DECLARATION

We HEMALATHA N K (4HG20CS009), SUPRITH M S (4HG20CS028), VINAY N (4HG20CS033) and NAGARAJA A S (4HG21CS416) students of 8th semester B.E, CSE, Government Engineering College, here by declare that the project entitled **"PERSON LOCATION TRACKING USING FACE RECOGNITION"** has been carried out by us, under the supervision of **Ms. Keerthana M.P.**, B.E faculty, Dept of CSE submitted in partial fulfilment of the requirements for the award of the degree of computer science and engineering by the Visvesvaraya technological university during the academic year 2023-24. This report has not been submitted to any other organization/university for any award of degree certificate.

BY

HEMALATHA N K [4HG20CS009]
SUPRITH M S [4HG20CS028]
VINAY N [4HG20CS033]
NAGARAJA A S [4HG21CS416]

ABSTRACT

Person location tracking using face recognization leveraging advanced face recognition technology. The system integrates facial recognition algorithms with geospatial data to accurately identify and track individuals in real-time vedio footage from surveillance cameras. A network of strategically placed surveillance cameras serves as the primary data source.

By utilizing a network of surveillance cameras, the system captures facial features, matches them against a predefined database, and subsequently determines the person's location, and then report thier location to the user. The fusion of facial recognition and location tracking enhances security, facilitates personalized services, and finds applications in area of education as in student safety, emergency responses. The research aims to optimize accuracy, efficiency, and privacy considerations in the implementation of this innovative person location tracking using face recognization.

ACKNOWLEDGEMENT

The completion of any project involves the efforts of many people. We have been lucky to have received a lot of help, support from all directions during this project, so with the gratitude we take this opportunity to acknowledge all those who guide and encouraged us.

We would like to express our profound sense of gratitude to our guide **Ms. Keerthana M.P.** for their guidance and our co-ordinater **Prof. Dr. Raghu M.E.**, B.E, MTech, Ph.D of CSE and our department HOD **Prof. Dr. K.C. Ravishankar**, B.E, M.Tech, Ph.D. We are extremely grateful to our principal **Dr. T. Rangaswamy** B.E, M.Sc(Engg.), Ph.D for creating an excellent and technically sound environment in our institution.

It's a great pleasure to acknowledge for their help and encouragement rendered towards the successful completion of project.

BY

HEMALATHA N K [4HG20CS009]
SUPRITH M S [4HG20CS028]
VINAY N [4HG20CS033]
NAGARAJA A S [4HG21CS416]

Contents

List of Figures

List of Tables

Chapter 1

Introduction

Person location tracking using face recognition is a technology that uses facial recognition to identify and track the location of a specific person in a given environment. It works by comparing a database of known faces to realtime video footage from cameras. When a match is found, the system can track the person's movements and report their location to the user. person location tracking using face recognition has a wide range of potential applications in area of education sector, to identify and track location of a student within the campus, enabling efficient and immediate response to emergency situations, emergency responses. This is aims to optimize accuracy and efficiency considerations in the implementation of this innovative person location tracking.

At its core, facial recognition offers a revolutionary method for uniquely identifying individuals based on their facial features. Leveraging artificial intelligence (AI) and machine dlearning algorithms, this technology has shown remarkable success in diverse applications, from authentication processes to surveillance system. One of the key motivations driving the incorporation of facial recognition into person location tracking systems is the pursuit of enhanced accuracy. Facial recognition, powered by machine learning models, adapts to these challenges by learning intricate facial patterns and features. This adaptive capability positions facial recognition as a potent tool for achieving higher accuracy in identifying and tracking individuals across diverse real-world settings. Person location tracking using face recognition that enables real-time identification and tracking of individuals within a defined area. The system should utilize facial recognition algorithms to identify unique facial features, allowing for precise location tracking and providing an efficient and secure solution for identifying and tracking individuals in various

environments. To implement this, the application would integrate a database of known individuals, comparing captured facial data with stored profiles. Machine learning models could enhance accuracy by adapting to varying lighting conditions and facial expressions.

Person location tracking using face recognition is a cutting-edge technology that combines the capabilities of facial recognition with real-time location tracking to monitor and manage the movements of individuals within a designated area. This innovative system leverages advanced computer vision algorithms to detect and recognize faces from live video feeds or static images, enabling accurate identification of individuals in various environments. With the proliferation of surveillance systems and the increasing demand for enhanced security measures, person location tracking using face recognition has emerged as a valuable solution for a wide range of applications. From ensuring safety and security in public spaces such as airports, train stations, and shopping malls to optimizing operational efficiency in corporate environments, this technology offers numerous benefits in terms of improved situational awareness, rapid response to security threats, and enhanced access control.

Moreover, person location tracking using face recognition goes beyond traditional surveillance methods by providing real-time insights into the whereabouts and movements of individuals. By integrating location tracking capabilities with facial recognition technology, organizations can effectively monitor and manage personnel, visitors, and assets, thereby enhancing overall security and operational efficiency.

In this context, this project aims to develop a robust and reliable person location tracking system using face recognition technology. By leveraging state-of-the-art algorithms and methodologies, the system will enable seamless detection, recognition, and tracking of individuals within a monitored environment. Through the integration of web-based interfaces, database management systems, and advanced image processing techniques, the project seeks to deliver a comprehensive solution for accurate and efficient person location tracking using face recognition.

1.1 Problem Statement

The challenge lies in the time-consuming and manpower-intensive process of physically locating individuals, particularly during emergency situations where swift identification is crucial. Develop a person location tracking using face recognition that enables real-time identification and tracking of individuals within a defined area. The system should utilize facial recognition algorithms to identify unique facial features, allowing for precise location tracking and providing an efficient and secure solution for identifying and tracking individuals in given environment.

The problem statement for personal location tracking using a face recognition system entails creating an efficient and accurate solution to monitor individuals' movements within a designated space. This system aims to harness the capabilities of facial recognition technology to identify and track individuals in real-time, providing location data that enables precise monitoring and analysis. It involves overcoming challenges such as varying lighting conditions, occlusions, and scale changes to ensure robust performance. The ultimate goal is to develop a reliable system capable of seamlessly tracking individuals' positions, enhancing security measures, optimizing resource allocation, and facilitating personalized services in diverse environments like airports, stadiums, or campuses.

1.2 Aim

The aim of person location tracking using face recognition is to usefacial recognition technology to identify and track the location of a specific person in a given environment.

1.3 Scope

Implement real-time processing for swift analysis of facial features. Ensure ethical data use, user-friendly interface, and scalability for diverse situations.

The scope for a person location tracking system using face recognition technology encompasses various aspects, including:

- Facial Detection and Recognition: Implementing algorithms to detect and recognize faces accurately in real-time.

- Location Tracking: Tracking the movements and whereabouts of individuals within a specified area using video feeds and location data.
- User Interface Development: Designing an intuitive and user-friendly interface for system administrators and users to interact with the system, including features such as adding new individuals, searching for persons, and viewing location history.
- Integration with Video Surveillance Systems: Integrating the face recognition system with existing video surveillance infrastructure to leverage live video feeds for tracking individuals.
- Database Management: Developing a robust database architecture to store and manage information about tracked individuals, including facial data, location history, and other relevant details.
- Security and Privacy Measures: Implementing stringent security measures to protect sensitive data and ensuring compliance with privacy regulations, including encryption, access controls, and anonymization techniques.
- Scalability and Performance Optimization: Designing the system to handle large volumes of data and concurrent users while maintaining optimal performance.
- Training and Support: Providing comprehensive training and support resources for system administrators and users to effectively utilize and maintain the system.
- Compliance with Regulations: Ensuring compliance with relevant regulations and standards governing the use of facial recognition technology and data privacy.
- Research and Development: Continuously exploring advancements in facial recognition technology and location tracking algorithms to enhance system accuracy and efficiency.

1.4 Objectives

The objectives of person location tracking using face recognition may includes:

- **Locating Students:** Identifying and locating students within educational institutions, enabling efficient and immediate response to emergency situations.

- **Security:** Face recognition can be used to track the movements of unauthorized individuals in secure areas, such as educational institutions.
- **Enable Real-time Tracking:** Using real-time tracking system that continuously monitors and updates the location of recognized individuals within a designated area.
- **Accurate Identification:** Develop algorithms and techniques to accurately identify individuals based on their facial features within a designated area or environment.
- **Real-time Tracking:** Implement a system capable of tracking individuals' movements in real-time, providing continuous updates on their locations within the monitored space.
- **Robust Performance:** Ensure the system's performance remains robust in various conditions, including changes in lighting, occlusions, and scale variations, to maintain accurate tracking capabilities.
- **Privacy Preservation:** Implement measures to safeguard individuals' privacy rights and ensure that the collection and processing of facial data comply with relevant privacy regulations and guidelines.
- **Security Enhancement:** Enhance security measures by detecting and monitoring the presence of individuals within restricted or sensitive areas, alerting authorities to potential security threats or unauthorized access.
- **Resource Optimization:** Optimize resource allocation by providing insights into crowd dynamics, traffic patterns, and occupancy levels, enabling more efficient utilization of space and personnel within the monitored environment.
- **Integration with Existing Systems:** Ensure seamless integration with existing security infrastructure, access control systems, and surveillance networks to enhance overall operational efficiency and effectiveness.
- **Ethical and Legal Compliance:** Adhere to ethical principles and legal regulations governing the use of facial recognition technology, including transparency, consent, and accountability, to mitigate potential risks and concerns associated with privacy, bias, and discrimination.

- **User Acceptance and Trust:** Build trust and acceptance among users by transparently communicating the purpose and capabilities of the system, addressing concerns related to privacy and security, and soliciting feedback to improve user experience and satisfaction.

  Overall, the objectives for person location tracking using a face recognition system aim to leverage advanced technology to enhance security, optimize resource allocation, and facilitate personalized services while upholding ethical standards and respecting individuals' privacy rights.

1.5 Applications

- **Lost and Found:-** Locating lost individuals in crowded places, such as events in colleges, using facial recognition.
- **Education:** Monitor the movement of students and staff within educational institutions for security purpose.
- **Public Safety:-** Identify and track individuals in public spaces for emergency response. Enhance overall public safety through surveillance.
- **Attendance Tracking:** Automating attendance management in educational institutions, workplaces, or events by accurately identifying individuals as they enter or exit premises. Streamlining payroll processes and ensuring transparency in attendance records.
- **Hospitality and Entertainment:** Enhancing guest experiences in hotels, resorts, or theme parks by providing personalized services and recommendations based on guest preferences and history. Managing crowd flow and wait times in entertainment venues such as stadiums, theaters, or amusement parks.
- **Healthcare:** Monitoring patient within healthcare facilities for efficient staff allocation and resource management. Ensuring compliance with safety protocols and infection control measures during pandemics or outbreaks.
- **Security and Surveillance:** Tracking individuals in public places. Monitoring crowds in public spaces for identifying individuals in real-time.

These applications demonstrate the versatility and utility of person location tracking using face recognition technology in various sectors, ranging from security and safety to customer service.

1.6 Advantages

The fallowing advantages highlight the versatility and positive impact of person location tracking using face recognization in enhancing security and efficiency.

- **Enhanced Security:-** Enables real-time identifying and tracking of individuals, enhancing overall security by preventing unauthorized access and responding promptly to security incidents.
- **Safety Assurance:-** Provides an additional layer of safety by allowing quick location identification, essential in emergency situations or when individuals are in distress.
- **Efficient Resource Management:-** Optimizes resource allocation by tracking the movement of people, leading to better utilization of personnel, assets, and facilities.
- **Improved Accountability:-** Enhances accountability in various settings, such as in educational institutions, by accurately identifiying and tracking individuals and also their activities.
- **Efficient Personnel Management:** The system facilitates efficient personnel management by tracking the movements of students within a facility, enabling better resource allocation, task assignment, and workflow optimization.
- **Real-time Monitoring:** With real-time location tracking capabilities, the system provides instant visibility into the whereabouts of individuals, allowing security personnel to monitor critical areas and respond promptly to emergencies or incidents.
- **Automated Attendance Tracking:** Integrating face recognition with attendance tracking systems automates the process of recording students attendance, reducing manual effort, eliminating errors, and ensuring accurate payroll processing.
- **Scalability and Flexibility:** The system can be scaled to accommodate the needs of various industries and environments, from small businesses to large-scale enterprises, and can be customized to meet specific requirements and regulatory compliance standards.
- **Integration with Other Systems:** Person location tracking systems can be integrated with existing security, surveillance, and business intelligence systems, allowing for seamless data exchange and interoperability with other technologies and platforms.

- **Accessibility:** For individuals with mobility impairments or disabilities that limit their ability to use traditional input devices, face recognition-based cursor tracking provides an accessible alternative. It enables users to navigate digital interfaces and interact with content using only facial movements, making computing tasks more inclusive and accessible to a wider range of users.
- **Hands-Free Operation:** Face recognition cursor tracking eliminates the need for hands or manual input devices, allowing users to operate devices or applications entirely hands-free. This is particularly beneficial in scenarios where users have limited mobility or are engaged in tasks that require their hands to be occupied, such as cooking, exercising, or operating machinery.
- **Improved Ergonomics:** By removing the need for users to constantly manipulate physical input devices, face recognition cursor tracking can help reduce strain and fatigue associated with prolonged computer use. This can lead to improved ergonomics and comfort, especially for users who spend extended periods interacting with digital interfaces.
- **Precision and Control:** Face recognition technology enables precise and responsive cursor control based on subtle facial movements and gestures. Users can achieve fine-grained control over cursor movements, allowing for accurate selection, navigation, and interaction with on-screen elements, which can enhance productivity and user experience.
- **Multi-Modal Interaction:** Combining face recognition with other input modalities such as voice commands or gestures can create a multi-modal interaction paradigm that offers users greater flexibility and convenience in controlling digital devices. This hybrid approach allows users to choose the most suitable input method based on their preferences, context, and task requirements.
- **Adaptive Interfaces:** Face recognition-based cursor tracking enables the creation of adaptive user interfaces that dynamically adjust based on user behavior and preferences. By continuously analyzing facial movements and interactions, the system can adapt interface elements such as cursor speed, sensitivity, or menu layout to better suit individual users' needs and preferences.

1.7 Disadvantages

While personal location tracking using face recognition systems offers various advantages, it also presents several disadvantages and challenges:

- **Privacy Concerns:** One of the most significant drawbacks is the potential infringement of privacy rights. Constant monitoring and tracking of individuals' movements raise concerns about surveillance and the misuse of personal data, leading to heightened privacy concerns among the general public.
- **Ethical Considerations:** The deployment of face recognition technology for location tracking raises ethical questions regarding consent, autonomy, and individual freedoms. There may be resistance or pushback from individuals who feel uncomfortable with being continuously monitored and tracked without their explicit consent.
- **Accuracy and Reliability:** Face recognition systems may encounter challenges in accurately identifying and tracking individuals, particularly in complex or crowded environments. Factors such as varying lighting conditions, occlusions, and scale variations can impact the system's accuracy and reliability, leading to false positives or missed identifications.
- **Bias and Discrimination:** Face recognition algorithms have been shown to exhibit bias, particularly against certain demographic groups such as people of color or women. This bias can result in inaccuracies and disparities in identification, leading to potential discrimination and unfair treatment of individuals.
- **Security Risks:** While face recognition systems are intended to enhance security measures, they also pose security risks if they are compromised or exploited. Hackers could potentially gain unauthorized access to sensitive personal data or manipulate the system to falsely identify individuals, leading to security breaches and vulnerabilities.
- **Legal and Regulatory Challenges:** The use of face recognition technology for location tracking may face legal and regulatory hurdles, particularly regarding data protection, surveillance laws, and privacy regulations. Compliance with relevant laws and guidelines can be complex and may vary across different jurisdictions, posing challenges for implementation and deployment.

- **Cost and Implementation Complexity:** Developing and deploying face recognition systems for personal location tracking can be costly and resource-intensive. Organizations may need to invest in advanced technology infrastructure, training, and maintenance to ensure the system's effectiveness and reliability, which can pose challenges for smaller entities or organizations with limited resources.

Overall, while personal location tracking using face recognition technology offers potential benefits in terms of security, efficiency, and convenience, it also raises significant concerns and challenges related to privacy, ethics, accuracy, bias, security, legal compliance, and public acceptance. Addressing these disadvantages and mitigating associated risks is essential to ensuring responsible and ethical deployment of such systems.

1.8 Organization of Report

This report is divided up into chapters, each dealing with different aspects of the project. Each chapter has a short introduction and explaining the subject of each chapter, and then the details of each module is explained separately. The following is a short overview of each of the chapters:

Chapter 1-Introduction:

- This chapter tells about the problem statement, background of the project,objectives, Advantages, Disadvantages,problem statement and scope of the project with its theoretical outline.

Chapter 2-Literature Survey:

- Discuss brief overview of the paper and the research sources that have been studied to establish through an understanding of the under consideration.

Chapter 3-Requirement Analysis:

- Discuss in detail about the different kind of requirement needed successfully complete the project.

Chapter 4-Technology:

- Discuss in detail about the technologies that are used to implement our project.

Chapter 5-Proposed Methodology:

- Discuss in detail about the methodologies to implement our project.

Chapter 6-Design:

- Discuss the design description of the project, conceptual and detailed design well supported with the design diagrams.

Chapter 7-Implementation:

- Discuss about the implementation description of the project, modules and its description used to develop this project.

Chapter 8-Conclusion:

- Discuss the overall project and its conclusion.

1.9 Summary

To summarize or brief out the above Introduction chapter, person location tracking using face recognition report begins with an Introduction, providing a contextual background on the project. It outlines the significance of leveraging face recognition for location tracking, emphasizing its relevance in enhancing security and operational efficiency. The Objectives section succinctly articulates the primary goals of the project, emphasizing the intent to develop a robust system for real-time tracking and identification of individuals. Following this, the Applications section explores the diverse fields where the technology finds practical use, including security, education and healthcare. Finally, the Advantages section outlines the benefits of implementing person location tracking through face recognition, underscoring its potential for improved security and safety, across various domains. This chapter serves as a foundation, setting the stage for the subsequent detailed exploration of the methodology, system architecture, and other key components in the report.

Chapter 2

Literature Survey

[1] K. Bharath S, Loke, Onkar, Jani, Shantanu, Dabre, Kanchan, 2018 International Conference on Smart City and Emerging Technology (ICSCET) - Tracking People In Real Time Video Footage Using Facial Recognition.

Face acknowledgment innovation measures and matches the striking attributes of a man for the motivations behind recognizable proof or confirmation, utilizing one of a kind facial qualities as it were. Facial acknowledgment is an innovation which has risen as a striking response to address many present day requirements for recognizable proof and the check of personality claims. It unites the guarantee of the more well-known usefulness of visual reconnaissance in the biometric frameworks. Face checking biometric innovation is amazingly flexible and this can be seen by its colossal capability of its current and forthcoming applications. Facial sweep is a viable biometric property/pointer. Different other biometric pointers are utilized for various types of ID applications because of their varieties like exactness, cost, and detecting ability. Face acknowledgment resembles each other PC application depends on particular calculations. Whichever calculation utilized right off the bat recognizes facial highlights by separating points of interest, or highlights, from a picture of the subject's face. For instance, a calculation may investigate the position, measure, state of the eyes, nose, cheekbones and jaw. These highlights are then used to look for different pictures with required coordinating highlights. Alternate counts have a fundamental display of face pictures and a short time later pack the face data, simply saving the data in the photo that is used for going up against affirmation, the required picture, and the face data is then differentiated and the face data. The main framework depended on a format coordinating strategy connected to an arrangement of one of a kind facial

highlights, giving a kind of packed face portrayal.

Acknowledgment calculations are of two fundamental methodologies Geometric and Photometric. Geometric which looks at the features where photometric is an authentic approach that distils a photo into features and differentiates the features and layouts to discard the differences. Broadly utilized acknowledgment calculations incorporate head part investigation utilizing Eigen faces, straight discriminant examination, versatile bundle chart coordinating utilizing the Fisher confront calculation, the shrouded Markov display, the multi-linear subspace picking up utilizing tensor portrayal, and the neuronal system spurred dynamic connection coordinating framework. The idea of the issue, PC related scientists are intrigued, as well as neuroscientists and clinicians. It is the general supposition that advances in PC vision research will give helpful experiences to neuroscientists and therapists into how human mind functions. There are an extensive number of business, security, and scientific applications requiring the utilization of face acknowledgment innovations. These applications incorporate computerized swarm observation, get to control, mug shot recognizable proof, confront remaking, plan of human PC interface HCI and substance based picture database administration. Various business confront acknowledgment frameworks have been sent, for example, Cognitec, Eyematic, Visage and Identix.

[2] Jin, Kai, Xie, Xuemei, Wang, Fangyu, Guangming, 2019 IEEE International Conference on Multimedia Expo Workshops (ICMEW) - Human Identification Recognition in Surveillance Videos.

Face recognition applies CNN as the feature extractor, and calculates the cosine similarity between reference gallery and query image feature. Face recognition has also developed rapidly in recent years and been applied in security checks and attendance marking system, achieving good performance. Most of the human identification recognition systems apply face detection and face recognition to achieve attendance marking. These systems can detect and recognize faces towards camera.

However, recognizing human identification in surveillance videos performs not well because of blurred and occluded images. Therefore, how to realize recognizing human identity in surveillance videos is a challenge. A few systems try to solve the problem using face tracking, but tracking often fails when face deformation is too large. In this paper, we propose to combine pedestrian information and face information. Global pedestrian detection information is used

to assist the local face information to achieve face detection and recognition in surveillance videos. We adopt the pedestrian detection and tracking to obtain the unique number of each person. Then we detect the face of the pedestrian. Finally, we recognize the identity according to the several faces. Specifically, considering that the pedestrian's moving direction is different, we propose a selective recognition algorithm based on pedestrian trajectory. The existing face recognition systems only use face detection and face recognition. As the heavy deformation of the face, the pedestrian moving in the opposite direction of the camera is always identified wrong after detected. So, we calculate the trajectory of pedestrian and analyze the moving direction. If the direction is in the opposite direction from the camera, the face will not be detected and recognized. According to the algorithm, there are fewer errors in pedestrian identification. Experiments show that the proposed method performs better than the methods only using face information. We also find that the proposed method with global information is more robust in complex environments.

[3] Baykara, Muhammet; Das, Resul (2013).IEEE 2013 International Conference on Electronics, Computer and Computation (ICECCO), Real time face recognition and tracking system.

Face recognition systems' senses of work are exactly the same with the biometric recognition systems. Face recognition system is based on the idea that each human being is different and unique in creation. If we elucidate this, facial structure has parts that are unique to each person like fingerprints. But people do not know about this unique facial structure. Each person has his own facial structure, these lines known as the symmetry of the faces are matched in computer environment and face recognition process takes place. As a result of the biometric matching carried out in computer environment, facial structure is compared to the faces on the database and the personnel who has the matching facial structure is allowed to log in. In card reading systems, people may give their cards to other people and may lose their cards.

But in face recognition systems, it is out of the question. Fingerprints reading systems may cause problems in reading the fingerprints in some sectors. Metal industry and firms where chemical materials are used, chemical material waste and skin irritation on hands make it hard for the system to read and therefore prevent such a system from working properly. With face recognition system, all the negativity is done away with, and safer and more useful access control products are put into service. Face recognition systems that can detect a large number of faces

can have many practices. For instance, ATM and credit card systems are interested in these systems in order to stop misuse and fraud. One way of achieving this is to put the picture of the owner on the credit card. Face recognition system can recognize the picture of the credit card owner and offer high level security. Security and enquiry institutions are preoccupied with the development of rapid and efficient methods of recognizing people. For some applications, facial vision is the only source of data that is appropriate for recognizing the face. One example of this is the picture taken from the video image. In such an image, facial vision may not even be seen partially. Face recognition can be used in the interfaces which are between human and computer. In this case, information can be used to limit searching and therefore face recognition algorithm is applied to a reduced amount of images. Such hybrid methods yield more reliable results.

[4] Nikom Suvonvorn, Anant Chocksuriwong, Real-Time Face Detection/Identification for Surveillance System.

Face detection and classification is one of video processing techniques needed as basic functions for third generation surveillance systems. System detected a present of faces in scene for identify known person in database and stored in case unknown. Face recognition acquires biometric information from a person to be verified in a less intrusive manner than other biometric recognition techniques, such as fingerprint recognition, without requiring the person to directly contact a recognition system with part of his or her body. Many architectures [1][2][3] has proposed for dealing with real-time processing. We propose here a component-based framework of on-line face processing for surveillance system. Our goal is first to obtain a real-time face detection and classification framework with some applicative aspects of surveillance domain, such as, acquisition, storage, alert and playback components. The processing system architecture based on the inter-components synchronization and the inner-component execution model is adopted in order to deal with the parallelization on the multi-cores and multi-processors. The seconde objective is to deal with the face detection and classification.

2.1 Summary

In summary, the literature survey on person location tracking using face recognition highlights the potential of these systems to improve real time tracking and face recognition. The survey identifies various approaches, including face recognition, face detection, and image and vedio analysis techniques, used to achieve accurate and efficient face recognition and location tracking. The survey also discusses the challenges and limitations of these approaches, including cost, accuracy, maintenance, privacy, and technical expertise. The survey suggests that further research and development are necessary to address these challenges and ensure the effective implementation and use of person location tracking using face recognition.

Chapter 3

Requirement Analysis

Requirements analysis, also called requirements engineering, is the process of determining user expectations for a new or modified product. These features, called requirements, must be quantifiable, relevant and detailed. In software engineering, such requirements are often called functional specifications. Requirements analysis is an important aspect of project management. Requirements analysis involves frequent communication with system users to determine specific feature expectations, resolution of conflict or ambiguity in requirements as demanded by the various users or groups of users, avoidance of feature creep and documentation of all aspects of the project development process from start to finish. Energy should be directed towards ensuring that the final system or product conforms to client needs rather than attempting to mold user expectations to fit the requirements. Requirement analysis is a crucial phase in the software development lifecycle that involves gathering, documenting, and analyzing the needs and expectations of stakeholders for a software system.

3.1 Hardware Requirements

Name	Minimum Requirement
Processor	Intel/AMD/others(1.5GHz or above)
RAM	4GB or more
Hard Disk	100GB

Table 3.1: Minimun Hardware Requirements

Hardware requirements are the most common set of requirements defined by any operating system or software application is the physical computer resources, also known as hardware, A hardware requirements list is often accompanied by a hardware compatibility list (HCL),especially in case of operating systems.It can vary depending on the complexity of the software application or system, the size of the data sets it handles, and the level of performance required.

The system features an Intel processor, which could be either an i3 or i5 variant. The processor operates at a clock speed of 2GHz, providing sufficient computing power for everyday tasks and moderate multitasking.With 4GB of RAM, the system offers adequate memory for running multiple applications simultaneously without significant performance slowdowns. While it may not support heavy multitasking or memory-intensive tasks, it should handle standard computing tasks efficiently.The system is equipped with a 100GB hard disk, providing ample storage space for storing documents, media files, and applications.

3.2 Software Requirements

Name	Minimum Requirement
Operating system	Windows/Linux/MAC/others
Coding Language	Python
Editor	Vscode/Pycharm/others
Libraries	Opencv,Pandas and dlib

Table 3.2: Minimun Software Requirements

Software requirements for a system are the description of what the system should do, the service or services that it provides and the constraints on its operation.It define what a software system or application should do or achieve. They are the features, functions, and qualities that the software should possess to meet the needs of its intended users.Software requirements are critical for the success of a software project, as they provide a clear and consistent understanding of what the software should deliver, and help to ensure that the software meets the needs of its users. OpenCV is a popular library for computer vision tasks. It's used extensively for capturing video frames, resizing frames, drawing rectangles and text on frames, and displaying frames.

3.3 Functional Requirements

Functional requirements for a person location tracking system using face recognition encompass various aspects of the system's capabilities. Here are specific functional requirements for such a system:

- **User Authentication:-** Users must authenticate securely to access the system, ensuring authorized usage.
- **Facial Detection:-** The system should detect faces accurately in real-time video footage from surveillance cameras.
- **Facial Recognition:-** Identify individuals based on detected faces using a trained facial recognition model.
- **Location Tracking:-** Continuously track the real-time location of recognized individuals within a specified area.
- **Real-Time Reporting:-** Provide real-time reporting of individuals' locations on a graphical interface or through notifications.
- **Historical Location Storage:-** Store historical location data, allowing users to review past movements and locations.
- **Database Integration:-** Integrate with a database system to store and retrieve facial data, user information, and location records efficiently.
- **User Interface (UI):-** Develop an intuitive and user-friendly UI for interacting with the system, facilitating easy navigation and access to information.
- **Multiple Face Recognition:** Ability to recognize and track multiple faces simultaneously, distinguishing between different individuals.
- **Accuracy and Reliability:** High accuracy and reliability in recognizing and tracking individuals to minimize false positives and negatives.
- **Privacy Protection:** Implementation of privacy protection measures to ensure that the system complies with privacy regulations by anonymizing or encrypting data where necessary.

- **Scalability:** The system should be scalable to handle large numbers of faces and tracking data efficiently, especially in crowded environments.
- **Adaptability:** Ability to adapt to changes in environmental conditions, such as varying lighting, occlusions, and background clutter.
- **Alerting Mechanism:** Provision of an alerting mechanism to notify security personnel or relevant authorities in case of recognized individuals with specific attributes (e.g., unauthorized persons, missing persons).
- **Integration with Other Systems:** Seamless integration with existing security systems, such as CCTV cameras, access control systems, and alarm systems, to enhance overall security measures.
- **User Interface:** An intuitive and user-friendly interface for system administrators to configure settings, manage databases, and view tracking data.
- **Logging and Reporting:** Logging and reporting capabilities to track system usage, access attempts, recognition accuracy, and any incidents for audit and analysis purposes.
- **Cross-Platform Compatibility:** Compatibility with various platforms and devices to ensure accessibility and ease of deployment.
- **Compliance with Regulations:** Compliance with relevant regulations and standards concerning facial recognition technology and data privacy.
- **Continuous Improvement:** Implementation of mechanisms for continuous improvement through feedback loops, machine learning algorithms, and updates to enhance recognition accuracy and system performance over time.
- **Low Latency:** Minimal latency in recognizing and tracking individuals to ensure timely responses in security-sensitive situations.
- **Robustness:** Robustness against common challenges such as changes in appearance (e.g., facial hair, accessories), partial occlusions, and variations in pose and illumination.
- **Security Measures:** Implementation of security measures to prevent unauthorized access to the system, such as encryption of data transmission and access control mechanisms.

- **Training and Support:** Provision of comprehensive training and ongoing support for system administrators and end-users to ensure effective utilization and troubleshooting.

3.4 Non Functional Requirements

Non-functional requirements define the characteristics and qualities of a system, specifying how the system should perform rather than what it should do. Here are non-functional requirements for a person location tracking system using face recognition:

- **Performance:** The system should deliver high-performance levels in face detection, recognition, and tracking, with minimal latency to ensure real-time responsiveness. This includes specifying response times for various operations and ensuring that the system can handle a certain number of concurrent users or tracking requests without degradation in performance.
- **Accuracy:** The face recognition system must exhibit a high level of accuracy in identifying individuals, minimizing false positives and negatives. This entails specifying acceptable error rates and continuously evaluating and improving the recognition algorithms to enhance accuracy over time.
- **Scalability:** The system should be scalable to accommodate growing volumes of data, users, and tracking requests without sacrificing performance or reliability. This involves ensuring that the system architecture, databases, and processing resources can scale horizontally or vertically as needed to handle increased loads.
- **Reliability:** The system should be highly reliable, with minimal downtime and robust error handling mechanisms in place to prevent data loss or corruption. This includes specifying system uptime requirements, implementing redundancy and failover mechanisms, and conducting regular maintenance and testing to identify and address potential failure points.
- **Security:** Security is paramount in face recognition systems to protect sensitive personal data and prevent unauthorized access or misuse. This includes implementing encryption for data transmission and storage, enforcing access controls and authentication mechanisms, and complying with relevant data privacy regulations and standards.

- **Privacy:** Ensuring the privacy of individuals is essential, requiring the system to incorporate privacy-preserving features such as anonymization of tracking data, secure storage and handling of biometric information, and user consent mechanisms for data collection and processing.
- **Usability:** The system should be user-friendly and intuitive, with a well-designed interface for administrators and end-users to configure settings, manage databases, and view tracking data. This involves conducting user testing and feedback sessions to identify and address usability issues and providing comprehensive documentation and training resources.
- **Compatibility:** The system should be compatible with a wide range of hardware and software platforms to ensure seamless integration with existing infrastructure and devices. This includes supporting various operating systems, databases, programming languages, and communication protocols commonly used in security and surveillance systems.
- **Interoperability:** Interoperability with other systems and technologies is essential for seamless data exchange and integration. This includes adhering to industry standards and protocols for interoperability, providing APIs or middleware for integration with third-party applications, and supporting common data formats for data exchange.
- **Maintainability:** The system should be easy to maintain and update, with well-documented code, modular architecture, and clear separation of concerns. This involves adhering to coding best practices, version control, and release management processes, and providing tools and resources for troubleshooting and debugging.
- **Adaptability:** The system should be adaptable to changes in environmental conditions, user requirements, and technological advancements. This includes incorporating flexibility into the system architecture and algorithms to accommodate future upgrades, enhancements, and customization options.
- **Compliance:** The system should comply with relevant laws, regulations, and industry standards governing the use of facial recognition technology and the handling of biometric data. This includes conducting regular audits and assessments to ensure compliance with data protection regulations such as GDPR, CCPA, and HIPAA.

- **Ethical Considerations:** Ethical considerations such as fairness, bias, and transparency should be addressed in the design and implementation of the system. This includes mitigating bias in facial recognition algorithms, providing transparency into how the system operates, and ensuring accountability for any decisions or actions taken based on the system's outputs.
- **Environmental Impact:** Minimizing the environmental impact of the system, such as energy consumption and carbon footprint, is important for sustainability. This includes optimizing algorithms and hardware for energy efficiency, using renewable energy sources where possible, and adopting eco-friendly practices in system deployment and operation.
- **Cultural Sensitivity:** Cultural sensitivity is crucial when deploying face recognition systems in diverse populations to avoid inadvertent discrimination or offense. This involves considering cultural norms and sensitivities in system design, training data selection, and user interactions to ensure inclusivity and respect for individual differences.
- **Auditability:** The system should maintain comprehensive audit logs of all user activities, system events, and data access and modifications for accountability and compliance purposes. This includes logging timestamps, user IDs, and actions performed, and implementing access controls to restrict access to audit logs to authorized personnel.
- **Legal Compliance:** Ensuring compliance with legal requirements, including laws related to surveillance, data protection, and human rights, is essential for the lawful operation of the system. This includes conducting legal reviews and risk assessments, obtaining necessary permits and approvals, and providing mechanisms for individuals to exercise their rights regarding their personal data.
- **Internationalization and Localization:** The system should support multiple languages, cultural conventions, and regional settings to cater to a global audience and diverse user base. This includes providing multilingual interfaces, date and time formats, and localization of content and documentation to meet the needs of users worldwide.
- **Cost-effectiveness:** The system should be cost-effective to develop, deploy, and maintain, considering factors such as hardware and software costs, licensing fees, personnel expenses, and total cost of ownership over the system's lifecycle. This includes cost-benefit analyses and optimizing resource allocation to minimize financial risks.

- **Community Engagement:** Engaging with stakeholders, including local communities, civil society organizations, and advocacy groups, is essential for building trust, addressing concerns, and fostering transparency and accountability in the deployment and operation of face recognition systems. This includes soliciting feedback, organizing public consultations, and collaborating with stakeholders to ensure the responsible and ethical use of the technology.

3.5 Summary

We discussed various project requirements in this chapter, including hardware requirements such as Intel Core i3 and i5 processors and 4 GB of RAM, software requirements such as the Windows 10 operating system and also discuss the functional requirements and nonfunctional requirements.

Chapter 4

Technology

The term "technology" generally refers to the tools, methods, and processes that are used to create, develop, and apply scientific knowledge to solve problems and improve the quality of life.

4.1 HTML

Figure 4.1: HTML

Html is the acronym that stands for hyper Text Mark Up Language.Html is used to organize, format and display a web page's content. The Markup languages is used to determine how elements are displayed on a webpage.Html elements are defined by their opening and closing

tags and can use elements to structure a web page into sections, headings and other content blocks. Html is a very necessary technology as by this Structuring web pages, Navigating the internet, Embedding images can be done. Html elements are the building blocks of HTML pages. With HTML constructs, images and other objects such as interactive forms may be embedded into the rendered page.

HTML provides a means to create structured documents by denoting structural semantics for text such as headings, paragraphs, lists, links, quotes, and other items. HTML elements are delineated by tags, written using angle brackets In the image-based vehicle damage and road condition prediction project, HTML can be used to:

- Create the structure of the web pages for the application.
- Embed images and videos to display the vehicle damages and road conditions.
- Define forms and input fields for user interaction.
- Establish links and navigation between different pages of the application.

4.2 CSS

Figure 4.2: CSS

CSS stands for Cascading Style Sheets and it is used to add style to a web page by dictating how a site is displayed on browser.

Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language such as HTML or XML. CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript. CSS is responsible for the text, style, size, positioning, and more on a website. It also controls how a website's style shifts between desktop and mobile versions. The best use of CSS is to save it as a .css file, separate from your .html file. The style sheet can then be linked to your HTML file. CSS is easy for users to learn and update, which makes global changes to style simple and quick. In the image-based vehicle damage and road condition prediction project, CSS can be used to:

- Style and format the user interface of the application.
- Create responsive designs that adjust to different screen sizes.
- Improve the accessibility of the application for users with disabilities.
- Create animations and interactive effects for a better user experience.

4.3 Python

Figure 4.3: Python

Python is a high-level, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation.

Python is a versatile, high-level programming language renowned for its simplicity, readability, and flexibility. It was created by Guido van Rossum and first released in 1991. Python's design philosophy emphasizes code readability with its use of significant whitespace and clear, expressive syntax, making it an ideal language for beginners and experienced developers alike. One of Python's key strengths is its extensive standard library, which provides modules and packages for a wide range of tasks, from file I/O to web development, networking, and scientific computing. This rich ecosystem reduces the need for developers to reinvent the wheel and accelerates the development process.

Python supports multiple programming paradigms, including procedural, object-oriented, and functional programming. This versatility allows developers to choose the approach that best suits their project requirements, fostering creativity and innovation. Python's popularity has soared in recent years due to its suitability for various domains, including web development (with frameworks like Django and Flask), data analysis and visualization (with libraries like NumPy, Pandas, and Matplotlib), artificial intelligence and machine learning (with libraries like

TensorFlow and PyTorch), and scientific computing (with tools like SciPy and SymPy).

Moreover, Python's community-driven development model ensures continuous improvement and innovation. Developers around the world contribute to the language's evolution by creating libraries, frameworks, and tools that address emerging needs and challenges.

In summary, Python's simplicity, readability, versatility, and vibrant ecosystem make it a top choice for developers across industries, enabling them to build powerful, efficient, and scalable applications with ease.

4.4 OpenCv

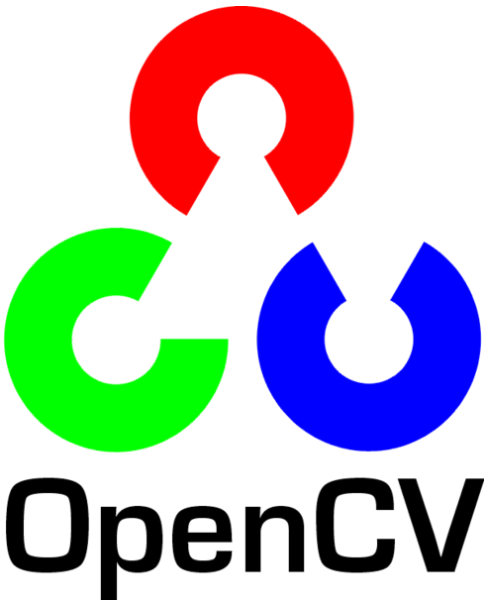

Figure 4.4: OpenCv

OpenCV(Open Source Computer Vision Library) is an open source computer vision also machine learning software library. It is the library we will be using for image conversion functions such as altering the image to grayscale.

OpenCV is written in C++ and its primary interface is in C++, but it still retains a less comprehensive though extensive older C interface. All of the new developments and algorithms appear in the C++ interface. There are bindings in Python, Java and MATLAB/OCTAVE. The API for these interfaces can be found in the online documentation.Wrappers in several programming languages have been developed to encourage adoption by a wider audience. In version 3.4, JavaScript bindings for a selected subset of OpenCV functions was released as

OpenCV.js, to be used for web platforms. Officially launched in 1999 the OpenCV project was initially an Intel Research initiative to advance CPU-intensive applications, part of a series of projects including real-time ray tracing and 3D display walls. The main contributors to the project included a number of optimization experts in Intel Russia, as well as Intel's Performance Library Team. OpenCV can be used in the image-based vehicle damage and road condition prediction project to:

- Read and preprocess images and videos for model training and evaluation.
- Implement computer vision algorithms for object detection and segmentation.
- Extract features and patterns from images for classification.
- Apply image processing techniques to improve image quality and remove noise.

4.5 Visual Studio

Figure 4.5: Visual Studio logo

Visual Studio Code, also commonly referred to as VS Code, is a source-code editor developed by Microsoft for Windows, Linux, macOS and web browsers. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded version control with Git. Users can change the theme, keyboard shortcuts, preferences, and install extensions that add functionality.Visual Studio Code is a source-code editor that can be used with a variety of programming languages, including C, C, C++, Fortran, Go, Java, JavaScript, Node.js, Python, Rust, and Julia. Visual Studio Code employs the same editor component (codenamed "Monaco") used in Azure DevOps .

The downloadable version of Visual Studio Code is built on the Electron framework. which is used to develop Node.js web applications that run on the Blink layout engine. Visual Studio Code for the Web is a browser-based version of the editor that can be used to edit both local files and remote repositories (on GitHub and Microsoft Azure) without installing the full program. It is officially supported and hosted by Microsoft and can be accessed at https://vscode.dev. Out of the box, Visual Studio Code includes basic support for most common programming languages. This basic support includes syntax highlighting, bracket matching, code folding, and configurable snippets. Visual Studio Code also ships with IntelliSense for JavaScript, TypeScript, JSON, CSS, and HTML, as well as debugging support for Node.js. Support for additional languages can be provided by freely available extensions on the VS Code Marketplace.

Instead of a project system, it allows users to open one or more directories, which can then be saved in workspaces for future reuse. This allows it to operate as a language-agnostic code editor for any language. It supports many programming languages and a set of features that differs per language. Unwanted files and folders can be excluded from the project tree via settings. Many Visual Studio Code features are not exposed through menus or the user interface but can be accessed via the command palette. The command palette is able to execute virtually every feature the graphical interface supports, making it very keyboard-accessible.

Visual Studio Code can be extended via extensions, available through a central repository. This includes additions to the editor and language support. A notable feature is the ability to create extensions that add support for new languages, themes, debuggers, time travel debuggers, perform static code analysis, and add code linters using the Language Server Protocol. Source control is a built-in feature of Visual Studio Code. It has a dedicated tab inside of the menu bar where users can access version control settings and view changes made to the current project. To use the feature, Visual Studio Code must be linked to any supported version control system (Git, Apache Subversion, Perforce, etc.). This allows users to create repositories as well as to make push and pull requests directly from the Visual Studio Code program. Visual Studio Code collects usage data and sends it to Microsoft to help improve the product. This telemetry feature can be disabled.[31] The information contained in this telemetry data can be inspected by the public, since the product is open source.

4.6 Xampp

Figure 4.6: Xampp

XAMPP helps a local host or server to test its website and clients via computers and laptops before releasing it to the main server. It is a platform that furnishes a suitable environment to test and verify the working of projects based on Apache, Perl, MySQL database, and PHP through the system of the host itself. Among these technologies, Perl is a programming language used for web development, PHP is a backend scripting language, and MariaDB is the most vividly used database developed by MySQL. The detailed description of these components is given below.

XAMPP is an abbreviation where X stands for Cross-Platform, A stands for Apache, M stands for MYSQL, and the Ps stand for PHP and Perl, respectively. It is an open-source package of web solutions that includes Apache distribution for many servers and command-line executables along with modules such as Apache server, MariaDB, PHP, and Perl. XAMPP helps a local host or server to test its website and clients via computers and laptops before releasing it to the main server. It is a platform that furnishes a suitable environment to test and verify the working of projects based on Apache, Perl, MySQL database, and PHP through the system of the host itself. Among these technologies, Perl is a programming language used for web development, PHP is a backend scripting language, and MariaDB is the most vividly used database developed by MySQL. The detailed description of these components is given below.

4.7 Flask

Figure 4.7: Flask

This Flask application is using various libraries and algorithms to process video streams for face recognition.

Flask, a lightweight web framework for Python, can be used to create a web application that interfaces with a face recognition system for person location tracking. Here's a simplified breakdown:

- Face Recognition System: This system identifies individuals in images or video streams. It can be implemented using libraries like OpenCV or dlib.
- Flask Web Application: Flask is used to create a web interface for the face recognition system. This allows users to interact with the system through a browser.
- Integration: Flask routes are defined to handle incoming requests from users, such as uploading images or streaming video. These routes interact with the face recognition system to process the data.
- User Interface: Flask templates and forms can be used to create a user-friendly interface where users can upload images, view tracked persons, or access other features of the system.

- Real-Time Updates: Flask can be used to implement real-time updates, allowing users to see tracked persons in near-real-time as new data is processed by the face recognition system.

Overall, Flask serves as the backbone for the web application, handling user interactions and interfacing with the face recognition system to provide person location tracking functionality.

4.8 Face Recognition library

The face recognition library is a wrapper around the dlib library, which is a powerful library for machine learning, computer vision, and deep learning. Here's an overview of how the face recognition library works for face recognition in video processing:

- Face Detection: The first step in face recognition is detecting faces in the video frames. The library utilizes the Histogram of Oriented Gradients (HOG) algorithm, which is a popular technique for object detection. HOG computes gradients of image intensity to capture the shape and edge information. It then forms histograms of gradient orientations in localized regions of the image. The face detection algorithm in face recognition uses these HOG features to detect potential face regions in the video frames.

- Face Encoding: Once faces are detected, the next step is to encode them into a feature vector. This is where the deep learning aspect comes into play. The face recognition library employs a deep neural network (specifically, a pre-trained model from dlib) to extract high-level features from the face regions. These features are essentially a numerical representation of facial characteristics such as the position of facial landmarks, shape of eyes, nose, and mouth, etc.

- Face Recognition: After encoding faces into feature vectors, the library compares these vectors with pre-stored vectors of known faces. The smaller the distance between two vectors, the more similar the faces are considered to be. If a match is found (i.e., the distance falls below a certain threshold), the library recognizes the face as belonging to one of the known individuals.

- Matching Faces: Once faces are recognized, the library can optionally draw bounding boxes around the detected faces and label them with the names of the recognized individuals. It can also perform additional tasks such as displaying the recognized faces.

- Real-Time Processing: The face recognition library is optimized for real-time face recognition applications. It can process video frames at high speed, making it suitable for applications such as surveillance, attendance tracking, access control, etc.

4.9 Threading

Threading: Threading is utilized to process video streams from multiple cameras concurrently. This allows the system to recognize faces and log attendance simultaneously from different camera sources. Threading is used to achieve concurrent execution of video processing tasks. Here's how threading is utilized and its function in this context:

- Parallel Video Processing: The application is designed to process video streams from multiple cameras simultaneously. Each camera corresponds to a separate video capture device. Threading allows the application to create separate threads for processing each camera's video stream concurrently.
- Improved Performance: By using threading, the application can process video streams from multiple cameras concurrently, improving overall performance and responsiveness. Without threading, if video processing for one camera were to block the main execution thread, it would affect the processing of other cameras.
- Efficient Resource Utilization: Threading enables efficient utilization of system resources by allowing the application to leverage multiple CPU cores effectively. Each thread can execute independently, making efficient use of available CPU time.
- Preventing Blocking: Video processing tasks, such as face recognition and attendance logging, can be time-consuming operations. Threading prevents these tasks from blocking the main thread of execution, ensuring that the web server remains responsive to incoming requests from clients.
- Enhanced Responsiveness: By processing video streams concurrently in separate threads, the application can maintain responsiveness to user interactions and provide real-time updates without delays caused by sequential processing.

Chapter 5

Methodology

5.1 Data Collection

Objective: Gather unique ID, name, and images of individuals systematically.

- Create a database schema to store the unique ID, name, and image paths.
- Develop a user interface (UI) to input the unique ID, name, and capture images using a webcam or upload from a file.
- Save the captured/uploaded images in a structured folder format (/dataset/unique_id/).
- Store the unique ID, name, and image paths in the database.

5.2 Pre-Processing

Objective: Prepare images for model training.

- Load images from the dataset.
- Convert images to grayscale (optional) to reduce computational complexity.
- Resize images to a consistent size (e.g., 128x128 pixels).
- Normalize pixel values to a range of [0, 1].
- Augment data by applying transformations (e.g., rotations, flips) to increase the dataset size.

5.3 Model Training

Objective: Train a machine learning model to recognize faces.

- Choose a model architecture (e.g., Convolutional Neural Network).
- Split the dataset into training and validation sets.
- Feed pre-processed images and their corresponding labels to the model.
- Train the model using an appropriate loss function and optimizer.
- Evaluate the model on the validation set and adjust hyperparameters as necessary.
- Save the trained model for later use.

5.4 Real-Time Face Recognition

Objective: Recognize faces in a video stream using the trained model.

- Set up a video capture stream (e.g., using OpenCV).
- Extract frames from the video stream.
- Pre-process each frame (similar to the training images).
- Use the trained model to detect and recognize faces in each frame.
- Draw bounding boxes and labels around recognized faces in the video stream.

5.5 Location Tracing

Objective: Track recognized faces over time.

- Assign a unique identifier to each detected face.
- Use tracking algorithms (e.g., SORT, Deep SORT) to maintain the identity of detected faces across frames.
- Update the position of each recognized face in real-time.

5.6 Storing Location to Database or Excel

Objective: Store the location information of recognized faces.

- Capture the timestamp, camera ID, and coordinates of recognized faces.
- Create a schema in the database to store this information.
- Insert the captured data into the database in real-time.
- Alternatively, write the data to an Excel file using libraries like pandas.

5.7 Searching

Objective: Search for the location of a person by their unique ID.

- Develop a search interface to input the unique ID.
- Query the database for the latest location information of the entered unique ID.
- Display the recent location status if the person is found.
- Display a "Not Found" message if there is no recent location information.

Chapter 6

Design

6.1 Data Flow Diagram

The data flow diagram (DFD) maps out the flow of information for any process or system. It uses defined symbols like rectangles, rhombus and arrows, plus short text labels, to show data inputs, outputs, storage points and the routes between each destination. A data flow diagram shows the way information flows through a process or system. It includes data inputs and outputs, data stores, and the various sub processes the data moves through.

The figure 6.1 shows the block diagram of the flow of the project which is used to design the basic structure of the project. The displayed flow chart consists of many steps which shows the step by step procedure to complete the task on hand i.e, the location tracking using face recognization.

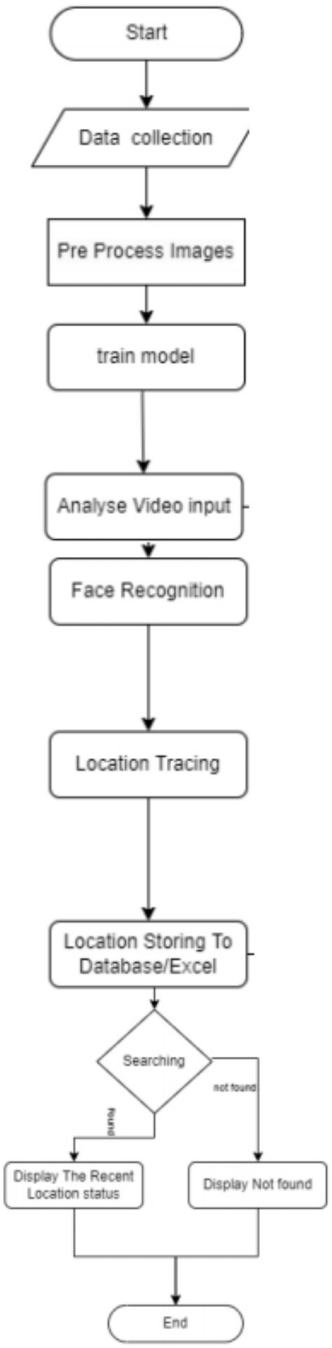

Figure 6.1: Data flow diagram

The figure 6.1 shows the block diagram of the flow of the project which is used to design the basic structure of the project.

The main steps consists of:

- **Data collection:**

  It involves gathering of unique ID, name and images in a systematic and organized manner.

- **Pre-Processing:**

  Pre-Processing the image that is imported from the datasets.

- **Train model:**

  Model training recognize patterns and make predictions by feeding it images as data. Analysis video input, recognizing face from the input video stream using the trained machine.

- **Face recognition:**

  It is done by comparing a input image to real-time vedio stream. 6. Location tracing: Onces the face has been recognized, it need to be tracked over time using location tracking.

- **Location storing to database or Excel:**

  storing the information of the camera location where the recognized person present in the video into the Excel sheet/database.

- **Searching:**

  Searching required person's location by entering his unique id, if the person is found it displays the recent location status, or if the person is not found it displays not not found.

6.2 Design

Here is a design for a person location tracking system using face recognition:

1. **System Architecture:**
   - Client-Server Architecture: The system can consist of client devices (e.g., cameras, smartphones) capturing images and a central server performing face recognition and location tracking.
   - Cloud-Based Solution: Utilize cloud infrastructure for scalability and centralized processing of face recognition tasks.
2. **Components:**
   - Client Devices: Devices with cameras for capturing images.
   - Face Detection Module: Responsible for locating faces within the captured images.
   - Face Recognition Module: Identifies individuals within the detected faces.

- Location Mapping Module: Associates identified individuals with their respective locations.
- Database: Stores face templates and associated location information for recognition and tracking.
- User Interface: Provides a dashboard for system monitoring, visualization of tracked individuals, and configuration settings.

3. **Workflow:**
   - Image Capture: Client devices capture images containing faces.
   - Face Detection: Detected faces are extracted from the images using a face detection algorithm.
   - Face Recognition: The extracted faces are matched against a database of known faces using a face recognition technique.
   - Location Mapping: Matched faces are associated with their respective locations based on predefined mappings or metadata associated with the image or vedios.
   - Tracking: The system maintains a history of locations associated with each recognized individual, enabling real-time or historical tracking of their movements.
4. **Scalability and Performance:**
   - Design the system to handle varying loads and scale resources dynamically based on demand.
   - Optimize algorithms and data processing pipelines for efficient face recognition and location tracking.
   - Monitor system performance and scalability metrics to ensure smooth operation under different conditions.
5. **Integration:**

   Integrate the system with existing infrastructure and technologies, such as surveillance systems, access control systems, and IoT devices, for enhanced functionality and interoperability.

6. **Maintenance and Updates**:

   - Regularly update face recognition models and algorithms to improve accuracy and adapt to changing conditions.
   - Monitor system logs and perform maintenance tasks to ensure smooth operation and identify potential issues early.

This design provides a framework for implementing a person location tracking system using face recognition technology, covering key components, workflows, and considerations for security, scalability, and maintenance.

6.3 Summary

In this chapter, we discussed the design part of our project, which involves the flow charts for face recognization and location tracking. The whole system is designed in such a way that it should be easy to use and easy to understand. This system identify and track the person location in real time. Although a person location tracking using face reconizaton model is typically designed to deal with eduactional intitutions.

Chapter 7

Implementation

7.1 Pseudo Code

```
# Initialise Flask
app = Flask(name)

# Main page connection function
def main_page():
    pass

# Login function
@app.route("/dept_login", methods=['POST','GET'])
def dept_login():
    pass

# Logout
@app.route("/logout")
def logout():
    pass
```

```
# Displaying existing list
def existing_list():
    pass

# Delete student data from database and deleting records
def delete_student():
    pass

# Adding new student/person
def add_student():
    pass
# Path to saved / trained images
app.static_folder = os.path.join(app.root_path, 'photos')



# Searching data
def data_search():
    pass

# Image capture function for adding new person
def capture_images(usn):
    pass

# Assigning current date and time to variable
current_date = datetime.now().date()

# Video processing function to identify the person
def process_video(video_capture, camera_id, known_face_encodings,
known_face_names, current_date, window_name, db_connection):
    pass
```

```
# To display the video capturing from camera
cv2.imshow(window_name, resized_frame)



# Capturing video from two cameras: 0 internal and 1 external camera
video_captures = [cv2.VideoCapture(0), cv2.VideoCapture(1)]

# Database connection
db = mysql.connector.connect(
    host='localhost',
    user='root',
    password='',
    database='face_rec_db'
)

# To run Flask
if __name__ == "__main__":
    app.run(host="0.0.0.0", debug=True)
```

7.2 Results

The system integrates facial recognition algorithms with geospatial data to accurately identify and track individuals in real-time video footage from surveillance cameras. It enhances security, facilitates personalized services, and finds applications in areas like education for student safety and emergency responses. The research aims to optimize accuracy, efficiency, and privacy considerations in implementing this innovative person location tracking using face recognition.

7.2.1 Home page

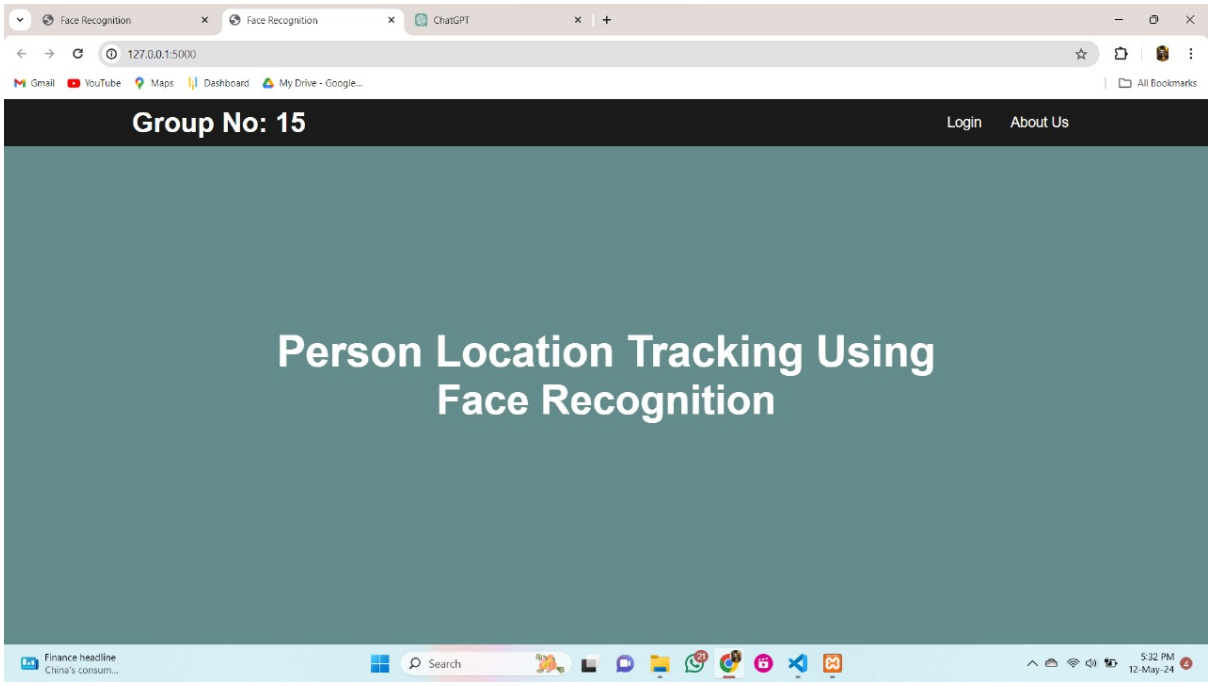

Figure 7.1: Home page

The figure 6.1 shows the home page of the person location tracking using face recognition system.

7.2.2 Admin Login Page

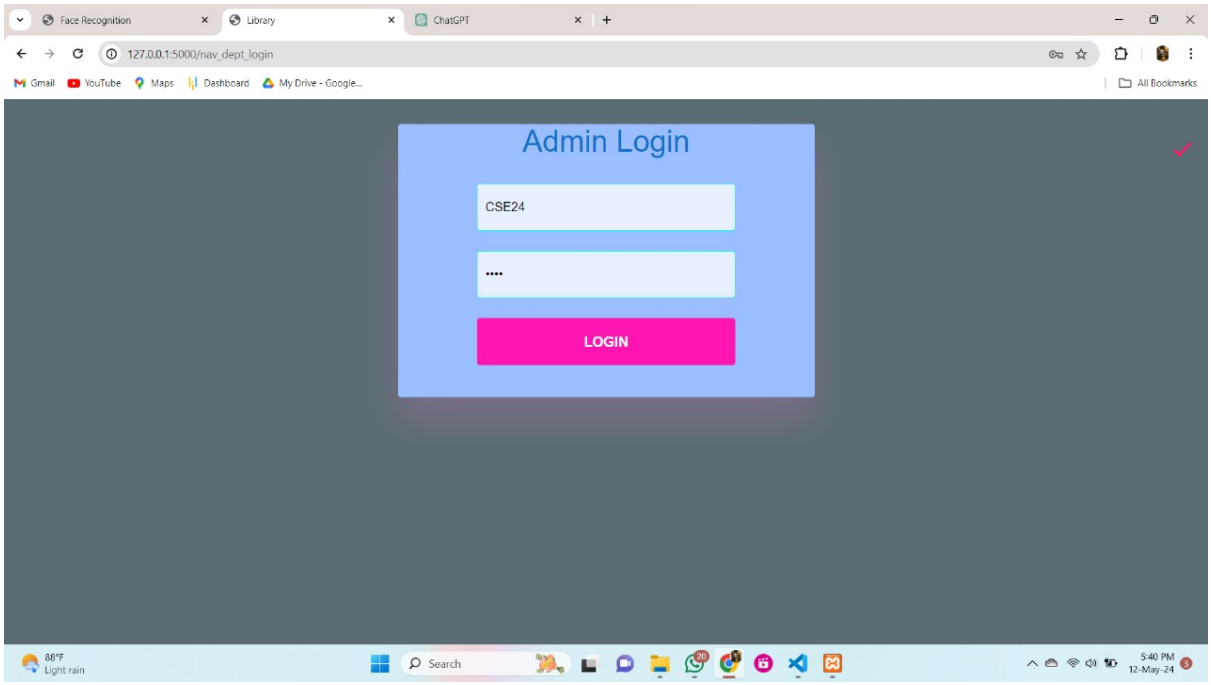

Figure 7.2: Admin login page

The figure 6.2 shows the Admin login page for which securely access the person location tracking system powered by advanced face recognition technology. Log in to manage and track individuals effortlessly, ensuring safety and efficiency in real-time location monitoring.

7.2.3 Video Capture Page

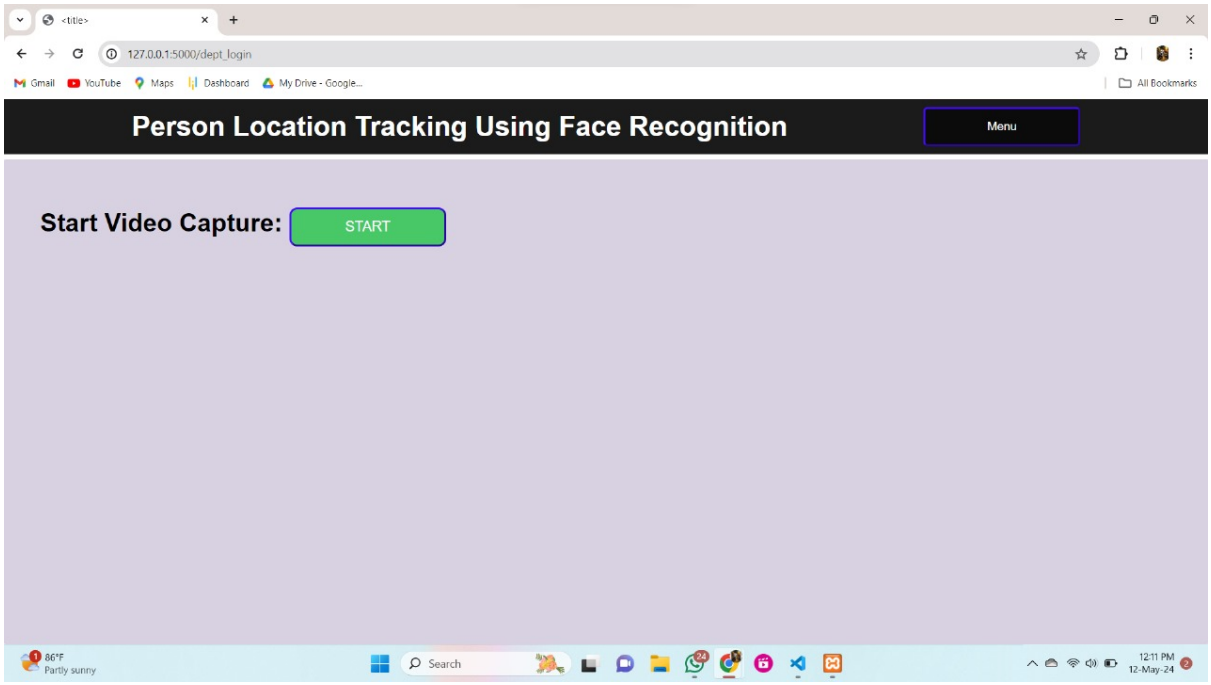

Figure 7.3: Vedio Capture page

The figure 6.3 shows the video capture page which is a vital component within the person location tracking system, specifically designed to facilitate the acquisition of live video footage essential for face recognition and location tracking functionalities. This interface allows authorized users to interact with connected cameras or devices, enabling them to initiate, control, and manage video recording sessions seamlessly. Users are provided with intuitive controls to select camera sources, adjust recording settings such as resolution and duration, and initiate or terminate recording sessions as required. The live video preview feature offers real-time visualization of the captured footage, enhancing monitoring capabilities.

7.2.4 Video Recognizing

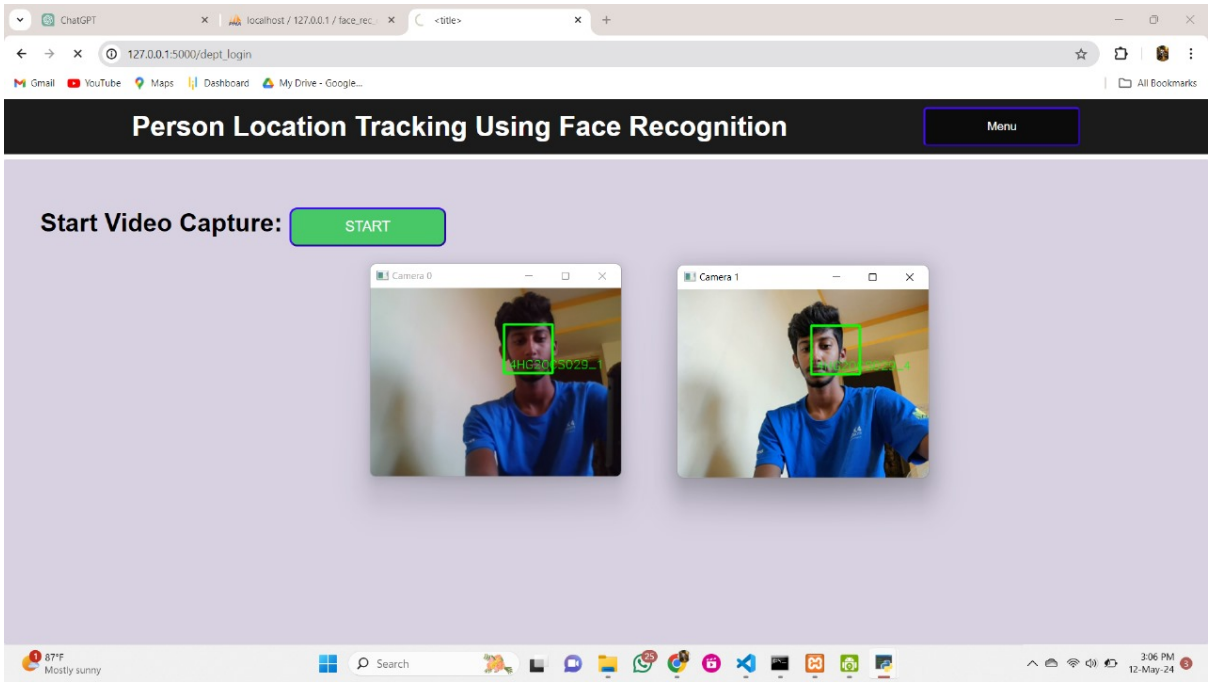

Figure 7.4: Vedio Recognizing

The figure 6.4 shows the vedio recognition page. In a person location tracking system utilizing face recognition technology, the face recognition page serves as a pivotal interface for identifying individuals within captured video footage. This page integrates sophisticated algorithms and machine learning models to detect and recognize faces accurately in real-time or from uploaded images or vedios. Users can upload images or access live video feeds from connected cameras, and the system processes this data to identify individuals based on pre-registered facial profiles.

7.2.5 Multiple Camera Input

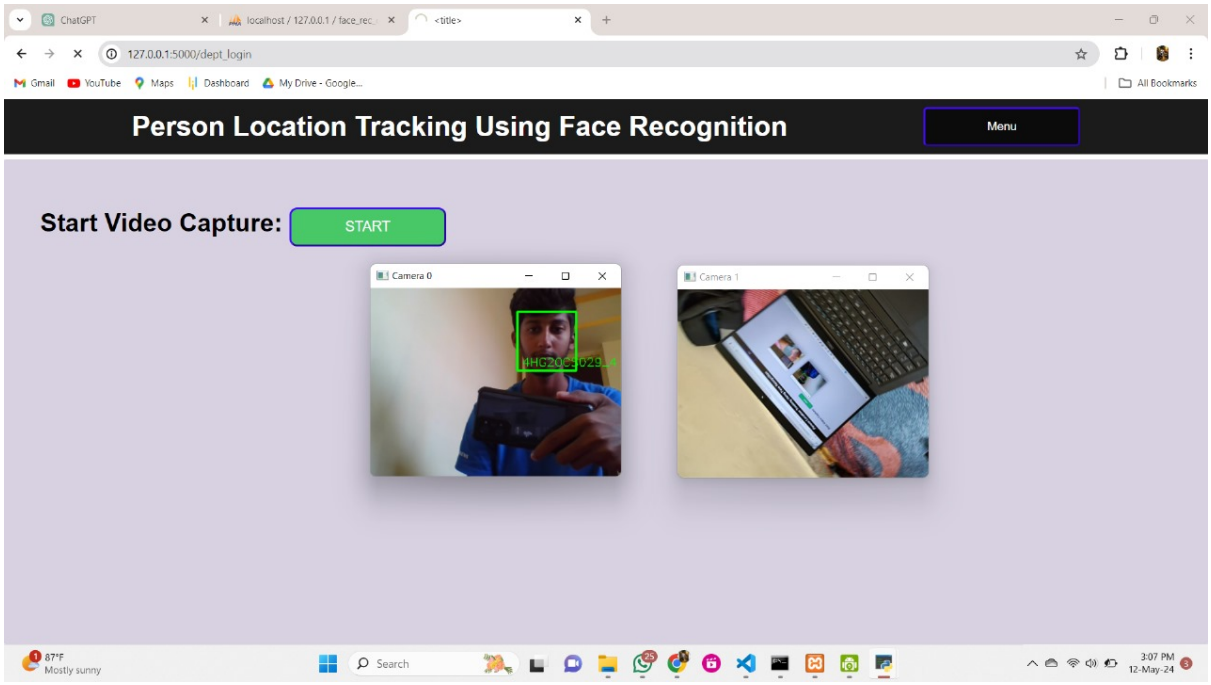

Figure 7.5: Multiple Camera Input

The figure 6.5 shows the Multiple camera input, the integration of multiple camera inputs enhances surveillance coverage and improves the accuracy of tracking individuals within the monitored area. This feature allows the system to simultaneously capture video feeds from multiple cameras positioned at different points, providing comprehensive coverage of the monitored space.

7.2.6 Searching Location using USN or ID

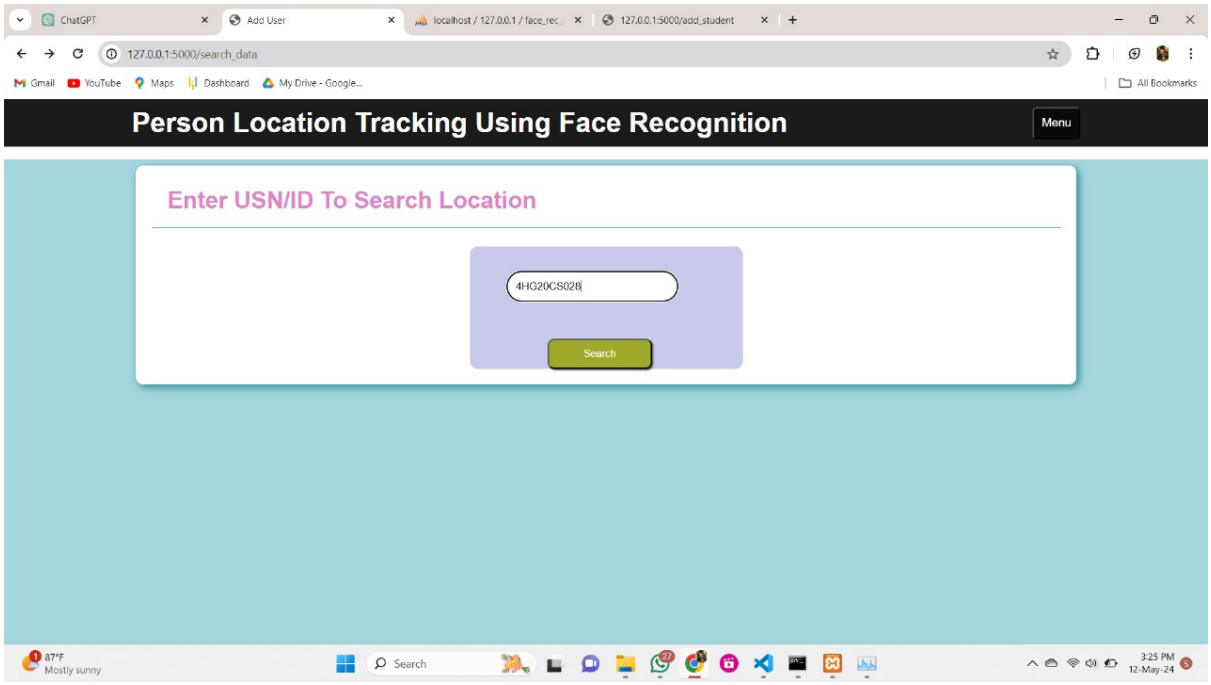

Figure 7.6: Searching Location using USN or Id

The figure 6.6 shows the searching a person location using thier USN or ID, the ability to search for an individual's location using their unique student number (USN) or identification (ID) provides users with a convenient and efficient method to locate specific individuals within the monitored area. This feature allows users to input a person's USN or ID into a search field, initiating a query that retrieves and displays the current or historical location of the identified individual.

7.2.7 If USN is Not Found in Database

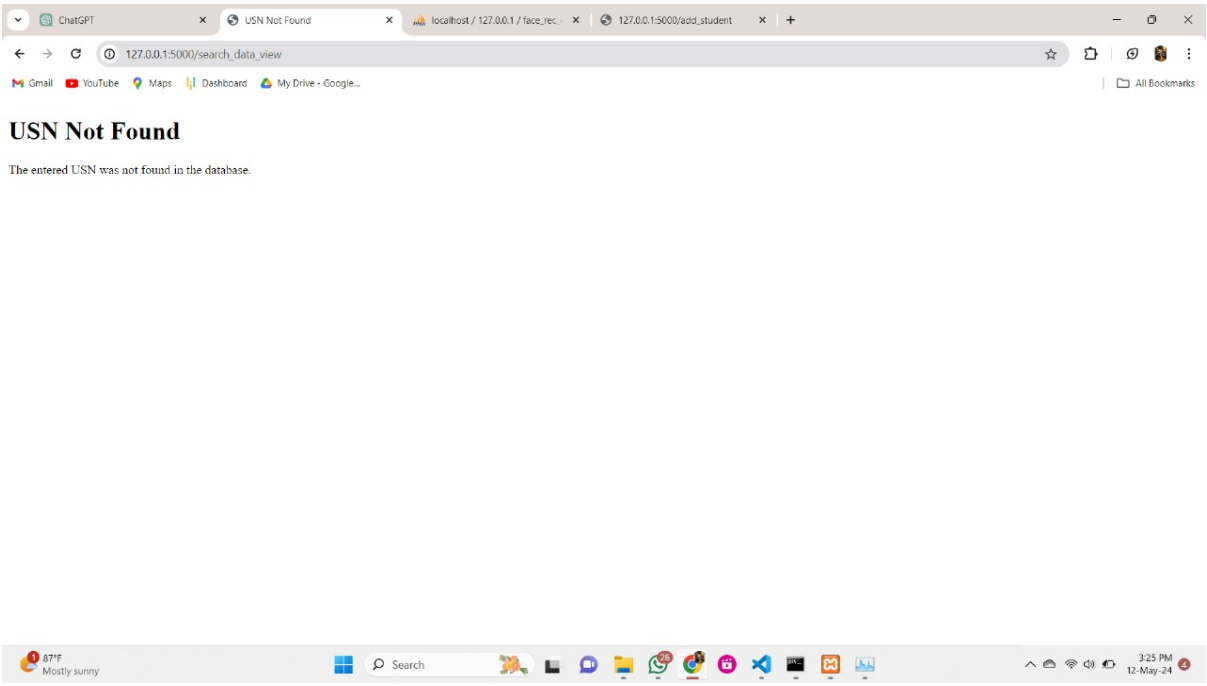

Figure 7.7: If USN is Not Found in Database

The figure 6.7 shows if a unique student number (USN) or identification (ID) is not found in the database, indicating that the requested USN or ID does not exist or is not registered in the system.

7.2.8 Found Result Displaying

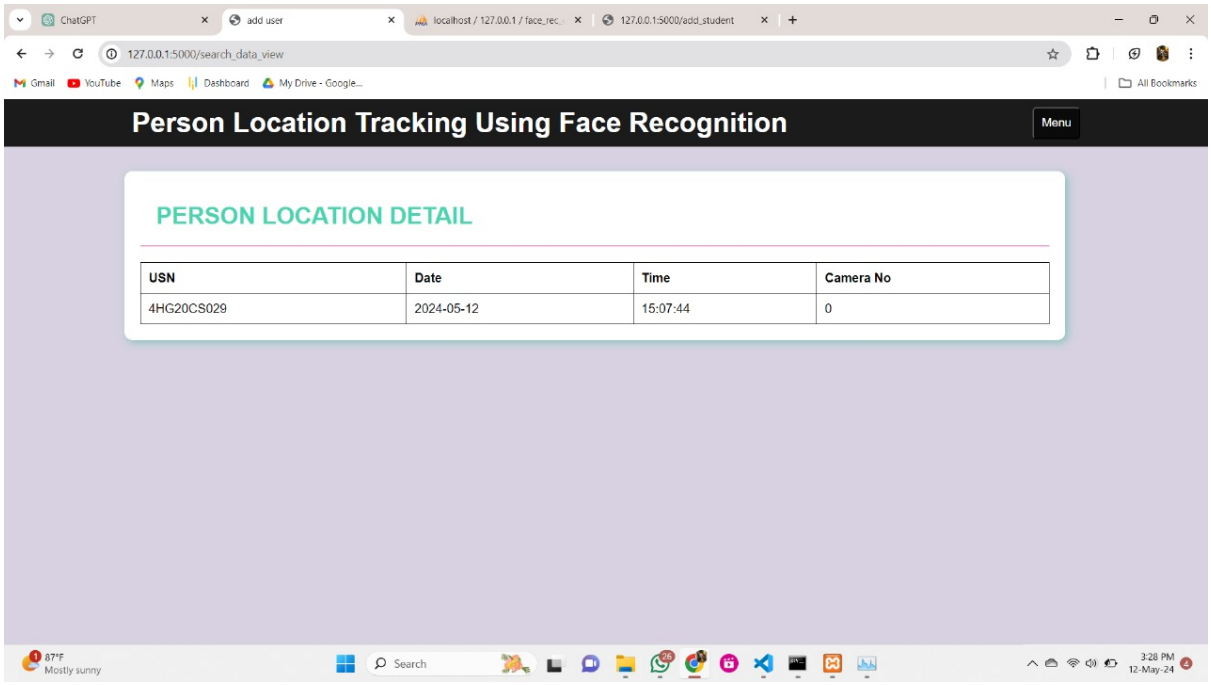

Figure 7.8: Found Result Displaying

The figure 6.8 shows the displaying the results found involves presenting the location information of the identified individual. After querying the database based on the unique student number (USN) or identification (ID), the system retrieves the USN, date time and camera number.

7.2.9 Adding New Person

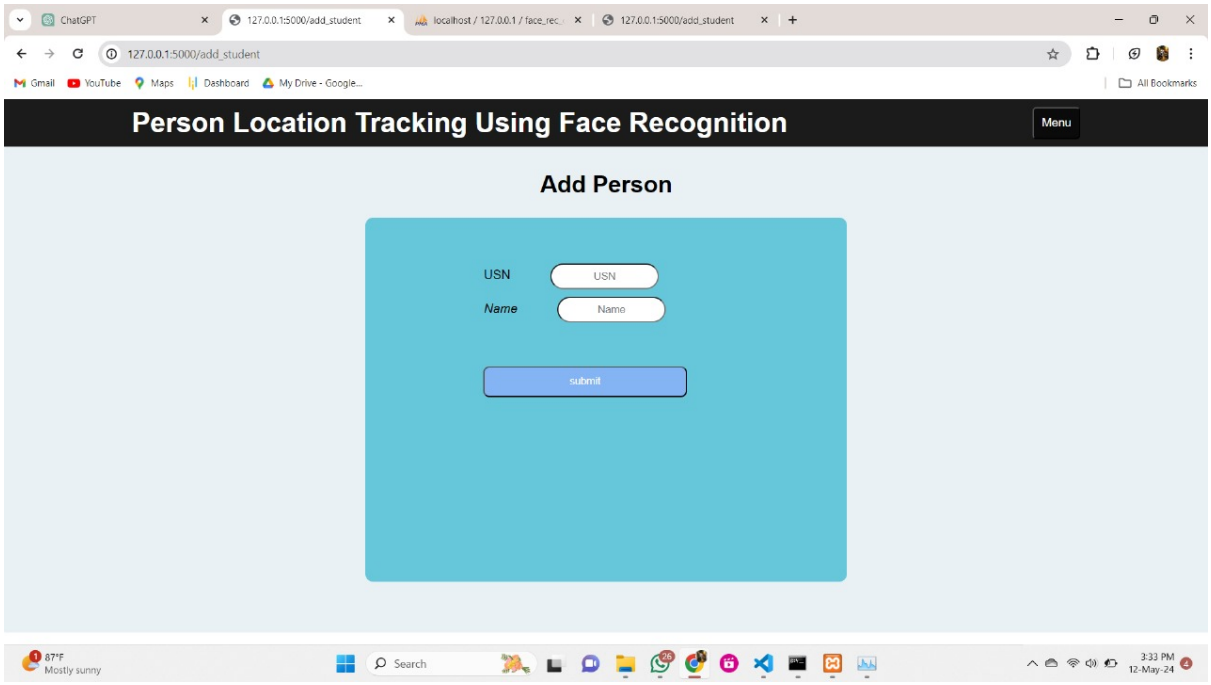

Figure 7.9: Adding new Person

The figure 6.9 shows the Adding a new person, it involves registering a new individual into the system's database, including their USN and name. This process allows the system to accurately identify and track the newly added person within the monitored area.

7.2.10 Showing Existing Details

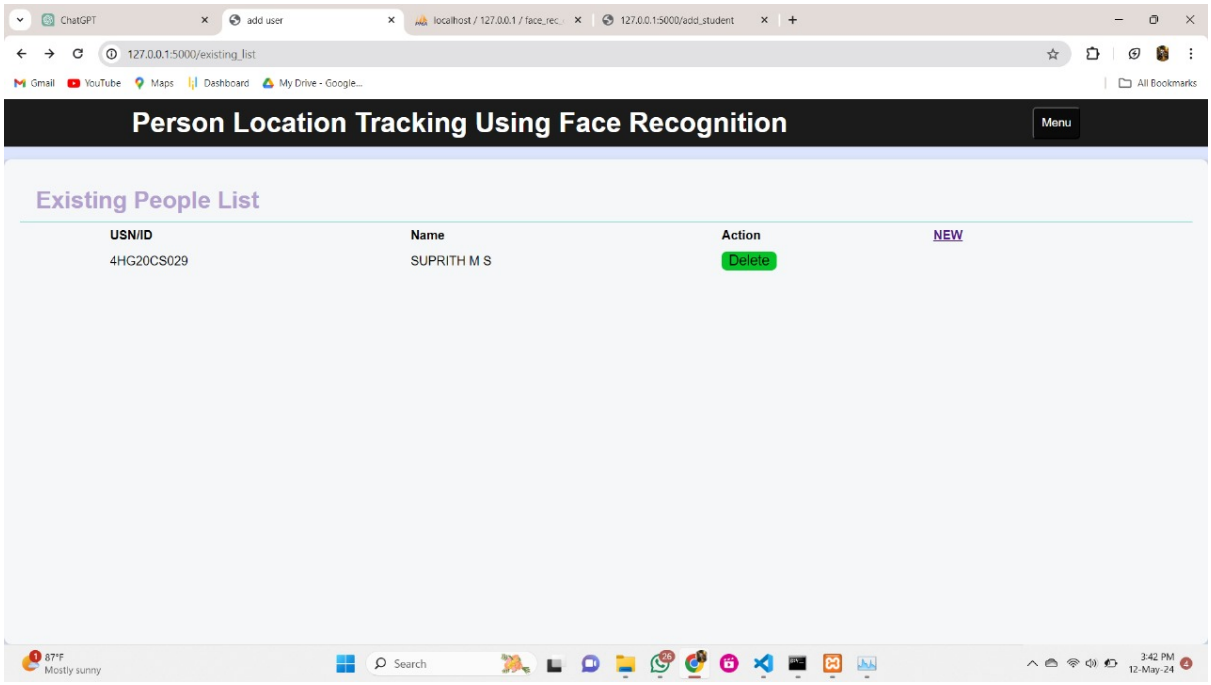

Figure 7.10: Showing Existing Details

The figure 6.10 shows the existing details, it serves as an interface for users to view and manage the details of individuals already registered within the system's database. This page displays comprehensive information about each person, including their personal details.

7.3 Summary

In this chapter, we discussed about our project implementations progress as The system consists of several pages, each serving a specific function in the person location tracking using face recognition. The Home page provides an overview, showcasing the system's interface. Admin Login ensures secure access for system management. Department Login requires department credentials for access. The Video Capture page facilitates live video acquisition for recognition. Video Recognizing utilizes face recognition to identify individuals from uploaded videos or live feeds. Multiple Camera Input enhances surveillance by integrating multiple camera feeds. Searching Location allows users to locate individuals using their unique IDs or USNs. If an ID is not found, an appropriate message is displayed. Found Result Displaying presents the location information of identified individuals. Adding New Person enables registration of new individuals into the system, while Show Existing Details displays comprehensive information about registered individuals.

Chapter 8

Conclusion and Future Enhancement

8.1 Conclusion

In conclusion, the person location tracking using face recognization project utilizing face recognition technology demonstrates significant potential in enhancing security and efficiency. By leveraging facial recognition algorithms, the system can accurately identify individuals and track their location. Accurately identifying and tracking individuals, the system provides valuable insights for various applications, such as surveillance and access control. While acknowledging the benefits, it's essential to address privacy concerns and implement robust security measures to ensure responsible and ethical use of this technology in real-world scenarios. The person location tracking system employing face recognition technology presents a robust solution for real-time monitoring and management. Through its various components such as the Admin and Department login pages, video capture functionality, and face recognition capabilities, the system offers comprehensive features for efficient tracking and identification of individuals. The integration of multiple camera inputs enhances surveillance coverage, while the ability to search for individuals using unique identifiers ensures quick and accurate location retrieval. Furthermore, the system's capacity to add new individuals and manage existing details provides flexibility and scalability. Overall, this system stands as a vital tool for enhancing security, safety, and efficiency across diverse applications, from security surveillance to attendance tracking. Continued advancements in face recognition technology promise further improvements, ensuring the system remains adaptive and effective in meeting evolving needs and challenges.

8.2 Future Enhancement

To enhance this Person Location Tracking Using Face Recognition project, we can improve various aspects. In data collection, capturing images from multiple angles and ensuring quality can improve accuracy. Advanced pre-processing techniques, like sophisticated augmentation and 3D face alignment, can make the model more robust. For model training, using pre-trained models, automated hyperparameter tuning, and model ensembling can boost performance. Speed optimization and edge computing can enhance real-time recognition. Improved tracking algorithms and handling occlusions will ensure better location tracing. Scalable databases and strong security measures can manage data efficiently. Enhancing search functionality with fuzzy search and geospatial visualization will improve usability. User interfaces can be upgraded for better feedback and mobile integration. Lastly, focusing on privacy, ethical considerations, and bias mitigation will ensure compliance and fairness.

Bibliography

[1] F Despotovski · 2018 · Cited by 4 — propose a parallel CUDA implementation of the KNN classifier and then compare it to a serial implementation to demonstrate its performance superiority.

[2] Viola, Paul A. and Jones, Michael J. "Rapid Object Detection using a Boosted Cascade of Simple Features", IEEE CVPR, 2001.

[3] L Cuimei · 2017 · Cited by 220 — A new human face detection algorithm by primitive Haar cascade algorithm combined with three additional weak classifiers is proposed in this paper.

[4] J Matuszewski · 2020 · Cited by 2 — Abstract: The article presents six different algorithms for tracking objects operating in real time on the video image of a visible light camera.

[5] Carlo Tomasi and Takeo Kanade. Detection and Tracking of Point Features. Carnegie Mellon University Technical Report CMU-CS-91-132, 1991.