POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

COIN SLOTEED LOCKER WITH SMS NOTIFICATION

Polytechnic University of the Philippines

Bachelor of Science in Computer Engineering

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<center>**Chapter 1**</center>

<center>**THE PROBLEM AND ITS SETTING**</center>

Introduction

In today's rapidly evolving technological landscape, life has become notably easier. Education is a key source of knowledge for individuals, and schools play a vital role in shaping one's learning experience. Upgrading school equipment is essential as it empowers students to study without unnecessary hesitations, streamlining their academic journey and providing a designated place to keep their belongings. This study focuses on a project that aims to assist individuals in effectively performing their tasks while ensuring the security and convenience of their personal items.

The researchers, students of Polytechnic University of the Philippines College of Engineering pursuing a Bachelor's degree in Science Computer Engineering (BSCpE 4-2P), are driven by a vision to harness the power of technology for societal advancement. This project proposes a Coin Slotted Locker with SMS Notification, equipped with an android charger. The lockers are secured with RFID technology, granting access to their owners and providing SMS notifications to alert them when their allotted time is about to end. Additionally, an extension time feature is included to allow users an opportunity to retrieve their belongings conveniently. Developing a useful and efficient project is a challenge that fuels our determination to achieve our main goal.

The significance of this project lies in the daily struggles faced by students who must carry numerous materials and belongings to school. Often, students endure unnecessary hardships, unaware that a simple solution can alleviate their burden. As per Google (March 2019), lockers are compact storage boxes commonly found in various

public settings, such as locker rooms, businesses, schools, and transportation hubs. While lockers themselves have eased the lives of many, infusing technology into this essential utility can bring further convenience. Our project aims to be the answer to everyone's quest for enhanced efficiency and security.

Education is a fundamental aspect of life, and equipping schools with innovative technological solutions can significantly improve the learning experience. By integrating Information Technology (IT) into our project, we ensure data security, streamlined data collection, and overall ease of management. IT plays a vital role in making this project feasible and successful.

As we embark on this research journey, we are dedicated to exploring the technical intricacies involved in creating a practical and user-friendly system. Our goal is to offer valuable insights and recommendations that contribute to the advancement of technology-driven solutions in modern society. Ultimately, we envision a future where our Coin Slotted Locker with SMS Notification becomes a standard feature in various educational and public settings, fostering convenience and ease for all users.

Background of the study

In today's fast-paced and technology-driven world, the demand for secure storage solutions and convenient amenities is increasing, especially in public places such as airports, bus terminals, train stations, shopping malls, and recreational areas. Traditional coin-slotted lockers have been a reliable option for storing personal belongings, but they often lack modern features to enhance user experience and accessibility. To address these

limitations, the researcher innovative concept has emerged – the integration of a Coin Slotted Locker with SMS Notification, equipped with an Android charger.

The proposed study combines the convenience of traditional coin-slotted lockers with advanced technology to improve user interaction and satisfaction. Users can easily store their items by inserting coins into the locker, just like in conventional lockers. However, what sets this system apart is the addition of an SMS notification feature, allowing users to receive real-time updates on locker availability, status, and reminders for timely retrieval. Furthermore, to cater to the ever-increasing use of mobile devices, the lockers are equipped with built-in Android chargers, providing a value-added service to users who require a convenient charging option for their smartphones and tablets while utilizing the locker facilities.

The background of the study focuses on several key aspects:

Growing Need for Secure and Convenient Storage Solutions:
As urban centers, public places and also schools and colleges become more crowded, the demand for secure storage options for personal belongings continues to rise. Travelers, visitors, and styudents also often seek safe and accessible storage facilities, and the traditional coin-slotted locker system has been a popular choice. However, there is room for improvement in terms of enhancing user experience and convenience.

Advancements in Locker Technology and User Interaction:

The integration of SMS notification and Android charging capabilities represents a step forward in modernizing the traditional locker system. Real-time updates through SMS provide users with convenience and peace of mind, knowing the availability and status of lockers remotely. Additionally, the inclusion of Android chargers caters to the needs of individuals who rely heavily on their mobile devices and need a reliable charging solution while on the go.

User Acceptance and Technology Adoption:

The success of any new technology hinges on user acceptance and adoption. Therefore, understanding users' perceptions, preferences, and concerns regarding this integrated locker system is essential to ensure its widespread use. Factors such as ease of use, security, reliability, and the value proposition of SMS notifications and Android charging are critical to gauge user acceptance.

Challenges and Viability of Implementation:

Implementing and maintaining the Coin Slotted Locker with SMS Notification and Android charger comes with its set of challenges. These challenges may include technical considerations, software integration, security protocols, and financial investments. Therefore, conducting a comprehensive cost-benefit analysis and assessing the overall viability of the system is crucial to inform stakeholders and decision-makers.

Potential Impact on User Experience and Customer Satisfaction:

A successful integration of these features could significantly impact user experience and customer satisfaction. The research aims to explore how the added convenience of SMS notifications and Android charging contributes to users' overall satisfaction with the locker system and their likelihood of recommending it to others.

By conducting a thorough study into these aspects, the research aims to provide valuable insights for students, locker service providers, faculties, and facility managers. The findings can guide the implementation, improvement, and expansion of the Coin Slotted Locker with SMS Notification and Android charger to cater to the evolving needs and preferences of users in various public spaces.

Theoretical Framework

In this research endeavor, the researchers aim to enhance the traditional locker system by introducing a progressive design that caters to the convenience of every student. Over time, locker storage units have undergone significant transformations to meet the growing demands of modern individuals in their daily lives. These innovations range from integrating technology to charge cell phones while resting inside the locker to offering customization options that allow students to personalize their lockers. The focus of these innovations goes beyond functionality, as they also emphasize aesthetics to improve the overall ambiance of the surrounding areas. By incorporating these enhancements, the researchers anticipate that students will take better care of the school premises, fostering a positive impact on the school environment and promoting a sense of ownership and responsibility.

Coin Slot

Wireless Notification

Automated coin slotted Locker with SMS notification

Sensors / Devices that collects data
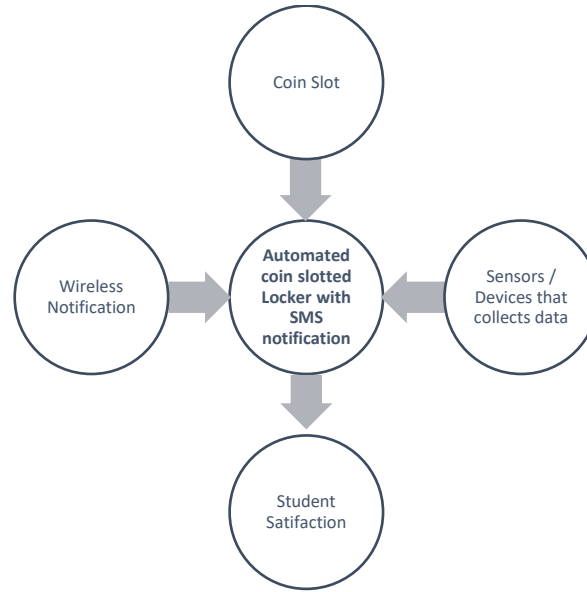
Student Satifaction

Figure 2: Theoretical Framework of the study

To achieve this vision, the researchers' study aims to evolve the conventional locker into a multitasking system, incorporating various features to maximize convenience for students on campus. The proposed features include SMS Notification powered by Arduino Uno, a coin slot mechanism, and an RFID system as a substitute for traditional locker keys. By integrating these elements, the locker will offer real-time SMS notifications, secure storage with coin-based access, and keyless entry through RFID technology. This comprehensive approach seeks to create a user-friendly and efficient locker system that optimizes students' experience while using the lockers within the campus premises.

Through their research, the team aspires to contribute to the evolution of locker systems in educational institutions, transforming them into versatile and practical tools that cater to the specific needs of students. By prioritizing convenience and user experience, the researchers' study aims to create a positive impact on students' daily

routines and foster an environment that promotes responsible behavior within the campus community. Ultimately, the researchers envision their enhanced locker design becoming an integral part of the campus infrastructure, revolutionizing the way students interact with lockers and improving overall campus life.

Conceptual Framework

The Coin Slotted Locker with SMS Notification equipped with an Android charger revolves around the integration of key components and their potential impact on user acceptance, user experience, and system efficiency. The framework seeks to understand how the combination of traditional coin-slotted lockers, SMS notifications, and Android charging capabilities can influence user behavior and overall system viability. Here's a conceptual framework for the study:
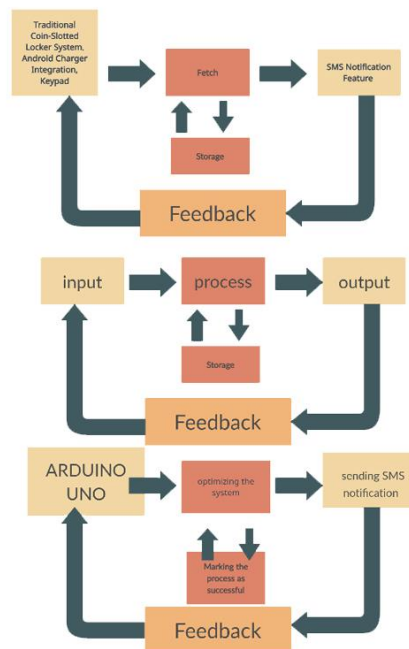
Figure 2: Conceptual framework of the study

Input: Traditional Coin-Slotted Locker System:

The input represents the conventional coin-slotted locker system, where users can store their belongings by inserting coins into the designated slots. This component serves as the foundation of the integrated locker system.

- SMS Notification Feature: The input also includes the SMS notification feature, which sends real-time updates to users regarding locker availability, status, and reminders for retrieval. Users' mobile numbers are used to deliver these notifications.

- Android Charger Integration: The integration of Android chargers into the lockers allows users to charge their smartphones and tablets while utilizing the locker facilities.

User Acceptance and Perception:

- Perceived Usefulness: The conceptual framework considers users' perceptions of the usefulness of the integrated system, encompassing the convenience of coin-slotted lockers, the real-time updates through SMS, and the added value of Android charging.

- Perceived Ease of Use: Users' perceptions of the system's ease of use, including the process of renting lockers, receiving SMS notifications, and utilizing the Android chargers, are vital factors influencing user acceptance.

- Security and Privacy Concerns: The framework acknowledges users' potential concerns about the security and privacy of their stored items and personal information, such as mobile numbers used for SMS notifications.

User Experience and Satisfaction:

- Convenience: The integration of SMS notifications and Android chargers enhances user convenience, and the framework evaluates how these features contribute to a seamless and efficient user experience.

- System Reliability: Users' satisfaction and continued use of the locker system depend on the reliability of SMS notifications, Android charging functionality, and the overall availability and functionality of the lockers.

User Engagement and Utilization: Frequency of Use:

The conceptual framework measures the frequency of locker usage by users, which may be influenced by the attractiveness of SMS notifications and the availability of Android chargers.

- User Interaction: User engagement with the locker system is analyzed, considering the interactions during locker rental, SMS notification response, and utilization of the Android chargers.

Impact on Customer Loyalty and Recommendation:

- Customer Loyalty: The conceptual framework explores the link between a positive user experience with the integrated locker system and user loyalty towards utilizing the lockers regularly.

- Word-of-Mouth Recommendation: Users' satisfaction and perception of the system's benefits influence their likelihood of recommending the integrated locker system to others.

System Viability and Cost-Benefit Analysis:

- Financial Viability: The framework evaluates the economic feasibility of implementing and maintaining the integrated system, considering the costs associated with technology integration and potential revenue generation.

- Cost-Benefit Analysis: This aspect assesses the value proposition for both the locker service provider and users, weighing the costs against the benefits offered by the integrated system.

The conceptual framework guides the study to understand the interplay between the components and their impact on user acceptance, user experience, and the overall viability of the Coin Slotted Locker with SMS Notification equipped with an Android charger. Through data analysis and interpretation, the study aims to provide valuable insights that can inform stakeholders and service providers in optimizing the system and enhancing user satisfaction.

Statement of the Problem

The lockers you see in PUP are for monthly rentals, and lack automation and a notification system, leading to inefficiencies and inconveniences for users. This study aims to develop and evaluate an automated coin-slotted locker system integrated with an SMS notification feature. In addition, the following questions will be addressed by this project:

1. What are the profiles of the respondents in terms of?

   1.1 Age

   1.2 Sex

   1.3 Course

2. What are the challenges encountered by respondents using the prototype?

   2.1 Accessibility

2.2 Interface

2.3 Security

3. What is the degree of acceptance of the respondents on the evolved prototype in terms of;

3.1 Security

3.2 Reliability; and

3.3 Usability?

4. Is the integration of SMS notification financially viable for the student or faculties, and does it justify the additional convenience for users?

This research aims to give significant insights into the acceptability, usage patterns, and effect of the automated coin-slotted locker system combined with SMS notification by addressing these issues fully. The results will not only help to improve knowledge of the system's feasibility, but they will also provide practical suggestions for improving user experience and overall system efficiency.

Scope and Limitation

This research aims to develop an innovative automated locker system tailored for implementation at the Polytechnic University of the Philippines Institute of Technology, which serves a significant number of students and university officials requiring enhanced security for their belongings during school hours. The study will focus on analyzing the locker's key features and evaluating its efficacy in providing a

secure storage solution. The proponents have outlined the following objectives for the project: (1) Campus-wide Implementation: The primary goal is to deploy the automated locker system extensively across the university campus, catering to the needs of the vast student and staff community. (2) RFID Card Access: Users will be granted access to the lockers through RFID cards. When the card is tapped on the sensor, it will activate the Servo motor, facilitating the locker's opening. (3) Exclusive Card Access: To ensure enhanced security, only a specific RFID card will have access to each locker, limiting usage to the rightful owner. (4) 5-Peso Coin Mechanism: The system will be powered by inserting a 5-peso coin into the coin slot, enabling the Arduino system to operate efficiently. The digital timer outside the locker will commence once the coin is inserted. (5) SMS Notification System: Upon usage, the student will receive an SMS notification triggered by the GSM module, providing them with a two-minute window for locker access. (6) Built-in Charging Port: The locker will feature a charging port equipped with an Android port, allowing users to charge their devices during the remaining time of locker usage. The study does have some limitations, which are essential to acknowledge: (1) Manual RFID Card Issuance: The locker system will not automatically produce RFID cards; users will need to obtain their designated cards separately. (2) Coin Flexibility: While the system requires a 5-peso coin for optimal operation, it may be powered by other coin denominations, potentially affecting its efficiency. (3) Limited Campus Usage: The design is exclusively intended for student use within the university campus. (4) Power Source Dependency: In the event of a main power source failure, the locker system may become inoperative. Although some projects incorporate secondary power sources like generators or batteries, this study

will not include such provisions. Through this research, we endeavor to pioneer an advanced and secure automated locker system that optimizes convenience and ensures the safety of belongings for students and university officials at Polytechnic University of the Philippines College of Engineering

Significance of the Study

The significance of the study shown below indicates all the possible benefits of the research study in contribution to students, to PUP faculties, and to future researchers.

To Students: the proposed study on a coin-slotted locker system holds significant implications for improving student material security, responsibility, and overall academic experience. The potential benefits of enhanced material management, reduced disruptions, and cost-effectiveness make this research relevant and valuable to the educational community. Moreover, the findings from this study can contribute to further research on campus security and best practices for student welfare.

To Faculties: the proposed study offers teachers and mentors a practical and secure solution to enhance material management and convenience. By adopting this system, educators can optimize their teaching environments, save time, and focus on their primary responsibilities effectively. Additionally, the study's potential cost-effectiveness and positive impact on educational infrastructure make it a relevant and valuable consideration for educational institutions. Ultimately, this research aims to

contribute to the well-being and productivity of educators, supporting them in their essential roles as facilitators of knowledge and mentors to students.

To Future Researchers: the results of this pioneering study on coin-slotted lockers will serve as an essential reference material and guide for future researchers aiming to explore material management innovations, particularly in the realms of software and hardware. By leveraging the study's empirical evidence, methodological insights, and conceptual framework, researchers can contribute to the continuous improvement of material management solutions in various professional and educational settings. This study sets the stage for an exciting journey of exploration and innovation, enriching the field and providing tangible benefits to educators, mentors, and professionals in diverse domains.

Definition of Terms alpha, unique words, and operational words

The terms appearing below are defined to facilitate understanding of the study.

Arduino - according to techopedia.com it is an open-source electronics platform or board and the software used to program it.

RFID - is by using electromagnetic fields to automatically know and track tags attached to objects. RFID tag consists of a small radio transponder a radio that receive and transmit.

Currency Detector - it is a device that determines if the notes or coins are genuine or not. This device is used in a wide range of automated machines, such as kiosks,

supermarket self-checkout machines, arcade gaming machines, launderette washing machines, car park ticket machines, automatic fare collection machines, public transport ticket machines, and other vending machines.

Locker - A drawer, cupboard, or compartment that may be closed with a lock especially.

Servo Motor - A rotary or linear actuator that can control angular or linear position, velocity, and acceleration with precision.

Sound Sensor - Sound Detection Sensor for Arduino This module allows you to detect when sound levels have exceeded a preset

threshold.

IDE - is a software application that helps programmers develop software code efficiently. It increases developer productivity by combining capabilities such as software editing, building, testing, and packaging in an easy-to-use application.

Chapter 2

Review Related of Literature and Studies

The literature review in this research aims to provide an overview of existing studies and research related to locker security systems, access control mechanisms, and the integration of innovative technologies such as microcontrollers, RFID, and password-based authentication. This chapter will explore the limitations of traditional locker systems, identify gaps in the existing literature, and lay the foundation for the proposed smart RFID system for locker cabinet security. Through a systematic review of the literature, this study aims to highlight the drawbacks associated with conventional locker systems. By analyzing previous research, it intends to identify the challenges faced by these systems and explore areas where improvements are necessary. Additionally, this literature review identifies gaps in the current body of knowledge, providing valuable insights into unexplored avenues for further investigation.

A. RFID

We now live in a world where everything is designed to make our lives simpler. Rapid technological advancement and change will continue for a very long time. For the students, the researchers are currently proposing an innovative multifunctional locker with a coin slot, USB port charger, and RFID. This chapter introduces numerous discussions, investigations, points of view and ideas by earlier scholars with international backgrounds. As this previous study has demonstrated, the present invention relates to an electronic locker system capable of effectively managing and distributing a locker by using an RFID tag on a student card that contains personal information in a locker management system that only allows students to use a public locker in a school for a

predetermined amount of time. (Kim Seong Chan, 2014) As the previous researcher suggested, we presumptively utilize an RFID-type locker for our own creation. A system and a method for calculating a facility use charge using a locker key embedded with an RF chip are provided in order to control entrance and make it simple to check the usage charge by recording a locker number, an entrance authority, or the use charge to a non-contact RFID (Radio Frequency Identification) tag in the locker key. CONSTITUTION: A calculating computer (50) receives all moving paths and uses particulars of a user from entrance to exit from terminals, stores it, and offers the stored information to each terminal. The present invention is directed to a user's access control. The facility used by the RFID chip is an embedded locker key that enables the movement path to check rates and availability. More specifically, the present invention is applied to a place of business to maintain a facility fee settlement system and a settlement method using the built-in lock key RF chip. (LIM HEE DAE, 2003)

The locks on rental lockers have often been mechanical, coin-operated locks that may be opened by placing money, such as quarters, into the lock. A person can move a key from an unlocked to a locked position with a door of a locker being rented in a closed position and, once being turned to the locked position, the key can be withdrawn from the lock when the locks have been given a particular amount of money. The key must be turned back to the unlocked position in order to get access to the locker in the future. (NELSON SCOTT [US]; TOIBERO DENNIS [US]; ZANIKER JOHN [US],2015-04-16) The coin-slotted insert in the locker in this instance demonstrates how it functions and is compatible with the researchers' findings.

The locks on rental lockers have often been mechanical, coin-operated locks, and have been set up so that customers may place coins, such quarters, inside of them. A person can move a key from an unlocked position to a locked position with a door of a locker being leased in a closed position and, once being turned to the locked position, the key can be withdrawn from the lock once it has reached the locked position after the locks have reached a particular monetary value. The individual can subsequently open the locker by rotating the key back to the unlocked position and re-inserting it into the lock. NELSON SCOTT [US]; TOIBERO DENNIS [US]; ZANIKER JOHN [US],2015-04-16) In this instance, the coin-slot insert in the locker's functionality for our research demonstrates how it works.

In a research study held by Wijaya et al. (2022), to propose a prototype of a Smart RFID System for Locker Cabinet Security Using an Android App. The prototype utilizes WeMos D1 R2 with ESP8266 Wi-Fi module as the microprocessor. Blynk app is used to monitor and control the microcontroller. The WeMos D1 R2 is connected to actuators and sensors, such as a servo motor, LCD, and RFID reader. The Android application is designed for the admin to identify the UID of the card being tapped by the user and grant permissions to open the locker. When the admin chooses "Accept," the cabinet will be unlocked, and when "Deny," the lock stays shut. The prototype is functional and serves as a starting point for further improvements, including the implementation of a database system, better application development, and the application of artificial intelligence to enhance the system.

In Hadiwiyatno et al. (2020b) study, the process of borrowing tools in the engineering laboratory often encounters issues, particularly with the monitoring of equipment during

the borrowing and returning process. This can lead to mistakes and errors when returning the items. To overcome these challenges, a monitoring system called "Microcontroller and Wireless Communication Based Smart Laboratory Box System Implementation" is being developed. The system utilizes wireless sensors and RFID technology to create a real-time monitoring system for locker status. By employing a wireless sensor network, the system uses Light Dependent Resistors (LDR) and RFID sensors to determine the status of the smart boxes. Each tool is differentiated using RFID tags to ensure accurate data information. Through analysis and experimentation, the effectiveness of this technology will be evaluated. The results indicate that the system operates according to planned specifications, with varying delays. The LAN network system exhibits minimal packet loss and superior performance compared to the WLAN network system. These findings contribute to the assessment of the quality and functionality of the developed technology, informing future improvements and enhancements.

B. Locking System

This point demonstrated how our local researchers fit within our study. The access Keyless Lock mechanism was created with the goal of giving Leyte Normal University's computer labs a greatly enhanced locking mechanism. It takes advantage of a feature of the Bluetooth-enabled mobile phone with a Python application loaded. Since they are in charge of granting access to the laboratory, Leyte Normal University's IT faculty was the system's main user. Hardware elements like a servo in place of a door strike and a buzzer in place of a security alert are used in the system. The usage of Bluetooth through a mobile device to access the computer labs is the sole distinction. The system incorporates hardware components such as a servo instead of a door strike and a buzzer instead of a

security alert. The main difference lies in the utilization of Bluetooth technology through a mobile device to gain access to the computer labs. The proposed solution involves the use of a Personal Identification Number (PIN) and an RFID, which is a device capable of detecting short-range data, to unlock the door. Which is a device capable of detecting short-range data, to unlock the door.

According to the study of K.Shrinavasa Ravi et al. entitled "RFID Based Security System", The utilization of RFID technology, including RFID tags and an RFID reader, is discussed as a means of identifying authorized and non-authorized individuals for their RFID-Based Gate Access Security System. When a card is brought near the RFID module, the system reads the data on the card and presents it on an LCD screen. The card's data is then verified by comparing it to the program memory or a central database, and the result (authorized or unauthorized) is displayed on a monitor. If the person is confirmed to be authorized, the door opens; otherwise, if the system identifies the card as "unauthorized," an alert is indicated through a buzzer. Additionally, a buzzer sounds to indicate when a card is successfully read by the RFID module. The RFID-Based Gate Access Security System has proven to be a successful development, providing a paperless environment and saving time for users. (Arcena's group 2012 Leyte Normal University).

Compared to the current study, both studies incorporate RFID technology in a door lock system for lockers. However, the present study goes beyond a single level of access control. It includes a validation process where the cardholder's identity is confirmed when they tap or access the RFID card to the device. Additionally, a program manages a database of students who have access to the lockers, and a coin mechanism is

implemented to provide user benefits. Another notable feature of this prototype is the inclusion of a USB port inside the locker, which enhances convenience and efficiency for users. The duration of locker usage is determined by the number of coins inserted by the student, enabling them to benefit from this cost-effective innovation within the campus environment.

According to Al-Qahtani et al. (2020) the integration of Internet of Things (IoT) technology. This integration has paved the way for the development of Smart Lockers, which utilize IoT capabilities to enhance security and convenience. In this study, a proposed Smart Locker design based on Bluetooth technology allows for remote control through a mobile phone application. This integration enables users to conveniently lock and unlock the locker, monitor its status, and receive real-time notifications. Additionally, a backup unlocking method using a Keypad 4x4 is incorporated to ensure access to the locker even when the mobile phone is unavailable. Through a comprehensive literature review, the benefits and challenges of integrating IoT technology into locking systems have been explored, providing valuable insights for the implementation of IoT-based solutions in this domain.

The integration of IoT technology in locking systems, specifically the development of Smart Lockers, offers enhanced security and convenience. The proposed design allows for remote control through a mobile phone application using Bluetooth technology, facilitating easy monitoring and management of the locker. The inclusion of a backup unlocking method using a Keypad 4x4 ensures uninterrupted access in scenarios where the mobile phone is not accessible. The findings from the literature review contribute to

a deeper understanding of the advantages and considerations involved in implementing IoT-based locking systems.

Zamri et al. (2021) presents a cost-effective keyless door lock system that offers improved security features. The system incorporates a servo motor as the door lock, which rotates based on specific angle commands received. To unlock the door, users are required to input a password code using a keyboard. Additionally, an internal touch sensor allows for door access from inside the house. To deter unauthorized intruders, an alarm buzzer is integrated into the system. Moreover, the inclusion of a GSM module enables users to receive instant message alerts on their mobile phones whenever an incorrect password attempt is detected by the door lock system. The developed prototype system aligns with the planned design and has undergone rigorous testing to ensure its functionality and compliance with the specified requirements. Through comprehensive analysis and testing, the results have verified the efficacy of each system component, as well as the overall prototype system, in delivering reliable and secure door lock capabilities.

Hassan et al. (2012) presents a research study focused on the development of a Graphical User Interface (GUI) for a face recognition system integrated with a Peripheral Interface Controller (PIC) to enhance the security of a door lock system. The objective of the study was to create a user-friendly interface that utilizes face recognition technology to control the activation and deactivation of a magnetic lock. The GUI was developed using MATLAB R2009a and connected to a PIC microcontroller via USB serial communication. This connection allowed for seamless data transmission between

the GUI and the microcontroller, enabling efficient control of the door lock system. In the experimental setup, the developed system demonstrated its capability to automatically switch the magnetic lock based on the identification of authorized individuals from the GUI database. When an individual's face image was successfully matched with the stored data, the GUI triggered the PIC microcontroller to activate the magnetic lock, granting access to the secured area. Conversely, if the face image did not match any authorized record, the GUI would command the microcontroller to deactivate the magnetic lock, denying access.

The findings of the study confirmed the successful integration of the GUI with the face recognition system and the PIC microcontroller. The developed system provided a reliable and efficient means of controlling the magnetic lock, enhancing the security of the door lock system. The user-friendly interface facilitated easy interaction, and the integration of face recognition technology added an additional layer of security by ensuring that only authorized individuals could gain access. The study demonstrated the feasibility and effectiveness of utilizing GUI-based face recognition systems for door lock security, contributing to the advancement of security systems in various applications.

C. Wireless Notification

Security plays a crucial role in our daily lives and has a significant impact. Various security measures have been implemented to address the risks associated with the safety of individuals and their belongings. Institutions across different locations have sought

ways to enhance security, particularly by controlling access and preventing unauthorized entry. Modern safety technologies have emerged to tackle these challenges effectively. One such technology is the door access control system, which aims to overcome issues like key loss, inadequate tracking of premises access, and key unavailability.

The researchers' objective is to provide an intelligent and efficient access control system for the Computer Laboratories at Leyte Normal University through an Automated Door Access-Control Mechanism. This system comprises several components, including a Microcontroller (MCU), a wireless module, an RFID reader, RFID cards, an LCD touchscreen, a solenoid lock, and a computer server. Its primary function is to secure the laboratories by controlling and monitoring employee access. The system caters to IT instructors, part-timers, and maintenance staff who require access to the laboratories.

To gather necessary information, the researchers employed the descriptive research method, which describes the current phenomenon based on the issues encountered in the Computer Laboratories. They also utilized Likert-type or Frequency Scales, a method that presents respondents with predetermined questions and asks them to rate their agreement or disagreement on a scale of 1 to 5. Additionally, random sampling was employed during the testing and system demonstration for post-user evaluation.

This prototype demonstrates the positive impact on everyday life, providing enhanced security and convenience. It offers a multi-purpose solution, ensuring the safety of students' belongings through the implementation of RFID technology and database integration. (Bluetooth Activated Door Lock With Theft Detector Via Global System For Mobile Communication, 2011 Marvin S. Angelo | Apolinario M. Consemino Iii | Patrick

Jayson L. Gevaña) In comparison with the present research the security will assume a high limit to protect the belongings with the ability to send a SMS for the students alerting them that the time limit provide for the locker will be stop and extend until they want to get their personal things.

The development of microcontroller technology has opened up opportunities for its application in various fields. (Leandros et al., 2020), an automatic lamp prototype is being developed to optimize electricity usage in a room and reduce wasteful energy consumption from the State Electricity Company (PLN). The prototype utilizes a Passive Infra-Red (PIR) sensor for human movement detection, an Arduino Uno microcontroller as the central control unit, and a Light Dependent Resistor (LDR) sensor to determine the required light intensity. These components work together to ensure that the lights are controlled based on human presence and the ambient lighting conditions in the room. Additionally, a GSM Sim 900A module is integrated to provide notifications in case of excessive electricity usage beyond the control of the sensors. The objective of this research is to create an efficient and sustainable lighting system that promotes energy conservation and reduces unnecessary electricity expenses. The subsequent sections will focus on the design, implementation, and evaluation of the prototype, highlighting its benefits and potential areas for further improvement.

SMS communication is gaining increasing popularity in people's daily life. Along with the growing number of times people sending and receiving SMSs every day, there are also increasing unwanted interruptions to people when they are busy with their work or feel less receptive to unimportant messages (Gao et al., 2010). These interruptions can

negatively impact productivity and user experience. Unfortunately, current SMS systems are unable to present notifications according to the user's states and willingness to be interrupted. In response to this issue, our research aims to develop an intelligent SMS system that can determine the optimal way to present notifications to the user at a suitable time. We propose the incorporation of a decision module that analyzes various factors when a new message is received. These factors include the content of the message, the relationship between the sender and the user, and the user's current state. By considering these factors, the decision module can make informed judgments about the importance and urgency of the message, and whether it should be presented as a notification to the user. The results of the decision module are then used to implement a notification system that is designed to minimize interruptions to a user's ongoing tasks. By intelligently assessing the context and relevance of each message, the system can determine whether to present the notification immediately, delay it until a more appropriate time, or even suppress it altogether. This personalized approach aims to enhance the user experience by reducing unnecessary interruptions and improving overall productivity.

Through the implementation and evaluation of our SMS system, we anticipate that users will benefit from a more tailored and context-aware notification management approach. By leveraging the insights provided by the decision module, we aim to optimize the delivery of SMS notifications and enhance the overall user satisfaction and productivity. This research contributes to the advancement of SMS systems by addressing the limitations of current systems and providing a more intelligent and user-centric approach to notification management (Gao et al., 2010).

On a researched done by Park et al. (2011) it proposes a MAC-based remote lock and wipe system using SMS push notifications to address the issue of private data disclosure when smartphones are lost or stolen. The system aims to protect sensitive data by remotely securing and erasing it. One key feature of our proposed system is the incorporation of an integrity checking mechanism, which prevents malicious users from launching denial-of-service attacks by intentionally sending lock or wipe commands to legitimate users. This mechanism ensures the system's security and integrity while complying with the 80-byte SMS length limitation. Through this research, we aim to provide an effective and secure solution for protecting private data on lost or stolen smartphones. The subsequent sections of the paper will focus on the design, implementation, and evaluation of our MAC-based remote lock and wipe system, highlighting its ability to safeguard user data and maintain security even in the event of device loss or theft.

The study conducted by Anusha et al. (2017) presents a comprehensive locker security system that tackles the security issues prevalent in traditional locker systems. The proposed system integrates Internet of Things (IoT), face recognition technology, and One Time Password (OTP) verification to enhance security measures. Users are required to enter a Personal Identification Number (PIN) to access the locker, after which a camera connected to the locker captures their image. This image is then compared to a database using Eigen face and PCA algorithms to determine a match. Upon successful verification, an OTP is generated and sent to the user's registered mobile number via SMS using GSM service. Additionally, an email notification is sent to the user to confirm access.

The study emphasizes the importance of advanced security measures in locker systems. By combining various technologies, the system provides an enhanced level of security by accurately verifying user identity and generating OTPs for additional authentication. The utilization of face recognition algorithms and OTP verification adds an extra layer of protection against unauthorized access attempts. Overall, the proposed locker security system demonstrates the potential to significantly enhance security and mitigate potential security risks associated with conventional locker systems.

D. Coin acceptor

The integration of coin acceptors in various service industries has revolutionized the way services are provided and payments are collected. Coin acceptors have emerged as a practical and efficient method for enabling secure access to services through the use of coins. This subcategory explores the application of coin acceptors as a payment mechanism within the context of service provision.

The coin detection process relies on examining the physical properties of the coin and comparing them to known characteristics of acceptable coins. (Vochozka et al., 2019) The coin acceptor assesses attributes such as size, diameter, thickness, mass, metal composition, and magnetism. This article explores the potential principle of differentiating Czech coins based on their impact on the magnetic field.

In CAD SolidWorks, a 3D model was developed to accommodate a standard school coil. The model was subsequently printed using a Prusa i3 MK3S 3D printer. Additionally, a magnetic field sensor from Vernier was incorporated into the setup. By

placing the coin within the coil's core, the changes in the magnetic field's magnitude were measured. Specifically, the alterations in the magnetic field's magnitude were recorded and analyzed.

In a study did by Suryakala et al. (2022); to develop a prototype of an RFID-based electric vehicle charging station with a focus on facilitating coin-based interactions. The module includes a coin acceptor mechanism that allows users to initiate the charging process by inserting coins. A blue LED indicator signifies the start of charging, while completion of the charging process is also notified. The prototype incorporates features such as displaying the remaining charging time and the balance amount in the user's account, providing a user-friendly experience. Additionally, the study addresses the implementation of emergency cut-off and reimbursement policies for uncharged durations during the charging process. The developed module can be switched between coin or RFID-based setups based on the user's preference, offering flexibility and accommodating different transaction methods.

There has been a significant increase in mobile phone usage, often resulting in instances where the battery drains in the middle of conversations. (Mapari et al., 2019) This highlights the need for convenient cell phone charging solutions that are accessible anytime and anywhere, especially in situations where standard charging options are unavailable. To address this issue, smart charging vending machines have been developed. The objective of this research is to design and implement a vending machine specifically tailored for mobile phone charging. Users will be required to plug their mobile phones into one of the available slots and insert a coin, with the charging process

varying based on the type of coin inserted. These vending machines can be easily and swiftly installed outside various business premises, such as railway stations, airports, hospitals, and shopping malls, providing a practical solution to the growing demand for on-the-go mobile phone charging. The research focuses on the design and implementation of this vending machine, aiming to offer a convenient and accessible charging option for mobile phone users.

To identify the needs of the community by leveraging the interests of environmentally conscious consumers while exploring potential business opportunities. To achieve this, Raihanah and Syafariani (2019) have drawn inspiration from a widely used product in Japan called Coin Lockers. To support the research, the conducted an in-depth analysis of relevant articles and reviews related to Coin Lockers. The findings indicate a significant demand for these lockers, particularly among the Japanese population, as they provide a convenient storage solution for items that individuals do not wish to carry with them. This research demonstrates the importance of such products as valuable community facilities. Coin Lockers are not only user-friendly but also cost-effective, benefiting individuals who utilize these facilities. Moreover, they offer lucrative prospects for entrepreneurs seeking to venture into an environmentally friendly and technologically advanced business sector in our country.

Tun (2019) proposes the design of an Arduino-based automatic vending machine as a new technological application in society. The system incorporates components such as the Arduino Mega board, Liquid Crystal Display (LCD), coin acceptor, servo motor, stepper motor, and push buttons. A rectifier circuit is employed for power supply, and a

step-down DC to DC module is used to reduce the rectifier output voltage from 12V to 5V. The Arduino Mega board is primarily responsible for running the vending machine's program. The LCD screen provides information, facilitates coin insertion, and enables product selection. Users can choose the desired product by pressing the corresponding button. Four push buttons are utilized to select from four different product options. The servo motor is employed to drop the selected product for retrieval by the user. In investigating a coin acceptor vending machine that utilizes a microcontroller system. Technology has significantly impacted various aspects of people's lives, streamlined their tasks and made them more efficient. Vending machines are one such rapidly evolving technology. These machines automatically dispense products like beverages, tickets, and snacks upon the insertion of currency or credit. Vending machines come in diverse forms and serve different functions, finding application in public and private spaces such as malls, markets, offices, schools, and street corners.

Mathew et al. (2020) presents a mobile phone charging system that utilizes a coin acceptor system connected to a solar panel and battery system. This innovative system not only provides a convenient service to the public at open places but also offers a profitable opportunity for the service provider. Its portability allows for easy installation in high footfall areas such as railway stations, bus terminals, and malls. The utilization of a solar panel as the primary energy source ensures minimal running costs, making it an economically viable solution. The system is designed using ARDUINO ATMEGA 32 microcontrollers, which enable the efficient transfer of input pulses from the coin acceptor to the battery module. When the coin acceptor is activated, the system processes the input pulses and initiates the charging process for the mobile phone. Even during

cloudy days, the system continues to function effectively due to the inclusion of a battery, which provides a backup power source.

The integration of the coin acceptor, solar panel, battery system, and microcontrollers ensures a seamless and sustainable mobile phone charging solution. This system offers convenience and accessibility to the public while minimizing the reliance on traditional power sources and reducing operational costs. The study demonstrates the feasibility and effectiveness of utilizing renewable energy sources and innovative technologies to meet the increasing demand for mobile phone charging services in public spaces.

Synthesis of the Review of Related Literature and Studies

The compilation of both foreign and local studies mentioned above provides valuable insights to the researchers, highlighting the similarities between their proposed study and existing widely used systems. It is recognized that research and technology have introduced new options for improvement. The interaction between the present study and previous research is facilitated through ideas derived from foreign and local studies as well as existing literature.

The use of RFID technology in locker systems has been widely explored in previous research. Scholars have proposed multifunctional lockers equipped with RFID tags on student cards to effectively manage and distribute lockers in educational institutions. This technology allows for secure and time-limited locker usage, providing convenience and control for students. Additionally, the integration of coin-operated mechanisms in lockers has been investigated to offer user benefits and cost-effectiveness.

Furthermore, studies have focused on access control systems using RFID and password-based authentication methods. These systems employ RFID readers to scan ID numbers from RFID tags and require users to enter corresponding passwords for access. The combination of RFID and password technology enhances security and reliability in locker systems, ensuring that only authorized individuals can unlock the lockers.

The development of intelligent and efficient access control systems for computer laboratories has also been explored. These systems utilize components such as microcontrollers, wireless modules, RFID readers, RFID cards, and LCD touchscreens to secure laboratory access. The integration of Bluetooth technology through mobile devices has been employed to provide convenient access control. The proposed solutions incorporate features like personal identification numbers (PINs) and wireless notifications to enhance security and convenience for users.

In terms of locker materials and delivery processes, lockers have been widely used in e-commerce and city logistics. Parcel lockers have emerged as a cost-saving solution that extends delivery options beyond home delivery. Studies have proposed novel variants of vehicle routing problems that include locker delivery as an additional option. Mathematical programming models and optimization algorithms, such as simulated annealing, have been developed to address these routing problems and improve the efficiency of last-mile delivery in city logistics.

In summary, previous research and studies have focused on integrating RFID technology, access control systems, and intelligent features in locker systems. These innovations aim to enhance security, convenience, and cost-effectiveness in various

contexts, including educational institutions, computer laboratories, and e-commerce logistics. The combination of RFID, password authentication, Bluetooth technology, and mathematical optimization techniques contributes to the development of robust and efficient locker solutions.

Chapter 3

RESEARCH METHODOLOGY

Research Design

Respondents of the Study

Research Instruments

Statistical Treatment of Data

Statistical treatment of data is the techniques on how the researchers will compute the gathered data in an accurate manner.

Percentage

Percentage is a formula that the quotient will be divided 100 to exchange the quotient to percentage (%).

It is computed as $P = \frac{n}{N}(100)$ Where:

P = Percentage

n = Frequency

N = Population size

Weighted Mean

Weighted average is a formula where it computes the average value of each set of numbers with different levels of weight.

It is computed as $WM = \frac{\Sigma WF}{\Sigma W}$ Where:

Σ = the sum of set of numbers

W = Weights

F = Frequency

Software Design and Development

System Architecture

Figure 2

Software Development

Chapter 4

Chapter 5

APPENDICES

Republic of the Philippines
POLYTECHNIC UNIVERSITY OF THE PHILIPPINES
BACHELOR OF SCIENCE IN COMPUTER
ENGINEERING
DEPARTMENT OF ENGINEERING
NDC Campus, Pureza St., Sta. Mesa Manila, Philippines

"AUTOMATED COIN-SLOTTED LOCKER SYSTEM "

Section 1: Demographics
1. Age: _____
2. Gender: _____

3. Occupation: _____

4. Educational Background: _____

Section 2: Experience with Locker Systems

1. Have you used traditional coin-slotted lockers before? (Yes/No)

     If yes, please briefly describe your experience with traditional coin-slotted lockers.

Section 3: Automated Coin-Slotted Locker System

2. Are you familiar with the concept of an automated coin-slotted locker system? (Yes/No)

     If yes, where have you encountered or used this system before? (e.g., public places, transportation hubs, leisure facilities)

Section 4: Perceived Benefits

   Please rate the following potential benefits of an automated coin-slotted locker system on a scale from **1 to 4**, with **1** being "**Not important**" and **4** being "**Very important**."

1. Enhanced Security: Protection against theft or unauthorized access
2. Convenience: Easy and quick access to lockers without the need for additional steps
3. Real-time Monitoring: Ability to check locker availability remotely
4. Cost-effectiveness: Affordable pricing and transparent payment system

Section 5: Perceived Challenges
   Please rate the following potential challenges of an automated coin-slotted locker system on a scale from **1 to 4**, with **1** being "**Not challenging**" and **4** being "**Very challenging**."

1. Technical Reliability: Concerns about system malfunctions or downtime
2. User Interface: Ease of use and clarity of instructions
3. Maintenance: Concerns about regular upkeep and system management
4. Coin Acceptance: Worries about coins not being accepted or jamming issues

Section 6: Overall Perception

1. Based on your knowledge and experience, do you believe that an automated coin slotted locker system is a viable and practical solution? (Yes/No)

Please share any additional comments or insights you have regarding the automated coin-slotted locker system.

_____

_____

_____

Conclusion:

Thank you once again for participating in this questionnaire. Your responses are instrumental in contributing to the success of our thesis. If you have any questions or would like to provide further feedback, please feel free to contact us. Your input is highly valued and appreciated.

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