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# Review Paper on Attendance Application using QR Code, Face Recognition and Location Tracking

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**Abstract:** *Attendance tracking is a critical component of academic success. Studies have shown that students who consistently attend school or college are more likely to succeed academically. Various automated attendance systems utilizing biometric recognition, barcode, and near field communication mobile devices have been proposed. However, existing systems that utilize HPB and KNN algorithms have been found to be inefficient in processing time, low in accuracy, and costly to install. To address these issues, we propose an Android-based attendance system that utilizes face recognition and location tracking. Teachers will display a QR code containing course information, and attendance will only be marked after verifying the student's face and confirming their presence within the teacher's location radius. Our system will use Haar cascade and Siamese Neural Network models, with model retraining to ensure that our model stays up-to-date with new registrations. The proposed system is expected to improve performance, automate processes, and reduce human errors.*

**Keywords:** Attendance, automated attendance system, biometric recognition, barcode, Android, face recognition, location tracking, QR code, Haar cascade, Siamese Neural Network, model retraining, performance, automation, human errors.

## I. INTRODUCTION

Attendance is an essential aspect of academic administration but can often be a cumbersome and redundant task, leading to inaccuracies. The traditional approach of making roll calls can be limited, particularly in cases where the number of students is high. Many organizations have implemented digital methods such as biometric fingerprinting and card-swapping techniques, but these methods can subject students to time-consuming queues, and if a student forgets their ID card, they will be unable to get attendance. With advancements in technology, intelligent attendance systems have been developed, with biometrics playing a key role. Facial recognition is one of the most productive methods for taking attendance. However, existing face recognition techniques and methodologies are unable to handle challenges such as scaling, pose, illumination, variations, rotation, and occlusions. To address the limitations of existing systems, we propose a new framework that leverages facial recognition and location tracking. The proposed system aims to improve reliability and convenience by allowing students to register by filling out their details and uploading their facial images to the server. During attendance marking, the student's face will be verified, and attendance will be marked accordingly. Additionally, location tracking will be used to further enhance the system's reliability. This proposed framework has the potential to revolutionize attendance tracking and make it more convenient and easier to use.

## II. LITERATURE SURVEY

The use of face recognition technology for attendance management has gained immense popularity in recent years. In this regard, numerous researchers have explored the potential of various face recognition algorithms for attendance monitoring. One such study conducted in 2020 by Djoanna Marie Vasquez Salac proposed an Android-based class attendance monitoring system using face recognition technology. The researchers utilized Principal Component

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Analysis (PCA), K-Nearest Neighbors (KNN), and Support Vector Machines (SVM) to improve the system's functionality, reliability, usability, and portability. However, the study has identified the need for further improvement to enhance accuracy. (1)

In 2019, Maliha Khan et al. proposed a face detection and recognition system using the HAAR cascade algorithm, which is a machine learning approach that detects faces from positive and negative images. The researchers employed PCA for detection and eigen face along with LBP for recognition. However, the study's demerit lies in the outdated algorithm and low accuracy rate, which necessitates the use of newer algorithms for better performance.(2)

Wei Deng et al. developed a mobile application of face recognition for attendance management in 2020, using Haar cascade for face detection and Eigen face, Fisher face, and LBP for recognition and feature reduction. However, the study's demerit lies in the low precision of Eigen Feature, Fisher Feature, and LBP algorithms, which can be improved by using a more advanced application.(3)

SerignModou Bah and Fang Ming proposed an improved face recognition algorithm in 2019, using PCA and LBP for face recognition. The researchers made several improvements, including contrast adjustment method, Gaussian blur filter, median filter, and bilateral filter. After applying these modifications, the study reported an accuracy increase of 135%.(4)

In 2020, Samridhi Dev and Tushar Patnaik developed a student attendance system using face recognition. The proposed system used Haar classifiers, KNN, CNN, SVM, and generative adversarial networks. After rigorous testing, the system proved to be an efficient and robust device for taking attendance in a classroom without any time consumption and manual work. (5)

## III. TECHNOLOGIES USED

The Android 4.4 (and above) version is chosen as it is compatible with most of the Android devices.

*Database*: The database present in a central server is used to store the information to be displayed to the user. The database used for our application is FIREBASE and SQLite, where all the information related to students and taeacher is stored.

### 3.1 Hardware and Software Requirements

**Hardware Components:**

- Processor –Intel Core i5
- Hard Disk – 5GB
- Memory – 4GB RAM
- Monitor, Keyboard, Mouse

**Software Requirements for developing the application**

- Operating System: Windows 10 (Ultimate or Enterprise version)
- Tools: Android Studio/ VS Code / Jupyter Notebook
- Database: FIREBASE and SQLite
- Technologies used: Kotlin, Java, XML, NodeJS, PyTorch, Python, NextJS
- Network: Wi-Fi Internet or cellular Network

## IV. SYSTEM ARCHITECTURE AND DESIGN

After finalizing the features to be implemented, the next crucial step is to determine the system level architecture. In the context of the Android platform, it is a software package and a Linux-based operating system specifically designed for touchscreen mobile devices such as smartphones, tablets, electronic book readers, and set-top boxes. However, it is not limited to mobile devices only as it is also used in various other devices such as tablets, notebooks, and set-top boxes for TV. Android is developed by Google, utilizing a modified version of the Linux kernel and other open-source software, and is governed by the Open Handset Alliance. Java and Kotlin are the primary programming languages used to write code for the Android platform, although other languages are also compatible

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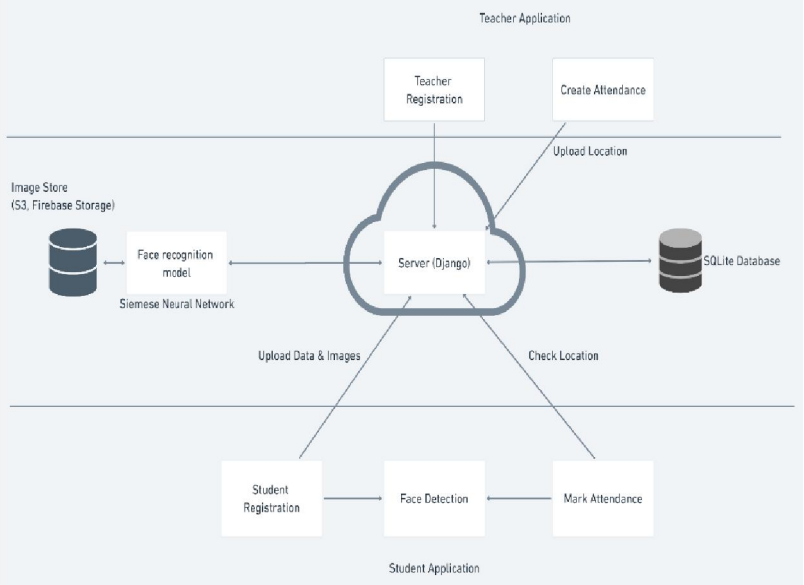


Fig. 1 Flowchart for User Login procedure.

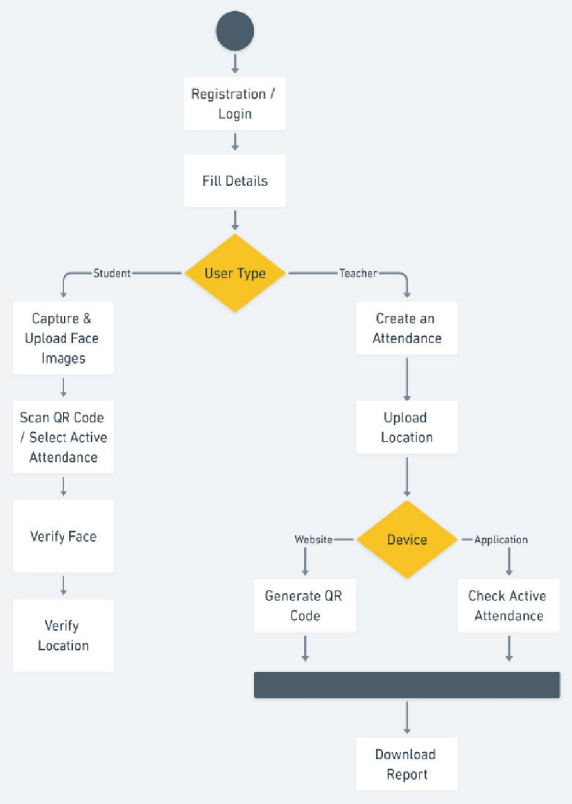


Fig. 2 System level block diagram

## V. IMPLEMENTATION RESULTS AND DISCUSSION

The user interface (UI) of the application has been designed with a focus on user experience, ensuring that it is simple and intuitive to use. The GUI has been carefully crafted to ensure that the user can navigate through the application with ease and without the need for any additional guidance. The main pages or screens of the GUI include:

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**Welcome Page**

The Home Page, the starting pageof the application is shown in Fig. 7(a). The Welcome Page.

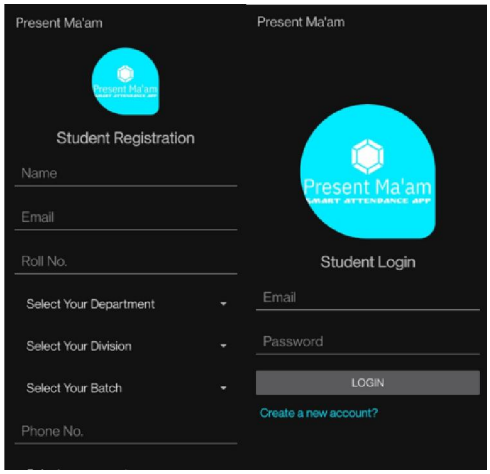


Fig. 5.1 Welcome Page

## VI. SYSTEM EVALUATION

The digital attendance application's face recognition feature demonstrated high accuracy in capturing and identifying individuals, with successful matching of faces to existing records and minimal false positives. However, low-light conditions and partial face obstructions presented occasional challenges. Future iterations could explore alternative algorithms or implement additional preprocessing techniques to improve performance. The location tracking feature accurately recorded attendance based on geographical coordinates, but occasional discrepancies arose when GPS signals were weak or individuals moved too quickly between areas. Integrating alternative positioning technologies, such as Wi-Fi or Bluetooth, could enhance location accuracy and overcome these limitations.

The QR code scanning functionality provided a fast and reliable attendance capture method, with minimal errors or failures.

Comparing the digital attendance application to traditional manual attendance systems, the automated nature reduced administrative efforts, eliminated paper-based processes, and mitigated errors caused by manual data entry. Additionally, the combination of face recognition, location tracking, and QR code scanning enhanced security and minimized potential for proxy attendance. Similar digital attendance systems in the literature exhibited varying degrees of performance and functionality.

The research objectives of developing a digital attendance application with face recognition, location tracking, and QR code scanning were successfully achieved, and the formulated research hypotheses were confirmed. However, occasional limitations and challenges arose, such as difficulty in identifying individuals under challenging lighting conditions or partially obscured faces, accuracy of location tracking affected by weak GPS signals, and challenges related to QR code scanning from damaged or improperly displayed codes. Future iterations could address these limitations and challenges by integrating additional sensors, exploring advanced algorithms or alternative scanning methods, or implementing error correction techniques.

## VII. CONCLUSION

In conclusion, the Android-based mobile application for attendance management with QR code, face recognition, and location tracking offers numerous benefits to organizations in terms of time and cost savings, improved accuracy, and enhanced security. By combining these technologies, the application provides a versatile and flexible option for attendance management that can be customized to meet the specific needs of organizations in various industries.While face recognition attendance provides a higher level of security and accuracy, location tracking attendance is particularly useful for organizations with field employees or students. The application can be used in physical classrooms, but location tracking cannot be utilized in online mode. Future research and development could focus on improving facial recognition accuracy, integrating with other systems, real-time data analytics, automated reporting, enhanced security

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features, and user-friendly interface to further enhance the efficiency and effectiveness of the application.Overall, the attendance application is a valuable tool for organizations seeking to improve their attendance management process. With the increasing adoption of technology in the workplace, it is likely to become even more common in the future, leading to a more streamlined and efficient attendance management system

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