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Geo Mark-Streamline Attendance Marking System

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ABSTRACT:

Geo Mark is a mobile-based attendance management application with dual panels Admin and User leveraging geo-location and biometric authentication. The system aims to replace traditional biometric hardware with an in-app solution using fingerprint and GPS tracking. Admins can add employees, monitor attendance, and receive alerts if users are outside the office premises during working hours. Employees can log in with admin-provided credentials, verify their presence through fingerprint and mark attendance based on their proximity to the defined geofence. This system ensures a hygienic, real-time, cost-effective, and secure method of tracking attendance.

Keywords: Attendance Management, Geo-location, Biometric Authentication, GPS Tracking, Geofence, Real-time Monitoring

I.INTRODUCTION

Attendance systems are essential in both academic and corporate environments for ensuring accountability and monitoring presence. Traditional methods like manual registers and biometric devices present limitations such as susceptibility to proxy attendance, hardware costs, and hygiene concerns [2]. With the widespread availability of smartphones equipped with GPS and biometric authentication, mobile-based attendance systems offer a more efficient and contactless alternative.

This app proposes an Android-based attendance system that utilizes geo-location and in-app biometric authentication to replace traditional biometric hardware. The system includes two panels: an admin panel for managing users and monitoring real-time attendance data, and a user panel for employees or students to log in and mark attendance. Attendance is only recorded if the user is within a defined geofenced area and successfully verifies identity through fingerprint. The solution ensures accuracy, security, and convenience while reducing infrastructure dependency.

II. LITERATURE SURVEY

Recent advancements in mobile and web technologies have led to the development of smarter attendance systems that aim to overcome the limitations of traditional methods such as manual registers and biometric scanners. Many existing systems have explored the use of geo-location services to track user presence within a predefined area. These systems typically allow attendance marking only when users are detected inside the geofenced location, improving the authenticity of location-based verification. However, such systems often lack a second layer of security, like biometric validation, making them vulnerable to misuse or proxy attendance. Other solutions include integrated technologies like near field communication (NFC), IP tracking, and GPS to improve accuracy and reduce time complexity [1]. These models demonstrated improved efficiency over conventional biometric systems but often require external hardware components such as NFC tags or RFID modules, which may increase deployment costs and reduce portability [1].

In contrast, the proposed system leverages smartphones' built-in capabilities, specifically GPS, for location tracking and biometric authentication (fingerprinting), to offer a secure and cost-effective solution. By combining real-time location verification with biometric validation, this system addresses the shortcomings of both hardware-dependent and single-factor authentication models. It ensures that attendance is marked only when the user is physically present within the designated premises and has verified their identity, offering improved reliability, hygiene, and scalability**.**

III. METHODOLOGY

The GeoMark mobile application is structured with two primary modules: the Admin Panel and the Employee Panel. The Admin Panel can be accessed using predefined static credentials and provides the ability to manage employee records. Once logged in, the admin is presented with a dashboard displaying a list of users in a table format, where new users can be added by inputting details like name, student ID, phone number, and password. Upon selecting a specific user, the app navigates to a screen that shows their real-time location status—confirming whether the employee is within or outside the set premises—by calculating the GPS-based distance from the college location. In addition to managing employee data, the admin has access to monitor punch-in and punch-out times and receives notifications if an employee is detected beyond the permissible range during work hours.

The Employee (User) Panel allows users to log in using the credentials created and managed by the admin. Once authenticated, the employee is granted access to an attendance feature that integrates both location tracking and biometric verification. When an employee attempts to mark attendance, the app first determines their current location through GPS. If they are found to be within the defined range of the college premises, a fingerprint or face recognition prompt appears for identity confirmation. Only upon successful biometric authentication is the attendance marked, and the corresponding data—time, location, and status—is stored in the local database and reflected on the admin panel. This method ensures secure, reliable, and contactless attendance tracking, effectively replacing traditional biometric hardware systems with a mobile-first solution.

IV. IMPLEMENTATION

The GeoMark App was implemented as a mobile-based attendance tracking system using the Android platform. The application is developed using Java and Kotlin, with Android Studio as the integrated development environment (IDE). It utilizes SQLite for local data storage, the Google Play Services Location API for real-time GPS tracking, and the Android Biometric API for fingerprint or facial authentication.

The implementation is divided into two primary modules: Admin Module and User Module. The Admin Module begins with a static login screen, where predefined credentials are used to authenticate the admin. Once logged in, the admin dashboard displays a list of registered users. The admin can add new users by entering details such as name, student ID, contact number, and password. These user details are stored locally in the SQLite database. Each user entry in the dashboard is clickable, allowing the admin to view individual user profiles and track their live location relative to the predefined institutional coordinates. If a user is found outside the permitted radius (typically 100 meters), the application dynamically calculates and displays the distance and notifies the admin with an alert.

On the other hand, the User Module facilitates login using credentials provided by the admin. After a successful login, the user is directed to the attendance screen. The punch-in and punch-out process is governed by two key checks: location validation and biometric verification. The application first verifies whether the user is within the campus boundary using real-time GPS data. If the location check is successful, the app triggers the device's built-in biometric authentication (fingerprint or face recognition). Upon successful authentication, the attendance record—including time, date, location coordinates, and status—is stored in the local database. If either the location or biometric check fails, the punch action is aborted, and an appropriate error message is displayed.

The UI components of the application are implemented using XML layouts, ensuring a user-friendly interface. Custom adapters and data access objects (DAOs) are used for efficient data handling and interaction with the Room database. The app architecture follows a modular structure, separating business logic from UI to enhance maintainability and scalability. The implementation ensures minimal hardware dependency by replacing traditional biometric machines with the mobile device's biometric sensor, making the solution cost-effective and scalable for educational institutions.

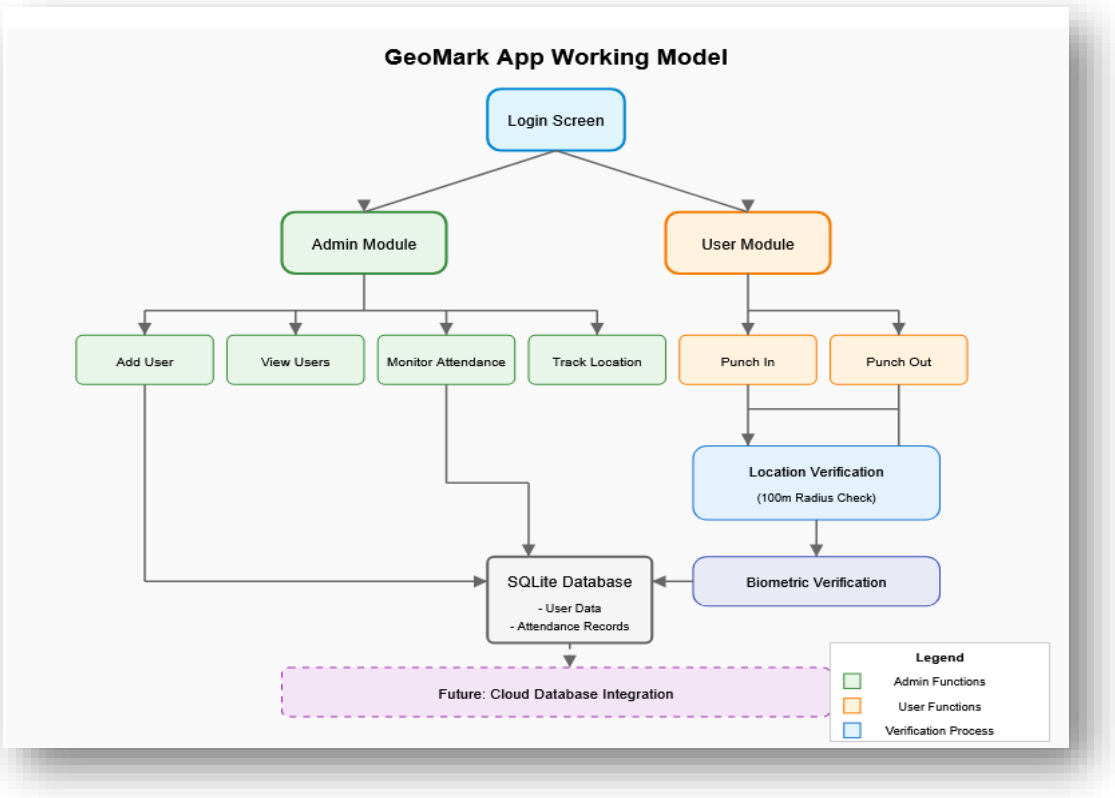

Fig 1: GeoMark app working model

V. RESULTS AND DISCUSSION

The GeoMark app functioned successfully, enabling secure admin and user login, geolocation-based punch-in/out, and biometric verification, as shown in the images.

The GeoMark app starts with **Fig. 2**, showing the splash screen that provides an initial branded loading view. **Fig. 3** shows the menu screen where users can select either admin or user login options. **Fig. 4** displays the admin login screen where the admin enters predefined credentials. In **Fig. 5**, the admin dashboard is shown, providing an overview of user details and attendance information. **Fig. 6** illustrates the "Add New User" screen where admins can input user details like name, roll number, and contact information. **Fig. 7** shows the display of registered users in the admin dashboard. **Fig. 8** presents the user login screen where users authenticate using their credentials provided by the admin. **Fig. 9** demonstrates the user dashboard displaying punch-in and punch-out options. **Fig. 10** captures the punch-in process where the system checks location and biometric verification. **Fig. 11** shows the punch-out screen, ensuring similar validation. **Fig. 12** illustrates how the admin can view punch-in and punch-out times of users within the dashboard. Finally, **Fig. 13** displays an unsuccessful punch-in attempt when a user is outside the permissible 100-meter range, confirming robust location enforcement.

Fig 2: Splash screen

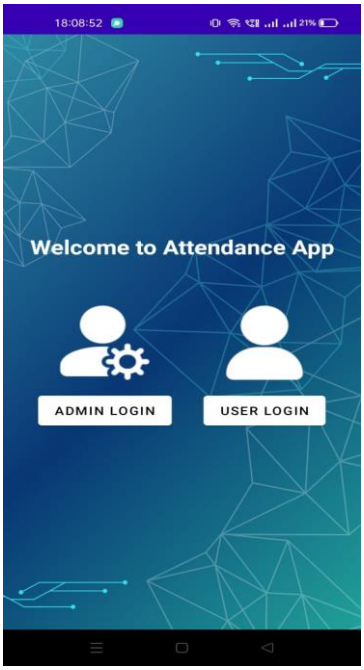

Fig 3: Menu Screen

Fig 4: Admin login screen

Fig 5: Admin dashboard

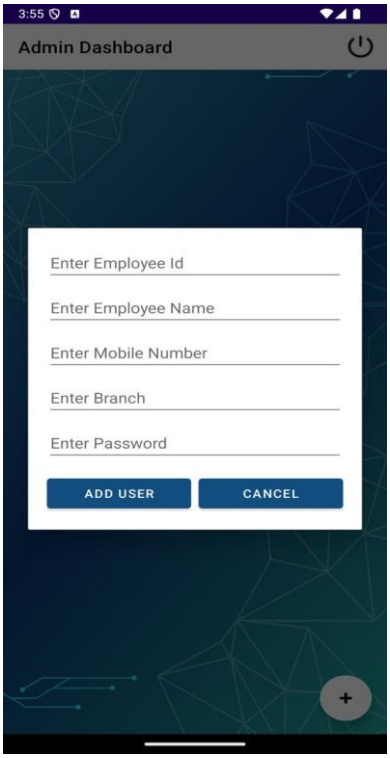

Fig 6: Add new user

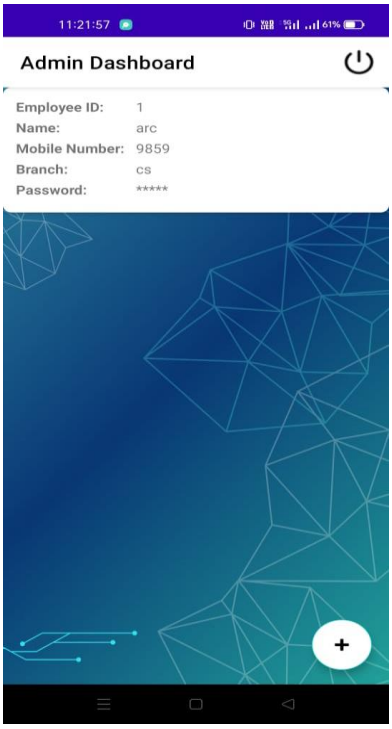

Fig 7: Display in dashboard

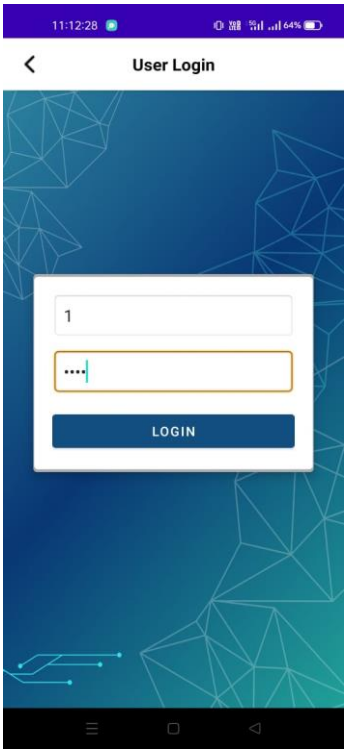

Fig 8: User login

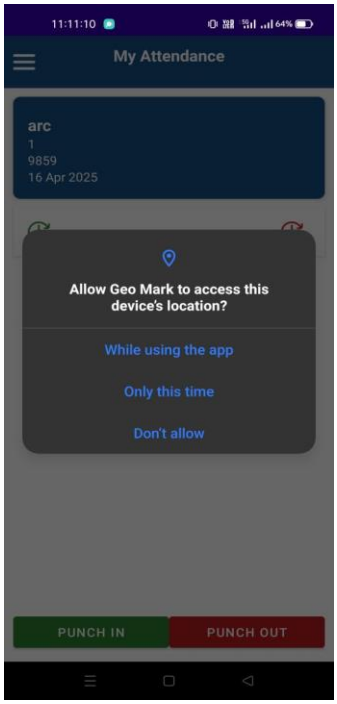

Fig 9: User dashboard

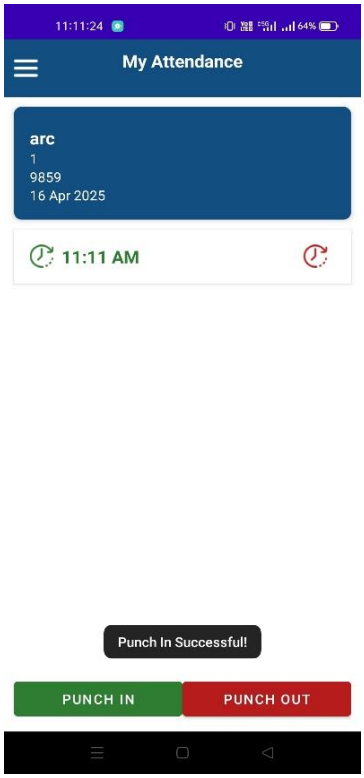

Fig 10: Punch In

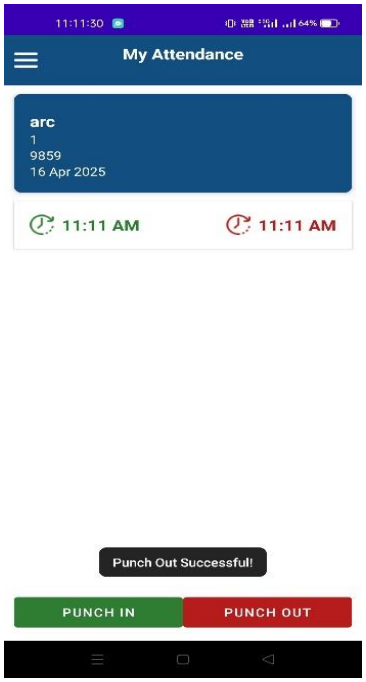

Fig 11: Punch out

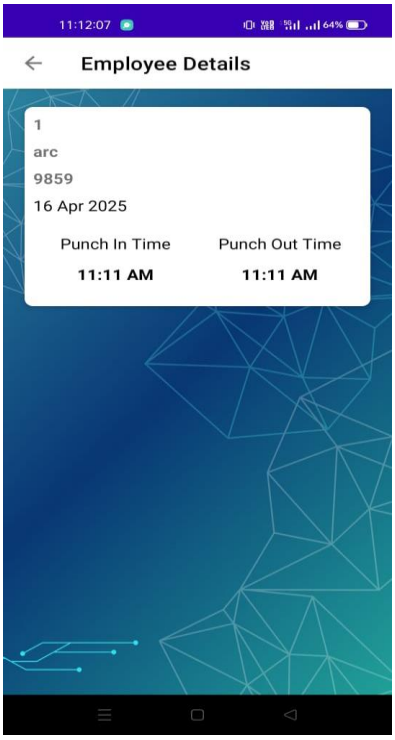

Fig 12: Display of time at admin

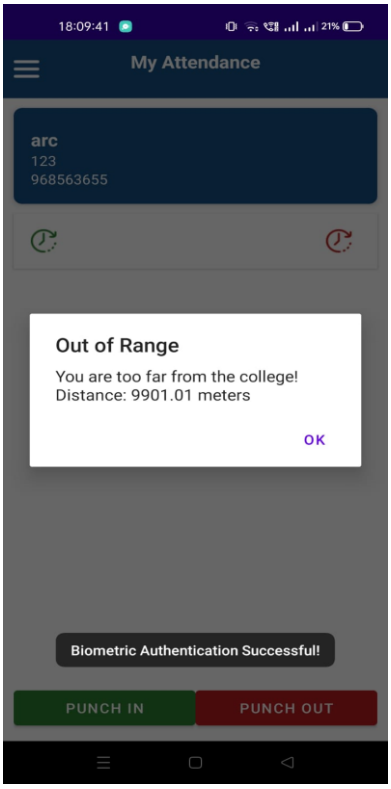

Fig 13: Unsuccessful punch in

VI. CONCLUSION

The development of the GeoMark mobile application successfully demonstrated the feasibility of integrating GPS-based location validation and biometric authentication into an attendance management system. By providing distinct Admin and User modules, the system ensures secure login, precise attendance tracking within a predefined geographic boundary, and efficient user management. The use of a local SQLite database enabled offline functionality while maintaining data integrity. Testing confirmed the reliability of location verification, the accuracy of biometric checks, and the robustness of the admin

dashboard for monitoring user activity. Overall, the GeoMark application offers a significant improvement over traditional attendance systems by enhancing security, reducing manual errors, and promoting operational efficiency.

VII. FUTURE SCOPE

Future enhancements for the GeoMark application include the integration of a cloud-based database to facilitate centralized data storage and real-time synchronization across multiple devices. Implementing automated notifications for unauthorized punch-in or punch-out attempts would further improve administrative oversight. Additionally, advanced analytics features could provide valuable insights into attendance patterns, enabling informed decision-making. Expanding the system to support dynamic geofencing, cross-platform compatibility, and two-factor authentication will enhance scalability, flexibility, and security. These developments will position the GeoMark system as a comprehensive and scalable solution for institutional attendance management.

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