

CONTEXT-AWARE INDOOR STAFF PRESENCE VERIFICATION USING BLE

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ABSTRACT

Traditional staff monitoring methods lack accurate indoor location and time-based verification. This project presents a context-aware indoor staff presence verification system using Bluetooth Low Energy (BLE). Each staff member carries a BLE-enabled ID card that broadcasts a unique identifier, detected by classroom-level BLE receivers using Received Signal Strength Indicator (RSSI) values. The system verifies presence by matching location with assigned classroom and scheduled time.

ABSTRACT (CONTD.)

Attendance is recorded automatically, and alerts are generated for delayed or absent staff. The system is low-cost, energy-efficient, and suitable for smart campus environments.

INTRODUCTION

- Global Positioning System (GPS)-based solutions are unreliable in indoor environments such as classrooms and offices.
- This project uses Bluetooth Low Energy (BLE) to verify staff presence based on correct indoor location and time.
- The system is context-aware, considering place and time instead of simple attendance.

LITERATURE SURVEY

Table 1. Literature survey

S. NO.	AUTHOR NAME	YEAR	TITLE	METHOD/ ALGORITHM
1.	Mohammadali Khazen, Mazdak Nik- Bakht, Osama Moselhi, Jeffrey Dungen	2025	A DEPLOYABLE SOLUTION FOR INDOOR TRACKING OF WORKERS IN CONSTRUCTION SITES THROUGH BLUETOOTH LOW ENERGY TECHNOLOGY	RSSI-based distance estimation, triangulation algorithm, and kalman filtering

LITERATURE SURVEY (CONTD.)

S. NO.	AUTHOR NAME	YEAR	TITLE	METHOD/ ALGORITHM
2.	Arjun Jain	2025	A BLE-Based Smart Attendance System for Scalable and Contactless Classroom Automation	RSSI-based proximity detection, and cloud-based data management

LITERATURE SURVEY (CONTD.)

S. NO.	AUTHOR NAME	YEAR	TITLE	METHOD/ ALGORITHM
3.	Bramesh S M, Arun P, Deekshith H R	2025	Smart Attendance System with Facial Recognition and GPS Verification	Facial recognition, and GPS-based location validation

EXISTING SYSTEM

- Facial recognition-based attendance systems combined with GPS verification are used to automate staff attendance by validating identity and location.
- These systems capture facial images and geographic coordinates to record attendance and prevent impersonation in monitored environments.

PROBLEM STATEMENT

- GPS-based location verification is unreliable in indoor classroom environments.
- Facial recognition accuracy depends on lighting, camera quality, and user positioning.
- Existing systems lack efficient indoor presence validation and real-time alert mechanisms.

HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE REQUIREMENTS

Processor	:	Intel Core i3 or above
RAM	:	Minimum 8 GB
Storage Space	:	40 GB
Tag	:	BLE tag(ID card type)
Microcontroller	:	ESP32(BLE Receiver)

HARDWARE AND SOFTWARE REQUIREMENTS (CONTD.)

SOFTWARE REQUIREMENTS

Operating System	:	Windows 10 or above
Language	:	Python 3.x
Software	:	VS Code / Arduino IDE
Backend	:	MongoDB

PROPOSED SYSTEM

- The proposed system enhances BLE-based indoor monitoring by integrating context-aware presence verification and automated alert mechanisms.
- It detects staff location using BLE tags and verifies their presence based on assigned classroom and scheduled time.
- This enables automated attendance tracking, punctuality monitoring, and rule-based notifications, improving accuracy, efficiency, and real-time classroom management.

BLOCK DIAGRAM

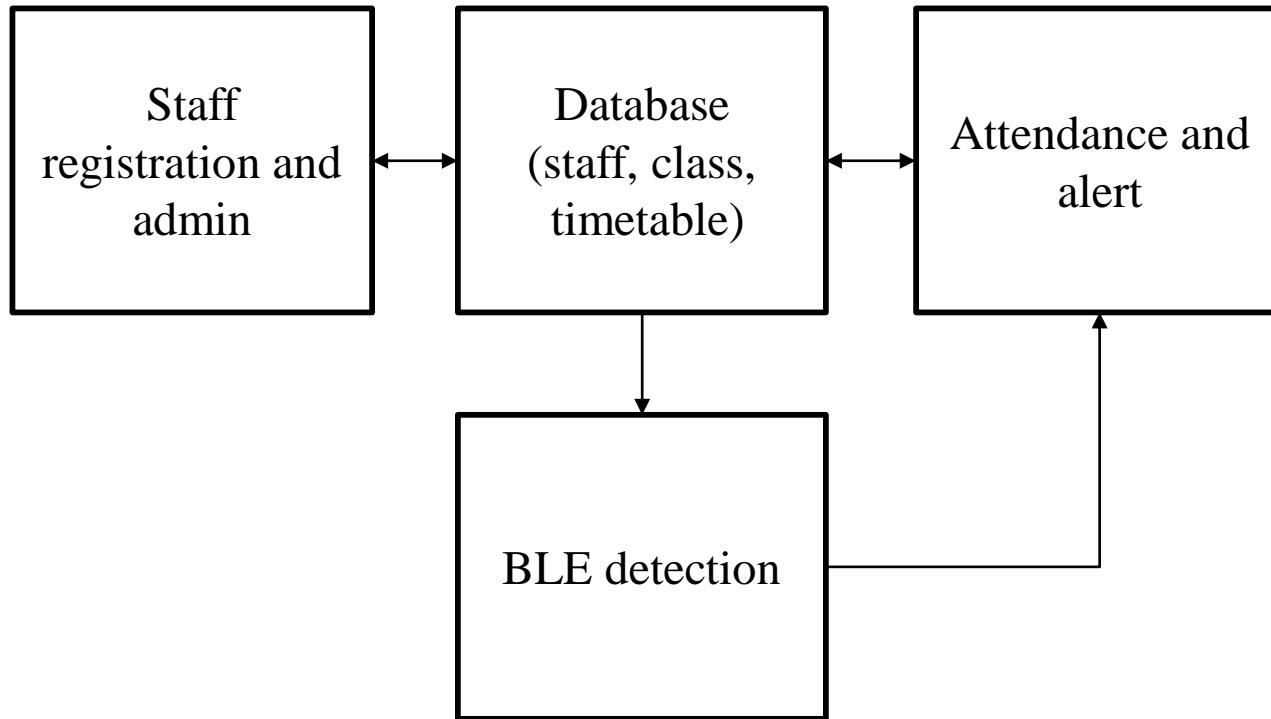


Fig. 1. Block diagram of context-aware indoor staff presence verification using BLE

MODULES AND DESCRIPTION

- Staff registration and admin
- BLE detection
- Attendance and alert

MODULES AND DESCRIPTION (CONTD.)

- **Staff registration and admin**
 - This module stores staff details such as staff ID, department, timetable, and assigned BLE tag ID.
 - Allows the admin to view staff presence, attendance records, and system alerts through a dashboard.

MODULES AND DESCRIPTION (CONTD.)

- **BLE detection**
 - Detects BLE signals from staff ID tags using ESP32 receivers placed inside classrooms.
 - Confirms staff presence by checking whether they are in the correct classroom at the scheduled time.

MODULES AND DESCRIPTION (CONTD.)

- **Attendance and alert**
 - Maintains attendance records by logging staff entry time, exit time, and classroom presence after successful verification.
 - Generates and sends real-time alert notifications to staff and administrators in case of delays, absences, or incorrect classroom presence.

IMPLEMENTATION - SCREENSHOTS

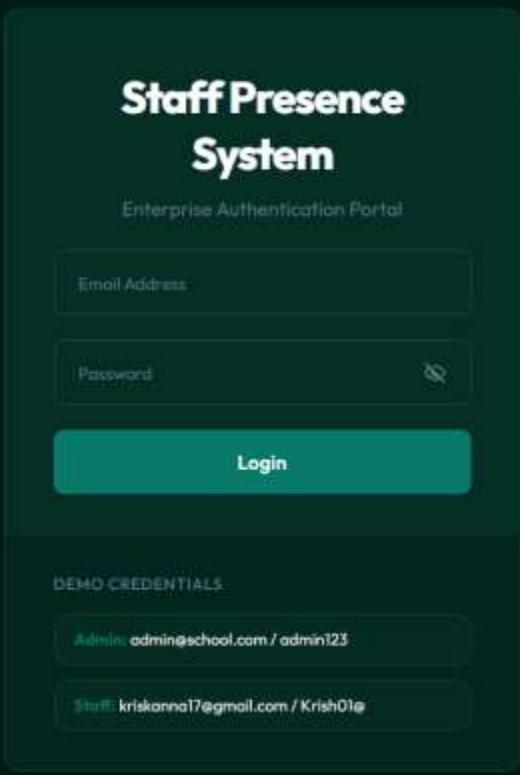


Fig. 2 (a). Login page

IMPLEMENTATION - SCREENSHOTS (CONTD.)

The screenshot shows the Admin Dashboard interface. At the top, there's a navigation bar with 'STAFF SYSTEM' on the left, a user profile for 'SA System Administrator ADMINISTRATOR' in the center, and a 'Logout' button on the right. Below the navigation bar is a 'Dashboard Overview' section with three cards:

- LIVE UPDATE PRESENT TODAY:** Shows 0 present staff.
- LIVE UPDATE LATE TODAY:** Shows 0 late staff.
- LIVE UPDATE PENDING LEAVES:** Shows 0 pending leave requests.

Below the overview is a 'Recent Activity' section with a table header:

STAFF NAME	CLASSROOM	CHECK-IN TIME	STATUS
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At the bottom left, a sidebar menu lists various administrative functions: Dashboard, Staff Locations, Manage Staff, Admin/Executive Users, Classrooms, Timetable, Attendance, Leave Requests, and Alerts. The 'Dashboard' item is highlighted with a green background.

Fig. 2 (b). Admin dashboard

IMPLEMENTATION - SCREENSHOTS (CONTD.)

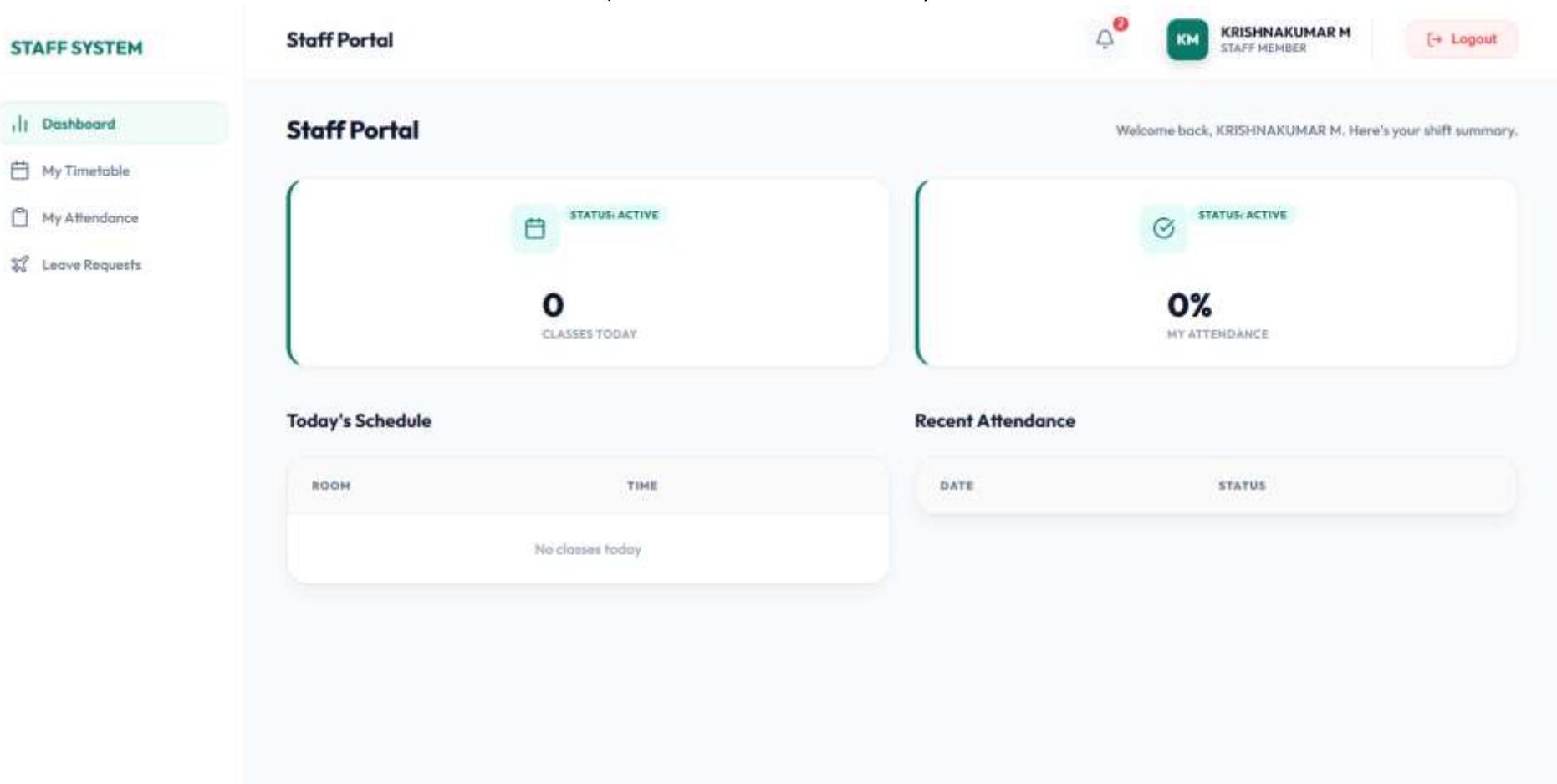


Fig. 2 (c). Staff portal

REFERENCES

1. Mohammadali Khazen, Mazdak Nik-Bakht, Osama Moselhi, Jeffrey Dungen (2025), “A DEPLOYABLE SOLUTION FOR INDOOR TRACKING OF WORKERS IN CONSTRUCTION SITES THROUGH BLUETOOTH LOW ENERGY TECHNOLOGY”, Journal of Information Technology in Construction (ITcon).

REFERENCES (CONTD.)

2. Arjun Jain (2025), “A BLE-Based Smart Attendance System for Scalable and Contactless Classroom Automation”, International Journal of Engineering Research & Technology (IJERT).
3. Bramesh S M, Arun P, Deekshith H R (2025), “Smart Attendance System with Facial Recognition and GPS Verification”, International Multidisciplinary Research Journal Reviews (IMRJR).