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Face Recognition-Based Attendance Management System

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Abstract - The main goal of this project is to develop a face recognition-based attendance monitoring system for educational institutions. This system aims to improve and make the current attendance process more efficient and effective than before. The existing system has many issues that lead to unclear and inefficient attendance recording. When authorities can't properly enforce the rules of the old system, many problems occur. The technology used in this project is a face recognition system. A person's face is a natural feature that can uniquely identify them. Because it's difficult for a face to be copied or altered, it's a reliable way to confirm someone's identity. In this project, we will create a face database to store data, which will be used by the recognition algorithm. During attendance checks, the system will compare the captured face with the database to find a match. Once a person is recognized, their attendance is recorded automatically, and the information is saved in an Excel sheet. At the end of the day, this Excel sheet with attendance details for everyone is sent to the relevant teachers.

1. INTRODUCTION

According to the previous attendance management system, the accuracy of the data collected is the biggest issue. This is because the attendance might not be recorded personally by the original person, in another word, the attendance of a particular person can be taken by a third party without the realization of the institution which violates the accuracy of the data. For example, student A is lazy to attend a particular class, so student B helped him/her to sign for the attendance which in fact student A didn't attend the class, but the system overlooked this matter due to no enforcement practiced. Supposing the institution establish an enforcement, it might need to waste a lot of human resource and time which in turn will not be practical at all. Thus, all the recorded attendance in the previous system is not reliable for analysis usage. The second problem of the previous system is where it is too time consuming. Assuming the time taken for a student to sign his/her attendance on a 3-4 paged name list is approximately 1 minute. In 1 hour, only approximately 60 students can sign their attendance which is obviously inefficient and time consuming. For an example, most of the parents are very concerned to track their child's actual whereabouts to ensure their kid really attend the classes in college/school.
However in the previous system, there are no ways for the parents to access such information.
Therefore, evolution is needed to be done to the previous system to improve efficiency, data accuracy and provides accessibility to the information for those legitimate party this is ok for introduction.

2. LITERATURE SURVEY

The second research journal titled "Face Recognition Based Attendance Marking System" (SenthamilSelvi, Chitrakala, Antony Jenitha, 2014) uses face recognition to fix the problems of earlier attendance systems. This system uses a camera to take pictures of employees for face detection and recognition. The captured image is then matched one by one with a face database to find the worker's face. Once a match is found, attendance is marked on the server. This setup is secure because no one can mark another person's attendance. The system also improves face detection using skin classification to make the detection process more accurate. Despite efforts to improve accuracy, the system isn't portable. It needs a standalone computer with a constant power supply, which makes it unsuitable for mobile use. This kind of system works well for staff who only need to mark their attendance once a day. However, for students who need to report attendance for each class, a non-portable system would be inconvenient. To address this, the entire attendance management system can be built on a portable module, allowing it to run simply by executing a Python program.

3. PROBLEM STATEMENT

Conventional Attendance systems face several challenges:

- Traditional methods of tracking attendance have several issues. For example, they rely on people manually checking in and being physically present.
- There's also a risk of someone else marking attendance on behalf of another person, which makes the data unreliable.
- These systems can be slow, especially in big classes, and they don't offer real-time updates or automatic record-keeping
- Plus, it's hard for teachers and parents to access the attendance information easily.
- Most current systems aren't good at making sure attendance records are accurate, secure, and efficient.
- Because of this, there's a need for a smarter, more reliable system that uses face recognition technology to manage attendance automatically.

4. OBJECTIVE

- To cut down on manual tasks and save time when taking attendance
- To stop people from attending on someone else's behalf and ensure accurate records
- To keep attendance records in a digital and well-organized format
- To let faculty members easily access attendance information
- To make the system simple, quick, and easy to use

5. SYSTEM ARCHITECTURE

The system adopts a modular layered architecture that Separates user interface, business logic, and data handling to Ensure scalability, maintainability, and efficiency.

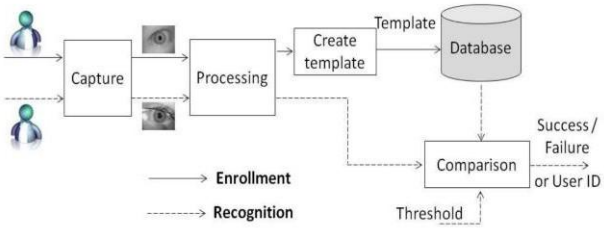

Figure 1: System Schematic (Block Diagram Overview)

5.1 Layers:

1. Data Acquisition Layer
- Collects biometric data such as facial or iris images using camera sensors
- Checks for good image quality by adjusting lighting and positioning
- Serves as the starting point of the system

2. Processing & Template Layer
- Does initial processing like removing noise and standardizing the image
- Identifies unique features from the image like patterns and textures
- Creates a template that is used for matching purposes

3. Database & Matching Layer
- Stores the biometric templates securely in a database
- Compares the generated template with existing data using specific algorithms
- Provides the result as a success or failure, or identifies the user based on a set threshold

4. External Services Layer
- Google Firebase used for cloud storage and student data
- Use Streamlit for UI and deployment

5.2 System Flow:

- First, give the supply
- The camera turns on and takes a photo of the user's face.
- The system checks if a face is present.
- If a face is found, it prepares the image for processing.
- Then, the system compares the face with the information stored in the database.
- If the face matches, the attendance is recorded successfully.
- If there's no match, the attendance isn't recorded.
- The attendance details are stored in the Firebase database.
- The user receives a message confirming the attendance.
- Admins or teachers can check the attendance records at any time.

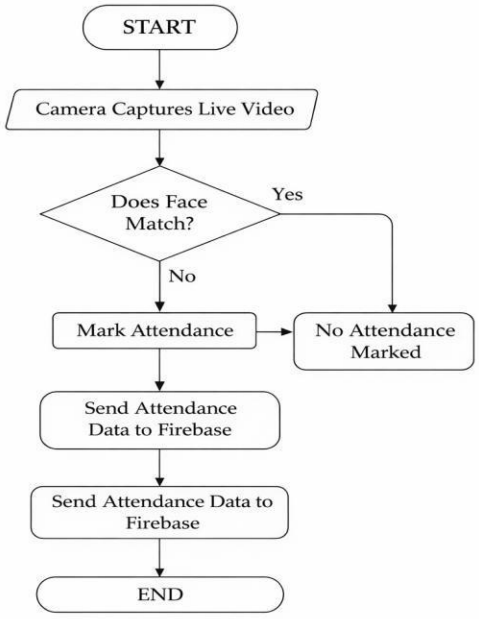

Figure 2: Flow-Chart

5. METHODOLOGY

5.1 Image Capture Module
- Captures student images through camera in real-time
- Collects multiple face samples for better accuracy

5.2 Face Dataset Module
- Stores captured images in a structured dataset
- Labels each image with student identity

5.3 Face Recognition Module
- Uses algorithms to detect and recognize faces
- Compares captured faces with stored dataset

5.4 Attendance Management Module
- Marks attendance automatically after successful recognition
- Records date and time of attendance

5.5 Data Storage Module
- Stores attendance data in an Excel file/database
- Maintains organized and secure record

6. IMPLEMENTATION

- Use Python to build the main face recognition system
- Employ OpenCV to process images and detect faces in real time
- Utilize the Face Recognition Library, which is based on dlib, for extracting and matching facial features
- Use NumPy to manage numerical calculations and image data
- Integrate a camera module, like a webcam or Raspberry Pi camera, to capture live video feeds

7. RESULTS AND DISCUSSION

7.1 Result Table

Parameter	Result Observed	Description
Face Detection Time	< 5 seconds	Fast detection of face using real-time camera input
Recognition Accuracy	80–90%	High accuracy under proper lighting conditions
Attendance Marking	Instant	Automatic marking without manual intervention
Database Update	Real Time	Attendance stored instantly in database

Comparison with Traditional System

Feature	Traditional System	Proposed System
Accessibility	Limited	Available anytime with camera system
Attendance Method	Manual (register/signature)	Automatic(face recognition)
Tracking System	Manual	Automated tracking
Proxy Attendance	Possible	Prevented using face detection
Efficiency	Low	High

7.2 Discussion

The results indicate that the proposed system enhances efficiency, accessibility, and usability compared to traditional attendance systems. Integration of Firebase for live attendance monitoring is also done. The system meets all objectives and offers a scalable solution.

8. CONCLUSION

Before the development of this project. There are many loopholes in the process of taking attendance using the old method which caused many troubles to most of the institutions. Therefore, the facial recognition feature embedded in the attendance monitoring system can not only ensure attendance to be taken accurately and also eliminated the flaws in the previous system. By using technology to conquer the defects cannot merely save resources but also reduces human intervention in the whole process by handling all the complicated task to the machine. The only cost to this solution is to have sufficient space in to store all the faces into the database storage. Fortunately, there is such existence of micro SD that can compensate with the volume of the data. In this project, the face database is successfully built. Apart from that, the face recognizing system is also working well. At the end, the system not only resolve troubles that exist in the old model but also provide convenience to the user to access the information collected by mailing the attendance sheet to the respected faculty

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