

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
JNANASANGAMA, BELAGAVI - 590018



A Project Based Learning
(23MCS216)
on

Face Attendance and Face Recognition System

Submitted in partial fulfillment for the award of degree of

**Masters of Technology
in
COMPUTER SCIENCE AND ENGINEERING**

Submitted by
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Department of Computer Science and Engineering

2023 – 2024

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



CERTIFICATE

Certified that the project work entitled “Face Attendance and Face Recognition System” carried out by **Ms. Swapnali Vijay Gawade (USN:1BG23SCS07)**, are bonafide student of I Semester, BNM Institute of Technology in partial fulfillment for the award of Masters of Technology in COMPUTER SCIENCE AND ENGINEERING of Visvesvaraya Technological University, Belagavi during the year 2023-24. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The Project-based learning report of Digital Image Processing and Computer Vision Subject has been approved as it satisfies the academic requirements in respect of project work.

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ABSTRACT

Face recognition is among the most productive image-processing applications and has a pivotal role in the technical field. Recognition of the human face is an active issue for authentication purposes specifically in the context of attendance of students and staff. An attendance system using face recognition is a procedure of recognizing students by using face biostatistics based on high-definition monitoring and other computer technologies. The development of this system is aimed to accomplish digitization of the traditional system of taking attendance by calling names and maintaining pen-paper records. Present strategies for taking attendance are tedious and time consuming. Attendance records can be easily manipulated by manual recording. The traditional process of making attendance and present biometric systems are vulnerable to proxies.

The main implementation steps used in this type of system are face detection and recognizing the detected face. The proposed automated attendance system using face recognition is a great model for marking the attendance of students in a classroom and for the staff. This system also assists in overcoming the chances of proxies and fake attendance. In the modern world, a large number of systems using biometrics are available. However, facial recognition turns out to be a viable option because of its high accuracy along with minimum human intervention. This system is aimed at providing a significant level of security.

Hence, a highly proficient attendance system for classroom attendance needs to be developed which can perform recognition on multiple faces at one instance. Also, there is no requirement for any special hardware for its implementation.

Keywords— Facial recognition, attendance management system, Convolutional Neural Network, Principle Component Analysis

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Attendance is prime important for both the teacher and student of an educational organization. So it is important to keep record of the attendance. The problem arises when we think about traditional process of taking attendance in classroom, which is not only time consumption but only also needs energy.

There are some automatic attendances making system which are currently used by much institution. One such system is biometric technique. Although it is automatic and step ahead of traditional method it fails to meet the tome constraint. The student has to wait in queue for giving attendance which is time consuming. This project introduces an involuntary attendance marking system, which avoids any kind of interference with normal teaching procedure.

AIM: To develop a real-time attendance system that overcomes the shortcomings of previous methods and to give the best solution. This project is divided into two parts:

- 1) Data: collection
- 2) Data analysis.

Generally, in the classroom attendance was taken by the teachers manually at the beginning and end of the class. The problem with this approach is that it requires some time to take and also the manual process will have chances to make mistakes in most cases. To overcome that problem, RFID (Radio Frequency Identification) was introduced in the past years. But those are also having the faith proof of attendance system.

So, we are introducing the concept of a Face Recognition based Attendance system, the main objective of the proposed system is to allow attendance to the students using face recognition-based algorithms to achieve a failproof attendance system. Face detection is used for many applications for the identification of human faces in digital images or video. It is defined as a specific case of object-class detection; where it is used to find the locations and sizes of all objects in an image that belongs to a given class. The technology is can be able to predict frontal or near-frontal faces in a photo, regardless of orientation, lighting conditions or skin colour. Face Recognition is a form of biometric software that maps an individual's facial features mathematically and stores the data as a face print.

1.2 MOTIVATION

The Aim of this project is to develop face recognition attendance system.

Expected achievements in order to fulfill the objectives are:

- To detect the face segment from the video frame.
- To extract the useful features from the face detected.
- To classify the features in order to recognize the face detected.
- To record the attendance of the identified student

1.3 PROBLEM STATEMENT

Traditional student attendance marking technique is often facing a lot of trouble. The face recognition student attendance system emphasizes its simplicity by eliminating classical student attendance marking technique such as 5 calling student names or checking respective identification cards. There are not only disturbing the teaching process but also causes distraction for students during exam sessions. Apart from calling names, attendance sheet is passed around the classroom during the lecture sessions. The lecture class especially the class with a large number of students might find it difficult to have the attendance sheet being passed around the class.

Thus, face recognition attendance system is proposed in order to replace the manual signing of the presence of students which are burdensome and causes students get distracted in order to sign for their attendance.

Furthermore, the face recognition based automated student attendance system able to overcome the problem of fraudulent approach and lecturers does not have to count the number of students several times to ensure the presence of the students.

1.4 EXISTING SYSTEM

Face recognition automatically identifies and confirms a person and records attendance based on their face detection. Using facial recognition technology, the attendance of students can be taken in a simple & efficient user-friendly manner with no time consumption compared to conventional method.

Authentication is an important feature of face recognition. Common difficulties such as student proxies and students being tagged present despite not being physically present are major concerns.

At the core of face recognition and attendance systems is the field of digital image processing. This discipline involves the mathematical manipulation and analysis of digital images to extract meaningful information and insights. Key topics covered in existing projects include image acquisition, image enhancement, image segmentation, and feature extraction.

The core of a face recognition system is the ability to accurately match an input face image or video frame against a database of known individuals. This can be achieved through various techniques, including template matching, eigenfaces, fisher faces, and deep learning-based approaches like convolutional neural networks (CNNs) and recurrent neural networks (RNNs).

Each of these face recognition techniques has its own advantages and trade-offs in terms of accuracy, computational complexity, and robustness to variations in lighting, pose, and facial expressions. The selection of the appropriate face recognition algorithm often depends on the specific requirements and constraints of the target application, such as the size of the target population, the need for real-time performance, and the available computing resources.

1.4 OBJECTIVES

The objective of a face attendance and face recognition project using image processing typically revolves around automating the attendance tracking process in various settings such as schools, offices, or any other organization.

Here's a breakdown of the objectives:

- **Automated Attendance Tracking:** The primary objective is to automate the process of taking attendance. Instead of manual methods like calling out names or using attendance sheets, the system uses facial recognition to identify individuals and mark their attendance.
- **Accuracy and Efficiency:** The system aims to improve accuracy and efficiency compared to manual methods. Facial recognition technology can quickly and accurately identify individuals, reducing the chances of errors or fraud.

- **Real-time Monitoring:** The system may offer real-time monitoring capabilities, allowing administrators to track attendance as it happens. This can provide insights into attendance patterns and trends.
- **Security:** Face recognition adds a layer of security by ensuring that only authorized individuals can mark their attendance. This can help prevent instances of proxy attendance or unauthorized access.
- **Integration with Existing Systems:** Depending on the project requirements, the system may need to integrate with existing attendance management systems or databases to store attendance records securely.
- **User-Friendly Interface:** The project should have a user-friendly interface for both administrators and users. Administrators should be able to easily manage the system, while users should find it convenient to mark their attendance.
- **Scalability:** The system should be scalable to accommodate varying numbers of users and locations. Whether it's a small classroom or a large office building, the system should be able to handle the workload effectively.
- **Privacy Considerations:** Given the sensitive nature of biometric data like facial images, the project should incorporate privacy measures to ensure that individuals' privacy rights are respected. This may include data encryption, access controls, and compliance with relevant regulations such as GDPR.
- **Adaptability to Different Environments:** The system should be adaptable to different environments and lighting conditions to ensure reliable performance across various settings.

CHAPTER 2

LITERATURE SURVEY

2.1 "Automated Attendance Management Using Hybrid Approach in Image Processing" by Arun Saharan, Munish Mehta, Piyush Makwana, and Sanju Gautam sounds like an academic paper that discusses a novel approach to automated attendance management leveraging a hybrid technique within image processing.

The paper likely explores the development and implementation of an attendance management system that combines multiple methods or algorithms within image processing. This hybrid approach could involve techniques such as face recognition, object detection, or other image processing methods to accurately identify and track individuals for attendance purposes.

Key components of the paper may include:

1. Hybrid Approach Description: The authors would likely describe the combination of different image processing techniques used in their attendance management system. They may explain how each method contributes to improving accuracy and reliability.

2. System Architecture: The paper would probably outline the overall architecture of the automated attendance management system, detailing the hardware and software components involved. This could include the cameras or sensors used for capturing images, as well as the algorithms and processing pipelines implemented for attendance tracking.

3. Algorithmic Details: The authors might provide insights into the specific image processing algorithms employed in their hybrid approach. This could involve explanations of face recognition algorithms, object detection methods, or any other techniques utilized for identifying individuals in images.

4. Performance Evaluation: The paper likely includes a section on the performance evaluation of the proposed system. This could involve testing the accuracy, efficiency, and robustness of the attendance management system under various conditions, such as different lighting environments, varying poses, or occlusions.

5. Comparison with Existing Methods: The authors may compare their hybrid approach with existing methods of automated attendance management, highlighting the advantages and limitations of their system compared to others in the literature.

Overall, this paper likely presents a comprehensive study on the development and implementation of an

automated attendance management system using a hybrid approach in image processing, contributing to advancements in the field of biometric-based attendance tracking.

2.2 “Automatic Attendance Monitoring System Using Image processing leveraging a hybrid technique within image processing”.

Authors: P.Vilash , V. Praveen Kumar , K. Srinivas Reddy , N. Sai Kalyan ,Mrs Soppari Kavitha.

The paper likely explores the development and implementation of an attendance management system that combines multiple methods or algorithms within image processing. This hybrid approach could involve techniques such as face recognition, object detection, or other image processing methods to accurately identify and track individuals for attendance purposes.

Key components of the paper may include:

1. **Hybrid Approach Description:** The authors would likely describe the combination of different image processing techniques used in their attendance management system. They may explain how each method contributes to improving accuracy and reliability.
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Overall, this paper likely presents a comprehensive study on the development and implementation of an automated attendance management system using a hybrid approach in image processing, contributing to advancements in the field of biometric-based attendance tracking.

2.3 "Real-Time Student Attendance System Based on Face Recognition" by S. S. Manikandan, R. R. Subhashree, and S. Venkatesan (2018) - This paper presents a real-time student attendance system using face recognition technology.

"Real-Time Student Attendance System Based on Face Recognition" by S. S. Manikandan, R. R. Subhashree, and S. Venkatesan is likely an academic paper that introduces a system for monitoring student attendance in real-time using face recognition technology.

Here's a breakdown of what the paper may cover:

- 1.Introduction: The paper would likely start with an introduction that discusses the importance of attendance monitoring in educational institutions and the limitations of traditional methods. It would also introduce the concept of using face recognition technology for this purpose.

- 2.Methodology: The authors would describe the methodology employed in their system, focusing on the face recognition algorithms and techniques used. This might include details about preprocessing steps, feature extraction methods, and classification algorithms.

- 3.System Architecture: The paper would likely present the architecture of the real-time student attendance system, including hardware components (such as cameras) and software components (including the face recognition algorithm and database).

- 4.Implementation: The authors would discuss the implementation details of the system, including how images are captured, processed, and compared against a database of student faces to determine attendance.

5. Performance Evaluation: The paper would include an evaluation of the system's performance, including metrics such as accuracy, speed, and reliability. This could involve testing the system in a real-world educational setting or using simulated data.

Discussion: The authors would likely discuss the advantages and limitations of the proposed system, as well as potential areas for improvement or future research.

Overall, this paper would contribute to the literature on attendance monitoring systems in educational institutions and demonstrate the feasibility of using face recognition technology for real-time student attendance tracking.

2.4 “An Automatic Attendance System Using Image processing” Aziza Ahmedi , Dr Suvarna Nandya

An automatic attendance system using image processing is a fascinating application of computer vision technology. Essentially, it involves using cameras to capture images of individuals, then employing image processing algorithms to detect and recognize faces, and finally

using this information to mark attendance.

Here's a simplified overview of how such a system might work:

1. Image Capture: Cameras are placed in strategic locations where individuals are expected to pass through, such as entry points to classrooms or office buildings.

2. Face Detection: The system first detects any faces present in the captured images. This step often involves algorithms like Haar cascades or deep learning-based approaches such as Convolutional Neural Networks (CNNs).

3. Face Recognition: Once faces are detected, the system compares them to a database of known faces. This could be achieved through techniques like eigenfaces, Fisherfaces, or more modern approaches like deep learning-based face recognition models (e.g., FaceNet or VGGFace).

4. Attendance Marking: If a recognized face matches a known face in the database, the system marks the

individual as present. This information can then be stored in a database for later retrieval and analysis.

5.Integration with Student/Employee Records: For a more comprehensive attendance system, the recognized faces can be linked to student or employee records, allowing for easy tracking of attendance history.

6.Real-time Monitoring and Alerts: Optionally, the system can provide real-time monitoring and alerts for attendance irregularities, such as a student arriving late or leaving early.

CHAPTER 3

MODEL IMPLEMENTATION

3.1 TECHNICAL SPECIFICATIONS

Python: Python is a computer programming language often used to build websites and software, automate tasks, and conduct data analysis. Python is a general-purpose language, meaning it can be used to create a variety of different programs and isn't specialized for any specific problems. This versatility, along with its beginner friendliness, has made it one of the most-used programming languages today.

What can you do with python?

- Data analysis and machine learning
- Web development
- Automation or scripting
- Software testing and prototyping

Performing the face recognition: In this step, the algorithm is already trained. Each histogram created is used to represent each image from the training dataset. So, given an input image, we perform the steps again for this new image and create a histogram which represents the image. So, to find the image that matches the input image we just need to compare two histograms and return the image with the closest histogram. We can use various approaches to compare the histograms (calculate the distance between two histograms), for example: Euclidean distance, chi- square, absolute value, etc. So the algorithm output is the ID from the image with the closest histogram. The algorithm should also return the calculated distance, which can be used as a 'confidence' measurement. We can then use a threshold and the 'confidence' to automatically estimate if the algorithm has correctly recognized the image. We can assume that the algorithm has successfully recognized if the confidence is lower than the threshold defined

Software Requirements

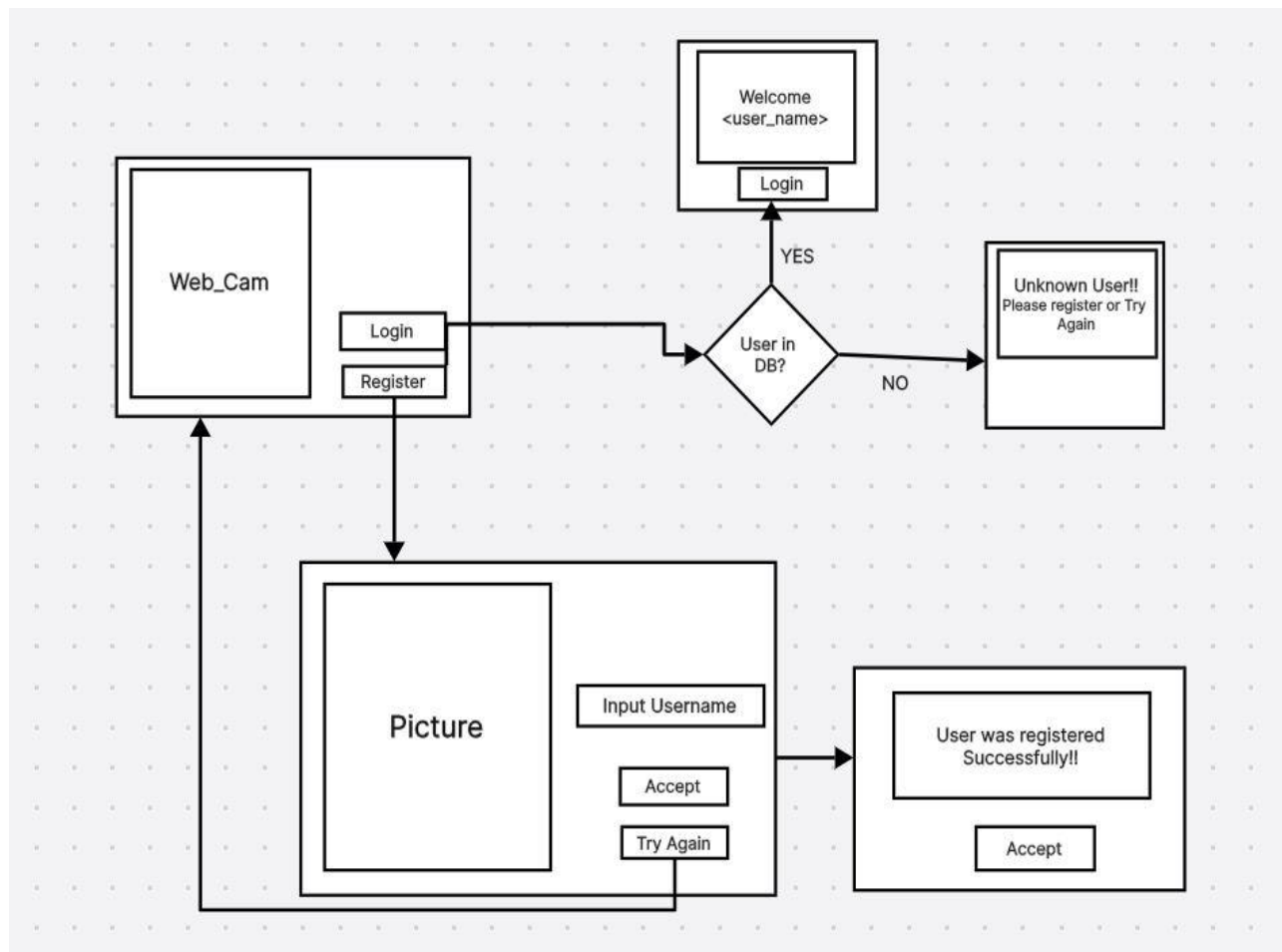
- a. Python IDE: There are lots of IDE's for python. Some of them are PyCharm, Ninja, Spyder and many more. You can install through "command prompt by(pip install python) latest version is installed
- b. OpenCV: OpenCV library is the dependency library of Python. It is used to process images & videos to identify objects, faces and even handwritings of humans
- c. face-recognition: Face Recognition library recognize and manipulate faces from Python or from command line.

- d. dlib: dlib is C++ toolkit, used for automatic color space conversion between various pixel types.

3.2 PROPOSED SYSTEM

The facial recognition student attendance system emphasizes its simplicity by eliminating standard attendance marking approaches such as calling students' names or checking their ID cards. As a result, it is proposed that a facial recognition-based attendance system be used to replace manual attendance marking.

Furthermore, the facial recognition-based automatic attendance system is capable of overcoming the problems associated with fraudulent methods, and faculty members do not need to count the number of students many times to confirm their presence. The provided framework makes use of the OpenCV library.



Fig(3.2)Implementation of Proposed System

It's a free Open-Source Computer Vision Library that's suitable for both academic and commercial use. It runs on a number of operating systems, including Windows, Linux, and MacOS, and has Python and PyQt interfaces. It emphasizes the importance of reality from a command line or a Python script.

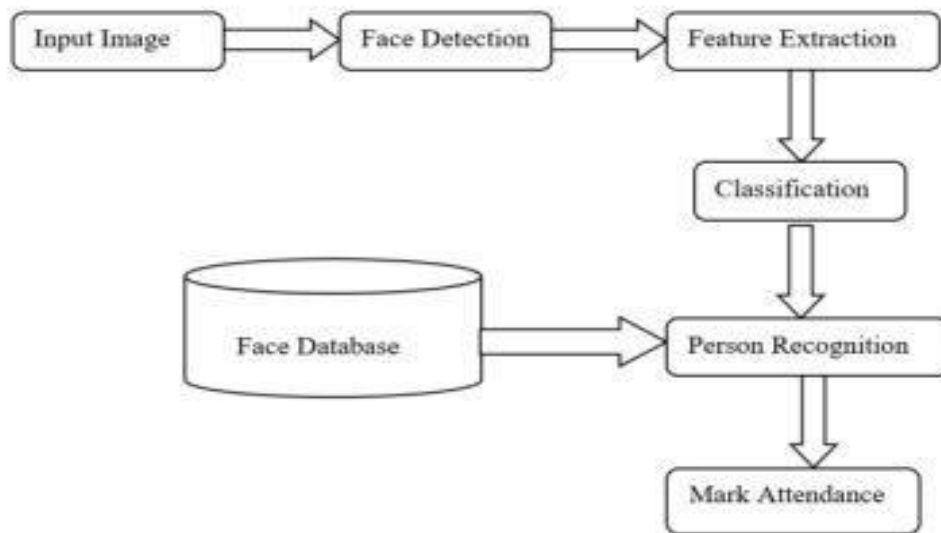
It's a straightforward library built using deep learning and dlib's cutting-edge facial recognition technology. The Dlib is an open-source cross-platform software library that operates on a range of platforms. This is a simple command-line face recognition application that may be used to recognize faces in a folder of images.

CHAPTER 4

METHODOLOGY

4.1 METHODOLOGY

Aim is to develop Real time attendance system that overcomes the issues occurred in existing system. The major issue comes with Authentication of a person. To overcome this, we are using "Spoofing detection". Spoofing is the act of detecting facial image falsification, Such as facial image spoofing. Spoofing occurs when someone try to pretend as registered user to obtain illegal attendance and gain advantage from protected system (Visual Proxy).



Fig(4.1) Block Diagram of the system

Input Image:

In the first step, the database will be generated at the time of enrollment students. The database consists of information about students such as name, roll num, course, semester. Simultaneously, image is captured by system for training of proposed system.

Face Detection:

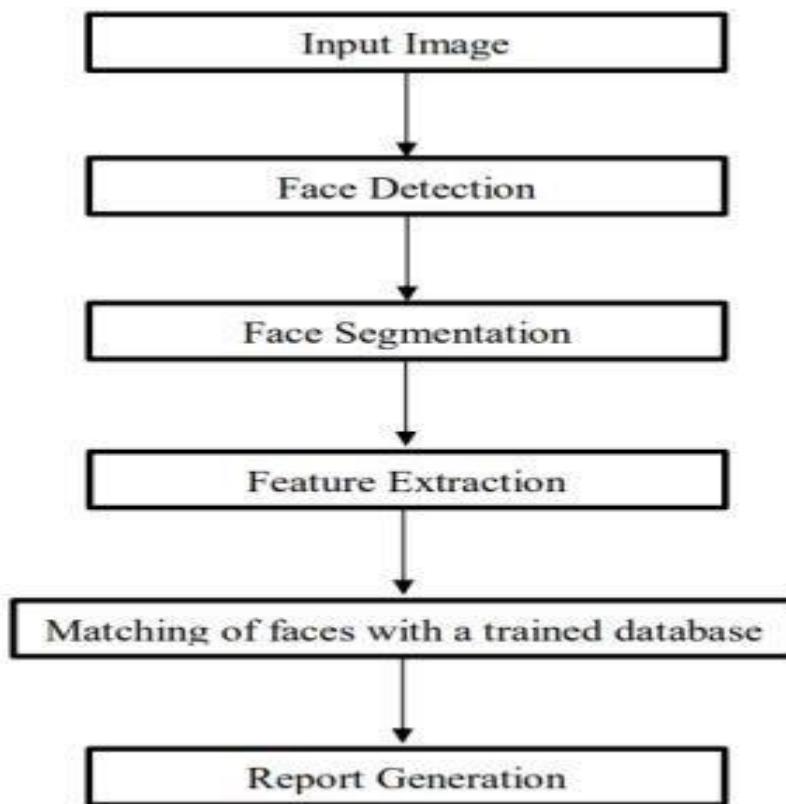
Once the image is detected by the system. The image is classified into pixel which consist of two-dimensional array arranged in rows and columns.

Feature Extraction & Classification:

After detecting image, image can blur or might consist of noise. The goal of digital image processing is to enhance the quality of images, extract meaningful information and automate image-based tasks. This can be done by using image processing algorithms such as Edge detections etc.

Person Recognition & Mark Attendance:

By using object detection algorithms, the person is identified and marked present and stored in the database



Fig(4.1) Flow Chart of the System

CHAPTER 5

TESTING

5.1 TESTING

Testing is a critical phase in the software development lifecycle (SDLC) that involves evaluating a system or its components to determine whether they meet specified requirements and to identify any defects.

The primary goal of testing is to ensure the quality, performance, and reliability of the software product. It is a vital part of the software development process, aimed at ensuring the software product is of high quality, meets user requirements, and is free of defects.

By systematically planning, designing, executing, and reviewing tests, organizations can deliver reliable, efficient, and secure software products that provide a good user experience and meet business objectives.

5.2 TEST CASES

Test Case 1:	Test Information
Name of Test	Capturing Candidate Image
Items being tested	Test for different captured images
Sample Input	Capture static candidate image
Expected output	Visualize Image on User-Interface
Actual output	Successfully Image is displayed
Remarks	Test Case → Pass.

Table 1: Test case for Live capturing of candidate images

Test Case 2:	Test Information
Name of Test	Display captured image details
Items being tested	Test for captured image and database image
Sample Input	Captured image
Expected output	Retrieve details of candidate
Actual output	Successfully display the details of candidate along with candidate image
Remarks	Test Case → Pass.

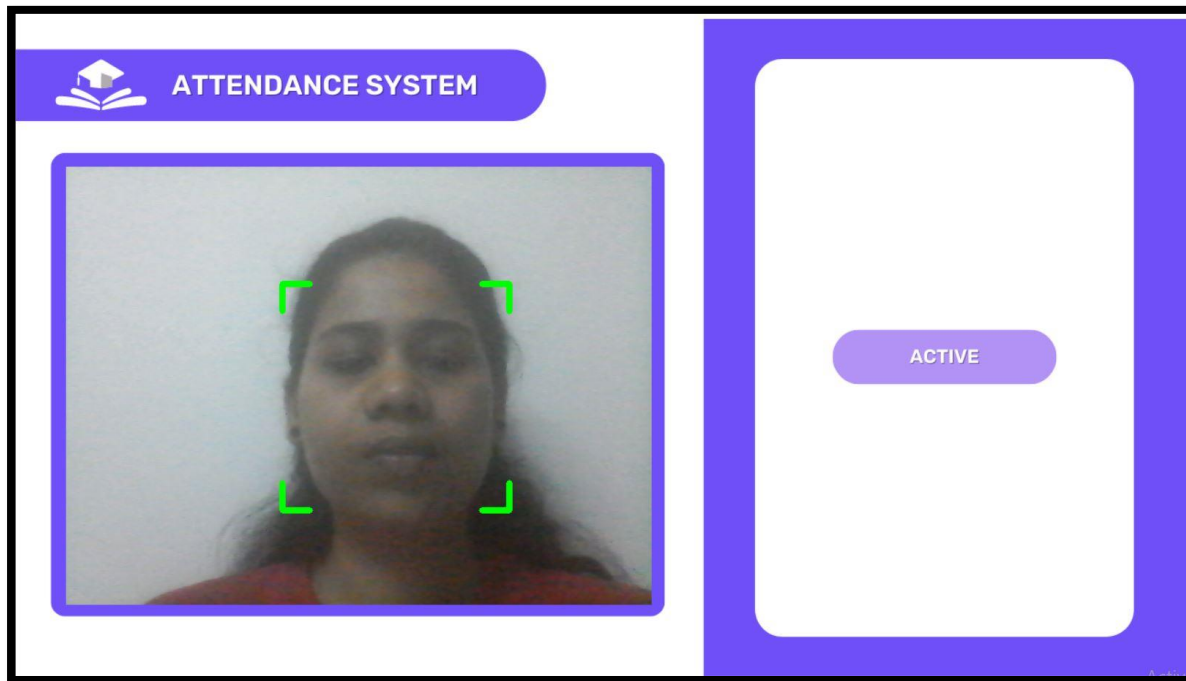
Table 2: Test case for retrieving Captured Candidate image details

Test Case 3:	Information
Name of Test	Attendance monitoring
Items being tested	Analyze the details of image captured and mark attendance in cloud-based database
Sample Input	Candidate image captured and details
Expected output	Mark attendance in firebase database (Absent or Present)
Actual output	Attendance updated successfully
Remarks	Test Case → Pass.

Table 3: Test case for Attendance Marking

CHAPTER 6

RESULTS AND DISCUSSIONS

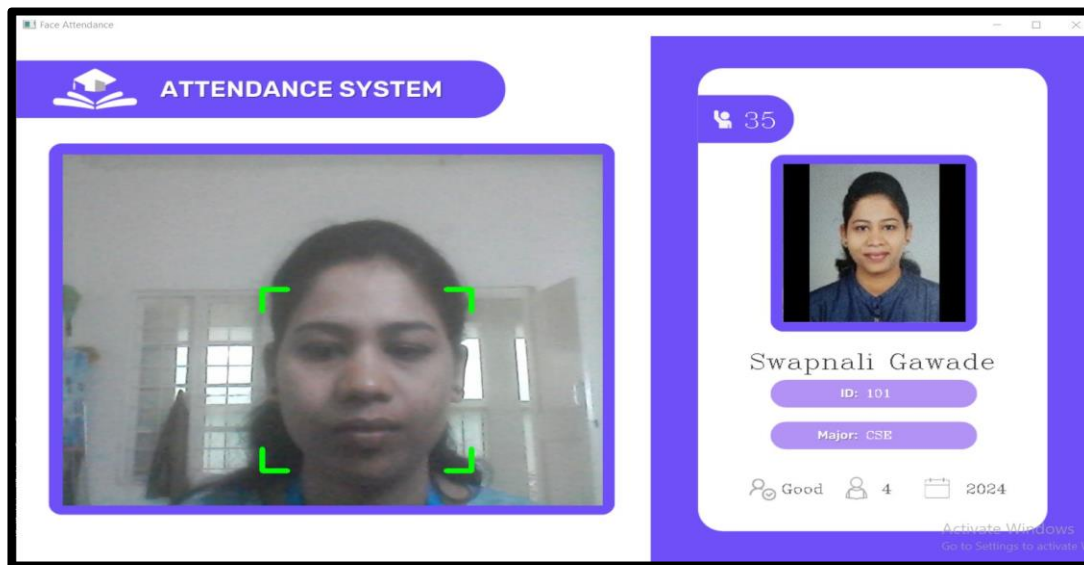


Fig(6.1) Image 1—Capturing instances of the image

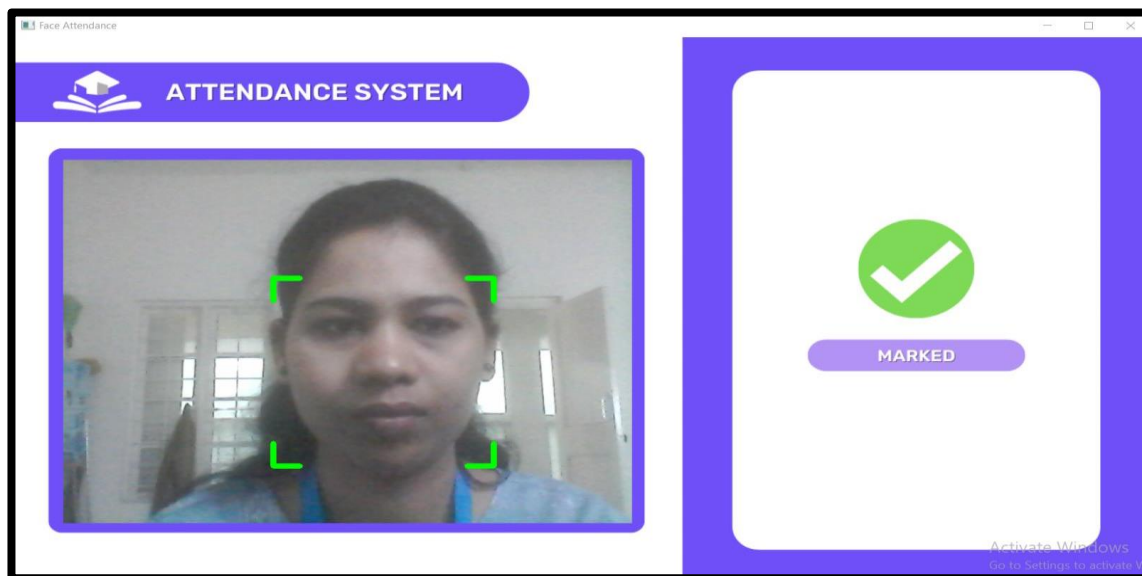
```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

3
Encoding Started
[array([-0.08817528,  0.04620837,  0.1017988 , -0.01267562, -0.05391221,
        -0.04586394, -0.02771717, -0.17983435,  0.14516135, -0.13606288,
         0.23132962, -0.07399829, -0.1281426 , -0.09427075,  0.04252017,
         0.16079733, -0.16825613, -0.14664334, -0.0499565 ,  0.03330559,
         0.01761871, -0.04623521,  0.04282977,  0.0462308 , -0.10115584,
        -0.37576741, -0.15073736, -0.07463273,  0.0994073 , -0.035987 ,
        -0.10685346,  0.06210819, -0.21877688, -0.03107087,  0.00910932,
         0.05720115,  0.02971634, -0.06430631,  0.15174258, -0.08601436,
        -0.27551788,  0.03864496,  0.06756132,  0.14527373,  0.19033772,
         0.04068214, -0.01949346, -0.07919946,  0.06506802, -0.19956183,
```

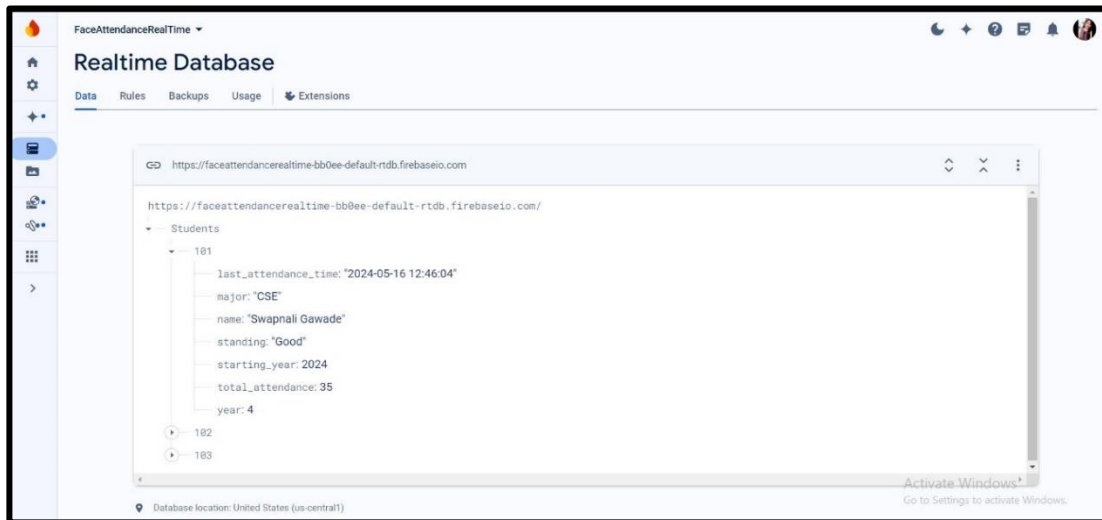
Fig(6.3) Image 2→ Encoding the instances



Fif(6.2) Image 3 → Face Captured and Detected with marking attendance



Fig(6.4) Image 4 → Face is matched with stored encoded values with binary values



Fig(6.5) Image 5 → Simultaneously real time data is stored in cloud based database (FIREBASE)

CONCLUSION

Face recognition systems are part of facial image processing applications and their significance as a research area are increasing recently. Implementations of system are crime prevention, video surveillance, person verification, and similar security activities. The face recognition system implementation can be part of universities. Face Recognition Based Attendance System has been envisioned for the purpose of reducing the errors that occur in the traditional (manual) attendance taking system.

The aim is to automate and make a system that is useful to the organization such as an institute. The efficient and accurate method of attendance in the office environment that can replace the old manual methods. This method is secure enough, reliable and available for use. Proposed algorithm is capable of detect multiple faces, and performance of system has acceptable good results.

REFERENCES

1. "Automated Attendance Management Using Hybrid Approach in Image Processing" by Arun Saharan, Munish Mehta, Piyush Makwana, and Sanju Gautam sounds like an academic paper that discusses a novel approach to automated attendance management leveraging a hybrid technique within image processing.
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Authors: P.Vilash , V. Praveen Kumar , K. Srinivas Reddy , N. Sai Kalyan ,Mrs Soppari Kavitha .
3. "Real-Time Student Attendance System Based on Face Recognition" by S. S. Manikandan, R. R. Subhashree, and S. Venkatesan (2018) - This paper presents a real-time student attendance system using face recognition technology.
4. “ An Automatic Attendance System Using Image processing”, Aziza Ahmedi , Dr Suvarna Nandya