Egyptian Russian University
Faculty of Artificial Intelligence
Department of Artificial Intelligence

Face Detection and Recognition System for Employee Monitoring

اكتشاف الوجوه والتعرف عليها نظام مراقبة الموظفين

Submitted to the Department of Artificial Intelligence at the Faculty of Artificial Intelligence, Egyptian Russian University, in partial fulfillment of the requirements for obtaining a Bachelor's degree.
(First Term)

By
1) Khalid Ashraf
2) Mohamed Ahmed
3) Mohamed Karm
4) Abdullah Naser
5) Abdelrhman lashen
6) Youssef Kassab
Supervisors
Dr. Asmaa Mohamed
Academic degree and specialization
2025

الجامعة المصرية الروسية

كلية الذكاء الاصطناعي

Face Detection and Recognition System for Employee Monitoring

by

Student Names	Student ID	Department
Khalid Ashraf	215189	AI
Mohamed Ahmed	215200	AI
Mohamed Karm	215199	AI
Abdullah Naser	205003	AI
Abdelrhman lashen	215138	AI
Youssef Kassab	215096	AI

Supervised by
Dr. Asmaa Mohamed
TA: Salma Maged

Degree Program
In partial fulfillment of the requirements for the degree of Bachelor of Artificial Intelligence
Egyptian Russian University
2025

الجامعة المصرية الروسية

كلية الذكاء الاصطناعي

Declaration

We, the undersigned, hereby declare that the work presented in this report titled " Face Detection and Recognition System for Employee Monitoring " is the result of our collective efforts and original research. The project was carried out under the supervision of Dr . Asmaa in partial fulfillment of the requirements for the degree of In partial fulfillment of the requirements for the degree of Bachelor of Artificial Intelligence. We confirm that this work has not been submitted elsewhere for any degree or qualification and that it complies with the ethical and academic standards of Dr. Asmaa.

Student Names	Student ID	Department	Signatures	date
Khalid Ashraf	**215189**	AI		
Mohamed Ahmed	**215200**	AI		
Mohamed Karm	**215199**	AI		
Abdullah Naser	**205003**	AI		
Abdelrhman lashen	**215138**	AI		
Youssef Kassap	**215096**	AI		

Acknowledgements

We have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organizations Our deep gratitude is extended to Dr. Asmaa for his invaluable guidance and unwavering support throughout the duration of this project. Dr. Asmaa's expertise, insightful perspectives, and continual encouragement have played a vital role in the successful completion of this undertaking. We would like to extend our gratitude to the dean
Prof. Dr. Hesham Hamed.
Under Dr. Asmaa's mentorship, we've had the privilege of refining our skills and broadening our knowledge. His unwavering commitment to excellence and meticulous attention to detail consistently motivate us to maintain the highest standards in our work.
We also acknowledge Dr. Asmaa's efforts in reviewing and providing feedback on our project, contributing significantly to the overall quality and effectiveness of our work.
Special appreciation is reserved for Eng. Salma Maged for his exceptional contributions and dedicated support throughout the project. Eng. Salma’s guidance and mentorship have been pivotal and also is guideness have been indispensable to our success, and we sincerely appreciate his patience and willingness to share his expertise, impacting both our project and personal growth profoundly.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Table.1 List of Abbreviations

Abbreviation	Abbreviation Meaning
AI	Artificial Intelligence
ML	Machine Learning
DL	Deep Learning
CNN	Convolutional Neural Network
API	Application Programming Interface
HRMS	Human Resource Management System
DB	Database
GUI	Graphical User Interface
PII	Personally Identifiable Information
RNN	Recurrent Neural Network
SVM	Support Vector Machine
XML	Extensible Markup Language
OCR	Optical Character Recognition
GUI	Graphical User Interface
ROI	Region of Interest
HTTP	Hypertext Transfer Protocol
SSL	Secure Sockets Layer
LBP	Local Binary Pattern

ABSTRACT

Employee monitoring and workplace management play a vital role in ensuring organizational security, productivity, and adherence to policies. This project focuses on developing an advanced Face Detection and Recognition System to automate access control and monitor behavioral issues such as unauthorized phone usage, smoking in restricted areas, and aggressive actions.

The system employs Convolutional Neural Networks (CNNs) trained on datasets like WIDER FACE and behavior-specific collections to achieve high accuracy in facial recognition and behavioral detection. It is designed to adapt to challenging conditions, including varying lighting and crowded environments. A centralized application provides real-time monitoring, automated alerts, and comprehensive reporting capabilities.

The system demonstrated exceptional performance in accurately identifying individuals and detecting behaviors in real-time under diverse conditions. Its scalability and adaptability make it suitable for multiple industries, while significantly reducing reliance on manual surveillance methods.

By integrating facial recognition with behavioral monitoring, the proposed system enhances workplace security and compliance, offering organizations a scalable, cost-effective solution for safer and more efficient work environments.

CHAPTER 1 INTRODUCTION

1.1 Overview

Employee monitoring has evolved significantly in recent years, driven by advancements in technology and increasing organizational demands for efficiency, security, and compliance. Traditional methods, such as manual attendance systems and ID-based access control, are gradually becoming obsolete due to their limitations, including inefficiencies, susceptibility to tampering, and lack of scalability. Organizations across industries now seek automated and intelligent systems that can seamlessly integrate with their existing infrastructure while addressing their unique challenges.

This project introduces a sophisticated Face Detection and Recognition System designed to redefine how employee monitoring is conducted in modern workplaces. By leveraging cutting-edge facial recognition technologies, the system provides automated access control, eliminating the dependency on physical identification methods such as ID cards or manual logbooks. Furthermore, the system incorporates behavioral monitoring capabilities, enabling organizations to detect and address issues such as unauthorized phone usage, smoking in restricted areas, and aggressive behavior.

A key strength of the proposed system lies in its adaptability and scalability. It is powered by convolutional neural networks (CNNs) trained on diverse datasets, such as WIDER FACE, ensuring high accuracy even under challenging conditions like fluctuating lighting, crowded spaces, or dynamic environments. The centralized application offers real-time monitoring, reporting, and alert generation, empowering security personnel to focus on critical tasks instead of routine surveillance.

In addition to improving operational efficiency, the system aligns with the increasing emphasis on data-driven decision-making. By providing actionable insights and detailed analytics, organizations can make informed decisions to enhance workplace policies, boost productivity, and mitigate risks. This project, therefore, represents a holistic solution that combines advanced AI technologies with practical applications, aiming to set a new standard in employee monitoring and workplace management.

1.2 Problem Description

The modern workplace is a dynamic environment characterized by complex challenges that require innovative solutions. Despite the availability of numerous tools and systems, many organizations continue to rely on outdated monitoring methods that fail to address current demands for efficiency, security, and compliance. Traditional access control systems, such as those based on ID cards or manual logbooks, are prone to human error, misuse, and operational inefficiencies. Employees can lose or share ID cards, leading to potential security breaches, while manual attendance tracking is both time-consuming and error-prone.

Another significant issue is the inability of traditional systems to monitor employee behavior effectively. For instance, smoking in restricted areas poses not only a violation of workplace policies but also a significant safety hazard, particularly in industries such as manufacturing and healthcare. Similarly, aggressive behavior or conflicts between employees can escalate quickly, leading to a negative impact on workplace harmony and productivity. Unauthorized phone usage, while seemingly minor, can contribute to significant productivity losses over time.

Existing solutions often fail to integrate access control with behavioral monitoring, resulting in fragmented systems that lack efficiency and real-time capabilities. Many organizations use separate tools for attendance tracking, video surveillance, and compliance monitoring, leading to higher costs and resource demands. Moreover, these systems typically require extensive manual oversight, further burdening security personnel and reducing their ability to focus on more critical tasks.

This project aims to address these challenges by developing a unified system that combines facial recognition with behavioral detection. By automating access control and providing real-time monitoring of workplace behaviors, the proposed system seeks to overcome the limitations of traditional methods. It ensures a higher level of accuracy, efficiency, and security, making it a valuable tool for organizations striving to meet the demands of the modern workplace.

1.3 Project Motivation

The motivation for this project stems from the increasing complexity of workplace management and the growing demand for innovative solutions that align with modern organizational needs. In today's fast-paced and competitive business environment, organizations are under pressure to optimize operations, enhance security protocols, and enforce workplace policies without compromising employee privacy or efficiency. Traditional approaches to employee monitoring, while effective in the past, are no longer sufficient to address these evolving challenges.

One of the key drivers behind this project is the potential to reduce dependency on manual surveillance methods. Security personnel often spend a significant amount of time on routine tasks such as verifying identities, monitoring behaviors, and ensuring compliance with workplace policies. By automating these processes, the proposed system not only improves efficiency but also allows security teams to focus on more critical issues, such as incident response and risk assessment.

Another motivating factor is the opportunity to harness the power of artificial intelligence (AI) and machine learning to enhance workplace safety and productivity. AI technologies, particularly convolutional neural networks (CNNs), have demonstrated remarkable capabilities in fields such as facial recognition and behavior detection. By leveraging these technologies, this project aims to create a system that is not only accurate and reliable but also adaptable to diverse environments and organizational requirements.

The integration of behavioral monitoring is another critical aspect of this project. Unauthorized actions such as phone usage, smoking, or aggressive behavior can have far-reaching consequences, ranging from safety risks to productivity losses and even reputational damage. By addressing these issues in real-time, the proposed system provides organizations with a proactive tool for maintaining a safe, compliant, and efficient workplace.

1.4 Project Objectives.

The proposed system is designed with the following key objectives:

1. **Automate Access Control**: Traditional access control methods often rely on physical ID cards or manual processes, which are prone to inefficiencies and errors. The proposed system aims to eliminate these challenges by leveraging facial recognition technology to provide secure and automated access control.

2. **Enhance Workplace Safety**: Ensuring workplace safety is a top priority for organizations, particularly in industries such as manufacturing, healthcare, and education. The system integrates advanced behavior detection capabilities to identify and respond to safety violations, such as smoking in restricted areas or aggressive actions.

3. **Ensure Policy Compliance**: Monitoring employee adherence to workplace policies is critical for maintaining productivity and organizational integrity. The system provides real-time monitoring and automated alerts to address issues such as unauthorized phone usage, ensuring compliance with company regulations.

4. **Boost Productivity**: By minimizing distractions and addressing non-compliant behaviors, the proposed system contributes to a more productive work environment. Additionally, the centralized application provides actionable insights and detailed reports, enabling organizations to make data-driven decisions that further enhance efficiency.

5. **Provide a Scalable and Adaptable Solution**: Recognizing the diverse needs of organizations across industries, the system is designed with scalability and adaptability in mind. Its modular architecture allows for the seamless integration of additional features or functionalities, making it a versatile investment for the future.

CHAPTER 2 RELATED WORK

2.1 Literature Review

The field of facial recognition and behavior monitoring has seen significant advancements with the advent of artificial intelligence (AI) and machine learning (ML). Researchers have explored various approaches to improve the accuracy and efficiency of these systems, addressing challenges in diverse environments, including workplaces, public spaces, and restricted areas. This review focuses on studies and systems directly relevant to the development of a Face Detection and Recognition System for Employee Monitoring. It examines prior work in facial recognition, behavior detection, and integrated monitoring solutions, emphasizing their methodologies, findings, and limitations.

The purpose of this review is to establish a comprehensive understanding of the current state-of-the-art technologies, highlighting key advancements and identifying gaps that this project aims to address. By analyzing prior studies, the review provides a foundation for the system's design, demonstrating how it builds on existing knowledge while introducing innovative solutions to enhance workplace management.

1. Facial Recognition Technologies

Facial recognition has been a central focus of research in AI, with numerous studies exploring techniques to enhance accuracy and scalability.

- This study introduced a convolutional neural network (CNN)-based model for facial recognition, achieving near-human-level accuracy. The authors utilized a large dataset to train their model, which demonstrated robustness in identifying faces under varying conditions. While the study highlighted the potential of CNNs, its reliance on high computational resources presented challenges for real-time applications. [1]

- This research focused on mapping facial features into a lower-dimensional space using deep learning. FaceNet improved recognition accuracy and enabled clustering of similar faces. However, its performance in crowded or dynamic environments was limited, which this project addresses through further model refinement. [2]

2. Behavior Detection and Monitoring

Behavior detection is a growing area of interest, particularly in workplace settings where safety and compliance are critical.

- The authors developed a model to detect cigarette usage using object detection and image processing techniques. Their approach identified cigarettes and smoking gestures in real-time, demonstrating its applicability in workplace monitoring. However, the study lacked scalability for monitoring multiple behaviors simultaneously. [3]

- This work employed deep learning models to analyze video data for smoking detection. The system achieved high accuracy but required substantial computational resources, limiting its integration into low-cost workplace setups. [4]

3. Integrated Monitoring Systems

Several studies have explored integrated systems combining facial recognition with behavior detection for enhanced workplace management.

- This paper discussed the benefits of integrating facial recognition and behavior monitoring into a unified system. It highlighted the efficiency of real-time monitoring and compliance enforcement but noted limitations in adapting to diverse workplace environments with varying lighting and crowd densities. [5]

- The authors presented an automated surveillance system designed to reduce labor costs and improve productivity. The system detected behaviors such as loitering and misuse of company resources, demonstrating its practicality in workplace settings. However, it lacked facial recognition capabilities, which this project integrates. [6]

Table.2 RELATED WORK Compare

Study	Authors & Year	Objective	Methodology	Strengths	Limitations	Accuracy (Approximate)
DeepFace	Taigman et al. (2014)	Achieve human-level facial recognition accuracy.	CNN-based facial recognition trained on large datasets.	Robust under varying conditions.	High computational requirements.	97.35%
FaceNet	Schroff et al. (2015)	Cluster faces by mapping features to a lower-dimensional space.	Deep learning for face embedding.	High accuracy and clustering capability.	Limited performance in dynamic environments.	99.63%
Cigarette Detection	Zhang & Xie (2016)	Detect cigarette usage in images.	Object detection and image processing techniques.	Real-time smoking detection.	Limited to single behavior detection.	**85%**
Smoking Detection	Yu & Wu (2018)	Identify smoking behavior in video data.	Deep learning applied to video analysis.	High accuracy in controlled environments.	High computational resource demand.	92%
AI-Based Monitoring Systems	Unknown (2022)	Integrate facial recognition and behavior monitoring.	Unified system with real-time alerts.	Efficient and comprehensive monitoring.	Performance issues in diverse environments.	90%
Surveillance for Productivity	Unknown (2020)	Enhance productivity through automated surveillance.	Behavior detection without facial recognition.	Reduced labor costs and efficient alerts.	Lack of facial recognition integrat	85%

While significant progress has been made in facial recognition and behavior detection, most studies have focused on isolated functionalities. Integrated systems combining facial recognition with real-time behavior monitoring remain limited in scalability and adaptability to diverse workplace conditions. Additionally, prior research has often overlooked the importance of a user-friendly, centralized interface and seamless integration into existing workplace infrastructures.

This project addresses these gaps by developing a comprehensive solution that combines high-accuracy facial recognition with behavior detection capabilities, ensuring adaptability to dynamic environments. By integrating real-time alerts, detailed reporting, and scalability for future enhancements, the proposed system provides a holistic approach to employee monitoring that surpasses existing solutions.

CHAPTER 3 PROJECT ANALYSIS

3.1 Problem Statement

Employee monitoring is a critical aspect of workplace management, but traditional methods—such as manual surveillance, physical ID cards, and attendance tracking—are fraught with inefficiencies, inaccuracies, and security vulnerabilities. These systems rely heavily on human intervention, leading to errors, increased operational costs, and limited real-time responsiveness. Furthermore, workplaces face challenges in detecting and addressing policy violations like unauthorized phone usage, smoking in restricted areas, and aggressive behavior, which can compromise safety, productivity, and organizational compliance. The absence of an integrated, automated system exacerbates these issues, leaving organizations ill-equipped to adapt to evolving security and efficiency demands.

The proposed **Face Detection and Recognition System for Employee Monitoring** seeks to address these challenges by providing a scalable, AI-driven solution that integrates facial recognition for access control with behavior detection for policy enforcement. This system eliminates reliance on manual processes, enhances workplace security, and improves operational efficiency, paving the way for a safer and more productive work environment.

3.2 Problem Analysis

The identified challenges are analyzed across three key dimensions:

1. **Security and Access Control**
    - **Current Challenge**: Unauthorized access due to stolen, lost, or shared ID cards compromises workplace security.
    - **Proposed Solution**: Use facial recognition technology for automated access control, ensuring accurate and secure employee identification.

2. **Policy Enforcement and Behavior Monitoring**
    - **Current Challenge**: Manual monitoring systems are ineffective at detecting behavioral violations, such as smoking in restricted areas or phone misuse.
    - **Proposed Solution**: Integrate AI-driven behavior detection to monitor and respond to policy breaches in real-time.
3. **Operational Efficiency**
    - **Current Challenge**: Manual processes are time-consuming, costly, and prone to human error.
    - **Proposed Solution**: Automate key monitoring tasks to reduce labor costs, enhance accuracy, and provide actionable insights through real-time alerts and reporting.

3.3 Project Visibility Study

A visibility study was conducted to assess the practicality, demand, and benefits of the proposed system. Key findings include:

1. **Technical Feasibility**:
    - Advances in AI, machine learning, and convolutional neural networks (CNNs) ensure the technical viability of implementing facial recognition and behavior detection.
    - Integration with existing workplace infrastructures is achievable through modular architecture.

2. **Market Demand**:
    - Surveys and industry reports reveal a growing need for automated monitoring systems in corporate offices, manufacturing plants, healthcare facilities, and government organizations.
3. **Economic Feasibility**:
    - The system reduces long-term costs by eliminating manual surveillance requirements and minimizing productivity losses due to behavioral issues.
    - Scalable architecture ensures adaptability to organizational growth, making it a cost-effective investment.
4. **Operational Feasibility**:
    - The system offers user-friendly interfaces for administrators, making it easy to adopt and implement with minimal training.
5. **Legal and Ethical Considerations**:
    - The system complies with data protection laws (e.g., GDPR) by encrypting employee data and ensuring transparency in monitoring practices.

3.4 Project Time Scheduling

A detailed project schedule was developed to ensure timely implementation and delivery. Key phases include:

Table.3 Project Time Scheduling

Duration	Activities	Status
September – October	Searching for Project Idea	Done
3 October (2024) / 10 October (2024)	Background, Main Objectives of Project	Done
11 October (2024) / 17 October (2024)	The Applications of the Project	Done
18 October (2024) / 31 October (2024)	Project Background and Survey	Done
1 November (2024) / 7 November (2024)	Problem Statement and Definition, Problem Analysis	Done
8 November (2024) / 21 November (2024)	Project Analysis , Project Design	Done
22 November (2024) / 19 December (2024)	Project Review	Done
20 December (2024) / 2 January (2025)	Abstract and Conclusion	Done
3 January (2025) / 16 January (2025)	Preparing Project Report	Done
17 January (2025) / 31 January (2025)	Presenting the Project	
1 February (2025) / 1 April (2025)	Project Implementation	
2 April (2024) / 10 May (2024)	Project Design	
11 May (2024) / 1 June(2024)	Project testing	

3.5 Functional Requirements

Functional requirements define the system's core operations:

1. **Facial Recognition for Access Control**
    - Detect and identify employees using pre-registered facial data.
    - Authenticate access and log entry/exit times automatically.
2. **Behavior Detection**
    - Identify specific behaviors, such as:
        - Phone usage.
        - Smoking.
        - Aggressive actions.
3. **Real-Time Alerts and Notifications**
    - Send automated alerts to administrators for unauthorized access or behavioral violations.
4. **Data Logging and Reporting**
    - Maintain comprehensive logs of employee activities.
    - Generate reports on policy violations and system performance.

3.6 Non-Functional Requirements

Non-functional requirements ensure the system meets performance, security, and usability standards:

1. **Performance**
   - Achieve at least 95% accuracy for facial recognition under diverse conditions.
   - Process access requests and behavior detection in under 1 second.
2. **Scalability**
   - Handle up to 500 simultaneous access requests in high-traffic workplaces.
   - Allow future integration of additional cameras, sensors, or modules.
3. **Reliability**
   - Ensure 99.9% system uptime for uninterrupted monitoring.
   - Include fallback mechanisms for manual access control during outages.
4. **Security**
   - Encrypt all sensitive data, including facial models and behavioral logs.
   - Restrict data access to authorized personnel and ensure secure data transmission.
5. **Usability**
   - Design a user-friendly interface with clear visualizations and intuitive controls.
   - Provide comprehensive training materials and system documentation.
6. **Maintainability**
   - Allow for easy updates and bug fixes using a modular design.
   - Simplify debugging processes to minimize downtime.
7. **Compliance**
   - Adhere to local and international privacy laws, such as GDPR.
   - Maintain transparency with employees regarding monitoring practices.

3.7 Use Case Diagram

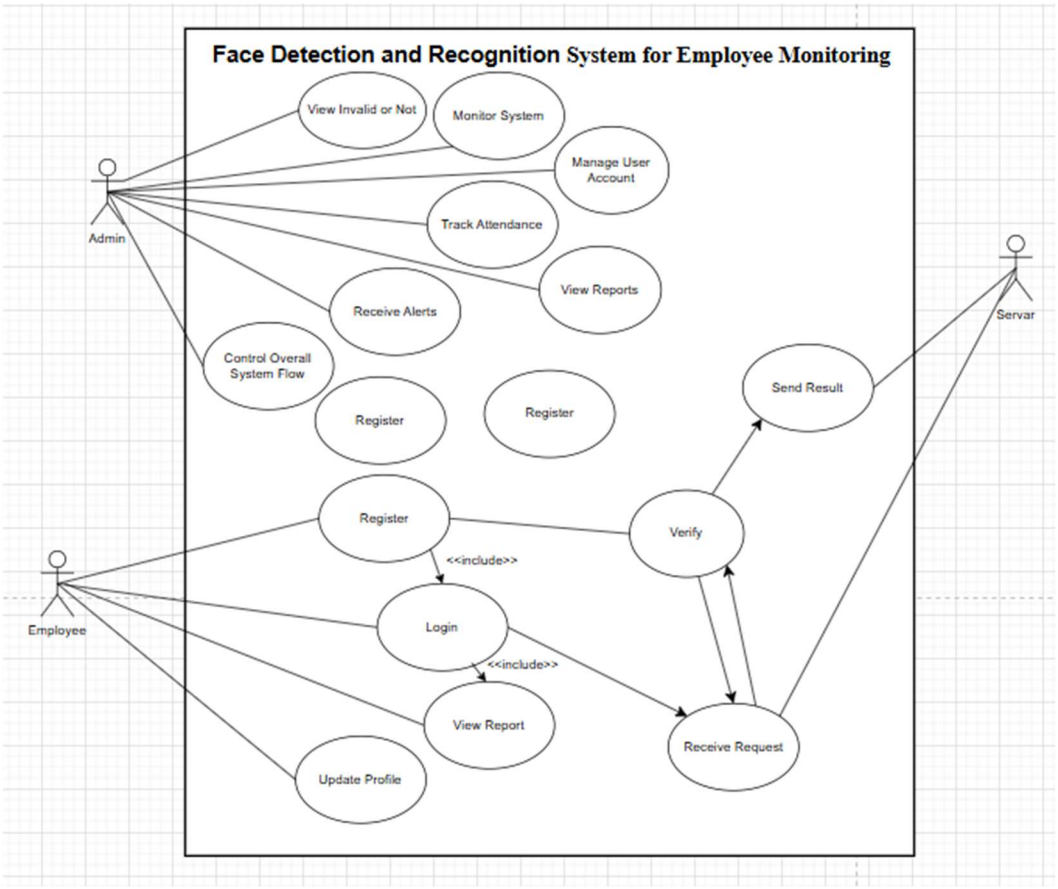

Figure.1 Use Case Diagram

Use Case Scenarios for Face Detection and Recognition System

Table 4 Use Case Scenarios

Use Case Name	Description	Actors	Preconditions	Basic Flow	Alternative Flow	Postconditions
View Invalid or Not	Allows the admin to check if data or actions are valid.	Admin	Admin is logged in.	1.Admin selects "View Invalid". 2. System checks the validity.	If the system cannot validate, it shows an error.	Admin gets results of the validation.
Monitor System	Allows admin to observe system activities in real-time.	Admin	Admin is logged in.	1. Admin accesses the dashboard. 2. System displays real-time monitoring data.	None	Admin observes the data.
Track Attendance	Logs employee attendance using face recognition.	Admin	Cameras are operational.	1. Cameras capture faces. 2. System matches faces and logs attendance. 3. Admin views attendance reports.	If face is not recognized, it is flagged for manual review.	Attendance is logged.
Receive Alerts	Alerts admin about unusual activities.	Admin	Behavior detection module is running.	1. System detects unusual activity. 2. Sends alert to admin's dashboard. 3. Admin acknowledges the alert and takes action.	If alert fails to deliver, the system retries or logs the issue.	Admin receives alerts.
Control Overall System Flow	Allows admin to manage the system's workflow.	Admin	Admin is logged in.	1. Admin accesses "Control System". 2. Adjusts system workflow or policies. 3. System implements changes.	If workflow control fails, an error is logged.	Workflow adjustments are applied.

Manage User Account	Admin manages employee accounts (add/update/remove).	Admin	Admin is logged in.	1. Admin selects "Manage Account". 2. Adds or updates employee information. 3. Saves changes to the database.	If operation fails, system prompts retry.	Employee accounts are updated.
Register	Allows employee to register their profile in the system.	Employee, Admin	Admin has granted registration access.	1. Employee/Admin accesses "Register". 2. Enters details and uploads face. 3. System saves data and links it to employee ID.	If face capture fails, retries or uses an uploaded image.	Employee profile is registered.
Login	Allows employee/admin to log in.	Employee, Admin	User has valid credentials.	1. User enters credentials. 2. System verifies identity. 3. Grants access to the dashboard.	If credentials fail, an error message is shown.	User is logged in.
Verify	Authenticates employee identity using face recognition.	System, Employee	Cameras are functional, and employee is present.	1. Employee stands before the camera. 2. System scans and matches face. 3. Grants or denies access.	If face is not recognized, access is denied and flagged.	Employee access is granted/denied.
View Reports	Enables admin to view detailed reports of employee activity and alerts.	Admin	Admin is logged in.	1. Admin accesses "Reports". 2. Selects report type. 3. System generates and displays the report.	If no data exists, system notifies admin.	Admin views or downloads the report.
Update Profile	Employees can update their profile details.	Employee	Employee is logged in.	1. Employee accesses "Update Profile". 2. Edits profile information. 3. System saves updates to the database.	If update fails, the system prompts retry.	Employee profile is updated.
Receive Request	System processes and responds to employee requests.	Employee, Server	Request is valid.	1. Employee sends a request. 2. Server processes	If request fails, the system	Employee receives a response.

				the request. 3. Sends the result back to the employee.	logs the issue.	
Send Result	Server sends processed results to the requesting party.	Server	A valid request is received.	1. Server processes the request. 2. Sends the response to the respective actor (Admin/Employee).	If result fails to send, system retries or logs the error.	Results are delivered.

3.8 Activity Diagram

3.8.1 Registration

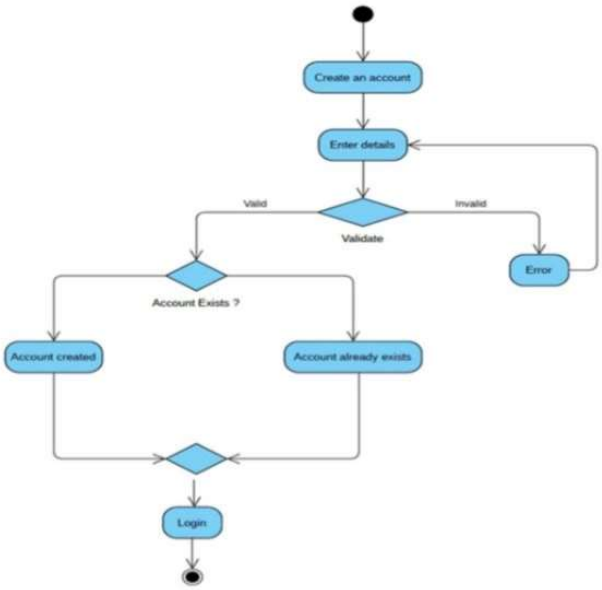

Figure.2 Registration

3.8.2 Login

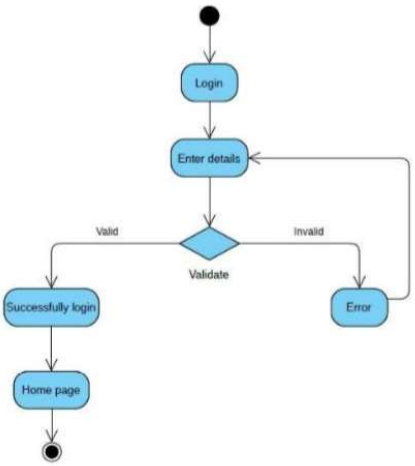

Figure.3 Login

3.8.3 Update Profile

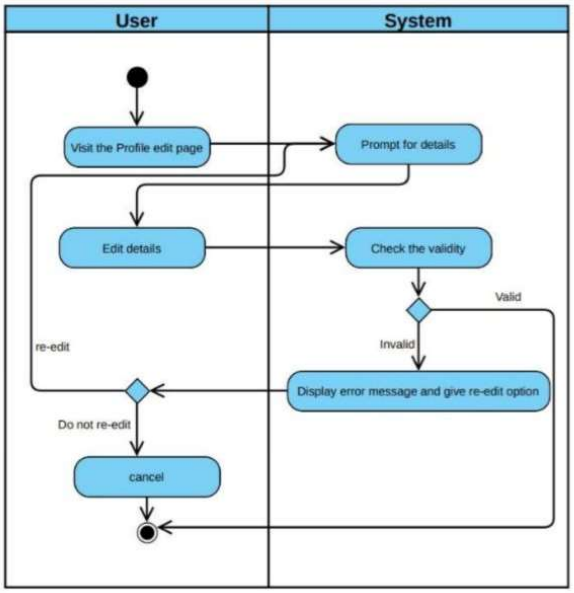

Figure.4 Update Profile

3.8.4 View Report

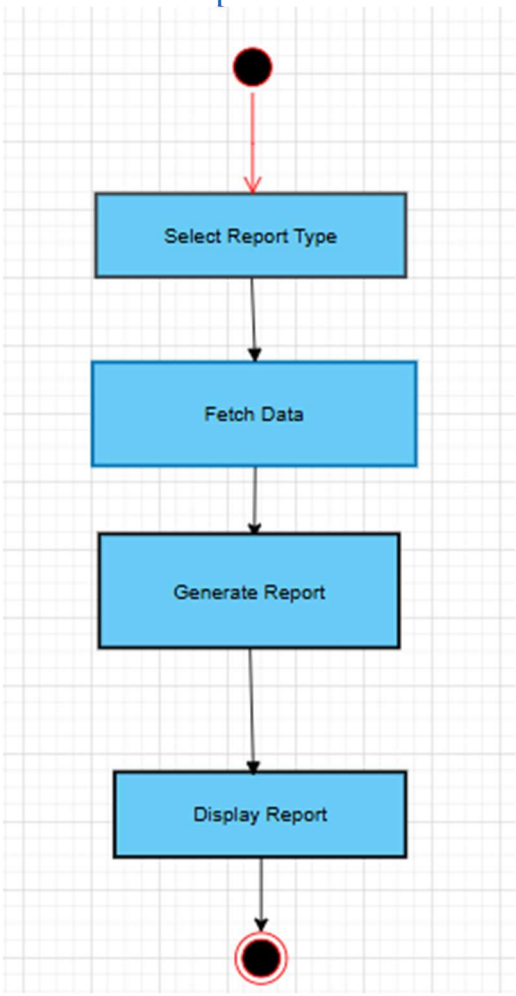

Figure.5 View Report

3.8.5 Monitor Behaviors

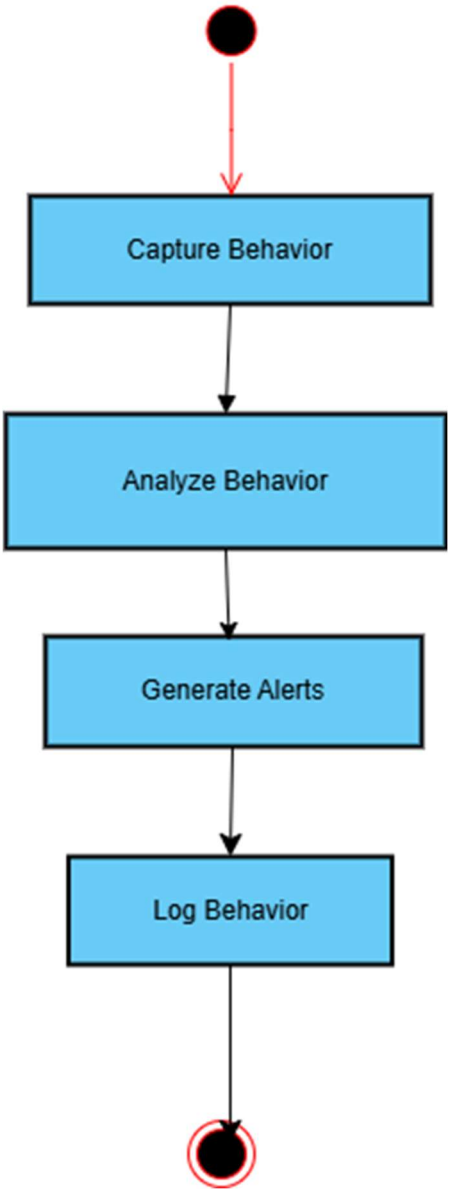

Figure.6 Monitor Behaviors

3.8.6 Track Attendance

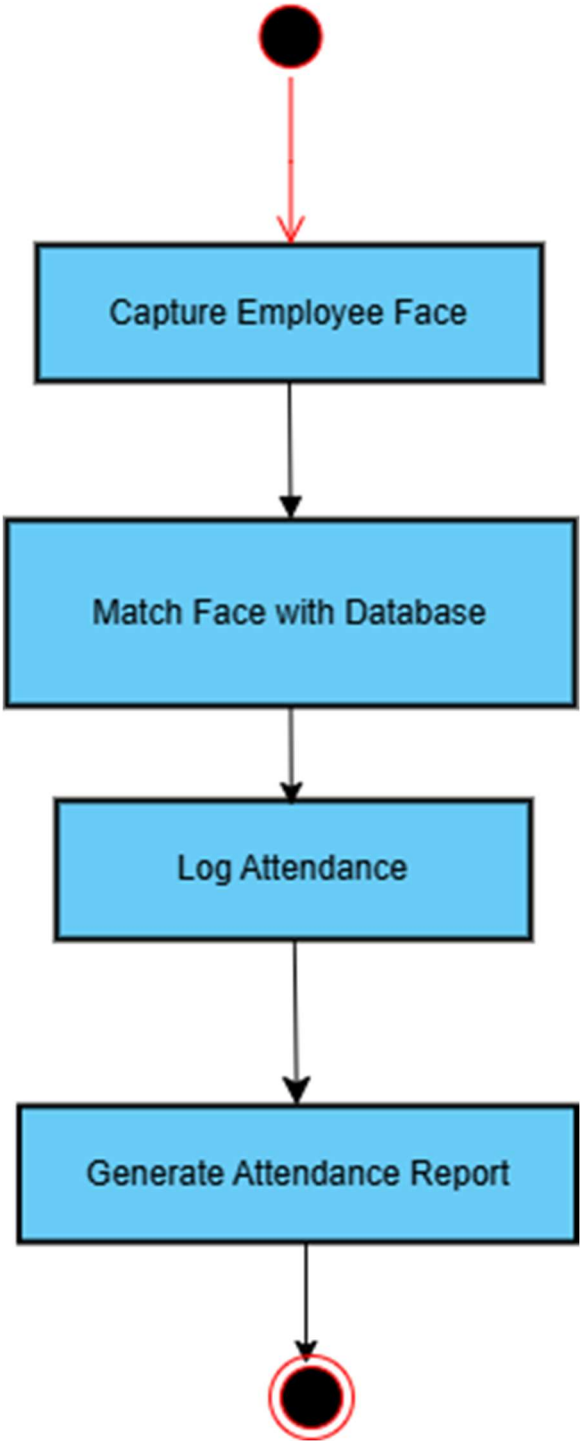

Figure.7 Track Attendance

3.9 Data Flow Diagram

3.9.1 Context diagram

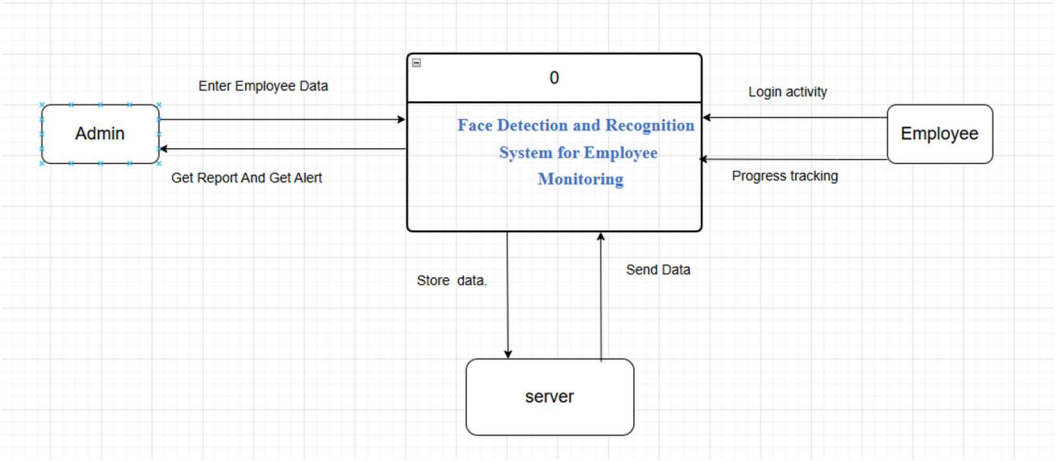

Figure.8 Context diagram

3.9.2 DFD Level 0 diagram

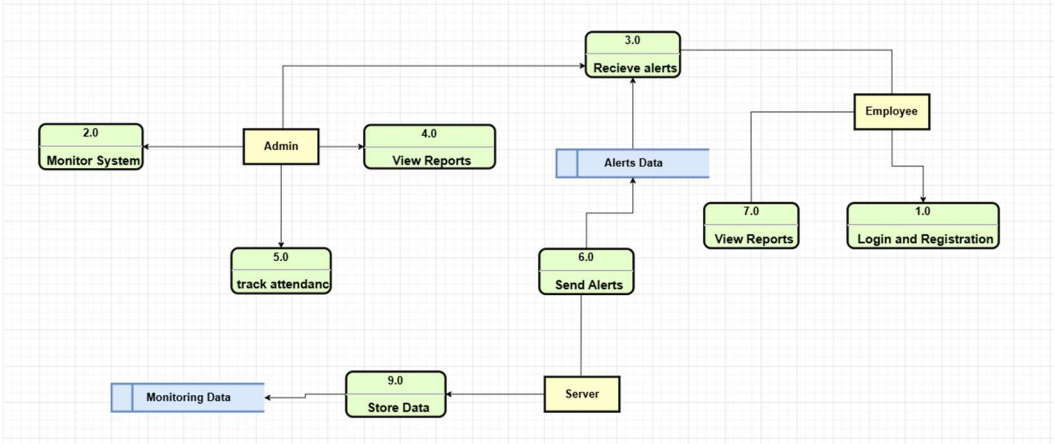

Figure.9 DFD Level 0 diagram

3.9.3 Level 1 diagram

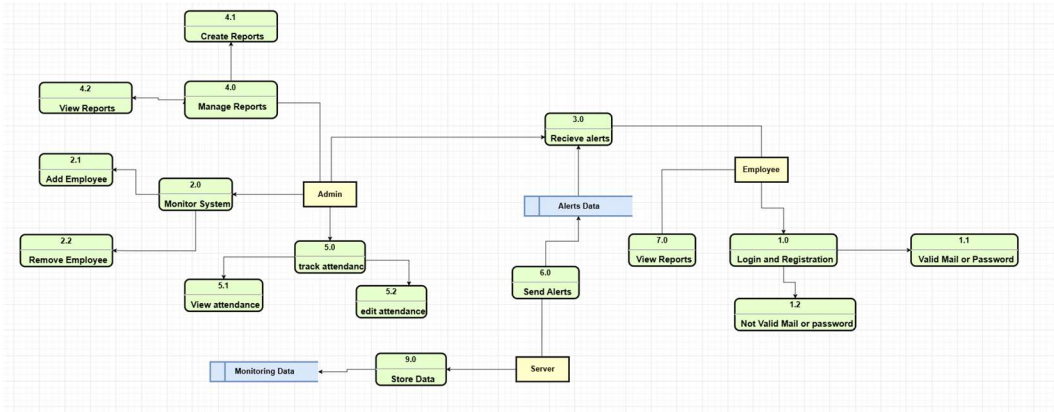

Figure.10 DFD Level 1 diagram

3.10 Entity Relationship Diagram

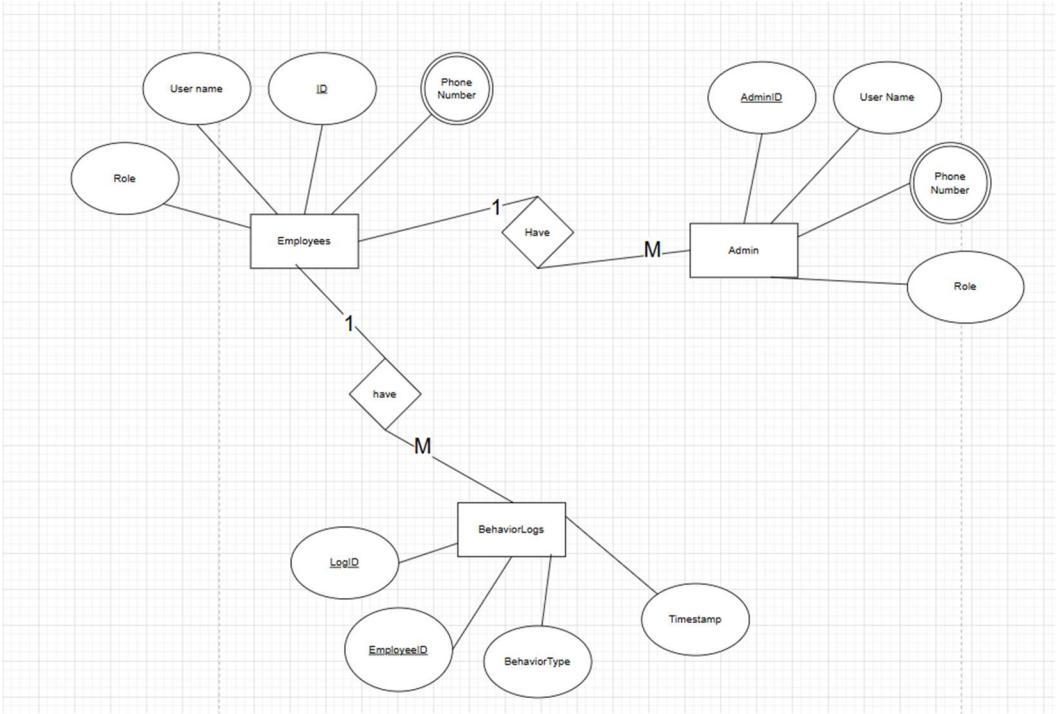

Figure.11 Entity Relationship Diagram

3.11 Class diagram

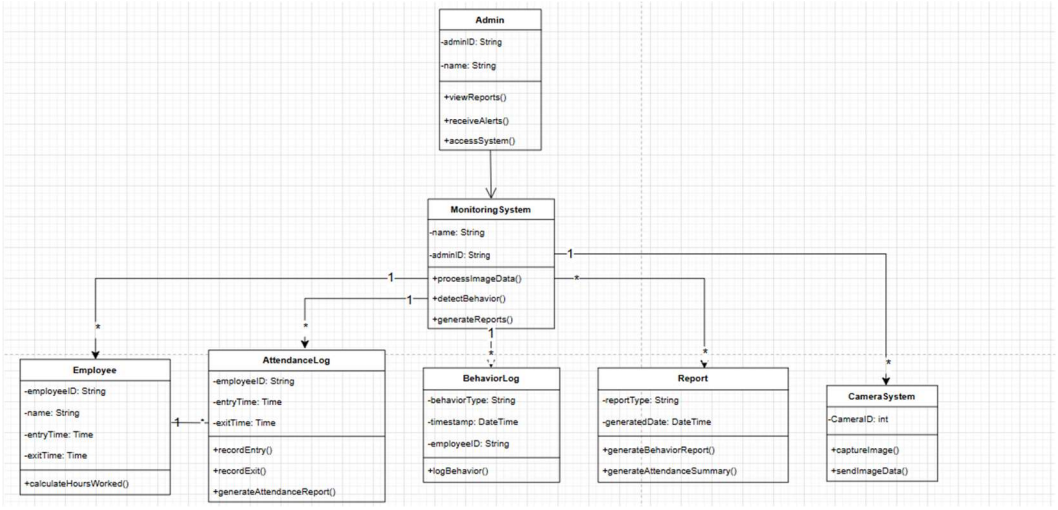

Figure.12 Class diagram

3.12 Sequence diagram

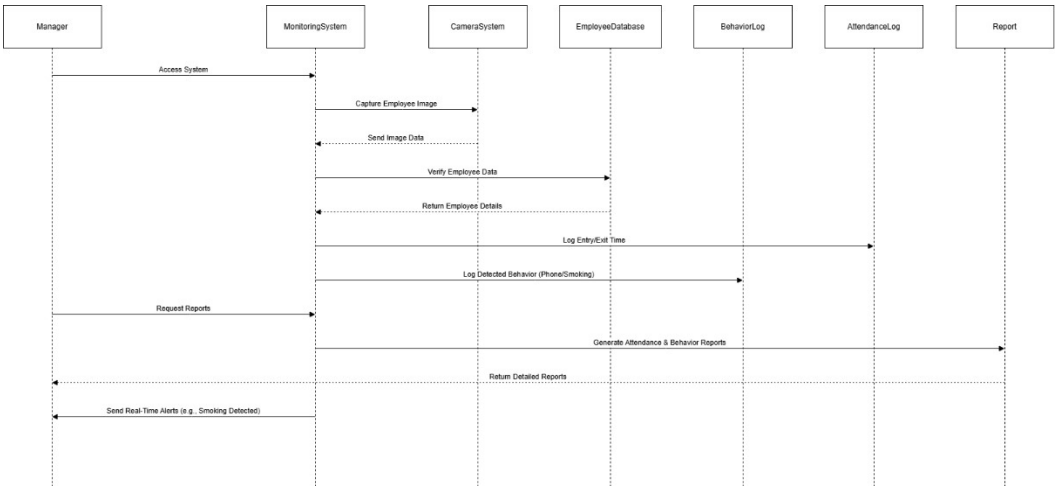

Figure.13 Sequence diagram

Chapter 4 PROJECT DESIGN

a. Overview of the Design

The design of the Face Detection and Recognition System for Employee Monitoring aims to create a robust, user-friendly, and efficient platform that seamlessly integrates AI-driven facial recognition and behavior monitoring. The primary goal is to provide a secure, scalable solution with a clean and intuitive user interface for administrators to manage access control, monitor employee activities, and generate detailed reports. Key considerations include responsiveness across devices, real-time data visualization, and adherence to accessibility standards to ensure usability for a diverse range of users.

The system is designed to balance advanced functionality with simplicity, prioritizing automation and real-time feedback while minimizing the need for extensive training or manual intervention.

b. System Architecture

The system architecture comprises three main layers:

1. **Data Collection and Input**
    - Cameras and sensors capture facial images and behavioral data in real-time.
2. **Processing Layer**
    - AI models, including convolutional neural networks (CNNs), process the collected data for facial recognition and behavior detection.
3. **Presentation Layer**
    - The user interface (UI) displays actionable insights, alerts, and reports to administrators.

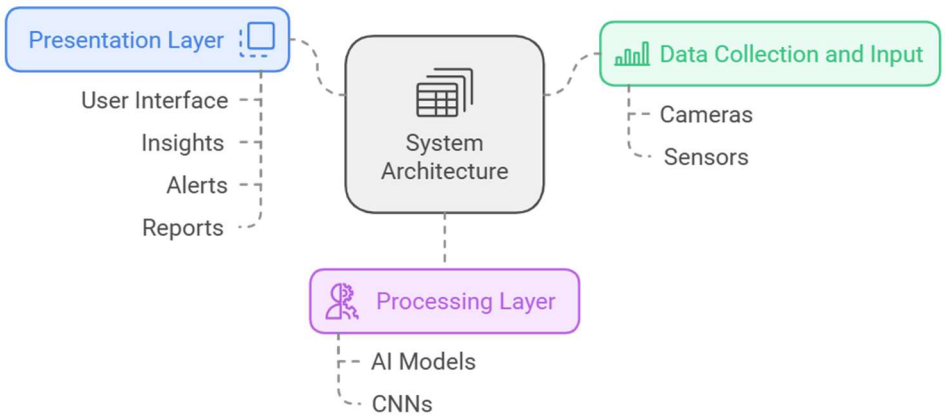

Figure.14 System Architecture

Component Roles:

- Cameras: Capture real-time facial data for recognition and behavioral analysis.
- AI Module: Processes inputs for face matching and detects behaviors like smoking or phone usage.
- Database: Stores employee profiles, access logs, and compliance reports.
- UI/UX Interface: Provides a dashboard for real-time monitoring, alerts, and reporting.

c. Design Methodology

The design follows an Agile methodology, emphasizing iterative development and continuous feedback. This approach was chosen to:

- Accommodate changing requirements during the design process.
- Ensure frequent testing and validation of system components.
- Enable rapid prototyping and user feedback for UI/UX improvements.

d. Detailed Component Design

1. Facial Recognition Module

- Purpose: Identify employees and verify access rights.
- Inputs/Outputs: Captures images as input and outputs identification results.
- Design Details: Uses CNNs trained on a dataset such as WIDER FACE for high-accuracy recognition.

2. Behavior Detection Module

- Purpose: Monitor behaviors such as phone usage, smoking, and aggression.
- Inputs/Outputs: Processes video data to detect and flag specific actions.
- Design Details: Employs a deep learning framework like TensorFlow for behavior classification.

3. User Interface (UI)

- Purpose: Display real-time monitoring and provide management tools.
- Inputs/Outputs: Receives system data and provides user-friendly visualizations.
- Design Details: Built with React.js for responsiveness and simplicity.

e. User Interface (UI) and User Experience (UX) Design

The UI/UX design ensures that administrators can interact with the system intuitively and efficiently. Key design principles include:

- Simplicity: Focus on clear, uncluttered layouts for quick access to critical features.
- Accessibility: Adheres to WCAG standards to support users with disabilities.
- Responsiveness: Optimized for desktops, tablets, and mobile devices.

Features:

1. Real-time monitoring dashboard with activity heatmaps.
2. Configurable alerts for access violations or behavioral issues.

3. Report generation with export options (PDF, CSV).

f. Workflow Design

The system's workflow follows these steps:

1. Data Capture: Cameras and sensors capture real-time inputs (e.g., facial images, behavioral data).
2. Data Processing: AI models analyze the inputs for facial recognition and behavior detection.
3. Decision Making: Based on the analysis, the system approves/denies access or triggers alerts.
4. User Interaction: Administrators interact with the dashboard for monitoring and reporting.

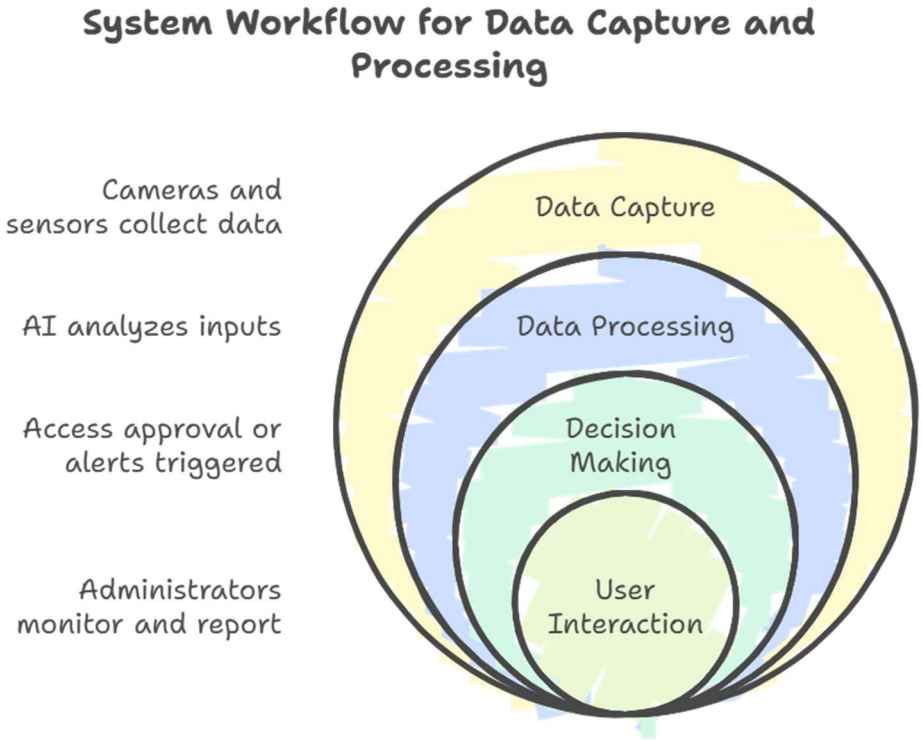

Figure.15 Workflow Design

g. Database Design

The database structure is designed to store and manage employee information, access logs, and behavioral data efficiently.

Database Schema:

- Tables:
    - Employees (fields: EmployeeID, Name, Role, FacialData).
    - AccessLogs (fields: LogID, EmployeeID, Timestamp, Status).
    - BehaviorLogs (fields: LogID, EmployeeID, BehaviorType, Timestamp).

Functionality:

- Centralized storage for all monitoring data.
- Supports real-time queries for alerts and reports.

h. Design Constraints

1. Hardware Limitations:
    - Dependence on high-resolution cameras for accurate recognition.
    - Processing power requirements for real-time AI computations.
2. Budget Restrictions:
    - Optimization of resources to ensure cost-effectiveness.
3. Standards and Compliance:
    - Ensures compliance with GDPR for data protection and privacy.

- Adheres to workplace monitoring regulations.

i. Rationale for Design Choices

1. Performance:
    - CNNs were chosen for their high accuracy in facial recognition tasks.
    - Real-time processing ensures quick decision-making.
2. Scalability:
    - The modular architecture supports the addition of new features or integration with other systems.
3. Cost-Effectiveness:
    - Use of open-source frameworks like TensorFlow and React.js reduces costs.
4. User Requirements:
    - User-friendly design prioritizes simplicity and accessibility for administrators.

CHAPTER 5 IMPLEMENTATION

CHAPTER 6 RESULTS AND TEST

CHAPTER 7 CONCLUSIONS AND FUTURE WORK

CONCLUSION

The **Face Detection and Recognition System for Employee Monitoring** represents a transformative approach to workplace management, leveraging advanced artificial intelligence and machine learning technologies to address critical challenges in security, compliance, and productivity. By automating employee access control and behavior detection, the system eliminates the inefficiencies of traditional methods, such as manual surveillance and physical ID-based access.

The project achieves several key objectives, including enhancing workplace security through facial recognition, promoting compliance by detecting behaviors such as smoking and phone usage, and improving productivity through real-time monitoring and alerts. The system's modular design ensures scalability, enabling future enhancements and seamless integration with existing organizational infrastructures.

Despite the system's robust design, certain features, such as the detection of aggressive behaviors like fighting, remain future work due to the unavailability of existing datasets. Plans to develop custom datasets and further expand functionality ensure the system's long-term adaptability and relevance.

FUTURE WORK

The proposed **Face Detection and Recognition System for Employee Monitoring** is designed to evolve and expand in its capabilities to address organizational needs more comprehensively. The following areas are identified for future development and enhancement:

1. **Seamless Compatibility with Existing Camera System**
   The project is designed to operate seamlessly with the existing camera systems of companies and organizations. This ensures compatibility with their current surveillance infrastructure, eliminating the need for additional hardware investments. By utilizing the organization's existing cameras, the system can efficiently perform real-time face recognition and behavior monitoring without disrupting the established setup.

2. **Development of a Fighting Detection Model**
   Due to the unavailability of suitable datasets for detecting aggressive behaviors such as fighting, this feature has been deferred to future work. We plan to create a custom dataset tailored to this specific need, capturing various scenarios of physical altercations in controlled environments. This dataset will serve as the foundation for developing and training a robust fighting detection model. Once completed, this model will be integrated into the system to enhance workplace safety further by identifying and addressing physical conflicts promptly.

3. **Dataset Expansion and Customization**
   To improve the overall performance and adaptability of the system, future efforts will focus on expanding the datasets used for training and testing. This will include creating organization-specific datasets to better align with the unique behaviors and conditions observed in different workplaces. The customization of datasets will help enhance model accuracy and ensure optimal functionality across diverse environments.

References:

[1] "DeepFace: Closing the Gap to Human-Level Performance in Face Verification" (Taigman et al., 2014)

[2] "FaceNet: A Unified Embedding for Face Recognition and Clustering" (Schroff et al., 2015)

[3] "Automated Cigarette Detection Using Machine Learning" (Zhang & Xie, 2016)

[4] "Smoking Detection in Videos using Deep Learning" (Yu & Wu, 2018)

[5] "AI-Based Workplace Monitoring Systems" (2022)

[6] "Automated Surveillance for Productivity Enhancement" (2020)

[7] "Mobile App Development with Flutter" (2021**)** Author: Simone [8] Alessandria, Michael Lanham, Craig Labenz

[8] "Learning SQL"(2020**)** Author: Alan Beaulieu

[9] "Firebase Essentials - Android Edition"(2022**)** Author: Neil Smyth

[10] "Designing Data-Intensive Applications"(2017**)**, Author: Martin Kleppmann

[11] Journal of Computer Science and Technology, Publisher: Springer https://link.springer.com/journal/11390

[12] ACM Transactions on Computing Education, Publisher: ACM Digital Library https://dl.acm.org/journal/toce

[13] IEEE Transactions on Mobile Computing, Publisher: IEEE Xplore https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7755

[14] Flutter Documentation **flutter.dev/docs**

[15] Firebase Documentation **firebase.google.com/docs**

[16] SQLCourse **sqlcourse.com**

[17] Stack Overflow (Flutter Tag) **stackoverflow.com/questions/tagged/flutter**

[18] GitHub Repository for Flutter **github.com/flutter/flutter**