



ISSN: 2454-9940



**INTERNATIONAL JOURNAL OF APPLIED
SCIENCE ENGINEERING AND MANAGEMENT**

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www.ijasem.org

RFID BASED STUDENT TRACKING IN CAMPUS

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Abstract— A modernization solution for the campus operations, known as the "RFID-Based Student Tracking System in Campus," utilizes Radio Frequency Identification (RFID) technology to track and manage student movement. In this system, each student is issued an RFID tag, which serves as identification for him. The RFID tags are also light in weight, inexpensive, and may be attached to ID cards or some wearable gadgets. RFID readers are located at strategic positions on campus such as classrooms, laboratories, libraries, and canteens.

When a student, carrying an RFID tag, moves through one of these gates, the RFID reader detects and stores the tag's unique identifier. This is transmitted to a central system for safe storage within a database for instant processing and analysis. The system accurately tracks all possible movements of the students, which can be used to automate attendance management, activate real-time alerts for unauthorized access into restricted areas, and generate full reports about students' activity patterns.

This project simplifies and efficiency makes the admin work concerning registration of attendance along with resource distribution by tracking unauthorized moves and giving them on-the spot messages in emergency situations. Plus, the entire system can even be extended and offer more useful features like tracking library books with their respective details about borrowing and also sending messages directly to parents hence making it more of an all-purpose tool for academic institutions.

Keywords: *RFID technology, Student tracking, Campus management, Real-time monitoring, Attendance automation, RFID tags, RFID readers, Database management, Campus security, Resource optimization.*

INTRODUCTION

Student tracking is very important in the dynamic education environment of today. Traditional attendance methods, including manual roll calls and physical registers, are typically time-consuming, error-prone, and lacking in real-time information. This reduces administrative efficiency, compromises student safety, and limits proactive response to emergencies.

The scope of this research has been the design and implementation of an innovative RFID based tracking

system that would particularly fit educational campuses. This system may take the benefit of RFID benefits in its entire spectrum so as to overcome deficiency by providing a valid, automatic, and data-driven solution towards:

Auto attendance: Manages to replace tedious roll call taking and removes workload from authorities and automatically gets all the information from students coming inside classrooms, labs, etc.

It automatically tracks all of the campus going students' location live and help students in finding his/her path even in time of emergency to control fire outbreaking, medicament, etc.

Improved Campus Safety: The presence of accurate and timely information regarding the whereabouts of students deters unauthorized access and allows for proactive measures in preventing possible incidents.

Data-Driven Decision-Making: Useful data on attendance patterns, movement trends, and utilization of campus resources will help enable data-driven decision-making to optimize resource allocation and campus planning.

This paper will delve deep into the technical specifics of an RFID-based tracking system including hardware and software components and approaches for data acquisition and processing methodologies, especially integrating the system with the already existing infrastructure on campus. Apart from that, it will focus upon the benefits, challenges, and ethical considerations associated with implementing a system like this in educational environments. This research contributes to more efficient, secure, and data-driven educational environments by exploring the transformative potential of RFID technology.

I. OBJECTIVES AND METHODOLOGY

This paper shall be developed below:

- Introduction and Implementation of RFID-Based Student Tracking System for Educational Campuses.
- Enable or allow real-time monitoring of student locations within the campus.
- Simplify attendance procedures for improvement.
- Enhance campus security by restricting access to areas.
- Apply analytics on data to provide valuable insights for optimizing resource allocation and campus planning.

II. LITERATURE SURVEY

This paper introduces a novel paradigm for Radio Frequency Identification, RFID, use in enhancing student tracking within a campus environment. Erratic attendance of students and other movements within institutes of learning make it a relevant challenge for authorities, hence making it impact scholarly performance and college safety. Traditional attendance techniques have relied on the old roll calls, paper registers, which consume much time and are prone to errors. In addition, the conventional methods do not illustrate the live points required to keep the campus running in order. The work therefore presents an independent new IoT framework that includes RFID technology to fill the gap. Lighting conditions, and complex hand movements still affect the robustness of gesture recognition systems.

Background

Many educational institutions still use manual methods to keep track of their students despite the availability of more advanced technologies. Lecturers bear the burden of recording attendance, which is very inefficient and not traceable in some cases. The manual process contradicts the requirements of the data to be analyzed since it cannot be analyzed in a timely fashion to respond appropriately to emergencies or security threats.

There are some bright solutions observed in this integration of RFID technology into an IoT framework. Deployed RFID tags and readers in strategic places around the campus can collect data concerning where the students are, which can then be wirelessly sent in real time to a central server for analysis. That data can be used in automating attendance tracking, which eliminates timesaving roll calls and increase accuracy, and can be used for enhancing campus security through real-time monitoring of the students' locations that can quickly be responded to during emergencies.

Methodology

This system will focus on the research and development of an RFID-based student tracking system in a campus environment. The critical stages of the system include the following:

- * Data Collection: the integration of real-time data of student locations using strategically placed RFID readers across the campus.
 - * System Analysis: analysis of student movement pattern, attendance trends, and resource utilization for improvement.
 - * System Design: Developing a robust architecture that can properly collect, transmit, and store data with suitable security measures in place.
- System Implementation: RFID-based tracking system development and its deployment with interfacing with existing campus infrastructure as well as interfaces for users accurate positioning and location-based services in indoor premises.

III. EXSISTING SYSTEM

Currently, the location systems of the students installed at most of the educational institutes have relied hugely on widely adopted RFID-based systems with only basic features tracking and access control. Mostly, RFID tags are mounted on the student ID cards or, in some instances, issued as wristbands.

Any entry or exit information of any student would be recorded within the system once any student enters or leaves a monitored area with an RFID reader. This would further be used for performing activities such as the following:

Automated Attendance: Counting of attendees in a classroom or laboratory or in other monitored locations.

Access control: Access to certain parts of the campus, depending on the status of the student, privileges, and time.

Security Monitoring: The movement of the students will be monitored within the campus for enhancing security and proper response in case of hazards. These systems though have some sort of automation with improvements in the levels of security still have various kinds of limitations and concerns.

1. Functionality Limitation

Basic Tracking: These systems are more concerned about the reporting of a student presence at some place. The system is unable to generate location data over time and cannot trace any pattern of movement within the campus.

Lack of Contextual Awareness: The system is not interested in paying heed to contextual information like class schedule, student groups, or emergency situation that would limit the effectiveness of the system at the time of decision-making.

Limited Data Analysis: Collecting data is not usually analyzed meaningfully so proper conclusions are drawn and implemented for improving the campus or student's experience.

2. Privacy Issue:

Data Security: the location-based data collection of the students may be vulnerable to the issues of data breach problems and their violation. Anyone unauthorized can misuse them and violate the privacy of the students.

Lack of transparency: the location data to be collected might not be well explained to students and how they might be used; therefore, mistrust and lack of transparency are observed.

Surveillance tendency: it turns out to be a tool of surveillance for all the students who are always under observation and thus lacks self-autonomy.

3. Technical Limitations:

Signal Interference: signals through RFID are prone to interference thus leading to some misleading reading and system error.

Battery Life: Where RFID tags utilize batteries, their relatively short life span may lead to systems losing their dependability and requiring frequent maintenance.

Installation Cost: Installation and maintenance of RFID-based systems are very costly and hence would demand heavy infrastructure and support at every stage.

IV. PROPOSED SYSTEM

It uses cutting-edge Radio Frequency Identification (RFID) and Internet of Things (IoT) infrastructure that identifies, tracks, and controls the real-time movement of students on campus. The system would rely heavily on the use of RFID tags pasted on

student ID cards in sending wireless communication signals to the RFID readers stationed at strategic points all over the campus. These readers track the whereabouts of students so that students can be kept under constant monitoring as they move through different spaces such as classes, libraries, labs, and rec spaces.

The system is aided by a central platform in which data captured by RFID readers undergo processing and storage. Information the system uses includes real-time tracking of student movement, monitoring of campus traffic patterns, and report generation. It is designed to support student attendance management, monitoring of campus security, coordination in case of an emergency, and optimal operation.

This would improve the feature of campus security through the real-time monitoring of student movements.

It recognizes the student and enables the rapid response in the event of an unsafe condition in addition to liaisoning with the concerned security personnel over the campus or any other emergency respondents. It will enable geofenced areas whereby, upon such entry by the student, it will send a notification to the authorities about entry into restricted areas or risky territory.

Streamlined Attendance Management: While compared to traditional systems, some disadvantages of traditional ones are related to human mistakes and delay of time, in which there can't be actual time insights. In this mechanism, the student presence is traced via RFID. It has immediately recorded their attendance. Thereby, administration overhead costs save by lessening error probabilities and facilitate achieving the needed target of the attendance. It would probably generate data to be created for some academic purposes in addition to reporting.

Operational Optimization: The system would leverage the opportunities to offer insights into the usage pattern of the campus by the universities. It would, therefore, optimize the different elements of campus activity. For instance, it may identify peak time for utilization in libraries, hall occupancies, or classroom traffic hence enabling optimized class schedule and resource. It can use facilities management for allocating cleaners or maintenance employees based on the real-time usage pattern.

Seamless integration with available infrastructures: The RFID-based tracking system will integrate with the existing infrastructures of the university regarding LMS, student portals, and other systems of campus security smoothly. This fosters effortless data sharing that improves the user experience of the students, faculty, and administrators.

V. HARDWARE AND SOFTWARE REQUIREMENTS

Hardware: Arduino: Uno/ESP32, MFRC522 RFID Reader, RFID tags, GSM Module, Power Supply, Server/Cloud Platform.

Software: Arduino IDE, Embedded C, PHP, MySQL/Firebase Database, Web Interface (HTML/CSS/JS), (Optional) Mobile App.

VI. BLOCK DIAGRAM

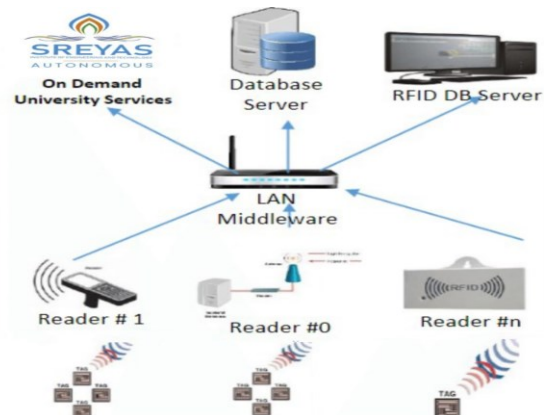


Fig 1: Block Diagram

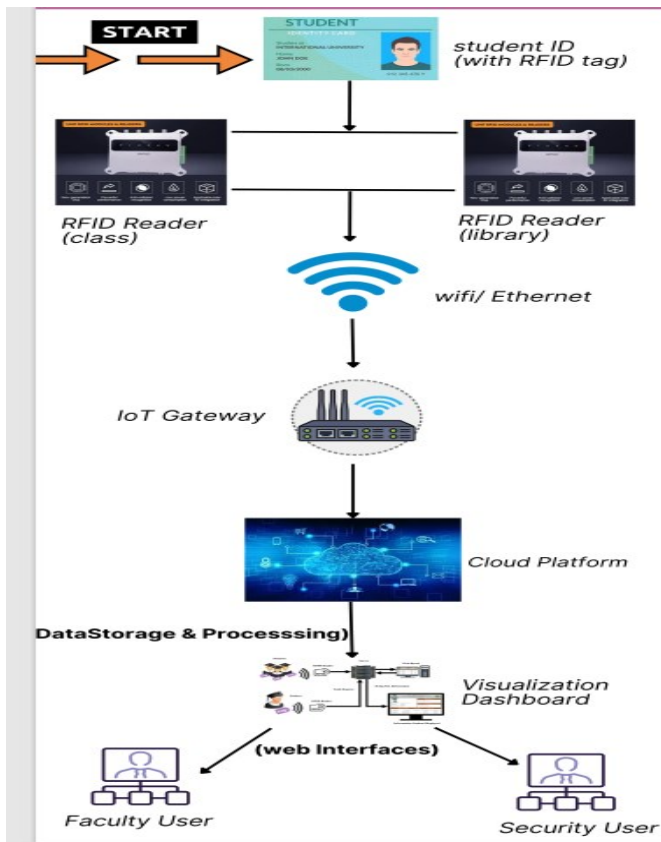


Fig 2: FlowChart

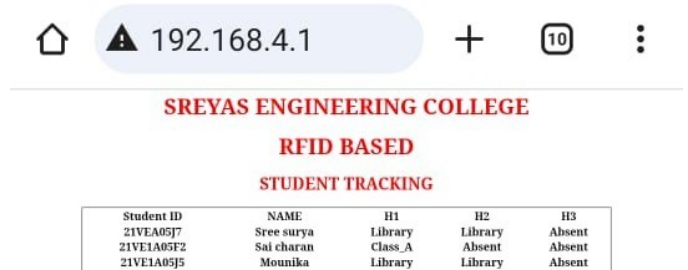
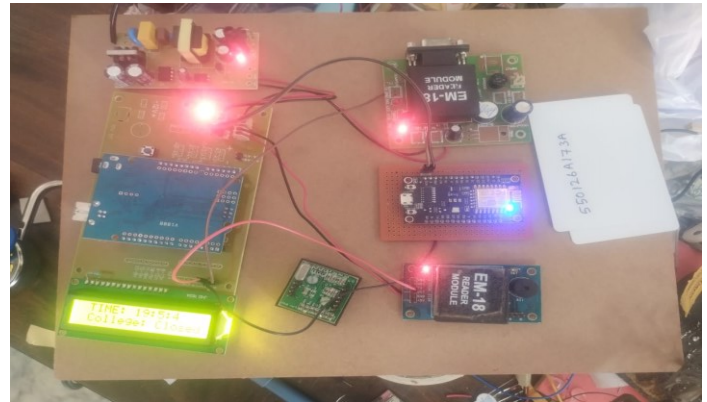


Fig 3: Students Data on IoT Page

VI. SIMULATION RESULTS

The simulation results of the project "RFID-Based Student Tracking in Campus" conclude that the proposed system is efficient enough for real-time student tracking in a designated area such as the classroom or canteen. The system correctly captures and logs the location data of students with low latency and maximum reliability. The performance of the RFID reader is tested on various conditions while its capability of reading tags with different readers operating concurrently is demonstrated. Therefore, in sum, these results validate the capabilities of the system to enhance safety on campus and attendance tracking together with operational efficiencies.

VII. CONCLUSION

The simulation results of the project "RFID-Based Student Tracking in Campus" conclude that the proposed system is efficient enough for real-time student tracking in a designated area such as the classroom or canteen. The system correctly captures and logs the location data of students with low latency and maximum reliability. The performance of the RFID reader is tested on various conditions while its capability of reading tags with different readers operating concurrently is demonstrated. Therefore, in sum, these results validate the capabilities of the system to enhance safety on campus and attendance tracking together with operational efficiencies.

VII. FUTURE SCOPE

1. Mobile Application Integration:

Design specific apps on the mobiles of students and administrators to send a push notification, control access, and generate particular reports.

2. Tracking Off Campus Events

Apply the tracking system to all the off-campus events so that the attendance and location tracking do not break during the field trips or internship.

3. AI-Powered Analytics

Attends analysis based on trends, optimization of resources, and predictions of future behavior of students

4. Greater Privacy and Security

Implement advanced encryption techniques and controls on privacy such that user information is kept secret and in complete compliance with regulations on data protection.

5. Scalability for larger campuses

Upgrade the system to handle a large campus system with minimal latencies and reliability.

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