Grenze International Journal of Engineering and Technology, Jan Issue

Face Recognition and Location based Online Attendance System

Pallavi M. Tekade[1], Dipmala Salunke[2], Sonali Rangdale [3], Adnaan Shaikh[4], Sachin Lokare[5], Gaurav Gangurde[6] and Harsh Dod[7]
[1-7]JSPM's Rajarshi Shahu College of Engineering/Information Technology, Pune, India
Email: {pmtekade_it, dtsalunke_it,sprangadale_it}@jspmrscoe.edu.in, {shaikhadnaan166, svloc39, rbt19it065, harsh.p.dod1234}@gmail.com

***Abstract*—This paper presents the implementation of an Android application for online attendance management, utilizing face recognition and GPS location technologies. The app automates the attendance process while ensuring the authenticity of records. Advanced face detection and recognition algorithms are employed to verify the identity of individuals, eliminating the possibility of proxy attendance. GPS location tracking further enhances reliability by confirming physical presence at the designated location. The user-friendly interface caters to both administrators and attendees, allowing for easy management of classes, attendance parameters, and generation of comprehensive reports. The app eliminates manual attendance-taking, reduces administrative burden, and saves time. It offers highly accurate attendance verification, minimizing errors and manipulation. With its transparency and features, the app revolutionizes attendance tracking for educational institutions, businesses, and event organizers. This implementation provides a reliable, efficient, and user-friendly solution for streamlined attendance management. It is a cost efficient system because there is no need of installing any extra device at the location to mark the attendance, users can mark the attendance using their personal phones.**

***Index Terms*— Face-recognition, Authentication, Geolocation, Biometric, Android.**

I. INTRODUCTION

Attendance management is a critical aspect of various domains, including education, corporate environments, and event management. Traditional methods of attendance tracking are often time-consuming, prone to errors, and susceptible to manipulation. To address these challenges, innovative solutions utilizing advanced technologies such as face recognition and GPS location tracking have emerged. This paper presents the implementation details of an Android application designed to streamline attendance management by leveraging face recognition and GPS location.The proposed online attendance Android app offers a convenient and reliable solution for automating the attendance process. By utilizing face recognition algorithms, the app verifies the identity of individuals based on their unique facial features. This eliminates the possibility of proxy attendance and ensures that the attendance records accurately reflect the presence of the intended individuals. Additionally, GPS location tracking is utilized to confirm the physical presence of users at the designated location, adding an extra layer of authenticity and reliability to the attendance records.The implementation of the app involves the integration of state- of- the- art face detection and recognition algorithms, enabling accurate and efficient

Grenze ID: 01.GIJET.10.1.548_1

identification of individuals. The user interface is designed to be intuitive and user-friendly, catering to both administrators and attendees. Administrators can easily create and manage classes, define attendance parameters, and generate comprehensive reports. Attendees, on the other hand, can register their profiles, upload their picture on first login and mark the attendance.The benefits of implementing an online attendance Android app based on face recognition and GPS location are numerous. It eliminates the need for manual attendance-taking, reducing administrative burden and saving valuable time for both educators and employers. The app provides a highly accurate and reliable method for attendance verification, minimizing the potential for errors and manipulation. Furthermore, it promotes transparency and accountability by providing a comprehensive audit trail of attendance data, facilitating the identification of attendance patterns and trends.User need to register on the application and then login. After first time login user should upload his/her picture. After successfully uploading the picture, user will be able to mark the attendance. User should click his/her photo and click on the mark attendance button then the current location is compared and faces are also compared. If both face and location matches, then only attendance will be marked.

II. METHODOLOGY

A. Existing Systems

1) Fingerprint based authentication

In the existing fingerprint based attendance framework, a movable finger impression gadget must be coordinated with the understudies' finger impression prior. Later either all through the talk hours or previously, the researcher needs to record the unique mark on the coordinated gadget to affirm their participation for the afternoon. Problem with this method is it need extra gadget to be installed at the location where attendance need to be marked, it needs extra cost for that device and also it is a time consuming process because at a time only one person can mark the attendance with one installed device.

2)Radio frequency identification based authentication

In the RFID based existing framework, the researcher needs to convey a successive positive distinguishing proof with them and put the ID on the cardboard reader to record their presence for the day. The framework is equipped for interfacing with RS232 and recording the attendance to the saved data. Problem is that there are possibilities for underhanded access could happen and proxy attendance may be marked.

3) Iris based authentication

In the Iris based generally understudy attendance framework, the scholar needs to exchange before a camera, all together that the camera can filter the Iris of the scholar. The examined iris is coordinated with data of scholars kept inside the data and subsequently the attendance on their presence needs to be refreshed. This decreases the paper and pen work of the school individuals from the foundation. This conjointly decreases the probabilities of intermediaries inside the class, and helps in keeping up with the scholar records safely. This method also have problem of installing extra device at location.

4) Face recognition using camera installed

There are many face recognition based participation frameworks as of now however they need a camera to be introduced at the site of checking attendance which at last inflates cost and demands greater investment to stamp attendance.

B) Proposed System

We have incorporated the TensorFlow Lite FaceNet machine learning model, resulting in a significantly reduced application size. This integration empowers us to perform face recognition operations directly on Android devices. What sets us apart is the elimination of the need to rely on external APIs for extracting facial features. By leveraging the capabilities of TensorFlow Lite, we ensure efficient and seamless face recognition functionality. And to gather location coordinated we are using android inbuilt GPS location service.

Different stages of the process:

Stage 1: Image capture and creating dataset:

Image capture:

Firstly the person should click his pictures in good lighting condition and looking straight into the camera and upload this image. This will improve the face recognition process.

Pre-processing:

In this stage the face is detected from the image using Google ML Kit and cropped image is then converted to the format which is acceptable by the tensorflow lite facenet machine learning model as given as input to the model. We get the

Storing the extracted features of the face to database:

After finishing the above stage, the features extracted from the face which is in the form of float array and is called as feature vector is stored in the database. In this way we don't need to store the actual image at the backend which saves bandwidth and storage at backend.

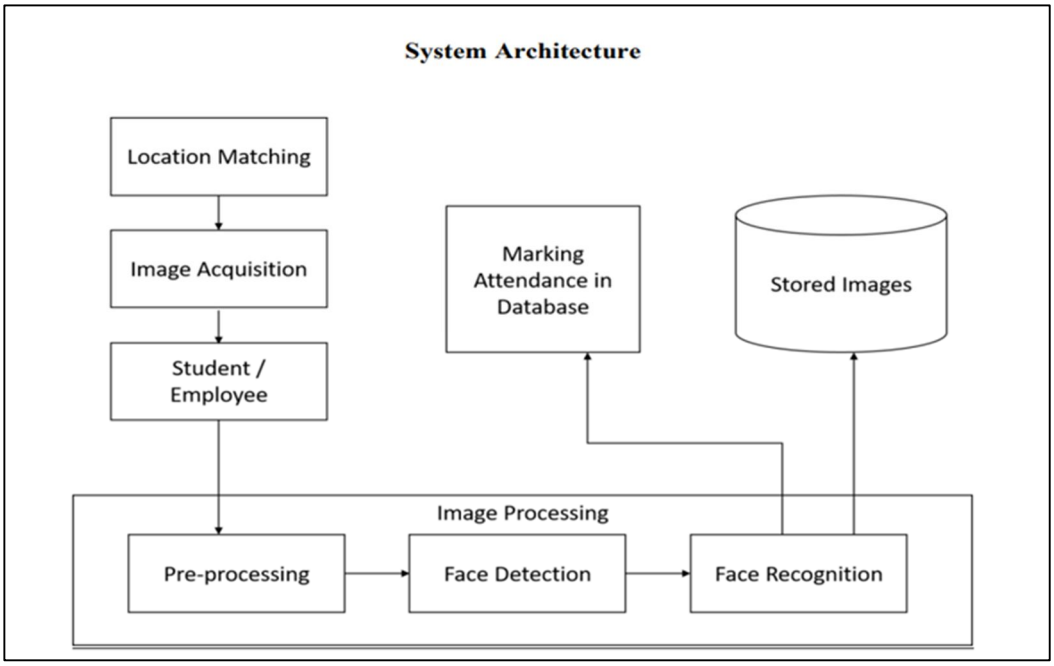

Fig.1 System architecture

Stage 2: Recognition of faces and location matching (attendance marking):

Image capture and face detection: For marking the attendance, user will click the image and click on mark attendance button. Then again image pre-processing is performed to extract the features of the face in the form of float array and then these features are compared with the array which is received from the database. Euclidean distance is calculated to find the distance between these arrays called feature vectors and if the distance is less than 10 then only the face is considered as same.

Location matching: When user click on mark attendance button, face matching process takes place at the same time location matching also takes place. Coordinates of the desired locations are stored in the database and these are compared with the coordinated of the current location of user.

Getting attendance data:

Data for each day's attendance can be downloaded in the form of CSV file.

Technologies Used

III. TECHNOLOGIES USED

A. Facenet TensorFlow Lite model

FaceNet is a deep learning model that enables face recognition and verification tasks with high accuracy. It was developed by Google researchers and released in 2015. FaceNet uses a neural network architecture called Siamese network, which consists of two identical sub-networks that share the same weights and learn to map the input faces into a common embedding space.The FaceNet model has achieved state-of-the-art results on several face recognition benchmarks, including LFW, YTF, and IJB-A. It has been widely adopted in various applications, such as access control, surveillance, and personalized marketing. To make FaceNet model more accessible and deployable on mobile devices, Google has released a TensorFlow Lite version of FaceNet. TensorFlow Lite is a lightweight version of TensorFlow, optimized for mobile and embedded devices. The FaceNet TensorFlow Lite model has a smaller size and faster inference speed than the original FaceNet model, making it ideal for real-time face recognition applications on mobile devices. The FaceNet TensorFlow Lite model can be easily integrated into mobile apps using the TensorFlow Lite API. Developers can use the model to perform face recognition and verification tasks on mobile devices, without the need for a server or internet

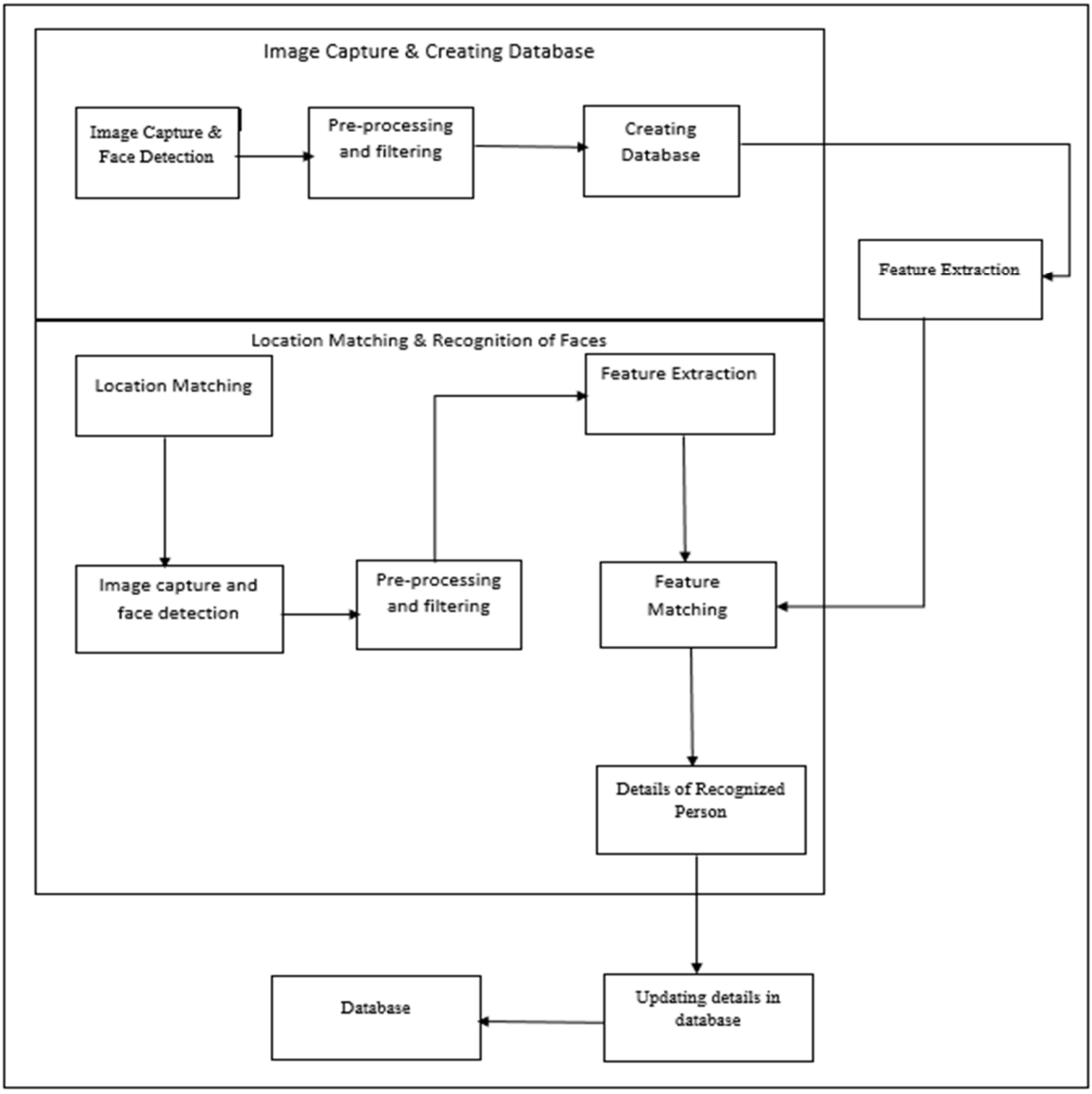

Fig.2 Different stages of process

connection. The model can be fine-tuned on custom datasets to improve its accuracy on specific use cases. In summary, the FaceNet TensorFlow Lite model is a powerful tool for face recognition and verification on mobile devices. Its high accuracy and fast inference speed make it ideal for real-time applications, while its lightweight design enables easy deployment on mobile and embedded devices.

B. Android inbuilt GPS location services

Android inbuilt GPS location services provide a convenient and accurate way to track the location coordinates of a user's device within an Android application. To use the Android inbuilt GPS location services in your application, you can make use of the Android Location API provided by the Android SDK. The Location API provides access to location data through several location providers, including GPS, Wi-Fi, and cellular networks. To track the user's location, you can request location updates from the Location API using the appropriate provider(s) for your use case. You can also specify various location parameters such as update frequency, accuracy, and distance to minimize battery consumption and optimize the performance of the location tracking. Once you receive the location updates, you can extract the latitude and longitude coordinates of the device's current location and use them in your application to mark the attendance or perform other location-based tasks. It

is worth noting that the accuracy of the location data provided by the Android inbuilt GPS location services can vary depending on several factors such as device hardware, environmental conditions, and location provider availability. Therefore, it is important to handle location data with care and ensure that it is appropriately used and stored in your application. In summary, the Android inbuilt GPS location services provide a powerful and flexible way to track the location coordinates of a user's device in an Android application. By utilizing the Android inbuilt GPS Location service, you can accurately track the user's location and leverage it in your application to provide location-based functionality.

C. Firebase database

Firebase Database is a cloud-hosted NoSQL database that allows developers to store and retrieve data in real-time. It is a popular choice for mobile and web applications, providing a flexible and scalable way to store and sync data across multiple devices. To store images and persons data in Firebase Database, you can first create a Firebase project and configure your application to use the Firebase SDK. Once configured, you can create a database instance and define the data structure to store your images and persons data. Firebase Database supports two main types of data storage: JSON and Binary. For storing images, you can use the Binary data type to store image files as binary data. Alternatively, you can store image URLs in the database and retrieve the images from a storage service like Firebase Storage. For storing persons data, you can use the JSON data type to define the structure of the data. You can create a persons object that contains fields such as name, age, and other identifying information. You can then store these persons objects in the database as JSON data. Firebase Database also provides real-time data synchronization and offline data persistence, allowing your application to seamlessly update and retrieve data even when the device is offline. Additionally, Firebase Database supports access control and security rules to ensure that only authorized users can access and modify the data. In conclusion, Firebase Database provides a powerful and flexible way to store and sync images and persons data in real-time. With its support for binary and JSON data types, real-time synchronization, offline persistence, and security rules, Firebase Database is an ideal choice for storing data in mobile and web applications.

IV. LITERATURE REVIEW

A. Trusted Application Using Biometrics for Android Environment

The framework covers the accompanying prerequisites. First and foremost, to open chosen android applications utilizing face recognition. Furthermore, the framework ought to have second layer secret phrase security, which is the graphical secret key. In the event that a client neglects to perceive their face, the client should utilize the graphical secret key to open the application. Finally, the framework likewise ought to catch the interloper's face assuming recognition flops multiple times. The caught picture is then shipped off the client's email address.

B. Design of Attendance System Based on Face Recognition and Android Platform

In the above mentioned topic, during the time spent face location on Android stage, the classifier that is utilized is Adaboost overflow to distinguish various features of face; During the stage of preparation, face picture is separated with LBP highlight, histogram is determined, with LBP histogram lastly face recognition classifier is developed; In the step of recognition, features of LBP are additionally removed & contributed to the classifier, & afterward the similitude estimation capability is determined to understand the recognizable proof of staff really. The face recognition attendance model planned and carried out in their paper is tried on face data sets of ORL & contrasted and Fisherface & Eigenfaces calculations. Finally, 30 analyzers are tried, & an end-product confirms that the exactness of face recognition of this framework can meet the functional use prerequisite.

C. A Mobile Application of Face Recognition Based on Android Platform:

To take care of the issue that clients need to recollect numerous client records and passwords for various versatile Applications, this paper carries out a portable Application which utilizes face recognition innovation for client confirmation, and gathers a dataset of human countenances for testing. The examination results demonstrate the way that our application accomplishes a decent presentation clients could effectively enlist or login through face recognition in various light powers and goals.

D. An Efficient Android-Based Multimodal Biometric Authentication System with Face and Voice

This research develops a cost-effective Android-based multimodal biometric verification system that uses voice and face biometrics. during this system, a better LBP extraction of feature technique came in picture to lower the space complexity and time complexity. They have a tendency to additionally gift an improved VAD technique to lower the misjudgment quantitative relation for the voice terminus, discard the voice section which

isn't valid , and boosting the Algorithms effectiveness within the low case of SNR. As per the performance of hardware Android-based good terminals, we have a tendency to gift a reconciling fusion strategy used for implementing biometric authentication, that overcomes the shortcomings of the unimodal identity verification and the performance is improved. The outcome of the Experiments show that the developed system will nicely implement the individuals authentication underneath numerous situations, and understand the management operation with high-security applications.

V. Applications

A. In Schools & Colleges

The proposed system can be used in schools and colleges to recognize students and mark attendance at the same time. This system is better than traditional attendance because it saves much time. The system will get to know that when the student leaves the college premises. tracking the entry and exit time.

B. In Offices

In the office, it can be used to monitor the employees in time, out time and this too saves the time of the employees, and the database is maintained properly.

VI. Result Analysis

The system used Facenet TensorFlow Lite Model for face recognition and Android inbuilt GPS location services for location information. We performed several experiments to evaluate the performance of the system under different conditions. The performance of the system was evaluated in terms of accuracy, precision and recall. The experimental results show that the system achieved high accuracy and reliability in performing the task of attendance marking by verifying all required parameters accurately. We compared the proposed system with other authentication methods such as RFID card based and other biometric authentication methods such as fingerprint based system and face recognition using installed camera at location. The comparison shows that the proposed system outperforms the other methods in terms of time and cost efficient.

This system respects user's privacy by not storing their image in the database instead it only stores the features extracted from the face image and use this data to verify user's identity. This also reduce bandwidth issues as it do not need to get the actual image from backend instead it just get the float array. Also there is no need of more space to store images at backend side.

There are some limitations and challenges of the proposed system like the system requires a good quality face image to perform accurate recognition, and it may not work well in low light conditions. Additionally, the system requires a smartphone with GPS capability to work, which may cause a problem if GPS doesn't work properly in user's device. Although the proposed system has achieved good results, there is still room for improvement. Future esearch can focus on improving the accuracy of face recognition, integrating other biometric authentication methods and tracking methods and some more features to make this application much more user friendly.

VII. Conclusion

To overcome the issues related to time, cost, and inconvenience associated with attendance marking in various workplaces, this research proposes the development of a mobile application that enables attendance marking. The application utilizes face recognition and location-based authentication mechanisms to ensure that the person marking attendance is authorized and present at the designated location. This approach simplifies the attendance marking process while minimizing time, costs, and challenges associated with traditional attendance systems. By utilizing modern technologies and adhering to best practices, the proposed mobile application serves as a practical and effective solution for attendance tracking in diverse settings.

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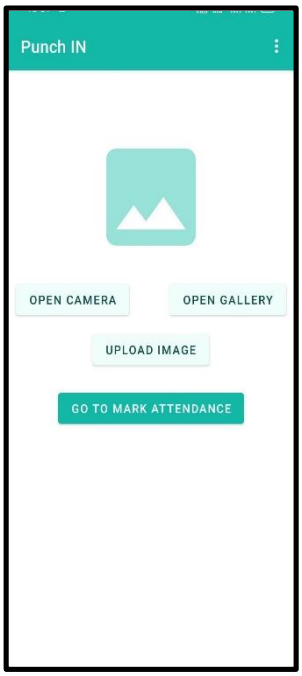
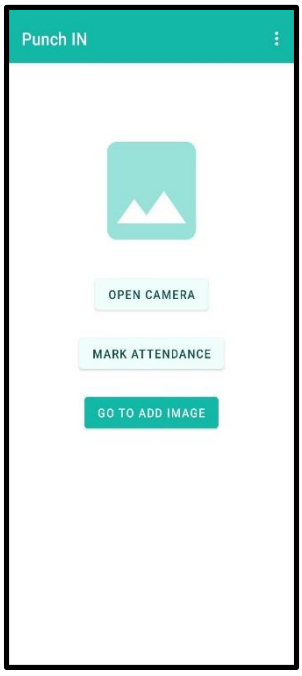


Fig.3.1

Fig.3.2



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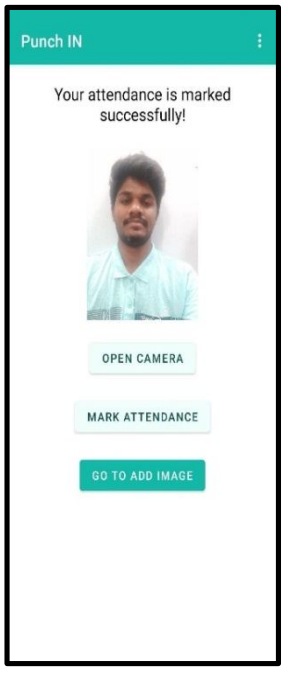

Fig.3.4

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