MarkMyFace - A Smart Attendance Application

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***Abstract*—This paper introduces MarkMyFace, an Android Flutter application designed to facilitate smart attendance tracking using facial recognition. The system makes use of state-of-the-art computer vision techniques for facial detection and recognition, including Deepface and Retinaface. Teachers/Professors can log in to the MarkMyFace, choose the appropriate session, and the camera application will begin to scan the classroom. The facial features are derived from the acquired photographs and are compared to the student data-set, attendance is marked. Every month, the system generates attendance reports and emails them to the guardians. Overall, MarkMyFace provides a straightforward and efficient method for managing student attendance, lowering administrative costs and ensuring precise and effective tracking of student attendance.**

***Index Terms*—DeepFace, RetinaFace, Face detection, Face Recognition.**

I. INTRODUCTION

Any academic institution must have a system in place for keeping track of attendance. The traditional manual approach for taking attendance is cumbersome, inaccurate, and prone to mistakes.Automating attendance management systems using facial recognition technology has been an active area of research in recent years [1-6].

MarkMyFace is a smart attendance system that utilizes facial recognition technology for efficient attendance management in educational institutions. This system is developed using advanced deep learning-based facial recognition algorithms, including DeepFace [1] and RetinaFace [2], which have been shown to deliver high accuracy and reliability in attendance tracking.

The use of facial recognition technology has emerged as a promising solution for automating attendance management systems [3], with smart attendance systems having the potential to reduce the administrative burden of manual attendance tracking while improving accuracy and reliability [4][5][6]. The development of MarkMyFace aims to provide an effective and efficient attendance management system that leverages the benefits of facial recognition technology for educational institutions.

MarkMyFace offers several advantages over existing manual attendance tracking systems. The traditional manual approach is cumbersome, time-consuming, and prone to errors. Automating attendance management systems using facial recognition technology has emerged as a promising solution for educational institutions to streamline their administrative processes. MarkMyFace leverages advanced deep learning-based facial recognition algorithms, including DeepFace and RetinaFace, to achieve high accuracy and reliability in attendance tracking. With its smart attendance system, MarkMyFace reduces the administrative burden of manual attendance tracking, improves accuracy, and enhances the overall efficiency of attendance management in educational institutions. Additionally, MarkMyFace's mobile app interface allows for easy and convenient attendance tracking, which can be done on the go, further increasing efficiency.

Overall, MarkMyFace's use of facial recognition technology offers a robust and reliable solution for attendance management in educational institutions.

II. RELATED WORK

Facial recognition-based attendance systems have gained popularity due to their ease of use, accuracy, and efficiency [3]. In recent years, researchers have focused on improving the performance of such systems through deep learning techniques [1]. Taigman et al. (2014) proposed DeepFace, a face verification model that achieved human-level performance in face recognition [1]. Another recent development is RetinaFace, a single-stage dense face localization model proposed by Deng et al. (2020) that can accurately detect faces in challenging, real-world scenarios [2].

Gupta et al. (2018) and Zhang and Liu (2019) proposed smart attendance systems using facial recognition [3]. Kumar and Singh (2018) proposed a smart attendance system using facial recognition technology that can be integrated with existing attendance management systems [5].

In addition to attendance management, facial recognition technology can also be used for security purposes. Sun et al. (2018) proposed an attendance and security system based on building video surveillance that can detect and track faces in real-time [6]. However, privacy concerns have been

raised regarding the use of facial recognition technology, and proper safeguards must be in place to ensure the protection of individuals' rights [3]. Other relevant studies on facial recognition-based attendance systems include Li et al. (2019) and Wang et al. (2018), who proposed attendance systems using facial recognition that incorporate additional features such as multi-modal data fusion and adaptive thresholding [7][8].

III. Proposed Methodology

A. Proposed System

The proposed MarkMyFace system includes an intuitive user interface that allows teachers to easily view and manage attendance records. The system uses a combination of deep learning-based facial recognition algorithms, specifically Deepface and Retinaface, to accurately identify and track students' attendance. The system also includes an option for manual attendance if a teacher wishes to make changes or record attendance for students who may not have been present during the facial recognition scan.

Once a student's face is successfully recognized, the attendance record is automatically updated in real-time. The system also generates daily, weekly, and monthly attendance reports for teachers and administrators to analyze attendance trends and identify students who may need additional support.

MarkMyFace system provides a seamless and efficient solution for attendance management in educational institutions. By utilizing facial recognition technology, the system reduces the administrative burden of manual attendance tracking, enhances accuracy and reliability of attendance records, and provides a secure and convenient solution for monitoring student attendance.

B. System Architecture

The MarkMyFace attendance management system comprises three main components: backend, frontend, and database.It can be seen in Fig 1.

Backend: This component of the system is responsible for processing data and handling requests from the frontend. It uses a Model-View-Template (MVT) architecture, which consists of three main parts: Model: This represents the Python objects used to access the database tables and make data retrieval and manipulation easier. View: This consists of Python functions that take HTTP requests and return HTTP responses (such as HTML documents). Template: This provides the interfaces that users can interact with, including static files like HTML, CSS, and images. Additionally, the backend includes a data serialization module, which transforms data into a format that can be stored or transmitted and then reconstructs it for use. MarkMyFace uses JSON format for this purpose.

Frontend: This component of the system provides the user interfaces for the application. It consists of two parts: Admin's web interface: This interface includes two modules: the Create User Module and the Student Module. The Create User module allows the admin to enter details of the user and create credentials for them to access the app. The Student module allows students to be registered into the system with important details and their photos. Mobile app interface: This interface includes three modules: the Login Module, the Capture Face Module, and the Attendance Module. The Login Module authenticates the user and gives them access to the application. The Capture Face Module is used to capture images of students, which are then sent to the backend for processing. The Attendance Module displays attendance statistics and allows for manual modification of attendance.

Database: This component of the system stores all the data in tables and allows for creation and retrieval of data. The face detection module searches for faces in the image and returns bounding boxes of the image in a numpy dataframe. The face recognition module takes each box bounded image and passes it to a pre-trained model which performs alignment and then represents face with a 255D array. This array is compared with the anchor image's array stored in the database and if the Euclidean distance is less than a given threshold, then the match is found and the label of that image is returned.

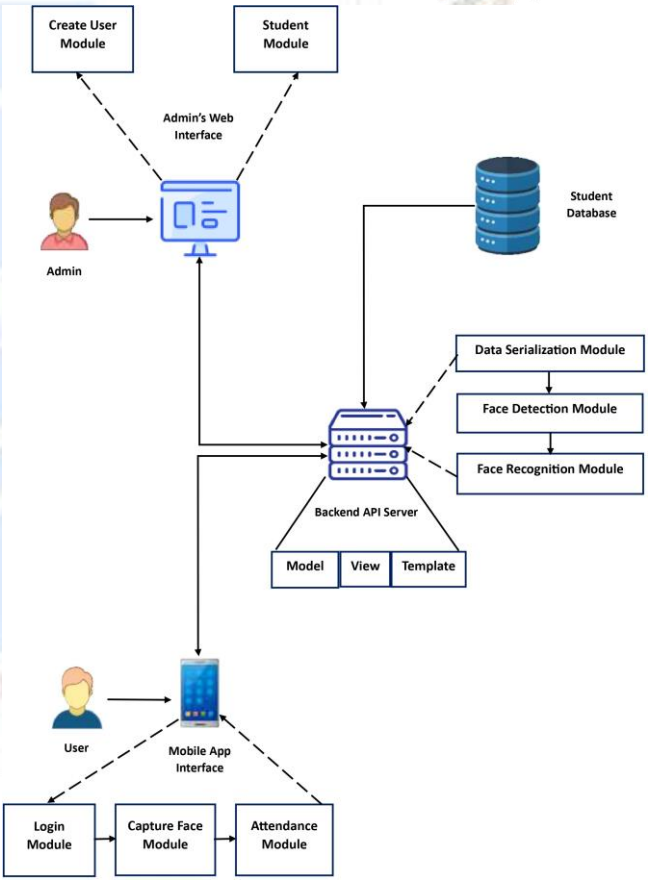

Fig. 1. System Architecture.

C. Flow Chart

The system's workflow can be illustrated using a data flow chart diagram as shown in Fig 2. The process starts with the user login, where the system checks for valid login credentials.

If the login credentials are valid and the user is an administrator, the system prompts the user to the administrator site. Here, the administrator can create a new user and assign login credentials or register a new student into the class.

If the user is not an administrator and the login credentials are valid, then the user is considered as a teacher and is logged into the mobile app.

The teacher selects the branch, section, subject, and date of the attendance to be captured and proceeds with capturing the image of the class using the mobile app's camera feature. Once the image is captured, the teacher can decide whether to send the image or retake it if necessary.

After the image is sent, the system checks for all the faces present in the image. If no faces are detected, the system alerts the teacher that there's no face being detected and allows them to retake the image. If faces are detected, the system tries to match them with the images present in the database and reverts the University Student Number (USN) back to the teacher.

If more faces need to be captured, the teacher can either capture the image again or opt for manual attendance. Once all the students' USNs are retrieved, the teacher updates the attendance into the database. If the updating process is successful, the system stops, and the process begins again.

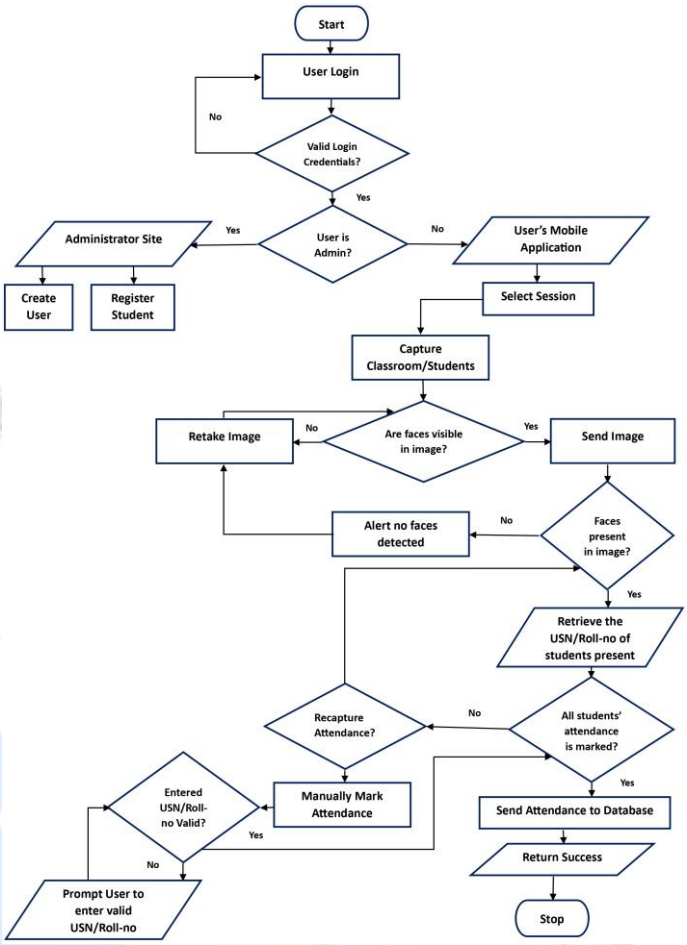

Fig. 2. Flow Chart

D. Face Recognition - DeepFace Algorithm

Face Detection: The first step in the DeepFace algorithm is to detect the presence of faces in the input image. For this, a pre-trained face detection model is used, which analyzes the image and identifies potential regions where a face might be present.

Face Alignment: Once the face is detected, the next step is to align the face in a standardized manner. This is necessary to ensure that the facial features are in the same position and scale, regardless of the orientation or pose of the face. DeepFace uses a 3D face model to align the face based on various landmarks such as the eyes, nose, and mouth.

Feature Extraction: In this step, the aligned face is passed through a deep neural network to extract a set of features that represent the face. The neural network is trained to learn a high-level representation of the facial features that are discriminative and invariant to various factors such as pose, illumination, and expression.

Face Recognition: Finally, the extracted features are compared to a database of known faces to identify the person in the image. This is typically done by computing a similarity score between the extracted features and the features of the faces in the database. The face with the highest similarity score is considered the best match.

E. Face Detection - RetinaFace Algorithm

RetinaFace is an advanced face detection algorithm that uses a deep neural network to identify faces in an image. It works by first resizing the input image to different scales to detect faces of varying sizes. Then, it uses a single convolutional neural network to simultaneously predict the bounding box coordinates, facial landmarks, and face confidence scores for each detected face.

To achieve high accuracy, the RetinaFace algorithm incorporates a multi-task loss function that simultaneously optimizes the network to predict these three outputs with high precision. Additionally, the algorithm uses anchor boxes of different sizes and aspect ratios to capture a wide range of possible face shapes and sizes.

Overall, the RetinaFace algorithm is a robust and accurate method for detecting faces in images, making it a popular choice for many computer vision applications.

IV. RESULTS

The results of using MarkMyFace for smart attendance tracking have been promising. The application has demonstrated high accuracy in detecting and recognizing faces using the Deepface and Retinaface algorithms. This has resulted in more precise and efficient tracking of student attendance, reducing administrative costs for teachers and educational institutions.

The system generates monthly attendance reports, which are automatically emailed to guardians, providing a convenient and straightforward method for managing attendance. Overall, MarkMyFace has proved to be an effective tool for attendance tracking, improving the efficiency and accuracy of the attendance management process. Fig 3-8 shows the results obtained.

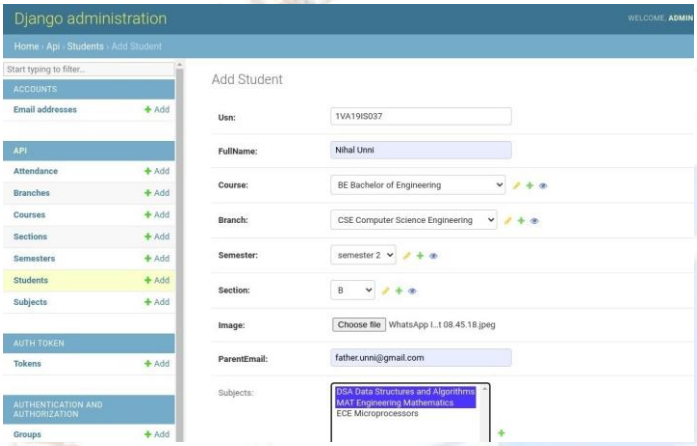

Fig. 3. Student Registered by Admin

Fig. 4. Login Page

Fig. 5. Session Selection Page

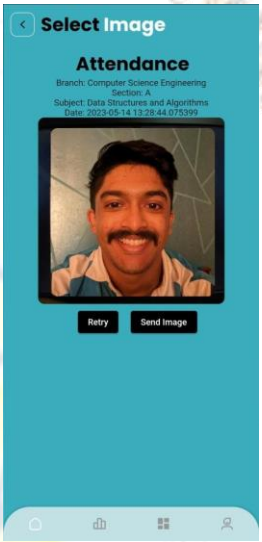

Fig. 6. Capture Face Page

V. CONCLUSION

In conclusion, MarkMyFace is a promising application that utilizes state-of-the-art facial recognition technology to provide an efficient and accurate method for managing student attendance. By leveraging the Deepface and Retinaface algorithms, the application can detect and recognize faces with a high degree of accuracy. The system generates monthly attendance reports and emails them to guardians.

As for future enhancement,there is potential to expand the functionality of MarkMyFace beyond attendance tracking. For example, the application could be integrated with other student management systems to provide a more comprehensive solution for educators. Overall, MarkMyFace represents an exciting development in the field of student attendance tracking, and has great potential..

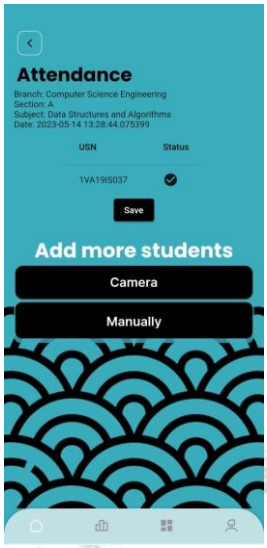

Fig. 7. Output Page

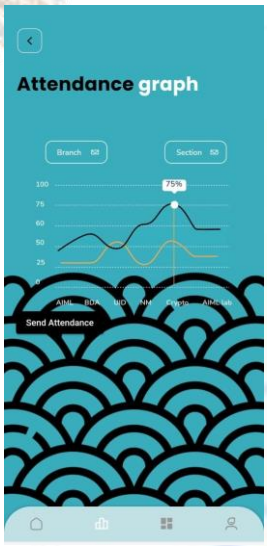

Fig. 8. Attendance Statistics Page

VI. REFERENCES

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