



Faculty of Computer Science and Information Technology

CAMPUSRETRIEVE: AQR BASED SOLUTION FOR MANAGING LOST AND FOUND

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Bachelor of Software Engineering with Honours
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CAMPUSRETRIEVE: AQR BASED SOLUTION FOR MANAGING LOST AND FOUND

Campusretrieve: Aqr Based Solution For Managing Lost And Found

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This project is submitted in partial fulfilment of the requirements for the degree of
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**CAMPUSRETRIEVE: PENYELESAIAN BERASASKAN QR UNTUK
MENGURUS BARANG HILANG DAN DIJUMPAI**

IRDINA FIKRIYAH BINTI RAJAK

Projek ini merupakan salah satu keperluan untuk
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ABSTRACT

CampusRetrieve is an innovative QR-based solution aimed at revolutionizing the management of lost and found items on campus. The system utilizes QR code technology to streamline the reporting, tracking, and retrieval of misplaced belongings in a more efficient and organized manner. By integrating a user-friendly web application, CampusRetrieve allows students and staff to easily register lost or found items, track their status in real-time, and facilitate secure item recovery. This approach eliminates the inefficiencies of traditional manual processes and minimizes the time and effort required to manage lost and found operations. The system also provides detailed records and accountability, ensuring a transparent and reliable process for all users. Furthermore, CampusRetrieve promotes a more connected campus community by leveraging modern technology to address everyday challenges, enhancing user convenience and satisfaction. The project ultimately aims to foster a more responsive and efficient campus environment that meets the needs of its users effectively.

ABSTRAK

CampusRetrieve ialah penyelesaian inovatif berasaskan QR yang bertujuan untuk memudahkan pengurusan barang yang hilang dan dijumpai di dalam kampus. Sistem ini menggunakan teknologi kod QR untuk mempermudah proses membuat laporan, penjejakan, dan juga pemulangan barang yang tersalah letak dengan lebih cekap dan teratur. Melalui integrasi aplikasi web mesra pengguna, CampusRetrieve membolehkan pelajar dan kakitangan mendaftarkan barang hilang atau dijumpai dengan mudah, menjejaki status barang secara masa nyata, dan memudahkan proses pemulangan barang secara selamat. Pendekatan ini untuk menghapuskan ketidakcekapan dalam proses manual tradisional dan mengurangkan masa serta usaha yang diperlukan untuk menguruskan operasi barang hilang dan dijumpai. Sistem ini juga menyediakan rekod yang lengkap serta sistematik, memastikan proses yang telus dan boleh dipercayai untuk semua pengguna. Selain itu, CampusRetrieve memupuk komuniti kampus yang lebih terhubung dengan memanfaatkan teknologi moden untuk menangani cabaran harian, sekaligus meningkatkan kemudahan dan kepuasan pengguna. Projek ini bertujuan untuk mencipta persekitaran kampus yang lebih responsif dan cekap yang memenuhi keperluan pengguna dengan berkesan..

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LIST OF ABBREVIATIONS

Abbreviation	Full Form
API	Application Programming Interface
CSS	Cascading Style Sheets
FYP	Final Year Project
HTML	Hypertext Markup Language
HTTPS	Hypertext Transfer Protocol Secure
ID	Identification
PHP	Hypertext Preprocessor
QR	Quick Response
RAD	Rapid Application Development
SDG	Sustainable Development Goals
SMTP	Simple Mail Transfer Protocol
SQL	Structured Query Language
UAT	User Acceptance Testing
UI	User Interface
UX	User Experience
UNIMAS	Universiti Malaysia Sarawak

CHAPTER 1 INTRODUCTION

1.1 Introduction

The introduction of CampusRetrieve, a QR-based web solution for managing lost and found items on university campuses, aligns closely with the principles of the United Nations' Sustainable Development Goal (SDG) 12: Responsible Consumption and Production. This goal emphasizes the importance of reducing waste and promoting sustainable practices in resource management.

As highlighted by Kumar et al. (2022) in the Web-Based Lost and Found System, modern living has introduced complexities that often lead to misplaced belongings in various locations. Traditional methods of handling lost and found items, such as posting physical notices or manual reporting, frequently result in inefficiencies that leave many items unclaimed. These unclaimed items are often discarded or improperly stored, contributing to waste and the misuse of resources. CampusRetrieve, a QR-based system for managing lost and found items, offers a sustainable and efficient alternative by leveraging QR (Quick Response) codes two-dimensional barcodes that store information and can be scanned using smartphones to access relevant data instantly. According to Zhang and Zhao (2020), QR codes improve accessibility and operational efficiency by enabling rapid data retrieval without the need for physical materials. In this project, QR codes are strategically placed around the UNIMAS campus to allow the university community to easily scan and browse the CampusRetrieve website, making it more convenient for users to report or search for lost items, thereby increasing the chances of successful item recovery while reducing paper waste.

By leveraging digital technology, CampusRetrieve minimizes waste and promotes the responsible management of resources. Its searchable database, automated notifications, and admin dashboard facilitate better accountability and traceability of lost and found items. This modern approach supports SDG 12 by fostering a culture of responsible consumption, where items are recovered, reused, and reintegrated into daily use instead of contributing to environmental waste.

Through these efforts, CampusRetrieve not only improves the lost and found process but also empowers campuses to adopt sustainable practices that align with global sustainability goals.

1.2 Problem Statement

The lack of an organized and efficient web-based system for managing lost and found items on campus leads to several significant challenges. One of the primary issues is delayed recovery; lost items are often not reported or found promptly, resulting in prolonged frustration for individuals who have misplaced their belongings. This delay not only complicates the recovery process but also diminishes the likelihood of items being returned to their rightful owners. Many academic institutions set up lost and found gathering stations, allowing students and teachers to return misplaced items. Examples include Cornell University and York University. Important items can still be left in the drop box at the public window for Lost & Found or by other conventional methods (Cornell, 2023; York, 2023), however they are inefficient because most students do not know where to look for the goods (RepoApp, 2019).

Moreover, many students and staff members are unaware of how or where to report lost items, which contributes to a cycle of inefficiency. The traditional methods of handling

lost and found items, such as noticeboards and manual reporting, are outdated and often unreliable, exacerbating the problem.

In addition to these challenges, existing lost and found locations are not well-known or frequently utilized by the campus community. This underutilization leads to a high number of unclaimed items, which further delays the recovery process. The lack of a particular lost and found system has disrupted the campus lives of students and staff, causing them to rely on social media platforms like WhatsApp and Facebook to report lost things, limiting the possibilities of recovery Tan, S. Y., & Chong, C. R. (2023).

The combination of these factors creates a fragmented and ineffective lost and found system, ultimately hindering the university's ability to assist students and staff in recovering their lost belongings. To address these pressing issues, there is a clear need for a modern, web-based solution that can streamline the reporting and retrieval processes, enhance user awareness, and facilitate better communication within the university community.

1.3 Aims & Objectives

The CampusRetrieve project is designed to address the current inefficiencies in managing lost and found items on campus. By leveraging technology, specifically a QR-based web platform, the system aims to streamline the reporting and recovery processes, improve accessibility, and increase the rate of item retrieval. The following objectives outline the key goals for the project:

- Develop a user-friendly platform for quick and easy reporting of lost and found items using QR codes.
- Create a searchable database of found items that users can filter by category, location, and date.

- Implement an automated notification system that alerts users when an item matching their lost report is found.

1.4 Scope

The scope of CampusRetrieve defines the system's boundaries and the user groups involved, focusing on the students of Universiti Malaysia Sarawak (UNIMAS) as the primary users.

System Boundaries: CampusRetrieve will operate as a web-based platform accessible through QR codes strategically placed around the UNIMAS campus. It will encompass the following functional areas:

- **Item Reporting and Tracking:** Users can report lost or found items by scanning QR codes and filling out a quick form. This information will be stored in a centralized database for easy tracking and retrieval.
- **Searchable Database:** A comprehensive and searchable database of lost and found items allows users to filter by categories such as item type, location, and date.
- **Automated Notifications:** The system will notify users when a found item matches the description of a lost item they have reported, enhancing the efficiency of the retrieval process.
- **Admin Dashboard:** University administrators will have access to a management interface for monitoring reported items, processing matches, and ensuring the system is functioning smoothly.
- **User Involvement:** The primary users are the students of UNIMAS, who frequently use campus facilities and are most likely to benefit from a more organized lost and found system. Additional users may include:

- **Faculty and Staff Members:** While students are the primary focus, faculty and staff members will also have access to the system for reporting or retrieving lost items.
- **University Administrators:** Assigned administrators will manage the system, oversee item recovery operations, and maintain database accuracy and user support.

This scope ensures CampusRetrieve meets the needs of its users while remaining manageable for the administrators overseeing lost and found operations at UNIMAS.

1.5 Brief Methodology

The methodology applied for this project is Rapid Application Development (RAD) model which is characterized by its focus on short iterative cycles, which facilitate ongoing user engagement and feedback throughout the software development process (Jan et al., 2020). This method is particularly well-suited for the CampusRetrieve project, as it facilitates rapid development and adaptability to meet the evolving needs of users at UNIMAS.

The stages of RAD for CampusRetrieve are as follows:

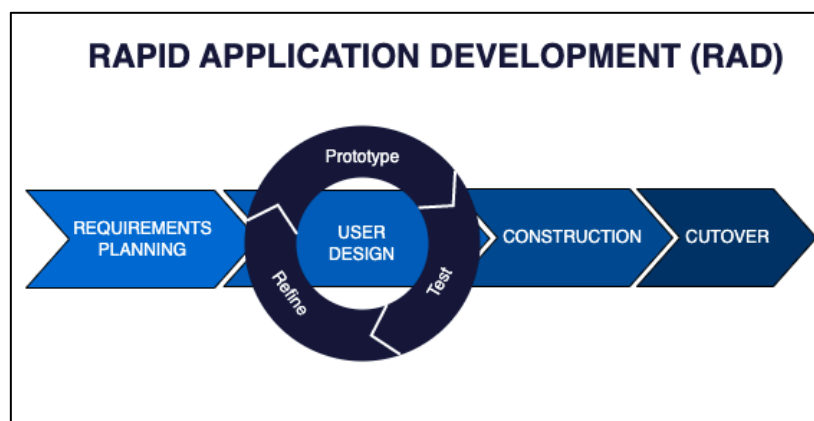


Figure 1.1:Rapid Application Development (RAD) (Airapetian, 2022)

1.5.1 Requirement Planning

In the initial stage, broad requirements will be gathered from feedback provided by students and university staff. This process will identify essential features for the lost and found system. Unlike traditional models, RAD allows for ongoing adjustments to requirements as new insights emerge. For CampusRetrieve, this will involve defining core functionalities, including QR-based reporting, item searchability, and notification features, while remaining flexible to incorporate changes as development progresses.

1.5.2 User Design

This phase focuses on creating rapid prototypes of the CampusRetrieve interface, such as the reporting form for lost items, the searchable database, and the QR code scanning interface. These prototypes will enable UNIMAS students and staff to interact with early versions of the system, providing feedback on usability, layout, and any missing features. By showcasing functionalities early, users can suggest improvements that will be quickly integrated into subsequent prototypes, ensuring that the system effectively addresses campus needs.

1.5.3 Construction and Testing

Following the user design phase, functional components of the system will be developed, including backend database integration and notification systems. Each iteration will undergo rigorous testing to ensure operational effectiveness, from QR code scanning to search filters. This phase will incorporate continuous adjustments based on user feedback, ensuring that the system is intuitive and reliable prior to full-scale deployment. Testing will involve participation from UNIMAS students, who will verify that the system operates as intended in day-to-day campus activities.

1.5.4 Cutover and Implementation

In the final stage, the completed CampusRetrieve system will be prepared for launch across the UNIMAS campus. This phase will prioritize system stability, user accessibility, and maintainability. A pilot launch will be conducted in a specific area of the campus for real-world testing. Based on feedback from this pilot, any necessary final adjustments will be made before a campus-wide rollout. Training sessions and guidance will be provided to ensure that students and staff understand how to access and utilize CampusRetrieve effectively.

The RAD methodology enables CampusRetrieve to be developed in a timely and responsive manner, ensuring that the final system closely aligns with the actual needs of UNIMAS students and administrators. Ultimately, this approach aims to enhance the efficiency and effectiveness of the lost and found process on campus.

1.6 Significance of Project

The significance of the project, CampusRetrieve: A QR-Based Solution for Managing Lost and Found, highlights the value and impact it will have on the university community.

Below are the key points that demonstrate its importance:

- 1. Increased Recovery Rates:**

By streamlining the process of reporting and retrieving lost items through a web-based platform, the project will reduce the time it takes for students and staff to recover their belongings. The quick and efficient reporting enabled by QR codes makes it easier to track and claim lost items, improving recovery rates.

- 2. Enhanced User Awareness:**

With QR codes placed in strategic locations across the campus, more people will become aware of the lost and found system. This awareness will lead to increased

engagement, where more items are reported and found, reducing the number of unclaimed belongings.

3. Improved Campus Security:

The system can help manage and track valuable or sensitive belongings. By recording found items in a structured way, it provides better accountability, helping deter theft or misuse of lost items and enhancing campus security.

4. Modern and Accessible Solution:

The use of a web-based platform accessible via mobile devices means that students and staff can easily access the system from anywhere on campus, promoting a more modern and connected campus environment. This is particularly relevant in today's digital age, where technology can provide faster and more reliable services.

5. Sustainability:

By replacing physical notices and manual records with a digital system, the project contributes to sustainability efforts by reducing paper use and other resource-heavy processes associated with traditional lost and found systems.

In summary, CampusRetrieve will not only simplify the lost and found process but also bring about increased awareness, improved security, and better resource management, making it a valuable addition to the university's infrastructure.

1.7 Project Schedule

To effectively manage the development and implementation of the CampusRetrieve project, a structured timeline has been established. The following Gantt chart outlines the key phases of the project, including planning, design, development, testing, and deployment. Each phase includes specific tasks and milestones, ensuring that the project

stays on track and meets its objectives within the designated timeframe. Refer to the appendices. Refer to the Appendix A for detail timeline.

1.8 Expected Outcome

CampusRetrieve is expected to transform the lost and found process on campus by providing a digital, streamlined, and user-friendly platform for item recovery. The anticipated outcomes of this project are:

i. Efficient and Accessible Reporting System

A user-friendly platform that allows students and staff to report and search for lost and found items quickly. The system will be accessible via QR codes placed in key areas around the campus, ensuring easy access and usability for all campus members.

ii. Automated Notification Alerts

An automated notification system to promptly inform users when a found item matches their report. This feature will help users retrieve their belongings quickly and with minimal effort, enhancing the overall efficiency of the lost and found process.

iii. Increased User Engagement and Satisfaction

A high level of user engagement and satisfaction, as students and staff actively use the platform. User feedback will indicate the system's ease of use, convenience, and its impact on improving the overall lost and found process on campus.

1.9 Report Outline

This section provides a detailed outline of the structure and organization of the study, which is divided into three main chapters. Each chapter is designed to focus on a specific aspect of the research, guiding the reader through the process from the background and context of the problem to the methodology used to develop and implement the solution.

The chapters have been carefully organized to support the overall objectives of the study and provide a comprehensive understanding of the topic.

Chapter 1: Introduction

Introduction introduces the research, establishing the context and highlighting the importance of addressing the challenges associated with managing lost and found items on university campuses. This chapter includes the problem statement, objectives of the project, the scope of the study, and the significance of the research in the academic and practical context.

Chapter 2: Literature Review

Literature Review provides a thorough review of existing literature related to the topic, focusing on the limitations of traditional lost and found systems and exploring the potential of new technologies such as QR codes. It delves into studies, case examples, and theoretical frameworks that inform the development of the proposed system.

Chapter 3: Requirement Analysis and Design

Methodology outlines the research design and development process for the proposed system. This chapter describes the methodology chosen for the project, including the use of the RAD model. It also details the development phases, tools, and technologies employed, as well as the data collection and testing procedures that will ensure the system meets the project's objectives.

Chapter 4: Implementation

This chapter describes the actual development of the system based on the design and requirements outlined in the previous chapter. It covers the implementation of core features such as user registration, item reporting, QR code generation and scanning, database integration, and user interfaces. Screenshots, code snippets, and descriptions of

key functionalities are included to illustrate the development process and how each component contributes to the overall system.

Chapter 5: Testing

This chapter discusses the testing strategies used to ensure the reliability and functionality of the system. It includes unit testing, integration testing, system testing, and user acceptance testing (UAT). Test cases, expected outcomes, actual results, and any bugs or issues identified are documented. The chapter also presents feedback from users and how it was used to improve the system.

Chapter 6: Conclusion and Future Works

The final chapter summarizes the project's achievements and assesses how well the objectives have been met. It reflects on the strengths and limitations of the current system and discusses challenges faced during the project. The chapter concludes with recommendations for future improvements, such as incorporating artificial intelligence for item matching, expanding the system to support multiple institutions, or developing a mobile application version for broader accessibility.

1.10 Chapter Summary

This chapter highlights the inefficiencies of traditional lost and found methods on university campuses, such as bulletin boards and manual reporting, which often result in delays and unclaimed items. CampusRetrieve, a QR-based web platform, is introduced as a solution to streamline the reporting and recovery process, enhance awareness, and improve efficiency. The chapter defines the problem, scope, and objectives, focusing on features like QR-based reporting, a searchable database, and automated notifications. It also briefly explains the use of the RAD model to ensure iterative and responsive

development. The significance of the project is emphasized, including its potential to boost recovery rates, enhance campus security, and support sustainability.

CHAPTER 2 LITERATURE REVIEW

2.1 Background Study

The proposed lost and found management system, CampusRetrieve, aligns with Sustainable Development Goal (SDG) 12, which highlights the importance of fostering sustainable consumption and production patterns. This goal emphasizes the need to minimize waste, utilize resources efficiently, and adopt practices that reduce environmental impact. Traditional lost and found systems, often characterized by manual and inefficient processes, contribute to unnecessary waste. Frequently, unclaimed items are discarded, leading owners to purchase replacements, which increases the demand for production and consumption. Such practices not only waste valuable resources but also contribute to environmental degradation (Khan, 2024).



Figure 2.1:Shows the SDG number 12 (Gasper et al., 2019)

The targets of SDG 12 specifically highlight the significance of sustainable corporate practices and reporting (Gasper, Shah, & Tankha, 2019, p. 4). This focus aligns with the idea that an effectively managed lost and found system can promote sustainable practices by decreasing the necessity for replacements and minimizing waste. By implementing CampusRetrieve, we can address these issues and contribute to the overarching goals of sustainability.

CampusRetrieve provides a contemporary, technology-enhanced solution to outdated systems. By utilizing QR-based technology, the platform ensures that lost items are systematically cataloged and swiftly returned to their rightful owners. This approach minimizes the chances of items being discarded or replaced, thereby directly supporting the goal of reducing waste and encouraging sustainable consumption as outlined in the Sustainable Development Goals (SDG 12) (Khan, 2023). Additionally, the system's streamlined processes save users time and alleviate frustration, promoting a more efficient and user-friendly method for managing lost and found items.

Furthermore, CampusRetrieve implements a completely digital solution, eliminating the dependence on paper-based processes such as bulletin board for missing items. By removing the necessity for physical records, the system not only conserves natural resources but also mitigates the environmental impact linked to paper production and waste. This shift to digital processes embodies sustainable production practices and demonstrates how technology can be utilized to tackle environmental challenges. As noted, effective sustainable waste management is essential for protecting the biosphere and preventing irreversible global damage by reducing toxic waste and environmental pollution while conserving natural resources (Ram & Bracci, 2024).

In addition to practical benefits, the system can serve as a platform for promoting awareness about sustainability. For example, with the existence of CampusRetrieve, it can encourage users to adopt responsible behaviors, such as reusing recovered items rather than purchasing new ones. CampusRetrieve not only addresses the operational inefficiencies of traditional lost and found systems but also contributes to building a culture of sustainability on campus, aligning with the broader goals of SDG 12. By integrating resource efficiency, waste reduction, and sustainability education, the system exemplifies how technology can enhance stakeholder awareness and engagement,

ultimately driving meaningful change in consumption and production patterns (Rahman & Hossain, 2024).

2.1.1 Reducing Waste and Improving Efficiency

One of the key contributions of CampusRetrieve to SDG 12 is its ability to reduce waste. Traditional lost and found systems often result in items being discarded or replaced unnecessarily. By enabling faster and more accurate recovery of lost items, CampusRetrieve minimizes waste and prevents the production of replacement items. It can enhance responsible consumption by facilitating the effective return of lost objects to their rightful owners instead of their disposal (Jayasooria & Yi, 2022). This minimizes waste and promotes item reuse, consistent with the tenets of sustainable consumption and production. This supports the goal of reducing the ecological footprint through sustainable consumption patterns.

In addition, the digitalization of the lost and found process eliminates the need for physical records such as announcement board. Sustainable Practices: The system can integrate sustainable practices, including the utilization of eco-friendly materials for storage and the promotion of digital tracking for missing objects to reduce paper waste. This corresponds with the overarching objectives of SDG 12 to guarantee sustainable production methods (Jayasooria & Yi, 2022). By using electronic records stored in a centralized database, the system conserves natural resources, aligns with environmentally friendly practices, and reduces the carbon footprint of campus operations.

2.1.2 Centralized Inventory for Reuse and Recycling

CampusRetrieve also contributes to SDG 12 through its centralized inventory of unclaimed items. This feature allows for better management of lost items, ensuring they are not wasted. By maintaining a digital record of all found items, the system enables

sustainable practices such as reuse and recycling. Effective management of resources, including comprehensive tracking and mapping of items, is essential for enhancing recycling efforts and minimizing waste (Ajwani-Ramchandani et al., 2021).

Reuse: Items like clothing, umbrellas, and accessories can be cleaned and redistributed to others in need, reducing the demand for new production. This helps minimize waste while supporting responsible consumption patterns.

Recycling: Unusable or outdated items, such as electronic devices, can be properly recycled, preventing them from being discarded irresponsibly. Responsible recycling ensures that materials are recovered and reused in other products, further reducing environmental impact.

To ensure efficient management, CampusRetrieve recommends a waiting period of 30 to 60 days for unclaimed items. This is to give the opportunity to recover their belongings. Valuable items, such as electronics or jewellery, may warrant a longer waiting period (e.g., 60–90 days), while everyday items like water bottles and umbrellas can follow shorter timelines (e.g., 30 days).

After the waiting period concludes, unclaimed items are evaluated for their potential for reuse. Items identified as reusable are cleaned and redistributed to charities, students, or staff in need. This practice aligns with the principles of circular resource management, which emphasizes the importance of keeping resources in use for as long as possible (Browning et al., 2021). Those that are damaged or outdated are sent to suitable recycling channels to ensure responsible disposal. This strategy not only reduces waste but also fosters a circular economy by extending the lifecycle of resources.

CampusRetrieve's centralized inventory supports a sustainable campus ecosystem by reducing the environmental impact associated with lost items. By emphasizing reuse and

recycling, the system aligns with SDG 12's goals of promoting efficient resource management and sustainable production practices.

2.2 Key Issues and Concepts in Lost and Found System

The challenges of lost and found management have persisted for decades, primarily due to inefficient processes and limited adoption of technology. In the fast-paced daily life, the phenomenon of losing things is common and the situation of picking up lost properties also happens frequently (Zhao, H., & Peng, S, 2018). Miscommunication, delayed retrieval, and the lack of a standardized system are common issues that lead to dissatisfaction among users. Understanding these challenges involves analyzing specific keywords that define the problems within the domain:

- **Lost Item Registration:** One of the primary challenges is providing users with a simple and effective way to report lost items. Without a streamlined reporting process, many items remain unrecorded, reducing the chances of their recovery.
- **Item Categorization:** Effective lost and found systems must organize items into clear categories such as electronics, clothing, personal documents, and more. Without categorization, the search and retrieval process become chaotic and time-consuming.
- **Owner Verification:** Ensuring the rightful owner retrieves an item is critical. Weak verification processes can lead to disputes or lost trust in the system, making this a key area for improvement.
- **Notification Systems:** Timely communication is essential for user satisfaction. Systems that notify users when their items are found or matched are more likely to succeed. This feature ensures users remain engaged and informed throughout the process.

- **Digitalized Inventory Management:** Transitioning from manual records to digital systems enables more accurate tracking, reduces human error, and improves the overall efficiency of the system.

These issues demonstrate the need for an innovative, technology-driven approach to lost and found management that prioritizes user experience, efficiency, and security.

2.3 Background of Existing System

Lost and found management systems are essential for helping users recover misplaced items efficiently by streamlining the processes of reporting, tracking, and retrieval. However, many of these systems are designed for specific audiences, such as individual users or large organizations, which limits their adaptability in community-based settings like campuses. Campuses are unique environments with diverse users, including students, staff, and visitors, and dynamic interactions that require more flexible, inclusive solutions. This highlights a gap in existing systems, emphasizing the need for solutions that are better suited to the distinct requirements of campus-based lost and found management. Below is an analysis of three existing systems and their relevance to this context.

2.3.1 System 1: Tagmefy



Figure 2.2: Shows the logo of Tagmefy (tagmefy.n.d.)

Tagmefy.com is an innovative lost and found platform that uses QR codes to tag personal belongings. Users purchase QR-code-enabled tags and attach them to their items. These

unique identifiers are linked to the user's profile, allowing for easy tracking of personal items. If a tagged item is lost and subsequently found, the finder can simply scan the QR code to access the owner's contact details. This system is designed to prioritize user privacy; rather than directly sharing personal information with the finder, the platform facilitates communication through secure messaging. This feature ensures that the owner's privacy is protected while still enabling the retrieval of their lost belongings.

One of Tagmefy.com's key features is its focus on QR code technology. By attaching a QR code to each item, users can easily locate and retrieve their lost items by having finders scan the code. This enables faster identification of the owner, and the process is relatively simple and straightforward. The secure messaging feature adds an extra layer of privacy, which is particularly useful for users who may be concerned about sharing their contact information directly with strangers.

However, the usability of Tagmefy.com is limited by a few key factors. The system heavily relies on users pre-tagging their items with QR codes. This requirement excludes items that were not tagged before being lost, which reduces the platform's effectiveness for spontaneous or unforeseen losses. If an item wasn't tagged beforehand, it cannot be identified through the system, making it unusable for those types of situations. This reliance on pre-tagging limits the accessibility and flexibility of the platform, especially in environments where users may not think to tag their belongings in advance.

Additionally, Tagmefy.com is primarily designed for individual users, with no centralized database to manage lost items within a shared environment, such as a campus or office. This makes it less effective for larger community-based settings where multiple individuals may be involved in reporting and retrieving lost items. Without a centralized system to organize and track lost items, the platform becomes less scalable and practical for environments with a higher volume of lost and found activity. As a result, while

Tagmefy.com offers privacy-focused and efficient solutions for personal use, it lacks the necessary features and infrastructure to serve the needs of community-based lost and found management.

2.3.2 System 2: Troov



Figure 2.3:Shows the logo of Troov (Troov.n.d.)

Troov.com is a centralized lost and found management platform designed for institutions, public spaces, and large organizations. Its core feature is a centralized database where users can report lost items and search for their belongings. This centralization allows organizations to maintain a comprehensive inventory of lost items, making it easier for users to locate their lost belongings within a single system. Once an item is reported as lost, users can search the database to see if a found item matches their description.

The platform leverages algorithmic matching to simplify the identification process. When a user reports a lost item, Troov.com automatically scans the database for potential matches with found items, making the retrieval process faster and more accurate. This matching feature helps reduce the time it takes to find lost belongings and improves the overall user experience.

Additionally, Troov.com includes notifications that alert users when a match is found. These alerts keep users informed about the status of their lost items and help them act quickly to retrieve their belongings. This feature enhances the system's efficiency by keeping users engaged and reducing the need for manual checking.

While Troov.com is effective in large organizations and public spaces, it has limitations in terms of flexibility and customization for environments like university campuses. The system lacks features that are particularly valuable in campus settings, such as QR code technology for real-time item identification. QR codes could streamline the process of reporting and retrieving items, making it easier for users to quickly scan and identify lost items. The absence of QR code functionality makes the system less efficient in scenarios where instant recognition is crucial, like on a campus with a high volume of lost items. Moreover, Troov.com's robust platform, designed for large organizations, may be too complex for smaller, community-focused settings like university campuses. Campuses often require a more personalized and flexible system to address the diverse needs of students, staff, and visitors. Troov.com's lack of customization options means that it may not offer the personalized user experience necessary for campus environments, where interactions tend to be more informal and varied compared to large, corporate organizations.

2.3.3 System 3: Faundit



Figure 2.4: Shows the logo of Faundit (Faundit.n.d.)

Faundit.com is a comprehensive lost and found management platform primarily designed for businesses in high-traffic environments such as hotels, airports, and public organizations. It offers several advanced features to streamline the process of tracking and managing lost items. One of its standout features is the advanced inventory tracking system, which allows businesses to monitor and manage large volumes of lost items. This

feature is critical for organizations that need to handle numerous lost items daily, ensuring that items are recorded, tracked, and located quickly.

Another key feature of Faundit.com is its automated communication system. When a lost item is reported or found, the platform automatically notifies the owner, streamlining the communication process and reducing the need for manual follow-up. This automated system is essential for businesses where operational efficiency and quick customer service are a priority.

Faundit.com also includes analytics tools that provide businesses with valuable insights into lost and found trends. These insights help businesses understand patterns in lost items, such as the most frequently misplaced items, peak times for loss, or common locations for lost items. With this data, businesses can make informed decisions about improving their processes or adjusting operations to reduce losses.

Despite these strengths, Faundit.com is not as well-suited for environments like university campuses, where the context is more personal, and community based. The platform's focus on businesses means it lacks features that would make it accessible and convenient for individual users in a campus environment. For instance, the platform is designed primarily for business staff, with less emphasis on user-friendly tools for everyday people, such as students and staff members who might need to report or retrieve a lost item. Additionally, the system does not incorporate QR codes for instant identification of items, a feature that would greatly enhance the speed and ease of reporting and retrieving lost belongings in a campus setting. This makes Faundit.com less effective for environments where quick, simple interactions and real-time notifications are essential

2.4 Comparison between Existing System and Proposed System

Table 2.1: Comparison Systems

Features	System 1 Tagmefy.com	System 2 Troov.com	System 3 Faundit.com	Proposed System CampusRetrieve
QR Code Integration	Yes, but limited to pre-tagged items, requiring users to purchase and register tags.	No QR code integration for real-time item identification.	No QR code support; item identification relies on manual search and categorization.	Robust QR code integration allows users to easily register and track items, enhancing retrieval efficiency.
Community-based Functionality	No, primarily focused on individual users tagging their belongings.	Partial, allows institutions to set up their lost and found database, but lacks personalization.	No, designed for businesses like hotels and airports rather than community-based environments.	Yes, tailored for campus communities to facilitate inclusive participation among students, staff, and visitors.
Real-time Notifications	Yes, users receive notifications if someone scans their tagged item.	Yes, users are notified when a potential match is found in the database.	Yes, notifications are sent to item owners automatically based on inventory updates.	Yes, real-time notifications will inform users of matched or found items as soon as they are identified.
Inventory Management	No, relies on individual users tracking their items; no centralized database.	Yes, provides a centralized database with search and categorization features.	Yes, includes advanced inventory management with reporting tools for businesses.	Yes, a centralized inventory system allows for seamless tracking, categorization, and reporting of lost and found items.
User Engagement	Moderate, as it requires users to pre-tag items; no	Moderate, allows users to report and search for	Low, focused on business efficiency rather than engaging	High, designed to foster user engagement through a simple,

	engagement for unregistered users.	items but lacks interactivity or gamification.	with individual users.	intuitive interface and inclusive features for the entire campus.
Adaptability of Campus Needs	Low, primarily a personal solution with limited scalability for community settings.	Moderate, suitable for institutions but lacks customization for specific campus requirements.	Low, tailored for businesses and corporate environments, not educational institutions.	High, specifically designed to meet the needs of campus environments with customizable features and scalability.
Ease of Use	Moderate, requires users to purchase and register tags; finders must scan and follow instructions.	High, provides an intuitive interface for reporting and searching lost items.	Moderate, interfaces are designed for business users, which might not be intuitive for all.	High, user-friendly design ensures that all campus members, including those less tech-savvy, can easily report or find items.
Cost-effectiveness	Low, requires individual users to invest in tagging solutions and ongoing subscriptions.	Moderate, may involve subscription fees for institutions but provides comprehensive features.	Low, primarily targeted at businesses with higher licensing and operational costs.	High, offers an affordable and scalable solution for campus environments with minimal cost to end users.

2.5 Proposed System Justification

CampusRetrieve is a specialised solution that solves the unique issues of lost and found management in campus settings by filling the gaps created by existing systems. Current platforms frequently lack capabilities that adapt to the dynamic and community-oriented nature of campuses. For example, Tagmefy.com focusses on personal tagging but only allows pre-tagged objects and lacks community-wide capabilities. Troov.com offers centralised management but lacks real-time identification technologies such as QR codes, which are critical for immediate access and usage. Similarly, Faundit.com serves to enterprises that handle high volumes of commodities but lacks the adaptability, personalisation, and inclusion required for campus environments.

CampusRetrieve solves these restrictions by using QR code technology in a unique manner. Instead of depending on users to pre-tag goods, CampusRetrieve inserts QR codes in key areas throughout campus. Scanning these QR codes connects users to the system's website, where they can report lost or discovered items easily. This simplifies the procedure for users, making it more accessible and simpler, and ensures that the system is actively used across campus.

The software also includes centralised inventory management to retain an organised record of reported things and real-time notifications to keep users informed about the status of their belongings. These features improve the system's efficiency, shorten delays, and increase user happiness.

Inclusivity is another key element of CampusRetrieve, as it allows all campus members, even unregistered users, to access the system. Its scalable and user-friendly architecture allows it to adapt to the needs of different campuses, ranging from small colleges to huge universities.

Lastly, CampusRetrieve provides a cost-effective and practical solution for lost and found management. It caters to both campus administrators and users by combining innovative technology, user accessibility, and operational effectiveness. This makes CampusRetrieve a comprehensive and innovative solution for today's campus contexts

2.6 Chapter Summary

This chapter analysed the issues of lost and found management and reviewed three existing systems: Tagmefy.com, Troov.com, and Faundit.com. The investigation emphasised their distinct capabilities, such as personal tagging, centralised inventory management, and high-volume handling, but also identified important drawbacks, such as a lack of adaptability, inclusivity, and real-time identification tools appropriate for college environments. These findings highlight the need for a solution such as CampusRetrieve, which combines QR code technology, centralised management, and real-time notifications to deliver an efficient and user-friendly experience. CampusRetrieve, designed exclusively for university environments, fills in the gaps left by existing systems while ensuring accessibility and ease for all users. This chapter provides the groundwork for CampusRetrieve's future development by aligning its features and capabilities with the specific demands of campus communities.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter outlines the methodology used in the development of the CampusRetrieve system. To ensure an efficient and user-centered development process, the Rapid Application Development (RAD) model was chosen. RAD emphasizes quick iterations, user involvement, and rapid prototyping, making it an ideal choice for projects requiring frequent feedback and adaptability. This methodology develops a life cycle design to provide rapid development with high quality compared to older and longer methods, taking advantage of the excellent opportunity for a strong program of development (Salleh et al., 2011). The methodology is divided into several phases, starting with requirement planning to establish the project's objectives and scope. Additionally, several development cycles can be created simultaneously, with each cycle consisting of two development and test phases, which are called modules (Grünloh et al., 2015).

3.2 Rapid Application Development (RAD)

The RAD model is a software development methodology that prioritizes speed and flexibility in the development process. It involves iterative prototyping, constant user feedback, and parallel development cycles to produce a high-quality system within a shorter time frame. As noted in the literature, Rapid Application Development (RAD) is a system development method with a prototyping approach designed to produce high-quality systems with relatively fast time and relatively low costs (Tabrani et al., 2021). Additionally, the RAD method is described as "suitable to produce software systems with urgent requirements and a short time in completing (Tabrani et al., 2021). CampusRetrieve adopted the RAD model to ensure the system met user expectations while adhering to tight development timelines. The methodology includes "main elements

as unique methodology including prototyping, iterative development, time boxing, the use of team members, management approach, and the use of tools in its implementing (Tabrani et al., 2021).

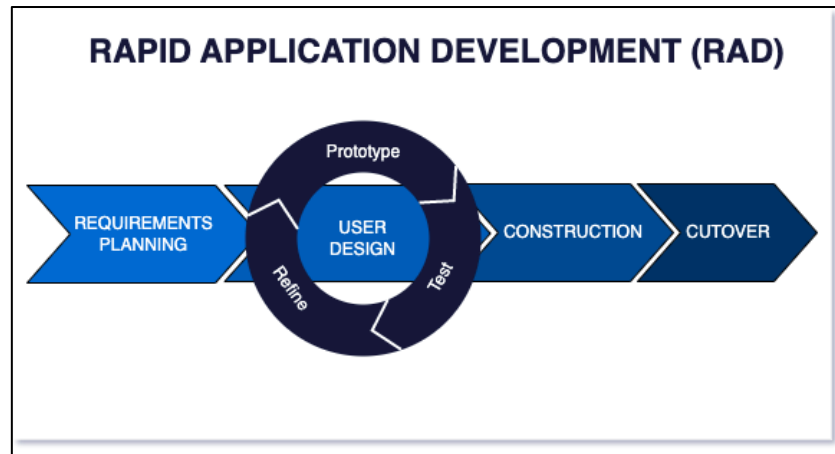


Figure 3.1:Rapid Application Development (RAD) (Airapetian, 2022)

3.2.1 Phase 1: Requirement Planning

The requirement planning phase involved identifying the system's primary objectives, target users, and essential functionalities. Key activities in this phase included continual user involvement, which is a fundamental aspect of the Rapid Application Development (RAD) model. This approach emphasizes the importance of accurately gathering user requirements through prototyping, allowing users to visualize the product and provide feedback early in the development process (Jan et al., 2020). The iterative nature of RAD facilitates adjustments based on user feedback, ensuring that the final product aligns with user expectations and needs (Jan et al., 2020). These are the overview of the requirements planning;

1. **Problem Identification:** The inefficiencies in the campus's current lost and found process were analysed, emphasizing the need for a centralized, technology-driven solution.

2. **Stakeholder Consultation:** Feedback was gathered from students, visitor and staff to understand their needs and pain points regarding lost and found management.
3. **Defining System Objectives:** The core objectives were outlined, including the use of QR codes to access the system, creating a searchable database of items, and implementing an automated notification system.
4. **Scope Definition:** The scope was defined to include essential functionalities such as reporting, searching, and admin management while ensuring scalability for future enhancements.

3.2.1.1 Questionnaire

The questionnaire was designed to gather feedback from the campus community about their experiences with lost and found items and their views on the proposed QR-based CampusRetrieve system. It targeted students, staff, and visitors, covering topics such as the frequency of campus visits, previous experiences with lost items, and the methods used to recover them. Respondents also shared their preferences for system features like quick reporting, searchable databases, and automated notifications. The survey targeted 50 respondents from the campus community, with the majority of responses coming from students. The survey was conducted over a one-week period using Google Forms and included 19 close-ended questions and one open-ended question. The data collected provides valuable insights to guide the development of a system that meets the community's needs and enhances the efficiency of managing lost and found items.

Close-Ended Question

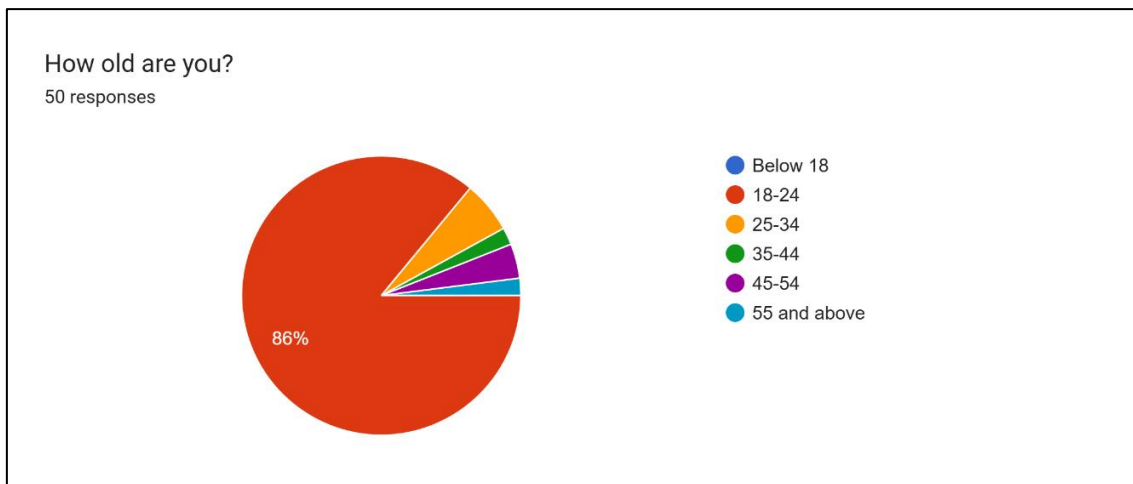


Figure 3.2:Pie Chart of Age Distribution.

The age distribution of the poll indicates that 86.3% of respondents are aged 18-24, which aligns with the majority age range of university students utilizing the CampusRetrieve system. This emphasis guarantees that the data provided is particularly relevant to the system's target audience. Furthermore, feedback from various age demographics, including academics and staff, offers comprehensive insights, making the survey results realistic and representative of the campus community's requirements.

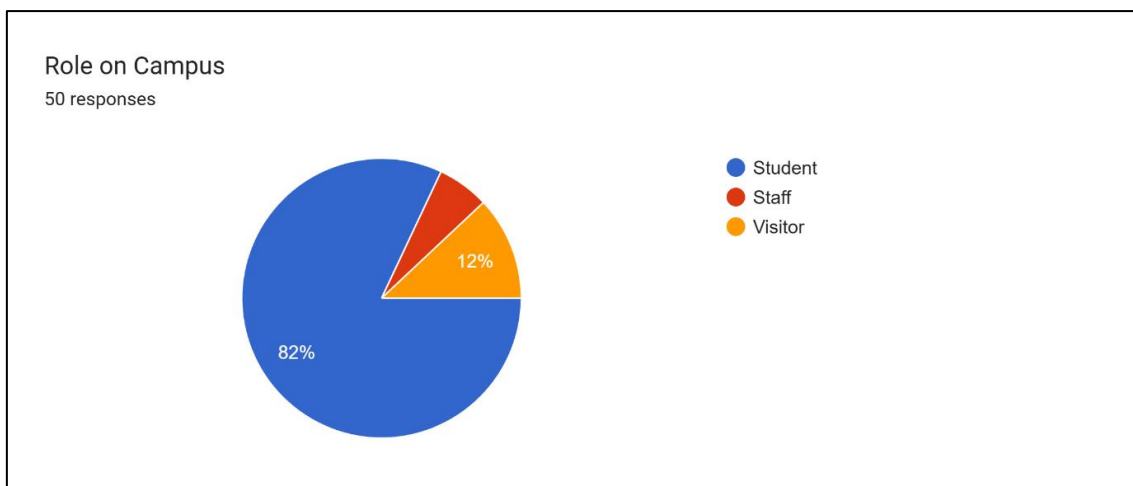


Figure 3.3:Pie Chart Role on Campus.

The survey's role distribution indicates that 80.4% of respondents are students, the main users of the CampusRetrieve system, thereby ensuring the feedback is important to its primary audience. Contributions from staff (6%) and visitors (13.7%) provide valuable

insights from other campus stakeholders, rendering the survey results comprehensive and representative of different positions within the campus community.

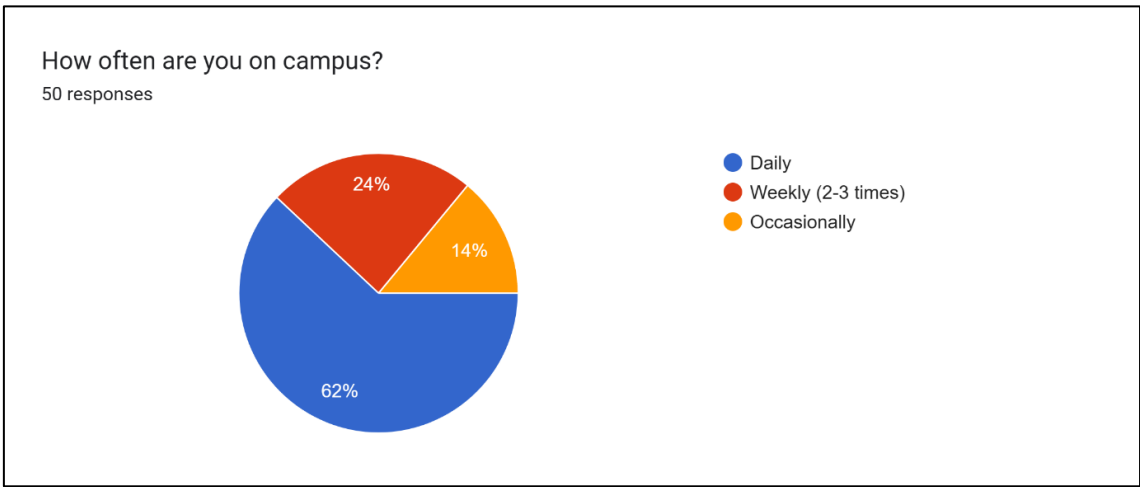


Figure 3.4:Pie Chart of Frequency of Campus Visits.

The survey finds that 60.8% of the respondents frequent the campus daily, corresponding with the system's main target demographic most prone to experiencing lost and found incidents. Furthermore, contributions from individuals visiting 2-3 times weekly (23.5%) and infrequently (15.7%) guarantee that the system is structured to adapt to all levels of campus participation, resulting it inclusive and adaptive for all users.

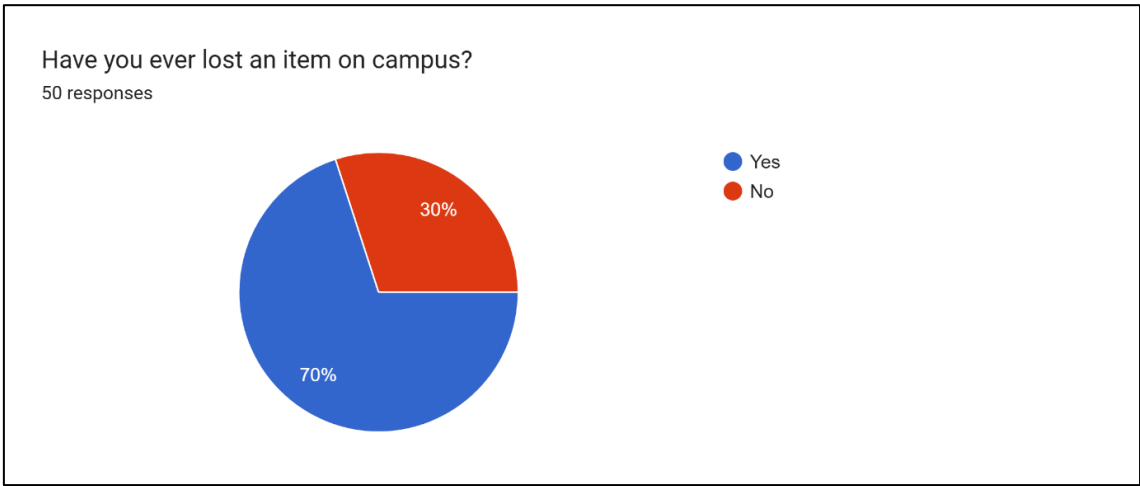


Figure 3.5:Pie Chart of Experience of Losing Items on Campus.

The poll indicates that 70.6% of participants have encountered the loss of an item on campus, highlighting the importance and need for the CampusRetrieve system. The

remaining 29.4% offers insights from those who may still gain from the system's capacity to recover lost goods, ensuring the system effectively serves both groups.

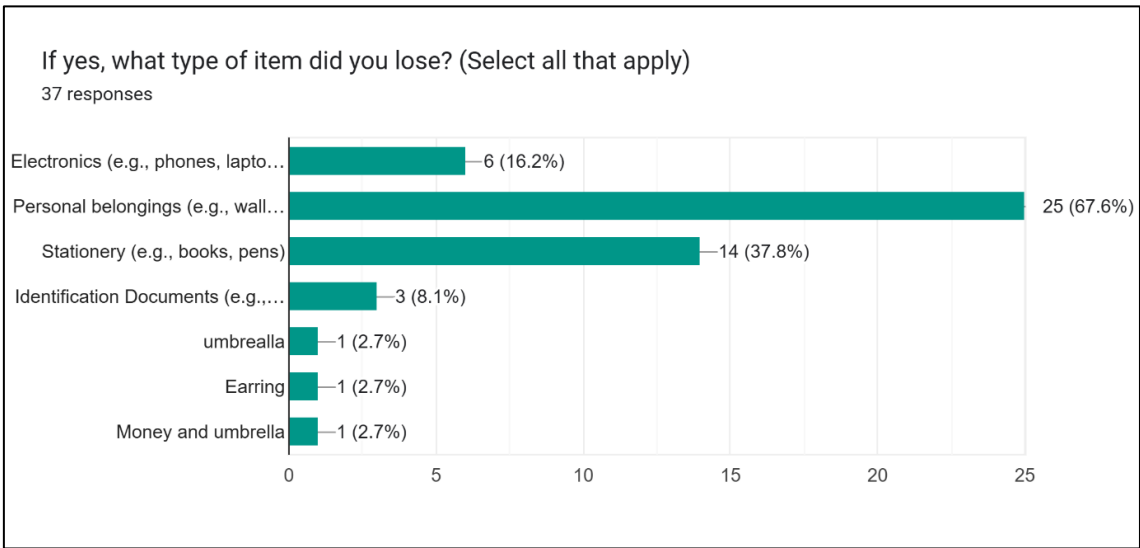


Figure 3.6:Bar Chart of Type of Lost Items.

The poll shows that personal belongings (68.4%) are the most frequently misplaced goods on campus, succeeded by stationery (39.5%), gadgets (15.8%), and identification documents (10.5%). This data underscores the necessity of creating the CampusRetrieve system that includes various item types, enabling users in promptly reporting and searching for a wide range of lost things.

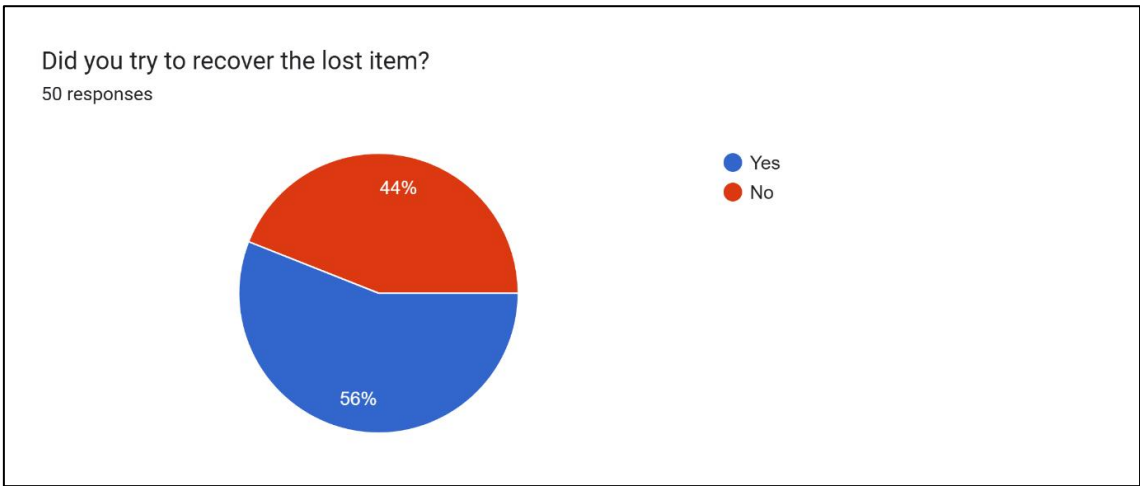


Figure 3.7:Pie Chart of Efforts to Recover Lost Items.

The survey shows that 56.9% of participants attempted to reclaim their lost goods, highlighting the need for a successful approach such as CampusRetrieve that can help this

process. The 43.1% who did not might benefit from the system's user-friendliness, promoting increased proactive involvement in retrieving lost items.

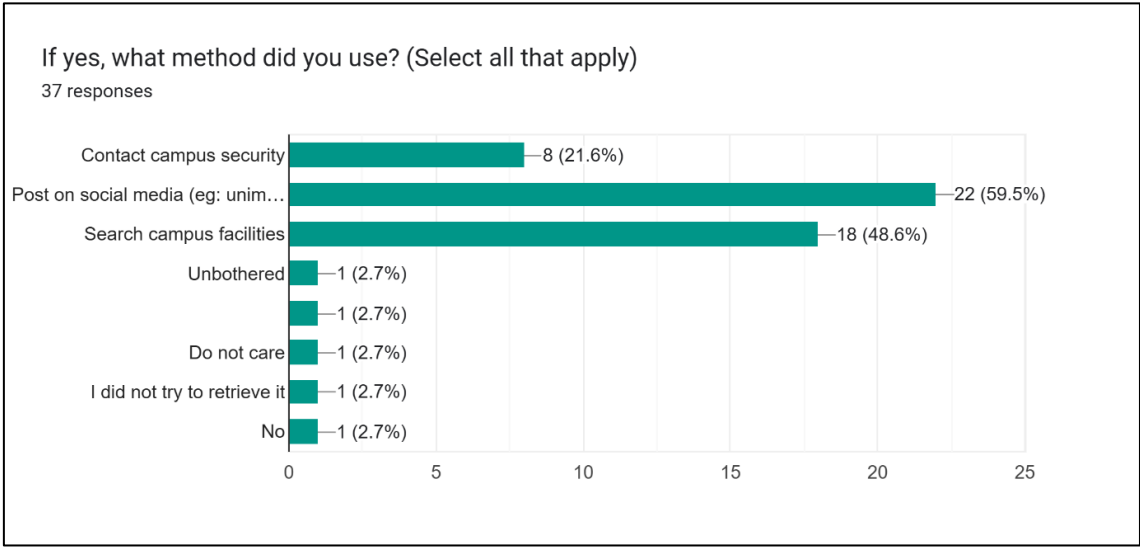


Figure 3.8:Bar Chart of Methods Used to Recover Lost Items.

The survey reveals that 57.9% of participants used social media, 50% searched information on campus facilities, and 21.1% reached out to university safety personnel for assistance in recovering lost things. This underscores its current dependence on informal and manual techniques, highlighting the need for a centralized, successful approach such as CampusRetrieve, which may improve the method and improve the possibility of item recovery.

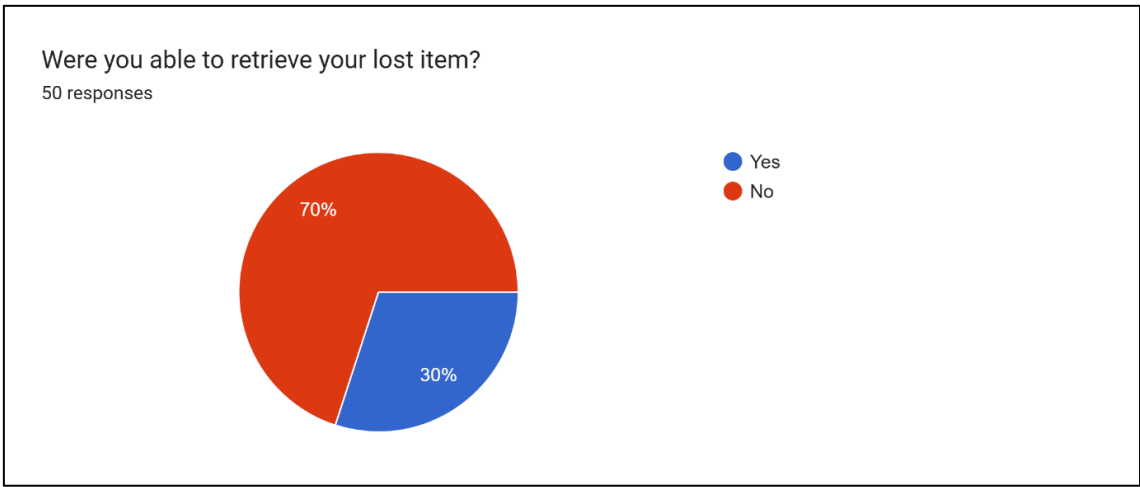


Figure 3.9:Pie Chart of Success in Retrieving Lost Items.

The survey finds that approximately 29.4% of participants successfully recovered their lost belongings, whereas 70.6% did not. This emphasizes the importance for a more

efficient system such as CampusRetrieve, which could increase the likelihood of retrieving lost things by offering a centralized platform for reporting and matching lost and found items.

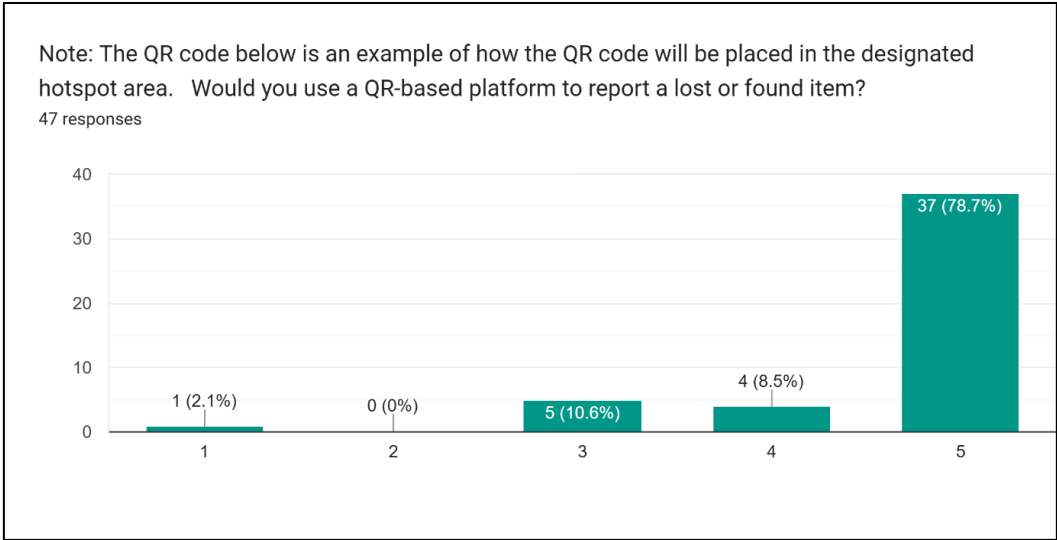


Figure 3.10:: Bar Chart of Willingness to Use QR-Based Platform.

The survey signifies that 79.2% of participants would absolutely use a QR-based platform for reporting lost or discovered things, showing significant interest and acceptance of the CampusRetrieve system. The 2.1% who would not utilize it as a minor part of the user base that may require further education or alternate reporting techniques; at this point the large number of favorable replies underscores the system's potential success and attractiveness.

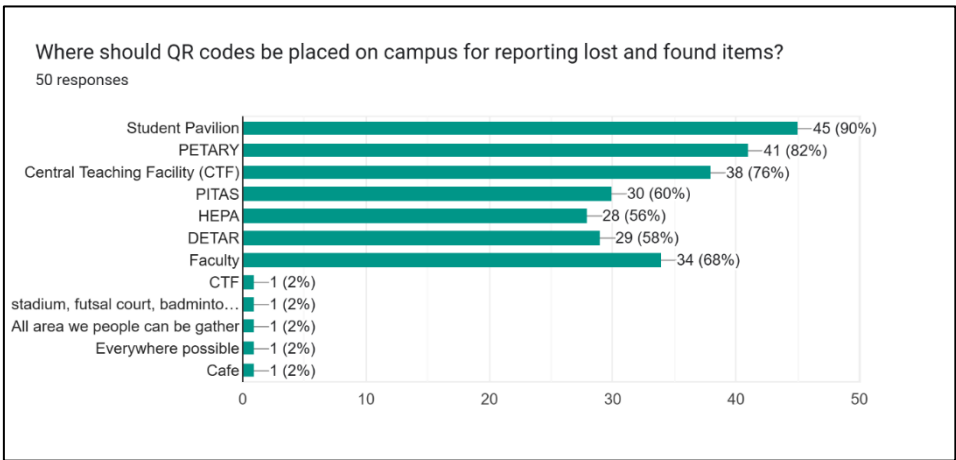


Figure 3.11:Bar Chart of Preferred Locations for QR Code Placement.

The results of the survey show that Student Pavilion (90.2%) is the most favored site for QR code deployment, followed by PETARY (82.4%), CTF (76.5%), and Faculty (68.6%). The increased percentages suggest that users consider these locations essential to campus activities and ideal for ease of access to the QR-based reporting tool. Strategic placement at these hotspots guarantees optimal visibility and accessibility, promoting increased utilization of the system by the university community.

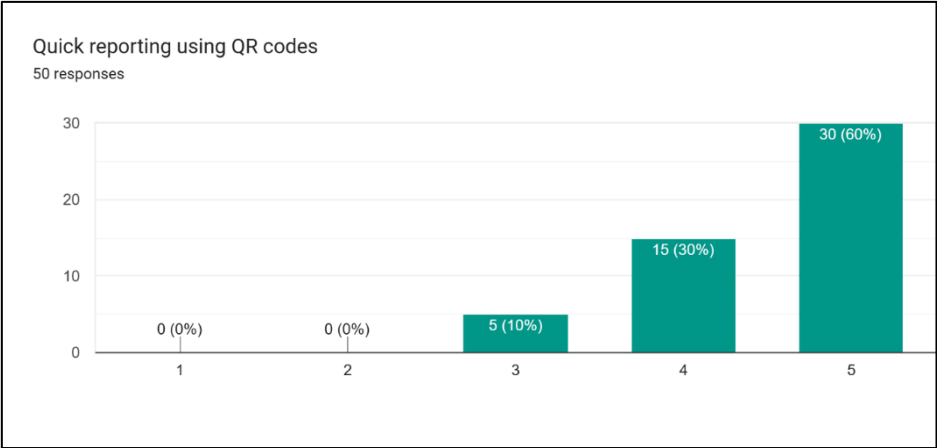


Figure 3.12: Bar Chart of Importance of Quick Reporting Feature.

The survey indicates that 60.8% of participants consider prompt reporting using QR codes as highly important, with no participants categorizing it as unimportant. This strong preference illustrates the importance of a rapid and effective reporting system, suggesting that QR codes are a crucial component for the CampusRetrieve platform to satisfy campus requirements community

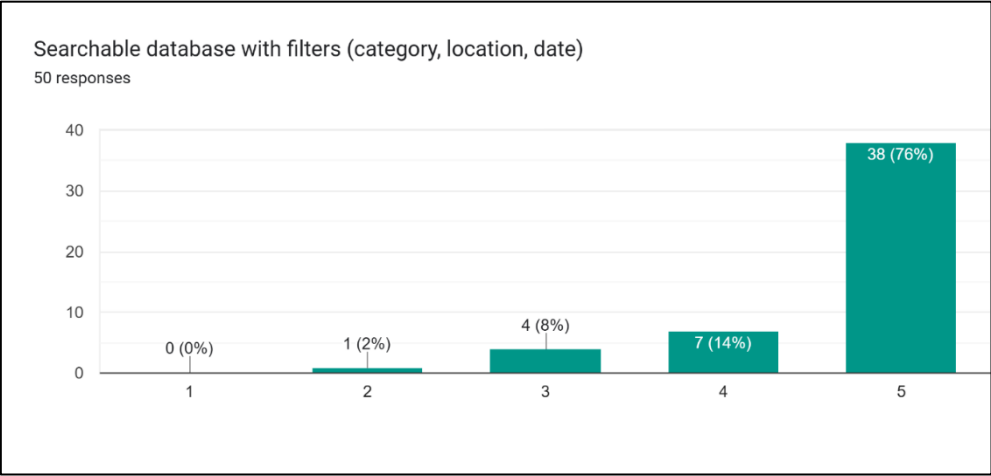


Figure 3.13: Bar Chart of the Importance of a Searchable Database.

The survey showed that 76.5% of participants notice a searchable database with filters as highly important, with no participants categorizing it as unimportant. This solid assurance highlights the need for an organized and efficient method for locating missing things, underlining that a filterable database is essential for improving the usability and efficiency of the CampusRetrieve system.

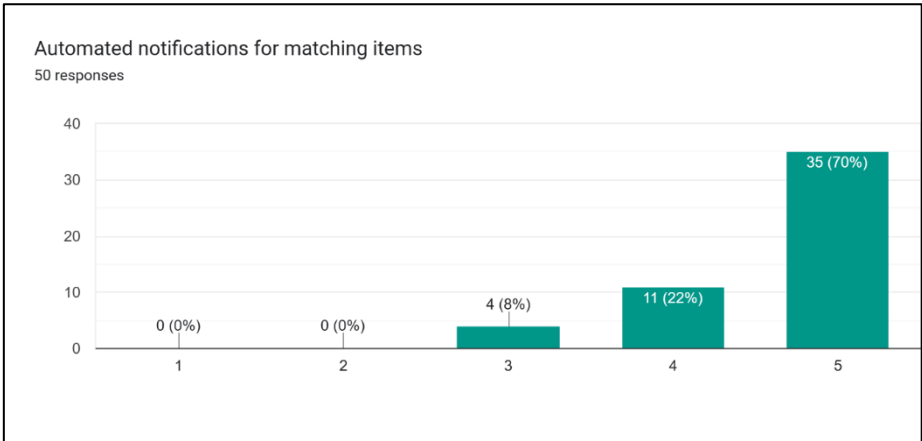


Figure 3.14: Bar Chart of Importance of Automated Notifications.

The survey reveals that 70.6% of participants determine automated notifications for matched items as highly significant, with none of them considering it unimportant. This underscores the need of timely updates, suggesting that an automated notification system is essential for enhancing the efficiency and efficacy of the CampusRetrieve platform in assisting users in retrieving their lost belongings.

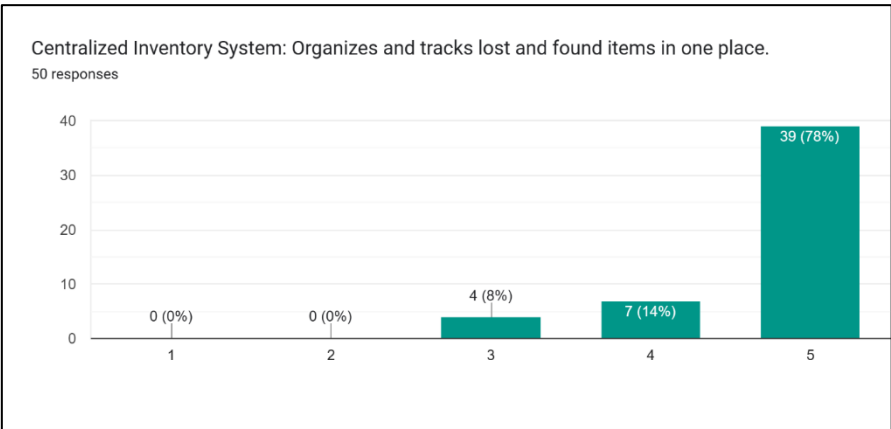


Figure 3.15: Bar Chart of Importance of a Centralized Inventory System.

The survey shows that 78.4% of participants consider a centralized inventory system as highly major, with none of them categorizing it as minor. This pronounced preference highlights the requirement for a system that centralizes all lost and found goods, facilitating users in reporting, searching for, and tracking items, hence improving the overall efficiency and satisfaction of users of the CampusRetrieve platform.

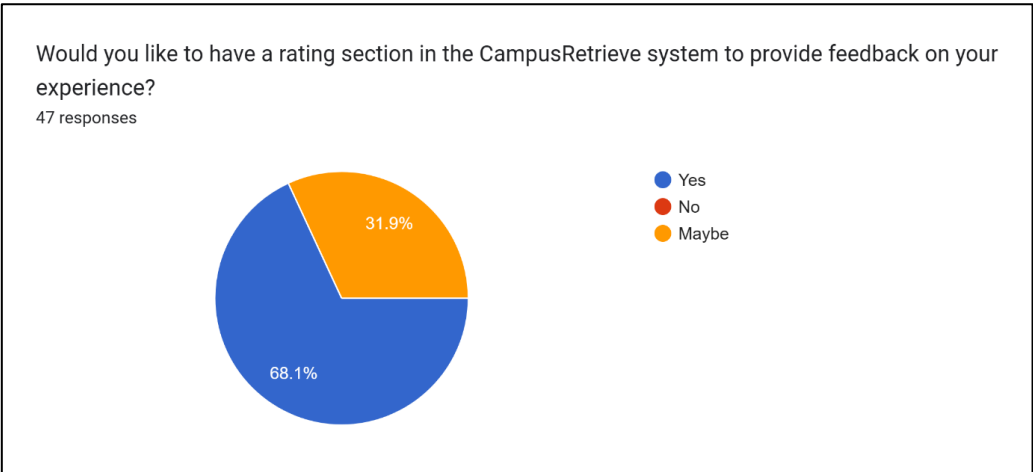


Figure 3.16:Pie Chart of Preference for a Feedback Rating Section.

The questionnaire finds that 68.8% respondents prefer a rating area for feedback on their experience, whereas 31.3% prefer not to have one. This major preference underscores the importance for collecting user feedback to constantly enhance the CampusRetrieve system, ensuring it meets consumer needs and expectations.

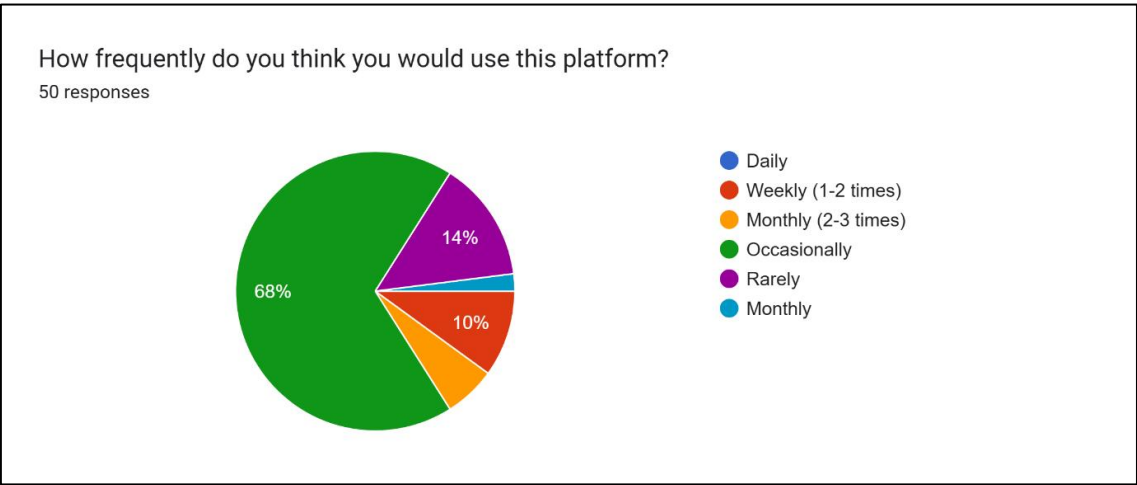


Figure 3.17:Pie Chart of Frequency of Using the Platform.

The survey shows that 68.6% of respondents plan on using the platform occasionally, suggesting that although the system may not be used daily, it will remain a helpful tool when required. A minor grouping, 13.7%, would use it rarely, 9.8% on a weekly basis, and 5.9% monthly, indicating that the platform's utility will be conditional but beneficial for users facing lost and found incidents.

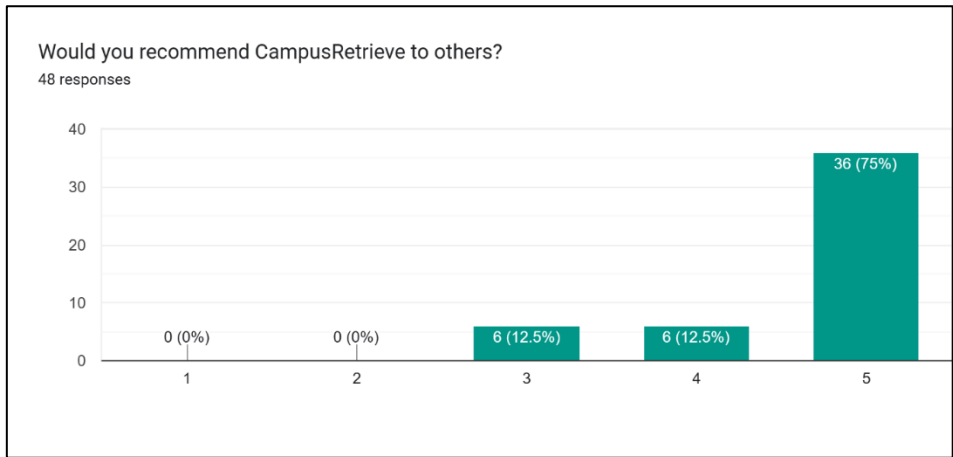


Figure 3.18:Bar Chart of Likelihood of Recommending CampusRetrieve.

The analysis reveals that 75.5% of the respondents would highly suggest CampusRetrieve to others, with no participants showing hesitation to promote it. This solid validation shows trust in the system's effectiveness and user satisfaction, implying that CampusRetrieve is considered as a valuable tool for the university community.

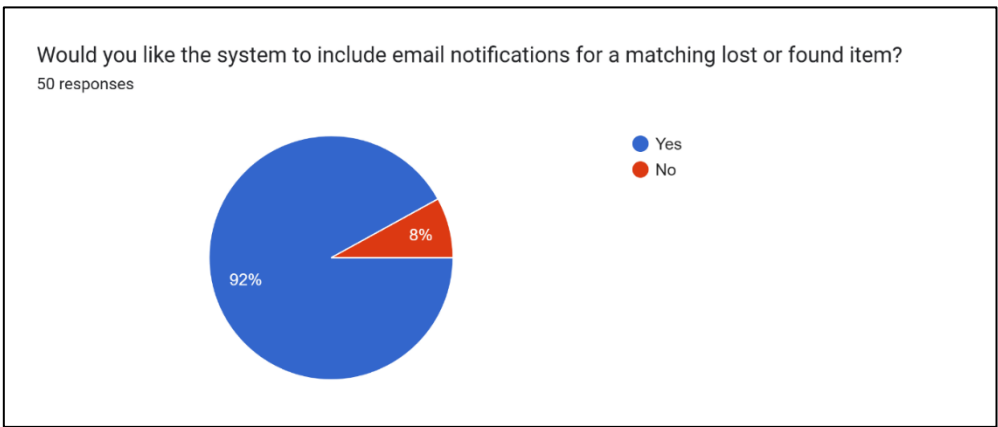


Figure 3.19:Pie Chart of Preference for Email Notifications.

The research shows that 92.2% of participants prefer the addition of email notifications for matching lost or found items, while only 7.8% express uninterested in this feature. This substantial support emphasises the need of prompt communication, showing that

email notifications would greatly improve the usability and effectiveness of the CampusRetrieve system for users.

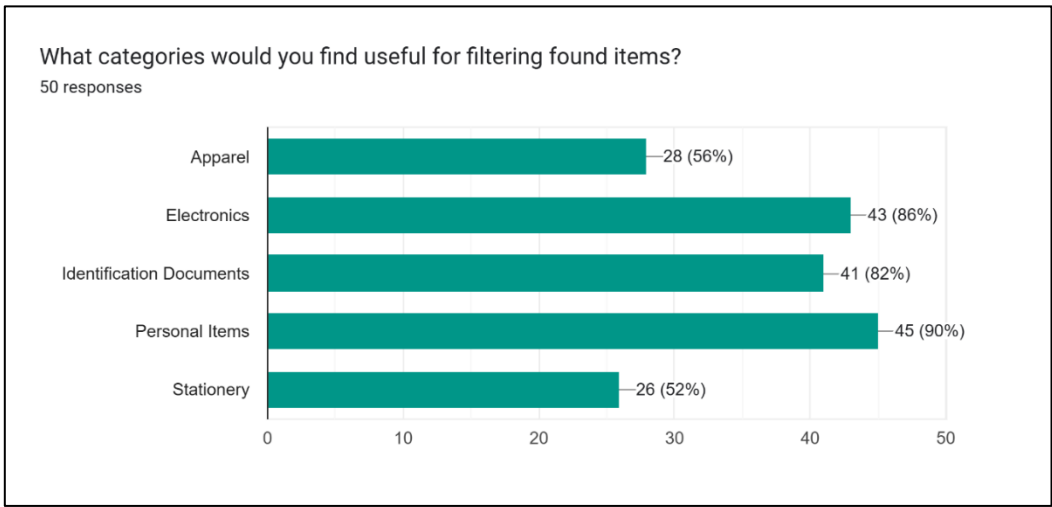


Figure 3.20:Bar Chart of Useful Categories for Filtering Items.

The survey shows that the most helpful categories for filtering discovered goods are personal items (88.2%), electronics (86.3%), and identification documents (82.4%), succeeded by apparel (56.9%) and stationery (52.9%). This data highlights the categories of objects users prioritise for recovery, suggesting that the CampusRetrieve system should focus on these categories for streamlined reliable item retrieval.

The survey results demonstrate a strong demand for the QR-based CampusRetrieve system, with the majority of respondents (79.2%) willing to use it and 75.5% recommending it to others. Key features such as quick reporting via QR codes, a searchable database, automated notifications, and a centralized inventory system were deemed crucial for improving the management of lost and found items. The survey highlights that most lost items are personal belongings, and current methods of recovery, like social media or campus facilities, are insufficient, with only 29.4% of participants successfully retrieving their lost items. The system's potential success is further supported by respondents' preference for QR code placement in high-traffic campus areas and the importance of categories like personal items and electronics for filtering found items. With a high interest in email notifications and feedback mechanisms, the data strongly

suggests that CampusRetrieve can significantly enhance the lost and found process, making it more efficient and accessible for the campus community.

Open-Ended Question:

The survey collected valuable feedback from respondents, emphasizing their suggestions and concerns about implementing the system. The insights provided highlight the community's expectations, potential challenges, and areas for enhancement. These perspectives are crucial for refining the system's design and functionality, ensuring it effectively addresses user needs and improves the management of lost and found items.

Below is a summary of the key insights shared by the respondents:

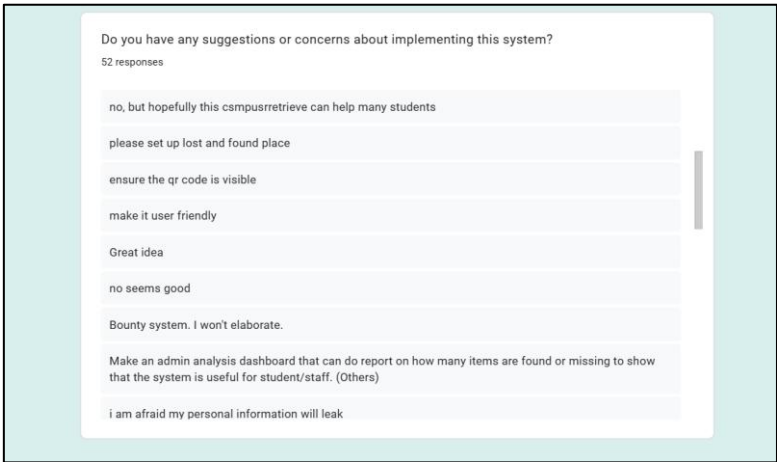


Figure 3.21:List of Suggestions and Concerns.

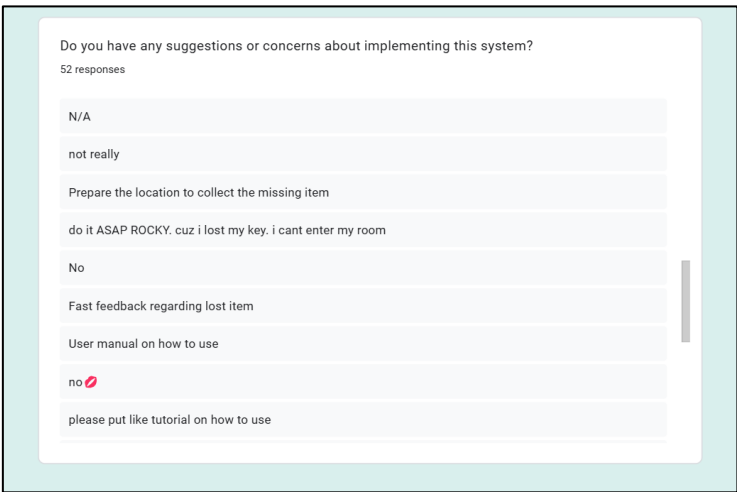


Figure 3.22:List of Suggestions and Concerns.

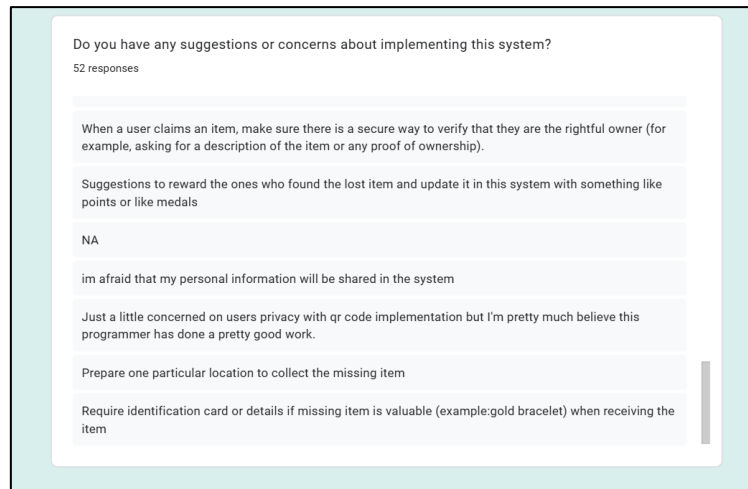


Figure 3.23:List of Suggestions and Concerns.

Based on the respondents' feedback, the following actions can be taken to address their suggestions and concerns:

1. **Improve System Usability:** Ensure QR codes are prominently displayed and easily accessible. Design the system to be intuitive and user-friendly for all users.
2. **Enhance Administrative Functionality:** Develop an admin dashboard to analyse data and generate reports, showcasing the system's effectiveness and utility.
3. **Establish Operational Processes:** Set up a designated location for collecting lost items and ensure fast feedback is provided to users regarding their reported items.
4. **Provide User Guidance:** Create a comprehensive user manual to help users navigate the system effectively.
5. **Ensure Security and Privacy:** Implement robust verification methods to confirm rightful ownership of items and adopt measures to safeguard user privacy and data security.

By focusing on these areas, the system can meet user expectations, improve trust, and enhance the overall management of lost and found items.

Summary of Findings

The survey results from both the close-ended and open-ended questions provide valuable insights into the community's expectations and concerns regarding the CampusRetrieve system. While the system's proposed features such as QR code reporting, a searchable database, and automated notifications were well-received, there were also important suggestions for improvement. Respondents highlighted the need for better system usability, emphasizing intuitive design, easy access to QR codes, and an admin dashboard for data management. Operational processes, clear user guidance, and strong security measures were also identified as critical to ensuring the system's success. Overall, the feedback indicates that the system has strong potential, but attention to user experience, operational efficiency, and security will be essential to fully meet the needs of the campus community.

3.2.1.2 Software Requirements

The software requirements outline the necessary tools, platforms, and technologies needed for the development and operation of the CampusRetrieve system.

Table 3.1:Software Requirements

Category	Details	Justification
Web Development Framework	Platform: Web application for accessibility on PCs, laptops, and smartphones. Frontend: HTML, CSS, JavaScript, and frameworks like React or Angular. Backend: PHP for handling business logic, database interactions, and server-side functionality.	To ensure cross-platform accessibility and user-friendly interaction while supporting scalable and robust server-side operations.
Database Management System	MySQL for managing lost and found item records, user data, reports, and other relevant information.	MySQL provides reliable and efficient database management with wide community support.
QR Code Generation and Scanning	Libraries: PHP QR Code for generating QR codes to browse the website.	QR codes simplify user access to the system and enhance user experience.

Server and Hosting	Hostinger: Reliable and user-friendly hosting platform.	Provides reliable, affordable, and beginner-friendly hosting with good performance.
Email Notifications	SMTP Server/Email API: Services to send email notifications for matching lost and found items.	To provide timely updates to users and improve system usability.
Testing and Debugging Tools	Selenium for end-to-end testing. Postman for API testing. PHPUnit for backend testing.	Comprehensive testing ensures system reliability, functionality, and performance across various scenarios.
Responsive Design	Bootstrap for responsive and mobile-friendly design. Tailwind CSS for lightweight and modern styling.	To create visually appealing, consistent, and mobile-friendly user interfaces.
Version Control	Git with GitHub for source control and collaboration.	Version control ensures organized development and collaboration while maintaining a history of changes.

3.2.1.3 Functional Requirements

Functional requirements define the core operations and feature that the system must be able to perform.

Table 3.2:Functional Requirements

Category	Feature	Description
User Authentication	Create Account & Login	Users can create accounts and log in securely using email dan password.
	Admin Login	Admins have a separate login to manage the platform.
Item Reporting	Report Lost & Found Items	Users can report lost and found items by scanning a QR code at hotspot areas.
	Collect Item Details	Item details (category, location, description) are collected for lost items.
	QR Code Scanning	Users can scan a QR code to be directed to the CampusRetrieve platform's page.

Search and Filter	Search Database	A searchable database allows users to search for lost and found items.
	Filter Results	Users can filter search results by category, location, and date.
Notification System	Email Alerts	Users receive notifications for matching lost or found items via email.
Feedback System	Rate Platform	Users can rate their experience with the platform.
	View Feedback	Admins can view feedback and implement improvements.
Admin Dashboard	Manage Reports	Admins can manage users; view reported items and monitor report statuses.
	Update/Delete Reports	Admins can delete or update incorrect reports.
Item Collection and Retrieval	Designated Collection Point	A designated location is available for collecting retrieved items.
	Update Item Status	Admins or users can update items statuses (e.g, claimed, unclaimed).

3.2.1.4 Data Requirements

The data requirements define the types of data the system will store, the format in which it will be stored, and how it will be used.

Table 3.3:Data Requirements

Category	Attributes	Usage
User Data	Name, email address, contact number, user type (student, staff, visitor)	To authenticate users and send notifications. Stored in an encrypted format to ensure privacy.
Lost and Found Items Data	Item name, category (electronics, personal items, etc) description, date and time lost/found, location and photo.	To report and track lost and found items, as well as facilitate searching and matching.
QR Code Data	QR code ID, linked to CampusRetrieve website	To generate QR code that direct to the CampusRetrieve website for reporting or viewing lost and found items.

Search and Filter Data	Search criteria (category, location, date)	To allow users to filter and find specific lost and found items.
Notification Data	Email addresses, item match details (lost item, found item), notification timestamp	To send automated email notifications to users about matching items.
Rating and Feedback Data	User rating (1-5), feedback comments, date of submission	To gather user feedback and evaluate the platform's effectiveness.
Admin Data	Admin username, role, access level	For managing platform content and user accounts.

3.2.2 Phase 2: User Design

The User Design phase focuses on creating a visual and functional representation of the CampusRetrieve system. This phase ensures that the system is user-friendly, intuitive, and meets the requirements outlined in the Requirement Planning phase. The design outputs provide a clear blueprint for the system's functionality and user interaction.

3.2.2.1 Flowchart

A flowchart will visually represent the process flow of the system, including how users report a lost item, search for found items, and receive notifications for matched items. It provides an overview of the operational steps and decision points in the system.

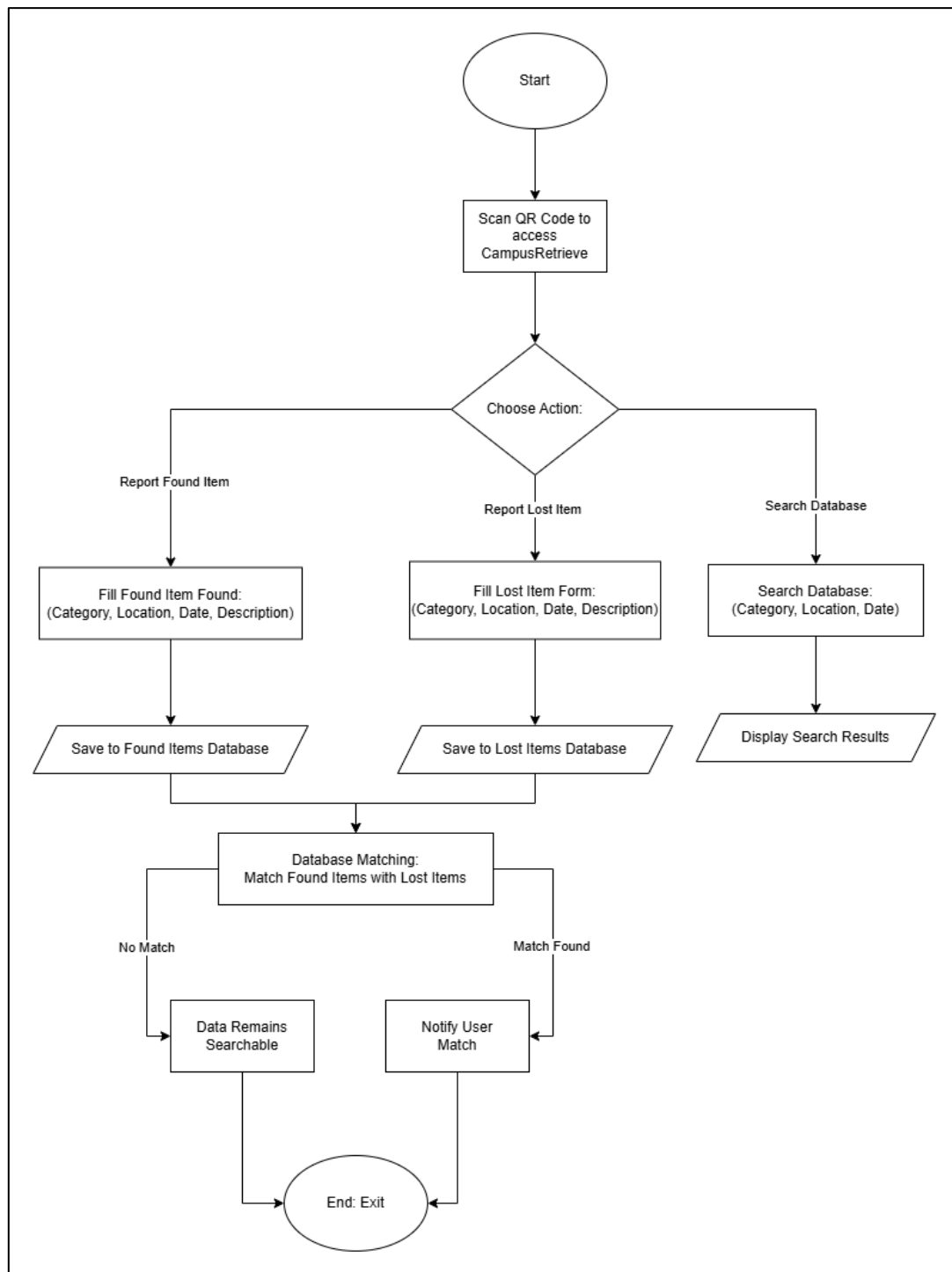


Figure 3.24:Flowchart of CampusRetrieve.

3.2.2.2 Use Case Diagram

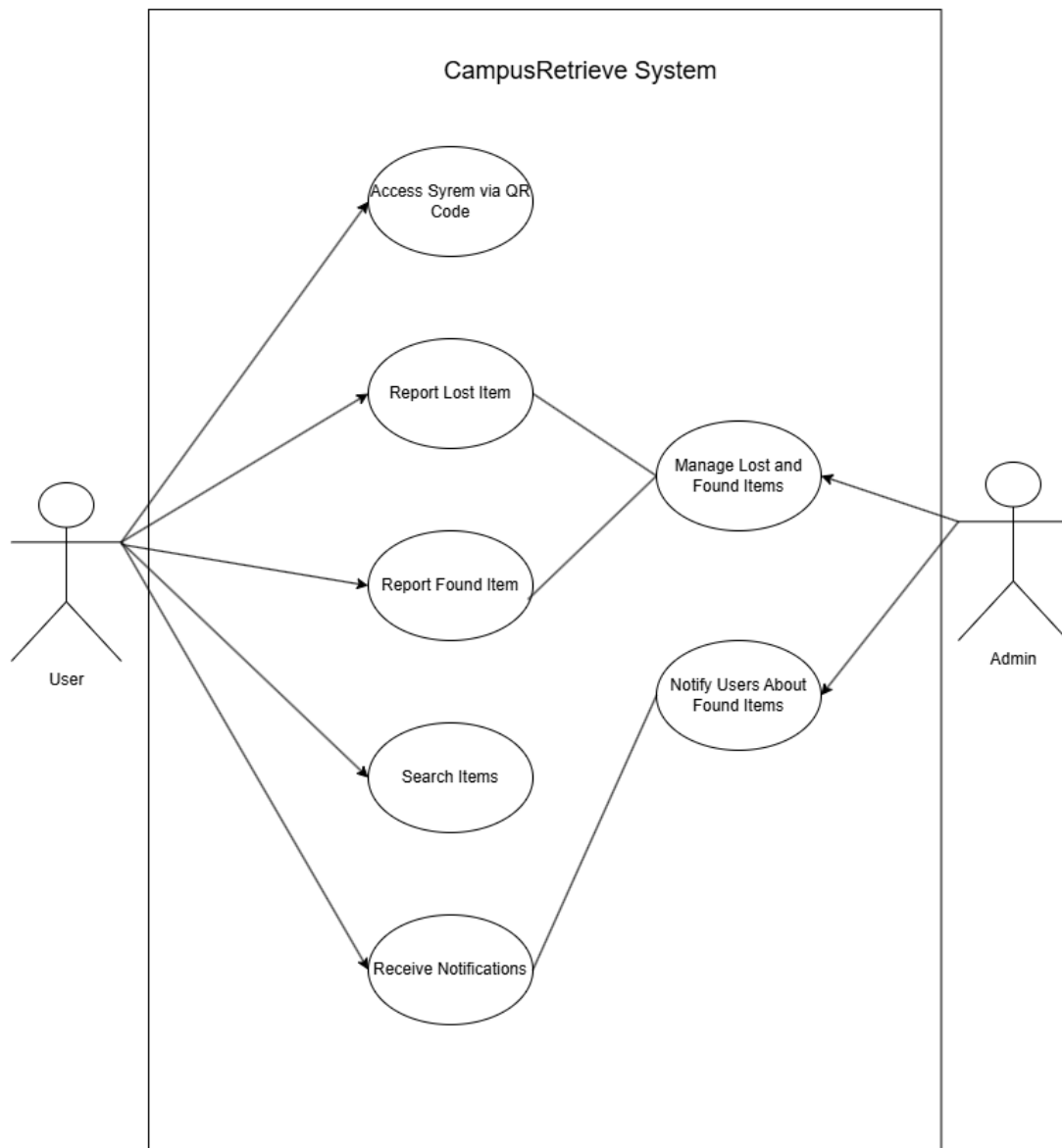


Figure 3.25:Use Case Diagram of CampusRetrieve.

Table 3.4:Use Case Description for Access System via QR Code.

Use Case Name	Access System via QR Code
Actor	User
Description Summary	User accesses the system directly by scanning a QR code with their mobile device.
Pre-condition	QR code is functional and linked to the system.
Post-condition	User is logged in or redirected to the appropriate system interface.

Basic path	1. User scans the QR code. 2. QR code redirects to the system login or interface page. 3. User interacts with the system.
Alternative path	1. QR code is invalid. 2. User does not have a compatible device to scan the QR code.

Table 3.5:Use Case Description of Report Lost Item.

Use Case Name	Report Lost Item
Actor	User
Description Summary	User reports details about a lost item to the system.
Pre-condition	User is logged into the system.
Post-condition	Lost item is recorded in the system database, and notification is sent if relevant.
Basic path	1. User logs in. 2. Navigates to "Report Lost Item." 3. Enters item details. 4. Submits the report.
Alternative path	1. User fails to log in. 2. User submits incomplete information.

Table 3.6:Use Case Description of Report Found Item.

Use Case Name	Report Found Item
Actor	User
Description Summary	User reports details about a found item to the system.
Pre-condition	User is logged into the system.
Post-condition	Found item is recorded in the system database, and notification is sent if it matches a lost item.
Basic path	1. User logs in. 2. Navigates to "Report Found Item." 3. Enters item details. 4. Submits the report.
Alternative path	1. User fails to log in. 2. User submits incomplete information.

Table 3.7:Use Case Description of Search Items.

Use Case Name	Search Items
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Actor	User
Description Summary	User searches for lost or found items in the system database.
Pre-condition	User has access to the search feature.
Post-condition	System displays results matching the search criteria or an empty list if no matches are found.
Basic path	1. User logs in. 2. Navigates to "Search Items." 3. Enters search criteria. 4. Views results.
Alternative path	1. User enters invalid search criteria. 2. No items match the search criteria.

Table 3.8:Use Case Description of Receive Notifications.

Use Case Name	Receive Notifications
Actor	User
Description Summary	User receives notifications about updates on lost or found items relevant to them.
Pre-condition	User is subscribed to notifications for specific items.
Post-condition	User receives notifications via email.
Basic path	1. System detects a matching lost/found item. 2. Sends notification to the user.
Alternative path	1. User unsubscribes from notifications.

Table 3.9:Use Case Description Admin Manage Inventory.

Use Case Name	Manage Inventory
Actor	Admin
Description Summary	Admin updates, deletes, or verifies the inventory of lost and found items.
Pre-condition	Admin is logged into the system and has appropriate privileges.
Post-condition	Inventory is updated, verified, or cleaned up.
Basic path	1. Admin logs in. 2. Navigates to "Manage Inventory." 3. Updates/verifies item records.
Alternative path	1. Admin lacks required privileges. 2. Admin encounters system errors.

Table 3.10:Use Case Description Receive Notification.

Use Case Name	Receive Notification
Actor	User
Description Summary	User receives notifications for updates, such as newfound items or status changes.
Pre-condition	User is registered and subscribed to notifications.
Post-condition	User is notified via email.
Basic path	1. System detects an update. 2. Sends notification to the user's registered contact method.
Alternative path	1. User unsubscribes from notifications. 2. Notification fails to send due to system error.

Table 3.11:Use Case Description Notify Users about the Found Items.

Use Case Name	Notify Users About Found Items
Actor	Admin
Description Summary	Admin manually notifies users when a found item matches a reported lost item.
Pre-condition	Admin is logged into the system and has appropriate permissions.
Post-condition	Users linked to the lost item are notified about the match.
Basic path	1. Admin logs in. 2. Navigates to the notifications section. 3. Selects a matching lost and found item. 4. Sends notification to the user(s).
Alternative path	1. Admin fails to log in. 2. Admin selects an incorrect match. 3. Notification fails to send due to technical issues.

3.2.2.3 Class Diagram

The class diagram defines the system's structure by depicting the main entities, their attributes, and their relationships. For example, it will include classes such as User, Item, and Notification, highlighting how these entities interact within the system.

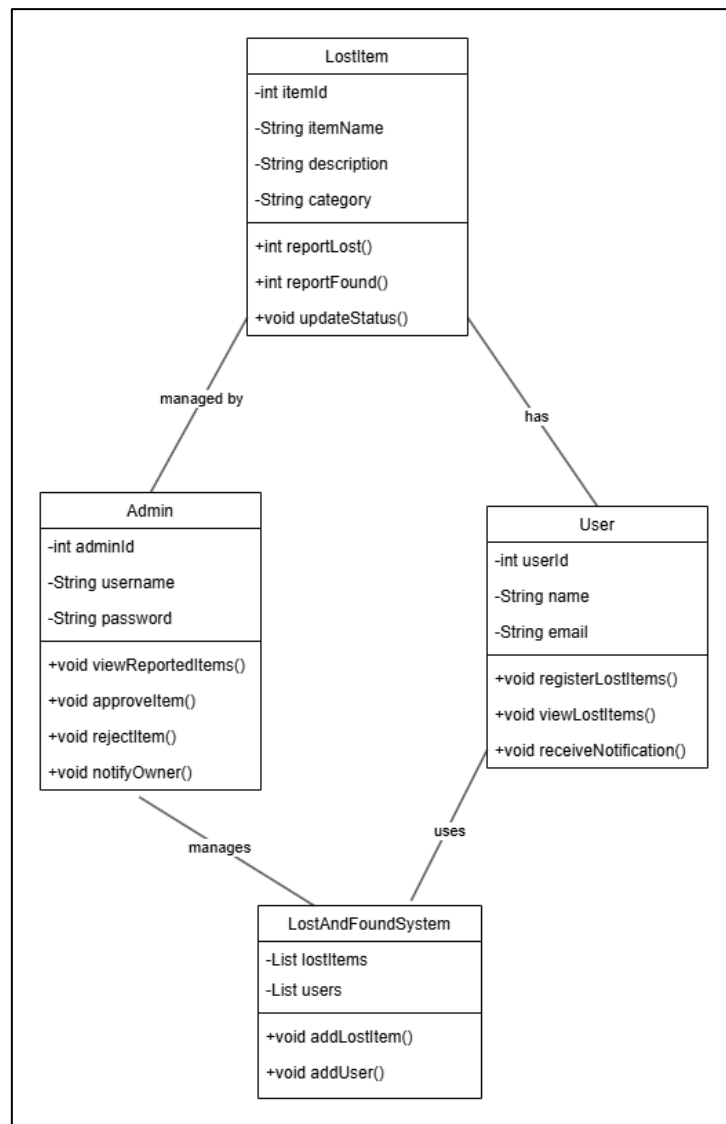


Figure 3.26:Class Diagram of CampusRetrieve.

3.2.2.4 Sequence Diagram

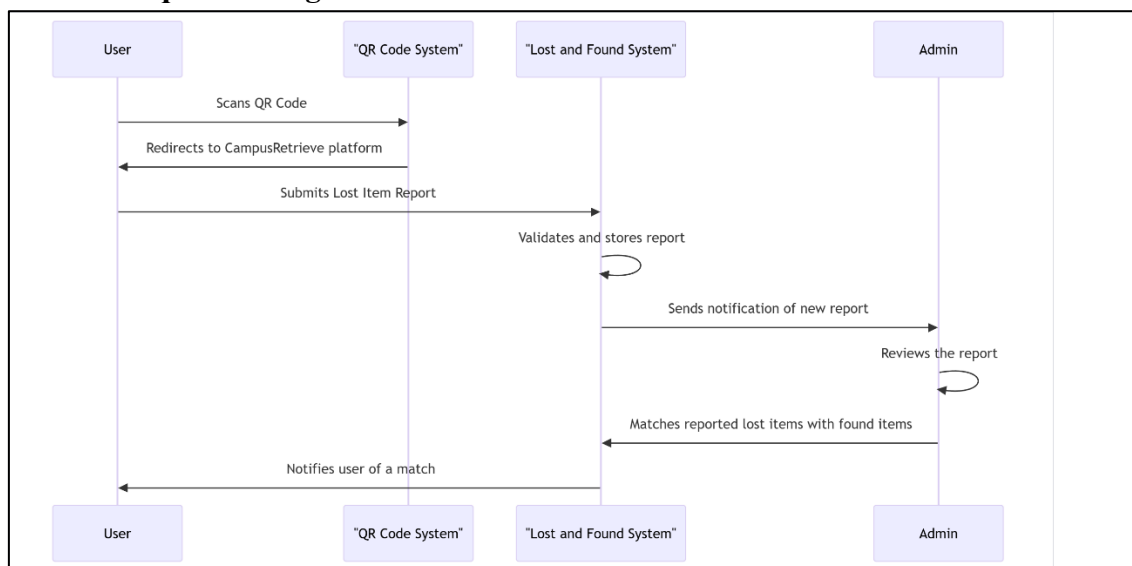


Figure 3.27:Sequence Diagram of CampusRetrieve.

3.2.2.5 System Architecture

The system architecture provides a high-level overview of how the CampusRetrieve system is structured and how its various components interact. It details the relationship between the QR code hotspots, the web platform, the database, and the notification mechanisms, illustrating the flow of data and processes across the system.

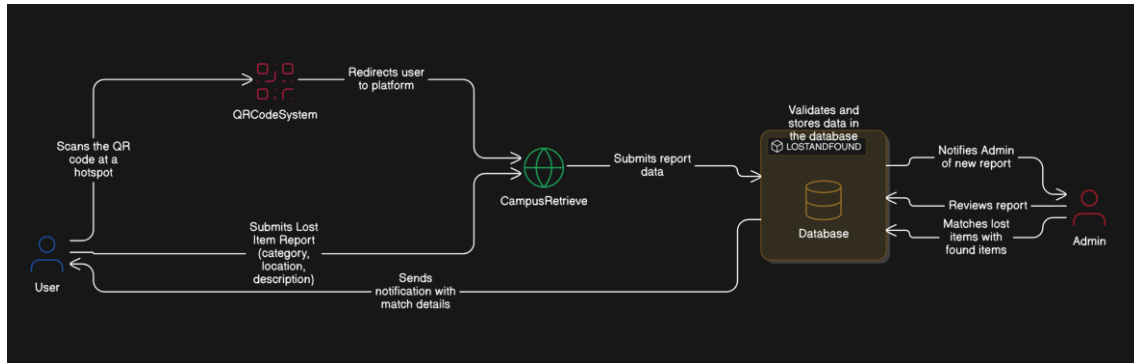


Figure 3.28: System Architecture of CampusRetrieve.

3.2.2.6 User Interface

Below are the key pages of the CampusRetrieve system, showcasing the design and functionality for both users and administrators. Each page is crafted to ensure ease of use, efficient navigation, and a seamless experience for reporting and managing lost and found items.

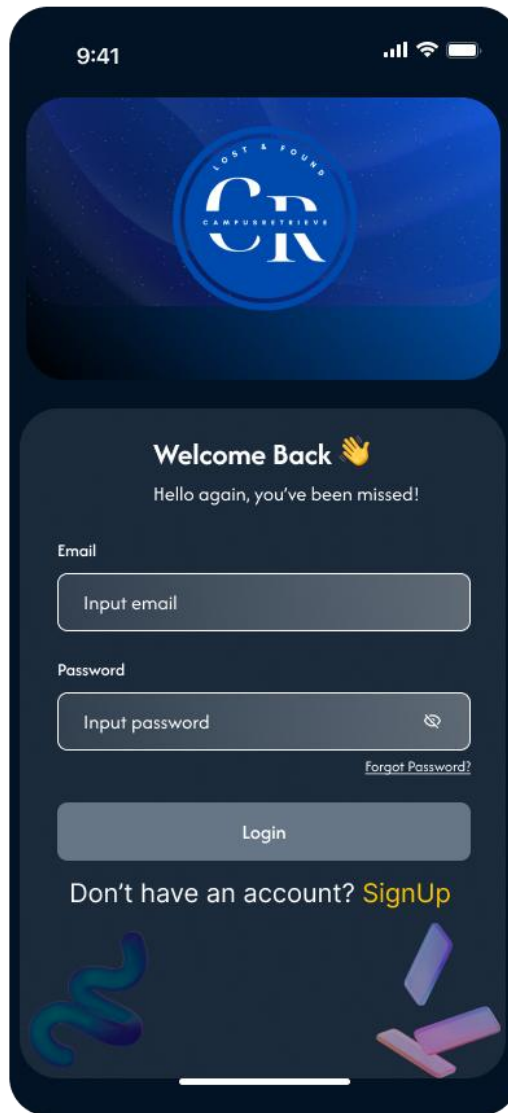


Figure 3.29:User Login Page.

The login page features fields for entering email and password, with clear labels for each. A "Forgot Password" link is provided for users who need to reset their credentials. Additionally, there is a link to the "Sign Up" page for new users who don't have an account yet. The design focuses on simplicity and ease of navigation for both existing and new users.

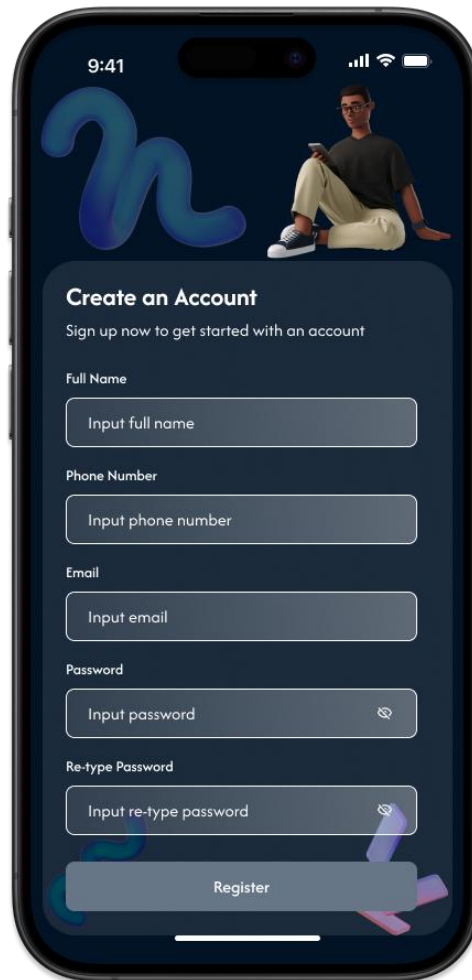


Figure 3.30: Sign-up Page.

The sign-up page allows users to create an account by providing their full name, phone number, email, password, and re-typing the password for confirmation. Each field is clearly labelled to ensure users understand what information is required. This page ensures that users provide accurate and consistent details for account creation, with the re-type password field helping to minimize errors in password entry. The layout is simple and user-friendly to facilitate easy account registration.

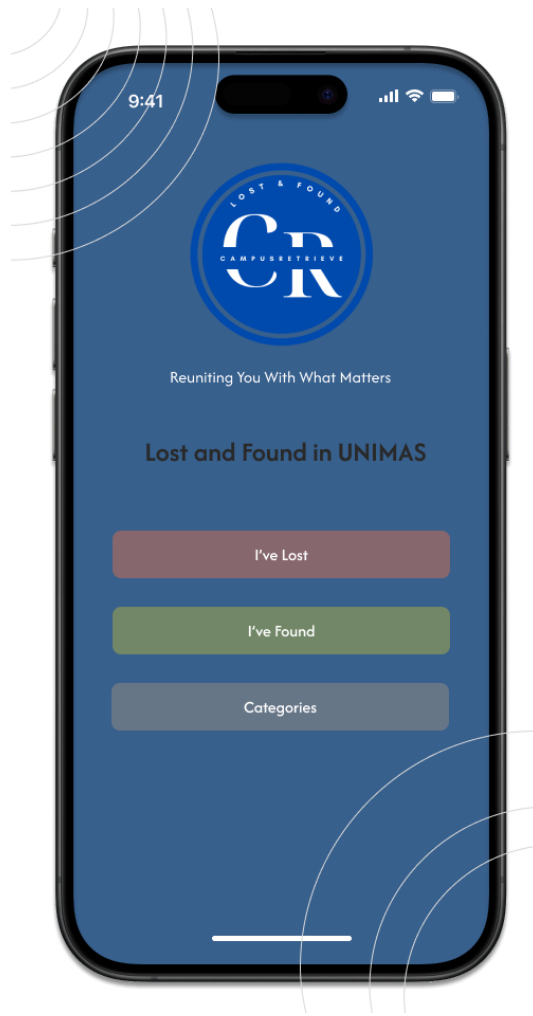


Figure 3.31:Homepage.

The user home page offers three clear options for users to choose from: "I've Lost," "I've Found," and "Categories." The first option, "I've Lost," allows users to report a lost item, while "I've Found" enables users to report an item they have found. The "Categories" option provides users with a list of item categories, helping them to easily filter or search for lost and found items. This simple and intuitive design ensures users can quickly navigate and select the appropriate action based on their situation.

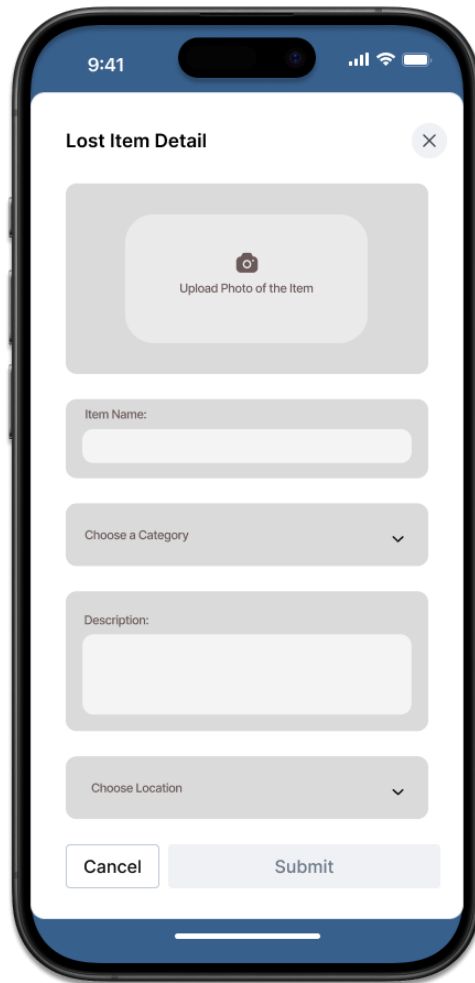


Figure 3.32:Lost Item Form Page.

The "Lost" page allows users to report a lost item by uploading a photo of the item, entering its name, selecting a category, and providing a description. Users are also prompted to choose the location where the item was lost. There are two buttons: a "Cancel" button to discard the report and a "Submit" button to finalize the submission.

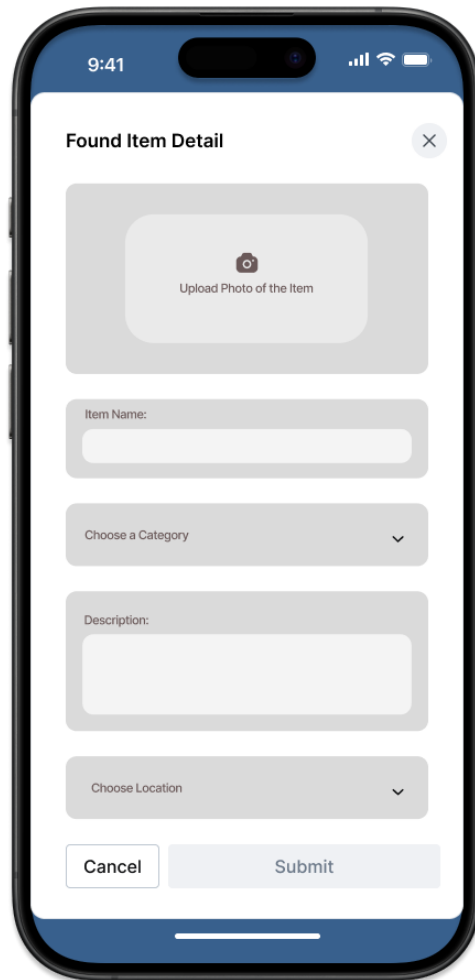


Figure 3.33: Found Item Form Page.

Similarly, the "Found" page reporting follows the same structure. Users are asked to upload a photo of the found item, enter its name, choose a category, provide a description, and select the location where the item was found. The same "Cancel" and "Submit" buttons are included for ease of use.

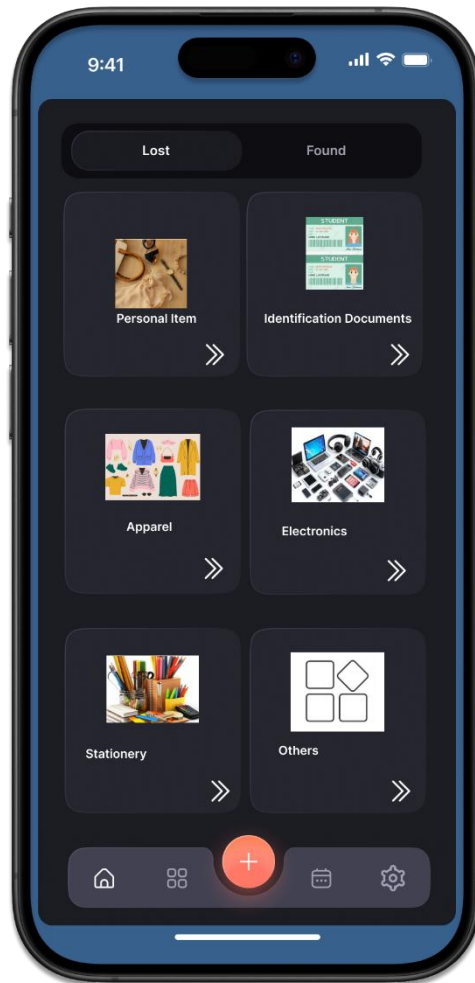


Figure 3.34:Category Page.

The "Category" page allows users to filter lost and found items by date, location, or category. The available categories include personal items, identification documents, apparel, electronics, stationery, and others. This filtering system enables users to quickly narrow down their search to find specific items. The design is simple and intuitive, ensuring that users can easily select their preferred filter options to view relevant results based on their needs.

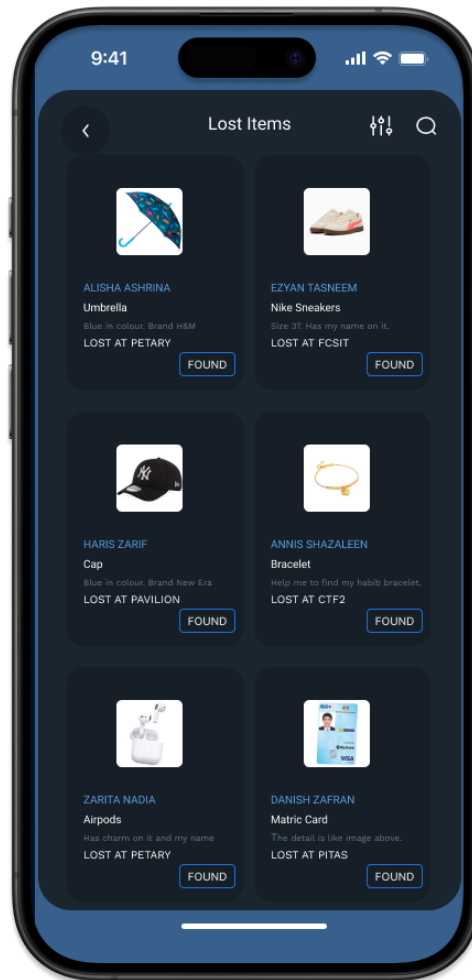


Figure 3.35:Listing Lost Item Page.

The "Listing" page displays a list of lost and found items, showing the item name, description, and location for each entry. Each listed item includes a "Found" button, which users can click if they have found an item that matches the one on the list. This allows users to easily report items they have found, helping to update the system and connect lost items with their rightful owners. The page is designed for straightforward navigation, with clear information and intuitive actions for users.

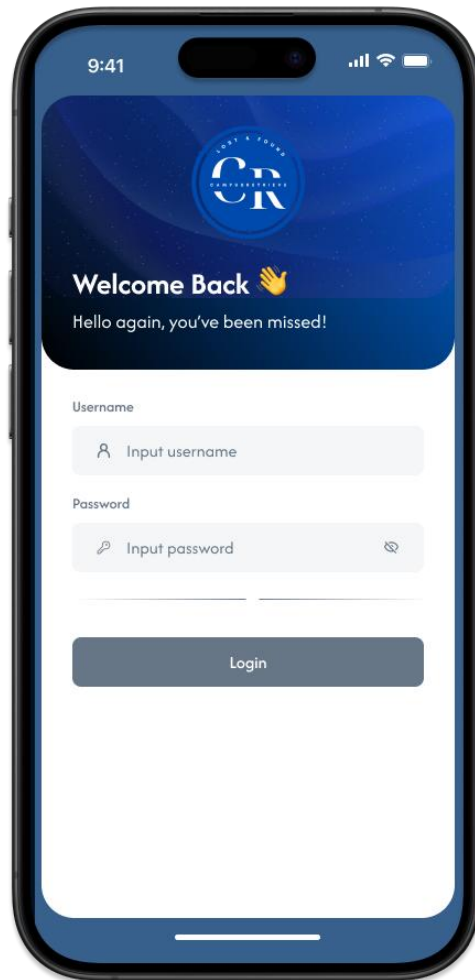


Figure 3.36:Admin Login Page.

The "Admin Login" page is designed for administrators to access the system. It requires the admin's username and password for authentication. The layout is simple, with clearly labelled fields for the username and password to ensure ease of use. A secure login process is essential to protect the admin area, allowing only authorized personnel to access and manage the system's data. The page also includes a login button to submit the credentials.

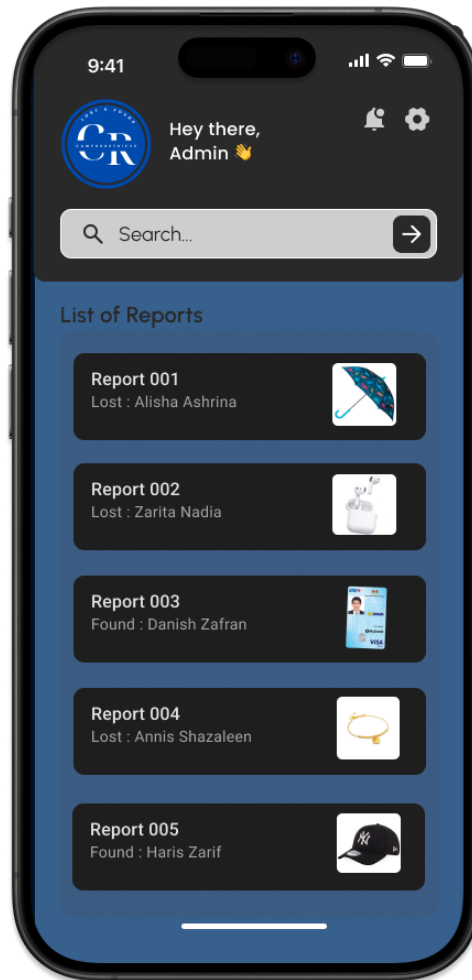


Figure 3.37:Admin Dashboard.

The "Admin Dashboard" page provides administrators with an overview of all reports submitted by users. It displays a list of reported items, including details such as item name, description, location, and whether the item has been marked as found. The dashboard is designed to allow admins to easily review and manage the reports, ensuring a smooth process for tracking lost and found items. The page includes options to filter or sort the reports as needed, making it easier for admins to efficiently monitor the system and respond to user submissions.

3.2.3 Phase 3: Construction and Testing

In the construction phase, the system's components were developed based on the earlier requirements. The focus was on coding the QR-based CampusRetrieve platform, creating

a simple yet effective user interface, and integrating the key functionalities, including quick reporting via QR codes, a searchable database for lost and found items, and an automated notification system.

The development process was iterative, with coding and testing cycles ensuring each module worked as expected before moving on to the next. A key part of this phase was the design and implementation of the backend database, which was essential for storing, retrieving, and managing the lost and found data efficiently. The QR code generation and scanning system were also developed and rigorously tested to ensure they worked seamlessly in various campus locations.

Regular feedback was gathered from stakeholders, including administrators and users, to make sure the system was user-friendly and met the needs of the campus community. This feedback was incorporated into the development process, allowing for continuous improvements and refinements to the system before moving into the next phase.

3.2.4 Phase 4: Cutover and Implementation

The cutover phase focused on transitioning the CampusRetrieve system from development to live operation. A major part of this phase was preparing the campus community for the new system. This included organizing training sessions for administrators and staff to ensure they were well-equipped to manage the system. User guides and promotional campaigns were also created to help students and staff understand how to use the platform effectively.

QR codes were strategically placed in key campus locations such as student pavilions, libraries, and cafeterias to ensure wide accessibility. The system underwent a pilot testing phase, where it was used in real-world conditions. This provided valuable insights and allowed for any issues to be addressed before the official launch.

Once the system was fully tested and refined, it was officially launched, with ongoing support and maintenance plans in place to ensure its continued success. The feedback gathered from users during the cutover phase helped to further optimize the platform for long-term use. This phase marked the final step before the system became fully operational and available to the entire campus community.

3.3 Chapter Summary

The Rapid Application Development (RAD) methodology provided an efficient framework for the development of the CampusRetrieve system, ensuring a user-centric and iterative approach to implementation. Through its four phases—Requirement Planning, User Design, Construction, and Cutover—the system was developed to address the inefficiencies in managing lost and found items on campus. Each phase contributed to refining the system's functionality, usability, and accessibility, culminating in a solution that aligns with the campus community's needs. The final product is expected to streamline reporting and retrieval processes, enhance user experience, and foster a more connected and organized campus environment.

CHAPTER 4 IMPLEMENTATION

4.1 Introduction

The implementation phase represents the crucial transition from theoretical design to practical application in the development of the CampusRetrieve system. This chapter provides a comprehensive overview of the steps taken to actualize the QR-based lost and found management solution, detailing the technical infrastructure, user interface development, and functional integration that brought the system to life. Building upon the requirements analysis and design phases, the implementation focused on creating a robust, user-friendly platform that addresses the specific challenges of lost and found item management in a university campus environment.

The implementation process was guided by the principles of the Rapid Application Development (RAD) methodology, emphasizing iterative progress, continuous user feedback, and adaptive problem-solving. This approach ensured that the system remained aligned with user needs while maintaining technical feasibility. Key aspects of implementation included setting up the appropriate development environment, designing intuitive user interfaces, establishing secure database architecture, and integrating QR code technology with the web platform. Special attention was given to creating seamless workflows for both end-users and administrators, ensuring the system would be adopted and maintained effectively within the campus ecosystem.

This chapter systematically documents these implementation efforts, providing insights into the technical decisions made, challenges encountered, and solutions developed. By transparently presenting this implementation journey, the chapter serves not only as a record of the development process but also as a potential guide for similar projects in educational or organizational settings.

4.2 Environment Setup

4.2.1 Frontend Layer

The frontend layer of the system focuses on delivering an intuitive and responsive user interface. It utilizes modern web technologies to enhance user interaction, visual design, and accessibility across devices.

Table 4.1: Frontend Technology Stack.

Technology	Version	Key Advantage
Bootstrap 5	5.2.3	Accelerated UI development with responsive, pre-styled components
JavaScript	ES6+	Enabled modern features such as AJAX and DOM manipulation for dynamic user experience
Font Awesome	6.4.0	Provided a wide set of icons to avoid the need for custom icon designs
HTML/CSS	-	Fundamental for page structure and styling

4.2.2 Backend Layer

The backend layer supports the core functionality and logic of the system. It handles data processing, server-side scripting, and database interactions to ensure smooth and secure operations.

Table 4.2: Backend Technology Stack.

Technology	Version	Key Advantage
PHP	8.1	Fast execution and native compatibility with MySQL, suitable for rapid development
MySQL	8.0	Robust and scalable data storage supporting complex queries
Apache	2.4	Reliable, modular server with .htaccess support for flexible URL handling and security

4.2.3 System Development Tools

These development tools were chosen to streamline coding, testing, version control, and deployment. They enable efficient local development, simplify database management, and support team collaboration and deployment to a live server.

Table 4.3: Development Tools of the System.

Tool	Purpose	Key Feature
XAMPP	Local Environment	Combines Apache, MySQL, and PHP for offline development and testing
VS Code	Integrated Development Environment (IDE)	Live Server extension enables instant browser previews
phpMyAdmin	Database Management	Graphical interface for managing MySQL databases
Git & GitHub	Version Control	Track and manage changes in code with collaboration support
Hostinger	Development	Easy deployment with 1-click PHP/MySQL hosting, scalable infrastructure, and built-in security



Figure 4.1:Figma.

Figma was used in the CampusRetrieve project to design intuitive user interfaces, including student dashboards, admin panels, and search functionalities. Wireframes and high-fidelity mockups were created to visualize navigation flows, ensuring a user-friendly

experience before development. Exported assets, such as icons and layout components, were directly implemented in the frontend code.



Figure 4.2:XAMPP.

XAMPP served as the local development environment for CampusRetrieve, hosting the Apache web server and MySQL database. It enabled offline testing of PHP-driven features like user authentication, data retrieval, and CRUD operations. The local server environment ensured stable backend functionality before deployment to a live hosting service.



Figure 4.3:phpmyadmin.

phpMyAdmin was utilized to manage CampusRetrieve's MySQL database, which stores student records, user credentials, and system logs. Tables were structured to optimize queries for student data retrieval, while SQL operations were tested to ensure efficient performance. Backup and export functions secured data integrity during development



Figure 4.4: Visual Studio Code.

VS Code was the primary editor for developing CampusRetrieve's frontend (HTML, CSS, JavaScript) and backend (PHP). Extensions like Live Server provided real-time previews, while PHP Intelephense assisted in debugging server-side scripts. The editor's Git integration facilitated version control, ensuring organized collaboration and code management.



Figure 4.5: Hostinger.

Hostinger was used to deploy the CampusRetrieve system, providing a live web hosting environment with PHP and MySQL support. The platform's control panel simplified domain management, database configuration, and file uploads via FTP. SSL certificates were enabled to ensure secure data transmission, particularly for sensitive student records and login credentials. Hostinger's performance analytics also helped monitor uptime and optimize loading speeds for end-users.



Figure 4.6:Git & GitHub.

Git was integrated into the CampusRetrieve development workflow for version control, tracking changes across frontend (HTML/CSS/JS) and backend (PHP) files. GitHub served as the remote repository, enabling collaborative code reviews and issue tracking. Branches were used to test new features—such as search algorithms or authentication upgrades—before merging into the main project. Commit histories documented iterative improvements, ensuring accountability and rollback capability during debugging.



Figure 4.7:ME-QR.

ME-QR was employed in CampusRetrieve to generate scannable QR codes that direct users to the lost-and-found platform, increasing visibility across the UNIMAS community. These QR codes—strategically placed on campus bulletin boards, digital screens, and social media—provided instant access to the website, eliminating manual URL entry. The tool’s customizable designs incorporated UNIMAS branding to foster

recognition and trust. By simplifying outreach, the QR codes amplified engagement, ensuring students and staff could quickly report or retrieve lost items.

4.3 User Interface Design

The user interface (UI) was designed to be intuitive and accessible, ensuring that all campus members could easily navigate the system. Below are the key UI components:

4.3.1 Login

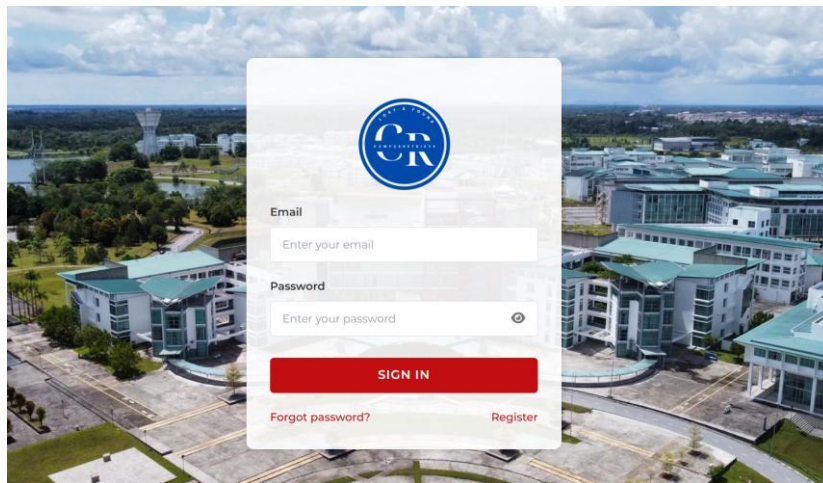


Figure 4.8:Login Page.

Login page of the CampusRetrieve that requires users to enter their email and password to sign in. Options for password recovery and registration are also provided.

4.3.2 Register

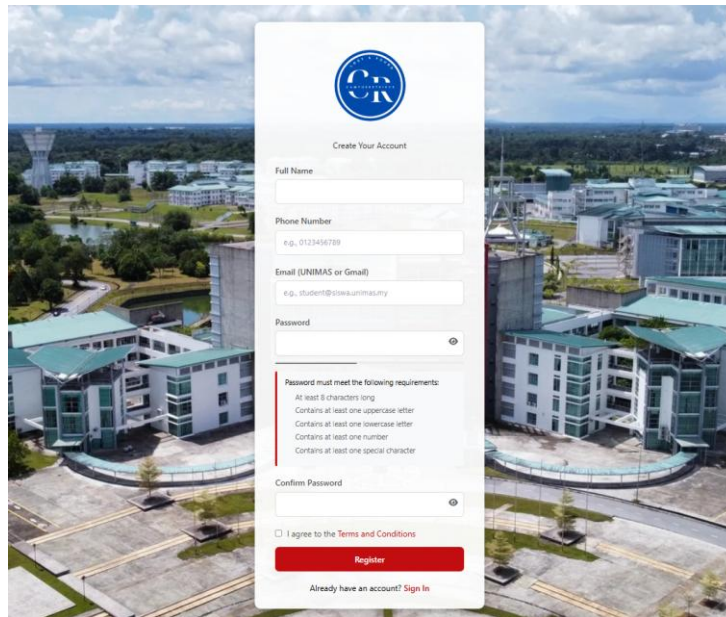
The image shows a registration form for CampusRetrieve overlaid on a background image of a university campus. The form is titled "Create Your Account" and features the CampusRetrieve logo at the top. It includes input fields for "Full Name", "Phone Number" (with a placeholder "e.g., 0123456789"), "Email (UNIMAS or Gmail)" (with a placeholder "e.g., student@pslwa.unimas.my"), "Password", and "Confirm Password". A red-bordered box lists password requirements: "At least 8 characters long", "Contains at least one uppercase letter", "Contains at least one lowercase letter", "Contains at least one number", and "Contains at least one special character". Below these fields is a checkbox for "I agree to the Terms and Conditions". A prominent red "Register" button is at the bottom, with a link "Already have an account? Sign In" underneath it.

Figure 4.9:Registration Page.

Registration page of the CampusRetrieve that requires users to enter their full name, phone number, email, password, and confirm password. It also includes password requirements, a checkbox to agree to the terms and conditions, and a button to complete the registration.

4.3.3 Verify

Email Verification

We've sent a 6-digit verification code to **irdinafikriyah07@gmail.com**. Please enter it below:

Verification Code

[Verify Account](#)

[Resend Verification Code](#)

Figure 4.10:Email Verification Page.

Email verification page of the CampusRetrieve that prompts users to enter a 6-digit verification code sent to their registered email address. It includes an input field, a "Verify Account" button, and an option to resend the verification code.

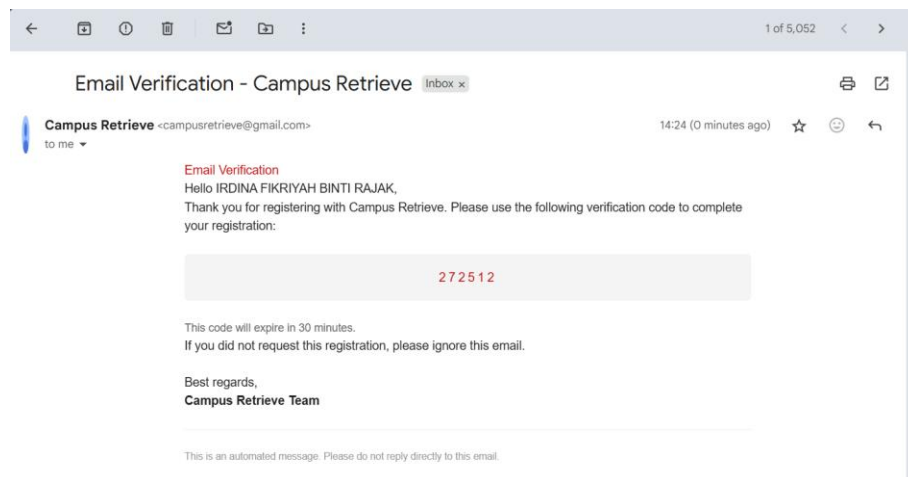


Figure 4.11:Email Verification Message.

Verification email from CampusRetrieve containing a 6-digit code sent to the user to complete the registration process. The email includes instructions, the verification code, and a note that the code will expire in 30 minutes.

4.3.4 Forgot Password

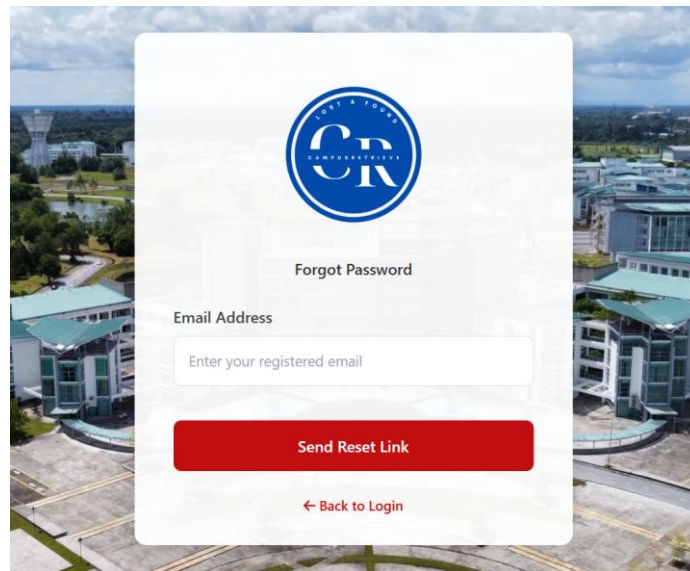


Figure 4.12:Forgot Password Page.

Forgot password page of the CampusRetrieve that prompts users to enter their registered email address to receive a password reset link. A button is provided to send the reset link, along with a navigation option to return to the login page.

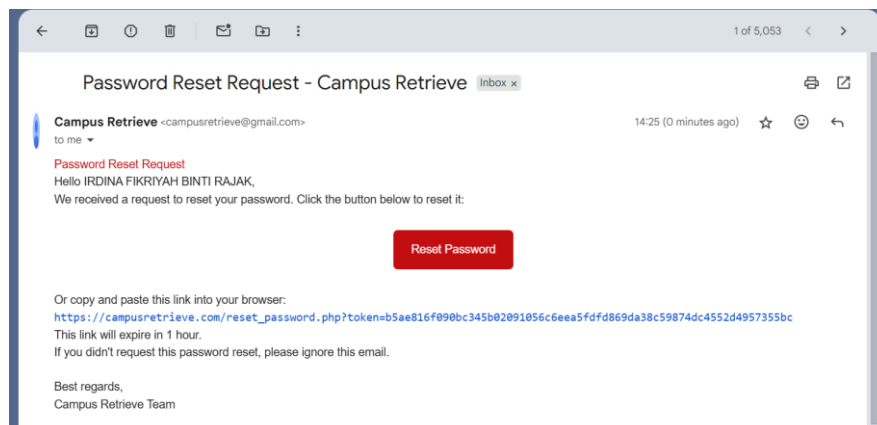


Figure 4.13:Password Reset Email.

Password reset email from CampusRetrieve containing a reset button and a link for users to securely reset their password. The link is valid for 1 hour and is provided in case the button does not work.

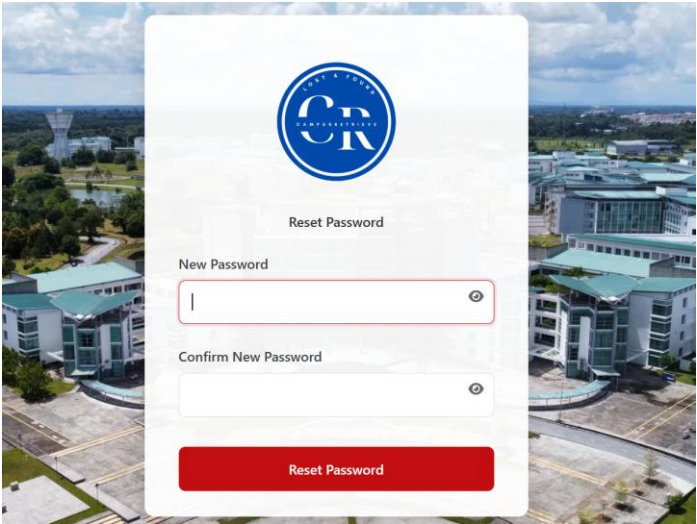


Figure 4.14:Reset Password Page.

Reset password page of the CampusRetrieve that allows users to enter and confirm a new password after receiving a reset link. A button is provided to submit and update the password.

4.3.5 Index

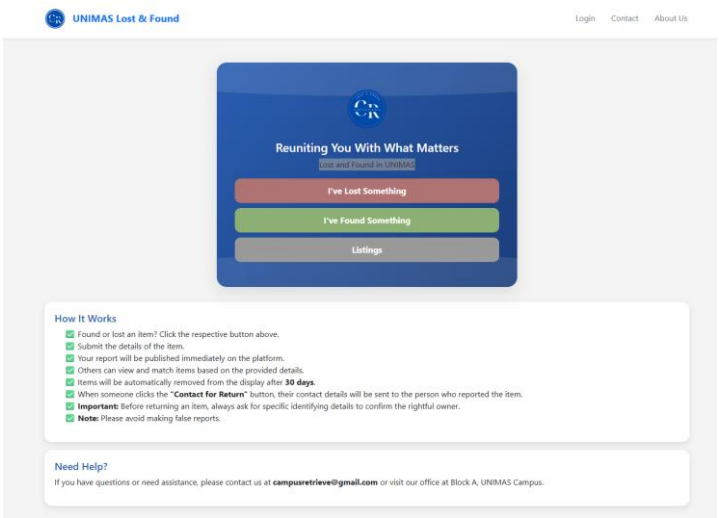


Figure 4.15:Homepage.

Homepage of the CampusRetrieve platform displaying three main actions—reporting a lost item, reporting a found item, and viewing listings. The page also includes guidance on how the system works and contact information for support.

4.3.6 Report Form

Lost Item Report

Item Photo: *

Upload

Click to upload a photo of the lost item

Upload a photo to help identify the lost item.

Item Name: *

Enter the name of the item

Enter the name of the lost item, e.g., "Wallet", "Phone".

Category: *

Select a category

Choose a category for the lost item, or specify your own category if not listed.

Description: *

Provide a detailed description of the item

Provide information like the item's condition, distinguishing features, or any other relevant details.

Last Seen Location: *

Select location

Select where the item was last seen or provide another location if it is not listed.

Your Name: *

Enter your full name

Please provide your name for contact purposes.

Your Email: *

Enter your email address

We'll use this to contact you if your item is found.

Your Phone Number:

Enter your phone number

Optional: Provide your phone number for faster contact.

Cancel

Submit

Figure 4.16:Lost Item Report Form.

Form page of the CampusRetrieve system for reporting lost items. Users are required to upload a photo, provide item details such as name, category, description, last seen location, and their contact information before submitting the report.

Found Item Report

Item Photo: *

Upload

Click to upload a photo of the found item

Upload a photo to help identify the found item.

Item Name: *

Enter the name of the item

Enter the name of the found item, e.g., "Wallet", "Phone".

Category: *

Select a category

Choose a category for the found item, or specify your own category if not listed.

Description: *

Provide a detailed description of the item

Provide information like the item's condition, distinguishing features, or any other relevant details.

Found Location: *

Select location

Select where the item was found or provide another location if it is not listed.

Your Name: *

Enter your full name

Please provide your name for contact purposes.

Your Email: *

Enter your email address

We'll use this to contact you regarding the found item.

Your Phone Number:

Enter your phone number

Optional: Provide your phone number for faster contact.

Cancel

Submit

Figure 4.17:Found Item Report Form.

90

Form page of the CampusRetrieve system for reporting found items. Users are required to upload a photo, provide item details such as name, category, description, found location, and their contact information before submitting the report.

4.3.7 Listings

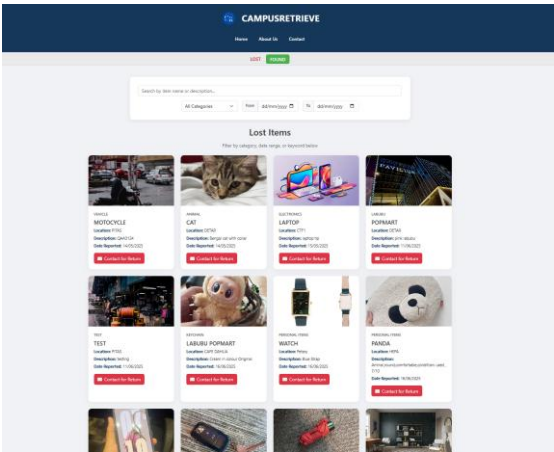


Figure 4.18:Lost Items Listing Page.

Lost items listing page of the CampusRetrieve platform showing reported items with details such as category, location, description, and date. Users can filter the results by category, date range, or keyword, and contact the reporter using the "Contact for Return" button.

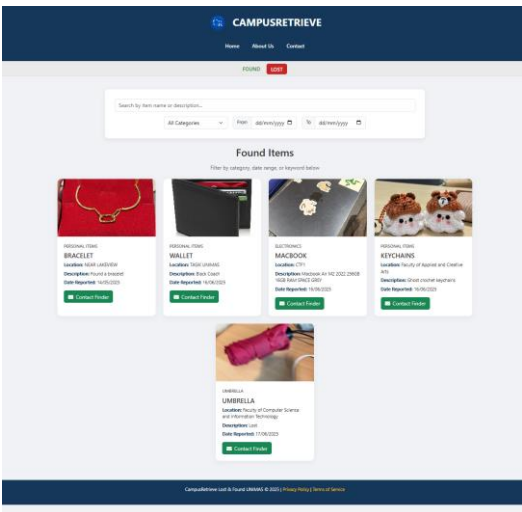
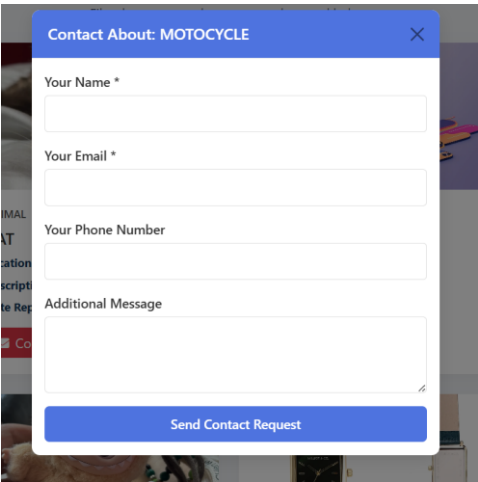


Figure 4.19:Found Items Listing Page.

Found items listing page of the CampusRetrieve platform showing items that have been reported found. Each card includes item details such as category, location, description, and report date. Users can filter listings and contact the finder using the "Contact Finder" button.

4.3.8 Contact for Return



A screenshot of a web form titled "Contact About: MOTOCYCLE". The form is white with a blue header bar containing the title and a close button. It contains four input fields: "Your Name *" (required), "Your Email *" (required), "Your Phone Number" (optional), and "Additional Message" (optional). A blue button labeled "Send Contact Request" is at the bottom.

Figure 4.20:Contact Request Form.

Contact form on the CampusRetrieve platform that allows users to reach out to the reporter of a lost or found item. Users are required to provide their name and email, with optional fields for phone number and additional message, before submitting the contact request.

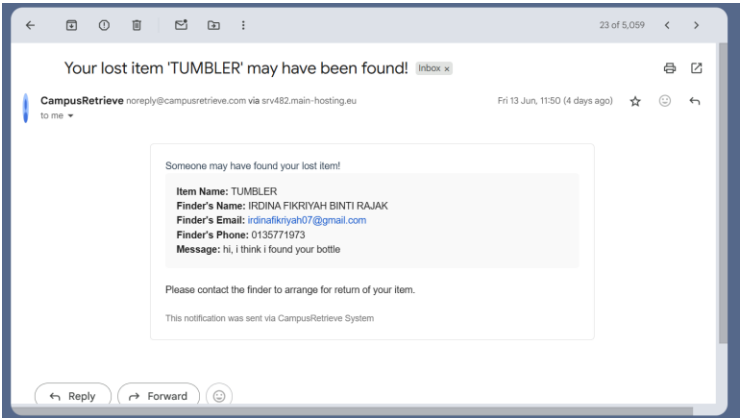


Figure 4.21:Lost Item Found Notification Email.

Notification email from CampusRetrieve informing the user that their reported lost item may have been found. The email includes the item name, finder’s contact information, and a message from the finder to facilitate the return.

4.3.9 Contact Us

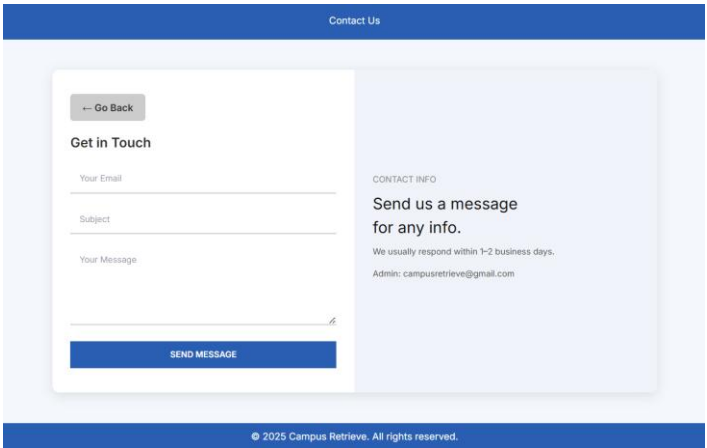


Figure 4.22:Contact Us Page.

Contact page of the CampusRetrieve platform where users can send a message by filling in their email, subject, and message. It also displays the admin contact information and typical response time.

4.3.10 Admin Login

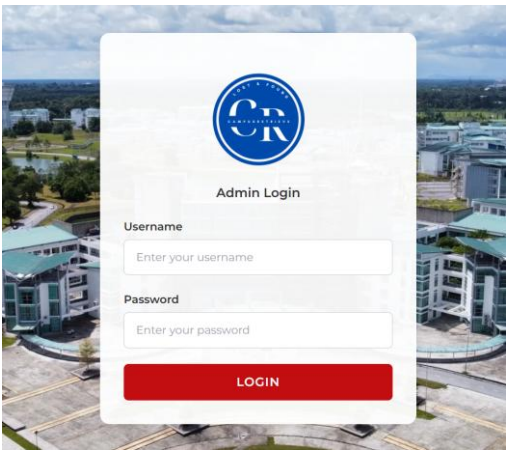


Figure 4.23:Admin Login Page.

Admin login page of the CampusRetrieve platform requiring administrators to enter their username and password to access the system. A red "Login" button is provided to proceed.

4.3.11 Dashboard

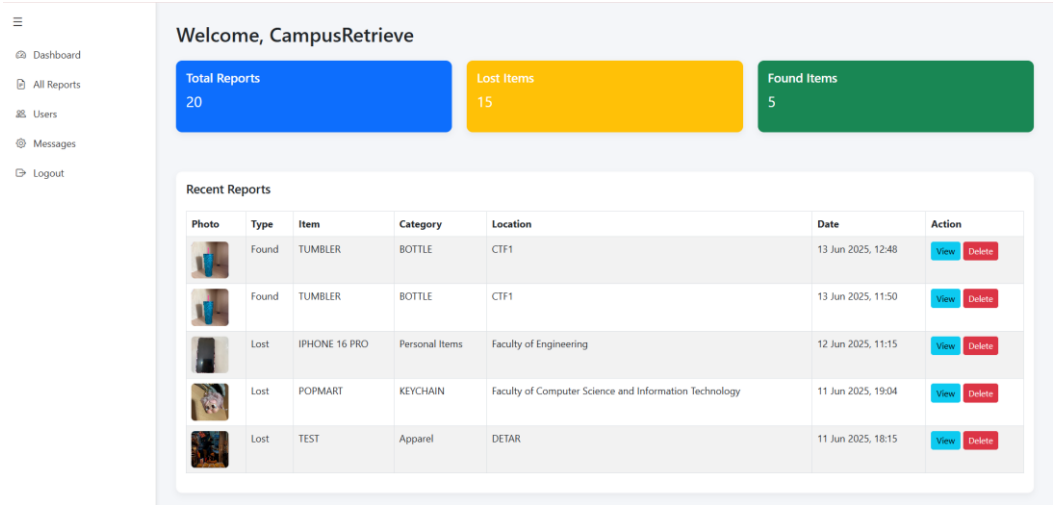


Figure 4.24:Admin Dashboard.

Admin dashboard of the CampusRetrieve platform displaying total reports, lost items, and found items. It includes a summary table of recent reports with item details, locations, timestamps, and action buttons for viewing or deleting entries.

4.3.12 Reports

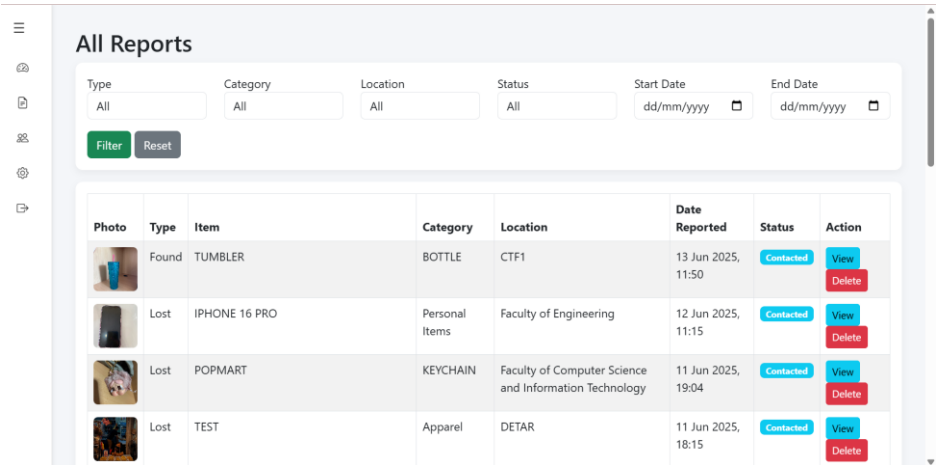
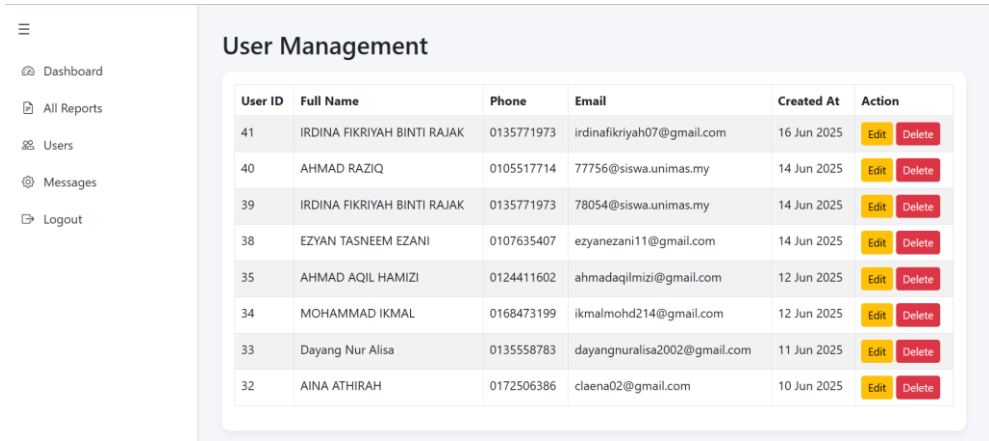


Figure 4.25:All Reports Page.

All reports page in the CampusRetrieve admin panel displaying a list of lost and found items with filtering options. Admins can filter by type, category, location, status, and date range, and take action on each report using the "View" and "Delete" buttons.

4.3.13 Users



User ID	Full Name	Phone	Email	Created At	Action
41	IRDINA FIKRIYAH BINTI RAJAK	0135771973	irdinafikriyah07@gmail.com	16 Jun 2025	Edit Delete
40	AHMAD RAZIQ	0105517714	77756@siswa.unimas.my	14 Jun 2025	Edit Delete
39	IRDINA FIKRIYAH BINTI RAJAK	0135771973	78054@siswa.unimas.my	14 Jun 2025	Edit Delete
38	EZYAN TASNEEM EZANI	0107635407	ezyanezani11@gmail.com	14 Jun 2025	Edit Delete
35	AHMAD AQIL HAMIZI	0124411602	ahmadaqilmizi@gmail.com	12 Jun 2025	Edit Delete
34	MOHAMMAD IKMAL	0168473199	ikmalmohd214@gmail.com	12 Jun 2025	Edit Delete
33	Dayang Nur Alisa	0135558783	dayangnuralisa2002@gmail.com	11 Jun 2025	Edit Delete
32	AINA ATHIRAH	0172506386	claena02@gmail.com	10 Jun 2025	Edit Delete

Figure 4.26:User Management Page.

User management page of the CampusRetrieve admin panel displaying a table of registered users with details such as full name, phone number, email, and registration date. Admins can edit or delete user records using the action buttons.

4.3.14 Message

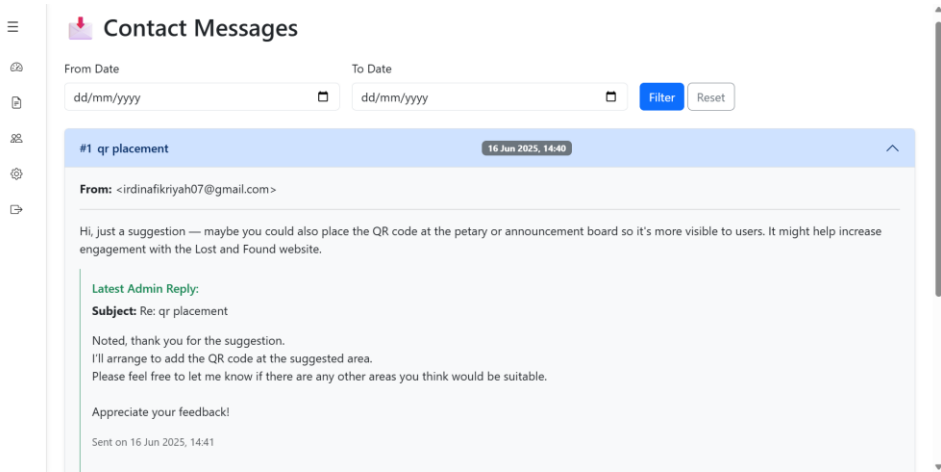


Figure 4.27:Contact Messages Page.

Contact messages page in the CampusRetrieve admin panel showing user-submitted feedback with admin replies. It includes message filtering by date, message details, and threaded responses for effective communication tracking.

4.3.15 Logout

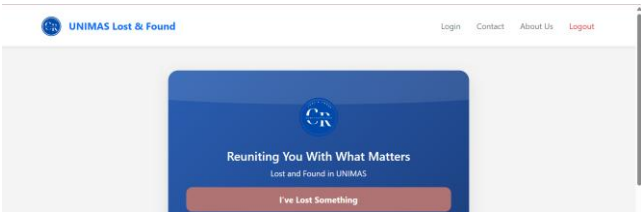


Figure 4.28:Logout Option in Navigation Bar.

The logout button in the CampusRetrieve platform is located on the top navigation bar, allowing users to securely exit their session after using the Lost and Found system.

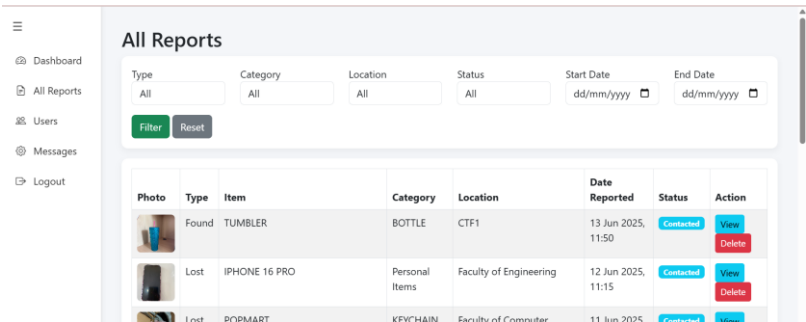


Figure 4.29:Admin Logout Option.

The admin logout button in the CampusRetrieve system is located in the left sidebar, enabling administrators to securely end their session after managing reports, users, or messages.

4.3.16 About Us

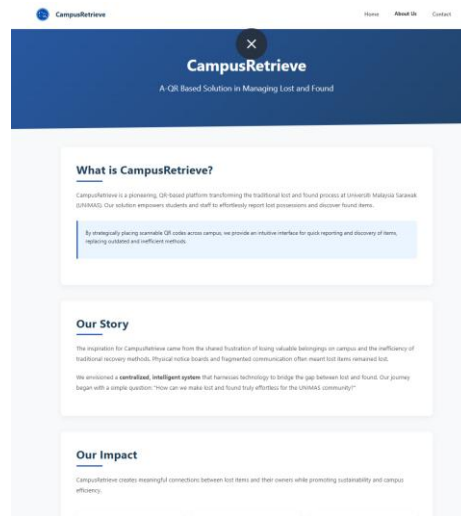


Figure 4.30:About Us Page.

The “About Us” page of the CampusRetrieve platform introduces the system as a QR-based solution for managing lost and found items at UNIMAS. It highlights the platform’s purpose, origin story, and impact on enhancing item recovery through centralized and efficient methods.

4.3.17 QR Code



Figure 4.31:CampusRetrieve Lost & Found QR Code.

QR code for the CampusRetrieve Lost & Found system, designed for easy scanning by users to quickly access the platform for reporting or searching lost and found items.

4.4 Chapter Summary

The implementation phase successfully transformed the CampusRetrieve system from design to reality by establishing a robust technical infrastructure and user-friendly interface. Key components such as QR code integration, database management, and notification systems were carefully implemented to ensure seamless functionality. The development followed an iterative approach, incorporating continuous feedback to refine features and enhance usability. By leveraging modern web technologies and strategic QR code placement across campus, the system achieved its goal of creating an accessible and efficient platform for lost and found management, setting a strong foundation for testing and deployment.

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CHAPTER 5 TESTING

5.1 Introduction

This chapter presents a comprehensive evaluation of CampusRetrieve through systematic testing methodologies designed to verify the system's functionality, reliability, and user experience. The testing phase employed a multi-tiered approach, beginning with functional testing to validate core features such as QR code scanning accuracy, item reporting workflows, and automated notification delivery. Performance testing followed to assess system stability under simulated peak usage conditions, measuring critical metrics including response times, database query efficiency, and concurrent user capacity. Finally, user acceptance testing engaged 30+ campus community members in real-world scenarios to evaluate practical usability and interface intuitiveness. These results not only confirm the system's technical robustness but also its effectiveness in addressing the practical challenges of lost-and-found management, providing a solid foundation for full-scale campus implementation.

5.2 Functional Testing

Functional testing was conducted to verify that each module of the CampusRetrieve system operates as expected. The following tables outline the test cases executed by module.

Table 5.1:Module Registration

Module: Registration Test Case Description: To ensure that the registration functionality works correctly and handles various inputs and system conditions effectively. Test Objectives: To verify that the user registration process is functioning correctly and includes proper email verification. Remarks: Test cases cover standard usage, edge cases, usability guidance, performance under load, and user feedback scenarios.							
Test Case ID	Test Scenario	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
F001	User registers and receives 6-digit verification code	1.Go to Register page 2. Fill in details 3. Submit form 4. Check email	Name, phone number, email, password	Verification code sent via email	As expected	Pass	Low

Table 5.2:Module Login

Module: Login Test Case Description: To validate the login mechanism across normal and error states, ensuring secure access and responsive behavior. Test Objectives: To verify that the login module performs its expected tasks correctly. Remarks: Includes tests for incorrect input handling, UI responsiveness, and concurrent access scenarios.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
F002	User logs in with valid credentials	1.Enter valid email and password 2. Click Login	E.g: 78054@siswa.unimas.my Irdina123@	User accesses the system	As expected	Pass	Low

F003	User fails to log in with invalid credentials	1. Enter invalid email and/or password 2. Click Login	E.g: 78054@siswa.my WrongPassword123	System displays an error message and does not allow access to the system	As expected	Pass	Low
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Table 5.3:Module Item Reporting

Module: Item Reporting Test Case Description: To confirm that the item reporting form accepts valid input, handles errors, and performs efficiently. Test Objectives: To verify that the item reporting module performs its expected tasks correctly. Remarks: Assesses both success and failure submissions, user guidance, and network performance handling.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
F004	Submit lost/found item report	1. Fill out item report form 2. Click submit	Valid item details	Item stored successfully	As expected	Pass	Low

Table 5.4:Module Item Listings

Module: Item Listings Test Case Description: To ensure that the listings page displays items clearly and handles scrolling and pagination effectively. Test Objectives: To verify that the item listings module performs its expected tasks correctly. Remarks: Tests focus on readability, performance under heavy data, and UI layout reliability.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure

F005	View list of items	1. Navigate to item listing page	None	Items are displayed correctly	As expected	Pass	Low
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Table 5.5:Module Item Search

Module: Item Search Test Case Description: To test that search features yield accurate results and filters work reliably across conditions. Test Objectives: To verify that the search module performs its expected tasks correctly. Remarks: Covers keyword accuracy, filter use, network tolerance, and user experience.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
F006	Search items using keywords	1. Enter keyword 2. Click search	Valid keyword	Matching items displayed	As expected	Pass	Low

Table 5.6:Module QR Access

Module: QR Access Test Case Description: To verify reliable QR scanning and redirection even under suboptimal conditions. Test Objectives: To verify that the QR access module performs its expected tasks correctly. Remarks: Ensure QR scanning and redirection work reliably across various lighting conditions and QR code quality levels.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
F007	Access site via QR Code	1. Scan static QR code	QR code	Redirects to homepage	As expected	Pass	Low

Table 5.7: Module Admin Panel

Module: Admin Panel Test Case Description: To validate that the admin functionalities work correctly and remain usable under heavy interaction. Test Objectives: Objective: To verify that the admin panel module performs its expected tasks correctly. Remarks: Includes multi-user edits, form flow, and management logic.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
F008	Admin views item reports	1. Log in as admin 2. Navigate to admin dashboard	Admin credentials	Report list displayed	As expected	Pass	Low
F009	Admin deletes inappropriate	1. Click delete on reported	Item ID	Item is deleted	As expected	Pass	Low
F010	Admin replies to user messages	1. Access contact messages 2. Click reply 3. Submit message	Message content	Response sent to user	As expected	Pass	Low
F011	Admin edits user profile	1. Open user list 2. Edit profile details 3. Save	User information	Profile updated	As expected	Pass	Low

Table 5.8:Module Email & Verification

Module: Email & Verification Test Case Description: To confirm timely email dispatch, link reliability, and security during authentication or recovery. Test Objectives: To verify that the email & verification module performs its expected tasks correctly. Remarks: Tests delays, retries, incorrect inputs, and message reliability.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure

F012	System sends 6-digit verification code	1. Register new user 2. Check email	Email	Verification code sent	As expected	Pass	Low
F013	User resets password via email	1. Click forgot password 2. Enter email 3. Check and follow link	Email	Password reset successful	As expected	Pass	Low

Table 5.9:Module Contact Button

Module: Contact Buttons Test Case Description: To ensure users can easily find and use contact buttons, and that messages are sent reliably. Test Objectives: To verify that the contact buttons module performs its expected tasks correctly. Remarks: Covers button visibility, form responsiveness, and email delivery success.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
F014	Contact for Return sends email to item owner	1. Click 'Contact for Return' 2. Submit message	Item ID user details	Owner receives email	As expected	Pass	Low
F015	Contact Finder sends email to item finder	1. Click 'Contact the Finder' 2. Submit message	Item ID user details	Finder receives email	As expected	Pass	Low

5.3 Non-Functional Testing

Nonfunctional testing was conducted to evaluate the system's stability, error handling, and behavior under non-standard or stress conditions. The following tables outline the test cases executed by module.

5.3.1 Reliability Testing

Table 5.10:Module Registration

Module: Registration Test Case Description: To ensure that the registration functionality works correctly and handles various inputs and system conditions effectively. Test Objectives: To verify that the registration module operates reliably under varying conditions. Remarks: Test cases cover standard usage, edge cases, usability guidance, performance under load, and user feedback scenarios							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R001	Empty registration form	1. Submit registration without filling form	Blank inputs	Validation error shown	As expected	Pass	Medium
R002	Register with already email	1. Register using an email already in user	Existing email	System rejects registration	As expected	Pass	Medium

Table 5.11:Module Login

Module: Login Test Case Description: To validate the login mechanism across normal and error states, ensuring secure access and responsive behavior. Test Objectives: To verify that the login module operates reliably under varying conditions. Remarks: Includes tests for incorrect input handling, UI responsiveness, and concurrent access scenarios.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R003	Login with incorrect credentials	1. Enter wrong credentials 2. Submit	Wrong email/password	Validation error shown	As expected	Pass	Medium

Table 5.12:Module Item Reporting

Module: Item Reporting Test Case Description: To confirm that the item reporting form accepts valid input, handles errors, and performs efficiently. Test Objectives: To verify that the item reporting module operates reliably under varying conditions. Remarks: Assesses both success and failure submissions, user guidance, and network performance handling.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R004	Submit under poor network	1. Fill item form 2. Submit with weak connection	Valid data	No data loss, retry on failure	As expected	Pass	Medium

Table 5.13: Module Item Search

Module: Item Search Test Case Description: To test that search features yield accurate results and filters work reliably across conditions. Test Objectives: To verify that the search feature performs reliably even under slow network conditions. Remarks: Covers keyword accuracy, filter use, network tolerance, and user experience.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R005	Search under slow connection	1. Enter search keywords with poor network 2. Submit search	Keywords search	Results still load successfully or show retry message	As expected	Pass	Medium

Table 5.14:Module QR Access

Module: QR Access Test Case Description: To verify reliable QR scanning and redirection even under suboptimal conditions. Test Objectives: To verify the system responds appropriately when QR access is attempted under device limitations. Remarks: To verify reliable QR scanning and redirection even under suboptimal conditions.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R006	Scan QR under poor camera conditions	1. Scan QR with low-light or slow device	QR scan	Redirects to homepage after scan with retry if failed	As expected	Pass	Medium

Table 5.15:Module Item Listings

Module: Item Listings Test Case Description: To ensure that the listings page displays items clearly and handles scrolling and pagination effectively. Test Objectives: To verify that the item listings module operates reliably under varying conditions. Remarks: Tests focus on readability, performance under heavy data, and UI layout reliability.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R007	Load and scroll through long list of items	1. Access item listing page 2. Scroll through numerous records	Large item dataset	System loads and renders items without lag or failure	As expected	Pass	Medium

Table 5.16: Module Admin Panel

Module: Admin Panel Test Case Description: To validate that the admin functionalities work correctly and remain usable under heavy interaction. Test Objectives: To verify that the admin panel module operates reliably under varying conditions. Remarks: Includes multi-user edits, form flow, and management logic.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R008	Multiple admin edits	1. Admin rapidly edits or deletes records	Bulk changes	System stable, no crashes	As expected	Pass	Medium

Table 5.17: Module Email & Verification

Module: Email & Verification Test Case Description: To confirm timely email dispatch, link reliability, and security during authentication or recovery. Test Objectives: To verify that the email & verification module operates reliably under varying conditions. Remarks: Tests delays, retries, incorrect inputs, and message reliability.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R009	Email server delay	1. Trigger email verification 2. Simulate delay	Valid email	System handles and retries	As expected	Pass	Medium
R010	Incorrect code entry	1. Enter wrong 6-digit code	Invalid code	System shows error and blocks access	As expected	Pass	Medium

Table 5.18: Module Contact Buttons

Module: Contact Buttons Test Case Description: To ensure users can easily find and use contact buttons, and that messages are sent reliably. Test Objectives: To verify that the contact buttons module operates reliably under varying conditions. Remarks: Covers button visibility, form responsiveness, and email delivery success.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
R011	Fail to send email	1. Click contact button with invalid emails	Invalid email	System logs failure and shows message	As expected	Pass	Medium

5.3.2 Usability Testing

Table 5.19: Module Registration

Module: Registration Test Case Description: To ensure that the registration functionality works correctly and handles various inputs and system conditions effectively. Test Objectives: To verify that the registration module operates reliably under varying conditions of usability testing. Remarks: Test cases cover standard usage, edge cases, usability guidance, performance under load, and user feedback scenarios							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U001	Empty form submission	Submit form with no input	Blank fields	Validation errors shown	Validation errors shown	Pass	Low
U002	Field guidance	Check if tooltips/helps are visible	User hovers inputs	Helpful guidance shown	Displayed tooltips	Pass	Low

Table 5.20: Module Login

Module: Login Test Case Description: To validate the login mechanism across normal and error states, ensuring secure access and responsive behavior. Test Objectives: To verify that the login module operates reliably under varying conditions of usability testing. Remarks: Includes tests for incorrect input handling, UI responsiveness, and concurrent access scenarios.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U003	Incorrect credentials	Enter wrong password	Valid email, wrong password	Error message displayed	Displayed error	Pass	Low
U004	Form responsiveness	Check layout on phone	Phone browser	Responsive layout	Layout adjusts	Pass	Low

Table 5.21: Module Item Reporting

Module: Item Reporting Test Case Description: To confirm that the item reporting form accepts valid input, handles errors, and performs efficiently. Test Objectives: To evaluate the usability testing aspects of the item reporting module, ensuring it performs as intended for end-users. Remarks: Assesses both success and failure submissions, user guidance, and network performance handling.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U004	Form completeness	Try submitting incomplete item report	Partial inputs	Validation error	Validation error shown	Pass	Low
U005	Attachment guidance	Check image upload help text	User hovers image field	Instruction visible	Tooltip shown	Pass	Low

Table 5.22: Module Item Search

Module: Item Search Test Case Description: To test that search features yield accurate results and filters work reliably across conditions. Test Objectives: To evaluate the usability testing aspects of the item search module, ensuring it performs as intended for end-users. Remarks: Covers keyword accuracy, filter use, network tolerance, and user experience.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U006	Keyword clarity	Search with partial match	Partial item name	Relevant results	Correct matches	Pass	Low
U007	Filter usability	Apply category/date filters	Dropdowns	Filtered results	Filtered correctly	Pass	Low

Table 5.23: Module QR Access

Module: QR Access Test Case Description: To verify reliable QR scanning and redirection even under suboptimal conditions. Test Objectives: To evaluate the usability testing aspects of the QR access module, ensuring it performs as intended for end-users. Remarks: To verify reliable QR scanning and redirection even under suboptimal conditions.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U008	Scan recognition	Scan QR using phone	QR Code	Page loads successfully	Redirect successfully	Pass	Low
U009	Instruction clarity	Observe scan instruction	User scanning	Steps understood	Understood easily	Pass	Low

Table 5.24: Module Item Listings

Module: Item Listings Test Case Description: To ensure that the listings page displays items clearly and handles scrolling and pagination effectively. Test Objectives: To evaluate the usability testing aspects of the QR access module, ensuring it performs as intended for end-users. Remarks: Tests focus on readability, performance under heavy data, and UI layout reliability.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U010	Item readability	Check if cards are clear	List view	Readable and distinct items	Clear layout	Pass	Low

U011	Navigation on ease	Move between pages	Multiple items	Pagination	Worked as expected	Pass	Low
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Table 5.25: Module Admin Panel

Module: Admin Panel Test Case Description: To validate that the admin functionalities work correctly and remain usable under heavy interaction. Test Objectives: To evaluate the usability testing aspects of the admin panel module, ensuring it performs as intended for end-users. Remarks: Includes multi-user edits, form flow, and management logic.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U012	Task flow clarity	Try approving claim	Claim ID	Smooth task completion	Admin completed task	Pass	Low
U013	Navigation on structure	Explore sidebar functions	Admin UI	Functions logically placed	Easy to find	Pass	Low

Table 5.26: Module Email & Verification

Module: Email & Verification Test Case Description: To confirm timely email dispatch, link reliability, and security during authentication or recovery. Test Objectives: To evaluate the usability testing aspects of the email & verification module, ensuring it performs as intended for end-users.. Remarks: Tests delays, retries, incorrect inputs, and message reliability.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U014	Email receipt	Check email	Valid claim	Email received	Email received	Pass	Low
U015	Link functionality	Click verification	Email link	Redirects to correct page	Verified correctly	Pass	Low

Table 5.27: Module Contact Button

Module: Contact Button Test Case Description: To ensure users can easily find and use contact buttons, and that messages are sent reliably. Test Objectives: To evaluate the usability testing aspects of the contact button module, ensuring it performs as intended for end-users. Remarks: Covers button visibility, form responsiveness, and email delivery success.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
U016	Visibility	Find contact button	User interaction	Button easily found	Visible	Pass	Low
U017	Form ease	Send message via form	Simple message	Message sent	Sent successfully	Pass	Low

5.3.3 Efficiency Testing

Table 5.28:Module Registration

Module: Registration Test Case Description: To ensure that the registration functionality works correctly and handles various inputs and system conditions effectively. Test Objectives: To evaluate the efficiency testing aspects of the registration module, ensuring it performs as intended for end-users. Remarks: Test cases cover standard usage, edge cases, usability guidance, performance under load, and user feedback scenarios							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
E001	Response time	Measure registration speed	Valid form data	Under 30 seconds	25s	Pass	Low

E002	Concurrent registrations	5 users register simultaneously	5 forms	All succeed	All succeed	Pass	Low
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Table 5.29: Module Login

Module: Login Test Case Description: To validate the login mechanism across normal and error states, ensuring secure access and responsive behavior. Test Objectives: To evaluate the efficiency testing aspects of the login module, ensuring it performs as intended for end-users.. Remarks: Includes tests for incorrect input handling, UI responsiveness, and concurrent access scenarios.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
E003	Login speed	Time taken after submitting	Valid credentials	Under 3 second	2s	Pass	Low
E004	Multiple login	5 users login at once	5 users	No crash	Stable	Pass	Low

Table 5.30: Module Item Reporting

Module: Item Reporting Test Case Description: To confirm that the item reporting form accepts valid input, handles errors, and performs efficiently. Test Objectives: To evaluate the efficiency testing aspects of the item reporting module, ensuring it performs as intended for end-users. Remarks: Assesses both success and failure submissions, user guidance, and network performance handling.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
E005	Form submit speed	Measure submit time	Full report	Under 45 seconds	40s	Pass	Low
E006	Multiple reports	Bulk reports added	5 items	All saved	All saved	Pass	Low

Table 5.31: Module QR Access

Module: QR Access Test Case Description: To verify reliable QR scanning and redirection even under suboptimal conditions. Test Objectives To evaluate the efficiency testing aspects of the QR access module, ensuring it performs as intended for end-users. Remarks: To verify reliable QR scanning and redirection even under suboptimal conditions.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
E007	Scan to load	Time QR to page	QR code	Under 2s	1.8S	Pass	Low
E009	Multiple scans	5 scans in 1 min	5 users	No error	All succeeded	Pass	Low

Table 5.32: Module Item Listings

Module: Item Listings Test Case Description: To ensure that the listings page displays items clearly and handles scrolling and pagination effectively. Test Objectives To evaluate the efficiency testing aspects of the item listings module, ensuring it performs as intended for end-users. Remarks: Tests focus on readability, performance under heavy data, and UI layout reliability.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
E010	List load time	Open listing page	Homepage	Under 3s	2.7s	Pass	Low
E011	Pagination load	Load page	Next page	Fast load	Loaded fast	Pass	Low

Table 5.33: Module Admin Panel

Module: Admin Panel Test Case Description: To validate that the admin functionalities work correctly and remain usable under heavy interaction. Test Objectives To evaluate the efficiency testing aspects of the admin panel module, ensuring it performs as intended for end-users. Remarks: Includes multi-user edits, form flow, and management logic.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
E012	Action time	Approve/reject item	Admin task	Under 20s	18s	Pass	Low
E013	Multi-admin load	3 admins act together	3 tasks	No slowdown	Performed well	Pass	Low

Table 5.34: Module Email & Verification

Module: Email & Verification Test Case Description: To confirm timely email dispatch, link reliability, and security during authentication or recovery. Test Objectives To evaluate the efficiency testing aspects of the email & verification module, ensuring it performs as intended for end-users. Remarks: Tests delays, retries, incorrect inputs, and message reliability.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
E014	Email delay	Time from action to email	Trigger event	Under 3s	2.5s	Pass	Low
E015	Link response	Click link response time	Verification link	Fast redirect	1.7s	Pass	Low

Table 5.35:Module Contact Button

Module: Contact Button Test Case Description: To ensure users can easily find and use contact buttons, and that messages are sent reliably. Test Objectives To evaluate the efficiency testing aspects of the contact button module, ensuring it performs as intended for end-users. Remarks: Covers button visibility, form responsiveness, and email delivery success.							
Test Case ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Severity Failure
E016	Form load	Open contact form	Click contact	Immediate	Opened fast	Pass	Low
E017	Message time	Time to send message	Short message	Under 15s	10s	Pass	Low

5.4 User Testing

User testing was conducted to evaluate the overall user experience, interface intuitiveness, and satisfaction level with the CampusRetrieve system. Feedback was collected through structured questionnaires and practical usage of the system.

5.4.1 User Acceptance Testing

The user acceptance testing for CampusRetrieve was conducted using a structured Google Form consisting of a single section with a total of six questions. The form was designed to gather both quantitative and qualitative feedback from users after they had interacted with the system. Four of the questions used a linear scale format, allowing participants to rate their experience on a scale of 1 to 5. These questions focused on evaluating the ease of use, clarity of the system's layout and instructions, overall system speed and responsiveness, and overall satisfaction with the system. In addition, two short answer questions were included to collect open-ended responses. These questions asked users to describe any issues or errors they encountered while using the system and to suggest any improvements they believed could enhance its functionality. This combination of rating and open-text feedback enabled a comprehensive understanding of user perceptions and areas for refinement.

Close-Ended Questions

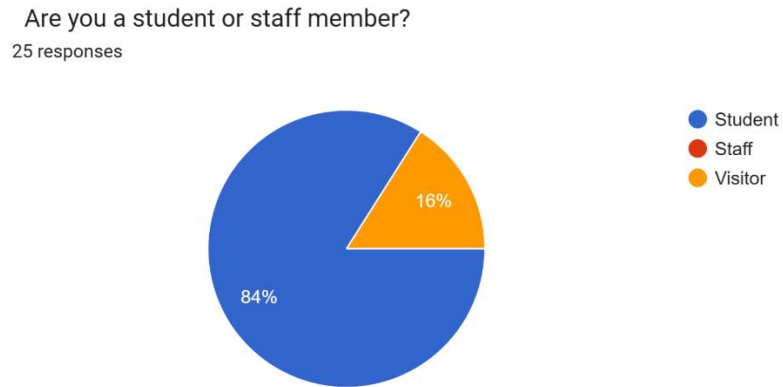


Figure 5.1: Role at Campus

This pie chart represents the response distribution to the survey question “Are you a student or staff member?” from the CampusRetrieve feedback form. Out of 25 participants, 84% identified as students and 16% as visitors, while no staff members responded. The survey was conducted to gather user feedback on the CampusRetrieve lost and found website, helping to evaluate its effectiveness and identify areas for improvement based on the target audience's experience.

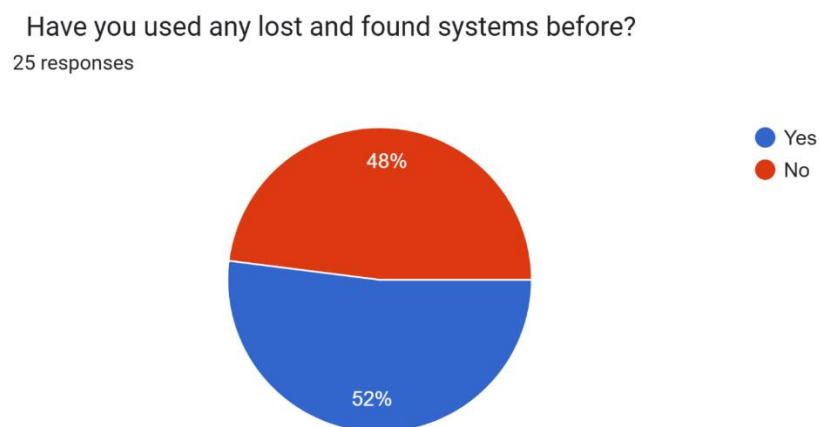


Figure 5.2: Respondents' Experience with Lost and Found Systems

This pie chart shows the responses to the question “Have you used any lost and found systems before?” from the CampusRetrieve feedback survey. Out of 25 participants, 52% reported having prior experience using lost and found systems, while 48% had not. This nearly even split highlights the importance of designing a system that is intuitive for both experienced and first-time users, ensuring accessibility and ease of use for all.

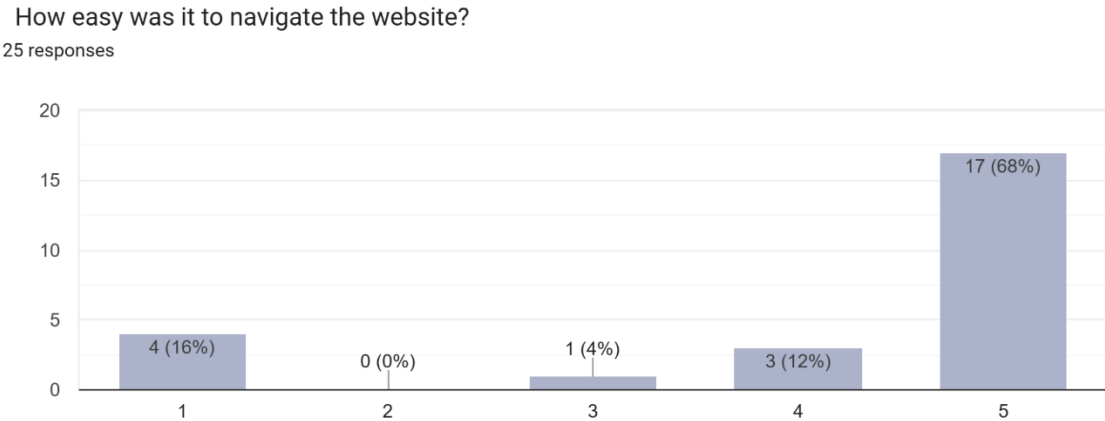


Figure 5.3: User Ratings on Website Navigation Ease

This bar chart presents the ease of navigation experienced by users on the CampusRetrieve lost and found website. Out of 25 respondents, the majority (68%) rated the navigation as very easy (score of 5), while 12% gave it a score of 4. A small number of users rated it lower: 4 respondents (16%) rated it 1, 1 respondent (4%) rated it 3, and none selected 2. These results indicate that most users found the website user-friendly, though there remains a small segment who experienced difficulty, suggesting potential areas for interface refinement.

How clear were the instructions or prompts on each page?
25 responses

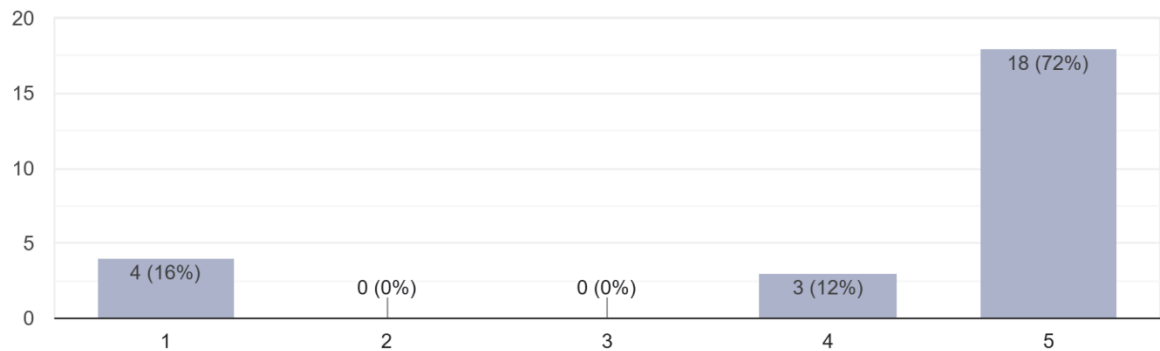


Figure 5.4: User Ratings on Clarity of Instructions or Prompts

This bar chart illustrates how clearly users perceived the instructions or prompts on each page of the CampusRetrieve website. Among the 25 respondents, a significant majority (72%) rated the clarity at the highest level (5), while 12% rated it a 4. However, 16% of users gave the lowest score (1), and none selected 2 or 3. These results indicate that while most users found the instructions clear and helpful, a small portion experienced confusion, suggesting a need to review and improve specific areas of guidance on the platform.

Did you experience any difficulties when using the system?
25 responses

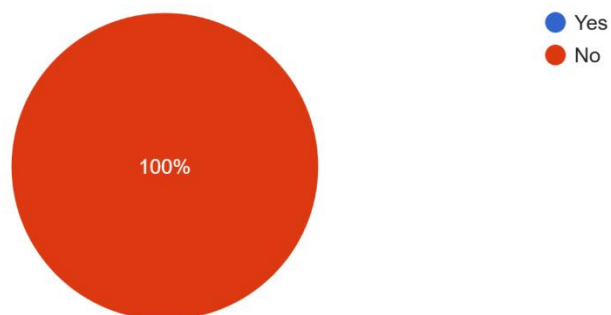


Figure 5.5: User Feedback on System Difficulties

This pie chart shows the response to the question “Did you experience any difficulties when using the system?” from the CampusRetrieve feedback survey. All 25 respondents (100%) selected "No," indicating that none of the users encountered issues while using the system. This reflects a high level of usability and smooth user experience, suggesting that the system functions as intended and is accessible to its intended audience.

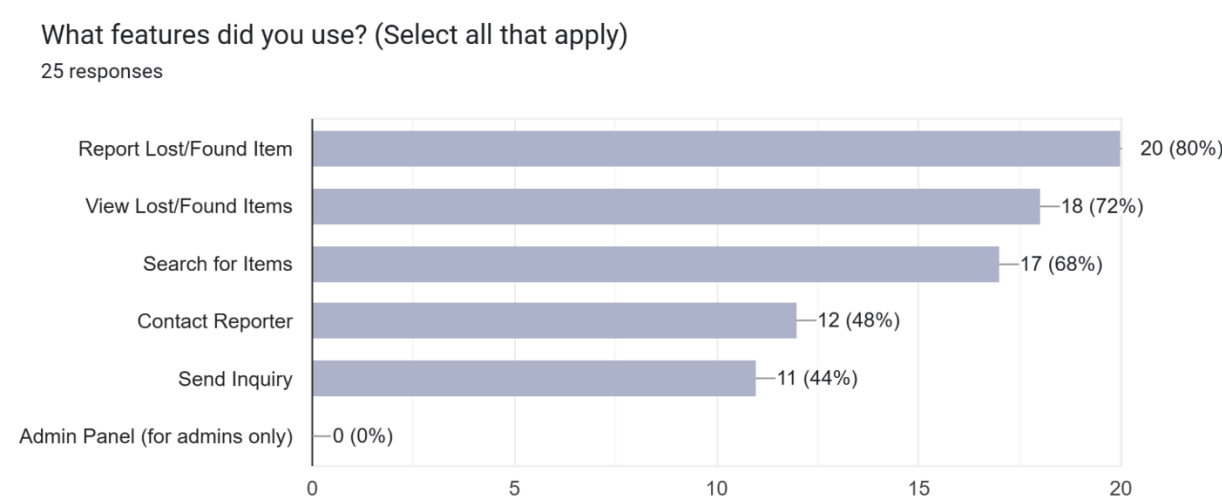


Figure 5.6: Features Used by CampusRetrieve Users

This bar chart illustrates the usage of various features on the CampusRetrieve lost and found system, based on 25 survey responses. The most frequently used feature was "Report Lost/Found Item" (80%), followed by "View Lost/Found Items" (72%) and "Search for Items" (68%). Less frequently used features included "Contact Reporter" (48%) and "Send Inquiry" (44%). No users accessed the "Admin Panel," which is restricted to administrators. These results indicate strong engagement with core user functionalities while also highlighting potential areas to enhance feature visibility or usability.

Did the system respond quickly and without errors?
25 responses

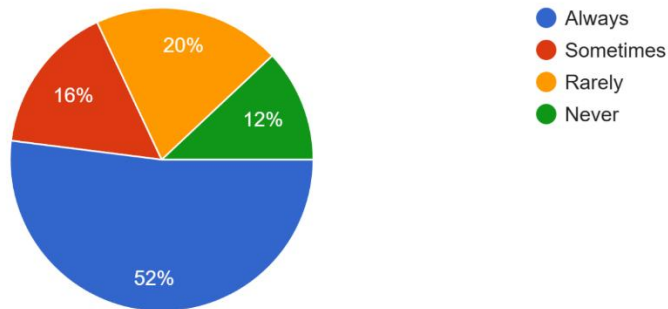


Figure 5.7: System Responsiveness and Error Handling

This pie chart shows user responses to the question “Did the system respond quickly and without errors?” from the CampusRetrieve feedback survey. Out of 25 respondents, 52% indicated that the system always responded well, while 20% said it rarely did, and 16% said sometimes. A smaller portion, 12%, reported that the system never responded quickly or without errors. Although the majority of users had a positive experience with system performance, the presence of inconsistent feedback suggests there may be occasional issues worth investigating to ensure smoother, more reliable interactions for all users.

Did the QR code integration work as expected?
25 responses



Figure 5.8: User Feedback on QR Code Integration Functionality

This pie chart displays responses to the question “Did the QR code integration work as expected?” from the CampusRetrieve system survey. All 25 participants (100%) answered "Yes," indicating that the QR code functionality was fully effective and met user expectations. This result highlights the successful implementation of the QR code feature, ensuring a seamless and accessible way for users to interact with the system.

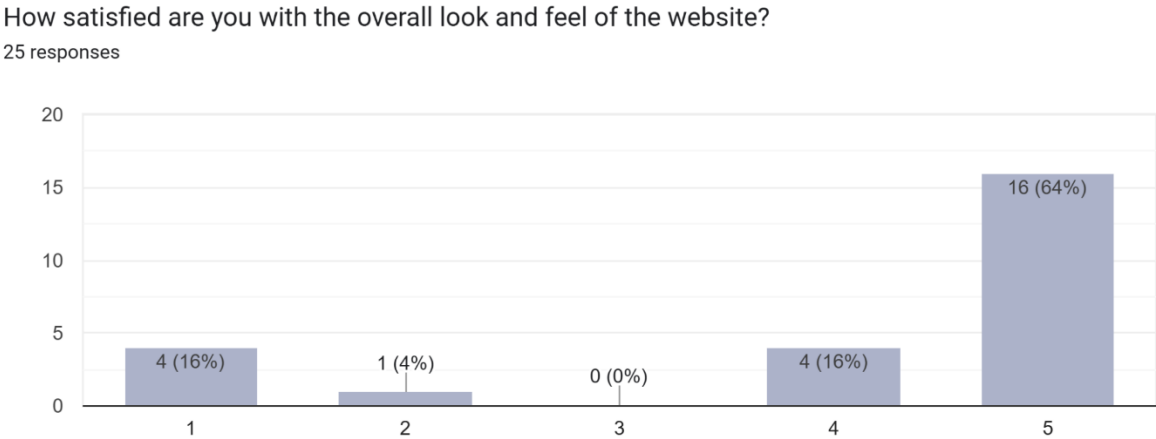


Figure 5.9: User Satisfaction with Website Design and Appearance

This bar chart reflects user satisfaction with the overall look and feel of the CampusRetrieve website. Among the 25 respondents, the majority (64%) rated their satisfaction at the highest level (5), while 16% chose level 4. However, another 16% rated it a 1, and one respondent (4%) rated it a 2. No respondents selected a neutral rating of 3. While most users found the design visually appealing and satisfying, the lower scores suggest there is still room for visual or stylistic improvement to better cater to all users’ preferences.

How likely are you to recommend CampusRetrieve to others?

25 responses

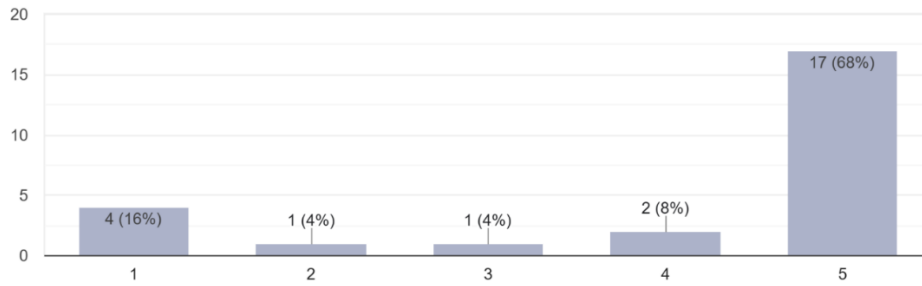


Figure 5.10: Likelihood of Users Recommending CampusRetrieve

Open-Ended Question

What improvements would you suggest for better usability or effectiveness?

25 responses

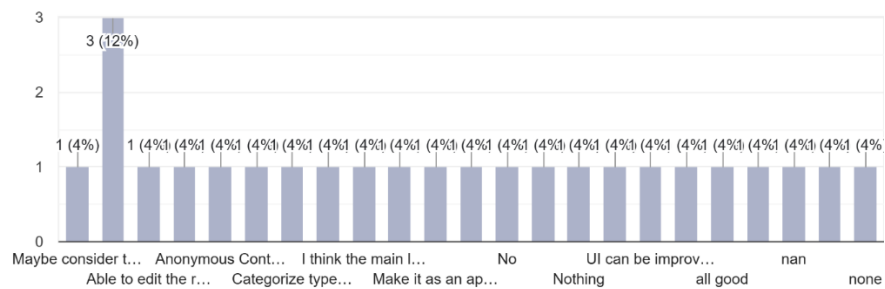


Figure 5.11: User Suggestions for Improving CampusRetrieve

Suggestions for Improvement

- Push notification/call
- Improve login interface
- Switch to app
- Able to edit report after submission
- Multilingual support
- Allow users to give feedback
- Add dark mode feature

- Auto-suggest description using AI
- Anonymous Contact System
- Suggest being added into UNIMAS Now

This figure presents a summary of open-ended suggestions provided by 30 users after using CampusRetrieve. These responses were gathered to identify areas for improving both the usability and overall effectiveness of the system. While most suggestions were mentioned only once, each representing approximately four percent of total feedback, several recurring themes emerged from the responses.

A significant portion of users expressed interest in having a dedicated mobile application, which would offer greater convenience and flexibility by allowing users to report or search for items directly from their smartphones. Others recommended enhancing the login interface to ensure a smoother and more intuitive user experience, especially for new users. Some participants also suggested introducing a feature that allows users to edit their reports after submission. This would be useful for correcting mistakes or adding additional information post-submission.

In addition, users highlighted the importance of multilingual support to cater to a diverse campus population, as well as a dark mode option to improve visual comfort during extended use or nighttime access. A few respondents recommended the inclusion of a feedback or rating mechanism, enabling users to share their experiences and help guide future improvements.

More advanced suggestions included implementing artificial intelligence to assist users by auto-suggesting item descriptions based on keywords or uploaded images. Another idea was to incorporate an anonymous contact system that would allow the reporter and finder to communicate within the platform without revealing personal details, improving

both security and privacy. Integration with the UNIMAS Now mobile application was also proposed to streamline access and promote wider adoption among students and staff. Finally, it is worth noting that approximately twelve percent of users reported no suggestions for improvement. Responses such as “no improvement,” “nothing,” or “all good” reflect general satisfaction with the current system, indicating that CampusRetrieve is already meeting the needs of a portion of its users effectively.

5.5 Chapter Summary

Comprehensive testing validated the CampusRetrieve system's performance, reliability, and user satisfaction. Functional testing confirmed all core features operated as intended, including QR code scanning, item reporting, and automated notifications. Non-functional testing demonstrated the system's stability under stress and its efficient response times. User acceptance testing with campus community members yielded positive feedback, particularly praising the intuitive interface and notification system, while also identifying minor areas for improvement. The successful testing outcomes confirmed the system's readiness for full campus deployment and provided valuable insights for future enhancements

CHAPTER 6 CONCLUSION & FUTURE WROKS

6.1 Introduction

The development and implementation of CampusRetrieve represent a significant advancement in campus lost-and-found management systems, demonstrating how targeted technological solutions can address persistent institutional challenges. This concluding chapter synthesizes key findings from all project phases, evaluating the system's effectiveness against its original objectives while reflecting on broader implications for campus operations and community engagement. The analysis encompasses technical achievements in system architecture and QR code integration, practical outcomes from real-world deployment, and unexpected insights gained through user interactions. By examining both quantitative performance metrics and qualitative user feedback, this chapter provides a holistic assessment of how the project has transformed lost-and-found processes at Universiti Malaysia Sarawak. Furthermore, it situates these results within the larger context of sustainable campus initiatives and digital transformation in higher education, highlighting how CampusRetrieve contributes to SDG 12 (Responsible Consumption and Production) through reduced waste and improved resource management. The discussion then transitions to an honest appraisal of system limitations and a forward-looking perspective on future enhancement opportunities, offering a balanced view of the project's legacy and potential evolution in the coming years.

6.2 Project Achievement

Objectives	Achievement
Develop a user-friendly platform for quick and easy reporting of lost and found items using QR codes.	A fully functional web-based system was developed.

Create a searchable database of found items that users can filter by category, location, and date.	A search and filtering feature was implemented, allowing users to locate items based on multiple criteria.
Implement an automated notification system that alerts users when an item matching their lost report is found.	This was partially achieved, as users receive an email notification when another user initiates contact through the "Contact for Return" or "Contact Finder" button.

The development of CampusRetrieve has successfully met its core objectives:

- Objective 1: Develop a user-friendly platform for quick and easy reporting of lost and found items using QR codes.

This objective was successfully achieved through the development of a fully functional web-based system. The platform allows users to report and search for lost items efficiently. Additionally, a QR code access point was integrated to provide quick system entry without the need to manually enter or remember the URL. This feature enhances user convenience and supports faster reporting, fulfilling the goal of ease-of-use.

- Objective 2: Create a searchable database of found items that users can filter by category, location, and date.

The system includes a powerful search and filtering feature that enables users to browse found items using specific criteria such as category, location, and date. This function simplifies the process of locating lost items. Moreover, an admin panel is available for backend management of user reports and system cleanliness, ensuring the database remains organized and reliable.

- Objective 3: Implement an automated notification system that alerts users when an item matching their lost report is found.

This objective is partially achieved. While a fully automated matching and alert mechanism has not been implemented, the system is capable of notifying users via email when a finder identifies a potential match for a lost item report. Future upgrades may

include an integrated notification system for automatic alerts, providing a more seamless and real-time experience for users.

6.3 Contribution

The project contributed significantly in the following ways:

- Improved lost and found management within the campus by digitalizing the entire process.

The system transformed the traditional, manual method of handling lost and found items into a digital solution. Users can now report and search for items online, making the process more efficient, transparent, and accessible at any time.

- Reduced workload for administrative staff by providing an automated and self-service platform for students and staff.

With CampusRetrieve, users are able to manage their own reports and inquiries without needing direct involvement from administrative personnel. This automation has lightened the staff's responsibilities and reduced time spent on routine lost and found issues.

- Encouraged user accountability through secure login and tracking features.

Each action within the system—whether reporting, searching, or contacting—is tied to a registered user. This helps track activity, discourages misuse, and fosters responsible engagement with the platform.

- Provided a real-world platform for applying web development, database management, and system design knowledge.

The project enabled hands-on application of skills learned in class, including PHP programming, MySQL database handling, and UI/UX design. It also involved the integration of features like QR codes and user authentication, enhancing technical proficiency.

6.4 Project Limitation

Despite its successes, CampusRetrieve has several limitations:

- The system does not support image-based search or AI detection for identifying items.

Users are currently required to search for lost or found items using textual descriptions and manual filters. Without image recognition or AI capabilities, the matching process may be slower and prone to human error, especially for items with vague or similar descriptions.

- It is restricted to a single campus and not scalable to multiple locations without modification.

The system was developed with a fixed structure tailored to one institution. To support deployment across multiple campuses or organizations, the codebase and database design would require significant restructuring to handle multiple environments or branches efficiently.

- Currently lacks a notification system or dashboard analytics to inform users or admins of updates.

There is no automated alert system to notify users of new item matches or changes in item status. Similarly, the admin side lacks analytics features to track system usage, monitor trends, or identify bottlenecks in real-time, limiting overall visibility and responsiveness.

- Item verification and return relies on manual email contact rather than a secure in-system chat or handover confirmation.

Communication between the finder and the owner is currently handled outside the system through email. This manual process can lead to delays, missed messages, or

confusion, as there is no built-in feature to confirm successful returns or securely manage conversations.

6.5 Future Works

For future improvements, the following enhancements are suggested:

- Add a notification system (email or in-system alerts) for item status changes or new matching reports.

Introducing a notification feature would improve user engagement and responsiveness. Users could receive real-time updates when there is a status change in their reported items or when a newly listed item matches their report, eliminating the need to check the system manually.

- Implement image recognition or matching for better identification of lost/found items.

Incorporating AI-based image recognition would enable users to upload images of their lost items and find visually similar matches. This would enhance search accuracy, especially when users are unsure how to describe their items in text form.

- Expand the system to support multi-campus or organization-wide deployment.

To make CampusRetrieve scalable, the architecture should be redesigned to handle data and access across different institutions. This enhancement would allow broader implementation and benefit larger networks or organizations with multiple locations.

- Include a chat module or secure communication feature between item reporter and finder to reduce reliance on email.

A built-in messaging system would enable users to communicate directly and securely within the platform. This would speed up the item return process, reduce the risk of miscommunication, and provide a record of interactions.

- Develop a mobile application version of the system for better accessibility.

Creating a mobile app would allow users to report, search, and manage items on the go. With features like QR code scanning, push notifications, and offline access, a mobile version would make the platform more user-friendly and accessible to a wider audience.

6.6 Conclusion

The CampusRetrieve project has successfully demonstrated how innovative application of QR code technology can transform the management of lost and found items in a university setting. By addressing the inefficiencies of traditional methods through a centralized, digital platform, the project has created a system that is not only more effective in reuniting owners with their belongings but also contributes to broader institutional goals of sustainability, community engagement, and operational efficiency.

The system's development journey, from initial concept through to implementation, has underscored the importance of user-centered design principles and iterative development methodologies. The positive feedback received during testing phases confirms that the solution meets real user needs and has the potential to significantly improve the campus experience for students, staff, and visitors alike. Moreover, the project's alignment with Sustainable Development Goal 12 highlights how localized technological solutions can contribute to global sustainability objectives by reducing waste and promoting responsible consumption.

While challenges were encountered, particularly in ensuring widespread awareness and adoption, these have provided valuable lessons for future development and implementation strategies. The project's limitations have been carefully documented to inform subsequent iterations and similar initiatives at other institutions. As CampusRetrieve moves from pilot phase to full campus deployment, it carries with it the potential to serve as a model for how universities can leverage technology to solve

practical, everyday problems while fostering a more sustainable and connected campus community.

Looking ahead, the foundations laid by this project open numerous possibilities for expansion and enhancement. The system's modular design and scalable architecture position it well for future development, whether through additional features, integration with other campus systems, or adaptation to new contexts. Ultimately, CampusRetrieve stands as testament to the power of focused technological innovation to make meaningful improvements in institutional operations and campus life.

REFERENCES

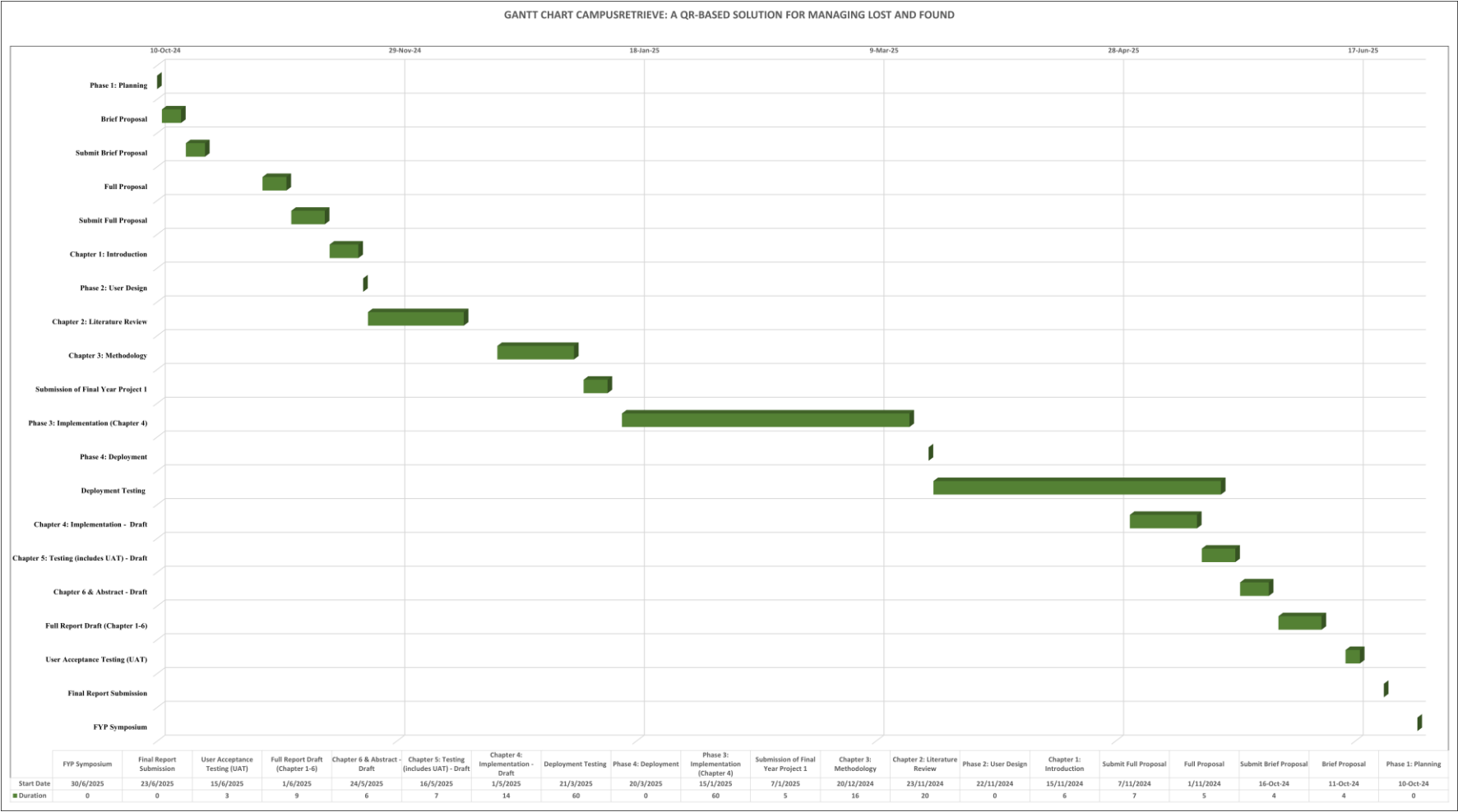
- Airapetian, G. (2022). *Rapid Application Development (RAD)*. Trusted Local Appliance Repair, Electrical & Plumbing Experts. <https://www.agilelonestar.com/knowledge-base/rapid-application-development>
- Ajwani-Ramchandani, S., Bui, X. T., & Valenzuela-Levi, A. (2021). Opportunities and challenges for solid waste reuse and recycling in emerging economies. *Resources, Conservation and Recycling*, 177, 105968. <https://doi.org/10.1016/j.resconrec.2021.105968>
- Browning, L., Fei, Y., & Patwa, N. (2021). Opportunities and challenges for solid waste reuse and recycling in emerging economies. *Resources, Conservation and Recycling*, 177, 105968. <https://doi.org/10.1016/j.resconrec.2021.105968>
- Cornell Police (2023). Lost and Found. Retrieved June 30, 2023, from <https://www.cupolice.cornell.edu/about-the-department/lost-and-found/>
- Faundit. (n.d.). <https://faundit.com/>
- Gasper, D., Shah, A., & Tankha, S. (2019). The Framing of Sustainable Consumption and Production in SDG 12. *Global Policy*, 10(S1), 83–95. <https://doi.org/10.1111/1758-5899.12592>
- Grünloh, C., Walldius, Å., Hartmann, G., & Gulliksen, J. (2015). Using online reviews as narratives to evoke designer's empathy. In J. Abascal et al. (Eds.), *INTERACT* (pp. 298-315). Springer, Switzerland.
- <https://www.cupolice.cornell.edu/about-the-department/lost-and-found/>
- Jan, S., Alzahrani, A., & Basahel, A. (2020). A comparative analysis of RAD and Agile technique for management. *CMC*, 64(2), 777-796.
- Jayasooria, D., & Yi, I. (2022). *Encyclopedia of the social and solidarity economy*. Retrieved from <https://www.elgaronline.com/> at 05/12/2024 16:18:32PM via

Open Access. This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 License.

- Khan, N. T. (2023). Environmental impact of solid waste landfilling in Balochistan - A risk assessment for various Sustainable Development Goals (SDGs).
- Kumar, Satendra & Bhatnagar, Divyang & Gahlot, Divyanshu & Gola, Bhoopendra & Rajput, Garvit. (2022). Web-Based Lost and Found System. 11. 7-10.
- Lost and found in Malaysia -Easy Peasy Lost and found property process!* (n.d.). <https://tagmefy.com/malaysia/>
- Maisyaroh, M., Untari, S., Chusniyah, T., Prestiadi, D., Adha, M. A., Ariyanti, N. S., Saputra, B. R., & Yulaidi, E. M. (2022). "LOST AND FOUND BOX" AS a SCHOOL INNOVATION IN STRENGTHENING THE CHARACTER OF STUDENTS BASED ON INTEGRITY VALUES IN ELEMENTARY SCHOOL. *International Research-Based Education Journal*, 4(1), 14. <https://doi.org/10.17977/um043v4i1p14-24>
- NotLost Press. (2020). 4.5 million items lost: The hidden cost of lost property at university. Retrieved June 30, 2023, from <https://notlost.com/the-hidden-cost-of-lost-property-at-university/>
- Rahman, M. M., & Hossain, M. E. (2024). Green technology, policy and sustainable finance nexus with SDG-12: Moderating effects of stakeholder awareness. *Sustainable Futures*, 8, 100405. <https://doi.org/10.1016/j.sftr.2024.100405>
- Ram, M., & Bracci, E. (2024). Waste management, waste indicators and the relationship with sustainable development goals (SDGs). *Sustainability*, 16(8486).
- RepoApp. (2019). Lost and Found Software for Universities. Retrieved June 30, 2023, from <https://www.repoapp.com/lost-found-software-universities/>

- Salleh, N., Mendes, E., & Grundy, J. (2011). Empirical studies of pair programming for CS/SE teaching in higher education: A systematic literature review. *IEEE Transactions on Software Engineering*, 37(3), 509-525.
- Tabassum, K. N. (2024). Environmental impact of solid waste landfilling in Balochistan- A risk assessment for SDG 3 (good health and well-being), SDG 6 (clean water and sanitation), SDG 11 (sustainable cities and communities), SDG 12 (responsible consumption and production), SDG 13 (climate action), SDG 14 (life below water) and SDG 15 (life on land). *Green Buildings and Materials*, 2(2). <https://doi.org/10.58396/gbm020201>
- Tabrani, M., Priyandaru, H., & Suhardi. (2021). Application of the Rapid Application Development Method to the BAZNAS Zakat Receipt Information System in Karawang. *Jurnal Teknologi dan Open Source*, 4(1), 78-84. <https://doi.org/10.36378/jtos.v4i1.1365>
- Tan, S. Y., & Chong, C. R. (2023). AN EFFECTIVE LOST AND FOUND SYSTEM IN UNIVERSITY CAMPUS. *Journal of Information System and Technology Management*, 8(32). <https://doi.org/10.35631/jistm.832007>
- Troov. (n.d.). *Lost property - Find your property on Troov*. Troov.com. <https://troov.com/en>
- Zhang, Y., & Zhao, H. (2020). *Application of QR Code Technology in Information Management Systems*. *Journal of Information Technology and Applications*, 15(2), 45–52.
- Zhao, H., & Peng, S. (2018, November). Design and Implementation of the Lost-and-Found System Based on Amap API. In *2018 IEEE 9th International Conference on Software Engineering and Service Science (ICSESS)* (pp. 1-4). IEEE

APPENDIX A: PROJECT SCHEDULE



APPENDIX B: QUESTIONNAIRE QUESTIONS

Survey on CampusRetrieve: A QR-BASED SOLUTION FOR MANAGING LOST AND FOUND at Universiti Malaysia Sarawak (UNIMAS)

🌟 Welcome to the CampusRetrieve Survey! 🌟

Thank you for taking the time to participate in our survey! 🙌 We are excited to introduce **CampusRetrieve**, a QR-based web platform designed to manage lost and found items at **Universiti Malaysia Sarawak (UNIMAS)** easier and more efficient. 💬 📱

Your input is super important to us 🧠—it will help us create a system that's easy to use, works smoothly, and meets the needs of everyone on campus. 🤖

This survey will only take a few minutes ⌚, and don't worry—your answers will be kept confidential.

💡 We appreciate your feedback and can't wait to hear your thoughts! 💡 ❤️

If you have any inquiries or suggestions, feel free to contact me Irdina Fikriyah Binti Rajak at 78054@siswa.unimas.my.

Let's get started! 🚀

* Indicates required question

General Information

1. How old are you? *

Mark only one oval.

- ☐ Below 18
- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55 and above

2. Role on Campus *

Mark only one oval.

- ☐ Student
- ☐ Staff
- ☐ Visitor

3. How often are you on campus? *

Mark only one oval.

- ☐ Daily
- ☐ Weekly (2-3 times)
- ☐ Occasionally

Current Experience with Lost and Found

4. Have you ever lost an item on campus? *

Mark only one oval.

- ☐ Yes
- ☐ No

5. If yes, what type of item did you lose? (Select all that apply)

Tick all that apply.

- ☐ Electronics (e.g., phones, laptops)
- ☐ Personal belongings (e.g., wallets, keys)
- ☐ Stationery (e.g., books, pens)
- ☐ Identification Documents (e.g., matric card, IC, license)
- ☐ Other: _____

6. Did you try to recover the lost item? *

Mark only one oval.

☐ Yes

☐ No

7. If yes, what method did you use? (Select all that apply)

Tick all that apply.

☐ Contact campus security

☐ Post on social media (eg: unimas confession, whatsapp group)

☐ Search campus facilities

☐ Other: _____

8. Were you able to retrieve your lost item? *

Mark only one oval.

☐ Yes

☐ No

Feedback on Proposed QR-based System

9. **Note:** The QR code below is an example of how the QR code will be placed in the designated hotspot area.



Would you use a QR-based platform to report a lost or found item?

CampusRetrieve



Mark only one oval.

1 2 3 4 5

Definitely ☐ ☐ ☐ ☐ ☐ Definitely

10. Where should QR codes be placed on campus for reporting lost and found items? *

Tick all that apply.

- ☐ Student Pavilion
☐ PETARY
☐ Central Teaching Facility (CTF)
☐ PITAS
☐ HEPA
☐ DETAR
☐ Faculty
☐ Other: _____

How important is it to have the following features in a lost and found system?

11. Quick reporting using QR codes *

Mark only one oval.

	1	2	3	4	5	
Not	☐	☐	☐	☐	☐	Very Important

12. Searchable database with filters (category, location, date) *

Mark only one oval.

	1	2	3	4	5	
Not	☐	☐	☐	☐	☐	Very Important

13. Automated notifications for matching items *

Mark only one oval.

	1	2	3	4	5	
Not	☐	☐	☐	☐	☐	Very Important

14. Centralized Inventory System: Organizes and tracks lost and found items in one place. *

Mark only one oval.

	1	2	3	4	5	
Not	☐	☐	☐	☐	☐	Very Important

15. Would you like to have a rating section in the CampusRetrieve system to provide feedback on your experience? *

Mark only one oval.

☐ Yes

☐ No

☐ Maybe

16. How frequently do you think you would use this platform? *

Mark only one oval.

☐ Daily

☐ Weekly (1-2 times)

☐ Monthly (2-3 times)

☐ Occasionally

☐ Rarely

17. Would you recommend CampusRetrieve to others? *

Mark only one oval.

	1	2	3	4	5	
Not	☐	☐	☐	☐	☐	Very Likely

System Design Preferences

18. Would you like the system to include email notifications for a matching lost or found item? *

Mark only one oval.

☐ Yes

☐ No

19. What categories would you find useful for filtering found items? *

Tick all that apply.

☐ Apparel

☐ Electronics

☐ Identification Documents

☐ Personal Items

☐ Stationery

☐ Other: _____

20. Do you have any suggestions or concerns about implementing this system? *

APPENDIX C: USABILITY TESTING QUESTIONNAIRE

CampusRetrieve Feedback

Thank you for using CampusRetrieve!

We hope you found our system helpful in managing lost and found items on campus.

We'd love to hear your thoughts so we can continue to improve the features, user experience, and overall functionality of the platform. Please take a moment to fill out this quick feedback survey – your responses are completely anonymous.

* Indicates required question

Section A: Background

1. Are you a student or staff member? *

Mark only one oval.

- ☐ Student
☐ Staff
☐ Visitor
☐ Other: _____

2. Have you used any lost and found systems before? *

Mark only one oval.

- ☐ Yes
☐ No

Section B: Usability

3. How easy was it to navigate the website?

Mark only one oval.

	1	2	3	4	5	
Very	☐	☐	☐	☐	☐	Very Easy

4. How clear were the instructions or prompts on each page? *

Mark only one oval.

	1	2	3	4	5	
Very	☐	☐	☐	☐	☐	Very Clear

5. Did you experience any difficulties when using the system? *

Mark only one oval.

☐ Yes	Skip to question 6
☐ No	Skip to question 7

Section B: Usability

6. If yes, please describe *

Section C: Functionality

7. What features did you use? (Select all that apply) *

Tick all that apply.

☐	Report Lost/Found Item
☐	View Lost/Found Items
☐	Search for Items
☐	Contact Reporter
☐	Send Inquiry
☐	Admin Panel (for admins only)
☐	Other: _____

8. Did the system respond quickly and without errors? *

Mark only one oval.

- ☐ Always
☐ Sometimes
☐ Rarely
☐ Never

9. Did the QR code integration work as expected? *

Mark only one oval.

- ☐ Yes Skip to question 11
☐ No (please specify) Skip to question 10

Functionality

10. If no, please specify *

Section D: User Satisfaction

11. How satisfied are you with the overall look and feel of the website? *

Mark only one oval.

- 1 2 3 4 5
Very ☐ ☐ ☐ ☐ ☐ Very Satisfied

12. How likely are you to recommend CampusRetrieve to others? *

Mark only one oval.

- 1 2 3 4 5
Very ☐ ☐ ☐ ☐ ☐ Very Likely

Section E: Suggestions & Improvements

13. What improvements would you suggest for better usability or effectiveness? *

APPENDIX D: REPORT SIMILARITY PERCENTAGE