SCHOOL MANAGEMENT SYSTEM 2: AUTOMATED DEFENSE ROOM SCHEDULING SYSTEM WITH REAL-TIME AVAILABILITY AND CONFIRMATION FOR CENTER FOR RESEARCH AND DEVELOPMENT AT BESTLINK COLLEGE OF THE PHILIPPINES

A Capstone
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The College of Computer Studies
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In Partial Fulfillment
Of the Requirements for the Degree of
Bachelor of Science in Information Technology

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THE RESEARCHERS

DEDICATION

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THE RESEARCHERS

ABSTRACT

Title: **SCHOOL MANAGEMENT SYSTEM 2: AUTOMATED DEFENSE ROOM SCHEDULING SYSTEM WITH REAL-TIME AVAILABILITY AND CONFIRMATION FOR CENTER FOR RESEARCH AND DEVELOPMENT AT BESTLINK COLLEGE OF THE PHILIPPINES**

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This Automated Defense Room Scheduling System was designed to address the inefficiencies of the room scheduling at the Center for Research and Development (CRAD) at Bestlink College of the Philippines (BCP). The current manual scheduling process has resulted in both conflicts and poor room management, thereby leaving most of the research and function rooms relatively underutilized and the overall productivity of

the department being impacted negatively. This project aims to centralize and automate the room allocation process with real-time availability and prevent double scheduling.

The system was meant for the management of limited defense rooms. This system introduces color-coded scheduling between different departments or courses which has a real-time calendar view for the smooth management of rooms. Use of the system shall be restricted to Center for Research and Development (CRAD) officers.

It features a user-friendly interface for Center for Research and Development (CRAD) officers, calendar view at a glance, and automated conflict management to prevent overlaps in scheduling. This system will automate room scheduling, thereby improving the utilization of the resources, reduce administrative work on the part of the officers, and optimize room allocation within the department. The project's relevance expands beyond the Center for Research and Development (CRAD) office, as the growing need for academic institutions to expand ensures efficient resource management.

TABLE OF CONTENTS

CHAPTER IV

CHAPTER V

REFERENCES

APPENDICES

DETAILED TECHNICAL DOCUMENTATION

Network Topology and Configuration Details

Security Measures (e.g., firewalls, encryption)

Protocols and Communication Methods Used

Load Balancing and Failover Mechanisms

6. **Deployment and Infrastructure:**

   Deployment Strategies (e.g., cloud, on-premises)

   Hardware Specifications and Server Configurations

   Configuration Management (e.g., scripts, automation tools)

   Scalability and Resource Optimization

7. **Security Measures:**

   Security Protocols and Measures Implemented

   Authentication and Authorization Mechanisms

   Encryption and Data Protection

   Incident Response and Mitigation Procedures

8. **Testing and Quality Assurance:**

   Detailed Test Cases and Scenarios

   Test Data and Expected Outcomes

   Test Results and Validation against Requirements

   Performance Testing and Optimization Efforts

9. **System Monitoring and Maintenance:**

   Tools and Techniques for Monitoring System Health

   Logging and Error Handling Mechanisms

Deployment Strategies and Rollback Procedures

15. **Licensing and Open-Source Libraries:**

    Information About Licenses for Software

    and Libraries Used

    Credits and Attributions for Open-Source Components

16. **Performance Metrics and Monitoring:**

    Metrics Collected and Monitored

    Tools and Dashboards used for Performance Analysis

    Actions Taken Based on Performance Data

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

Resource management plays a vital role in the effective administration of academic institutions, particularly in scheduling facilities essential for key academic activities. At the Center for Research and Development (CRAD) of Bestlink College of the Philippines (BCP), defense rooms are critical for hosting thesis defenses, research presentations, and collaborative academic discussions. Traditionally, the scheduling of these rooms has been managed manually, relying on spreadsheets, physical logs, and verbal or written communications. While functional in some cases, this manual system has proven to be inefficient and prone to errors, resulting in challenges such as double bookings, scheduling conflicts, and delays in confirming reservations.

Recognizing these recurring issues, this study proposes the development of an **Automated Defense Room Scheduling System with Real-Time Availability and Confirmation**. The system seeks to replace the manual process with a streamlined, digital solution designed to address the limitations of the current setup. By leveraging automation, the system will enable users to view real-time availability of defense rooms, book reservations seamlessly, and receive instant confirmation notifications.

This approach minimizes errors, reduces administrative workload, and ensures a more efficient allocation of resources.

The transition from a manual to an automated scheduling system not only improves operational efficiency but also aligns with the institution’s commitment to technological innovation and academic excellence. By addressing the identified challenges, this research contributes to a more effective and user-friendly resource management system that benefits students, faculty, and administrative staff.

This chapter provides an overview of the study, including the background of the problem, the objectives of the research, the significance of the proposed system, and its scope and limitations. These elements establish a comprehensive foundation for the design, development, and implementation of the Automated Defense Room Scheduling System at Center for Research and Development (CRAD).

Background of the Capstone Project

The Center for Research and Development (CRAD) at Bestlink College of the Philippines (BCP) manages student and faculty research activities and requires an efficient method for scheduling defense rooms. The manual scheduling process in the Center for Research and

Development (CRAD) office leads to inefficiencies and scheduling conflicts due to limited room availability.

The department has requested an automated room scheduling system that automates room allocation and offers real-time availability to solve this. Center for Research and Development (CRAD) officer, who will enter schedule requests from academics’ personnel, will only utilize the system. This project intends to streamline the scheduling process, reduce errors, and increase room management efficiency.

The demand for such a system reflects the increasing importance of efficiently managing academic resources, ensuring that staff may access the resources that were required without unnecessary delays or conflicts.

Context and Scope

This particular room scheduling system will be implemented in the Center for Research and Development (CRAD) department at Bestlink College of the Philippines (BCP). Today, the department needs an automated system to manage room allocation; therefore, there are instances of double room scheduling, poor room management, and monitoring of room usage. It will be a relevant tool for the Center for Research and Development (CRAD) officer to control and assign rooms more efficiently.

It will also have functionality in scheduling defense rooms.

The system will apply color codes to distinguish between scheduling of different departments.

A calendar view option will help reflect the schedules that have been made in advance.

Employees in the Center for Research and Development (CRAD) office have permission to use the system, while students or professors are not allowed into this particular version of the system.

This scope ensures that the project can be completed by the end of the given period, thereby providing a clean solution that would benefit the department in the short term.

Problem Statements

The Center for Research and Development (CRAD) department requires assistance in scheduling defense rooms. The department used a manual system to reserve rooms and check availability. Due to this antiquated system, a number of operational inefficiencies exist, and production was negatively impacted, from the staff person to the department as a whole.

The biggest issue with this approach was that it leads to scheduling conflicts. If multiple users unintentionally request the same room over overlapping time slots, without real-time visibility to where the next room was and subsequently issues, everyone must be notified to facilitate changes. Also, the manual way was not efficient because it does not give a clear output to employees, and they are unable to see which room was available and which one was already occupied. This vagueness will not let you make better use of the space.

The lack of an automated, computerized system implies that room consumption was not the most effective, with some rooms underutilized and others potentially overbooked. Furthermore, employees must spend much time on administrative tasks such as checking availability, communicating with other parties, and manually recording scheduling, which could be allocated to more critical tasks. A lack of integration and automation leads to insufficient resource management, limiting the department's ability to facilitate research and collaboration.

Goals and Objectives

The following table lists the business goals and objectives that the system supports and how it supports:

Goals	Objectives
1. Centralize and Automate Defense Room Allocation for Center for	Develop segregated access for defense room users.

Research and Development (CRAD).	Design an intuitive interface for Center for Research and Development (CRAD) officers.
2. Develop a Calendar Interface.	Create a calendar view showing the finalized schedules.
3. Real-Time Scheduling and Conflict Management.	Prevent double scheduling. Enhance security measures and data protection.

Table 1: Goals and objectives

Significance and Relevance

This project was very important to the Center for Research and Development (CRAD) department as it will solve the inefficiencies of the manual defense room scheduling procedure, which was currently the process. It will increase the overall efficiency of running the department by automating room scheduling and visually showing room availability. The color-coded system shall provide clarity for the officer in charge of scheduling, and the calendar view shall allow improved planning and utilization of space.

The project was also relevant to the larger context of utilizing resources in academic institutions. As the institute grows, there is a greater need to manage academic spaces more effectively, ensuring that resources such as research rooms are fully utilized.

Structure of the Document

1. Introduction
    - Project Overview
    - Purpose of the System
    - Scope and Limitations
    - Stakeholders
2. Objectives
    - Real-time Defense Room Availability
    - Automated Scheduling and Confirmation
    - User-friendly Interface
3. System Requirements
    - Functional Requirements
    - Non-Functional Requirements
    - Performance
    - Security
    - Scalability
4. EIS Standards Compliance

CHAPTER 2

RELATED STUDIES AND LITERATURE REVIEW

Introduction

This chapter presents the existing literature on the development and use of School Management Systems especially the automated defense room scheduling systems. The purpose was to identify ongoing technologies, frameworks, and methodologies on the design and functionality of such systems. This literature review will use the analysis of prior studies or findings and existing practices in an effort to discover the shortcomings of the current systems as well as come up with new ideas for the Center for Research and Development at Bestlink College of the Philippines (BCP).

Defense Room Allocation and Scheduling in Center for Research and Development (CRAD): A Review

This system aims to automate the scheduling process, providing users with real-time access to defense room availability and instant confirmation, which enhances overall efficiency.

Defense Room Scheduling

The defense room scheduling system enables users to schedule room reservations for research defenses efficiently.

Resource Management

Effective appointment scheduling helps in managing defense room resources efficiently. Administrators can analyze scheduling patterns, allowing for better allocation of defense rooms.

Conflict Prevention

By automatically checking defense room availability before confirming scheduling, the system reduces the risk of double scheduling and scheduling conflicts. This ensures smooth operations and minimizes disruptions during important events.

Real-Time Availability

The system provides real-time visibility into defense room availability, enabling users to make informed decisions when scheduling spaces. This transparency helps prevent conflicts and ensures that rooms are used optimally.

Defense Room Allocation and Scheduling Implementation in Student Management System

The integration of defense room allocation and scheduling into the student management system provides benefits, including:

Increased Efficiency: Automation of repetitive tasks streamlines the process of reserving rooms, reducing both the time and effort required for scheduling, while lowering administrative overhead and user frustration.

Improved User Satisfaction: The system provides a user-friendly platform that enables faster, more reliable scheduling processes, leading to higher satisfaction.

Real-Time Accuracy: Instant feedback on defense room availability minimized scheduling conflicts.

Enhanced Security: Allows for controlled access to rooms, ensuring that only authorized users can schedule or enter certain spaces.

Customizable Features: Allows for customization based on the specific needs of different departments or courses, enhancing the system's usability.

Challenges and Considerations for Future Growth:

Real-time data synchronization

Maintaining accurate and real-time data on room availability, equipment, and other resources can be challenging, especially in a dynamic research and development environment with constantly changing schedules and requirements.

Ensuring data security

Protecting sensitive data and ensuring the security of the automated scheduling system to prevent unauthorized access or misuse.

Scalability

Designing the system to accommodate the varying needs of different departments and research groups within the center, considering factors such as room types, capacity, and specific equipment requirements.

Analytics and Reporting

Incorporating tools to capture and analyze usage data, such as room utilization rates, popular time slots, and peak scheduling periods, to inform future resource allocation and scheduling decisions.

Access Control

Access control to ensure that specific rooms or resources are only accessible to authorized personnel or research teams.

Best Practices for Implementation

User Training: Users need to be trained on each element of system functionality.

Clear Communication: The process requires a clear set of directions as well as the constant instructions for users in order to let them know about the system.

Regular Maintenance: Carry out regular checks on maintenance so that the system continues functioning and remains secure in its use.

User Feedback: Implement feedback mechanisms for improvement.

Agile Scrum Methodology Overview

The Agile Scrum methodology will be implemented for the development of the Automated Defense Room Scheduling System with Real-Time Availability and Confirmation for the Center for Research and Development at Bestlink College of the Philippines (BCP). This methodology was chosen to ensure flexibility, adaptability, and continuous improvement throughout the development process.

Agile Scrum was a collaborative and iterative approach to software development that emphasizes adaptability, customer feedback, and cross-functional teamwork. In the context of developing the Automated Defense Room Scheduling System, the Agile Scrum methodology will enable the team to:

Sprint Planning: Divide the project into smaller units of work, and then order them according to customer demand and stakeholders' feedback.

Daily stand-up meetings: Conduct daily meetings to give a brief review and catch any obstacles that come up and ensure that everyone was on the same page.

Review: Demonstrate the functionalities developed during the sprint with stakeholders, short to gather feedback and iterate as required.

Sprint Retrospective: This was the final scrum meeting at the end of each sprint for the team to reflect on the process during the last sprint and discuss what needs to be improved or done further in order to make things more efficient for Sprints coming later. Introduction of Agile Scrum Methodology into the Automated Defense Room Scheduling System.

Key Features of Agile Scrum:

Iterative Development: Project will be divided into multiple sprints through which specific functionalists of the Automated Defense Room Scheduling System will be delivered.

Product Backlog: A ranked list of features and functions will be maintained so it can change in scope that provides flexibility to the customer by adapting to the requirements as it evolves.

Scrum Master: A dedicated Scrum Master to facilitate the Scrum process, making sure that agile protocols are followed and obstacles which could prevent progression, are removed.

Cross-Functional Teams: The development team will include people with different skills and knowledge, who will work together to produce superior solutions quickly.

By implementing Agile Scrum methodology for the development of the Automated Defense Room Scheduling System, the Center for Research and Development at Bestlink College of the Philippines (BCP) can expect a transparent, collaborative, and iterative approach that prioritizes customer satisfaction, responds to changing requirements, and delivers a high-quality solution aligned with the needs.

Agile Scrum Related Studies and Research

Agile Scrum is a widely used framework in software development that emphasizes collaboration, flexibility, and iterative progress through sprints. It allows development teams to manage a project by breaking it down into smaller deliverables, which are completed in time-boxed iterations called sprints. For an Automated Defense Room Scheduling System, Agile Scrum ensures the delivery of functional features incrementally, such as room availability tracking, scheduling confirmations, and administrative access for the Center for Research and Development at Bestlink College of the Philippines (BCP).

(Foreign)

Research on Agile Scrum in Educational Systems

Agile Scrum and User-Centric Design for Scheduling Systems

The study by Shania et al., (2023) supports this approach as it combines the use of Agile Software Development (ASD) with User- Centered Design (UCD) for managing the scope and requirement challenges. This approach would ensure the automated defense room the scheduling system was responsive to user needs, specifically for those Center for Research and Development (CRAD) officers who needed a clean and practical scheduling solution. The outputs from this research in using agile to gain continuous user feedback really strengthen the view that releases must be iterative, further to increase the functionality of the system and enhance user satisfaction (Shania et al., 2023).

Integration and Real-Time Availability in Educational Systems

The study by Zayatand Senvar (2020) demonstrates the applicability of Scrum for projects involving frequent coordination, iterative reviews, and organized task handling, this aligned well with the Automated Defense Room Scheduling System. Focusing on structured sprints and continual reviews, Scrum offers a base for integration feature or the real- time availability feature ensuring the system was adaptable and responsive to requirements in an educational environment (Zayat and Senvar, 2020).

Enterprise Architecture Concepts

(Foreign)

The study by Kotusev and Kurnia, 2023, demonstrates an Automated Defense Room Scheduling System mainly applies the core enterprise architecture principles of scalability, security, and integration of systems, hence improving sustainability. The use of actor- network and cognitive fit theories encourages stakeholder involvement, usability, and knowledge management principles that support decision- making hence aligning the system with the set goals of the institutions (Kotusev and Kurnia, 2023).

(Local)

The study by Balbacal, 2021, on Sustainability of Local Economic Enterprises (LEEs) seeks to analyze the status, sustainability, and operational continuity of the public enterprise. This approach aligned with the Automated Defense Room Scheduling System by focusing the scalability, stability, and operational continuity of the system as critical aspects the study specifically mentioned (Balbacal, 2021).

Microservices Architecture

Microservices architecture is a software development strategy that considers an application a set of small services. Each service deals with one and only one business capability, making it more manageable, deployable, and scalable. This increases flexibility, accelerates development, and increases maintainability since teams can work simultaneously on different components.

Proposed Microservices Architecture

The recommended microservices design enables the required step forward in enhancing the defense room reservation process for learners and teachers by making room scheduling system automation for the Center for Research and Development (CRAD) division in Bestlink College of the Philippines (BCP). Over time, this approach will allow for real-time reservations and will help improve the frontend performance of the tool as well as ensure it can scale and be maintained easily.

Key Microservices

User Management Service

The system will be pre-configured with the Center for Research and Development (CRAD) officer’s credentials.

A simple login system will provide secure access using the Center for Research and Development (CRAD) officer’s username and password.

Scheduling Service

Provides easy facility modification, and cancellation of room appointments.

Conflict checking, schedule validation, and confirmation notifications

Availability Service

Provides real-time updates on defense room availability.

Checks and updates room status based on current scheduling and maintenance schedules.

Weather Forecast Service

Retrieves real-time weather information from an external API. It enables Center for Research and Development (CRAD) officers to view weather conditions while scheduling,

Benefits of Microservices Architecture

Improved User Experience

Quicker responses and enhanced application stability can result in a better user experience by reducing the likelihood of outages or delays.

Resilience and Redundancy

The distributed nature of microservices increases resilience. If one service fails, others can continue to operate, resulting in a better customer experience.

Scalability

Each microservice can be scaled autonomously in response to demand. For example, if the scheduling service was heavily trafficked during peak hours, it can be scaled without disrupting other services.

Understanding the Problem

Bestlink College of the Philippines (BCP), specifically the Center for Research and Development (CRAD), plans to establish a software-based scheduling system. Currently, staff book and schedule rooms using a paper calendar and notes, which was inefficient and error-prone. To improve operational efficiency and streamline the scheduling process, Center for Research and Development (CRAD) was looking to create a specialized system for this.

DevOps and CI/CD

(Foreign)

DevOps is a software development and IT operations methodology that includes every type of collaboration and automation for its objectives. In such ideology, the word infinite loop symbolizes the iterative process, continuous development, testing, and deployment. It fosters constant improvement regarding software quality by making proper lifecycle management possible at every step through feedback and collaboration amongst teams (Yarlagadda, 2021).

Key Principles of DevOps:

Automation: Automate a workflow to avoid redundancy.

Coordination: Motivates interface between the development and operations teams.

Continuous Feedback: Ensure early detection of problems through feedback loops.

Infrastructure as Code (IaC): Manage infrastructure in a consistent manner through code.

Monitoring: Monitor performance toward optimizing the processes.

(Local)

The study "Designing Grit: Discovering Features Towards Supporting Novice Programmer DevOps Integration" adds value by addressing the issues that novice programmers face in the process of learning DevOps practices within the educational setup (Sta Maria et al., 2020). This was relevant to the Automated Defense Room Scheduling System in that it underlines the importance of providing programmers with key skills to code scalable systems, thereby enhancing collaboration and outcomes on projects.

(Foreign)

CI/CD stands for Continuous Integration and Continuous Deployment/Delivery. Continuous Integration and Continuous Deployment/Delivery emphasizes the automated integration and release processes in software development. CI refers to integrating code changes continuously followed by automatic tests, while CD refers to automated code deployment into production; it keeps consistency up, accelerates feedback, and supports fast delivery (Thatikonda, 2023).

Key Principles of CI/CD:

Continuous Integration: Many codes are merged with automated tests at frequent intervals;

Continuous Delivery: Ensures that the release process was automated so code would always be deployable;

Automated Testing: Tests running at multiple stages automatically;

Infrastructure as Code: Defining CI/CD processes in code for consistency and

Quick Response: Providing instant feedback for quick iteration.

The adoption of DevOps and CI/CD in the Automated Defense Room Scheduling System would provide several benefits:

Continuous integration and automated deployment ensure faster updates and fixes. This makes the system respond to the needs of the users quickly.

Helps in coordination between developers and operations, which would bring smooth workflows and improve collaboration during the times of updates for systems.

Automation of testing and monitoring reduces errors while ensuring correct and working functionality features of defense room availability and scheduling.

Infrastructure as Code (IaC) applies homogenous scalable management to the system infrastructure so that the performance improves further as the system is scaled up.

Relevant Studies and Research

(Foreign)

User-Centered Design-Based Approach in Scheduling Management Application Design and Development, authored by Herumurti et al., (2023), explores the development of scheduling management applications and its development that employs the User-Centered Design (UCD). The study also highlights the importance of implementing iterative prototyping in response to feedback from scheduling application users. This approach was essential for the capstone project, as it underscores the importance of designing a user-friendly scheduling system that effectively meets the needs of its users at the Center for Research and Development (Herumurti et al., 2023).

Abohamama et al., (2022) examine real-time task scheduling algorithms. The study titled Real-Time Task Scheduling Algorithm for IoT-Based Applications in the Cloud-Fog Environment presents a semi-dynamic scheduling algorithm to address the data's difficulties. This was useful for gaining an understanding of real-time scheduling, which can be used to improve the advanced scheduling capabilities of the automated defense room scheduling system to handle room schedules while also being able to adapt dynamically to the updated data (Abohamama et al., 2022).

Lopateeva (2021) highlights in the study the development of an automated information system to support computational procedures for scheduling and the strategies of university timetables based on automated systems. Thus, the research emphasizes the benefits of adding characteristics such as use case diagrams and database design to enhance the scheduling process and optimization of the distribution of educational resources. These insights are valuable regarding the concept of a defense room scheduling system geared towards improving scheduling at the Center for Research and Development (Lopateeva, 2021).

La Macchia (2020), in the study Identifying Challenges with Course Scheduling and Accessibility at Gateway Technical College, explored some of the issues that affect scheduling and students' accessibility. The related issues are highlighted in the study, and it was suggested that the emphasis was on reviewing scheduling practices, gathering student feedback, and ensuring that systems accommodate diverse needs, such as different delivery methods and schedules, to serve students and faculty better. The work contributes to the analysis of typical challenges in scheduling and suggestions of possible resolutions that are instrumental in dealing with similar issues in the context of the automated defense room scheduling system. (La Macchia, 2020).

(Local)

German et al., (2021) propose An Integrated Room Reservation System in streamlining the process of room reservations in a higher education facility. The online system replaces delays and man-hour exercise processing while automatically providing real-time information on the arrangements made. Similar to the Automated Defense Room Scheduling System, it strives to ease the room reservation process and make it more efficient; however, this system was designed to be scheduled by a Center for Research and Development (CRAD) officer rather than through direct user input.

Lumanog (2020) proposed an Online Reservation System that ensures usability and convenience for any target users. The proposed system would not only help centralized scheduling reservations but also organize the site itself, in such a way that it was rather user-friendly to the customers (Lumanog, 2020). The systems must therefore be reliable, fast, and comprehensive as will ensure that the processes are done effectively and without complications between reservation users.

Potential Application

Real-Time Room Reservations

A simple, on-line interface to view availability and schedule a room immediately.

Resource Management

Better manage defense room spaces, tracking schedules and usage to allow optimal resource allocation

Enhanced User Experience

Inform schedule confirmation through notifications for users to know the reservations.

Integrations with Academic Calendars

Synching schedules with academic events so as to avoid double scheduling when scheduling classes or activities.

Admin Dashboard

Dashboards for admin to view schedules, and track upcoming schedules centrally

Strategic Approach for Implementation

Define Clear Objectives

Accurate implementation of goals such as reducing scheduling conflicts, enhancing user satisfaction, and enhancing operational efficiency.

User Training and Documentation

Create thorough training and user guides. Conduct training sessions to ensure understanding of the new system and its features.

Integration of Information Systems in Enterprise Environments

(Local)

The "eReserba Cardinal" study by Barzaga et al., 2020 discussed the problems with manual room scheduling systems and showed that connecting info methods can increase performance. The capstone project, integrating an automated defense room scheduling system, will soon improve scheduling in the rooms of different departments and will lessen the delayed and troubling engagements (Barzaga et al., 2020).

The study was all about integrating systems that could access data in real time and make the best decisions in the future with consistent information across departments. This project allowed the Center for Research and Development (CRAD) department, along with other departments, to effectively handle the defense room usage, which can help them avoid scheduling conflicts and better manage the resources.

These microservices link departments, ensuring compliance with enterprise architecture principles. Implementing this system will minimize manual processes, leading to faster and more precise scheduling that can benefit the institute's performance as a whole.

CHAPTER 3

METHODOLOGY

Agile Scrum Methodology in the Project

The development of the Automated Defense Room Scheduling System with Real-Time Availability and Confirmation for the Center for Research and Development at Bestlink College of the Philippines (BCP) leverages the Agile Scrum Methodology to ensure an efficient, user-centered, and adaptable project lifecycle. Agile Scrum's focus on iterative progress, stakeholder collaboration, and flexibility makes it an ideal framework for developing a complex system that integrates with existing institutional tools and meets dynamic scheduling needs.

Roles and Responsibilities

Scrum Master: Supervises and coordinates internal communication and arranges tracking of progress within all the remaining groups.

Karl Aaron P. Alvendo	**Scrum Master**	Ensures a unified perspective on project objectives and addresses details during submodule integrations. Supports Scrum events, keeps in touch with project managers to receive updates, removes blockers, and maintains focus

		on the Sprint Goal. Takes care of cluster-wide issues as well as continuous improvement, while encouraging team self-organization and responsibility.

Table 2: Scrum master

Center for Research and Development (CRAD) Department: Essential for the proper functioning of the system and its integration within the School Management System (SMS), while ensuring proper validation of requirements based on academic and research processes.

Center for Research and Development (CRAD) Department	Close collaboration with the development team to inform the needs of the Center for Research and Development (CRAD) department when it comes to the defense room scheduling system. Reports verifications and module testing to identify whether the system accommodates the processes involved within the department. This provides real-world usage feedback and insights for the development team to refine features in the system.

Table 3: Center for Research and Development (CRAD) department

Development Team: A development team was a set of professionals with assigned roles to collaborate towards ensuring the successful implementation of a software system. Each team member offers expertise in designing, constructing, and testing the system to meet user requirements and project objectives.

Joseph Alfredo B. Pastores	**Project Manager**	Monitors the progress of teams in terms of work done according to Agile principles and the Scrum process, facilitates effective communication between the Scrum Master and team members regarding the work assignment according to individual strengths, and interacts with stakeholders to get feedback about whether the outputs are aligned according to business needs and advises on risk management.
Mark Joshua V. Trinidad	**Lead Programmer**	Writing, testing, and debugging of the code for the system while ensuring that technical components meet the

		requirements through active engagement in code reviews and also collaborating with the project manager to align tasks into Sprint goals.
Cedrick J. Del Prado	**Assistant Programmer**	Writing supplementary code, working with the lead programmer on stability, support for technical problem-solving, testing, and documentation to ensure well maintenance of the code.
Amina P. Sanson	**Document Specialist**	Responsible for recording all technical specifications, process flows, and development stages, while tracking system development, modifications, updates, and testing feedback. Ensures documentation was accurate and accessible to stakeholders for effective knowledge transfer.
Rosever P. Cunanan	**Document Analyst**	Works with the team and project manager to accurately document all

		features and functionalities, hence all documentation was accurate and allows for integration within the team.

Table 4: Development team

Sprint Cycles

This Sprint plan organizes the development of the Automated Defense Room Scheduling System effectively. Every sprint delivers the development in a logical phased manner, containing critical features such as access to the system, scheduling defense rooms and events, and integration. Testing and refinement are done in the last sprint to produce a clean working system.

Sprint Cycle	**Duration**	**User Stories / Task**	**Key Features/ Tasks**	**Deliveries s**	**Responsible Team Member**
Sprint Cycle 1 **Goal: Project Setup & User Management**					
Sprint Planning	4 days	Define project scope, objectives, and requirements	- Set up dev environment - System architecture - User	- Working user registration & login	**TRINIDAD MARK**

Daily Standups	4 days	Maintain team alignment and communication	registration & login		**JOSHUA V.**
Sprint Review	5 days	Review and validate the project initiation phase			
Sprint cycle 2: **Goal: Defense Room Availability Display & Calendar Integration**					
Sprint Planning	4 days	Plan calendar integration & UI mockups	- Real-time defense room availability - UI design (desktop)	Availability display	**TRINIDAD MARK JOSHUA V. & DEL PRADO, CEDRICK J.**
Daily Standups	4 days	Track UI and API integration progress			
Sprint Review	5 days	Present calendar syncing & UI for feedback			
Sprint Cycle 3 **Goal: Scheduling Functionality & Confirmation**					

Sprint Planning	4 days	Plan scheduling logic, notifications	- Defense room scheduling feature	Functional scheduling system	**TRINIDAD MARK**
Daily Standups	4 days	Daily check-ins on scheduling logic & API dev	- Conflict detection	Automated confirmation	**JOSHUA V.**
Sprint Review	5 days				
Sprint Cycle 4 **Goal: Schedule Management and Log Book**					
Sprint Planning	4 days	Plan cancellation, rescheduling logic, and log book implementation.	- Implement cancel/reschedule feature - Implement a log book feature.	- Scheduling management & notification system - Log Book Feature	**TRINIDAD MARK JOSHUA V.**
Daily Standups	4 days	Daily updates on notification & reminder system			

Sprint Review	5 days	Present cancellation process, notification system, and log book feature.			
Sprint Cycle 5 **Goal: Access Control & Permissions**					
Sprint Planning	4 days	Define user roles, set access permissions	- Room access restrictions	- Room restriction features	**TRINIDAD** **MARK** **JOSHUA** **V.**
Daily Standups	4 days	Standups on access control system progress			
Sprint Review	5 days	Review role-based access & room restrictions demo			
Sprint Cycle 6 **Goal: Security, Testing, & Final Tweaks**					
Sprint Planning	4 days	Plan security measures & assign testers	- Data privacy & security - System testing (performance,	- Secure, fully tested system	

Daily Standups	4 days	Daily updates on testing progress & bug tracking	security) - Bug fixes & refinements		**DEL** **PRADO,**
Sprint Review	5 days	Present final system, test results, bug fixes			**CEDRICK** **J.**

Table 5: Sprint cycles

Scrum Artifacts

Product backlog (user stories) Table

User Stories No.	User Stories	Priority	Status
1	As a Center for Research and Development (CRAD) researcher, I want to schedule a specialized research room so that I can conduct studies.	High	Completed
2	As a Center for Research and Development (CRAD) officer, I want the system to automatically block rooms that are already scheduled so scheduling conflicts will not occur.	High	Completed

3	As a Center for Research and Development (CRAD) staff member I want to log in using my official credentials so that I can securely access and manage the system	Medium	Completed
4	As a Center for Research and Development (CRAD) researcher, I want to receive reminders for upcoming defense room schedules so that I'm prepared.	Medium	Completed
5	As a Center for Research and Development (CRAD) researcher, I want to add, remove, and update room details to ensure that room availability is accurate.	Medium	Completed
6	As a Center for Research and Development (CRAD) admin, I want to generate usage reports for research rooms so that I can track past schedules and room utilization.	Low	Completed
7	As a Center for Research and Development (CRAD) admin, I want to manage scheduling access for specific research rooms so that only authorized personnel can use them.	High	Completed
SEAMLESS INTEGRATION			
8	As a Center for Research and Development (CRAD) researcher, I want to use my faculty login credentials to access the scheduling system so that I have single sign-on (SSO).	High	Completed

9	As a Center for Research and Development (CRAD) admin, I want to integrate defense room equipment data with the IT asset management system so that equipment usage is tracked.	Medium	Completed
10	As a Center for Research and Development (CRAD) researcher, I want to access IT support through the scheduling system so that I can request help with room technology.	Medium	Completed
11	As a Center for Research and Development (CRAD) admin, I want a logbook feature in the system to track individuals entering and exiting the Center for Research and Development (CRAD) department for record-keeping.	Medium	Completed
12	As a Center for Research and Development (CRAD) IT staff member, I want to monitor room and equipment usage so that I can plan maintenance efficiently.	Low	Completed

Table 6: Product backlog for seamless integration

Product Backlog for EIS Information Security

User Stories No.	User Stories	Priority	Status
13	As a user, I want data encryption for all scheduling information so that sensitive data is protected.	High	Completed

14	As a user, I want to ensure that all data backups are encrypted so that backup data is secure from breaches.	High	Completed
15	As a user, I want to ensure that user session timeouts are enforced to protect against unauthorized access.	Medium	Completed

Table 7: Product backlog for EIS information security

Product Backlog for EIS Standards

User Stories No.	User Stories	Priority	Status
16	As a user, I want a custom logo for the scheduling system so that it reflects the Center for Research and Development (CRAD) branding.	High	Complet ed
17	As a user, I want a set of custom icons for the interface so that actions are easily identifiable.	High	Complet ed
18	As a user, I want the interface to have a uniform design so that it is visually cohesive and user-friendly.	High	Complet ed
19	As a user, I want to have sidebar navigation so that I can easily access different sections of the scheduling system.	High	Complet ed
20	As a user, I want to ensure that all design elements comply with accessibility standards so that all users can navigate easily.	High	Complet ed

21	As a user, I want to include tooltips for icons so that I can get descriptions of the functions.	High	Completed
22	As a user, I want to conduct user testing on the new design elements to gather feedback for improvements.	Medium	Completed

Table 8: Product backlog for EIS standards

UI/UX (Icons, color, etc.)

User Stories No.	User Stories	Priority	Status
23	As a user, I want the system to have a consistent color scheme (e.g., Center for Research and Development (CRAD)'s official colors) so that it aligns with the college branding.	High	Completed
24	As an admin, I want the interface to have a clean and minimalistic design so that I can quickly view scheduling and availability without visual clutter.	High	Completed
25	As an admin, I want the login page design to reflect the college branding and look professional so that the system feels cohesive and trustworthy.	High	Completed
26	As a user, I want the system to use icons in action buttons for intuitive understanding of actions.	High	Completed
27	As a user, I want uniform icon styles across the application (e.g., consistent line thickness and size) for a visually cohesive experience.	Medium	Completed

Table 9: Product backlog for UI/UX

Product Backlog for Integration

User Stories No.	User Stories	Priority	Status
28	As a user, I want the scheduling system to integrate with the IT system for resource management, so that available resources can be viewed and booked seamlessly.	High	Completed
29	As a user, I want to synchronize user data across the scheduling system and other integrated systems to ensure consistent user profiles.	High	Completed
30	As a user, I want to create reports that pull data from integrated systems for analysis and decision-making regarding room usage and resources.	Medium	Completed
31	As a user, I want to ensure secure data transfer between integrated systems to protect sensitive information.	Low	Completed

Table 10: Product backlog for integration

Product Backlog for analytics

Application System Analytics

User Stories No.	User Stories	Priority	Status
32	As an admin, I want to analyze user scheduling patterns to improve resource allocation and scheduling.	High	Completed

33	As an admin, I want to generate reports on resource utilization to ensure efficient use of resources.	Medium	Completed
34	As a user, I want to access my scheduling history to review past reservations and make future reservations easier.	Medium	Completed
35	As an admin, I want to integrate analytics with other systems to provide a holistic view of departmental performance.	Low	Completed

Table 11: Product backlog for analytics

Sprint Backlog

User stories

User Stories No.	User Stories	Task	User Story Points (hours)	Responsible Team Member
Sprint 1: System Access				
1.	To view real-time defense room availability so I can easily schedule a defense room.	Design UI	7 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
2.		Design UI		

	To track and monitor Center for Research and Development (CRAD) department user access to the system to ensure data security and compliance.	Design Data Model Develop a workflow Perform QA and Test	8 hours	**TRINIDAD** **MARK** **JOSHUA V.**
3.	As a system admin, I want to update the scheduling system without downtime to ensure continuous service availability.	Design UI Design Data Model Develop a workflow Perform QA and Test	4 hours	**TRINIDAD** **MARK** **JOSHUA V.**
4.	To view the log book to track individuals entering and exiting the CRAD department.	Design UI Design Data Model Develop a workflow Perform QA and Test	9 hours	**TRINIDAD** **MARK** **JOSHUA V.**
Sprint 2: Defense Room Scheduling Management (Submit Requests & Check Availability)				
5.		Design UI		

	To receive instant confirmation of the defense room scheduling system to ensure my schedule was secured.	Design Data Model Develop a workflow Perform QA and Test	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
6.	To search for available defense rooms by name and student number to quickly find a suitable room.	Design UI Design Data Model Develop a workflow Perform QA and Test	8 hours	**TRINIDAD** **MARK** **JOSHUA V.**
7.	To prevent double-scheduling, scheduling rooms to optimize room usage.	Design UI Design Data Model Develop a workflow Perform QA and Test	4 hours	**TRINIDAD** **MARK** **JOSHUA V.**
Sprint 3: Defense Room Scheduling Management (Finalize Reservations)				
8.		Design UI		

	To manage defense room scheduling to optimize room usage and prevent overscheduling.	Design Data Model	5 hours	**TRINIDAD MARK JOSHUA V.**
		Develop a workflow		
		Perform QA and Test		
9.	To cancel my schedule if plans change so that other students can use the defense room.	Design UI	8 hours	**TRINIDAD MARK JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
10.	To view a list of my upcoming defense room scheduling to manage my schedule.	Design UI	6 hours	**TRINIDAD MARK JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
11.	As a system admin, I want to log and track all scheduling	Design UI		**TRINIDAD**
		Design Data Model		

	changes (e.g., cancellations and extensions) for auditing purposes.	Develop a workflow Perform QA and Test	7 hours	**MARK** **JOSHUA V.**
Sprint 4: Defense Scheduling				
12.	To monitor the system's usage and performance for continuous improvement.	Design UI Design Data Model Develop a workflow Perform QA and Test	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
13.	To give scheduling suggestions for alternative defense rooms if my preferred choice was unavailable.	Design UI Design Data Model Develop a workflow Perform QA and Test	5 hours	**TRINIDAD** **MARK** **JOSHUA V.**
14	To assign defense	Design UI Design Data Model		**TRINIDAD**

	scheduling to specific courses or departments for better organization.	Develop a workflow Perform QA and Test	6 hours	**MARK** **JOSHUA V.**
.				
Sprint 5: Room Coordination				
15.	To book multiple defense room at once for group studies or events.	Design UI Design Data Model Develop a workflow Perform QA and Test	7 Hours	**DEL PRADO,** **CEDRICK J.**
16.	As a system admin, the system ensures regular backups of all scheduling data to prevent data loss.	Design UI Design Data Model Develop a workflow Perform QA and Test	5 hours	**DEL PRADO,** **CEDRICK J.**
17.	As a user	Design UI		

	I want to modify or cancel my reservation So that others can use the room if I no longer need it	Design Data Model	5 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Develop a workflow		
		Perform QA and Test		
18.	As a user I want to receive reminders about my upcoming reservations So that I don't forget my scheduled room usage	Design UI	8 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
Sprint 6: Final Review and Refine				
19.	To check my past schedules to plan future defenses more efficiently.	Design UI	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
20.		Design UI		

	To generate reports on room usage to assess peak times and underutilized resources.	Design Data Model	4 hours	**DEL PRADO,** **CEDRICK J.**
		Develop a workflow		
		Perform QA and Test		
21.	To receive a reminder notification before my booked class to ensure I attend on time.	Design UI	8 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
22.	As an admin, the system provides a central dashboard to manage scheduling, enabling easy viewing and modification of room allocations.	Design UI	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
23.	As a system admin, the system automatically	Design UI		**TRINIDAD**
		Design Data Model		

	archives old schedules after a specified time to keep the system organized.	Develop a workflow	5 hours	**MARK** **JOSHUA V.**
		Perform QA and Test		
24.		Design UI		
	As an admin, I want to generate custom reports based on specific criteria (e.g., schedules by date, department).	Design Data Model	4 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Develop a workflow		
		Perform QA and Test		
25.	As an admin, the system allows configuring notification settings.	Design UI	7 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
26.	To extend my defense room scheduling if I need extra time for room usage.	Design UI	8 hours	**DEL PRADO,** **CEDRICK J.**
		Design Data Model		
		Develop a workflow		

		Perform QA and Test		
27.	To manage schedules for recurring classes (e.g., weekly seminars).	Design UI		
		Design Data Model		
		Develop a workflow	5 hours	**TRINIDAD MARK JOSHUA V.**
		Perform QA and Test		

Table 12: Sprint Backlog

Information security

User Stories No.	User Stories	Task	User Story Points (hours)	Responsible Team Member
28.	Session Based Authentication	Design UI	8 Hours	**DEL PRADO, CEDRICK J.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
29.	Cloud Platform	Design UI		**TRINIDAD**
		Design Data Model		

	Security	Develop a workflow	6 Hours	**MARK** **JOSHUA V.**
		Perform QA and Test		

Table 13: Sprint backlog for information security

EIS standard

User Stories No.	User Stories	Task	User Story points (hours)	Responsible Team Member
30.	Uniform Interface	Design UI	7 Hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
31.	Real-Time Data Synchronization	Design UI	7 Hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		

32.	Scalability	Design UI	5 Hours	**DEL PRADO, CEDRICK J.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
33.	Platform Compatibility	Design UI	5 Hours	**TRINIDAD MARK JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
34.	Automated Scheduling Confirmation	Design UI	7 Hours	**TRINIDAD MARK JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		

35.	User-Friendly Interface	Design UI	5 Hours	TRINIDAD MARK JOSHUA V.
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		

Table 14: Sprint backlog for EIS standard

EIS integration

User Stories NO.	User Stories	Task	User Story points (hours)	Responsible Team Member
36.	Integrate defense room scheduling with the faculty system to allow faculty to integrate the list of professors needed.	Design UI	6 Hours	TRINIDAD MARK JOSHUA V.
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		

Table 15: Sprint backlog for EIS integration

Microservices Architecture

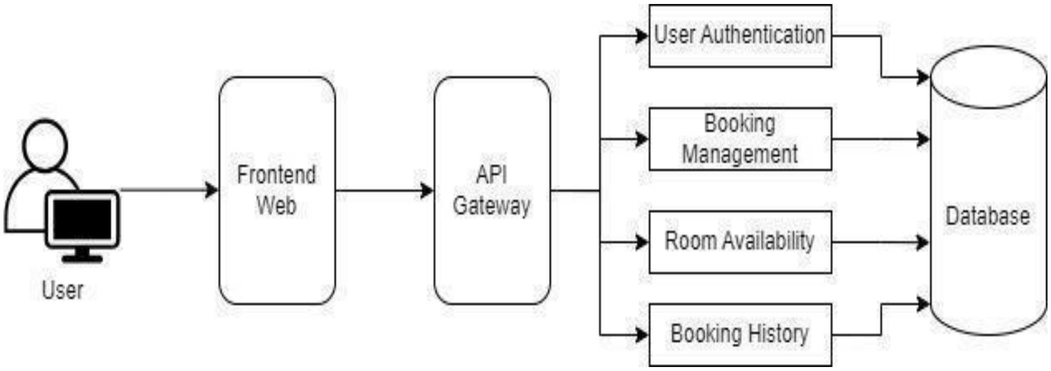

Figure 1: Communication pattern

DevOps Implementation

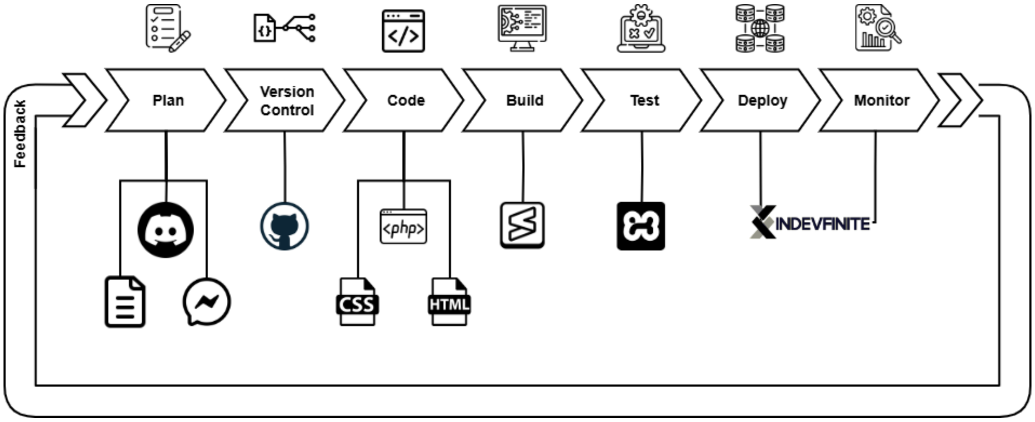

Figure 2: DevOps pipeline

Plan: The development team laid down and developed the initial outline of the system and conducted in-person and online meetings. In addition, online collaboration was used through platforms like Discord for meetings, Messenger for follow-up updates, and Google Docs for real-time editing files and documents, thereby keeping track of all relevant information regarding the system's development process.

Version Control: All the code implemented was stored and managed through GitHub.

Code: The programming language applied here for managing the backend logics was PHP, whereas the coding languages used to structure and style the frontend of the system have been HTML and CSS.

Build: The system was developed in a code editor, Sublime Text.

Test: The XAMPP environment simulation was used to do local testing of the system.

Deploy: The system went live, using Indevfinite as the cloud platform and domain for hosting the application.

Monitoring: The error logs and performance monitoring tools available on the Indevfinite cloud platform were used to monitor any issues or performance metrics in the live environment.

Feedback: The process involves continual gathering and review of user feedback and performance data. Information gathered was used in finding areas that need improvement to enable the system to evolve and expand accordingly.

Infrastructure as Code (IaC)

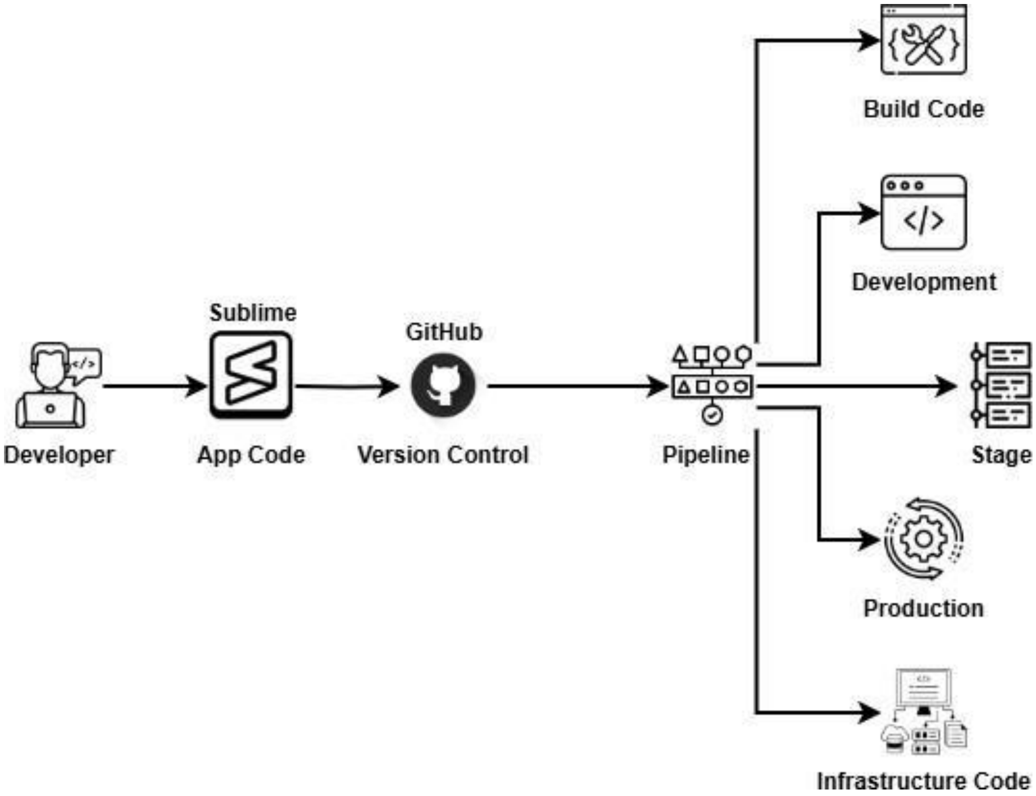

Figure 3: IaC

Infrastructure as Code (IaC) was the management and the provisioning of infrastructure through code and automation that will ensure efficient deployment and resource management.

Developers: Individuals responsible for writing and maintaining application code.

App Code: Code developed using Sublime Text, a lightweight text editor.

Version Control: Managed using GitHub, which tracks code changes and enables collaboration among developers.

Pipeline: A CI/CD pipeline automates code integration, testing, and deployment, streamlining the development workflow.

Build Code: The process of compiling and packaging the application into deployable artifacts, including running tests.

Development: An environment where developers write, test, and debug code, allowing for active development without affecting live applications.

Stage: It was a pre-production environment where the final test occurs, mimicking production to ensure stability before deployment.

Production: This was the actual running environment where the application runs and users get to use it; it needs high reliability and high stability.

Integration

Innovation Integration

Automated Defense Room Scheduling explores the innovative integration of a computerized defense room schedule system with real-time availability and confirmation for the Center for Research and Development (CRAD) at Bestlink College of the Philippines (BCP). This system aims to streamline room utilization, enhance efficiency, and provide a user-friendly experience for the Center for Research and Development (CRAD) department.

Key features of the system would include:

Automated Scheduling: The user can view available defense rooms in real time, which helps avoid scheduling conflicts or overlaps.

Calendar View with Color Coding: The system will permit the user to view scheduling in calendar format and color-code entries between different departments.

Real-Time Conflict Management: The system will handle double scheduling for the Center for Research and Development (CRAD) officer to manage.

Edit Room Schedule: The room schedules can be altered by the officer to avoid overscheduling, and ensure fair usage.

Schedule History Access: The officer can manage history scheduling through the calendar interface

User-friendly interface: The system will have a user-friendly interface to meet the needs of the Center for Research and Development (CRAD) officer.

Artificial Intelligence (AI) Chatbot Scheduling Assistant: The system includes an AI-powered chatbot assistant that helps the CRAD officer interact with the scheduling system using natural language. This chatbot can respond to commands making the system more intuitive and efficient. This feature enhances usability by reducing the time spent navigating the interface, offering a conversational approach to scheduling.

Integrating an automated defense room scheduling system with real-time availability and confirmation for the Center for Research and Development (CRAD) at Bestlink College of the Philippines (BCP) represents a significant step toward enhancing research and development activities. This innovative solution streamlines room management, improves efficiency, and fosters a more collaborative and productive environment for the Center for Research and Development (CRAD) department and researchers. By embracing technology and implementing this system, Bestlink College of the Philippines (BCP) can further strengthen its commitment to academic excellence and research innovation.

Business Process Architecture (BPA) Top Level 1

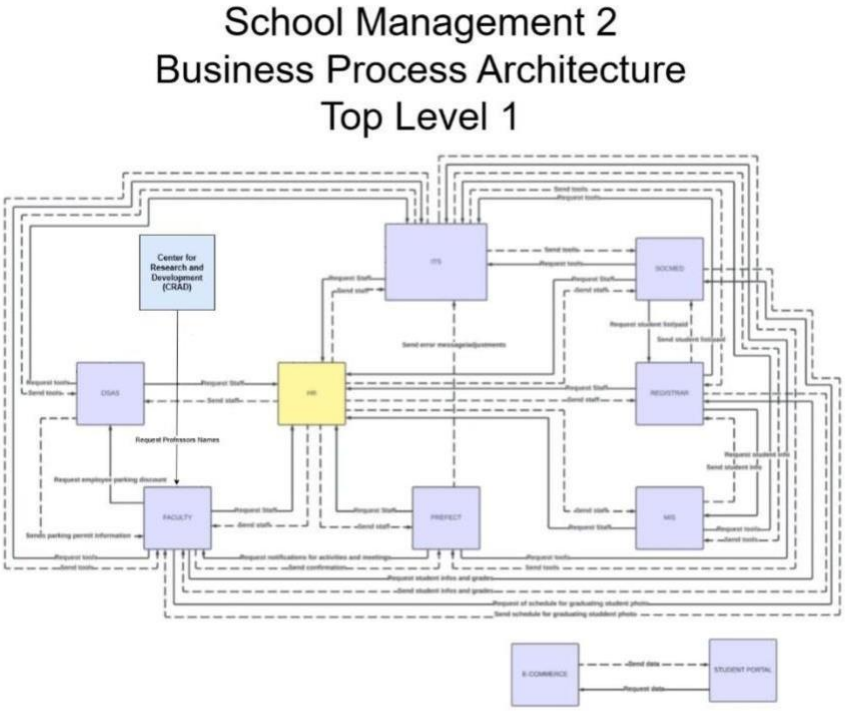
School Management 2
Business Process Architecture
Top Level 1
Center for Research and Development (CRAD)
ITS
SOCMED
OSAS
HR
REGISTRAR
FACULTY
PREFECT
MIS
E-COMMERCE
STUDENT PORTAL
Send tools
Request tools
Request Staff
Send staff
Send error message/adjustments
Request student fee/paid
Send student fee/paid
Request Professors Names
Request employee parking discount
Sends parking permit information
Request student info
Send student info
Request notifications for activities and meetings
Send confirmation
Request student infos and grades
Send student infos and grades
Request of schedule for graduating student photo
Send schedule for graduating studdent photo
Send data
Request data

Figure 4: BPA top level 1

Business Process Architecture (BPA) Top Level 2

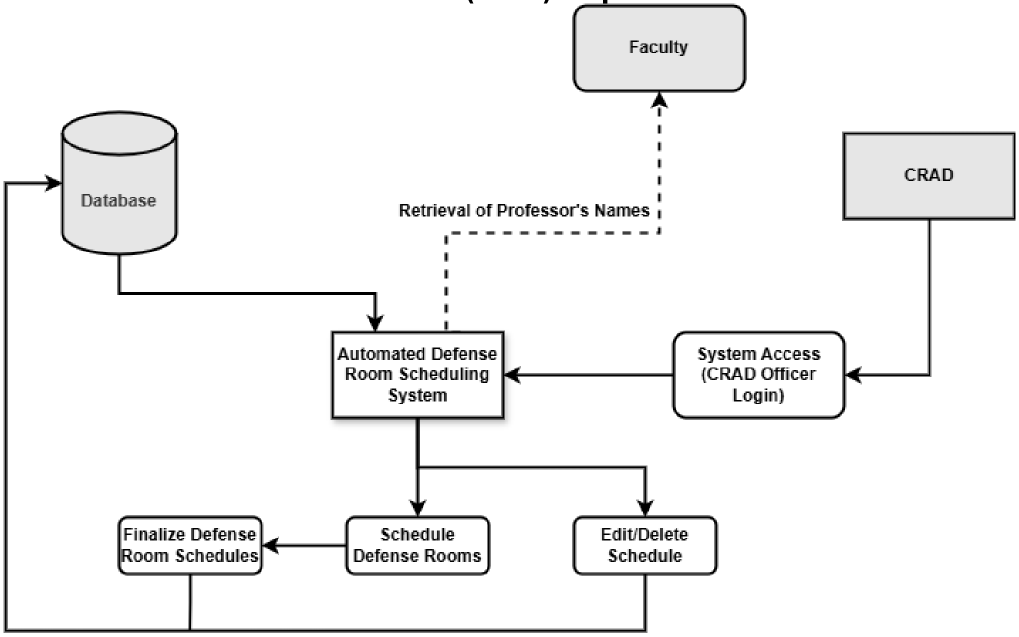
Faculty
Database
Retrieval of Professor's Names
CRAD
Automated Defense Room Scheduling System
System Access (CRAD Officer Login)
Finalize Defense Room Schedules
Schedule Defense Rooms
Edit/Delete Schedule

Figure 5: BPA top level 2

Data Flow Diagram

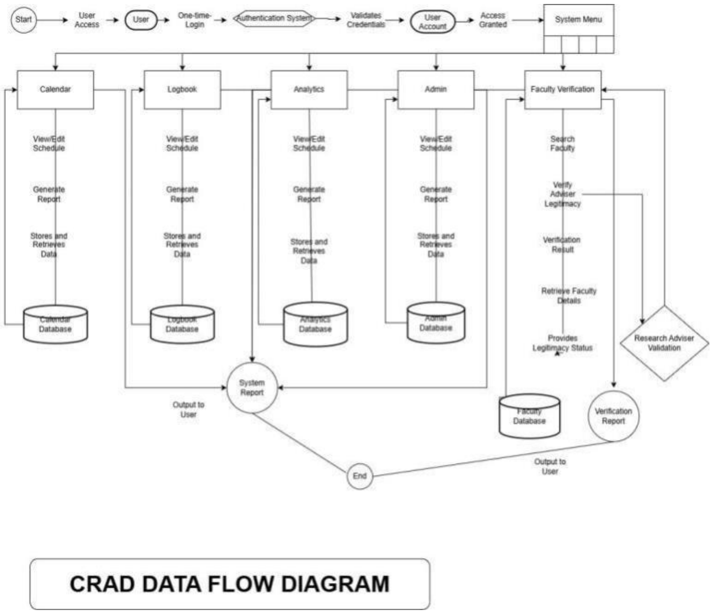

Figure 6: Data Flow Diagram

API Gateway

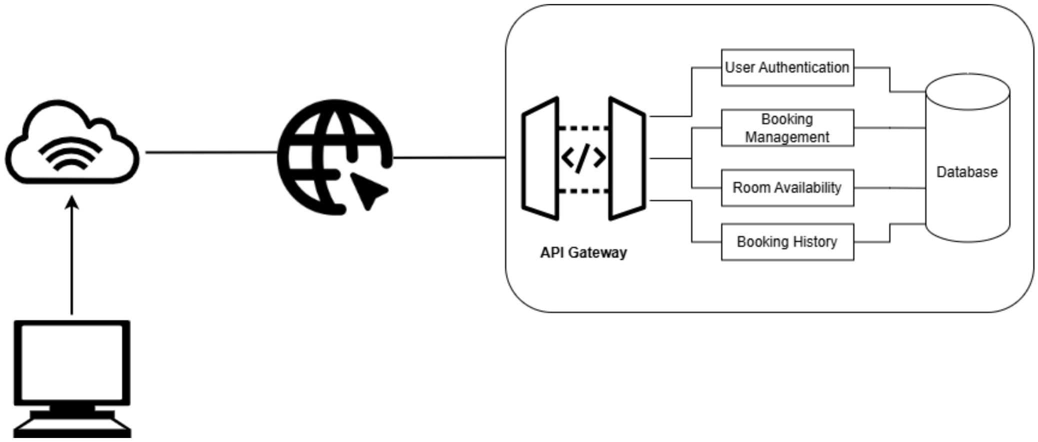

Figure 7: System Architecture

Additional Considerations

Use Case Diagram

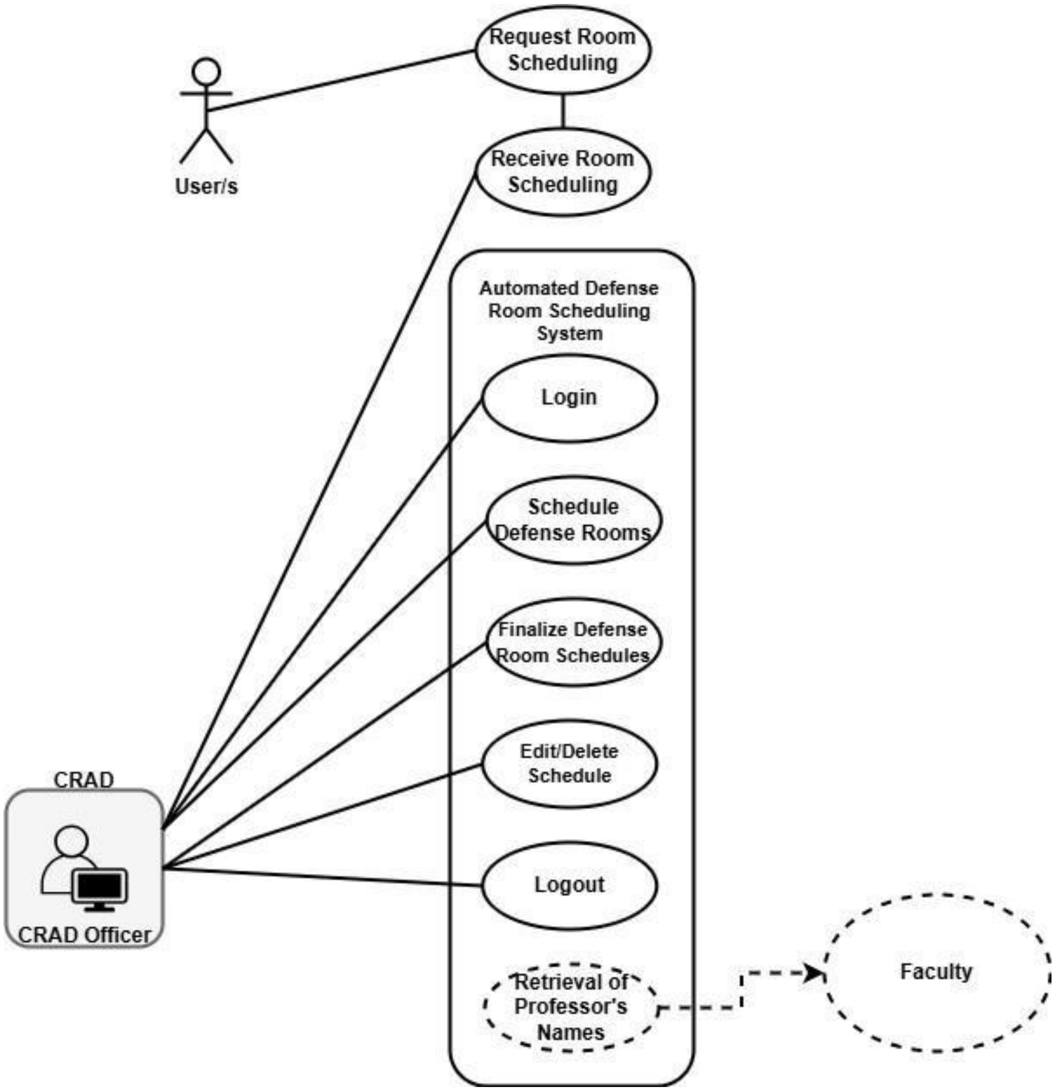

Figure 8: Use case diagram

Sequence Diagram

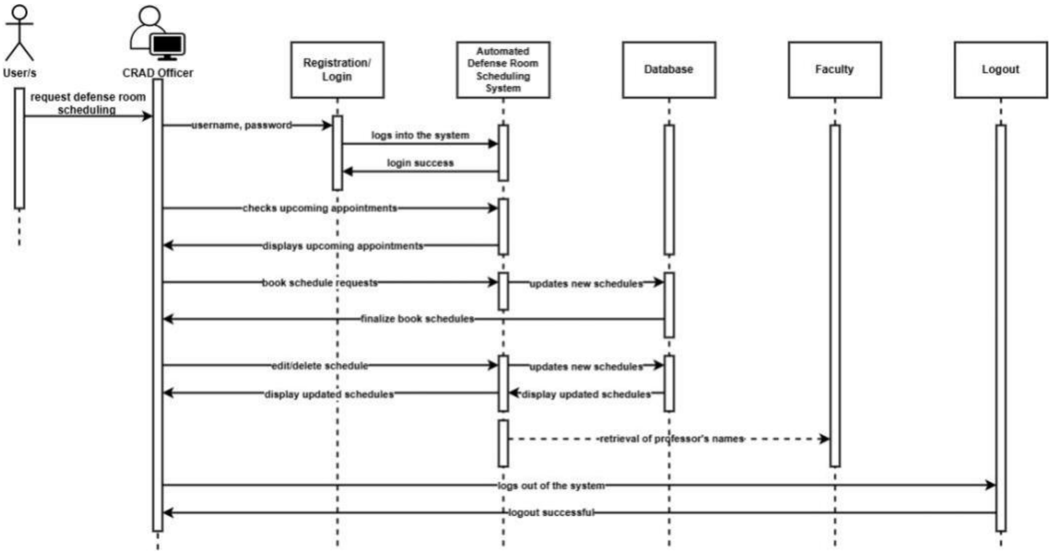

Figure 9: Sequence diagram

CHAPTER 4

SYSTEM DEVELOPMENT AND IMPLEMENTATION

REQUIREMENTS ANALYSIS

Stakeholder Identification

The project team will classify and analyze every stakeholder to determine the power or influence on the project, identify the proper communication and involvement strategy, and realize the potential impact on the system's development and implementation. This classification guarantees that every stakeholder's management is appropriate, depending on the role and interest level.

Every stakeholder will be classified according to the department or organization. After identifying all the stakeholders, the project team will apply a Power/Interest Matrix to show how each stakeholder may influence the project. This will enable the team to determine which stakeholders need constant attention and which require less communication. Based on this analysis, the project team will also complete a Stakeholder Analysis Matrix, outlining each stakeholder's concerns, level of involvement, and management strategy.

Key	Stakeholder	Power (1-5)	Interest (1-5)
A	Center for Research and Development (CRAD) Department	5	5
B	Research Adviser	4	4
C	Scrum Master	3	4
D	Development Team	3	5
E	Faculty	1	2

Table 16: Power/Interest Matrix

Stakeholder	Concerns	Level of Involvement	Management Strategy
Center for Research and Development (CRAD) Department	Accurate scheduling and efficient usage	High	Regular updates, active involvement
Research Adviser	System meets academic standards	High	Frequent consultations, feedback

Scrum Master	Project timeline, agile process	High	Frequent involvement, facilitation
Development Team	Functional and technical requirements	High	Direct involvement in development
Faculty	Retrieval of professors' names for defense scheduling	Low to moderate	Monitor, and update to ensure accurate information

Table 17: Stakeholder Analysis Matrix

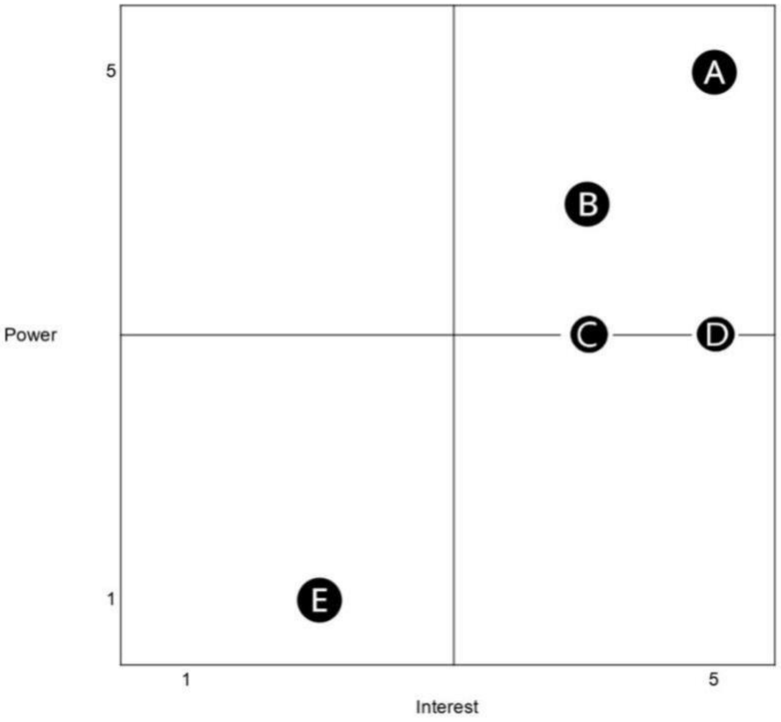

Figure 10: Power/Interest Chart

This chart will visually illustrate the categorization of stakeholders based on the power and interest in the project.

Requirements Gathering Techniques

Several techniques were employed to gather requirements for this system, ensuring a clear understanding of stakeholder needs:

1. Interviews: Conduct one-on-one interviews with Center for Research and Development (CRAD) head to gather detailed information about the daily workflows, scheduling needs, and challenges.
2. Observation: Observe existing Center for Research and Development (CRAD) workflows, particularly how defense room bookings are managed manually, and document areas for automation.

Stakeholder Interview Process

To ensure the new system addresses the needs and challenges of the Center for Research and Development (CRAD) department and enhances the user experience, the researchers conducted an interview with the head of the Center for Research and Development (CRAD) department. The interview focused on understanding the department's roles, responsibilities, operational challenges, and specific requirements for the Automated Defense Room Scheduling System.

Role and Responsibilities of the Center for Research and Development (CRAD) Officer

1. What are your core duties in managing defense room scheduling, and how do you interact with other departments to facilitate the scheduling process?
2. What features do you feel would significantly ease your responsibilities in managing room scheduling?

Current Challenges in Defense Room Scheduling

1. What pain points do you experience with the current manual scheduling system that we need to address?
2. How do you currently handle overlapping schedules or conflicting schedules, and what solutions would you prefer?

System Requirements:

Defense Room Scheduling Process

1. How should the system allow the scheduling of defense rooms to ensure smooth operations and prevent conflicts?
2. What features do you consider essential for viewing room availability in real time, and how should this information be

displayed?

User Interaction and Scheduling Flexibility

1. How do you envision handling recurring schedules for classes or departmental events? Should the system allow for automatic or manual adjustments to recurring events?
2. What flexibility would you like the system to offer for cancellations, changes in schedule, or last-minute requests?

Integration with Existing Systems

1. Are there any current systems, such as faculty scheduling tools or student management systems, that need to be integrated into the new scheduling system to improve operational efficiency?
2. How important is it for the system to be integrated with other institutional systems to streamline data sharing and reduce redundancy?

User Experience and Usability

1. How can the system be designed to be intuitive for the Center for Research and Development (CRAD) officer, ensuring a smooth and efficient experience with minimal training required?
2. What features or interfaces would enhance the user experience, both for administrative staff and faculty, in terms of ease of use and quick access to necessary information?

Data Security and Compliance

1. What level of security is required to ensure the integrity of schedule information and avoid unauthorized changes to the schedules?
2. Are there any institutional policies or regulations the system must adhere to, particularly concerning the storage and handling of sensitive data?

Future Considerations and System Scalability

1. How do you foresee the system scaling as defense room scheduling needs grow, such as the addition of more rooms or scheduling for larger events?
2. Are there any potential future requirements or technological advancements in room management that should be considered for the system's future development?

The insights gathered from the interview with the Center for Research and Development (CRAD) department head are vital in shaping the Automated Defense Room Scheduling System to meet the needs of the department effectively. This process has highlighted key challenges, required features, and potential areas for improvement in the system.

User Stories

User Stories No.	User Stories	Priority	Status
Seamless Integration			
1	As a Center for Research and Development (CRAD) researcher, I want to schedule a specialized research room so that I can conduct studies.	High	Completed
2	As a Center for Research and Development (CRAD) officer, I want the system to automatically block rooms that are already scheduled so scheduling conflicts will not occur.	High	Completed
3	As a Center for Research and Development (CRAD) staff member I want to log in using my official credentials so that I can securely access and manage the system	Medium	Completed
4	As a Center for Research and Development (CRAD) researcher, I want to receive reminders for upcoming defense room schedules so that I'm prepared.	Medium	Completed
5	As a Center for Research and Development (CRAD) researcher, I want to add, remove, and update room details to ensure that room availability is accurate.	Medium	Completed

6	As a Center for Research and Development (CRAD) admin, I want to generate usage reports for research rooms so that I can track past schedules and room utilization.	Low	Completed
7	As a Center for Research and Development (CRAD) admin, I want to manage scheduling access for specific research rooms so that only authorized personnel can use them.	High	Completed
8	As a Center for Research and Development (CRAD) researcher, I want to use my faculty login credentials to access the scheduling system so that I have single sign-on (SSO).	High	Completed
9	As a Center for Research and Development (CRAD) admin, I want to integrate defense room equipment data with the IT asset management system so that equipment usage is tracked.	Medium	Completed
10	As a Center for Research and Development (CRAD) researcher, I want to access IT support through the scheduling system so that I can request help with room technology.	Medium	Completed
11	As a Center for Research and Development (CRAD) admin, I want a logbook feature in the system to track individuals entering and exiting the Center for Research and Development (CRAD) department for record-keeping.	Medium	Completed

12	As a Center for Research and Development (CRAD) IT staff member, I want to monitor room and equipment usage so that I can plan maintenance efficiently.	Low	Completed
EIS Information Security			
13	As a user, I want data encryption for all scheduling information so that sensitive data is protected.	High	Completed
14	As a user, I want to ensure that all data backups are encrypted so that backup data is secure from breaches.	High	Completed
15	As a user, I want to ensure that user session timeouts are enforced to protect against unauthorized access.	Medium	Completed
EIS Standards			
16	As a user, I want a custom logo for the scheduling system so that it reflects the Center for Research and Development (CRAD) branding.	High	Completed
17	As a user, I want a set of custom icons for the interface so that actions are easily identifiable.	High	Completed
18	As a user, I want the interface to have a uniform design so that it is visually cohesive and user-friendly.	High	Completed
19	As a user, I want to have sidebar navigation so that I can easily access different sections of the scheduling system.	High	Completed
20	As a user, I want to ensure that all design elements comply with accessibility standards so that all users	High	Completed

	can navigate easily		
21	As a user, I want to include tooltips for icons so that I can get descriptions of the functions.	High	Completed
22	As a user, I want to conduct user testing on the new design elements to gather feedback for improvements.	Medium	Completed
UI/UX			
23	As a user, I want the system to have a consistent color scheme (e.g., Center for Research and Development (CRAD)'s official colors) so that it aligns with the college branding.	High	Completed
24	As an admin, I want the interface to have a clean and minimalistic design so that I can quickly view scheduling and availability without visual clutter.	High	Completed
25	As an admin, I want the login page design to reflect the college branding and look professional so that the system feels cohesive and trustworthy.	High	Completed
26	As a user, I want the system to use icons in action buttons for intuitive understanding of actions.	High	Completed
27	As a user, I want uniform icon styles across the application (e.g., consistent line thickness and size) for a visually cohesive experience.	Medium	Completed
Integration			

28	As a user, I want to synchronize user data across the scheduling system and other integrated systems to ensure consistent user profiles.	High	Completed
29	As a user, I want to create reports that pull data from integrated systems for analysis and decision-making regarding room usage and resources.	Medium	Completed
30	As a user, I want to ensure secure data transfer between integrated systems to protect sensitive information.	Low	Completed
System Analytics			
31	As an admin, I want to analyze user scheduling patterns to improve resource allocation and scheduling.	High	Completed
32	As an admin, I want to generate reports on resource utilization to ensure efficient use of resources.	Medium	Completed
33	As a user, I want to access my scheduling history to review past reservations and make future reservations easier.	Medium	Completed
34	As an admin, I want to integrate analytics with other systems to provide a holistic view of departmental performance.	Low	Completed

Table 18: User Stories

Functional Requirements for Integration

To ensure efficient and seamless operation, the Automated Defense Room Scheduling System incorporated the following integration requirements.

Real-time Room Availability Synchronization	The system ensured that defense room availability was updated quickly, preventing double scheduling and scheduling conflicts.
Automated Scheduling Conflict Detection	The system automatically checks for scheduling conflicts before confirming a defense room schedule, notifying the Center for Research and Development (CRAD) officer if adjustments are required.
Data Import and Export Mechanism	The system provided a structured data exchange format to facilitate easy data sharing with other department systems.
Secure Authentication and Authorization	Integrated systems required authentication via secure login credentials, ensuring only authorized users could access scheduling and panelist information.

Batch Processing for Scheduled Data Updates	Non-real-time updates, such as monthly scheduling reports and historical scheduling records, were processed in batches to optimize system performance.
Error Handling and Logging	Any integration errors, such as failed scheduling requests or incorrect room availability data, were logged for review and resolution.
Scalability for Future Expansion	The system was designed to accommodate additional defense room, new scheduling rules, or further integration with future institutional tools without requiring significant modifications.
User-friendly Interface for Data Exchange	The system provided an intuitive dashboard where the Center for Research and Development (CRAD) officer could review integration status, track requests, and efficiently manage scheduling updates.

Table 19: Functional Requirements

Business Process Architecture

The Business Process Architecture (BPA) of the Automated Defense Room Scheduling System at Bestlink College of the Philippines aims to document, optimize, and enhance the critical processes of scheduling defense rooms for academic purposes. This architecture ensures that the system supports the institution's operational needs while aligning with strategic goals, improving efficiency, and providing reliable services. Each process optimizes the overall system performance and contributes to a seamless user experience.

Identification of Business Processes

To ensure a smooth and effective operation of the Automated Defense Room Scheduling System, it is crucial to document and optimize the following key business processes,

Business Processes	Performance Measure
Defense Room Scheduling Request Faculty or students can request a defense room by submitting a formal request	Ensures proper submission of scheduling requests and minimizes conflicts in scheduling.

to the Center for Research and Development (CRAD) officer. The request must include the preferred room, date, and time for the defense.	
Room Availability Verification The Center for Research and Development (CRAD) officer uses the system to verify room availability in real time. This verification process checks for conflicts and ensures rooms are allocated based on availability.	The system should instantly reflect real-time availability, minimizing the risk of overscheduling or scheduling conflicts.
Scheduling Confirmation The schedule is finalized once the Center for Research and Development (CRAD) officer confirms that	Guarantees that defense room reservations are confirmed quickly, with immediate acknowledgment sent to users, ensuring smooth

a room is available. This step ensures no double-scheduling and secures the room for the requested defense session.	communication and confirming availability.
Schedule Adjustments and Cancellations The Center for Research and Development (CRAD) officer can modify or cancel room reservations as needed based on changes in requirements, such as faculty availability, room requirements, or panelist changes.	The system should allow for flexible adjustments, ensuring that all changes are reflected immediately and communicated to all involved parties.

Table 20: Business Processes

Business Process Diagrams

These diagrams visually represent how a scheduling request moves through verification, confirmation, and adjustments, providing a clear understanding of how the system operates.

BPA 1

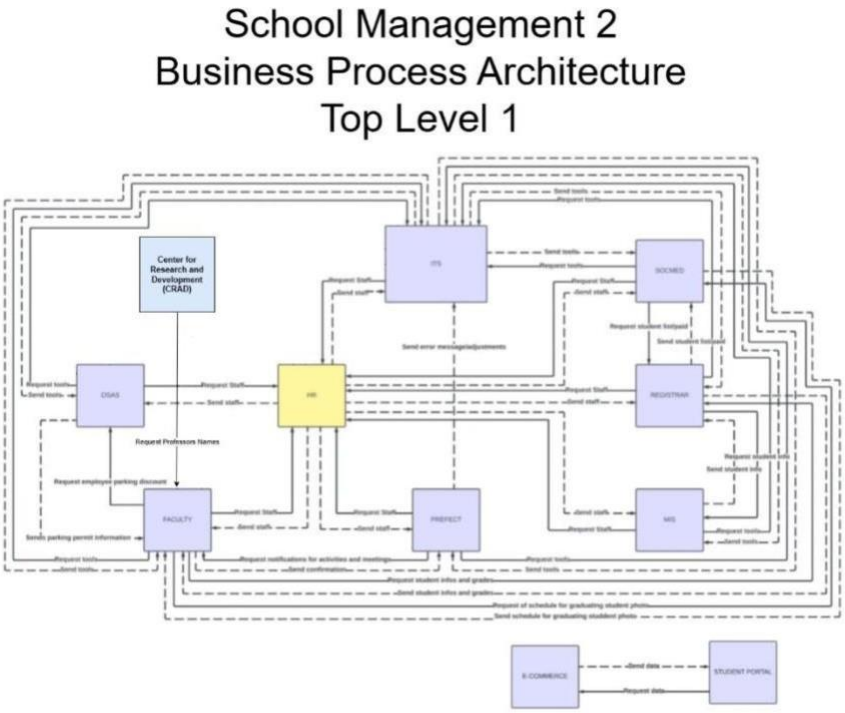
School Management 2
Business Process Architecture
Top Level 1
ITS
SOCMED
Center for Research and Development (CRAD)
DSAS
HR
REGISTRAR
FACULTY
PREFECT
MIS
E-COMMERCE
STUDENT PORTAL
Send tools
Request tools
Request Staff
Send staff
Send error message/adjustments
Request student fee/paid
Send student fee/paid
Request Professors Names
Request employee parking discount
Sends parking permit information
Request student info
Send student info
Request notifications for activities and meetings
Send confirmation
Request student infos and grades
Send student infos and grades
Request of schedule for graduating student photo
Send schedule for graduating student photo
Send data
Request data

Figure 11: Business Process Diagram (BPA Top Level 1)

BPA 2

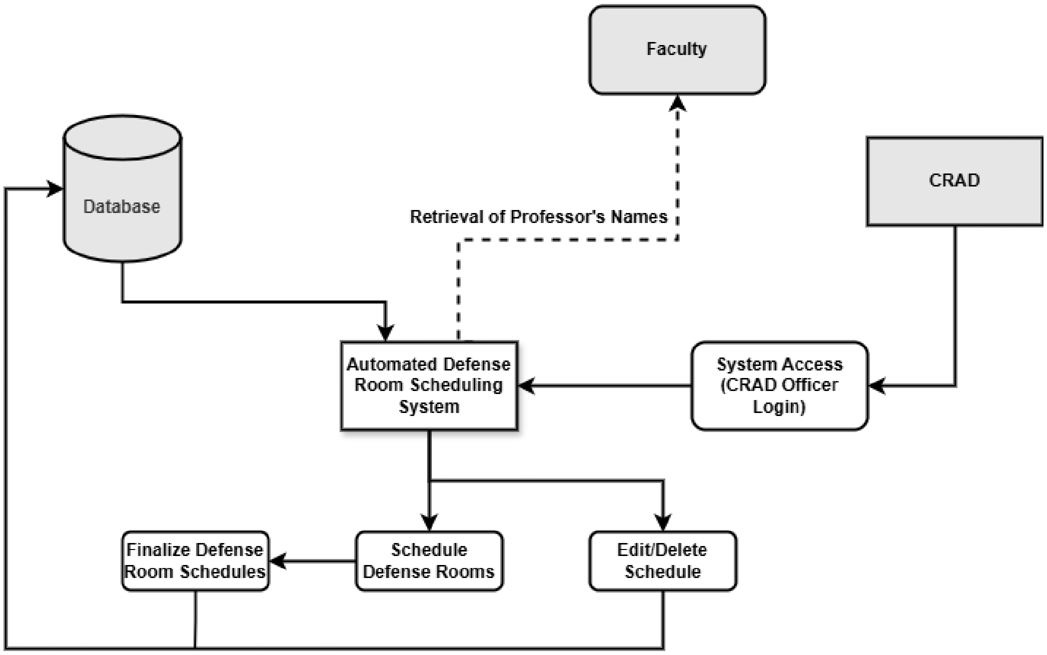
Faculty
CRAD
Database
Retrieval of Professor's Names
Automated Defense Room Scheduling System
System Access (CRAD Officer Login)
Finalize Defense Room Schedules
Schedule Defense Rooms
Edit/Delete Schedule

Figure 12: Business Process Diagram (BPA Top Level 2)

Alignment of Integrated System with Business Processes

To ensure operational efficiency and streamlined scheduling, the Automated Defense Room Scheduling System aligns its integrated components with key business processes. This enhances usability, optimizes room utilization, and supports institutional goals.

1. Centralized Scheduling Management

   Objective: Streamline defense room reservations within Center for Research and Development (CRAD) to prevent scheduling conflicts.

Integration: The system centralizes all scheduling activities, allowing Center for Research and Development (CRAD) officers to manage room allocations efficiently.

2. Optimized Room Availability Checks

   Objective: Ensure real-time updates on room availability to prevent double bookings.

   Integration: The system updates availability dynamically when a booking is made or canceled.

3. Seamless Scheduling Confirmation

   Objective: Provide instant confirmation to ensure room reservations are secured.

   Integration: The system notifies users immediately upon successful scheduling.

4. Efficient Cancellation and Rescheduling

   Objective: Enable flexible booking modifications while maintaining system integrity.

   Integration: Users can cancel or reschedule bookings based on system policies, with real-time availability updates.

5. Historical Schedule Tracking

   Objective: Allow users to reference past bookings for future scheduling.

   Integration: The system maintains a record of previous reservations accessible to Center for Research and Development (CRAD) officers.

6. Automated Conflict Resolution

   Objective: Prevent scheduling conflicts through an intelligent booking system.

   Integration: The system automatically detects conflicts and suggests alternative rooms when necessary.

7. Comprehensive Reporting and Analytics

   Objective: Provide data-driven insights into room utilization and scheduling trends.

   Integration: The system generates reports for Center for Research and Development (CRAD) officers to evaluate peak times, underutilized rooms, and overall scheduling efficiency.

8. Security and Compliance Measures

Objective: Ensure secure data handling and compliance with institutional policies.

Integration: The system implements user authentication and access controls to maintain data integrity.

9. Scalable System Architecture

   Objective: Support future expansion and additional scheduling features as institutional needs evolve.

   Integration: The system is designed with a scalable framework, allowing integration with other campus systems if needed.

Business Process Improvements

The Automated Defense Room Scheduling System is not only meant to automate the current scheduling process but also improve it.

Minimize Manual Effort: Automate repetitive functions, including room assignments and confirmations, to conserve time and reduce the Center for Research and Development (CRAD) officer's workload.

Improve Accuracy: Reduce scheduling conflicts and errors by ascertaining real-time room availability and system-initiated alerts for confirmations, cancellations, and changes.

Facilitate Data-Driven Decision-Making: Offer reports and analytics on room use and scheduling patterns to enable data-driven decisions on resource allocation and future planning.

These improvements will help schedule defense rooms more effectively, distribute resources, and enhance the overall scheduling process for students and faculty.

The project's Business Process Architecture documents the steps it took to discover, model, and improve the significant business processes entailed in the defense room scheduling process at Bestlink College of the Philippines. By linking the processes with the integrated system and implementing continuous process enhancements, the Automated Defense Room Scheduling System will boost operation efficiency and support the institution's pursuit of providing quality education and facilities to its academe.

Application Architecture

Components of Application Architecture

The Automated Defense Room Scheduling System consists of several key components that work together to provide a seamless user experience and ensure the system's reliability, security, and performance.

Components	Role and Purpose
User Interface (Frontend)	The user interface provides an interactive experience for the Center for Research and Development (CRAD) officer. It enables them to access system features. The front end uses HTML and CSS to ensure responsiveness and a user-friendly design.
Server-Side Logic (Backend)	The server-side logic handles all the system's business rules and processes. It is responsible for receiving requests from the user interface, processing them, interacting with the database, and returning the appropriate responses. The backend is developed using PHP to handle dynamic content, data processing, and database interactions.
Database (MySQL)	The database stores all critical data related to the defense room scheduling system. MySQL is used to ensure data integrity, reliability, and scalability. The

	database facilitates querying, updating, and retrieving scheduling data in real-time.
Authentication & Security Modules	The security modules ensure only authorized user can access and modify defense room schedules. Authentication will be managed via a secure login system, where the CRAD officer must provide valid credentials. PHP will handle session management and ensure data confidentiality.
Reporting and Analytics Module	This module provides the CRAD officer and administrators with detailed reports on room usage, scheduling trends, and cancellations.
Artificial Intelligence (AI) Chatbot Component	Enhances user interaction by providing instant, conversational support for room scheduling. Integrated within the system, it answers common queries, checks real-time room availability, and guides users through the booking process. Using natural language processing, it can respond to user inputs and assist with tasks like confirming bookings or providing reminders.

Table 21: Components of Application Architecture

Application Architecture Diagrams

In order to get a better understanding of how these components of the system work together, the diagram below defines the connections between the user interface, server logic, database, and other system components.

High-Level System Architecture Diagram

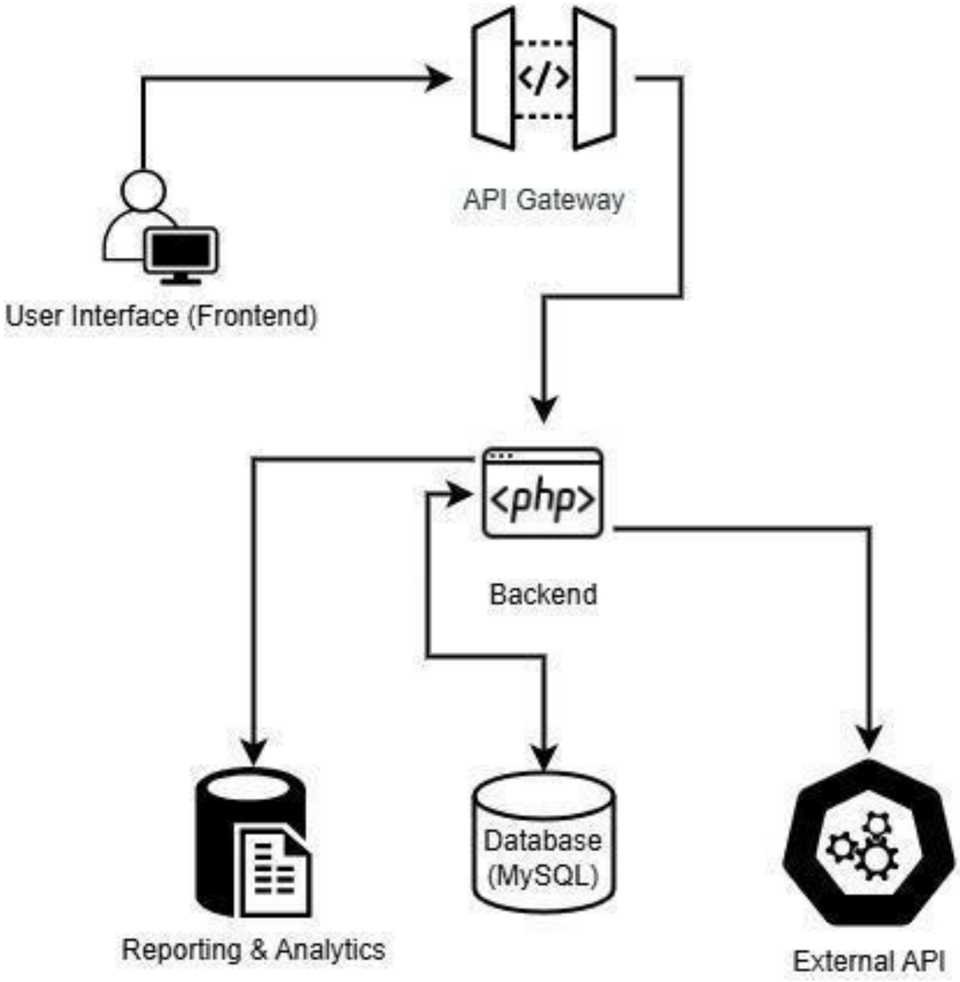

Figure 13: High-level System Architecture

Application Architecture

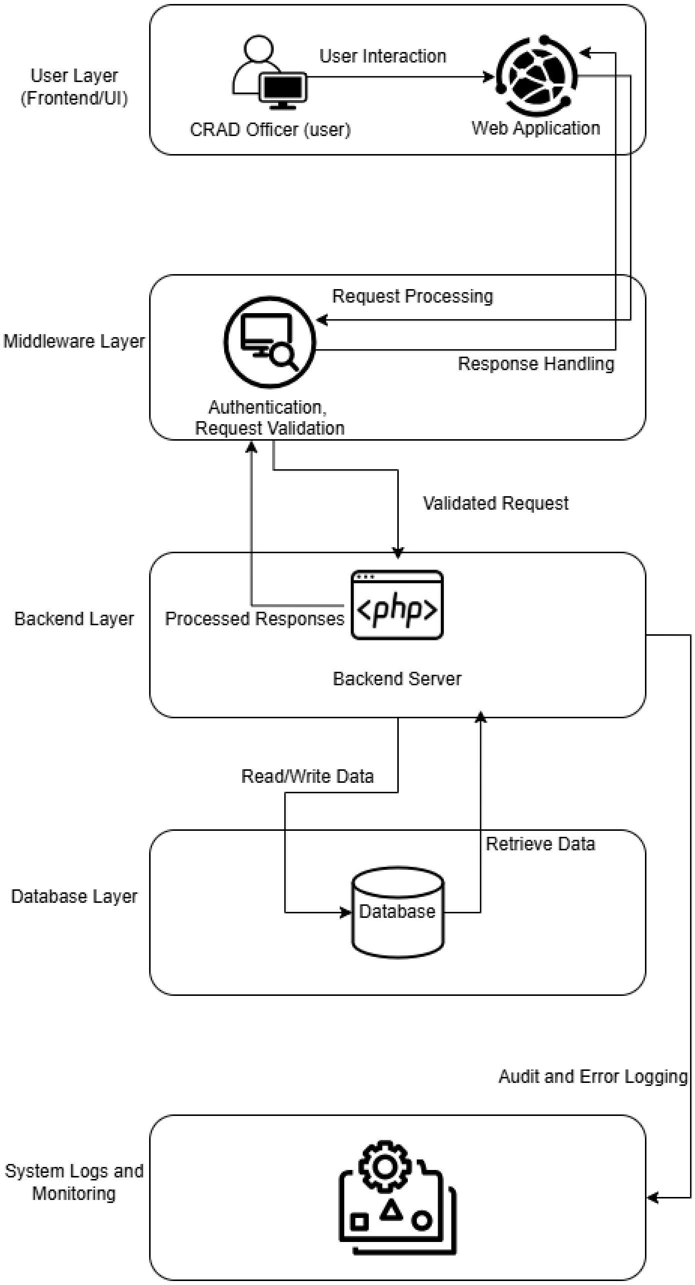

Figure 14: Application Architecture

Integration of Software Modules

The Automated Defense Room Scheduling System integrates its modules through APIs and middleware, enabling the UI, business logic, and database to communicate efficiently. When the Center for Research and Development (CRAD) officer schedules a room, the UI sends a request to the business logic, which checks availability and updates the database. The system sends a confirmation response back to the UI. Standard protocols such as HTTP communicate between components for integrated operation.

Communication and Interaction Patterns

Effective communication is vital to ensuring seamless collaboration, coordination of tasks, and system design in an Agile setting. The team practices communication patterns to aid real-time decision-making, monitor progress, and resolve issues. The table below summarizes the types of key communication, purpose, frequency, and participants.

Communication Type	Description	Frequency	Participants
Daily Stand-up Meetings	Short updates where team members	Daily	Scrum Master, Developers,

	discuss progress, blockers, and tasks for the day.		Project Manager
Sprint Planning Meetings	Defines sprint objectives, prioritizes tasks, and assigns responsibilities.	Every Sprint (Weekly)	Scrum Master, Project Team
Sprint Review & Retrospective	Reviews completed work, collects feedback, and discusses improvements for the next sprint.	End of Each Sprint	Scrum Master, Project Team, Center for Research and Development (CRAD) Officer (for feedback)
Asynchronous Online Communication	Quick discussions, updates, and	Completed	Project Team

	issue resolutions via messaging apps.		
System Development Collaboration	Developers push code changes, review pull requests, and track version history.	Completed	Developers, Project Manager
Stakeholder Updates	Reports on project progress, major changes, and Center for Research and Development (CRAD) officer feedback.	Weekly	Project Manager, Center for Research and Development (CRAD) Officer

System Testing & Bug Reporting	Identifies issues in the system, documents them, and assigns fixes.	Per Testing Cycle	Developers, Testers, Document Analyst
Deployment & Maintenance Coordination	Ensures smooth system deployment, checks for issues, and applies fixes.	As Needed	Developers, Project Manager
Documentation	Updates documentation.	Before Major Releases	Center for Research and Development (CRAD) Officer, Document Specialist, Document Analyst

Table 22: Communication and Interaction Patterns

Regular check-ins (daily stand-ups, sprint reviews) keep development on track.

Web-based messaging software provides instant and versatile collaboration.

Formal meetings (sprint planning, stakeholder updates) offer formalized decision-making.

Repeat cycles of feedback (testing, retrospectives) enhance system quality.

Scalability and Performance Factors

1. Load Balancing: Spreads traffic across servers to ensure performance under high load.
2. Caching: Minimizes database load by keeping often accessed data in memory, making responses faster.
3. Database Indexing: Improves data retrieval to make searches and updates faster.
4. Data Storage Strategies: Makes data organization efficient for fast access and retrieval.

Data Architecture

Data architecture specifies the data structure, storage, flow, and management in the Automated Defense Room Scheduling System. It makes data secure, accurate, and accessible, enabling the system's scheduling capability and overall performance.

Data Sources and Types

Data Sources

The system utilizes different data sources to schedule the rooms effectively. These are:

1. Defense Room Scheduling System Database – Maintains all room scheduling, availability, and historical scheduling.
2. Center for Research and Development (CRAD) Department Scheduling Records – Stores manual changes and external scheduling conflict resolved by the Center for Research and Development (CRAD) officer.
3. User Authentication System – Manages login identities and access levels for Center for Research and Development (CRAD) officers.
4. System Logs & Audit Data – Monitors room scheduling changes, user activity, and system performance logs.

Data Types

Data Category	Description
User Information	Center for Research and Development (CRAD) officer login credentials and access privileges.
Room Scheduling Data	Room name, availability status, time slots, and assigned faculty/student.
Booking History	List of past and upcoming scheduling, including timestamps, user who scheduled, and cancellation/modification logs.
System Logs	Records of user activities, changes in schedules, and login attempts for auditing purposes.
Error & Issue Tracking	Data on failed schedules, system errors, and user-reported issues for debugging and maintenance.

Table 23: Data Types

Data Flow & Governance

Data Capture: Schedule requests are processed through the system, validating room availability before confirming reservations.

Data Storage: All scheduling and authentication data is securely stored in the MySQL database, ensuring integrity and easy retrieval.

Data Processing: The PHP backend handles business logic, including scheduling conflicts and rule-based schedule approvals.

Data Usage: The Center for Research and Development (CRAD) officer interacts with the frontend interface to manage schedules, review availability, and update schedules.

Data Security & Governance: Access control ensures only authorized users (Center for Research and Development (CRAD) officers) can modify schedules. Logs track changes for auditing purposes.

Data Flow Diagram

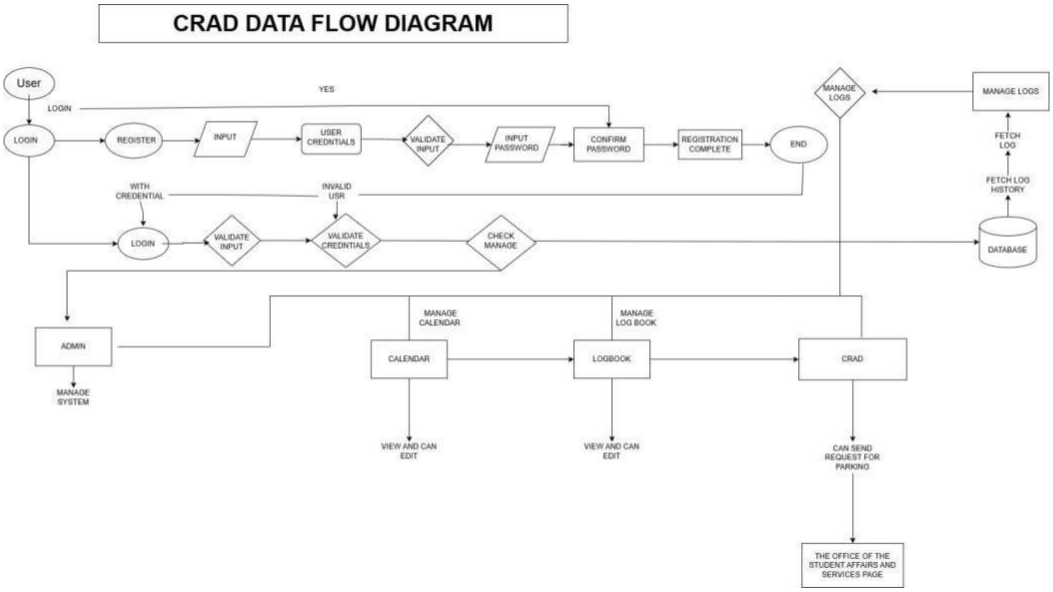

Figure 15: Data Flow Diagram

Data Storage and Management

The Automated Defense Room Scheduling System's data storage and management capabilities are critical to maintaining the accuracy, security, and availability of scheduling information. The system employs a MySQL relational database to support structured data such as defense room scheduling, schedule history, user identification records, and system logs.

Data is kept in relational tables with well-defined constraints to prevent data duplication or conflict and to maintain data integrity. The primary storage entities are:

Data Storage Entity	Purpose	Primary Fields	CRUD Operations
Defense Room Scheduling Table	Stores core data related to room scheduling, availability, and assigned users.	- Room ID - Date and Time of Schedule - Assigned Faculty/Student ID - Room Status (Available,	- **Create**: Add a new room schedule - **Read**: Retrieve room availability or schedule for a specific date - **Update**: Modify scheduling details

		Scheduled, etc.)	- **Delete**: Cancel a schedule
User Authentication Table	Maintains login credentials and access levels for Center for Research and Development (CRAD) officers.	- User ID - Username - Password (hashed) - Access Level (e.g., Admin)	- **Create**: Add a new CRAD officer record - **Read**: Verify login credentials - **Update**: Change password or access level - **Delete**: Remove user record
Scheduling History Table	Logs past and upcoming defense room schedules for auditing and reference.	- Schedule ID - Room ID - Date and Time - Faculty/Student ID - Schedule Status	- **Create**: Log a new defense room schedule - **Read**: Retrieve past or upcoming schedule details - **Update**: Modify scheduling status

		(Confirmed, Pending, Cancelled)	- **Delete**: Remove obsolete records after retention period
System Logs Table	Captures changes, cancellations, conflicts, and system activities.	- Log ID - Timestamp - Action Type (Change, Cancel, Conflict) - Affected Room/Schedule ID - User ID (of Center for Research and Development (CRAD) officer)	- **Create**: Record changes, cancellations, or conflicts - **Read**: Retrieve logs for debugging or auditing - **Update**: Not applicable - **Delete**: Archive or purge old logs after retention period

Table 24: Data Storage

Data Synchronization Across Systems

Data synchronization plays a vital role in maintaining consistency between all system elements, including databases, user interfaces, and external integrations. All system components require immediate data reflection from changes made in any system area, including room scheduling cancellations or scheduling history updates.

Real-Time Synchronization

This method allows system modules to display updated data immediately whenever someone makes a schedule or cancellation.

Conflict Resolution

Resolving conflicts that emerge during system synchronization of multiple platforms is crucial.

Data Mapping and Transformation

Data arrives from different sources with unique structural formats; thus, the integration layer needs to convert the received data into a standard format.

Integration Layer Role

The Integration Layer is responsible for managing data flow between all databases and external services. Its functions include:

1. The system retrieves data from the Defense Room Scheduling Table, User Authentication Table alongside other information sources.
2. The data needs transformation to convert its structure and assign value mappings.
3. The system places data into its proper destination location which includes updating the scheduling history table together with external record synchronization.

Technology Architecture

Technology Stack and Infrastructure

Category	Technology/Tools Used	Description
Operating System	Windows (for local deployment)	The system runs on Windows OS using XAMPP for local hosting.
Developmen t Environment	XAMPP (Apache, MySQL, PHP, phpMyAdmin)	Provides an all-in-one local server for development.
Backend Technology	PHP	Handles server-side processing and logic.
Frontend Technology	HTML, CSS, JavaScript, Bootstrap, jQuery	Manages the user interface and interactivity.
Database Management	MySQL (MariaDB via XAMPP), phpMyAdmin	Stores and manages system data efficiently.

Web Server	Apache (via XAMPP)	Serves system requests and handles client-server interactions.
Development Tools	Sublime Text / VS Code	Used for writing and editing code.
Version Control	GitHub	Tracks change and manages the source code.
Network Configuration	Localhost, Firewall Rules	Limits access to the system for security.
Security Measures	Database authentication, phpMyAdmin access restrictions	Ensures data protection and restricted access.
Scalability Features	SQL Indexing, Page Caching	Improves database performance and system speed.
Backup & Recovery	Database exports via phpMyAdmin	Prevents data loss through regular backups.

Table 25: Technology Architecture

Network Architecture and Configuration

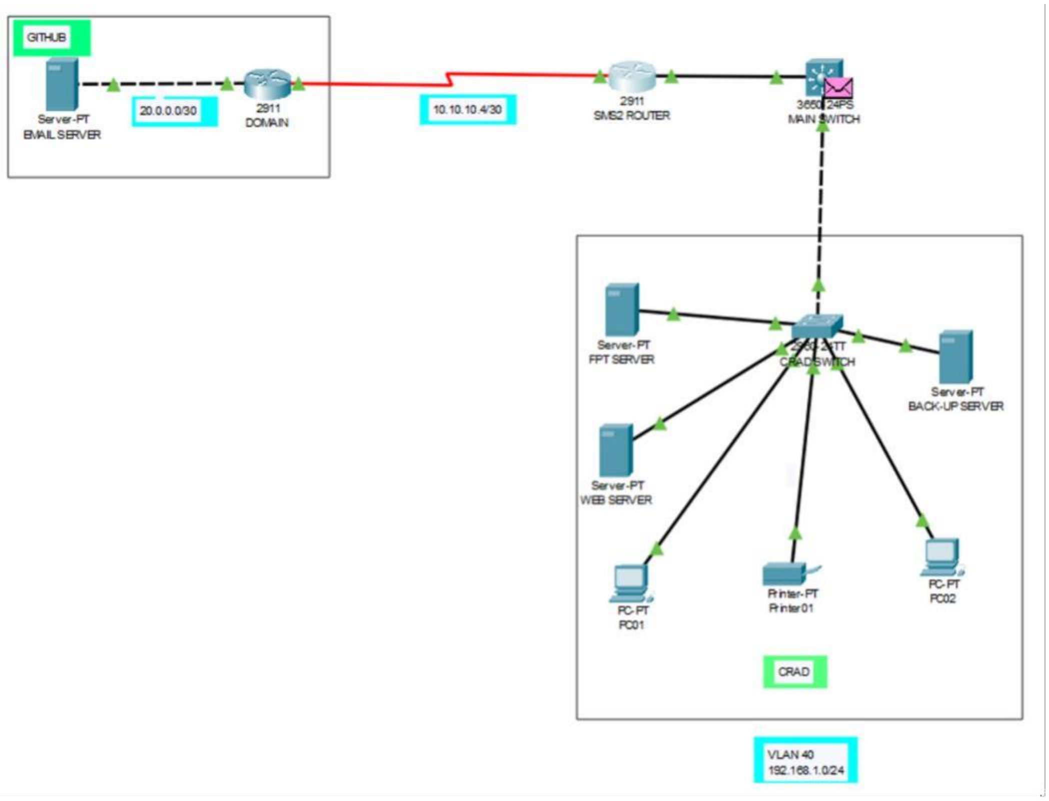

Figure 16: Network Topology

Software Technologies

1. Scheduling System

   Software: The system is developed using PHP and MySQL within the XAMPP environment to handle defense room scheduling efficiently.

APIs: RESTful APIs for integration with other department systems.

2. User Authentication & Access Control

   Software: The system implements secure authentication using PHP sessions to ensure only Center for Research and Development (CRAD) officers can access the scheduling system.

3. Database Management

   Software: MySQL is used to store and manage defense room schedules, user access logs, and historical records.

   Optimization: SQL indexing and query optimization are implemented to improve performance.

4. Frontend Development

   Software: The user interface is developed using HTML, and CSS, for a simple and functional web-based experience.

   Frameworks: Bootstrap is used to ensure a clean and responsive design.

5. Data Backup & Recovery

   Software: MySQL database backups are scheduled using automated scripts.

   Storage: Backup files are stored on an external storage device or cloud storage for data recovery.

6. Cloud Hosting & Deployment

Service: The system is planned for deployment on Indevfinite cloud hosting to ensure accessibility and performance.

7. System Monitoring & Logging

   Software: Logging mechanisms track user activity and system performance for troubleshooting and auditing purposes.

   Analysis: Logs help administrators maintain system reliability.

8. Security Implementation

   SSL Encryption: Protects data transmission between the client and server.

   Data Protection: Passwords are encrypted using hashing before storage in the database.

9. Performance Optimization

   Caching: PHP-based caching techniques reduce database load and improve system speed.

   Efficient Queries: Database queries are optimized to prevent slowdowns.

10. Software Development Tools

    Code Editor: The team uses Sublime Text for coding.

    Version Control: GitHub is used for source code management, collaboration, and tracking changes.

Scalability and Performance Considerations

In order to make the Automated Defense Room Scheduling System efficient, scalable, and responsive, essential strategies with an emphasis on scalability, performance optimization, data migration, and system monitoring have been adopted.

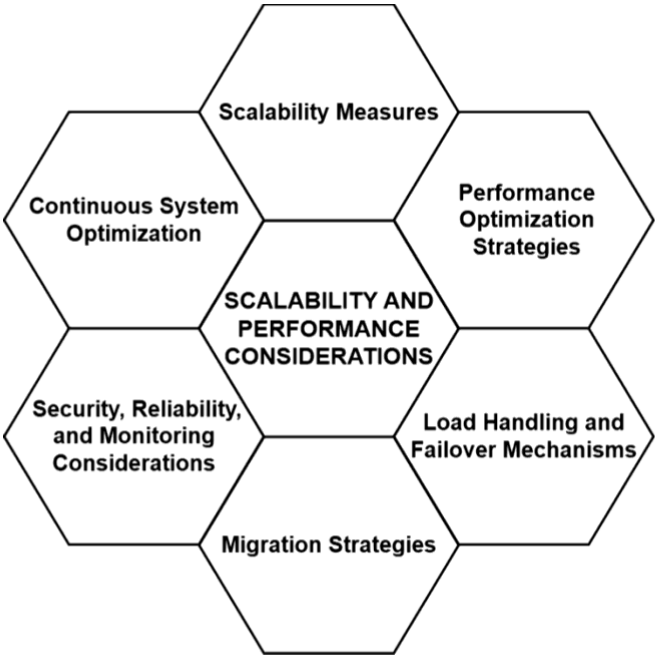
Scalability Measures
Continuous System Optimization
Performance Optimization Strategies
SCALABILITY AND PERFORMANCE CONSIDERATIONS
Security, Reliability, and Monitoring Considerations
Load Handling and Failover Mechanisms
Migration Strategies

Figure 17: Scalability and Performance Considerations

1. **Scalability Measures**

Horizontal and Vertical Scaling:

The system is designed for horizontal scaling, allowing additional server instances to be added when the number of users increases. Vertical scaling is also considered by upgrading resources on the Indevfinite cloud platform when necessary.

Database Optimization:

Indexing is applied to frequently queried fields, such as room availability lookups, to enhance database query speed.

Future database partitioning is considered for handling larger datasets efficiently.

Normalization and denormalization strategies are applied based on performance needs.

Cloud-Based Deployment:

The system is hosted on Indevfinite Cloud Services, supporting elastic scaling and high availability.

Cloud-based MySQL databases allow seamless scaling without downtime.

2. **Performance Optimization Strategies**

Efficient Caching Mechanisms:

Server-side will minimize redundant database queries.

Client-side caching will store frequently accessed static assets for improved performance.

Optimized Database Queries:

Queries are optimized to fetch only necessary data, reducing load on the database.

Batch processing is used instead of multiple individual queries for bulk operations.

Stored procedures and prepared statements enhance execution speed and security.

Optimized Code Execution:

Lightweight PHP scripts and minimized server-side computations improve processing time.

AJAX implementation enables asynchronous data fetching to avoid unnecessary page reloads.

3. Load Handling and Failover Mechanisms

Load Balancing:

Future implementation of load balancing to distribute traffic across multiple servers, ensuring stability during peak usage.

Connection Pooling:

MySQL connection pooling will manage simultaneous user requests efficiently, reducing database strain.

Scheduled Database Backups & Data Integrity Checks:

Automated backups will ensure quick data recovery in case of failures.

Transaction logs will help maintain data integrity.

4. Migration Strategies

Since the system is newly developed, migration focuses on future scalability and version upgrades rather than legacy data transfer.

Data Migration for System Upgrades:

Zero-Downtime Migration: Future updates will be deployed using rolling updates.

Backup & Restore Mechanism: Regular database snapshots ensure fail-safe migration.

Incremental Data Migration:

If historical scheduling data needs to be transferred in the future, incremental migration techniques will be used.

Schema Evolution & Versioning:

Future database changes will follow a structured versioning approach to ensure backward compatibility.

5. Security, Reliability, and Monitoring Considerations

Data Security Measures:

SSL Encryption protects data transmission.

Session Management & Role-Based Authentication prevent unauthorized access.

Performance Monitoring Tools:

System logs help detect and resolve performance issues.

Real-time performance tracking ensures responsiveness.

Benchmark Testing:

Load testing and stress testing validate system performance under high-traffic conditions.

6. Continuous System Optimization

Regular Performance Audits help identify bottlenecks and optimize system resources.

Automated testing ensures updates do not degrade system performance.

Proactive issue resolution through logs and monitoring tools prevents downtime.

By integrating these strategies, the Automated Defense Room Scheduling System is designed to be highly scalable, responsive, and efficient, ensuring a seamless experience for Center for Research and Development (CRAD) officers managing defense room schedules.

Development Process

Agile Scrum Roles and Responsibilities

Name	Role	Responsibilities
Center for Research and Development (CRAD) Department	Client/End User	Provides real-world usage feedback and insights for the development team to refine features in the system.
Mr. Ronald Roldan Jr.	Research Adviser	Ensures the capstone aligns with research standards and methodologies, guiding the documentation process to maintain clarity and academic rigor. Additionally, offers advice on improvements to enhance the quality of the project

Karl Aaron P. Alvendo	Scrum Master		Supervises and coordinates internal communication and arranges tracking of progress within all the remaining groups.
Joseph Alfredo B. Pastores	Development Team	Project Manager	Monitors team progress, ensures Agile principles, facilitates communication, assigns tasks based on strengths, gathers stakeholder feedback, and advises on risk management.
Mark Joshua V. Trinidad		Lead Programmer	Develops, tests, and debugs system code, engages in code reviews, and collaborates with the project manager to align

			tasks with Sprint goals.
Cedrick J. Del Prado		Assistant Programmer	Assists the lead programmer with stability, troubleshooting, testing, and documentation to maintain code quality.
Amina P. Sanson		Document Specialist	Records technical specifications, tracks development changes, and ensures documentation accuracy for effective knowledge transfer.
Rosever P. Cunanan		Document Analyst	Works with the team to document features and functionalities, ensuring clear integration and accessibility of system documentation.

Table 26: Agile Scrum Roles and Responsibilities

Sprint Planning and Backlog Management

Sprint planning for the Automated Defense Room Scheduling System is aimed at improving scheduling efficiency, avoiding conflicts, and maintaining real-time room availability updates for the Center for Research and Development (CRAD) department.

Sprint Goal

Enhance the efficiency of the scheduling system by incorporating real-time updates, avoiding scheduling conflicts, and providing a smooth scheduling experience for Center for Research and Development (CRAD) officers.

Sprint Planning Breakdown

Sprint Planning Stage	Details
Backlog Review	Prioritize features that improve scheduling accuracy, real-time room availability, and scheduling conflict prevention.
Story Point Allocation	Assign points based on complexity: Real-time availability (8 points), conflict prevention (7 points), UI refinement (5 points).

apacity Planning	Evaluate team workload to ensure completion within the sprint timeline.
Sprint Backlog Selection	Select high-priority tasks: schedule confirmation module, improved calendar view, and validation rules for scheduling conflicts.
Definition of Done (DoD)	Features must be fully tested, functionally stable, and meet user expectations before deployment.

Table 27: Sprint Panning Breakdown

Sprint Backlog

Feature	Task	Story Points	Expected Outcome
Real-time Availability	Develop and test the live availability display.	8	User can see up-to-date room availability.
Conflict Prevention	Implement logic to detect and block double scheduling.	7	The system prevents scheduling conflicts before confirmation.

Improved Scheduling Interface	Enhance the UI for better navigation.	5	Center for Research and Development (CRAD) officers can quickly reserve rooms without confusion.
Schedule Confirmation Module	Automatically send confirmation upon successful schedules.	6	The user receives instant verification of room reservations.

Table 28: Sprint Backlog

Sprint Execution and Deliverables

This sprint is dedicated to fundamental system improvements, with development split into tasks for different team members. Testing is integrated to guarantee stability prior to deployment.

Task Breakdown

User Story	Task	Assigned to	Status

Prevent Double-Booking	Develop logic to block conflicting schedules.	Lead & Assistant Programmer	Completed
Real-Time Availability	Integrate a calendar view.	Lead & Assistant Programmer	Completed
Scheduling Confirmation	Automate scheduling confirmation messages.	Lead & Assistant Programmer	Completed
User-Friendly Interface	Improve the room selection UI.	Lead & Assistant Programmer	Completed
System Testing	Conduct end-to-end testing for stability.	Project Manager	Completed

Table 29: Task Breakdown

Sprint Deliverables

Deliverable	Description	Impact
Conflict Prevention Module	Detects and prevents overlapping schedules.	Ensures accurate and reliable room reservations.
Real-Time Room Availability	Updates on defense room status.	Reduces schedule uncertainty and improves efficiency.

Automated Scheduling Confirmation	Send verification messages instantly.	Ensures that the user knows that the schedule is secured.
UI Enhancements	Improved calendar and room selection layout.	Makes the system easier to navigate for Center for Research and Development (CRAD) officers.

Table 30: Sprint Deliverables

Sprint Review

The sprint delivered key features that enhanced the scheduling process for Center for Research and Development (CRAD) officers by providing real-time updates, automated confirmation processes and conflict prevention features. The conflict prevention feature provided precision and reliability by preventing double scheduling effectively. The user interface enhancements made it easier for the user to select the preferred rooms while enhancing the overall interaction with the system.

The implementation of the scheduling system identified challenges that involved short delays during real-time updates. To address these, the team optimized database queries and adjusted the layout for better compatibility. There was also a need for more customization in scheduling rules, which has been noted for future iterations.

Challenges Faced in the Development Process

Different challenges faced the development team which reduced both the reliability of the system as well as its level of efficiency for the Automated Defense Room Scheduling System. A Major challenge came from the inability to achieve real-time availability update due to lack of real-time system synchronization resulting in periodical room status mismatches. Periodic updates by the Center for Research and Development (CRAD) officer offer regular manual schedule maintenance that allows correct data while removing the need for continuous synchronizations.

The team needed to create a user interface with scheduling ease that handled multiple constraints. The initial iterations of the interface had user experience issues that made it hard for the user to choose rooms. User interface enhancements were done by the team from feedback to create a straightforward scheduling process with easy steps. The integration of double schedule prevention with the preservation of required flexibility presented significant challenges to the delivery system. The team introduced validation features that identify scheduling conflicts prior to a session becoming final so the operation remains efficient.

Data security and integrity were critical maintenance criteria. The operations may be afflicted with interrupted functionality if security mechanisms are not implemented. The Center for Research and Development (CRAD) officer was the only user permitted to access the system and the team installed a controlled data backup system as a protective mechanism. Consistent systematic problem-solving strategies helped the team come up with a system that is more reliable and user-friendly with security in order to have smooth scheduling functionalities.

Implementation

Technical Implementation Details

The system architecture consists of three main layers, the presentation layer, the application layer, and the data layer. The presentation layer is built using HTML and CSS to create a user-friendly interface. The application layer is developed using PHP, handling business logic and processing user requests. The data layer utilizes MySQL as the relational database for storing scheduling information and schedule records. The system is deployed on the Indevfinite cloud platform, ensuring accessibility and scalability.

Tools and Technologies Used

The system's development involved various tools and technologies to support implementation

1. Frontend Development: HTML and CSS for designing the user interface.
2. Backend Development: PHP for handling scheduling processes and data management.
3. Database Management: MySQL for storing scheduling records and ensuring data integrity.

4. Version Control: GitHub for tracking changes and collaborative development.
5. Deployment Platform: Indevfinite cloud for hosting and managing the system online.

These technologies were chosen based on the compatibility, scalability, and ease of integration, ensuring an optimized development process.

Code Integration and Interoperability

The system takes a modular development path, with various modules like system scheduling, checking room availability, and confirming schedules developed individually and then integrated smoothly. Version control is enabled with GitHub, which facilitates easy collaboration among the developers without the occurrence of code conflicts. Integration issues like correlating real-time availability updates and double scheduling were resolved by having validation rules implemented in the system. The system is not integrated with third-party software but maintains internal modules working in unison for effective scheduling.

Integration Testing and Debugging

To guarantee the system's performance and dependability, extensive testing strategies were employed. The process of testing and debugging was carried out in stages:

1. **Unit Testing Phase:** Individual module testing, such as schedule validation and confirmation, was performed to validate if it worked correctly. Bugs for inappropriate user input validation were detected and resolved in this phase.

2. **Integration Testing Phase:** Module interaction, like confirmation of schedule and updates of room availability, was tested. Inconsistencies in room availability status and invalid schedule confirmations were identified and fixed.

3. **System-Wide Testing Phase:** The entire system was tested as a single entity in order to verify whether the components integrated seamlessly. This phase indicated occasional scheduling clashes when user tried to schedule rooms multiple times. Modifications were done on the scheduling validation process to avoid double scheduling.

4. **User Acceptance Testing (UAT) Phase:** The Center for Research and Development (CRAD) officers deployed the system in actual scenarios to find usability flaws and confirm workflows. Feedback was gathered, resulting in slight UI improvements and more descriptive error messages to improve user experience.

5. **Final Debugging and Optimization Phase:** After several iterations, all the bugs that were identified were fixed, and the system was optimized for performance. Database queries were optimized to enhance response time, and the scheduling logic was optimized to provide correct room allocation.

The structured approach to implementation, integration, and testing ensures the Automated Defense Room Scheduling System meets the Center for Research and Development (CRAD) department's requirements efficiently and effectively.

Testing and Quality Assurance

A systematic approach to testing and quality assurance is necessary to ensure that the Center for Research and Development (CRAD) Defense Room Scheduling System performs as expected. This section provides an overview of the testing strategies, methodologies, and measures used to ensure system reliability and performance.

Testing Strategies and Methodologies

Test Objectives Definition – The main objective is to confirm system accuracy, efficiency, and security. Testing is aimed at confirming booking procedures, avoiding scheduling conflicts, and ensuring seamless user interactions.

Defining Test Scope – Testing encompasses defense room scheduling, user authentication, data retrieval, and system performance under different loads.

Functional Testing – Tests every feature, including room availability checks and booking confirmations, to ensure that they function as expected. Scenario-Based Testing – Creates test cases based on real-world usage, including booking a room during peak hours or canceling a scheduled defense.

Exploratory Testing – Testers move within the system at will to discover usability problems, surprising behavior, and subtle bugs.

Test Cases and Test Data

Test cases ensure each function operates correctly, using controlled test data.

Test Scenario	Test Data	Expected Outcome
Scheduling A defense room	Select an available room	Scheduling is confirmed
Scheduling an occupied room	Choose a reserved room	System prevents double-booking
Canceling a reservation	Request cancellation	Schedule updates accordingly
Logging in with incorrect credentials	Enter wrong username/password	System denies access

Table 31: Test Cases and Data

Test Results and Bug Reports

Testing results are documented to track system performance and issues.

Issue	Status	Resolution
System allows duplicate bookings under rare conditions	Resolved	Fix being developed
Booking history not updating immediately	Identified	Optimizing data refresh

Table 32: Test Results and Bug Reports

Quality Assurance Measures

Code Review and Optimization – Code is continually reviewed and optimized by programmers to improve efficiency and security.

User Feedback Implementation – Changes are implemented based on Center for Research and Development (CRAD) officer feedback to enhance usability.

Performance Monitoring – System performance is monitored to avoid slowing down and to provide a smooth experience.

Data Integrity Checks – Periodic checks ensure stored data is correct and consistent.

Results and Evaluation

This section provides an assessment of the School Management System 2: Automated Defense Room Scheduling System, focusing on project outcomes, alignment with objectives, user feedback, and key lessons learned.

Project Outcomes and Deliverables

All the major project deliverables have been examined, verified, and tested for conformity to determine the functionality and usability. The system efficiently provides an automated solution to defense room scheduling, reducing the amount of manual effort needed by the Center for Research and Development (CRAD) officer and preventing scheduling conflicts. Deliverables include the system's functional requirements, design specifications, user guide, technical documentation, test reports, and implementation guidelines. The final version of the system was extensively tested to verify its reliability, security, and usability.

Some of the core features of the system include real-time updates for defense room availability, prevention of conflicts, secure access to the system, and efficient management of scheduling. These features combine to make scheduling easy with proper records of room scheduling being maintained and updated. The deployment of the system has efficiently eliminated the inefficiencies present in the previous manual scheduling system, and it becomes simple for the Center for Research and Development (CRAD) officer to make scheduling.

Alignment with Project Objectives

The system was developed following systematic project milestones to ensure its alignment with the set objectives. The primary objective was to create a conflict-free, secure, and streamlined defense room scheduling system tailored to the needs of the Center for Research and Development (CRAD) department. The below project goals were met:

Improved Scheduling Efficiency – The system facilitates automated reservation, reducing manual effort and errors.

Conflict-Free Scheduling – The system does not allow defense rooms to be double-schedule, improving reliability.

User Authentication and Security – Access is restricted to the Center for Research and Development (CRAD) officer to guarantee that only authorized staff can make changes to schedules.

User-Friendly Interface – The system is user-friendly to allow quick and efficient scheduling management.

Throughout the project, iterative development methodology was adopted to bring about continuous enhancements along with feedback and requirements from the users. The system was implemented on schedule and met functional specifications set in the initial project scope.

Stakeholder and User Feedback

Stakeholder feedback was important in shaping the system's functionality. The Center for Research and Development (CRAD) officer, being the main user, offered feedback that informed the final design of the system.

Positive Feedback:

The system saves a lot of time in scheduling and altering schedules.

Real-time updates avoid scheduling conflicts, allowing for smooth operations.

The interface is easy to use and simple, hence user-friendly.

Recommended Enhancements:

More customization capabilities for booking lengths and rules would further enhance scheduling flexibility.

The system performed as expected, with stakeholders being pleased with its reliability and ease of use.

Lessons Learned

Development and implementation of the Automated Defense Room Scheduling System provided valuable insights with regard to system design, project management, and user-focused development.

Major lessons learned are:

Collaboration is Crucial – Strong communication among developers, document analysts, and stakeholders made sure that the system satisfied actual user needs.

Security Should Be Priority – Installation of access control and data protection features was very important in ensuring system security.

Flexibility in Design – Flexibility to modify system functions according to feedback resulted in a better-developed final output.

Proper Testing Improves System Stability – Proper testing and bug fixing enhanced the performance and dependability of the system.

Future-Proofing Matters – Forward planning for scalability and possible feature additions in the early stages of development can provide longevity to the usage.

Through the use of these lessons on future projects, the development process itself can become more streamlined, producing higher-quality system implementations.

CHAPTER 5

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Key Takeaways and Summary

The School Management System 2: Automated Defense Room Scheduling System was able to overcome the inefficiencies of manual scheduling like real-time updates on availability, conflict-free scheduling, and an efficient reservation process for the Center for Research and Development (CRAD) department. Implementation of the system has resulted in a more systematic and efficient scheduling process, reduced administrative workload, and improved accuracy.

The key results of the project are:

Enhanced Scheduling Efficiency – The system reduces scheduling conflicts and maximizes the utilization of available defense rooms.

Real-Time Availability – Instant availability can be checked, hence reducing delays and miscommunication.

User-Centric Design – The system is designed with the specific needs of the Center for Research and Development (CRAD) department in mind so that it is reusable and beneficial.

Secure Access Control – Defense room scheduling can be managed exclusively by Center for Research and Development (CRAD) officers to avoid unauthorized changes.

By automating the room scheduling, the system has significantly enhanced operational efficiency, transparency, and resource utilization.

Future Work and Enhancements

Even though the system meets its key objectives, several enhancements can serve to make it more usable and functional:

Advanced Reporting and Analytics – Utilizing analytics software to track room usage patterns and shift resources.

Integration with Other Departmental Systems – Integration with other school administrative systems to support real-time data synchronization.

Customization of Scheduling Rules – Enabling Center for Research and Development (CRAD) to define specific scheduling rules and restrictions for specific users.

Mobile-Friendly Interface – Extending availability by means of the system's adjustment for mobile use, enabling users to verify availability at a distance.

Future development will be focused on enhancing automation, flexibility, and user interface to further enhance the efficiency of the system.

Conclusions and Recommendations

The Automated Defense Room Scheduling System has effectively automated the Center for Research and Development (CRAD) department's scheduling process, defense room scheduling having become a hassle-free, orderly, and punctual process. Eliminating the inefficiency of human errors and rationalizing the use of rooms, the system has significantly facilitated the achievement of operational effectiveness and transparency.

Recommendations for Future Development

Routine System Administration and Support – Performing regular system scans to achieve consistent performance and security.

User Support and Training – Organizing training sessions for the Center for Research and Development (CRAD) officer to utilize the system to the fullest.

Feedback-Driven Improvements – Gaining feedback from Center for Research and Development (CRAD) officers in order to shape system features to fit real-use needs.

Scalability for Future Use – Investigating the future scope for growth of the system's functionality to support future scheduling needs.

Improved Security Controls – Ongoing improvement of data security controls to safeguard scheduling data.

The system efficiency validates the need for digital transformation in schools. In the years ahead, remaining proactive in system development and support to users will ensure efficiency and sustainability in the long run.

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Appendices

Appendix A: Process Diagrams

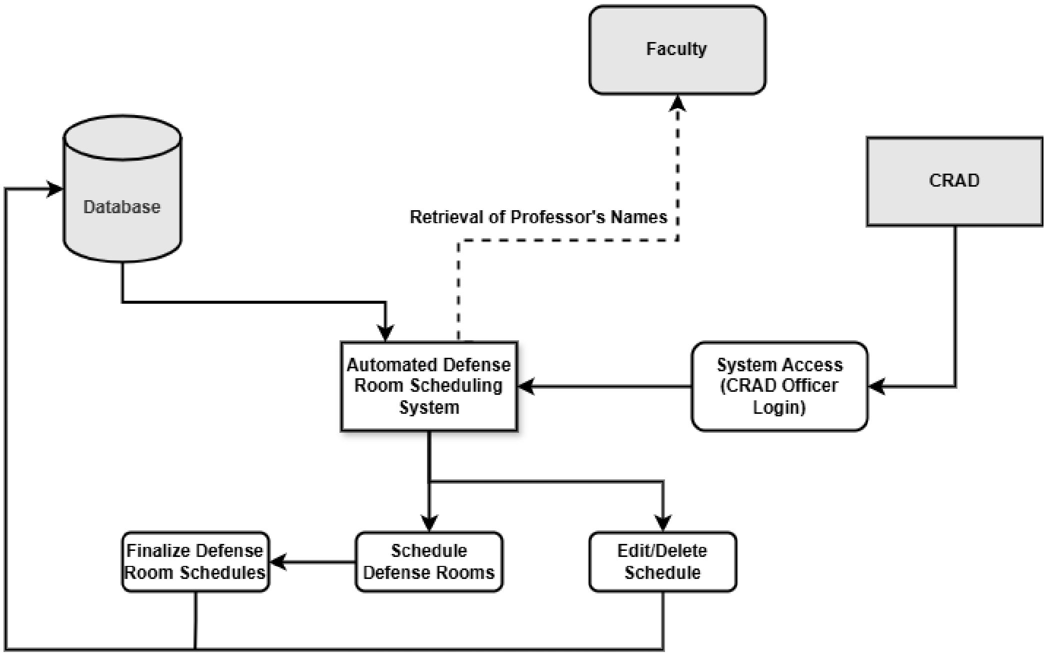

Faculty
Database
Retrieval of Professor's Names
CRAD
Automated Defense Room Scheduling System
System Access (CRAD Officer Login)
Finalize Defense Room Schedules
Schedule Defense Rooms
Edit/Delete Schedule

Figure 18: Process Diagram (BPA Top Level 2)

Appendix C: User Stories and Use Cases

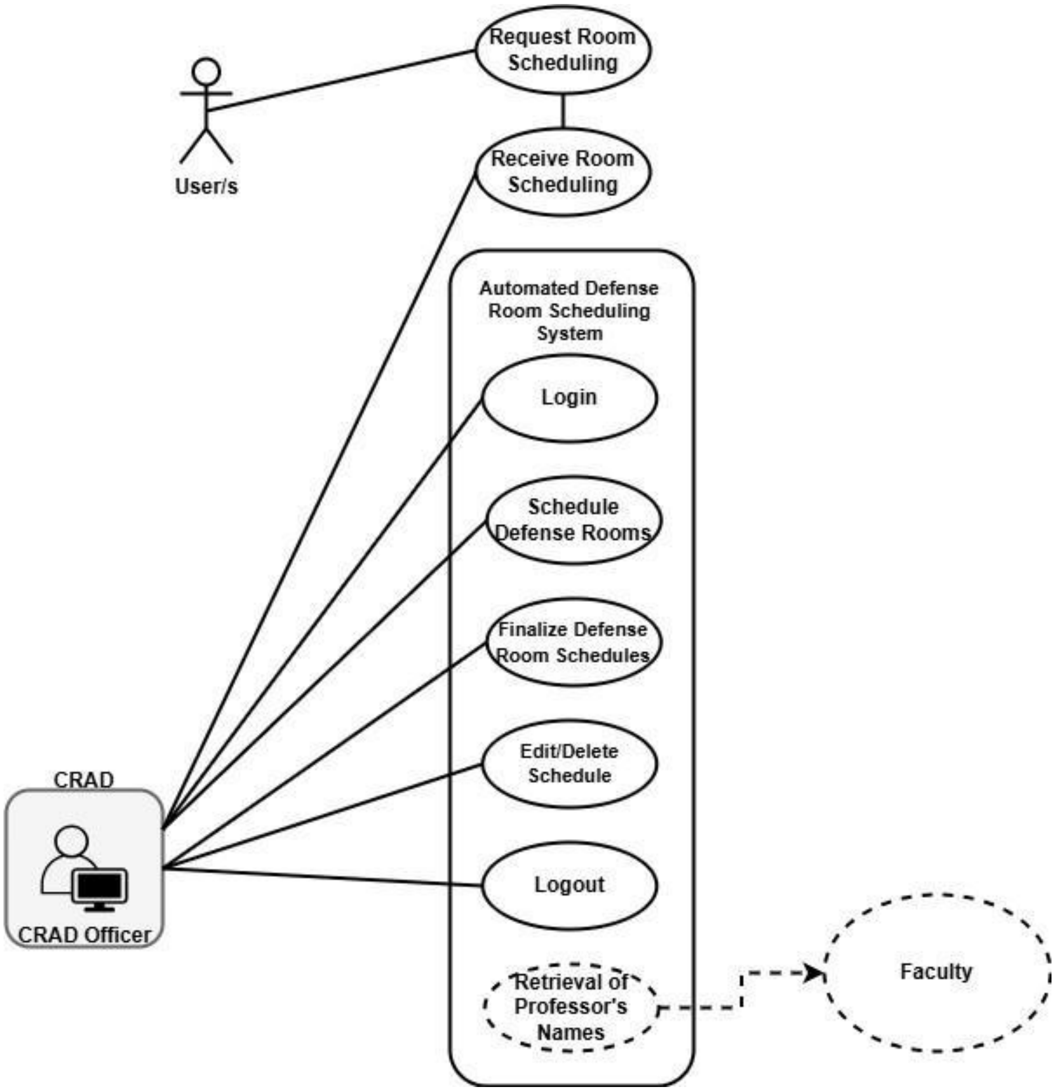


Figure 19: User Stories and Use Cases

Appendix D: Sample Data

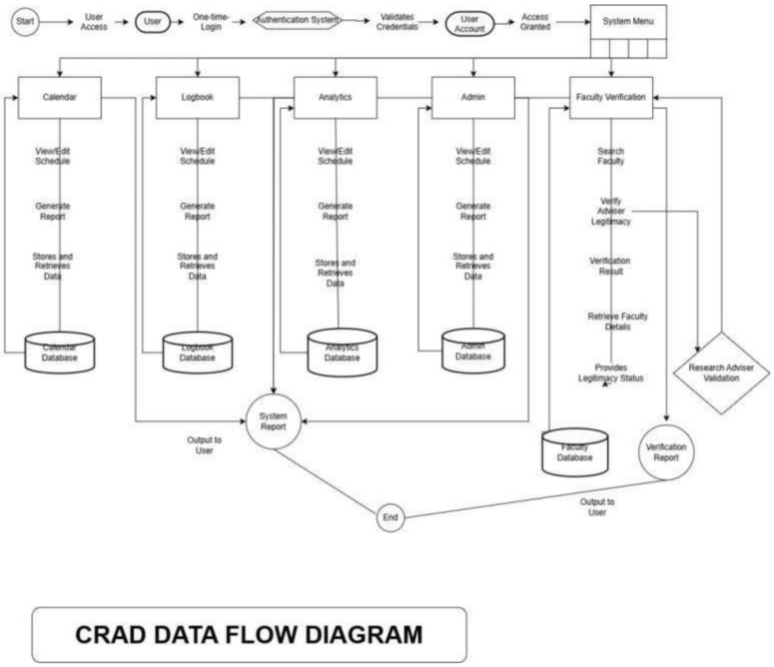


Figure 20: Sample Data (DFD)

Appendix E: Stakeholder Interview Transcripts

Role and Responsibilities of the Center for Research and Development (CRAD) Officer

1. What are your core duties in managing defense room scheduling, and how do you interact with other departments to facilitate the scheduling process?
2. What features do you feel would significantly ease your responsibilities in managing room scheduling?

Current Challenges in Defense Room Scheduling

1. What pain points do you experience with the current manual scheduling system that we need to address?
2. How do you currently handle overlapping schedules or conflicting schedules, and what solutions would you prefer?

System Requirements:

Defense Room Scheduling Process

1. How should the system allow the scheduling of defense rooms to ensure smooth operations and prevent conflicts?
2. What features do you consider essential for viewing room availability in real time, and how should this information be displayed?

User Interaction and Scheduling Flexibility

1. How do you envision handling recurring schedules for classes or departmental events? Should the system allow for automatic or manual adjustments to recurring events?
2. What flexibility would you like the system to offer for cancellations, changes in schedule, or last-minute requests?

Integration with Existing Systems

1. Are there any current systems, such as faculty scheduling tools or student management systems, that need to be integrated into the new scheduling system to improve operational efficiency?

2. How important is it for the system to be integrated with other institutional systems to streamline data sharing and reduce redundancy?

User Experience and Usability

1. How can the system be designed to be intuitive for the Center for Research and Development (CRAD) officer, ensuring a smooth and efficient experience with minimal training required?
2. What features or interfaces would enhance the user experience, both for administrative staff and faculty, in terms of ease of use and quick access to necessary information?

Data Security and Compliance

1. What level of security is required to ensure the integrity of schedule information and avoid unauthorized changes to the schedules?
2. Are there any institutional policies or regulations the system must adhere to, particularly concerning the storage and handling of sensitive data?

Future Considerations and System Scalability

1. How do you foresee the system scaling as defense room scheduling needs grow, such as the addition of more rooms or scheduling for larger events?

2. Are there any potential future requirements or technological advancements in room management that should be considered for the system’s future development?

Appendix F: System Performance Test Results

The System Performance Test Results prove the system's responsiveness and reliability. Load testing proved that the system handled multiple simultaneous scheduling requests effectively without noticeable delays. Stress testing proved that the system was stable under heavy usage, recovering from peak loads in a timely manner without crashes or sudden failures. Response time testing proved that core functions, including scheduling confirmation and room availability checking, performed within acceptable performance limits.

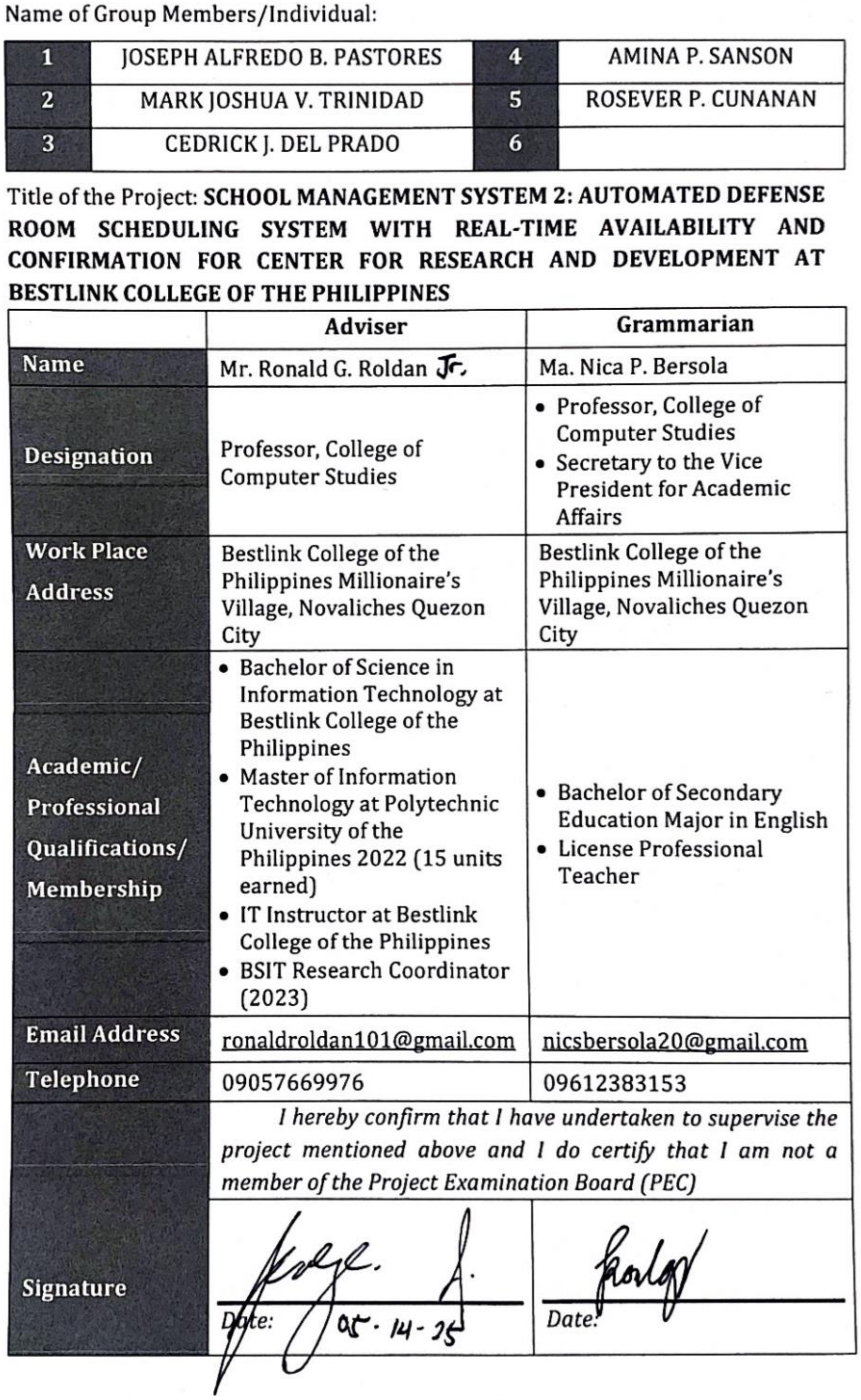
Database performance testing confirmed that scheduled queries were run optimally, and retrieval and storage of schedule records were smooth. Security testing established that the system successfully restricted unauthorized access and protected schedule information. The system operated well under average and peak loads, with the areas of possible ptimization aimed at improving query execution and caching systems to enhance scalability further.

Appendix G: Data Security Measures

The Data Protection Measures protect sensitive scheduling information from unauthorized disclosure. The system provides for the adherence to authentication schemes to prevent unauthorized access and ensure that Center for Research and Development (CRAD) officers authenticate by inputting special access credentials prior to accessing scheduling.

Data encryption is applied to stored scheduling history and user credentials to exclude unauthorized users, and secure communication protocols protect the data transfer. Database backups are executed regularly to assist in safeguarding against data loss, enabling system continuity in case of unexpected failure. In addition, input validation and security prevent SQL injection and other common cyber-attacks, ensuring integrity and confidentiality of scheduling data.

Appendix I: Adviser/Grammarian Acceptance (Functional)



Name of Group Members/Individual:

1	JOSEPH ALFREDO B. PASTORES	4	AMINA P. SANSON
2	MARK JOSHUA V. TRINIDAD	5	ROSEVER P. CUNANAN
3	CEDRICK J. DEL PRADO	6	

Title of the Project: **SCHOOL MANAGEMENT SYSTEM 2: AUTOMATED DEFENSE ROOM SCHEDULING SYSTEM WITH REAL-TIME AVAILABILITY AND CONFIRMATION FOR CENTER FOR RESEARCH AND DEVELOPMENT AT BESTLINK COLLEGE OF THE PHILIPPINES**

	Adviser	Grammarian
Name	Mr. Ronald G. Roldan Jr.	Ma. Nica P. Bersola
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Work Place Address	Bestlink College of the Philippines Millionaire's Village, Novaliches Quezon City	Bestlink College of the Philippines Millionaire's Village, Novaliches Quezon City
Academic/ Professional Qualifications/ Membership	• Bachelor of Science in Information Technology at Bestlink College of the Philippines • Master of Information Technology at Polytechnic University of the Philippines 2022 (15 units earned) • IT Instructor at Bestlink College of the Philippines • BSIT Research Coordinator (2023)	• Bachelor of Secondary Education Major in English • License Professional Teacher
Email Address	ronaldroldan101@gmail.com	nicsbersola20@gmail.com
Telephone	09057669976	09612383153
Signature	*I hereby confirm that I have undertaken to supervise the project mentioned above and I do certify that I am not a member of the Project Examination Board (PEC)*	
	Date: 05-14-25	*Date:*

Appendix J: Panel Evaluation and Signature (plus photo ops during defense)

Figure 21: Pre-Oral Defense

Figure 22: Final Defense

Appendix K: Capacity Planning (Estimates on Storage Consumption – 5 years)

Projected Storage Consumption

Year 1: 5 GB

Year 2: 10 GB

Year 3: 15 GB

Year 4: 20 GB

Year 5: 30 GB

Factors Considered

Booking Records Growth: A projected 20% increase in bookings per year due to higher system adoption.

User Logs & Tracking: Increased logging for security and auditing purposes.

System Enhancements: Potential feature additions, such as advanced reporting and archival mechanisms.

Backup and Data Retention: Periodic data backups stored for redundancy and historical reference.

Recommendations for Capacity Management

1. Regular Data Archiving: Implement an archiving strategy to move older records to secondary storage while maintaining easy retrieval.
2. Optimized Database Storage: Use indexing and efficient queries to reduce database bloat and improve performance.
3. Scalable Cloud Storage: Increase storage capacity dynamically using Indevfinite cloud to prevent storage bottlenecks.
4. Scheduled Data Purging: Remove obsolete records based on Center for Research and Development (CRAD)'s data retention policies.
5. Compression Techniques: Implement data compression for logs and historical records to reduce storage consumption.

Appendix L: Pilot Companies' Background with proofs of interviews

The Center for Research and Development (CRAD) at Bestlink College of the Philippines is responsible for monitoring academic research programs, coordinating capstone and thesis projects, and handling defense room reservations for student presentations. The department makes sure research practices are up to institutional standards and students and faculty have the resources needed to conduct and present research work.

The pilot implementation was conducted in Bestlink College of the Philippines, specifically at the Center for Research and Development (CRAD) department. The initial interview, the Center for Research and Development (CRAD) department gave descriptions of the manual scheduling challenges and expectations regarding the system outcome.

Follow-up interviews were conducted within the Center for Research and Development (CRAD) department, where they shared the experiences with the system. Such interviews were documented and included within the technical report as supporting evidence of the application of the system in real-world scenarios. The feedback gathered was utilized to modify the system’s compatibility with the department's operational requirements.

Figure 23: Center for Research and Development (CRAD) Department Interview

Appendix M: Cloud Copy of the Codes (1 year validity)

https://github.com/markjoshua922002/crad_calendar_booking

Appendix N: IMRAD Format Summary

Introduction

The Automated Defense Room Scheduling System was created to solve the problems of the Center for Research and Development (CRAD) of Bestlink College of the Philippines in defense room scheduling management. The current manual scheduling process tends to be inefficient, resulted in scheduling conflicts, and made it hard to monitor reservations. To enhance the process, the system was created to give real-time defense room availability, avoid double scheduling, and simplify scheduling management for the Center for Research and Development (CRAD) department.

Methodology

The system was built with a systematic approach using the Agile Scrum methodology, ensuring iterative development and continuous feedback throughout the process. PHP was utilized for backend coding, MySQL for database management, and HTML and CSS for the frontend interface. The development was done in a modular approach, with easy integration of core features like room scheduling, schedule validation, and data management. Testing involved unitesting, integration testing, and real-world testing by Center for Research and Development (CRAD) officers to determine system reliability and usability. The Solution was launched on Indevfinite cloud infrastructure for ease of access and scalability.

Results

The application of the system enhanced the efficiency of defense room scheduling. The system achieved real time room availability as well as reduction in scheduling conflict and better record keeping. The Center for Research and Development (CRAD) officers were able to increase the accuracy in scheduling and streamline the process of defense schedules. Performance testing showed that the system can handle these multiple schedules without delays, ensuring smooth operation during peak scheduling periods.

Discussion

The results indicate that the automation of the defense room scheduling process effectively addresses the inefficiencies of manual scheduling. The system enhances organization, optimizes utilization of resources, and minimizes human error. Center for Research and Development (CRAD) officers' input was used to further enhance the system to address operational needs. Future improvements may include additional features such as report generation and enhanced scheduling analysis to enable data-driven decision-making.

Appendix O: Comparison of the EIS to existing EIS's (5 pages)

Enterprise Information Systems (EIS) are intended to make business processes faster and more automated, enhancing efficiency, data management, and decision-making. The Automated Defense Room Scheduling System implemented for the Center for Research and Development (CRAD) of Bestlink College of the Philippines is an EIS meant for defense room scheduling management. This section contrasts the system with other EIS solutions based on functionality, efficiency, scalability, usability, and security.

Functionality

General purpose EIS solutions usually encompass a wide spectrum of business activities like finance, human resources, and supply chain management. By comparison, the Automated Defense Room Scheduling System is a special purpose EIS concentrating solely on room scheduling and administration. Generic EIS systems with room scheduling as a function of larger resource management systems usually lack customized features like real-time update of room availability and conflict detection. The system developed explicitly serves the purpose of Center for Research and Development (CRAD) by providing precise scheduling, double- schedule avoidance, and a clean interface for managing room reservations.

The system includes unique academic needs like department scheduling, which is not standard within more general EIS systems. By matching up directly with the operational needs of Center for Research and Development (CRAD), the system is a more appropriate solution than general EIS scheduling modules.

Efficiency

The Automated Defense Room Scheduling System improves efficiency through the replacement of the manual process with an automated system. Most EIS platforms with scheduling applications tend to involve extensive customization to meet the precise requirements of universities. By dedicating itself to defense room scheduling, the system avoids complexity and minimizes the time for Center for Research and Development (CRAD) officers to handle defense schedules. The system maximizes the allocation of rooms to avoid mistakes and administrative work.

Automation reduces human errors, leading to fewer scheduling conflicts and better resource utilization. The system's real-time updates provide immediate feedback on room availability, allowing Center for Research and Development (CRAD) officers to make faster and more informed scheduling decisions. In contrast, many EIS solutions require additional data processing steps before availability can be confirmed.

Scalability

Unlike existing EIS systems, the Automated Defense Room

Scheduling System is optimized for a specific application, thereby is lightweight and easy to scale within the institution. Traditional EIS systems are built for large business operations and take a heavy toll on resources to implement and run. The system built using the Indevfinite cloud platform ensures accessibility and can be scaled in the future, for instance, by adding other scheduling modules or increasing database capacity based on the institution's growth.

The system's modular structure enables potential future scalability beyond scheduling defense rooms. Future versions can include interfaces with other scheduling systems within the academic setting, such as faculty meeting scheduling or lab room reservations, to ensure long-term flexibility.

Usability

Enterprise Information Systems have advanced interfaces due to the extensive range of functionalities. Generic EIS platforms, which most institutions utilize, require heavy user training to properly use the system. The Automated Defense Room Scheduling System, on the other hand, is user-friendly-oriented, with the objective that Center for Research and Development (CRAD) officers can easily schedule and manage defense rooms with minimal training. The user interface, created using HTML and CSS, is user-centric, with minimal cognitive load and ease of scheduling compared to traditional EIS solutions.

With a clean, structured layout, the system eliminates unnecessary functions that would otherwise complicate the user experience. Unlike conventional EIS software, which might overwhelm users with excessive options, the system streamlines scheduling tasks, focusing only on essential functionalities. This targeted usability approach enhances productivity and user satisfaction.

Security

Security is an important element in any EIS since sensitive information is held in these systems. Most existing EIS solutions have robust security features, ranging from multi-factor authentication to encryption schemes. Automated Defense Room Scheduling System, however, applies necessary security functions like user login and database consistency checks to help protect scheduling data. Although not as elaborate on security layers as a full EIS, the system is nonetheless tailored to respond to the distinct security requirements of Center for Research and Development (CRAD) through limiting access to authorized users and blocking unauthorized modifications to scheduling information.

Conclusion

Traditional Enterprise Information Systems may offer a broad range of functionalities; they tend to need customization and more resources to fit individual institutional requirements. The Automated Defense Room Scheduling System, being specific to defense room scheduling, provides a customized solution that increases efficiency, usability, and security without the complexity of full-scale EIS platforms. Its special nature of design ensures that Center for Research and Development (CRAD) officers can deal with scheduling activities with higher precision and ease, thus being a more convenient alternative for academic scheduling purposes.

The system’s ability to automate scheduling processes while remaining lightweight and user-friendly gives it a distinct advantage over traditional EIS solutions. By addressing the unique requirements of Center for Research and Development (CRAD), the system improves operational efficiency and supports future scalability. As academic institutions continue to evolve, systems like the Automated Defense Room Scheduling System will play a crucial role in enhancing institutional efficiency and optimizing resource management.

Appendix P: Declaration

DECLARATION

The researchers of this group certify that this project study does not incorporate, without acknowledgement, any material previously submitted for a degree of Diploma in any University and to the best of our knowledge and belief. It does not contain any material previously published or written by another person or ourselves except where due reference is made in the text, we also hereby give consent for our project study. If accepted, to be made available for photocopying and for interlibrary and for the title and summary to be available to outside organizations.

Signature of Group/ Individual: Date: May 2025

ROSEVER P. CUNANAN **CEDRICK J. DEL PRADO**

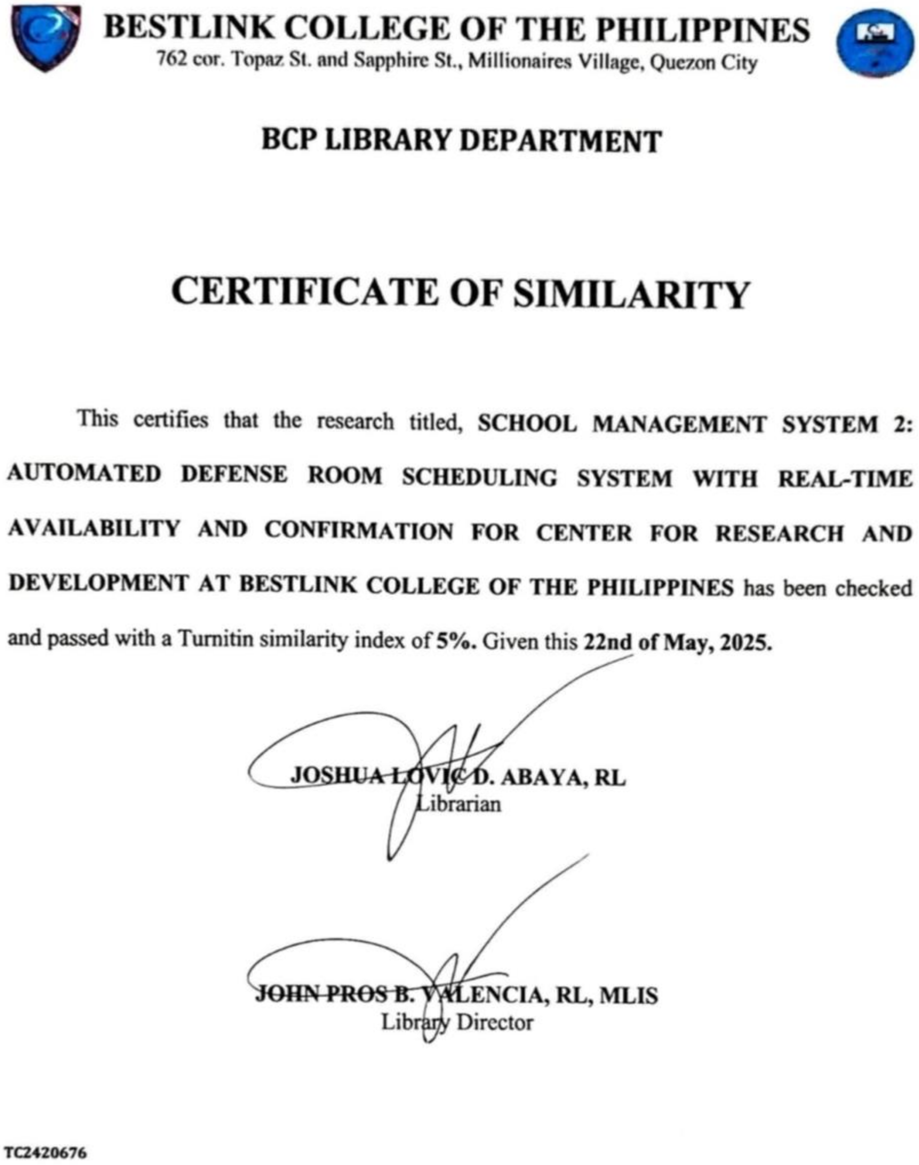
JOSEPH ALFREDO B. PASTORES

AMINA P. SANSON **MARK JOSHUA V. TRINIDAD**

Counter Signed By:

Mr. Ronald G. Roldan Jr.
Project Adviser

Appendix Q: Certificate of Similarity



BESTLINK COLLEGE OF THE PHILIPPINES
762 cor. Topaz St. and Sapphire St., Millionaires Village, Quezon City

BCP LIBRARY DEPARTMENT

CERTIFICATE OF SIMILARITY

This certifies that the research titled, **SCHOOL MANAGEMENT SYSTEM 2: AUTOMATED DEFENSE ROOM SCHEDULING SYSTEM WITH REAL-TIME AVAILABILITY AND CONFIRMATION FOR CENTER FOR RESEARCH AND DEVELOPMENT AT BESTLINK COLLEGE OF THE PHILIPPINES** has been checked and passed with a Turnitin similarity index of **5%.** Given this **22nd of May, 2025.**

JOSHUA LOVIC D. ABAYA, RL
Librarian

JOHN PROS B. VALENCIA, RL, MLIS
Library Director

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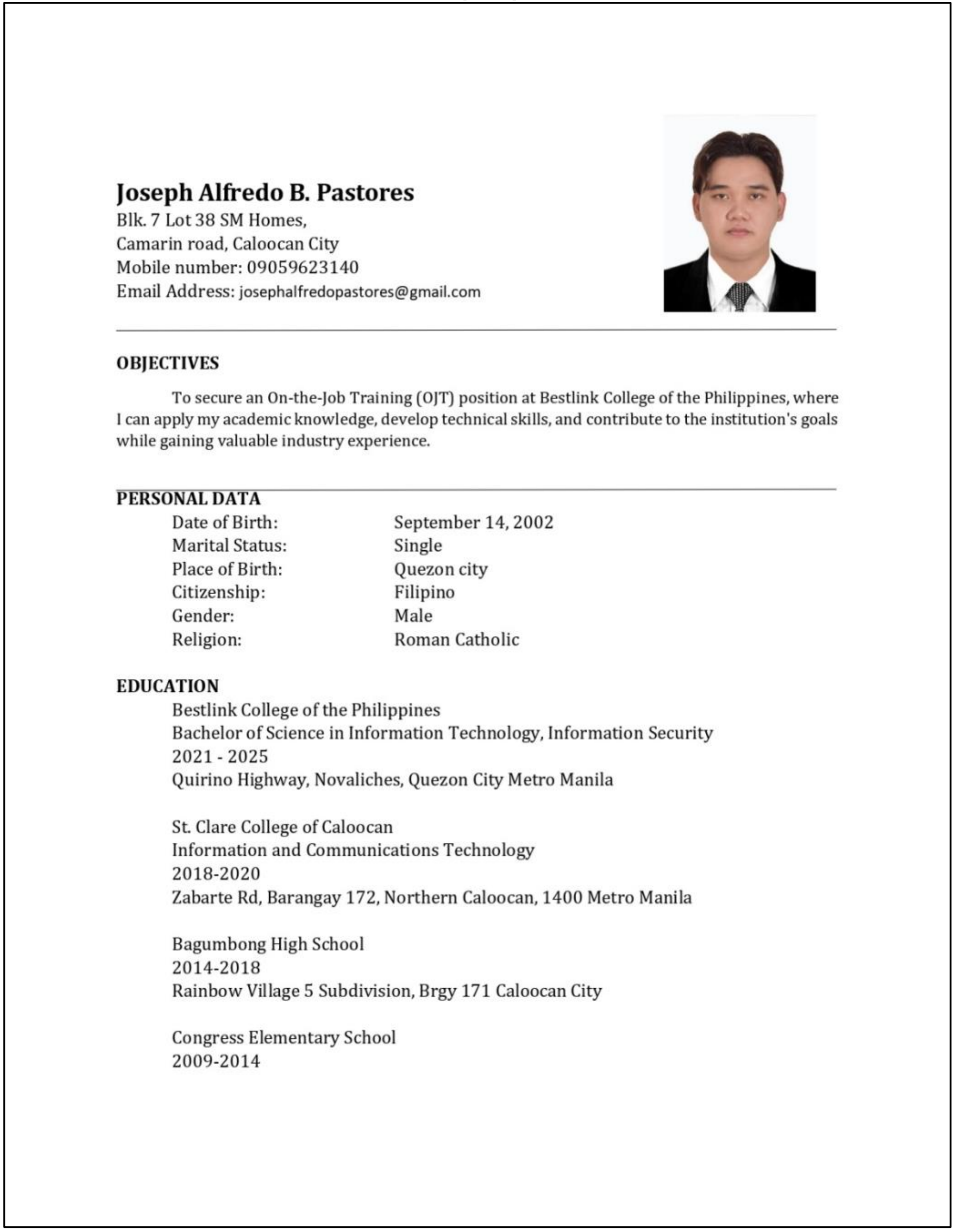
Appendix R: Curriculum Vitae (CV)



Joseph Alfredo B. Pastores
Blk. 7 Lot 38 SM Homes,
Camarin road, Caloocan City
Mobile number: 09059623140
Email Address: josephalfredopastores@gmail.com

OBJECTIVES

To secure an On-the-Job Training (OJT) position at Bestlink College of the Philippines, where I can apply my academic knowledge, develop technical skills, and contribute to the institution's goals while gaining valuable industry experience.

PERSONAL DATA

Date of Birth:	September 14, 2002
Marital Status:	Single
Place of Birth:	Quezon city
Citizenship:	Filipino
Gender:	Male
Religion:	Roman Catholic

EDUCATION

Bestlink College of the Philippines
Bachelor of Science in Information Technology, Information Security
2021 - 2025
Quirino Highway, Novaliches, Quezon City Metro Manila

St. Clare College of Caloocan
Information and Communications Technology
2018-2020
Zabarte Rd, Barangay 172, Northern Caloocan, 1400 Metro Manila

Bagumbong High School
2014-2018
Rainbow Village 5 Subdivision, Brgy 171 Caloocan City

Congress Elementary School
2009-2014

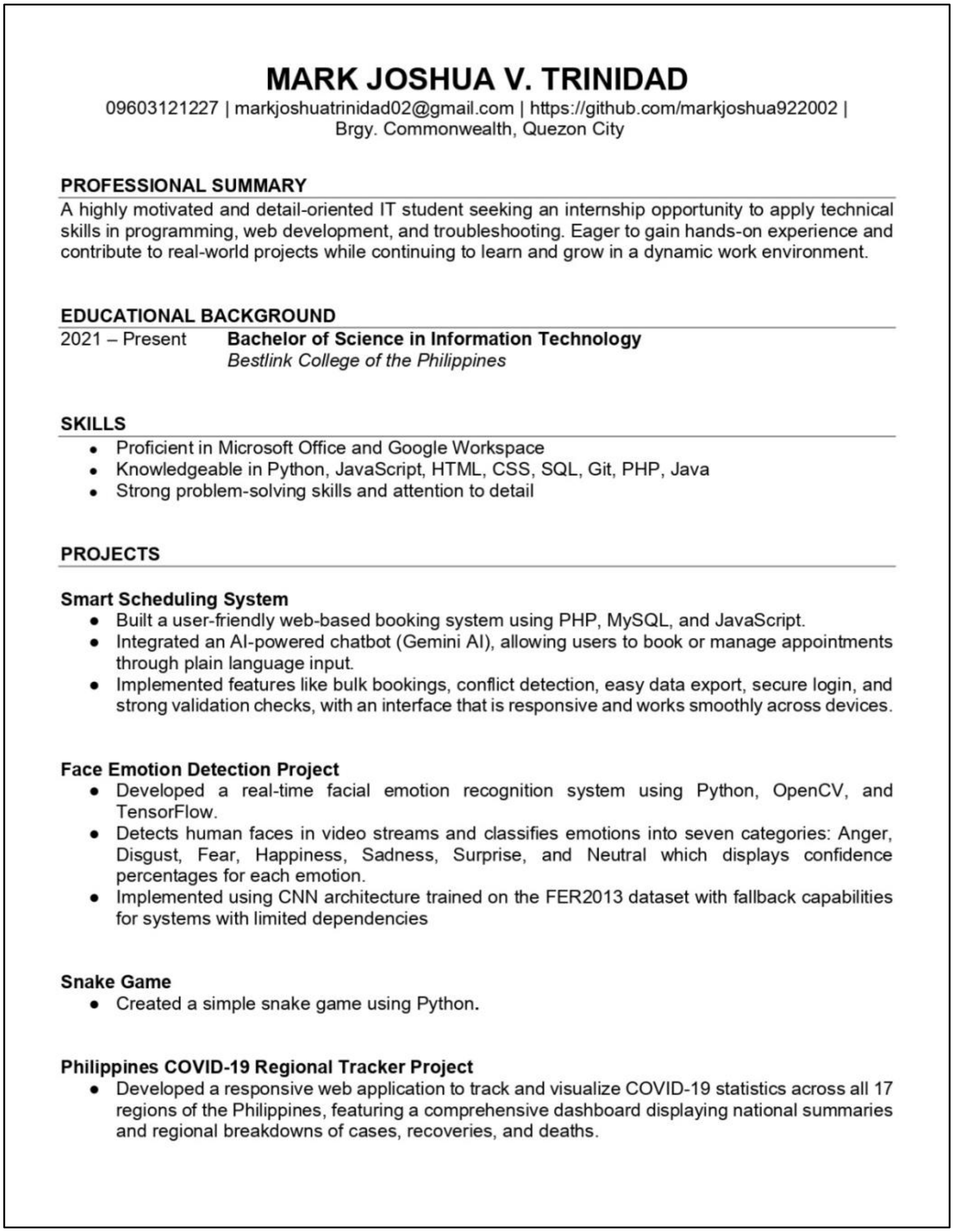
SKILLS

- Detail Oriented.
- Organizational skills.
- Planning skills.
- Technical skills
- Communication skills.
- Responsible to all the task assigned.

I hereby certify that all information above is true and correct to the best of my knowledge and belief.

Joseph Alfredo B, Pastores

Applicant



MARK JOSHUA V. TRINIDAD

09603121227 | markjoshuatrinidad02@gmail.com | https://github.com/markjoshua922002 |
Brgy. Commonwealth, Quezon City

PROFESSIONAL SUMMARY

A highly motivated and detail-oriented IT student seeking an internship opportunity to apply technical skills in programming, web development, and troubleshooting. Eager to gain hands-on experience and contribute to real-world projects while continuing to learn and grow in a dynamic work environment.

EDUCATIONAL BACKGROUND

2021 – Present	**Bachelor of Science in Information Technology** *Bestlink College of the Philippines*

SKILLS

- Proficient in Microsoft Office and Google Workspace
- Knowledgeable in Python, JavaScript, HTML, CSS, SQL, Git, PHP, Java
- Strong problem-solving skills and attention to detail

PROJECTS

Smart Scheduling System

- Built a user-friendly web-based booking system using PHP, MySQL, and JavaScript.
- Integrated an AI-powered chatbot (Gemini AI), allowing users to book or manage appointments through plain language input.
- Implemented features like bulk bookings, conflict detection, easy data export, secure login, and strong validation checks, with an interface that is responsive and works smoothly across devices.

Face Emotion Detection Project

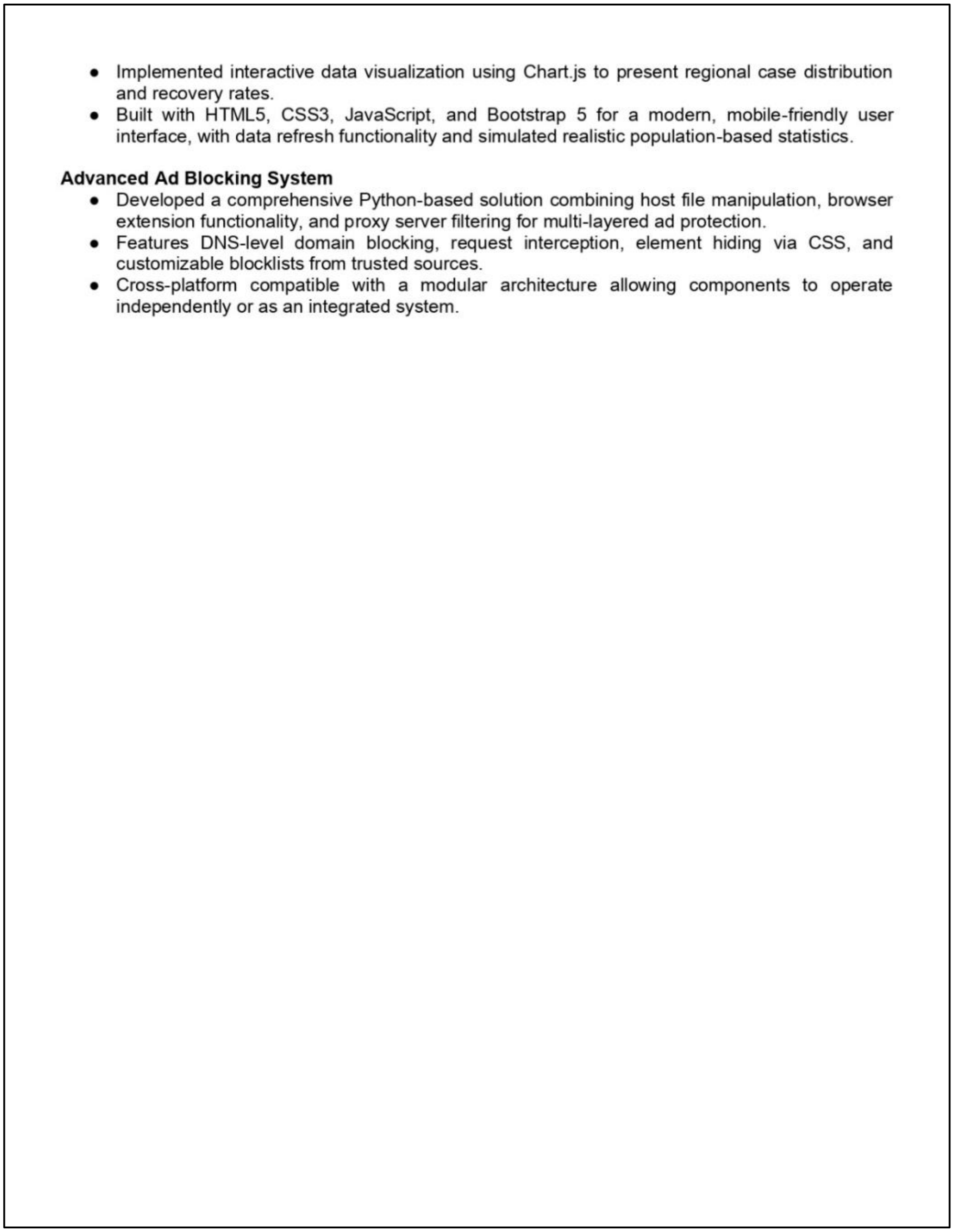
- Developed a real-time facial emotion recognition system using Python, OpenCV, and TensorFlow.
- Detects human faces in video streams and classifies emotions into seven categories: Anger, Disgust, Fear, Happiness, Sadness, Surprise, and Neutral which displays confidence percentages for each emotion.
- Implemented using CNN architecture trained on the FER2013 dataset with fallback capabilities for systems with limited dependencies

Snake Game

- Created a simple snake game using Python.

Philippines COVID-19 Regional Tracker Project

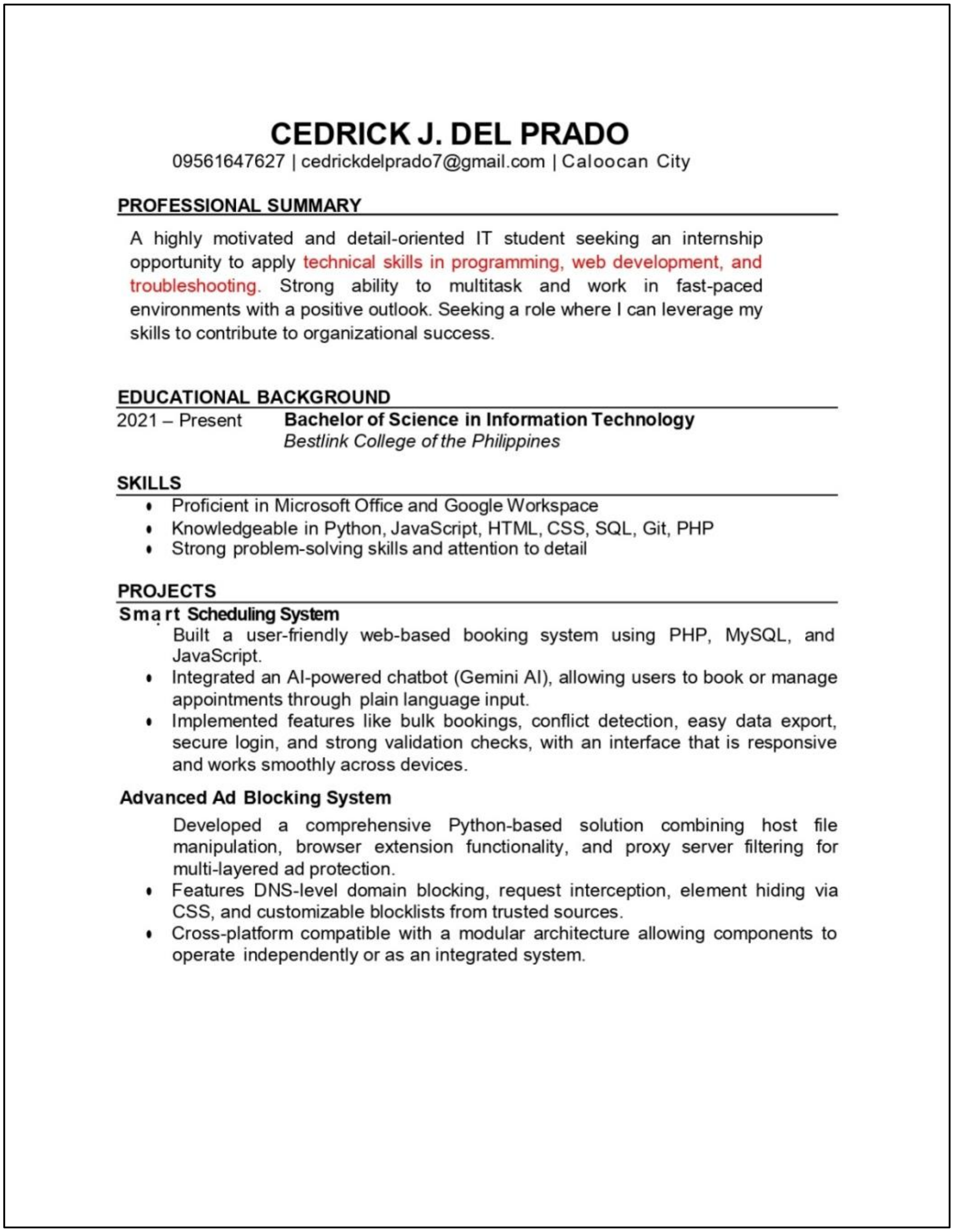
- Developed a responsive web application to track and visualize COVID-19 statistics across all 17 regions of the Philippines, featuring a comprehensive dashboard displaying national summaries and regional breakdowns of cases, recoveries, and deaths.



- Implemented interactive data visualization using Chart.js to present regional case distribution and recovery rates.
- Built with HTML5, CSS3, JavaScript, and Bootstrap 5 for a modern, mobile-friendly user interface, with data refresh functionality and simulated realistic population-based statistics.

Advanced Ad Blocking System

- Developed a comprehensive Python-based solution combining host file manipulation, browser extension functionality, and proxy server filtering for multi-layered ad protection.
- Features DNS-level domain blocking, request interception, element hiding via CSS, and customizable blocklists from trusted sources.
- Cross-platform compatible with a modular architecture allowing components to operate independently or as an integrated system.



CEDRICK J. DEL PRADO

09561647627 | cedrickdelprado7@gmail.com | Caloocan City

PROFESSIONAL SUMMARY

A highly motivated and detail-oriented IT student seeking an internship opportunity to apply technical skills in programming, web development, and troubleshooting. Strong ability to multitask and work in fast-paced environments with a positive outlook. Seeking a role where I can leverage my skills to contribute to organizational success.

EDUCATIONAL BACKGROUND

2021 – Present	**Bachelor of Science in Information Technology** *Bestlink College of the Philippines*

SKILLS

- Proficient in Microsoft Office and Google Workspace
- Knowledgeable in Python, JavaScript, HTML, CSS, SQL, Git, PHP
- Strong problem-solving skills and attention to detail

PROJECTS

Smart Scheduling System

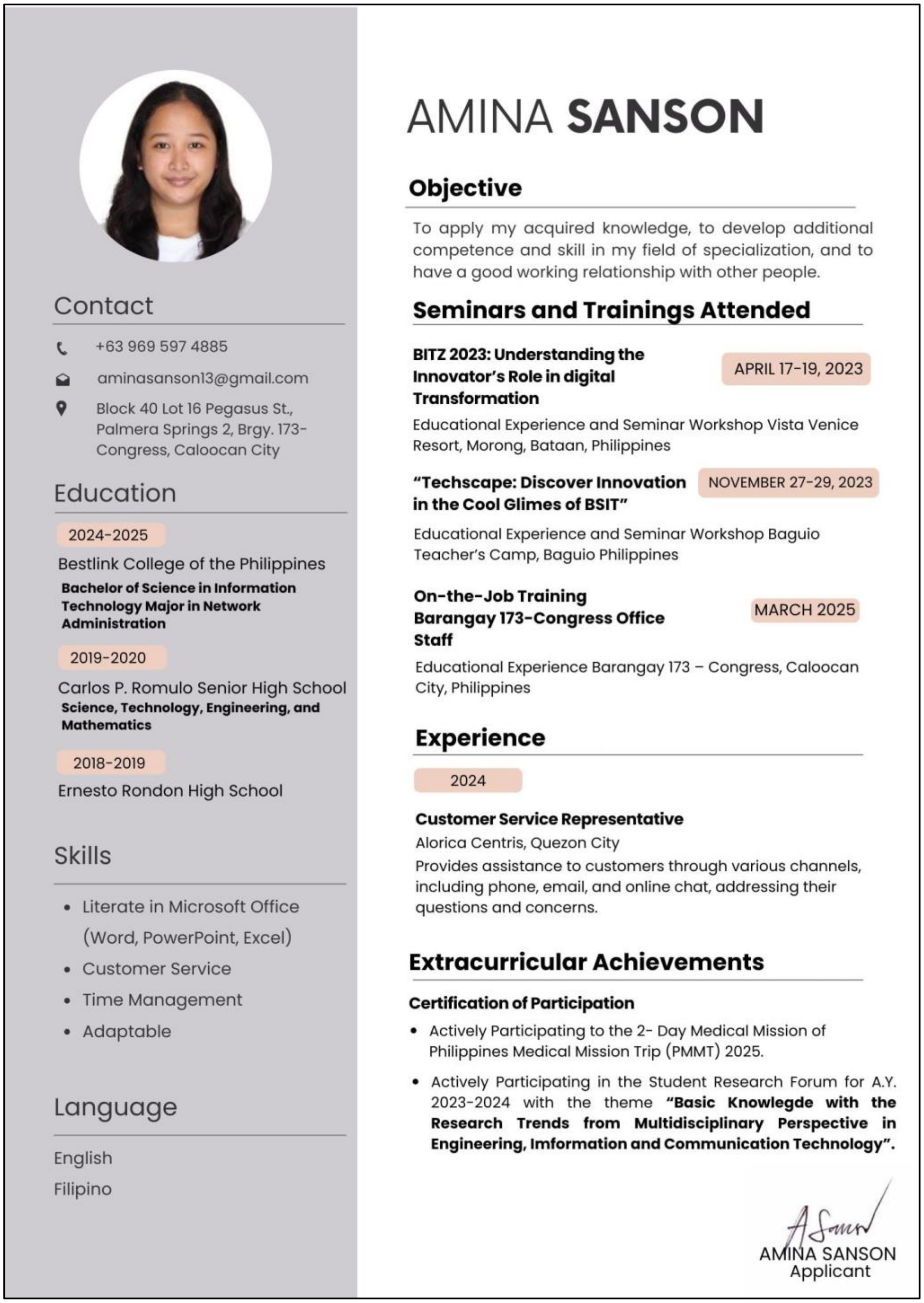
Built a user-friendly web-based booking system using PHP, MySQL, and JavaScript.

- Integrated an AI-powered chatbot (Gemini AI), allowing users to book or manage appointments through plain language input.
- Implemented features like bulk bookings, conflict detection, easy data export, secure login, and strong validation checks, with an interface that is responsive and works smoothly across devices.

Advanced Ad Blocking System

Developed a comprehensive Python-based solution combining host file manipulation, browser extension functionality, and proxy server filtering for multi-layered ad protection.

- Features DNS-level domain blocking, request interception, element hiding via CSS, and customizable blocklists from trusted sources.
- Cross-platform compatible with a modular architecture allowing components to operate independently or as an integrated system.



AMINA **SANSON**

Contact

☎ +63 969 597 4885

✉ aminasanson13@gmail.com

📍 Block 40 Lot 16 Pegasus St.,
Palmera Springs 2, Brgy. 173-
Congress, Caloocan City

Education

2024-2025

Bestlink College of the Philippines

Bachelor of Science in Information Technology Major in Network Administration

2019-2020

Carlos P. Romulo Senior High School

Science, Technology, Engineering, and Mathematics

2018-2019

Ernesto Rondon High School

Skills

- Literate in Microsoft Office (Word, PowerPoint, Excel)
- Customer Service
- Time Management
- Adaptable

Language

English

Filipino

Objective

To apply my acquired knowledge, to develop additional competence and skill in my field of specialization, and to have a good working relationship with other people.

Seminars and Trainings Attended

BITZ 2023: Understanding the Innovator's Role in digital Transformation — APRIL 17-19, 2023

Educational Experience and Seminar Workshop Vista Venice Resort, Morong, Bataan, Philippines

"Techscape: Discover Innovation in the Cool Glimes of BSIT" — NOVEMBER 27-29, 2023

Educational Experience and Seminar Workshop Baguio Teacher's Camp, Baguio Philippines

On-the-Job Training Barangay 173-Congress Office Staff — MARCH 2025

Educational Experience Barangay 173 – Congress, Caloocan City, Philippines

Experience

2024

Customer Service Representative

Alorica Centris, Quezon City

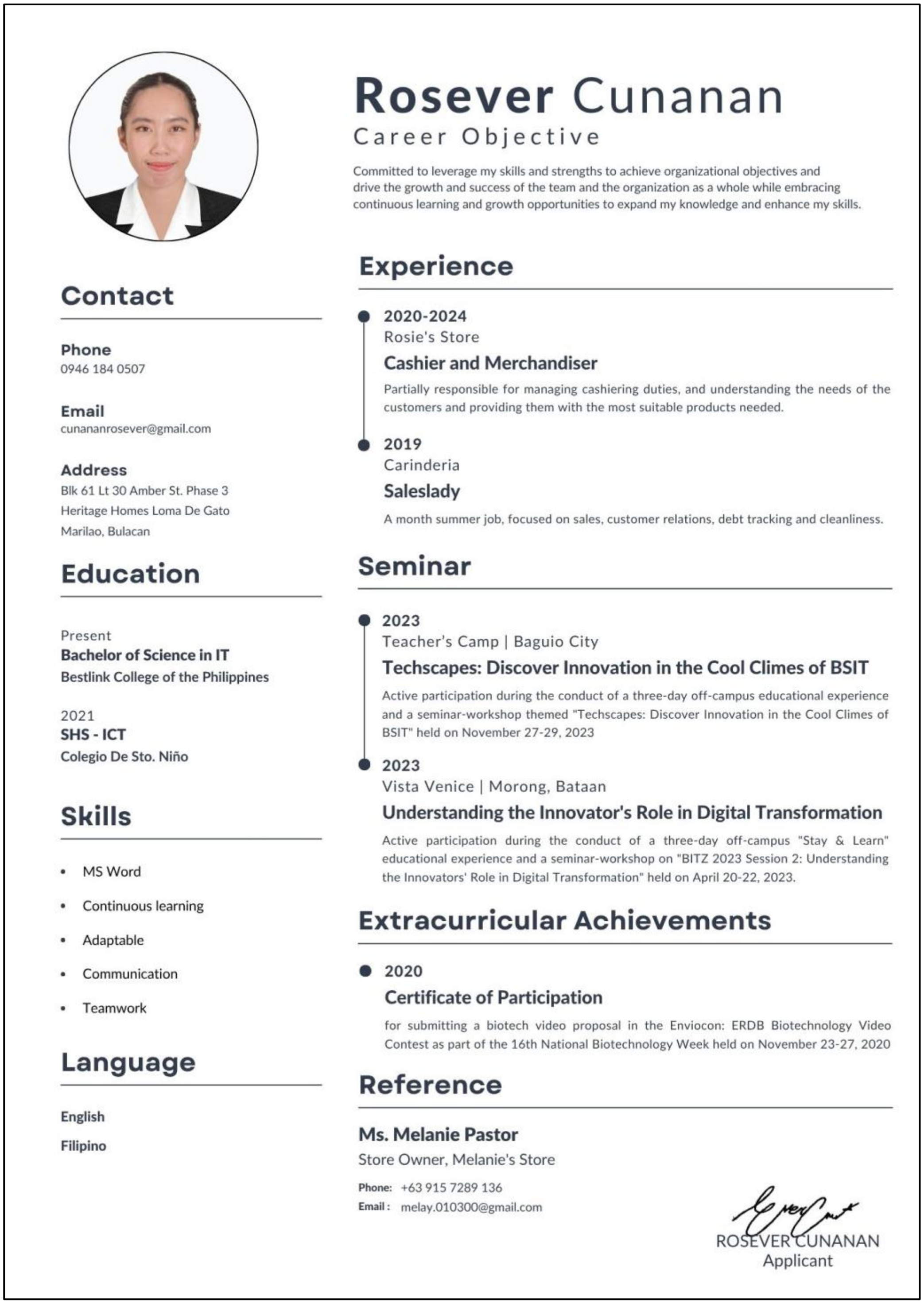
Provides assistance to customers through various channels, including phone, email, and online chat, addressing their questions and concerns.

Extracurricular Achievements

Certification of Participation

- Actively Participating to the 2- Day Medical Mission of Philippines Medical Mission Trip (PMMT) 2025.
- Actively Participating in the Student Research Forum for A.Y. 2023-2024 with the theme **"Basic Knowlegde with the Research Trends from Multidisciplinary Perspective in Engineering, Imformation and Communication Technology".**

A Sanson
AMINA SANSON
Applicant



Rosever Cunanan

Career Objective

Committed to leverage my skills and strengths to achieve organizational objectives and drive the growth and success of the team and the organization as a whole while embracing continuous learning and growth opportunities to expand my knowledge and enhance my skills.

Contact

Phone
0946 184 0507

Email
cunananrosever@gmail.com

Address
Blk 61 Lt 30 Amber St. Phase 3
Heritage Homes Loma De Gato
Marilao, Bulacan

Education

Present
Bachelor of Science in IT
Bestlink College of the Philippines

2021
SHS - ICT
Colegio De Sto. Niño

Skills

- MS Word
- Continuous learning
- Adaptable
- Communication
- Teamwork

Language

English
Filipino

Experience

2020-2024
Rosie's Store
Cashier and Merchandiser

Partially responsible for managing cashiering duties, and understanding the needs of the customers and providing them with the most suitable products needed.

2019
Carinderia
Saleslady

A month summer job, focused on sales, customer relations, debt tracking and cleanliness.

Seminar

2023
Teacher's Camp | Baguio City
Techscapes: Discover Innovation in the Cool Climes of BSIT

Active participation during the conduct of a three-day off-campus educational experience and a seminar-workshop themed "Techscapes: Discover Innovation in the Cool Climes of BSIT" held on November 27-29, 2023

2023
Vista Venice | Morong, Bataan
Understanding the Innovator's Role in Digital Transformation

Active participation during the conduct of a three-day off-campus "Stay & Learn" educational experience and a seminar-workshop on "BITZ 2023 Session 2: Understanding the Innovators' Role in Digital Transformation" held on April 20-22, 2023.

Extracurricular Achievements

2020
Certificate of Participation

for submitting a biotech video proposal in the Enviocon: ERDB Biotechnology Video Contest as part of the 16th National Biotechnology Week held on November 23-27, 2020

Reference

Ms. Melanie Pastor
Store Owner, Melanie's Store

Phone: +63 915 7289 136
Email : melay.010300@gmail.com

ROSEVER CUNANAN
Applicant

Supplementary Material

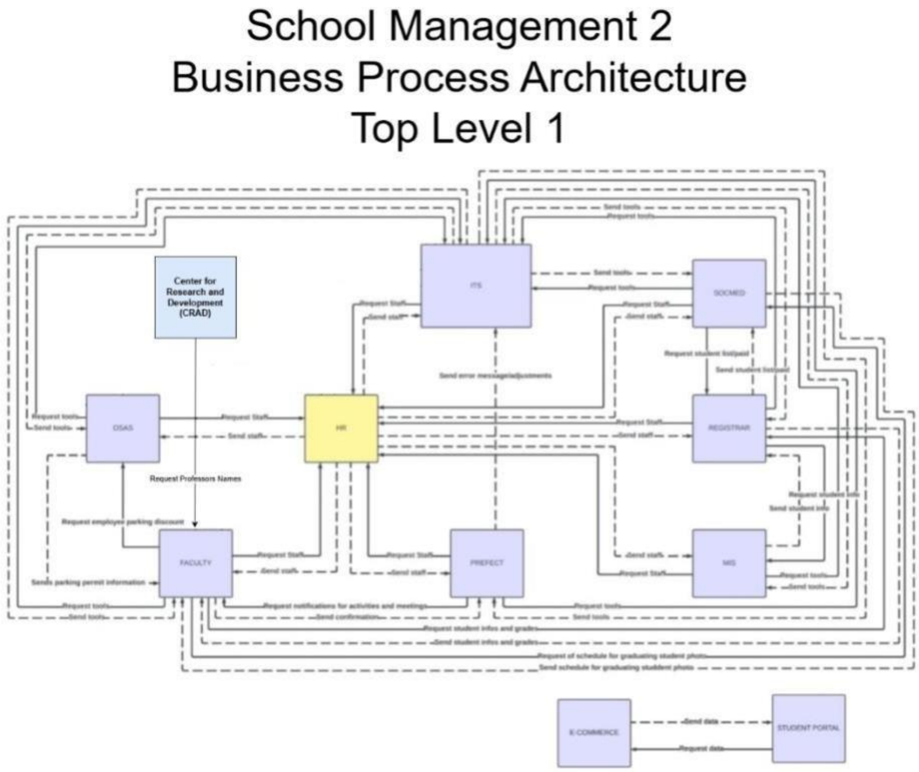

School Management 2
Business Process Architecture
Top Level 1
Center for Research and Development (CRAD)
ITS
SOCMED
OSAS
HR
REGISTRAR
FACULTY
PREFECT
MIS
E-COMMERCE
STUDENT PORTAL
Send tools
Request tools
Request Staff
Send staff
Request Professors Names
Request employee parking discount
Sends parking permit information
Send error message/adjustments
Request student list/paid
Send student list/paid
Request student info
Send student info
Request notifications for activities and meetings
Send confirmation
Request student infos and grades
Send student infos and grades
Request of schedule for graduating student photo
Send schedule for graduating studdent photo
Send data
Request data

Figure 24: Supplementary Material (BPA Top Level 1)

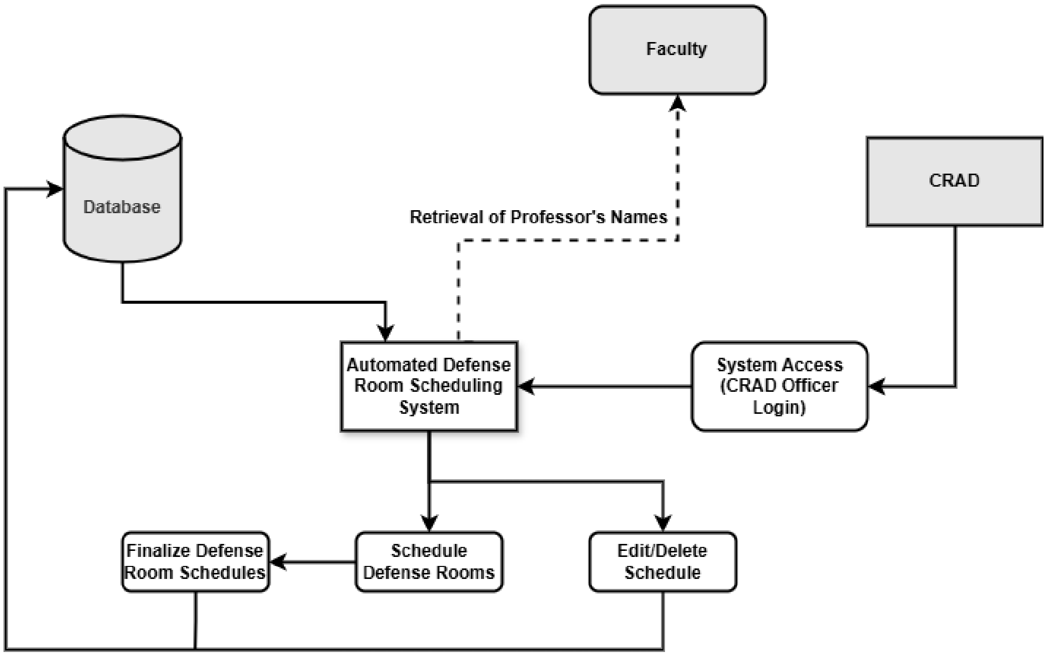

Faculty
Database
Retrieval of Professor's Names
CRAD
Automated Defense Room Scheduling System
System Access (CRAD Officer Login)
Finalize Defense Room Schedules
Schedule Defense Rooms
Edit/Delete Schedule

Figure 25: Supplementary Material (BPA Top Level 2)

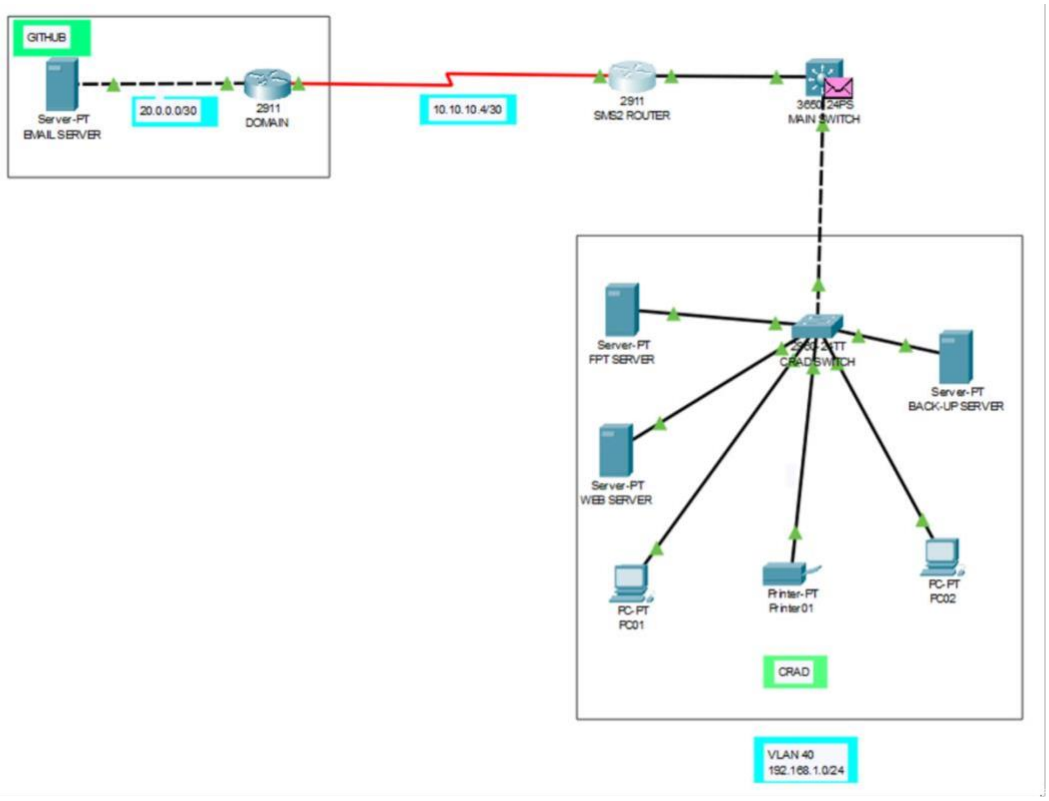


Figure 26: Supplementary Material (Network Architecture)

Scrum Artifacts (e.g., Burndown Charts, Sprint Backlogs)

User Stories No.	**User Stories**	**Task**	**User Story Points (hours)**	**Responsible Team Member**
Sprint 1: System Access				
1.	To view real-time defense room availability so I can easily schedule a defense room.	Design UI	7 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
2.	To track and monitor The Center for Research and Development (CRAD) department user access to the system to ensure data security and compliance.	Design UI	8 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
3.	As a system admin, I want to update the scheduling system without downtime to	Design UI	4 hours	
		Design Data Model		

	ensure continuous service availability.	Develop a workflow		**TRINIDAD** **MARK** **JOSHUA V.**
		Perform QA and Test		
4.	To view scheduling limits set by the admin to understand room availability restrictions.	Design UI	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
Sprint 2: Defense Room Scheduling Management (Submit Requests & Check Availability)				
5.	To receive instant confirmation of the defense room scheduling system to ensure my schedule was secured.	Design UI	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
6.	To search for available defense rooms by name and student number to	Design UI	8 hours	
		Design Data Model		

	quickly find a suitable room.	Develop a workflow Perform QA and Test		**TRINIDAD** **MARK** **JOSHUA V.**
7.	To prevent double-scheduling, scheduling rooms to optimize room usage.	Design UI Design Data Model Develop a workflow Perform QA and Test	4 hours	**TRINIDAD** **MARK** **JOSHUA V.**
Sprint 3: Defense Room Scheduling Management (Finalize Reservations)				
8.	To manage defense room scheduling to optimize room usage and prevent overscheduling.	Design UI Design Data Model Develop a workflow Perform QA and Test	5 hours	**TRINIDAD** **MARK** **JOSHUA V.**
9.	To cancel my schedule if plans change so that other students can use the defense room.	Design UI Design Data Model	8 hours	

		Develop a workflow Perform QA and Test		**TRINIDAD** **MARK** **JOSHUA V.**
10.	To view a list of my upcoming defense room scheduling to manage my schedule.	Design UI Design Data Model Develop a workflow Perform QA and Test	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
11.	As a system admin, I want to log and track all scheduling changes (e.g., cancellations and extensions) for auditing purposes.	Design UI Design Data Model Develop a workflow Perform QA and Test	7 hours	**TRINIDAD** **MARK** **JOSHUA V.**
Sprint 4: Research and Defense Scheduling				
12.	To monitor the system's usage and performance for continuous improvement.	Design UI Design Data Model	6 hours	

		Develop a workflow Perform QA and Test		**TRINIDAD** **MARK** **JOSHUA V.**
13.	To give scheduling suggestions for alternative defense rooms if my preferred choice was unavailable.	Design UI Design Data Model Develop a workflow Perform QA and Test	5 hours	**TRINIDAD** **MARK** **JOSHUA V.**
14.	To assign defense scheduling to specific courses or departments for better organization.	Design UI Design Data Model Develop a workflow Perform QA and Test	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
Sprint 5: Room Coordination				
15.		Design UI		

	To book multiple defense rooms at once for group studies or events.	Design Data Model Develop a workflow Perform QA and Test	7 Hours	**DEL PRADO, CEDRICK J.**
16.	As a system admin, the system ensures regular backups of all scheduling data to prevent data loss.	Design UI Design Data Model Develop a workflow Perform QA and Test	5 hours	**DEL PRADO, CEDRICK J.**
17.	To be notified if a scheduled defense room's equipment (e.g., projector) was out of order.	Design UI Design Data Model Develop a workflow Perform QA and Test	5 hours	**TRINIDAD MARK JOSHUA V.**
18.	As an admin, I want to define scheduling rules and restrictions for specific users	Design UI Design Data Model	8 hours	

	(e.g., faculty and students).	Develop a workflow		**TRINIDAD** **MARK** **JOSHUA V.**
		Perform QA and Test		
Sprint 6: Final Review and Refine				
19.	To check my past schedules to plan future defenses more efficiently.	Design UI	6 hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
20.	To generate reports on room usage to assess peak times and underutilized resources.	Design UI	4 hours	**DEL PRADO,** **CEDRICK J.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
21.	To receive a reminder notification before my booked class to ensure I attend on time.	Design UI	8 hours	
		Design Data Model		

		Develop a workflow Perform QA and Test		**TRINIDAD MARK JOSHUA V.**
22.	As an admin, the system provides a central dashboard to manage scheduling, enabling easy viewing and modification of room allocations.	Design UI Design Data Model Develop a workflow Perform QA and Test	6 hours	**TRINIDAD MARK JOSHUA V.**
23.	As a system admin, the system automatically archives old schedules after a specified time to keep the system organized.	Design UI Design Data Model Develop a workflow Perform QA and Test	5 hours	**TRINIDAD MARK JOSHUA V.**
24.	As an admin, I want to generate custom reports based on specific criteria (e.g., schedules by date, department).	Design UI Design Data Model Develop a workflow	4 hours	**TRINIDAD MARK JOSHUA V.**

		Perform QA and Test		
25.	As an admin, the system allows configuring notification settings for different types of users (students, faculty, etc.).	Design UI Design Data Model Develop a workflow Perform QA and Test	7 hours	**TRINIDAD MARK JOSHUA V.**
26.	To extend my defense room scheduling if I need extra time for room usage.	Design UI Design Data Model Develop a workflow Perform QA and Test	8 hours	**DEL PRADO, CEDRICK J.**
27.	To manage schedules for recurring classes (e.g., weekly seminars).	Design UI Design Data Model Develop a workflow Perform QA and Test	5 hours	**TRINIDAD MARK JOSHUA V.**

Table 33: Sprint Backlog

Information security

User Stories No.	User Stories	Task	User Story Points (hours)	Responsible Team Member
28.	Session Based Authentication	Design UI	8 Hours	**DEL PRADO, CEDRICK J.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
29.	Cloud Platform Security	Design UI	6 Hours	**TRINIDAD MARK JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		

Table 34: Sprint backlog for information security

EIS standard

User Stories No.	User Stories	Task	User Story points (hours)	Responsible Team Member
30.	Uniform Interface	Design UI	7 Hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
31.	Real-Time Data Synchronization	Design UI	7 Hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
32.	Scalability	Design UI	5 Hours	**DEL PRADO,** **CEDRICK J.**
		Design Data Model		
		Develop a workflow		

		Perform QA and Test		
33.	Platform Compatibility	Design UI	5 Hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
34.	Automated Scheduling Confirmation	Design UI	7 Hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		
		Perform QA and Test		
35.	User-Friendly Interface	Design UI	5 Hours	**TRINIDAD** **MARK** **JOSHUA V.**
		Design Data Model		
		Develop a workflow		

		Perform QA and Test		

Table 35: Sprint backlog for EIS standard

EIS integration

User Stories NO.	User Stories	Task	User Story points (hours)	Responsible Team Member
36.	Integrate defense room scheduling with the faculty system to allow faculty to view	Design UI Design Data Model Develop a workflow Perform QA and Test	6 Hours	**TRINIDAD** **MARK** **JOSHUA V.**
37.	Ensure seamless communication between the scheduling system and IT system for equipment management (e.g., projectors, computers).	Design UI Design Data Model Develop a workflow Perform QA and Test	6 Hours	**TRINIDAD** **MARK** **JOSHUA V.**

38.	The integration will allow the Center for Research and Development (CRAD) department to submit requests for hiring new staff directly through the HR system.	Design UI Design Data Model Develop a workflow Perform QA and Test	7 Hours	**DEL PRADO,** **CEDRICK J.**

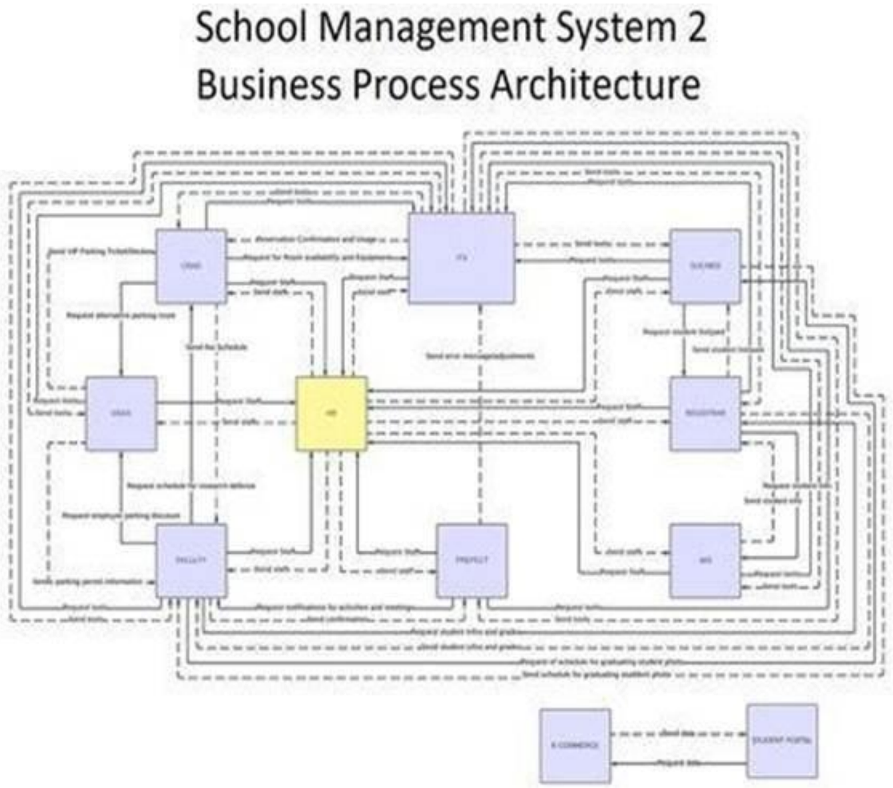
Table 36: Sprint backlog for EIS integration

Technical Documentation

System Architecture

Overview of the Overall system Architecture

The overall system design of the School Management System (SMS) includes several integrated subsystems that facilitate different academic and administrative operations. Every module operation has its own processes and services and is integrated with other modules to facilitate smooth data flow and system efficiency. The Automated Defense Room Scheduling System, being a specialized module of the SMS, is specifically designed to schedule defense rooms effectively. It is integrated with other academic and administrative procedures for efficient scheduling and tracking of availability.

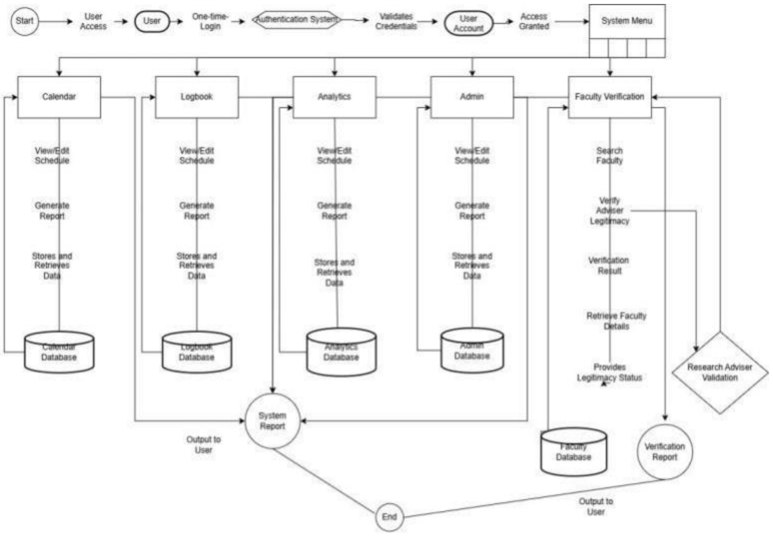


School Management System 2
Business Process Architecture
ITS
HR
REGISTRAR
FACULTY
PREFECT
MIS
Send for Schedule
Send error message/adjustments
Request schedule for research defense
Request employee parking discount
Request notifications for activities and meetings
Send confirmation
Request student info and grades
Send student info and grades
Request of schedule for graduating student photo
Send schedule for graduating student photo
E-COMMERCE
STUDENT PORTAL
Send data
Request data

Figure 27: Business Process Architecture Top Level 1

Detailed Diagrams Illustrating System Components and Their Interactions

The system has several interdependent parts, such as the frontend UI, backend logic, database, and cloud deployment. This diagram gives a visual representation of these parts, indicating how data moves among them, and how scheduling requests are processed.



CRAD DATA FLOW DIAGRAM

Figure 28: Sample Data (DFD)

Explanation of Component Responsibilities and Relationships

Each part of the system performs a specific task. The frontend deals with the users' input, the backend deals with scheduling rules and business logic, while the database takes care of schedule records and the users' login details. Collectively, all the parts deal with proper room availability tracking to avoid scheduling overlap, maximizing the scheduling process efficiency in the Center for Research and Development (CRAD) department.

Information Systems Integration

Description of how the Class's Information System were Integrated

The Automated Defense Room Scheduling System is part of the overall School Management System (SMS) to facilitate easy sharing of data and smooth scheduling operations.

User Authentication Module: The system makes sure that only approved Center for Research and Development (CRAD) officers can use the scheduling system by authenticating login details.

Defense Room Scheduling System: Controls defense room scheduling, avoiding conflicts and maintaining proper scheduling.

Notification Module: Provides notifications to Center for Research and Development (CRAD) officers of confirmed schedule, cancellations, or schedule changes.

Diagram Showing the Integration Points and Data Flows

The integration diagram shows how information is exchanged between the Automated Defense Room Scheduling System and other SMS modules. Some of the most important data exchanges are:

Authentication Requests: Center for Research and Development (CRAD) officers authenticate using the login credentials.

Student and Faculty Data Retrieval: The system retrieves student and faculty schedules to check availability.

Room Scheduling Updates: Confirmed schedules are updated in the SMS database.

Automated Notifications: Triggers notifications for schedule confirmations and modifications.

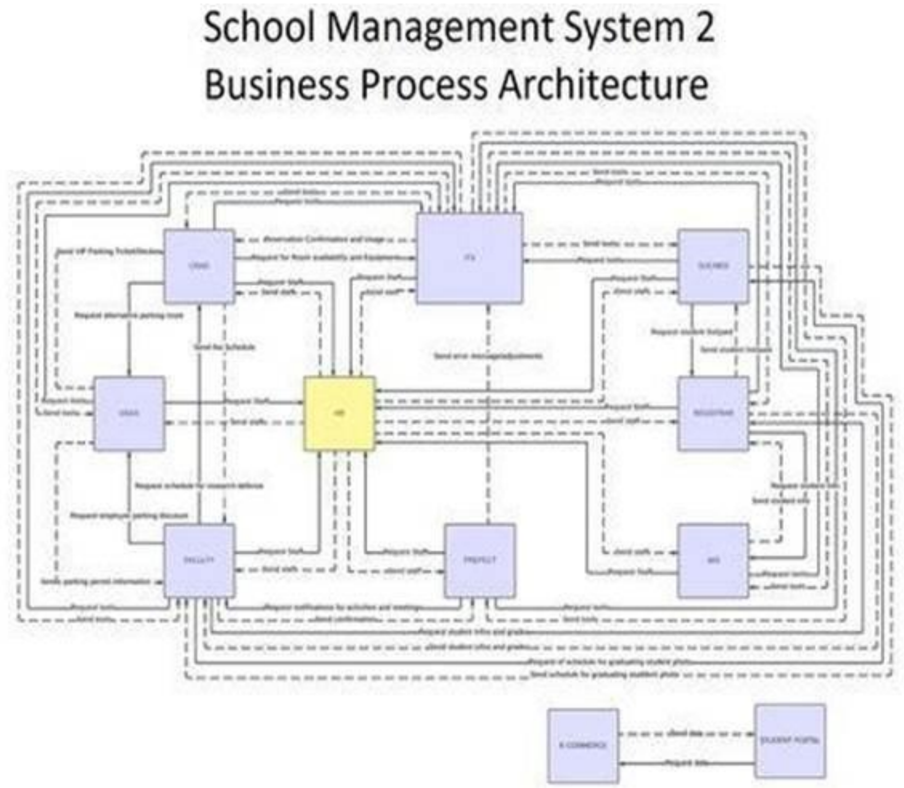

School Management System 2
Business Process Architecture
ITS
HR
FACULTY
PREFECT
REGISTRAR
Request Staffs
Send staffs
Request student info and grades
E-COMMERCE
STUDENT PORTAL

Figure 29: Business Process Architecture Top Level 1

The diagram visually illustrates these interactions, describing how different subsystems interact to have up-to-date scheduling records.

Data Transformation and Mapping Processes

To ensure data integrity, the system adopts rigorous data processing practices:

Data Collection: Retrieves corresponding information from the authentication system, student database, and scheduling module.

Data Integration: Conforms data formats into uniformity throughout all systems.

Data Transformation: Cleans and normalizes data to eliminate inconsistencies when aggregating scheduling data.

Data Mapping: Student and faculty schedules are mapped to defense room availability and scheduling records are linked for tracking.

Data Storage and Access: Structured data is stored in a centralized database and APIs are provided for authorized access.

Application Design and Development

Detailed Information about the Software Modules and Components

The Center for Research and Development (CRAD) Defense Room Scheduling System is designed with distinct software modules that collaborate to enable easy scheduling and management.

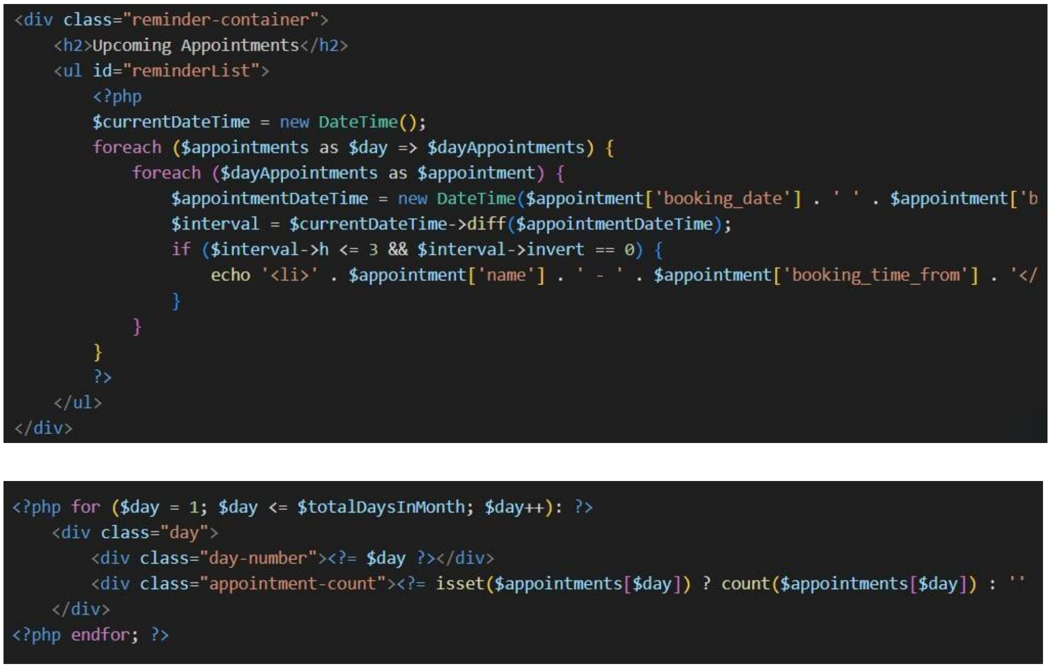
User Management Module: Manages authentication and access rights, allowing only Center for Research and Development (CRAD) officers to login and manage schedules.

Defense Room Scheduling Module: Enables Center for Research and Development (CRAD) officers to schedule, reschedule, and cancel room scheduling in a way that avoids double-schedules.

Database Management Module: Saves and retrieves scheduling data, user details, and system logs to ensure proper records.

Notification Module: Informs Center for Research and Development (CRAD) officers of confirmed schedule, cancellations, and any schedule changes.

Code Snippets and Code Structure



```
<div class="reminder-container">
    <h2>Upcoming Appointments</h2>
    <ul id="reminderList">
        <?php
        $currentDateTime = new DateTime();
        foreach ($appointments as $day => $dayAppointments) {
            foreach ($dayAppointments as $appointment) {
                $appointmentDateTime = new DateTime($appointment['booking_date'] . ' ' . $appointment['b
                $interval = $currentDateTime->diff($appointmentDateTime);
                if ($interval->h <= 3 && $interval->invert == 0) {
                    echo '<li>' . $appointment['name'] . ' - ' . $appointment['booking_time_from'] . '</
                }
            }
        }
        ?>
    </ul>
</div>
```

```
<?php for ($day = 1; $day <= $totalDaysInMonth; $day++): ?>
    <div class="day">
        <div class="day-number"><?= $day ?></div>
        <div class="appointment-count"><?= isset($appointments[$day]) ? count($appointments[$day]) : ''
    </div>
<?php endfor; ?>
```

Figure 30: Code Snippets and Code Structure

Algorithms and Data Structures Used

The Center for Research and Development (CRAD) Defense Room Scheduling System utilizes efficient algorithms and data structures to facilitate effective scheduling, rapid data retrieval, and smooth defense room schedule management.

Data Structures:

Relational Database (MySQL): The system uses a relational database with a structured schema to store and manage defense room schedules, Center for Research and Development (CRAD) account, and schedule records. This maintains data integrity and allows for effective querying and retrieval of data.

Hash Maps: Used to support quick lookups of room availability and reservations. This minimizes the time needed to check scheduling conflicts and maintains rapid response times.

Queues: Employed to handle waiting scheduling requests on a First In, First Out (FIFO) basis to ensure that reservations are processed in a linear order and minimize processing delays.

Algorithms:

Scheduling Algorithm: The system uses a scheduling algorithm that identifies conflicts in the schedules to avoid double-scheduling of defense rooms. It optimizes room allocation so that there is efficient use based on availability and time slots.

Search Algorithm: Indexing and filtering mechanisms enable users to access available defense rooms rapidly using search. This makes the user experience faster by saving search time.

Sorting Algorithm: The system sorts defense room schedules in chronological order, so that future reservations are presented in a clean and clear manner. This enables the Center for Research and Development (CRAD) officer to manage and monitor room schedules easily and efficiently.

Through the combination of these data structures and algorithms, the Center for Research and Development (CRAD) Defense Room Scheduling System has a speedy, efficient, and user-friendly scheduling process that suits the requirements of the Center for Research and Development (CRAD) department.

Libraries and Frameworks Used

Backend: PHP

PHP is utilized for server-side processing, managing core operations like defense room scheduling, database operations, and user authentication.

Database: MySQL

MySQL is the relational database management system, where all scheduling information, user data, and schedule history are stored. It provides efficient data retrieval and organized data management.

Frontend: HTML & CSS

The user interface of the system is developed with HTML for content organization and CSS for presentation, providing a clean and user-friendly interface designed specifically for the Center for Research and Development (CRAD) officer in charge of defense room schedules.

Cloud Deployment: Indevfinite Cloud

The system is deployed on Indevfinite Cloud, providing secure remote access, scalability, and data availability.

Additional Libraries & Tools:

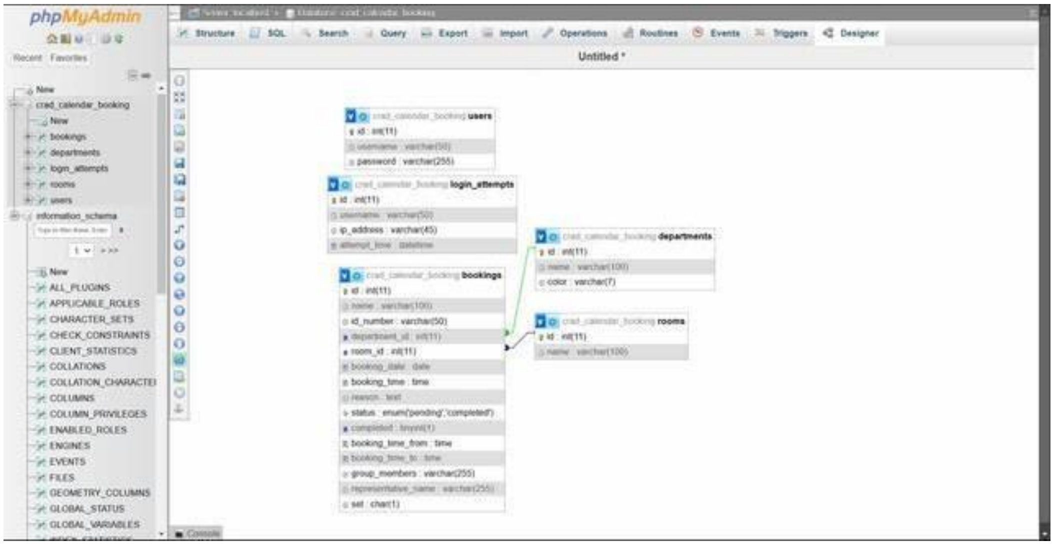
PHP MySQLi: Provides secure and optimized database queries between PHP and MySQL.

Bootstrap: Improves UI responsiveness and keeps the design uniform across varying screen sizes.

By incorporating these frameworks and libraries, the system ensures a smooth scheduling process with security, accessibility, and efficiency for the Center for Research and Development (CRAD) department.

Database Schema and Data Management

Database Schema Design



crad_calendar_booking users
- id : int(11)
- username : varchar(50)
- password : varchar(255)

crad_calendar_booking login_attempts
- id : int(11)
- username : varchar(50)
- ip_address : varchar(45)
- attempt_time : datetime

crad_calendar_booking departments
- id : int(11)
- name : varchar(100)
- color : varchar(7)

crad_calendar_booking bookings
- id : int(11)
- name : varchar(100)
- id_number : varchar(50)
- department_id : int(11)
- room_id : int(11)
- booking_date : date
- booking_time : time
- reason : text
- status : enum('pending','completed')
- completed : tinyint(1)
- booking_time_from : time
- booking_time_to : time
- group_members : varchar(255)
- representative_name : varchar(255)
- set : char(1)

crad_calendar_booking rooms
- id : int(11)
- name : varchar(100)

Figure 31: Database Schema Design

Entity-Relationship Diagrams (ERDs)

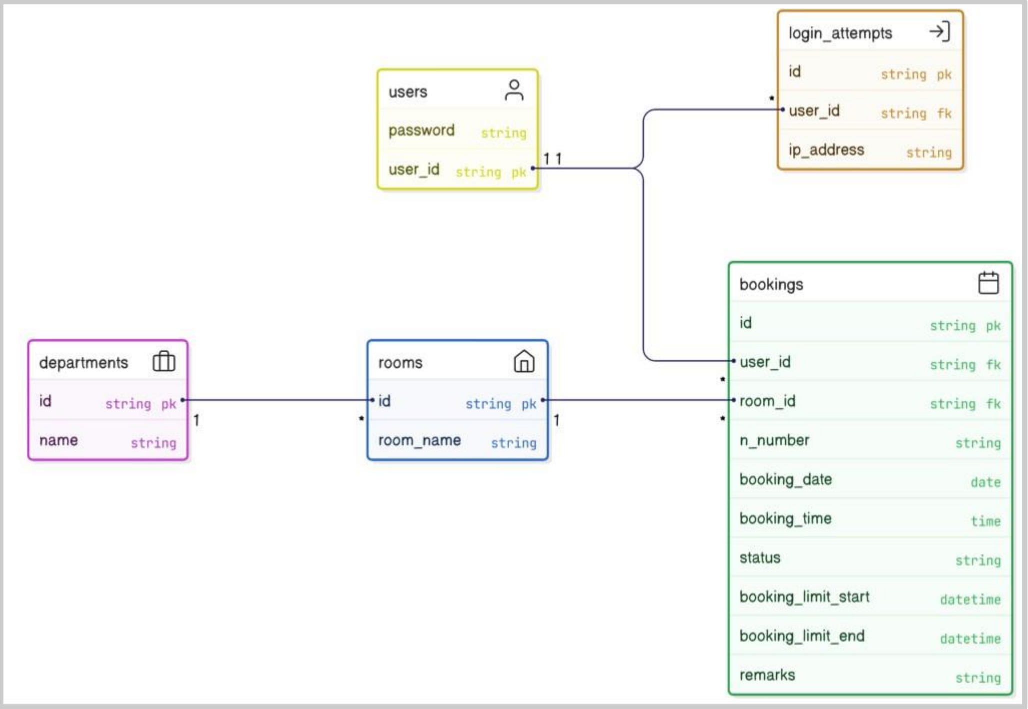


Figure 32: Entity-Relationship Diagrams (ERDs)

Data Modeling and Normalization

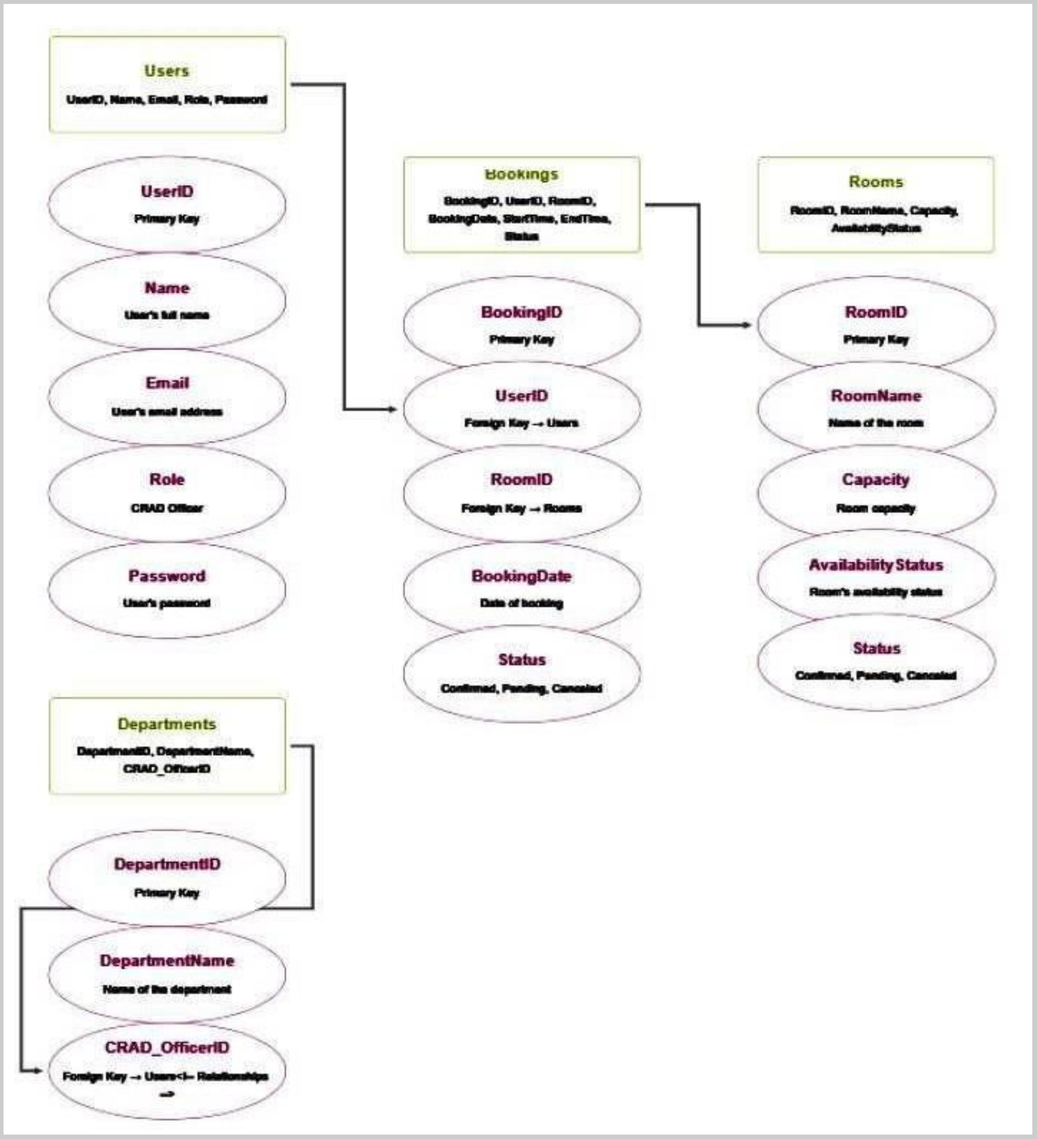
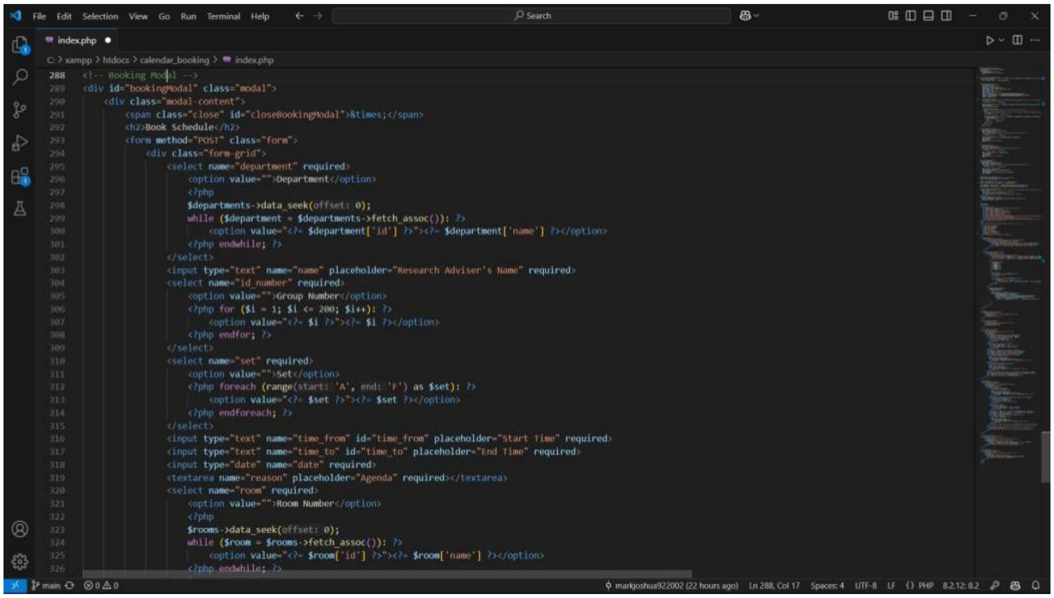


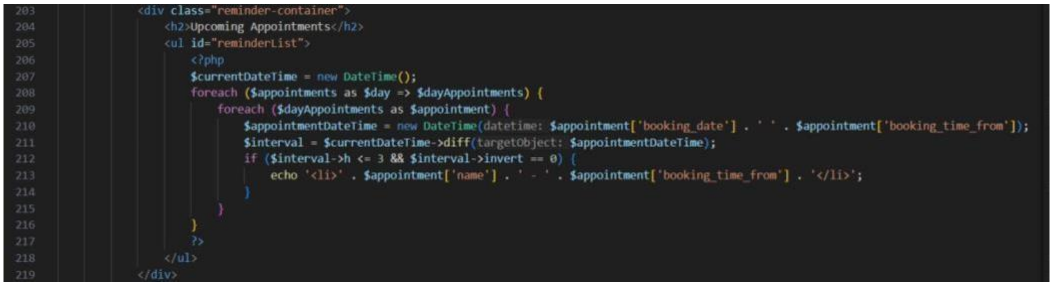
Figure 33: Data Modeling and Normalization

CRUD (Create, Read, Update, Delete) Operations



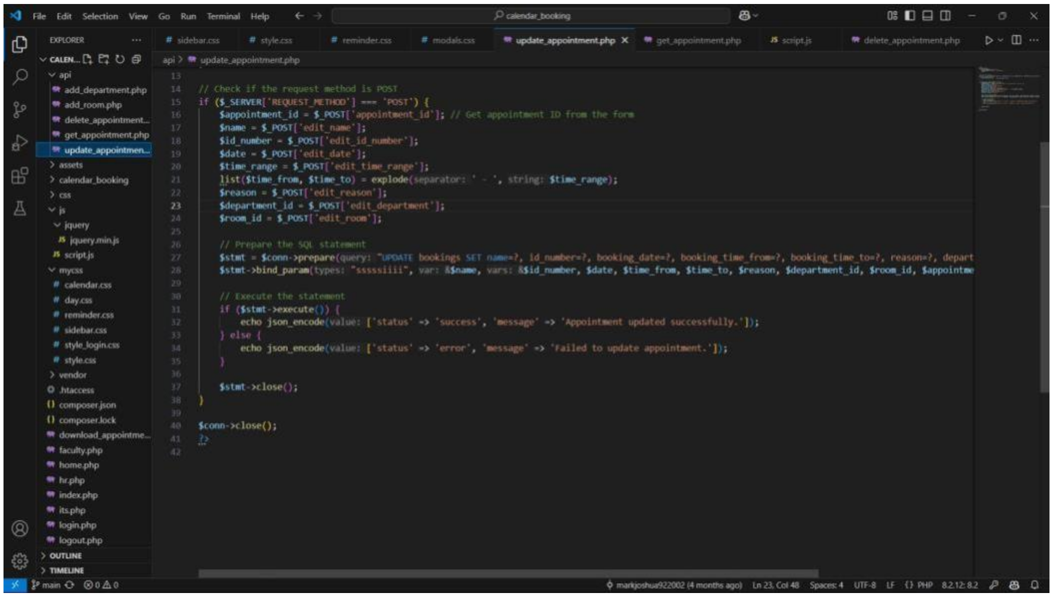
```
<!-- Booking Modal -->
<div id="bookingModal" class="modal">
    <div class="modal-content">
        <span class="close" id="closeBookingModal">&times;</span>
        <h2>Book Schedule</h2>
        <form method="POST" class="form">
            <div class="form-grid">
                <select name="department" required>
                    <option value="">Department</option>
                    <?php
                    $departments->data_seek(offset: 0);
                    while ($department = $departments->fetch_assoc()): ?>
                        <option value="<?= $department['id'] ?>"><?= $department['name'] ?></option>
                    <?php endwhile; ?>
                </select>
                <input type="text" name="name" placeholder="Research Adviser's Name" required>
                <select name="id_number" required>
                    <option value="">Group Number</option>
                    <?php for ($i = 1; $i <= 200; $i++): ?>
                        <option value="<?= $i ?>"><?= $i ?></option>
                    <?php endfor; ?>
                </select>
                <select name="set" required>
                    <option value="">Set</option>
                    <?php foreach (range(start: 'A', end: 'F') as $set): ?>
                        <option value="<?= $set ?>"><?= $set ?></option>
                    <?php endforeach; ?>
                </select>
                <input type="text" name="time_from" id="time_from" placeholder="Start Time" required>
                <input type="text" name="time_to" id="time_to" placeholder="End Time" required>
                <input type="date" name="date" required>
                <textarea name="reason" placeholder="Agenda" required></textarea>
                <select name="room" required>
                    <option value="">Room Number</option>
                    <?php
                    $rooms->data_seek(offset: 0);
                    while ($room = $rooms->fetch_assoc()): ?>
                        <option value="<?= $room['id'] ?>"><?= $room['name'] ?></option>
                    <?php endwhile; ?>
```

Figure 34: Create



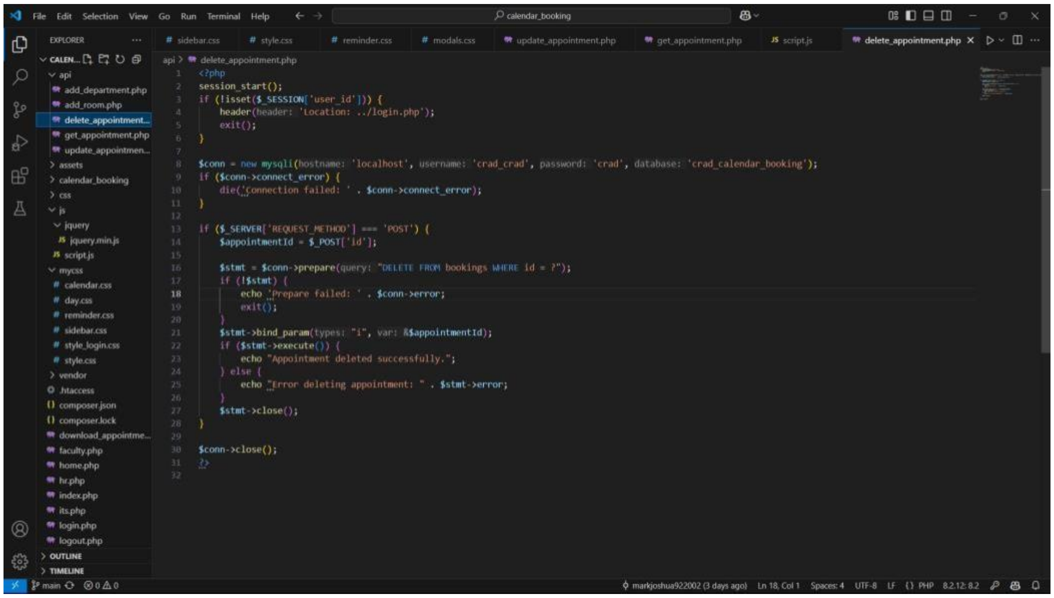
```
<div class="reminder-container">
    <h2>Upcoming Appointments</h2>
    <ul id="reminderList">
        <?php
        $currentDateTime = new DateTime();
        foreach ($appointments as $day => $dayAppointments) {
            foreach ($dayAppointments as $appointment) {
                $appointmentDateTime = new DateTime(datetime: $appointment['booking_date'] . ' ' . $appointment['booking_time_from']);
                $interval = $currentDateTime->diff(targetObject: $appointmentDateTime);
                if ($interval->h <= 3 && $interval->invert == 0) {
                    echo '<li>' . $appointment['name'] . ' - ' . $appointment['booking_time_from'] . '</li>';
                }
            }
        }
        ?>
    </ul>
</div>
```

Figure 35: Read



```php
// Check if the request method is POST
if ($_SERVER['REQUEST_METHOD'] === 'POST') {
    $appointment_id = $_POST['appointment_id']; // Get appointment ID from the form
    $name = $_POST['edit_name'];
    $id_number = $_POST['edit_id_number'];
    $date = $_POST['edit_date'];
    $time_range = $_POST['edit_time_range'];
    list($time_from, $time_to) = explode(separator: ' - ', string: $time_range);
    $reason = $_POST['edit_reason'];
    $department_id = $_POST['edit_department'];
    $room_id = $_POST['edit_room'];

    // Prepare the SQL statement
    $stmt = $conn->prepare(query: "UPDATE bookings SET name=?, id_number=?, booking_date=?, booking_time_from=?, booking_time_to=?, reason=?, depart
    $stmt->bind_param(types: "sssssiiii", var: &$name, vars: &$id_number, $date, $time_from, $time_to, $reason, $department_id, $room_id, $appointme

    // Execute the statement
    if ($stmt->execute()) {
        echo json_encode(value: ['status' => 'success', 'message' => 'Appointment updated successfully.']);
    } else {
        echo json_encode(value: ['status' => 'error', 'message' => 'Failed to update appointment.']);
    }

    $stmt->close();
}

$conn->close();
?>
```

Figure 36: Update



```php
<?php
session_start();
if (!isset($_SESSION['user_id'])) {
    header(header: 'Location: ../login.php');
    exit();
}

$conn = new mysqli(hostname: 'localhost', username: 'crad_crad', password: 'crad', database: 'crad_calendar_booking');
if ($conn->connect_error) {
    die('Connection failed: ' . $conn->connect_error);
}

if ($_SERVER['REQUEST_METHOD'] === 'POST') {
    $appointmentId = $_POST['id'];

    $stmt = $conn->prepare(query: "DELETE FROM bookings WHERE id = ?");
    if (!$stmt) {
        echo 'Prepare failed: ' . $conn->error;
        exit();
    }
    $stmt->bind_param(types: "i", var: &$appointmentId);
    if ($stmt->execute()) {
        echo "Appointment deleted successfully.";
    } else {
        echo "Error deleting appointment: " . $stmt->error;
    }
    $stmt->close();
}

$conn->close();
?>
```

Figure 37: Delete

Network Configuration

The Center for Research and Development (CRAD) Defense Room Scheduling System is configured with a secure and efficient network to provide reliable access and data security.

Network Topology and Configuration

Client-Server Architecture: The system is based on a client-server architecture, where the Center for Research and Development (CRAD) officer uses the web-based system through a browser, and requests are handled by the PHP backend running on Indevfinite Cloud with a MySQL database.

Cloud Deployment: The system is hosted on Indevfinite Cloud, making it scalable, remotely accessible, and securely data-managed.

LAN and Internet Connectivity: The system is accessible through a secured local network (LAN) within the Center for Research and Development (CRAD) office or the internet with authentication controls.

Security Measures

Firewalls: Network firewalls are used to block and monitor traffic, ensuring no unauthorized access to the system.

Encryption:

HTTPS with SSL/TLS provides safe communication between the server and client (Center for Research and Development (CRAD) officers).

Password Hashing keeps user passwords stored securely in the database.

Access Control: Only Center for Research and Development (CRAD) officers are authorized to have access to the system, keeping data from being made inappropriately.

Regular Backups: Scheduled backups of databases protect against data loss in case the system crashes.

Protocols and Communication Methods

HTTP/HTTPS: HTTPS is utilized by the system to securely encrypt data transmission.

MySQL Protocol: The backend is talked to by the database via secure MySQL connections.

TCP/IP: The system utilizes standard TCP/IP protocols for communication over the network.

Load Balancing and Failover Mechanisms

Cloud Load Balancing (if used): If the system is high-traffic, the cloud environment can load balance requests to ensure performance.

Failover Mechanism: Automated recovery and backup servers provide continued availability in the event of system downtime.

This network configuration provides the security, availability, and performance of the Center for Research and Development (CRAD) Defense Room Scheduling System.

Deployment and Infrastructure

Deployment Strategies

An efficient, scalable, and stable cloud-based system can be guaranteed by a defined deployment strategy. Center for Research and Development (CRAD) Defense Room Scheduling System has a well-structured deployment process that involves incremental testing and validation at each step. This reduces downtime and ensures seamless rollouts of system updates. Tools for automation like containerization and orchestration frameworks ease deployment, increasing consistency and supporting rapid scalability in response to demand. A well thought out deployment approach ensures system stability while providing flexibility in managing resources.

The system is deployed on Indevfinite Cloud, and remote access is ensured while security and scalability are maintained. Cloud deployment provides hassle-free resource allocation, ensuring that the system is able to manage different workloads effectively.

Hardware Specifications and Server Configurations

The hardware and server setup of the system are developed to respond to defense room scheduling requirements. These include consideration of processing capabilities, memory capacity, storage space, and connectivity. For optimal performance, the server has a multi-core processor and adequate RAM to support numerous scheduling requests efficiently. Storage is handled by large capacity drives set up in data redundancy mode for performance boosts.

Network infrastructure is responsible for maintaining seamless communication between the clients and the server. Scalability in the future is also taken into account, with the possibility of upgrading hardware without much disruption to system processes.

Configuration Management

Consistency in software and system setups is maintained through configuration management practices. Automation scripts perform work such as software installation, updates, and system setup to minimize manual intervention and deployment time. Version control systems like GitHub keep track of configuration changes so that rollbacks and backups can be easily done if needed.

Utilizing PHP MySQLi guarantees secure, efficient communication with the database and backend. Structured deployment procedures are also incorporated into configuration management for reliability purposes, for ensuring ease of maintenance, and increasing overall infrastructure effectiveness.

Scalability and Resource Optimization

The Center for Research and Development (CRAD) Defense Room Scheduling System is optimized to handle scheduling requests in an efficient manner while providing the best performance. The system architecture allows for future scalability, ensuring that further defense rooms, scheduling policies, and user data can be incorporated without extensive structural modifications.

For resource optimization, the system:

Uses MySQL indexing methods to optimize query performance while fetching room availability and scheduling history.

Enforces load-efficient queries to avoid putting extra stress on the database in handling multiple scheduling requests.

Retains past scheduling data in an archived database to maintain the active database streamlined and enhance retrieval time.

Optimizes efficient usage of memory and server loading by utilizing optimized PHP scripts for processing scheduling requests with minimal computational overhead.

Security Measures

It is crucial to secure the Center for Research and Development (CRAD) Defense Room Scheduling System to safeguard sensitive scheduling information and avoid unauthorized access. The system has been equipped with security features to ensure confidentiality, integrity, and availability of the data. The security features are firewalls, encryption, access control, authentication features, and backups to ensure the system is secured from any threats.

Security Protocols and Measures Implemented

Firewalls: Network firewalls are set up to observe and screen incoming and outgoing traffic in a way that unauthorized access attempts are blocked. This shields the system from possible cyber-attacks and unauthorized intrusions.

Password Hashing: Protects passwords in a hashed format and prevents unauthorized access via credential exposure.

Access Control: The system is limited to the Center for Research and Development (CRAD) officer, and the defense room scheduling can be controlled by only authorized users. No unauthorized users can view or alter the data.

Scheduled Backups: The system schedules backups of the database at regular intervals, maintaining data integrity and availability in case the system crashes or gets corrupted.

Authentication and Authorization Mechanisms

In order to prevent unauthorized users from accessing and modifying the Center for Research and Development (CRAD) Defense Room Scheduling System, the authentication and authorization process is strictly implemented. The system applies Access Control, which permits the Center for Research and Development (CRAD) officer to log in and conduct scheduling operations. By applying security measures, the system does not permit unauthorized users to access the information and modify it, ensuring data integrity and preventing unauthorized modifications.

Encryption and Data Protection

Keeping confidentiality and integrity of data is of utmost importance while ensuring system security. The system maintains encryption and secure communication through having:

HTTPS/SSL Encryption: Information shared between client and server is encrypted by SSL/TLS to avoid interception and tampering.

Secure Database Connections: The system utilizes secure MySQL connections to enable data security and avert unauthorized alteration.

Incident Response and Mitigation Procedures

In order to further improve security, additional steps are taken to prevent loss or corruption of data:

Database Integrity Protection: Safe queries and data validation are employed to defend against SQL injection and database vulnerabilities.

Access Logging: Monitors system access and user activity to track potential security threats and unauthorized activity.

These security features protect the Center for Research and Development (CRAD) Defense Room Scheduling System, keeping sensitive scheduling information safe while enabling only authorized personnel to effectively manage scheduling of defense rooms.

Testing and Quality Assurance

Detailed test cases and scenarios

Test cases and scenarios for "School Management System 2: Automated Defense Room Scheduling System with Real-Time Availability and Confirmation for Center for Research and Development at Bestlink College of the Philippines."

System Access:

Scenario 1: Test Case: CRAD officer login.

Navigate to the system login page.

Enter valid login credentials (username and password).

Click the Login button.

Verify that the user is redirected to the system dashboard.

Scenario 2: Test Case: Incorrect login credentials.

Enter invalid username or password.

Click the Login button.

Verify that an error message is displayed and access is denied.

Defense Room Scheduling:

Scenario 1: Test Case: Schedule a defense room.

Log in as the Center for Research and Development (CRAD) officer.

Navigate to the schedule booking.

Select an available defense room.

Input the necessary schedule booking details (date, time, room details).

Confirm the schedule booking.

Verify that the scheduling appears on the schedule and is saved in the database.

Scenario 2: Test Case: Preventing double-scheduling.

Attempt to schedule a defense room that is already scheduled.

Verify that the system prevents the scheduling and displays an appropriate error message.

Scenario 3: Test Case: Canceling a defense room schedule booking.

Log in as the CRAD officer.

Navigate to the scheduled bookings.

Select a schedule to cancel.

Confirm the cancellation.

Verify that the scheduled booking is removed from the system.

Scenario 4: Test Case: Extending an existing schedule.

Log in as the Center for Research and Development (CRAD) officer.

Select a previously scheduled defense room.

Choose the option to extend the schedule.

Ensure that the extension does not conflict with other reservations.

Confirm the update.

Verify that the extension is saved successfully.

Test Data and Expected Outcomes

Test Data	Expected Outcome
Correct username/password	Successful login
Incorrect username/password	Error message displayed
Complete schedule booking details	Successful schedule booking
Defense room already scheduled	Error: Room is unavailable
Delete scheduled booking	Booking successfully deleted

Table 37: Test Data and Expected Outcome

Test Results and Validation Against Requirements

Requirements	Test Result	Validation
System allows authorized Center for Research and Development (CRAD) officers to log in.	Pass	Verified login functionality.
Prevent double-schedule of defense rooms.	Pass	Attempted duplicate schedules were rejected.
Allow Center for Research and Development (CRAD) officers to modify or cancel schedules.	Pass	Successfully modified and canceled schedules.
Provide real-time availability updates.	Pass	Changes reflected immediately in the system.

Table 38: Test Results and Validation

Performance Testing and Optimization Efforts

Performance Metrics:

System response time: Average login time 1-2 seconds.

Room booking processing time is 1-3 seconds.

System uptime: 90% during operational hours.

Load Testing:

Simulated 30 concurrent users schedule rooms simultaneously.

Ensured system stability without significant delays.

Stress Testing:

Increased concurrent users to 50 to determine system breaking point.

Identified necessary optimizations for better scalability.

Optimization Efforts:

Database indexing for faster queries.

Caching frequently accessed data to reduce load.

Code refactoring to improve efficiency.

System Monitoring and Maintenance

Continuous monitoring and routine maintenance are put in place to secure the reliability and effectiveness of the Center for Research and Development (CRAD) Defense Room Scheduling System. This practice identifies any potential problems, maximizes performance, and validates data integrity. Through the utilization of monitoring resources, structured error handling, periodical updates, and routine backup, the system is kept functional and secure to support the day-to-day operations of the Center for Research and Development (CRAD) officer.

Tools and Techniques for Monitoring System Health

System health monitoring involves tracking system performance, resource usage, and database activity. MySQL performance monitoring is used by the system to detect slow queries and improve database performance. PHP logging also helps in tracking errors and performance. Server logs are also checked on a regular basis to detect any suspicious activity or performance slowdown.

Logging and Error Handling Mechanisms

Error logging is an important feature for identifying and fixing system problems. The system makes use of PHP's error logging functionality to store runtime errors, warnings, and failed database queries. MySQL error logs assist in fixing database performance problems and connection problems. In addition, the system gives appropriately formatted error messages to the Center for Research and Development (CRAD) officer, thereby any problems faced are adequately defined and can be addressed effectively.

Scheduled Maintenance and Updates

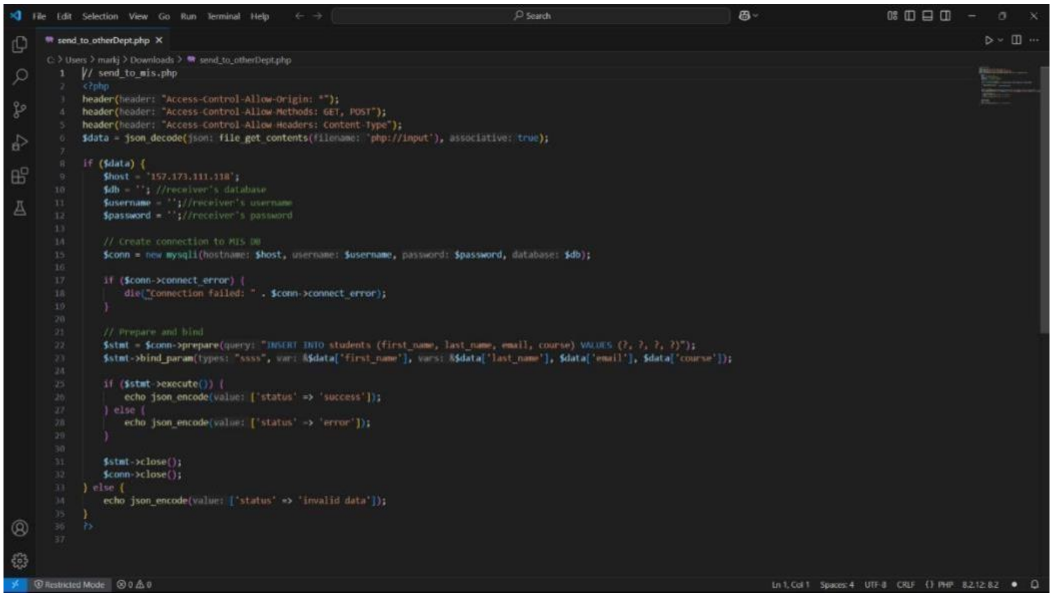
Maintenance of the system on a regular basis is necessary to ensure smooth uninterrupted functioning. Database optimization, deletion of old or redundant records, and maintenance of all the components of the system are all part of maintenance. Improvements to the system's functioning, and small bug fixes are first tested in a controlled environment before they are released to prevent interference.

Disaster Recovery and Backup Procedures

Security of data is given importance, and backup operations are implemented in order to avoid loss of data. Routine backups of the database occur, protecting recently added data safely. These backups are saved in secure locations, and if failures or mishaps occur during processing, recovery from backups becomes easy.

PIs and Integration Points

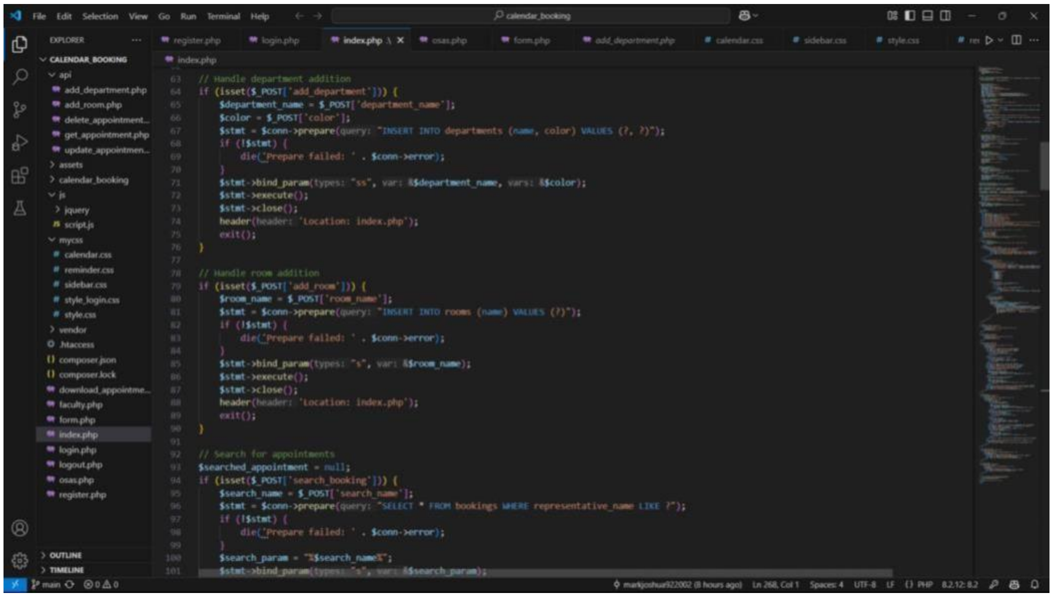
Documentation of APIs used for Integration


File Edit Selection View Go Run Terminal Help
Search
send_to_otherDept.php
C: > Users > markj > Downloads > send_to_otherDept.php
Restricted Mode
Ln 1, Col 1 Spaces: 4 UTF-8 CRLF PHP 8.2.12 8.2

```php
// send_to_mis.php
<?php
header(header: "Access-Control-Allow-Origin: *");
header(header: "Access-Control-Allow-Methods: GET, POST");
header(header: "Access-Control-Allow-Headers: Content-Type");
$data = json_decode(json: file_get_contents(filename: 'php://input'), associative: true);

if ($data) {
    $host = '157.173.111.118';
    $db = ''; //receiver's database
    $username = '';//receiver's username
    $password = '';//receiver's password

    // Create connection to MIS DB
    $conn = new mysqli(hostname: $host, username: $username, password: $password, database: $db);

    if ($conn->connect_error) {
        die("Connection failed: " . $conn->connect_error);
    }

    // Prepare and bind
    $stmt = $conn->prepare(query: "INSERT INTO students (first_name, last_name, email, course) VALUES (?, ?, ?, ?)");
    $stmt->bind_param(types: "ssss", var: &$data['first_name'], vars: &$data['last_name'], $data['email'], $data['course']);

    if ($stmt->execute()) {
        echo json_encode(value: ['status' => 'success']);
    } else {
        echo json_encode(value: ['status' => 'error']);
    }

    $stmt->close();
    $conn->close();
} else {
    echo json_encode(value: ['status' => 'invalid data']);
}
?>
```

Figure 38: Documentation of APIs used for Integration

API Endpoints, Methods, and Data Formats



```php
// Handle department addition
if (isset($_POST['add_department'])) {
    $department_name = $_POST['department_name'];
    $color = $_POST['color'];
    $stmt = $conn->prepare(query: "INSERT INTO departments (name, color) VALUES (?, ?)");
    if (!$stmt) {
        die('Prepare failed: ' . $conn->error);
    }
    $stmt->bind_param(types: "ss", var: &$department_name, vars: &$color);
    $stmt->execute();
    $stmt->close();
    header(header: 'Location: index.php');
    exit();
}

// Handle room addition
if (isset($_POST['add_room'])) {
    $room_name = $_POST['room_name'];
    $stmt = $conn->prepare(query: "INSERT INTO rooms (name) VALUES (?)");
    if (!$stmt) {
        die('Prepare failed: ' . $conn->error);
    }
    $stmt->bind_param(types: "s", var: &$room_name);
    $stmt->execute();
    $stmt->close();
    header(header: 'Location: index.php');
    exit();
}

// Search for appointments
$searched_appointment = null;
if (isset($_POST['search_booking'])) {
    $search_name = $_POST['search_name'];
    $stmt = $conn->prepare(query: "SELECT * FROM bookings WHERE representative_name LIKE ?");
    if (!$stmt) {
        die('Prepare failed: ' . $conn->error);
    }
    $search_param = "%$search_name%";
    $stmt->bind_param(types: "s", var: &$search_param);
```

Figure 39: API Endpoints, Methods and Data Formats

How External Systems Interact with your Project

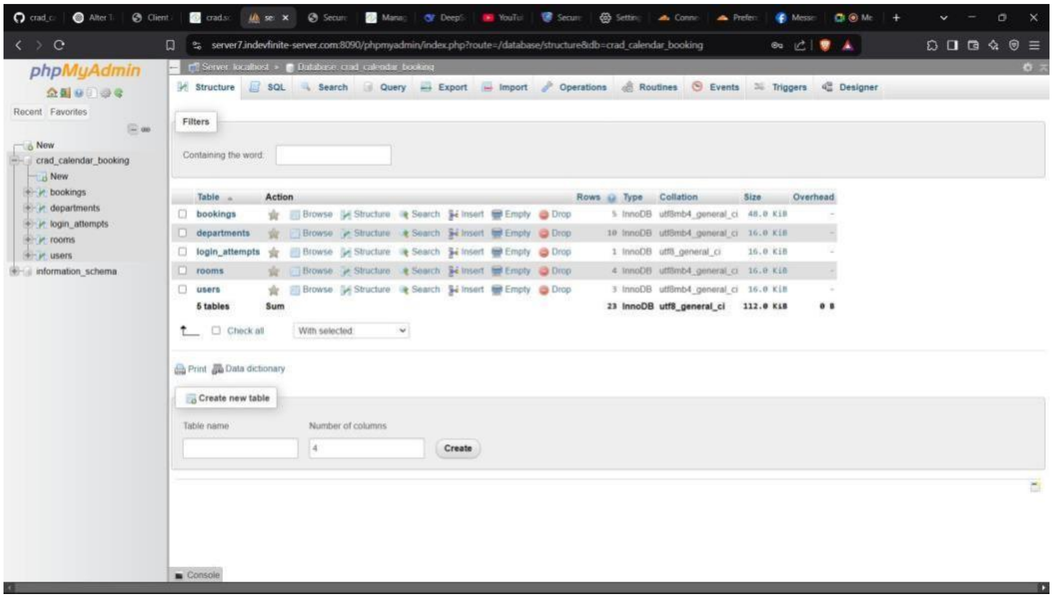
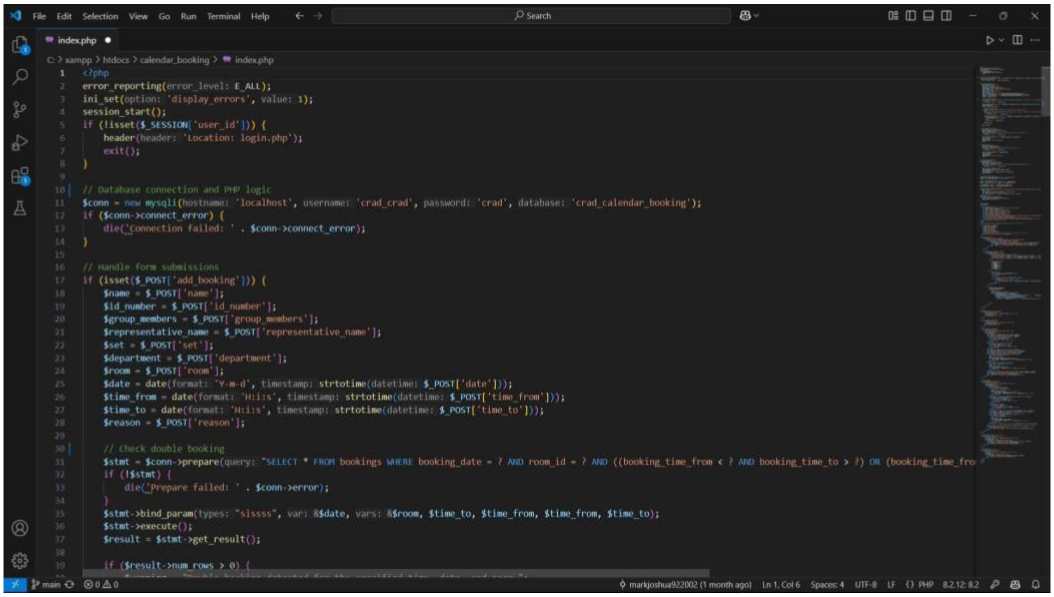


Table	Action							Rows	Type	Collation	Size	Overhead
bookings	★	Browse	Structure	Search	Insert	Empty	Drop	5	InnoDB	utf8mb4_general_ci	48.0 KiB	-
departments	★	Browse	Structure	Search	Insert	Empty	Drop	10	InnoDB	utf8mb4_general_ci	16.0 KiB	-
login_attempts	★	Browse	Structure	Search	Insert	Empty	Drop	1	InnoDB	utf8_general_ci	16.0 KiB	-
rooms	★	Browse	Structure	Search	Insert	Empty	Drop	4	InnoDB	utf8mb4_general_ci	16.0 KiB	-
users	★	Browse	Structure	Search	Insert	Empty	Drop	3	InnoDB	utf8mb4_general_ci	16.0 KiB	-
5 tables	Sum							23	InnoDB	utf8_general_ci	112.0 KiB	0 B



```php
<?php
error_reporting(error_level: E_ALL);
ini_set(option: 'display_errors', value: 1);
session_start();
if (!isset($_SESSION['user_id'])) {
    header(header: 'Location: login.php');
    exit();
}

// Database connection and PHP logic
$conn = new mysqli(hostname: 'localhost', username: 'crad_crad', password: 'crad', database: 'crad_calendar_booking');
if ($conn->connect_error) {
    die('Connection failed: ' . $conn->connect_error);
}

// Handle form submissions
if (isset($_POST['add_booking'])) {
    $name = $_POST['name'];
    $id_number = $_POST['id_number'];
    $group_members = $_POST['group_members'];
    $representative_name = $_POST['representative_name'];
    $set = $_POST['set'];
    $department = $_POST['department'];
    $room = $_POST['room'];
    $date = date(format: 'Y-m-d', timestamp: strtotime(datetime: $_POST['date']));
    $time_from = date(format: 'H:i:s', timestamp: strtotime(datetime: $_POST['time_from']));
    $time_to = date(format: 'H:i:s', timestamp: strtotime(datetime: $_POST['time_to']));
    $reason = $_POST['reason'];

    // Check double booking
    $stmt = $conn->prepare(query: "SELECT * FROM bookings WHERE booking_date = ? AND room_id = ? AND ((booking_time_from < ? AND booking_time_to > ?) OR (booking_time_fro
    if (!$stmt) {
        die('Prepare failed: ' . $conn->error);
    }
    $stmt->bind_param(types: "sissss", var: &$date, vars: &$room, $time_to, $time_from, $time_from, $time_to);
    $stmt->execute();
    $result = $stmt->get_result();

    if ($result->num_rows > 0) {
```

Figure 40: How External Systems Interact with your Project

User Documentation

The Center for Research and Development (CRAD) Defense Room Scheduling System is intuitive to use, ensuring a seamless process for the Center for Research and Development (CRAD) officer to schedule defense rooms. This guide is intended to assist the user in gaining the maximum benefit from the system, resolve common problems, and locate answers to frequently asked questions.

Instructions for System User

Logging into the System

Open the system using a web browser.

Enter assigned username and password.

Click the Login button to access the scheduling dashboard.

Scheduling a Defense Room

Navigate to the Book Schedule.

Enter the required booking details (e.g., department, research advisor's name, defense time and date, etc.).

Click Book Schedule to finalize the reservation.

Edit or Delete a Scheduled Defense Room

Navigate to the Calendar and select a date.

List of schedules will appear and select the preferred schedule to edit or delete.

Checking Past and Upcoming Schedules

Use the Calendar View to see past and upcoming defense room schedules.

Logging Out

Click on the Logout button to exit the system securely.

Troubleshooting and FAQs

Unable to log in due to a forgotten password.

Reach out to the system administrator for password recovery assistance.

The system is not loading correctly.

Ensure a stable internet connection.

Refresh the page or clear your browser's cache.

A room appears unavailable when attempting to book.

Confirm that the room has not been reserved for the selected time slot.

Check if scheduling restrictions apply.

Need to change a scheduled appointment.

Navigate to Calendar Overview and select the scheduled date, a list of schedules will appear and select the preferred schedule to edit.

Changes are not saving in the system.

Make sure all required fields are completed before submitting.

Try logging out and back in or restarting your browser.

How frequently is the system backed up?

Frequent backups are performed to prevent data loss. Contact the administrator for backup details.

This guide ensures smooth operation of the Center for Research and Development (CRAD) Defense Room Scheduling System, allowing the user to manage room scheduling effectively.

Known Issues and Troubleshooting

The Center for Research and Development (CRAD) Defense Room Scheduling System is made to be efficient and reliable. Nevertheless, there are some issues that may occur while using it. The following is a list of known issues, the status, troubleshooting, and technical support information.

List of Known Issues and Its Status

Intermittent System Lag – Occurs during peak usage hours.

Status: Under investigation.

Overlap Reservation Errors – Reservations might not be updated instantly.

Status: Repair in process.

Page Load Slowness – Caused by heavy server loads or old browser cache.

Status: Workarounds available in the meantime.

Session Expiration Errors – Users will be logged out suddenly after being inactive for a while.

Status: Watching for additional reports.

Delayed Data Updates – Room availability changes may not reflect immediately.

Status: Manual refresh every now and then recommended.

Troubleshooting Steps for Common Problems

System is slow or unresponsive.

Verify internet connection and reload page.

Clear browser cookies and cache.

Prevent multiple concurrent requests.

Cannot schedule a room even if available.

No conflicting reservations should be present.

Refresh the schedule view first before proceeding.

Attempt to choose a different time slot or date.

System logs out unexpectedly.

Log in once more and verify saved session settings.

Prevent idle periods of extended duration when using the system.

Schedule booking changes won't save.

Verify fields that must be completed before submitting.

Attempt logging out and back in prior to trying again.

Room schedule doesn't update in real time.

Refresh the system or clear browser cache.

Wait a few minutes for manual data refreshing.

Contact Information for Technical Support

For further information and inquiry contact via email:

Email: bcp-inquiry@bcp.edu.ph

Version Control and Source Code Repository

Description Of Version Control System

Git serves as the version control system for the project, facilitating collaboration among multiple developers concurrently. This distributed system tracks source code updates, maintains a history of changes, and enables organized collaboration among team members.

Repository Location and Access Details

https://github.com/markjoshua922002/crad_calendar_booking

Credentials:

SSH: git@github.com/markjoshua922002/crad_calendar_booking

HTTPS:
https://github.com/markjoshua922002/crad_calendar_booking

Repository Name: CRAD Calendar Booking

Hosting Service: GitHub

Branching And Merging Strategies

In development, a good branching and merging approach keeps things in order, reduces conflicts, and allows for easy collaboration.

Branching Strategy

The master branch is the ultimate, stable copy of the system and is only updated after extensive testing. The develop branch is the working copy, where all new functionality and fixes are merged prior to finalization.

To aid in development, more branches are created:

Feature branches are applied to add new functionality. Every feature has a dedicated branch.

Bugfix branches are created to address problems discovered in testing. These branches get merged to develop to make sure all fixes are adequately tested.

Release branches are created in the process of preparing a new system version. These branches enable final testing and minor tweaks before merging into main.

Merging Strategy

A developer makes a feature branch out of develop while implementing a new feature. Upon completion and testing of the feature, it gets merged back to develop.

When a bug is found, a bugfix branch is made from develop. The issue is then fixed, after which the branch is merged back into develop in order to retain stability.

When the project is about to have a new release, a release branch is made from develop. This branch is tested and fine-tuned for the final time. After approval, it is merged into main, which makes it the current stable version.

DevOps And Continuous Integration/Continuous Deployment (CICD)

Ci/cd Pipeline Setup and Configurations

The development team followed a structured CI/CD pipeline that guaranteed smooth development, testing, and deployment. The pipeline ensured code integration, testing, and deployment were automated, ensuring system stability.

Plan – The team developed an initial system plan and had in-person and online meetings utilizing Discord for chat, Messenger for reminders, and Google Docs for simultaneous document collaboration.

Version Control – GitHub was employed to keep the source code saved and organized and maintain version control, collaboration, and history of all the code changes.

Code – PHP was utilized to build the backend and HTML and CSS for structure and design on the frontend.

Build – The system was coded in Sublime Text, where code was written, organized, and debugged.

Test – XAMPP local testing was used to mimic server conditions prior to deployment.

Deploy – The application was deployed upon Indevfinite, a hosting and domain-enabled cloud platform.

Monitor – System performance and monitoring were tracked for the live system using Indevfinite error logs and performance analytics.

Feedback – System performance indicators and user feedback were monitored consistently, enabling constant iterative improvements as well as enhancement of the system.

Automation Scripts and Tools Used

To streamline operations, the team leveraged various tools for automation:

GitHub Actions for automating testing and deployment processes.

XAMPP for local testing before deployment.

Indevfinite's monitoring tools for tracking system errors and performance.

Deployment Strategies and Rollback Procedures

The system followed a structured deployment strategy to minimize downtime and ensure seamless updates.

Deployment Strategy

incremental Deployment – Updates were rolled out gradually to ensure stability and avoid disruptions.

Zero-Downtime Deployment – Deployment was designed to avoid service downtime, maintaining continuous availability.

Rollback Procedures

Version Control Rollback – GitHub kept older versions, and the team could roll back to a stable release if necessary.

Database Backup & Restore – Database backups were done before making any significant updates to avoid data loss during rollback.

Error Log Analysis – If there were errors, Indevfinite's error logs were looked at to help identify and rectify problems expediently.

Licensing And Open-Source Libraries

Information About Licenses for Software and Libraries Used

System development employed a blend of open-source and proprietary software solutions for optimum efficiency, security, and scalability. Open-source libraries and tools were selected according to the licensing terms to ensure compliance with industry standards.

PHP was used for backend development, being an open-source scripting language licensed under the PHP License. HTML and CSS were used on the frontend.

For local testing, the system utilized XAMPP, licensed under the GNU General Public License (GPL), which guarantees it is freely modifiable and redistributable. The version control of the system was through GitHub, where open collaboration is facilitated under terms of service by GitHub.

The deployment platform, Indevfinite, runs with a proprietary license, so its use and modifications are governed by the provider's terms of conditions.

Credits And Attributions for Open-source Components

Componet	Creator/Ddeveloper	Organization	Function	License	Open-Source Componen t s
PHP	Rasmus Lerdorf	The PHP Group	Backend development	PHP License	www.php.net

XAMPP	Kai ‘Oswald’ Seidler	Apache Friends	Local server setup	GNU GPL	www.apachefriends.org
GitHub	Tom Preston-Werner, Chris Wanstrath, PJ Hyett	GitHub, Inc.	Source code management	GitHub Terms of Service	www.github.com

Table 39: Credits and Attributions for Open-Source Components

Performance Metrics and Monitoring

Metrics Collected and Monitored

System Uptime and Downtime – Records the system availability to maintain low disruptions and reliability.

Response Time – Records how fast the system responds to user requests, guaranteeing efficient scheduling.

Error Rate – Tracks failed system requests and unexpected errors to aid in debugging and stability enhancement.

CPU and Memory Usage – Assesses resource usage on the Indevfinite cloud platform for optimal performance.

Database Query Performance – Evaluates MySQL query efficiency, allowing for the free flow of data retrieval and storage.

Traffic and Load Metrics – Monitors user activity for controlling system load and avoiding overload.

Scheduling Confirmation Rate – Tests successful scheduling of defense rooms for evaluating system performance.

Tools And Dashboards Used for Performance Analysis

Indevfinite Cloud Monitoring Tools – Offers real-time error logs, resource utilization data, and uptime reports.

PHP Debugging Tools – Utilized for examining backend performance and optimizing execution time.

MySQL Query Analyzer – Tracks and optimizes database query performance.

GitHub Actions for CI/CD Monitoring – Guarantees seamless code integration and deployment processes.

Actions Taken Based on Performance Data

System Optimization – Analysis of error logs and performance metrics to fine-tune PHP and MySQL queries.

Cloud Resource Scaling – Scaling server resources on Indevfinite to ensure stability during high usage.

Bug Fixes and Debugging – Finding and fixing problems impacting system reliability and performance.

Load Balancing Strategies – Balancing simultaneous scheduling requests to avoid system slowdown.

Database Indexing and Optimization – Minimizing query execution time and enhancing response rates.

Ongoing Deployment Tuning – Streamlining CI/CD pipelines according to performance feedback.