E-PROCEEDINGS

INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"

23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

ORGANIZED BY:

Electrical Engineering Studies, College of Engineering
Universiti Teknologi MARA (UiTM) Cawangan Johor
Kampus Pasir Gudang
https://tiec-uitmpg.wixsite.com/tiec

e ISBN 978-967-0033-34-1

9 789670 033341

E-PROCEEDINGS
of International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"

23rd JANUARY 2025
PTDI, UiTM Cawangan Johor, Kampus Pasir Gudang

Organized by

Electrical Engineering Studies, College of Engineering,

Universiti Teknologi MARA (UiTM) Cawangan Johor, Kampus Pasir Gudang.

https://tiec-uitmpg.wixsite.com/tiec

Editors

Aznilinda Zainuddin

Maisarah Noorezam

e ISBN: 978-967-0033-34-1

Published in Malaysia by
Universiti Teknologi MARA (UiTM) Cawangan Johor
Kampus Pasir Gudang, 81750 Masai

A-ST092: SMART PERSONAL LOCKER SYSTEM: AN IOT-BASED INNOVATION FOR ENHANCED SECURITY

Iman Ariff Ahmad Rashidi, Zatul Iffah Abd Latiff, and Aznilinda Zainuddin
Electrical Engineering Studies, College of Engineering, Universiti Teknologi MARA, Johor Branch, Pasir Gudang Campus, Masai, Malaysia

Corresponding author: Zatul Iffah Abd Latiff, zatul0130@uitm.edu.my

ABSTRACT

In an increasingly digital and interconnected world, traditional lock and key mechanisms have become inadequate for ensuring adequate security. Addressing this gap, the Personal Locker Security System integrates cutting-edge technological advancements, offering enhanced protection against unauthorized access. This sophisticated system leverages features such as biometric authentication, encryption protocols, and real-time monitoring capabilities, alongside innovative components like temperature sensor, IR sensor, and Arduino Uno for seamless operation. By incorporating Internet of Things (IoT) technology and a WiFi module, the system ensures constant connectivity and remote access. An LCD display provides user-friendly interaction, while a buzzer alerts users to security breaches, and a servo motor ensures secure locking mechanisms. Additionally, the significance of privacy and confidentiality is paramount, with adherence to stringent data protection standards and customizable access controls. Whether safeguarding sensitive documents, valuable possessions, or confidential information, the system guarantees that only authorized individuals have access, mitigating risks of theft, tampering, or unauthorized disclosure. The Personal Locker Security System represents a paradigm shift in personal security solutions, setting a new standard through its innovative features, robust architecture, and commitment to privacy, catering to the evolving needs of individuals in today's dynamic landscape.

Keywords: Arduino Uno, Internet of Things (IoT), WiFi module, Temperature sensor, Servo motor

1. Product Description

The Personal Locker Security System is a cutting-edge solution designed to provide superior protection for personal belongings, sensitive documents, and confidential information. Combining advanced technologies, this system features biometric authentication for secure and personalized access, encryption protocols to safeguard data, and real-time monitoring to detect and respond to threats immediately. Core components such as temperature and IR sensors, Arduino Uno, and a servo motor work together for seamless operation and robust security. The system incorporates Internet of Things (IoT) technology, enabling constant connectivity and remote access through a WiFi module. An intuitive LCD display ensures easy interaction, while a buzzer promptly alerts users to any security

breaches customizable access controls and adherence to strict data protection standards prioritize user privacy and confidentiality. Whether used at home or in the workplace, the Personal Locker Security System delivers a comprehensive security solution that minimizes risks of theft, tampering, or unauthorized access. Designed to meet the evolving demands of a digital world, it offers reliability, convenience, and peace of mind, setting a new benchmark in personal security technology.

2. Flow Charts & Block Diagram

1.1 Block Diagram

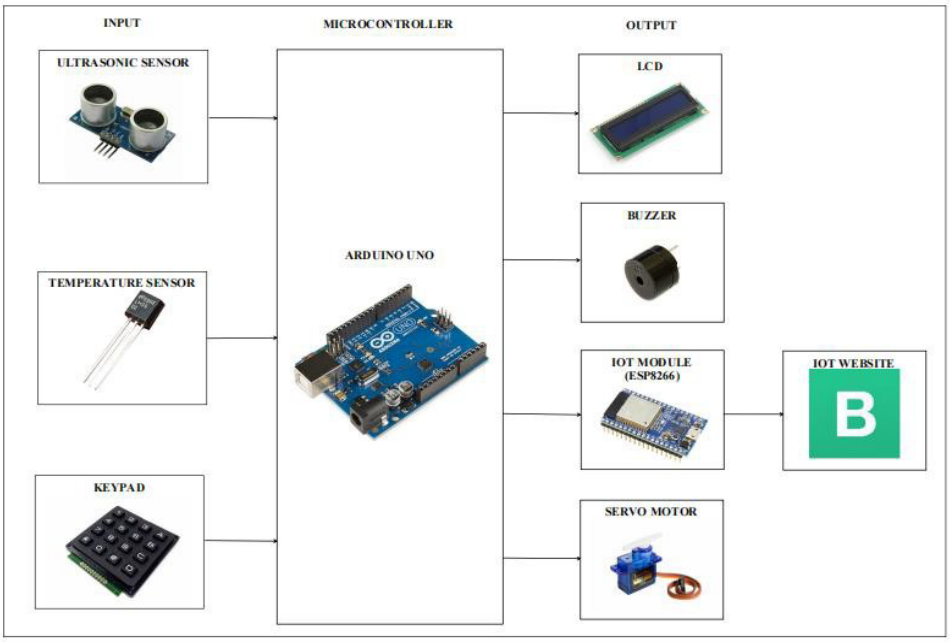

Figure 1. Block Diagram

Figure 1 shows the block diagram of Personal Locker Security System project. A Personal Locker Security System designed using an Arduino Uno microcontroller exemplifies this trend by integrating various input and output components to safeguard personal belongings. The system utilizes three primary inputs: an ultrasonic sensor to detect the presence of an object (or person) near the locker, a temperature sensor (TMP36) to monitor internal temperature, and a keypad for password entry. These inputs feed data into the Arduino Uno, which processes the information to manage security operations effectively.Upon receiving signals from the input components, the Arduino Uno coordinates several outputs to provide feedback and control. An LCD display offers visual prompts and status messages to guide the user. If the correct password is entered via the keypad, the Arduino activates a servo motor to unlock the locker. In the event of an incorrect password,

a buzzer sounds an alert to indicate an unauthorized access attempt. Additionally, the system is connected to the Blynk IoT platform, enabling remote monitoring and control through a smartphone app. This integration allows users to receive notifications and manage the locker's status from anywhere, ensuring continuous oversight.

The interplay between these components creates a robust and reliable security solution. The ultrasonic sensor, temperature sensor, and keypad work in unison to provide critical inputs, while the LCD, buzzer, servo motor, and Blynk platform deliver comprehensive output responses. This synergy not only ensures the security of personal items but also demonstrates the practical application of microcontroller-based systems in everyday security challenges. Understanding the block diagram of this system highlights the seamless interaction and data flow between components, illustrating the sophistication and effectiveness of modern security technologies.

Project Flowchart

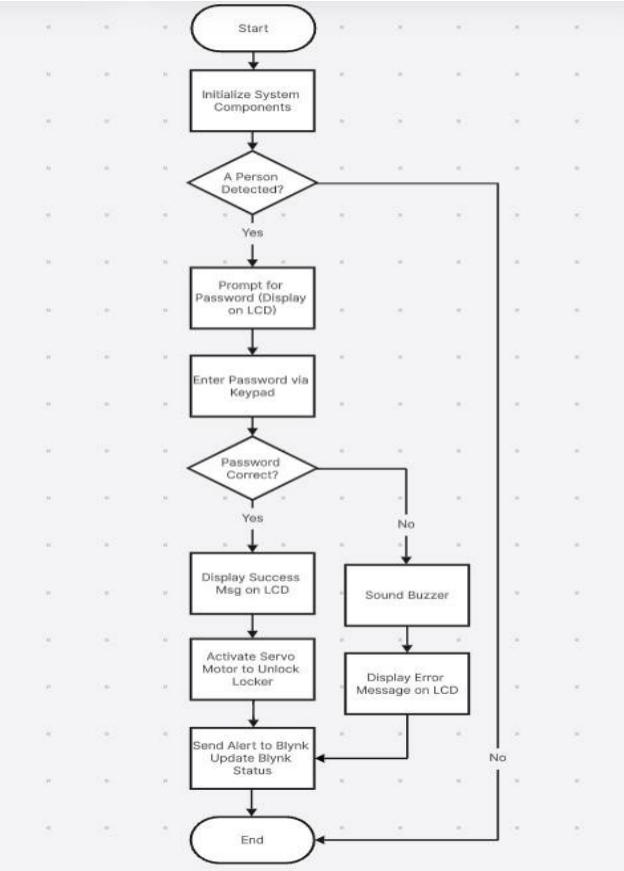

Figure 2. Flowchart of the Personal Locker Security System

Figure 2 shows the flowchart for the Personal Locker Security System linked with Blynk outlines the systematic interaction between various inputs, the Arduino Uno microcontroller, and outputs to provide comprehensive security. The system starts by

initializing all components, including the ultrasonic sensor, temperature sensor (TMP36), keypad, LCD display, servo motor, buzzer, and the Blynk IoT platform. Once initialized, the system continuously monitors the ultrasonic sensor for detect if someone is getting close to the locker. If motion is detected, the system prompts the user to enter a password via the keypad, displaying the prompt on the LCD.

Upon password entry, the Arduino Uno checks the password's correctness. If the entered password is incorrect, the system sounds the buzzer to alert of a failed attempt and displays an error message on the LCD, simultaneously sending an alert to the Blynk platform to notify the user remotely. If the password is correct, the system activates the servo motor to unlock the locker, displays a success message on the LCD, and updates the status on Blynk, allowing the user to monitor the locker's status in real-time.

In parallel, the system continuously monitors the temperature inside the locker using the TMP36 sensor. If the temperature exceeds a predefined threshold, the system triggers the buzzer to alert locally and sends a notification through Blynk, ensuring the user is informed of potential safety hazards. This integrated approach ensures that the locker is not only secure from unauthorized access but also monitored for environmental safety, providing a robust, multi-faceted security solution.

List of Components

Table 1. List of Components of Personal Locker Security System

No	*Component*	*Function*
1.	Arduino Uno Microcontroller	*Controls The Personal Locker Security System by Processing Sensor Inputs and Managing Outputs Like the Lcd, Buzzer, Motor, and Blynk Notifications.*
2.	IR Sensor	*Detects The Presence of An Object or A Person Infront of The Locker.*
3.	Temperature Sensor (LM35)	*Monitors The Temperature Inside the Locker.*
4.	Keypad	*Allows The User to Input a Password to Unlock the Locker.*
5.	Servo Motor	*Controls The Locking Mechanism of The Locker.*
6.	Buzzer	*Emits Sound Alerts for Various Conditions, Such as Successful or Failed Password Attempts.*
7.	LCD	*Provides Visual Feedback to The User, Displaying Information Such as Status Messages and Prompts.*
8.	Blynk	*Provides Remote Monitoring and Control of The Locker System Via The Internet.*

Table 1 shows the Personal Locker Security System uses an Arduino Uno microcontroller to control and integrate various components: an IR sensor to detect motion, a temperature sensor (LM35) to monitor internal temperature, and a keypad for password entry. The system's outputs include a DC motor to control the lock, a buzzer for sound alerts, an LCD for visual feedback, and Blynk for remote monitoring and control via the internet, ensuring a comprehensive and user-friendly security solution.

Schematic Diagram

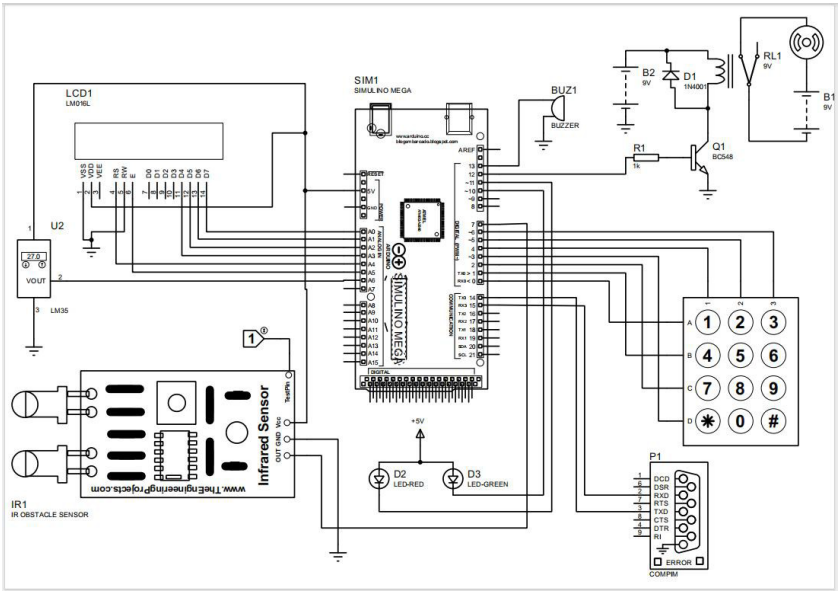

Figure 3. Schematic Diagram of Personal Locker Security System

Based on **Figure 3**, the schematic diagram for a Personal Locker Security System involving an Arduino Uno would include various input and output components connected to the microcontroller to achieve secure access control. The inputs consist of a keypad, an TMP36 temperature sensor, and an ultrasonic sensor. The keypad allows the user to input a security code, which the Arduino will verify to grant access. The TMP36 temperature sensor monitors the locker's internal temperature to ensure it remains within safe limits, and the ultrasonic sensor detect the presence of an object (or person) near the locker. The Arduino processes these inputs to determine whether to trigger the output components based on predefined conditions.The outputs include a buzzer, a servo motor, and an LCD. The buzzer acts as an alarm system, sounding when an incorrect code is entered by the person that is detected by the ultrasonic sensor. The servo motor is used to control the locking mechanism, engaging or disengaging the lock based on the correct input from the keypad. The LCD provides real- time feedback to the user, displaying prompts for entering the security code, temperature readings from the TMP36 sensor, and status messages such as "Access Granted" or "Access Denied."

Together, these components create a comprehensive security system managed by the Arduino Uno, ensuring secure and monitored access to the locker.

Software Simulation

1) Object Detected by IR Sensor

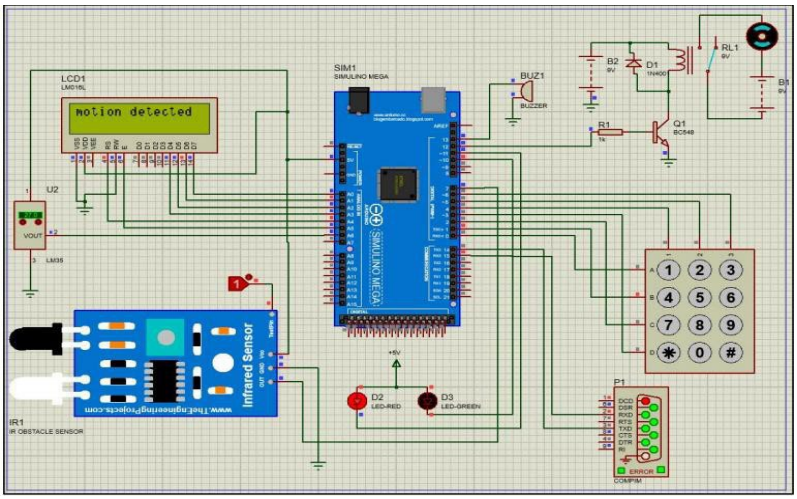

Figure 4. Object Detected by IR Sensor

2) Password required to open the locker

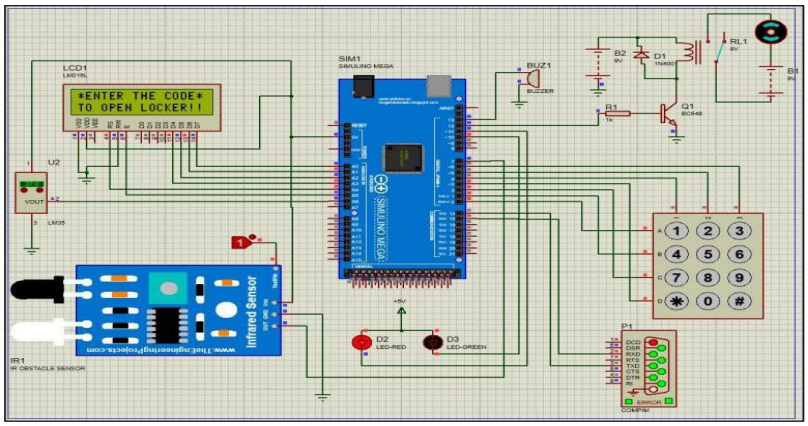

Figure 5. Main Screen of the system

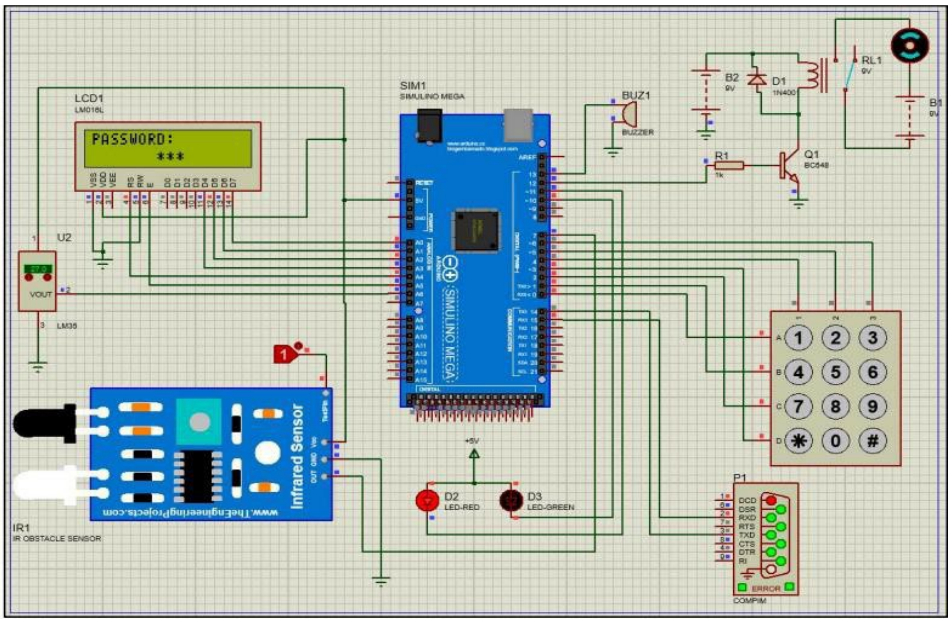

Figure 6. User need to insert password to open the locker

3) Locker Unlocked

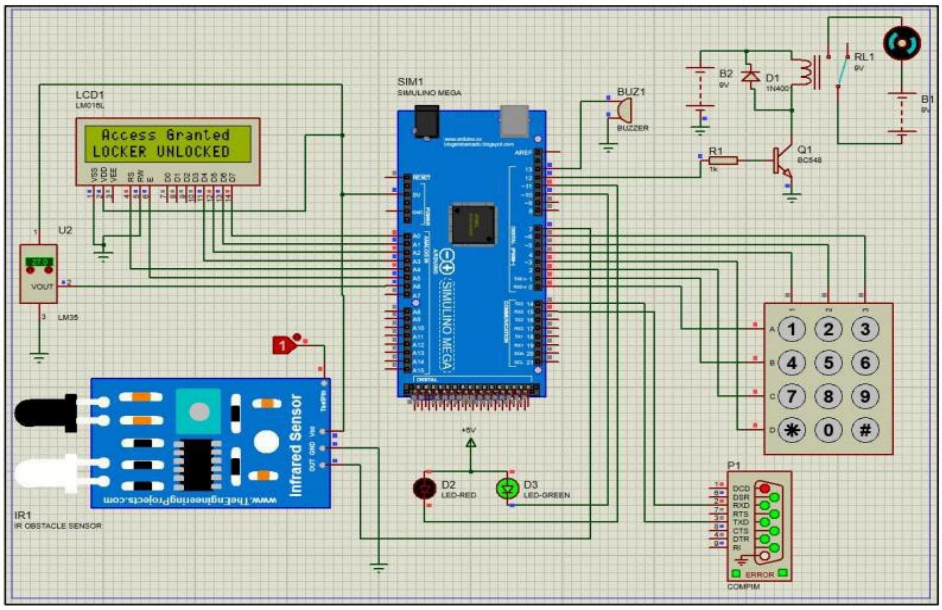

Figure 7. Locker Unlocked and Servo Motor opened the locker

The results of the Personal Locker Security System are illustrated through three key figures. **Figure 1** demonstrates the system's ability to detect object or person using the infrared sensor, which triggers an initial security response. This detection prompts the system to display a message requiring password entry, as shown in **Figure 2**, where the user is prompted to enter the correct security code on the keypad. Upon successful code verification, **Figure 3** shows the locker being unlocked, with the servo motor disengaging the lock mechanism and the LCD confirming access. These results validate the system's functionality, highlighting its ability to effectively detect unauthorized access, prompt for secure password entry, and unlock the locker upon verification, thus ensuring a robust security solution.

3. Novelty and uniqueness

The Personal Locker Security System stands out for its innovative integration of advanced technologies, redefining personal security in a highly interconnected world. Unlike traditional lock-and-key mechanisms, this system combines biometric authentication, IoT connectivity, and real-time monitoring, ensuring unmatched security and user convenience. Its unique design incorporates a temperature sensor, IR sensor, and Arduino Uno, enabling responsive and seamless operation tailored to diverse security needs.

A key differentiator is its use of IoT technology, which allows remote monitoring and control through a WiFi module—an essential feature in today's fast-paced, mobile lifestyle. The inclusion of an LCD display for user-friendly interaction, a buzzer for instant security breach alerts, and a servo motor for reliable locking mechanisms further enhances its functionality.

What truly sets this system apart is its holistic approach to privacy and data security, with encryption protocols and customizable access controls that prioritize confidentiality. By blending these cutting-edge features into a single, compact solution, the Personal Locker Security System offers a novel approach to safeguarding personal belongings, sensitive documents, and valuable assets, setting a new benchmark in modern security solutions. This project uniquely addresses evolving security challenges, making it a game-changer in personal and professional settings.

4. Benefit to mankind

The Personal Locker Security System provides significant benefits to mankind by addressing modern security challenges with innovative technology. It enhances the safety of personal belongings, sensitive documents, and confidential data through biometric authentication, IoT connectivity, and real-time monitoring. By minimizing risks of theft, tampering, and unauthorized access, the system fosters a sense of security and peace of mind for users in personal and professional environments. Its remote access capabilities and instant alerts enable users to monitor and control their lockers from anywhere, ensuring convenience and responsiveness in managing security. Additionally, the system's commitment to privacy through encryption protocols and customizable access controls protects sensitive information, aligning with the increasing global emphasis on data security. By integrating advanced technology with user-friendly features, this

project promotes a safer, more secure lifestyle, empowering individuals to protect their valuables and maintain confidentiality in an interconnected world.

5. Innovation and Entrepreneurial Impact

The Personal Locker Security System exemplifies innovation by integrating advanced technologies such as IoT, biometric authentication, and real-time monitoring into a comprehensive security solution. Its design encourages creative problem-solving by combining hardware like Arduino Uno, sensors, and servo motors with software-driven features like encryption protocols and remote access capabilities. This fusion of disciplines inspires a multidisciplinary approach to tackling security challenges, fostering a culture of innovation within the community, institutions, and industry. By addressing a real-world need for enhanced personal security, the project provides a platform for entrepreneurial ventures, showcasing how cutting-edge technology can be applied to everyday problems. It serves as a model for aspiring innovators, encouraging them to develop practical, scalable solutions that align with emerging market demands. Furthermore, the project highlights the value of user-centric design, promoting a mindset of continuous improvement and technological advancement, which is essential for driving entrepreneurship and economic growth.

6. Potential commercialization

The Personal Locker Security System has significant potential for commercialization due to its innovative features and wide-ranging applications. With growing concerns over personal and data security in homes, offices, and institutions, the demand for reliable and advanced security solutions is increasing. This system's integration of biometric authentication, IoT connectivity, and real-time monitoring makes it highly appealing to consumers seeking convenience and robust protection for their valuables. Its customizable design and compatibility with modern technology allow it to cater to diverse markets, from individual users to corporate clients. The system’s user-friendly interface and adherence to strict data privacy standards further enhance its marketability. Additionally, its scalability and cost-effective implementation position it as a competitive product in the security technology industry. By addressing a critical need for enhanced security, the project presents a strong opportunity for commercial success and long-term growth in the global security market.

7. Acknowledgment

We extend our heartfelt gratitude to everyone who contributed to the successful development of the Personal Locker Security System. Our sincere thanks go to our mentors and advisors for their invaluable guidance and expertise, which helped shape the project’s innovative design and implementation. We also appreciate the support of our institution for providing the resources and infrastructure needed to bring this idea to life. Special thanks to our peers and collaborators for their constructive feedback and encouragement throughout the process. Additionally, we acknowledge the importance of the technological tools and

platforms that enabled the seamless integration of advanced components like Arduino Uno, sensors, and IoT modules. Finally, we are grateful to the community and industry experts who inspired us to address the growing need for enhanced personal security solutions. Their insights and support have been instrumental in creating a project that aims to make a meaningful impact.

8. Authors' Biography

Iman Ariff Ahmad Rashidi was born in Malaysia who is currently persue his studies as a undergraduate student majoring in Electrical Engineering at UiTM Cawangan Johor, Kampus Pasir Gudang. He can be contacted at email:imanarifff04@gmail.com

Zatul Iffah Abd Latiff completed her PhD studies in Universiti Teknologi MARA, focusing on the research of Space and Earth Electromagnetism. She received her Bachelor of Engineering Degree in Electrical Engineering from Korea University, South Korea in 2010 and her Master of Science in Telecommunication and Information Engineering from Universiti Teknologi MARA (UiTM), Malaysia in 2013. She is one of the co-researchers of MAGDAS (Magnetic Data Acquisition System) network who is responsible for monitoring and maintaining one of the MAGDAS observatories located in Johor, Malaysia. Her research interests include geomagnetically induced currents (GICs) activity in the equatorial and low latitude region, space weather activity, ionospheric currents, Earth's electromagnetism, and application of ground magnetic and satellite data.

Aznilinda Zainuddin obtained both her bachelor's degree and master's degree in electrical engineering from Universiti Teknologi MARA (UiTM), Shah Alam, Malaysia. Her research activities are centered on engineering education, inventive problem-solving, and space weather. Currently, she is a senior lecturer at the Electrical Engineering Studies, UiTM Johor Branch, Pasir Gudang Campus and her current research focuses on the development of prediction models for geomagnetically induced current.