Isabela State University Linker:
Journal of Engineering, Computing, and Technology
Volume 2, Issue 2
ISSN (Print): 3082-3676 ISSN (Online): 3082-3684
DOI: https://doi.org/10.65141/ject.v2i2.n5

Fingerprint Door Unlocking and Light Control System with Short Message Service (SMS) Notification Capability

Jake D. La Madrid
College of Engineering, Isabela State University, Cabagan, Isabela, 3328, Philippines
jake.d.lamadrid@isu.edu.ph

RESEARCH ARTICLE INFORMATION

Received: August 29, 2025
Reviewed: November 17, 2025
Accepted: December 20, 2025
Published: December 31, 2025

ABSTRACT

Security has been playing a key role in many places, such as offices, institutions, libraries, and laboratories, to protect confidential data and prevent unauthorized access. At Isabela State University, traditional padlocks are still used to secure rooms, a method that lacks access logs and automation. To ensure data confidentiality and prevent unauthorized access, security technologies such as automated access, Short Message Service (SMS) alert, and light control are needed. The main objective of the study was to develop a security lock system and switching automation of devices that have features of storing fingerprints, operating the door lock, activating lights, and sending Short Message Service (SMS) notifications to the administrator based on stored fingerprints. The developmental research method, consisting of hardware and software development, was utilized in the study. Flowchart, block diagram, and wiring diagram were used to document the requirements, analysis, and design. In addition, the respondents' perception of the system's performance was gathered using a survey questionnaire, and total enumeration was employed in selecting the respondents. As a result, the device was perceived to be highly functional, usable, and reliable. Future researchers may integrate a database to store access logs and to send notifications not only to the building in charge but also to other heads of the institution. The system may also be expanded to facial recognition or two-factor authentication. These enhancements aim to make the system more reliable, scalable, and efficient for use in different environments.

Keywords: *biometric security, fingerprint recognition, door unlocking system, Short Message Service notification, microcontroller*

Introduction

The fast advancement of global technologies has transformed how institutions manage communication, security, and efficient operation. Many organizations have adopted smart security systems, including biometrics, automated access control, and real-time notification to protect properties and safeguard facilities. These innovations highlight a global change towards improving traditional mechanical locks, adding an intelligent system for authentication, monitoring, and automation. Developing countries like the Philippines, however, continue to face challenges in adopting such development, particularly in ensuring that innovations are accessible, affordable, scalable, and responsive to institutional needs.

In Isabela State University-Cabagan Campus, traditional padlocks are used to secure rooms and computer laboratories. This method has no records as to who enters the facility and no automated control of electrical equipment, such as light control, making it vulnerable to unauthorized access and equipment misuse. This gap underlines the need for modern technologies, such as automated security system appropriate for academic environments. Security is an undeniably global concern everywhere.

The elegance of the technology solution to this problem lies in the fact that it can be applied to provide pre-emptive action rather than a reactionary response after the action. That is why Fingerprint Door Unlocking and Light Control System with Short Message Service (SMS) Notification capability are proposed, which helped to improve the security system in our campus through the help of this endeavor.

This study helped to secure school equipment, specifically in the laboratory, where computers and other valuable items can be stolen. The use of biometrics, which is one of the top choices, has brought significant changes to gaining access to rooms and establishments. In this study, the usual mechanical door lock that uses metal keys was merged with a fingerprint door lock unlocked with fingerprint authentication using a fingerprint sensor for the user, which will serve as the key.

This study is designed not only for security purposes but also to contribute to the access, including the maintenance of the equipment inside the room. It also helps in reducing electricity consumption by controlling the laboratory equipment in a way that only registered and authorized faculty staff can access the room.

Existing literature underscores the growing importance of biometric systems in access control and security (Aditya et al., 2015; Ayoob & Ali, 2019). This research builds upon prior research by combining biometric security with automated functionalities to address these gaps. The study aimed to develop a comprehensive system for securing computer laboratories by integrating fingerprint authentication, light control, and SMS notifications. The specific objectives of this study were to design a switching device with fingerprint storage, door lock operation, and light activation notification to administrators; and assess the system's performance in terms of functionality, usability, and reliability.

Methods

This chapter presents the research methodology employed by the researcher into a practical research strategy by analyzing its stages.

Respondents and Locale of the Study

The respondents were 14 faculty members of College of Computing Studies, Information and Communication Technology at Isabela State University – Cabagan Campus. They represent the full population directly using the establishment and accessing the rooms and computer laboratories. Total enumeration was applied for the research testing and evaluation, as this is appropriate and justified since the said population was the only qualified respondents to evaluate the system's functionality, usability, and reliability.

Data Gathering Procedures

The researcher used the internet and library methods in gathering data for the construction and development of the designed project. The researcher used survey through questionnaires in gathering data to have a complete view of the performance of the designed project. This instrument was used to gather data about the insights of the respondents as to the functionality, usability, and reliability of the design project.

Data Analysis and Statistical Tools

The data obtained from the questionnaire were treated using frequency count. The weighted mean was computed based on the respondents' responses to the questionnaire and interpreted using the five-point Likert scale shown in Table 1.

Table 1. The Likert Scale

Scale	Statistical Limits	Descriptive Value	Interpretation
5	4.21 – 5.0	Strongly Agree	Fully meets or exceeds expectations
4	3.41 – 4.20	Agree	Meets expectations with minor issues
3	2.61 – 3.40	Undecided	Partially meets expectations; some improvements needed
2	1.81 – 2.60	Disagree	Does not meet expectations; significant issues present
1	1.0 – 1.80	Strongly Disagree	Does not meet expectations; critical failures Encountered

The study utilized a perception-based approach to collect data, aiming to evaluate the functionality, usability, and reliability of the quality and environmental monitoring system. A five-point Likert scale was utilized to rate the results of responses as shown in Table 2. This illustrates the interpretation of the weighted survey results according to the defined Likert ranges.

Table 2. Likert Scale for Interpretation of Results

Range	Functionality	Usability	Reliability
4.21 – 5.0	Highly Functional	Highly Usable	Highly Reliable
3.41 – 4.20	Functional	Usable	Reliable
2.61 – 3.40	Moderately Functional	Moderately Usable	Moderately Reliable
1.81 – 2.60	Not Functional	Not Usable	Not Reliable
1.0 – 1.80	Poorly Functional	Poorly Usable	Poorly Reliable

Design Procedures

The researcher utilized the PIPE concept, as illustrated in Figure 1. This comprises purpose, ideation, prototyping, and enhancement, a systematic approach to follow to ensure the device will work properly.

The study began with the identification of issues related to device automation and secure access. Through surveys and seeking the advice of an expert, a solution was established. These included RFID with notification function, dependable door locking mechanisms, efficient light control, and reliable SMS notifications. During the ideation phase, innovative strategies were conceptualized to integrate biometric authentication with automated door and lighting functions, complemented by SMS alerts for administrators. In the prototyping stage, the hardware and software components were fabricated and tested, which involved programming the microcontroller and attaching sensors and other peripherals. The final stage is to enhance the technology based on the feedback and find problems to make it effective in its intended function.

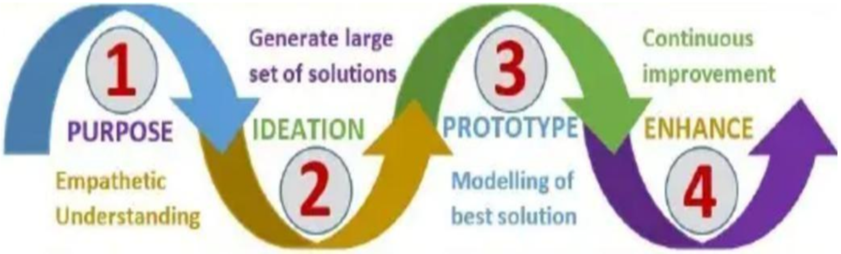


Figure 1. *Research Roadmap*

Phase I: Conceptualization

The design was all about the Fingerprint Door Unlocking and Light Control System with Short Message Service (SMS) Notification Capability. The researcher came up with this idea to develop a better security system and to switch to automation. The researcher believed in the idea that this project will ease activities like improper and abusive usage of the devices. The researcher gathered data and information from the internet and from the previous design projects related to the study to ease all the possible difficulties of the design.

Phase II: Designing the Project

The design phase involved creating the research block and circuit diagrams to establish the flow of information between components. After identifying the required devices and materials, the construction began. Key components such as the fingerprint sensor, GSM module, servo motor, relay module, and infrared receiver were tested individually to ensure functionality.

Figure 2 shows the flowchart of the design project, presenting the step-by-step process of how it works. The operation of the project starts from scanning the fingerprint of the user through the use of a fingerprint sensor. If the captured fingerprint is a registered user, the relay turned on the lights, and the servo motor unlocked the door. A bypass button was also included that served as an exit button inside the room, and a remote to turn on/off the lights.

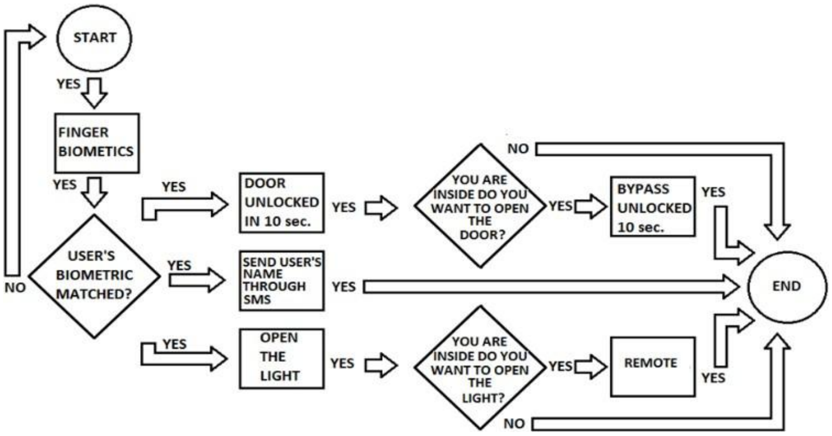

START
YES
FINGER BIOMETICS
YES
USER'S BIOMETRIC MATCHED?
NO
YES
DOOR UNLOCKED IN 10 sec.
YES
YOU ARE INSIDE DO YOU WANT TO OPEN THE DOOR?
NO
YES
BYPASS UNLOCKED 10 sec.
YES
YES
SEND USER'S NAME THROUGH SMS
YES
END
YES
OPEN THE LIGHT
YES
YOU ARE INSIDE DO YOU WANT TO OPEN THE LIGHT?
YES
REMOTE
YES
NO

Figure 2. *Flowchart of Fingerprint Door Unlocking and Light Control System with SMS Notification Capability*

Figure 3 shows the block diagram of the design project in which a fingerprint is captured through the use of a fingerprint sensor and serves as the input to the Arduino Microcontroller that will process the received fingerprint. If the captured fingerprint is a registered user, the relay turned on the lights, and the servo motor unlocks the door. The door will automatically lock within 10 seconds after accessing the fingerprint sensor. It also sends a SMS notification to the assigned administrator containing the name of the user who used the room. A bypass button was also included as another way to unlock the door whenever an unauthorized user is entering a room, and it will automatically lock within 10 seconds.

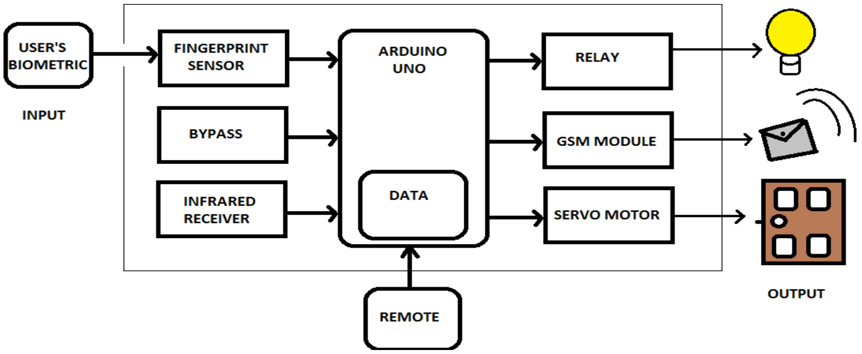


Figure 3. *Block Diagram of Fingerprint Door Unlocking and Light Control System with SMS Notification Capability*

Phase III: Implementation and Testing

In this phase, system performance was evaluated using key operational metrics including fingerprint recognition accuracy, door locking and unlocking response time, successful SMS alert delivery, and light activation time. Multiple trials were conducted to verify the stability of the system under repeated use. This strategy provides quantitative validation of the device's operational reliability and supports the overall assessment of its functionality.

Ethical Considerations

In the conduct of the study, the respondents were not subjected to harm in any way. Their participation during the evaluation of the developed device was voluntary on the basis of informed consent. All of their personal details were kept anonymous.

Results and Discussion

Hardware Development

Figure 4 shows the wiring diagram, which served as a guide in connecting each of the components for the design project. The system used two Arduino boards, which served as the microcontroller of the different modules. Each module has its own dedicated power supply in order for the system to sustain the needed current and to work efficiently.

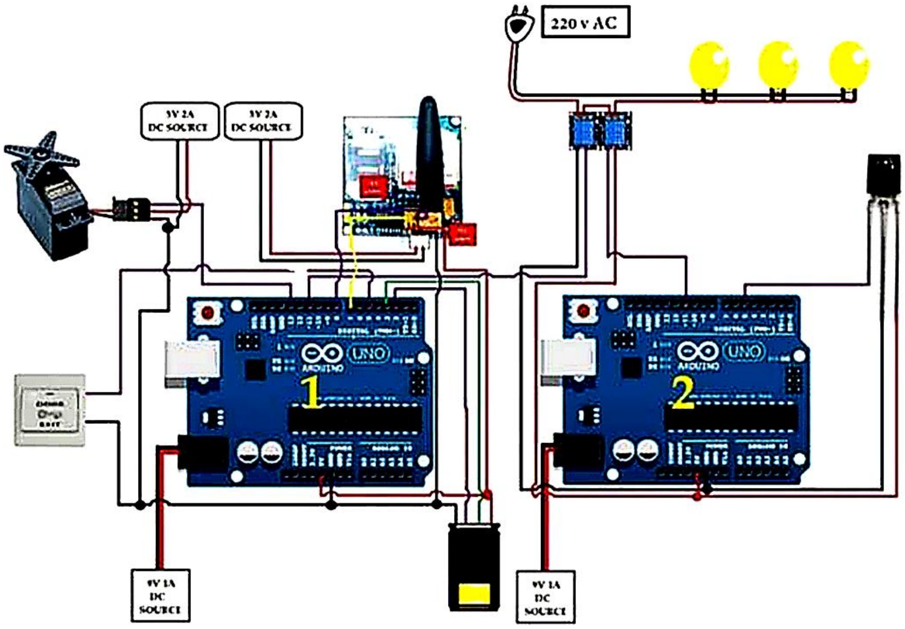
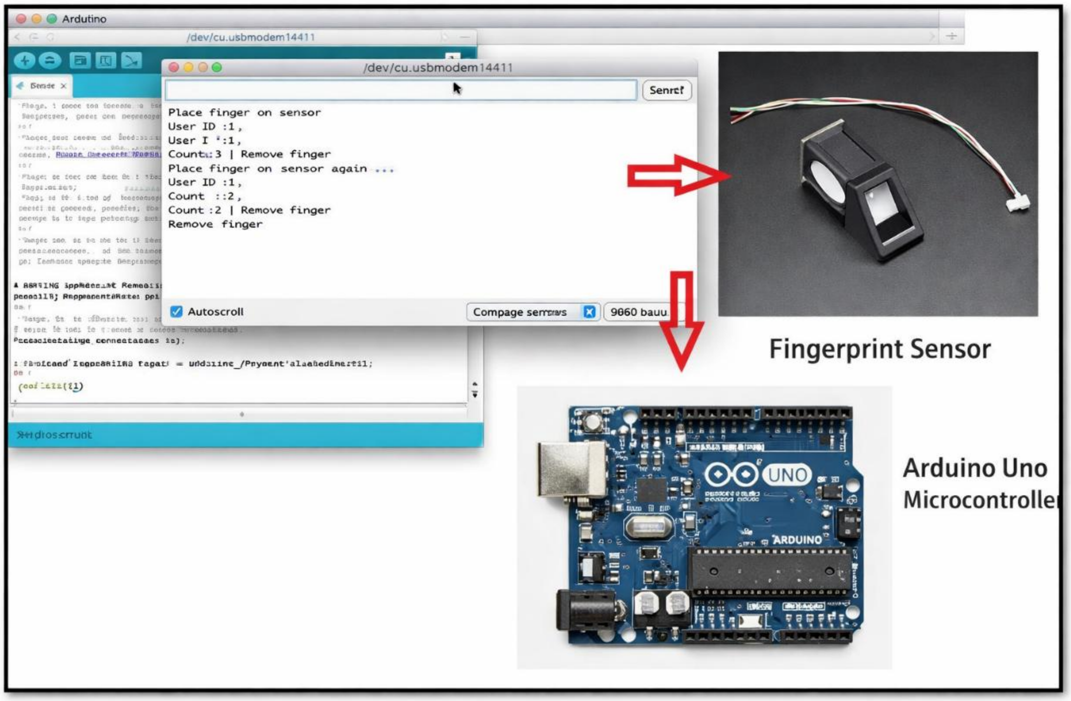


Figure 4. *Wiring Diagram of Fingerprint Door Unlocking and Light Control System with SMS Notification Capability*

Application Development

Figure 5 shows that the design project was able to store a fingerprint using an Arduino Uno microcontroller. The Arduino software is displayed on a computer screen on the left. By requesting an ID number and instructing the user on when to lay their finger on the sensor, it walks them through the procedure. When the fingerprint is located and saved, the messages appear. The Arduino is displayed at the bottom right after the fingerprint sensor at the top right takes a picture of the fingerprint and transmits the information to it. Everything is managed by the Arduino, which receives the fingerprint data and stores it with the designated ID. The system first prepares itself, then requests a user ID, waits for the finger to be scanned, and then saves the fingerprint. Because the system uses these stored fingerprints to verify who is authorized to unlock the door in the future, this step is important.



```
Place finger on sensor
User ID :1,
User I ':1,
Count::3 | Remove finger
Place finger on sensor again ...
User ID :1,
Count ::2,
Count :2 | Remove finger
Remove finger
```

Figure 5. *Arduino Uno Microcontroller of the Final Prototype*

Figure 6 shows that the design project was able to operate the door lock using a Tower Pro SG-5010 servo motor, which ensures its opening and closing.

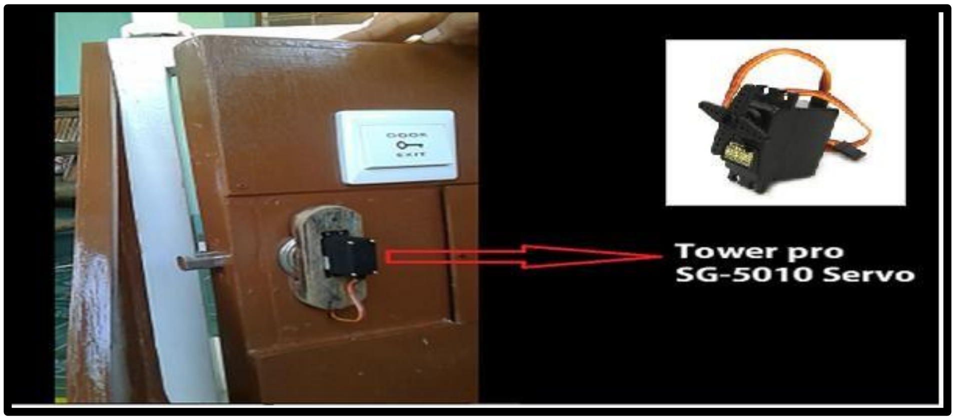


Figure 6. *Servo Motor of Final Prototype*

Figure 7 shows how the system controls the lights using the Arduino. A four-channel power relay was used to control the lights, outlet, and door access, which serves as an automated switch of the developed device.

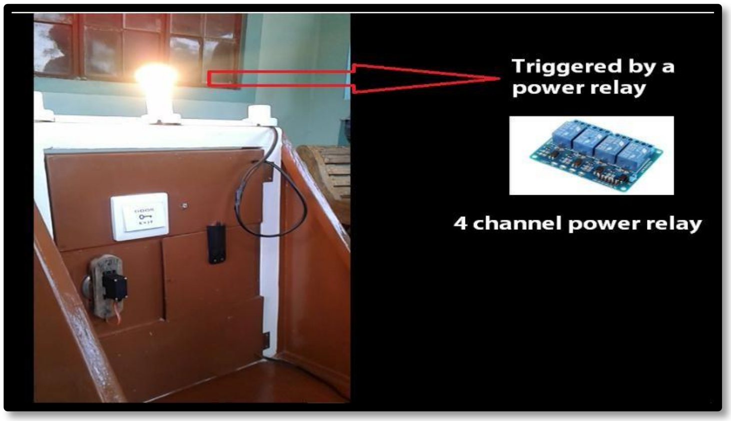
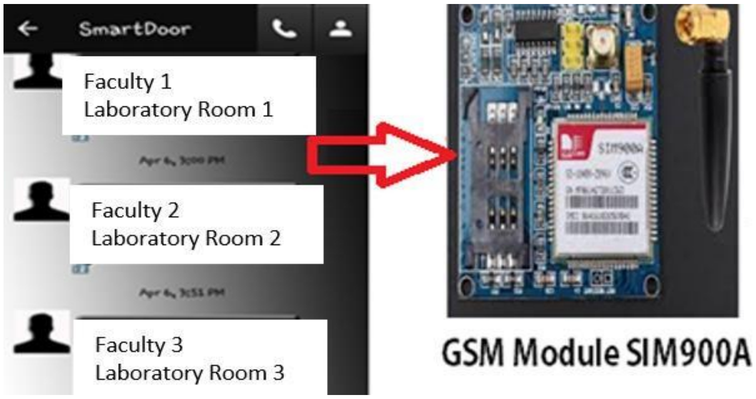


Figure 7. *Power Relay of Final Prototype*

Figure 8 shows the SIM900A GSM module of the developed device. The GSM module was used to ensure that SMS notification would be sent to the administrator once the room was accessed.



Faculty 1
Laboratory Room 1

Apr 6, 3:00 PM

Faculty 2
Laboratory Room 2

Apr 6, 3:51 PM

Faculty 3
Laboratory Room 3

Figure 8. *SMS Notification*

Figure 9 shows the developed device. The device consists of Arduino Uno that serves as the microcontroller of the modules, a fingerprint sensor that serves as an access to open the door, servo motor which operates the door lock when fingerprint matched, and four-channel power relay that will trigger the lights on, bypass button, and GSM module that sends SMS notifications to the administrator that will serve as the history of using the room. The developed device was found to be fully functional during the testing and implementation.

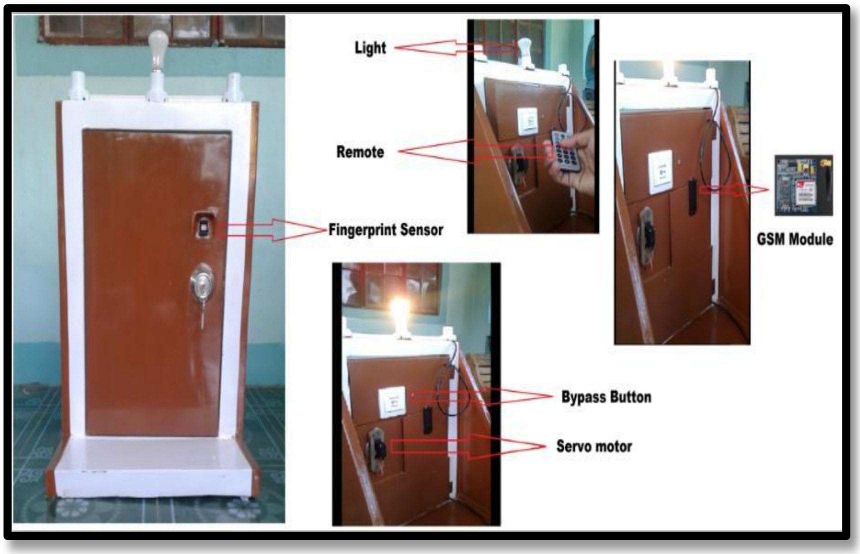


Figure 9. The *Developed Device*

Research Evaluation

Table 3 shows the respondents' rating of the functionality of the system. The respondents strongly agreed that the system fully met its intended function in all criteria.

Table 3. Respondents' Rating of the Functionality

Criteria	Weighted Mean	Interpretation
1. The system can be manually and automatically operated.	4.86	Highly Functional
2. The system has secure access through biometrics.	4.93	Highly Functional
3. The system provides SMS notification when the door is unlocked by the user.	4.64	Highly Functional
4. The system is secured with the fingerprint wherein only authorized users can add student allowed to use the laboratory.	4.93	Highly Functional
5. The system's wiring configuration was tested to ensure safety of the user.	4.64	Highly Functional
Overall Weighted Mean	**4.80**	**Highly Functional**

Table 4 shows that respondents agreed that the system is highly usable. The result shows that the device fully meets expectations, making it effective in classroom management.

Table 4. Respondents' Rating of the Usability

Criteria	Weighted Mean	Interpretation
1. The system is user-friendly.	4.79	Highly Usable
2. The system research is easy to use.	4.64	Highly Usable
3. The system operations and task can be easily learned by the users.	4.93	Highly Usable
4. The system is suitable for its intended use.	4.71	Highly Usable
5. The system has the ability to notify the assigned administrator about the entry of the user.	4.93	Highly Usable
Overall Weighted Mean	**4.80**	**Highly Usable**

Table 5 shows that respondents rated the system as highly reliable, demonstrating strong agreement that the device stays reliable after failure, keeps connection problems low, fixes errors when detected, unlocks the door for a valid fingerprint, and quickly sends SMS notification.

Table 5. Respondents' Rating of the Reliability

Criteria	Weighted Mean	Interpretation
1. The system maintains its level of performance after recovering from failure.	4.79	Highly Reliable
2. The system's connectivity ensures frequency of failure in its minimum.	4.64	Highly Reliable
3. The system is capable of recovering from error when fault is detected.	4.93	Highly Reliable
4. The system unlocks the door if fingerprints matched.	4.71	Highly Reliable
5. The system sends SMS notification promptly.	4.93	Highly Reliable
Overall Weighted Mean	**4.80**	**Highly Reliable**

Table 6 summarizes the respondents' overall ratings of the system. The system is considered highly functional, highly usable, and highly reliable, as reflected by the value of its weighted mean and given values of interpretation.

Table 6. Summary of Ratings

Criteria	Weighted Mean	Interpretation
1. Functionality	4.80	Highly Functional
2. Usability	4.80	Highly Usable
3. Reliability	4.57	Highly Reliable

Conclusion and Future Works

This study successfully developed the Fingerprint Door Unlocking and Light Control System with Short Message Service (SMS) Notification Capability. The device is highly capable of capturing and storing fingerprints, unlocks the door with a servo motor, and controls lighting through a power relay through fingerprint verification. Also, it sends timely SMS notifications to administrators upon authorized access. Respondents strongly agreed that the system's functionality, usability, and reliability met all performance expectations. Moving forward, the system may integrate the creation of a database to store access logs that it may send notifications not only to the building in charge but also to other heads of the institution. The system may also be expanded to facial recognition or two-factor authentication. These enhancements aim to make the system more reliable, scalable, and efficient for use in different environments.

References

[1] Aditya, S., Sastry, P. R. K., Vishnu Ram, A. L., & Vamsidhar, A. (2015). Fingerprint-based door locking system. *International Journal of Engineering and Computer Science*, *4*(3), 10810-10814.

[2] Al-Turjman, F., & Abujubbeh, M. (2020). IoT-enabled smart doors: Design and security aspects. *Sensors*, *20*(3), Article 828. https://doi.org/10.3390/s20030828

[3] Anubala, B., Rahini, M., & Bavithra, T. (2014). Intelligent door locking system. *International Journal of Engineering Research and Applications*, *7,* 50-53. https://www.ijera.com/special_issue/Humming%20Bird_March_2014/Version%20%207/GK5053.pdf

[4] Arduino. (n.d.). *Arduino Uno Rev3*. https://docs.arduino.cc/hardware/uno-rev3

[5] Ayoob, M., & Ali, A. H. (2019). Secure home automation using GSM and biometrics. *Journal of Engineering Science and Technology*, *14*(3), 145–151.

[6] Bird, F., Sharma, A., & Kumar, P. (2018). Design and implementation of a biometric door locking system using GSM. *International Journal of Emerging Technology and Advanced Engineering*, *8*(5), 123–128.

[7] Borse, C., Gaikwad, S., & Patil, S. (2023). Greenhouse monitoring system using GSM. *Semantic Scholar*, *3*(1). https://www.semanticscholar.org/paper/Greenhouse-Monitoring-System-Using-GSM-Borse-Gaikwad/6f9769b7e569469ecfb73b79e44a38916edd3d63

[8] Chandra, P. S., Jain, S., & Jain, A. (2014). Literature survey on fingerprint recognition using level 3 feature extraction method. *International Journal of Engineering and Computer Science*, *3*(1), 3804-3812. https://www.ijecs.in/index.php/ijecs/article/view/80/70

[9] Cortez, C. D., Badwal, J. S., Hipolito, J. R., Astillero, D. J. C., Dela Cruz, M. S., & Inalao, J. C. (2016). Development of a microcontroller-based biometric locker system with short message service. *Lecture Notes on Software Engineering*, *4*(2), 103–106. https://doi.org/10.7763/LNSE.2016.V4.233

[10] Cuartielles, D. (n.d.). *Arduino FAQ*.

[11] Fingerprint-based security system. (n.d.). Nevon Projects. https://nevonprojects.com/fingerprint-based-security-system/

[12] Gupta, R., & Mehra, S. (2021). Biometric security systems: An overview of fingerprint-based door locking systems. *International Journal of Security and Its Applications*, *15*(2), 88–95.

[13] Khalid, A., & Hussain, S. (2020). A survey on GSM-based home security systems with biometrics. *International Journal of Information and Electronics Engineering*, *10*(4), 123–127.

[14] Kumar, P., & Verma, R. (2019). Design and development of a GSM-based SMS notification system for security applications. *Journal of Telecommunication, Switching Systems, and Networks, 6*(2), 34-38.

[15] Lerit, A., & Torres, J. R. (2012). *USB door lock using fingerprint biometrics technology* (Undergraduate thesis). Mapúa University.

[16] Palsodkar, S. S., & Patil, S. B. (2014). Review: Biometric and GSM security for lockers. *International Journal of Engineering Research and Applications*, *4*(12), 237–239. https://www.ijera.com/papers/Vol4_issue12/Part%20-%206/AH041206237239.pdf

[17] Rani, S., & Kumar, R. (2019). Development of a smart door lock system using fingerprint and GSM technology. *International Journal of Innovative Research in Computer and Communication Engineering*, *7*(4), 3217–3223.

[18] Reddy, P. M., & Rao, K. R. (2017). Biometric door lock system using fingerprint recognition. *International Journal of Engineering and Technology (IJET), 9*(4).

[19] Zhang, X., & Li, J. (2019). Smart home control systems using fingerprint sensors and GSM communication. *International Journal of Control Theory and Applications*, *12*(2), 453–458.

Acknowledgement

The author would like to express sincere gratitude to all individuals who contributed to the successful completion of this study, especially the respondents for their cooperation and valuable feedback, which were essential to the conduct and completion of the research.

Conflict of Interest

The author declares that there are no conflicts of interest regarding the publication of this paper. There are no personal, financial, or institutional relationships that could have influenced the research process, analysis, or presentation of results. The study was conducted independently and in accordance with institutional research ethics and transparency standards.

Artificial Intelligence (AI) Declaration Statement

Artificial intelligence tools were used in a limited capacity during the preparation of this manuscript, primarily to assist in language refinement, grammar checking, and structural organization of the text. No AI tools were used in data collection, system design, implementation, analysis, or interpretation of results.