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DEVELOPMENT OF AN AUTOMATED ATTENDANCE MONITORING SYSTEM USING ULTRA HIGH FREQUENCY RFID FOR COLEGIO DE SAN JUAN DE LETRAN MANILA

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ABSTRACT

The objective of the study is to create and assess the use of an Automated Attendance Monitoring System (A.A.M.S.) through the utilization of Ultra High Frequency (UHF) Radio Frequency Identification (RFID) technology. The proposed system has been created to address common concerns associated with the traditional process of attendance checking. The A.A.M.S. utilizes a UHF RFID reader, tags, a raspberry Pi 4, and a web-based system to collect the attendance of Colegio students in real-time through walk-through method detection. Non-iterative development research design was utilized, and system analysis, development, and evaluation were performed. Data gathering was carried out through observation and distribution of Likert scale questionnaires to selected faculty members in order to determine the accuracy, functionality, usability, and reliability of the system. The system went through series of trial sessions to test the accuracy of RFID technology in being detected. The results showed that the system obtained a 93.3% RFID detection accuracy and a 100% success rate in achieving data logging accuracy. The results of the faculty evaluations indicated substantial agreements in the usability of the system, software application, and hardware reliability, with the overall mean ratings obtained classified under "Strongly Agree" categories. The study concludes that the implementation of the UHF RFID-Based A.A.M.S., as a system for attending attendance monitoring in the Senior High School environment, is indeed feasible and effective and worthy of institutionalization/institution-wide implementation with further enhancement for wider implementation.

Keywords: *UHF RFID, Automated Attendance Monitoring System, Attendance System, Web-Based Application*

INTRODUCTION

Background of the Study

Throughout the history of education, monitoring the attendance of students has been essential as it allows institutions to track and record the presence of students, which is necessary for academic success of students. Traditionally, the method used in monitoring attendance has been manual, often through roll-calls or signing attendance sheets. Be that as it may, Aniñon et al. (2020) stated that various issues are present in the manual method: individuals take advantage of its flaw, committing hoax and forgery. These issues will lead to unjust practices including submitting a falsified attendance report for schools to wrongly reward students that exert minimal effort in their studies. Furthermore, they explained that tracking attendance manually consumes

a significant portion of the class hours, and the record can also get lost, misplaced, or skip a student's name, causing inconvenience in the long run.

As technology continuously grows, educational institutions have begun to adapt to automated systems for administrative processes. For instance, some adapted the use of biometrics which identifies individuals based solely on their distinct physical characteristics (e.g., fingerprints and facial recognition). This way, a high level of accuracy is certain and falsification is prevented. However, biometric systems have a drawback on their own. Implementing it requires heavy financial investment and it can sometimes be inaccurate due to an individual having a physical deformation.

Another common approach is the use of Radio Frequency Identification (RFID) powered technology; it emerged as a solution for more convenient attendance monitoring. Contrary to manual ways, RFID-enabled systems allow for quick and accurate identification, that way, the occurrence of human error and potential forging of data reduces. Yet, this system also has a drawback, where students may impersonate others or lend their IDs to friends.

Typically, existing RFID attendance systems utilize Low Frequency (LF) or High Frequency (HF) tags; however, their limited detection ranges and slower data transmission rates make them unsuitable for simultaneously processing a significant number of students at classroom entryways.

In the setting of Colegio de San Juan de Letran, a prestigious institution, attendance monitoring is necessary for both student and faculty performance. At present, the biometric-enabled attendance system is limited to teachers, while students still depend on manual methods. LF and HF RFID technologies, albeit offering improvements over manual methods, their limited frequencies are not optimal for the dimensions of classroom doors. A potential approach is the use of Ultra High Frequency (UHF) RFID, which gives longer range and faster processing.

The shift to UHF technology is supported by recent empirical research; for instance, Calo, Barbosa, and Llevado (2021)

demonstrated that utilizing UHF RFID for in-classroom attendance significantly enhances tracking reliability and effectively eliminates proxy attendance due to its superior cross-verification capabilities. Therefore, this study aims to bridge that gap by assessing the feasibility and effectiveness of UHF RFID in monitoring classroom attendance.

Objectives of the Study

The main objective of this study is to develop an automated classroom attendance monitoring system using UHF RFID combined with a web-based application as a database of the students for Colegio de San Juan de Letran Manila.

This study aims to develop a hardware module that utilizes UHF RFID technology to record student attendance in real time and monitor students' classroom entry and exit. The system is designed to prevent falsification of attendance records, reduce the time required for recording attendance, and provide a more convenient method of tracking student presence. It will also include a website for storing records, displaying each section's class schedule, and showing the time of students' ins and outs. Additionally, the system will allow authorized school faculty to view and edit attendance records, generate summaries of attendance data, and integrate a seat plan to help teachers identify students and visualize absentees in real time. Furthermore, the automated attendance monitoring system will be assessed in terms of its accuracy in detecting RFID tags and processing student data in real time, usability in terms of effectiveness, efficiency, and user-friendliness of the website interface, reliability in maintaining stable and error-free recording and storage of attendance data, and functionality in evaluating the performance and completeness of both hardware and software components in meeting attendance monitoring requirements.

Literature Review

RFID Technology as a Tool for Automated Attendance Monitoring

A variety of frequency ranges are used by RFID systems, with each type having unique features. In accordance with RFID Label (2021), Low Frequency (LF) RFID works at 125–134.2 kHz and has a short read range of about 10 cm, but it is not easily affected by metal or liquids. High Frequency (HF) operates at 13.56 MHz and can reach slightly farther, often used for things like access cards. Ultra High Frequency (UHF), on the other hand, works between 860–960 MHz and can read multiple tags over longer distances, which is useful for big areas.

El Mrabet and Ait Moussa (2020) designed an IoT-School Attendance System Using RFID Technology that records student attendance automatically. Findings show that using RFID makes attendance faster and reduces errors compared to manually calling names. With the system's ability to record multiple students at once, it saves teachers a lot of time and makes keeping track of attendance much easier. This feature is helpful in larger classrooms where manually keeping track of attendance can be slow and prone to mistakes.

Furthermore, another research conducted by Calo, Barbosa, and Llevado in 2021 also implemented an "In-Classroom Faculty Attendance Monitoring System" using Ultra High Frequency ("UHF") RFID technology, which is also used in this research. In this research, it has been found that "the greater read range and capability to read multiple tags simultaneously make UHF RFID an attractive solution for academic environments where speed and accuracy are critical." This research directly supports the rationale for using UHF RFID technology rather than using any other frequency bands in the development of this A.A.M.S.

Attendance-related settings offered by Hutabarat, Hendri, and Pribadi (2025) in their research conducted in a real classroom environment within STMIK TIME Campus gives empirical evidence of RFID efficiency, where the efficiency of an RFID-based attendance system was measured. As a matter of fact, this research has validated that the overall processing of each attendance transaction is completed in a matter of 1-2 seconds, and all the main features of the system, including login management, attendance, and recap, are functioning properly without any failure. According to this research, it is evident that the overall quality of RFID technology in attendance management is significantly improved in academic environments, thus validating the viability of the methodology used in this research.

Efficiency, security, and accuracy of automated attendance systems

Creatrix Campus (2022) stated that an automated attendance system compared to manual methods is superior in terms of speed, accuracy, and security. The conventional manner or manual attendance checking requires teachers to allocate class time to calling names individually or passing around an attendance sheet, which consumes several minutes of class time. Manual methods tend to be unreliable, since some students respond on behalf of their absent classmates. Such unfair practices create situations that become problematic in large classroom settings where teachers encounter challenges to verify students that are present.

Automated attendance systems address these limitations by implementing technologies such as RFID cards and biometric systems to ensure student identification when recording attendance. These automated technologies eliminate human error while providing immediate data in a digital database, therefore making records more secure, more organized, and easily accessible at any time. Interest in the disclosed advantages reported in the article, the system has also been targeted to save time, prevent falsification, and give accurate and efficient attendance monitoring, thus being a fair and effective tool in the classroom for monitoring.

The aforementioned benefits are further corroborated by the empirical research conducted by Chakraborty, Rahman, Joy, and Islam (2024), wherein they have explored the integration of RFID technology with Arduino microcontrollers for enhancing security and efficiency in attendance management. It is evident from their research that if a unique identification code is assigned to each and every RFID tag, then it is very difficult to indulge in any kind of forgery or duplication of attendance records. Moreover, the smooth integration of all parts of the system also adds to the reliability of the system. The relevance of this research is very high in respect to the objective of the current research, wherein it is proposed to avoid forgery by incorporating a unique Electronic Product Codes assigned to each and every UHF RFID tag.

Research Framework

Theoretical framework

Introduced by Davis (1989) as cited in Lin and Yu (2023), the Technology Acceptance Model is a model that describes how people accept and use a technology in terms of two key determinants, which are: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). It finds its roots in the Theory of Reasoned Action (TRA) that was proposed by Martin Fishbein and Icek Ajzen. The model points out that such factors essentially result in the formation of users' attitudes toward the technology, which, in turn, influences their behavioral intention to use the technology, and consequently, the actual system usage occurs.

Perceived Usefulness is the extent to which an individual presumes that using a given technology or system will improve their performance or productivity. For instance, some businesses might

consider adopting mobile marketing if they perceive that these services will draw more customers and improve their sales. This leads to a beneficial financial outcome for the business. On the other hand, Perceived Ease of Use refers to the extent to which an individual presumes that using the technology or system given will be free from effort. To give an example, an individual utilizing a McDonald's kiosk, these systems are designed with close visualization of the menu and simple buttons, which makes it easy for customers to order or even complete a transaction without the assistance of a cashier. These perceptions of usefulness and ease of use drives their willingness to use the technology or system.

An RFID-based attendance system allows automation and gets rid of the problems of manual processes, such as falsification and missing attendance sheets, which directly address the perceived usefulness component of the Model. TAM also integrates external variables that can affect both PU and PEOU, such as characteristics of the user, characteristics of the system, and organizational factors that may influence the adoption of the technology.

In this study, TAM serves as a framework to understand how the students, faculty and administrators of Colegio de San Juan de Letran Manila may accept and use the automated UHF RFID attendance monitoring system. The system's ability to reduce the time spent on attendance checking and prevent falsification falls into the perceived usefulness aspect, while the automation of the RFID technology is in the perceived ease of use aspect. By applying TAM, this study aims to evaluate user acceptance factors and to design the system to expand the adoption rates among stakeholders.

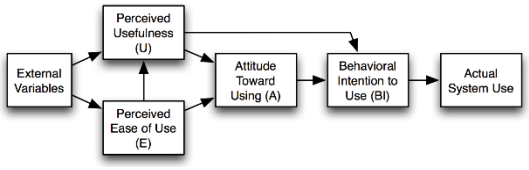

Figure 1. Technology Acceptance Model

As illustrated in Figure1, the process begins when a student's RFID tag is detected by the UHF RFID reader. Upon detection, the reader captures the Electronic Product Code (EPC) and transmits the data to the Raspberry Pi for processing. The system then verifies whether the EPC corresponds to a registered student within the database. If the tag is valid, the system retrieves the associated student information and identifies any active schedule linked to the student at the time of scanning.

Once an active schedule is confirmed, the system determines the appropriate type of attendance entry whether it is a time-in, time-out, or return-from-break record. It then generates or updates the corresponding attendance record, including details such as the student's ID, name, time of scan, and attendance status. This information is subsequently stored in the database, after which the system updates the web-based platform to reflect the student's most recent attendance activity.

In contrast, if the EPC does not match any registered student or if no active schedule exists at the time of scanning, the system generates an error response and displays the appropriate message on the terminal interface.

To support usability and ensure immediate feedback, the system incorporates both audio and visual indicators. A successful scan triggers a buzzer sound, with distinct tones assigned to time-in, time-out, and return-from-break events. Invalid or unregistered tags prompt a separate alert tone. Additionally, if multiple RFID tags are detected simultaneously, the system emits multiple corresponding buzzer signals, assisting in identifying potential misuse or unauthorized tag carrying.

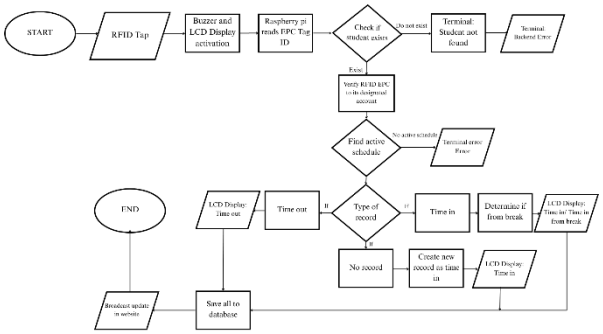

Figure 2. Conceptual framework of the study

(UHF-RFID) for Colegio de San Juan de Letran Manila during the academic year of 2025-2026. The system aims to integrate automatic attendance taking by way of walk-through with real-time tracking of data, time in and time out detection, data logging, a feedback system, and student identification. The researchers will utilize one UHF-RFID reader only, and create a web-based application for data management. Selected faculty members will be selected by the researchers to evaluate the system by performance testing during regular classes and using a Likert-scale assessment to determine the system's functionality and usability.

The study will only cover the attendance of SHS students of the Colegio. At the same time, excluding external and internal factors that are beyond the researcher's control, such as scattered attendance detection, students forgetting, leaving, losing, or refusing to wear their RFID tags, student's room cross checking due to backend and database error, and excusing students will not be measured as part of the system's performance evaluation. The study will not include faculty attendance monitoring and integration with the existing school management systems. Additionally, the study will not delve into a detailed comparison with alternative attendance technologies.

METHODOLOGY

Research Design

The study will utilize a non-iterative developmental research design as a guide the development and evaluation of the automated attendance monitoring system using Ultra High Frequency Radio Frequency Identification (UHF RFID) technology for Colegio de San Juan de Letran Manila.

A non-iterative (single-cycle) design is a type of approach within developmental research that follows a linear path consisting of analysis, development, and evaluation. It focuses on creating a final product in a single complete sequence and then subjecting it to a comprehensive, one-time evaluation.

Through this approach, the researchers can determine whether the system demonstrates the expected performance in terms of accuracy, functionality, and usability. The evaluation results will give concrete evidence on the system's feasibility, which guides future studies without engaging in revisions.

Analysis and Formulation

This part identifies the need for an automated attendance monitoring system. The foundations are drawn from the theoretical framework and review of related literature sections to justify the development of the UHF RFID technology integrated with a web-based platform.

Development
The prototype of the A.A.M.S. will be designed and built. The hardware will consist of a UHF RFID reader, RFID tags, Buzzer module, LCD module, and a Raspberry Pi for data processing. The system will then be connected to a created web-based application where the attendance logs, student records, and schedules are stored, managed, and displayed.

Evaluation
The product will be subjected to trials and a one-time comprehensive evaluation to determine its accuracy and functionality in a classroom environment, and to assess the web-based application's user interface.

Procedures
The development of the Automated Attendance Monitoring System (A.A.M.S.) will consist of two primary components: the hardware and the web-based application.

For the hardware development, the system will utilize the M5Stack UHF RFID Unit (JRD-4035) as the primary reader, which has a detection range of approximately 1.5 to 2 meters and can process up to 200 tags simultaneously. Additional components include UHF RFID tags compatible with ISO 18000-6C standards, a Raspberry Pi 4, an LCD module, and a buzzer module. In terms of hardware assembly, the RFID reader will be embedded in a wall to maximize detection range and minimize scattered readings, making it optimal for classroom doorway coverage. The reader will be connected to the Raspberry Pi, which will process tag data and communicate with the web application. The buzzer will provide auditory feedback upon detection, while the LCD module will display confirmation messages to inform users that their tags have been successfully scanned.

For the web application development, a web-based database will be established to manage attendance logs and student records. The database will store relevant data such as student ID numbers, names, sections, courses, schedules, seat plans, and attendance status. The web application will be designed to provide faculty members with access to the attendance system. Its features will include real-time monitoring of student entry and exit, automatic attendance logging linked to class schedules, a student directory with a live seat plan, password-protected summaries of attendance logs, dedicated accounts for each section, and options for manual attendance entry and removal within the system.

System programming will be divided into two parts: the hardware side and the web-based application. Both components will be developed to ensure seamless communication, real-time attendance logging, and secure data management. On the hardware side, the Raspberry Pi 4 will function as the central processing unit, acting as a bridge between the RFID reader and the web application. Python will be used to manage serial communication with the reader, process EPC data from RFID tags, and determine whether a time-in or time-out event has occurred. The processed attendance data, including student ID number, name, timestamp, and status, will be formatted in JSON and transmitted to the backend server via REST API requests. In cases of network interruption, the Raspberry Pi will temporarily store the data locally and automatically synchronize it once connectivity is restored.

On the web application side, development will involve an integrated backend, database, and frontend system to ensure smooth operation. The backend will be built using FastAPI (Python), which will handle communication with the Raspberry Pi and process attendance data before storage. The database will utilize SQL to maintain structured records such as student information, class schedules, and attendance logs. For the frontend, the Next.js framework will be used to design the interface, manage styling, and enable user interactivity, resulting in a responsive and user-friendly system for faculty and administrators.

Data Gathering Procedures
The developed A.A.M.S. will undergo multiple trials in a controlled setup to verify its accuracy and speed of RPi data processing, and the reliability of the buzzer feedback in actual conditions. These variables will be tested through 3 sessions of trial runs. Each session will involve 5 registered RFID tags to determine whether the system correctly logs and exits. The results of the trials will provide evidence of the system's accuracy in detecting RFID tags and accurately recording attendance on the website.

A Likert-scale will be used to collect feedback on two main aspects:
System Functionality - based on how well the system performs its intended function (real-time logging, proper RFID tags detection)
Website User Interface (UI) - based on clarity, ease of navigation, and user friendliness of the web-based application.

The Likert-scale will be administered exclusively to teaching faculty of Colegio de San Juan de Letran Manila, as they are the primary users and evaluators of the system.

Research Instrument
In this study, the researchers will use Observation and a Likert-scale questionnaire as instruments for data gathering. The purpose of using these two instruments is to collect both technical performance data of the system and personal insights of its intended users. By synthesizing the results, the researchers will be able to evaluate the A.A.M.S in terms of its practicality and user friendliness when applied in a real classroom setting.

For the observation, the system will be tested by the researchers using registered RFID tags to measure its accuracy in recording attendance. This will help determine how well the A.A.M.S. performs its intended functions in real circumstances. For the Likert-scale questionnaire, Google Forms will be used and distributed to selected faculty members of Colegio de San Juan de Letran Manila. This questionnaire will allow the researchers to gather valuable feedback from teachers regarding the system's functionality and the ease of use of the website's user interface.

Sampling Method
This study will adopt a purposive sampling method in terms of selecting participants who can best provide insightful feedback regarding the A.A.M.S. This non-probability method is most appropriate because the nature of the study requires input from individuals with direct experience and expertise in terms of classroom management and attendance monitoring.

The respondents will include faculty members from any Department of the Colegio de San Juan de Letran Manila. As they are the foremost users of the system, and their assessments are needed for establishing the practicality, usability, and functionality of the system within the school. A set of criteria for selection is developed by the researchers in selecting participants that fit the purposes of the study. The faculty members who will be eligible are those who: (1) Are currently teaching in any department during the Academic Year 2025-2026. (2) Have first-hand experience with the existing, manual methods of attendance monitoring. (3) Be willing to participate in the evaluation of the system and provide feedback.

The first advantage of purposive sampling is that it is practical

for focused developmental research. It efficiently allows the research to collect rich and relevant data from an informed population without the need for large, randomized samples. This will be of great assistance in this research because it would allow the researchers to target those people whose professional inputs are directly relevant to refining and assessing the system's performance in terms of accuracy, usability, and functionality.

According to Memon et al. (2023), purposive sampling has been helpful in quantitative and developmental research into practical problems. While generalization of findings to all populations cannot be done statistically, this design allows an investigation into the efficiency of the system within its specific context, which furthers in-depth understanding of its potential integration into the academic setting of Colegio de San Juan de Letran.

Ethical Considerations

Informed consent shall be acquired from all selected faculty members who will participate in this study, which ensures that their participation is on a voluntary basis and that they are fully aware of the purpose of the study. The research will adhere to R.A. 10173, otherwise known as the Data Privacy Act of 2012, through the strict security measures regarding the attendance information to be gathered within the system, as well as the response sheets from the faculty evaluations. Data will be utilized solely for the evaluation of the A.A.M.S and shall be accessible only to the researchers.

RESULTS AND DISCUSSION

Website User Interface (Usability)

Table 1. Assessment on the system's website UI

Items	Mean	SD	Interpretation
The website layout is visually appealing.	4.87	0.35	Strongly Agree
The font style and size are easy to read.	4.77	0.43	Strongly Agree
The navigation menu is clear and easy to understand.	4.80	0.41	Strongly Agree
The placing of contents is well-structured and easy to follow.	4.77	0.43	Strongly Agree
The text and background colors provide good contrast for readability	4.83	0.38	Strongly Agree
Overall	**4.81**	**0.4**	**Strongly Agree**

Note: Legend: 1.00-1.79 Strongly Disagree; 1.80-2.59 Disagree; 2.60 -3.39 Neutral; 3.40-4.19 Agree; 4.20-5.00 Strongly Agree

The high scores indicate that the web application successfully achieved its goal of being user-friendly and intuitive for its primary users—the faculty. The visually appealing layout and clear navigation (Mean=4.80) suggest that faculty can access attendance data and system features with minimal effort, directly supporting the Perceived Ease of Use dimension of the Technology Acceptance Model (TAM). A system that is easy to navigate reduces the time and frustration associated with administrative tasks, thereby encouraging adoption.

Software Functionality and Reliability.

Table 2. Assessment on the system's website functionality and reliability

Items	Mean	SD	Interpretation
The website loads quickly without delays.	4.67	0.48	Strongly Agree
All links and buttons work properly.	4.77	0.43	Strongly Agree
The website is responsive across different devices (mobile, tablet, desktop).	4.83	0.38	Strongly Agree
The system performs tasks without errors or bugs.	4.73	0.45	Strongly Agree
The website allows users to complete their tasks successfully (e.g., manage and monitor attendance logs).	4.90	0.31	Strongly Agree
Overall	**4.78**	**0.41**	**Strongly Agree**

Note: Legend: 1.00-1.79 Strongly Disagree; 1.80-2.59 Disagree; 2.60 -3.39 Neutral; 3.40-4.19 Agree; 4.20-5.00 Strongly Agree

The high rating for task completion (Mean=4.90) confirms that the software effectively meets its core functional requirements, such as managing and monitoring attendance logs in real-time. The responsiveness across devices (Mean=4.83) is a significant strength, offering flexibility for faculty to check attendance from their desks or mobile devices. The strong performance in reliability (Mean=4.73 for error-free operation) fulfills the study's objective to create a stable system that records and stores data without loss, building trust among users and reinforcing the Perceived Usefulness of the system by providing accurate and accessible data.

Hardware Functionality and Reliability

Table 3. Assessment on the system's hardware functionality and reliability

Items	Mean	SD	Interpretation
The device is easy to operate.	4.70	0.47	Strongly Agree
Auto-transition between classes saves administrative work	4.77	0.43	Strongly Agree
The device prevents falsified or proxy attendance.	4.77	0.43	Strongly Agree
The hardware reduces time spent recording attendance.	4.67	0.48	Strongly Agree
The device is reliable during class hours	4.93	0.25	Strongly Agree
Overall	**4.77**	**0.41**	**Strongly Agree**

Note: Legend: 1.00-1.79 Strongly Disagree; 1.80-2.59 Disagree; 2.60 -3.39 Neutral; 3.40-4.19 Agree; 4.20-5.00 Strongly Agree

The hardware results directly address the primary drawbacks of manual and lower-frequency RFID systems. The high score for preventing falsification (Mean=4.77) demonstrates that the UHF RFID system, with its unique EPC codes and anti-tampering features, successfully mitigates the risk of proxy attendance. Furthermore, the significant reduction in time spent recording attendance (Mean=4.67) and the auto-transition feature (Mean=4.77) validate the system's core purpose: to automate a tedious administrative process. The exceptional reliability score (Mean=4.93) is critical for continuous, uninterrupted operation in a busy school environment, ensuring that attendance data is captured consistently throughout the day.

Table 4. Observation Table (RFID Detection Accuracy)

Session	Total Attempts	Valid Detections	Missed Detections	Data Logging Success	Buzzer Feedback (Yes)
1	5	5	0	5/5 (100%)	5/5 (100%)
2	5	4	1	4/4 (100%)	4/5 (80%)
3	5	5	0	5/5 (100%)	5/5 (100%)
Total	**14**	**14**	**1**	**14/14 (100%)**	**14/15 (93.3%)**

Note: Legend: Total Attempts – Number of RFID scans conducted. Valid Detections – Successfully detected RFID tags. Missed Detections – Undetected RFID tags. Data Logging Success – Detected tags correctly recorded in the database. Buzzer Feedback – Audio signal triggered upon detection

The system achieved an overall detection rate of 93.3%, successfully identifying 14 out of 15 registered tag attempts. This high accuracy validates the choice of UHF RFID technology for efficient, walk-through attendance logging in a classroom doorway setting. Most significantly, the data logging reliability was 100%, meaning every single successful detection was accurately captured and recorded in the web database without any loss of data. This fulfills the critical objective of creating a reliable system for recording attendance. The single missed detection in Session 2 could be attributed to factors like temporary signal obstruction or tag orientation, but the overall performance confirms the hardware's robustness for daily use.

The prototype's high performance aligns with recent empirical evaluations of RFID-based attendance technologies. The 100% success rate achieved in data logging reliability reflects the benchmarks established by Ajayi et al. (2025), who empirically verified that integrated RFID and microcontroller systems ensure real-time server logging with virtually no data loss. Furthermore, the 93.3% detection accuracy during the walk-through method is consistent with the findings of Hutabarat, Pribadi, and Hendri (2025). Their testing in a university campus environment confirmed that modern RFID systems process high-volume attendance data with exceptional accuracy and an average processing time of merely fractions of a second, validating the efficiency of the A.A.M.S. prototype deployed in this study.

CONCLUSIONS

This study successfully developed and evaluated an Automated Attendance Monitoring System (A.A.M.S.) using Ultra High Frequency (UHF) RFID technology for Colegio de San Juan de Letran Manila. The system, comprising a UHF RFID reader, a Raspberry Pi processor, and a web-based application, was designed to address the limitations of manual attendance checking and existing lower-frequency RFID systems.

The evaluation results conclusively demonstrate that the system is highly accurate in detecting RFID tags and recording attendance in real-time. It is functionally robust, performing all intended tasks such as entrance/exit logging and schedule-based auto-transition without errors. Furthermore, the system was found to be highly usable, with an intuitive user interface, and reliable, operating consistently during class hours. Most importantly, it achieved its core objectives of significantly reducing the time required for attendance monitoring and effectively preventing the falsification of records.

Therefore, the UHF RFID-based A.A.M.S. presents a feasible, effective, and superior alternative for automated attendance monitoring in an educational setting like Colegio de San Juan de Letran Manila.

Recommendations

The following recommendations are proposed based on the successful development and favorable evaluation of the A.A.M.S. For the school administration, it is recommended that resources be allocated for the implementation of the system in the Senior High School department. The system's established 93.3% accuracy and 100% data-logging reliability provide a strong technical foundation for this rollout and may be further optimized when applied on a larger scale.

For future researchers, it is suggested to maximize the use of the system's highly reliable attendance data by developing advanced analytics capable of predicting student absenteeism trends, as well as more comprehensive reporting tools for administrators. Further studies may also focus on improving the hardware setup by optimizing the placement of the reader and the configuration of the antenna to increase detection accuracy from 93.3% to as close to 100% as possible, particularly by addressing edge-case scenarios that resulted in missed detections. Additionally, future work may explore the expansion of system integration through the development of secure APIs, enabling seamless data exchange and improved control by integrating the A.A.M.S. with the school's existing Student Information System (SIS).

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