Volume 2, Issue 3

Innovation Series Quarterly

https://journal.academicapress.org/aps/index.php/isq

Research Article

Lecturer Room Alert System (LRAS): An IoT-Based Smart Notification System for Improving Student-Lecturer Communication

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Keywords:
LRAS
Internet of Things
Smart notification system
Lecturer availability
Student-lecturer communication

Abstract: *The Lecturer Room Alert System (LRAS) is an Internet of Things (IoT)-based smart notification system developed to improve student-lecturer communication at Sanggar Bakti, Kolej Vokasional Shah Alam. It addresses uncertainty over lecturer availability, communication delays and unsystematic meeting arrangements that cause time wastage and lower productivity. LRAS integrates an Arduino Nano, nRF24L01 wireless module, buzzer, keypad and web platform to deliver faster, more accurate and user-friendly notifications. Developed using Agile methodology, its effectiveness was evaluated through 21 respondents. Findings show 95.2% agreed LRAS reduced waiting time and improved communication, while 100% supported its implementation as an alternative to the manual system.*

1. INTRODUCTION

The advancement of digital technology and the Internet of Things (IoT) has encouraged the implementation of smart systems in educational environments, including room alert systems and smart classroom technologies. These systems are capable of detecting human presence, monitoring room usage, and improving attendance management. IoT-driven attendance systems have been reported to support highly accurate attendance data by reducing human error, while IoT applications in education can strengthen communication, collaboration, safety, resource management and administrative efficiency (ColorWhistle, 2026; Fitria et al., 2023).

Despite these developments, many educational institutions still rely on manual practices to determine lecturer availability, such as asking directly, knocking on the door or waiting outside the lecturer's room. At Kolej Vokasional Shah Alam, students may experience uncertainty and time wastage when lecturers are not immediately available at Sanggar Bakti. Lecturers may also be unaware that students are waiting due to the lack of an automated notification mechanism. In addition, the absence of a systematic visit record limits monitoring and safety control. Therefore, the Lecturer Room

Alert System (LRAS) was developed as an IoT-based smart notification system to improve two-way communication, reduce waiting time and support more organized student-lecturer interaction.

2. LITERATURE REVIEW

Previous studies and prototypes indicate that IoT and embedded systems are widely used to improve monitoring, notification and attendance processes in educational settings. The RFID Attendance System uses Arduino Uno, an RFID reader, a temperature sensor, an LCD display, and a buzzer to record attendance and support health screening before students enter the classroom (Hasman & Ahmad, 2022). The Smart Classroom with IR-Based Sensor focuses on detecting the number of students in a classroom and controlling electrical appliances, such as lights and fans, to reduce energy waste (Mohmad Nasir, 2019).

Another related prototype, the Lecturer Alert System, uses Arduino Nano, ESP32-CAM, a wireless module and a buzzer to notify lecturers when students intend to meet them (MKChannelIOT, n.d.). These systems demonstrate the value of automatic notification and embedded communication in learning institutions. However, most existing solutions focus mainly on attendance, classroom automation or simple alerts. LRAS extends this concept by combining a lecturer code interface, wireless communication through nRF24L01, buzzer notification and a web platform that displays lecturer information for students. The Arduino Nano was selected because it is compact, low-power and suitable for embedded IoT applications, while the nRF24L01 module supports low-power wireless data transmission in the 2.4 GHz ISM band (Arduino, n.d.; Nordic Semiconductor, n.d.).

Table 1 outlines the position of LRAS relative to existing educational IoT systems. The comparison shows that RFID- and IR-based systems mainly focus on attendance recording, occupancy detection, and classroom automation, whereas the lecturer alert prototype focuses on basic notification. LRAS extends these functions by combining lecturer-code display, wireless alert transmission and a structured approach for managing student-lecturer visits.

Table 1. Comparison of related systems and their contribution to LRAS.

System	Main Function	Key Components	Contribution or Limitation
RFID Attendance System	Records student and lecturer attendance and supports temperature screening	Arduino Uno, RFID reader, temperature sensor, LCD, buzzer	Useful for attendance verification but not designed for lecturer-room meeting notification
Smart Classroom with IR-Based Sensor	Detects classroom occupancy and controls lights and fans	Arduino Uno, IR sensor, LED, LCD	Improves classroom automation but focuses on energy control rather than student-lecturer communication
Lecturer Alert System	Alerts lecturers when students want to meet them	Arduino Nano, ESP32-CAM, wireless module, buzzer	Provides a direct notification concept but requires improvement in structured information display and visit management
LRAS	Enables students to view lecturer codes and send meeting alerts through a wireless notification system	Arduino Nano, nRF24L01, keypad, buzzer, web platform	Provides a more systematic communication method for managing lecturer-room visits

3. METHODOLOGY

The LRAS project was developed using the Agile methodology because it supports iterative development, continuous testing and user feedback. Agile emphasizes individuals and interactions, working solutions, customer collaboration and responsiveness to change, making it suitable for a prototype that requires continuous improvement based on user needs (Beck et al., 2001; Chan & Thong, 2009). In this project, the Agile process was divided into six phases: planning, analysis, design, development, testing and improvement.

During the planning phase, the project objectives, scope and user problems were identified. The analysis phase examined existing manual practices and determined the required hardware and software components. The design phase involved preparing the system workflow, circuit layout, web interface and user interaction process. The development phase included Arduino Nano programming, nRF24L01 wireless communication setup, keypad input configuration, buzzer notification and web platform development. Testing was conducted through unit testing and system testing to verify data transmission, buzzer response and web display functionality. The improvement phase focused on refining the system based on testing outcomes and user feedback.

The main hardware components consisted of two Arduino Nano Type-C boards, a keypad membrane, an active buzzer, push buttons and two nRF24L01 wireless modules. The software tools used included Arduino IDE, Visual Studio Code and Microsoft Edge with no additional cost. The system was evaluated through a survey of 21 respondents, comprising students and lecturers at Kolej Vokasional Shah Alam.

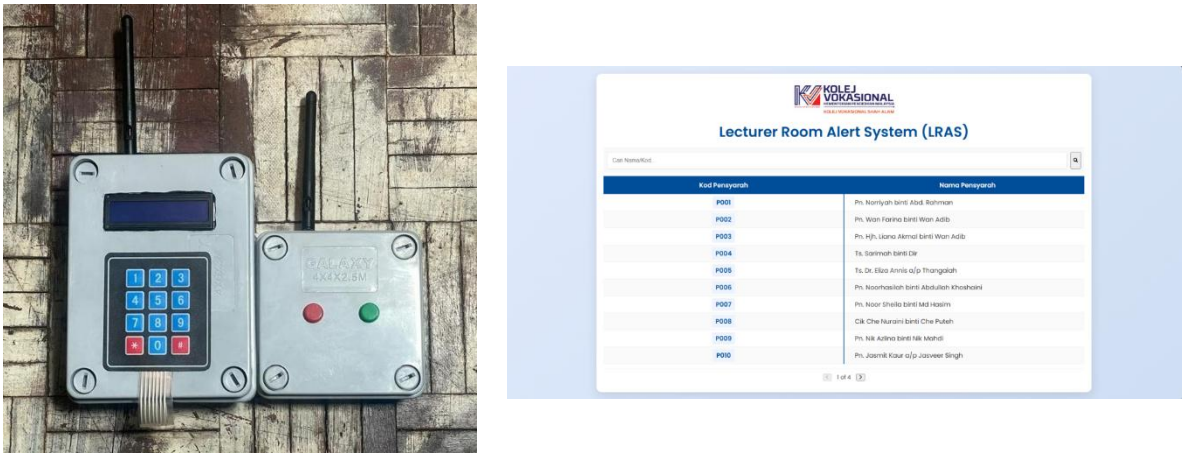

Figure 1. Completed LRAS prototype and web interface.

Figure 1 shows the completed LRAS prototype together with its supporting web interface. The physical prototype consists of a student input unit, where students enter the lecturer code using a keypad, and a receiver unit that alerts the lecturer through a buzzer and response buttons. The web interface displays the lecturer names and codes so that students can identify the correct lecturer before sending a meeting request. Table 2 presents the main development elements used to build and evaluate LRAS. The hardware components process input and activate the notification system, while the software tools support Arduino programming and web interface development. The nRF24L01 module serves as the wireless communication medium between the transmitter and receiver. The questionnaire and User Acceptance Test (UAT) were used to evaluate usability and user acceptance.

Table 2. Summary of LRAS development tools and components.

Category	Items	Purpose
Hardware	Arduino Nano Type-C, keypad membrane, active buzzer, push buttons, nRF24L01 modules	Processes lecturer code input and transmits notification signals
Software	Arduino IDE, Visual Studio Code, Microsoft Edge	Supports embedded programming and web interface development
Communication	nRF24L01 wireless module	Arduino Nano, ESP32-CAM, wireless module, buzzer
Evaluation	Questionnaire and User Acceptance Test (UAT)	Arduino Nano, nRF24L01, keypad, buzzer, web platform

4. FINDINGS

The pre-implementation survey results showed that 85.7% of respondents frequently wasted time waiting due to uncertainty about lecturers' availability. In addition, 90.5% agreed that existing methods, such as knocking on the door or waiting outside the lecturer's room, were ineffective at informing lecturers of student presence. All respondents agreed that the absence of a notification system left lecturers unaware of students waiting to meet them. Furthermore, 95.2% reported that the existing meeting method was difficult to manage and lacked systematic structure.

After the implementation of LRAS, the findings demonstrated strong user acceptance. A total of 95.2% of respondents agreed that LRAS helped reduce waiting time, and 95.2% also agreed that the notification function effectively informed lecturers about student presence. All respondents provided positive feedback that LRAS improved communication compared with the existing method. Moreover, 100% of respondents agreed that LRAS was effective in improving the management of meetings between students and lecturers. The UAT further confirmed that the system performed as expected, including lecturer code input, wireless alert transmission, and buzzer-based notification.

Table 3 summarises the changes observed before and after LRAS implementation. Before LRAS, respondents reported time wastage, ineffective manual notification and unsystematic meeting management. After implementation, the results show clear improvement with most respondents agreeing that LRAS reduced waiting time, improved notification effectiveness and made communication between students and lecturers more efficient.

Table 3. Summary of survey findings before and after LRAS implementation.

Evaluation Aspect	Before LRAS	After LRAS
Waiting Time	85.7% reported time wastage due to uncertainty of lecturer availability	95.2% agreed that LRAS reduced waiting time
Notification effectiveness	100% agreed that the absence of notification caused lecturers to miss student presence	95.2% agreed that LRAS notification functioned effectively
Meeting management	95.2% agreed that the existing method was difficult and unsystematic	100% agreed that LRAS improved meeting management efficiency
Evaluation	Manual methods caused uncertainty and delayed interaction	Respondents indicated improved communication between students and lecturers

5. DISCUSSION

The findings indicate that LRAS successfully addressed the core problems identified in the project, particularly uncertainty about lecturer availability, delayed communication and unsystematic meeting management. The integration of a web-based lecturer list and code system allows students to identify the appropriate lecturer before triggering a notification. Meanwhile, the buzzer alert enables lecturers to receive an immediate signal when a student is waiting. This supports faster interaction and reduces students' reliance on manual methods, such as waiting or repeatedly checking the lecturer's availability.

From a practical perspective, LRAS contributes to institutional efficiency by reducing waiting time and improving communication flow in Sanggar Bakti. It also supports user well-being by minimizing stress from uncertainty and creating a more organized learning support environment. Nevertheless, the project has several limitations. Wireless communication may be affected by radio-frequency interference or distance constraints. In addition, the current web platform mainly displays lecturers' names and codes, without fully automated, real-time information on lecturer availability. These limitations suggest that future work should integrate motion sensors and real-time web updates to automatically display lecturer availability before students send meeting notifications.

6. CONCLUSION

In conclusion, LRAS has achieved its objective of providing an IoT-based smart notification system for improving communication between students and lecturers at Sanggar Bakti, Kolej Vokasional Shah Alam. The system combines Arduino Nano, nRF24L01 wireless communication, keypad input, buzzer notification and a web platform to provide a more systematic alternative to manual meeting practices. Survey findings from 21 respondents showed high acceptance: 95.2% reported improved efficiency, and 100% supported its implementation. LRAS has strong potential to be expanded to other lecturer rooms, teacher rooms and educational institutions. Future enhancement should focus on motion-sensor integration and real-time availability updates.

Acknowledgments: This research article is supported by Kolej Vokasional Shah Alam, appreciation to Programme of Information Technology lecturers, project supervisor, respondents and all individuals who contributed guidance, feedback and support throughout the development and evaluation of LRAS.

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