

Attendance Tracking and Monitoring System using Radio Frequency Identification Technology with SMS Notification

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Abstract

This study developed and evaluated an Attendance Tracking and Monitoring System using Radio Frequency Identification (RFID) Technology with SMS Notification for Quirino State University to address the limitations of the existing manual attendance monitoring system, including recording inaccuracies, delayed reporting, administrative inefficiencies, and limited real-time monitoring. The study was anchored on RFID technology, SMS notification, the Feature-Driven Development (FDD) methodology, the Input–Process–Output (IPO) model, and the ISO/IEC 25010 Software Quality Standards. A descriptive-developmental research design employing qualitative and quantitative approaches was used. Qualitative data were collected through interviews to identify attendance monitoring problems, while quantitative data were gathered using an ISO/IEC 25010 standardized questionnaire to evaluate software quality. The study involved 162 purposively selected participants consisting of administrators, IT personnel, IT experts, students, and employees. Data were analyzed using thematic analysis and weighted mean. The developed system automated attendance recording, generated real-time attendance reports, maintained a centralized database, and provided SMS notifications to stakeholders. Findings showed that the system effectively addressed the operational challenges of manual attendance monitoring and achieved a Very Great Extent of compliance with the ISO/IEC 25010 Software Quality Standards in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. The study concluded that the developed system is an effective and reliable solution for improving attendance management and institutional efficiency. It recommends the adoption of the system by Quirino State University, appropriate user training, and further enhancement of the system's functionalities for broader institutional application. The study supports Sustainable Development Goal (SDG) 4 (Quality Education), SDG 9 (Industry, Innovation and Infrastructure), and SDG 16 (Peace, Justice and Strong Institutions) by promoting digital transformation, efficient educational management, and accountable institutional processes. The system contributes to technological, educational, institutional, and socio-economic sustainability by improving operational efficiency, strengthening data management and communication, and supporting evidence-based decision-making.

Keywords: Attendance Monitoring System, Feature-Driven Development, ISO/IEC 25010, Radio Frequency Identification (RFID), Short Message Service (SMS), Software Quality, Quirino State University, System Development

1. Introduction

Educational institutions increasingly adopt digital technologies to improve administrative efficiency, strengthen campus security, and support data-driven decision-making. Among these technologies, Radio Frequency Identification (RFID) has become an effective solution for automatically identifying and monitoring individuals and resources with minimal human intervention (Bean, 2023; Abadi, 2023; Izang, 2022; Putra, 2021). When integrated with Short Message Service (SMS) notifications, RFID systems facilitate real-time communication, improve attendance monitoring, enhance institutional security, and streamline campus operations (Abraham, 2023; Bharatiraja, 2023; Konatham et al., 2016; Nkalo, 2019). Globally, these technologies are utilized for attendance monitoring, access control, asset tracking, library management, and emergency response, contributing to operational efficiency, improved data accuracy, and reduced administrative workload (Akbar, 2018; Ashworth & Shemoi, 2023). SMS notifications further strengthen communication by providing timely attendance and security updates to students, faculty, administrators, and parents (Selvaganesh, 2023). In the Philippines, many educational institutions continue to depend on manual attendance recording and resource monitoring systems that are susceptible to human error, delays, and inefficient record management. In response to national digital transformation initiatives, there is an increasing demand for automated systems that enhance transparency, security, and institutional efficiency. At Quirino State University (QSU), attendance monitoring still relies largely on manual logbooks, resulting in inaccuracies, reporting delays, congestion, and limited analytical capability for institutional planning. These challenges underscore the need for an RFID-based attendance monitoring system integrated with SMS notifications to automate attendance recording, improve communication, and support evidence-based administrative decisions. The developed

system was further evaluated using the ISO/IEC 25010 Software Quality Framework to ensure its functional suitability, reliability, usability, and overall effectiveness.

1.1 Background of the Attendance Tracking and Monitoring System Using RFID Technology with SMS Notification

The digital transformation of educational institutions has accelerated the adoption of smart technologies that improve administrative operations, security, and resource management. RFID technology enables automatic identification and tracking of individuals and assets with minimal manual intervention, while SMS notifications facilitate immediate communication among institutional stakeholders (Bean, 2023; Abraham, 2023; Bharatiraja, 2023). Educational institutions worldwide have adopted RFID systems to automate attendance monitoring, improve data accuracy, strengthen institutional security, and enhance operational efficiency (Akbar, 2018; Ashworth & Shemoui, 2023; Selvaganesh, 2023; Gining et al., 2020; Kurniadi et al., 2020). Despite these advancements, many Philippine educational institutions continue to implement manual attendance systems characterized by paper-based records, delayed reporting, and data inconsistencies. These limitations affect administrative efficiency and institutional planning. At Quirino State University, manual attendance recording creates congestion, increases the likelihood of recording errors, and limits timely generation of attendance reports. Consequently, integrating RFID technology with SMS notifications offers an opportunity to modernize attendance management through automated data capture, centralized reporting, real-time monitoring, and improved communication with students, faculty, administrators, and parents (Bean, 2023; Mendoza, 2019; Kineber, 2023). Beyond attendance monitoring, RFID technology enhances asset management, strengthens campus security through controlled access to restricted facilities, and supports emergency response by enabling rapid identification of individuals on campus (Baviskar & Dighe, 2017; Heliasadat, 2019; Chaniago & Junaidi, 2019; Ashworth & Shemoui, 2023). Although implementation requires investments in infrastructure, maintenance, personnel training, and data security, while security and privacy mechanisms remain essential to protect RFID-enabled systems from unauthorized access (Jaikumar et al., 2015; Kamaraj et al., 2016; Heliasadat, 2019). The Attendance Tracking and Monitoring System using RFID Technology with SMS Notification was therefore developed to automate attendance recording, provide analytical reports, facilitate real-time monitoring, strengthen stakeholder communication, and support institutional digital transformation while complying with the ISO/IEC 25010 software quality framework.

1.2 Themes and Insights on RFID-Based Attendance Monitoring and SMS Notification Systems

Related literature consistently demonstrates that automated attendance systems improve efficiency, accuracy, and accountability compared with conventional manual methods. Biometric systems, including fingerprint and facial recognition technologies, provide secure attendance verification and minimize proxy attendance, although they require suitable environmental conditions and specialized hardware (Pichumani & Pugazhendhi, 2020; Kumar et al., 2018; Sunehra et al., 2016). RFID-based attendance systems have been widely recognized for their efficiency, scalability, ease of implementation, and ability to support centralized attendance management in educational institutions (Gining et al., 2020; Putra, 2021; Izang, 2022). Studies report that RFID automates attendance recording, minimizes manual attendance processing, improves data accuracy, facilitates centralized attendance management, supports real-time monitoring, and integrates effectively with institutional information systems (Adebayo & Olorunfemi, 2019; Raza et al., 2017; Sihombing et al., 2019). RFID systems have also demonstrated favorable usability and functionality in monitoring faculty attendance through web-based platforms (Calo, Barbosa, and Llevado, 2021). Beyond attendance monitoring, RFID technology has been successfully applied in document management, supply chain operations, transportation systems, asset monitoring, healthcare monitoring, and vehicle tracking, demonstrating its versatility across various industries. These applications highlight RFID's capability to improve operational efficiency, data accuracy, asset visibility, and real-time monitoring, further supporting its adoption in educational attendance systems (Abadi, 2023; Puica, 2023; Ramesh & Ramesh, 2023; Jana et al., 2023; Ahmed et al., 2023; Altaf et al., 2023). Existing literature further identifies numerous limitations of manual attendance methods, including time consumption, record inaccuracies, proxy attendance, delayed reporting, and inefficient resource utilization. RFID technology addresses these concerns by improving attendance monitoring, institutional productivity, security, data management, and decision-making while minimizing human error and supporting timely parental notifications. Several studies further emphasize RFID's capability to provide rapid identification, efficient database management, and high-speed verification while reducing waiting time and administrative overhead (Kurunthachalam et al., 2021). The integration of RFID with biometric verification and mobile applications further enhances security, eliminates proxy attendance, improves scalability, and strengthens accountability (Shushmitha et al., 2026). Additional research likewise demonstrates that RFID systems automate attendance recording, generate reliable attendance data for analysis, reduce instructional time devoted to attendance, and support institutional accountability (Mohanani et al., 2026; Soumya et al., 2026). Mobile-based attendance systems provide flexibility through GPS and QR-code technologies, particularly in remote or hybrid environments, although they depend on mobile devices and network availability (Wang and Zhang, 2018; Choudhary et al., 2021). Similarly, IoT-enabled attendance systems integrate RFID and cloud technologies to provide real-time monitoring, automated reporting, and improved administrative decision-making while reducing manual workload (Hassan & Mahbub, 2017; Anwar et al., 2019; Swain et al., 2021). Literature on RFID integration further highlights its contribution to efficient attendance tracking, real-time communication, enhanced accountability, and campus security through automated identification and GSM-enabled notifications (Smith et al., 2022).

However, successful implementation requires careful consideration of infrastructure costs, staff training, system integration, and robust data security measures to ensure compliance with privacy regulations (Vinod, 2021). Studies integrating RFID with biometric verification and GSM technology likewise demonstrate improved attendance monitoring, location tracking, and automated SMS notifications for parents and administrators. Related studies also establish the effectiveness of SMS notifications in improving communication, punctuality, attendance consistency, accountability, and parental involvement. SMS notifications also improve emergency response, increase user awareness, and facilitate the timely dissemination of institutional information, making them valuable tools for both attendance monitoring and campus safety (Hassan & Abdurrahman, 2019; Agbo et al., 2020; Perusomula et al., 2023; Josephinshermila et al., 2023). GSM-enabled attendance systems further enhance communication by automatically transmitting attendance information to parents and administrators through mobile networks, thereby strengthening institutional monitoring (Vandana et al., 2018). SMS-based attendance systems provide immediate attendance feedback, reduce absenteeism, support remote monitoring, and remain effective even in areas with limited internet connectivity (Hassan and Abdurrahman, 2019; Agbo et al., 2020; Srinivasan et al., 2019; Khan and Raza, 2020). Finally, literature supports evaluating RFID-based attendance systems using the ISO/IEC 25010 Software Quality Standards to ensure functional suitability, reliability, usability, security, maintainability, compatibility, portability, and performance efficiency. Previous studies demonstrate that applying ISO/IEC 25010 strengthens software evaluation, improves software quality, and supports evidence-based system enhancement (Tungcul & Kummer, 2021; Fadilah et al., 2023; Suzuki et al., 2025; Hanggoro et al., 2025; Rojas et al., 2025). Overall, the reviewed literature consistently indicates that RFID, SMS, biometric, mobile, and IoT technologies significantly enhance attendance monitoring, although implementation challenges related to cost, privacy, security, and user acceptance must be effectively addressed.

1.3 Global, National, and Local Context of RFID-Based Attendance Monitoring in Educational Institutions

Globally, educational institutions increasingly utilize RFID, IoT, artificial intelligence, and automated notification technologies to modernize campus operations, improve attendance monitoring, strengthen security, and support efficient institutional management. RFID technology enables automatic identification and tracking of individuals and resources, while SMS notifications facilitate real-time communication among stakeholders. These technologies improve operational efficiency, data accuracy, asset management, access control, and emergency response, reducing administrative workload and enhancing institutional safety (Bean, 2023; Abraham, 2023; Bharatiraja, 2023; Akbar, 2018; Ashworth & Shemoi, 2023; Selvaganesh, 2023). At the national level, many Philippine educational institutions continue to rely on manual attendance recording and paper-based monitoring systems that are prone to human error, delayed reporting, data inconsistencies, and inefficient resource utilization. As educational institutions pursue digital transformation initiatives promoted by the Department of Education and the Commission on Higher Education, there is an increasing need for automated information systems that improve transparency, institutional efficiency, security, and evidence-based decision-making. The adoption of RFID and SMS technologies supports these national initiatives by modernizing attendance monitoring and enhancing educational service delivery (Bean, 2023; Mendoza, 2019; Kineber, 2023). Locally, Quirino State University experiences challenges associated with manual attendance monitoring, including long queues, inaccurate recordkeeping, delayed statistical reporting, and limited capability to analyze attendance patterns. These limitations affect institutional planning, compliance monitoring, and timely administrative responses. The proposed RFID-based attendance tracking and monitoring system with SMS notification addresses these concerns by automating attendance recording, generating real-time reports, strengthening communication among stakeholders, improving campus security, and supporting data-driven institutional management. The system also contributes to the university's ongoing digital transformation while ensuring software quality through evaluation based on the ISO/IEC 25010 framework.

1.4 Theoretical and Conceptual Basis of the RFID-Based Attendance Tracking and Monitoring System

The study is anchored on the integration of RFID technology, SMS notification, the Feature-Driven Development (FDD) methodology, the Input–Process–Output (IPO) model, and the ISO/IEC 25010 Software Quality Standards. RFID technology serves as the core mechanism for automatically identifying and tracking students, faculty, and staff through RFID-enabled identification cards and strategically positioned readers that transmit attendance data to a centralized database (Bean, 2023). SMS technology complements RFID by providing immediate notifications regarding attendance status, security events, and institutional updates to students, faculty, administrators, and parents (Mendoza, 2019; Kineber, 2023). The conceptual framework follows three development phases. The first phase involves identifying attendance management problems at Quirino State University through observations, interviews, and questionnaires to determine hardware and software requirements. The second phase applies the Feature-Driven Development methodology to analyze system requirements and design the RFID-based attendance monitoring system with features that improve attendance management, security, communication, and administrative processes. The final phase consists of pilot implementation, performance evaluation, and refinement of the developed system based on user feedback and recommendations. System evaluation focuses on functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability using the ISO/IEC 25010 Software Quality Standards. The study is further guided by the Input–Process–Output (IPO) model. The input includes institutional attendance management problems, university policies on identification cards, and compliance with Republic Act 10173 (Data Privacy Act of 2012). The process employs the

Feature-Driven Development methodology and adherence to ISO/IEC 25010 software quality standards throughout system development. The output is the developed RFID-based attendance tracking and monitoring system with SMS notification, evaluated through pilot implementation and user feedback to ensure continuous improvement and compliance with software quality requirements.

1.5 Research Gaps and Rationale for Developing the RFID-Based Attendance Tracking and Monitoring System

The reviewed literature demonstrates that biometric, RFID, mobile, and IoT-based attendance systems significantly improve attendance monitoring by enhancing automation, accuracy, accountability, security, and administrative efficiency (Pichumani and Pugazhendhi, 2020; Kumar et al., 2018; Adebayo and Olorunfemi, 2019; Raza et al., 2017; Hassan & Mahbub, 2017; Anwar et al., 2019). Studies also establish the effectiveness of SMS notifications in strengthening communication, improving punctuality, increasing accountability, and supporting attendance management across educational and corporate settings (Hassan and Abdurrahman, 2019; Agbo et al., 2020; Srinivasan et al., 2019; Khan and Raza, 2020). Despite these developments, the reviewed literature indicates that existing RFID-based attendance systems primarily focus on attendance monitoring without incorporating SMS notification features. Likewise, previous studies have not specifically reported the integration of Microsoft Visual Studio.NET (VB.NET), MySQL, Arduino IDE, Genuino, GSM/Arduino technologies, and RFID within a single attendance monitoring platform that provides automated SMS notifications. Existing systems also vary in their implementation technologies and software architectures, leaving opportunities for developing a more integrated solution that combines automated attendance recording, centralized database management, real-time notification, and comprehensive reporting capabilities (Calo, Barbosa, and Llevado, 2021; Kurunthachalam et al., 2021). Accordingly, the present study was undertaken to develop an Attendance Tracking and Monitoring System using RFID Technology with SMS Notification for Quirino State University. The proposed system addresses the limitations of manual attendance monitoring by automating attendance recording, generating analytical reports, enhancing institutional communication, strengthening campus security, and providing software quality evaluation based on the ISO/IEC 25010 framework. This integrated approach supports the university's digital transformation initiatives while responding to the operational challenges identified within the institution.

1.6 Alignment of the RFID-Based Attendance Tracking and Monitoring System with Relevant Sustainable Development Goals (SDGs)

The study supports several Sustainable Development Goals (SDGs) through the development of an RFID-based Attendance Tracking and Monitoring System with SMS Notification.

SDG 4 – Quality Education is directly aligned with the study because the system enhances educational management by automating attendance monitoring, improving record accuracy, reducing administrative workload, and providing reliable attendance information for timely academic and administrative decision-making. Efficient attendance monitoring also promotes accountability among students, faculty, and staff while supporting a more effective learning environment.

SDG 9 – Industry, Innovation and Infrastructure is reflected through the integration of RFID, SMS notification, database management, and software technologies that modernize institutional operations. The proposed system demonstrates the application of innovative digital infrastructure to improve operational efficiency, automate institutional processes, and support evidence-based management within higher education.

SDG 16 – Peace, Justice, and Strong Institutions is likewise relevant because the system strengthens institutional transparency, accountability, and campus security through automated attendance recording, controlled access, real-time monitoring, and secure management of institutional data. Compliance with Republic Act 10173 (Data Privacy Act of 2012) and evaluation using ISO/IEC 25010 further reinforce responsible information management and software quality.

1.7 Importance of the RFID-Based Attendance Tracking and Monitoring System to Multidisciplinary Sustainability

The study contributes primarily to technological sustainability by promoting the adoption of RFID and SMS technologies that modernize attendance monitoring and institutional management. The automation of attendance recording, report generation, and real-time communication reduces dependence on manual processes while improving the efficiency, reliability, and long-term sustainability of university operations. The study also contributes to educational sustainability by providing a reliable attendance monitoring system that supports effective teaching, learning, and institutional planning. Accurate attendance records enable administrators and faculty members to make timely, evidence-based decisions while improving accountability among students and personnel. The system further strengthens communication with parents and guardians through automated SMS notifications, promoting collaborative support for student welfare. In terms of institutional sustainability, the developed system enhances administrative efficiency by streamlining attendance management, improving resource utilization, strengthening campus security, and supporting policy implementation through accurate and accessible attendance data. The adoption of the ISO/IEC 25010 Software Quality Standards ensures that the system meets recognized software quality characteristics, thereby promoting long-term maintainability, reliability, security, and usability. Finally, the study contributes to socio-economic sustainability by reducing administrative workload, minimizing errors associated with manual attendance recording, improving organizational productivity, and facilitating more efficient institutional operations. These improvements benefit university administrators, faculty members, staff, students, and parents through timely information, enhanced accountability, and improved service delivery.

2. Material and methods

2.1 Research Design

The study employed a descriptive-developmental research design using both qualitative and quantitative approaches. The qualitative method was used to identify and document the problems and challenges encountered in managing and monitoring the attendance of employees and students, while the quantitative method assessed the extent of compliance of the developed system with the ISO/IEC 25010 Software Quality Standards. The system was developed using the Feature Driven Development (FDD) methodology because of its iterative and incremental approach to software development. The methodology guided the systematic planning, design, construction, implementation, and evaluation of the Attendance Tracking and Monitoring System using RFID Technology with SMS Notification. It addressed the limitations of the university's manual attendance system, including time-consuming data entry, reporting difficulties, human errors, limited real-time information, and administrative inefficiencies. Through interviews, observations, and continuous coordination with end users and evaluators, the researcher developed the overall system model by establishing the system architecture, identifying and organizing system features, planning and designing each feature, and implementing and evaluating the completed system. Throughout the development process, user feedback, pilot testing, code inspection, and evaluation based on ISO/IEC 25010 Software Quality Standards were incorporated to improve the functionality, usability, compatibility, and overall quality of the system.

2.2 Locale of the Study

The study was conducted at Quirino State University–Diffun Campus, where the Attendance Tracking and Monitoring System using RFID Technology with SMS Notification was developed, implemented, and pilot-tested. The university served as the setting for identifying attendance monitoring problems, gathering user requirements, evaluating system functionality, and assessing software quality. The developed system automated attendance recording through RFID technology, generated attendance reports, provided SMS notifications, and supported administrative monitoring of students, faculty, and staff.

2.3 Respondents of the Study

The study involved 162 participants, consisting of one Unit Head of the Human Resource Management Office, one University IT Management System Officer, ten IT experts, one hundred selected students, and fifty selected employees of Quirino State University–Diffun Campus. The Human Resource Management Unit Head and IT Management System Officer evaluated the overall workflow, administrative processes, and system security. The IT experts assessed the developed system based on the ISO/IEC 25010 Software Quality Standards, including functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. The students and employees participated in pilot testing to evaluate the performance, functionality, and usability of the developed system. Their evaluations and recommendations served as the basis for system improvement.

2.4 Sample and Sampling Procedure

The study utilized purposively selected participants who were directly involved in the development, implementation, management, and evaluation of the attendance monitoring system. Administrators, IT personnel, IT experts, students, and employees were selected because of their respective roles in system operation, evaluation, and utilization. The developed system underwent one week of pilot testing, during which participants evaluated its performance, functionality, and software quality. The collected feedback and recommendations were used to refine and improve the developed system.

2.5 Research Instrument

Data were collected using an interview guide and an ISO/IEC 25010 Software Quality Standardized Questionnaire. The interview guide was employed to gather qualitative information regarding the problems and challenges encountered in the university's existing attendance monitoring process. The standardized questionnaire evaluated the extent of compliance of the developed system with the ISO/IEC 25010 Software Quality Standards, specifically functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. These instruments provided the basis for assessing the overall functionality, performance, and quality of the developed attendance monitoring system.

2.6 Data Gathering Procedure

The researcher first secured ethical clearance from the Ethics Review Committee of St. Paul University Philippines and obtained endorsement from the dissertation adviser and the Dean of the Graduate School before conducting data collection. Participants voluntarily participated after providing informed consent and were assured that confidentiality and data privacy would be maintained throughout the study. Interviews and questionnaire surveys were then conducted to identify the attendance monitoring problems and challenges encountered by Quirino State University. The developed system was subsequently evaluated by information technology experts using the ISO/IEC 25010 Software Quality Standardized Questionnaire. Quantitative data were organized using Microsoft Excel for statistical analysis, while qualitative responses were analyzed through thematic analysis.

2.7 Data Analysis Techniques

The study employed descriptive statistical techniques to summarize, analyze, and interpret the collected data. Thematic analysis was used to examine the problems and challenges encountered in the existing attendance monitoring process and to analyze the recommendations of IT experts for improving the developed system. Weighted mean was utilized to determine the extent of compliance of the Attendance Tracking and Monitoring System with the ISO/IEC 25010 Software Quality Standards in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. The resulting weighted mean scores were interpreted using the corresponding descriptive scale to determine the overall level of software quality compliance.

2.8 Ethical Considerations

The study adhered to established ethical standards throughout the research process. Ethical clearance was obtained from the Ethics Review Committee of St. Paul University Philippines before data collection commenced. Endorsement from the dissertation adviser and the Dean of the Graduate School was likewise secured. Participation in the study was voluntary, and informed consent was obtained from all participants before interviews and surveys were conducted. Participants were informed of the purpose of the study, assured of the confidentiality of their responses, and guaranteed that their personal information would be protected in accordance with ethical research practices and data privacy requirements.

3. Results and Discussion

3.1 System Development and Identified Problems

3.1.1 Problems and Challenges in Attendance Monitoring

The findings revealed that Quirino State University experienced several challenges in managing and monitoring attendance using manual processes. The existing paper-based attendance system was time-consuming, susceptible to human error, and inefficient for handling large numbers of students and employees. Manual recording also resulted in inaccurate and duplicated records, delayed report generation, difficulty retrieving historical attendance data, absence of real-time monitoring, lack of instant notifications for absences, and challenges in generating reports for compliance and payroll. Security and privacy concerns were likewise identified because paper records were vulnerable to tampering and unauthorized access. These limitations affected administrative efficiency and hindered timely decision-making. These findings demonstrate the need for an automated attendance monitoring system capable of improving efficiency, accuracy, security, and data management. The identified challenges provided the basis for developing an RFID-based attendance tracking system integrated with SMS notifications to streamline attendance recording, facilitate real-time monitoring, and support institutional decision-making.

3.1.2 Development of the Attendance Tracking and Monitoring System

The developed Attendance Tracking and Monitoring System using RFID Technology with SMS Notification was designed to automate attendance recording for students, faculty, and staff. The system records attendance in real time through RFID technology, securely stores attendance data in a centralized database, generates attendance reports, supports payroll and compliance reporting, and sends automated SMS notifications. The system also provides an organized and user-friendly platform that improves transparency, accountability, and efficiency in attendance management. The results indicate that integrating RFID technology with automated notification and database management effectively addresses the operational limitations of manual attendance monitoring. The centralized system improves record accuracy, minimizes opportunities for data manipulation, and supports timely communication with stakeholders, thereby strengthening attendance management within the university.

3.1.3 Administrator and User Functionalities

The developed system provides administrators with comprehensive tools for managing users, classes, attendance records, notifications, and institutional information. Administrators can register students, faculty, and staff; update user profiles and RFID information; upload photographs; create and manage classes; assign advisers; maintain academic records; configure notification settings; manage user accounts; recover passwords through One-Time Password (OTP) verification; generate attendance and Daily Time Record (DTR) reports; and send announcements through SMS and email. The system also supports importing and exporting records using spreadsheet files, allowing efficient management of institutional data. Attendance records are automatically captured when registered users tap their RFID cards, immediately displaying user information while securely storing attendance logs in the database. Parents and guardians receive real-time SMS notifications when students enter or leave the campus, while faculty and staff receive corresponding attendance notifications. The system likewise generates printable attendance reports and maintains complete attendance records for monitoring and documentation purposes. These findings demonstrate that the developed system provides an integrated attendance management platform that supports administrative efficiency, accurate recordkeeping, and real-time communication. The automation of user registration, attendance recording, reporting, notification, and account management simplifies institutional processes while enhancing monitoring, transparency, and accessibility of attendance

information. The integration of RFID technology with SMS notifications further strengthens operational efficiency by providing immediate attendance verification and timely communication to users and stakeholders.

3.1.4 Attendance Monitoring, Reporting, and Notification Features

The developed system provides automated attendance monitoring and reporting for students, faculty, and staff through RFID technology. Employees' Daily Time Records (DTR) can be generated monthly by entering the employee identification number and selecting the desired reporting period. The system automatically displays arrival and departure records and allows reports to be printed or exported in PDF or Word formats. Student attendance records can likewise be generated by adviser, class, month, or semester and exported for documentation. When registered users tap their RFID cards, the system immediately displays their names, photographs, academic or office information, and log-in or log-out times while automatically saving attendance records in the database. Parents and guardians receive real-time SMS notifications whenever students enter or leave the school premises, while faculty and staff also receive attendance notifications. The system continuously updates attendance logs, enabling administrators to monitor attendance efficiently and maintain accurate institutional records. The results demonstrate that the integration of RFID technology with automated reporting and SMS notifications improves attendance monitoring by providing real-time recording, faster report generation, and immediate communication with stakeholders. The automated recording of attendance minimizes manual processing, enhances record accuracy, and supports efficient monitoring of students and employees while facilitating timely administrative actions.

3.1.5 RFID Hardware and System Components

The developed attendance monitoring system utilizes RFID cards, RFID readers, broadband devices with SIM cards, and RFID printers to support its operation. Each registered user is issued an RFID identification card embedded with a unique identifier that serves as the access key to the system. Attendance is recorded when the RFID card is tapped on the RFID reader, which communicates with the host computer through a USB connection. The broadband device with a SIM card enables the transmission of SMS notifications to registered parents, guardians, faculty, and staff. An RFID printer is used to produce secure identification cards for registered users, supporting both identification and attendance monitoring functions. These findings indicate that the combination of RFID hardware and communication devices provides an integrated platform for automated attendance recording and real-time notification. The coordinated use of RFID cards, readers, SMS technology, and secure identification cards enhances the efficiency, accuracy, and reliability of attendance management while strengthening institutional security and user authentication.

3.2 Extent of Compliance of the Developed System with ISO/IEC 25010 Software Quality Standards

3.2.1 Functional Suitability

The evaluation results showed that the developed system complied with the ISO/IEC 25010 Software Quality Standard in terms of functional suitability to a very great extent, obtaining an overall mean of 4.80. The system demonstrated functional completeness, correctness, and appropriateness, indicating that it adequately performed the required tasks, produced accurate results, and effectively supported users in accomplishing their intended objectives. The findings indicate that the developed system successfully delivers its intended functions with accuracy, completeness, and appropriateness, making it effective for attendance monitoring and management. These results support the study of Canlas et al. (2021), which emphasized that functional suitability is a fundamental software quality attribute that ensures systems perform their intended functions accurately and effectively, thereby improving user acceptance and overall system performance.

3.2.2 Performance Efficiency

The developed system achieved a category mean of 4.80, interpreted as Very Great Extent, indicating a high level of compliance with the ISO/IEC 25010 Software Quality Standard in terms of performance efficiency. The evaluation showed that the system met the required standards for response time, resource utilization, and operational capacity, demonstrating efficient processing and reliable overall performance. These findings suggest that the system efficiently manages computing resources while maintaining responsive operation under normal conditions. The results validate the study of Kurniasari and Rochimah (2025), which highlighted the importance of evaluating software performance efficiency using the ISO/IEC 25010 Software Quality Model to determine system responsiveness, capacity, and operational effectiveness.

3.2.3 Compatibility

The evaluation revealed that the developed system complied with the ISO/IEC 25010 Software Quality Standard in terms of compatibility to a Very Great Extent, obtaining an overall mean of 4.55. The system effectively performed its required functions while sharing resources with other applications and operating efficiently within a common software environment. The results indicate that the system can be integrated into existing software environments with minimal compatibility issues, supporting efficient information exchange and resource sharing. These findings are consistent with the study of Rojas et al. (2025), which emphasized that software compatibility enables systems to operate effectively across different applications, environments, and resources while maintaining performance efficiency.

3.2.4 Usability

The developed system obtained an overall mean of 4.80, interpreted as Very Great Extent, indicating a high level of compliance with the ISO/IEC 25010 Software Quality Standard in terms of usability. The evaluation showed that users recognized the system as appropriate for their needs, found it easy to learn and operate, experienced protection against user errors, appreciated its interface, and considered it accessible to a wide range of users. These findings demonstrate that the system provides an effective and user-friendly interface that supports efficient interaction and satisfactory user experience. Similar findings have been reported in RFID-based attendance systems developed for educational institutions, where improved usability, faster attendance processing, and enhanced administrative efficiency contributed to greater user acceptance and more effective attendance management (Aniñon, 2020; Kirmani, 2017). The results corroborate the study of Jornadal et al. (2025), which reported that systems demonstrating high usability provide effective operation, minimize user errors, and ensure accessibility while fulfilling their intended functions.

3.2.5 Reliability

The evaluation showed that the developed system complied with the ISO/IEC 25010 Software Quality Standard in terms of reliability to a Very Great Extent, obtaining an overall mean of 4.68. The system demonstrated high ratings in maturity, availability, fault tolerance, and recoverability, indicating that it consistently operated as intended, remained accessible when needed, tolerated hardware and software faults, and effectively recovered affected data following system disruptions. The findings indicate that the developed system provides dependable and stable operation while maintaining continuous service and rapid recovery from failures. These results corroborate the study of Prameswari et al. (2025), which reported that compliance with the ISO/IEC 25010 reliability requirements contributes to operational consistency, recoverability, accessibility, and overall user satisfaction.

3.2.6 Security

The developed system obtained an overall mean of 4.72, interpreted as Very Great Extent, indicating a high level of compliance with the ISO/IEC 25010 Software Quality Standard in terms of security. The evaluation demonstrated that the system effectively maintained confidentiality, integrity, non-repudiation, accountability, and authenticity by restricting unauthorized access, protecting sensitive information, and supporting secure user authentication and data management. The results suggest that the implemented security mechanisms provide adequate protection for institutional data while promoting user trust and data confidentiality. These findings validate the study of Sekarini et al. (2020), which emphasized that software systems complying with ISO/IEC 25010 should implement secure access controls and proper data handling procedures to preserve confidentiality and safeguard sensitive information.

3.2.7 Maintainability

The evaluation results revealed that the developed system complied with the ISO/IEC 25010 Software Quality Standard in terms of maintainability to a Very Great Extent, obtaining an overall mean of 4.62. The system demonstrated strong modularity, reusability, analyzability, modifiability, and testability, indicating that it can be efficiently maintained, modified, and tested while preserving software quality. These findings indicate that the system supports future enhancements and maintenance without significantly affecting existing functions. The results are consistent with the study of Jornadal et al. (2025), which found that iterative software development contributes to high-quality systems that effectively satisfy ISO/IEC 25010 maintainability requirements.

3.2.8 Portability

The developed system achieved an overall mean of 4.83, interpreted as Very Great Extent, demonstrating a high level of compliance with the ISO/IEC 25010 Software Quality Standard in terms of portability. The evaluation showed that the system can be efficiently adapted, installed, transferred, and replaced across different hardware and software environments with minimal difficulty. The findings indicate that the developed system possesses strong adaptability, installability, and replaceability, making it suitable for deployment in various operational environments. Similar studies reported that portable information systems designed using modular architectures can be deployed across multiple computing environments with minimal configuration requirements (Yurindra et al., 2021). The results support the study of Moumane et al. (2023), which emphasized that evaluating software portability using the ISO/IEC 25010 Software Quality Standard helps determine the adaptability and deployment capability of software systems across different computing environments.

3.2.9 Overall Compliance with ISO/IEC 25010 Software Quality Standards

The overall evaluation revealed that the Attendance Tracking and Monitoring System using RFID Technology with SMS Notification obtained an overall mean of 4.72, interpreted as Very Great Extent. All software quality dimensions—functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability—received ratings within the Very Great Extent category, indicating that the developed system consistently met the ISO/IEC 25010 Software Quality Standards. These findings demonstrate that the developed system exhibits a high level of software quality and is capable of meeting user requirements while maintaining efficient, secure, reliable, maintainable, and portable operation. The results validate the findings of Jornadal et al. (2025), which concluded that

software demonstrating a Very Great Extent of compliance with the ISO/IEC 25010 Software Quality Model reflects high overall software quality and adherence to internationally recognized software standards.

3.3 Recommended System Enhancements

3.3.1 Automated Database Backup

The findings identified the need to incorporate an automated database backup mechanism into the developed system. The proposed enhancement includes automatic backup scheduling, backup verification, data encryption, and support for off-site or cloud storage to safeguard institutional records. These features are intended to preserve data integrity, facilitate disaster recovery, minimize downtime, and enable rapid restoration of attendance records in the event of system failure or physical disasters. The proposed enhancement emphasizes the importance of strengthening data protection and business continuity within the attendance monitoring system. Implementing automated and secure backup procedures would reduce the risk of data loss, improve system reliability, and ensure uninterrupted institutional operations during unforeseen system failures.

3.3.2 Password Security Through Hashing

The results also recommend strengthening user authentication by implementing a secure password hashing mechanism instead of storing passwords in plain text or using reversible encryption. The proposed enhancement advocates the use of computationally intensive one-way hashing algorithms that convert passwords into irreversible hash values, thereby preventing unauthorized disclosure of user credentials in the event of database compromise. The recommended implementation of password hashing enhances the overall security of the developed system by protecting user credentials against unauthorized access and exploitation. Strengthening the authentication process through secure hashing contributes to improved data confidentiality, reinforces user trust, and further enhances compliance with secure software development practices for institutional information systems.

4. Conclusion & Recommendations

The study concluded that the existing manual attendance monitoring system at Quirino State University was inefficient, prone to errors, and vulnerable to data security issues. The developed Attendance Tracking and Monitoring System using Radio Frequency Identification (RFID) Technology with SMS Notification successfully addressed these limitations by automating attendance recording, improving the accuracy and accessibility of records, and facilitating real-time communication through SMS notifications. Furthermore, the system achieved a Very Great Extent of compliance with the ISO/IEC 25010 Software Quality Standards in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability, demonstrating that it is an effective and reliable solution for modernizing attendance management.

Quirino State University is encouraged to adopt and implement the developed Attendance Tracking and Monitoring System using RFID Technology with SMS Notification to improve attendance management and institutional efficiency. The university should also provide training for the Human Resource Management Unit to ensure the effective utilization of the system. Future researchers are likewise encouraged to build upon this study by enhancing the system's efficiency, expanding its functionalities, and exploring its application in other institutional settings.

This study was limited to the development and evaluation of the Attendance Tracking and Monitoring System using RFID Technology with SMS Notification for Quirino State University. The system was designed to address identified issues related to manual attendance monitoring and was evaluated based on the ISO/IEC 25010 Software Quality Standards. Consequently, the findings and recommendations are limited to the scope, objectives, participants, and implementation setting of the study.

Compliance with ethical standards

This study was conducted in accordance with established ethical standards throughout the research process. Ethical clearance and the necessary institutional endorsements were secured before data collection. Participation was voluntary, informed consent was obtained from all participants, and the confidentiality and privacy of participant information were maintained throughout the conduct of the study in accordance with ethical research practices and data privacy requirements.

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