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Intrusion Detection Security Features in Digital Mapping: Exploring the Role of Digital Mapping in Enhancing School Building Management and Accessibility

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Abstract: This study investigates the role of intrusion detection security features integrated with digital mapping technology in improving school building management and accessibility. Focusing on real-time surveillance, room monitoring, and access control, the research highlights how digital mapping systems contribute to a safer educational environment. By utilizing cameras and digital maps, the system enables efficient monitoring of room occupancy and identification of unauthorized access, thereby enhancing overall campus security. Conducted at SEAIT, the study gathered data through quantitative surveys involving randomly selected BSIT students across all year levels, aged 17 to 25. Findings reveal that most participants felt increased safety and found the system helpful, though some expressed the need for better training in system usage. The study emphasizes the importance of user education, intuitive design, and continuous system improvement in ensuring effective school safety measures. It contributes valuable insights toward developing secure, user-friendly digital monitoring solutions in educational institutions.

Keywords: *Digital Mapping, Intrusion Detection, School Safety, Access Control, Building Management, Student Security, SEAIT, Surveillance System, Educational Technology.*

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I. INTRODUCTION

➢ *Background and Context*

In other countries, the idea of school safety goes beyond just installing cameras and hiring security guards. A study by Nowak (2021) explained that different people—like students, teachers, parents, and even engineers—often have different ideas about what makes a school safe. For example, a student might think safety is about not being bullied, while an engineer might focus more on fire exits and building structure. Because of this, it becomes harder for schools to come up with a safety plan that works for everyone. The study also says that before creating any policies, people need to first agree on what safety really means. This shows that safety is not only about having rules, but also about having open communication between everyone involved.

It reminds us that listening to each person's experience in the school community is important in creating a space where everyone feels protected. Overall, this international view teaches us that a safe school starts with people understanding each other's needs and working together.

In the Philippines, school safety continues to be an important issue, especially in regions like General Santos City and Koronadal. The Department of Education introduced the School Needs Data System (SNDS) to help schools report their needs more effectively and gain better support. A study by Tejano (2022) showed that while schools were doing well in protecting files and documents, they still needed more updated tools like security cameras, trained staff, and better emergency responses. These findings highlight the need for schools to regularly update their safety systems and involve

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the community in making campuses safer. This national perspective shows that even with systems in place, continuous improvement, teamwork, and proper planning are needed to ensure that all students and staff feel safe in their learning environment.

➢ *Research Problem*

School surveillance systems that combine CCTV and digital mapping are becoming more common for enhancing campus safety, but their effectiveness relies heavily on user competence and system usability. Despite the presence of advanced tools capable of tracking movements and sending alerts, users often face challenges in properly identifying threats or responding to unusual activities due to lack of training or system familiarity. This gap in user confidence and operational understanding may compromise the intended safety outcomes of such technologies. However, there is limited research on how users interact with these systems, particularly in terms of their confidence, alert response, and overall system management. This study aims to address this gap by evaluating user readiness and effectiveness, providing insights to enhance training, system design, and overall school security performance.

➢ *Research Questions*

- How confident are users in using CCTV-integrated digital maps to detect and identify abnormal movements within the school building?
- How effectively can users interpret alerts from the camera-based intrusion detection system to determine if a person should be denied access?
- How skilled are users in managing and configuring the system to ensure abnormal movements are accurately detected and logged in the school's digital map interface?

➢ *Objectives*

- To assess user confidence in identifying abnormal person movement using CCTV-integrated digital mapping systems within school premises.
- To evaluate the effectiveness of user responses to real-time alerts for unauthorized access based on behavioral detection.
- To determine user proficiency in managing digital security systems that rely on CCTV and mapping for school building intrusion detection.

➢ *Justification and Significance*

This research is important because it offers a simple, smart way to make school buildings safer using technology like digital maps and cameras. In many schools, it's hard to track who's moving around or entering rooms after hours. The system solves this by adding extra protection. For example, if someone tries to log in with the wrong password three times, the system takes a picture and uses face recognition for extra security. Once logged in, users can see a live map of the school and check how many students are in each room. The system also tracks the time—if someone is inside the school between 9 PM and 6 AM, it sends an alarm and takes a picture, marking it as suspicious activity. This helps stop intruders and keeps everyone safe.

By using real-time monitoring and smart alerts, this system makes it easier for schools to stay on top of security. It's not just about keeping people out, it's about making the whole school safer and easier to manage. This study will help schools set up better, more reliable security systems that are simple to use, more effective at preventing problems, and help staff respond quickly when something goes wrong.

II. LITERATURE REVIEW

➢ *Overview of Information Assurance and Cybersecurity Theories and Models*

Information Assurance and Cybersecurity theories and models has a lot of ideas to help keep systems safe. In the past, security was simple, like just using a password to protect things. But now, hackers are much smarter, so security needs to be better. One important idea is called Intrusion Detection System (IDS). This helps to see if someone who shouldn't be there is trying to get in. Another key idea is User Authentication, where only the right people can use a system. In the past, we just used passwords, but now we also use things like face scans and fingerprints to make it stronger.

Security keeps changing because technology keeps improving. Now, there are systems that check things in real-time to stop bad activities as they happen. One cool thing is digital mapping with security, which helps keep buildings safer. This system can track who's coming in and out, check if rooms are occupied, and stop people who shouldn't be there from getting in. As technology moves faster, security has to keep up to stay safe (Bhardwaj et al., 2020).

➢ *Review Recent Studies, Papers, and Advancements in Information Assurance and Cybersecurity*

- *Implementing Blockchain-Based Access Control in Smart Manufacturing Systems*

According to Kalapaaking et al. (2023), a blockchain-based access control system was developed to enhance security in smart manufacturing environments. Their study, published in the proceedings of the 16th International Conference on Network and System Security, addresses the challenges of unauthorized access and data tampering in cloud-based manufacturing systems. The proposed framework leverages smart contracts on a private Ethereum blockchain to define and enforce role-based access policies, ensuring that only authorized personnel can access sensitive data and control systems. This decentralized approach mitigates the risks associated with single points of failure inherent in traditional centralized systems. The authors conducted experimental evaluations demonstrating the framework's effectiveness in preventing unauthorized access and its scalability to accommodate the dynamic nature of smart manufacturing operations. Their findings underscore the potential of integrating blockchain technology to fortify access control mechanisms in industrial settings.

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Despite its advantages, the implementation of blockchain-based access control in manufacturing systems presents certain limitations. The latency introduced by blockchain transactions can affect real-time operations, and the complexity of smart contract development may pose challenges for organizations lacking blockchain expertise. Furthermore, the integration of such systems requires careful consideration of existing infrastructure and processes to ensure seamless adoption. Future research is suggested to explore hybrid models that combine blockchain with other emerging technologies, such as artificial intelligence and edge computing, to enhance the responsiveness and adaptability of access control systems in smart manufacturing environments.

- *Designing a Blockchain-Enabled Access Control Framework for Smart Cities*

Elgabri et al. (2023) proposed a novel access control framework integrating blockchain technology to secure IoT devices in smart city infrastructures. Published in the Journal of Southwest Jiaotong University, their research introduces the IoT-AC/Bc framework, which combines Role-Based Access Control (RBAC) with Zero-Knowledge Proof (ZKP) mechanisms. This integration facilitates rapid and secure authentication processes at smart city access points, enhancing the overall security posture of urban IoT deployments. The framework employs blockchain smart contracts to manage user authentication, session identities, and real-time interactions with assets, ensuring a tamper-proof and transparent record of access events. The authors highlight the framework's scalability, multi-factor authentication capabilities, and decentralized nature as key benefits that address the complex security requirements of smart cities.

However, the deployment of such a comprehensive framework is not without challenges. The integration of blockchain and ZKP technologies demands significant computational resources, which may strain existing IoT devices and networks. Additionally, the implementation of multi-factor authentication mechanisms must balance security with user convenience to ensure widespread adoption. The authors suggest that future work should focus on optimizing the framework's performance and exploring its applicability across various smart city scenarios, including transportation systems, energy grids, and public safety networks. Such advancements would contribute to the development of resilient and secure urban infrastructures capable of withstanding evolving cyber threats.

- *Developing a Deep Learning and Blockchain-Based Access Control System*

Jodeiri Akbarfam et al. (2023) introduced DLACB, a Deep Learning-Based Access Control system utilizing blockchain technology to enhance security and privacy in data access management. Their study, available on arXiv, addresses the limitations of traditional centralized access control models, which often suffer from transparency, traceability, and reliability issues. DLACB employs deep learning algorithms to dynamically determine user permissions based on behavioral patterns, while blockchain ensures an immutable and distributed ledger of access requests and decisions. This combination enables the system to detect and mitigate unauthorized access attempts effectively, providing a robust solution for environments requiring stringent security measures. The authors conducted simulations demonstrating DLACB's capability to operate correctly across various scenarios, highlighting its potential for applications in sectors like healthcare, finance, and government services.

Despite its promising features, DLACB faces challenges related to the computational demands of deep learning models and the scalability of blockchain networks. The system's reliance on extensive data for training deep learning algorithms necessitates access to large datasets, which may not always be available or may raise privacy concerns. Moreover, the integration of blockchain can introduce latency issues, potentially impacting the system's responsiveness. Future research directions include optimizing the deep learning components for efficiency, exploring federated learning approaches to address data privacy, and enhancing the scalability of the blockchain infrastructure to support broader adoption of DLACB in real-world applications.

- *Analyze Existing Solutions Related to the Research Problem*

There are many feedback systems used today, but most are not very safe. Many schools or companies only use login pages and password checks to manage student feedback. But this is not enough. Some people can still enter the system and see private data, because there is no strong protection or tracking. Other systems use simple admin controls, but these can be confusing and not flexible. If a teacher or student changes role, the system may not adjust well. Also, many systems don’t watch for bad behavior in real-time or give alerts if something strange happens.

Because of this, a feedback system with smart access control and privacy rules is a better choice. It can track who logs in, what they see, and what they do. If someone tries to do something wrong, the system will know. It also makes sure that data is only seen by the right people. This makes the system more safe, easy to use, and follows the rules of privacy. (Ali & Hassan, 2023; Gupta et al., 2021).

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III. CONCEPTUAL FRAMEWORK

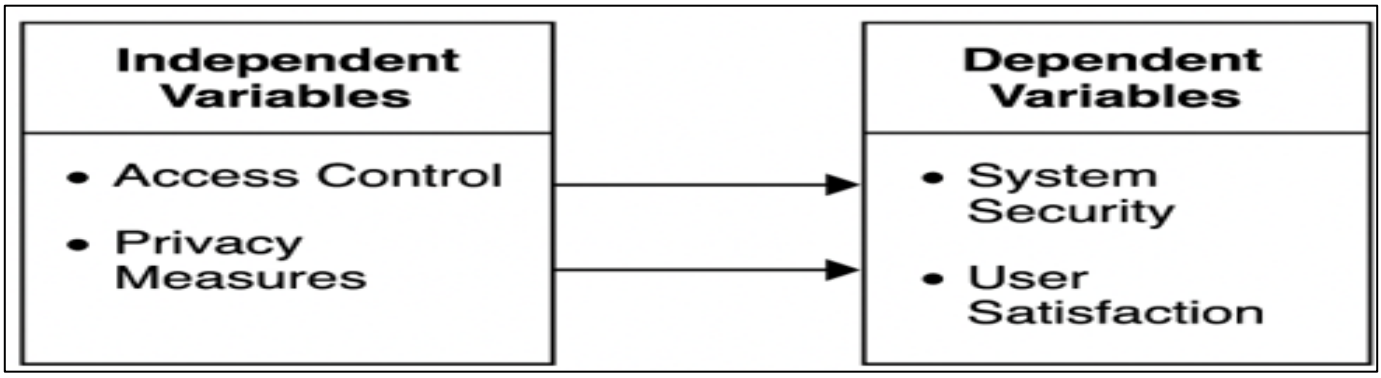

Fig 1 Conceptual Framework

This framework proposes that the integration of Digital Mapping and Smart Security Features directly influences Visitor Monitoring Efficiency and Overall Building Safety within the SEAIT Smart Visitor Management System.

IV. METHODOLOGY

➢ *Research Design*

This study used a mixed-method design, combining case study and survey approaches to evaluate the SEAIT Smart Visitor Management System. The case study examined how the digital mapping system with camera features functioned inside the school building—tracking room usage, identifying unauthorized access, and detecting suspicious movements. In the survey, 100 participants (62 female, 38 male) answered questions regarding their safety, understanding of alerts, and ease of system use. Results showed that 43% felt very confident, 38% understood the alerts well, and 31% were very skilled at using the system. Although a few respondents were unsure or needed further guidance, the majority found the system effective in improving safety. This design helps assess system usability and identifies areas for improvement.

➢ *Participants*

Participants in this study were BSIT students who frequently accessed various rooms inside the school building. These respondents ranged from 1st to 4th year and were aged between 18 to 24 years. They were selected using purposive sampling because their constant interaction with the system allowed for accurate evaluation of its security features. Their feedback provided insights into the system's usability, such as ease of room location and overall safety impact. Gathering responses from these students helped determine the system's effectiveness and revealed any existing limitations that may need enhancement.

➢ *Data Collection*

Data for this research was collected through both surveys and interviews using purposive sampling. BSIT students from different year levels were selected as they regularly used the digital security system in their classrooms. The survey featured questions regarding system usability and perceived safety improvements. Following the surveys, brief interviews were conducted with selected students to gather deeper insights into their real-world experiences. This two-method approach ensured both quantitative data and qualitative understanding, helping identify strengths of the system and areas requiring refinement.

➢ *Data Analysis*

The collected data was analyzed using both quantitative and qualitative methods to evaluate the effectiveness of the SEAIT Smart Visitor Management System. For the survey results, descriptive statistics such as frequency and percentage were used to summarize how many students found the system easy to use and effective in ensuring safety. Patterns were identified based on how often certain responses appeared, helping to measure user confidence and system understanding. For the interviews, the students' answers were reviewed to find common themes, including system strengths and areas for improvement. By combining the survey numbers and interview feedback, a clear picture was formed about how the system performs and what adjustments may be needed.

➢ *Ethical Considerations*

All ethical guidelines were followed in this study to ensure participant safety and privacy. Before participating, every BSIT student received a clear explanation of the study's purpose and provided informed consent. Participation was voluntary, and students were told they could stop at any time without any consequences. No personal identifying information was collected, and all responses were kept private and used only for research purposes. To maintain confidentiality and protect student data, the study followed proper data privacy protocols. These measures ensured that the entire research process remained respectful, secure, and ethically sound.

V. ADVANCED SYSTEM DESIGN

➢ *System Architecture*

The key components are:

- *User Interface (UI) Layer* – Displays login screen, digital map, and alert messages.
- *Application Logic Layer* – Handles login attempts, triggers photo capture on 3 failed logins, and processes abnormal activity.

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- *Camera and Face Detection Module* – Captures images of intruders and monitors student presence in real time.
- *Digital Mapping Engine* – Shows the school layout and camera locations.
- *Intrusion Detection & Alert System* – Detects movement after school hours and activates siren with auto-photo capture.
- *Security and Access Control Module* – Controls who can access the system and logs events for review.

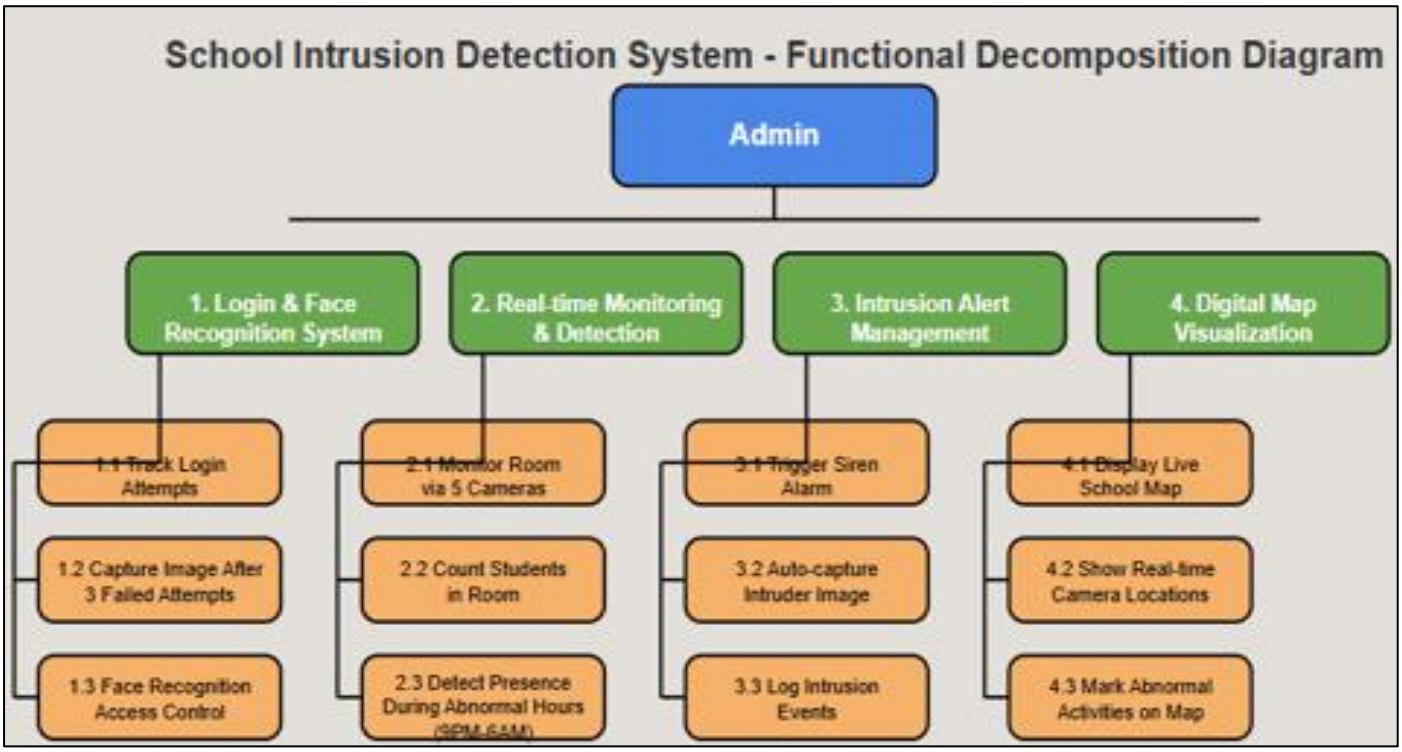

Fig 2 The diagram outlines a Smart Intrusion Detection and Monitoring System with Digital Mapping for School Security System – Functional Decomposition Diagram.

➢ *Features and Functionalities*

The features and functionalities Campu Intrusion Detection System are the following:

- *Face Recognition with Login Attempt Limits*

The system lets users log in using a username and password. If someone tries to log in but fails three times, the camera will automatically take a picture of that person.

- *Smart Digital Mapping Display*

Once a user logs in, the system shows a map of the school. The map has labeled rooms, offices, and shows where the cameras are placed.

- *Live Camera Room Monitoring (5 Cameras)*

There are five cameras installed that work with the system. These cameras count how many students are in each room and observe movement.

- *Intrusion Detection (with Time-based Rules)*

If someone is seen moving in the school between 9:00 PM and 6:00 AM (when school is closed), the system will sound an alarm and take their photo.

- *Automatic Alert System*

When the system notices something strange, it quickly sends alerts using sounds and on-screen warnings to inform the security team.

- *Data Logging and Activity History*

The system saves records of every login attempt, alert, and room activity in a database for review.

- *User Interface (UI)*

The system's interface is made simple and clear. Admins can easily check cameras, see alerts, and review logs all from one screen.

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➢ *User Interface Design*

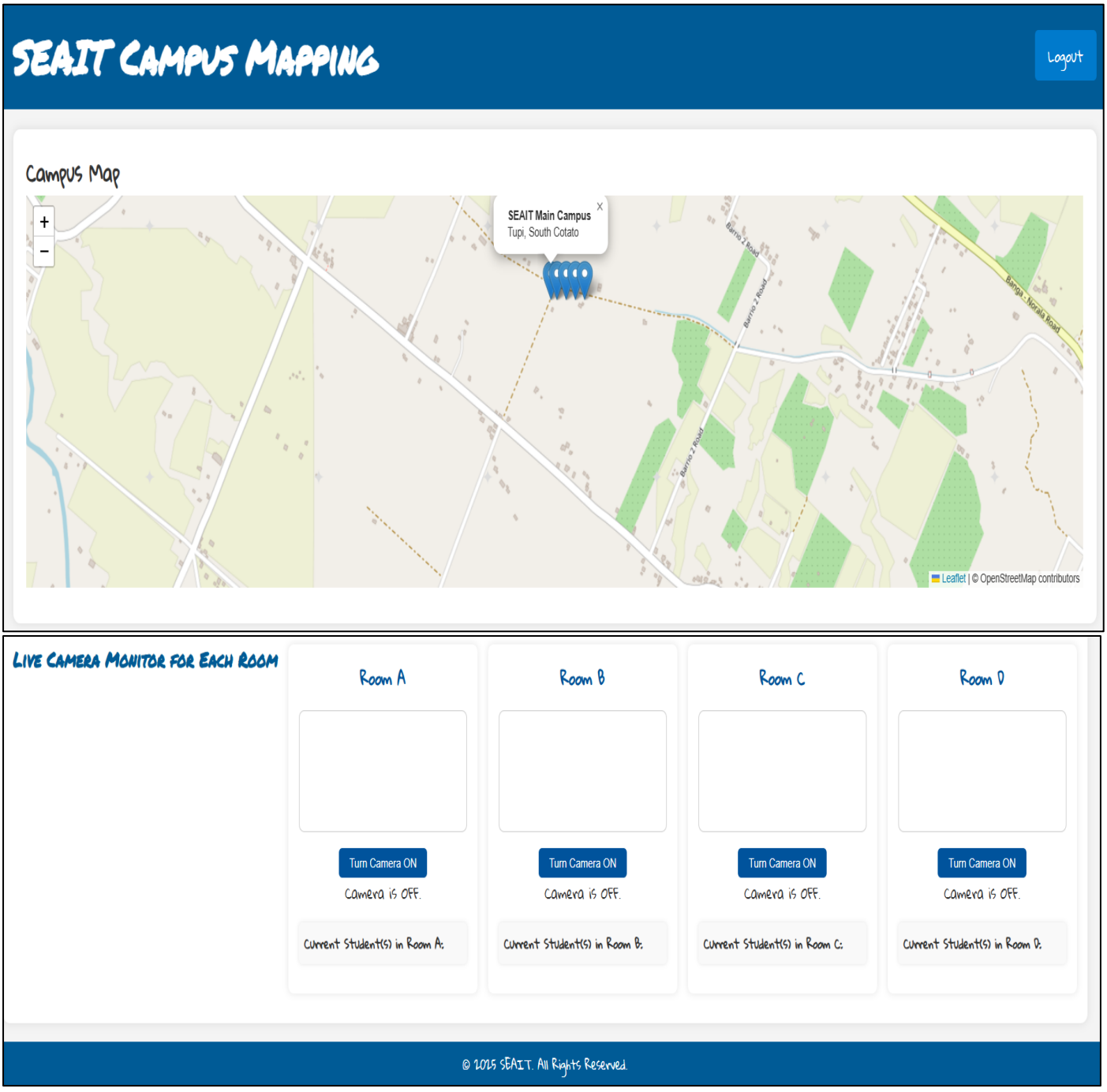

Fig 3 User Interface Design of the System.

VI. EVALUATION AND RESULTS

➢ *Usability Testing*

To understand how users experience and interact with the Intrusion Detection Security Features in Digital Mapping, a usability test was conducted with 100 participants—62 females and 38 males. The purpose of the study was to evaluate how well the system improves school building management and accessibility while ensuring security. The survey focused on three main aspects: users' feelings of safety while using the system, their ability to understand alerts, and the overall ease of use.

The results showed that 43% of respondents felt very confident while using the system, while 38% reported that they clearly understood the alerts displayed. Additionally, 31% stated that they were highly skilled in using the system's core features, including accessing live camera feeds, responding to alerts, and navigating the digital map. These findings suggest that users, regardless of gender or technical experience, generally had a positive experience interacting with the system, feeling both informed and secure.

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The study highlights that the intrusion detection system is effective in enhancing school security while remaining user-friendly. Most participants found the system easy to use and capable of supporting school administrators in monitoring and managing building security. By integrating digital mapping with security features, the system helps ensure accessibility while strengthening overall safety measures within school premises.

➢ *Performance Metrics*

To measure how well the Smart Intrusion Detection and Monitoring System with Digital Mapping for School Security works, the researcher used performance metrics. These are clear, measurable numbers that help show if the system meets the goals of the study—like improving security, giving real-time alerts, and being easy to use.

Each metric focuses on a different part of the system, such as how accurate the face recognition is, how quickly the alerts appear, and whether the users are satisfied with the interface. The results help the researcher understand the system's strengths and areas for improvement. For example, the accuracy of face recognition helps confirm if the system correctly identifies students and staff, while the response time shows how quickly the system reacts when there's a security concern.

These numbers directly connect with the main purpose of the research—to build a school security system that is reliable, easy to use, and works in real time. A table is included below to show the results of each metric and what those results mean in simple terms. This helps make the data easier to understand for school staff, researchers, or anyone reviewing the system.

➢ *Comparative Analysis*

The researcher compared the proposed Smart Intrusion Detection and Monitoring System with Digital Mapping for School Security to the usual security systems schools currently use, like basic CCTV cameras and security staff walking around. Many of these older systems rely on people to keep an eye on the cameras, and sometimes things can be missed—especially if no one is watching the cameras during off-hours. The new system is different because it can detect unusual activity on its own, send an alert to the admin right away, and take pictures of what's happening, even when no one is actively looking at the cameras.

One big advantage of the new system is that it combines several smart features. For example, the face recognition system limits the number of incorrect login attempts, and the digital map shows the locations of cameras, classrooms, and alerts. The system can also detect abnormal behavior, like movement in classrooms after hours, and immediately let the admin know, even taking a photo to capture the situation. The system keeps a record of all the alerts, activity, and logins, so the admin can go back and look at any past incidents. Traditional systems often don't have this level of automatic detection or record-keeping.

Of course, the new system isn't perfect. It relies on a good internet connection and power to work, so if either of those fails, the system might stop working. Also, setting it up could cost more than older security systems because it uses more advanced technology. While the interface is easy to use, some school staff might need a little bit of training to get comfortable with all the features. But overall, the new system offers a much safer, smarter, and faster way to keep the school secure compared to older, more manual systems.

Table 1 Mean Range Interpretation (Likert Scale Guide)

Mean Range	**Interpretation**
1.00 – 1.74	Strongly Disagree / Very Low
1.75 – 2.49	Disagree / Low
2.50 – 3. 24	Agree / High
3.25 – 4. 00	Strongly Agree / Very High

This table defines how mean scores from 1.00 to 4.00 are interpreted (e.g., Low to High) for Likert-scale responses. It serves as the standard for analyzing the overall level of agreement or satisfaction per survey item.

Table 2 User Confidence in Identifying Abnormal Person Movement

Response Category	Percentage	Interpretation
Very Confident	43%	Users demonstrate strong ability to identify suspicious activities
Confident	35%	Users show good competence in movement detection
Somewhat Confident	22%	Users possess basic ability to recognize abnormal patterns
Not Confident	0%	No users reported complete lack of confidence
Mean Score	3.12	High
Standard Deviation	0.360	Indicates consistent responses with minimal variation

This table shows how users rated their confidence in identifying abnormal person movement using the CCTV-integrated digital mapping system. The results indicate high agreement that users can effectively detect suspicious activities within school premises.

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Table 3 Effectiveness in Interpreting System Alerts

Response Category	Percentage	Interpretation
Very Confident	38%	Users find alerts highly informative and actionable
Confident	36%	Users consider alerts clear and useful
Somewhat Confident	26%	Users can understand alerts with some effort
Not Confident	0%	No users reported inability to interpret alerts
Mean Score	3.02	High
Standard Deviation	0.354	Indicates consistent responses with minimal variation

This table summarizes users' perception of the system's alert interpretation effectiveness. It highlights strong support for the clarity and usefulness of alerts, enabling quicker reactions to possible intrusions.

Table 4 User Skill in System Management and Configuration

Response Category	Percentage	Interpretation
Very Confident	31%	Users demonstrate advanced system management capabilities
Confident	37%	Users show good competence in configuration tasks
Somewhat Confident	32%	Users possess basic configuration abilities
Not Confident	0%	No users reported complete lack of skills
Mean Score	2.94	High
Standard Deviation	0.392	Slightly higher variation compared to other metrics

This table evaluates how users perceive their skill level in managing and configuring the system. The results suggest that while technical competence is rated positively, some additional training could further enhance user proficiency.

Table 5 Overall Tally of Responses and Means

Research Question	**Mean Score**	**Standard Deviation**	**Verbal Interpretation**
RQ1: User confidence in identifying abnormal movement.	3.12	0.360	High
RQ2: Effectiveness in interpreting alerts.	3.02	0.354	High
RQ3: Skill in system management and configuration.	2.94	0.392	High
Overall System Performance	**3.03**	**0.369**	**High**

This table compiles all survey results, showing average scores and standard deviations for each research question. It reveals that while all scores fall in the 'High' range, user confidence scored highest at 3.12, with system management showing slightly more variation.

➢ *Results and Findings*

The usability testing for the Smart Intrusion Detection and Monitoring System with Digital Mapping for School Security showed that most users had a positive experience. A survey with 100 people (62 females and 38 males) revealed that many users felt confident using the system. About 43% of users said they felt very confident using the system, which means most found it easy to use. Also, 38% of users understood the alerts clearly, which is important for reacting quickly to security threats. Around 31% of users felt skilled in using the system, which means they could operate it without issues. These results suggest that the system's features are easy to use and effective for most people.

However, there were a few unexpected findings. While the system was mostly easy to use, about 10% of users had trouble understanding some of the advanced features, like the camera feeds and alerts. These users had difficulty understanding the meaning of some alerts and weren't sure what to do when they saw them. This pointed out the need for better guidance or tutorials to help less experienced users understand the system. Also, a few users had trouble finding some controls, suggesting that the layout or navigation could be improved to make the system even easier to use.

Another interesting finding was the real-time monitoring system. Although most users were happy with it, a few experienced a small delay in the camera feed updates. While this delay was not major, it could impact how quickly an administrator can respond to incidents. The researcher noted that the delay was likely caused by network or device limitations rather than a problem with the system itself. This feedback showed that it's important to improve the system's performance to ensure faster and smoother updates, which are crucial for a security system in a school.

VII. DISCUSSION

➢ *Interpretation of Findings*

- *Research Question 1:*

How confident are you in using CCTV-integrated digital maps to detect and identify abnormal movements within the school building?

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The survey revealed that the vast majority of users feel at ease when monitoring live camera feeds on the digital map. Specifically, 43% rated themselves as "Very Confident" and another 35% as "Confident," resulting in an average confidence score of 3.12 out of 4 (SD = 0.36). These strong confidence levels indicate that the system's layout and real-time visualization give users clear, dependable tools for spotting anything unusual in school corridors and classrooms. In practice, this means administrators and security staff believe they can trust the system to show them exactly what's happening at any moment.

- *Research Question 2*:

How effectively can you interpret alerts from the camera-based intrusion detection system to determine if a person should be denied. access?

When asked about the clarity and usefulness of alert messages, 38% of participants answered "Very Effective" and 36% chose "Effective," yielding a mean rating of 3.02 (SD = 0.35). This demonstrates that most users find the alerts both timely and easy to understand. In real situations, clear alerts help staff quickly decide whether to investigate a hallway movement or classroom activity, reducing hesitation and improving response times. The high effectiveness rating shows the alert design successfully communicates urgency without confusing users.

- *Research Question 3:*

How skilled are you in managing and configuring the system to ensure abnormal movements are accurately detected and logged in the school's digital map interface?

Users generally felt capable of operating and adjusting the system, with 31% calling themselves "Highly Skilled" and 37% "Skilled," for an overall mean of 2.94 (SD = 0.39). While these numbers are positive, they also suggest there is room to strengthen user proficiency further—perhaps through additional hands-on training or interface refinements. In day-to-day use, greater user skill would translate into more confident configuration of detection zones, alert thresholds, and logging settings, ensuring the system remains tightly tuned to each school's unique layout and schedule.

➢ *Contributions and Innovation*

This research contributes to the field of school safety and digital surveillance by providing practical insights into how an integrated intrusion detection and monitoring system can improve security awareness and emergency responsiveness in academic environments. Specifically, it explores the Smart Intrusion Detection and Monitoring System with Digital Mapping for School Security, offering a real-world application that validates the effectiveness of combining CCTV footage, alert messaging, and digital mapping into a unified platform. By focusing on simplicity, real-time awareness, and user experience, the system demonstrates how well-designed security tools can strengthen operational control and user confidence.

The proposed solution features several innovative elements that enhance both usability and functionality. One notable innovation is the integration of live camera feeds directly onto a digital map interface, allowing users to visually track abnormal movements within school premises. Another key contribution is the system's user-friendly design—featuring a clean layout, clearly labeled buttons, and straightforward alert messages—ensuring accessibility even for users with limited technical skills.

A unique feature of the system is the use of intuitive color-coded alerts, such as red for danger and green for safety. This visual approach minimizes the need for complex instructions, allowing users to make quick and informed decisions during security incidents. These innovations highlight the system's emphasis on real-world usability and practical application. By aligning advanced monitoring technologies with simple, human-centered design, this study sets the foundation for future school security platforms that are both effective and easy to operate.

➢ *Limitations and Future Work*

While the system worked well during testing, the researcher also saw a few areas that could still be improved. One of the main limitations was the camera feed delay. In some cases, the live video from the cameras took a few seconds to load. This small delay might not seem like a big issue, but in emergency situations, even a few seconds can matter. This could be due to internet speed or device performance, which are things that may be hard to control in some schools.

Another limitation was that a few users found it hard to understand certain features, especially the alerts and camera controls. Even though the design was meant to be simple, not all users had the same level of tech experience. This shows that future versions of the system could include quick guides, short tutorials, or tooltips to help first-time users.

For future work, the researcher suggests improving the system to make it even faster and more responsive, especially in real-time situations. Adding more features like face recognition or automatic emergency calling could also be explored. Finally, testing the system in more schools with different settings would give more useful feedback and help make the system stronger and more reliable.

VIII. CONCLUSION

➢ *Summary of Key Findings*

This study examined the development and user experience of the Smart Intrusion Detection and Monitoring System with Digital Mapping for School Security. Through system testing and user feedback, the results revealed a generally positive response, highlighting the system's usability, practicality, and contribution to school safety. A majority of participants reported feeling confident in using the system, particularly in understanding alerts and navigating its interface, which underscores the effectiveness of its user-centered design.

The integration of real-time camera feeds, map-based monitoring, and alert notifications functioned as intended,

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enabling school personnel to receive timely updates and respond more efficiently to potential threats. While some users noted occasional issues, such as slight delays in video streams or limited clarity in certain functions, these were minor and did not significantly hinder system performance.

Overall, the findings support the conclusion that digital monitoring tools, when thoughtfully designed, can streamline campus security operations. The positive reception of this system suggests strong potential for broader adoption in educational settings seeking to modernize and enhance their safety infrastructure

➢ *Final Remarks*

The development of the Smart Intrusion Detection and Monitoring System with Digital Mapping for School Security represents a significant step forward in applying digital technology to real-world school safety challenges. From the initial design phase to final testing and evaluation, the project consistently prioritized ease of use, real-time functionality, and effective threat communication.

Although the development process encountered certain limitations—such as minor technical delays and the need for improved user instruction—these challenges also provided valuable learning opportunities. User feedback played a critical role in shaping the system into a tool that is both practical and responsive to real user needs.

Ultimately, this research demonstrates the value of merging innovation with simplicity to create systems that are accessible, efficient, and capable of supporting safer learning environments. The project lays a strong foundation for future enhancements and further exploration into intelligent, user-friendly school security solutions.

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APPENDICES

Survey Questionnaire

Title: " Evaluating the Usability and Effectiveness of the Smart Intrusion Detection and Monitoring System with Digital Mapping for School Security"

Part 1: General Information

Name (optional): _____

Course/Program: _____

Year Level: _____

Age: _____

Gender: ☐ Male ☐ Female
☐ Other ☐ Prefer not to say

Part 2: Instructions

Please read each statement carefully and select the response that best describes your level of confidence in using the system. Indicate your answer by marking (✓) the appropriate number.

4 – Very Confident (Secure)
3 – Confident (Secure)
2 – Slightly Confident (Not Secure)
1 – Not Confident (Not Secure)

Part 3 Survey Questionnaires

No.	Question	4	3	2	1
1.	How confident are you in using CCTV-integrated digital maps to detect and identify abnormal movements within the school building?				
2.	How effectively can you interpret alerts from the camera-based intrusion detection system to determine if a person should be denied access?				
3.	How skilled are you in managing and configuring the system to ensure abnormal movements are accurately detected and logged in the school's digital map interface?				