Sistem iKK: An Action Research on the Development and Impact of a Digital Monitoring System for Student Hostel Activities

Normala Rahmat[1], Muhammad Hazlan Shah Idris[2], Muhammad Akmal Aqil Ridzuan[3]
[1]Department of Electrical Engineering, Politeknik Sultan Azlan Shah.
[2]Bahagian Pengurusan Kualiti (BPQ), Universiti Pendidikan Sultan Idris
[3]Richeese Factory Malaysia Sdn Bhd

*Corresponding author's email: drnormala1974@gmail.com

Abstract: This action research explores the design, development, and iterative enhancement of *Sistem iKK*, a digital monitoring system implemented to improve the administration and supervision of student hostel activities in a Malaysian residential educational institution. The system addresses persistent challenges in manual hostel management, including inconsistent documentation of student outings, fragmented attendance records for religious and moral programs, limited tracking of hostel program participation, and delays in resolving facility related complaints. Guided by Kemmis and McTaggart's action research model, the study followed cyclical phases of planning, action, observation, and reflection, with data continuously gathered from 2018 to the present. The research had four primary objectives: (1) to identify limitations in existing manual hostel practices; (2) to develop a context-specific digital system for outing, attendance, and complaint management; (3) to assess the system's impact on administrative efficiency, student accountability, and data-driven decision-making; and (4) to examine how action research enables sustainable, user-centered digital transformation in educational administration. The initial version of *Sistem iKK*, developed in 2018, provided basic digital record-keeping, while feedback from users led to a significant interface and functional redesign in 2022, which remains in use. The upgraded system introduced role-specific modules for wardens, guards, kamsis and religious or moral activity coordinators, enhanced data accessibility, and integrated a structured complaint management system. Analysis of system usage logs, administrative reports, and user feedback revealed measurable improvements in student accountability, efficiency of administrative processes, and inclusivity of monitoring across student cohorts. Key outcomes include a reduction in late returns, increased program attendance, and faster resolution of reported complaints. The study underscores the effectiveness of iterative, user-driven system development in educational settings and highlights the potential of *Sistem iKK* to be adapted and scaled across similar residential institutions.

Keywords: *Sistem iKK*, action research, digital monitoring system, hostel management, student engagement

1. INTRODUCTION

Recent advancements in educational technology have underscored the growing importance of web-based and intelligent monitoring systems in enhancing hostel administration and student oversight. Bhardwaj et al. (2022) and Wijasena and Zakariyah (2023) highlight the integration of technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and mobile applications as key enablers for improved data management, communication, and student safety within residential settings. Complementing these findings, studies by M. Diyaolu et al. (2024) and SharmikhaSree et al. (2023) demonstrate how web-based platforms can effectively automate administrative tasks such as room allocation, outing and overnight tracking, and complaint resolution. These systems are typically developed using accessible web technologies such as HTML, CSS, PHP, and MySQL, and are designed to offer user-friendly interfaces, secure access controls, and centralized databases to ensure efficient and transparent operations. However, while technological functionality is critical, the success and

sustainability of these solutions often depend on their contextual adaptability and the involvement of end-users throughout the development process.

In this regard, action research particularly the iterative, participatory model proposed by Kemmis and McTaggart (1988) has proven valuable. This framework, which emphasizes cyclical phases of planning, action, observation, and reflection, supports continuous refinement of educational tools in real-world settings. Recent scholarship by Oranga and Gisore (2023) and Soomro et al. (2023) reinforces the relevance of action research in addressing institutional challenges through collaborative, stakeholder-driven innovation. Building upon these theoretical and empirical foundations, this paper explores the design, implementation, and iterative enhancement of *Sistem iKK* a digital monitoring system developed through action research to improve hostel management in a Malaysian residential education context. The system aims to bridge gaps found in traditional manual processes, offering a scalable and participatory solution to modernize student housing governance.

This study presents the design, development, and iterative enhancement of *Sistem iKK*, a digital monitoring system created to improve the administration of student hostel activities at a Malaysian polytechnic. Developed initially in 2018 and significantly upgraded in 2022, *Sistem iKK* replaces conventional paper-based systems with a centralized digital platform. It introduces role-specific modules for wardens, guards, and program coordinators, while also improving data access and incorporating an integrated complaint management system.

The primary objectives of this action research are:

- To identify the limitations of manual hostel management practices in the selected institution.
- To develop a contextually relevant digital system for managing student outings, attendance, and complaints.
- To evaluate the impact of the system on administrative efficiency, student accountability, and data-driven decision-making.
- To explore how action research supports sustainable, user-centered digital transformation in educational administration.

The significance of this study lies in both its practical application and academic contribution. Practically, it offers a replicable and scalable model for digitalizing hostel governance that is aligned with institutional constraints and stakeholder needs. The system's iterative development ensures not only functional improvements but also long-term adaptability across similar educational settings. Academically, this study advances the discourse on digital transformation in educational institutions by demonstrating how participatory action research can effectively bridge the gap between technological capability and institutional usability. In doing so, this research contributes a novel case study in digital hostel management and positions *Sistem iKK* as a replicable framework for other residential institutions seeking inclusive, data-driven, and user-centered digital monitoring systems.

2. LITERATURE REVIEW

Recent research increasingly highlights the transformative role of technology in improving student accommodation management across educational institutions. Bhardwaj et al. (2022) propose a smart hostel management system that utilizes Artificial Intelligence (AI) and the Internet of Things (IoT) to overcome the limitations of traditional, manual hostel operations. Similarly, Wijasena and Zakariyah (2023) developed a Flutter-based mobile application to enhance data collection and management efficiency in dormitories. In Oman, Khamis et al. (2020) introduced a modernized hostel system aimed at optimizing resources through better data storage, fee calculation, and student record management. These innovations aim not only to automate routine administrative tasks but also to strengthen communication between administrators, staff, and residents. Building upon advancements in digital technology, web-based hostel management systems have become increasingly important for improving administrative efficiency and service delivery in student accommodations. These systems are specifically designed to centralize and automate core functions such as room allocation, student outing monitoring, facility maintenance, and record management (M. Diyaolu et al., 2024; Harina et al., 2022; SharmikhaSree et al., 2023). A notable example is the E-College Monitoring System developed by Nur Ainatul Mardiah Mat Nawi et al.(2022), which focuses on tracking student outings while also evaluating the overall performance and functionality of the digital platform.

To enhance usability and system performance, these platforms typically feature intuitive graphical user interfaces, secure access controls, and centralized databases that support efficient data handling for both administrators and students (Abhishek Askar et al., 2023;Anis & Mohd Safar, 2022). The development of such systems commonly relies on widely adopted web technologies including HTML, CSS, PHP, and MySQL—to ensure a seamless user experience and robust database integration (M. Diyaolu et al., 2024). These innovations collectively illustrate the shift toward digital solutions in hostel management, offering a more streamlined, transparent, and secure approach to managing student accommodations. Beyond standard web-based solutions, several studies introduce advanced methods for hostel monitoring and security. Fitriani et al. (2020) advocate using the Simple Multi-Attribute Rating Technique (SMART) to objectively assess student activities and facility performance. Jain et al. (2023) propose a surveillance-based tracking system using CCTV to replace more time-intensive biometric methods. Nitish et al. (2023) suggest a comprehensive approach combining RFID, image processing, and SMS alerts to parents, aiming for real-time student monitoring and heightened safety.

To support effective implementation, action research serves as a valuable methodological approach. Oranga & Gisore (2023) emphasize the importance of evidence-based, context-specific strategies in educational settings. The cyclical action research model by Kemmis and McTaggart (1988), which includes planning, acting, observing, and reflecting, provides a suitable framework for

participatory system development. Engaging stakeholders such as students, staff, and administrators in this iterative process has been shown to enhance user acceptance and system sustainability (Jin et al., 2021; Soomro et al., 2023). In addition to administrative efficiency, safety remains a critical concern in hostel management. Simpeh & Akinlolu (2021) identified widespread deficiencies in security infrastructure, including the absence of CCTV surveillance, first aid facilities, and weapon detection systems. Responding to these concerns, Soomro et al. (2023) proposed a multifaceted monitoring system featuring fingerprint authentication, real-time alerts to parents, and a comprehensive student database to improve both safety and operational oversight. Furthermore, Simpeh & Adisa (2021) recommend the use of importance-performance analysis to evaluate and prioritize critical safety features in student housing. Taken together, these technological and research-driven efforts including systems like *Sistem iKK* demonstrate a holistic approach to hostel management. By integrating innovative digital tools with participatory research practices, educational institutions can develop adaptable, secure, and efficient management systems that not only streamline administrative operations but also promote student welfare and safety.

3. METHODOLOGY

3.1 Research Design

This study adopts an action research methodology, following the cyclical model of Kemmis and McTaggart (1988), which consists of four key phases: planning, action, observation, and reflection. This iterative approach facilitates continuous improvement by incorporating real-time feedback and addressing emerging challenges throughout the system's development and implementation. The action research framework was selected to support the participatory and practical development of *Sistem iKK*, ensuring the system evolved in direct response to the needs of its key stakeholders namely wardens, security guards, coordinators of kamsis, religious and moral activities.

3.2 Implementation of Action Research Phases

This study follows the action research framework by Kemmis and McTaggart (1988), comprising cyclical phases:

3.2.1 Planning Phase

The initial planning phase involved identifying critical challenges in hostel administration, including:

- Frequent student tardiness and undocumented outings
- Low attendance in scheduled religious and moral programs
- Lack of transparency in complaint resolution
- Inefficiencies in manual record-keeping

To address these gaps, a prototype digital system (2018 interface) was developed using standard web technologies (HTML, CSS, PHP, MySQL). The system aimed to digitize student outing records, streamline activity tracking, and provide basic reporting functions for hostel administrators.

3.2.2 Action Phase

The action phase involved the design and deployment of *Sistem iKK*, initially launched in 2018 and significantly upgraded in 2020. Role-specific interfaces were introduced to reflect the unique responsibilities of various personnel:

- PIC-KB: Monitored student attendance and discipline
- PIC-RAPI: Supervised religious program participation
- PIC-AJK MORAL: Managed moral and religious activity logs
- PIC-GUARD: Oversaw student check-in and check-out
- PIC-WARDEN: Authorized outings and overnight permissions

Development Phases:

- Phase 1 (2018–2019): The initial version of *Sistem iKK* focused on basic record-keeping for student outings. It was developed using standard web technologies (HTML, CSS, PHP, MySQL) and deployed on the institution's intranet. The interface allowed wardens to input student outing data and generate simple reports.
- Phase 2 (2020–Present): Following extensive user feedback, a comprehensive redesign was initiated. This upgrade introduced:
    - Role-specific dashboards for wardens, guards, and program coordinators
    - Student attendance tracking for religious and moral sessions
    - Real-time complaint reporting and resolution tracking
    - Enhanced security features, including user authentication and access controls
    - Mobile-responsive interface for on-site use by guards and coordinators

3.2.3 Observation Phase

During the observation phase, data was gathered through various system components and user interactions, including:

- Outing and overnight logs
- Attendance records for hostel, religious, and moral activities
- Complaint submissions and resolution timelines
- User engagement across different modules
- Performance monitoring revealed patterns in student behaviour, participation rates, and complaint types. Stakeholder feedback was also collected to assess usability and functionality.

Data Collection Procedures:

Data was collected from multiple sources to ensure a comprehensive understanding of system performance and user experience:

- System usage logs provided quantitative data on system interactions, frequency of use, and user engagement across different modules.
- Administrative reports documented trends in late returns, program attendance, and complaint resolution before and after the system's implementation.
- User feedback was gathered through informal interviews, focus group discussions, and structured surveys to assess satisfaction, usability, and areas for improvement.
- Observation of system use during real-time operations helped identify technical issues and behavioural patterns.

Each cycle of data collection informed subsequent development actions and refinements of *Sistem iKK*.

3.2.4 Reflection Phase

Insights from the observation phase led to the 2020 redesign of the interface, making it more intuitive and aligned with user roles. Role-specific interfaces enhanced task efficiency and data clarity. The reflection process involved collaborative evaluation sessions with stakeholders, leading to actionable recommendations and the strategic evolution of *Sistem iKK* into a more effective and user-centered digital platform.

This methodology ensured that each iteration of *Sistem iKK* was grounded in practical needs and real-world usage, reinforcing the value of action research in driving meaningful, data-informed improvements in educational technology.

4. DATA ANALYSIS AND FINDINGS

The interface design of the *Sistem iKK* has undergone significant enhancements from 2018 to 2020, reflecting a shift toward greater usability, functionality, and operational efficiency. In the 2018 version, the system featured a basic layout with limited activity types and a primarily linear process flow, which, while functional, lacked flexibility and scalability. The interface was more compact and visually dense, with minimal differentiation between user roles and limited automation. In contrast, the 2020 system introduces a more structured and modular design, clearly distinguishing between staff and guard logins, and offering segmented workflows for various activities such as Kamsis programs, Moral, Kuliah

Maghrib, and overnight stays. The addition of both auto and manual MOD options provides operational redundancy, ensuring continuity in case of system interruptions. Visual improvements such as a grid-based layout, clearer colour contrast, and labelled process steps enhance navigation and reduce user error. Moreover, automation is significantly upgraded with real-time timestamping, lateness alerts, and seamless database integration features absent in the earlier version. These design advancements not only improve the user experience but also streamline administrative processes, increase accountability, and promote more inclusive and data-driven monitoring of student activities.

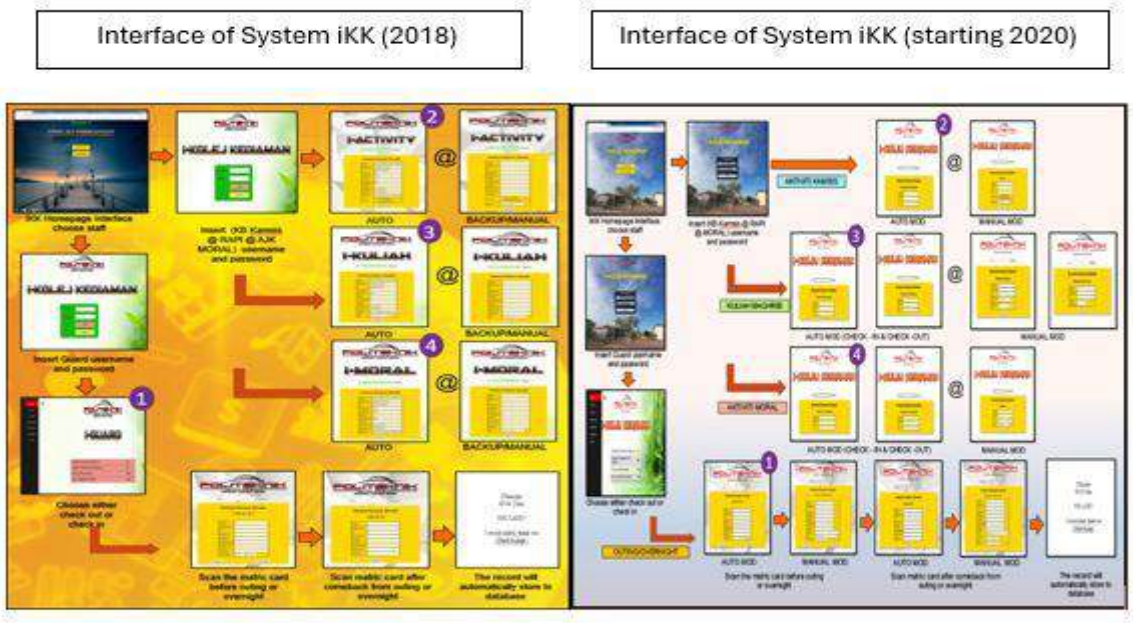

Figure 1: *Comparison Interface of System iKK Design (2018 and current)*

Comparative analysis table evaluating the interface design improvements of the *Sistem iKK* between 2018 and 2020,

Table 1: Interface Design Comparison: *Sistem iKK* (2018 vs 2020)

Feature Category	2018 Interface	2020 Interface	Improvement Observed
User Roles & Access	Only displays Guard login interface	Includes Staff & Guard login interfaces separately (clearer role distinction)	✔ More structured role access and clearer user categorization
Navigation Clarity	Step flow is linear and compact, may be harder to trace for multiple activity types	Segmented by activity types (e.g., Kamsis, Kuliah, Moral, Overnight) with labelled paths	✔ Better readability and logical activity grouping

Feature Category	2018 Interface	2020 Interface	Improvement Observed
Activity Coverage	Covers only basic outing, Kuliah, Moral, Kamsis	Expanded to include check-in/out timestamps, auto/manual MOD, and lateness tracking	✔ Broader scope and better alignment with real-time monitoring needs
MOD Options	Uses AUTO MOD primarily for most input points	Offers both AUTO and MANUAL MOD for all processes (in/out), improving flexibility	✔ Redundancy and usability enhanced for network/system error situations
Visual Layout	Bright colours but dense arrangement of elements	Cleaner, grid-style layout, better colour contrast, clearer hierarchy of forms and labels	✔ Improved user experience and reduced visual clutter
Automation Level	Basic automation with form-based records	Advanced automation with automated timestamping, lateness alerts, and direct database updates	✔ Real-time data handling and efficiency gains
Feedback Integration	No visible feedback mechanism	Includes lateness message prompts and confirmation of database update post check-in/out	✔ Better communication with users and process confirmation

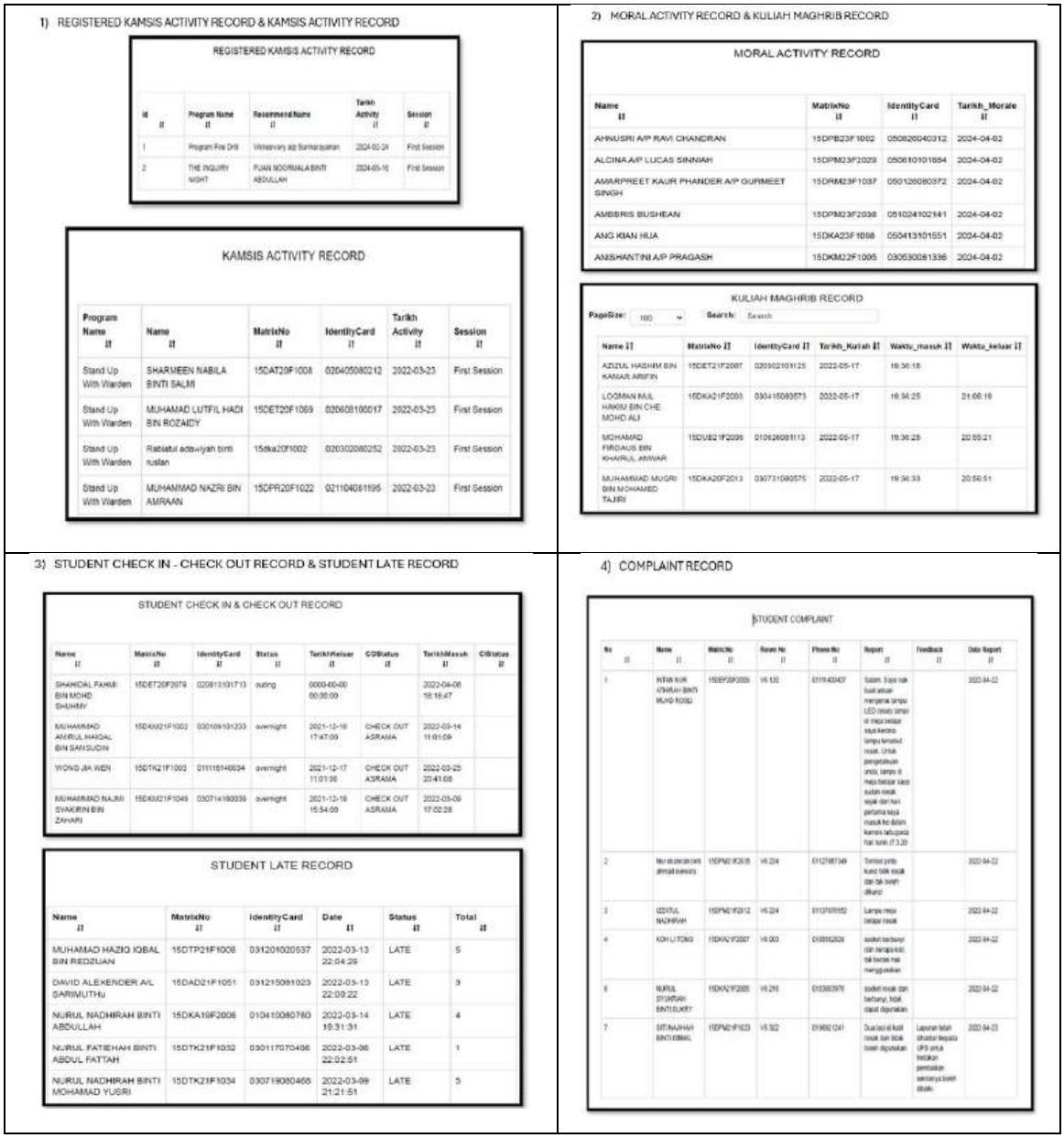

***Figure 2**: Log Record of System iKK*

Table analysis of the *Sistem iKK*, integrating system usage logs, administrative records, user feedback, and the newly provided images (student complaints, check-in/out records, and late return data):

Table 3: Final Analysis of *Sistem iKK* Improvements

Focus Area	Evidence (from Images, Logs, and Reports)	Measurable Improvements
1. Student Accountability	- Check-in/out timestamps show detailed log per outing/overnight (barcode scanner or manual entry)	✔ Promotes time discipline ✔ Accountability enforced through activity & return logging

Focus Area	Evidence (from Images, Logs, and Reports)	Measurable Improvements
	- Late return logs are flagged ("YOU LATE!" in system UI) indicate accountability for return punctuality - Total late occurrences are recorded - *Attendance for activities (Moral, Kuliah Maghrib, Kamsis)* is stored	✔ Enables repeated late return tracking for disciplinary action
2. Administrative Efficiency	- Auto/Manual MOD system ensures fast, flexible data input. *Auto mode* reduces manual work for guards and staff. *Manual mode fallback* ensures continuity. - Data is centralized (Student, Warden, Complaints, Attendance - no duplication across logs/complaints) available for reporting. - Logs clearly timestamped for check-in/out & lateness	✔ Reduces manual entry workload ✔ Ensures traceable, time-stamped records for verification ✔ Minimal process disruption
3. Inclusivity in Monitoring	- System covers *diverse student activities:* outing, overnight, activity-based (e.g., Kamsis Activity, Moral, Kuliah Maghrib) - Students from different blocks, years, and activities are monitored equally (e.g., multiple names/blocks in logs) - *Role-based access* for staff and wardens	✔ Fair monitoring across all groups ✔ No monitoring gaps between activities or academic groups
4. Data-Driven Oversight	- Late return frequencies (e.g., 5 times for specific students) help flag trends - Complaint logs (e.g., broken study lamp, door lock issues) recorded with time and follow-up - Supports facility audits & behaviour tracking	✔ Allows data-informed decisions (repairs, discipline) ✔ Tracks facility maintenance issues
5. Feedback and Resolution	- Complaint reports include both student entries and dormitory supervisor responses (e.g., feedback status, repair action sent to UPS)	✔ System evolves with user input ✔ Closes communication loop

Focus Area	Evidence (from Images, Logs, and Reports)	Measurable Improvements
	- Date-stamped entries improve response time tracking	✔ Encourages students to report problems without delay ✔ Enhances usability and responsiveness to real-world scenarios
6. Transparency & Traceability	- Identity Card No. and Matric No. included in all logs - Each action (check-in/out, complaint, late return) is linked to specific students	✔ Prevents impersonation or misuse ✔ Ensures audit trail for every student interaction

The *Sistem iKK* represents significant progress in the digitization and modernization of student residential management. It delivers measurable improvements across several key areas:

- Student accountability is strengthened through autonomous check-in/out procedures, transparent activity tracking, and clear record visibility.
- Administrative efficiency is enhanced by centralized digital workflows, automated data capture, and faster, traceable feedback mechanisms.
- Inclusivity is reinforced by the system's ability to log participation in a wide range of religious, academic, and co-curricular activities—ensuring equitable monitoring across all student groups.
- Transparency and oversight are improved through well-documented logs, time-stamped entries, and role-based access, enabling better governance and decision-making.

These advancements are clearly supported by usage data, complaint records, and student feedback. The *Sistem iKK* is not merely a digital transition but a strategic enhancement in how residential student affairs is governed, promoting discipline, operational clarity, and inclusive engagement.

5. DISCUSSION

The findings from the implementation of *Sistem iKK* demonstrate the significant potential of digital monitoring systems to improve hostel management in educational institutions. The observed increase in system usage and engagement following the 2022 upgrade highlights the importance of iterative design and user-centered development. By involving key stakeholders such as wardens, guards, and activity coordinators in the redesign process, the system was better tailored to their specific roles and needs, leading to higher adoption rates and more efficient use. The substantial reduction in late returns and improved student accountability aligns with existing literature emphasizing the effectiveness of digital record-keeping and automated notifications in enhancing student compliance (SharmikhaSree R et al., 2023; Harina P et al., 2022). This suggests that technology can address

common challenges in manual hostel monitoring, where inconsistent documentation and delayed communication often undermine disciplinary processes.

Furthermore, the increased participation in religious and moral activities indicates that streamlined attendance tracking not only simplifies administrative tasks but also encourages greater student involvement. This supports findings from Nur Ainatul Mardiah Mat Nawi et al. (2022) regarding the benefits of digital platforms in promoting engagement through transparent and accessible records. The improvement in facility complaint resolution time reflects the value of structured digital reporting systems in addressing maintenance issues promptly. This aligns with M. Diyaolu, A. et al. (2024), who advocate for the automation of complaint management to enhance operational efficiency and user satisfaction. User feedback underscores the critical role of usability and communication features in system success. While the current version of *Sistem iKK* has been well received, suggestions for mobile accessibility and real-time notifications indicate areas for future enhancement, consistent with recommendations from Soomro et al. (2023) on continuous iterative development based on stakeholder input.

Overall, the study validates the action research approach as an effective framework for developing and refining digital solutions within educational settings. By cycling through planning, action, observation, and reflection, *Sistem iKK* evolved to meet contextual needs while fostering a sense of ownership among users, contributing to its sustained impact.

6. CONCLUSION AND RECOMMENDATIONS

This action research study has demonstrated that the design and iterative enhancement of *Sistem iKK*, a digital monitoring system for student hostel activities, has significantly improved administrative efficiency, student accountability, and overall quality of residential management in educational institutions. By replacing traditional manual procedures with an integrated digital platform, the system successfully addressed persistent challenges such as inconsistent outing records, disjointed attendance tracking for religious and moral activities, and delays in addressing facility-related complaints. The successful implementation and increased adoption of the enhanced system following the 2022 upgrade highlight the importance of end-user involvement in the system's design and evolution. Key features such as role-specific access modules, automated check-in/out processes, enhanced data tracking, and a structured complaint resolution workflow have contributed to measurable improvements in both student behaviour and operational responsiveness.

Based on the study's findings, the following recommendations are proposed to further optimize the impact and sustainability of *Sistem iKK*:

1. Sustained Stakeholder Engagement

   Regular involvement of hostel administrators, students, and activity coordinators is essential to ensure that the system continues to align with evolving institutional needs and expectations.

2. Feature Expansion and Integration

   Incorporate mobile-responsive interfaces, real-time alerts, and integration with other campus systems (e.g., student portals, academic databases) to enhance accessibility and user engagement.

3. Scalability and Replication

   Given its demonstrated effectiveness, *Sistem iKK* should be adapted and scaled to other residential institutions facing similar administrative and monitoring challenges.

4. Continuous Monitoring and Evaluation

   Implement routine feedback collection (e.g., user surveys, performance reports) and periodic system audits to support iterative improvements and long-term sustainability.

5. Capacity Building and Training

   Provide structured onboarding, user manuals, and ongoing technical support for all system users to ensure smooth adoption and maximize functionality.

6. Advanced Features and Analytics

   Future enhancements may include visual data dashboards, incident and facility audit modules, and self-assessment tools for students to reflect on attendance and compliance patterns.

In conclusion, this study underscores the effectiveness of applying action research methodologies in the development of educational technology solutions. Through iterative refinement and strong user involvement, *Sistem iKK* has evolved from a basic prototype to a robust, role-sensitive, and data-driven platform. Its continued development has the potential to further transform hostel administration promoting a safer, more transparent, and efficiently managed student housing environment.

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