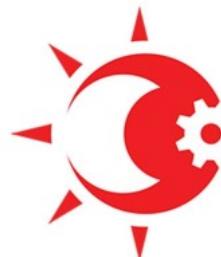


**A Project Report On**  
**AUTOMATED ATTENDANCE SYSTEM USING OPENCV BASED  
ON FACE RECOGNITION**

*Submitted in partial fulfilment of the requirements for the award of  
degree  
of  
Bachelor of Technology  
in  
INFORMATION TECHNOLOGY  
by*

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Academic Year : 2022-2023**



INSTITUTE OF  
TECHNOLOGY &  
ENGINEERING  
TADEPALLIGudem  
West Godavari District



## Department of Information Technology

### CERTIFICATE

This is to certify that the project work entitled "**AUTOMATED ATTENDANCE SYSTEM USING OPENCV BASED ON FACE RECOGNITION**" is being submitted by **A.Aditya Durga Siva Satya Sai (19K61A1204)**, **K.Sri Lakshmi (19K61A1228)**, **A.Pavan Sai (19K61A1206)**, **K.Bharath Sri Sai (19K61A1225)** in partial fulfilment for the award of the degree of **BACHELOR OF TECHNOLOGY** in **Information Technology** affiliated to Jawaharlal Nehru Technological University, Kakinada during the academic year 2022 to 2023 is a record of bonafide work carried out by them under my guidance and supervision. The results presented in this thesis have been verified and are found to be satisfactory. The results embodied in this thesis have not been submitted to any other University or Institute for the award of any other degree or diploma.

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We wish to thank my family and many other people whose names are not mentioned here but this does not mean that we have forgotten their help.

**With gratitude,**

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## **INSTITUTE VISION AND MISSION**

### **Institute Vision**

Aspire to be a leading institute in professional education by creating technocrats to propel societal transformations through inventions and innovations

### **Institute Mission**

1. To impart technology integrated active learning environment that nurtures the technical and life skills.
2. To enhance scientific temper through active research leading to innovations and sustainable environment.
3. To create responsible citizens with highest ethical standards.

## **DEPARTMENT VISION AND MISSION**

### **Department Vision**

To become recognized centre for excellence for quality Information Technology education and create professionals with ability to solve social needs.

### **Department Mission**

1. Provide quality teaching learning environment oriented towards employability and career development.
2. Conduct training/events for overall development of stakeholders with collaborations.
3. Impart value base education to serve the society with high integrity and good character.
4. Provide state of the art facilities to enable innovation, student centric learning.



## PROGRAM OUTCOMES (POs)

Students in the Information Technology program should, at the time of their graduation, be in possession of :

**PO1. Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2. Problem analysis :** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3. Design/development of solutions :** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to valid conclusions.

**PO5. Modern tool usage :** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6. The engineer and society :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7. Environment and sustainability :** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

**PO8. Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9. Individual and Team Work :** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

**PO10. Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

**PO11. Project Management and Finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12. Life-long Learning :** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadcast context of technological change.

## **PROGRAM SPECIFIC OUTCOMES (PSOs)**

**PSO1. Application Development :** Develop risk free innovative IT applications or industrial needs.

**PSO2. Successful Career and Entrepreneurship :** Explore technical knowledge in diverse areas of IT and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies.

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

**PEO1.** Possesses strong knowledge about Information Technology applications and leadership qualities.

**PEO2.** Pursue successful career in Information Technology and allied industries, innovate and provide solutions for global needs.

**PEO3.** Have attitude towards life-long learning attitude and practice professional ethics.

## **PROJECT OUTCOMES (PROs)**

**PRO1.** Identifying the problems by doing a thorough literature survey of the existing research related to content validating and verifying AI system and generate solutions to the same with innovative ideas.

**PRO2.** Analyze, design and develop a solution for automatic subjective answer evaluation problems to meet societal needs and industry standards for project management and finance.

**PRO3.** Develop employability and the ability to work in a team following the best ethical practices with a spirit for life-long learning and sharpening communication and presentation skills for validating .

**PRO4.** Make use of appropriate tools or techniques for sustainable development of a Automated

Attendance.

**PRO5.** Make use of appropriate tools or techniques for sustainable development of a Automated Attendance.

**PRO6.** Construct a platform that makes users to interact with proposed system.

#### **EXPECTED OUTCOMES**

##### **1. PROGRAM OUTCOMES(POs)**

- **PO1** : Engineering knowledge
- **PO2** : Problem analysis
- **PO3** : Design/development of solutions
- **PO4** : Conduct investigations of complex problems
- **PO5** : Modern tool usage
- **PO6** : The engineer and society
- **PO7** : Environment and sustainability
- **PO8** : Ethics
- **PO9** : Individual and team work
- **PO10** : Communication
- **PO11** : Project management and finance
- **PO12** : Life-long learning

##### **2. PROGRAM SPECIFIC OUTCOMES(PSOs)**

- **PSO1** : Application Development
- **PSO2** : Successful Career and Entrepreneurship

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# **SYNOPSIS OF THE PROJECT**

## **Title of the project:**

AUTOMATED ATTENDANCE SYSTEM USING OPENCV BASED ON FACE RECOGNITION

## **Abstract**

One of the key components of the human body that helps to distinguish one individual from another is their face. The face recognition system can be developed using facial features as a biometric. The kids are called out by the teachers in the traditional attendance method, and their presence or absence is noted appropriately. This time-consuming process interferes with the student's ability to learn. The OpenCV-based facial recognition approach has been put forth in this project. This system combines a camera to capture an input image, a face identification algorithm to encode and identify the student's face, and mark the attendance in a spread sheet. The faces of the kids are used to train the system. The photographs are kept with the appropriate labels. We will utilise the HOG (Histogram of Oriented Gradients) method and a linear SVM classifier to detect faces.

## **Objectives of the study:**

The aim of this project is to create a facial recognition system for taking attendance of students. Research suggests that students' attendance is directly proportional to the effective learning and student retention. Several automated models of attendance are used in schools and universities and they are extensively studied in the literature. One of these methods is utilizing a finger print reading device, which can be either placed in front of the classroom, or hand held. A similar approach is employing an RFID card for taking attendance. These methods present a time issue because only one student can use the equipment employed in each method at once. Another option is applications that employ the Bluetooth communication protocol.

In these applications, the Bluetooth connection of the students' mobile devices is either used directly or specialized Bluetooth tags are used to automatically generate the attendance list. Academic research on computer vision based approaches to attendance taking has gained momentum in the recent years as these methods provide lower time consumption and higher accuracy

compared to the conventional counterparts. Utilized to generate the attendance list automatically.

As these systems need less time and are more accurate than their conventional counterparts, academic research on computer vision-based approaches to attendance taking has gathered steam in recent years. Students are detected and recognized when they enter the classroom using the images captured by a video camera stationed there, and their names are recorded on the attendance list.

## **The rational of the study:**

- Surveying base papers
- Analysis on existing system
- Problem identification in existing system
- Requirements gathered for the proposed system
- Develop the proposed system

## **Detailed methodology used for carrying out the study:**

- Using Support Vector Machines (SVM) and Histogram of Oriented Gradients (HOG), face identification is a popular method in computer vision for recognizing people by their facial features. Here is a general description of what happens:
  1. The system records pictures or videos of the people
  2. To identify the face region and extract pertinent information, the photos are first processed.
  3. In order to represent the features in a histogram, the HOG technique is utilised to extract the local gradient data from the face region
  4. The SVM classifier is then given the extracted HOG features once it has been trained on a labeled dataset of recognized faces. The SVM classifier divides the various classes (faces) in the feature space by generating a decision boundary based on the features
  5. Using the HOG properties of an unknown face, the SVM classifier may then be used to predict the class (face) of the face.
  6. Once the person is recognized, their attendance is automatically stored in the database.

## **The expected contribution from the study:**

- Computer vision is a process by which we can understand the images and videos how they are stored and how we can manipulate and retrieve data from them. Computer Vision is the base or mostly used for Artificial Intelligence. Computer-Vision is playing a major role in self-driving cars, robotics as well as in photo correction apps.

- HOG, or Histogram of Oriented Gradients, is a feature descriptor similar to the Scale Invariant Feature Transform (SIFT) Canny Edge Detector. For the goal of object detection, it is employed in computer vision and image processing.
- One of the most well-liked supervised learning techniques, Support Vector Machine (SVM). The major goal of this work is to create a face recognition system based on computer vision for automated attendance taking. Both conventional and machine learning computer vision techniques are used for the face recognition classifier.

**Steps involved in Automated Attendance are:**

1. Image Acquisition
2. Face Detection
3. Feature Extraction
4. Model Training
5. Face Recognition
6. Attendance Marking

**List of activities to be carried out to complete the project (with the help of bar chart showing the time schedule):**

- Problem Identification
- Requirement Gathering
- Design
- Implementation
- Result Analysis
- Project Report Writing

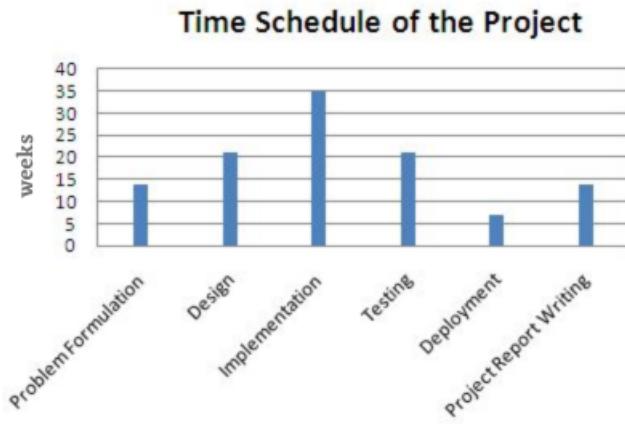
**Places/Labs/Equipment and tools required and planning of arrangements:****HARDWARE REQUIREMENTS:**

- Integrated camera/Webcam
- Minimum of 4GB RAM
- Hard Disk - 50GB

**SOFTWARE REQUIREMENTS:**

- You can use any OS- mac OS, Windows and Linux based OS.
- Python version 3.6(any python version 3.x will be fine)
- Pycharm (Community Version)
- Firebase
- OpenCV version 4.1

## **Problems envisaged in carrying out the project, if any :Nill**



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# **Abstract**

One of the key components of the human body that helps to distinguish one individual from another is their face. The face recognition system can be developed using facial features as a biometric. The kids are called out by the teachers in the traditional attendance method, and their presence or absence is noted appropriately. This time-consuming process interferes with the student's ability to learn. The OpenCV-based facial recognition approach has been put forth in this project. This system combines a camera to capture an input image, a face identification algorithm to encode and identify the student's face, and mark the attendance in a spread sheet. The faces of the kids are used to train the system. The photographs are kept with the appropriate labels. We will utilise the HOG (Histogram of Oriented Gradients) method and a linear SVM classifier to detect faces.

# **Chapter 1**

## **INTRODUCTION**

This system combines a camera to capture an input image, a face identification algorithm to encode and identify the student's face, and a spreadsheet to track attendance.

### **1.1 Description**

In the traditional attendance method, the kids are called out by the teachers and their presence or absence is noted appropriately, which is a time consuming process. A facial recognition system is created in this project to take attendance of students. Research suggests that students' attendance is directly proportional to the effective learning and student retention. Several automated models of attendance are used in schools and universities and they are extensively studied in the literature. One of these methods is utilizing a finger print reading device, which can be either placed in front of the classroom, or hand held. A similar approach is employing an RFID card for taking attendance.

These methods present a time issue because only one student can use the equipment employed in each method at once. Another option is applications that employ the Bluetooth communication protocol. In these applications, the Bluetooth connection of the students' mobile devices is either used directly or specialized Bluetooth tags or beacons are used to automatically generate the attendance list. Academic research on computer vision based approaches to attendance taking has gained momentum in the recent years as these methods provide lower time consumption and higher accuracy compared to the conventional counterparts. Utilized to generate the attendance list automatically. As these systems need less time and are more accurate than their conventional counterparts, academic research on computer vision-based approaches to attendance taking has gathered steam in recent years. Students are detected and recognized when they enter the classroom using the images captured by a video camera stationed there, and their names are recorded on the attendance list.

## 1.2 Problem Formulation

The Most demanding task in any organization is attendance marking. In traditional Attendance system, the students are called out by teachers and the presence or absence is marked accordingly. These traditional techniques are Time-Consuming and tedious. We aims to propose automated attendance system that detects the student's face and mark the attendance automatically in a spreadsheet.

## 1.3 Existing System

There are other existing Automated attendance systems available in the market, each with their own unique features and specifications. For example, The system consist of both hardware and software components based on IoT Technology. The hardware component consists of RC522 RFID card reader and RFID tags/cards. The software component consists of the Web-based GUI for viewing the employee's or student's attendance, which is hosted on a web server and which stores the data in a database server. The employees or students just need to place their RFID card or tag on the reader and their attendance will be recorded for the day. Also, the attendance recorded will be more accurate as the system is synced with a real-time clock.

## 1.4 Motivation

The motivation behind using an automated attendance system using OpenCV based on face recognition is to improve the efficiency, accuracy, and security of the attendance-taking process. By automating the attendance process using facial recognition technology, schools and organizations can reduce the time and effort required to take attendance manually, while also improving the accuracy and reliability of attendance records.

## 1.5 Proposed System

A proposed smart attendance system is an automated system that uses advanced technologies, such as facial recognition,OpenCV to track and manage attendance records. The system is designed to improve the efficiency, accuracy, and security of attendance-taking processes in schools, universities, and other organizations.

## 1.6 Scope of the Project

The scope of an automated attendance system using OpenCV based on face recognition is broad and includes a wide range of industries and organizations. Some of the key areas where this system can be implemented includes Educational institutions, Corporate organizations, Healthcare industry, Government institutions.

# **Chapter 2**

## **LITERATURE SURVEY**

In the context of a project, a literature survey plays a crucial role in establishing the project's scientific validity and informing its design and implementation. By examining and synthesizing previous research and literature relevant to the project's objectives and methodology, the survey provides a theoretical framework and establishes the project's context. This enables the project team to identify and build on existing knowledge, avoid duplication of efforts, and address any gaps or shortcomings in the existing research. Furthermore, a literature survey can help to refine the research question or project objectives, identify potential challenges or limitations, and establish criteria for measuring success.

A literature survey typically involves a systematic search for relevant literature using appropriate keywords and search terms, followed by a critical evaluation of the quality and relevance of the identified literature. The survey should be comprehensive and objective, and the findings should be documented and referenced to ensure transparency and accuracy. By leveraging the insights gained from a literature survey, project teams can improve the quality and effectiveness of their research or development efforts, ensure the project's relevance and impact, and contribute to the advancement of knowledge in the field.

### **Literature Review**

In 2021 Sajid, Hussain, and Usman [1] put out a conceptual framework for a facial recognition-based automatic attendance system. The reliability of your model is increased by the usage of an integral validation method in their suggested model. We can quickly identify the student by their face thanks to similarities in their eyes, nose, etc. It has been determined that the issue exists, hence work on a solution should be done in the future.

In 2021 Chintalapati and Raghunadh [2] proposed a system To assess the effectiveness of

various facial recognition systems, numerous real-world circumstances are taken into account. This essay also suggests some methods for dealing with issues like spoofing. LBPH beats other algorithms in real-world circumstances thanks to its higher recognition rate and lower false positive rate. When compared to distance classifiers, SVM and Bayesian also show to be superior classifiers. The method that has been built can only distinguish differences in face angles up to 30 degrees; it has to be improved. Gait recognition systems can be combined with facial recognition systems to improve system performance.

In 2021 Akay, Canbek, and Oniz [3] The Histogram of Oriented Gradients and Haar-Cascade face identification techniques are used in this research to create and construct an automated attendance taking system. Convolutional neural networks (CNNs) are used in deep learning to identify the students in a classroom. Python is used to create a graphical user interface (GUI) system.

In 2020 Sawhney, Kacker, Jain, *et al.* [4] suggested automatic attendance system utilizing face recognition is an excellent example of how to record student attendance in a classroom. Additionally, this system aids in reducing the likelihood of proxies and phone attendance. There are many methods that use biometrics that are available in the modern world. However, due to its great accuracy and minimal need for human participation, facial recognition emerges as a potential solution. The system's goal is to offer a high level of security. Therefore, it is necessary to create an extremely effective attendance system for the classroom that can simultaneously recognize many faces. Additionally, no specialized hardware is needed for its implementation. For building the system, a camera, a computer, and database servers are sufficient.

In 2020 Samet and Tanrıverdi [5] Proposed A face recognition-based mobile attendance management solution that is adaptable and real-time. The development of a filtering method based on Eigenfaces, Fisherfaces, and LBP-derived Euclidean distances. The suggested solution eliminates the need for additional equipment, cuts down on time spent collecting attendance, and gives users access to the information whenever and wherever they choose. The usage of smart devices for tracking student attendance in the classroom is particularly user-friendly. The programme is available in real-time and without any limitations to teachers, students, and parents. High quality, bigger photographs can be sent to the server because internet connection speed has been rising steadily. The server's processor capacity is likewise growing on a daily basis. The proposed system's accuracy rate will rise along with these technical advancements. Other facial recognition methods, such as Support Vector Machine, Hidden Markov Model, Neural Networks, etc., could be used to evaluate face recognition in greater detail. Additionally, once smart devices' processor capacities are sufficiently expanded, detection and recognition operations may be car-

ried out on them.

In 2020 Raghuvanshi and Swami [6] Proposed a system For feature extraction utilizing Eigen faces and Fisher faces subspace projection and matching with Euclidean distance classifier, a PCA and LDA-based face recognition system was created. According to the observation, PCA and LDA both perform well in the right circumstances, such as: Normal lighting, no position changes, and a distance of 1-3 feet from the camera for the best outcomes. Higher resolution is needed because both use pixel-to-pixel computation. Although there isn't much of a performance difference between PCA and LDA, PCA takes less time than LDA during the recognition step. However, LDA is preferred because to its better rate of recognition. More creative approaches that get around PCA's shortcomings must be employed to recognize a huge number of people.

In 2020 Arjun Raj, Shoheb, Arvind, *et al.* [7] proposed system has several methods in terms of overall system capacity, throughput, and accuracy. The result shows that the PCA algorithm is incredibly effective in extensive database. PCA has better performance in the system of attendance management based on facial recognition than manual attendance system that is time-consuming. Convolutional neural network also contributes to attendance management system based on facial recognition by providing strong classifier. The focus in future work is improving the accuracy of the system by incorporating principal component analysis with convolutional neural network. The objective is to obtain good generalization abilities. In [25], ANN and PCA has been integrated to solve a blocking issue of attendance management system based on facial recognition. However, this system still has issues with system performance and accuracy in recognizing human face. Future work will use fast PCA with back-propagation to resolve this problem.

In 2019 Lukas, Mitra, Desanti, *et al.* [8] proposed a smart model for a facial recognition-based student attendance monitoring system is developed. The presence of students throughout the entire lecture hour is determined via real-time facial recognition combined with frequent updates of the attendance data. This might motivate pupils to show up to class on time and with diligence. The following activity will involve keeping track of students' attendance during the whole module and examining the relationship between attendance and academic success.

In 2019 Arsenovic, Sladojevic, Anderla, *et al.* [9] proposed the ten-year increase in interest in computer vision. Face detection and recognition has evolved from a niche to a well-liked area of research in computer vision, and one of the better and effective uses of picture analysis and algorithm based comprehension, driven by the consistent doubling rate of processing power every 13 months. Computer vision is not only a computer science field of study due to the inherent nature of the problem, but it is also the focus of neuroscientific and psychological research. This is largely

due to the widespread belief that advancements in computer image processing and understanding research will provide insights into how our brains function and vice versa. The author has offered to develop an application that would grant user access to a certain machine based on an in-depth analysis of a person's facial features out of general curiosity and interest in the subject. The .NET framework from Microsoft and the OpenCV open source computer vision project from Intel will be used to create this application.

In 2019 Wagh, Thakare, Chaudhari, *et al.* [10] Proposed the smart and automated attendance system for managing the attendance can be implemented using the various ways of biometrics we come to know that, there are various techniques and algorithms which are used for face recognition. In the recent ten years, a lot of algorithms are developed for face recognition. The AdaBoost Algorithm is the most efficient algorithm for multiple face recognition.

In 2019 Zeng, Meng, and Li [11]Proposed the process of identifying students using a face biostatistics system based on high definition monitoring and other computer technologies is called a face recognition attendance system. The suggested system uses generative adversarial networks, SVM, KNN, CNN, Haar classifiers, and Gabor filter. The SIFT algorithm is used in the creation of the face recognition system. MATLAB will be used by this system to take attendance. After the image has been taken and compared with the database, an SMS will be delivered to the designated number. The scientists have used two databases, the first for storing student faces and the second for storing student data, to leverage these skin pixels for face detection.

In 2019 Bhattacharya, Nainala, Das, *et al.* [12] Proposed Students' frequent attendance in class is crucial for performance evaluation and quality control in the current educational system. Calling names or signing documents are the traditional procedures used in the majority of institutions, both of which are time-consuming and unsafe. The automatic attendance management system is discussed in this article for convenience or data accuracy. The system is created by combining widely available parts to create a portable gadget for managing the attendance.

In 2019 Raj, Shoheb, Arvind, *et al.* [13] proposed a paper, of smart model for a facial recognition-based student attendance monitoring system is developed. The presence of students throughout the entire lecture hour is determined via real-time facial recognition combined with frequent updates of the attendance data. This might motivate pupils to show up to class on time and with diligence. The following activity will involve keeping track of students' attendance during the whole module and examining the relationship between attendance and academic success.

In 2019 Bhatti, Mughal, Khuhawar, *et al.* [14] proposed a face recognition-based mobile

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attendance management solution that is adaptable and real-time. The development of a filtering method based on Eigenfaces, Fisherfaces, and LBP-derived Euclidean distances. The suggested solution eliminates the need for additional equipment, cuts down on time spent collecting attendance, and gives users access to the information whenever and wherever they choose. The usage of smart devices for tracking student attendance in the classroom is particularly user-friendly. The programme is available in real-time and without any limitations to teachers, students, and parents. High quality, bigger photographs can be sent to the server because internet connection speed has been rising steadily.

In 2019 Patel, Kumar, Garg, *et al.* [15] proposed several methods in terms of overall system capacity, throughput, and accuracy. The result shows that the PCA algorithm is incredibly effective in extensive database. PCA has better performance in the system of attendance management based on facial recognition than manual attendance system that is time-consuming. Convolutional neural network also contributes to attendance management system based on facial recognition by providing strong classifier. The focus in future work is improving the accuracy of the system by incorporating principal component analysis with convolutional neural network.

In 2019 Bussa, Mani, Bharuka, *et al.* [16] proposed the process of identifying students using a face biostatistics system based on high definition monitoring and other computer technologies is called a face recognition attendance system. The suggested system uses generative adversarial networks, SVM, KNN, CNN, Haar classifiers, and Gabor filter. The SIFT algorithm is used in the creation of the face recognition system. MATLAB will be used by this system to take attendance. After the image has been taken and compared with the database, an SMS will be delivered to the designated number. The scientists have used two databases, the first for storing student faces and the second for storing student data, to leverage these skin pixels for face detection.

In 2018 Akbar, Sarker, Mansoor, *et al.* [17] proposed model that is made up of several crucial components that were created utilising the most cutting-edge methods available right now, including CNN cascade for face detection and CNN for creating face embeddings. It is suggested to use a novel method of picture augmentation for face recognition tasks. On a limited dataset of the original face photos of employees working in a real-time setting, the Principle Component Analysis (PCA) approach was applied to recognise the employees' faces and achieve a 68% overall accuracy was 95.02% justified by the fact that an ordinary IP camera would be used to monitor the staff at the entry to the business. Poor network traffic or other technical issues could potentially introduce noise to the data and the associated production costs. The algorithms used are CNN, ANN.

In 2018 Preethi and Vodithala [18] proposed Smart Attendance System maintains the accurate records of each registered student and substantially reduces the time-consuming, traditional task. The components of this intelligent system include Image Processing, OpenCV, Facial Recognition, RFID Tags, RFID Readers, Arduino Project, IR Module, Class Attendance, and Smart Classroom. Additionally, it keeps the information of every student registered for a specific course in the attendance log and provides necessary information according to the need. The automated classroom system based on GSM is another project that we learned about while conducting our investigation. Before, an RFID-based classroom system employing a Raspberry Pi and an ATmega32 development kit was suggested.

In 2018 Alhanaee, Alhammadi, Almenhali, *et al.* [19] proposed Smart Attendance with Real-Time Face Recognition is a practical method for managing the student attendance system on a daily basis. The student's attendance system can be maintained in one of two ways: Manual Attendance System (MAS) Automated Attendance System (AAS). Face detection and identification systems can reduce manual labour required from humans and improve security by taking decisions based on the results of image capture from a camera or cc camera.

In 2018 Setialana, Jati, Wardani, *et al.* [20] proposed a system that provide an accurate real-time attendance marking system in this article. In a large classroom with plenty of students present, it can be challenging to record each student's attendance. In recent study, numerous attendance management systems have been used. However, there are still problems with the facial recognition-based attendance management system. Thus, numerous studies have been carried out to enhance the system. This study examined earlier research on facial recognition-based attendance management systems. This page contains a comprehensive examination of Principal Component Analysis, discussion, and recommendations for future research in addition to a review of the literature on earlier or comparable work.

In 2017 Khan, Akram, and Usman [21] proposed This essay discusses the significance of effective attendance management in the business sector. It is crucial to identify the primary symptom, a high temperature, at the entry-level because a disease like covid-19 can be extremely contagious in crowded public spaces. This study suggests a mechanism that records an employee's attendance using RFID, facial recognition, and a temperature check. Additionally, it records the employee's expression to capture their emotions. At the entrance, the temperature is first checked, and if it is high, an alert message is sent to the appropriate authorities. The person with a normal temperature, on the other hand, will go through a two-tier security check using RFID and face recognition. As a result, the employee's attendance will be graded according to the outcomes.

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S.No	Author Name and Year	Methodology	Advantages	Disadvantages
1	Sajid, Hussain 2021	This project is used an algorithm for detecting face from input image and for detecting face, identifying and encoding face, marking attendance in a spreadsheet.	Saves the time and More accurate	Smart attendance systems collect and store student data, including attendance records, which can raise privacy concerns
2	Chintalapati and Raghunadh 2021	This Model captures the facial expression of the employee to detect the emotion. Starting with, a temperature check is done at the entrance and if found high, an alert message is sent to the concerned authorities.	Easy to use and user friendly.	Cost is high as sensors are using in this project.
3	E. Omer Akay 2021	An automated attendance taking system is developed and implemented.Two different face detection algorithms, namely Histogram of Oriented Gradients and Haar- Cascade algorithms, are applied and their performances are compared. Deep learning based on CNN is employed for the identification of the students in the classroom. Furthermore, a mask checking feature is also included	Improved Security	Network issue can cause disturbance
4	Sawhney, Kacker 2020	This project makes the use of Haar classifiers, KNN, CNN, SVM, Generative adversarial networks, and Gabor filters. After face recognition attendance reports will be generated and stored in excel format. The system is tested under various conditions like illumination, head movements, the variation of distance between the student and cameras.	Cost Effective and need less installations food for needy people.	Reliance on specific devices need to update regularly
5	Samet and Tanrıverdi 2020	This paper proposes a model for implementing an automated attendance management system for students of a class by making use of face recognition technique, by using Eigenface values, Principle Component Analysis (PCA) and Convolutional Neural Network (CNN). After these, the connection of recognized faces ought to be conceivable by comparing with the database containing student's faces.	Improved Flexibility and more effective.	Arising of More Technical Issues
6	Raghuvanshi and Swami 2020	This paper proposes a model this model to face recognition and combined with RFID card reading technology, which developed a smart classroom attendance system based on face recognition. Research shows that the system is efficient and stable, which effectively reduce classroom attendance costs.	Improved Security Improved Flexibility and more effective.	Need to update regularly.
7	Arjun Raj 2020	This paper proposes a model this model to face recognition and combined ANN and PCA has been integrated to solve a blocking issue of attendance management system based on facial recognition. However, this system still has issues with system performance and accuracy in recognizing human face. Future work will use fast PCA with back-propagation to resolve this problem.	Improved Flexibility and more effective.	Arising of More Technical Issues
8	Lukas, Mitra 2019	This paper proposes a model this The presence of students throughout the entire lecture hour is determined via real-time facial recognition combined with frequent up- dates of the attendance data. This might motivate pupils to show up to class on time and with diligence. The following activity will involve keeping track of students' attendance during the whole module and examining the relationship between attendance and academic success.	Reduces cost and time effective	Security issues.
9	Arsenovic 2019	This This is largely due to the widespread belief that advancements in computer image processing and understanding research will provide insights into how our brains function and vice versa. The author has offered to develop an application that would grant user access to a certain machine based on an in-depth analysis of a person's facial features out of general curiosity and interest in the subject.	Improved Flexibility and more effective.	Issues are arising while detecting faces
10	Wagh, Thakare 2019	This paper proposes a model this model to face recognition and combined with RFID card reading technology, which developed a smart classroom attendance system based on face recognition. Research shows that the system is efficient and stable, which effectively reduce classroom attendance costs.	Improved Security Improved Flexibility and more effective.	Arising of More Technical Issues
11	Meng Zeng 2021	This paper proposes a model this model to face recognition and combined The suggested system uses generative adversarial networks, SVM, KNN, CNN, Haar classifiers, and Gabor filter. The SIFT algorithm is used in the creation of the face recognition system. MATLAB will be used by this system to take attendance. After the image has been taken and compared with the database, an SMS will be delivered to the designated number. The scientists have used two databases, the first for storing student faces and the second for storing student data	More effective.	More Network Issues
12	Bhattacharya 2019	This paper proposes a model this model The automatic attendance management system is discussed in this article for convenience or data accuracy. The system is created by combining widely available parts to create a portable gadget for managing the attendance.	Improved Security effective.	marking attendance multiple times for the same student.

S.No	Author Name and Year	Methodology	Advantages	Disadvantages
13	Raj Shoheb, 2019	This paper proposes a model this model to face recognition and combined with RFID card reading technology. which developed a smart classroom attendance system based on face recognition. Research shows that the system is efficient and stable, which effectively reduce classroom attendance costs.	Improved Security Improved Flexibility and more effective.	Arising of More Technical Issues
14	Bhatti, Mughal 2019	This project is used an algorithm for detecting face from input image and for detecting face, identifying and encoding face, marking attendance in a spreadsheet.	Saves the time and More accurate	Smart attendance systems collect and store student data, including attendance records, which can raise privacy concerns
15	Patel Kumar 2019	This paper proposes a model this model to face recognition and combined with RFID card reading technology. which developed a smart classroom attendance system based on face recognition. Research shows that the system is efficient and stable, which effectively reduce classroom attendance costs.	Improved Security Improved Flexibility and more effective.	Need to update regularly.
16	Mani Bharuka, 2019	This paper proposes a model this model to face recognition and combined with RFID card reading technology. captures the facial expression of the employee to detect the emotion. Starting with, a temperature check is done at the entrance and if found high, an alert message is sent to the concerned authorities.	Easy to use and user friendly.	Cost is high as sensors are using in this project.
17	Akbar Sarker 2018	This paper proposes a model this model to face recognition and combined. The suggested system uses generative adversarial networks, SVM, KNN, CNN, Haar classifiers, and Gabor filter. The SIFT algorithm is used in the creation of the face recognition system. MATLAB will be used by this system to take attendance. After the image has been taken and compared with the database, an SMS will be delivered to the designated number. The scientists have used two databases, the first for storing student faces and the second for storing student data	More effective.	More Network Issues
18	Preethi 2018	This project makes the use of Haar classifiers, KNN, CNN, SVM, Generative adversarial networks, and Gabor filters. After face recognition attendance reports will be generated and stored in excel format. The system is tested under various conditions like illumination, head movements, the variation of distance between the student and cameras.	Cost Effective and need less Installations	Reliance on specific devices need to update regularly
19	Alhammadi Almenhal 2021	This paper proposes a model for implementing an automated attendance management system for students of a class by making use of face recognition technique, by using Eigenface values, Principle Component Analysis (PCA) and Convolutional Neural Network (CNN). After these, the connection of recognized faces ought to be conceivable by comparing with the database containing student's faces.	Improved Flexibility and more effective.	Arising of More Technical Issues
20	Setialana 2018	This paper proposes a model this model to face recognition and combined with RFID card reading technology. which developed a smart classroom attendance system based on face recognition. Research shows that the system is efficient and stable, which effectively reduce classroom attendance costs.	Improved Security Improved Flexibility and more effective.	Arising of More Technical Issues
21	Wenxian Zeng 2021	An automated attendance taking system is developed and implemented.Two different face detection algorithms, namely Histogram of Oriented Gradients and Haar Cascade algorithms, are applied and their performances are compared. Deep learning based on CNN is employed for the identification of the students in the classroom. Furthermore, a mask checking feature is also included	Improved Security	Network issue can cause disturbance

Table 2.1: Literature Study Table

## 2.1 Used Software Installations

### 2.1.1 OpenCV

OpenCV is a Python library that allows you to perform image processing and computer vision tasks. It provides a wide range of features, including object detection, face recognition, and tracking.

OpenCV is an open-source software library for computer vision and machine learning. The OpenCV full form is Open Source Computer Vision Library. It was created to provide a shared infrastructure for applications for computer vision and to speed up the use of machine perception in consumer products. OpenCV, as a BSD-licensed software, makes it simple for companies to use and change the code. There are some predefined packages and libraries that make our life simple and OpenCV is one of them



## 2.2 OpenCV working process

### 2.2.1 How does computer recognize the image

Human eyes provide lots of information based on what they see. Machines are facilitated with seeing everything, convert the vision into numbers and store in the memory. Here the question arises how computer convert images into numbers. So the answer is that the pixel value is used to convert images into numbers. A pixel is the smallest unit of a digital image or graphics that can be displayed and represented on a digital display device

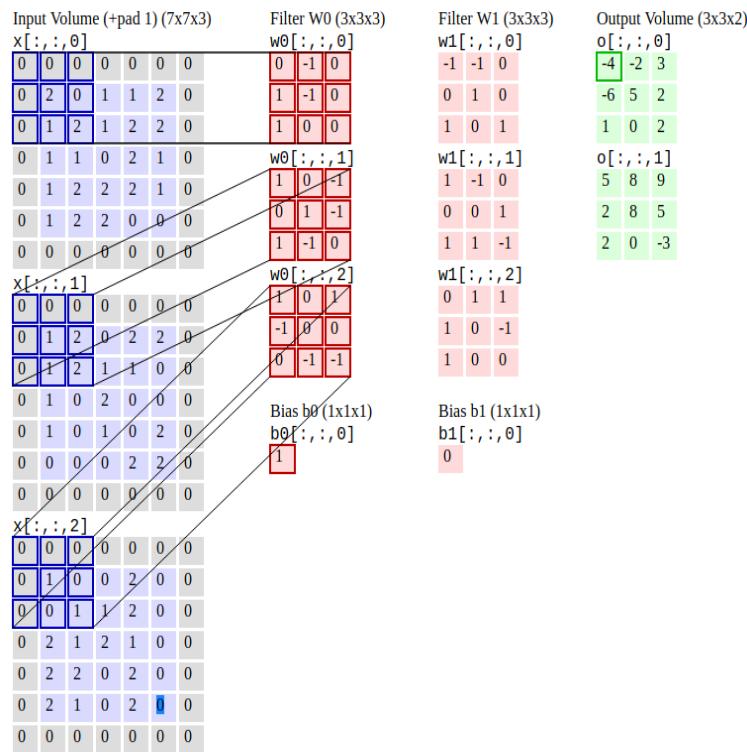


Figure 2.1: Computer vision

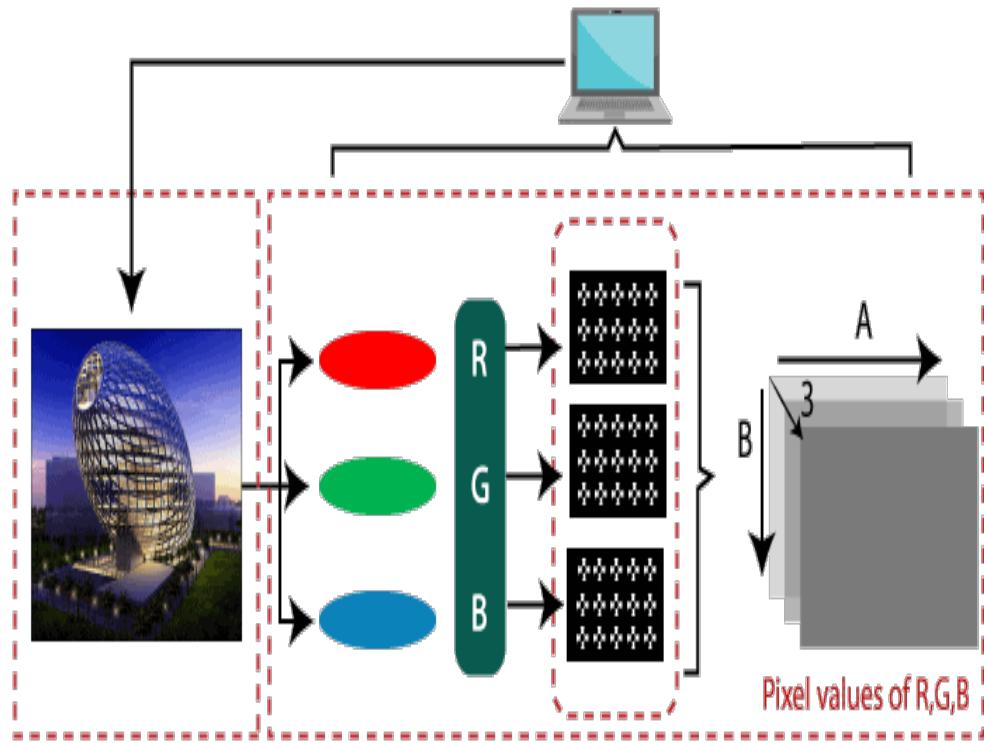
The picture intensity at the particular location is represented by the numbers. In the above image, we have shown the pixel values for a grayscale image consist of only one value, the intensity of the black color at that location.

There are two common ways to identify the images:

1. **Grayscale** Grayscale images are those images which contain only two colors black and white. The contrast measurement of intensity is black treated as the weakest intensity, and white as the strongest intensity. When we use the grayscale image, the computer assigns each pixel value based on its level of darkness.
2. **RGB** An RGB is a combination of the red, green, blue color which together makes a new color. The computer retrieves that value from each pixel and puts the results in an array to be interpreted.

## 2.3 Advantage of computer vision

1. OpenCV is available for free of cost.
2. Since the OpenCV library is written in C/C++, so it is quite fast. Now it can be used with Python.



3. It require less RAM to usage, it maybe of 60-70 MB.
4. Computer Vision is portable as OpenCV and can run on any device that can run on C.

## 2.4 Face recognition and Face detection using the OpenCV

The face recognition is a technique to identify or verify the face from the digital images or video frame. A human can quickly identify the faces without much effort. It is an effortless task for us, but it is a difficult task for a computer. There are various complexities, such as low resolution, occlusion, illumination variations, etc. These factors highly affect the accuracy of the computer to recognize the face more effectively. First, it is necessary to understand the difference between face detection and face recognition.

**Face Detection:** The face detection is generally considered as finding the faces (location and size) in an image and probably extract them to be used by the face detection algorithm.

**Face Recognition:** The face recognition algorithm is used in finding features that are uniquely described in the image. The facial image is already extracted, cropped, resized, and usually converted in the grayscale.

There are various algorithms of face detection and face recognition. face detection using the HAAR cascade algorithm.

## 2.5 HAAR Cascade Classifier

The HAAR cascade is a machine learning approach where a cascade function is trained from a lot of positive and negative images. Positive images are those images that consist of faces, and negative images are without faces. In face detection, image features are treated as numerical information extracted from the pictures that can distinguish one image from another.

We apply every feature of the algorithm on all the training images. Every image is given equal weight at the starting. It finds the best threshold which will categorize the faces to positive and negative. There may be errors and misclassifications. We select the features with a minimum error rate, which means these are the features that best classifies the face and non-face images.

All possible sizes and locations of each kernel are used to calculate the plenty of features.

### 2.5.1 HAAR-Cascade Detection in OpenCV

OpenCV provides the trainer as well as the detector. We can train the classifier for any object like cars, planes, and buildings by using the OpenCV. There are two primary states of the cascade image classifier first one is training and the other is detection.

OpenCV provides two applications to train cascade classifier opencv haartraining and opencv raincascade. These two applications store the classifier in the different file format.

For training, we need a set of samples. There are two types of samples:

**Negative sample:** It is related to non-object images.

**Positive samples:** It is a related image with detect objects.

A set of negative samples must be prepared manually, whereas the collection of positive samples are created using the opencv createsamples utility.

### 2.5.2 Negative Sample

Negative samples are taken from arbitrary images. Negative samples are added in a text file. Each line of the file contains an image filename (relative to the directory of the description file) of the negative sample. This file must be created manually. Defined images may be of different sizes.

### 2.5.3 Positive Sample

Positive samples are created by opencv createsamples utility. These samples can be created from a single image with an object or from an earlier collection. It is important to remember that we require a large dataset of positive samples before you give it to the mentioned utility because it only applies the perspective transformation.

## 2.6 Cascade Classifier

Here we will discuss detection. OpenCV already contains various pre-trained classifiers for face, eyes, smile, etc. Those XML files are stored in opencv/data/haarcascades/ folder. Let's understand the following steps:

**Step - 1** First, we need to load the necessary XML classifiers and load input images (or video) in grayscale mode.

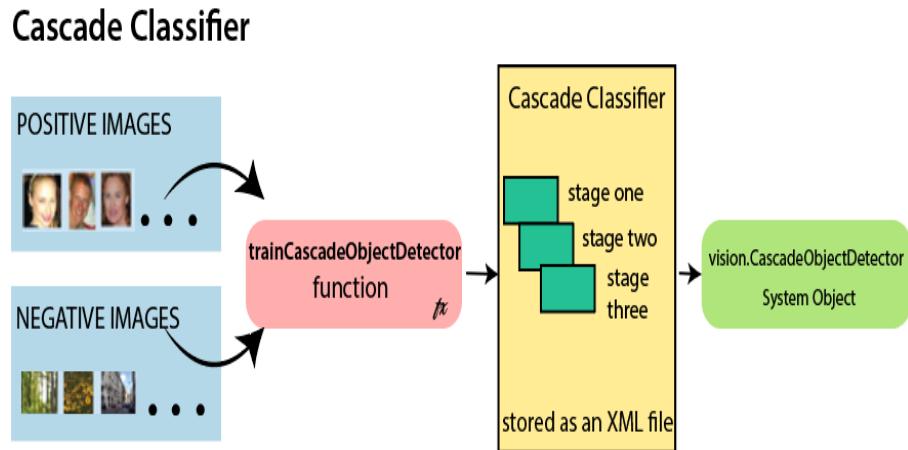


Figure 2.2: Cascade Classifier

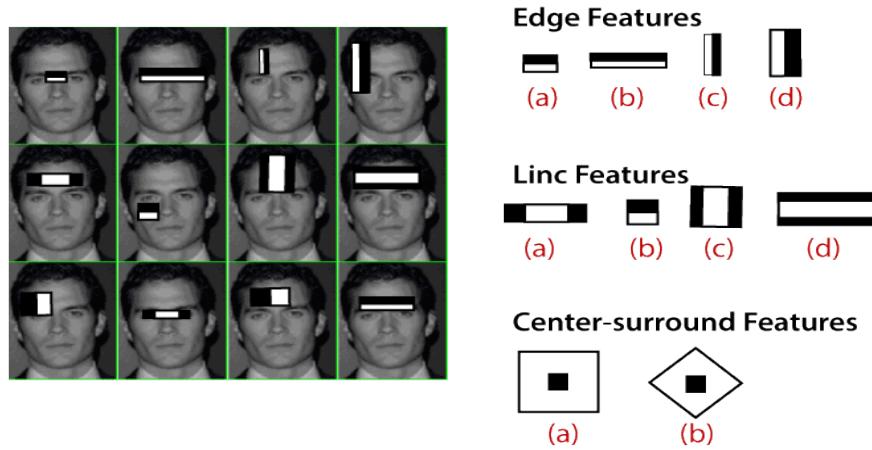
**Step 2 :** After converting the image into grayscale, we can do the image manipulation where the image can be resized, cropped, blurred, and sharpen if required. The next step is image segmentation; identify the multiple objects in the single image, so the classifier quickly detects the objects and faces in the picture.

**Step 3:** The haar-Like feature algorithm is used to find the location of the human faces in frame or image. All the Human faces have some common universal properties of faces like the eye region is darker than its neighbor's pixels and nose region is more bright than the eye region.

**Step 4:** In this step, we extract the features from the image, with the help of edge detection, line detection, and center detection. Then provide the coordinate of x, y, w, h, which makes a rectangle box in the picture to show the location of the face. It can make a rectangle box in the desired area where it detects the face.

## 2.7 Face recognition using OpenCV

Face recognition is a simple task for humans. Successful face recognition tends to effective recognition of the inner features (eyes, nose, mouth) or outer features (head, face, hairline). Here the question is that how the human brain encode it?



The basic idea of face recognition is based on the geometric features of a face. It is the feasible and most intuitive approach for face recognition. The first automated face recognition system was described in the position of eyes, ears, nose. These positioning points are called features vector (distance between the points).

The face recognition is achieved by calculating the Euclidean distance between feature vectors of a probe and reference image. This method is effective in illumination change by its nature, but it has a considerable drawback. The correct registration of the marker is very hard.

The face recognition system can operate basically in two modes:

**Authentication or Verification of a facial image:** It compares the input facial image with the facial image related to the user, which is required authentication. It is a 1x1 comparison.

**Identification or facial recognition:** It basically compares the input facial images from a dataset to find the user that matches that input face. It is a 1xN comparison.



Figure 2.3: Facial Recognition

## 2.8 Encoding images using HOG

- The training process works by looking at 3 face images at a time:
- Load a training face image of a known person
- Load another picture of the same known person
- Load a picture of a totally different person
- Then the algorithm looks at the measurements it is currently generating for each of those three images. It then tweaks the neural network slightly so that it makes sure the measurements it generates for 1 and 2 are slightly closer while making sure the measurements for 2 and 3 are slightly further apart:

## 2.9 OpenCV installations

To use the OpenCV library you have two options: Installation by Using the Pre-built Libraries or Installation by Making Your Own Libraries from the Source Files . While the first one is easier to complete, it only works if you are coding with the latest Microsoft Visual Studio IDE and do not take advantage of the most advanced technologies we integrate into our library.

### Step 1: Prerequisites

- You need Visual Studio pre-installed on your system. You can download the latest version of Visual Studio from Otherwise, you can find older versions.

### Step 2: Download the Installer

- Once you have set up Visual Studio on your system, download the installer according to the Visual Studio version you have installed.

### Step 3: Install OpenCV on Windows

- Once you download the installer, double click it to run the installer. Before the installer starts, it'll ask you permission to run the executable.

It is a free source code editor developed by Microsoft that runs on Windows, mac OS, and Linux. It has quickly become a popular choice among developers due to its intuitive user interface, fast performance, and a wide range of features that make coding more efficient and enjoyable

## 2.10 pycharm Installation

- First, go to the official PyCharm website: <https://www.jetbrains.com/pycharm/download/>.
- On the download page, select the version of PyCharm that you want to download. There are two versions available: Community and Professional. Community edition is free, while Professional edition requires a license .
- Once you have selected the version you want, click the "Download" button to start the download.

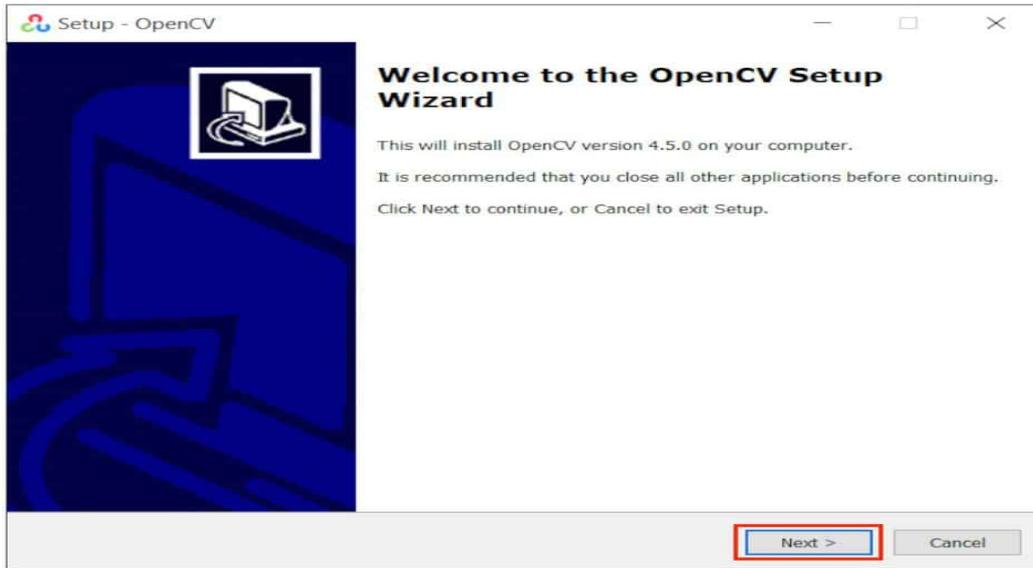


Figure 2.4: Well screen

The installer starts with a welcome screen. Click on Next to read the License.

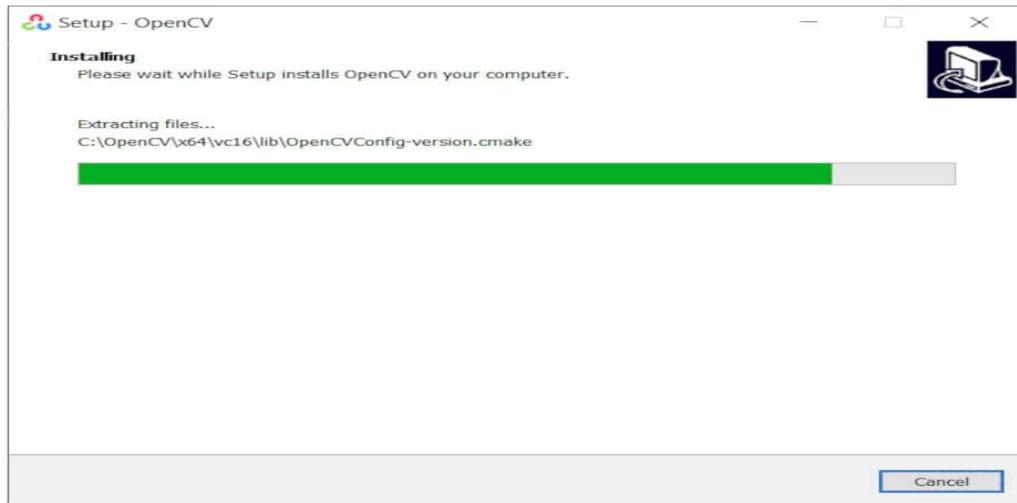


Figure 2.5: Install

- On the first screen of the installer, you can select the installation location and whether or not you want to create a desktop shortcut.

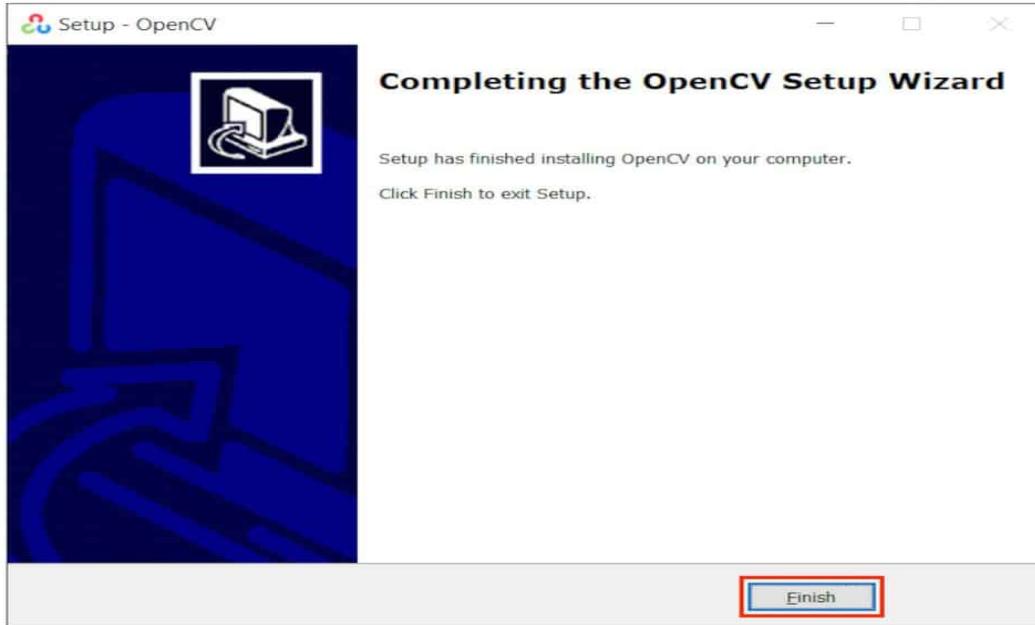


Figure 2.6: Finish Installation

## Download PyCharm

Windows      macOS      Linux

**Professional**

For both Scientific and Web Python development. With HTML, JS, and SQL support.

[DOWNLOAD](#)

Free trial

**Community**

For pure Python development

[DOWNLOAD](#)

Free, open-source

Figure 2.7: Pycharm Community version

- On the next screen, you can select the theme that you want to use for PyCharm.
- The next screen allows you to select the components that you want to install. You can

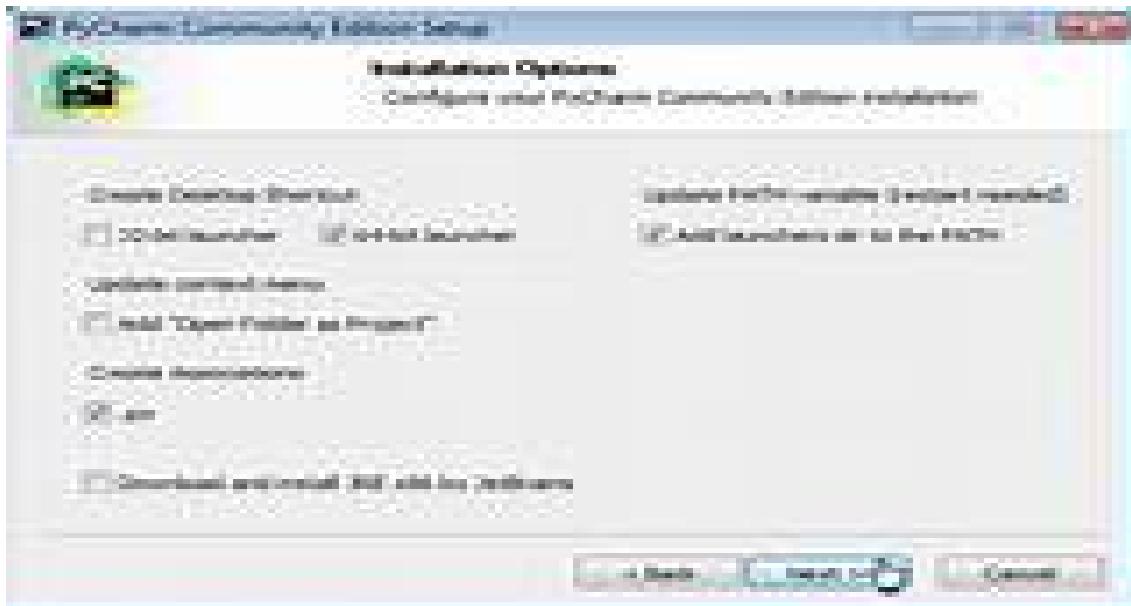


Figure 2.8: Installation Options

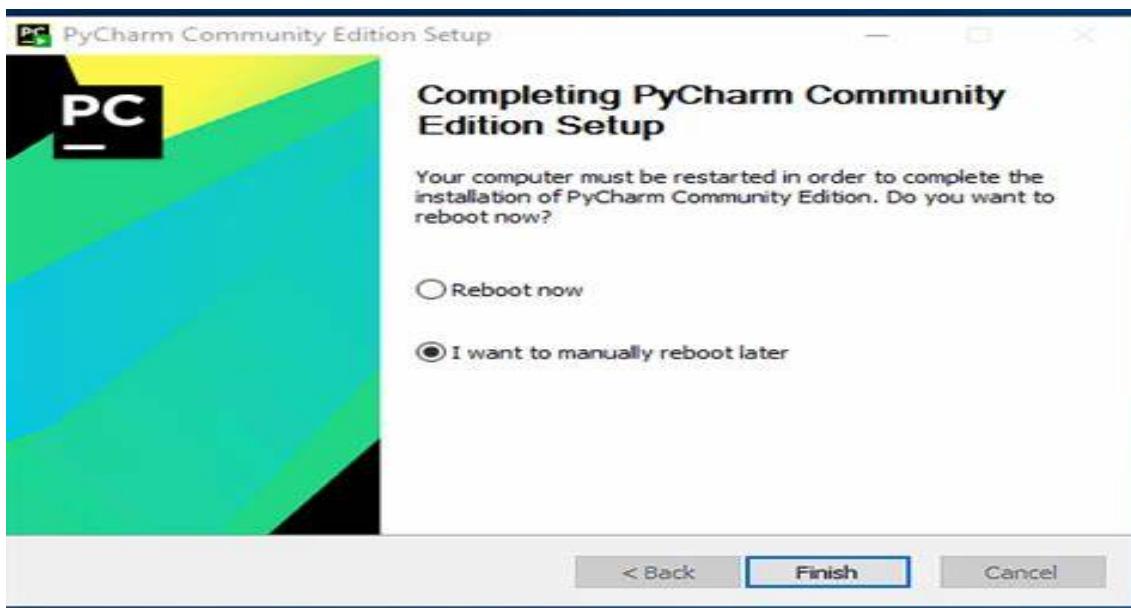


Figure 2.9: Pycharm Community setup

also choose to install PyCharm for all users or just for your user account.

- On the final screen, you can review your selections and click "Install" to begin the installation process.
- Wait for the installation process to complete. When the installation is finished, you can click the "Run PyCharm" button to launch PyCharm.
- That's it! You have successfully installed PyCharm.

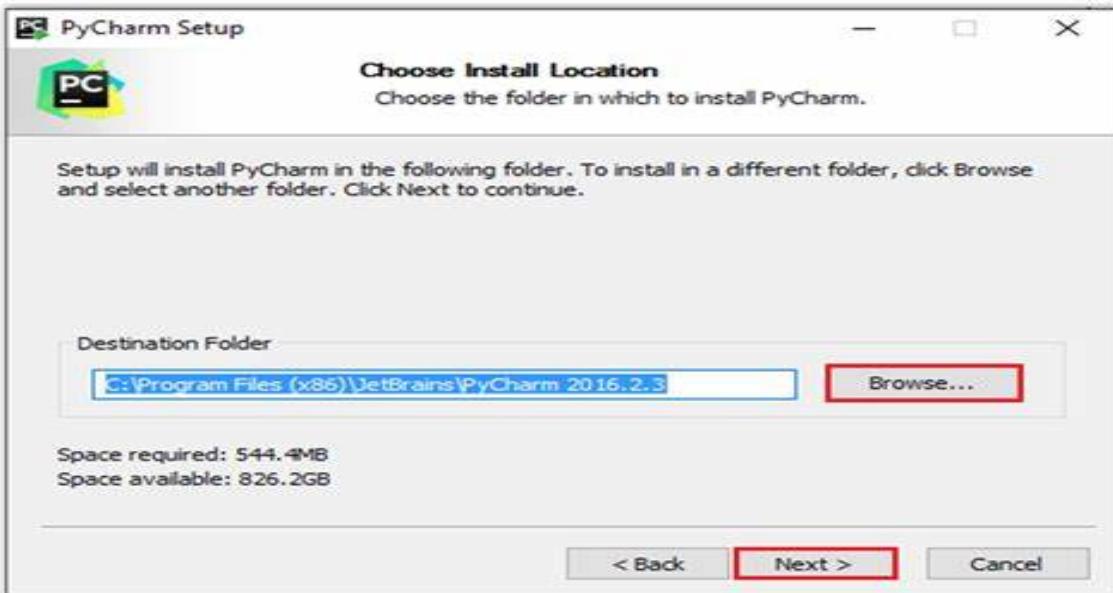


Figure 2.10: Installation Location

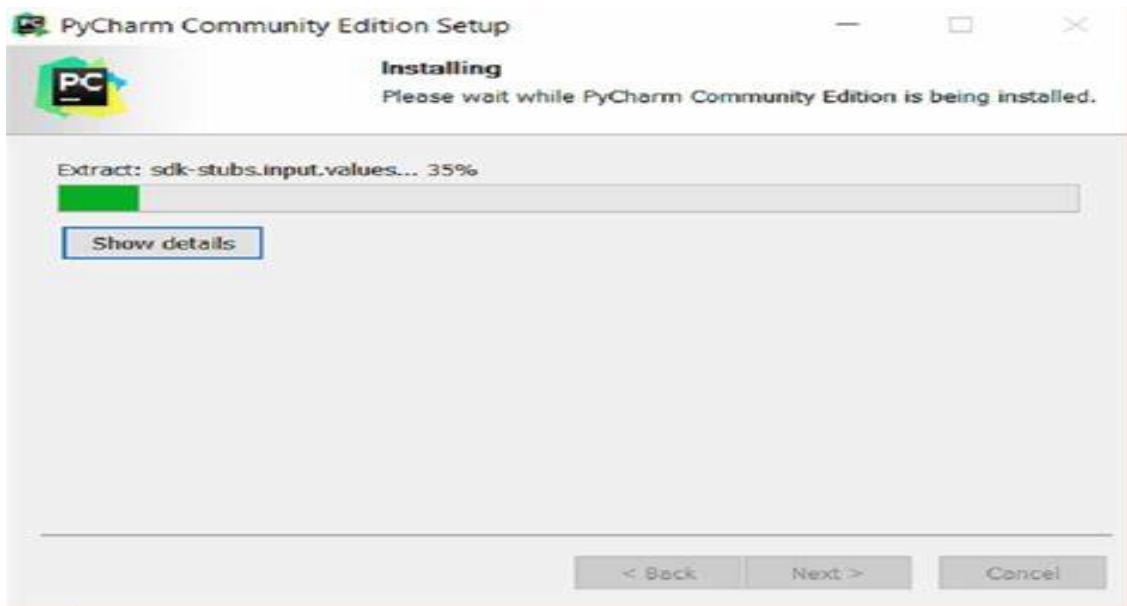


Figure 2.11: Installation begins

## 2.11 Firebase Installation

Firebase is a platform developed by Google that allows developers to build, manage, and deploy web and mobile applications quickly and easily. In this tutorial, we will go through the step-by-step process of installing Firebase.

### 2.11.1 Go to the Firebase Website

First, go to the Firebase website (<https://firebase.google.com/>).

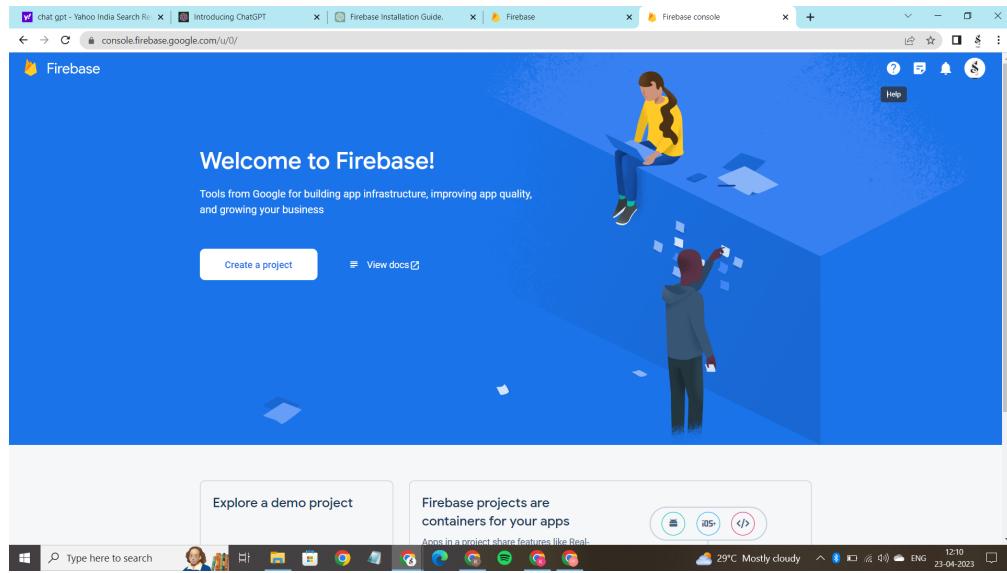


Figure 2.12: Firebase Website

### 2.11.2 Sign in to Firebase

Next, sign in to Firebase with your Google account, or create a new account if you don't have one already.

### 2.11.3 Access the Firebase Console

After signing in, click on the "Go to console" button to access the Firebase Console.

### 2.11.4 Create a New Firebase Project

Click on the "Add project" button to create a new Firebase project.

### 2.11.5 Set up Firebase Products

Select which Firebase products you want to use in your project. For example, select "Firestore" and "Storage".

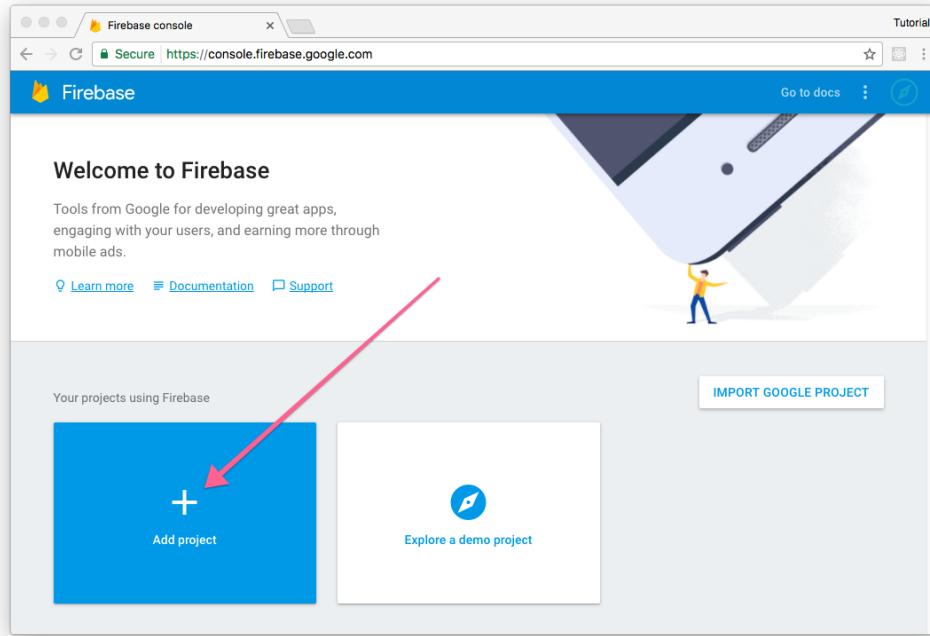


Figure 2.13: Firebase Console

### 2.11.6 Set up Firebase Products

Follow the prompts to set up each product. For example, to set up Firestore, click on the "Create database" button and choose your location.

### 2.11.7 Set up Firebase Products

To set up Storage, click on the "Get started" button and follow the prompts to create a new bucket.

### 2.11.8 Firebase Overview

Finally, click on the "Project overview" button in the left-hand menu to see an overview of your Firebase project.

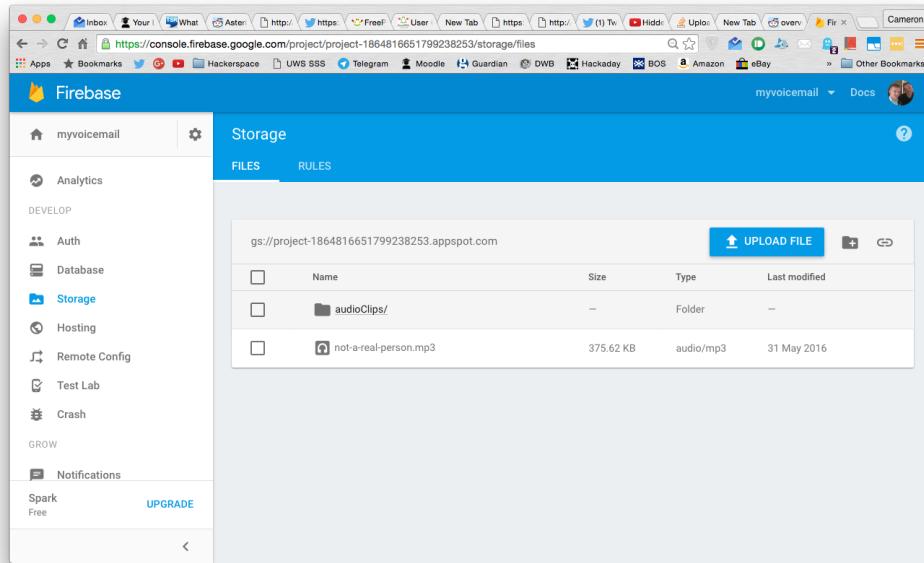


Figure 2.14: Firebase Set up Firestore

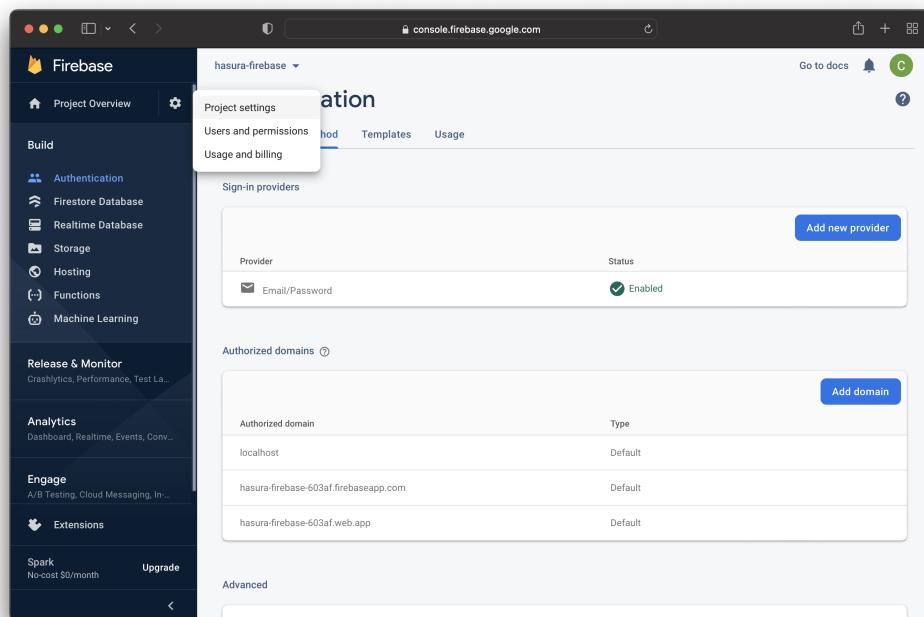


Figure 2.15: Firebase Set up Storage

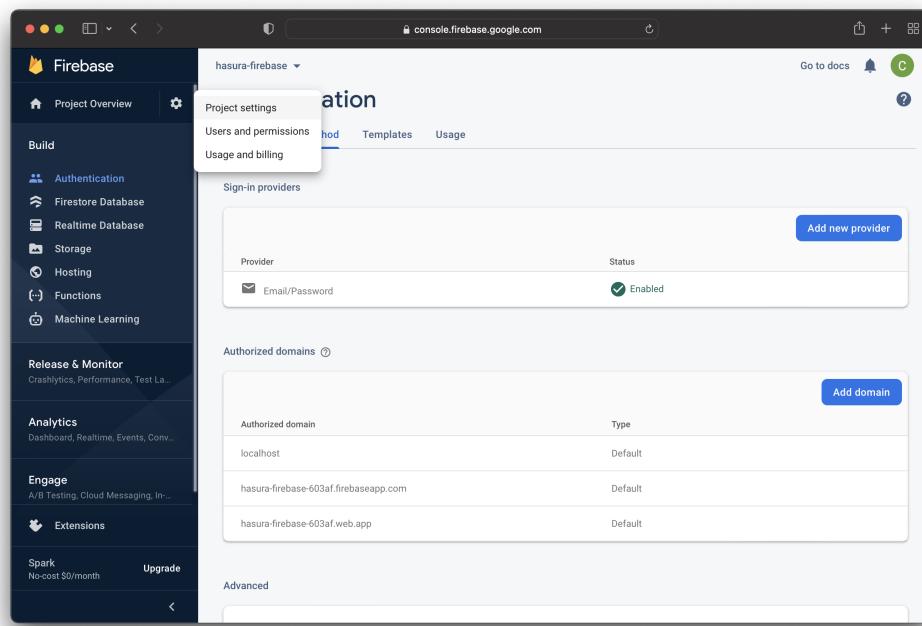


Figure 2.16: Firebase Set up overview

# **Chapter 3**

# **SYSTEM DESIGN AND ANALYSIS**

## **3.1 System Architecture**

A system architecture is the conceptual model that defines the structure, behavior and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. A system architecture can consist of system components and the sub-systems developed, that will work together to implement the overall system.

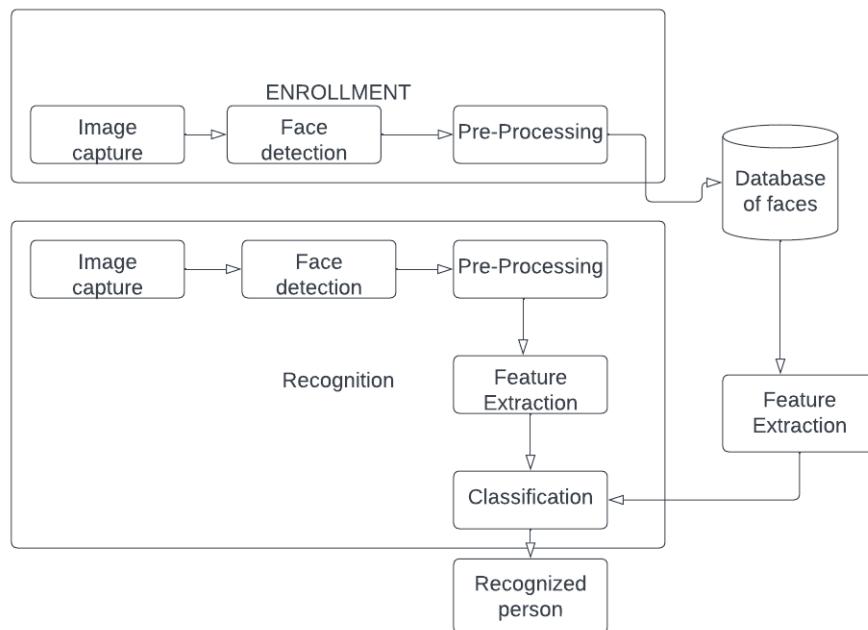


Figure 3.1: Architecture Diagram

## 3.2 DFD Diagram

A data-flow diagram is a way of representing a flow of data through a process or a system. The DFD also provides information about the outputs and inputs of each entity and the process itself.

- Data-flow diagram has no control flow — there are no decision rules and no loops. For each data flow, at least one of the endpoints (source and / or destination) must exist in a process.

DFDs are again classified into three types:

- Level-0 DFD
- Level-1 DFD
- Level 2 DFDs

### 3.2.1 Level 0 DFDs

- DFD Level 0 is also called a Context Diagram. It's a basic overview of the whole system or process being analyzed or modeled.

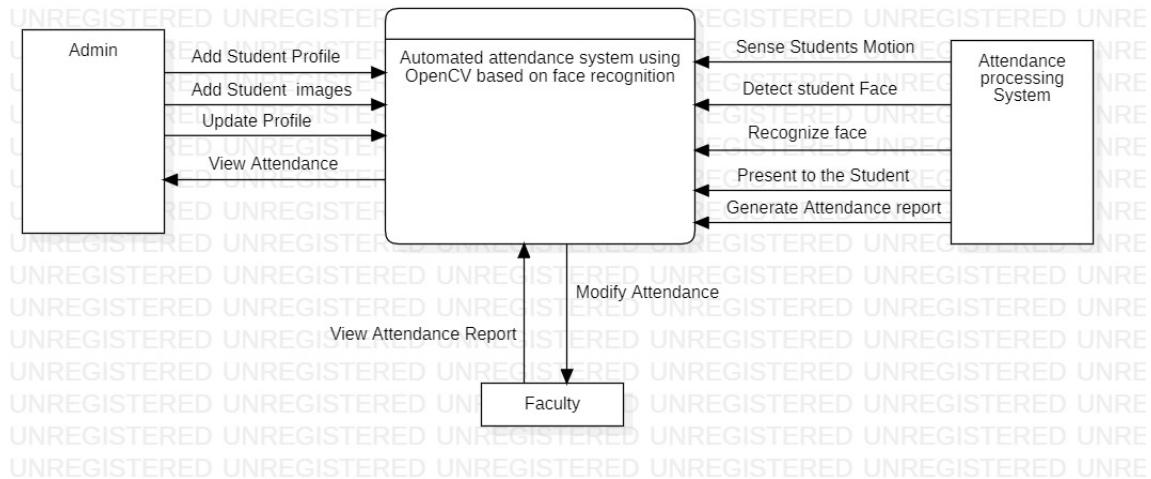


Figure 3.2: Level-0 DFD Diagram

### 3.2.2 Level 1 DFDs

- In level 1 DFD, the single process node from the context diagram is broken down into sub-processes.

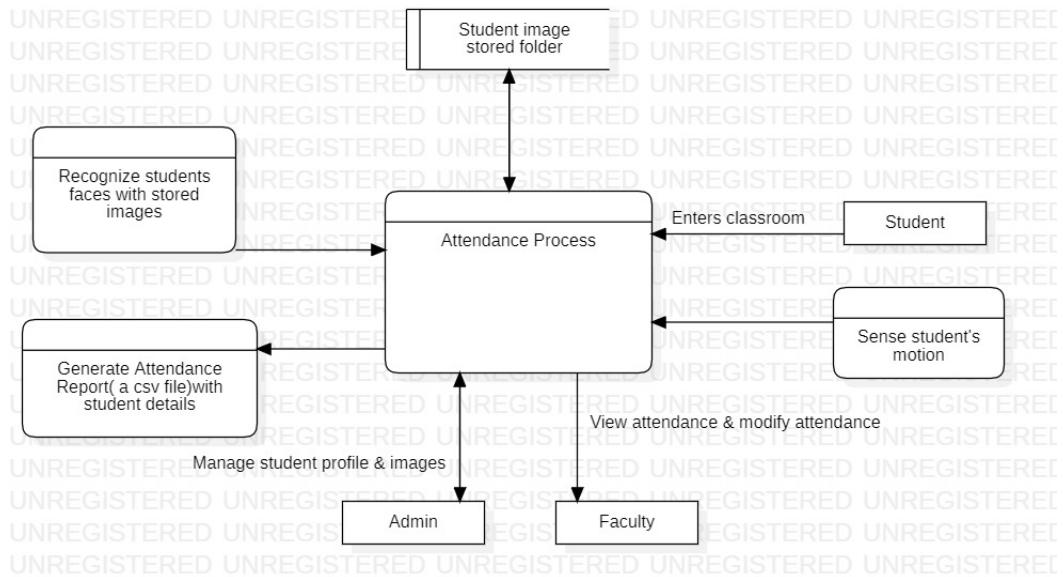


Figure 3.3: Level-1 DFD Diagram

### 3.2.3 Level 2 DFDs

2-level DFD goes one process deeper into parts of 1-level DFD. It can be used to project or record the specific/necessary detail about the system's functioning.

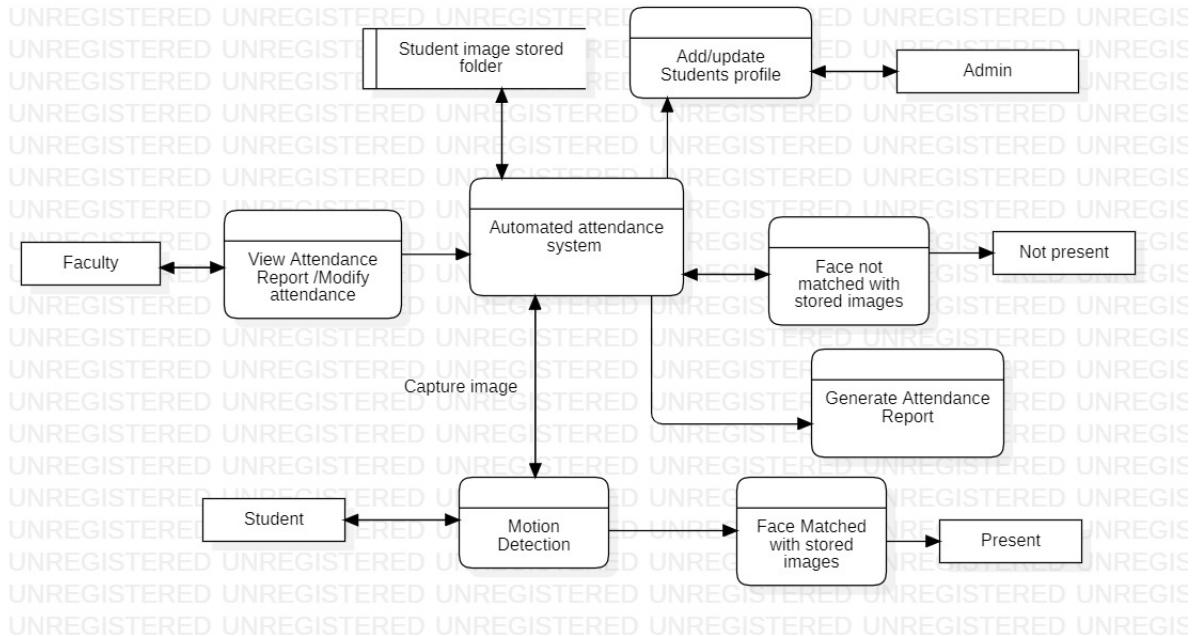


Figure 3.4: Level-2 DFD Diagram

### 3.2.4 Control Flow

Control flow testing is a testing technique that comes under white box testing. The aim of this technique is to determine the execution order of statements or instructions of the program through a control structure. The control structure of a program is used to develop a test case for the program. In this technique, a particular part of a large program is selected by the tester to set the testing path. It is mostly used in unit testing. Test cases represented by the control graph of the program.

#### Notations used for Control Flow Graph

1. Node
2. Edge
3. Decision Node
4. Junction node

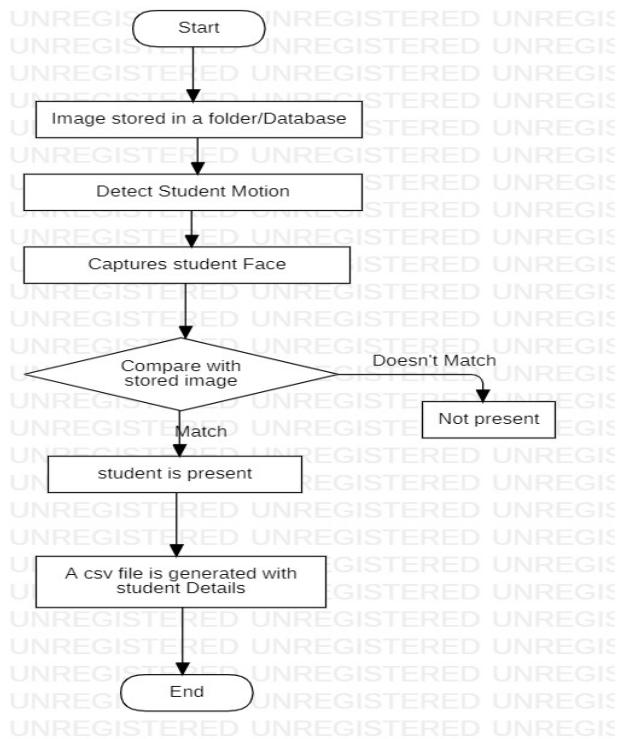


Figure 3.5: Control Flow for Automated Attendance System

### **3.3 Advantages of Proposed System:**

1. Improved accuracy.
2. Time Saving.
3. More Secured.

### **3.4 Requirement Specification**

#### **3.4.1 Hardware Requirements:**

The hardware requirement specifies each interface of the software elements and the hardware elements of the system. These hardware requirements include configuration characteristics.

#### **Hardware Requirements**

- Integrated camera/Webcam
- Minimum of 2GB RAM
- Hard Disk-50GB

#### **3.4.2 Software Requirements**

The software requirements specify the use of all required software products like data management system. The required software product specifies the numbers and version. Each interface specifies the purpose of the interfacing software as related to this software product.

#### **Software Requirements**

- You can use any OS- mac OS, Windows and Linux based OS.
- Python version 3.6(any python version 3.x will be fine)
- OpenCV version 4.1
- Firebase
- Pycharm (Community Version)

# **Chapter 4**

## **IMPLEMENTATION**

### **4.1 Installing Libraries**

1. dlib Library
2. face-recognition Library
3. cmake
4. opencv-python
5. numpy

#### **4.1.1 Dlib Library**

Dlib is mostly used for face recognition purposes. They analyzed the object/face using the functions called HOG (Histogram of oriented gradients) and CNN . Face recognition nowadays are been used widely in many applications. The dlib library is a C++ library that provides a wide range of tools and functions for various applications, including computer vision, machine learning, and image processing. The library has been designed to be highly modular and extensible, making it easy to use in various projects.

- Face detection and recognition: dlib provides a pre-trained face detector that can detect faces in images or videos. Additionally, it provides tools for face recognition using various techniques, including deep learning-based methods.
- Object detection: The dlib library includes tools for object detection using the Histogram of Oriented Gradients (HOG) feature descriptor and a linear support vector machine (SVM) classifier.

#### **4.1.2 Face-recognition Library**

Face recognition Library is used in order to recognize faces of the people. The use of a face recognition library is to provide an automated way of recognizing human faces in digital images or video frames. Such libraries usually include pre-trained models and algorithms that can detect and recognize faces, and provide useful features such as face alignment, tracking, and identification. These libraries can be used in various applications, such as:

- Security and surveillance: face recognition libraries can be used in security and surveillance systems to identify individuals and track their movements in real-time.

#### **4.1.3 cmake Library**

CMake is an open-source, cross-platform build system that provides a high-level syntax for defining the build process of software projects. CMake generates build files for various build systems such as Make, Visual Studio, and Ninja. It simplifies the build process and allows for easy portability of projects across different platforms and build environments.

- Cross-platform compatibility: CMake generates build files that are compatible with different operating systems and build environments, making it easy to build and use the library on various platforms.
- Flexibility: CMake provides a high-level syntax for defining the build process, which allows for flexibility in the configuration and customization of the build process.

#### **4.1.4 opencv-python Library**

OpenCV-Python is a library of Python bindings for the OpenCV computer vision library. It provides easy-to-use functions and classes that enable users to access OpenCV's functionality using Python. The library includes various tools and algorithms for image and video processing, such as:

- Image and video I/O: OpenCV-Python provides functions to read and write images and videos in various formats.
- Image processing: The library includes tools for image filtering, color conversion, thresholding, edge detection, and morphology operations. Feature detection and extraction: OpenCV-Python provides tools for detecting and extracting various features, such as corners, edges, and keypoints.

#### 4.1.5 numpy

NumPy is a Python library that provides support for multi-dimensional arrays and matrices, as well as a large collection of mathematical functions to operate on them. NumPy is one of the most popular libraries for scientific computing with Python, and it is widely used in various fields such as physics, engineering, and data science. Some of the key features of NumPy are:

- Ndarray: NumPy's main object is the ndarray, which is a multi-dimensional array of elements of the same type. Ndarrays can have any number of dimensions, and they provide efficient storage and manipulation of large amounts of data.
- Broadcasting: NumPy provides a powerful broadcasting mechanism that allows for efficient element-wise operations on arrays of different shapes and sizes
- Numpy is a library for the python programming language, adding support for large, multidimensional arrays .

## 4.2 Adding student images to the database

To add images to a database. in PyCharm, you can follow these steps:

- In the PyCharm project, locate the database. where you want to add the images. Right-click on the database. and select "New" and then "File" or "Directory," depending on whether you want to add a new database. or a new file.
- If you select "File," give the file a name with the appropriate extension (.jpg, .png, etc.).
- You can now drag and drop your image file(s) into the database. you just created. Alternatively, you can also add images to the database. through the PyCharm file explorer by clicking "File" on the top menu bar, then "Open," and then selecting the database. where you want to add the images. Once you have the database. open in the file explorer, you can drag and drop your image files into the database..

## 4.3 Encoding of the images

- The HOG algorithm is used to extract the local gradient information from the face region and create a histogram representation of the features.
- The HOG features capture the shape and texture information of the face and are used to distinguish between different individuals.

- The training process works by looking at 3 face images at a time:
- Load a training face image of a known person
- Load another picture of the same known person
- Load a picture of a totally different person

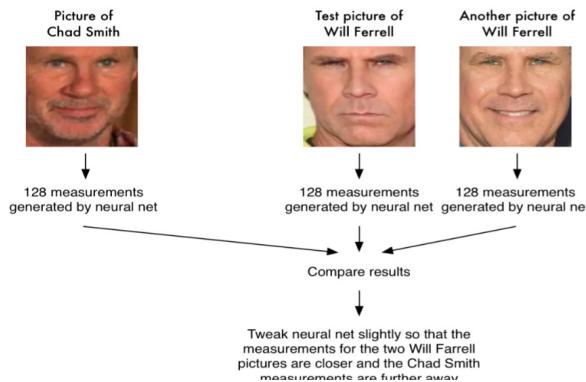


Figure 4.1: Encoding images using HOG

128 Measurements Generated from Image			
0.0974608486808	0.0452223989384	-0.1281466782093	0.03209491854014
0.12529824674129	0.061039179127216	0.17521631717682	0.02097085215807
0.03080439718723	-0.01981477253193	0.1601389563835	-0.0005163278451189
0.0360569938403	0.055542386585339	0.07313090154	-0.13185100111
-0.007468838401871	0.126262807253	-0.0206367425154	-0.00557510536889
-0.0066401711665094	0.036750309169292	0.15958009660244	0.043374512344599
-0.1413125158888	0.14114324748516	-0.031351584941149	-0.05334361270701
-0.04864054009595	-0.06190158792907	-0.15046432945035	0.07819105096817
-0.12567179244778	-0.1658645013866	-0.1278635384171	-0.0762891562173
-0.061418771147374	-0.074287034571171	-0.06556325272556	0.1236467318558
0.0467418671574	0.008761881224811	0.147465437650	0.06541842269598
-0.1211350143147	-2.2105591947651	0.06410122793956	0.09727461762558
0.06160574616964	0.1134576573669	0.02135224051952	-0.08584329584223
0.06169894072915	0.19372203946114	-0.08672632330152	-0.022388197491632
0.10904195904732	0.08463303741215	0.03943594658378	0.02065640551136
-0.01941462741723	0.084811256761056	0.2118012335491	-0.05056439210049
0.1524594575167	-0.1658228081131	-0.03557794168515	-0.02727454236379
-0.122166857802	-0.007277755539491	-0.0369121945799	-0.04365277337379
0.0333405121613	-0.059730963394111	-0.0702684736914	-0.04501356725697
0.087945111059505	0.11478432267904	0.086621491730213	-0.013955107890009
-0.02414075195934	0.1484119549971	0.07833575817745	-0.1788695713887
-0.0182869041626	0.04652542483966	0.132278330744756	-0.0726032742156
-0.011014151388917	-0.051016287191381	-0.14132921376786	0.050511952875228
0.009367633468628	-0.02812767322878	-0.13407498598099	-0.0482935338863
0.05813957133007	0.0468538740554452	-0.039470170222387	-0.04376546012003
-0.02421037402351	-0.1144379235355	0.07199755441475	-0.01206226464002
-0.05722334980223	0.01468389567351	0.0528154733777	0.012774495407939
0.02355301501486	-0.081752559671096	-0.03109209261458	0.069833961612392
-0.009803973183324	0.03702205669853	0.1100947014099	0.11638780978918
0.0202030541949	0.1278811833076	0.18632389465045	-0.01536792916059
0.00433788033902	-0.05438801247417	-0.1176248677254	0.1028145751989
0.051597066223821	-0.10343151582777	-0.04097258233216	-0.08204133809612

Figure 4.2: 128 measurements get generated from the image

## 4.4 Recognition of face

- HOG features are extracted and passed to the trained SVM classifier to predict the class (face) of the unknown face.
- The class with the highest prediction score is considered as the match.

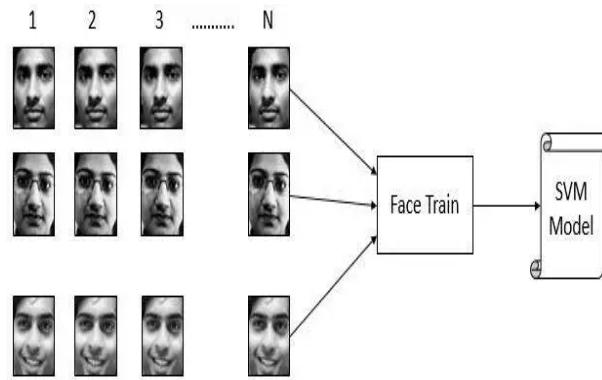


Figure 4.3: Face recogniiton using SVM

## 4.5 Adding images in storage bucket

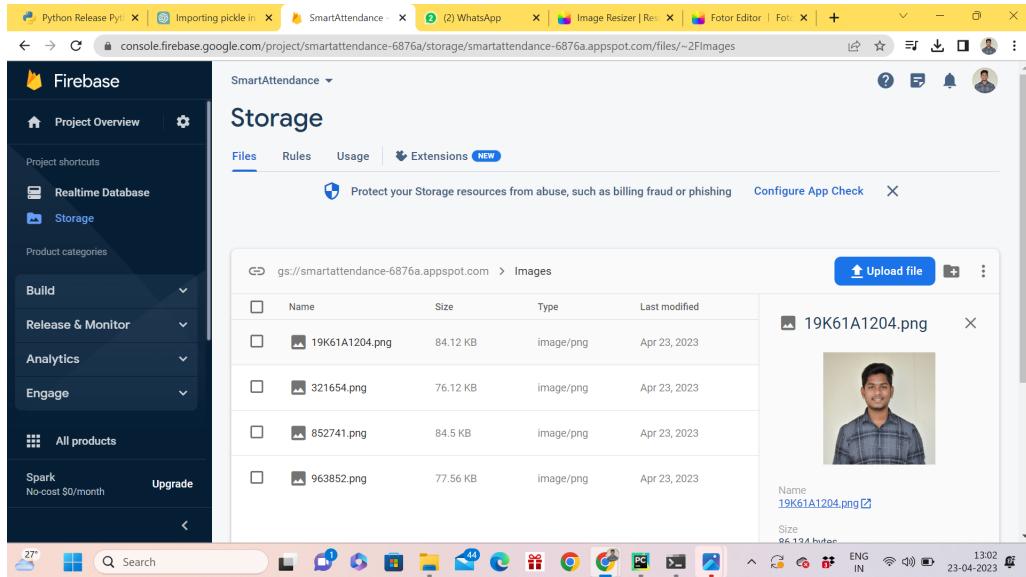


Figure 4.4: Adding Students details in storage bucket

# **Chapter 5**

## **RESULTS**

Project results are the changes or effects expected to take place after implementing the project. The results are generally positive improvements to the lives of the beneficiaries.

- The image of the student is stored in the database with the details of the student.
- Initially, the webcam is active and there is no one in front of the webcam.

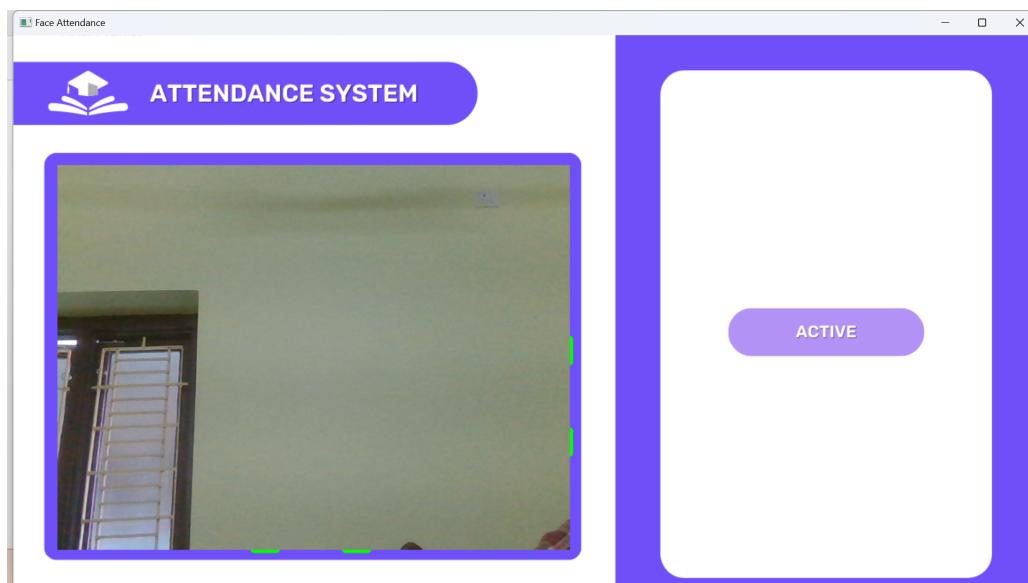


Figure 5.1: Webcam is active

- Once the student is in front of the webcam, the webcam detects the face.
- Once the face is detected, if the image of the student is in the database it will automatically recognize the face and displays the student's details.

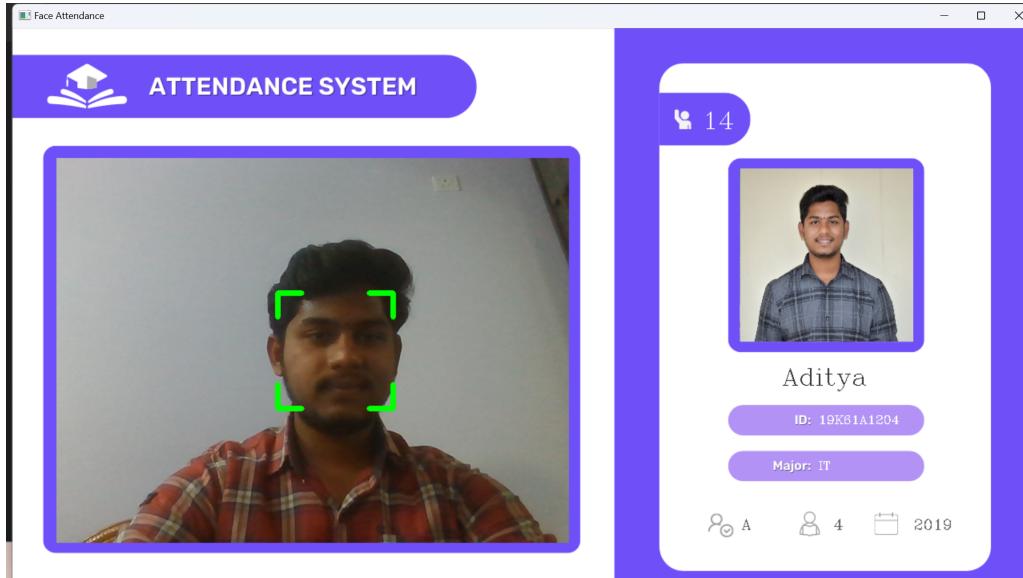


Figure 5.2: Displaying Student details

- Once the student's face is recognized, it will mark the attendance of the student.

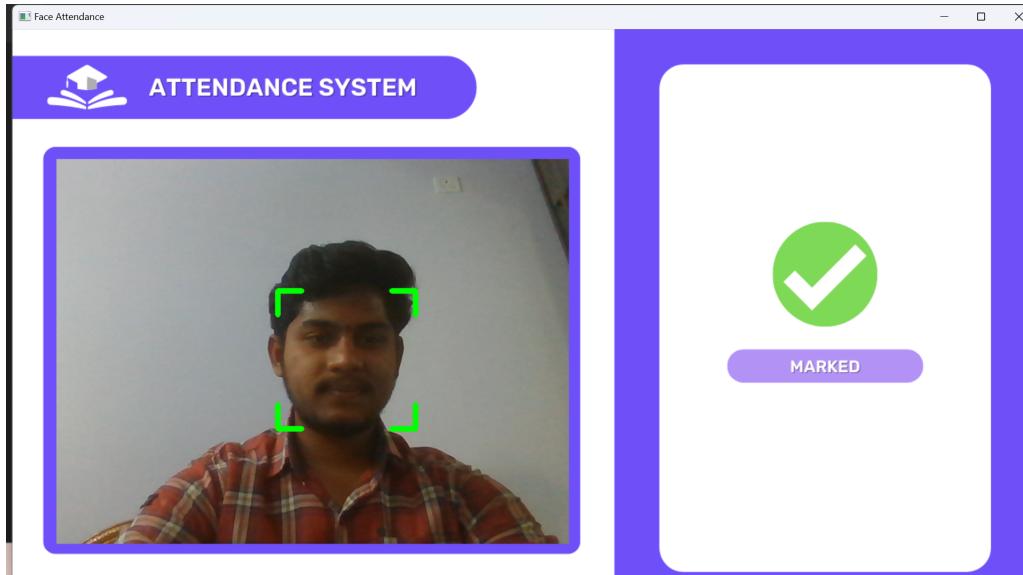


Figure 5.3: Mark the attendance

- Eventhough if the same student face is detected and recognized many number of times , the attendance is marked only one time i.e.,at the first time at which the students face got identified and it will display that the attendance is already marked.

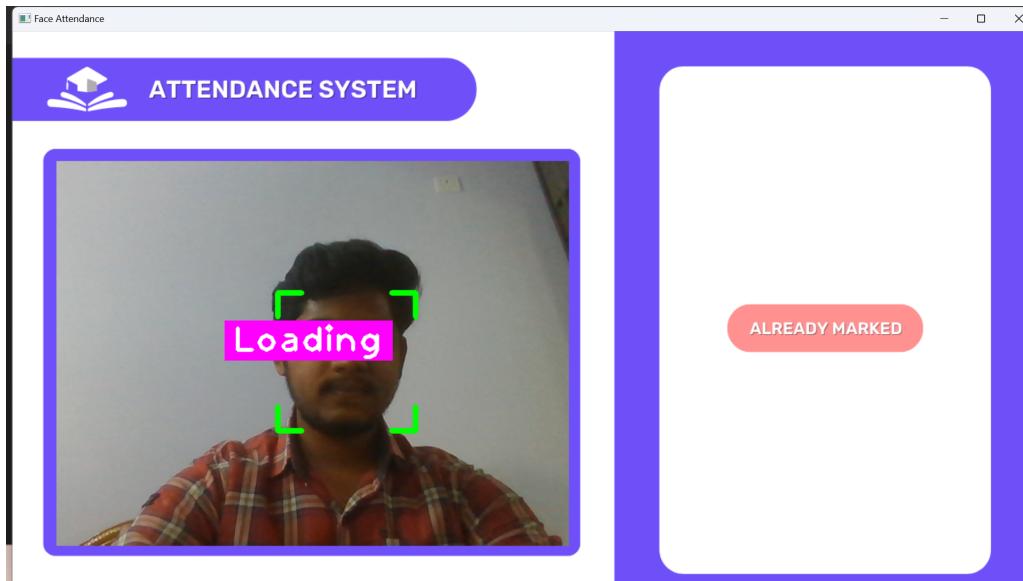


Figure 5.4: Attendance is already marked.

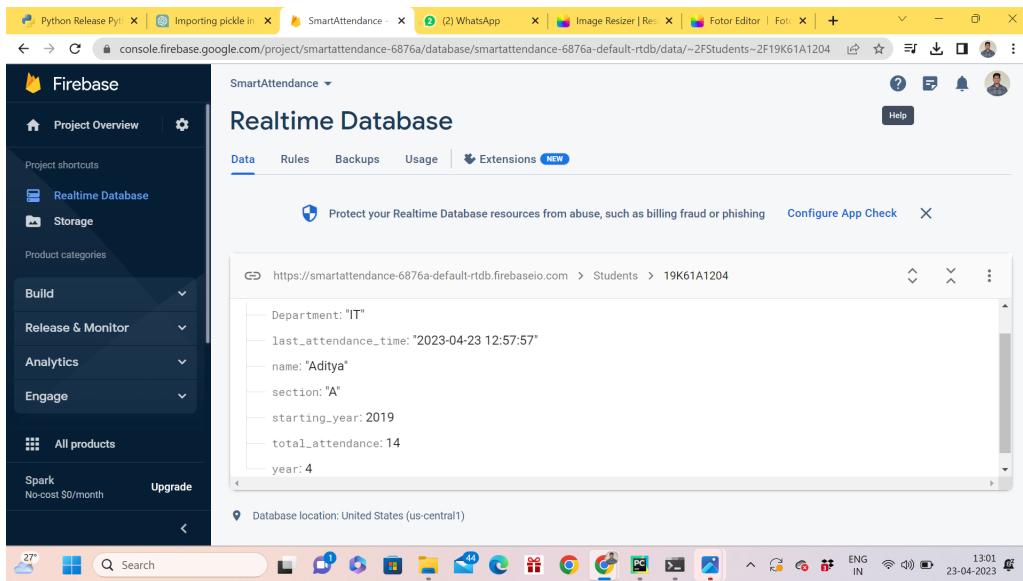


Figure 5.5: Attendance is marked in database

# **Chapter 6**

## **TESTING**

### **6.1 Testing**

Testing is the process of detecting errors. Testing performs a very critical role for quality assurance and for ensuring the reliability of software. The results of testing are used later on during maintenance also. Software testing is the process used to access the quality of computer software. Software testing the empirical technical investigation conducted to provide stakeholder with information about the quality of the product or service under test, with respect to the context in which it is intended to operate.

There are many approaches to software testing. Reviews, walk throughs or inspections are considered as static testing, and where actually running the program with a gives t test cases in a given development stage is referred to as dynamic testing Software testing is ed in association with verification and validation.

#### **Verification:**

Have we built the software right (i.e., does it match the specification).

#### **Validation:**

Have we built the right software (i.e., is this what the user wants). Software testing methods are traditionally divided into black box testing and white box testing these two approaches are used to describe the point of view that a test engineer takes when designing test cases.

### **6.1.1 Black Box Testing**

Black box testing treats the software as a black-box without any understanding as to how the internals behave. It aims to test the functionality according to the requirements. Thus, the tester inputs the data and only sees the output from the test object. This level of testing usually requires through test cases to be provided to the tester who then can simply verify that for a given input, the output value (or behavior), is the same as the expected value specified in the test cases. Black box testing methods include equivalence partitioning boundary.

### **6.1.2 White Box Testing**

White box testing is done when the tester has access to the internal data structure, code, and algorithms. White box testing methods include creating tests to cause all statements in the program to be executed at least once. Other examples of white box testing are mutations testing and fault injection methods. White box testing methods can also be used to evaluate the completeness of a test suite that was created with black box testing methods.

### **6.1.3 Pre-Release Testing**

Unit testing tests the minimal software component, or module. Each unit (basic component) of the software is tested to verify that the detailed design for the unit has been correctly implemented. In an object-oriented environment this is usually at the class level, and the minimal unit tests include the constructors and destructors.

### **6.1.4 Integration Testing**

Integration testing exposes defects in the interfaces and interaction between integrated components(modules). Progressively larger groups of tested software components correspond to the element of architectural design are integrated and tested until the software works as a system. Functional testing tests at any level (class, module, interface or system) for proper functionality as defined in the specification.

### **6.1.5 Acceptance Testing**

Acceptance testing can be conducted by the end-user, customer, or client to validate whether or not to accept the product. Acceptance testing may be performed as a part of the hand-on process between any two phases of development.

### 6.1.6 Post Release Testing

Alpha testing is simulated or actual operation testing by potential users or customers or an independent test team at the developer's site. Alpha testing is often employed for on-the shelf software as a form of internal acceptance testing Beta testing comes after alpha testing Versions of the software, known as beta versions, are released to limited audience outside of the programming team. The software is released to groups of people so that further testing can ensure the product has few faults or bugs sometimes, beta versions are made available to public to increase the feedback field to a maximal number of future users.

## 6.2 Software Testing Strategies

The software testing strategies are:

1. Unit Testing
2. Integration Testing
3. Functional Testing
4. System Testing
5. Acceptance Testing
6. Maintenance Testing

### 6.2.1 Unit Testing

Unit Testing concentrates on each unit of the software as implemented in source code and is a white box oriented. Using the component level design description as a guide, important control paths are tested to uncover errors within the boundary of the module in the unit testing, the steps can be conducted in parallel for multiple components in my project. I tested all the modules individually related to main function codes.

### 6.2.2 Integration Testing

Integration Testing focus is on design and construction of the software architecture. Integration Testing is a systematic technique for constructing the program structure while at the same time conducting tests to uncover errors associated with interfacing. The objective to take unit tested components and build a program structure that has been dictated by design. The goal here is to see if modules can be integrated properly, the emphasis being interfaces

between modules.

### **6.2.3 Functional Testing**

FUNCTIONAL TESTING is a type of software testing that validates the software system against the functional requirements/specifications. The purpose of Functional tests is to test each function of the software application, by providing appropriate input, verifying the output against the Functional requirements.

Functional testing mainly involves black box testing and it is not concerned about the source code of the application. This testing checks User Interface, APIs, Database, Security, Client/Server communication and other functionality of the Application Under Test. The testing can be done either manually or using automation.

### **6.2.4 System Testing**

System testing of software or hardware is testing conducted on a complete, integrated system to evaluate the system compliance with its specified requirements. System testing falls thin the scope of black box testing, and as such, should require no knowledge of the inner design of the code or logic. Here the entire software system is tested. The reference document for this process is the requirements document, and the goal is to see if software meets its requirements.

### **6.2.5 Acceptance Testing**

acceptance testing is a test conducted to determine if the requirements of a specification or contract are met. It may involve chemical tests, physical tests, or performance tests. Acceptance testing can be conducted by the end-user, customer, or client to validate whether or not to accept the product. Acceptance testing may be performed as a part of the hand-on the process between any two phases of development.

### **6.2.6 Maintenance Testing**

Once a system is deployed it is in service for years and decades. During this time the system and its operational environment is often corrected, changed or extended. Testing that is provided during this phase is called maintenance testing.

Maintenance testing consists of two parts:

- First one is, testing the changes that has been made because of the correction in the system or if the system is extended or because of some additional features added to it.
- Second one is regression tests to prove that the rest of the system has not been affected by the maintenance work.

## 6.3 Test Cases

Test case in software engineering in a set of conditions or variables under which tester will determine whether an application or software system meets specifications. The mechanism for determining whether a software program or system has passed or failed such as known as a test oracle. It may take many test cases to determine that a software program system is functioning correctly. The written test cases are usually collected into test suites.

### 6.3.1 Objective

To verify the functionality of the Automated Attendance system using OpenCV based on face recognition **Assumptions:**

1. Camera webcam is installed and configured properly.
2. The face recognition software is installed and configured properly.
3. A test subject is available for testing.

### 6.3.2 Preconditions:

1. Webcam or camera is running .
2. The face recognition software is running.

### 6.3.3 Test Steps:

1. Wait for the software to detect the face.
2. Verify that the face is recognized by the system.
3. Verify that the attendance is generated automatically.
4. Generated attendance will be available in data base.

Test ID	Test Steps	Expected Result	Actual Result	Status Pass/Fail
hms01	Verify that the face attendance system is properly installed .	The system is installed properly	System is properly installed .	Pass
hms02	Add students to the system's database, including their name and face images.	students are added to the system's database.	students are added successfully.	Pass
hms03	verify whether it marking attendance for an unauthorized user's face.	Attendance is not generated.	Attendance is not generate.	Pass
hms04	verify whether it marking attendance for an unauthorized user's face.	Attendance is generated.	Attendance is generated.	Pass
hms05	Verify that The attendance is stored properly in database	The attendance is stored properly in database	The attendance is generated properly in database.	Pass
hms06	Check whether it is marking attendance only one time even though same student's face is detecting no of detecting no of times.	For student attendance is generating only one time even though same student's face is detecting no of times.	For student attendance is generating only one time even though same student's face is detecting no of times.	Pass
hms07	Check whether students attendance is generating along with time	Attendance is generating along with time	Attendance is generating along with time	Pass

Table 6.1: Test Cases

## **Chapter 7**

# **CONCLUSION & FUTURE ENHANCEMENTS**

### **Conclusion**

In this system we have implemented an attendance system by which a lecturer or faculty can record students' attendance automatically. It saves time and effort, especially if it is a lecture with huge number of students. Automated Attendance System has been envisioned for the purpose of reducing the drawbacks in the traditional (manual) system. This attendance system demonstrates the use of image processing techniques in classroom. This system is not only helpful in taking attendance system, but also improve the goodwill of an institution.

### **Future Enhancements**

The System we proposed here is only used for classroom attendance for students. However, this system can be improved and enhanced in a way that it can also be used in multi-national companies for maintaining the surveillance of a much larger database, filled with huge amount of entries of the employees. This will be able to help in maintaining security and also the company will be able to keep a track on its workers whether they are completing the desired working hours in a day or not.

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# PRO vs PO RELEVANCE

## Project Outcomes:

Outcome No.	Description
PRO1	Identifying the problems by doing a thorough literature survey of the existing research related to detect and recognize face and to generate the attendance automatically.
PRO2	Analyze, design and develop a solution for automatic Attendance System which improves productivity and standards for project management and finance.
PRO3	Develop employability and the ability to work in a team following the best ethical practices with a spirit for life-long learning and sharpening communication and presentation skills for validating .
PRO4	Make use of appropriate tools or techniques for sustainable development of a Automated Attendance.
PRO5	Create interest to research different sources to recognize the student image automatically.
PRO6	Construct a platform that makes users to interact with proposed system.

Table 7.1: Project Outcomes

PRO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PRO1	3	3	2	2	3	0	2	0	3	0	1	2	2	2
PRO2	2	2	3	2	3	1	3	0	2	3	1	2	3	2
PRO3	2	2	2	1	3	2	1	3	0	2	1	1	3	2
Overall Course	2	2	1	2	3	1	2	1	2	3	1	1	3	2

Table 7.2: Summary of Project Outcomes mapping to Program Outcomes Project Phase - 1

PRO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PRO4	2	3	2	1	2	0	1	1	1	3	2	0	3	1
PRO5	2	3	2	2	2	1	1	1	3	2	1	1	3	1
PRO6	2	3	1	2	2	2	2	0	3	3	1	2	3	2
Overall Course	2	3	2	2	2	1	1	1	2	3	1	1	3	1

Table 7.3: Summary of Project Outcomes mapping to Program Outcomes Project Phase - 2

## PROs Relevance TO POs

<b>PRO</b>	<b>PO</b>	<b>PI</b>	<b>Relevance</b>
PRO1	PO1	1.2.2	Apply the concepts of Image processing, Training on database modeling of computer-based system,
	PO2	2.5.1	Ability to identify problem statements and objectives for evaluating subjective
	PO3	3.5.1	Ability to define a precise problem statement with objectives and scope for answer evaluation.
	PO4	4.5.1	Design and develop appropriate procedures methodologies based on the study objectives.
	PO7	7.3.1	Identify risks/impacts in the life-cycle of an engineering process or activity
	PO9	9.4.1	Recognize a variety of working and learning preferences; appreciate the value of team work
	P10	10.4.3	Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
	P12	12.5.2	Read image, Recognize the image in data base vitally important to keep current regarding new developments in your system
PRO2	PO1	1.2.2	Apply the application which detects and recognizes faces automatically.
	PO2	2.7.2	Identify design constraints for required performance criteria applications.
	PO3	3.7.1	Able to perform systematic evaluation of the degree to which several design implemented the image processing.
	PO4	4.4.2	Able to choose haar cascade classifier, image dataset and test cases.
	PO5	5.4.2	Create modify tools and techniques to solve content validating and verifying detecting image processing.
	PO6	6.4.1	To Interpret regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the people for automated attendance.
	PO7	7.3.1	Identify impacts in the automation of implement answer checking on image.
	PO9	9.4.1	Recognize a variety of working and learning preferences of team members.

<b>PRO</b>	<b>PO</b>	<b>PI</b>	<b>Relevance</b>
	PO10	10.4.3	Create flow in a document or presentation-CV of idea so that the main point of the automation.
	PO11	11.6.2	Use project management tools to schedule an engineering project, so it is completed on time and on budget.
	PO12	12.6.2	Analyze sourced technical and popular information for feasibility, viability, sustainability, etc..
PRO3	PO1	1.5.1	Apply implementation work on project and code implementation.
	PO2	2.6.2	Identify functionalities and computing resources like data preprocessing techniques for OpenCV.
	PO3	3.7.2	create a design for prototype to select subjective answer design development.
	PO4	4.6.1	Use appropriate procedures, tools, and techniques to collect and analyze data such as OpenCV.
	PO5	5.6.1	Discuss limitations like only files with .xml extensions are allowed.
	PO6	6.4.1	Interpret OpenCV legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public.
	PO7	7.4.1	Describe Subjective answer verifier management techniques for sustainable development form automation.
	PO8	8.4.1	Identify situations of unethical professional conduct and propose ethical alternatives identified unauthorized person
	PO10	10.5.1	Listen to and comprehend information instructions, and viewpoints of public
	PO11	11.4.1	Analyze different forms of financial statements to evaluate the financial status of an OpenCV project.
	PO12	12.5.2	Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your automation OpenCV lidating
PRO4	PO1	1.6.1	Apply engineering fundamentals for Content Validating and verifying image checking in data base .
	PO2	2.8.1	Applies automation to implement the solution of coding like OpenCV and os .
	PO3	3.8.2	Able to implement OpenCV modules and integrate the modules.

<b>PRO</b>	<b>PO</b>	<b>PI</b>	<b>Relevance</b>
	PO4	4.6.2	Critically analyzed evaluator data testing Automated attendance system in , stating possible errors and limitations.
	PO5	5.5.2	Demonstrate cvvs proficiency in using motor,realy,camera,sd card tools.
	PO7	7.4.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the subjective answer verifier.
	PO8	8.4.2	Examine and application & creating process.
	PO9	9.5.4	Maintain composure in difficult situations like in giving inputs as installing os and OpenCV only.
	PO10	10.5.1	Listen to and comprehend information, instructions, and viewpoints of others in the team of project.
	PO11	11.6.2	Use project management tools to schedule an Automated attendance, so it is completed on time and on budget..
PRO5	PO1	1.2.1	Apply the knowledge of haar cascade classifier similarity to solve problems of smart attendance
	PO2	2.6.1	Reframe the cv computer-based system into interconnected subsystems.
	PO3	3.8.1	Able to refine content by validating and verifying OpenCV system architecture design into a detailed design within the existing constraints
	PO4	4.4.1	Ability to define a problem for purposes of content validating and verifying the OpenCV system, its scope, and importance.
	PO5	5.6.2	Verify the credibility of results from OpenCV Packages use with reference to the accuracy and limitations, and the assumptions in the use of CV.
	PO6	6.4.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public.
	PO7	7.3.1	Reframe the cv computer-vision system into interconnected OpenCV.
	PO8	8.3.1	Identify situations of unethical professional conduct and propose ethical method of mobile remote control.
	PO9	9.4.1	Identify situations of unethical professional conduct and propose ethical alternatives.

<b>PRO</b>	<b>PO</b>	<b>PI</b>	<b>Relevance</b>
	PO10	10.4.3	Create flow in a document or presentation - a logical progression of ideas so that the main point of the Automated attendance.
	PO11	11.5.1	Analyze and select the most appropriate proposal based on economic and financial considerations.
	PO12	12.5.1	Listen to other members of the CV project included.
PRO6	PO1	1.6.1	Apply engineering fundamentals for Content validating and OpenCV system..
	PO2	2.8.2	Analyze and interpret the results using OpenCV tools.
	PO3	3.5.4	Able to choose flask framework quality attributes as defined by IEEE paper reference in application project.
	PO4	4.6.3	Represent grading and test cases data in tabular forms so as to facilitate analysis and explanation of the data, and implementation process haar cascade classifier.
	PO5	5.5.2	Demonstrate CV proficiency in using discipline-specific OpenCV tools.
	PO6	6.3.1	Identify and describe subjective answer correction importance in Automated attendance project
	PO7	7.4.1	Describe management techniques for sustainable development of the OpenCV answer verifier image processing
	PO9	9.4.2	Examine and apply subjective answer correction moral principles to known case studies of system.
	PO10	10.6.1	Presented qualitative grades as a team, with smooth integration of contributions from all individual efforts using CV.
	PO11	11.6.2	Use a variety of media effectively to convey a message in a document or a document or a presentation for content validating and verifying detecting image system.
	PO12	12.4.1	Describe various economic and financial benefits of a subjective institution environment.

Table 7.4: PRO Relevance to PO

## PROs Relevance to PSO

<b>PRO</b>	<b>PSO</b>	<b>Relevance</b>
PRO1	PSO1	Ability to develop objectives of system .
	PSO2	To deploy stoppage of manual activities of the Attendance system
PRO2	PSO1	To deploy solutions for the existing problem for a Automated attendance system using openCV based on face recognition
	PSO2	To analyze existing real-world problems of Automated attendance
PRO3	PSO1	To develop appropriate methods like implementing new series to solve the existing problem.
	PSO2	Ability to apply ethical principles to proposed system.
PRO4	PSO1	To deploy services based on the copied sources in training data.
	PSO2	Ability to develop a System using OpenCV in python language.
RRO5	PSO1	To implement code for developing Automated attendance system using opencv based on face recognition.
PRO6	PSO1	Choosing alternative techniques to work with the OpenCV
	PSO2	Studying about Face recognition techniques that uses OpenCV.

Table 7.5: PRO Relevance to PSO

# APPENDIX 1

```
1 import os
2 import pickle
3 import numpy as np
4 import cv2
5 import face_recognition
6 import cvzone
7 import firebase_admin
8 from firebase_admin import credentials
9 from firebase_admin import db
10 from firebase_admin import storage
11 import numpy as np
12 from datetime import datetime
13 cred = credentials.Certificate("serviceAccountKey.json")
14 firebase_admin.initialize_app(cred, {
15     'databaseURL': "https://smartattendance6876a.firebaseio.com",
16     'storageBucket': "smartattendance6876a.appspot.com"
17 })
18 bucket = storage.bucket()
19 cap = cv2.VideoCapture(0)
20 cap.set(3, 640)
21 cap.set(4, 480)
22 imgBackground = cv2.imread('Resources/background.png')
23 # Importing the mode images into a list
```

```
24 folderModePath = 'Resources/Modes'
25 modePathList = os.listdir(folderModePath)
26 imgModeList = []
27 for path in modePathList:
28     imgModeList.append(cv2.imread(os.path.join(folderModePath, path)))
29 # print(len(imgModeList))
30 # Load the encoding file
31 print('Loading Encode File ...')
32 file = open('EncodeFile.p', 'rb')
33 encodeListKnownWithIds = pickle.load(file)
34 file.close()
35 encodeListKnown, studentIds = encodeListKnownWithIds
36 # print(studentIds)
37 print('Encode File Loaded')
38 modeType = 0
39 counter = 0
40 id = -1
41 imgStudent = []
42 while True:
43     success, img = cap.read()
44     imgS = cv2.resize(img, (0, 0), None, 0.25, 0.25)
45     imgS = cv2.cvtColor(imgS, cv2.COLORBGR2RGB)
46     faceCurFrame = face_recognition.face_locations(imgS)
47     encodeCurFrame = face_recognition.face_encodings(imgS, faceCurFrame)
48     imgBackground[162:162 + 480, 55:55 + 640] = img
49     imgBackground[44:44 + 633, 808:808 + 414] = imgModeList[modeType]
50     if faceCurFrame:
51         for encodeFace, faceLoc in zip(encodeCurFrame, faceCurFrame):
52             matches = face_recognition.compare_faces(encodeListKnown, encodeFace)
53             faceDis = face_recognition.face_distance(encodeListKnown, encodeFace)
```

```

54         # print("matches", matches)
55
56         # print("faceDis", faceDis)
57
58         matchIndex = np.argmin(faceDis)
59
60         # print('Match Index', matchIndex)
61
62         if matches[matchIndex]:
63
64             # print('Known Face Detected')
65
66             # print(studentIds[matchIndex])
67
68             y1, x2, y2, x1 = faceLoc
69
70             y1, x2, y2, x1 = y1 * 4, x2 * 4, y2 * 4, x1 * 4
71
72             bbox = 55 + x1, 162 + y1, x2 - x1, y2 - y1
73
74             imgBackground = cvzone.cornerRect(imgBackground, bbox, rt=0)
75
76             id = studentIds[matchIndex]
77
78             if counter == 0:
79
80                 cvzone.putTextRect(imgBackground, "Loading", (275, 400))
81
82                 cv2.imshow("Face Attendance", imgBackground)
83
84                 cv2.waitKey(1)
85
86             counter = 1
87
88             modeType = 1
89
90             if counter != 0:
91
92                 if counter == 1:
93
94                     # Get the Data
95
96                     studentInfo = db.reference(f'Students/{id}').get()
97
98                     print(studentInfo)
99
100                    # Get the Image from the storage
101
102                    blob = bucket.get_blob(f'Images/{id}.png')
103
104                    array = np.frombuffer(blob.download_as_string(), np.uint8)
105
106                    imgStudent = cv2.imdecode(array, cv2.COLORBGRA2BGR)
107
108                    # Update data of attendance
109
110                    datetimeObject = datetime.strptime(studentInfo['last_attendance_time'],
111
112                                         "%Y-%d-%B %H:%M:%S")

```

```
84         secondsElapsed = (datetime.now() - datetimeObject).total_seconds()
85
86         print(secondsElapsed)
87
88         if secondsElapsed > 60:
89
90             ref = db.reference(f'Students/{id}')
91
92             studentInfo['total_attendance'] += 1
93
94             ref.child('total_attendance').set(studentInfo['total_attendance'])
95
96             ref.child('last_attendance_time').set(datetime.now().strftime("%Y-%m-%d %H:%M:%S"))
97
98         else:
99
100            modeType = 3
101
102            counter = 0
103
104            imgBackground[44:44 + 633, 808:808 + 414] = imgModeList[modeType]
105
106            if modeType != 3:
107
108                if 10 < counter < 20:
109
110                    modeType = 2
111
112                    imgBackground[44:44 + 633, 808:808 + 414] = imgModeList[modeType]
113
114                    if counter <= 10:
115
116                        cv2.putText(imgBackground, str(studentInfo['total_attendance']), (861,
117
118                            125),
119
120                            cv2.FONT_HERSHEY_COMPLEX, 1, (255, 255, 255), 1)
121
122                    cv2.putText(imgBackground, str(studentInfo['Department']), (1006, 550),
123
124                            cv2.FONT_HERSHEY_COMPLEX, 0.5, (255, 255, 255), 1)
125
126                    cv2.putText(imgBackground, str(id), (1006, 493),
127
128                            cv2.FONT_HERSHEY_COMPLEX, 0.5, (255, 255, 255), 1)
129
130                    cv2.putText(imgBackground, str(studentInfo['section']), (910, 625),
131
132                            cv2.FONT_HERSHEY_COMPLEX, 0.6, (100, 100, 100), 1)
133
134                    cv2.putText(imgBackground, str(studentInfo['year']), (1025, 625),
135
136                            cv2.FONT_HERSHEY_COMPLEX, 0.6, (100, 100, 100), 1)
137
138                    cv2.putText(imgBackground, str(studentInfo['starting-year']), (1125, 625),
139
140                            cv2.FONT_HERSHEY_COMPLEX, 0.6, (100, 100, 100), 1)
```

```
112     (w, h), _ = cv2.getTextSize(studentInfo['name'], cv2.FONT_HERSHEY_COMPLEX  
113     , 1, 1)  
114     offset = (414 - w) // 2  
115     cv2.putText(imgBackground, str(studentInfo['name']), (808 + offset, 445),  
116                 cv2.FONT_HERSHEY_COMPLEX, 1, (50, 50, 50), 1)  
117     imgBackground[175:175 + 216, 909:909 + 216] = imgStudent  
118     counter += 1  
119     if counter >= 20:  
120         counter = 0  
121         studentInfo = []  
122         imgStudent = []  
123         imgBackground[44:44 + 633, 808:808 + 414] = imgModeList[modeType]  
124     else:  
125         modeType = 0  
126         counter = 0  
127         # cv2.imshow('Webcam', img)  
128         cv2.imshow('Face Attendance', imgBackground)  
129         cv2.waitKey(1)
```

Listing 7.1: Basic Code for testing

## APPENDIX 2

```
1 import firebase_admin
2 from firebase_admin import credentials
3 from firebase_admin import db
4 cred = credentials.Certificate("serviceAccountKey.json")
5 firebase_admin.initialize_app(cred,{
6     'databaseURL': "https://smartattendance6876a-default.firebaseio.com/"
7 })
8 ref = db.reference('Students')
9 data = {
10     "19K6IA1228":
11         {
12             "name": "Sri lakshmi",
13             "Department": "IT",
14             "starting_year": 2019,
15             "total attendance": 7,
16             "section": "A",
17             "year": 4,
18             "last attendance time": "2023-04-23 12:57:57"
19         },
20     "19K6IA1225":
21         {
22             "name": "Bharath",
23             "Department": "IT",
```

```
24     "starting_year": 2020,  
25     "total_attendance": 12,  
26     "section": "A",  
27     "year": 3,  
28     "last_attendance_time": "2023-04-23 12:57:57"  
29 },  
30 "19K6IA1205":  
31 {  
32     "name": "Keerthi",  
33     "Department": "IT",  
34     "starting_year": 2019,  
35     "total_attendance": 7,  
36     "section": "A",  
37     "year": 4,  
38     "last_attendance_time": "2023-04-23 12:57:57"  
39 },  
40 "19K6IA1204":  
41 {  
42     "name": "Aditya",  
43     "Department": "IT",  
44     "starting_year": 2019,  
45     "total_attendance": 7,  
46     "section": "A",  
47     "year": 4,  
48     "last_attendance_time": "2023-04-23 12:57:57"  
49 },  
50 "19K6IA1206":  
51 {  
52     "name": "pawan",  
53     "Department": "MECH",
```

```
54     "starting year": 2021,  
55     "total attendance": 8,  
56     "section": "B",  
57     "year": 3,  
58     "last attendance time": "2023-04-23 12:57:57"  
59   }  
60 }  
61 for key, value in data.items():  
62     ref.child(key).set(value)
```

Listing 7.2: Add Data to the database

# APPENDIX 3

```
1 import cv2
2 import face_recognition
3 import pickle
4 import os
5 import firebase_admin
6 from firebase_admin import credentials
7 from firebase_admin import db
8 from firebase_admin import storage
9 cred = credentials.Certificate("serviceAccountKey.json")
10 firebase_admin.initialize_app(cred, {
11     'databaseURL': "https://smartattendance6876a-default.firebaseio.com/",
12     'storageBucket': "smartattendance6876a.appspot.com"
13 })
14 # Importing student images
15 folderPath = 'Images'
16 pathList = os.listdir(folderPath)
17 print(pathList)
18 imgList = []
19 studentIds = []
20 for path in pathList:
21     imgList.append(cv2.imread(os.path.join(folderPath, path)))
22     studentIds.append(os.path.splitext(path)[0])
23     fileName = f'{FolderPath}/{path}'
```

```
24     bucket = storage.bucket()
25
26     blob = bucket.blob(fileName)
27
28     blob.upload_from_filename(fileName)
29
30     # print(path)
31
32     # print(os.path.splitext(path)[0])
33
34     print(studentIds)
35
36 def findEncodings(imagesList):
37
38     encodeList = []
39
40     for img in imagesList:
41
42         img = cv2.cvtColor(img, cv2.COLORBGR2RGB)
43
44         encode = face_recognition.face_encodings(img)[0]
45
46         encodeList.append(encode)
47
48     return encodeList
49
50 print('Encoding Started ...')
51
52 encodeListKnown = findEncodings(imgList)
53
54 encodeListKnownWithIds = [encodeListKnown, studentIds]
55
56 print('Encoding Complete')
57
58 file = open('EncodeFile.p', 'wb')
59
60 pickle.dump(encodeListKnownWithIds, file)
61
62 file.close()
63
64 print("File Saved")
```

Listing 7.3: EncodeGenerator.py

## **APPENDIX 4**

**(Literature Survey Publication and Certificates)**

# Automated Attendance System using OPENCV based on Face Recognition

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**Abstract-** One of the key components of the human body that helps to distinguish one individual from another is their face. The face recognition system can be developed using facial features as a biometric. The kids are called out by the teachers in the traditional attendance method, and their presence or absence is noted appropriately. This time-consuming process interferes with the student's ability to learn. The Open CV-based facial recognition approach has been put forth in this project. This system combines a camera that records an input image, a face detection algorithm, encoding and face identification, and marks attendance in a spreadsheet. The faces of the kids are used to train the system. The photographs are kept with the appropriate labels. We will utilise the HOG (Histogram of Oriented Gradients) method and a linear SVM classifier to detect faces.

**Keywords-** HOG, SVM classifier, OpenCV, attendance, face detection, face recognition, camera

## I. INTRODUCTION

A facial recognition system is created in this project to take attendance of students. Research suggests that students' attendance is directly proportional to the effective learning and student retention. Several automated models of attendance are used in schools and universities and they are extensively studied in the literature. One of these methods is utilizing a finger print reading device, which can be either placed in front of the classroom, or hand held. A similar approach is employing an RFID card for taking attendance. These methods present a time issue because only one student can use the equipment employed in each method at once. Another option is applications that employ the Bluetooth communication protocol. In these applications, the Bluetooth connection of the students' mobile devices is either used directly or specialized Bluetooth tags or beacons are used to automatically generate the attendance list. Academic research on computer vision based approaches to attendance taking has gained momentum in the recent years as these methods provide lower time consumption and higher accuracy compared to the conventional counterparts. Utilized to generate the attendance list automatically. As these systems need less time and are more accurate than their conventional counterparts, academic research on computer vision-based approaches to attendance taking has gathered steam in recent years. Students are detected and recognized when they enter the classroom using the images captured by a video camera stationed there, and their names are recorded on the attendance list.

## II.LITERATURE SURVEY

E. Omer Akay, et al [1] The Histogram of Oriented Gradients and Haar-Cascade face identification techniques are used in this research to create and construct an automated attendance taking system. Convolutional neural networks (CNNs) are used in deep learning to identify the students in a classroom.

Python is used to create a graphical user interface (GUI) system.

Mashhood Sajid, et al [2] In this research, they put out a conceptual framework for a facial recognition-based automatic attendance system. The reliability of your model is increased by the usage of an integral validation method in their suggested model. We can quickly identify the student by their face thanks to similarities in their eyes, nose, etc. It has been determined that the issue exists, hence work on a solution should be done in the future.

Shireesha Chintalapati et al [3] To assess the effectiveness of various facial recognition systems, numerous real-world circumstances are taken into account. This essay also suggests some methods for dealing with issues like spoofing. LBPH beats other algorithms in real-world circumstances thanks to its higher recognition rate and lower false positive rate. When compared to distance classifiers, SVM and Bayesian also show to be superior classifiers. The method that has been built can only distinguish differences in face angles up to 30 degrees; it has to be improved. Gait recognition systems can be combined with facial recognition systems to improve system performance.

Elavarasan, Dhivya, et al [4] The techniques for an automated attendance system employing video-based facial recognition are suggested and contrasted in this study. Here, a video serves as the system's input, and an excel file containing the pupils' attendance in the movie serves as its output. Various biometrics techniques can be used to construct an automated attendance system. One of them that doesn't require human involvement is face recognition. In this study, face detection, which distinguishes between faces and non-faces, and face recognition, which locates a match for the detected face

from the face database (a collection of students' names and photographs), are used to track attendance from a video of students in a class. If the match is legitimate, attendance is recorded on an excel sheet. Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA) methods are used to perform and compare face recognition on the basis of recognition accuracy.

Sonal Agarwal et al [5] Although there is frequently a generalized face image accessible, in this research it is suggested that identifying and tracking human faces may be necessary for face recognition or countenance analysis. Research in the domain of computer-based face recognition employing objective facial data as an analysis is still mostly unexplored. This essay explores the idea of face recognition utilizing facial information that isn't entirely full. The experiment relies on the accurate classification and identification of the face using OPENCV (Open Computer Vision) and the Object Oriented Programming Language (OOP). In this work, we'll put a Haar-Classifier for Face Detection and Tracking with Haar characteristics into practice.

Shailendra Narayan Singh et al [6] The suggested automatic attendance system utilizing face recognition is an excellent example of how to record student attendance in a classroom. Additionally, this system aids in reducing the likelihood of proxies and phone attendance. There are many methods that use biometrics that are available in the modern world. However, due to its great accuracy and minimal need for human participation, facial recognition emerges as a potential solution. The system's goal is to offer a high level of security. Therefore, it is necessary to create an extremely effective attendance system for the classroom that can simultaneously recognize many faces. Additionally, no specialized hardware is needed for its implementation. For building the system, a camera, a computer, and database servers are sufficient.

Louis Mothw et al [7] In this paper, a smart model for a facial recognition-based student attendance monitoring system is developed. The presence of students throughout the entire lecture hour is determined via real-time facial recognition combined with frequent updates of the attendance data. This might motivate pupils to show up to class on time and with diligence. The following activity will involve keeping track of students' attendance during the whole module and examining the relationship between attendance and academic success.

Anshun Raghuvanshi et al [8] For feature extraction utilizing Eigen faces and Fisher faces subspace projection and matching with Euclidean distance classifier, a PCA and LDA-based face recognition system was created. According to the observation, PCA and LDA both perform well in the right circumstances, such as: Normal lighting, no position changes, and a distance of 1-3 feet from the camera for the best outcomes. Higher resolution is needed because both use pixel-to-pixel computation. Although there isn't much of a performance difference between PCA and LDA, PCA takes less time than LDA during the recognition step. However, LDA is preferred because to its better rate of recognition. More creative approaches that get

around PCA's shortcomings must be employed to recognize a huge number of people.

Refik Samet et al [9] a face recognition-based mobile attendance management solution that is adaptable and real-time. The development of a filtering method based on Eigenfaces, Fisherfaces, and LBP-derived Euclidean distances. The suggested solution eliminates the need for additional equipment, cuts down on time spent collecting attendance, and gives users access to the information whenever and wherever they choose. The usage of smart devices for tracking student attendance in the classroom is particularly user-friendly. The programme is available in real-time and without any limitations to teachers, students, and parents. High quality, bigger photographs can be sent to the server because internet connection speed has been rising steadily. The server's processor capacity is likewise growing on a daily basis. The proposed system's accuracy rate will rise along with these technical advancements. Other facial recognition methods, such as Support Vector Machine, Hidden Markov Model, Neural Networks, etc., could be used to evaluate face recognition in greater detail. Additionally, once smart devices' processor capacities are sufficiently expanded, detection and recognition operations may be carried out on them.

Risanuri Hidayat et al [10] proposed several methods in terms of overall system capacity, throughput, and accuracy. The result shows that the PCA algorithm is incredibly effective in extensive database. PCA has better performance in the system of attendance management based on facial recognition than manual attendance system that is time-consuming. Convolutional neural network also contributes to attendance management system based on facial recognition by providing strong classifier. The focus in future work is improving the accuracy of the system by incorporating principal component analysis with convolutional neural network. The objective is to obtain good generalization abilities. In [25], ANN and PCA has been integrated to solve a blocking issue of attendance management system based on facial recognition. However, this system still has issues with system performance and accuracy in recognizing human face. Future work will use fast PCA with back-propagation to resolve this problem.

Risanuri Hidayat et al [10] proposed several methods in terms of overall system capacity, throughput, and accuracy. The result shows that the PCA algorithm is incredibly effective in extensive database. PCA has better performance in the system of attendance management based on facial recognition than manual attendance system that is time-consuming. By offering a powerful classifier, convolutional neural networks also support facial recognition-based attendance management systems. Future research will concentrate on enhancing the system's accuracy by combining principal component analysis with convolutional neural network. The goal is to develop strong generalisation skills. [25] integrates ANN and PCA to address the blockage problem of a facial recognition-based attendance management system. This technology still struggles with system performance and human face recognition accuracy, though. Future research will

overcome this issue using rapid PCA with back-propagation.

Priyanka Wagh et al [11] In this paper the smart and automated attendance system for managing the attendance can be implemented using the various ways of biometrics we come to know that, there are various techniques and algorithms which are used for face recognition. In the recent ten years, a lot of algorithms are developed for face recognition. The AdaBoost Algorithm is the most efficient algorithm for multiple face recognition.

Samridhi Dev et al [12] The process of identifying students using a face biostatistics system based on high definition monitoring and other computer technologies is called a face recognition attendance system. The suggested system uses generative adversarial networks, SVM, KNN, CNN, Haar classifiers, and Gabor filter. The SIFT algorithm is used in the creation of the face recognition system. MATLAB will be used by this system to take attendance. After the image has been taken and compared with the database, an SMS will be delivered to the designated number. The scientists have used two databases, the first for storing student faces and the second for storing student data, to leverage these skin pixels for face detection.

Andras Anderla et al [13] This model is made up of several crucial components that were created utilising the most cutting-edge methods available right now, including CNN cascade for face detection and CNN for creating face embeddings. It is suggested to use a novel method of picture augmentation for face recognition tasks. On a limited dataset of the original face photos of employees working in a real-time setting, the Principle Component Analysis (PCA) approach was applied to recognise the employees' faces and achieve a 68% accuracy rate. The overall accuracy was 95.02%. The use of these methods is justified by the fact that an ordinary IP camera would be used to monitor the staff at the entry to the business. Poor network traffic or other technical issues could potentially introduce noise to the data and the associated production costs. The algorithms used are CNN, ANN.

Jia Uddin et al [14] Smart Attendance System maintains the accurate records of each registered student and substantially reduces the time-consuming, traditional task. The components of this intelligent system include Image Processing, OpenCV, Facial Recognition, RFID Tags, RFID Readers, Arduino Project, IR Module, Class Attendance, and Smart Classroom. Additionally, it keeps the information of every student registered for a specific course in the attendance log and provides necessary information according to the need. The automated classroom system based on GSM is another project that we learned about while conducting our investigation. Before, an RFID-based classroom system employing a Raspberry Pi and an ATmega32 development kit was suggested.

Divya Pandey et al [15] Smart Attendance with Real-Time Face Recognition is a practical method for managing the student attendance system on a daily basis. The student's attendance system can be maintained in one of two ways:

- Manual Attendance System (MAS)
- Automated Attendance System (AAS).

Face detection and identification systems can reduce manual labour required from humans and improve security by taking decisions based on the results of image capture from a camera or cc camera.

Khem Puthea et al [16] It is difficult to provide an accurate real-time attendance marking system in this article. In a large classroom with plenty of students present, it can be challenging to record each student's attendance. In recent study, numerous attendance management systems have been used. However, there are still problems with the facial recognition-based attendance management system. Thus, numerous studies have been carried out to enhance the system. This study examined earlier research on facial recognition-based attendance management systems. This page contains a comprehensive examination of Principal Component Analysis, discussion, and recommendations for future research in addition to a review of the literature on earlier or comparable work.

Shubhobrata Bhattacharya et al [17] Students' frequent attendance in class is crucial for performance evaluation and quality control in the current educational system. Calling names or signing documents are the traditional procedures used in the majority of institutions, both of which are time-consuming and unsafe. The automatic attendance management system is discussed in this article for convenience or data accuracy. The system is created by combining widely available parts to create a portable gadget for managing the attendance of the pupils using face recognition technology.

Keerthana Sanath et al [18] This essay discusses the significance of effective attendance management in the business sector. It is crucial to identify the primary symptom, a high temperature, at the entry-level because a disease like covid-19 can be extremely contagious in crowded public spaces. This study suggests a mechanism that records an employee's attendance using RFID, facial recognition, and a temperature check. Additionally, it records the employee's expression to capture their emotions. At the entrance, the temperature is first checked, and if it is high, an alert message is sent to the appropriate authorities. The person with a normal temperature, on the other hand, will go through a two-tier security check using RFID and face recognition. As a result, the employee's attendance will be graded according to the outcomes of the aforementioned procedural steps.

Shervin EMAMI et al [19] the ten-year increase in interest in computer vision. Face detection and recognition has evolved from a niche to a well-liked area of research in computer vision, and one of the better and effective uses of picture analysis and algorithm based comprehension, driven by the consistent doubling rate of processing power every 13 months. Computer vision is not only a computer science field of study due to the inherent nature of the problem, but it is also the focus of

neuroscientific and psychological research. This is largely due to the widespread belief that advancements in computer image processing and understanding research will provide insights into how our brains function and vice versa. The author has offered to develop an application that would grant user access to a certain machine based on an in-depth analysis of a person's facial features out of general curiosity and interest in the subject. The .NET framework from Microsoft and the OpenCV open source computer vision project from Intel will be used to create this application.

Tejashree Dhawle1 et al [20] , The method described in this study for detecting and identifying human faces with Python and OpenCV, both of which are used in deep learning, is great. This study describes how deep learning,a significant area of computer science, may be utilised to identify faces utilising many OpenCV packages and Python. This paper will include a suggested method that will assist in real-time face detection. This solution works with many different hardware platforms, including computers, smartphones, and software programs.

### III.ARCHITECTURE OF AUTOMATED ATTENDANCE PROCESS

The majority of the publications in our survey used OpenCV algorithms to automatically mark the students' attendance. This section illustrates the model's methodical design and describes many steps in the procedure. This architectural diagram is solely intended for conceptual use.

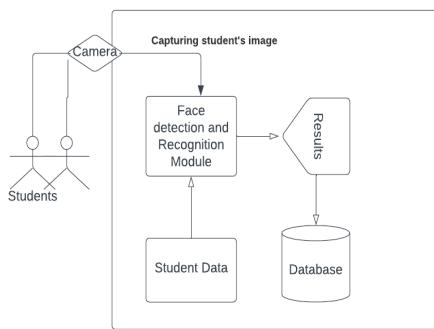


Fig: Architecture diagram

To do this, we will first build folders for each student in the database, clearly stating their information and including images of the students. Once the student is in front of the camera, the camera recognizes their faces and compares them to student faces that have previously been saved in the database. The student is automatically tagged as present if the image of the student matches the image in the database.

### IV.METHODOLOGY

#### A. Techniques involved in existing systems:

##### *COMPUTER VISION:*

Computer vision is a process by which we can understand

the images and videos how they are stored and how we can manipulate and retrieve data from them. Computer Vision is the base or mostly used for Artificial Intelligence. Computer-Vision is playing a major role in self-driving cars, robotics as well as in photo correction apps.

##### *OPEN CV:*

OpenCV is a sizable open-source library for image processing, machine learning, and computer vision. It now plays a significant part in real-time operation, which is crucial in modern systems. Using it, one may analyze pictures and movies to find faces, objects, and even human handwriting.

##### *HISTOGRAM OF ORIENTED GRADIENTS:*

HOG, or Histogram of Oriented Gradients, is a feature descriptor similar to the Scale Invariant Feature Transform (SIFT) Canny Edge Detector. For the goal of object detection, it is employed in computer vision and image processing.

##### *SUPPOURT VECTOR MACHINE:*

One of the most well-liked supervised learning techniques, Support Vector Machine (SVM), is used to solve Classification and Regression problems. However, it is largely employed in Machine Learning Classification issues. The major goal of this work is to create a face recognition system based on computer vision for automated attendance taking. Both conventional and machine learning computer vision techniques are used for the face recognition classifier.

#### B. Face Recognition process using SVM and HOG

Using Support Vector Machines (SVM) and Histogram of Oriented Gradients (HOG), face identification is a popular method in computer vision for recognizing people by their facial features. Here is a general description of what happens:

- The system records pictures or videos of the people.
- To identify the face region and extract pertinent information, the photos are first processed.
- In order to represent the features in a histogram, the HOG technique is utilised to extract the local gradient data from the face region.
- The SVM classifier is then given the extracted HOG features once it has been trained on a labeled dataset of recognized faces. The SVM classifier divides the various classes (faces) in the feature space by generating a decision boundary based on the features.
- Using the HOG properties of an unknown face, the SVM classifier may then be used to predict the class (face) of the face.
- Once the person is recognized, their attendance can be noted and kept on file.

V.COMPARISON TABLE

Title	Year of published	Description	Algorithms Used	Results
Smart Attendance System Using Face Recognition	2021	Traditional methods are laborious and time-consuming. The Open CV-based facial recognition approach has been put forth in this project.	LBPH (Local Binary Pattern Histogram)	A time and effort-saving system was implemented by the author. This attendance system serves as an example of how image processing methods are applied in the classroom. No mention is made about accuracy.
RFID and Face Recognition based Smart Attendance System	2021	It is crucial to identify the primary symptom, high temperature at the entry-level, as diseases like COVID-19 can be extremely communicable in crowded public spaces. This study suggests a mechanism that records an employee's attendance using RFID, facial recognition, and a temperature check.	RFID(Radio-frequency identification ), VGG19 ,VGG16 MobileNet , Resnet101 , Dense net, Xception ,Inception_v3 25.0 Resnet50 24.6	VGG19 96.916 VGG16 95.5 Mobile Net 74.25 Resnet101 34.0 Dense net 27.5 Xception 25.9 Inception_v3 25.0 Resnet50 24.6.
Automated Student Attendance System Using Face Recognition	2020	HOG and Haar-Cascade algorithms are used to create and implement an automatic attendance taking system..	CNN, HOG, SVM, Haar-Cascade.	According to the results, it can be seen that the HOG algorithm offers more accuracy in a variety of lighting situations. Deep learning based on convolutional neural networks (CNNs) and SVM classifier is used for face identification.
Student Attendance System using Face Recognition	2020	The creation of this system aims to digitally replace the outdated method of taking attendance by calling names and keeping handwritten records. The methods used today to take attendance are cumbersome and time-consuming. Manual recording allows for simple manipulation of the attendance records.	KNN, SVM, VIOLA-JONES, HAAR classifiers, CNN.	Three algorithms—K-nearest neighbour, convolutional neural networks, and support vector machines—have been used for face recognition, and the KNN approach has proven to be the most accurate, with a 99.27% accuracy rate. Low computational complexity was demonstrated for convolutional neural networks. The SVM algorithm was shown to be less effective.
Real-Time Smart Attendance System using Face Recognition Techniques	2019	This paper suggests a concept for using face recognition technology to construct an automated attendance management system for students in a class.	Eigen face values, Principle Component Analysis (PCA) and	The system's goal is to offer a high level of security. Therefore, it is necessary to create an extremely effective attendance system for the classroom that can

		<p>By comparing identified faces to the database of student faces, it should be possible to discover connections between them. This model will be an effective method for keeping track of students' attendance and records.</p>	Convolutional Neural Network (CNN)	<p>simultaneously recognise many faces. To build a smart attendance system, just add a camera, a computer, and database servers.</p>
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## VI.CONCLUSION

We have implemented an attendance system which automatically allows a lecturer or faculty member to record the attendance of students. It saves time and effort, especially if there are a lot of students in the lecture. The goal of the automated attendance system is to minimise the shortcomings of the conventional (manual) approach. The application of image processing techniques in the classroom is demonstrated through this attendance system. This technique not only helps with keeping track of attendance but also enhances an institution's reputation.

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