

Development of a Smart Wearable System for Monitoring Student Attendance and Activity Participation through ID Scanning

Amuncio, Jun Rey¹; Crisostomo, Kenneth²; Gatinao, Hannah Michaela G³; Palomo, Gerber Jay L⁴; Paculan, Kristian Jay C.⁵; Cedia E. Gabriel⁶ MIT; Reginald S. Prudente⁷ MIT

^{1;2;3;4;5;6;7}College of Information and Communication Technology, South East Asian Institute of Technology Incorporated, 9505 Crossing Rubber, Tupa, South Cotabato Philippines

Publication Date: 2025/05/23

Abstract: The study presents the development and evaluation of a smart wearable system to monitor student appearance and activity participation through ID scanning at South East Asian Institute of Technology (SEAIT), Tupa, South Cotabato. Methods of traditional appearance in educational institutions are often disabled, error-prone and susceptible to manipulation. The project integrates human-computer interaction (HCI) principles into a smart wearable device that uses ID scanning to automate the attendance and recording of student participation. The system aims to improve accuracy, reduce administrative burden, and increase the user experience through user-friendly interfaces and real-time data processing. The purposeful test and performance assessment demonstrated that the system provides more efficiency and satisfaction than traditional methods, although some users expressed concern over the need for privacy and additional support. Overall, the system shows strong ability to increase institutional operations in the resource-limit environment.

Keywords: Smart Wearable System, Student Attendance, ID Scanning, Human-Computer Interaction (HCI), SEAIT, Real-Time Monitoring, Educational Technology, Usability Testing, Activity Participation, Automation.

How to Cite: Amuncio, Jun Rey; Crisostomo, Kenneth; Gatinao, Hannah Michaela G; Palomo, Gerber Jay L; Paculan, Kristian Jay C.; Cedia E. Gabriel; Reginald S. Prudente (2025). Development of a Smart Wearable System for Monitoring Student Attendance and Activity Participation through ID Scanning. *International Journal of Innovative Science and Research Technology*, 10(5), 1084-1091. <https://doi.org/10.38124/ijisrt/25may665>

I. INTRODUCTION

➤ Background and Context

Educational institutions continuously seek efficient and accurate methods for student attendance and monitoring their participation in campus activities. Traditional attendance systems often relying on manual calls or basic card swiping are time consuming and prone to human error. Laziness on the part of students, nonchalance to schoolwork, extra social activities that have no importance in aiding the objectives of the institution and a lot more may prevent students from attending lectures. Sequel to these, lecturers and administrators in most developing countries have had to come up with ways to ensure a healthy participation from students. HCI ensures that these systems are accessible and effectively meet the needs of students. For instance, in a study on a smart interactive education system based on wearable devices, the integration of HCI principles allowed for real-time feedback and interaction between students and teachers thereby improving the learning experience systems

not only for attendance tracking but also for more engaging and responsive educational experiences.

Attendance is an essential element in every institute, whether it is an educational or working office. But some academic institutions are still using the traditional means of taking attendance (i.e., register, paper sheet, or attendance sheet). These methods are not so perfect because they are always time-consuming, and there can be many flaws like cheating in attendance when a friend of one of the absentees marks the fake attendance. To address the challenges of traditional attendance tracking implementing automated systems that easily process and reduce errors using smart wearable system students can check in by simply scanning their ID cards, which records their attendance instantly and accurately.

The development of a smart wearable system for monitoring student attendance and activity participation through ID scanning is helpful because everyone can

benefit, not only teachers and students but also the institution, and it is very accessible and easy to use, so there is much less error, cheating, and time consumption, and it is not manual, and also helps students monitor their participation effectively. They monitor what steps they will take to correct their mistake if wrong, so it's nice to implement this system in every school.

These difficulties are made even more noticeable in my school, the SouthEast Asian Institute of Technology (SEAIT) in Tupi, South Cotabato, because of a growing student body and a lack of technological resources and manual methods of recording attendance. The urgent need for a cutting-edge is developing a smart wearable device that incorporates ID scanning to enhance operational effectiveness and help to the teachers by monitoring student attendance effectively and accessible for every user and in our educational setting is highlighted.

➤ *Research Problem*

In SEAIT they struggle to keep track of students showing up and joining in class and after school activities, old ways of doing this often don't work well; they slow, make mistakes. A smart wearable gadget that can scan ID might help solve this. It could make corrections, work faster and let school watch what's happening right away.

➤ *Research Questions and Objectives*

- How can ID scanning at SEAIT be used to efficiently record student attendance utilizing a smart wearable system?
- What effect does incorporating wearable ID scanning have on tracking student involvement in recreational and academic activities?
- In a situation with limited resources like SEAIT how well does the smart wearable system perform in terms of accuracy efficiency and user acceptance when compared to conventional attendance methods?
- How to embrace a smart wearable technology affects how school can monitor students and manage their operations?
- When we integrate smart wearable techniques in school administration systems to track students and handle operating functions, what levels can we expect for accuracy and user satisfaction?

➤ *Objectives*

- To be able to create a smart wearable system that tracks student attendance using ID scanning.
- To be able to assess how the system records attendance and monitors students' participation in the classroom.
- To be able to evaluate the wearable system that can be used among SEAIT teachers and students
- To be able to evaluate the wearable system's cost-effectiveness and in good performance
- To be able to offer suggestions for incorporating smart wearable technology into school administration systems to improve overall student monitoring and operational activities

➤ *Justification and Significance*

The justification for developing a smart wearable system for monitoring student attendance and activity participation is efficiencies and limited for those individual who used. This systems often dependent on manual method or basic card swiping are not only time consuming but also make to human error which can lead to wrong records and also increased much work by automating attendance using integrated ID scanning within a wearable device the propose system can lead these in effectively and minimizes disruptions during class time thereby allowing educators to give more attention to teaching. The resource-limited environments such as SEAIT at Tupi, South Cotabato, where technical resources and administrative processes rely on outdated methods a cost-effective and smart solutions.

The significance of this research is the potential to transform campus management by developing wearable technology. Smart wearable systems have real-time data collection and high technology which enhance operational easy in student activity

The integration of smart wearable systems and real-time based attendance systems has streamlined verification processes and ensured that students meet attendance requirements essential for academic success. These technological advancements have improved the quality and accuracy of student attendance directly influencing student performance. By Implementing this system at SEAIT everyone can benefits, the proposed smart wearable system offers a significant advancement technological over traditional attendance methods.

II. LITERATURE REVIEW

➤ *Overview of HCI Theories and Models*

User-Centered Design theory (UCD) is the HCI approach that emphasizes creating systems tailored to the needs, preferences, and limitations of end users (IJRASET, 2021). In the part of Smart wearable attendance monitoring systems, User-Centered Design theory involves gathering data directly from students and administrators to understand their specific needs. The design process includes repetitive prototyping and testing of interfaces to ensure usability and effectiveness. This approach ensures that the system works and is easy for events, while also enabling staff to efficiently and effectively generate reports and manage data of the students.

➤ *Recent Studies*

- *In Enhancing Room Security and Automating Class Attendance Using ID Cards*

According to Bhat, et al.,(2023), the present an innovative system that leverages RFID-based ID card scanning to improve both classroom attendance tracking and overall room security. The study outlines a comprehensive system architecture that integrates RFID technology with automated data processing, enabling real-time verification of student identities as they enter a room. This automated approach significantly reduces the time and labor associated

with traditional manual attendance methods, while also enhancing security by ensuring that only authorized individuals gain access to secure areas. The system transmits scanned data to a centralized server, where attendance records are updated immediately, and security alerts can be generated if unauthorized access is detected. The results demonstrate that this method not only improves data accuracy but also reduces administrative burdens, making it a scalable solution for educational institutions looking to modernize their attendance and security protocols.

- *Classroom Attendance Systems Based on Bluetooth Low Energy Indoor Positioning Technology for Smart Campus*

According to Puckdeevongs et al. (2020), developed a system that leverages Bluetooth Low Energy (BLE) to accurately track student positions in classrooms. By measuring Received Signal Strength Indicator (RSSI) values from multiple BLE reference points, the system automatically records attendance and generates spatial data on student activity. This work demonstrates that integrating wireless positioning with automated attendance can significantly reduce manual errors and save time compared to traditional methods.

- *IoT Based Smart Attendance System Using RFID: A Systematic Literature Review*

According to Ishaq and Bibi (2023), provide a comprehensive review of IoT-based attendance systems that utilize RFID technology, focusing on various methodologies applied across educational and organizational settings. Their review highlights that RFID-based systems offer significant advantages in automating attendance processes, thereby reducing manual workload and improving the accuracy of records through real-time data collection. However, they also point out challenges such as high installation costs, the need for dedicated hardware, and issues related to signal interference and system scalability. To overcome these limitations, Ishaq and Bibi suggest the integration of RFID with wearable devices, which could facilitate continuous, real-time monitoring and reduce the infrastructure costs associated with fixed RFID installations. This hybrid approach not only promises enhanced operational efficiency but also provides a more flexible and user-friendly solution for attendance tracking.

III. METHODOLOGY

- *Research Design*

The system will be subjected to a descriptive developmental approach. Descriptive research component

analysis and understand the current method of attendance monitoring and activity participation to evaluate the important activities performance and including error rates, accuracy and reaction time. Data input from manual attendance record techniques will be contrasted with these findings. The developmental research focuses on the design development of smart wearable attendance monitoring and improves the overall experience for students and teachers in institutional events.

- *Participants*

Participants in the study are students enrolled at the South East Asian Institute of Technology (SEAIT), Tupi South Cotabato the smart wearable system for tracking participation in activities and attendance. Convenience sampling will be used to choose participants and as part of the inclusion requirement participants must be enrolled in classes where attendance is required at the time of the study and give their informed consent.

- *Data Collection*

Statistical methods will be used to assess data gathered from the system's automatic logs, such as student ID Analyzing attendance records from a subset of students using the system, you can estimate overall attendance trends and assess the system's effectiveness across the institution. The information gathered from surveys This analysis will reveal important patterns concerning the system's overall impact on user satisfaction the system's performance in improving student monitoring and attendance tracking will be possible accurate findings.

- *Ethical Considerations*

The ethical standards will be followed in this study. Each participant's rights students, faculty, and administrative staff will be asked for their informed consent, so that they are fully aware of the study's purpose, their role, and their right to withdraw at any time. All personal data will be kept confidential only authorized research personnel can access. To reduce privacy risks by making sure that private data is managed in wcompliance data protection. The study will have ethical guidelines that prioritize respect for human fairness and the confidentiality of participants' identities.

IV. ADVANCED HCI SYSTEM DESIGN

- *System Architecture*

The proposed Smart Wearable ID Scanning System follows a modular and layered system architecture to ensure reliability, scalability, and efficient data processing.

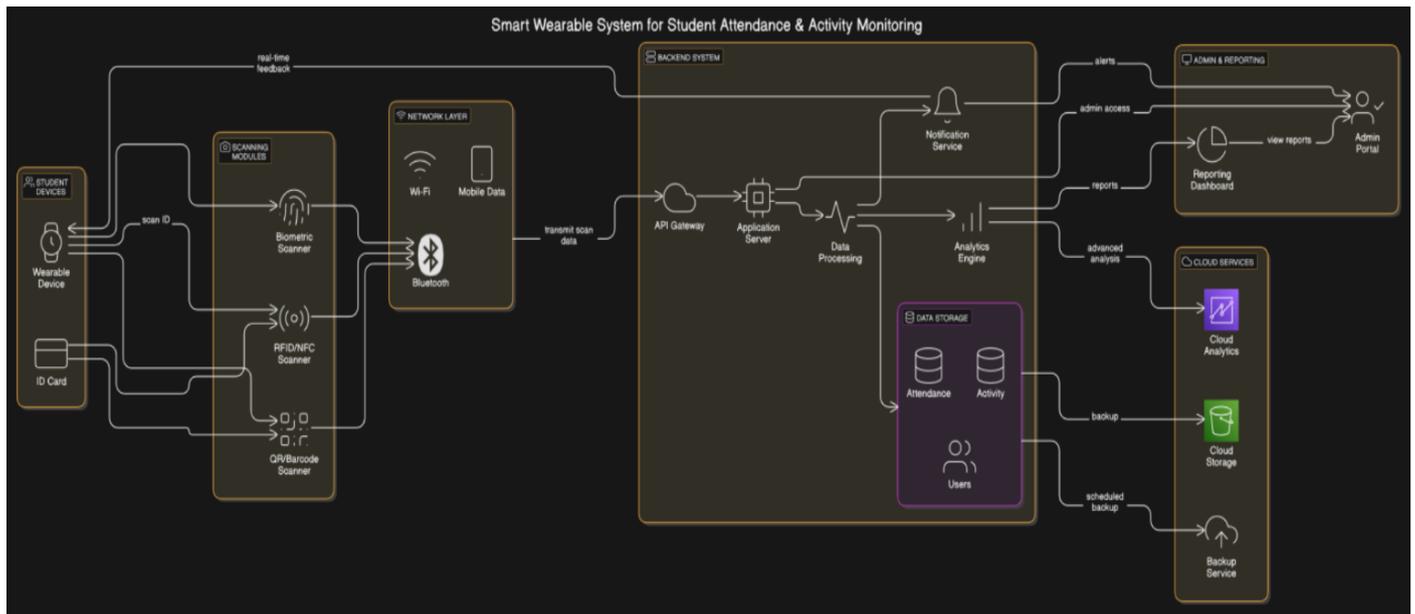


Fig 1 System Architecture

➤ *Features and Functionalities*

Smart wearable ID scanning device attendance tracking and monitoring student participation in Seat by automatic by automatic the process through real-time ID scanning with a user-friendly interface the device allows students for quick identity as they enter classes or attach to activities, it tracks participation which provides valuable insight into the student and better student support services.

➤ *User Interface Design*

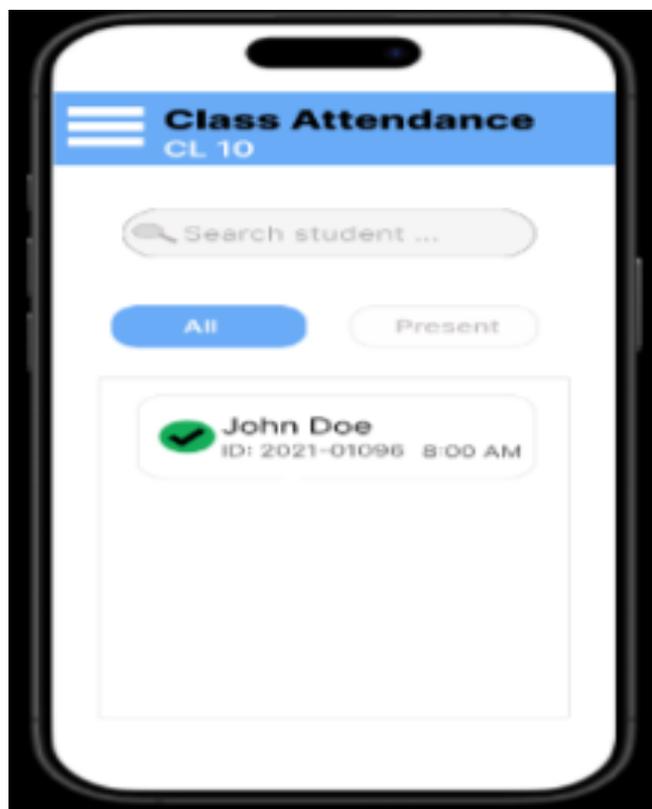


Fig 2 In this Figure, it Shows the Login Section of the System.

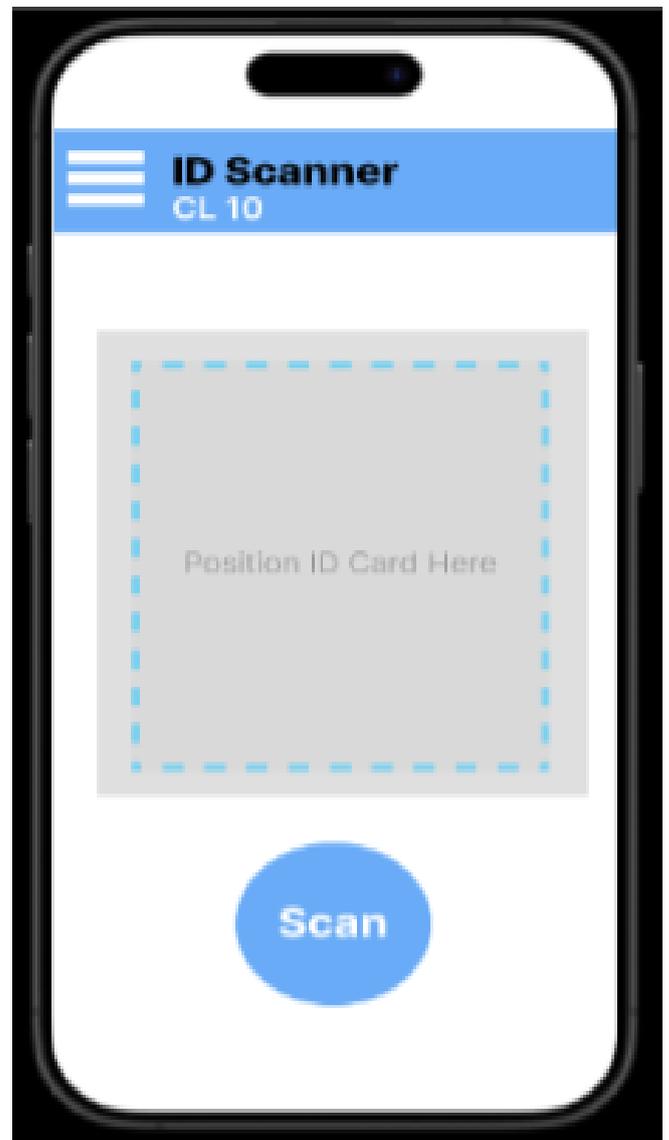


Fig 3 In this Figure, it Shows the ID Scanning n of the System.

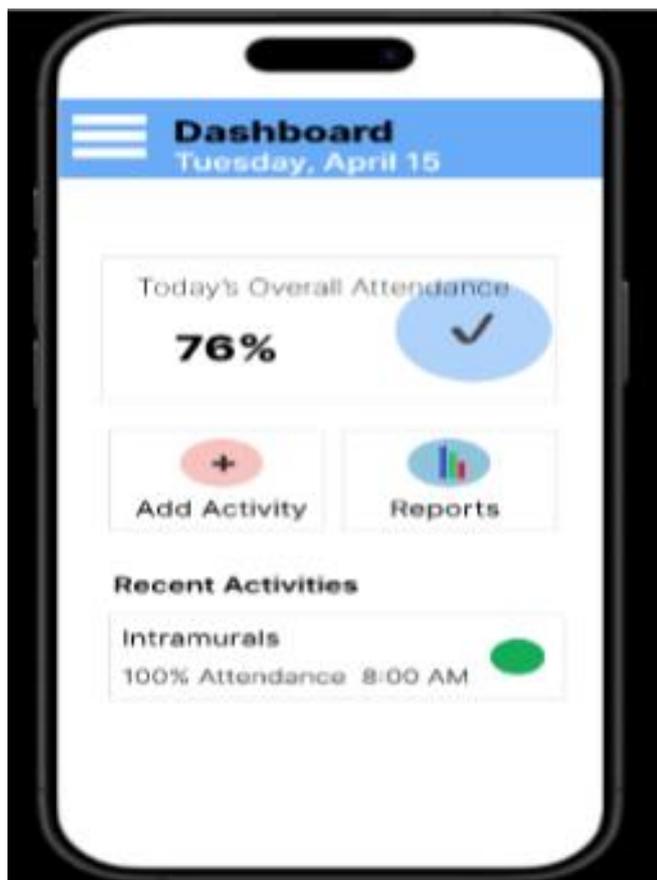


Fig 4 In this Figure, it Shows the Dashboard of the System.



Fig 6 In this figure, it shows the attendance of the students



Fig 5 In this Figure, it Shows the Activity of the Students

V. EVALUATION AND RESULTS

➤ Usability Testing

The Usability testing was centered on the South East Asian Institute of Technology (SEAIT) staff that used smart wearable ID scanning system actively a structured approach to the recruitment of various groups such as students and teachers to ensure a representative sample. Participants will have to answer the survey, interview to familiarize themselves with the device and work with specific landscapes, such as scanning their ID for appearance and reaching the participation data. To monitor these sessions users, take notes on interactions and challenges, while sessions can also be recorded for further analysis. After completing the tasks, the participants will fill a post-test questionnaire, which will include both quantitative. The data collected will be synthesized in a comprehensive report, which will be described for the recommendations for the purpose.

Table 1 Usability Testing

Questions	Mean	Interpretation
1. What is your position in the seat? (Student / Faculty / Administrative Employees)	-	
2. How difficult was it for you to master the use of smart wearable ID scanning devices?	2.95	Users found it moderately easy to learn how to use the device. Some initial effort was needed.
3. How easy did you find the mobile application that comes with the wearable device?	3.28	The mobile app was generally easy to use and navigate.
4. How would you compare the speed of recording attendance through the system vs conventional?	3.36	Attendance recording was perceived as faster than traditional methods.
5. How much are you sure that the attendance records are accurate?	3.42	Users are fairly confident in the accuracy of attendance records.
6. Overall, how satisfied are you with the system?	3.35	Users reported good overall satisfaction with the system.
7. Will you recommend the system to others?	3.40	Most users would recommend the system to peers or colleagues.
8. How concerned are you about privacy and data security?	2.88	Some concerns about privacy and data security were noted, but not very high.
9. Are you satisfied that the system enhanced participation in activities?	3.18	Users felt the system helped increase participation in activities to some extent.
10. Suggestions for enhancing the system?	Open	
TOTAL MEAN	3.20	

➤ *Performance Metrics*

The performance measures employed four primary areas of assessment that comprised Accuracy, Efficiency, effectiveness and user satisfaction that calculates the percentage of recorded examples and measures the average time gain ,measure the level of acceptance between students and teacher.

➤ *Comparative Analysis*

The advanced Human-Computer Interaction (HCI) system of the smart wearable ID scanning device contrasts with what currently exists, like conventional attendance tracking systems such as manual methods and other software applications. Though conventional is simple and what is known, they tend to be time-wasting and vulnerable to human mistakes. The implementation of individuals takes time to learn the new system. it has obstacles that must be overcome for effective implementation of features built into the system to ensure data accuracy as well as an improved interface which enhances user experience at each step.

➤ *Results and Findings*

The results were the variation in rates of user adaptation and the fact that while the majority of participants rapidly adapted to the technology, especially those who were not as comfortable with digital devices struggled initially and needed further training some users also expressed concern over privacy and data security which suggested the need for better communication about data handling practices.

VI. DISCUSSION

➤ *Interpretation of Findings*

The findings offer valuable insights within the research questions context. One of the research questions was about whether the system would make attendance tracking more efficient and accurate compared to conventional methods the system is that it successfully serves user purposes resolving

another research question about user experience and usage. The significance of creating user-friendly interfaces that meet different levels is that some users need extra support for the issues of concern regarding privacy and data security.

➤ *Contributions and Innovation*

This research contributes to the HCI field by enhancing the user experience in Smart wearable system through an intuitive and accessible system to enhance efficiency and accuracy of attendance tracking in educational environments. It emphasizes user experience and simple design. It presented here is integrates ID scanning with smart wearable ID scanning for attendance monitoring system and provides access to real -time data through a mobile app efficient and satisfying experience for students and administrators.

➤ *Limitations and Future Work*

This study has several limitations. The Smart Wearable System primarily focuses on the students attendance and monitoring activity participation of the students. Some of the participants expressed concerns regarding privacy and data security suggesting the need for improved privacy, By addressing these limitations, future studies could refine the system design, improve user experience, and contribute to the broader adoption of digital attendance solutions in educational institutions. Students will also be meaningful to study the long -term impact of the system on engagement and performance.

VII. CONCLUSION

➤ *Summary of Key Findings*

The major conclusions of the study are that intelligent wearable ID enhanced human-computer interaction (HCI) system enhances the efficacy and accuracy of occupying the student appearance in the learning environment. Some users, especially less comfortable with technology, were initially

some difficulty and were concerned with privacy and data security. The system is designed with core Human-Computer Interaction (HCI) principles in mind, ensuring that the interface is accessible, efficient, accuracy and centered around user needs.

➤ *Final Remarks*

The research process has given important input in applying advanced Human-Computer Interaction (HCI) systems, in this case, with smart wearable ID scanning technology in monitoring attendance at SEAIT. The study proved that technology could significantly increase efficiency and accuracy by revising the conventional administrative procedures, and users enjoyed the simplicity of design. It also identified areas of difficulty, such as the need to provide support for users with abilities and addressing the importance of privacy and data security issues. This study emphasizes how important it is to incorporate user feedback into system design and how careful, user-centered improvements affect overall user satisfaction.

REFERENCES

- [1]. Arulogun, O. T., Olatunbosun, A., Fakolujo, O. A., & Olaniyi, O. M. (2013). RFID-Based Students Attendance Management System. *International Journal of Scientific & Engineering Research*, 4(2). Retrieved from https://www.researchgate.net/publication/235598499_RFIDBased_Students_Attendance_Management_System
- [2]. Development of a Smart Attendance System Using Near Field Communication (SMAT-NFC). *Global Journal of Engineering and Technology Advances*, 12(2), 121–139.
- [3]. Shoewu, O. O., Akinyemi, L. A., Mumuni, Q. A., Ajasa, A. A., Folorunso, C. O., & Edozie, R. (2022). Development of a smart attendance system using near field communication (SMAT-NFC). *Global Journal of Engineering and Technology Advances*, 12(2), 121–139. <https://doi.org/10.30574/gjeta.2022.12.2.0150>
- [4]. Bhat, S., Nithin, R., & Pranav, S. (2023). Enhancing Room Security and Automating Class Attendance Using ID Cards. *arXiv preprint*. <https://arxiv.org/abs/2307.03926>
- [5]. Chiu, C.-Y., & Kao, T.-C. (2020). Classroom Attendance Systems Based on Bluetooth Low Energy Indoor Positioning Technology for Smart Campus. *Information*, 11(6), 329. <https://doi.org/10.3390/info11060329>
- [6]. Ishaq, K., & Bibi, S. (2023). IoT Based Smart Attendance System Using RFID: A Systematic Literature Review. *arXiv preprint*. <https://arxiv.org/abs/2308.02591>

APPENDICES

➤ *Questionnaires*

- What is your position in the seat? (Student / Faculty / Administrative Employees)
- How difficult it was for you to master the use of smart wearable ID scanning devices?
- How easy did you find the mobile application that comes with the wearable device?
- On a scale of 1 to 5, how would you compare the speed of recording attendance through the smart wearable system with that through conventional methods?
- How much are you sure that the attendance records produced by the smart wearable system are accurate?
- In general, how satisfied are you with smart wearable ID scanning system?
- Will you recommend the use of smart wearable ID scanning systems to other students or employees?
- How concerned are you about privacy and data security when using a smart wearable ID scanning system?
- Are you satisfied with the fact that smart wearable system enhanced your participation in study and extracurricular activities?
- What are your ideas for enhancing the smart wearable ID scanning system or your experience with it?