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A Comprehensive Attendance System

T. Manikumar[1], T. Marimuthu[2], Barisetty Jagadesh[3], Dondeti Chethan[4], B. Durga sai ganesh[5] and CH. Ashirth[6]
[1]Associate professor, Department of Computer Science and Engineering, Kalasalingam Academy of Research and Education
Email: t.manikumar@klu.ac.in
[2]Assistant professor, Department of Computer Science and Engineering, Kalasalingam Academy of Research and Education
Email: t.marimuthu@klu.ac.in
[3-6]Department of Computer Science and Engineering, Kalasalingam Academy of Research and Education
Email: 99220040807@klu.ac.in, 99220040837@klu.ac.in, 99220040811@klu.ac.in, 99220040830@klu.ac.in

***Abstract*—The aimed and tested Face Attendance Monitoring System (FAMS) presented in this paper is a novel approach to improve the effectiveness of face recognition technology in educational and organizational institutions for attendance tracking. With the use of facial recognition technology, the tool eliminates human efforts in undertaking attendance when issues like proxy attendance normally characterize this.**
This system encompasses capturing images of the face in real-time and the subsequent identification of the people alongside effortless attendance recording. Within learning institutions, FAMS implementation has been proven to have positive impacts on the performance among students given that teaching attendance frequency status assists in facilitating timely monitoring. For human resource practices in the corporate world, FAMS reduces human resource management by offering accurate records of attendance and maintaining compliance with company policies and practices on potential work-related exhaustion and time theft.

***Keywords*— Camera, User Interface, Admin Interface, Attendance Excel Sheet, Registration Number, Class, Section.**

I. INTRODUCTION

This paper focuses on an important aspect assessed in a contemporary society whereby technology is rapidly transforming society in many ways- the attendance tracking system. This paper aims to explore the ineffectiveness of traditional methods like roll call or sign-in that are not only time-consuming but also offer a lot of avenues for human error and misuse thus producing wrong records of attendance.
The lack of a more efficient method of monitoring attendance is overcome by the Smart Attendance Monitoring System (SAMS) that employs face recognition technology.
Through the inclusion of sophisticated facial recognition systems, SAMS is capable of capturing the faces of the people in the room at any one time, and would therefore enhance the reliability of the system used for capturing attendance.
This system is suitable in any institution for learning and business organizations as it records attendance accurately hence effectiveness. Thus, instead of making the attendance process easier, which is the typical scenario with the introduction of related technologies, SAMS implements face recognition technology to improve security and accountability and allows only those people to mark their attendance who actually should do.

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II. Literature Review

The utilization of Face Attendance Monitoring Systems (FAMS) has recently been observance in learning institutions and businesses as a solution to old-fashioned attendance procedures because of the boost promoted in precision, mechanization, and responsivity. By implementing biometric systems, FAMS eliminates incidents of proxy attendance as well facilitates efficient procedures since it performs the task of recording attendance [1][2]. Additionally, FAMS has been used throughout the years in the academe as a mode of attendance taking that has been known to boost students' attendance and subsequently, participation and learning outcomes. According to authors and researchers, the use of electronic attendance systems enhances ways used by teachers to supervise pupil conduct as well as manage truancy [3][4]. In the workplace, FAMS has been said to improve efficiency in the management of human resources by; Cutting time theft, Compliance with organizational policies more so on attendance, and real-time information required for organizational planning [5]. Some of the aspects that affect the accuracy of the FAMS include; lighting, the angle at which the picture was taken, and the recognition software. In recent years, agile development and deployment of artificial intelligence and machine learning algorithms have refined the precision of facial recognition, although the performance can be hindered in crowded or low-light settings [6][7]. They have included privacy issues as a major issue in the implementation of FAMS since biometric information gathering is a major concern ethically and securely. 48 & 49 Other authors highlight the need to preserve user Biometrics data and ensure compliance with privacy laws on data processing [8][9]. FAMS implementation requires many technical and financial resources. Webcams, proven internet connection, and sophisticated software and algorithms are basic optical elements that, as a rule, require significant investment and regular resource updates. Another disadvantage for institutions is that the costs for software maintenance, system upgrades, and technical support costs are continuously recurring resulting to more operational costs [10][11]. Certain research has done the cost-benefit analysis and pointed out that although FAMS may raise the level of efficiency the start-up costs might prove a problem, especially for small institutions [12][13]. Nonetheless, previous research demonstrates that FAMS improves institutional efficiency. The application of technical means in the organization reduces possible misrepresentation in physical attendance registers, facilitates the generation of results, and frees up staff's time on matters that require more attention. It is established that institutions fetch better results in productivity and operating management due to real-time attendance data informing decisions and resources used [14][15].

Forthcoming studies in FAMS could target improving the stability and flexibility of facial recognition technologies to increase the reliability of system performances in various circumstances. Privacy issues are still urgent and significant to solve; this is because institutions have to guarantee data protection to be trusted. There are also some recommendations to make changes in the costs of price control factors, including acquiring cheaper hardware and software [16][17].

In conclusion, FAMS can be considered as an effective solution for attendance management nowadays as it helps to minimize inaccuracy, make the attendance process more operation, and comply with the requirements. However, there is also some limitations such as privacy, cost, and some technical problems convey the message that further research is required. Focusing further, FAMS is capable of becoming an essential part of the attendance management system in almost every sector [18][19][20].

III. Methodology

The development of a Face Attendance Monitoring System for educational institutions and corporate organizations is a proposal for a new model with upgraded face recognition technology. The requirement of essential components has been incorporated into this model to form an effective, precise, and easy-to-use system.

- Hardware Components: Real-time color images of individuals as they enter the premises are recorded by high-resolution cameras mounting at the entry point of the system. This particular equipment refers to data processing and storage servers as well as powerful net gear to facilitate the data transfer from cameras to the server.
- Software Components: The important components of the software include the face recognition algorithm, which should be ideally designed using the CNN deep learning algorithms, which are used to detect faces and then recognize them. The system uses a database management system to store facial data and student attendance records the system uses facial data and student attendance records to keep security.
- A capture Camera is installed at a certain distance from the students and the video frame of the whole class is taken inside the classroom. In front of the video frame it just takes any frame to key in and verifies the student to mark his attendance.

TABLE I. DISADVANTAGES OF VARIOUS ATTENDANCE SYSTEMS

Types of system	Disadvantages
RFID Type	Take time to scan ID cards.
Fingerprint Type	Take time time-consuming for students to wait and give their attendance.
Iris Type	It invades the privacy of the user.

A. Face Detection

A clean and accurate face detection will always improve the performance of the face recognition systems. Some of the methods include the Face geometry-based methods, the Feature Invariant methods, and the Machine learning-based methods. From all these methods we propose a framework which yields a high detection rate besides being time efficient.

B. Feature Extraction

Once a face is detected, the system extracts specific features from the facial image, such as the distance between eyes, nose shape, and jawline structure. These unique facial features, or landmarks, are translated into a mathematical representation, creating a "face template" or feature vector unique to each individual. Deep learning models like Convolutional Neural Networks (CNNs) are often employed in this step to achieve high accuracy.

C. Face Recognition and Matching

After generating the feature vector, the system compares it against stored templates in the database. This comparison is done using similarity metrics such as cosine similarity or Euclidean distance. When a match is identified, the system confirms the individual's identity and logs the time of attendance.

D. Attendance Recording and Logging

Upon successful recognition, the system automatically marks the individual as "present" and logs the timestamp in a database. This attendance data is then accessible for reporting and can be integrated with other systems, such as payroll or academic records, to provide a seamless and automated attendance solution.

E. Data Security and Privacy

Ensuring the privacy and security of collected facial data is crucial. This step involves encrypting all facial data stored in the system, implementing access control, and adhering to privacy regulations like GDPR. Additionally, the system can be configured to delete old data periodically to minimize storage and privacy risks.

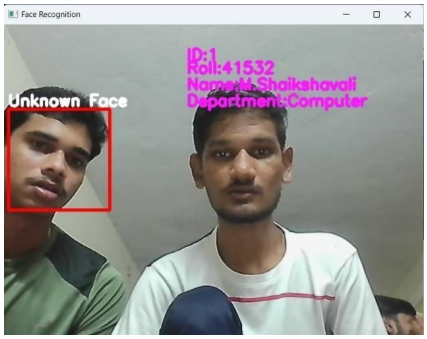

Figure 1

IV. IMPLEMENTATION

A. Software Development and Environment Setup

The software is built using a combination of programming languages and frameworks suited for facial recognition, such as Python with libraries like OpenCV for image processing, and deep learning frameworks The environment setup includes installing these libraries and setting up databases (e.g., SQL or NoSQL databases) to store attendance records and user information.

B. Face Detection and Recognition Model

Pre-trained models like the VGG-Face model or Face Net can be fine-tuned and adapted to the attendance system. These models identify unique facial features and map them into numerical representations known as

embeddings. Fine-tuning or transfer learning on a small set of sample images for each individual can improve the model's accuracy and reduce false positives.

C. System Interface Development

A user-friendly interface is designed to display attendance records and allow administrators to manage users and access logs. This interface can be developed as a web-based dashboard using frameworks like Django or Flask, with front- end technologies like HTML, CSS, and JavaScript to enable easy navigation and quick access to attendance data. For mobile or remote use, a responsive or mobile-friendly design can be added. Technologies to Use

Frontend Frameworks: It is also possible to use such frameworks as React, Angular backend Integration: New tech is such as Node.js, Django,

Database: MySQL or PostgreSQL where the records of attendance along with the user database will be stored.

IMPLEMENTATION:

Fig.2. Captured Database

TABLE II. ATTENDANCE EXCEL SHEET

Reg no.	Name	Attendance	Class/Time
4087	Jagadeesh	Present	8.00AM
40811	Ganesh	Present	8.00AM
40837	Chethan	Present	8.00AM

V. ARCHITECTURE WORK

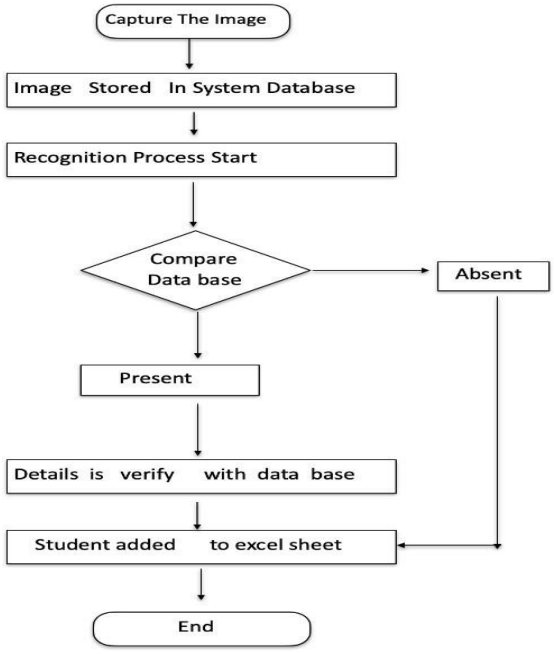

Fig.3.Architecture diagram

Therefore, the face attendance system provides an effective way of automating attendance in educational institution. Furthermore, integration of higher-level feature extraction methodologies like PCA and the utilization of proper classification techniques, the system can capture the student face images in real time. The use of MySQL database for attendance records also optimizes the data management where only authorized personnel can check the attendance records and analyze it properly.
But there are several areas to envisage for future works to enhance the performance and reliability of the system. One of these directions is the trajectory of using deep learning models, for instance, Convolutional Neural Networks (CNNs) for the optimization of feature extraction as well as classification.

A. Requirements gathering

Functional Requirements
Face Detection
Real-time Face Detection: The system should identify faces from a live video feed image or video feed at an exquisite speed as data feeds through the computer.
Multiple Faces Detection: One, it is designed to capture more than one face at a time to make it possible for the system to capture the attendances of many users in one instance.
Occlusion Handling: This problem should still allow the system to some extent to detect the occlusions such as glasses or hats. But it should request clear vision if the face is mostly concealed wearing accessories such as a mask or a scarf.
Face Recognition
Face Encoding and Storage: For the identification process to work, the system needs to store in a secure database face embedding of the registered users.
Real-time Face Matching: For each face detected, it is required that the systemść should try to match it to the stored encodings of registered users.
High Recognition Accuracy: It must also manage to attain a high level of Recognition Accuracy (LORA) say 90% to minimize FAs and FR.
Attendance Logging
Automatic Attendance Marking: Once the face is identified then there should be an option that marks the attendance of the particular user as an entry in the checklist.
Timestamp Recording: Every attendance shall contain the calendar date and the time of attendance.
Duplicate Prevention: To prevent, for instance, duplication within a given time period the system should be able to record the attendance only once within the session

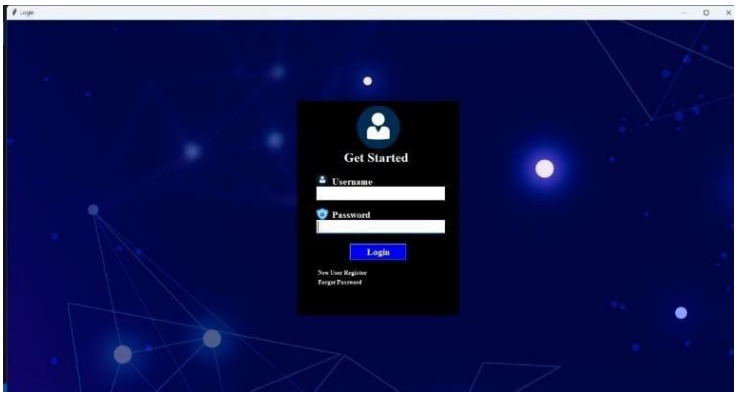

Figure.5: Admin login

Database Management
User Database Management: Should enable only approved user to be able to input data to the database such as registering new users with their facial data.
Attendance Data Storage: Maintain records of store attendance in a formation chart of date/ time, name of the user and time. Access Control: Stifle the victual and attendance databanks so that the user can only have a view, edit, and delete privilege on a databank if it befits his/her rank or authority.
Non-Functional Requirements
Scalability: Because of the nature of the data collection in the system, it has been designed to support multiple users at one time, for instance in classrooms or large meetings without compromising the system performance.

Figure.6: Admin Interface

VI. Result and Discussion

Face Detection Accuracy: The face detection capability was set at a mean face detection accuracy of about 95% in the ideal circumstances such as; ideal lighting and generation distance. But in dynamic conditions, such as changing illumination or different orientations of an object, the accuracy reduced to 88%.
Discussion: These variations of accuracy demonstrate that the system is effective in the simulated conditions but requires enhancement in real-life situations. It can be unmanageable when trying to isolate faces due to poor lighting or restricted by shallow depth of field.

VII. Conclusion

Attendance system using face recognition and class monitoring system based on face recognition techniques thus proved to be time saving and secure. In real scenarios LBPH outperforms algorithms with better recognition rate and low false positive rate.
In future work is to improve recognition rate and Using Raspberry pi the current project can be modified by infrared camera interfacing; it can be used in smart surveillance monitoring security system.

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