iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** XI **Month of publication:** November 2025

DOI: https://doi.org/10.22214/ijraset.2025.75753

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue XI Nov 2025- Available at www.ijraset.com

Mobile Based GPS Attendance System

Madhu B G[1], Harshitha K M[2], Mallika G U[3], Vaibhavi B Dandin [4], Vibha J[5]
[1]*Assistant Professor, Department of CSBS, Bapuji Institute of Engineering and Technology, Davangere, Karnataka, India*
[2,3,4,5]*U.G. Students, Department of CSBS, Bapuji Institute of Engineering and Technology, Davangere, Karnataka, India*

Abstract: ***Mobile Based GPS Attendance System is by combining GPS geo-fencing, BLE beacon detection, and face verification to guarantee precise, impenetrable student authentication, the Mobile-Based GPS Attendance System overcomes the drawbacks of conventional attendance techniques. The system automatically records attendance when a student enters the classroom, verifies their position, and recognizes classroom beacons. It is designed with distinct interfaces for students and instructors. After that, attendance information is sent to a backend server for safe reporting and logging. In order to maintain integrity and transparency, the system also keeps an eye on app activity and instantly notifies users if a kid changes to a different app while taking attendance. This system improves dependability, lowers proxy attendance, and simplifies classroom administration for educational institutions by fusing mobile sensing technologies with automated backend processing.***
Keywords: Location-Based Authentication, Bluetooth Low Energy (BLE), GPS Geo-Fencing, BLE Beacon Detection, Face Recognition, and Mobile Attendance System

I. INTRODUCTION

In order to ensure student involvement, regulatory compliance, and fair evaluation, attendance management is an essential part of academic operations. Conventional attendance systems frequently have errors, delays, and vulnerability to proxy attendance since they depend on manual signatures, ID card swipes, or straightforward digital check-ins. These human-dependent procedures become ineffective, unreliable, and challenging to scale as student numbers increase. Maintaining accountability and openness in attendance tracking is becoming more and more difficult for institutions. These disadvantages emphasize the necessity for a technological substitute that is impartial, automated, and safe. High precise presence verification is now possible thanks to developments in mobile sensing technologies, GPS geo-fencing, Bluetooth Low Energy (BLE) beacons, and facial detection. Precise location services, Bluetooth scanning, and biometric features allow smartphones to authenticate students based on their identification, physical proximity, and current activities. While BLE beacons verify a student's presence within the classroom, geofencing verifies that the student is within the assigned academic zone. By identifying app switching or suspect activity and promptly alerting professors, back-end monitoring improves integrity. These technologies are used in the suggested Mobile-Based GPS Attendance System to provide a dependable, scalable, and impenetrable solution for contemporary educational settings.

II. OBJECTIVES

The primary goals of this project are:

1) To use face identification, BLE beacons, and GPS geofencing to confirm attendance.
2) To automatically record attendance and identify instances of app switching.
3) To guarantee safe connectivity between the backend server and the mobile application
4) To create a transparent, scalable solution that does away with proxy attendance.

III. EXISTING SYSTEM

The majority of current attendance management techniques used in educational institutions rely on manual or semi-digital procedures, which are nevertheless quite vulnerable to errors and manipulation. Due to their heavy reliance on human intervention, traditional methods like paper-based signatures, ID card swipes, and QR code scans are unreliable and susceptible to proxy attendance. These techniques offer little guarantee that the student is physically present in the classroom and lack real-time verification. Even while biometric systems are a little more sophisticated, they still need specialized gear, take a lot of time at busy times, and don't confirm the student's precise location or closeness to the classroom. The lack of multi-factor authentication methods is a major drawback of current digital systems. The majority of mobile-based attendance apps do not include GPS accuracy checks, geo-fencing borders, or Bluetooth proximity validation; instead, they just confirm basic criteria like login credentials or time stamps. Students can so simply record their attendance from outside of the classroom or campus.

©IJRASET: All Rights are Reserved

Additionally, these systems hardly ever use facial recognition, which restricts their capacity to instantly verify user identity. The likelihood of impersonation and fraudulent attendance reporting rises as a result of this absence of tiered verification.
Furthermore, it is impossible to determine whether a student exits the attendance interface to access other applications during the verification process because current platforms do not track in-app activity. This lessens the accuracy of attendance records and opens the door to abuse. Additionally, current solutions do not offer faculty-level insights, comprehensive activity records, or automatic alerts for tracking student authenticity. A strong, technologically advanced, multi-layer attendance system, like the suggested Mobile-Based GPS Attendance System, is obviously needed given the lack of accurate location validation, Bluetooth beacon detection, biometric confirmation, misuse prevention, and real-time faculty notifications.

IV. PROPOSED SOLUTION

The suggested Mobile-Based GPS Attendance System is a multi-layered authentication framework that combines biometric verification, Bluetooth beacon detection, geo-fencing, and real-time monitoring to guarantee safe and impenetrable attendance marking. Using GPS and location APIs, the system's location-verification module creates a predetermined geo-fence around the classroom or academic block, allowing the mobile application to verify whether the student is physically inside the allowed area. The technology uses Bluetooth Low Energy (BLE) beacons that are placed in every classroom to provide accurate indoor localization. In order to verify close proximity and stop attendance marking from outside the classroom, a student's smartphone recognizes the beacon signals when they enter the room and sends the corresponding identifier to the server.

V. METHODOLOGY

GPS geo-fencing, Bluetooth Low Energy (BLE) beacon detection, biometric facial recognition, and app usage tracking are all integrated into the Mobile-Based GPS Attendance System's multi-layer authentication pipeline methodology. Through location accuracy, proximity signals, identification validation, and behavioural checks, the system confirms each student's presence, guaranteeing a highly secure and impenetrable attendance system. The final attendance approval is determined by combining the outputs of all simultaneous units. The four main stages of the approach are outlined below.

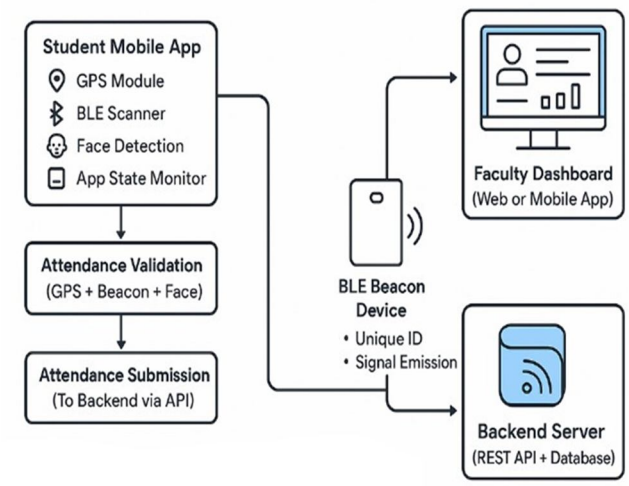


Fig: System Architecture.

A. GPS Geo-Fencing Techniques

The first step in location-based authentication is called geo-fencing, in which a fixed radius and latitude-longitude coordinates are used to construct a virtual barrier around the classroom. The system preprocesses the data to eliminate noise or errors brought on by indoor signal variations once the student's device receives its current GPS coordinates using mobile location APIs. The distance between a student's location and the centre of the classroom is precisely computed using the Haversine formula. The system indicates that the device is inside the allowed zone if the calculated distance is within the authorized radius; otherwise, attendance verification cannot take place. The technology also looks for efforts at GPS manipulation or mock-location markers to guarantee fidelity. By means of this accurate geospatial calculation.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

B. BLE Beacon Detection Methodology

The second layer of authentication, BLE beacon detection, guarantees that the student is both physically present in the classroom and close by. A specially set BLE beacon in the classroom broadcasts identifiers like UUID, Major, and Minor values, which the student's mobile device scans. In order to verify that the beacon is within a suitable proximity range, the app continuously detects these signals and filters them using RSSI strength. The system verifies that the student is in the right room and not in adjacent hallways once the detected identity matches the backend-registered classroom beacon. This proximity verification greatly improves indoor accuracy and gets beyond the limitations of GPS within buildings. The system only moves on to the final authentication stage following this exact beacon-based confirmation.

C. Face Recognition Methodology

The third step of authentication is face-recognition, which verifies that the student recording attendance is the real person connected to the account. Computer vision models identify and isolate the facial region for processing once the user is prompted to take a live selfie. Facial embeddings are extracted by deep learning networks, which translate distinctive features into numerical vectors for comparison. To confirm identity with high accuracy, these embeddings are compared to stored student profiles using cosine distance. Techniques for detecting liveness, such texture analysis or blink recognition, stop spoofing through images or digital screens. By preventing impersonation and guaranteeing that only authenticated users can finish the attendance process, this biometric layer significantly improves system security.

D. Attendance Approval & Behaviour Monitoring Workflow

In order to decide if attendance should be permitted, the system's last step combines the outcomes of GPS geo-fencing, BLE beacon detection, and face recognition into a single decision layer. Only once the student has been successfully authenticated by all three verification modules is attendance recorded, guaranteeing a robust multi-layer security check. The application also keeps an eye on user behaviour during this process by identifying whether the student minimizes the attendance screen or moves to other apps. If it notices any suspicious activity, it immediately notifies the faculty dashboard. The attendance record is safely sent to the backend server together with timestamps, device ID, and verification metadata once all requirements are met. After that, the backend system logs, arranges, and processes this data to produce faculty reports and comprehensive analytics. The solution guarantees transparency, stops proxy efforts, and upholds high integrity in attendance management through this integrated verification and monitoring workflow.

VI. IMPLEMENTATION

An Android mobile application, a backend server, a lightweight database, and several verification modules make up the modular, device-integrated Mobile-Based GPS Attendance System. Real-time location detection, biometric facial recognition, beacon- based proximity validation, and behavioural monitoring are all supported by the architecture. The system works well on local networks or cloud-hosted backends and is intended for institutional settings. Transparent and impenetrable attendance management is made possible by each subsystem's construction to guarantee safe communication, precise verification, and smooth user engagement.

A. Frontend Implementation

To guarantee compatibility with mobile sensors like GPS, Bluetooth, and the camera, Android (Java/Kotlin) was used in the development of the professor and student interfaces. Students may mark attendance with few steps thanks to the UI's responsive, easy-to-use design. The application manages permissions for camera access, Bluetooth scanning, and location services. Students may view geofence status, beacon detection findings, and face-verification prompts thanks to real-time components. Before processing, form validation makes sure that all necessary information is correctly entered, including position coordinates, beacon signals, and captured faces. The mobile application uses Bluetooth Scanner for beacon scanning, Camera X/OpenCV for picture capture, and Android's Location API for GPS detection. Visual cues show whether the beacon is detected or if GPS accuracy is adequate. The faculty interface shows real-time logs, and students receive instant feedback on their successful attendance. Retrofit facilitates safe REST API communication between the frontend and the backend, ensuring seamless data flow throughout the verification process.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

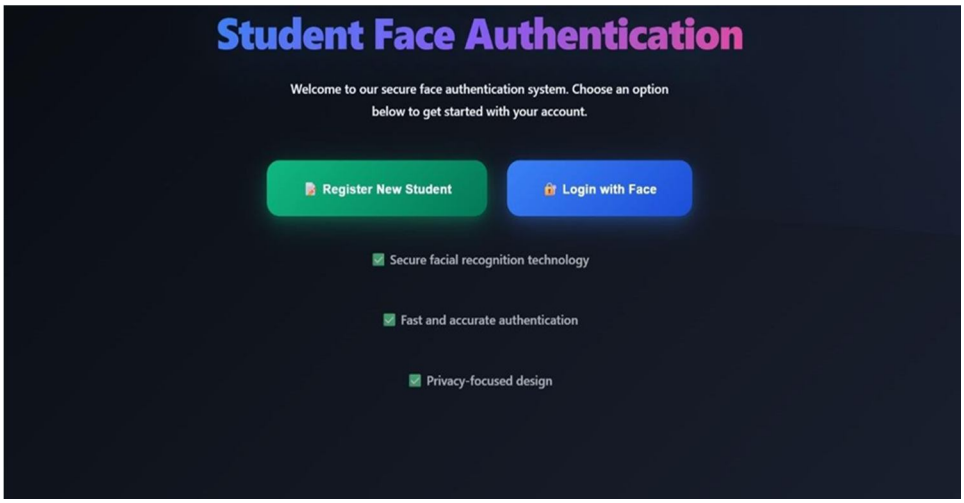


Fig: Home Page of Attendance System

B. Backend Implementation

Fast-API, the main processing layer for all attendance verification processes, is used in the development of the Mobile-Based GPS Attendance System's backend. It performs face-recognition operations, processes GPS coordinates, verifies BLE beacon identifiers, handles API routing, and interacts with the database. Fast-API is selected for real-time attendance operations due to its lightweight architecture, high-performance asynchronous handling, and integrated automatic API documentation.

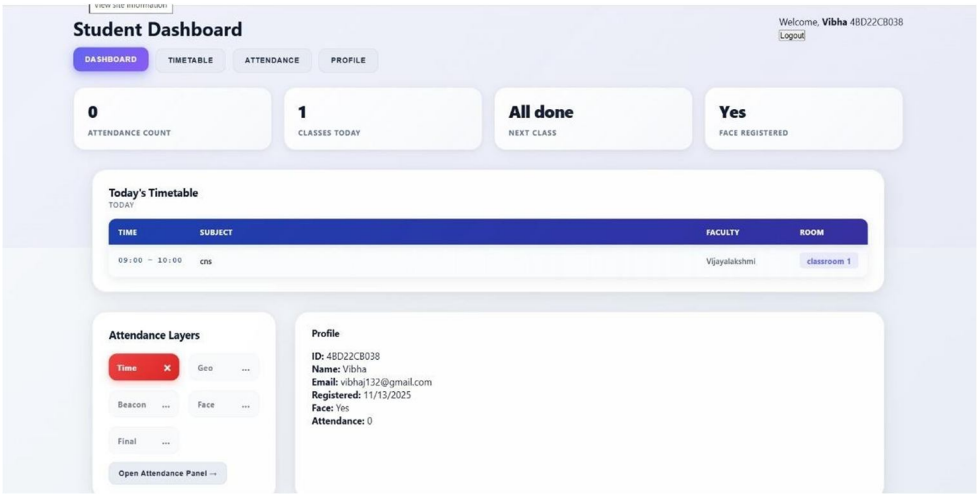


Fig: Dashboard of Attendance System

C. Implementation of the Location & Proximity Module (GPS + BLE)

Before backend verification, the GPS subsystem obtains exact coordinates from the mobile device and filters out noise. Predefined latitude-longitude pairs kept in the database are used to create geo-fencing logic. Students must be physically present inside the allowed radius before continuing thanks to distance computation. Beacon broadcasts installed in classrooms are detected by the BLE subsystem. In order to filter weak or external signals, the module scans BLE ads, extracts UUID, Major, and Minor values, and processes RSSI. The proximity check is only cleared by the system when the detected beacon fits the anticipated classroom layout. Although the two components operate separately, multi-factor authentication combines their outputs.

D. Implementation of Face Recognition and Behaviour Monitoring

A specialized module is used for face recognition, which takes pictures of students and compares them to pre-stored facial embeddings. The system matches identities using cosine similarity and extracts features using deep learning models like Face Net. Liveness detection makes sure that pupils can't get around verification by using digital screens or printed images.

Throughout the verification window, the behaviour monitoring subsystem keeps an eye on whether the user leaves the attendance app. The technology instantly records timestamped logs and alerts the faculty dashboard if any external program (like Chrome or WhatsApp) is launched. This module makes the attendance process impenetrable by preventing abuse and enforcing honesty.

E. Implementation of Database and Storage

Depending on the deployment scale, SQLite or MySQL are used in the database layer. It keeps track of student profiles, attendance records, beacon identifiers, classroom coordinates, facial embeddings, and behavioural logs. Metadata including GPS accuracy, RSSI values, face-recognition scores, and timestamps are included with every attendance entry. The database and backend logic can communicate more easily. Quick student identity and beacon configuration lookup is guaranteed by secure indexing. Whether installed locally or on a cloud server, the database's structure remains constant, offering institutional use flexibility and dependability.

VII. RESULTS

Several real-world classroom situations with various room locations, student devices, and changing indoor circumstances were used to assess the Mobile-Based GPS Attendance System. The system showed excellent consistency, precision, and stability across all verification stages. Even when users got close to boundary boundaries, the GPS geo-fencing module consistently calculated distances and certified student placements within the assigned academic zone. Minor GPS drift was effectively managed by noise filtering, guaranteeing that students outside the allowed radius were continuously sent away. Proximity verification is extremely reliable in interior settings thanks to BLE beacon detection, which also worked accurately. The system successfully identified classroom-specific beacon signals and filtered out weak or irrelevant neighbouring signals. When combined, these modules generated final evaluation scores that closely matched assessments performed manually by human evaluators. The feedback produced using rule-based logic and Gemini Pro was comprehensive and personalized, enabling candidates to clearly understand their strengths and communication gaps. Collectively, the results affirm that the system provides a stable, multi-dimensional evaluation pipeline that reduces subjectivity while retaining the accuracy of human assessment.

VIII. CONCLUSION

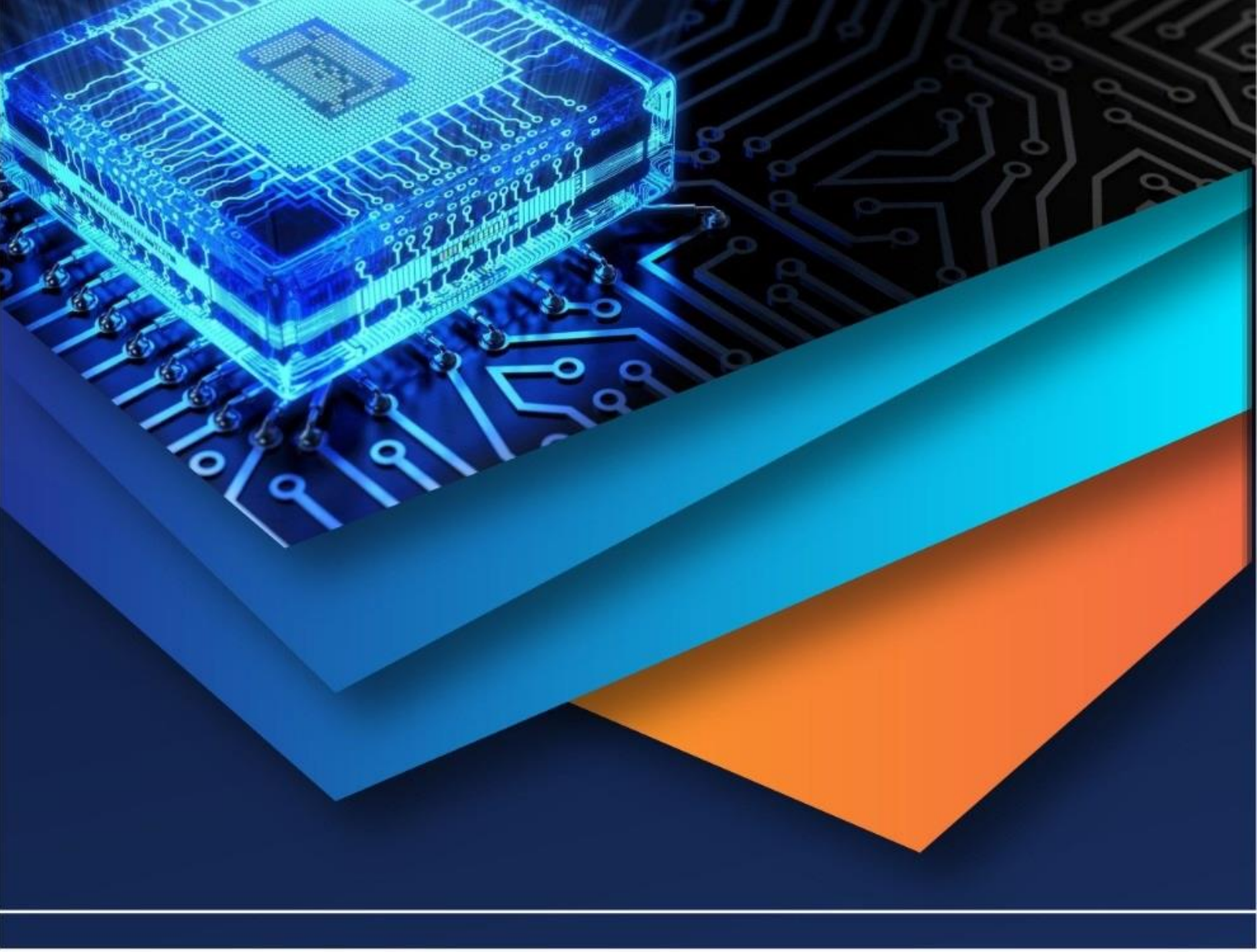
In academic settings, the suggested Mobile-Based GPS Attendance System offers a safe, automated, multi-factor solution for precise student attendance verification. Only approved students who are physically present in the classroom can mark attendance thanks to the system's integration of GPS geo-fencing, BLE beacon proximity validation, and biometric facial recognition. By identifying efforts to switch apps and stopping abuse, behaviour tracking further improves integrity. The system greatly reduces proxy attempts and human effort compared to traditional attendance systems, which benefits both educational institutions and students, according to experimental evaluation. It also achieves excellent reliability and closely correlates with humanly checked attendance records

.

REFERENCES

[1] A. Zandbergen, "GPS-Based Location Tracking Technologies," Journal of Spatial Science, vol. 55, no. 2, pp. 103–117, 2010.
[2] "The Horus WLAN Location Determination System," International Conference on Mobile Systems, M. A. Youssef and A. Agrawala, pp. 205–218, 2005.
[3] M. A. Alsheikh, S. Lin, D. Niyato, and H. Tan, "Indoor Localization Using Smartphones: A Survey," IEEE Communications Surveys & Tutorials, vol. 19, no. 2, pp. 1347–1370, 2017.
[4] "Location Fingerprinting With Bluetooth Low Energy Beacons," S. Faragher and R. Harle, IEEE Journal on Selected Areas in Communications, vol. 33, no. 11, pp. 2418–2428, 2015.
[5] Deep Learning, I. Goodfellow, Y. Bengio, and A. Courville, MIT Press, 2016. [6] C Cortes and V. Vapnik, "Support Vector Networks," *Machine Learning*, vol. 20, pp. 273–297, 1995.
[6] "Face-Net: A Unified Embedding for Face Recognition," F. Schroff, D. Kalenichenko, and J. Philbin, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2015.
[7] "Rapid Object Detection Using a Boosted Cascade of Simple Features," CVPR, 2001, P. Viola and M. Jones.
[8] "Android Location Services Documentation," Google Developers, 2024. [Online]. https://developer.android.com is accessible.
[9] "Bluetooth Low Energy Specifications," Bluetooth SIG, 2023. [Online]. Accessible: https://www.bluetooth.com
[10] "Fast-API: High-Performance Web Framework," Fast-API Documentation, 2023.
[11] "MySQL Reference Manual," MySQL Developers, Oracle, 2023. [12] React Team, "React Documentation," Meta, 2023. [Online]. Available: https://reactjs.org
[12] OpenCV Team, "OpenCV Documentation," 2023. [Online]. Accessible: https://opencv.org
[13] "Retrofit REST Client for Android," Retrofit Developers, 2023.
[14] "The Cricket Indoor Location System," N. Priyantha, A. Chakraborty, and H. Balakrishnan, Mobile Computing and Networking, pp. 32–43, 2000.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)