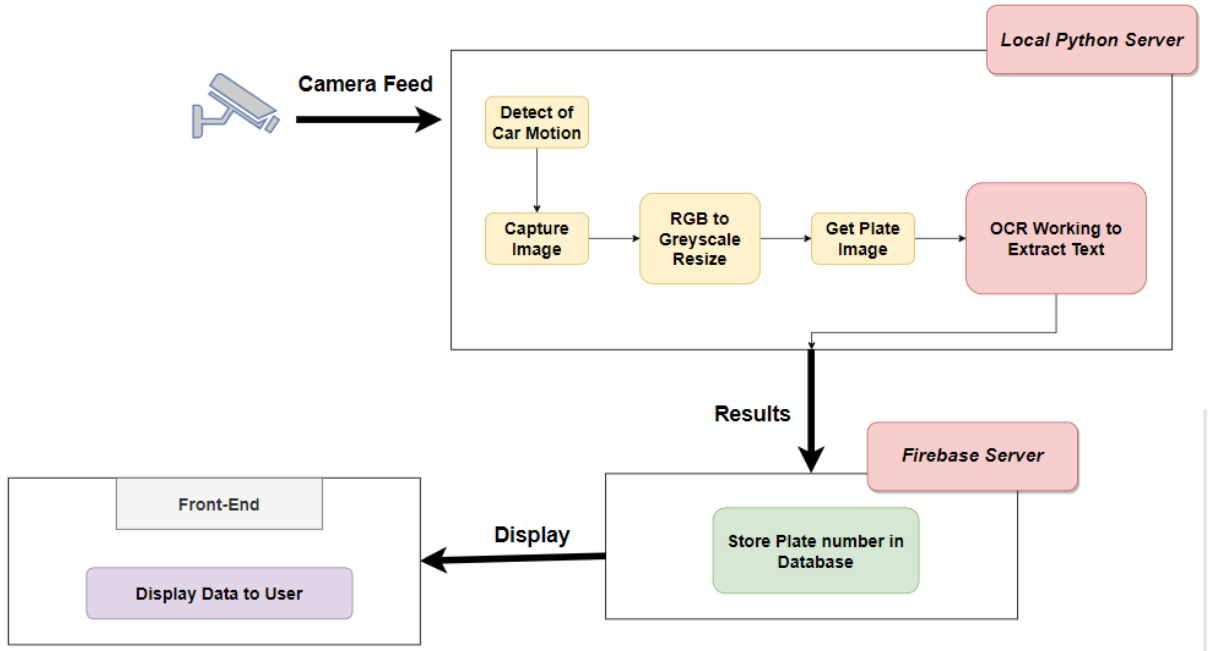

Figure 3:Block Diagram for Car Tracking Module

The block diagram illustrates a system for capturing, processing, and displaying vehicle license plate data from a camera feed. Here's the detailed workflow:

1. **Camera Feed:** The process begins with a camera that captures the motion of cars. When motion is detected, the camera captures an image.
2. **Local Python Server:** The captured image undergoes several processing steps here.
    - RGB to Greyscale Resize: The image is converted from RGB to greyscale and resized to make it suitable for further processing.
    - Get Plate Image: Specific algorithms or methods are employed to isolate and capture the vehicle's license plate from the processed image.
    - OCR Working to Extract Text: Optical Character Recognition (OCR) technology is applied to extract text (the license plate number) from the isolated license plate image.
    - Results: The extracted license plate number text is then sent as a result for further actions.
3. **Firebase Server:** This server receives the extracted text.
    - It stores the license plate number in a database for record-keeping or other purposes.
4. **Front-End Display Data to User:** Finally, there's a front-end display where users can view the captured and processed data – in this case, vehicle license plate numbers.

6.1.4 Behavior Analysis Module

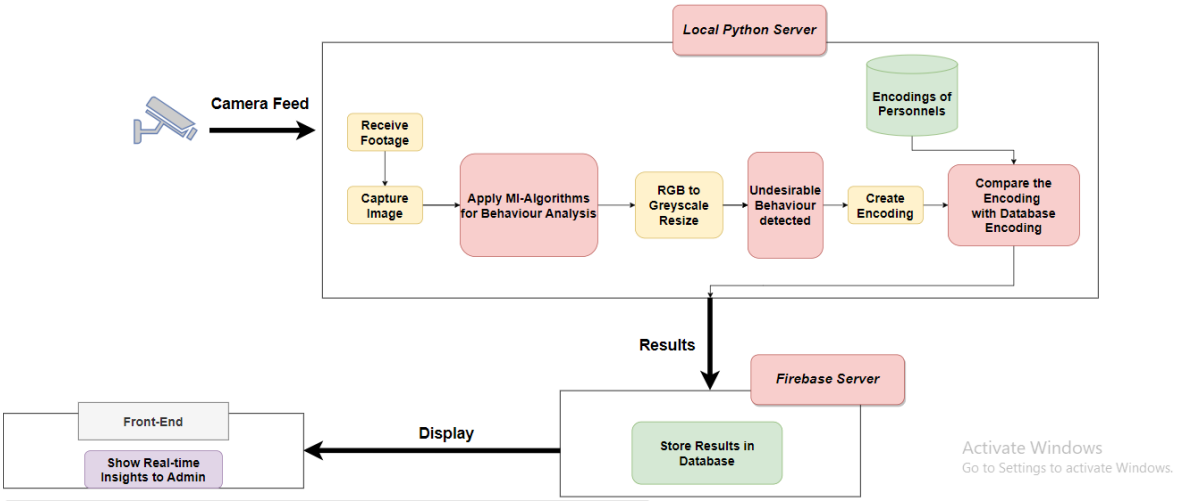

Figure 4:Block Diagram For Behavior Analysis Module

The block diagram represents a system for real-time behavior analysis using camera feed, machine learning algorithms, and database comparison. Here's a detailed breakdown:

1. **Camera Feed:** The process begins with a camera capturing live footage.
    - Capture Image: Images are captured from the live feed.
    - Receive Footage: The captured images are then received for processing.
2. **Local Python Server:** This is where the main processing occurs.
    - Apply ML Algorithms for Behavior Analysis: The received images undergo analysis using machine learning algorithms to detect behaviors.
    - These algorithms likely involve pattern recognition and data analytics to identify specific behaviors in the captured images.
    - RGB to Greyscale/Resize: Images are converted from RGB to greyscale, possibly to reduce complexity and computational requirements. Resizing helps in faster processing.
    - Undesirable Behavior Detected: Specific behaviors deemed undesirable are identified at this stage. Criteria for such behaviors would be predefined based on the application's requirements.

- Create Encoding: An encoding of the detected behavior is created, converting visual data into a format that can be compared with stored data.
- Encodings of Personnels: There seems to be a database of encodings related to personnel behaviors stored for comparison purposes.
- Compare the Encoding with Database Encoding: The newly created encoding is compared with existing encodings in the database to identify matches or anomalies.
- Results: Outcomes from the behavior analysis process – The results of this comparison, indicating whether undesirable behavior has been detected or not, are then sent forward.

3. **Firebase Server:** A cloud-based server where results are stored and managed – The server receives results from the local Python server and stores them in a database.

4. **Display/Front-End:** Show Real-time Insights to Admin – The front-end interface displays real-time insights derived from analyzed data directly to an admin overseeing the system. This could include alerts on detected undesirable behaviors or statistical data on recorded footage.

6.2 Decomposition Description

6.2.1 Overall

The flow of information starts with camera data being fed into models which make predictions. These predictions are then compared. Admins interact with an interface allowing them access to view and check specific types of data. Users register/login through a dedicated component ensuring secure access.

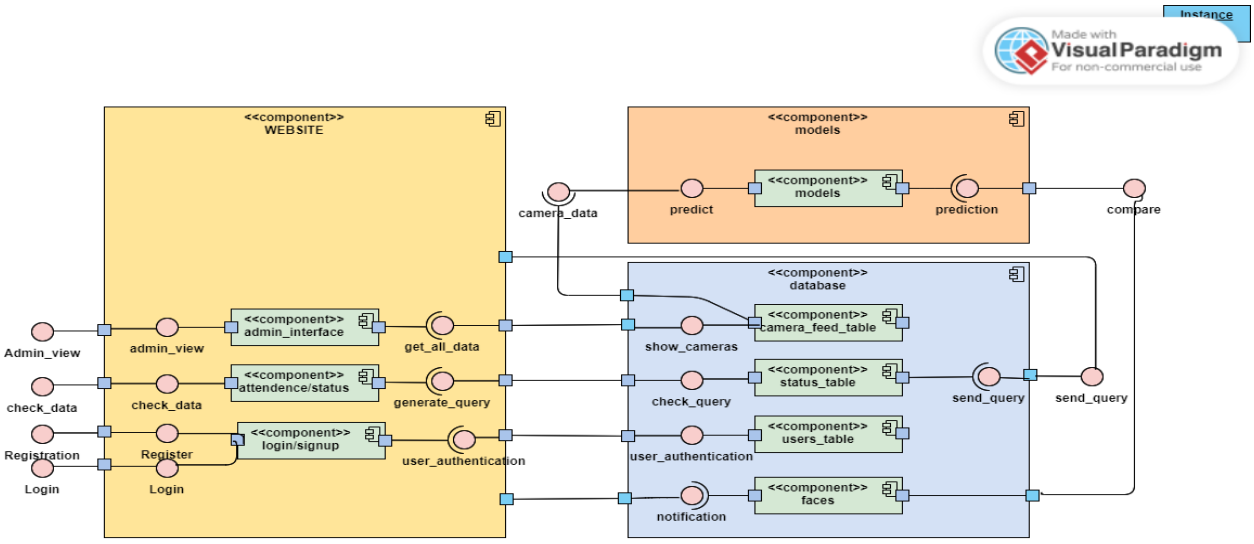

Figure 5:Component Diagram For Overall System

1. **Website Component (Yellow Block):**
    - Admin Interface: Allows admin views and check data functionalities.
    - Admin View: Enables administrators to view specific data.
    - Check Data: A function for administrators to verify the accuracy or completeness of the data.
    - Registration: Handles user registration processes.
    - Register: A component where new users can create their accounts.
    - Login: Allows existing users to access their accounts.
    - Login/Signup User Authentication: Ensures that only authorized individuals can log in.
2. **Models Component (Orange Block):**
    - Accepts camera data and makes predictions based on it.
    - The prediction is then compared, although it's not clear from the diagram what the comparison entails or results in.
3. **Database Component (Blue Block):**
    - Consists of various tables and functionalities related to camera feeds, status, users, and faces notifications.

- Camera Feed Table: Stores data feeds from cameras.
- Status Table & Users Table: Likely store information regarding the status of different entities/users within the system.
- Notifications: Notifications triggered by facial recognition or attendance status changes.

Summary: This diagram outlines an intricate attendance management system integrated with a website. Users interact with the website for registration and login while admins have access to comprehensive data views. Camera feeds provide real-time data that undergo prediction modeling for attendance status determination. A robust database stores various types of information including camera feeds, user statuses, queries, etc., ensuring efficient data management and retrieval. Notifications serve as alerts or updates regarding face detections enhancing user engagement and experience.

6.2.2 Smart Attendance Module

The flow of information starts with camera data being fed into models which make predictions. These predictions are then compared (the nature of this comparison is not detailed in the image). Admins interact with an interface allowing them access to view and check specific types of data. Users register/login through a dedicated component ensuring secure access.

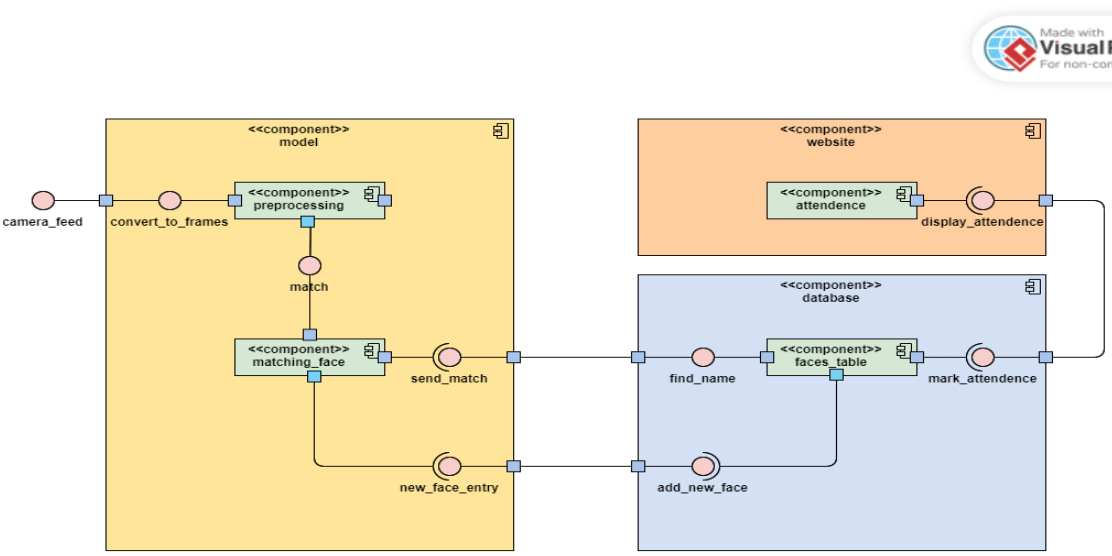

Figure 6:Component Diagram For Smart Attendance Module

1. **Website Component (Yellow Block):**
    - Admin Interface: Allows admin views and check data functionalities.
    - Admin View: Enables administrators to view specific data.
    - Check Data: A function for administrators to verify the accuracy or completeness of the data.
    - Registration: Handles user registration processes.
    - Register: A component where new users can create their accounts.
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3. **Database Component (Blue Block):**
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    - Camera Feed Table: Stores data feeds from cameras.
    - Status Table & Users Table: Likely store information regarding the status of different entities/users within the system.

Summary: This diagram outlines an intricate attendance management system integrated with a website. Users interact with the website for registration and login while admins have access to comprehensive data views. Camera feeds provide real-time data that undergo prediction modeling for attendance status determination. A robust database stores various types of information including camera feeds, user statuses, queries, etc., ensuring efficient data management and retrieval. Notifications serve as alerts or updates regarding face detections enhancing user engagement and experience.

6.2.3 Car Tracking Module

The flow of information starts with camera data being fed into models which make predictions. These predictions are then compared (the nature of this comparison is not detailed in the image). Admins interact with an interface allowing them access to view and check specific types of data. Users register/login through a dedicated component ensuring secure access.

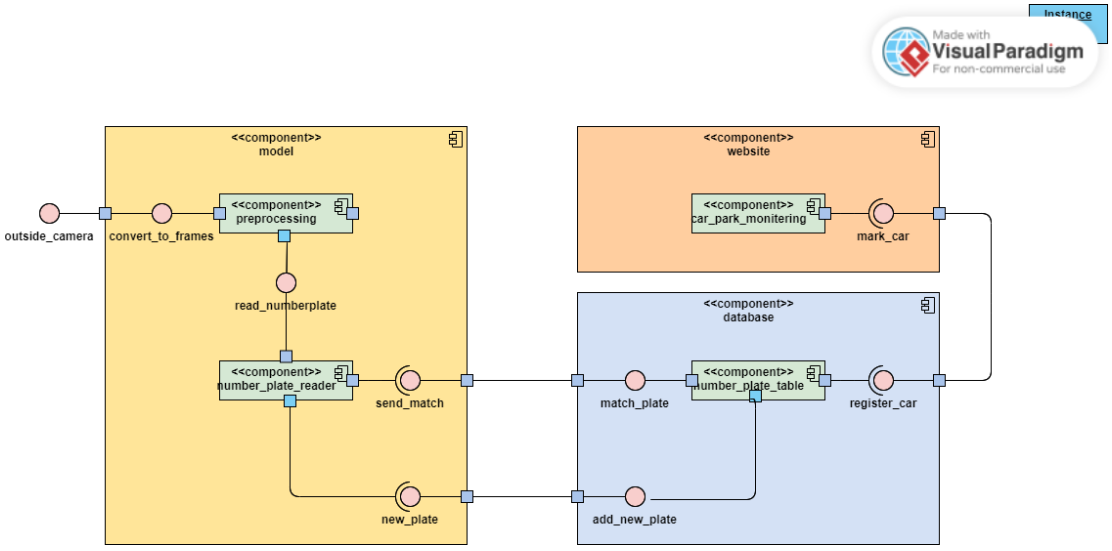

Figure 7:Component Diagram For Car Tracking Module

1. **Website Component (Yellow Block):**
   - Admin Interface: Allows admin views and check data functionalities.
   - Admin View: Enables administrators to view specific data.
   - Check Data: A function for administrators to verify the accuracy or completeness of the data.
   - Registration: Handles user registration processes.
   - Register: A component where new users can create their accounts.
   - Login: Allows existing users to access their accounts.
   - Login/Signup User Authentication: Ensures that only authorized individuals can log in.
2. **Models Component (Orange Block):**
   - Accepts camera data and makes predictions based on it.

- The prediction is then compared, although it's not clear from the diagram what the comparison entails or results in.

3. **Database Component (Blue Block):**
    - Consists of various tables and functionalities related to camera feeds, status, users, and faces notifications.
    - Camera Feed Table: Stores data feeds from cameras.
    - Status Table & Users Table: Likely store information regarding the status of different entities/users within the system.

Summary: This diagram outlines an intricate attendance management system integrated with a website. Users interact with the website for registration and login while admins have access to comprehensive data views. Camera feeds provide real-time data that undergo prediction modeling for attendance status determination. A robust database stores various types of information including camera feeds, user statuses, queries, etc., ensuring efficient data management and retrieval. Notifications serve as alerts or updates regarding face detections enhancing user engagement and experience.

6.2.4 Smoking Detection Module

The components of the system interact with each other in the following ways:

- The camera feed continuously captures video footage.
- The detect smoking component analyzes the video footage using the model and outputs a prediction of whether or not smoking is present.
- If smoking is detected, the warning display component displays a visual warning on the screen.
- The face recognition component may be used to identify the person who is smoking.
- The check warnings component checks for any pending warnings and takes appropriate actions.
- The display component displays information about the system and any detected smoking events.

- The database stores data about the system, such as logs of detected smoking events and user settings.
- The send warning component sends a warning notification to the appropriate person or device when smoking is detected.
- The find name component uses face recognition to identify the name of the person who is smoking.
- The send notification component sends a notification to the user about the detected smoking event.

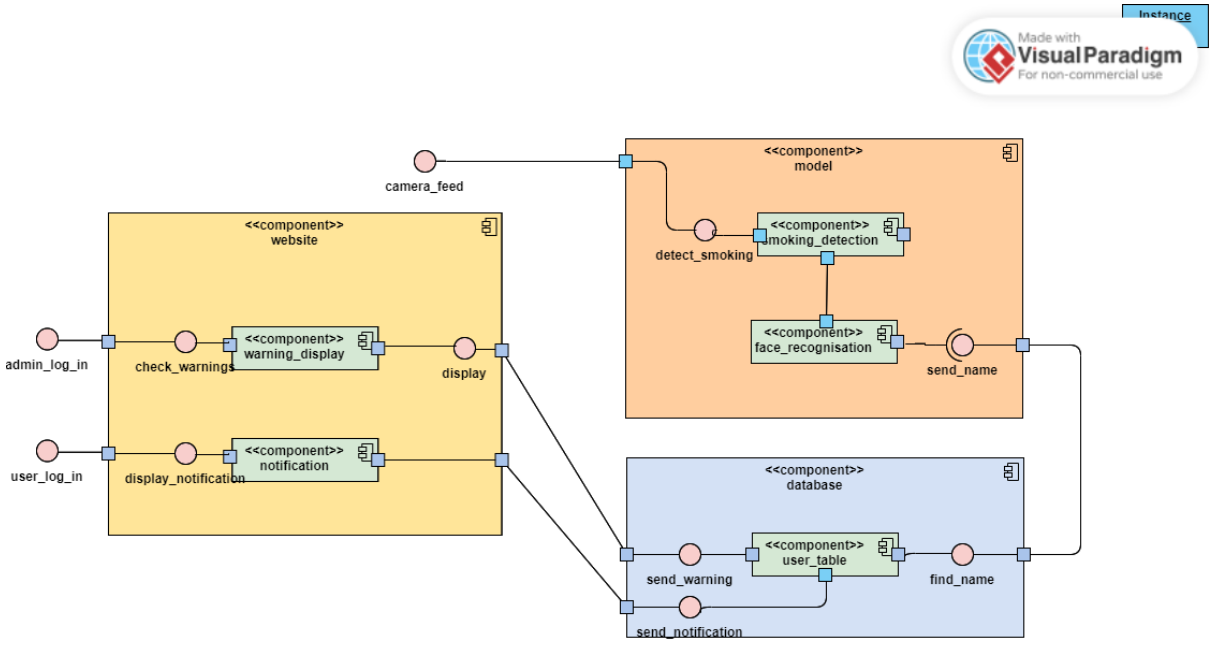

Figure 8:Component Diagram For Smoking Detection Module

The main components of the system are:

- Camera feed: This is the source of the video input for the system.
- Model: This is the machine learning model that is used to detect smoking in the video footage.
- Detect smoking: This component takes the video input from the camera feed and passes it to the model for analysis. The model then outputs a prediction of whether or not smoking is present.
- Warning display: This component displays a visual warning on the screen if smoking is detected.

- Face recognition: This component is used to identify the person who is smoking.
- Admin log in: This component allows authorized users to log in to the system and view logs and manage settings.
- Check warnings: This component checks the system for any pending warnings and takes appropriate actions, such as sending notifications or recording the event.
- Display: This component displays information about the system, such as the status of the camera and the model, and any detected smoking events.
- Database: This component stores data about the system, such as logs of detected smoking events and user settings.
- User table: This table in the database stores information about users of the system, such as their names and login credentials.
- Send warning: This component sends a warning notification to the appropriate person or device when smoking is detected.
- Find name: This component uses face recognition to identify the name of the person who is smoking.
- Send notification: This component sends a notification to the user about the detected smoking event.

Summary

The smoking detection system is a complex system that uses a variety of components to detect smoking and take appropriate actions. The system is likely to be effective in deterring smoking in areas where it is deployed. However, it is important to consider the accuracy of the model, the need for calibration, and the privacy of the people being monitored.

6.2.5 Sleep Detection Module

- The workplace camera continuously captures video footage of employees.

- The sleep detection component analyzes the video footage using the model and outputs a prediction of whether or not the employee is sleeping or fatigued.
- If the employee is detected as sleeping or fatigued, the admin can send an alert to the employee.
- The system may also send a warning to a supervisor or manager if an employee is detected sleeping or fatigued.
- Data about the events is stored in the database.

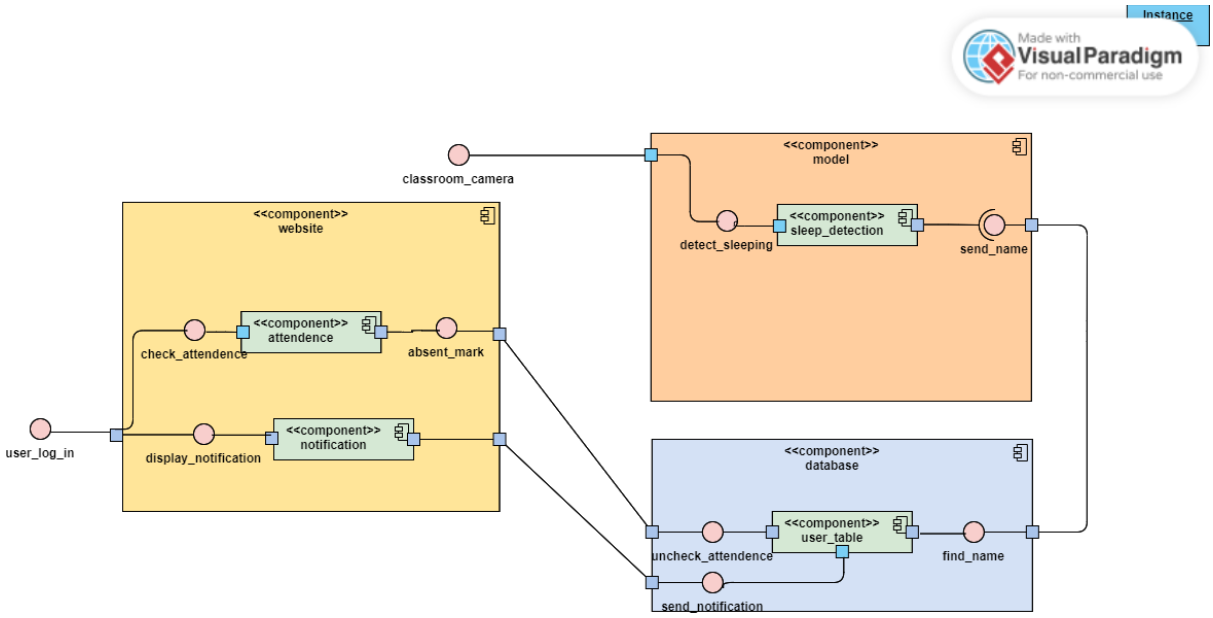

Figure 9:Component Diagram for Sleeping Detection Module

The main components of the system are:

- Workplace camera: This is the source of the video input for the system.
- Model: This is the machine learning model that is used to detect sleepiness or fatigue in the video footage.
- Sleep detection: This component takes the video input from the camera and passes it to the model for analysis. The model then outputs a prediction of whether or not the employee is sleeping or fatigued.
- Alert manager: This component receives the output from the sleep detection component and determines what action to take.

- Warning: If the alert manager determines that the employee is sleeping or fatigued, it may send a warning to the employee, such as an audible or visual alert.
- Attendance system: This component may be used to track the employee's attendance and mark them as absent if they are detected sleeping for an extended period.
- Notification: The system may also send a notification to a supervisor or manager if an employee is detected sleeping or fatigued.
- Database: This component stores data about the system, such as logs of detected sleep events and employee attendance records.

Summary

The sleep detection and response system is a complex system that uses a variety of components to detect when employees are sleeping or fatigued on the job and take appropriate actions. The system may be helpful in improving workplace safety and productivity.

6.2.6 Login/Signup Module

1. Login Process

- User arrives at login page: The user opens the website or app and navigates to the login page.
- User enters credentials: The user enters their username or email address and password into the designated fields on the login page.
- System verifies credentials: The system compares the entered credentials against the stored user data in the database.
- Login successful: If the credentials match, the user is granted access to the website or app, and they are redirected to the homepage or their account dashboard.

- Login unsuccessful: If the credentials don't match, the system displays an error message, and the user is prompted to try again. They may have forgotten their password or mistyped their credentials.

2. Signup Process

- User arrives at signup page: The user navigates to the signup page, either from the login page or another location on the website or app.
- User enters signup information: The user enters their desired username, email address, password, and potentially other optional information like their name, location, or date of birth.
- System checks for existing account: The system checks if the username or email address entered is already associated with an existing account.
- Account creation successful: If the information is valid and unique, the system creates a new user account in the database and stores the user's information. The user may be automatically logged in or directed to a confirmation page.
- Account creation unsuccessful: If the username or email address is already taken, the system displays an error message and prompts the user to choose a different one.

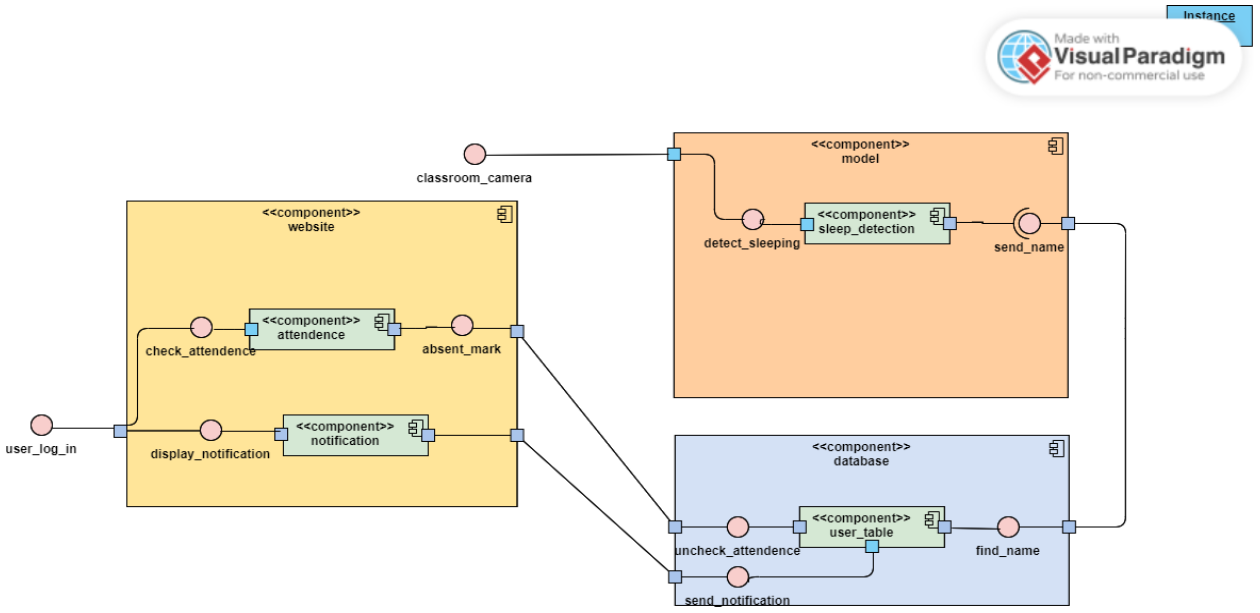

Figure 10:Component Diagram for Login/Signup Module

6.3 Data Design

In our system we will be using cameras to take input on various stages throughout the work environment to check for various activities. In that case we believe that the use of a client/server architecture is the best approach for this. The system is going to use a web application and therefore the client/server architecture will divide the workload in a logical manner.

The server is the backend which will be housing our machine learning algorithm that will do the actual video processing, analysis of the frames and the making of predictions for the

frontend to display. The model will be taking a video as in out and cut it into slices or frames to provide the pictures that it will then run through its model to predict the activity that is happening. The model will also house functions that will be performing activities like the preprocessing, segmentation and division of the video in frames. Client is responsible for presenting the data to the user and receiving user input. the View could be a user interface (UI) for administrators and students. For attendance, the client would display dashboards and real-time attendance updates. It could also provide interfaces for manual entry or correction of attendance data. The client would present live alerts for incidents, and historical reports. It might allow users to configure and customize the display. Server handles user input, updates accordingly, and refreshes the client. The server would receive signals from the camera system and update the client. It would also handle requests from the client for generating reports or making corrections. The components in this have high cohesion and low coupling meaning all of them are separate and there are no real dependencies between each other and that is a significant advantage.

6.4 Design Patterns

A design pattern is a reusable and general solution to a recurring problem in software design. It provides a template or guideline for structuring code to address common challenges, promoting best practices and maintainability in software development.

Here are the design patterns relevant to the project.

1. **Observer Pattern:**

Use the Observer pattern to allow cameras to act as observers, triggering events when a person is detected or other relevant actions.

2. **Strategy Pattern:**

Apply the Strategy pattern to encapsulate different algorithms or approaches for AI modules handling tasks such as attendance detection, smoking analysis, and behavior analysis.

6.5 Data Flow Diagrams

6.5.1 Attendance Module

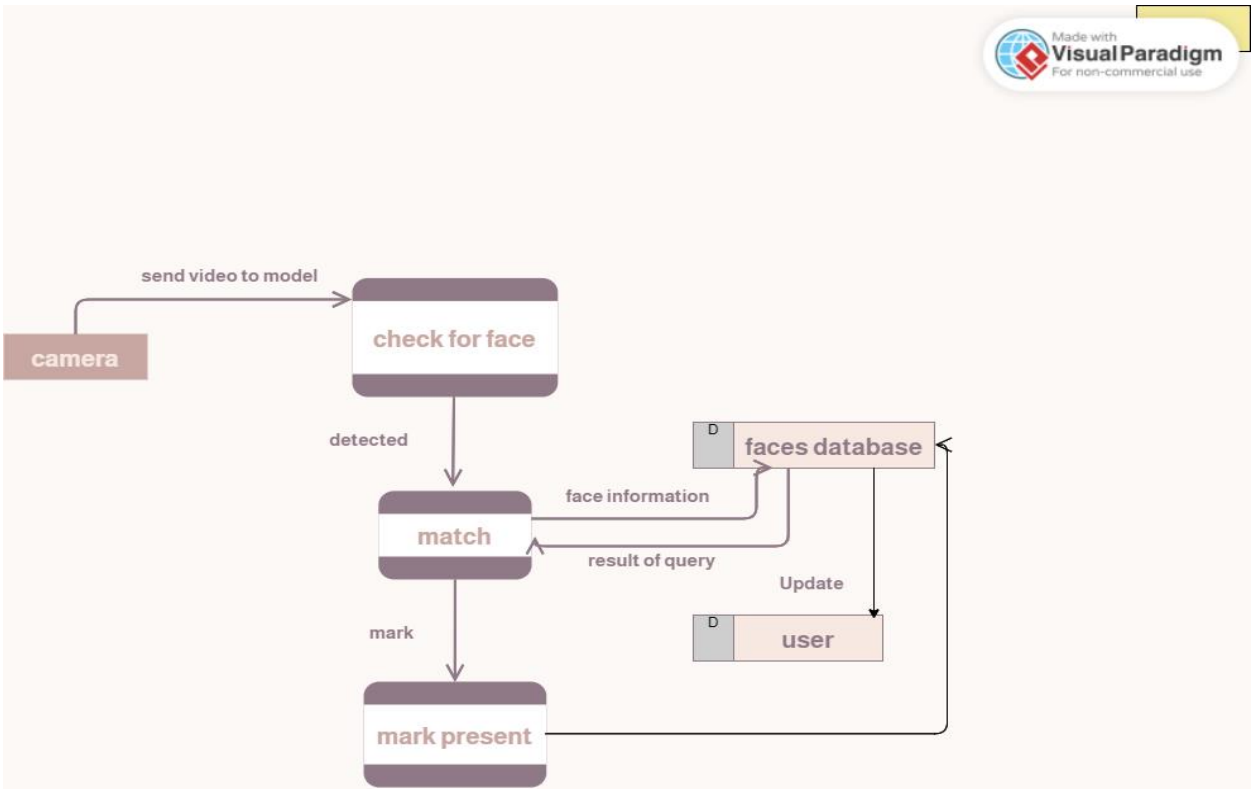

Figure 11:Data Flow Diagrams for Attendance Module

6.5.2 Smoking Detection Module

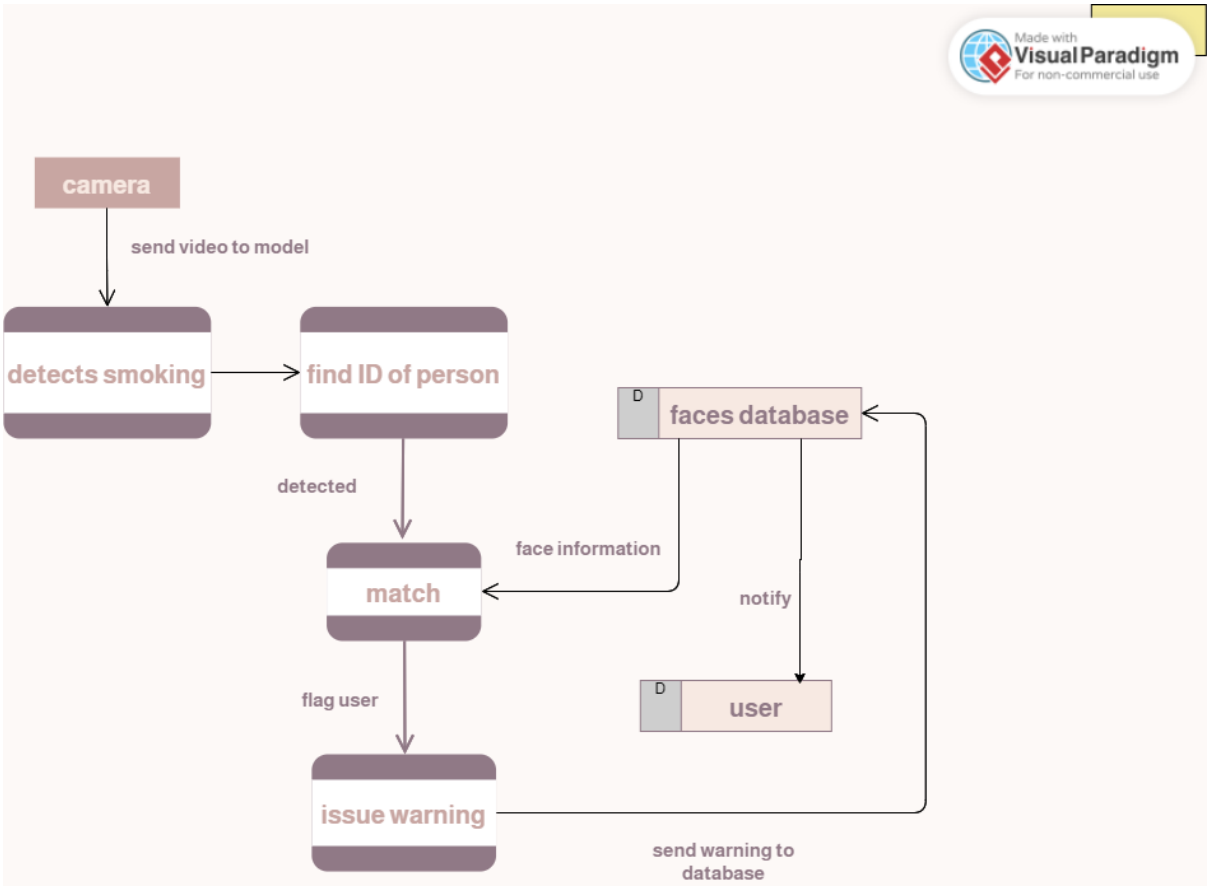

Figure 12:Data Flow Diagrams for Smoking Detection Module

6.5.3 Sleep Detection Module

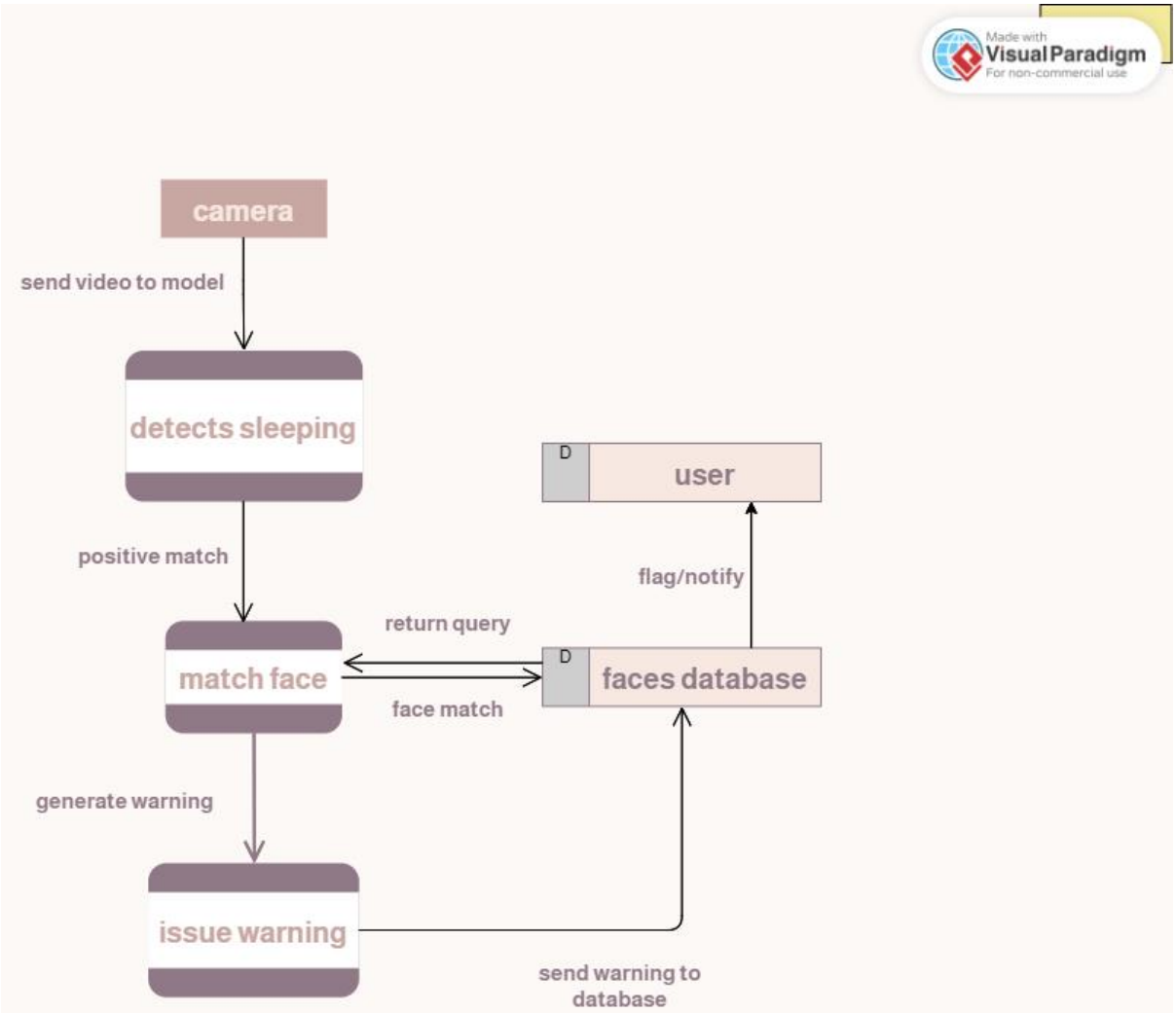

Figure 13:Data Flow Diagrams for Sleeping Module

6.5.4 Car Tracking Module

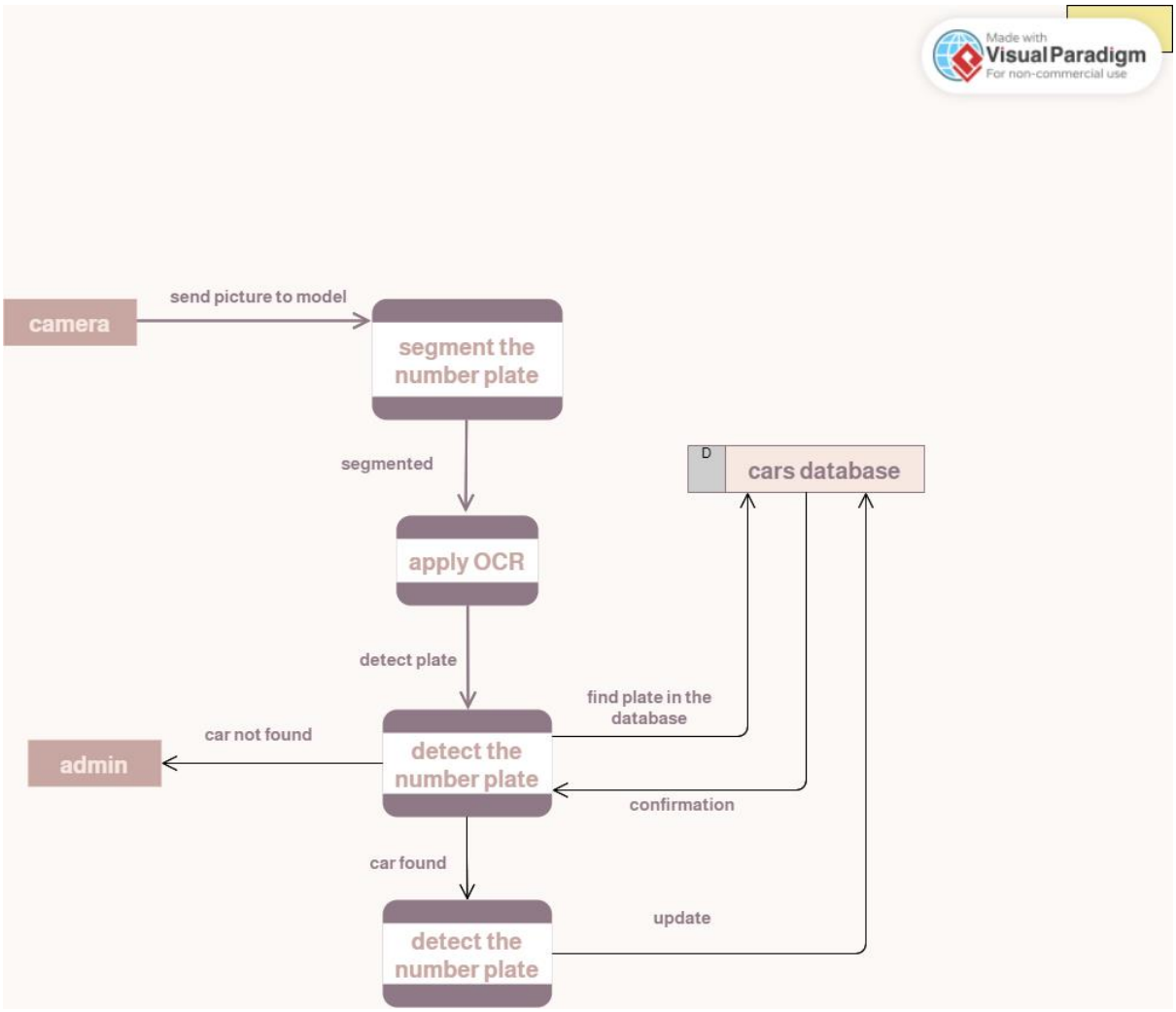

Figure 14:Data Flow Diagrams for Car Tracking Module

6.6 Data Description

The Data Required for the smooth working of modules running in the server are as follow:

6.6.1 Attendance Module

1. People Data must be added to the database using a unique id.

2. Images of people required to generate their encoding by the face recognition model and then use the encodings in the future.

6.6.2 Smoking Detection Module

1. Images of people are required to generate their encoding by the face recognition model and then use the encodings to detect which person is smoking in the premises.
2. Dataset for detection of smokers and non-smokers required for the smooth running of Smoking model.
    - https://www.kaggle.com/datasets/sujaykapadnis/smoking/data

6.6.3 Sleep Detection Module

1. Images of people required to generate their encoding by the face recognition model and then use the encodings to detect which person is sleeping in the premises.
2. Dataset to detect whether the person is sleeping in premises or not
    - https://www.kaggle.com/datasets/uom190346a/sleep-health-and-lifestyle-dataset

6.6.4 Car Tracking Module

1. Datasets of both Pakistan and International Number Plates are required to train the model according to the respective region's plate.

a. https://github.com/opencv/opencv/blob/master/data/haarcascades/haarcascade_russian_plate_number.xml

b. https://github.com/faisalshahbaz/ANPR-Pakistan-Plate/blob/master/pak.xml

6.7 Data Dictionary

6.7.1 Website

1. login() > This function will logged in every user which is present in the database.
2. getData() > This function will retrieve the data from database for both admin and users.
3. generate_Warnings() > This function is for admin only by which admin generate warnings and alerts to the people violating premises rules.
4. insert_Data() > This function is for admin only by which admin add, update or delete specific user from the system
5. logout() > This function will logout the user from the system.

6.7.2 Server Side

1. load_Database() > This function will load the online database in the server.
2. create_Encodings() > This function will convert the images in encodings for the purpose of image recognition.
3. mark_Attendance() > This function will mark the attendance of person in the database.
4. number_Plate_Tracking() > This function will analyze the number plates of vehicles entering in the premises and extract the text from the plate and keep record in the database.
5. person_Smoking() > This function will analyze if a person is smoking or not with the help of machine learning model. If detected then face recognition model will try to detect his/her face and record the data in the database.
6. person_Sleeping() > This function will analyze if a person is sleeping in the premises or not. If yes then the model try to detect his/her face and record data in the database.

6.8 Use Case Diagram

Figure 15:Use Case Diagram

6.9 Activity Diagrams

Before we delve into the intricate activity diagram, let's paint a picture of your smart business premises in action. Imagine employees breezing through facial recognition turnstiles, their movements subtly analyzed for safety and productivity. Meanwhile, intelligent cameras track vehicle entries and exits via license plate recognition, streamlining parking management and access control. This seamless blend of security and automation not only enhances employee well-being but also empowers informed decision-making, optimizing operations and cost-efficiency.

Now, let's dissect the activity diagram to understand the intricate interplay of these technologies.

6.9.1 Attendance Module Activity Diagram

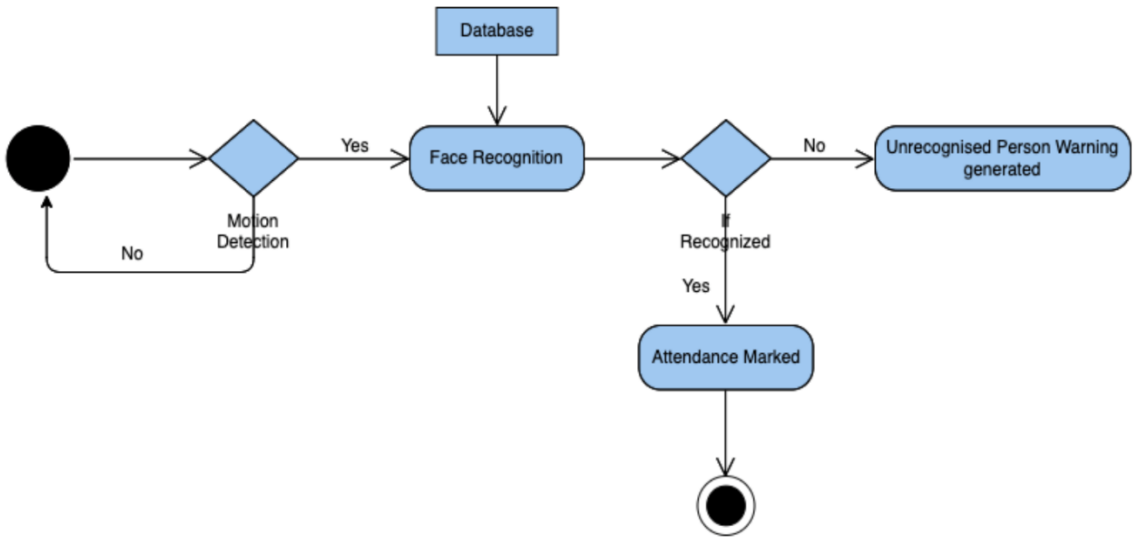

Figure 16:Attendance Module Activity Diagram

6.9.2 Number Plate Tracking Module Activity Diagram

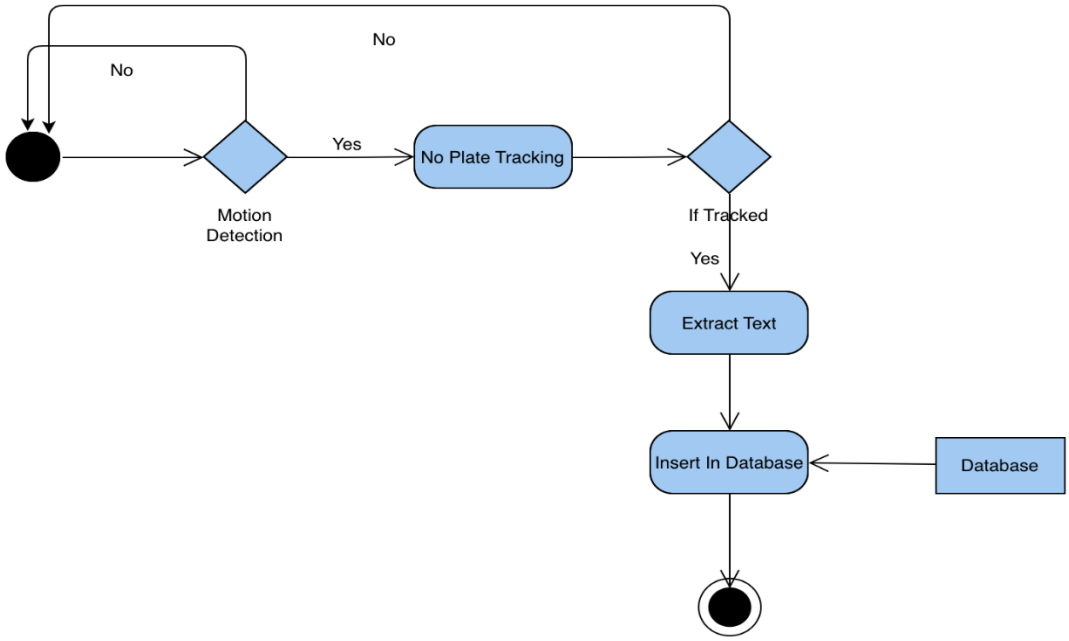

Figure 17:Number Plate Module Activity Diagram

6.9.3 Smoking Detection Module Activity Diagram

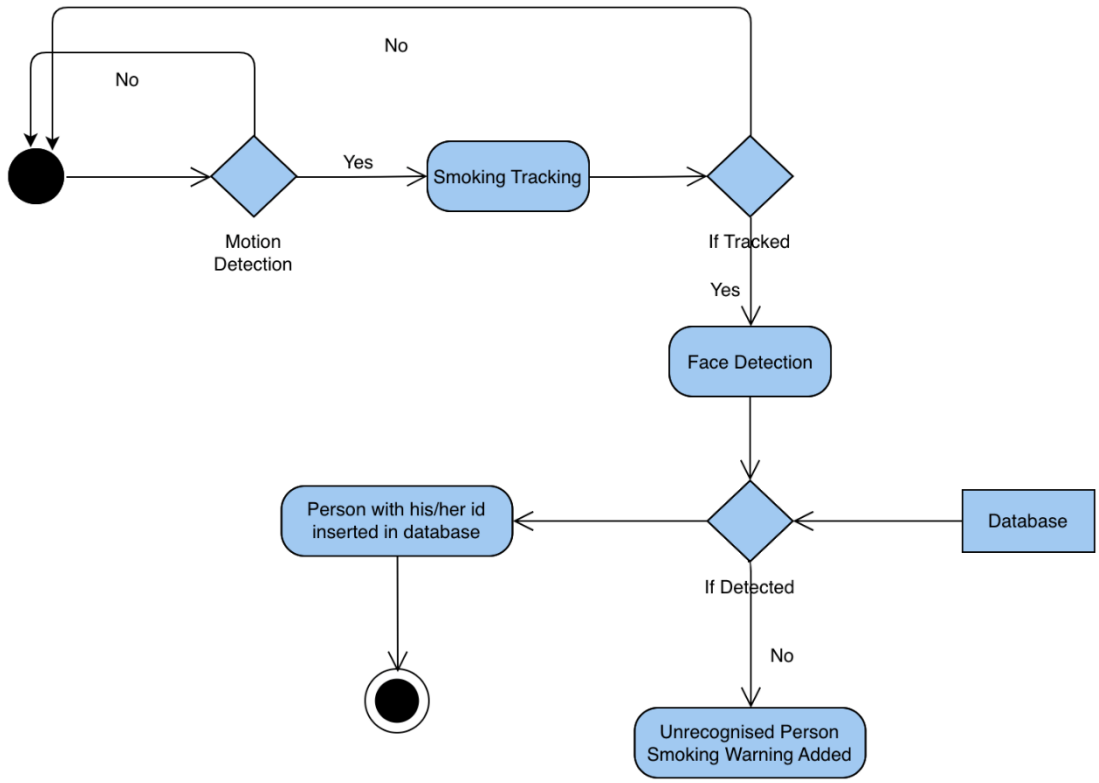

Figure 18:Smoking Detection Module Activity Diagram

6.9.4 Sleep Detection Module Activity Diagram

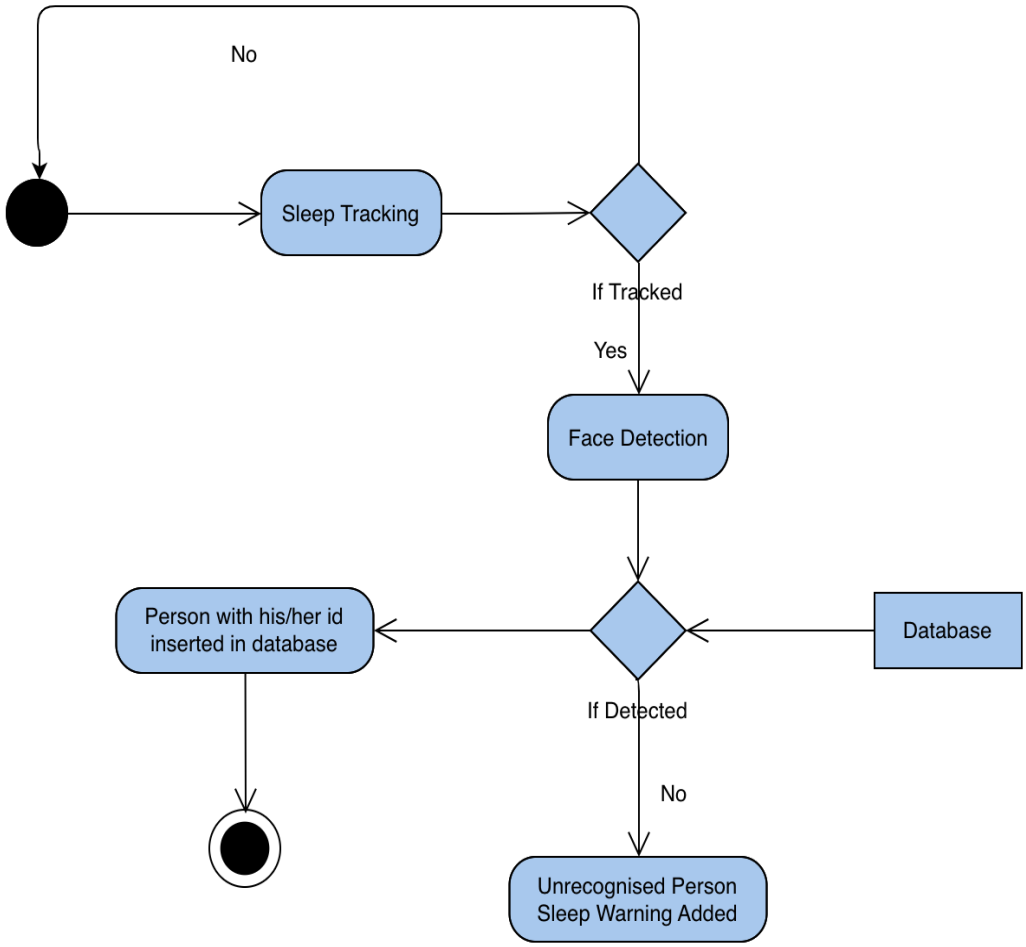

Figure 19:Sleeping Module Activity Diagram

6.10 Sequence Diagrams

The sequence diagram unfolds the precise choreography of interactions between systems, revealing a captivating ballet of data exchange and decision-making.

6.10.1 Admin Screen

Figure 20:Sequence Diagrams For Admin Screen

6.10.2 User Screen

Figure 21:Sequence Diagrams For User Screen

6.10.3 Server

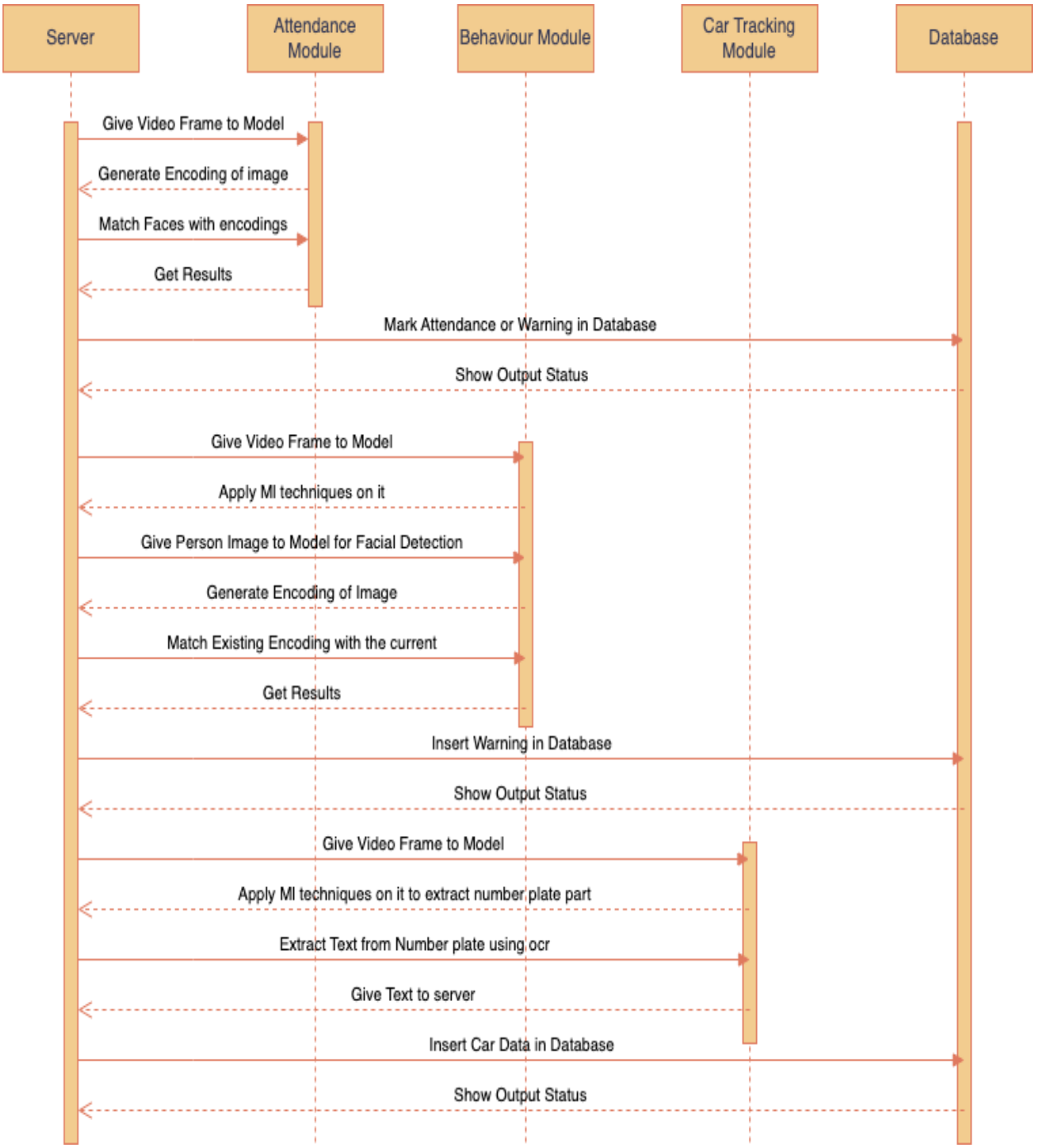

Figure 22:Sequence Diagrams For Server

6.11 Class Diagrams

Unveiling the blueprint of your smart business premises, the class diagram meticulously maps out the key players and their intricate relationships.

6.11.1 Server Class Diagram

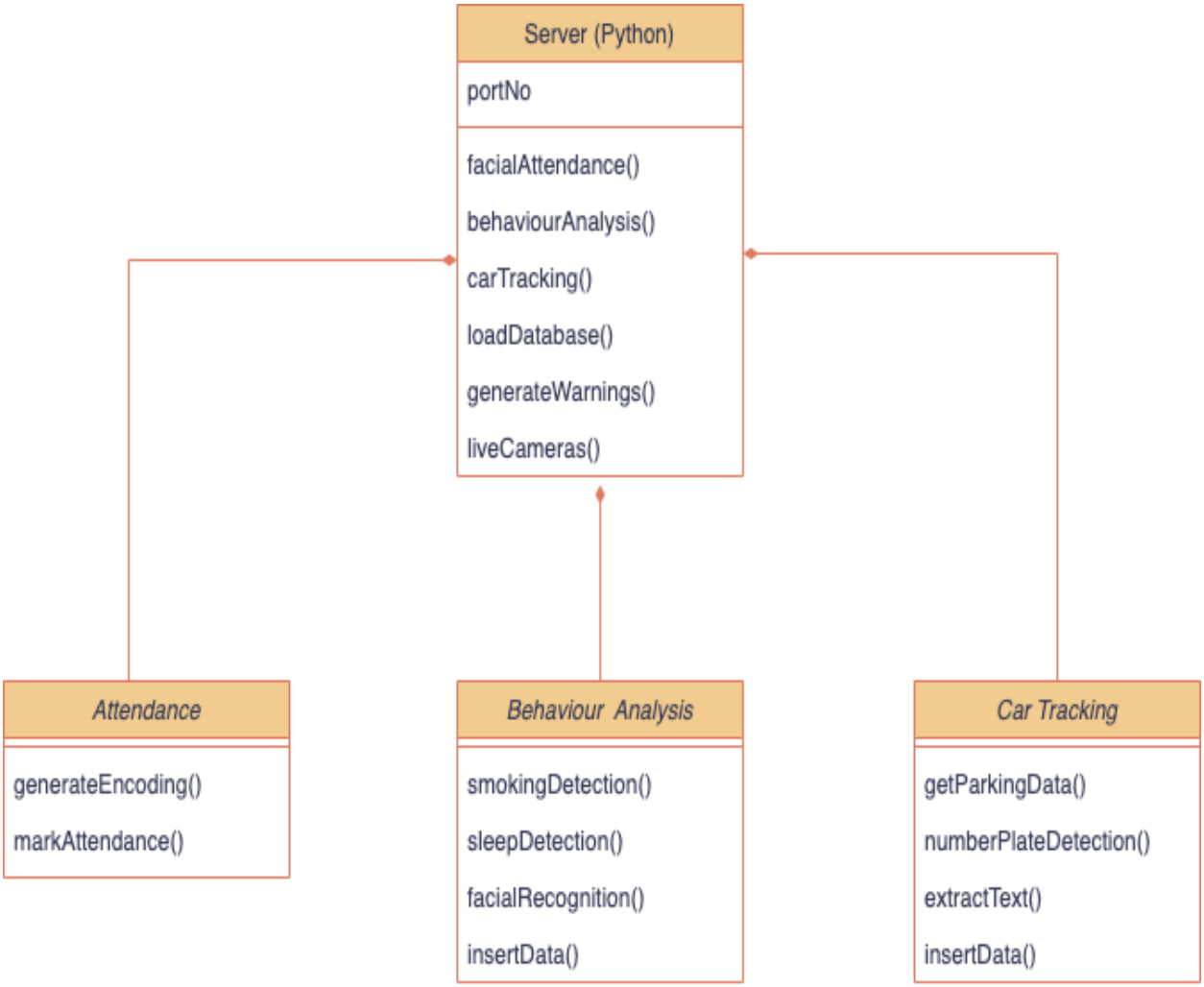

Figure 23:Server Class Diagram

6.11.2 Website Class Diagram

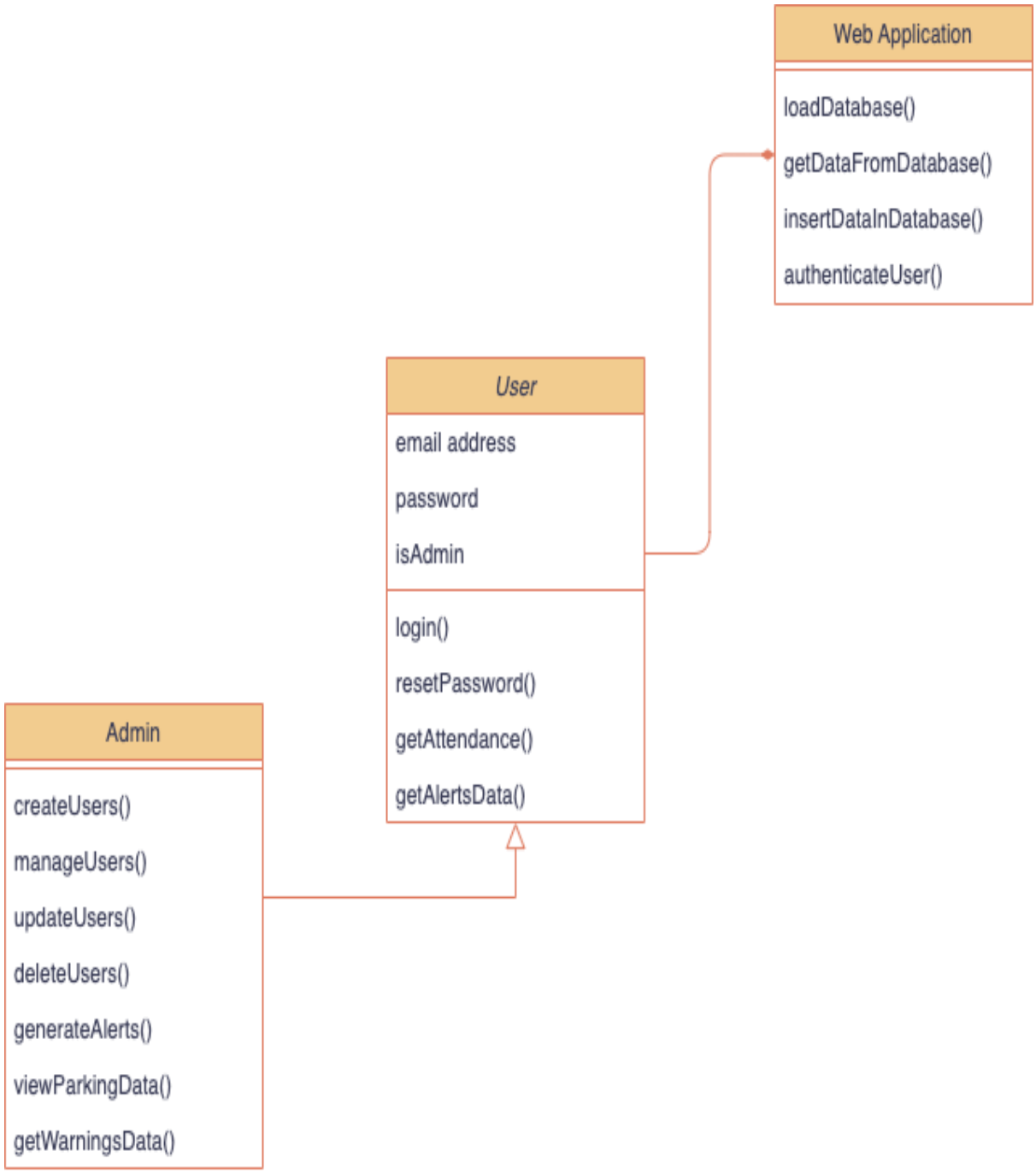

Figure 24: Server Class Diagram

Chapter 7: System Implementation

7.1 Screen Images

7.1.1 Login Screen

The login screen serves as the gateway for administrators to access the Smart Progressive Web App for Business Premises. It features a secure login mechanism where administrators can enter their credentials. Additionally, a "Forget Password" option is available to facilitate account recovery if needed.

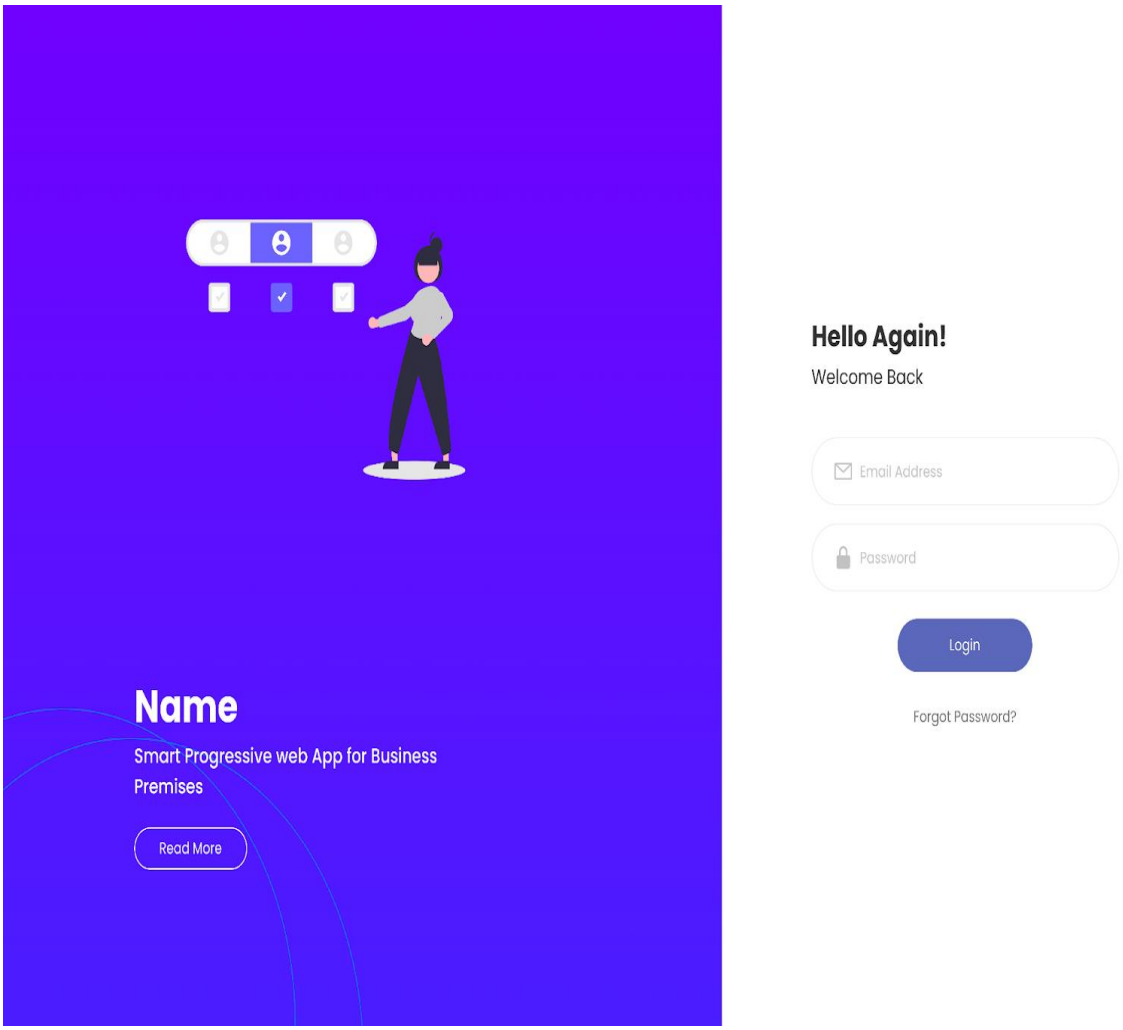

Figure 25:Login Screen UI

7.1.2 Dashboard

The dashboard is the central hub of the Smart Campus system, providing a comprehensive overview of activities. It features a vertical navigation bar on the left, allowing easy access to specific modules such as Attendance, Behavior Analysis, and Car Tracking. The top of the screen displays key metrics like attendance, behavior incidents, smoking detection, and the number of parked cars. The remaining portion comprises a table presenting details such as name, phone number, attendance status, behavior/smoking reports, and associated car numbers for individual.

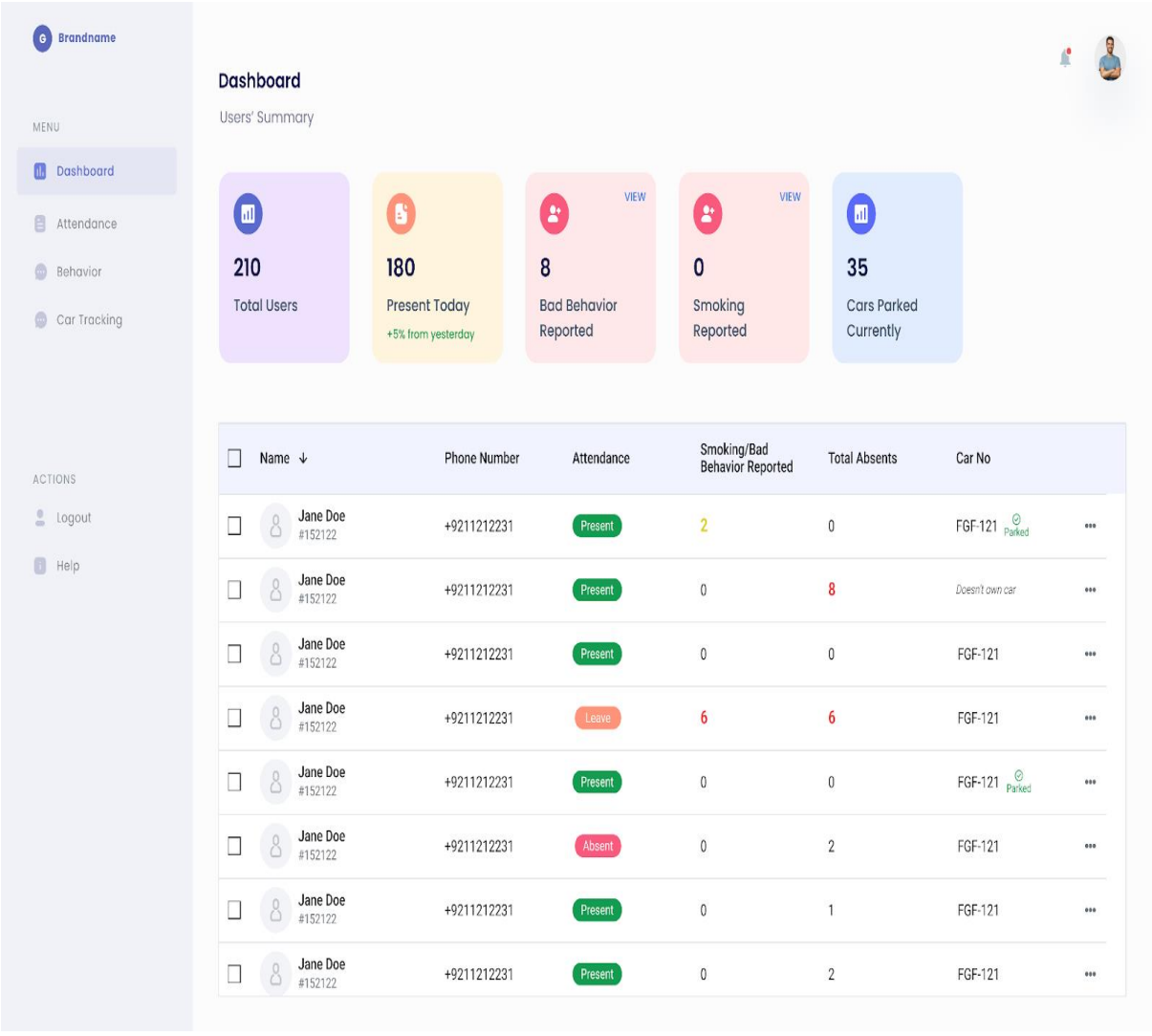

Figure 26:Dashboard UI

7.1.3 Attendance Screen

The attendance screen offers a detailed analysis of the attendance module. Similar to the dashboard, it includes a vertical navigation bar and buttons for logout and help. The top of the screen displays statistics on total present, total absent, and total late entries. The main section features a table with columns for name, check-in/out times, date, camera number, and status (on time/late) for each individual.

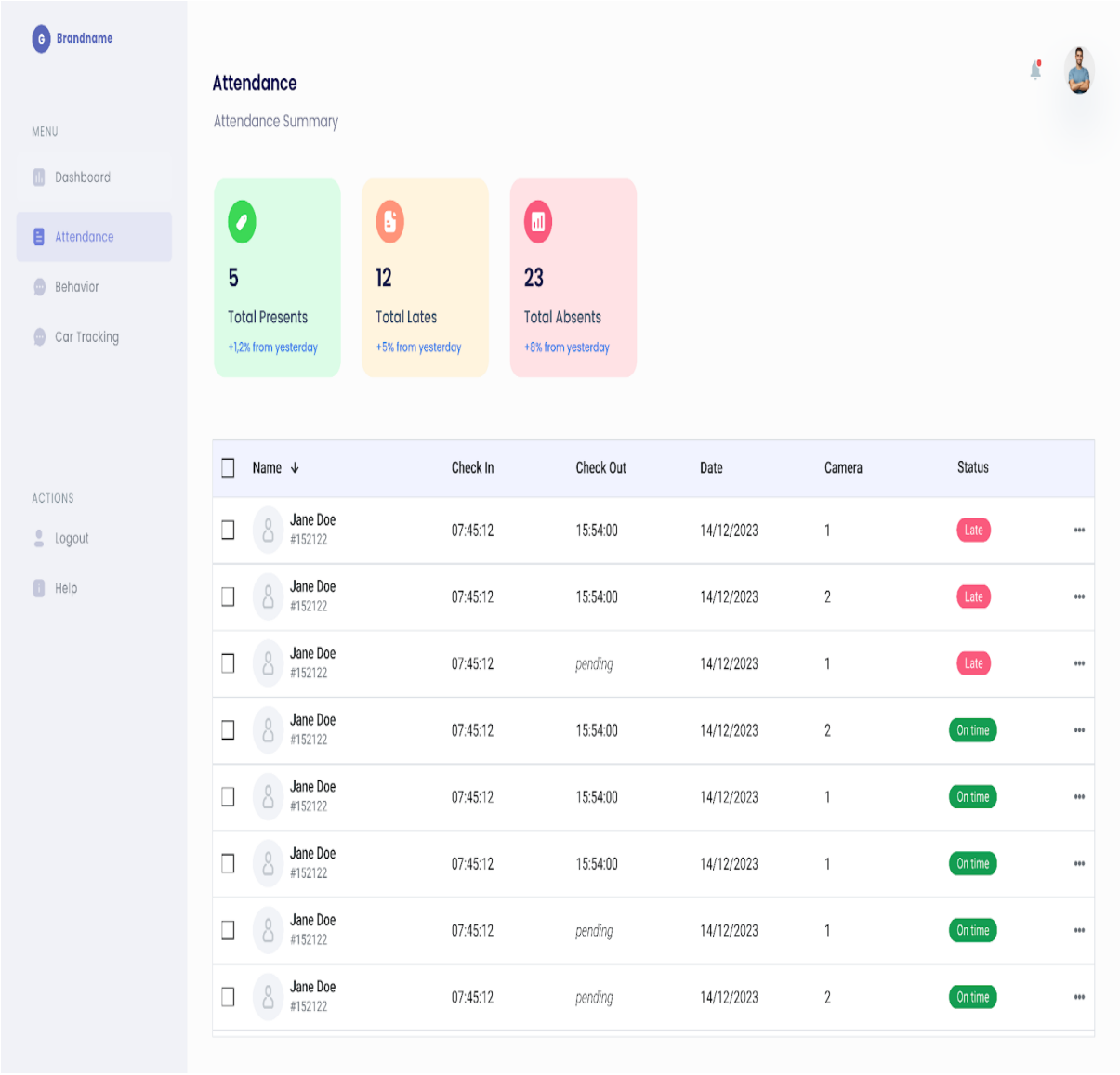

Figure 27:Attendance Module UI

7.1.4 Behavior Stats Screen

This screen provides an in-depth analysis of behavior incidents within the business premises. The vertical navigation bar and logout/help buttons are present for easy navigation. Key metrics such as total incidents today and this month are displayed at the top. The main section consists of a table with columns like name, incident type (clash, fight, sleeping), incident time, date, camera number, and severity level (high, medium, low).

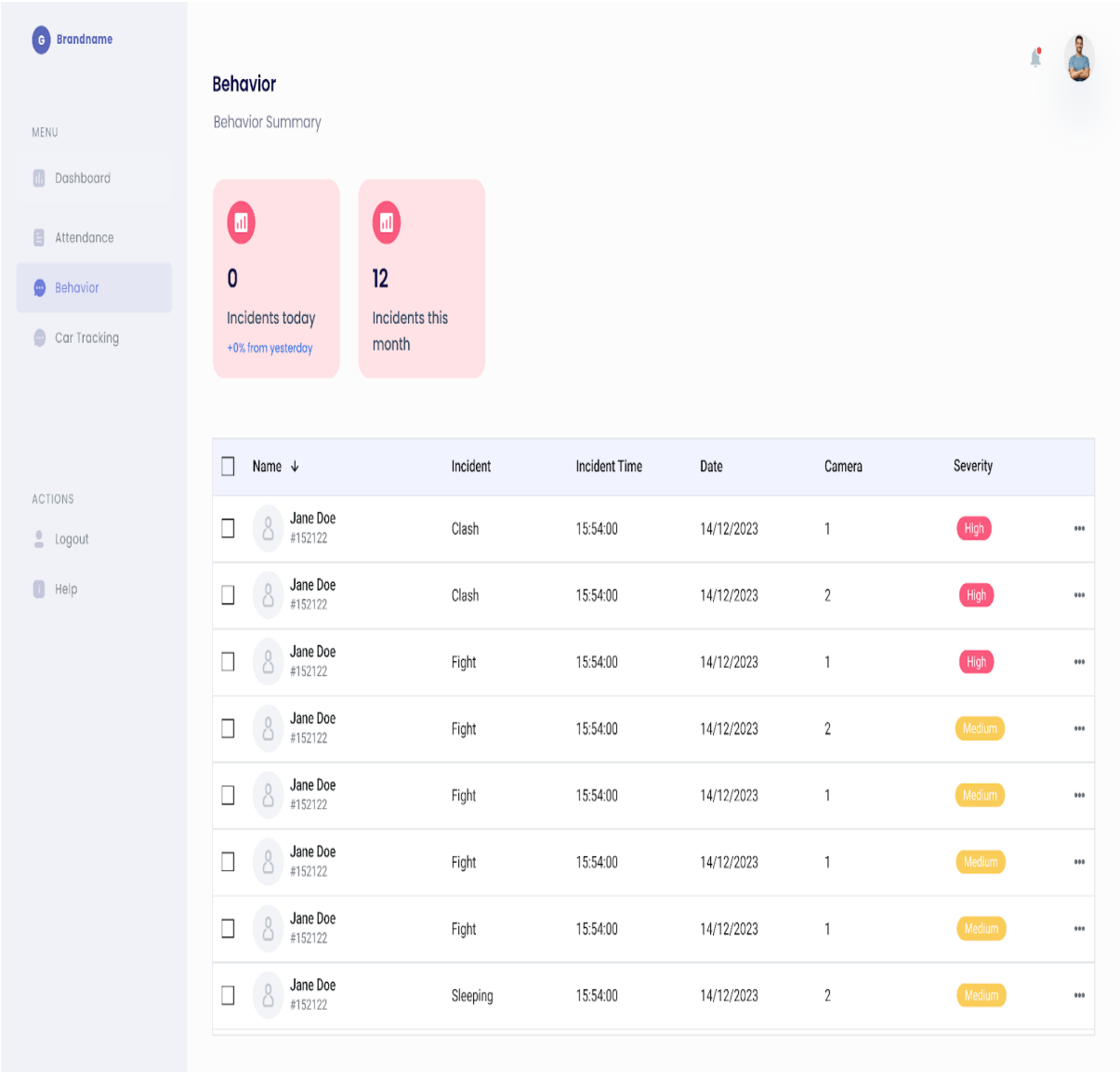

Figure 28:Behaviour Module UI

7.1.5 Car Tracking Screen

The Car Tracking screen focuses on monitoring and managing vehicle movements within the premises. It maintains consistency with the overall design, featuring a vertical navigation bar and logout/help buttons. The top of the screen displays information on total slots and available slots. The table below includes columns like vehicle ID, owner's name, parking time, parking out time, and owner's phone number associated with each individual vehicles.

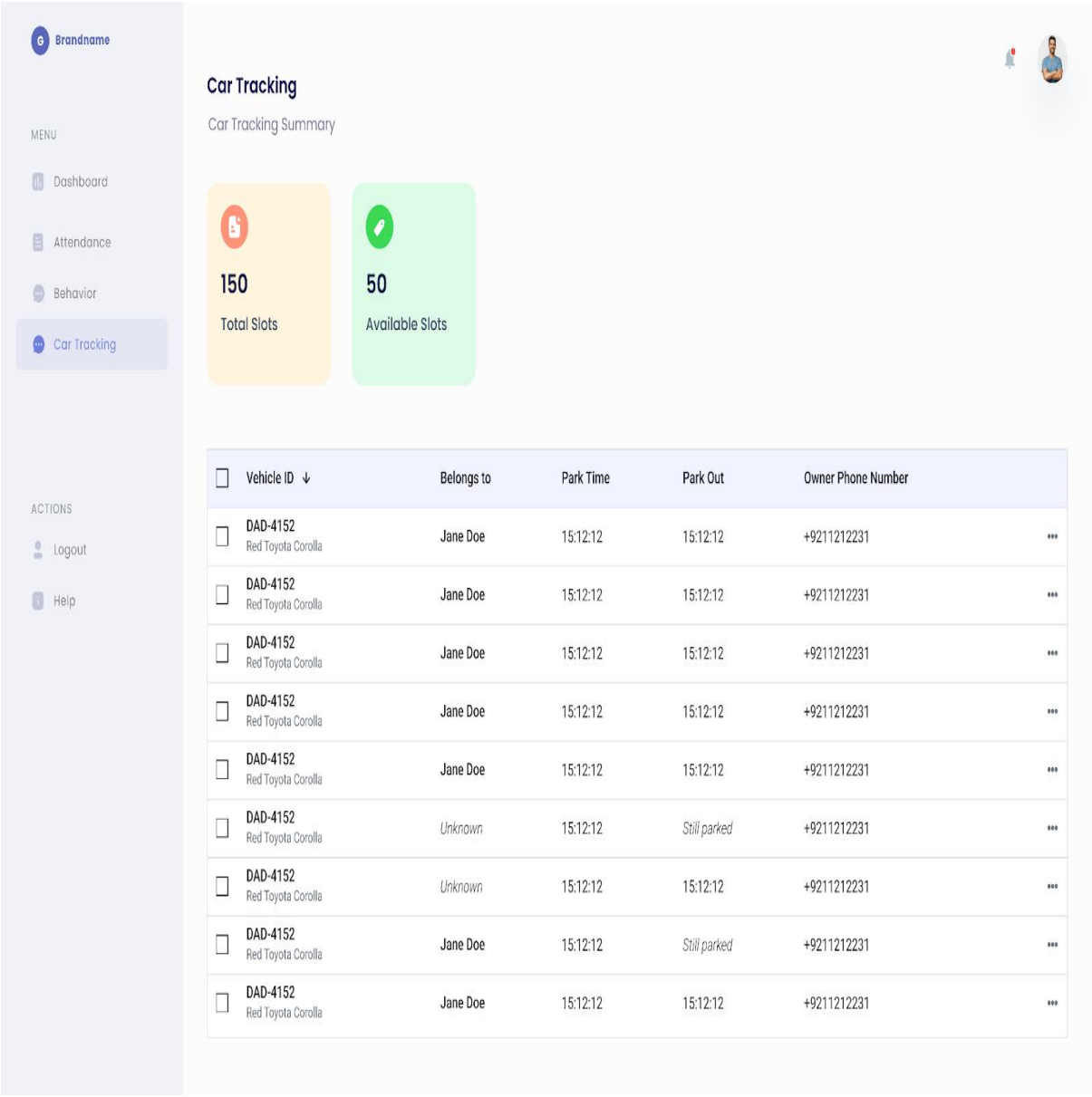

Figure 29:Car Tracking Module UI

7.2 Screen Objects and Actions

7.2.1 Login Flowchart Diagram

1. **Start**

   The process starts with a prompt for the user to enter their password.

2. **Password Entry**

   The user enters their password into the designated field.

3. **Password Validity Check**

   The entered password is checked against a stored or validated value (e.g., the user's actual password).

4. **Valid Password**

   If the password is valid, the user is allowed to proceed, often indicated by logging in or gaining access to the desired system.

5. **Invalid Password**

   If the password is invalid, the user is notified with an error message. Depending on the specific system, there may be additional steps:

   - Password reset: The user may be offered the option to reset their password through a verification process, such as answering security questions or receiving a verification code via email. The flowchart shows this option with a prompt asking, "Forget Password?" If the user selects yes, they are directed to a separate password reset process (not shown in this flowchart).
   - Verification code: If the user chooses to reset their password, the flowchart shows a step where a verification code is sent to their registered email address. This code would then be used in the password reset process to confirm the user's identity.

6. **End**

   The process ends either when the user successfully logs in (with a valid password) or when they choose to abandon the process (e.g., by not resetting their password after multiple attempts).

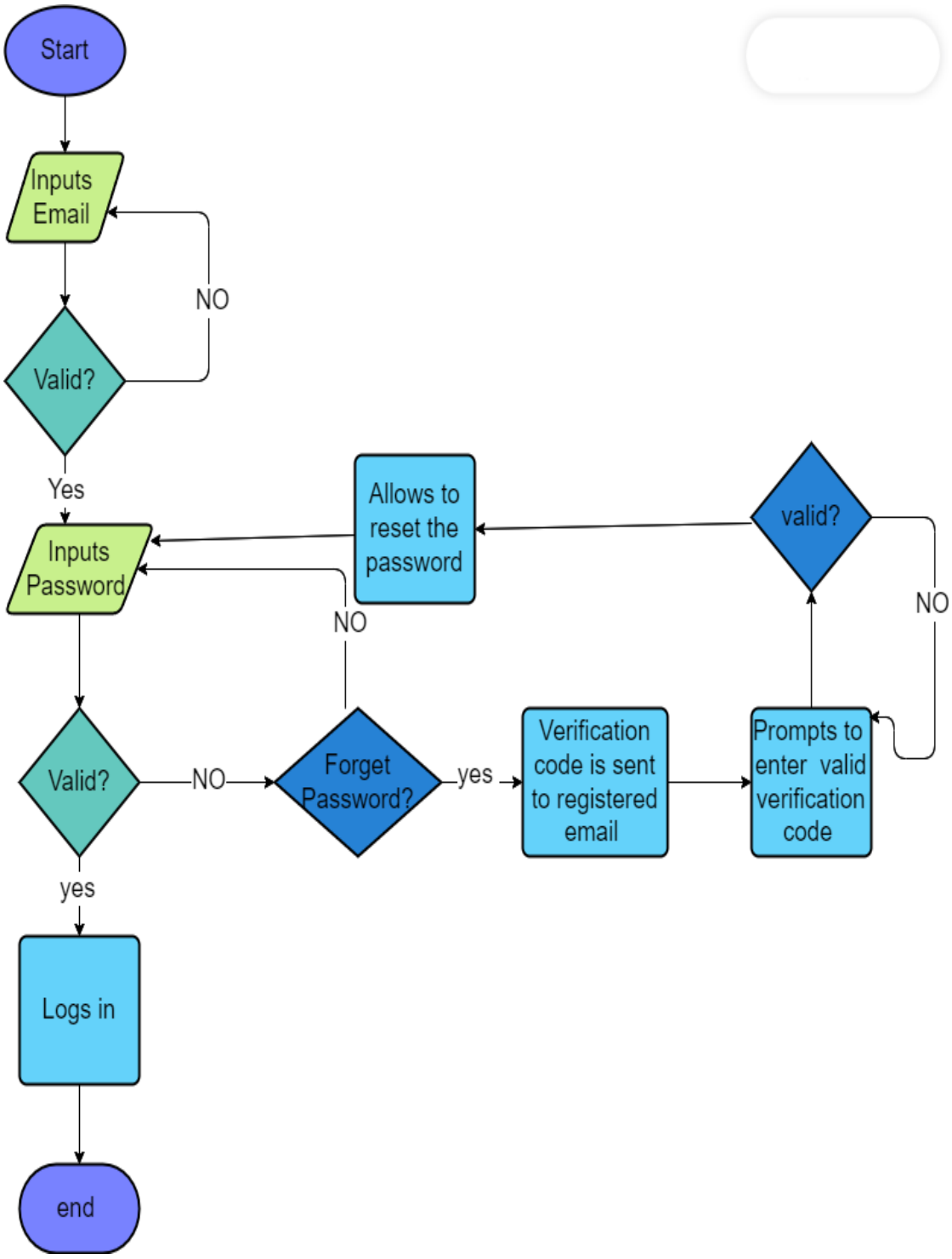

Figure 30:Login Flowchart Diagram

7.2.2 Dashboard Flowchart Diagram

1. Start

The process begins when a user accesses the Dashboard, the central hub of the Smart Campus system.

2. Navigation and Access

- Vertical Navigation Bar: Users can easily navigate to specific modules, including Attendance, Behavior Analysis, and Car Tracking, using a prominent navigation bar on the left side of the screen.
- Help and Logout: Options for accessing Help resources and logging out of the system are likely available for user convenience.

3. Key Metrics Overview

a. Visual Summary: The top of the screen prominently displays key metrics that provide a quick overview of the campus's activities:

- Attendance: Likely indicating the total number of individuals present on campus or in a specific area.
- Behavior Incidents: Highlighting the number of reported behavioral issues.
- Smoking Detection: Informing users about detected smoking incidents.
- Parked Cars: Displaying the total number of vehicles currently parked on campus.

b. Visual Representations: It incorporate charts, graphs, or other visual elements to depict trends or patterns in these metrics.

4. Individual Details Table

Comprehensive Data: The main section of the Dashboard presents a table that includes more granular information about individuals, potentially organized by name or student/employee ID:

- Name: The individual's name.
- Phone Number: Their contact information.

- Attendance Status: Indicating their current attendance (present, absent, late).
- Behavior/Smoking Reports: Highlighting any associated behavioral incidents or smoking detections.
- Associated Car Numbers: Linking individuals to their registered vehicles
-

5. End

The process ends when the user navigates to a different module or logs out of the system.

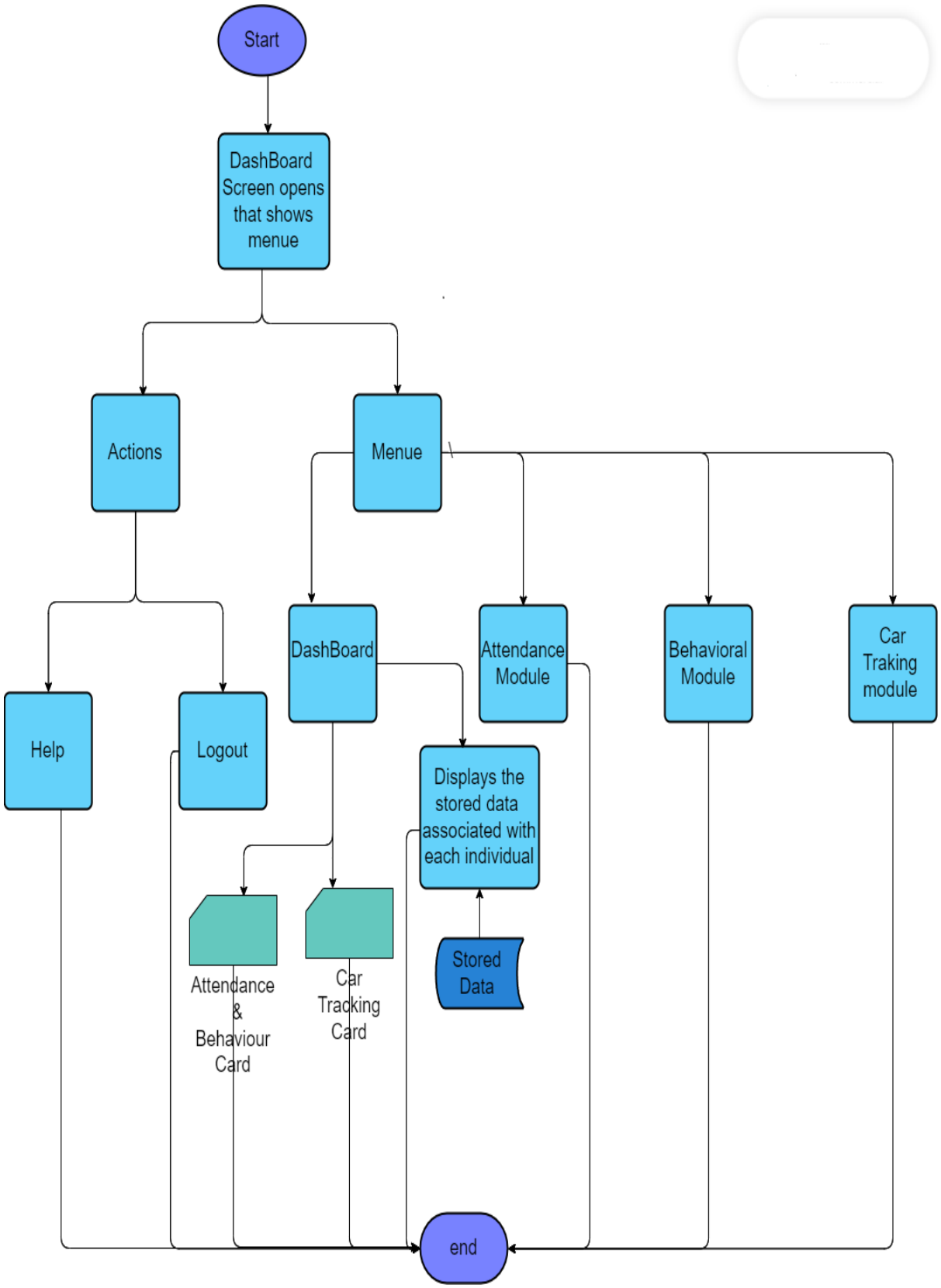

Figure 31:Dashboard Flowchart Diagram

7.2.3 Attendance Module Flowchart Diagram

1. Start

The process begins when a user accesses the Attendance screen from the Dashboard.

2. Navigation and Access

- Vertical Navigation Bar: Users can quickly navigate to other modules within the system using the vertical navigation bar on the left.
- Logout and Help: The screen includes options for logging out and accessing help resources.

3. Attendance Overview

a. Key Metrics: The top of the screen prominently displays summary statistics for immediate insight:

- Total Present: The number of individuals recorded as present.
- Total Absent: The number of individuals marked as absent.
- Total Late: The number of individuals who checked in late.

b. Visual Representations (Inferred): While not explicitly mentioned, the flowchart might incorporate charts or graphs to visualize attendance trends or patterns based on these metrics.

4. Individual Attendance Table

a. Detailed Attendance Information: A table in the main section presents granular attendance details for each individual, likely organized by name:

- Name: The individual's name.
- Check-In/Out Times: The timestamps for their arrival and departure (if applicable).
- Date: The date of the attendance record.
- Camera Number: The camera that captured their attendance (if applicable).

- Status (On-Time/Late): Indicating whether they were on time or late.

b. Sorting and Filtering (Inferred): The table likely allows users to sort and filter data based on various criteria, such as name, date, status, or camera number, to focus on specific information.

5. Stored Data (Inferred)

Access to Additional Information: The "Stored Data" section could potentially provide access to:

- Historical attendance records for individuals or groups
- Configuration settings for the attendance module
- Administrative tools for managing attendance policies and data

6. End

The process ends when the user navigates away from the Attendance screen or logs out of the system.

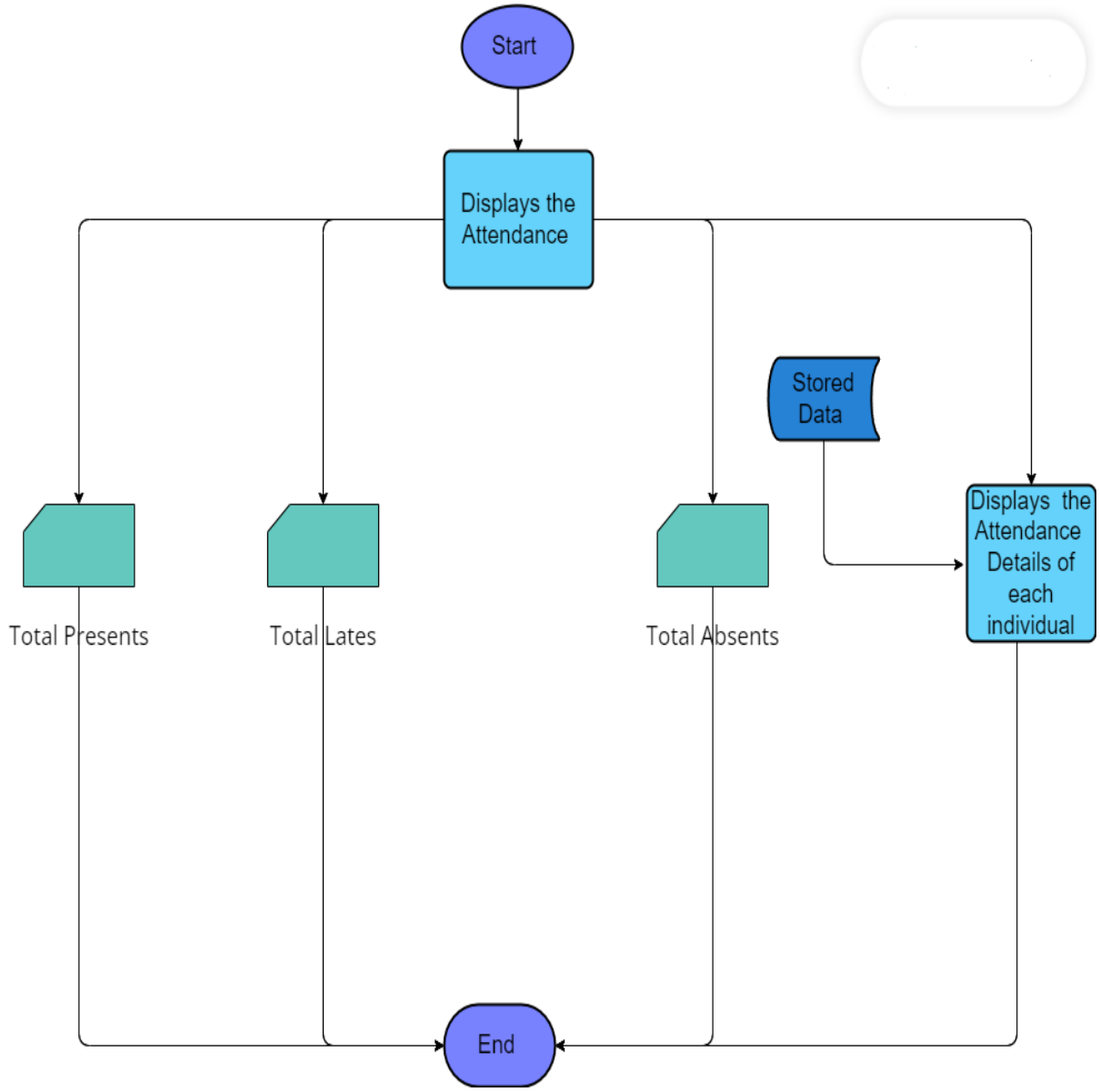

Figure 32:Attendance Flowchart Diagram

7.2.4 Behavior Analysis Module Flowchart Diagram

1. Start

The process begins when a user accesses the Behavior Analysis screen.

2. Navigation and Access

- Vertical Navigation Bar: Users can easily navigate to other modules using a navigation bar on the left.
- Logout and Help: Options for logging out and accessing help resources are available.

3. Key Incident Metrics

Summary of Incident Activity: The top of the screen prominently displays two counts of incidents:

- Total Incidents Today: The number of incidents recorded today.
- Total Incidents This Month: The total number of incidents recorded this month.

4. Incident Details Table

Comprehensive Incident Information: A table presents detailed information about each reported incident:

- Name
- Incident Type (clash, fight, sleeping, etc.)
- Incident Time
- Date
- Camera Number
- Severity Level (high, medium, low)

5. Stored Data (Inferred)

Access to Additional Information: The "Stored Data" section could potentially provide access to:

- More detailed incident reports
- Historical data on past incidents and trends
- Configuration settings
- Administrative tools

6. End

The process ends when the user navigates away or logs out.

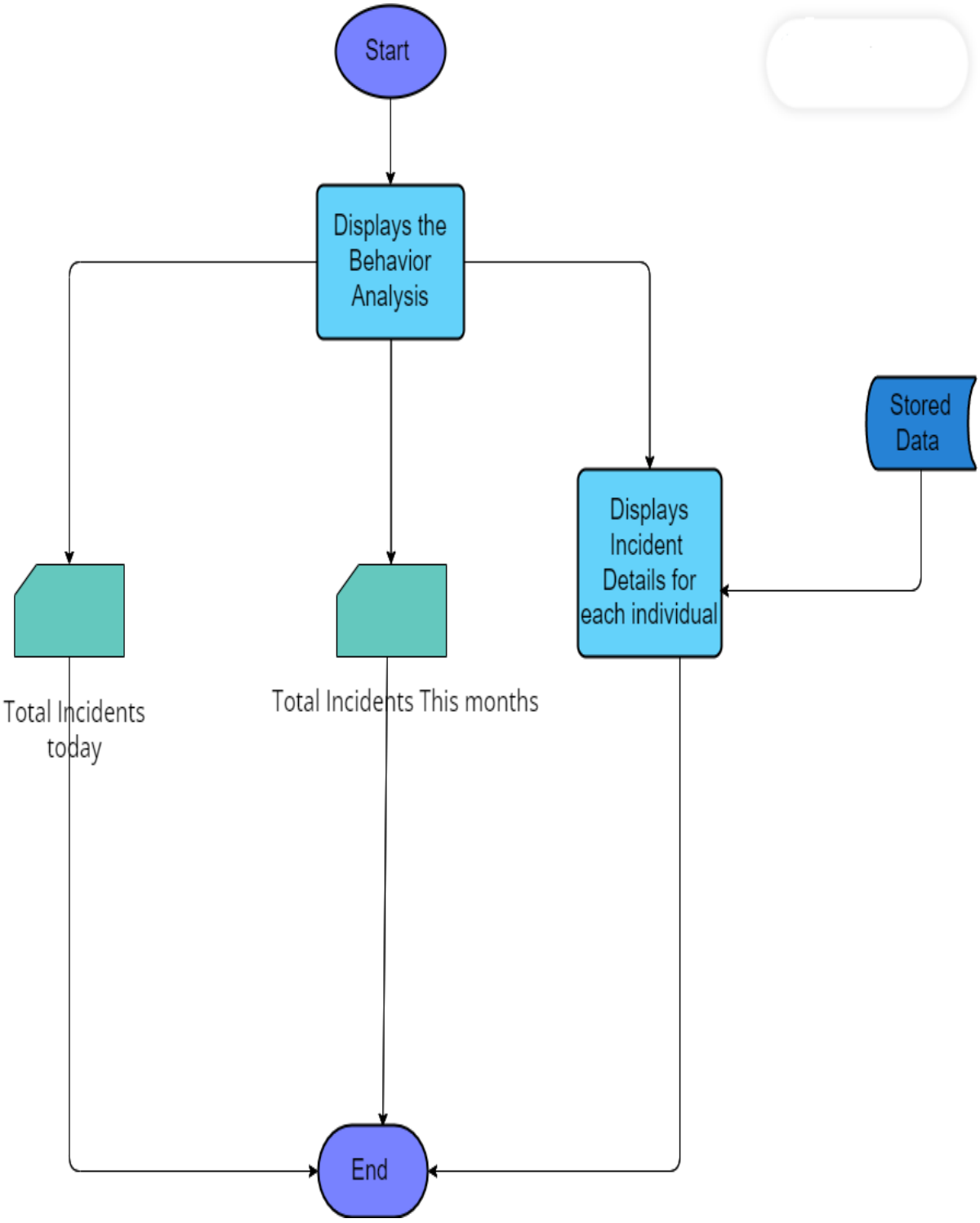

Figure 33:Behaviour Analysis Module Flowchart Diagram

7.2.5 Car Tracking Module Flowchart Diagram

1. Start

The process begins when a user accesses the Car Tracking screen.

2. Display Overview

a. Vehicle Tracking Summary: A summary of key tracking information is displayed, likely including:

- Total number of vehicles being tracked within the premises
- Overall status of vehicle movements or locations
- Any recent alerts or events related to tracked vehicles (if applicable)

b. Available Parking Slots: The system prominently displays information about parking availability:

- Total number of parking slots available in the system
- Number of currently available slots, highlighting parking occupancy

3. Display Vehicle Parking Details

a. Table of Vehicle Information: A detailed table presents parking details for each vehicle:

- Vehicle ID (likely a unique identifier, possibly a license plate number)
- Owner's Name
- Parking Time (when the vehicle entered the premises)
- Parking Out Time (when the vehicle exited, if applicable)
- Owner's Phone Number

b. Potential Sorting and Filtering: While not explicitly shown in the flowchart, the system might offer options to sort or filter the table based on various criteria (e.g., parking time, vehicle ID, owner name).

4. Stored Data

Access to Additional Information: The Stored Data section potentially provide access to:

- More detailed historical tracking data for individual vehicles
- Vehicle profiles or specifications

- Configuration settings for the tracking system
- Administrative tools for managing the system

5. End

The process ends when the user navigates away from the Car Tracking screen or logs out of the system.

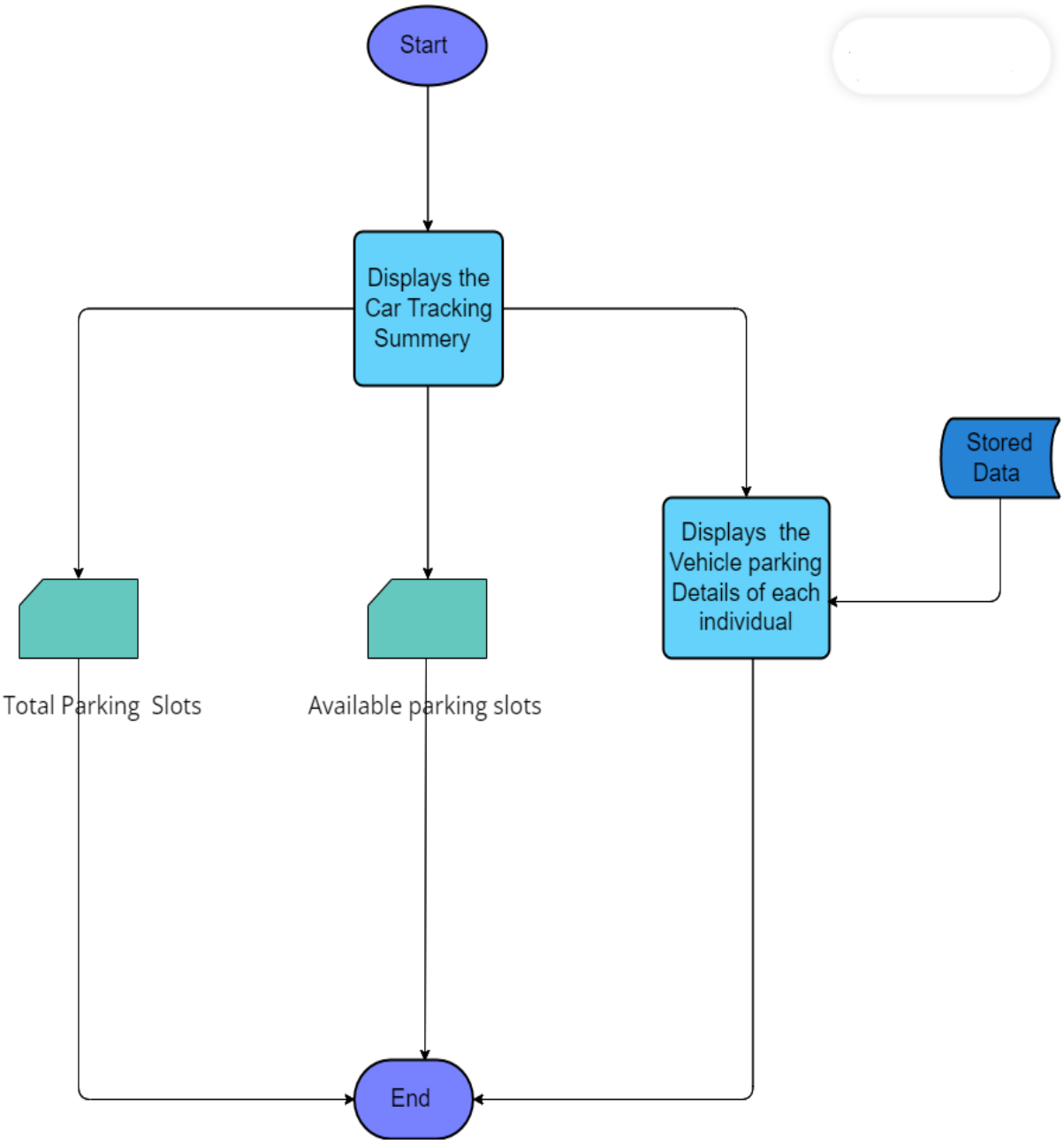

Figure 34:Car Tracking Module Flowchart Diagram

Chapter 8: System Analysis

The smart web app for business premises has the capability to ensure that it utilizes working and industry proven technologies to perform a wide array of different tasks that can range from facial recognition for employee check ins and leaving marking and presence detection in certain areas of the office to bigger and more complex crowd activity analysis such as smoking, and license plate reading of employee cars in a parking lot to classify the employees parked. This objective can be achieved through the implementation of security cameras feeding through to some deep learning algorithms and architectures including YOLO.to make the tasks accuracy better we have used a total of four distinct models on specific data for the increased performance.

8.1 Facial Recognition Model

The face recognition Python library is a versatile tool for facial recognition tasks, designed to simplify the process of detecting, identifying, and encoding faces within images and video streams. Developed by Adam Geitgey, it builds upon the robust facial recognition capabilities of the dlib library, offering an intuitive interface for developers to integrate facial recognition functionality into their applications with ease.

At its core, the library leverages state-of-the-art machine learning algorithms implemented in dlib to achieve accurate and efficient face detection and recognition. Using techniques such as Histogram of Oriented Gradients (HOG) for face detection and deep learning-based feature extraction for face encoding, face recognition can reliably identify faces, even in challenging conditions like varying lighting and facial expressions.

The model has an accuracy of 99.38% on the Labelled Faces in the Wild benchmark.

8.1.1 Task of Face Recognition

In order to detect faces effectively we need to ensure that we are able to provide some form of understanding behind the face recognition and the parameters that are important for it. For this we will need to understand thoroughly the internal working of the system

Face recognition works by comparing certain key features of a persons face like the distance between eyes, jawline etc. We can get the training data through an array of different sources like airport cameras, mall cams or even dashcam footage that is publicly available for free.

There are two primary tasks in face recognition: verification and identification. Verification involves comparing two faces to determine if they belong to the same person, identification is matching a given face with a database of stored faces.

The process happens by identifying a face in an image, extracting features from the face, and matching these features to those stored in a database.

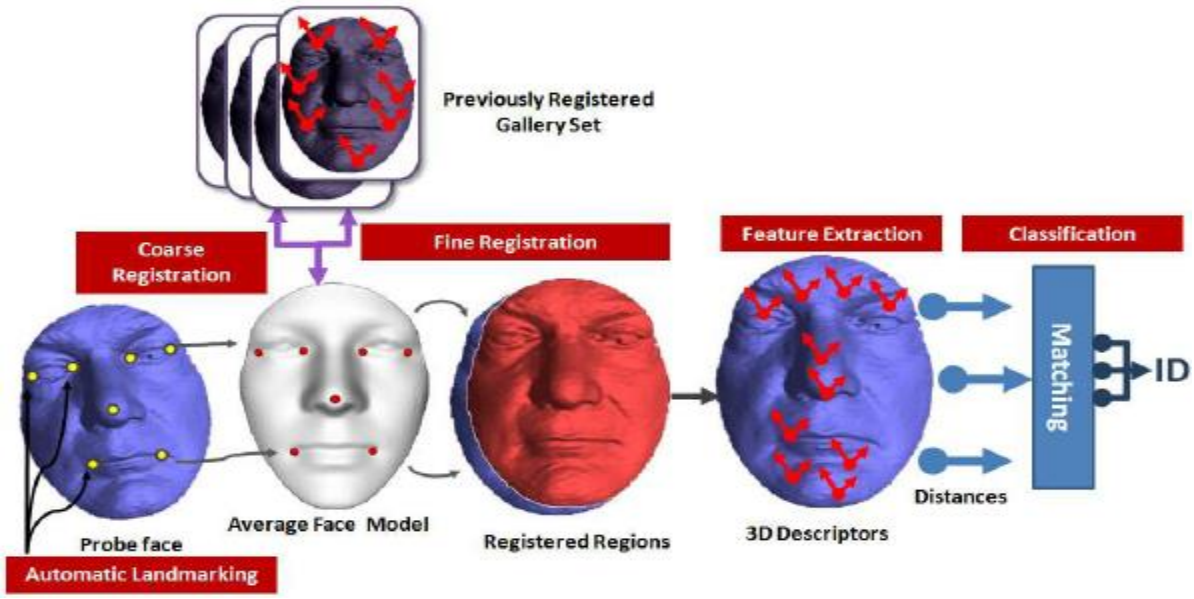

Figure 35:Face Recognition Images

8.1.2 Face Matching

The library uses a pre-trained face detector based on Histogram of Oriented Gradients (HOG) features and a linear Support Vector Machine (SVM) classifier. This detector is implemented in dlib and is highly efficient in locating faces within images or video frames. The HOG features capture the shape and texture information of faces, while the SVM classifier learns to distinguish between face and non-face patterns. Once a face is detected, the library employs a facial landmark detector to identify specific points on the face, such as the corners of the eyes, the tip of the nose,

and the corners of the mouth. This step is crucial for tasks like face alignment and feature extraction. The facial landmark detector is also based on dlib and utilizes a shape predictor model trained on annotated facial landmark datasets. After detecting and landmarking a face, the library computes a numerical encoding (a vector representation) for the face. This encoding captures essential features of the face that are useful for differentiating between individuals. It may include information about the shape of the face, the spatial arrangement of facial features, and other discriminative characteristics. The face encoding process typically involves feeding the detected face region into a deep neural network model trained specifically for face recognition tasks. The model extracts feature from the face and outputs a fixed-length vector representation. Using the computed face encodings, the library can perform face recognition tasks such as identifying known faces or verifying if a face matches a given identity. This involves comparing the face encoding of the detected face with a database of known face encodings to find the closest match.

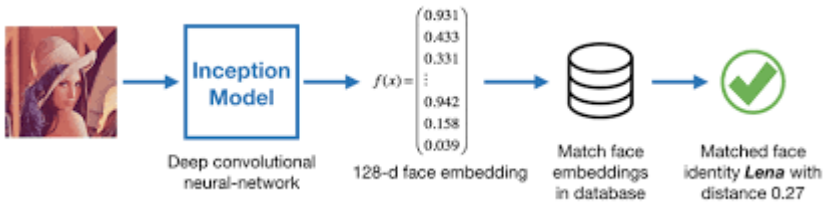

Figure 36:Face matching Images

8.1.3 Labelled Faces in the Wild

"Labelled Faces in the Wild" (LFW) is a benchmark facial recognition dataset commonly used for evaluating and benchmarking facial recognition algorithms and models. It consists of a collection of face images gathered from the internet, specifically from various websites. The images are labelled with the identities of the individuals depicted in them. The dataset contains over 13,000 labelled images of faces. The images in LFW exhibit a wide range of variations in terms of lighting conditions, facial expressions, poses, and occlusions. This diversity makes the dataset challenging for facial recognition algorithms' is often accompanied by a standard evaluation protocol, which specifies a predefined training and testing split. This ensures consistent evaluation across different algorithms and facilitates fair comparisons.

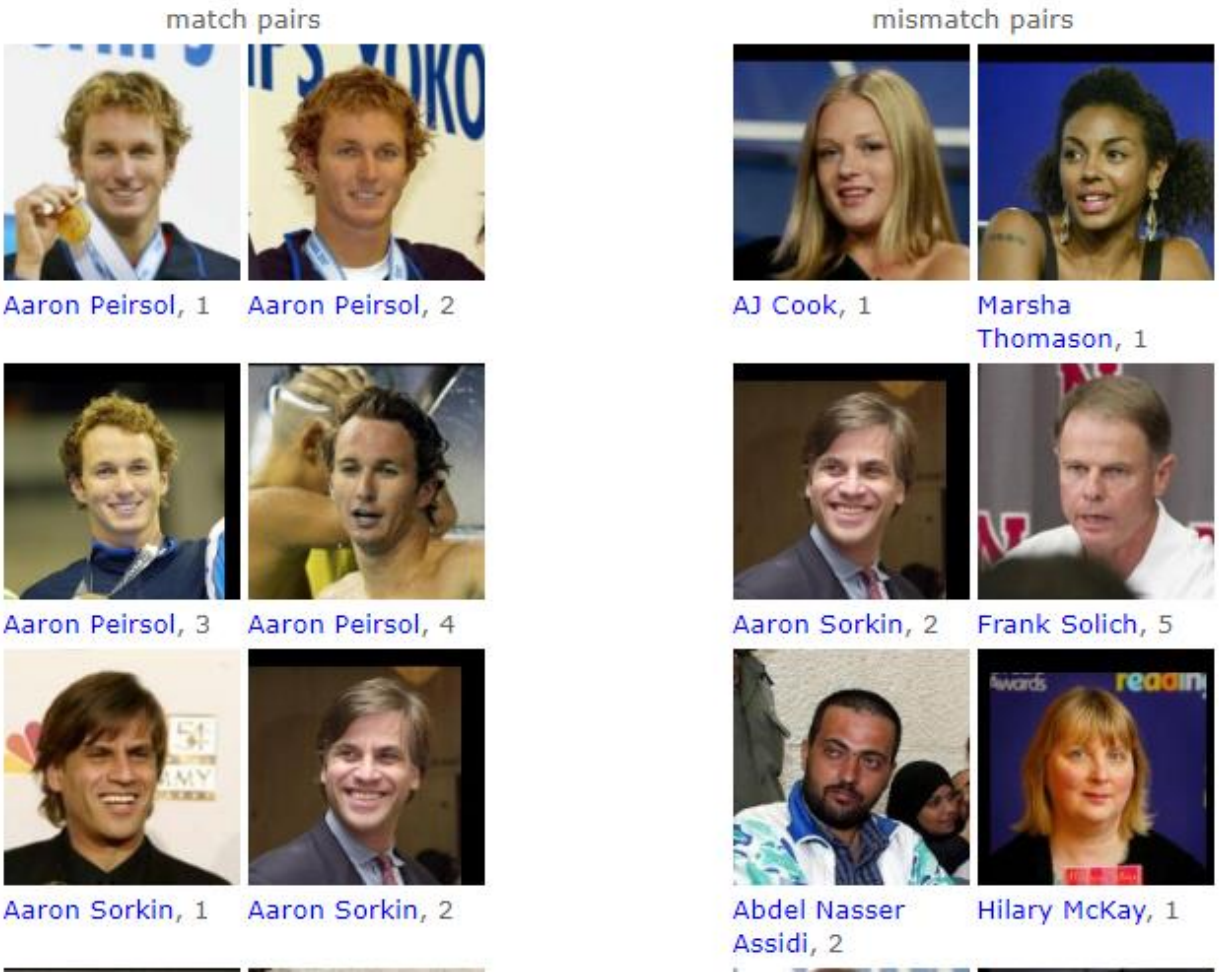

Figure 37:Labelled Faces Images

8.1.4 Evaluation

Training was done on google collab with a T4 gpu system

```
2500/2500 ━━━━━━━━━━━━━━━━━━━━ 6s 2ms/step
Epoch 49/50
2500/2500 ━━━━━━━━━━━━━━━━━━━━ 5s 2ms/step
Epoch 50/50
2500/2500 ━━━━━━━━━━━━━━━━━━━━ 6s 2ms/step
```

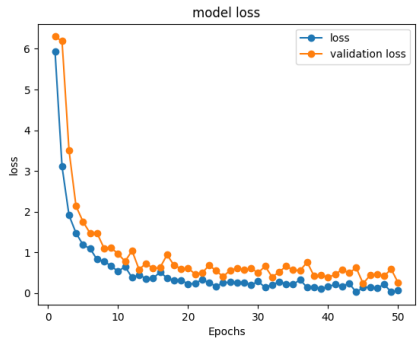

Figure 38:Face Recognition Model Loss

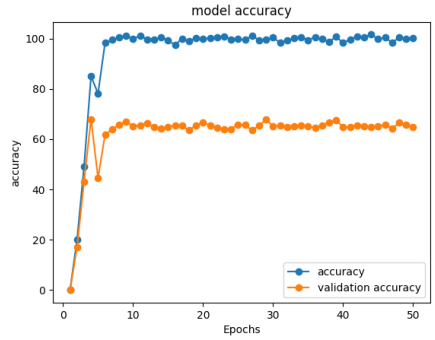

Figure 39: Face Recognition Model Accuracy

8.2 Smoking Model

Data collection: Gathering accurate and abundant training data is a vital task for the proper training of the machine learning model and it is also very crucial for ensuring the effectiveness of the smoke detection algorithm. The dataset should not be simple as the simple images cannot be replicated in real life. Real life has a very different approach from a perfect picture. In the day-to-day life we will inevitably encounter many diverse conditions such as varying degrees of lighting, camera perspectives, and other relevant factors influencing model accuracy. Sources for

data collection may include social media platforms, drones, and surveillance cameras, enabling comprehensive coverage of relevant scenarios.in order to meet the requirements of proper training the data is also augmented by applying various operations on the images like rotation, flipping and changing contrast, hue and saturation to create many different real life situation's reflections.

Preprocessing: Before we are giving the training or testing data to the algorithm, preprocessing is essential to improve data quality and applicability. Since data in the real world will be diverse, we need to ensure that it follows some standard to allow our model to make a standardized prediction all the time. This involves tasks such as resizing the image to ensure that the matrix is the size the model can take, filtering to remove additional distractions like too little or too much exposure to the camera lens, cropping the image to fit the model, and normalizing images to ensure that the effects of harsh lightening and sun flares is minimized.

Feature extraction: Subsequently, relevant features used for the prediction by the model are extracted from the pre-processed image data. The features can include image curves and histograms that might be useful for prediction.

ML model: Various machine learning techniques, like convolutional neural networks (CNNs), known for their proficiency in image-based tasks, can achieve high accuracy given ample training data.in this case we will be using a YOLO model to allow the predictions to happen. We have trained it on our own data for the desired classification.

Evaluation: we can employee various Metrics like precision, recall, and F1 score are used to gauge how algorithm really is. The evaluation's findings are then used to help the model improve and ensure that the performance and weights keeps on getting better.

Implementation: after all the training is done with satisfactory results, we will then be able to use the model to check if smoking is happening in certain areas. The model can be used in conjunction with security cameras to give real-time monitoring for the perpetrators of this activity.

Limitation: The accuracy of the machine learning model can be affected by bad lighting, and positioning of individuals in a space. Moreover, crowded scenarios may pose challenges for precise detection thus hindering accuracy of the model.

8.2.1 Model Evaluation

after the model is done training the testing will commence.it will be based on many different matrices like precision, recall and the f1 score of predictions

Precision: Precision is a measure of the accuracy calculated as true positives / true positives and false positives.

Recall: recall is a measure of the accuracy calculated as true positives / true positives and false negatives

F1 score: it is the harmonic mean of precision and recall

```
Epoch 50/50
1750/1750 ━━━━━━━━━━━━━━━━━━━━ 4s 2ms/step
```

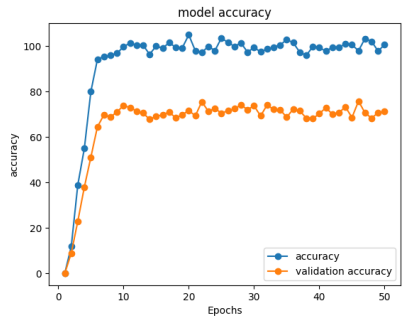

Figure 40: Smoking Analysis Model Accuracy

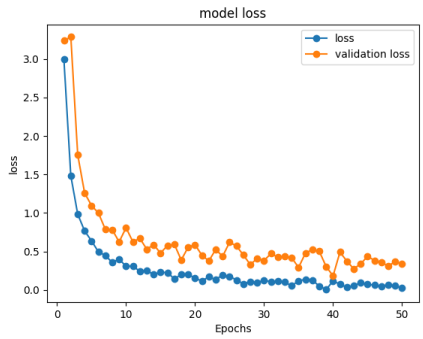

Figure 41:Smoking Analysis Model Loss

8.3 Number plate Model

The task is to be completed by using ML models that will be part of an algorithm that involves detecting car number plates. The challenge lies in ensuring that the algorithm does correct plate detection despite the plates of the car being in conditions such as different brightness, plate angle, and image resolution. To accomplish this task traditional image processing techniques like contouring have been used and provably are useful for shape scanning of the number plate, they may not be able to take all factors into account and provide reasonably accurate results in all scenarios, this is truer for extreme situations particularly when the image is tilted. To address this, the idea is to utilize a deep neural network approach like YOLO specifically YOLOv8 for the task od detecting number plate. Character recognition becomes pivotal in finding the number plate of a car. Although there are many algorithms for this task the one commonly employed is Artificial Neural Network (ANN), using feedforward and backpropagation. Additionally, to allow us to get accurate results we have used an Optical Character Recognition (OCR). the OCR that we have chosen is based on neural networks, like Convolutional Neural Networks (CNN).

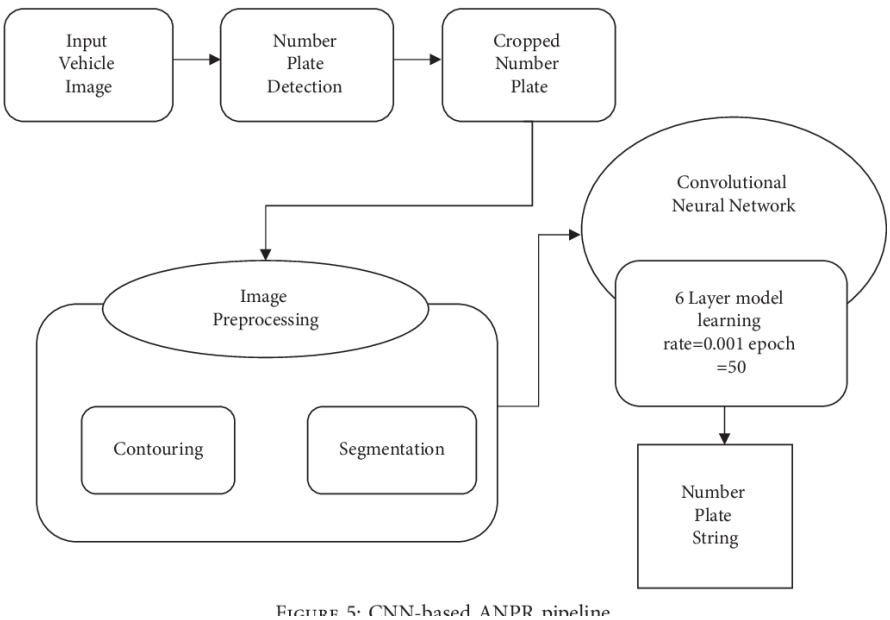

FIGURE 5: CNN-based ANPR pipeline

Figure 42:Number plate detection Flow Chart

8.4 Sleep detection Model

In an office environment, utilizing Convolutional Neural Networks (CNNs) for sleep detection can offer valuable insights into employees' well-being and productivity. By integrating sensors or cameras into office spaces, CNNs can analyses subtle cues indicative of drowsiness or fatigue in employees, such as facial expressions, body posture, or eye movements. Real-time monitoring using CNN-based systems can help identify individuals who may be at risk of decreased alertness or productivity due to insufficient sleep or fatigue. Moreover, CNNs can be employed to analyses patterns in employees' work schedules, break times, and environmental factors to provide personalized recommendations for optimizing sleep quality and promoting healthier habits. By fostering a culture of well-being and prioritizing sleep health in the workplace, CNN-based sleep detection systems have the potential to enhance employee satisfaction, engagement, and overall performance, contributing to a more productive and vibrant office environment.

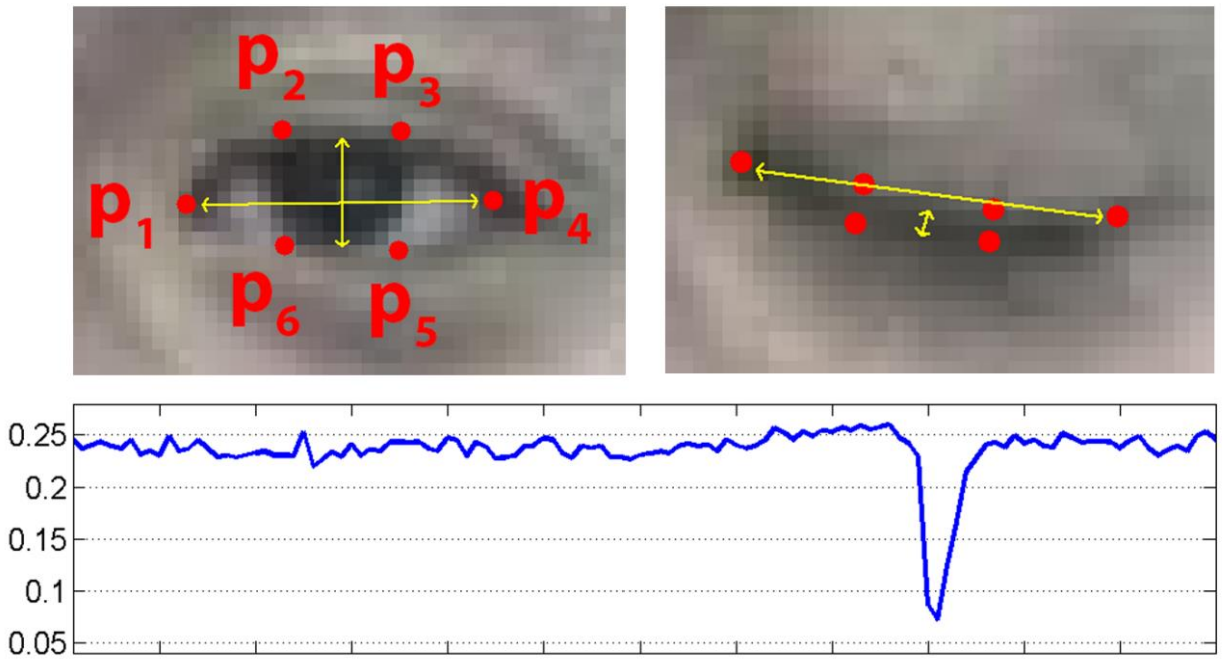

Figure 43:Sleeping Detection

The input layer expects images with the shape defined by input shape, which is (IMAGE_WIDTH, IMAGE_HEIGHT, 3). Here, the width and height are both set to 128 pixels, and 3 represents the three colour channels (RGB). The first Conv2D layer has 16 filters/kernels with a kernel size of 3x3. Since there's no padding specified, the output shape of this layer will be (126, 126, 16) because each filter reduces the spatial dimensions by 2 (due to the 3x3 kernel

and no padding) and increases the depth to 16. The subsequent MaxPooling2D layer with a pool size of (2, 2) halves the spatial dimensions, resulting in an output shape of (63, 63, 16).

The second Conv2D layer also has 16 filters with a kernel size of 3x3. Since there's no padding, the output shape is (61, 61, 16). The following MaxPooling2D layer halves the spatial dimensions again, resulting in an output shape of (30, 30, 16).

The Flatten layer reshapes the 3D output from the previous layer into a 1D vector. For this model, it will flatten the output to a shape of (30 * 30 * 16) = (14400,).

The Dropout layer randomly drops 70% of the neurons during training to prevent overfitting.

Two Dense layers with 16 units each and RELU activation follow the Dropout layer. Each Dense layer introduces 16 parameters, resulting in a flattened output of size (16,) for each layer.

The final Dense layer has a single neuron with a sigmoid activation function. This neuron represents the output of the model, providing a binary classification prediction (0 or 1) for the input image.

Chapter 9: Implementation & Test cases

The Smart Progressive Web App for Business Premises integrates various modules leveraging computer vision and machine learning techniques to enhance security and operational efficiency. Below, we discuss the implementation and testing of key modules:

9.1 Facial Recognition

Facial recognition is a pivotal module in the Smart Progressive Web App for Business Premises, facilitating secure access control and attendance tracking. Implementation involves:

- Utilizing pre-trained deep learning models like Convolutional Neural Networks (CNNs) for facial feature extraction.
- Integration with the backend server for real-time processing of camera feeds.
- Development of algorithms to match extracted features with stored facial templates.
- Testing involves assessing the accuracy and speed of facial recognition under varying lighting conditions, angles, and facial expressions.

9.2 Smoking Analysis

The smoking analysis module aims to detect and discourage smoking within business premises. Implementation includes:

- Training machine learning models on smoking behavior datasets to recognize patterns associated with smoking.
- Integration with surveillance cameras to monitor smoking activities.
- Development of algorithms to trigger alerts upon detection of smoking.
- Testing involves evaluating the module's ability to differentiate between smoking and other activities, along with false positive and false negative rates.

9.3 Behavior Analysis

Behavior analysis module analyzes activities within the premises to identify suspicious behavior. Implementation encompasses:

- Training machine learning models to classify various behaviors, such as fighting or vandalism.
- Integration with surveillance cameras to capture and analyze real-time footage.
- Development of algorithms to generate warnings or alerts based on detected behavior.
- Testing involves validating the accuracy and responsiveness of behavior detection algorithms in diverse scenarios.

9.4 Car Tracking

Car tracking module monitors vehicle movements within the premises to enhance security and parking management. Implementation involves:

- Employing image processing techniques to detect and track vehicles from camera feeds.
- Integration with backend systems to record entry and exit timestamps.
- Development of algorithms to analyze parking space occupancy and detect unauthorized vehicles.
- Testing includes assessing the accuracy of vehicle detection and tracking algorithms under various lighting and weather conditions.

Test cases:

S. No	description	Expected result	Actual result
TC1	Valid face recognized from database	Face identified correctly	As desired
TC2	Invalid face rejected	Face identified as not in database	As desired
TC3	Smoking detection	Smoking is detected successfully	As desired
TC4	Non smoker detection	No smoking detected	As desired
TC5	Car numberplate detection	Car numberplate detected and read correctly	As desired
TC6	Sleep detection	Sleeping employee detected	As desired
TC7	Non car plate detection	Car numberplate not detected	As desired

TC8	new face storing in database	New face stored in database successfully	As desired
TC9	Awaken detection	Employee who is not sleeping is detected as not sleeping	As desired
TC10	Damaged car numberplate detection	Number plated detected partially	As desired
TC11	Blinking in front of camera	Person labelled as wake	As desired
TC12	Fake smoking in front of camera	Detected as not smoking	As desired
TC13	User signing up with preexisting name	Sign error displayed	As desired
TC14	User signing up with unique name	Sign up successful	As desired
TC15	User logging in with Incorrect credentials	Log in error for incorrect username/password	As desired
TC16	User logging in with correct credentials	Log the user in	As desired
TC17	credentials not filled	Error message to fill credentials	As desired
TC18	Detect awoken person in poor lighting	Person detected as awake no action needed	As desired
TC19	Valid face recognized in poor lighting	Face identified correctly	As desired
TC20	Invalid face rejected in poor lighting	Face identified as not in database	As desired
TC21	Smoking detection in poor lighting	Smoking is detected successfully	As desired
TC22	Non smoker detection in poor lighting	No smoking detected	As desired
TC23	Car numberplate detection in poor lighting	Car numberplate detected and read correctly	As desired

TC24	Sleep detection in poor lighting	Sleeping employee detected	As desired
TC25	Non car plate detection in poor lighting	Car numberplate not detected	As desired

Chapter 10: Requirement Matrix

ID	Requirement Type	Requirement Description	Priority	Use Case
R1	Functional	The system should have a login screen for both admin and users.	High	Login
R2	Functional	Admin should be able to access a dashboard with navigation to different pages and real-time activity monitoring.	High	Admin Screens - Dashboard
R3	Functional	Admin should be able to manage user attendance in real-time with alerts for unrecognized persons.	High	Admin Screens - Attendance
R4	Functional	Admin should be able to track and analyze car movements with real-time data.	Medium	Admin Screens - Car Tracking
R5	Functional	Admin should have user management capabilities, including adding, updating, and deleting users.	High	Admin Screens - User Management
R6	Functional	Admin should be able to monitor smoking behavior with real-time alerts.	High	Admin Screens - Smoking Screen
R7	Functional	Admin should be able to analyze behavior patterns with real-time alerts.	High	Admin Screens - Behavior Screen

R8	Functional	Users should have access to their own dashboard with real-time activity and notifications.	High	User Screens - Dashboard
R9	Functional	Users should be able to view their daily attendance and performance.	High	User Screens - Attendance
R10	Functional	The system should analyze smoking behavior, generate warnings, and allow admin and users to view alerts.	High	Smoking Analysis
R11	Functional	The system should analyze behavior, generate warnings, and allow admin and users to view alerts.	High	Behaviour Analysis
R12	Functional	The system should analyze and record car movements with alerts for admin.	Medium	Car Tracking
R13	Non-Functional	The system should operate 24/7 for continuous business premises monitoring.	High	-
R14	Non-Functional	The system should provide high accuracy in facial recognition for attendance tracking.	High	-
R15	Non-Functional	Cameras should be placed strategically to prevent damage and exposure to elements.	High	-
R16	Non-Functional	The system should employ robust security measures to protect the database and models.	High	-

R17	Non-Functional	The system should be adaptable to unusual conditions like weather variations.	Medium	-
R18	Non-Functional	The code should be easy to maintain with high cohesion and no bottlenecks.	Medium	-
R19	Non-Functional	The model should run reliably with consistent output and high accuracy.	High	-
R20	Non-Functional	The system should be portable across different devices and resolutions.	Medium	-
R21	Non-Functional	The system should be easy to use and have a simple interface without special training.	High	-
R22	Non-Functional	The model should provide precise predictions and accurate results in all testing scenarios.	High	-
R23	Non-Functional	The system should be easily testable with simple unit isolation for effective testing.	High	-

Chapter 11: Conclusion

We created a Smart Web App for Business Premises in this project which makes operations easier and more secure using advanced technology integration. Our proposed system is better than the way things have always been done because it uses facial recognition, machine learning algorithms and real time data analytics. Weve explained how these work for attendance tracking, behavior analysis, smoking detection as well as vehicle tracking so you can see what they do in today's world of work.

By carrying out our experiments with this new method of doing things we had initially set out to achieve high productivity levels while addressing limitations faced by previous solutions. In addition all staff and visitors records will be kept securely without any difficulties encountered such as losing files or dishonest editing. Also the need for monitoring behavior among people within the premises shall be effectively met through this innovation plus overall security enhancement. Moreover there are user-friendly interface designs coupled with adequate authorization levels which enable one.

Chapter 12: Future Work

The Smart Web App for Business Premises currently provides a number of features that can improve the running of the business as well as security within the area. Nevertheless, there are a couple of things which need to be looked into the future in order to broaden its scope and make it more effective.

12.1 Integration with IoT Devices

The system currently uses mainly face recognition and machine learning algorithms for data analysis. It would be better if the system could be expanded to include IoT devices such as smart sensors, cameras among others so as to ensure more areas are monitored and automate more things. Doing this will make it possible for the app to respond dynamically to different activities on the ground since there will be real time environmental monitoring. Internet Of Things devices.

12.2 Enhanced Complex Behavior Analysis

The existing system does simple behavior analysis on employees or guests. Later on, more advanced AI and deep learning methods should be used to make complex behavioral analytics possible. It will help to have finer details about how productive an employee is or if they are likely to engage more thereby improving decision making as a result identifying potential security threats when they arise.

12.3 Management Of Multiple Locations

Currently, this application only supports one organization premise but in the future it should be able to handle many. The reason for this is so that businesses operating in different areas can manage security centrally and also do other things like cross premises data analysis among others which will require features such as centralized reporting & remote management capabilities.

12.4 Enhanced Data Privacy and Compliance

Although the current system guarantees safe data management, there is need for future updates to enhance privacy as well as compliance with world standards like GDPR and CCPA. This may involve employment of sophisticated methods of encryption, provision of detailed logs for data access and inclusion of user consent management features.

12.5 Customizable Modules

Presently, the application has four primary modules namely; taking attendance, analyzing behavior, detecting smoking and tracking vehicles. In future, there should be customizable modules which can allow businesses to adjust the app's functionality to fit into their specific needs. These may include but not limited to inventory management module, energy consumption monitoring module or any other industry related requirements module.

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