Faculty of Computer Science and Information Technology

eArena: UNIMAS COURT RESERVATION SYSTEM

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This project is submitted in partial fulfilment of the requirements for the degree of Bachelor of Computer Science with Honours

(Information Systems)

Faculty of Computer Science and Information Technology

UNIVERSITY MALAYSIA SARAWAK

2025

DECLARATION

I hereby declare that this project is my original work. I have not copied from any other student's work or from any other sources except where due reference or acknowledgement is not made explicitly in the text, nor has any part had been written for me by another person.

_____

(Mohamad Norriduan bin Norhizamudin) Date: 23 June 2025

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ABSTRACT

The project eArena: The UNIMAS Court Reservation System aims to modernize the sports court reservation process at University Malaysia Sarawak (UNIMAS) by providing an efficient online platform that addresses the limitations of the current manual booking system. Challenges such as scheduling conflicts, limited accessibility, and operational inefficiencies reduce user satisfaction and participation. By implementing a real-time booking system, eArena enables students and staff to conveniently create, modify, and manage court reservations anytime and from any location. The project employs the Waterfall development methodology to ensure a systematic approach through requirement analysis, design, implementation, and testing phases. Ultimately, eArena is expected to enhance user experience, optimize resource utilization, and encourage greater engagement in sports activities, aligning with UNIMAS's commitment to deliver quality services to its community.

Keywords: eArena, online booking, court reservation system, UNIMAS sport centre

ABSTRAK

Projek eArena: Sistem Tempahan Gelanggang UNIMAS bertujuan untuk memodenkan proses tempahan gelanggang sukan di University Malaysia Sarawak (UNIMAS) dengan menyediakan platform dalam talian yang cekap bagi mengatasi kekangan sistem tempahan manual semasa. Cabaran seperti konflik jadual, akses yang terhad, dan ketidakcekapan operasi mengurangkan kepuasan pengguna dan penyertaan dalam aktiviti sukan. Dengan melaksanakan sistem tempahan masa nyata, eArena membolehkan pelajar dan staf membuat, mengubah, dan mengurus tempahan gelanggang dengan mudah pada bila-bila masa dan dari mana-mana lokasi. Projek ini menggunakan model pembangunan Waterfall bagi memastikan pendekatan yang teratur melalui fasa pengumpulan keperluan, reka bentuk, pelaksanaan, dan ujian. Akhirnya, eArena dijangka dapat meningkatkan pengalaman pengguna, mengoptimumkan penggunaan sumber, dan menggalakkan penyertaan yang lebih tinggi dalam aktiviti sukan, sejajar dengan komitmen UNIMAS dalam menyediakan perkhidmatan berkualiti kepada komuniti university.

Kata Kunci: eArena, sistem tempahan dalam talian, sistem tempahan gelanggang, Pusat Sukan UNIMAS

CHAPTER 1: INTRODUCTION

1.1 Background

Managing its badminton court reservations is a major concern for University Malaysia Sarawak (UNIMAS) in the ever-changing world of higher education. The manual reservation system in use today is rife with inefficiencies, resulting in laborious procedures and a significant risk of mistakes. In addition to frustrating students and staff, this condition restricts accessibility because reservations must be made in person at the sports complex. Similar issues have been brought to light in other research, as Basir et al. (2018), which focused on the shortcomings of manual booking systems and the necessity of automation to increase user happiness and operational efficiency. Similarly, manual systems frequently result in mistakes, disagreements, and inefficiencies, especially when data entry is involved, as mentioned by Chavan et al. (2021), which emphasises the significance of switching to a computerised reservation system. The problem is made worse by the lack of a centralised system, which leads to scheduling conflicts and duplicate reservations that make the reservation process even more difficult.

The UNIMAS Court Reservation System, eArena concept is being offered to address the urgent demand for a better alternative. The purpose of this cutting-edge web platform is to make the booking process faster, simpler, and more effective for all users. By automating the reservation process and reducing the need for in-person visits, both staff and students will benefit from increased accessibility and convenience. Furthermore, the adoption of a real-time booking system is projected to prevent scheduling conflicts and dramatically reduce operational errors, improving the entire client experience.

The successful installation of the eArena system is expected to revolutionise the UNIMAS court reservation environment. In addition to addressing the immediate concerns with the present manual process, this project seeks to improve user happiness and resource utilisation. To foster a more engaged and active university community, it is planned that every user will be able to easily access and manage their court reservations via a specialised online platform.

1.2 Problem Statement

The UNIMAS Court Reservation System is currently facing severe issues as a result of

its manual reservation process. This system is plagued by inefficiencies that result in time-consuming procedures and a high rate of error, eventually frustrating users and diminishing their experience. Furthermore, the existing system's limited accessibility poses a difficulty, since both staff and students must physically visit the sports complex to make reservations, creating extra hurdles to participation.

Furthermore, the lack of a centralised booking system causes scheduling conflicts and double bookings, complicated the reservation process and contributing to consumer displeasure. These difficulties underscore the critical need for a fully automated online platform that may speed the court reservation process, improve accessibility, and reduce operational errors. By solving these essential issues, the UNIMAS Court Reservation System, eArena project hopes to provide a more efficient and user-friendly experience for all parties.

1.3 Objectives

The UNIMAS Court Reservation System, eArena project aims to develop an effective online platform that streamlines the badminton court reservation procedure for students and staff at University Malaysia Sarawak (UNIMAS). By creating this system, we hope to improve the user experience, reduce wait times, and eliminate the inefficiencies associated with the present manual reservation procedure.

i. To streamline the entire process and reduce operational errors by automating the reservation process by offering an online booking system that enables consumers to reserve courts without having to visit in person.

ii. To increase accessibility, the court reservation system should be made easily accessible to all staff and students by allowing users to make and modify reservations at any time and from any place.

iii. To eliminate scheduling conflicts by putting in place a real-time booking system that guarantees effective use of court resources and helps prevent duplicate bookings, thereby enhancing the general client experience.

By achieving these goals, the eArena project hopes to greatly improve UNIMAS's badminton court reservation experience, which is consistent with the university's dedication to

offering its community high-quality services.

1.4 Scope

The UNIMAS Court Reservation System, eArena project has a clear scope that focusses on improving the badminton court reservation experience for students and staff at University Malaysia Sarawak. This online platform's major geographic focus is the UNIMAS campus and it’s near surrounds, ensuring that the system is available to all users who want to schedule badminton courts in this area.

The project includes a comprehensive set of features aimed at streamlining the court reservation process. One of the most important features is the online booking system, which allows customers to reserve courts without the need for in-person visits, solving the inefficiencies of the current manual process. This system will also contain a real-time booking feature to help avoid scheduling conflicts and double bookings, hence considerably improving the overall user experience.

Additionally, the eArena initiative will prioritise user accessibility, allowing students and staff to make and alter appointments from any place at any time. The first development will prioritise web-based access, ensuring that the platform is compatible with a wide range of devices, which is consistent with the goal of increasing resource utilisation and improving the efficiency of court reservations. This strategic scope seeks to build a user-friendly environment that satisfies the demands of the UNIMAS community while also encouraging active involvement in sports activities.

1.5 Brief Methodology

A good technique for The UNIMAS Court Reservation System, eArena project would be the Waterfall model. The project's goals, which comprise distinct phases for concept, design, and implementation, are well-aligned with this methodical and sequential methodology. Previous studies, such the creation of the Sweet8Bakery Booking System (Basir et al., 2018), have revealed the Waterfall model's applicability for similar projects. This project successfully used the Waterfall technique to move from a manual booking procedure to an automated system. Every step of the process, from gathering requirements to implementation and testing,

was finished in detail, making the system more effective and user-friendly. Because it offers a clear framework to solve inefficiencies like limited accessibility and schedule conflicts while maintaining an orderly and systematic development process, the Waterfall model is a perfect fit for the eArena project.

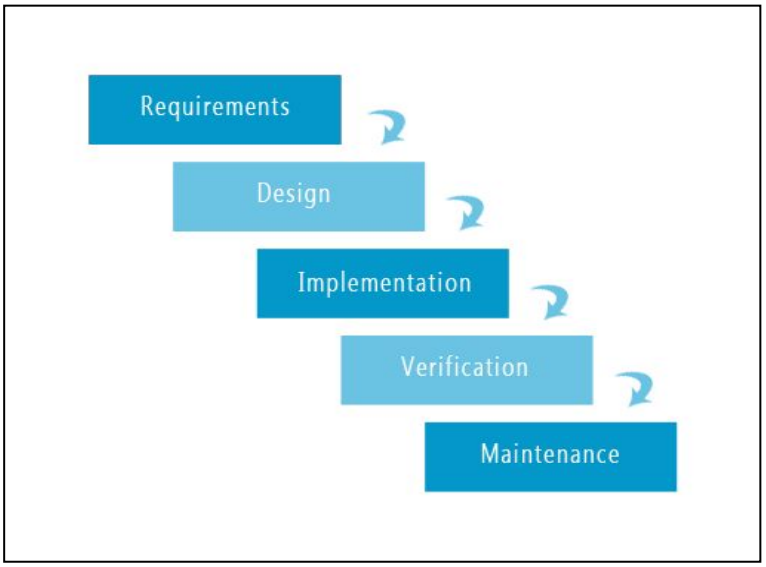


Figure 1.1: Waterfall Methodology (Oxagile, 2014)

As stated in the project description, the first phase, known as the requirements phase, will entail obtaining comprehensive requirements for the online reservation system with an emphasis on the necessity of removing inefficiencies from the current manual method. Inefficiency, restricted accessibility, and schedule conflicts are the issues that need to be addressed.

A thorough architectural plan for the eArena system will be developed in the following Design Phase, with a focus on user-friendly interfaces that make court reservations simple and real-time booking features that avoid duplicate bookings. The real implementation phase will come next, during which web development tools including Laravel, Alpine.js, Flowbite, Tailwind, Visual Studio Code, and Xampp will be used to create the online reservation system. The goal of this phase is to automate the reservation process so that people can book courts online without having to come in person.

Following creation, the eArena system will undergo extensive testing during the

Verification Phase to make sure it satisfies the specified requirements and operates as intended, especially with regard to avoiding scheduling conflicts and reducing operational errors. The system will then go through a maintenance phase, during which user input will be gathered and examined in order to develop data-driven enhancements that will guarantee the system keeps up with user demands. The eArena project will be developed in an organised fashion thanks to this scientific approach, which will finally result in a strong and effective court reservation system for UNIMAS.

1.6 Significance of Project

The eArena project at UNIMAS Court Reservation is very important to the university and its student and staff community. Through the implementation of an online reservation system, the project seeks to streamline the court booking procedure, improving user experience and efficiency. Important problems with the present manual reservation system, like inefficiency and restricted accessibility, are addressed by this upgrade.

A real-time booking system will also assist avoid scheduling conflicts and duplicate bookings, guaranteeing efficient use of available resources. This improves resource usage and reduces operational faults, giving users a more streamlined and dependable reservation experience. In the end, the eArena project will yield insightful data that can guide future modifications and enhancements, supporting the university's dedication to improving its offerings based on analytics and user input.

1.7 Project Schedule

Refer Appendix 1 for Gantt chart FYP 1 & 2.

Table 1.1: Project Schedule

Activities	Start Date	Finish Date	Duration
Submission of the Approved Brief Proposal	10 October 2024	20 October 2024	11 Days

Feedback and Comment from Reviewer/Examiner	21 October 2024	28 October 2024	8 Days
Submission of Full Proposal	29 October 2024	14 November 2024	17 Days
Submission of Chapter 1	15 November 2024	21 November 2024	7 Days
Submission of Chapter 2	22 November 2024	13 December 2024	22 Days
Submission of Chapter 3	14 December 2024	5 January 2025	23 Days
Submission of FYP 1 Final report & Paper for assessment	6 January 2025	17 January 2025	12 Days
Submission of the Proposed FYP Report, Title, and Ganth Chart.	18 January 2025	1 April 2025	74 Days
Submission of First Draft for Chapter 4	2 April 2025	15 May 2025	45 Days
Submission of First Draft for Chapter 5,6 and Abstract for Paper	16 May 2025	31 May 2025	16 Days
Submission of First Draft for FYP 2 Full Report & Paper	1 June 2025	10 June 2025	10 Days
Submission of Final Report(Word & Pdf), source code, installation kits, user manual, and Paper for Assessment	11 June 2025	23 June 2025	13 Days

1.8 Expected Outcome

The UNIMAS Court Reservation System, eArena program is anticipated to significantly enhance the entire experience for both staff and students at University Malaysia Sarawak (UNIMAS). The idea is expected to extend court bookings by automating the reservation process, making them more efficient and effective. In the end, this will reduce waiting times and increase customer happiness. It is anticipated that the implementation of a real-time booking system will reduce operational errors and scheduling conflicts, guaranteeing that courts are used to their full potential.

Additionally, by enabling users to make and change reservations at any time and from any location, the eArena system is anticipated to improve accessibility and encourage more participation in sporting events. This is consistent with research by Ghani et al. (2020), which showed that incorporating web-based reservation systems greatly boosts sports facilities' productivity and patron involvement. Additionally, by gathering and analysing user data, the system will produce insightful information that will help UNIMAS make data-driven decisions that will continuously enhance the reservation process.

All things considered, the eArena project's successful completion will probably show UNIMAS' dedication to raising student wellbeing and engagement, which will eventually improve the university's standing and attract more potential students.

1.9 Project Outline

Chapter 1 presents the project and discusses its background, problem description, objectives, methodology, scope, significance, project timetable, and expected outcomes. The problem statement section focusses on the inefficiencies and challenges of UNIMAS's current manual court reservation system. The objectives define the project's purpose and how the proposed eArena system would effectively handle these concerns. The methodology section explains how the Waterfall model was implemented to guarantee a systematic and structured approach throughout the project development process.

Chapter 2 investigates related works and evaluates comparable systems or approaches that are now available on the market. This chapter examines existing court reservation or booking systems, citing articles, journals, and conference papers. The evaluation covers the

technologies and operating platforms employed by these systems, emphasising their benefits and drawbacks. This chapter contributes to a thorough knowledge of the proposed eArena system by drawing comparisons with existing solutions.

Chapter 3 goes into the methods used to construct the eArena system, providing a full overview of the Waterfall process. This chapter describes the procedures taken to collect and analyse user needs, transforming them into actionable insights. Following the user requirement analysis, the chapter examines system design issues, with a focus on creating critical diagrams such as the Use Case Diagram, Sequence Diagram, and Activity Diagram. Furthermore, database design, including the Entity-Relationship Diagram and data normalisation, is emphasised to guarantee a strong and well-structured backend system.

Chapter 4 focuses on the implementation of the proposed eArena system. It starts with an overview of the implementation phase and the system's configuration including server installation and database setup. Along with comprehensive guidelines for customising the development environment, specifics on the installation process for technologies such Laravel, XAMPP, and Visual Studio Code are given. The chapter also addresses the application of system features, therefore illustrating the way the design is turned into a completely working tool.

Chapter 5 presents the testing phase of the project, where the functionality and performance of the eArena system are evaluated. It starts with a general review of the testing procedure and then lists the tested functionality. Functional testing guarantees that the system runs as expected, therefore verifying elements such user login, court booking, and viewing availability. To guarantee the system satisfies operational needs and user expectations, non-functional testing assesses performance, security, and usability. A synopsis of the test results points out areas of achievement and areas needing future development.

Chapter 6 concludes the report by summarizing the project's accomplishments, limitations, and potential for future development. It begins with an overview, followed by an evaluation of the extent to which project objectives were achieved. The chapter also discusses the challenges and limitations faced during development. Recommendations for future work are provided, suggesting improvements and extensions to enhance the system’s performance and user experience. Finally, a conclusion is presented to reflect on the significance and impact of the eArena system within the UNIMAS community.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter digs into court reservation and booking services, laying the groundwork for the construction of the eArena system. It reveals the strengths and shortcomings of present technology, as well as potential for innovation, by reviewing existing research, papers, and practical solutions. This research is critical for creating a system that not only covers holes in current approaches but also expands on successful strategies.

The evaluation focusses on the technological foundations, features, and user experiences of associated systems, including web-based reservation systems and automated booking platforms. The chapter shows how eArena intends to enhance current methods by contrasting these systems with the suggested eArena system. Addressing inefficiencies, improving accessibility, and adding real-time booking tools are its main goals.

Finally, this chapter establishes the foundation for developing a state-of-the-art solution tailored to University Malaysia Sarawak's (UNIMAS) unique requirements.

2.2 Review of similar websites

2.2.1 Manual System

The typical manual booking approach for court bookings has numerous serious shortcomings that impede productivity and customer pleasure. To make a reservation using this method, consumers must physically visit the court or sports facility. This frequently entails standing in queue to interact with workers, who record bookings in a real logbook or on paper. As a result, users must check the availability of courts in person, which might cause delays, particularly at peak hours when many people are attempting to book courts at once.

The lack of a real-time scheduling system is one of the main problems with this manual technique. Users could come at the venue and discover that the court they wanted to reserve is already booked if there are no real-time updates. Users who may have scheduled their schedules around the court's availability become frustrated in addition to wasting time.

Some users even turn to unofficial booking techniques, such messages court supervisors or administrators via WhatsApp. Although there could be some flexibility in this approach,

there are a number of possible issues. For example, it is easy for misunderstanding to happen, which might result in mistakes like multiple bookings or inaccurate information regarding court availability. The reservation procedure is made more difficult by the fact that these unofficial solutions lack a centralised structure, which prevents availability updates from being synchronised.

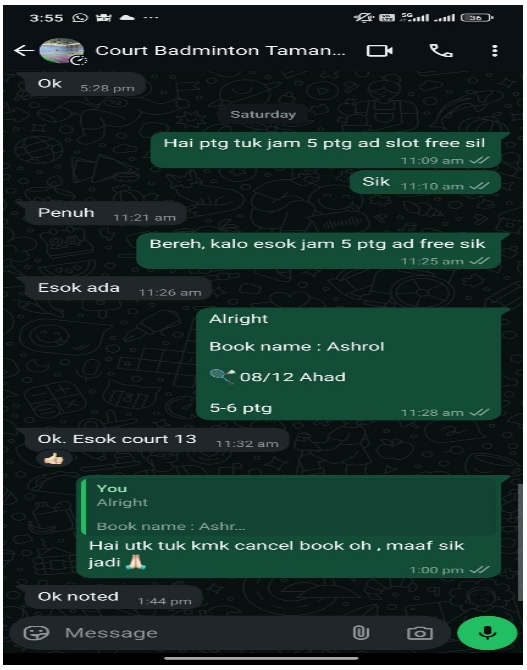


Figure 2.1: Reservation via Whatsapp

2.2.1.1 Strengths of Manual System

- Flexibility for users to interact directly with staff, enabling personalized assistance.
- There is no need for internet access, ensuring offline usability.

2.2.1.2 Weaknesses of Manual System

- Inefficiency due to long queues, especially during peak hours.
- No real-time updates, causing booking conflicts or unavailable slots upon arrival.
- High risk of errors due to paper-based or logbook recordings.

- Lacks centralization, leading to miscommunication or double bookings via informal channels like WhatsApp.

2.2.2 Current System

A sports reservation platform called E-ARENA was created in 2024 specifically for the community of University Malaysia Sarawak (UNIMAS) after I proposed the topic for my Final Year Project. Accessible through *https://arena.ia.unimas.my/*, the portal, intended solely for students and staff, mandates users to authenticate using their university credentials, therefore guaranteeing safe and limited access to authorised personnel. The site offers three options to users who have logged in scheduling events like competitions or group activities, scheduling for individual usage, and viewing a calendar. The calendar functionality is presently inoperative and unavailable for user use.

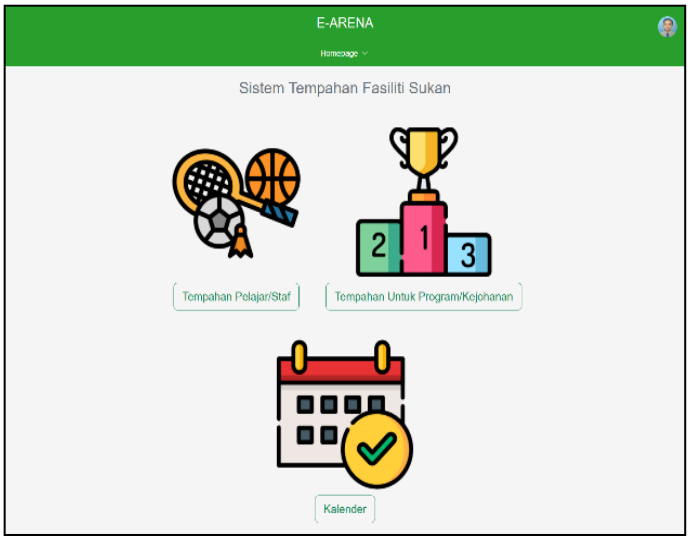


Figure 2.2: Homepage

Users choose between "events" or "personal use" for bookings, after completing a comprehensive reservation form. This form necessitates essential facts, such as the facility type, date, and time, to ensure comprehensive information is collected for efficient processing. Upon submission, reservations are forwarded to a system administrator for approval. Users may only utilise the reserved facilities following getting administrative confirmation. This approval method mitigates schedule disputes and guarantees efficient resource management.

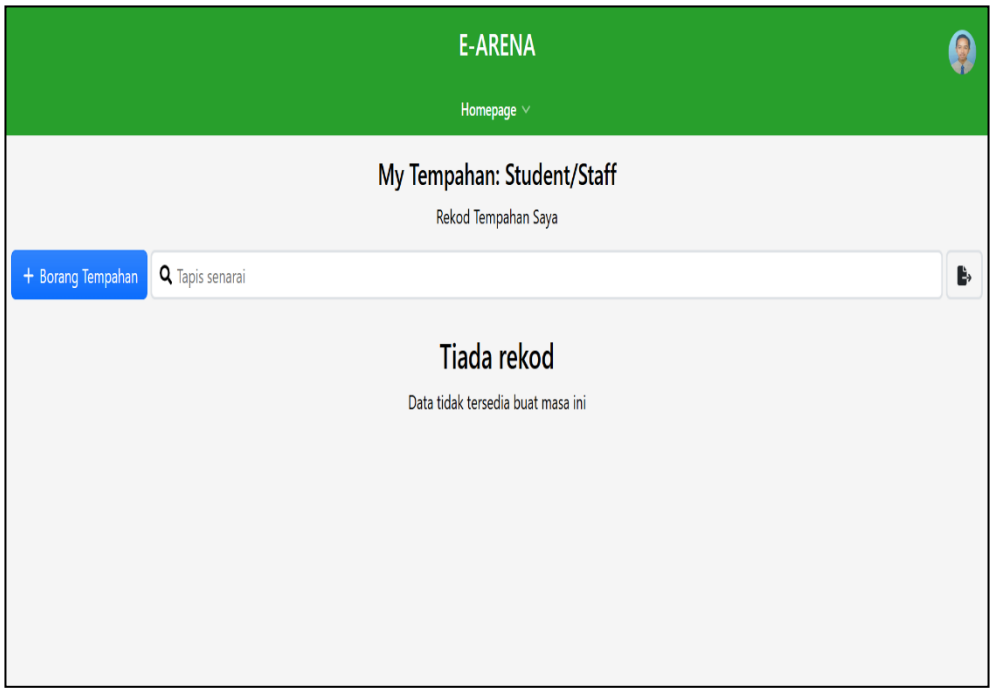


Figure 2.3: Records Section

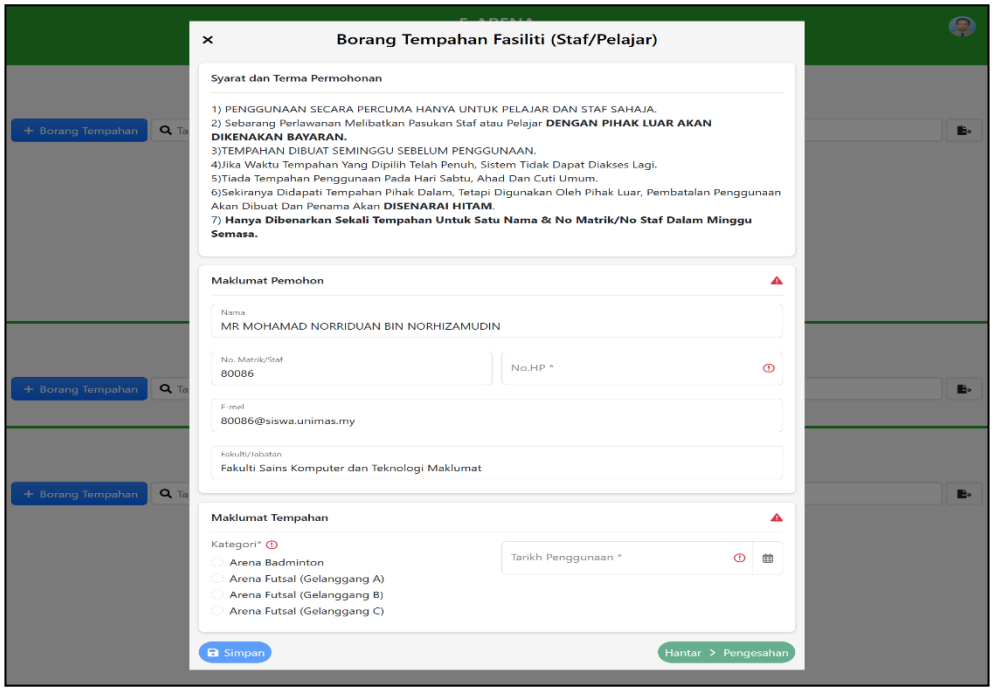


Figure 2.4: Booking Section

The system also includes a record-keeping feature, allowing users to view their past reservations. This functionality helps users track their booking history and simplifies the rebooking of frequently used facilities. Users should definitely log off of their accounts following their sessions to guarantee account security. One can accomplish this via the "Profile" or "Logout" part of the platform. Ignoring to log off might cause the session to remain alive, therefore posing a major security concern particularly on public or shared devices. An active session might perhaps provide illegal access to private or delicate data. Just by signing off, people may help to better defend their accounts and data.

2.2.2.1 Strengths of Current System

- Accessible exclusively to authorized UNIMAS students and staff, ensuring secure usage.
- Streamlined process with detailed reservation forms for clear communication of requirements.
- Includes a record-keeping feature for tracking and rebooking purposes.
- Automatically fills personal information, saving time for users.
- Simplifies booking through an intuitive and user-friendly interface.
- Reduces physical visits for reservations, improving convenience.

2.2.2.2 Weaknesses of Current System

- Lacks offline accessibility for users without stable internet.

- The calendar feature is non-functional, reducing booking efficiency.
- Manual approval by administrators may delay confirmation.
- Limited interface design compared to modern platforms, reducing user appeal.
- Lack of dual-language support for wider accessibility.
- Security risks from sessions remain active if users forget to log out.

2.2.3 e-Arena System

University Malaysia Terengganu (UMT) implemented the e-Arena sports booking system to make it easier for university personnel, including staff and students. Accessible through *https://mynemo.umt.edu.my/*, to reserve sports facilities such futsal and badminton courts. The method solves the problems with manual bookings, which frequently need for in-person attendance and make it challenging to verify the courts' availability. Through an easy-to-use platform, e-Arena allows consumers to quickly book reservations online.

The MyNemo website, the official gateway for UMT employees and students, is smoothly integrated with the system. Users must enter the e-Arena system, go to the support tab, and connect into their MyNemo accounts in order to make a reservation. To guarantee appropriate and secure use of the facilities, users must read and accept a set of guidelines before continuing.

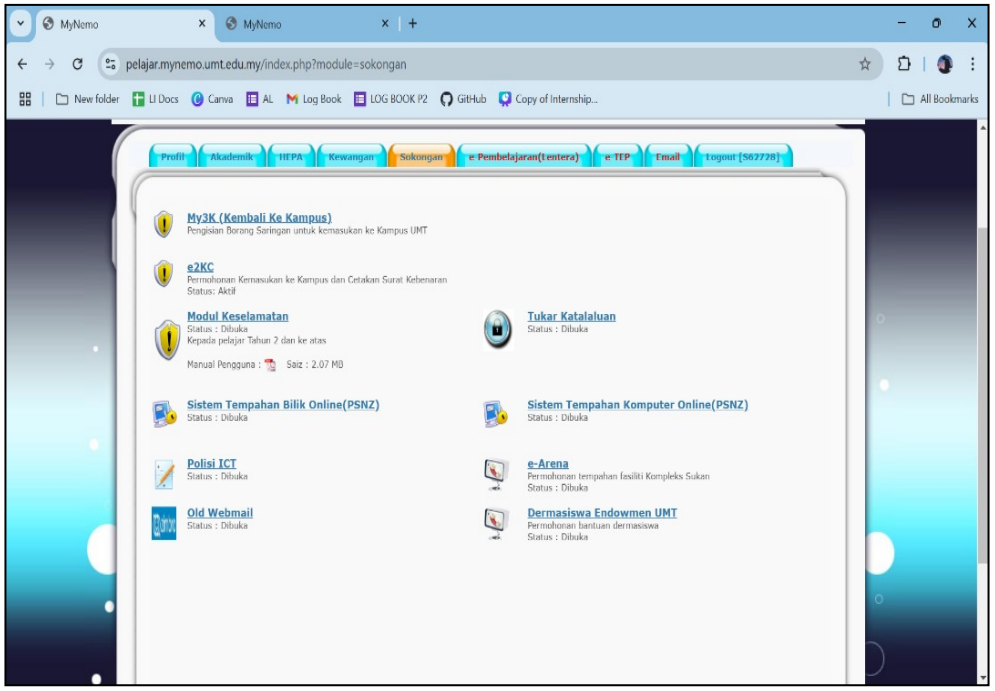


Figure 2.5: My Nemo Website

The reservation procedure is uncomplicated and effective. Users designate the sport and venue, for instance, Badminton Court 1, and select their chosen day and hour, ensuring it is at least seven days in advance. Personal information such as name and student ID is automatically entered by the system due to its connection with the user's MyNemo account. Upon submission of the booking, users must await administrative approval. Upon approval,

individuals may utilise the facilities at the designated time.

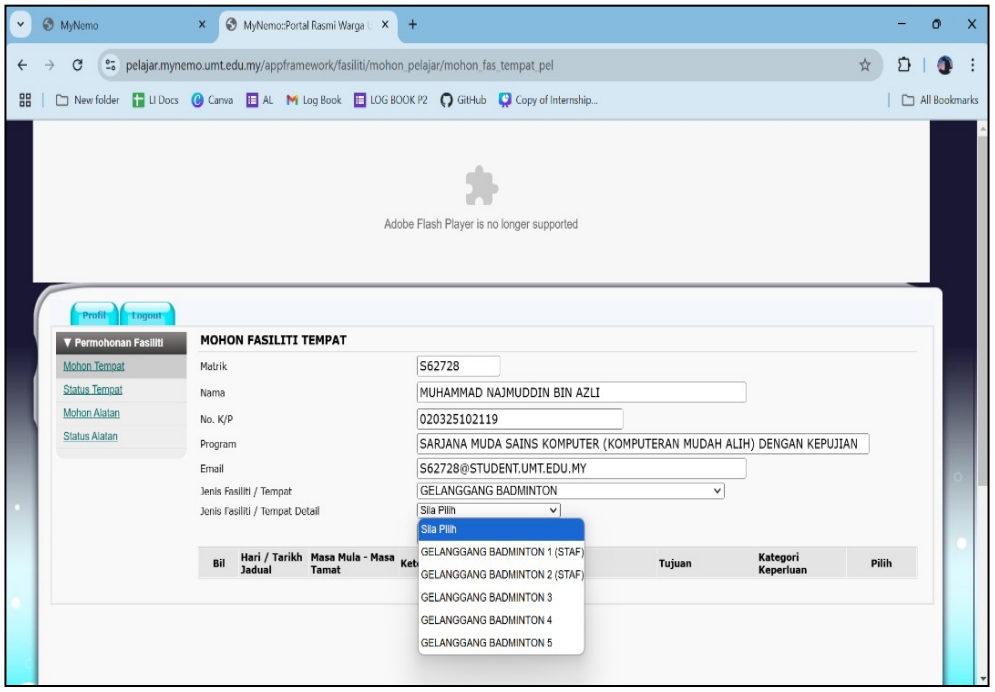


Figure 2. 6: UMT e-Arena Booking section

This approach offers significant advantages, including time efficiency and the removal of the necessity for physical presence to make reservations or verify availability. Furthermore, customers circumvent lengthy waits, and the system guarantees that only accessible courts are reservable, hence minimising the likelihood of scheduling conflicts.

2.2.3.1 Strengths of e-Arena System

- Accessible exclusively to UMT students and staff through secure university credentials.
- Simplifies booking through an intuitive and user-friendly interface.
- Automatically fills personal information, saving time for users.
- Eliminates the need for physical presence at the venue for bookings.

2.2.3.2 Weaknesses of e-Arena System

- Lacks offline accessibility for users without stable internet.
- Manual approval by administrators may delay confirmation.

- Limited interface design compared to modern platforms, reducing user appeal.
- Lack of dual-language support for wider accessibility.
- No calendar feature

2.2.4 STARS System

The Sistem *Tempahan Alatan dan Ruang Sukan (STARS)* is a digital platform built by University Tun Hussein Onn Malaysia (UTHM) to expedite the reservation of sports equipment and facilities, such as courts for badminton and futsal. Accessible through *https://stars.uthm.edu.my*, the system offers a transparent and effective approach for students and staff to manage their bookings. The homepage has a calendar that displays all current reservations, allowing users to verify court availability at a glance. This tool lets users to check which days and hours are still open for booking, allowing them to plan their activities without needing to log in as shown at figure 2.7.

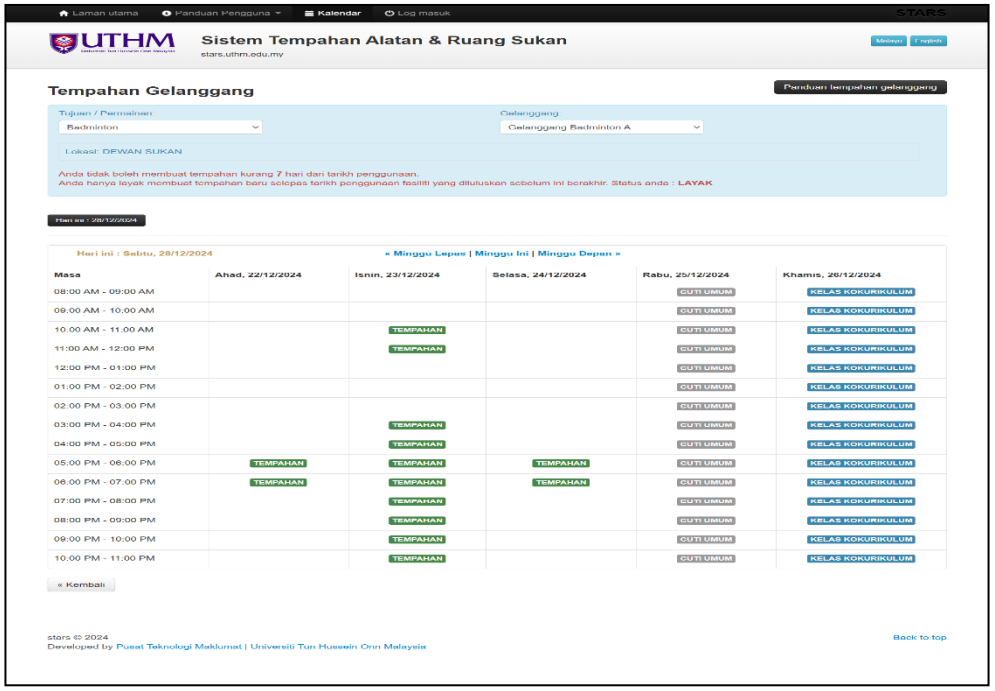


Figure 2.7: STARS Homepage before login

To proceed with a booking, customers must log in using their UTHM credentials linked to their university accounts. This login method guarantees that only approved students and staff may use the site, guaranteeing fairness and security. Once logged in, users are brought to their

dashboard, which contains a profile area, a booking menu for making appointments, and a list of their past and current bookings. The list area also allows users to check the status of their bookings, including whether they have been accepted. However, the user profile displays a random ID made up of letters and numbers instead of the individual's name, which can be confusing and impersonal. Improving this function would increase the user experience.

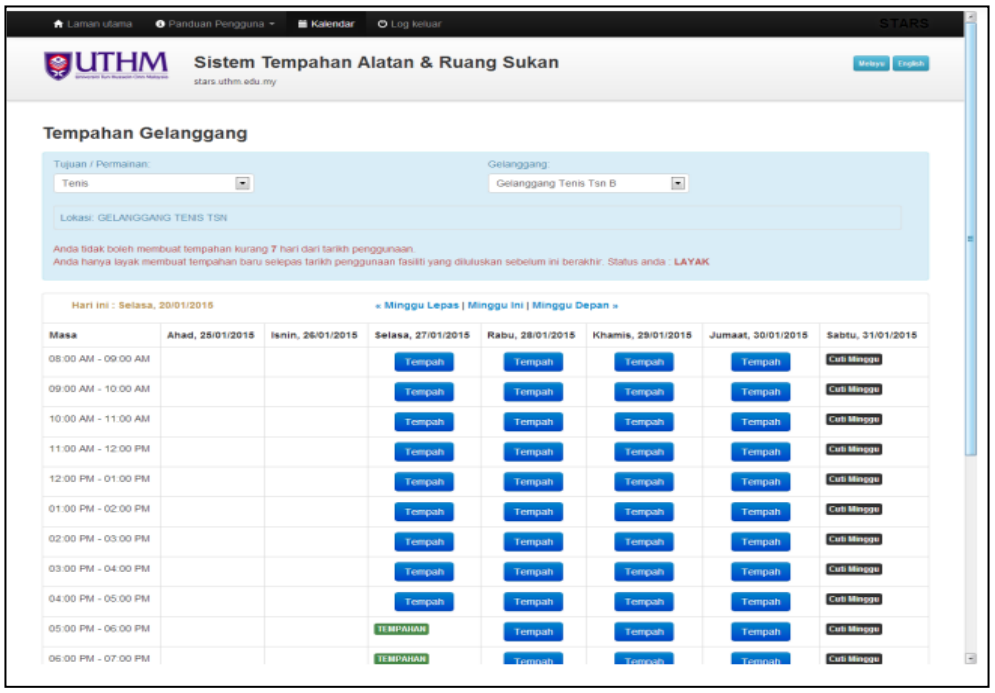


Figure 2.8: Choose available date and time

The booking procedure is easy and user-friendly. To pick a date and time, users just refer to the calendar presented in the system. If a date and time are available, customers can proceed to make a reservation, as the system only enables bookings for slots that are not now reserved as shown in Figure 2.8. This removes any uncertainty and guarantees that users can immediately discover and pick available times for their activity. After selecting the desired day and time, customers complete the booking form by picking the type of sport and the individual court they wish to rent. Bookings must be made at least seven days in advance to guarantee efficient scheduling and resource management.

Once the booking is submitted, users may follow its status in the list area of their dashboard. If the university cancels a booking due to official usage of the facilities, users are notified via email, and the status is updated in the system.

Figure 2.9: STARS Homepage after login

Despite its numerous virtues, the STARS system has a few limitations. Firstly, the user profile displays a random ID instead of the user's name, which might be confusing and impersonal for users monitoring their bookings. Secondly, the system gives a button to switch between Malay and English languages, but this functionality does not operate when selected, which may annoy users who like to browse the system in their preferred language. Addressing these concerns will considerably increase the system's usability and overall user experience. Refer Figure 2.9

Overall, the Sistem Tempahan Alatan dan Ruang Sukan (STARS) is a well-designed platform that streamlines sports facility and equipment bookings for the UTHM community. Its visible calendar display, fast booking procedure, and secure login mechanism make it an efficient and user-friendly option. Resolving the highlighted flaws will significantly improve the system's functioning and user happiness.

2.2.4.1 Strengths of STARS System

- Accessible exclusively to UTHM students and staff through secure university credentials.

- Displays a visual calendar of current reservations, ensuring clear visibility

of available slots.

- Allows users to check availability without logging in, enhancing convenience.
- Automatically fills personal information, saving time for users.
- Eliminates the need for physical presence at the venue for bookings.
- Simplifies booking through an intuitive and user-friendly interface.

2.2.4.2 Weaknesses of STARS System

- Displays impersonal random IDs instead of usernames in profiles, reducing user-friendliness.
- The dual-language toggle option is non-functional, causing inconvenience.
- Lacks offline accessibility for users without stable internet.
- Manual approval by administrators may delay confirmation.

2.2.5 e-Tempahan System

The e-Tempahan sport booking system, supplied by Perbadanan Putrajaya, is a digital platform for renting sport facilities in Putrajaya. Accessible through *https://spt.ppj.gov.my/sport*, the system streamlines the booking procedure for sports aficionados by giving a user-friendly interface and extensive functionality. Without logging in, users may browse the available sporting facilities in various regions within Putrajaya. By selecting the desired area and kind of sport, customers may browse a list of available courts and their details, including the number of visitors or bookings. This function allows potential customers to measure the popularity of each facility, enabling them to make educated decisions regarding their appointments.

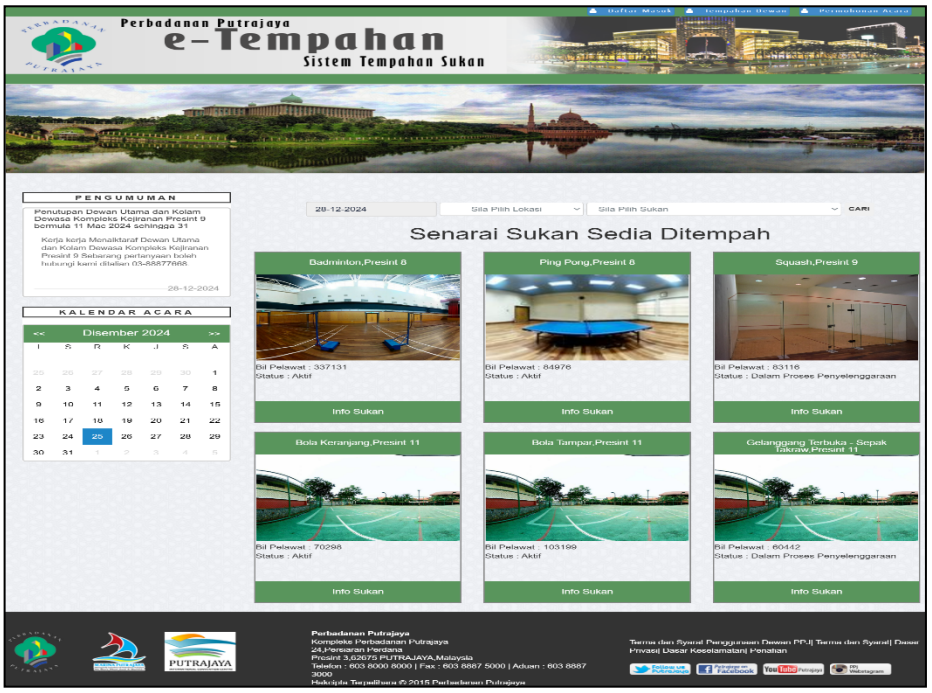


Figure 2.10: e-Tempahan Homepage

To proceed with a booking, users must log in or establish an account. This criterion guarantees that the system can auto-fill personal information throughout the booking process, saving time and reducing data entry mistakes. Once logged in, members may pick their chosen location and sport. The system will display just the sports and facilities available at the given location. Each facility's state is displayed clearly: “active” means that the court is open for booking, while other statuses signal that it cannot be utilised at the present.

After selecting a facility, visitors may click on the "Info Sukan" button to discover further facts about the court, including its price rates, user ratings, and a virtual tour in 360° format. This lets users judge the appropriateness of the facility. If satisfied, they can proceed by pressing the "Teruskan Tempahan" button. Users are then requested to choose their chosen day and time from the available slots. The technology automatically filters out unavailable slots, ensuring only open hours are visible.

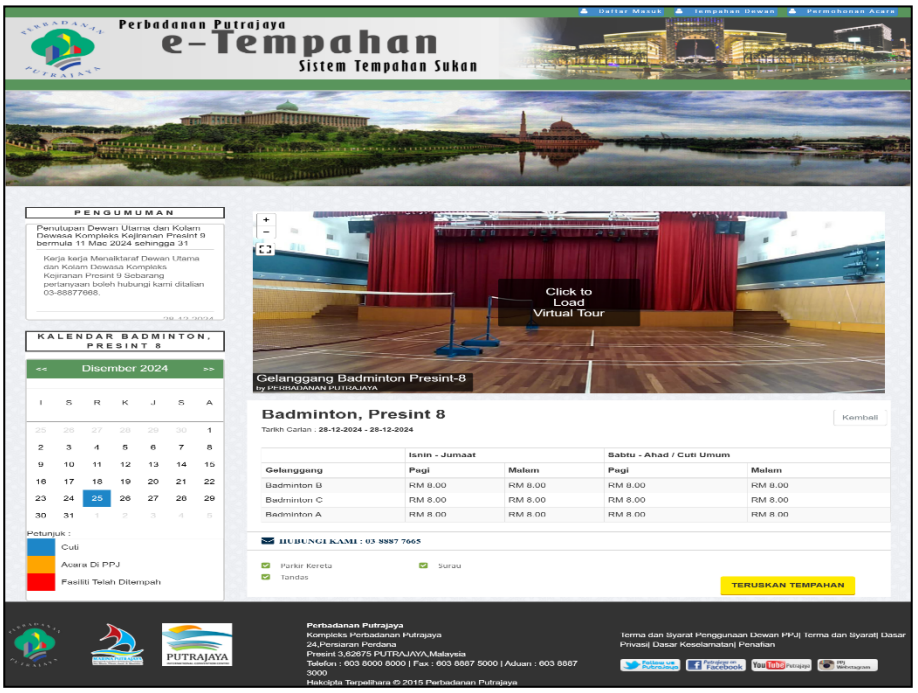


Figure 2.11: e-Tempahan price rates and virtual tour

The booking procedure comprises numerous verification processes. After picking a slot and completing the reservation form, users must confirm their booking and agree to the terms of use. For paid amenities, customers can proceed to online payment straight through the system. Payment is securely completed using FPX, and consumers are directed through the transaction with explicit instructions. Successful bookings are confirmed by email, and consumers can print their receipts for reference. In case of failed payments, users are warned, and they must retry to finish the reservation.

The system also has a "Tempahan Saya" component, where users may browse their booking history and check the status of existing bookings. Clicking on the booking number offers full information about each reservation, making it easy to track and manage.

The e-Tempahan system is a complete platform for reserving sports facilities in Putrajaya, featuring features such as facility ratings, availability status, virtual tours, and integrated payment choices. By meeting the demands of consumers through straightforward design and transparent processes, it offers a flawless booking experience. However, its dependency on internet access for all tasks may be a hindrance for certain users. Improving offline capabilities might further boost the system’s usefulness.

2.2.5.1 Strengths of e-Tempahan System

- Provides a user-friendly interface with features like facility ratings and virtual tours.
- Displays real-time availability and facility status for better decision-making.
- Supports integrated payment options (FPX) for seamless transactions.
- Allows non-logged-in users to browse facilities, improving transparency.
- Enables users to check their booking history and statuses in detail.
- Eliminates the need for physical presence at the venue for bookings.

2.2.5.2 Weaknesses of e-Tempahan System

- System complexity might deter less tech-savvy users.
- Lacks offline accessibility for users without stable internet.
- Manual approval by administrators may delay confirmation.
- No Dual Language

2.2.6 Comparative Analysis

Table 2.1: Comparison of features between existing system and proposed system

System / Features	**Similar Existing System**				***Current System (E)***	***Proposed System (F)***
	Manual System (A)	***e-Arena System (B)***	***STARS System (C)***	***e-Tempahan System (D)***		
User Profile	No	Yes	Yes	Yes	Yes	Yes
Accessibility	Physical	Requires UMT credentials	Requires UTHM credentials	Open to the public	Requires UNIMAS credentials	Requires UNIMAS credentials
Booking Calendar	Not Applicable	No	Yes	Yes	No	Yes

Interface Design	None	Basic	User Friendly	User Friendly, Modern design	User Friendly	User Friendly, Modern design with Flowbite
Dwi-language	No	No	Yes, but not function	No	No	Yes
Report Section	No	No	No	No	No	Yes
Session Timeout	No	Not Sure	Not sure	Yes	No	Yes

Table 2.1 shows the Proposed system together with a thorough comparison of the characteristics provided by many systems, including the Manual System, e-Arena System, STARS System, e-Tempahan System, and Current Unimas e-Arena System. System A relates to the Manual System for clarity; System B is the e-Arena System; System C is the STARS System; System D is the e-Tempahan System, System E is the Current UNIMAS e-Arena System and System F matches the proposed eArena system. Every aspect is thoroughly examined to highlight its value and explain how the suggested eArena system addresses the flaws he the current system.

i. User Profile

The user profile feature in the proposed eArena system is the basis of its design, offering a highly personalized and efficient experience for UNIMAS students and staff. Each user can create a specific profile that includes important details such as their name and contact information including university information such as matric number and email. Beyond the basic attributes, the user profile integrates a comprehensive booking history, allowing users to easily view past bookings and manage future bookings. Unlike system A, which has no tracking capabilities, or existing digital platforms such as systems B and C that offer limited profile functionality, the proposed eArena system provides an intuitive dashboard to seamlessly manage bookings. User profiles ensure that users stay informed about their bookings and activities centrally via email. By combining convenience, personalization and accountability, user profiles in eArena significantly enhance the user experience and differentiate it from the previously mentioned existing systems.

ii. Accessibility

The proposed eArena system promotes accessibility by enabling users to make and manage court bookings online, minimising the need for actual visits to the sports complex. Unlike System A, which needs in-person booking and preference, eArena streamlines the procedure, assuring consumers may use it remotely at any time. It is adaptable across numerous platforms, including PCs, laptops, tablets, and smartphones, giving a user-friendly experience regardless of the technology used by students and staff. Using safe UNIMAS credentials ensures a customised and safe environment while restricting access to authorised persons, thereby verifying authenticity. The eArena system is comparable to Systems B, C, and E in terms of its digital character, allow online booking only for their respective university communities and availability. However, it varies from System D by giving public access, where users just need to register in order to utilise the system. This inclusive strategy provides a bigger user base while preserving the essential security safeguards.

iii. Booking Calendar

The eArena system features a booking calendar function, which gives users with a straightforward and easy method to view court availability. This functionality is vital for preventing scheduling conflicts and streamlining the reservation process. The calendar displays real-time availability, allowing users to know which slots are open before making a reservation. This reduces the uncertainty and irritation commonly associated with manual procedures and less capable digital platforms.

The booking calendar is meant to show only open slots, ensuring that customers cannot attempt to book already-occupied hours. By adding this capability, the system corresponds with the booking capabilities of the System C and the System D, which both contain graphic calendars for effective scheduling. Unlike systems B and E, which lack a working booking calendar, the proposed eArena system streamlines the user experience, making it easier for students and staff to schedule and confirm bookings. This feature promotes transparency and efficiency, contributing to a more streamlined and user-friendly reservation process.

iv. Interface Design

The proposed eArena system has a user-friendly interface with a modern design that increases the overall user experience. Inspired by current design ideas, the platform combines clean layouts, straightforward navigation, and visually attractive features to make interactions simple and efficient. The interface is optimized to be accessible on many platforms, guaranteeing that users can browse the system pleasantly, whether on a desktop or mobile device.

This design style corresponds closely with the System D, which likewise contains a modernised user-friendly interface. Unlike simpler or less visually attractive designs featured in systems B, C and E, the eArena system promotes usability and aesthetic appeal to suit to the demands of UNIMAS students and staff. This emphasis on easy functionality lessens learning curves and reduces the possibility of errors during the booking process, making it easier for users to reserve courts swiftly and confidently.

v. Dwi-Language

The planned eArena system features support for a dual-language (Dwi-Language) interface, offering both English and Malay as selectable languages. This feature guarantees that users may engage with the system in their own language, encouraging inclusion and responding to the different linguistic demands of the UNIMAS community. The dual-language feature promotes accessibility, particularly for users who may be more comfortable browsing the site in their native language.

This functionality parallels the design purpose of the System C, which likewise gives a dual-language option. However, unlike system C, where the language toggle option is non-operational, the proposed eArena system assures that the dual-language feature functions effortlessly. This dedication to functionality makes the eArena system a more stable and user-friendly platform, thus boosting the booking experience for all users.

vi. Report Section

The planned eArena system offers a report area, enabling users to submit feedback or report concerns about the amenities. This tool allows students and staff to connect directly with facility management regarding damaged equipment, maintenance problems, or recommendations for improvement. Users may send extensive reports that may include descriptions, dates, and even images of the problem.

This proactive strategy ensures that facility managers are instantly aware of difficulties, enabling speedier reactions and timely fixes. By addressing user comments, the report section aids to preserving the quality and safety of sporting facilities while developing a feeling of accountability and continual development.

Unlike the preceding systems (A, B, C, D, and E), which lack this feature, the eArena system distinguishes out by allowing users to engage in the care and improvement of facilities. This functionality not only enhances customer happiness but also helps facility managers prioritize renovations and repairs, guaranteeing a better overall experience for the UNIMAS community.

vii. Session Timeout

The proposed eArena system contains a session timeout function to boost security, especially for users accessing the platform on public or shared devices. This feature guarantees that idle sessions are automatically logged out after a set time of inactivity. Additionally, users may manually log out using the "Profile" or "Logout" parts of the site to stop their sessions safely.

This capability tackles the crucial issue of session persistence, as emphasised in System E, where sessions may stay active if users forgot to log out. An unattended session might possibly expose sensitive or private user data to unwanted access. By adopting automated session termination, the eArena system mitigates these security vulnerabilities, guaranteeing that user accounts and data are better safeguarded.

This functionality highlights the eArena system’s dedication to ensuring the privacy and security of its users while providing a smooth and user-friendly experience. It not only builds confidence but also conforms to best practices in current online systems, offering a safe environment for UNIMAS students and staff.

2.3 Review of Tools and Related Technologies

2.3.1 Visual Studio Code

Visual Studio Code (VS Code) is a popular code editor created by Microsoft, recognised for its versatility and comprehensive features, rendering it suitable for web development. It accommodates many programming languages, including as HTML, CSS, JavaScript, and Python, which is crucial for developers engaged in diverse web technologies. VS Code's principal features encompass IntelliSense for intelligent code completion, an integrated terminal for a streamlined workflow, robust debugging functionalities, and an extensive extension marketplace that augments the programming experience (Microsoft, 2016). Its lightweight design enhances efficiency, while its open-source nature and cost-free availability guarantee accessibility for all users.

2.3.2 Laravel

Laravel is a very efficient PHP framework that streamlines the development of web applications. It adheres to the prevalent MVC (Model-View-Controller) architectural pattern and is founded on the resilient Symfony framework, providing developers with a formidable toolkit for constructing scalable and maintainable applications. Laravel's modular package structure enables developers to augment their applications with additional modules, hence increasing flexibility. Laravel expedites development by reusing components from different frameworks, while maintaining the application's security and functionality (Subecz, 2021). Its attributes, including support for various databases, an efficient routing engine, and integrated tools for web application development, render it an optimal selection for contemporary online applications. The scalability and efficiency in design of Laravel enhance its attractiveness. Furthermore, as an open-source framework licensed under MIT, Laravel is available to developers globally, enhancing its increasing popularity and community backing.

2.3.3 Tailwind & Flowbite

Tailwind CSS is an outstanding choice for web development due to its utility-first approach, enabling developers to rapidly construct customised user interfaces with considerable flexibility. Unlike traditional CSS frameworks that provide pre-built components, Tailwind allows developers to create designs by directly applying utility classes to HTML elements, leading to more efficient and scalable development. This technique expedites website development while offering complete control over layout and style, guaranteeing that the final product aligns with the project's specific objectives. Furthermore, Tailwind's intrinsic

responsiveness and mobile-first design principles make it an ideal choice for creating websites that provide a consistent user experience across various devices and screen sizes. The flexibility to customise Tailwind through its configuration file and the optimisation of redundant styles with tools like PurgeCSS improve efficiency, making it a highly efficient framework for modern online applications. To enhance development efficiency, Flowbite, a component library based on Tailwind, offers pre-designed UI components such as modals, navigation bars, and buttons, all stylised with Tailwind's utility classes. This enables developers to expedite the development of responsive, uniform, and customisable web interfaces, conserving time while preserving complete design authority (Azhariyah & Muhammad Mukhlis, 2024).

2.3.4 XAMPP

XAMPP is a free and open-source software package that offers a complete local server environment for web development. It encompasses Apache, a popular web server; MySQL, a relational database management system for data storage; PHP, a server-side scripting language; and Perl, a programming language. XAMPP is built to be cross-platform, functioning on Windows, macOS, and Linux, enabling developers to effortlessly establish a local server for testing and developing websites prior to deployment. The package streamlines the development process by offering all essential tools in a single bundle, featuring phpMyAdmin for managing MySQL databases. XAMPP serves as an excellent tool for learning web development, testing applications locally, and constructing projects within a controlled environment, eliminating the need for a live server (Joshi et al., 2022).

2.3.5 Alpine.js

Alpine.js is a streamlined, efficient JavaScript framework crafted to enrich HTML with reactive and declarative capabilities. It enables developers to incorporate interactivity into a webpage through straightforward attributes like x-data for state management and x-on for event handling. Alpine.js is perfect for projects that need minimal JavaScript and can be seamlessly integrated into HTML without a complicated build process. It integrates seamlessly with CSS frameworks such as Tailwind, making it an excellent option for creating fast, dynamic user interfaces. The framework offers a straightforward syntax and is tailored for small to medium-sized projects (Start Here Alpine.js, 2024).

2.4 Proposed System

The proposed system, eArena: UNIMAS Court Reservation System, is designed to revolutionize the badminton court booking process at University Malaysia Sarawak

(UNIMAS). It aims to address the limitations of the existing manual reservation system, which suffers from restricted accessibility, scheduling conflicts, and overall inefficiencies. Unmatched simplicity and flexibility are made possible by the contemporary, web-based platform that the eArena system presents, which lets users book and manage reservations anywhere, anytime. By using a real-time booking system, which guarantees effective resource usage and a better user experience by eradicating multiple bookings and operational mistakes, this is achieved.

Designed to improve usability for both tech-savvy and inexperienced users, the contemporary and easy-to-use interface of the system is one of its strongest points. The platform enables dual-language options, English and Malay, to respond to the different linguistic demands of the UNIMAS community, assuring inclusion. Additionally, a comprehensive session timeout functionality is incorporated to strengthen security, particularly for users using the platform on shared or public devices. Another unique component is the dedicated report area, which allows users to provide feedback or report facility concerns, promoting improved contact between users and facility management.

Furthermore, the eArena system incorporates a booking calendar that clearly indicates real-time court availability, speeding the reservation process and decreasing user irritation. The platform's flexibility with many platforms, including desktops, laptops, tablets, and smartphones, assures accessibility for all users, regardless of their favourite technology. By solving inefficiencies in the present system while adding unique features, eArena not only improves resource utilization but also fosters increased involvement in sporting activities. Ultimately, the system is positioned to dramatically enhance the overall sports booking experience at UNIMAS, highlighting the university's dedication to leveraging technology to improve student and staff services.

2.5 Summary

By means of arguments for its goals, the proposed eArena: UNIMAS Court Reservation System has been exhaustively examined in Chapter 2. Five current reservation systems were examined in this chapter, and their characteristics were compiled in a comparative table to show both parallels and contrasts.

CHAPTER 3: REQUIREMENT ANALYSIS & SYSTEM DESIGN

3.1 Introduction

The requirement analysis and system architecture for the planned eArena UNIMAS Court Reservation System are examined in great detail in this chapter. It starts with a synopsis of the Waterfall model, the technique used. This model is selected for its methodical, sequential approach, therefore guaranteeing organisation and clarity through the development process (Sallu et al., 2023).

The chapter will go over the steps needed to compile and evaluate user needs, therefore guiding the design of a strong and easy-to-use system. Emphasising important design issues like system architecture, user interface, and database structure helps to guarantee flawless functioning and fit with user demands. Use case diagrams, sequence diagrams, and activity diagrams among visual tools to show system interactions and flow.

This chapter guarantees that the eArena system satisfies its goals of accessibility, efficiency, and user happiness by fully addressing these elements, therefore laying the foundation for the development and effective use of the system.

3.2 User Requirement Specification/ Requirement Analysis

3.2.1 Questionnaires and Findings Gathered

i) Example of Questions

Five (5) sections were included, demographic information, current challenges with court reservations, feature preferences for eArena, accessibility and security expectations, and feedback and suggestions.

- **Section A: Demographic Information**

  This section collects basic demographic and user-related information to understand who is using the badminton court reservation system

- **Section B: Current Challenge with Court Reservation**

  This section identifies the challenges and pain points users experience with the current booking system.

- **Section C: Feature Preferences for Earena**

This section explores the features and functionalities users want in the new eArena online reservation system.

- **Section D: Accessibility and Security Expectations**

This section focuses on users' expectations regarding accessibility and data security for the system.

- **Section E: Feedback And Suggestions**

This section gathers feedback and suggestions to enhance the proposed eArena system.

ii) Gathered Findings

Only the answers to the most important question are displayed since they will make it evident what requirements this system needs.

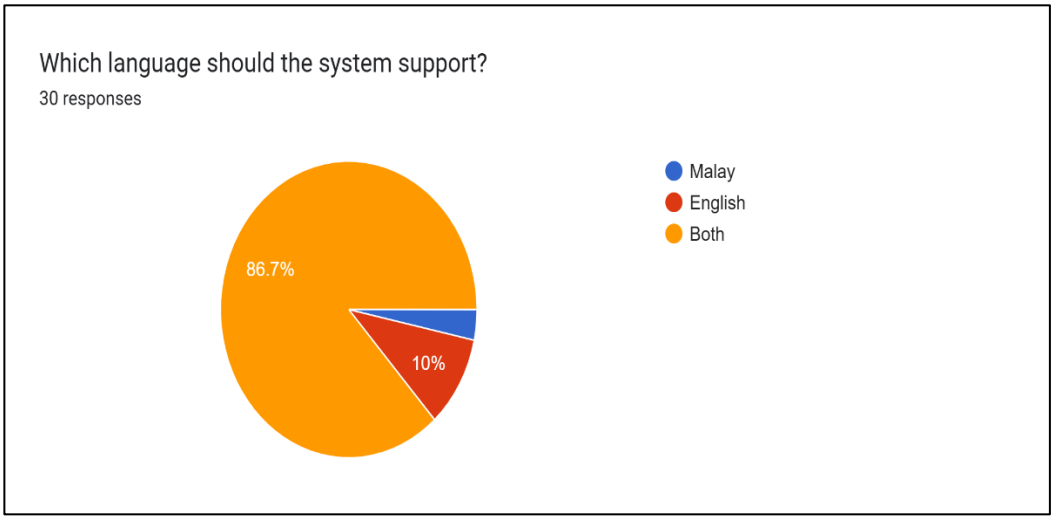


Figure 3.1: Preferred Language Support

As shown in Figure 3.1, the survey reveals that 86.7% (26) of respondents prefer the eArena system to support both English and Malay. Only a small portion, 10% (3), selected English as their preferred language, and an even smaller percentage, 3.3% (1), opted for Malay alone. These results emphasize the importance of implementing dual-language functionality to ensure accessibility for a diverse group of users within the UNIMAS community, including students and staff. Dual-language support will cater to students and staff, who may feel more comfortable using the system in their native or preferred language. This feature will enhance inclusivity and usability, ensuring that the system aligns with the linguistic preferences of its users. Additionally, by offering both languages, the eArena system will improve user

satisfaction and engagement, reducing any potential language barriers that could hinder effective usage.

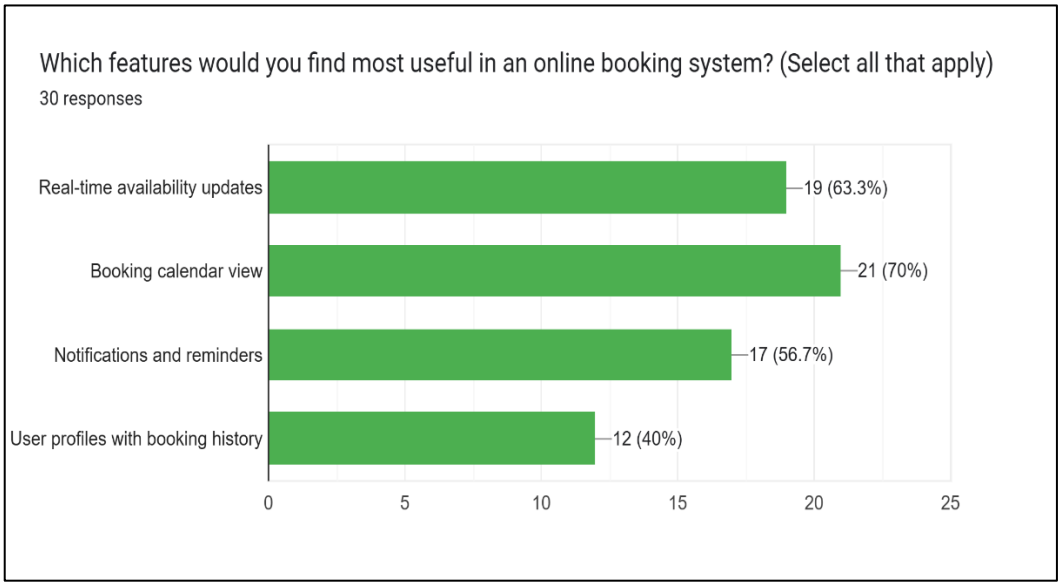


Figure 3.2: Most Useful Features

Figure 3.2 highlights the features that users believe are most beneficial for an online booking system. The most favoured features include a booking calendar view and real-time availability updates, each selected by 70% (21) of respondents. Notifications and reminders were also identified as essential, chosen by 63.3% (19), while user profiles with booking history were considered useful by 56.7% (17). These insights indicate that users prioritize functionality that provides transparency and convenience in the booking process.

A booking calendar view will allow users to visually see court availability, enabling them to make informed decisions about their reservations. Real-time updates will prevent double bookings and scheduling conflicts, two key issues identified in the survey. Notifications and reminders ensure users stay informed about their bookings, reducing the likelihood of missed appointments. Lastly, personalized user profiles with booking histories will allow users to track their reservations and easily rebook frequently used courts. By incorporating these features, the eArena system can significantly improve user experience and address pain points with the current manual process.

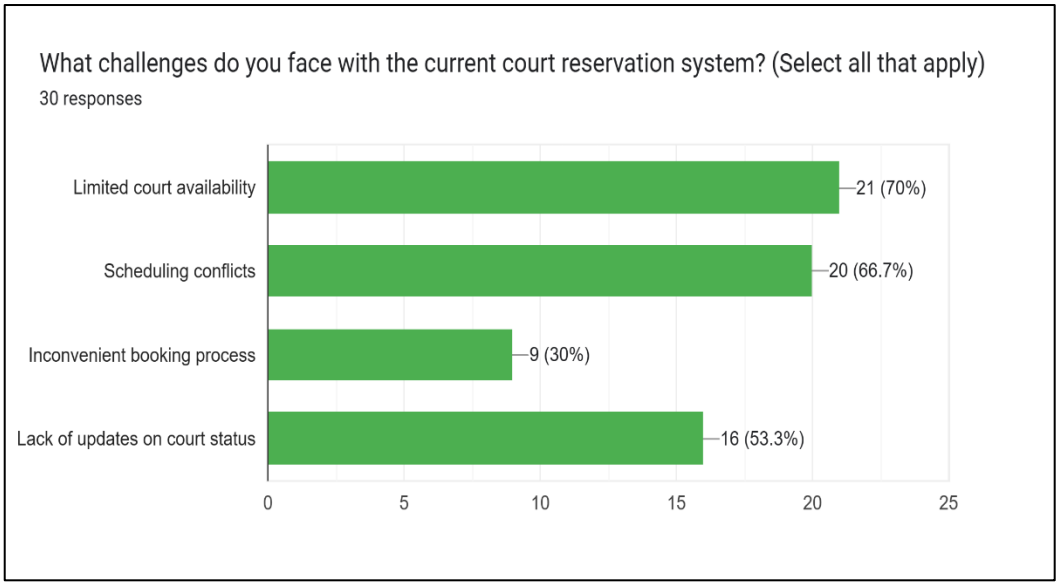


Figure 3.3: Current Challenges

As presented in Figure 3.3, the survey results reveal several challenges users face with the current court reservation system. The most reported issues are limited court availability and scheduling conflicts, each cited by 70% (21) of respondents. An inconvenient booking process was highlighted by 66.7% (20), and 53.3% (16) noted a lack of updates on court status as a significant problem. These findings highlight several critical areas where the current system fails to meet user expectations. Limited court availability is a key issue caused by the lack of real-time information and the inability to optimize court utilization. Scheduling conflicts often arise because users cannot view or manage overlapping bookings. The manual booking process is seen as inconvenient, requiring physical visits and additional effort to secure reservations. Lastly, the absence of status updates leaves users unaware of changes in court availability or booking approvals, leading to frustration. To address these challenges, the eArena system must prioritize automation and real-time updates, ensuring users have immediate access to availability information. A streamlined and user-friendly interface will resolve booking inefficiencies, while features like automated notifications and conflict resolution will help eliminate scheduling issues.

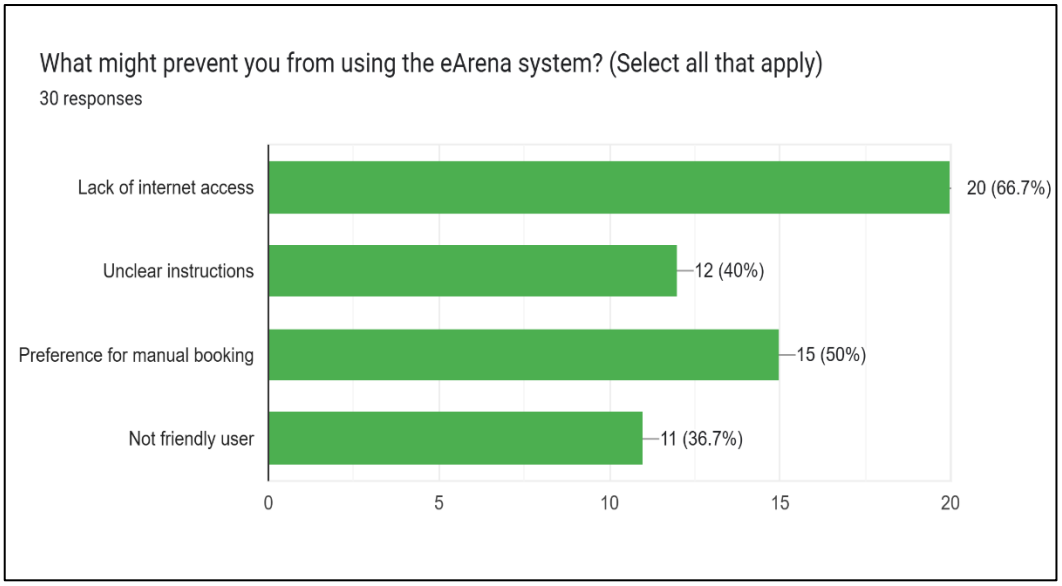


Figure 3.4: Potential Barriers to Usage

Figure 3.4 identifies the factors that might prevent users from adopting the eArena system. The most significant barriers include a lack of internet access and unclear instructions, both cited by 66.7% (20) of respondents. A preference for manual booking was mentioned by 50% (15), while 36.7% (11) expressed concerns about a non-user-friendly interface. These findings emphasize that while the eArena system offers a digital solution, it must address practical barriers to ensure widespread adoption. A lack of internet access could hinder users who do not have reliable connectivity, suggesting the need for offline or assisted booking options. Unclear instructions highlight the importance of a well-designed onboarding process, with tutorials or guides to help users understand the system's functionality. Some users' preference for manual booking may stem from familiarity with the current process, indicating a need for engagement strategies to encourage adoption. Lastly, ensuring a highly user-friendly interface will help users of all technical skill levels feel confident in navigating the system.

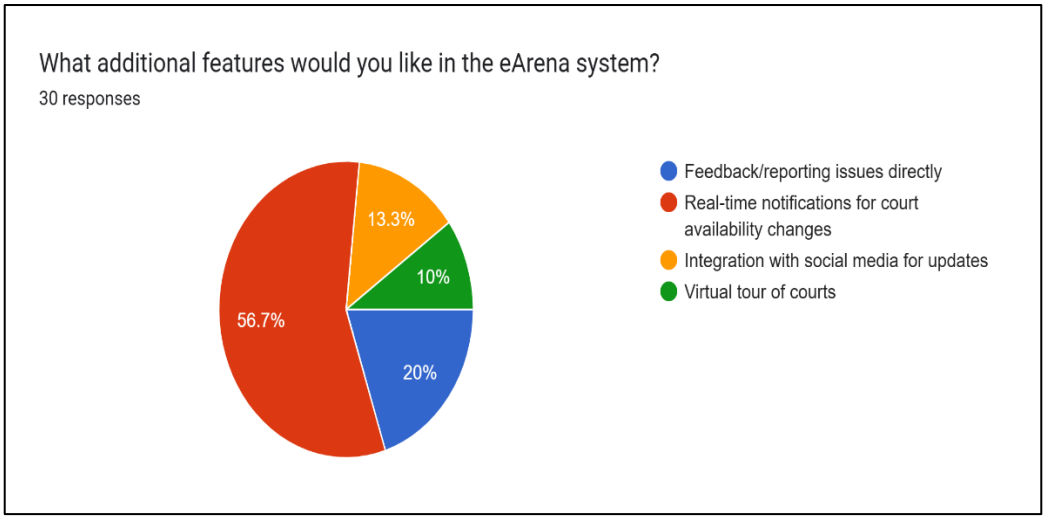


Figure 3.5: Additional Features

As seen in Figure 3.5, users provided several suggestions for additional features to improve the eArena system. The most requested feature was real-time notifications for court availability changes, selected by 56.7% (17) of respondents. Feedback and reporting mechanisms for facility issues were highlighted by 20% (6), while 13.3% (4) suggested social media integration for updates. A smaller portion, 10% (3), proposed a virtual tour of courts to provide users with a visual overview of the facilities. Real-time notifications are crucial to keep users updated on sudden changes, cancellations, or availability. Feedback and reporting mechanisms will empower users to communicate directly with administrators about facility issues, ensuring timely resolutions and improving overall maintenance. Social media integration could help increase user engagement by providing updates and announcements in a format that users already frequent. Finally, virtual court tours can enhance the user experience, particularly for first-time users unfamiliar with the facilities. These features would make the eArena system not only functional but also engaging and interactive.

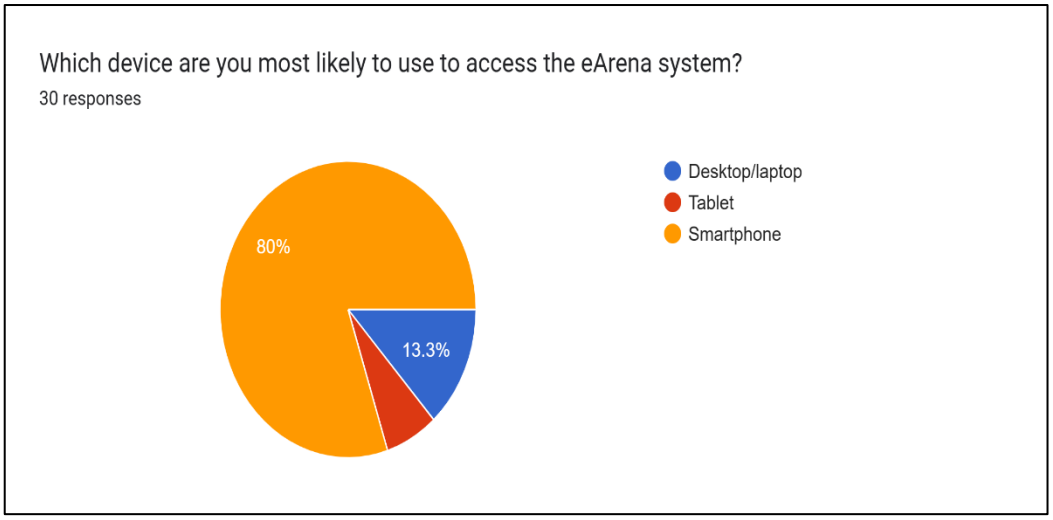


Figure 3.6: Device Preferences

As shown in Figure 3.6, the majority of respondents (80%, 24) prefer accessing the eArena system via smartphones, while 13.3% (4) indicated a preference for desktops or laptops, and only 6.7% (2) chose tablets. This reflects the importance of creating a mobile-optimized and responsive design for the eArena system. The system must prioritize smartphone compatibility to cater to the primary access method of most users. A responsive design ensures that the platform adjusts seamlessly to various screen sizes, providing a consistent and user-friendly experience across devices. This mobile-first approach will make the eArena system convenient for users who are on the go and rely on their smartphones for quick access to reservations.

3.2.1.1 Website

Designed to provide staff and students with a flawless and user-friendly interface, the eArena website is the main platform for the UNIMAS court reservation system. Survey responses reveal that the website has to have a responsive, mobile-first design since eighty percent of respondents said smartphones were their preferred access tool. This guarantees that the platform is functional and easily available on many devices, including tablets and desktop computers. As asked by 86.7% of respondents, the website will feature dual-language assistance for both English and Malay to meet the various linguistic demands of the UNIMAS community. By letting users negotiate the system in their preferred tongue, this function encourages inclusion.

Real-time updates and a booking calendar view help users to see court availability and prevent scheduling conflicts on the website. Additionally included will be automated alerts that provide consumers quick updates on cancellations, bookings confirmed, or modifications. Additionally, the website will contain a secure login system using UNIMAS credentials, guaranteeing that only authorized users may access the platform. Session timeout capability will log users out automatically following periods of inactivity, therefore safeguarding private information for increased security.

Additionally, featuring a feedback and reporting system, the website will let users document problems with the facilities or offer ideas for development. This will stimulate direct contact between users and administrators, guaranteeing timely action on maintenance or updates. The website will have keyboard navigation and screen reader compatibility to assist people with impairments, therefore improving accessibility. By embracing these aspects, the eArena website will serve as an efficient and inclusive platform that overcomes the key difficulties of the present manual reservation system.

3.3 System Requirements Specification

This part specifies and confirms the user demands for the suggested eArena system, therefore guaranteeing that it satisfies their expectations and requirements. Functional and non-functional criteria separate the system's needs. While non-functional requirements specify how the system should run and operate under certain limitations, functional requirements define what the system must accomplish.

3.3.1 Functional requirements

The functional requirements for the eArena: UNIMAS Court Reservation System are designed to ensure a smooth and efficient user experience while meeting the core objectives of the system. These requirements define the essential features and functionalities necessary for users, including UNIMAS staff, students, and admins, to interact with the system effectively. Below is a table summarizing the key functional requirements:

Table 3.1: eArena Functional Requirements

Feature	Actor	Description
Login	UNIMAS staff, students, and admins	Users should be able to log in using their UNIMAS credentials.
View Court Availability	UNIMAS staff, students, and admins	Users should be able to view the real-time availability of courts.
Make and manage Reservations.	UNIMAS staff and students	Users should be able to reserve badminton courts for specific time slots and edit or cancel their reservations if needed.
User Profile Management	UNIMAS staff and students	Users should be able to update their details, such as contact information.
Report Submission	UNIMAS staff and students	Users should be able to submit feedback or report issues related to the courts or the system.
Administrative Dashboard	Admins	Admin should be able to view, approve, or manage reservations and monitor system usage.
Notifications	UNIMAS staff, students, and admins	The system should send notifications for booking confirmations, reminders, and cancellations.

3.3.2 Non-functional requirements

Non-functional requirements establish the broad behavioral aspects of the system that enable it to run efficiently and fulfil the expectations of users. These traits are critical for sustaining operational efficiency, security, usability, and conformity with institutional ideals. Below is a full description of these qualities in the context of the system:

i. Operational

The system must be capable of managing many concurrent user operations seamlessly, such as users signing in, seeing court availability, and making bookings concurrently. This involves ensuring the system stays online during peak usage periods, such as prior to big events, when many people are expected to engage with it. Downtime should be avoided by effective maintenance plans and resilient system architecture. Regular performance monitoring and server optimizations should be undertaken to ensure operational dependability.

ii. Performance

Performance is an important part of user happiness. The system must guarantee that operations like login authentication, booking confirmation, and real-time calendar changes are done swiftly. For instance, page load times should not exceed a few seconds, even with significant quantities of concurrent user activities. Performance testing should be undertaken to detect possible bottlenecks, and caching methods should be implemented where available to maximise system responsiveness.

iii. Security

Security is an important part of how the system is built. It has to keep user data safe, which includes private data like usernames, passwords, and booking records. This can be done by encrypting data while it's being sent or stored, using two-factor authentication (2FA) to make logins safer, and regularly checking for security holes to fix any problems that might arise. Also, only authorised users should be able to access the system, and role-based rights should control who can see what data or features. It is required that you follow the rules for institutional and civil protection.

iv. Cultural & Political

For the system to fit with UNIMAS's mission and ideals, it needs to be customised for the people it helps. For instance, it should only let people with proper UNIMAS email addresses (like @unimas.my) use it, so that only people from the UNIMAS group can use its features. To suit the wide range of users, the system could also offer support for multiple languages or other features that are sensitive to different cultures. Local and organisational rules should be followed when making policies about data safety and usage. This will help users trust the system with their data.

3.3.2.1 Integration

The solution must seamlessly interact with the current UNIMAS infrastructure to deliver a smooth and efficient user experience. This involves the use of single sign-on (SSO) techniques, allowing users to log in with their current UNIMAS credentials without having separate accounts. Integration with current databases guarantees that user information and booking data are consolidated and consistent. For alerts, the system should link with email servers to provide automatic booking confirmations, reminders, or cancellation messages. Additionally, the system should enable third-party tools, such as calendar software, to synchronize booking schedules properly. Integration is vital not just for operational efficiency but also for ensuring that the system complements other services supplied by UNIMAS, minimising redundancy and establishing a more unified digital environment.

3.3.2.2 User Friendly

User-friendliness is a major non-functional criterion to achieve widespread acceptance and satisfaction among users. The system must have an easy and clear interface that lowers the learning curve for new users. Features such as straightforward navigation menus, clearly labeled buttons, and a flexible design guarantee that users may simply fulfil their goals, such as checking court availability or making bookings. The system should also adapt to numerous platforms, including PCs, tablets, and smartphones, to accommodate users with varying tastes and demands. Accessibility features, such as compatibility with screen readers and keyboard navigation, enable inclusion for persons with impairments. Providing real-time feedback, such as error warnings or confirmation prompts, may guide users through procedures and decrease irritation. By focusing on user-friendly design principles, the system not only promotes usability but also fosters trust and happiness among its users, leading to better engagement and efficiency in attaining its goals.

3.4 Software Requirement Specification

Table 3.2: Software Requirement Specification

Software	Description
Operating System	Microsoft Windows 10/11, 64-bit operating system. Provides a stable environment for developing and running web applications.
Xampp	A free and open-source cross-platform web server solution stack developed by Apache Friends. Includes Apache, MySQL, PHP, and

	Perl, making it ideal for testing and hosting the eArena system locally.
Laravel	A PHP framework for web application development. Provides a clean and modular structure, simplifying tasks such as routing, authentication, and database interactions for the eArena system.
Visual Studio Code	A source-code editor developed by Microsoft. Equipped with extensions for PHP, JavaScript, and database management, it is used for writing and debugging code during development.
Tailwind	A utility-first CSS framework that simplifies the creation of responsive and modern designs for the eArena system. It allows for highly customizable styling directly in HTML files.
Flowbite	A component library built on Tailwind CSS. Used to create pre-designed UI components such as buttons, forms, and modals, ensuring a consistent and user-friendly interface for the eArena system.
Alpine.js	A lightweight JavaScript framework that enhances interactivity within the eArena system. Used for simple client-side interactions without the need for larger frameworks like React or Vue.
Google Crome	Web browsers used for testing and accessing the system. Their developer tools assist in debugging and ensuring compatibility with modern web standards.

3.5 Hardware Requirements Specifications

Table 3.3: Hardware Requirements Specifications

Hardware	Descriptions
Laptop	A standard laptop with a built-in 14-inch or larger screen. Provides portability and integrates all necessary components, such as a monitor, keyboard, and trackpad.
Processor	Intel Core i3 (8th Gen or higher) or AMD Ryzen 3. These processors provide sufficient power for running Laravel, XAMPP, and Visual Studio Code without performance issues.
Ram	8 GB minimum. This ensures smooth multitasking, allowing tools

	like Visual Studio Code, XAMPP, and a web browser to run concurrently without significant slowdowns.
Storage/Hard Disk	256 GB SSD. An SSD is recommended for faster boot times, application loading, and improved system responsiveness during development tasks.
Keyboard and Trackpad	The built-in laptop keyboard and trackpad are sufficient for basic development. An external keyboard or mouse is optional for extended development sessions.
Network	Wi-Fi or 4g ethernet. Reliable internet connectivity is essential for downloading dependencies, syncing with GitHub, and testing web features.
Graphics Card	Integrated graphics, such as Intel UHD Graphics or AMD Radeon Vega 8, are sufficient for coding and lightweight UI design. No dedicated GPU is required for this project.

3.6 System Design

The System Design part expands upon the concepts described in earlier chapters, converting the specified requirements into a thorough technological architecture for the eArena system. To optimise the badminton court reservation experience at UNIMAS, this chapter focuses on describing how the system will function, both from the user's perspective and behind the scenes.

3.6.1 Use Case Diagram

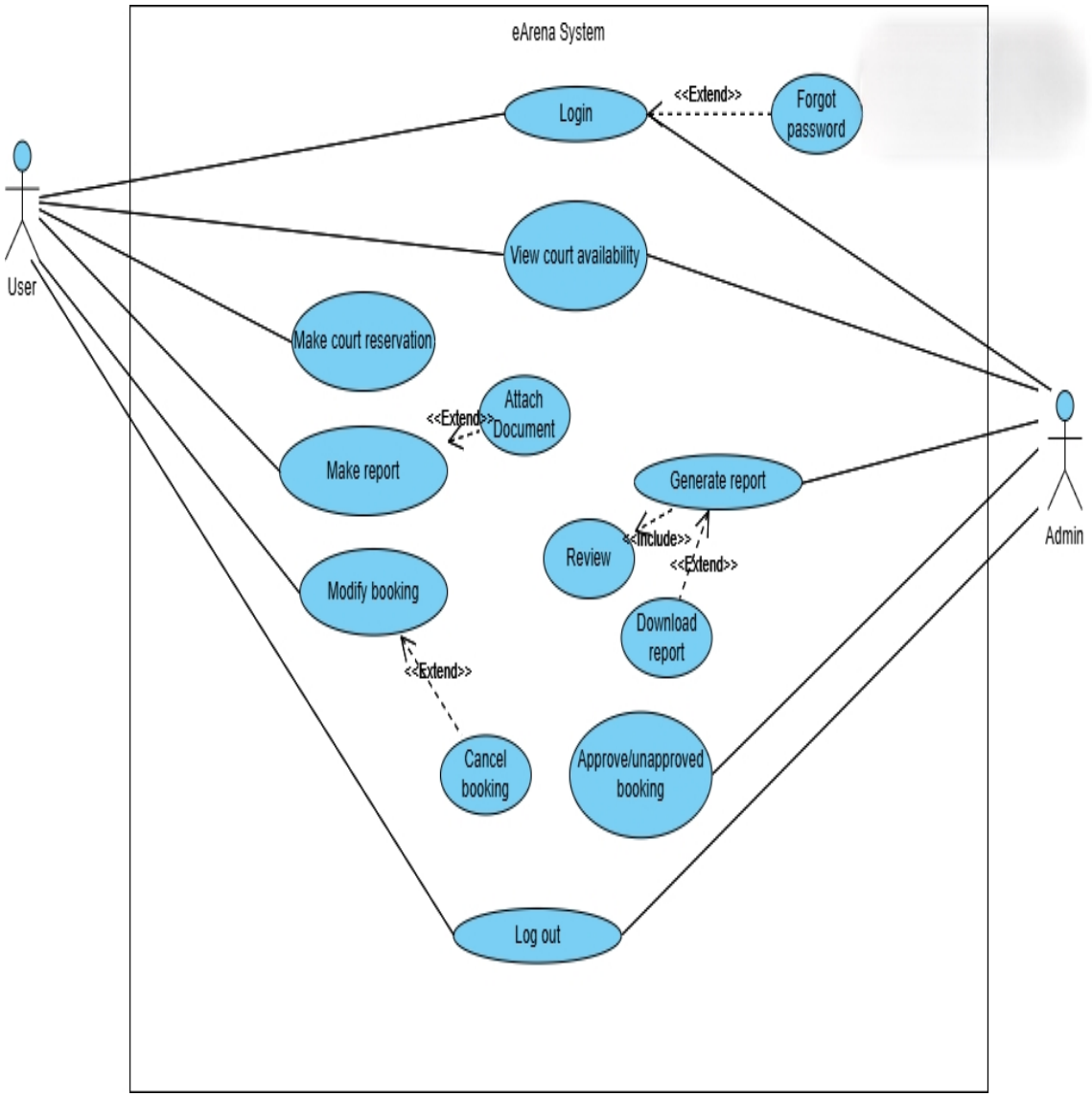

eArena System
Login
<<Extend>>
Forgot password
User
View court availability
Make court reservation
Attach Document
<<Extend>>
Make report
Generate report
Review
<<Include>>
<<Extend>>
Modify booking
Download report
<<Extend>>
Cancel booking
Approve/unapproved booking
Log out
Admin

Figure 3.7: eArena System Use Case Diagram

Table 3.4: Use Case for Login

Use Case Name	Login
Actor	User/Admin
Summary Description	The actor logs into the system by providing UNIMAS credentials.
Pre-condition	The actor has a UNIMAS-registered account.
Post-condition	The actor gains access to specific functionalities based on role(user/admin)
Basic Path	1. Open the website. 2. Enter valid credentials (email and password). 3. Click "Login". 4. System verifies credentials and grants access.
Alternative Path	1. If invalid credentials are entered, display an error message and allow retry.

Table 3.5: Use Case for Forgot Password

Use Case Name	Forgot Password
Actor	User/Admin
Summary Description	Allows actors to reset their password securely if they forget their login credentials.
Pre-condition	The user has an existing account in the system.
Post-condition	The user successfully resets their password and can log in with the new credentials.
Basic Path	1. User clicks the "Forgot Password" link on the login page. 2. User provides their registered email address. 3. System sends a password reset link or OTP to the registered

	email. 4. User clicks the link or enters the OTP and provides a new password. 5. System validates the input, updates the password, and confirms the change.
Alternative Path	1. If the email address is not registered, display an error message and allow retry. 2. If the OTP or link is invalid/expired, display an appropriate error message and prompt the user to request again.

Table 3.6: Use Case for View Court Availability

Use Case Name	**View Court Availability**
Actor	User/Admin
Summary Description	The actor views the schedule of courts to check availability for booking or managing purposes.
Pre-condition	The actor is logged into the system.
Post-condition	The actor sees the list of available courts based on the selected date and time.
Basic Path	1. Navigate to the "Calendar" page. 2. Select a date and time range. 3. System displays available courts.
Alternative Path	1. If no courts are available for the selected time, display an appropriate message.

Table 3.7: Use Case for Make Court Reservation

Use Case Name	**Make Court Reservation**
Actor	User
Summary Description	The user reserves a specific sport and court for a specific date and time.
Pre-condition	The actor is logged into the system.

Post-condition	The system confirms the reservation and saves the data in the database, and notifies the admin for approval.
Basic Path	1. Navigate to the "Bookings" page. 2. User clicks the “Create Booking” button. 3. Select a sport and a court. 4. Select an available date and time. 5. Confirm the reservation. 6. The system validates, confirms the reservation and saves it into the databases. 7. System notifies the admin of the pending reservation for approval. 8. System notifies to the user that the reservation request has been submitted successfully and is awaiting approval.
Alternative Path	1. If the reservation details are invalid, display an error message and allow a retry. 2. If the user cancels the reservation (e.g., by clicking "Cancel" during the booking process), the system should discard any reservation details and return the user to the "Booking" page. 3. If the user cancels after selecting a court and time but before confirming the reservation, the system should display a confirmation message, asking if the user is sure they want to cancel. 4. If the user clicks "Cancel" after submitting the booking, the system can either allow them to cancel the request (if it's still pending) or inform them that the action cannot be undone if the reservation is confirmed or already in process.

Table 3.8: Use Case Diagram Approve/Reject Reservation

Use Case Name	**Approve/Reject Reservation**
Actor	Admin

Summary Description	The admin approves or rejects pending court reservation requests.
Pre-condition	The admin is logged into the system.
Post-condition	The reservation status is updated, and the user is notified of the admin's decision.
Basic Path	1. Navigate to the "Bookings" page. 2. Review reservation details. 3. Approve or reject the request. 4. System updates the status and notifies the user.
Alternative Path	1. If the reservation details are invalid, display an error message and allow a retry.

Table 3.9: Use Case Diagram Modify Booking

Use Case Name	**Modify Booking**
Actor	User
Summary Description	The user modifies an existing booking by updating sport or court details, date, or time.
Pre-condition	The user is logged in and has an existing booking.
Post-condition	The booking details are updated in the system, and the admin is notified of the modification for approval.
Basic Path	1. Navigate to the "Bookings" page. 2. Select the booking to modify. 3. Update the required fields (sport, court, date, or time). 4. Submit the modified booking. 5. System validates the new details. 6. System saves the changes to the database. 7. System notifies the admin of the modification for approval. 8. User is notified that the modification is pending admin approval.
Alternative Path	1. If invalid inputs are provided (e.g., conflicts or unavailable times), display an error message and allow retry. 2. If the modification request is rejected by the admin, notify the user. 3. If the user cancels the modification process (e.g., by clicking

	"Cancel" or closing the modification form), the system should discard any changes and return the user to the "Booking" page without saving the modifications. 2. If the user cancels after modifying booking details but before confirming the changes, the system should ask for confirmation (e.g., "Are you sure you want to cancel the modification?"). 3. If the user cancels after submitting the modified booking request, the system will either allow them to cancel the request (if still pending admin approval) or inform them that the modification cannot be undone once the request is submitted.

Table 3.10: Use Case for Cancel Booking

Use Case Name	**Cancel Booking**
Actor	User
Summary Description	The user cancels an existing booking, and the system releases the court for others to book.
Pre-condition	The user is logged in and has an existing booking.
Post-condition	The booking is canceled, and the court is updated as available for the selected time.
Basic Path	1. Navigate to the "Bookings" page. 2. Select the booking to cancel. 3. Confirm the cancellation. 4. System validates the request. 5. System updates the database to mark the booking as canceled. 6. System releases the court for others to book. 7. User is notified that the booking has been successfully canceled.
Alternative Path	If the booking has already been approved or is within a restricted cancellation period, display an appropriate error message.

Table 3.11: Use Case for Make Report

Use Case Name	**Make Report**
Actor	User

Summary Description	The user make a report detailing any broken or damaged facilities, allowing the system to flag the issue for further action.
Pre-condition	The user is logged into the system and has noticed or encountered a facility issue.
Post-condition	The system saves the facility damage report and notifies the admin or relevant staff for corrective action (e.g., repair).
Basic Path	1. Navigate to the "Reports" page 2. User click “Create Report” button. 3. Select "Facility Damage" as the report type. 4. Specify parameters such as facility type, location, and damage description. 5. Submit the report. 6. System validates the input and ensures all required details are provided. 7. System saves the report and flags it for review. 8. The admin or responsible staff are notified to review the report and take corrective action (e.g., repair). 9. User receives confirmation that the report has been submitted successfully.
Alternative Path	1. If invalid parameters are provided (e.g., incomplete or incorrect information), display an error message and allow retry. 2. If the report fails to submit (e.g., due to a system issue), display an appropriate error message and allow retry. 3. If no damage is reported or if there is an issue with the report submission, allow saving the draft for later submission. 4. If the user cancels the report creation (e.g., by clicking "Cancel" or closing the form), the system should discard any unsaved data and return the user to the previous page. 5. If the user chooses to cancel after entering partial information, the system should ask for confirmation before discarding any entered data. 6. If the user decides not to submit the report and clicks "Cancel," the system will clear the entered data and return the user to the report page or main menu.

Table 3.12: Use Case for Make Report with Attached File

Use Case Name	Make Report (Facility Damage Report with Attached File)
Actor	User
Summary Description	The user creates a report detailing any broken or damaged facilities and attaches a file (e.g., image or document) as evidence to support the claim.
Pre-condition	The user is logged into the system and has noticed or encountered a facility issue.
Post-condition	The system saves the facility damage report with the attached file and notifies the admin or relevant staff for corrective action (e.g., repair).
Basic Path	1. Navigate to the “Reports" page. 2. User click “Create Report” button. 3. Select "Facility Damage" as the report type. 4. Specify parameters such as facility type, location, and damage description. 5. Attach a file (e.g., image, PDF) as proof of the damage. 6. Submit the report. 7. System validates the input and ensures the file is within the allowed size and format. 8. System saves the report along with the attached file and flags it for review. 9. The admin or responsible staff are notified to review the report and take corrective action (e.g., repair). 10. User receives confirmation that the report has been submitted successfully and the file has been attached.
Alternative Path	1. If the file is not in an acceptable format (e.g., unsupported file type), display an error message and prompt the user to upload a valid file. 2. If the file size exceeds the allowed limit, display an error

	message and allow the user to retry with a smaller file. 3. If the user cancels the report creation (e.g., by clicking "Cancel" or closing the form), discard any unsaved data and return to the previous page. 4. If the user submits the report with an invalid file (e.g., corrupted file), prompt the user to upload a valid file before proceeding.

Table 3.13: Use Case for Generate Report

Use Case Name	Generate Report for Review
Actor	Admin
Summary Description	The admin generates a report summarizing all submitted facility damage reports, including any attached files, to review the issues and decide on the next steps (e.g., repair, action).
Pre-condition	The admin is logged into the system and has the appropriate permissions to generate and review reports.
Post-condition	The system generates and displays the report for the admin to review, which includes the list of all submitted reports, along with any attachments and details for further action.
Basic Path	1. Admin navigates to the "Reports" section in the admin dashboard. 2. Admin selects the "Generate Damage Report for Review" option. 3. Admin selects relevant filter options (e.g., date range, damage status, facility location). 4. Admin submits the request to generate the report. 5. The system compiles all the submitted damage reports based on the selected parameters. 6. The system generates the report, including all necessary details (damage descriptions, locations, attachment links). 7. Admin reviews the generated report, including access to any attached files (e.g., images, documents). 8. The admin can take action based on the report (e.g., approve repairs, assign to maintenance).
Alternative Path	1. If no reports match the selected criteria (e.g., no reports

	submitted in the selected date range), display a message such as "No reports found for the selected criteria." 2. If the filter inputs are invalid (e.g., incorrect date range), show an error message and prompt the admin to correct the inputs. 3. If the report generation fails due to a system error (e.g., server issue), display an error message and allow the admin to retry the process. 4. If the report includes attached files, but some files are corrupted or inaccessible, show an error message for the affected files and notify the admin.

Table 3.14: Use Case for Download Report

Use Case Name	Download Report
Actor	Admin
Summary Description	The admin downloads the generated and reviewed report (which may include details of facility damage, repairs, and file attachments) for further action or record-keeping.
Pre-condition	The admin is logged into the system and has reviewed the generated report.
Post-condition	The system prepares and allows the admin to download the report in the desired format (e.g., PDF, Excel).
Basic Path	1. Admin navigates to the "Reports" section in the admin dashboard. 2. Admin selects the "Reviewed Reports" or "Download Report" option. 3. Admin selects the report they wish to download from the list of reviewed reports. 4. Admin selects the desired download format (e.g., PDF, Excel). 5. System prepares the selected report in the chosen format. 6. Admin clicks the "Download" button. 7. The system processes the download request and makes the report available for download on the admin's device.
Alternative Path	1. If the report is unavailable (e.g., the file has been deleted or is corrupted), display an error message and prompt the admin to try

	again later. 2. If the selected report cannot be generated in the chosen format (e.g., system incompatibility), display an error message and allow the admin to select an alternative format.

Table 3.15: Use Case for Log Out

Use Case Name	**Log Out**
Actor	Admin, User
Summary Description	The actor logs out of the system, terminating their session securely to ensure privacy and prevent unauthorized access.
Pre-condition	The actor is logged into the system.
Post-condition	The actor is logged out of the system, and the session is terminated. The actor is redirected to the login page.
Basic Path	1. The actor clicks the "Log Out" button in the system's navigation or profile menu. 2. The system terminates the actor's session securely. 3. The system redirects the actor to the login page or the home page.
Alternative Path	1. If the actor is inactive for a predefined period (e.g., 15 minutes), the system automatically logs the actor out and redirects them to the login page. 2. If the actor is in the middle of an ongoing task (e.g., editing a report), display a warning message before logging out to prevent unsaved changes from being lost.

Sequence Diagram

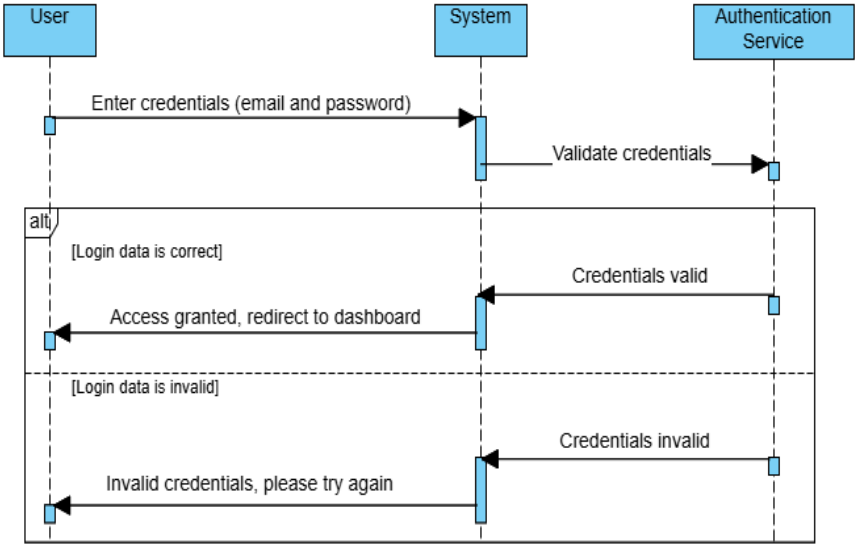


Figure 3.8: Login Sequence Diagram

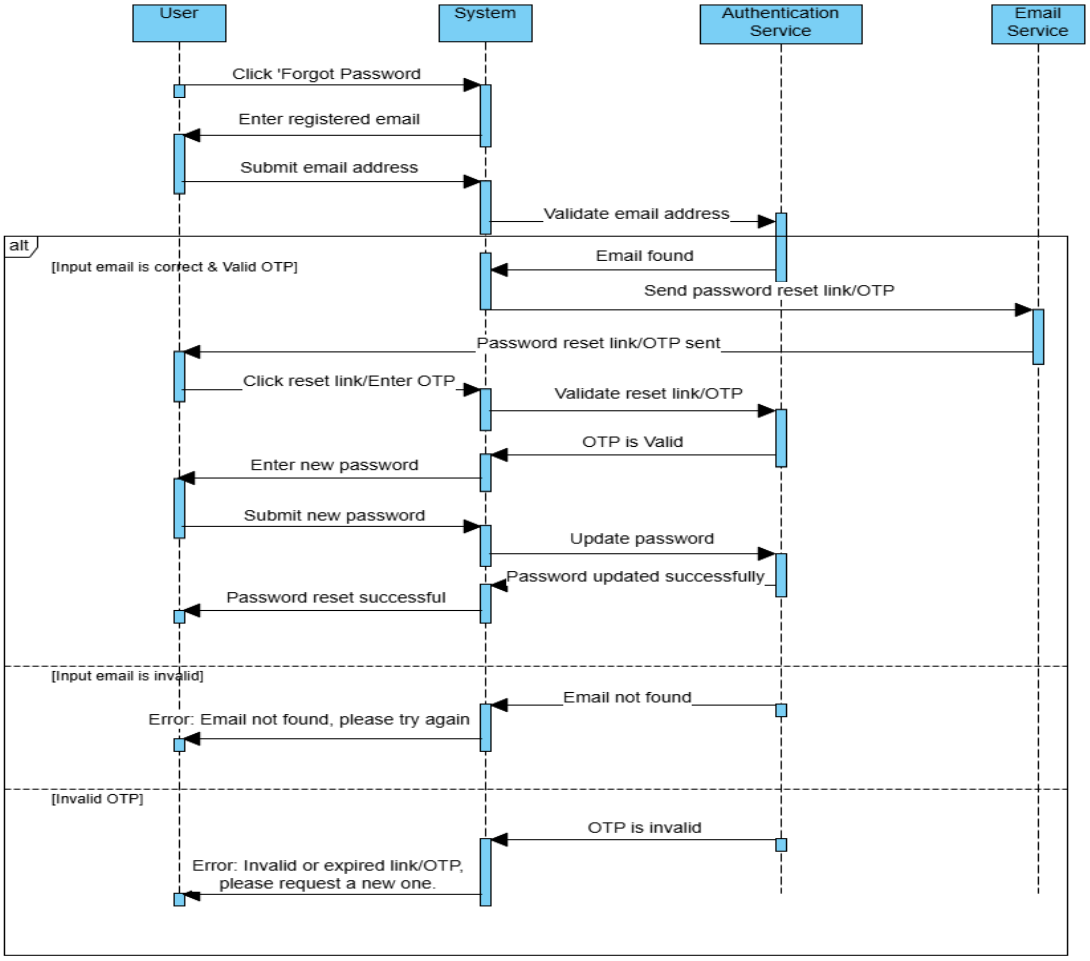


Figure 3.9: Forgot Password Sequence Diagram

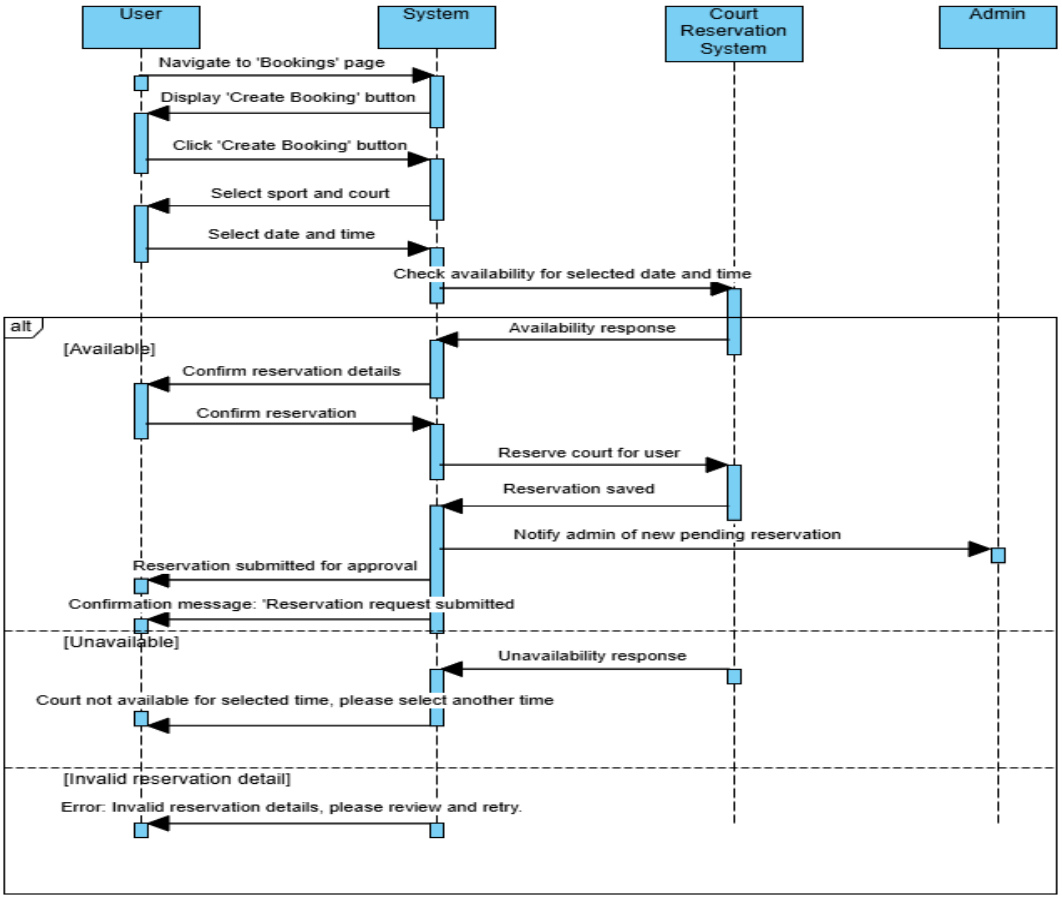


Figure 3.10: Make Reservation Sequence Diagram

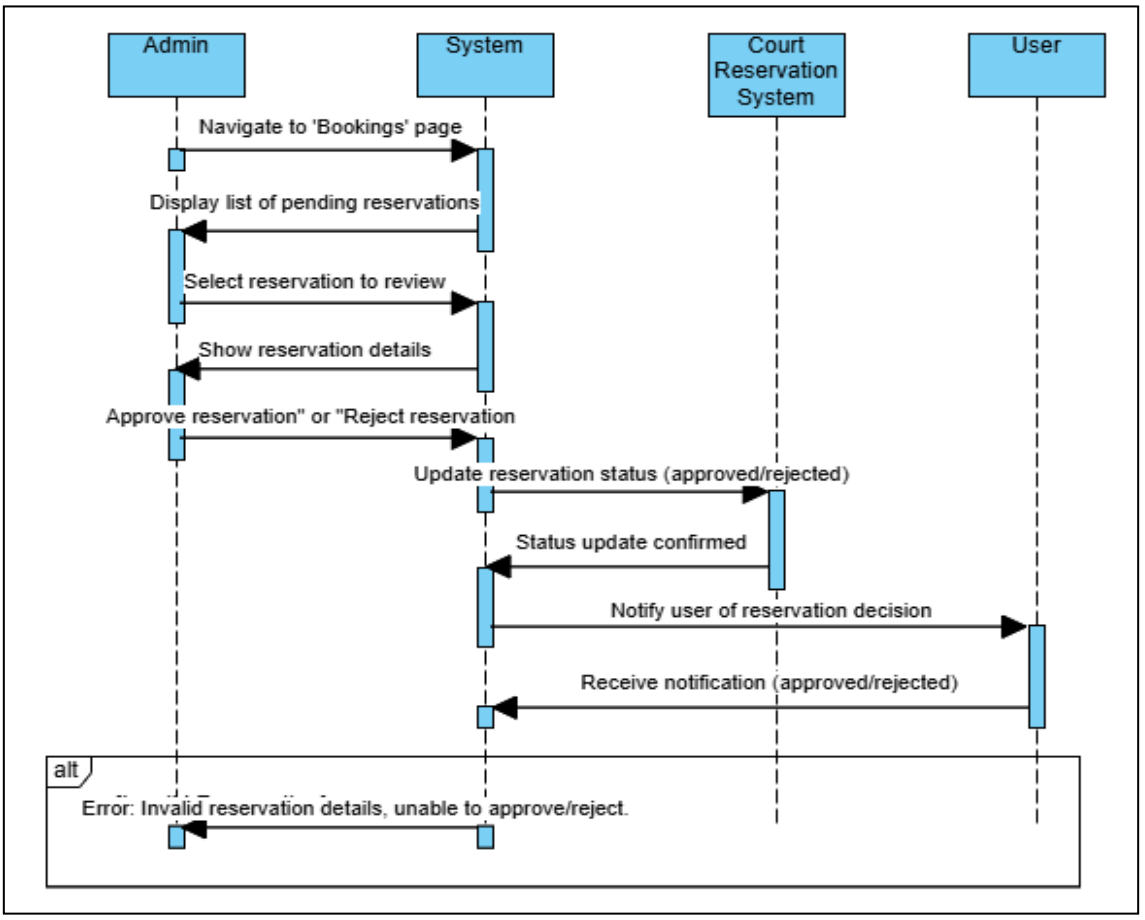

Admin
System
Court Reservation System
User
Navigate to 'Bookings' page
Display list of pending reservations
Select reservation to review
Show reservation details
Approve reservation" or "Reject reservation
Update reservation status (approved/rejected)
Status update confirmed
Notify user of reservation decision
Receive notification (approved/rejected)
alt
Error: Invalid reservation details, unable to approve/reject.

Figure 3.11: Approve Booking Sequence Diagram

Activity Diagram

i) Login Process

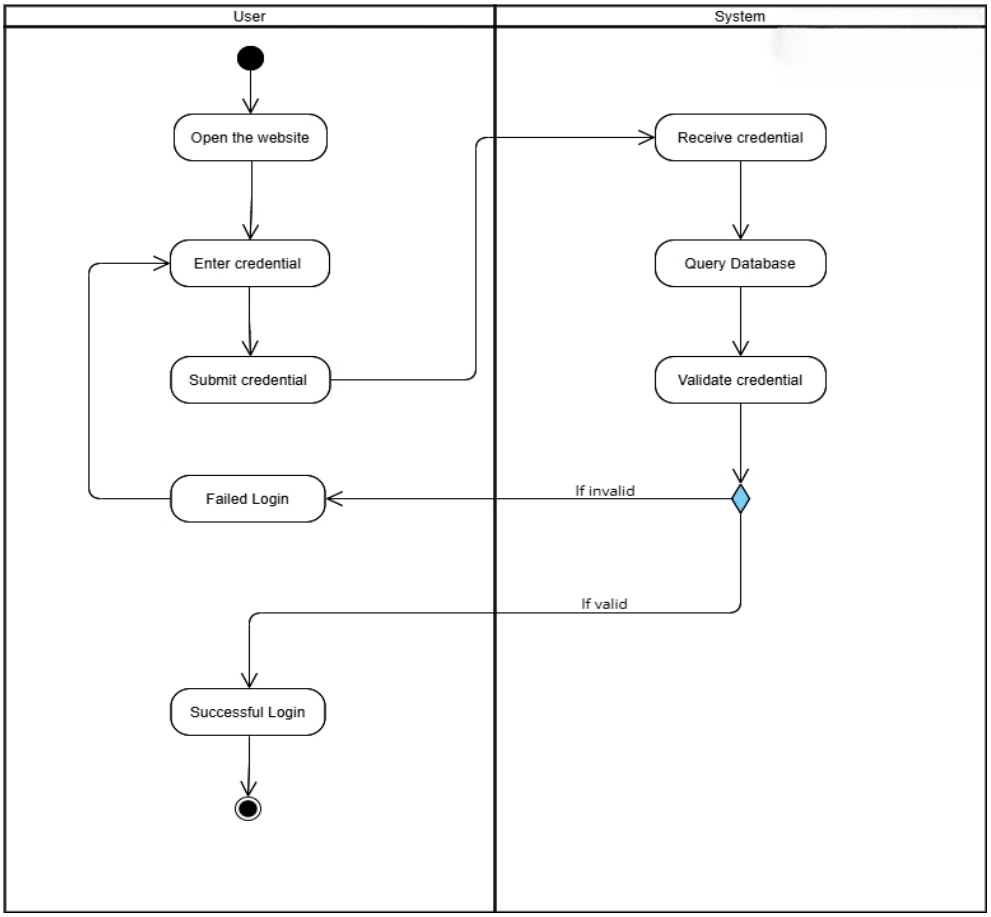


Figure 3.12: Login Process

Figure 3.1 shows the eArena system user login mechanism. Admin is also referred to as a user at this diagram. Users of this system have to first access it by accessing the webpage. Only UNIMAS community members are allowed to log in, therefore guaranteeing the system's restriction to authorised users. Users must provide their credentials, a username and a password to move further. The system checks the credentials after they are entered by looking through the database to verify if they match an existing account linked to a current UNIMAS domain, e.g., @unimas.my. If the credentials are valid, the user is effectively registered in and guided to the main page. If the credentials are invalid, nevertheless, an error notice shows and forces

the user to re-enter the accurate information. This login method guarantees that the UNIMAS community only access to the system is safe and exclusive.

ii) Reservation Process

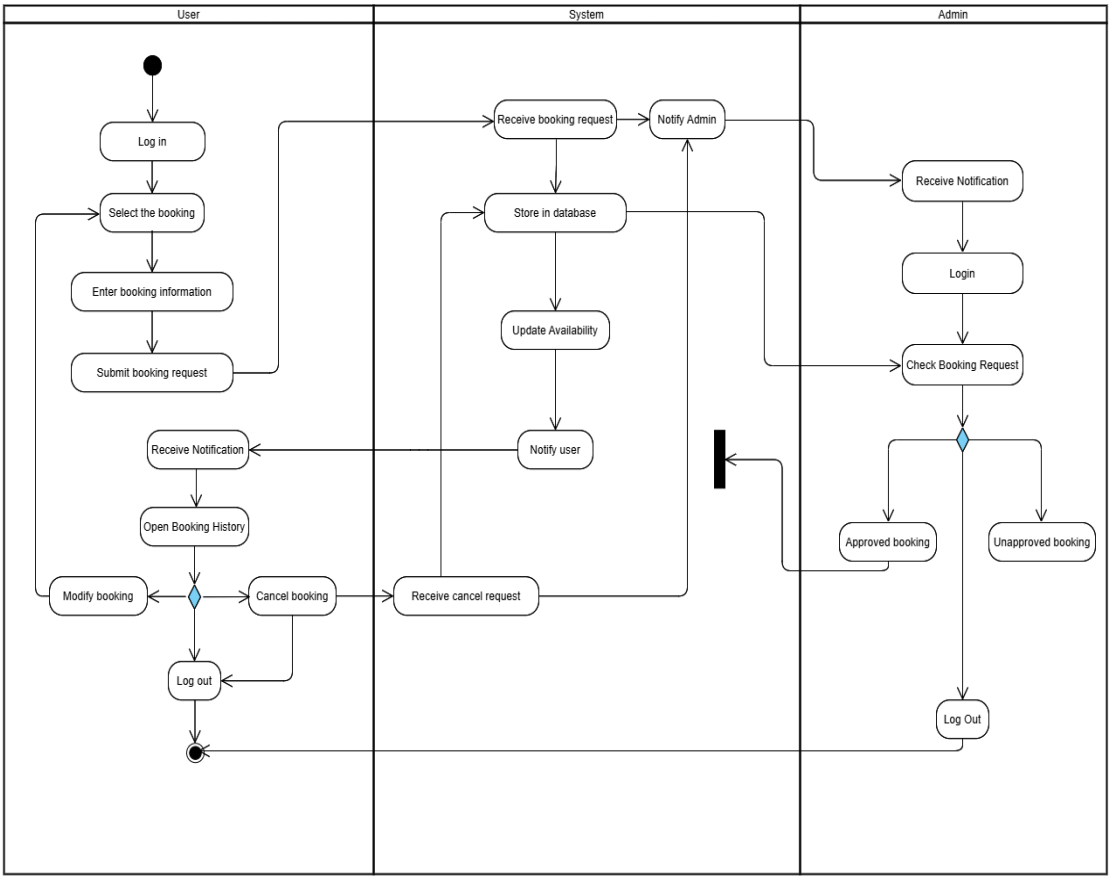


Figure 3.13: Reservation Process

Figure 3.2 shows the eArena system's reservation procedure. The eArena system's reservation procedure begins with the user logging into the system. Once logged in, the user selects the booking option and provides necessary booking details, such as the desired date, time, and court preferences. After completing the booking information, the user submits the booking request to the system. The admin also logs into the system to perform their responsibilities, such as reviewing and approving booking requests, usually after receiving notification. Upon receiving a booking request, the system validates the details and temporarily stores them in the database and notifies the admin. The admin then checks the booking request to determine whether it should be approved or rejected. If approved, the system confirms the booking, updates court availability, and notifies the user. If the booking is unapproved, the system notifies the user accordingly.

After receiving the notification, the user can view their booking history. If changes are needed, the user can modify the booking information and resubmit it for revalidation. Alternatively, the user can cancel the booking. In the case of a cancellation, the system processes the cancellation request, updates the database, and notifies the admin. The admin is notified about any cancellations to ensure the court's availability is updated appropriately. Both users and admins can log out after completing their respective actions, marking the conclusion of their sessions. This procedure ensures a streamlined and user-friendly approach to court reservations while maintaining system integrity through admin validation, real-time availability updates, and user flexibility for managing bookings.

iii) Viewing the court availability process

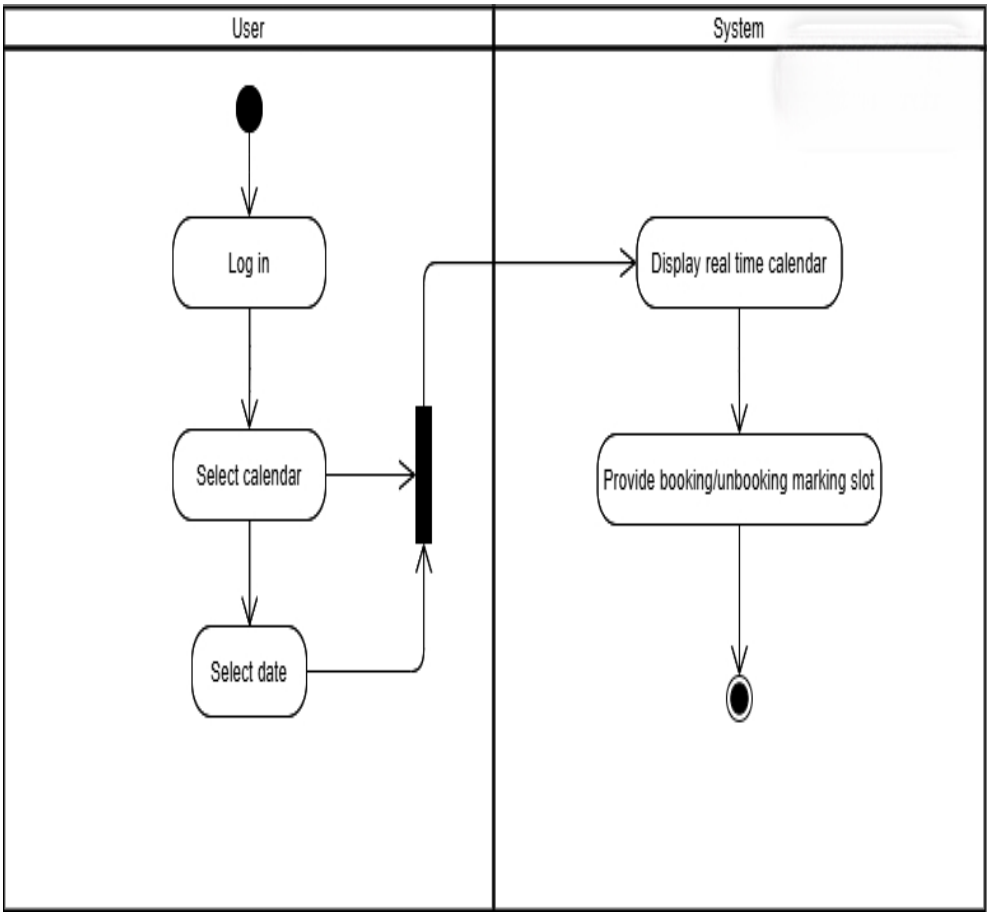


Figure 3.14: Viewing Court Availability Process

Figure 3.3 illustrates the process of viewing court availability within the eArena system. The process begins with the user logging into the system. Admin is also referred to as user in this diagram. Once logged in, the user selects the calendar option to check the availability of courts. The system responds by displaying a real-time calendar interface. This calendar includes visual indicators for available and unavailable time slots, making it easy for the user to identify open slots for booking. The user can then select a specific date to view detailed availability for that day. This process ensures that users can efficiently view and plan their reservations by providing up-to-date information about court availability in a user-friendly format.

iv) Report process

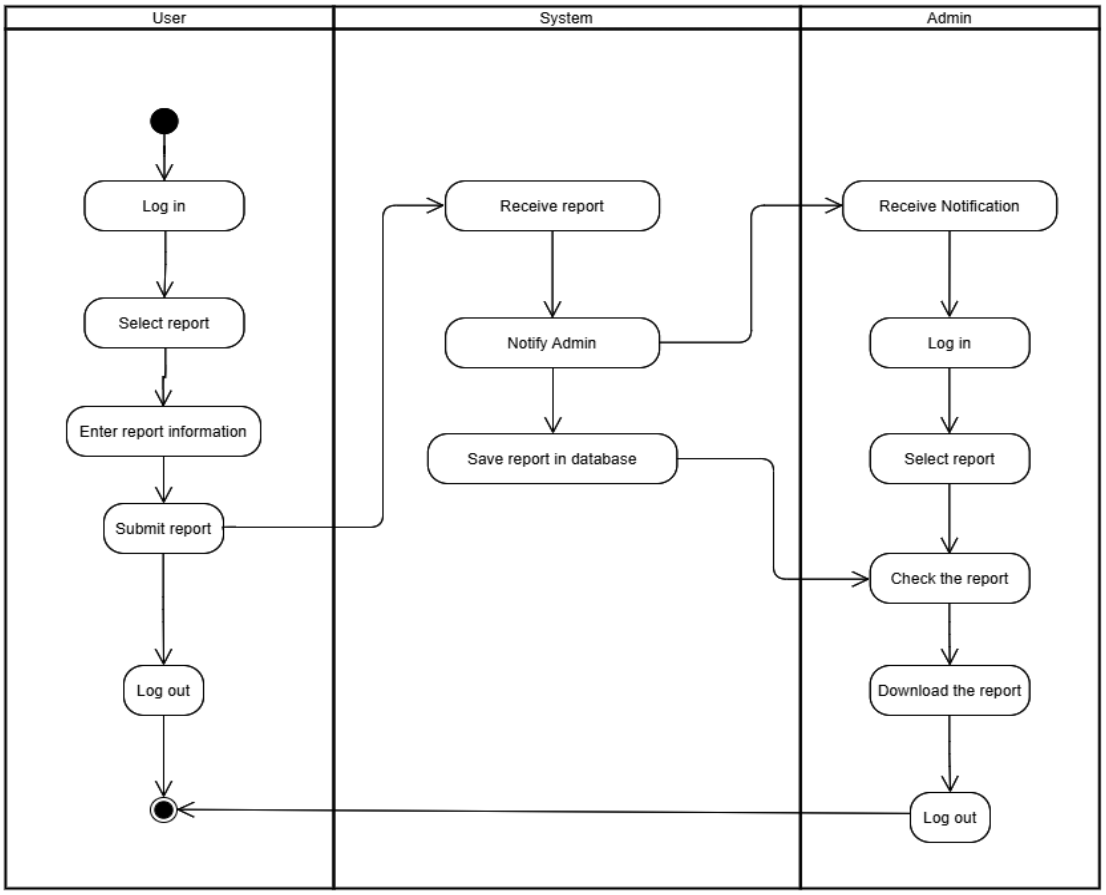


Figure 3.15: Make a Report Process

Figure 3.4 illustrates the process of reporting issues related to facilities in the eArena system. The process starts with the user logging into the system. Once logged in, the user selects the "Report" option from the interface to initiate the reporting process. The user then provides specific details about the issue, such as the type of problem (e.g., damaged court, faulty equipment), the affected sports facility, and any supporting information (e.g., a written description or photos). After entering the required details, the user submits the report to the system. Upon receiving the report, the system saves it securely in the database and sends a notification to the admin. The admin logs into the system, selects the report, and reviews the submitted details. Once the report is checked, the admin has the option to download the report for further processing or documentation purposes. Both the user and admin can log out of the system after completing their respective actions. This streamlined reporting process ensures effective communication of facility issues and enables timely action to maintain the sports facilities in optimal condition for all users.

3.6.2 Database Design

3.6.2.1 Entity Relationship Diagram

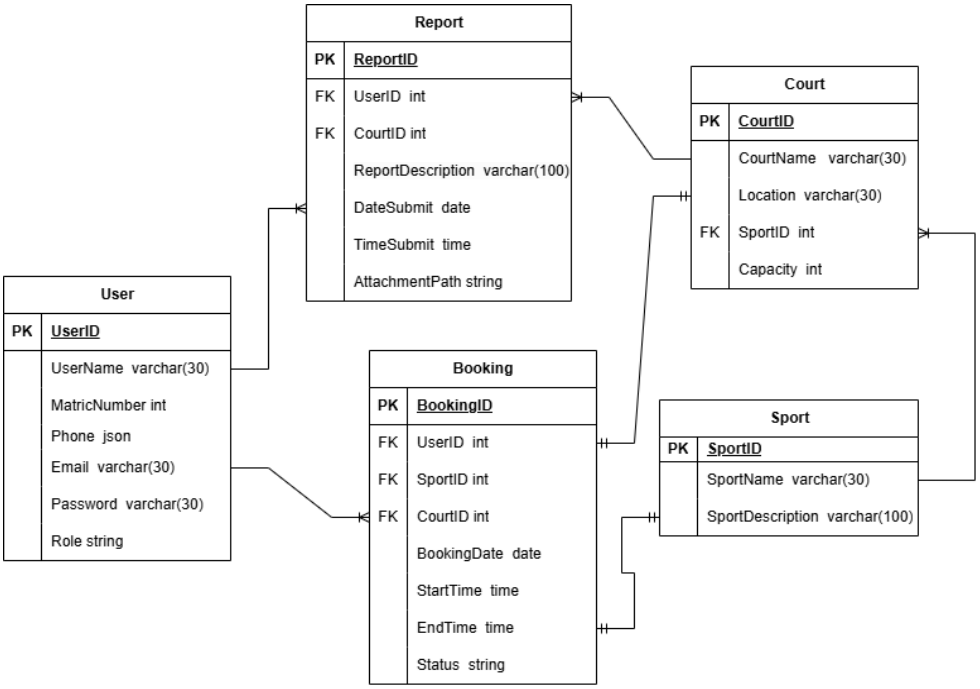


Figure 3.16: eArena Entity Relationship Diagram

3.6.2.2 Normalization of Tables

- **Table: User**

  Primary Key: UserID

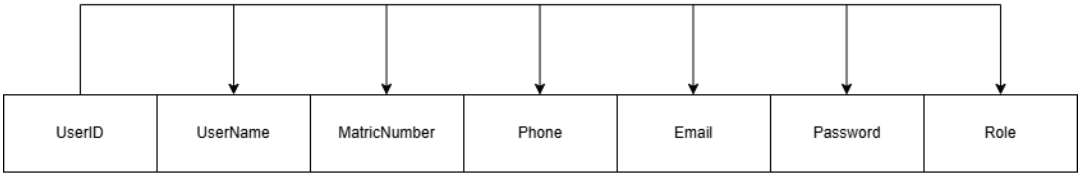


Figure 3.17: User Dependency Diagram

1NF: Ensure atomic values.

2NF: Ensure all non-key attributes depend on UserID.

3NF: No transitive dependencies exist.

- **Table: Court**

  Primary Key: CourtID

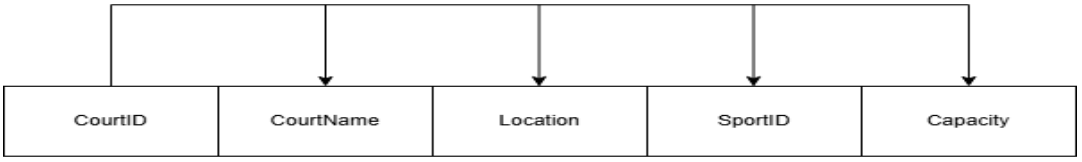


Figure 3.18: Court Dependency Diagram

1NF: Ensure atomic values.

2NF: Ensure all non-key attributes depend on CourtID.

3NF: No transitive dependencies exist.

- **Table: Sport**

  Primary Key: SportID

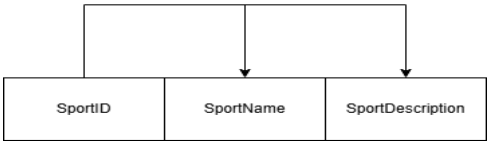


Figure 3.19: Sport Dependency Diagram

1NF: Ensure atomic values.

2NF: Ensure all non-key attributes depend on SportID.

3NF: No transitive dependencies exist.

- **Table: Booking**

  Primary Key: BookingID

  Foreign Key: UserID (User), SportID (Sport), CourtID (Court)

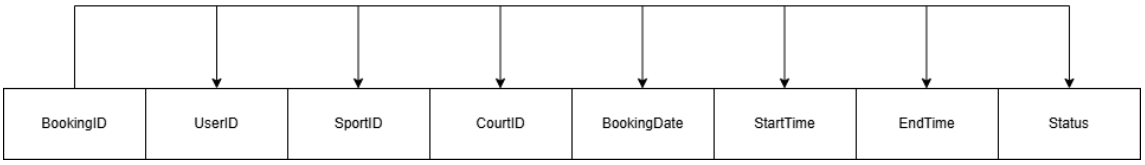


Figure 3.20: Booking Dependency Diagram

1NF: Ensure atomic values.

2NF: Ensure all non-key attributes depend on BookingID.

3NF: No transitive dependencies exist.

- **Table: Report**

  Primary Key: ReportID

  Foreign Key: UserID (User), CourtID (Court)

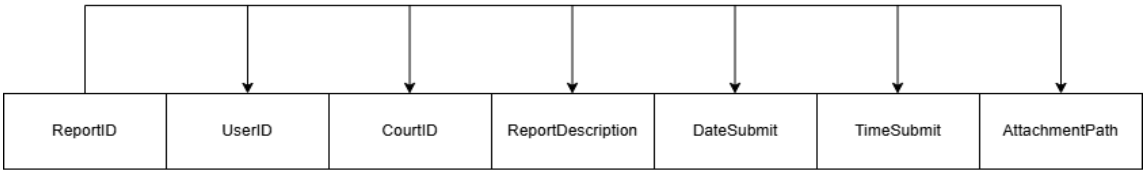


Figure 3.21: Report Dependency Diagram

1NF: Ensure atomic values.

2NF: Ensure all non-key attributes depend on ReportID.

3NF: No transitive dependencies exist.

3.6.2.3 Data Dictionary

- **Data Dictionary: User**

Table 3.16: User Data Dictionary

Attribute Name	Data Type	Description

UserID	Integer (PK)	Unique identifier for each user.
UserName	Varchar (30)	User's full name.
MatricNumber	Integer	User's matriculation number.
Phone	Json	User's phone number.
Email	Varchar (30)	User's email address.
Password	Varchar (30)	User's password.
Role	String	User's role in the system.

- **Data Dictionary: Court**

Table 3.17: Court Data Dictionary

Attribute Name	Data Type	Description
CourtID	Integer (PK)	Unique identifier for each court.
CourtName	Varchar (30)	Name of the court.
Location	Varchar (30)	Physical location of the court.
SportID	Integer (FK)	Related sport for the court.
Capacity	Integer	Maximum capacity of the court.

- **Data Dictionary: Sport**

Table 3.18: Sport Data Dictionary

Attribute Name	Data Type	Description
SportID	Integer (PK)	Unique identifier for each sport.

SportName	Varchar (30)	Name of the sport.
SportDescription	Varchar (100)	Description of the sport.

- **Data Dictionary: Booking**

Table 3.19: Booking Data Dictionary

Attribute Name	Data Type	Description
BookingID	Integer (PK)	Unique identifier for each booking.
UserID	Integer (FK)	The user who made the booking.
CourtID	Integer (FK)	The court being booked.
BookingDate	Date	Date of the booking.
StartTime	Time	Start time of the booking.
EndTime	Time	End time of the booking.
Status	String	Status for booking

- **Data Dictionary: Report**

Table 3.20: Report Data Dictionary

Attribute Name	Data Type	Description
ReportID	Integer (PK)	Unique identifier for each report.
UserID	Integer (FK)	User who submitted the report.
CourtID	Integer (FK)	Court related to the report.
ReportDescription	Varchar (100)	Description of the report.
DateSubmit	Date	Date the report was submitted.
TimeSubmit	Time	Time the report was submitted

AttachmentPath	String	Path to the attached file (if any).

3.7 User Interface Design

i. Wireframe: Login

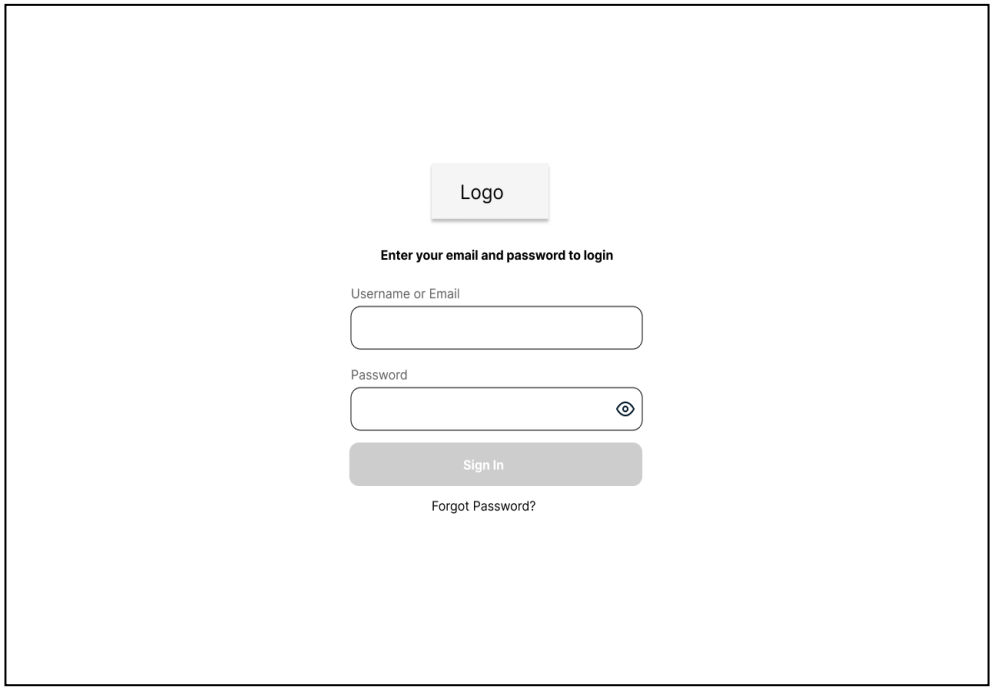


Figure 3.22: Login wireframe

ii. Wireframe: User Dashboard

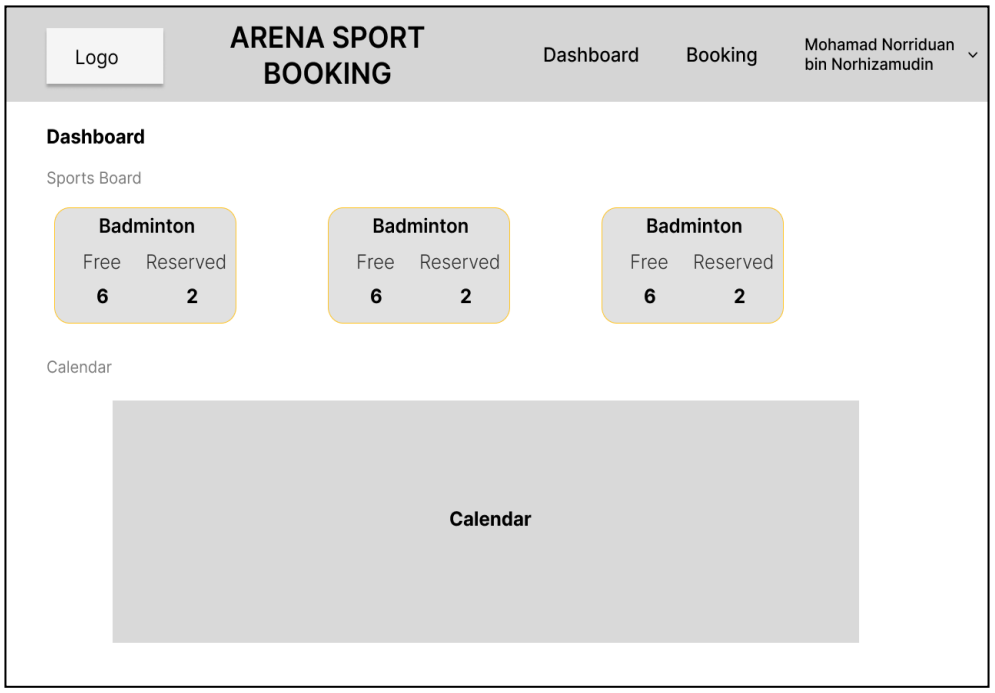


Figure 3. 23: User Dashboard

iii. Wireframe: User Booking/Report Form

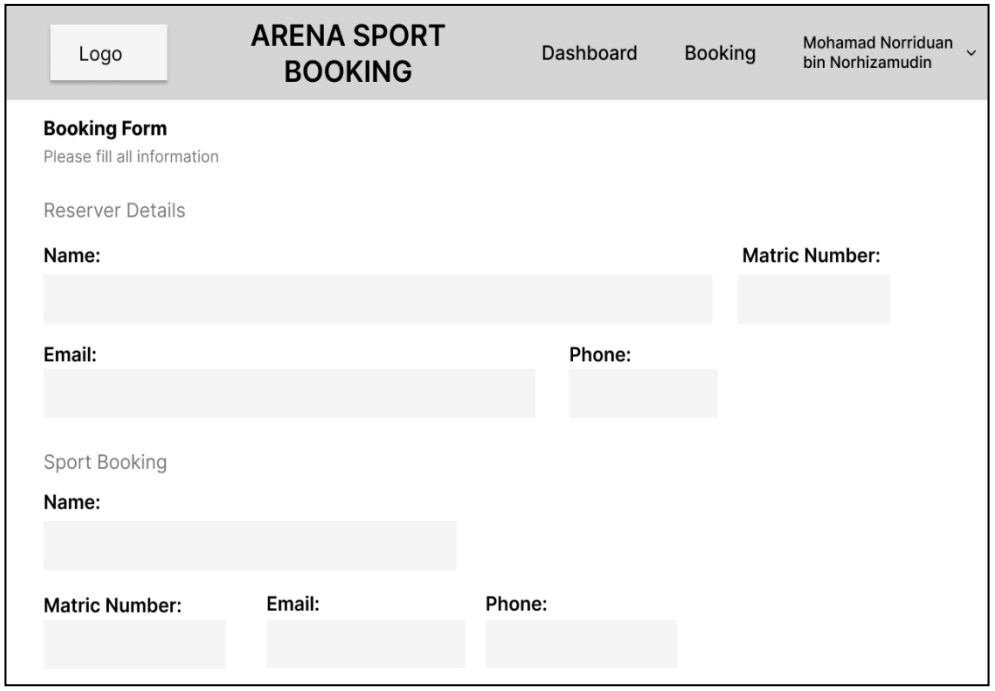


Figure 3.24: User Booking/Report Form

iv. Wireframe: Booking List

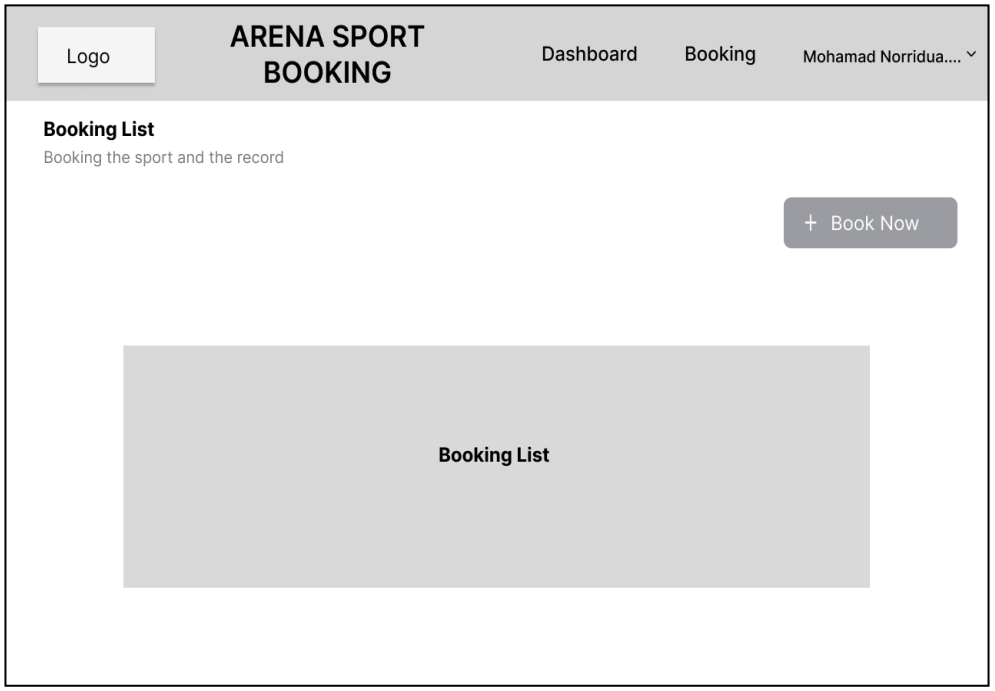


Figure 3.25: Booking List

v. Wireframe: Admin Dashboard

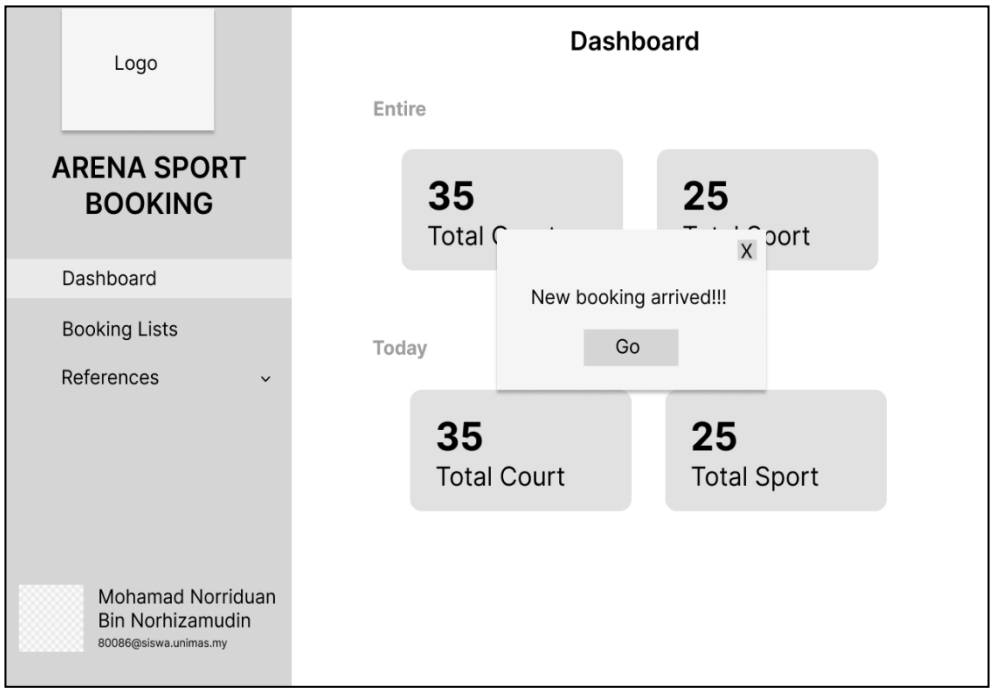


Figure 3.26: Admin Dashboard

vi. Wireframe: Admin Approve Section

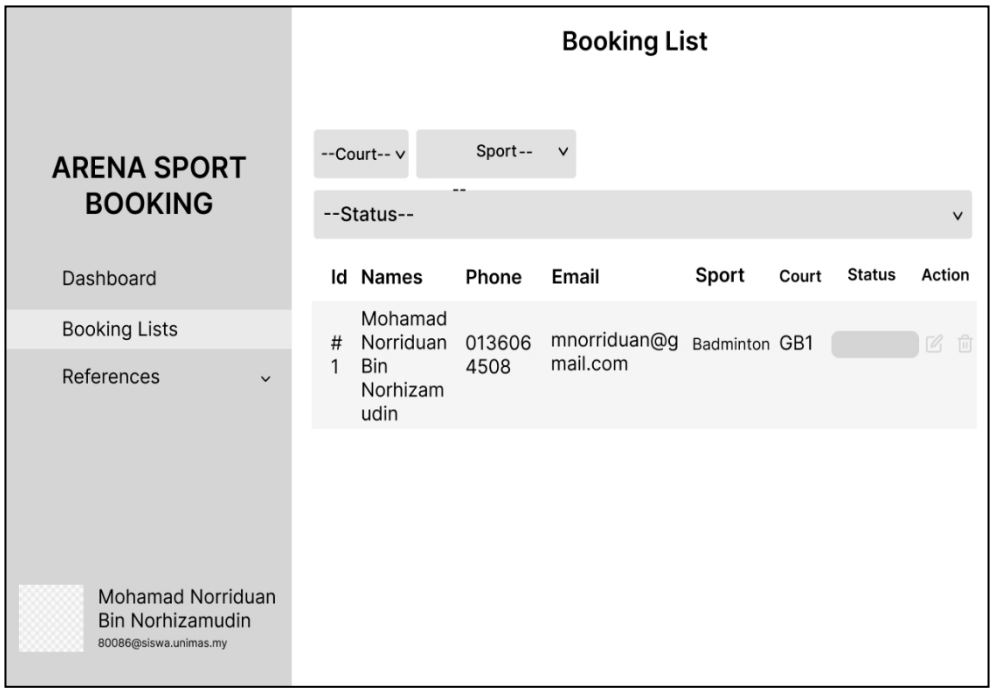


Figure 3.27: Admin Approve Section

3.8 Summary

After going through the full technique, it is now evident how the system functions and is constructed. Conducting a survey enables the collection of useful data during the requirement analysis phase, which can be utilised to revise and develop the system based on user feedback. Additionally, the hardware and software requirements have been described to act as a guide for the ensuing development process. The Entity-Relationship Diagram (ERD) efficiently

illustrates the entities, workflows, processes, and properties inside the system. It serves a significant role in boosting users' comprehension of how the system performs. Furthermore, this chapter highlights the design of the user interface, giving users further insights into the system’s general structure and usefulness.

CHAPTER 4: IMPLEMENTATION

4.1 Introduction

In this section, the eArena is discussed as talking about how, UNIMAS Court Reservation System was made, and it was tested. It elaborates on the usage of such tools as Laravel, Tailwind CSS, Flowbite, Alpine.js, and XAMPP for the system's construction. Step by step, the major components of the system, such as logging as a user, booking a court date, waiting for admin approval, and submission of report, among others, were developed using the covered designs and needs discussed in earlier chapters.

This part also mentions the testing phase that follows the implementation phase. It speaks about how the system was physically tested in order to ensure that all its parts function the way they are supposed to and that they meet the users' needs. Non-functional testing was concerned with such things as speed, usability, and security, while functional testing ensured that every feature did what it was supposed to do. The results of the tests are discussed to demonstrate the things that work fine with the system and the things that can be improved in the course of time.

4.2 System Configuration

4.2.1 Server Installation

The eArena system has been built and tested with the help of XAMPP, which is an open-source and cross-platform web server package. The XAMPP combines Apache as a web server, MySQL as a database engine, and supports PHP, which is the main language in the system that is under development. XAMPP created a local server that is very similar to a production server environment, and the development team was able to run the application and test it locally without the need for an internet connection or a live server.

The server environment was set to accommodate PHP web applications. XAMPP allowed developers to test how the system would behave once it is placed on a real server. This involved processing of HTTP requests, processing of PHP scripts, and communication with the MySQL database. The system files were installed locally in the XAMPP folder, and a web application was run through the browser with a localhost address. This system allowed testing, troubleshooting, and modification to be done efficiently during development.

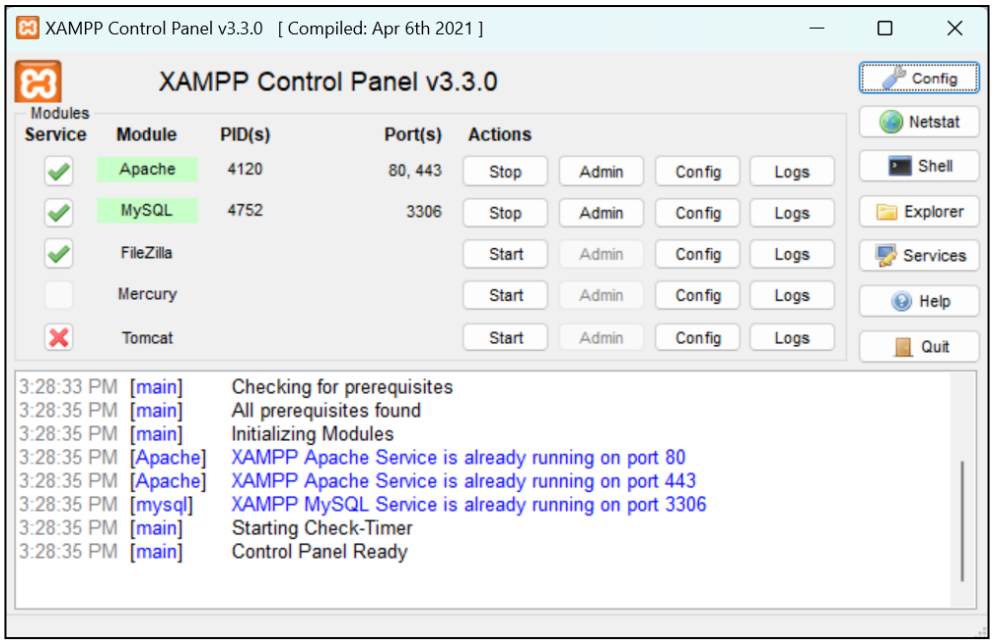


Figure 4.1: XAMPP Control Panel

4.2.2 Database

All the relevant data is stored in the system based on an organized MySQL database. These are user registration details, court details, booking history, time slots, reports, and approval status. The database was to facilitate an easy flow of data among the users, staff, and administrators with a proper relationship among the tables in order to define data integrity and consistency. phpMyAdmin was utilized to manage and view the database. This web-based tool

enabled developers toperform many sorts of database functionality, like creating tables, adding test data as well and updating records.

The environment settings of the application were set to the database connection so that a stable connection between the backend application and the database server is established. Database tables were designed as per the requirements obtained in the design phase, and the structure evolved in the development iterations. Each of the tables was outlined in such a way that it represented a certain aspect of the system, such as bookings, courts, users, and feedback. The database was fundamental towards making the booking system a real-time system, thereby eliminating cases of overlapping bookings and making it possible to keep proper records.

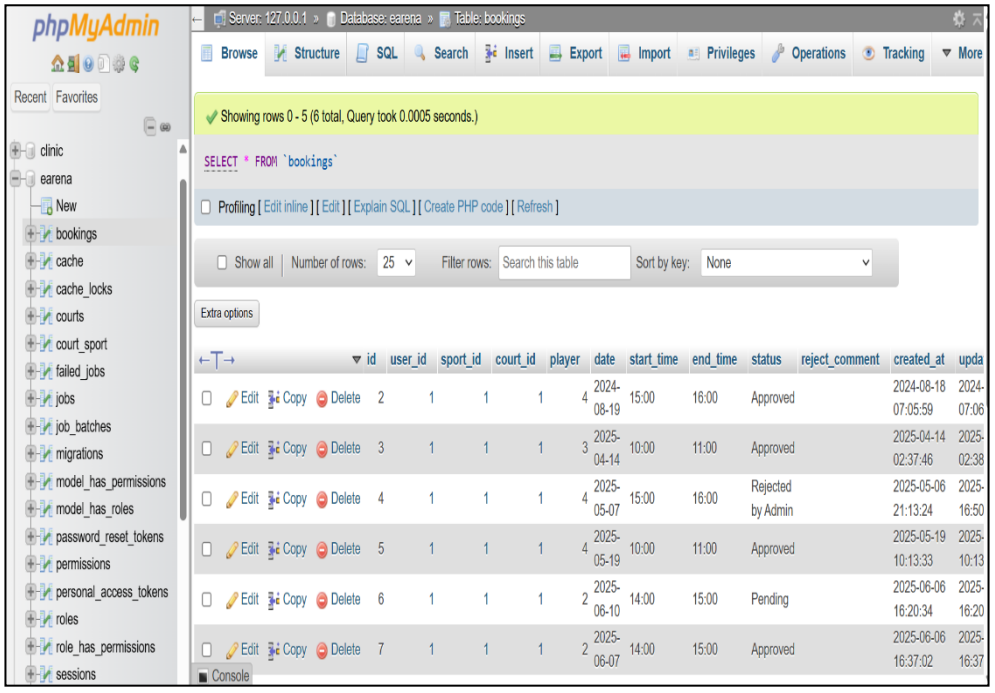


Figure 4.2: phpMyAdmin Database

4.3 Implementation of Proposed System

This part explains the implementation of the eArena system that is meant to enhance the process of badminton court reservation at UNIMAS. The system has been installed to enable convenient and easy access to online court availability, bookings, and confirmation of

bookings by students and staff. User authentication, real-time booking updates, admin approval, and report submission were also considered key features to provide smooth operation and proper management of the courts. The implementation process transformed the system design into an active application that promotes user experience and efficient use of resources.

4.3.1 Login & Sign-Up Page

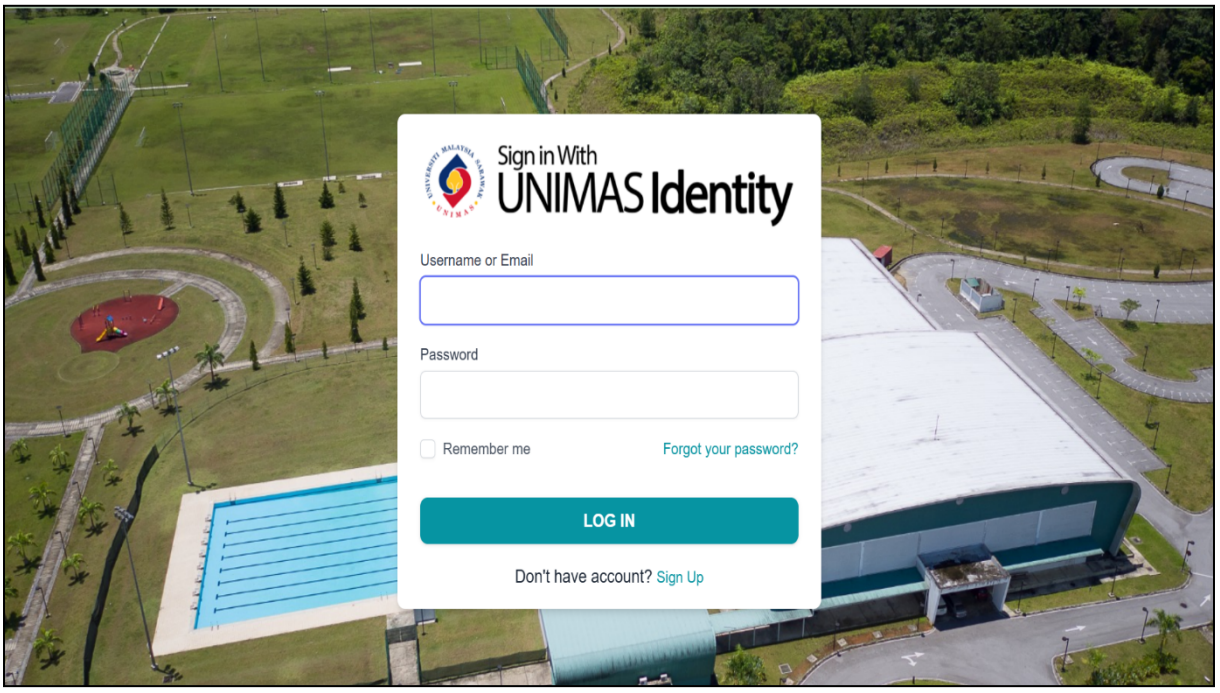
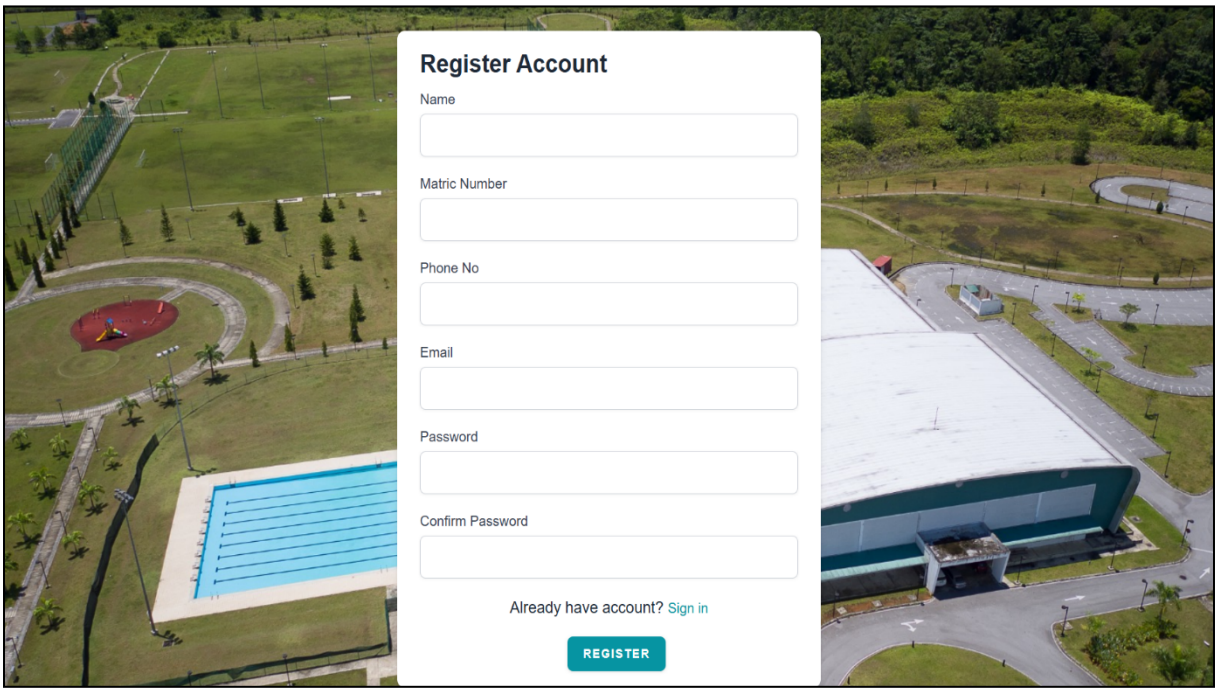


Figure 4.3: Login Page

Figure 4.3 shows the login page of the eArena system, where users (students or admins) enter their credentials to access the court booking system. It features fields for entering registered email and password, a login button, and links for actions such as password recovery or registration, like figure 4.4, which is the sign-up page.

Figure 4.4



: Sign-Up Page

```
<form method="POST" action="{{ route(name: 'login') }}">

    <div>
        <x-label for="email" value="{{ __(key: 'Username or Email') }}" />
        <x-input id="email" class="block mt-1 w-full" type="email" name="email" :value="old(key: 'email')"
            required autofocus autocomplete="username" />
    </div>

    <div class="mt-4">
        <x-label for="password" value="{{ __(key: 'Password') }}" />
        <x-input id="password" class="block mt-1 w-full" type="password" name="password" required
            autocomplete="current-password" />
    </div>

    <div class=" mt-4 mb-4 flex justify-between">
        <label for="remember_me" class="flex items-center">
            <x-checkbox id="remember_me" name="remember" />
            <span class="ms-2 text-sm text-gray-600 dark:text-gray-400">{{ __(key: 'Remember me') }}</span>
        </label>

        @if (Route::has(name: 'password.request'))
        <a class="text-sm text-teal-500 dark:text-gray-400  dark:hover:text-gray-100 rounded-md hover:underline"
            href="{{ route(name: 'password.request') }}">
            {{ __(key: 'Forgot your password?') }}
        </a>
    @endif
    </div>

    <div class="text-center">

    </div>

    <button type="submit"
        class="font-bold mt-4 w-full bg-teal-500 text-white uppercase py-2 rounded-lg shadow">
        {{ __(key: 'Log in') }}
    </button>

    <div class="text-center mt-4"> Don't have account?
        <a class="text-sm text-teal-500 dark:text-gray-400  dark:hover:text-gray-100 rounded-md hover:underline"
            href="{{ route(name: 'register') }}">
            {{ __(key: " Sign Up") }}
```

Figure 4. 5 Login Front End Code

The code snippet corresponds to the HTML and Blade template code used to create the login page interface. It includes form inputs for email and password, with proper labels and placeholders to guide users. The form action submits the credentials securely for backend validation.

The code also incorporates frontend validation to ensure that the user fills in both email and password fields before submitting. The login form is styled using Tailwind CSS and Flowbite components to provide a clean, responsive, and user-friendly interface.

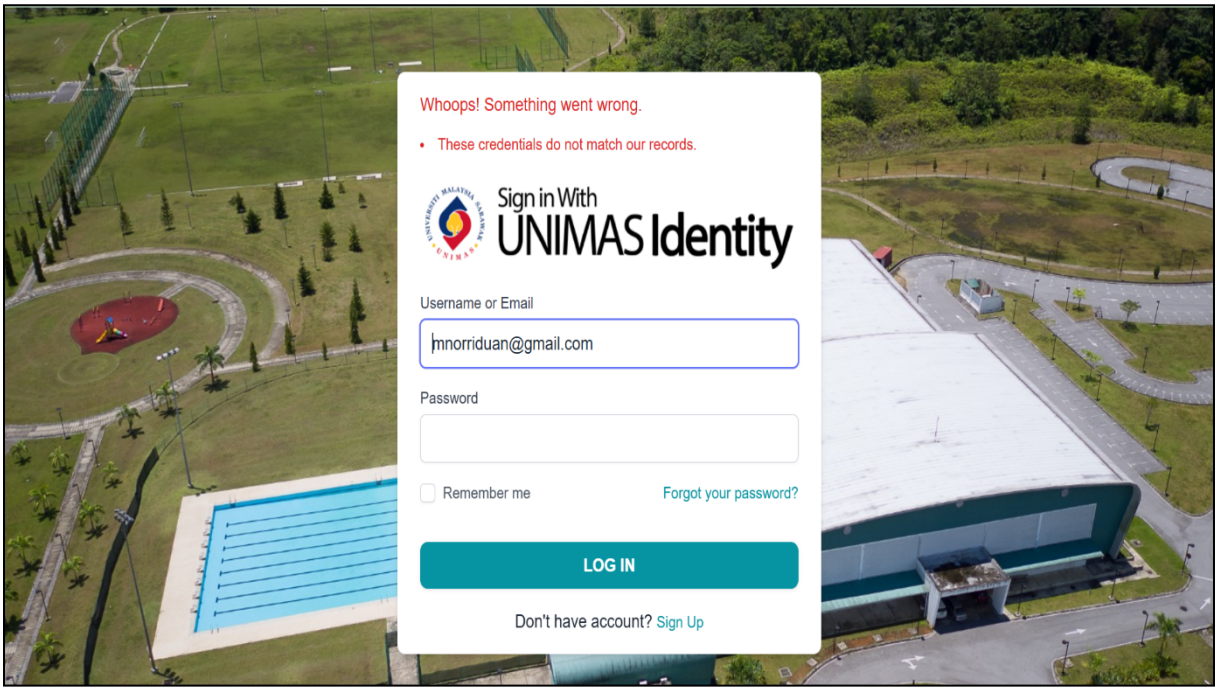


Figure 4.6: Validation Message for Login

Figure 4.6 demonstrates how the system handles user input errors on the login page. If a user submits incorrect or incomplete credentials, the system displays appropriate error messages (e.g., "These Credentials…"). These messages help users know the input is wrong and fix it.

```
1  @if ($errors->any())
2      <div {{ $attributes }}>
3          <div class="font-medium text-red-600 dark:text-red-400">{{ _(key: 'Whoops! Something went wrong.') }}</div>
4
5          <ul class="mt-3 list-disc list-inside text-sm text-red-600 dark:text-red-400">
6              @foreach ($errors->all() as $error)
7                  <li>{{ $error }}</li>
8              @endforeach
9          </ul>
10     </div>
11 @endif
```

Figure 4.7: Validation Code

This code snippet contains the backend validation logic implemented in Laravel (likely in the controller or request validation class). It checks if the email and password inputs are present and valid. If validation fails, the system redirects the user back to the login page with detailed error messages, which are then shown on the frontend (as in Figure 4.6).

4.3.2 Dashboard

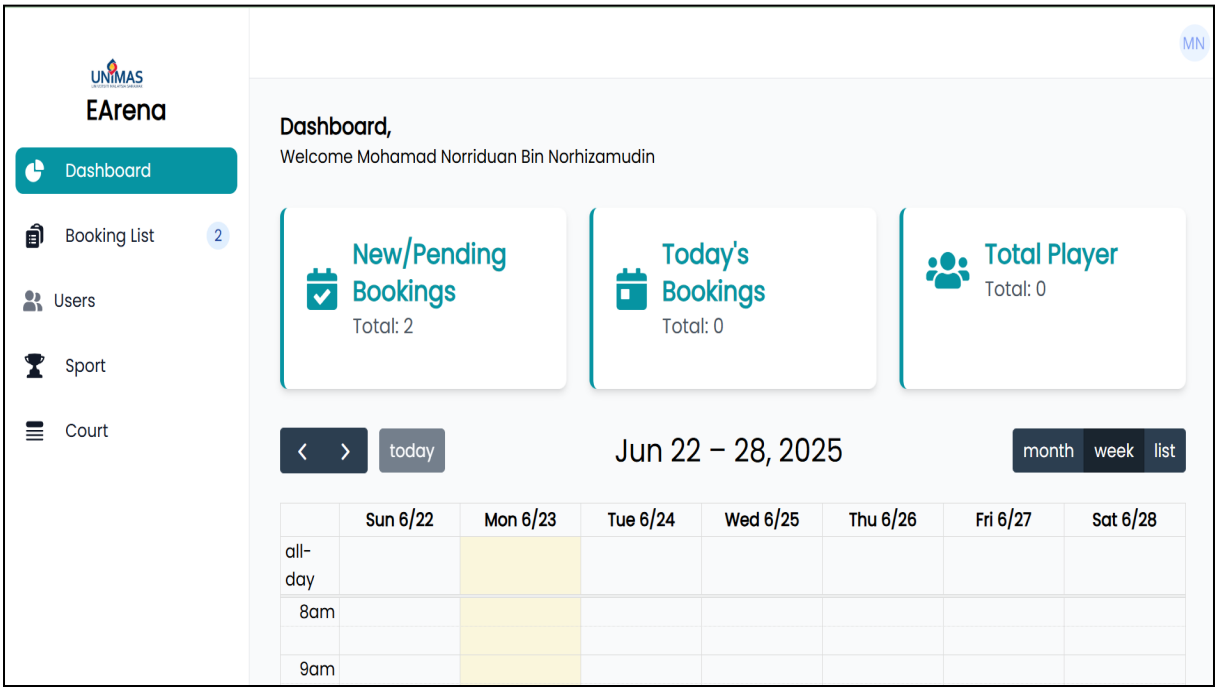
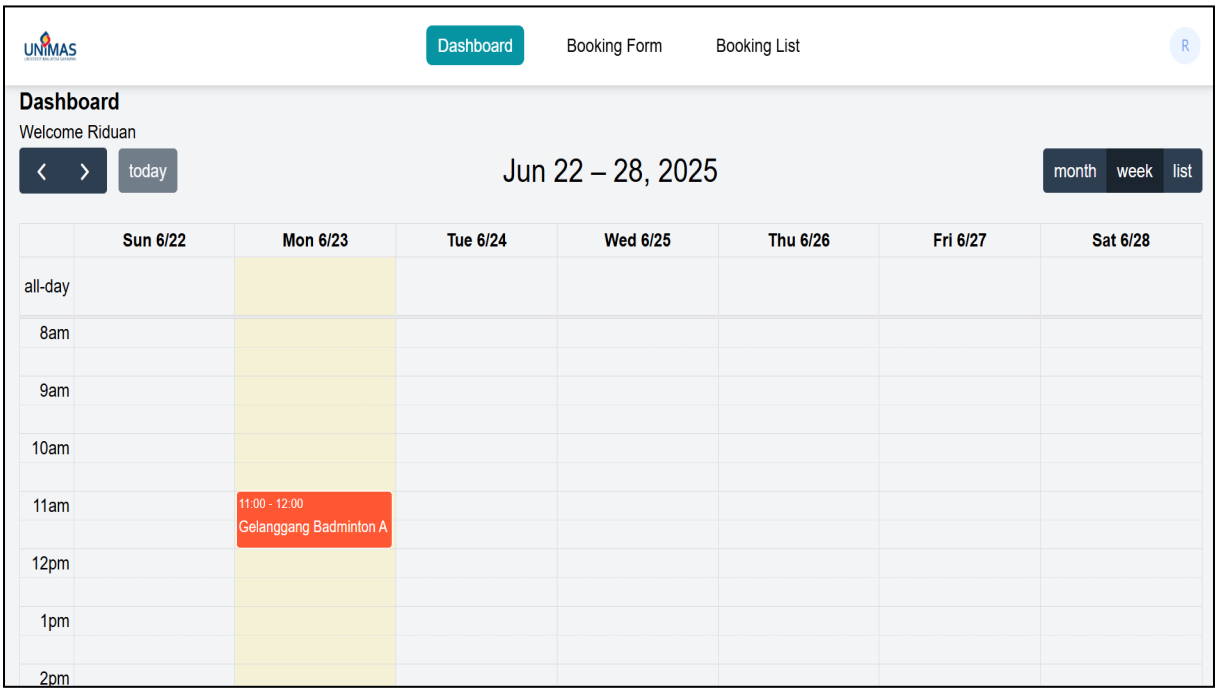


Figure 4.8: Admin Dashboard

Figure 4.8 shows the Admin Dashboard of the eArena system, which provides administrators with a comprehensive overview of the court reservation platform. The dashboard displays summary cards indicating the number of new or pending bookings, today's bookings, and the total number of players registered. The total number of players serves an important safety function in the event of an emergency, such as a fire, authorities can quickly determine how many individuals are present at the facility, enabling faster and more effective evacuation or emergency response. Below the summary, there is an interactive calendar view showing the week's court booking schedule, allowing admins to visualize court usage and manage bookings effectively. The sidebar menu on the left offers navigation to other administrative sections such as Booking List, Users, Sport, and Court management. The clean, intuitive interface helps administrators monitor and control court reservations efficiently.

Figure 4.9



: Student Dashboard

Figure 4.9 depicts the Student Dashboard, presenting the user with a personalized calendar view of their bookings. The interface features navigation tabs for Dashboard, Booking Form, and Booking List, enabling users to seamlessly manage their reservations. The calendar shows the current week's schedule with time slots. The simple and focused design provides students with an easy way to track their court usage and plan future reservations, improving the overall user experience of the eArena system.

```php
<?php

namespace App\Http\Controllers\Student;

use App\Http\Controllers\Controller;
use App\Models\Sport;
use App\Models\Booking;
use App\Models\Court;
use Carbon\Carbon;
use Illuminate\Support\Facades\Http;

2 references | 0 implementations
class DashboardController extends Controller
{

    1 reference | 0 overrides
    public function index(): Factory|View        Chat (CTRL + I) / Share (CTRL + L)
    {
        // $currentDateTime = Carbon::now();
        $sports = Sport::all();
        $newPendingBookings = Booking::where(column: 'status', operator: 'pending')->count();
        $todaysBookings = Booking::whereDate(column: 'date', operator: today())
            ->where(column: 'status', operator: 'Approved')
            ->count();
        $bookingsToday = Booking::whereDate(column: 'date', operator: today())->get();
        $totalPlayer = null;
        foreach($bookingsToday as $bt)
        {
            $totalPlayer += $bt->player;
        }

        // Define a set of colors to use for events
        $colors = [
            '#FF5733', // Red
            '#33FF57', // Green
            '#3357FF', // Blue
            '#FF33A8', // Pink
            '#33FFD1', // Turquoise
            '#FFC733', // Yellow
            '#8D33FF', // Purple
        ];

        // Fetch events
```

Figure 4.10: Admin Dashboard Controller Code

Figure 4.10 displays the Admin Dashboard Controller code in the eArena system, implemented in PHP using the Laravel framework. The index () function fetches key data for the admin dashboard, including the total number of pending bookings, today's approved bookings, and total players involved. It retrieves all sports information and calculates booking counts by querying the Booking model with specific conditions such as booking status and date. Additionally, it defines an array of colour codes to visually distinguish booking events on the calendar. This controller prepares and passes the collected data to the corresponding view, enabling the admin dashboard to display real-time statistics and a color-coded booking calendar, enhancing management efficiency.

4.3.3 Court Availability

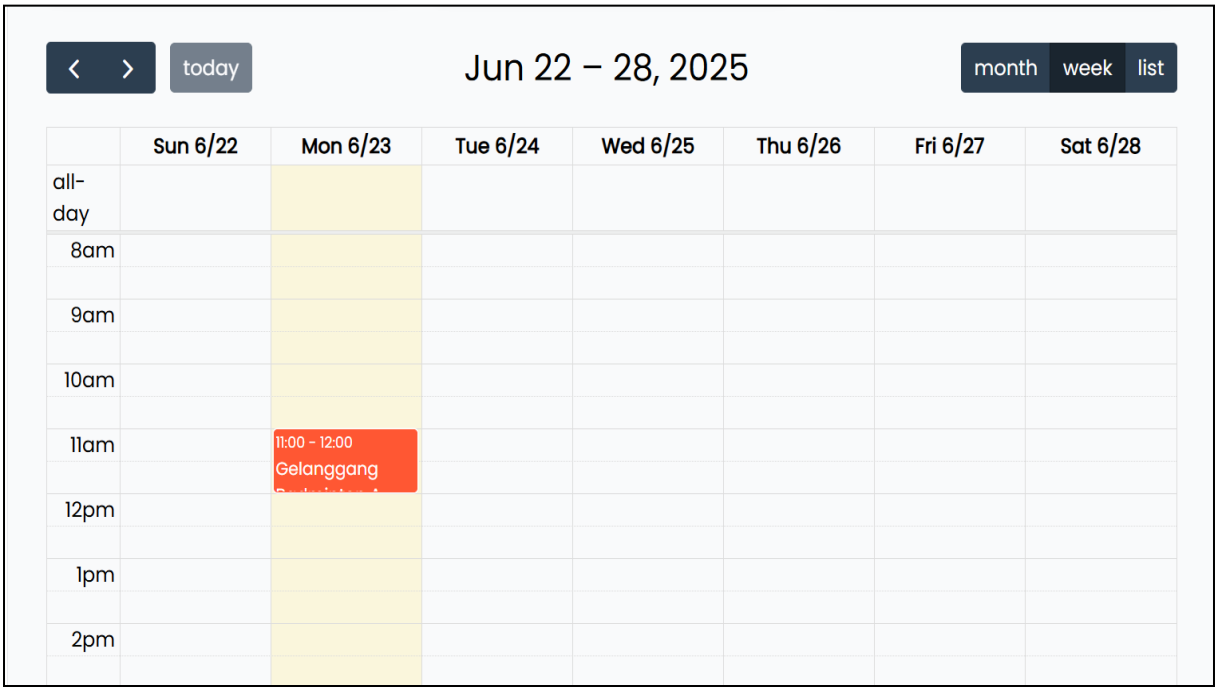


Figure 4.11: Calendar

Figure 4.11 displays the calendar interface used in the eArena system to show court availability for a selected week. The calendar presents time slots from early morning to evening across the days of the week, clearly indicating booked slots in red with details such as the court name and time. This visual representation enables users and administrators to quickly identify free and occupied time slots, facilitating efficient court management and reservation planning.

Figure 4.12

```php
foreach ($bookings as $booking) {
    if ($booking->status === 'Approved') {  // Check if the booking status is 'approved'
        $date = Carbon::parse(time: $booking->date)->format(format: 'Y-m-d'); // Get the date
        $startTime = Carbon::parse(time: $booking->start_time);
        $endTime = Carbon::parse(time: $booking->end_time);

        // Initialize color index for the date if not already set
        if (!isset($dateColorIndex[$date])) {
            $dateColorIndex[$date] = 0;
        }

        // Assign color to the event
        $color = $colors[$dateColorIndex[$date] % count(value: $colors)];
        $dateColorIndex[$date]++;

        $events[] = [
            'title' => $booking->court->name,
            'start' => "{$date}T{$startTime->format(format: 'H:i:s')}",
            'end' => "{$date}T{$endTime->format(format: 'H:i:s')}",
            'color' => $color, // Set the color
        ];
    }

}
```

: Calendar Code

Figure 4.12 shows the backend code responsible for generating the calendar events displayed in the interface. This snippet iterates through the collection of bookings, filtering for those with an ‘Approved’ status. For each booking, it parses the booking date and start/end times using the Carbon date-time library. The code dynamically assigns a colour to each event based on the booking date to visually differentiate bookings on the calendar. The event array is constructed with keys for title (court name), start and end datetime strings, and the assigned colour. This data structure is then used by the front-end calendar component to render a color-coded and accurate schedule of court bookings.

4.3.4 User Profile

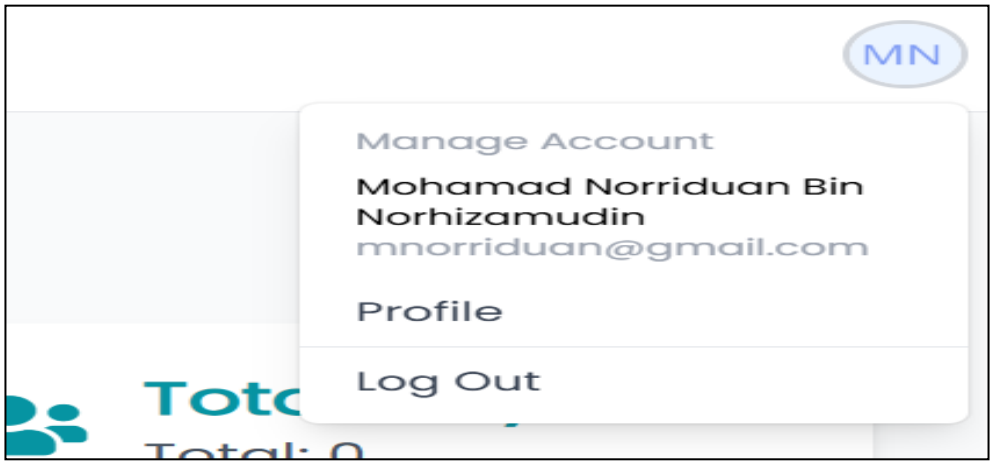
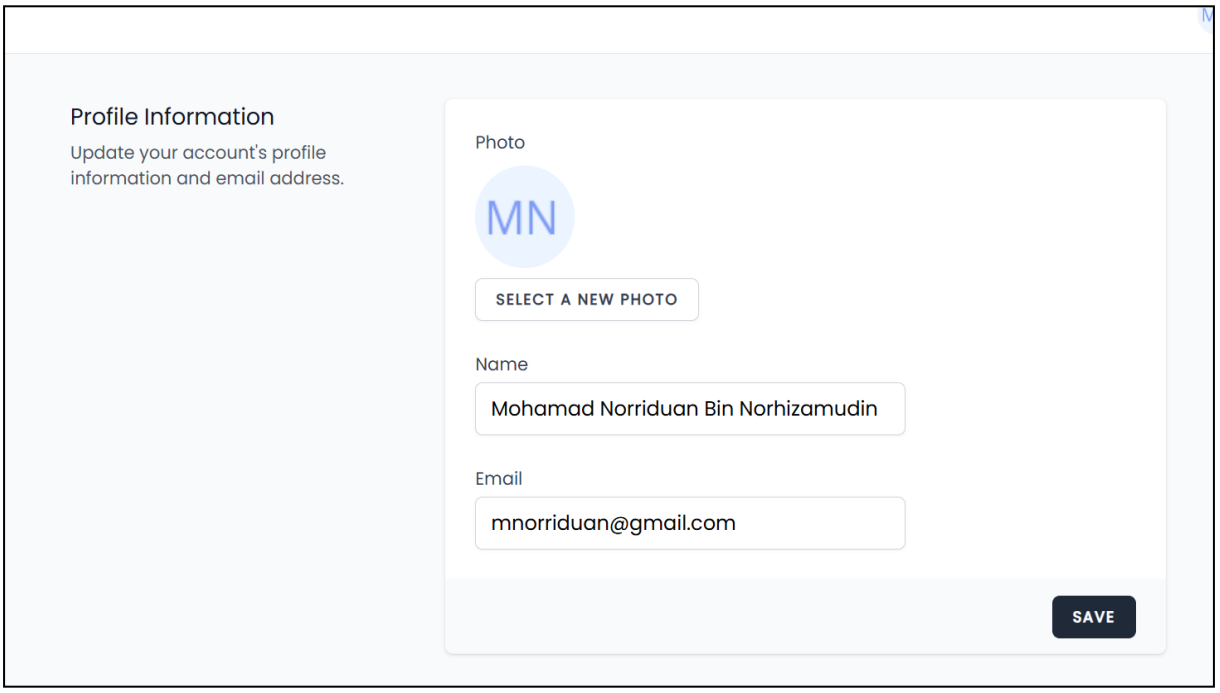


Figure 4.13: Profile Button

Figure 4.13 shows the Profile Button in the eArena system, located typically at the top right corner of the dashboard. When clicked, it reveals a dropdown menu that displays the logged-in user's name and email address, along with options to access the user's profile page or to log out. This feature provides quick access to account management functions, enhancing usability and navigation convenience.

Figure 4.14



: User Profile

Figure 4.14 presents the User Profile page where users can view and update their personal information. The interface allows users to change their display photo, name, and email address. A simple and clean layout, styled with Tailwind CSS, ensures the form is easy to use. The Save button submits the updated information, helping keep user data current and accurate within the system.

Figure 4.15

```php
class ProfileController extends Controller
{
    1 reference | 0 overrides
    public function show(): Factory|View
    {
        return view(view: 'profile.show');
    }

    0 references | 0 overrides
    public function updateProfileInformation(Request $request): RedirectResponse
    {
        $user = Auth::user();

        $request->validate(rules: [
            'name' => ['required', 'string', 'max:255'],
            'email' => ['required', 'string', 'email', 'max:255', 'unique:users,email,' . $user->id],
        ]);

        $user->name = $request->name;
        $user->email = $request->email;
        $user->save();

        return back()->with(key: 'status', value: 'profile-information-updated');
    }

    0 references | 0 overrides
    public function updatePassword(Request $request): RedirectResponse
    {
        $request->validate(rules: [
            'current_password' => ['required', 'string'],
            'password' => ['required', 'string', 'min:8', 'confirmed'],
        ]);

        $user = Auth::user();

        if (! Hash::check(value: $request->current_password, hashedValue: $user->password)) {
            return back()->withErrors(provider: ['current_password' => 'Current password does not match']);
        }

        $user->password = Hash::make(value: $request->password);
        $user->save();
```

: User Profile Code

Figure 4.15 displays the backend User Profile Controller code implemented in Laravel. The show() function returns the profile view to display the user's current information. The updateProfileInformation() method handles validation and updates of the user's name and email, ensuring inputs meet required formats and uniqueness constraints. Additionally, the updatePassword() method verifies the current password before allowing the user to set a new one, enhancing security by preventing unauthorized changes. This controller ensures robust profile management while maintaining data integrity and user security.

4.3.5 Manage Booking

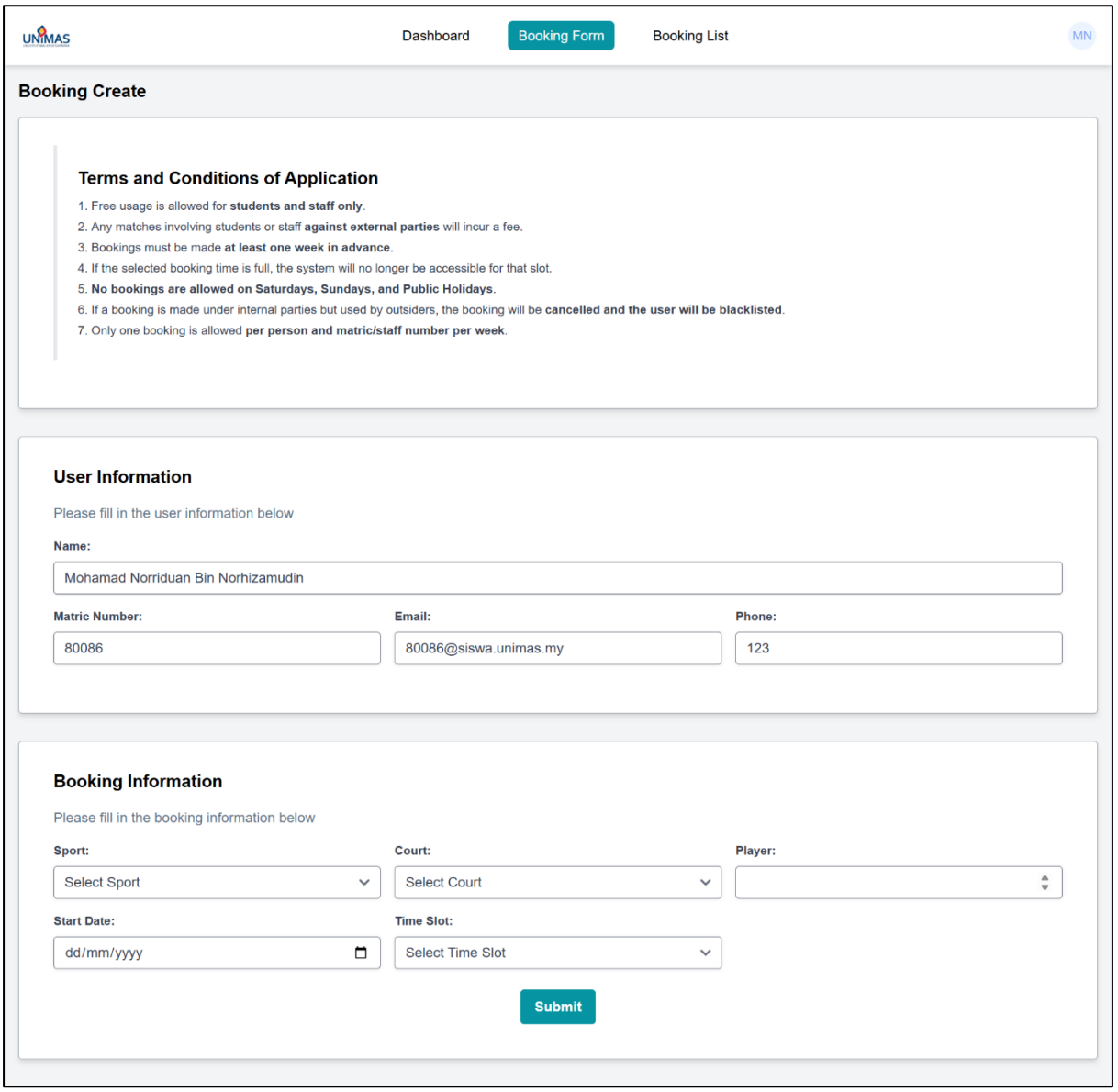


Figure 4.16: Booking Form

Figure 4.16 displays the Booking Form interface in the eArena system, designed for UNIMAS students and staff to make court reservations efficiently. At the top, a clearly defined Terms and Conditions of Application section outlines the booking rules, ensuring users are informed before proceeding. Below it, the form is divided into two main parts: User Information, where users provide their name, matric number, email, and phone number; and Booking Information, where users select the sport, court, number of players, date, and time slot. The clean and structured layout ensures a user-friendly experience while enforcing reservation policies effectively.

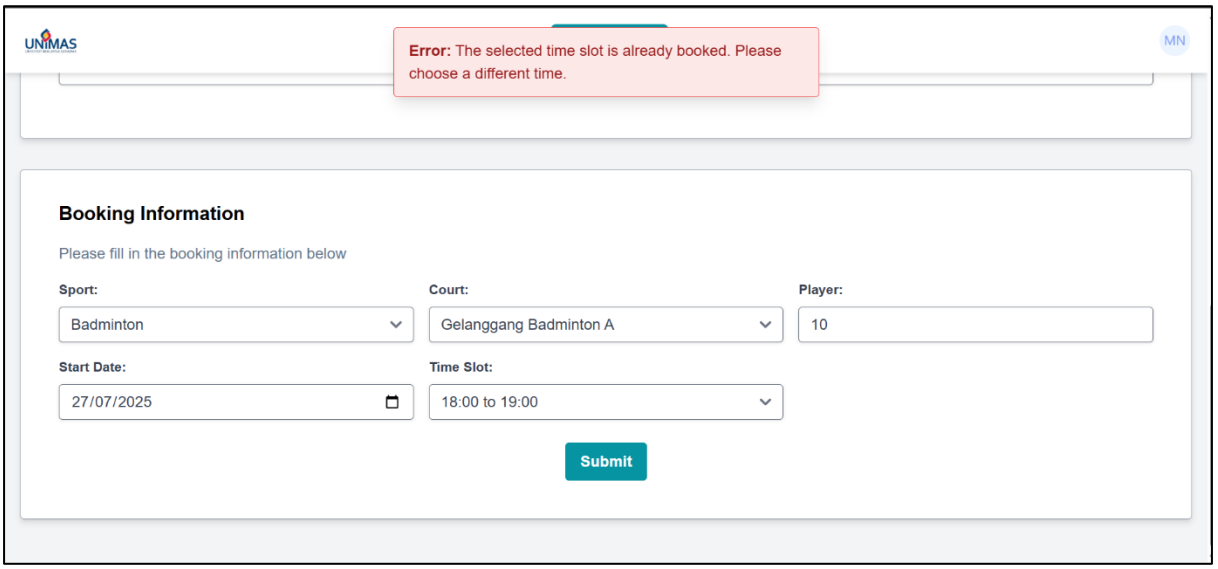


Figure 4.17: Double Booking Function

Figure 4.17 illustrates the system's double booking prevention feature in action. When a user attempts to book a court for a time slot that has already been reserved, in this case, *"Gelanggang Badminton A"* on 27/07/2025 from 18:00 to 19:00, the system displays an error message at the top of the screen: "Error: The selected time slot is already booked. Please choose a different time." This validation ensures that overlapping reservations are not allowed, thereby maintaining accurate court availability and preventing scheduling conflicts. The feature is crucial for ensuring fair usage and efficient management of court resources.

```
// Check for overlapping bookings
if ($this->isOverlappingBooking()) {
    session()->flash(key: 'error', value: 'The selected time slot is already booked. Please choose a different time.');
    return;
}

$times = explode(separator: ' to ', string: $this->time_slot);
$startTime = $times[0];
$endTime = $times[1];
```

Figure 4.18: Double Booking Code

Figure 4.18 shows a PHP code snippet that plays a critical role in preventing double bookings in a time-slot-based reservation system. This code is typically used in a Laravel Livewire component or controller where a user selects a time slot for booking. The main function of this code is to validate whether the selected time slot overlaps with any existing

bookings. If an overlap is detected, the system alerts the user and stops further processing.

```
0 references | 0 overrides
public function store(): array|RedirectResponse
{


    $this->validate();

    // Check for overlapping bookings
    if ($this->isOverlappingBooking()) {
        session()->flash(key: 'error', value: 'The selected time slot is already booked. Please choose a different time.');
        return;
    }

    $times = explode(separator: ' to ', string: $this->time_slot);
    $startTime = $times[0];
    $endTime = $times[1];

    $this->status = 'Pending';

    $this->booking->fill(attributes: [
        'user_id' => $this->user_id,
        'sport_id' => $this->sport_id,
        'court_id' => $this->court_id,
        'player' => $this->player,
        'date' => $this->date,
        'start_time' => $startTime,  // Set the start time
        'end_time' => $endTime,  // Set the end time
        'status' => $this->status,
    ])->save();

    $this->user->fill(attributes: ['phone' => $this->phone])->save();

    if ($this->user->hasRole(roles: [config(key: 'system.roles.student')])) {
        return redirect()->route(route: 'student.bookings.index')->with(key: 'success', value: 'Booking has been successfully created/updated.');
    } elseif ($this->user->hasRole(roles: config(key: 'system.roles.admin'))) {
        return redirect()->route(route: 'admin.bookings.index')->with(key: 'success', value: 'Booking has been successfully created/updated.');
    } else {
        return [];
    }
}
```

Figure 4.19: Booking Function

Figure 4.19 illustrates the backend Booking Function implemented in Laravel. Before saving a new booking, it performs validation and checks for any overlapping bookings to prevent double reservations. The booking status is initially set to 'Pending', and both booking and user details are saved. Based on the user's role (student or admin), the function redirects the user to the appropriate booking list with success messages, ensuring role-specific workflows.

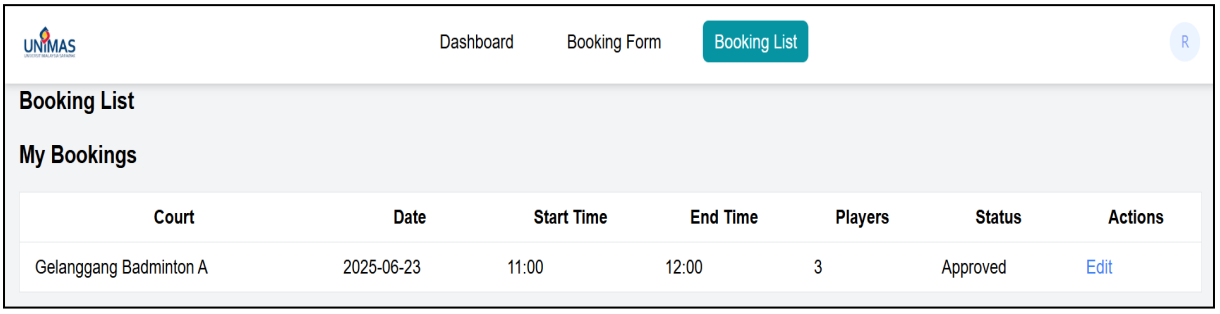


Figure 4.20: Student Booking List

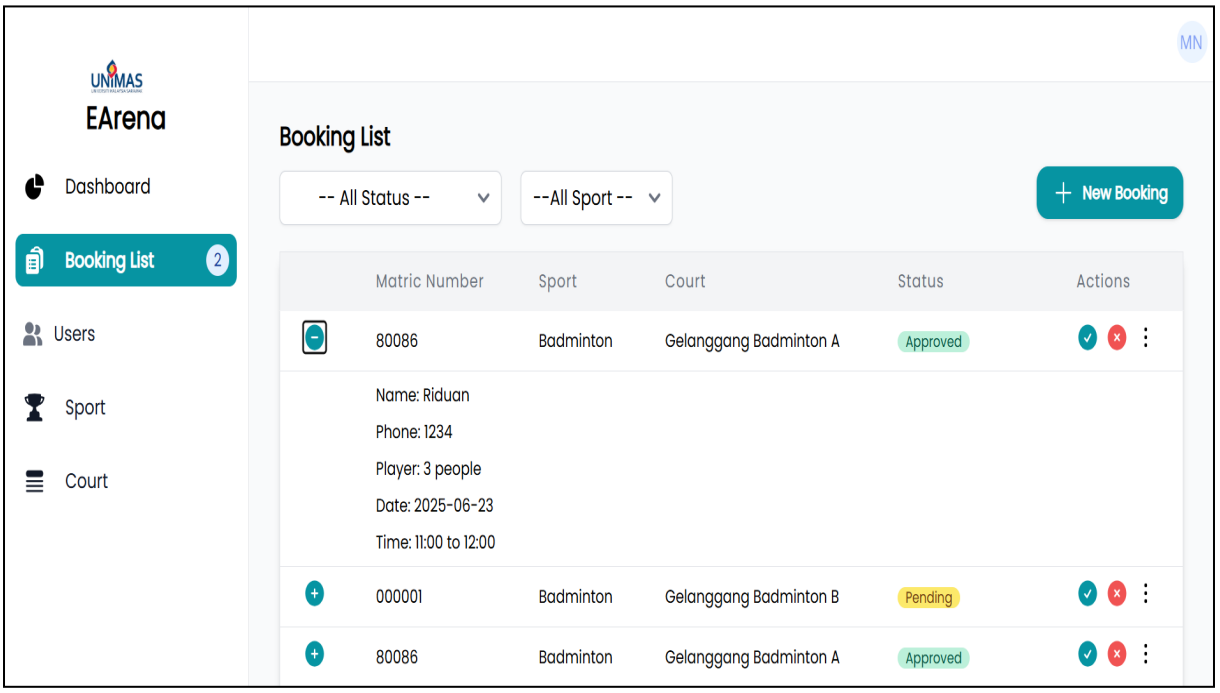


Figure 4.21: Admin Booking List

Figures 4.20 and 4.21 compare the Student and Admin Booking Lists, respectively. The Student Booking List (Figure 4.20) displays the user's bookings in a simple table format with details such as court, date, time, number of players, status, and options to edit. In contrast, the Admin Booking List (Figure 4.21) presents a more detailed overview, including filtering options by status and sport, along with administrative actions to approve, reject, or edit any booking. This interface also shows extra booking information like username and phone number to assist in management decisions.

Figure 4.22

```
        class="inline-flex items-center gap-2 bg-teal-500 text-white hover:bg-teal-700 text-sm rounded-xl shadow font-semibold py-2 px-4 ml-auto">
        <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 24 24" fill="currentColor" class="size-6">
            <path fill-rule="evenodd"
                d="M12 3.75a.75.75 0 0 1 .75.75v6.75h6.75a.75.75 0 0 1 0 1.5h-6.75v6.75a.75.75 0 0 1-1.5 0v-6.75H4.5a.75.75 0 0 1 0-1.5h6.75V4.5a.75.75 0 0 1 .75-.
                clip-rule="evenodd" />
        </svg>
        <div>New Booking</div>
    </button>
    @endhasanyrole
</div>



<div class="py-4 pb-4">
    <table class="w-full divide-y divide-gray-100 mx-auto shadow-md border border-gray-200 rounded-xl">
        <thead>
            <tr>
                <th class="px-6 py-3 bg-gray-100"></th>
                <th class="px-6 py-3 bg-gray-100 text-left text-sm font-medium text-gray-500 tracking-wider">Matric
                    Number</th>
                <th class="px-6 py-3 bg-gray-100 text-left text-sm font-medium text-gray-500 tracking-wider">Sport
                </th>
                <th class="px-6 py-3 bg-gray-100 text-left text-sm font-medium text-gray-500 tracking-wider">Court
                </th>
                <th class="px-6 py-3 bg-gray-100 text-left text-sm font-medium text-gray-500 tracking-wider">Status
                </th>
                @hasanyrole([config(key: 'system.roles.admin')])
                    <th class="px-6 py-3 bg-gray-100 text-left text-sm font-medium text-gray-500 tracking-wider">Actions
                    </th>
                @endhasanyrole
            </tr>
        </thead>
        <tbody class="bg-white divide-y divide-gray-200 text-sm">
            @if ($bookings && $sports && $bookings->count() > 0 && $sports->count() > 0)
                @foreach ($bookings as $booking)
                    <tr class="place-items-center">
                        <td class="px-6 py-2 whitespace-no-wrap">
                            <button class="text-teal-500"
                                @click="openRows.includes({{ $booking->id }}) ? openRows = openRows.filter(item => item !== {{ $booking->id }}) : openRows.push({{ $
                                <svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 24 24" fill="currentColor"
```

: Admin Booking List Code

Figure 4.22 reveals the Blade template code for the Admin Booking List. It dynamically renders booking data with Tailwind CSS styling and includes conditional logic to ensure that only users with admin roles see the management actions. The code uses loops and conditionals to handle various booking statuses and display corresponding controls effectively.

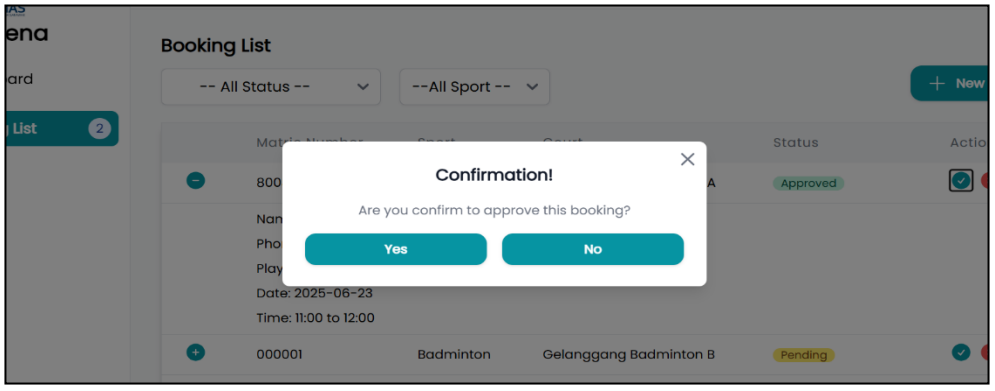


Figure 4.23: Approve Booking Confirmation

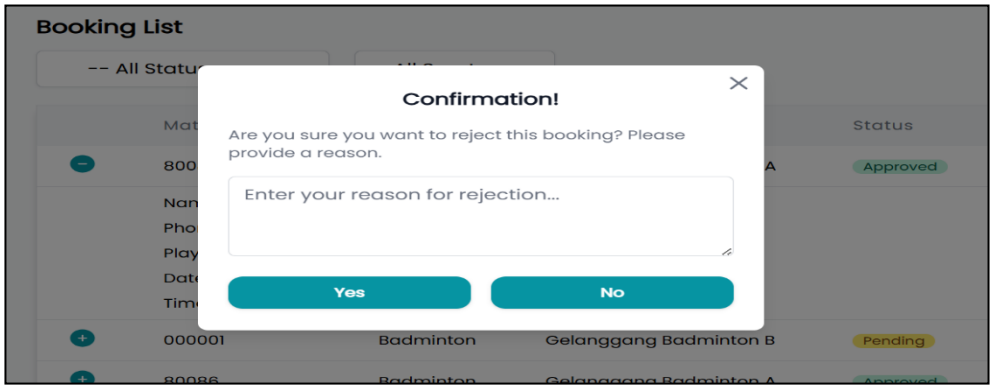


Figure 4.24: Reject Booking Confirmation

Figures 4.23 and 4.24 show modal confirmation dialogs that prompt the admin to confirm approving or rejecting a booking. The rejection modal requires the admin to provide a reason, ensuring accountability and clear communication.

```
public function toggleApprove(): void
{
    $this->booking = Booking::findOrFail(id: $this->id);
    if ($this->booking->status === 'Pending') {
        $this->booking->status = 'Approved';
    }

    $this->booking->save();
    $this->showModalApprove = false;
    $this->dispatch(event: 'refresh')->self();

    session()->flash(key: 'message', value: 'Booking status updated successfully.');
}

0 references | 0 overrides
public function toggleReject(): void
{
    $this->booking = Booking::findOrFail(id: $this->id);
    if ($this->booking->status === 'Pending') {
        $this->booking->status = 'Rejected by Admin';
        $this->booking->reject_comment = $this->reject_comment;
    }

    $this->booking->save();
    $this->showModalReject = false;
    $this->dispatch(event: 'refresh')->self();

    session()->flash(key: 'message', value: 'Booking status updated successfully.');
}
```

Figure 4.25: Approve and Reject Function

Figure 4.25 displays the backend functions for approving and rejecting bookings. The

toggleApprove() method updates the booking status from 'Pending' to 'Approved' and saves changes to the database, while the toggleReject() method changes the status to 'Rejected by Admin' and stores the rejection comment. Both functions refresh the view and flash success messages to inform the admin of the update results.

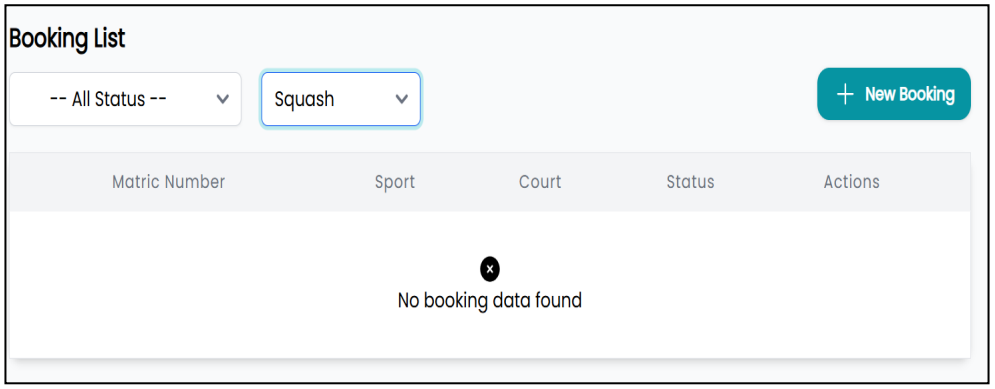


Figure 4.26: No Data Found

Figure 4.26 demonstrates the system behavior when no booking data matches the current filters, displaying a user-friendly message 'No booking data found' to inform admins or users that there are no relevant records to show. This ensures the interface gracefully handles empty data scenarios without errors or confusion.

4.3.6 Sport & Court

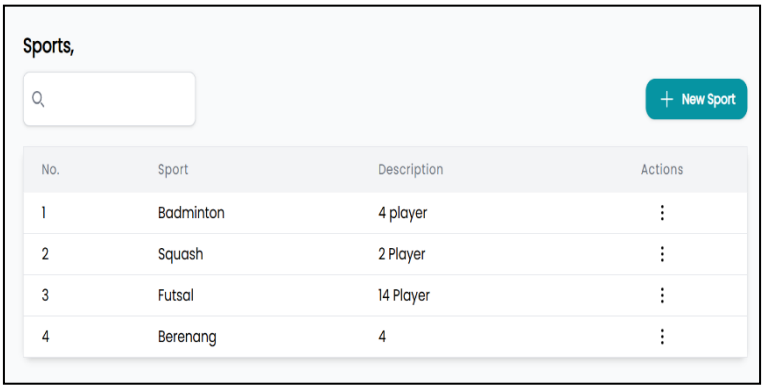


Figure 4.27: Sport List

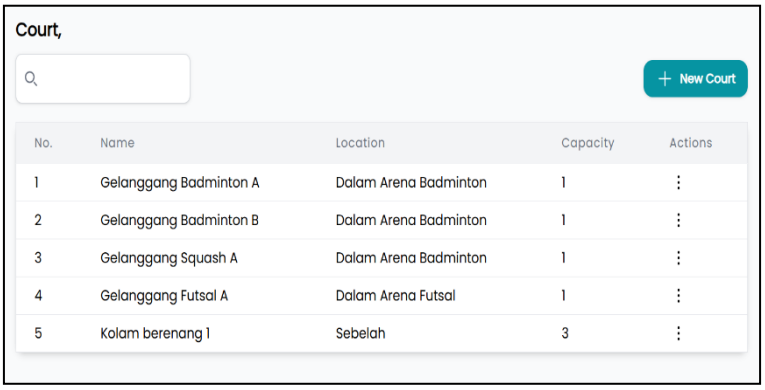


Figure 4.28: Court List

Figure 4.27 and 4.28 display the Sport and Court List interfaces within the eArena system. The Sport List shows all available sports with details such as the sport name and a brief description, including the typical number of players. The Court List provides information about each court's name, location, and capacity. Both lists feature search bars and action buttons, enabling administrators to quickly find, edit, or manage sports and courts, enhancing system flexibility and data management.

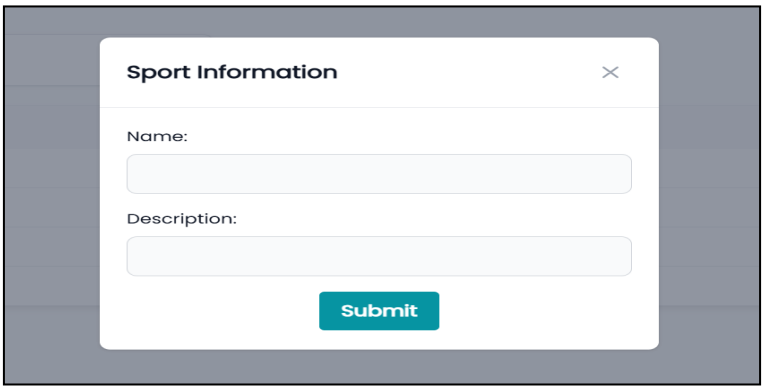


Figure 4.29: Add Sport

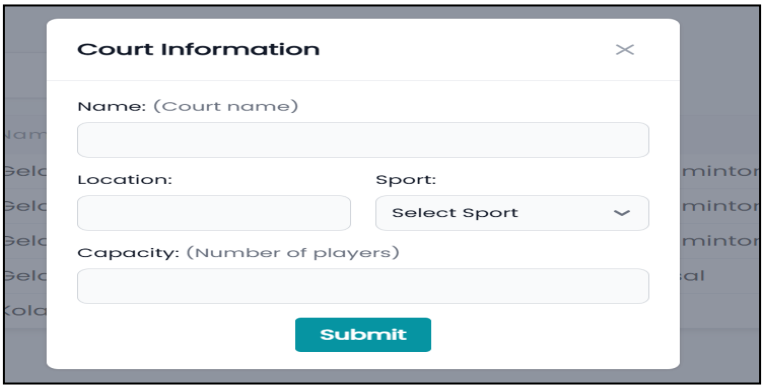


Figure 4.30: Add Court

Figure 4.29 and 4.30 shows the input forms for adding new sports and courts. The Sport Information form allows administrators to input the name and description of a sport, while the Court Information form collects details such as court name, location, associated sport, and player capacity. These modal forms streamline the process of expanding the sports facilities available in the system.

4.3.7 Logout

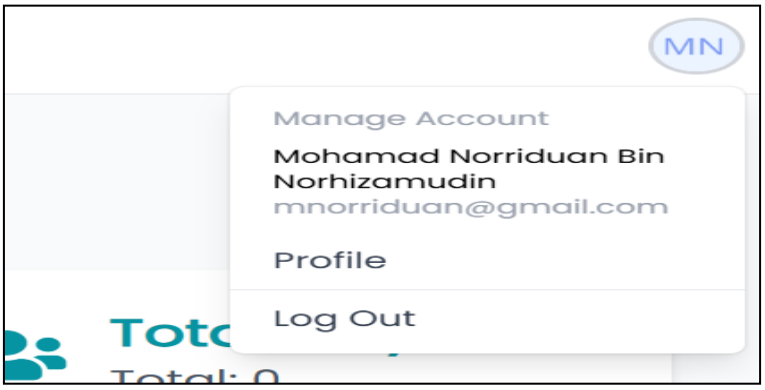


Figure 4.31: Logout Button

Figure 4.31 illustrates the Logout Button dropdown in the user interface. Accessible via the user's profile menu, it provides a clear option for users to securely log out of the system, along with quick access to their profile and account management options.

```
<!-- Authentication -->
<form method="POST" action="{{ route(name: 'logout') }}" x-data>
    @csrf

    <x-dropdown-link href="{{ route(name: 'logout') }}" @click.prevent="$root.submit();">
        {{ __(key: 'Log Out') }}
    </x-dropdown-link>
</form>
```

Figure 4.32: Logout Code

Figure 4.32 presents the Logout Code implemented in the Laravel Blade template syntax. The logout is handled via a POST form submission to ensure secure logout requests, protecting against CSRF attacks. The form uses Alpine.js directives to intercept the click event on the logout link and submit the form programmatically, providing a smooth and safe user experience.

4.4 Summary

Chapter 4 details the comprehensive implementation process of the eArena Court Reservation System, translating the design and requirements into a fully functional web application. It covers critical system components, including user authentication, dashboard functionalities for both students and administrators, real-time court availability calendars, and comprehensive booking management features. The chapter highlights how user profiles enable personalized account management and how administrators efficiently oversee sports, courts, and bookings through intuitive interfaces. Emphasis is placed on usability, security, and responsiveness achieved through modern frameworks and technologies such as Laravel, Tailwind CSS, and Alpine.js. The inclusion of real-time validation, session management, and role-based controls ensures that the system meets functional and non-functional requirements. Overall, the implementation phase transforms conceptual designs into a practical and accessible platform that significantly improves the badminton court reservation experience at University Malaysia Sarawak.

CHAPTER 5: TESTING

5.1 Introduction

This chapter is devoted to the testing of the eArena system because it is necessary to make sure that all the features operate as required and that the system meets its needs. Different tests were done to test the functionality and non-functionality of the system. Functional testing will be used to ensure that the basic functions of user login, court booking, and admin approval are functional. Non-functional testing includes testing the performance, usability, and security, to ensure that the system is reliable and comfortable to use. The outcomes of these tests are displayed and discussed to show the strong points of the system and outline the directions where it may be improved.

5.2 Functional Testing

Functional testing focuses on verifying that each feature of the eArena Court Reservation System operates according to the specified requirements. This testing phase involves systematically checking all core functionalities to ensure they work correctly and reliably from the user's perspective.

5.2.1 Unit Testing

i) System Menu

Table 5.1: Test Case of System Menu

Test Description: To verify that all system menu links open the correct pages.				
Test Case ID	**Test Case**	**Expected Result**	**Actual Result**	**Pass/Fail**
SM1	Click on the link	The login page is displayed	Login page displayed	Pass
SM2	Click on the Login button (on the login page)	User authenticated and redirected to the dashboard	User redirected to dashboard	Pass
SM3	Click on the Dashboard menu	The dashboard page is displayed	Dashboard page displayed	Pass
SM4	Click on the Booking	The Booking List	The Booking List page is	Pass

	List menu	page is displayed	displayed	
SM5	Click on the Booking Form menu (Student)	The booking form page is displayed	Booking form displayed	Pass
SM6	Click on the Court menu (admin only)	Admin court page is displayed	Admin court page displayed	Pass
SM7	Click on the Sport menu (admin only)	Admin sport page is displayed	Admin sport page displayed	Pass
SM8	Click on the Profile button	The user profile page is displayed	User profile page displayed	Pass
SM9	Click on the Logout button	User logged out and redirected to the login page	Redirected to the login page	Pass
SM10	Click on the Report menu (admin only)	Report submission page displayed (if implemented) / Not implemented	See the report by the student	Fail / Not Implemente d

ii) Login Page

Table 5.2: Test Case of Login Page

Test Description: To ensure users can log in successfully with valid credentials and receive validation messages for invalid inputs.				
Test Case ID	**Test Case**	**Expected Result**	**Actual Result**	**Pass/Fail**
LG1	User enters a valid email and password	User is authenticated and redirected to the dashboard	User logged in and redirected successfully	Pass
LG2	User enters incorrect email, incorrect password, or leaves	Validation error message displayed, indicating invalid or	Appropriate validation message	Pass

	email/password empty.	missing credentials.	displayed	
LG3	User clicks “Forgot Password” link	The password reset page is displayed	Password reset page opens	Pass

iii) Register Page

Table 5.3: Test Case of Register Page

Test Description: To verify that new users can register successfully and that proper validation is enforced for missing or invalid inputs.				
Test Case ID	**Test Case**	**Expected Result**	**Actual Result**	**Pass/Fail**
RG1	User fills all required fields correctly	Account is created successfully, and user is redirected to the login page	Account created and redirected	Pass
RG2	User submits form with one or more required fields empty	Validation error messages are displayed prompting to fill the required fields	Appropriate validation errors are shown	Pass
RG3	User attempts to register with an email that already exists	An error message is displayed indicating a duplicate email	Duplicate email error shown	Pass
RG4	User enters an invalid email format	Validation error displayed for invalid email	Invalid email error shown	Pass

iv) Booking Page

Table 5.4: Test Case of Booking Page

Test Description: To verify that users can create, modify, and cancel bookings properly, with validation and an admin approval workflow.				
Test Case ID	**Test Case**	**Expected Result**	**Actual Result**	**Pass/Fail**
BK1	User opens the Booking Form	The booking form page loads, showing the form	Booking form displayed	Pass
BK2	User submits booking with all valid data	Booking saved successfully, pending admin approval	Booking saved and pending approval	Pass
BK3	User submits booking with missing required fields	Validation error message displayed, booking not submitted	Validation errors shown	Pass
BK4	User tries to book a court in an unavailable time slot	An error message is shown indicating the slot is unavailable	Error message displayed	Pass
BK5	User modifies an existing booking with valid data	Booking updated successfully	Booking updated	Pass
BK6	Student cancels an existing booking	Booking cancelled and slot freed	Booking cancelled	Fail/Not implemented
BK7	Admin approves a pending booking	Booking status updated to approved	Booking approved	Pass
BK8	Admin rejects a pending booking	Booking status updated to rejected	Booking rejected	Pass
BK9	Admin deletes an existing booking	Booking removed from system; slot freed;	Booking deleted successfully.	Pass

v) Admin Court Page

Table 5.5: Test Case of Admin Court Page

Test Description: Verify that the admin can manage courts effectively by adding, editing, and deleting court information.				
Test Case ID	**Test Case**	**Expected Result**	**Actual Result**	**Pass/Fail**
AC1	Admin views the list of courts	The list of all courts is displayed	Courts list displayed	Pass
AC2	Admin adds a new court	A new court has been added and appears in the list	Court added successfully	Pass
AC3	Admin edits the details of an existing court	Changes saved and updated court info displayed	Court info updated successfully	Pass
AC4	Admin deletes a court	The court was removed from the list after confirmation	Court deleted successfully	Pass
AC5	Admin attempts to add a court with missing required fields	Validation error shown; court not added	Validation error displayed	Pass

vi) Admin Sport Page

Table 5.6: Test Case of Sport Court Page

Test Description: Verify that the admin can manage sports effectively by adding, editing, and deleting court information.				
Test Case ID	**Test Case**	**Expected Result**	**Actual Result**	**Pass/Fail**
AS1	Admin views the list of sports	The list of all sports is displayed	Sports list displayed	Pass

AS2	Admin adds a new sport category	A new sport has been added and appears in the list	Sport added successfully	Pass
AS3	Admin edits the details of an existing sport	Changes were saved, and updated the sport info displayed	Sport info updated successfully	Pass
AS4	Admin deletes a sport category	Sport removed from the list after confirmation	Sport deleted successfully	Pass
AS5	Admin attempts to add a sport with invalid or missing data	Validation error shown; sport not added	Validation error displayed	Pass

vii) Profile Page

Table 5.7: Test Case of Profile Page

Test Description: Verify that users can view and update their profile information correctly.				
Test Case ID	**Test Case**	**Expected Result**	**Actual Result**	**Pass/Fail**
UP1	User navigates to the Profile page	User profile page loads, displaying current info	Profile page displayed	Pass
UP2	User edits profile information with valid data	Changes saved and updated profile displayed	Profile updated successfully	Pass
UP3	User attempts to submit a profile update with missing required fields	Validation error displayed; changes not saved	Validation error shown	Pass

5.3 Non-Functional Testing

Non-functional testing assesses the eArena system's efficiency in terms of performance, usability, and reliability. This process includes evaluating the system's response times, stability, scalability, security features, and overall user experience. Throughout the testing phase, eArena exhibited robust performance in an online setting, demonstrating consistent reliability, strong security measures, and effective functionality. These results confirm that the system is well-prepared to support real-world user demands and interactions.

5.4 Summary

Chapter 5 presented the testing activities conducted to validate the functionality and quality of the eArena: UNIMAS Court Reservation System. Both functional and non-functional testing were performed to ensure the system meets the specified requirements. Functional testing confirmed that all core features, including user authentication, court booking, booking management, admin approval, and profile management that operate as intended with no critical issues. The system also demonstrated proper handling of error cases and input validations. Non-functional testing evaluated the system's performance, reliability, usability, and security. The eArena system showed strong performance under typical user loads, maintained stability during extended usage, and provided a user-friendly interface. Security measures such as role-based access control and session management were effectively implemented. Overall, the testing phase validated that the eArena system is reliable, secure, and ready for deployment to support UNIMAS users' sport booking needs.

CHAPTER 6: CONCLUSION AND FUTURE WORKS

6.1 Introduction

The eArena system effectively overcomes the drawbacks of the current manual badminton court booking system in University Malaysia Sarawak (UNIMAS). The platform will increase convenience for users due to automation of the booking system and the availability of real-time information on court availability, which will minimize scheduling conflicts and generally help to manage the resources better. The user-friendly nature of the system and secure login system guarantee accessibility and data security to both the students and the staff. The main features, including user authentication, booking management, and admin approval, were tested to be reliable and fulfill the project requirements.

To improve in the future, the system may be extended to a mobile application that would be simpler to use on the move. User experience could be further improved with such additional features as in-built payment options, support for more languages other than English and Malay, and improved notification systems. Other developments could include implementing AI-recommended ideas on the best time to book and integration with university schedules. The user feedback will be crucial to the improvement of the system and to ensure the system is effective and relevant to the UNIMAS fraternity.

6.2 Objective Achievements

There were several main objectives for this project. All objectives have been addressed through the development and implementation of the eArena system.

Table 6.1: List of Objectives and Achievements

Objectives	Achievements
To streamline the court reservation process by automating bookings, reducing operational errors.	An online booking system was developed, allowing users to make reservations without in-person visits, reducing errors and manual processes.
To increase accessibility by enabling users to make and modify bookings anytime and anywhere.	The system supports online access 24/7 from multiple devices, allowing convenient booking and management of reservations.
To eliminate scheduling conflicts with a real-time booking system, ensure effective court usage.	Real-time availability and booking calendar features were implemented, preventing double bookings and scheduling conflicts.

6.3 Project Limitations and Constraints

During the development and implementation of the eArena system, several limitations were identified:

i. **Report Page Not Implemented:** The feature allowing users to submit maintenance or issue reports for courts was planned but has not been developed in this version of the system.

ii. **Mobile Responsiveness:** Although the system can be accessed on multiple devices, the user interface is primarily optimized for desktop use. Mobile experience may require further enhancement for better usability.

iii. **Notification System:** The current system lacks automated notifications such as email or SMS alerts to inform users about booking confirmations, cancellations, or admin approvals.

iv. **Integration with University Systems:** eArena currently operates as a standalone system without integration to UNIMAS's existing authentication or scheduling systems, which could improve user management and data synchronization.

v. **Limited User Roles:** The system currently supports basic roles such as student, staff, and admin, but does not include finer permission levels or advanced user management features.

vi. **Lack of Dual Language Functionality:** The system does not support switching between Bahasa Melayu and English, which limits accessibility and user experience for bilingual users.

These limitations highlight areas for improvement and serve as a foundation for future enhancements to increase system usability and effectiveness.

6.4 Future Works

To further enhance the eArena system and address current limitations, the following improvements are proposed for future development:

i. **Implementation of Report Page:** Develop a fully functional report submission feature that allows users to report court damages or issues directly within the system, enabling timely maintenance and improved facility management.

ii. **Improved Mobile Responsiveness:** Redesign the user interface to be fully responsive and optimized for various mobile devices, providing seamless access and a better user experience for students and staff on smartphones and tablets.

iii. **Automated Notification System:** Integrate email and SMS notification capabilities to inform users about booking confirmations, reminders, cancellations, and administrative updates, improving communication and reducing missed bookings.

iv. **Integration with University Systems:** Connect eArena with UNIMAS's centralized authentication and scheduling systems to provide a unified login experience and data synchronization, enhancing security and usability.

v. **Enhanced User Roles and Permissions:** Introduce more granular user roles and permissions to support diverse administrative functions, enabling more efficient system management and access control.

vi. **Analytics and Reporting Dashboard:** Incorporate advanced analytics tools for administrators to monitor booking trends, court utilization, and user activity, aiding in data-driven decision-making and resource allocation.

vii. **Development of Dual Language Functionality:** Implementing a language toggle that allows users to switch dynamically between Malay and English within the system.

Implementing these enhancements will strengthen the system's capabilities, improve user satisfaction, and ensure long-term sustainability.

6.5 Conclusion

In conclusion, the eArena system has been successfully developed as an online sport court booking platform tailored to meet the needs of UNIMAS students and staff. The system achieves its main objectives by providing a convenient, reliable, and secure platform for managing court reservations. Through comprehensive testing, the system demonstrated functional correctness, performance stability, and user-friendly interfaces. Despite some limitations, such as the absence of a report submission module and limited mobile optimization, the core functionalities like booking management, admin approvals, and user authentication work effectively. The eArena system streamlines the booking process, reduces manual errors, and improves accessibility, making it a valuable tool for UNIMAS. With the proposed future enhancements, it has strong potential to evolve into a more comprehensive and integrated system that further enhances user experience and operational efficiency.

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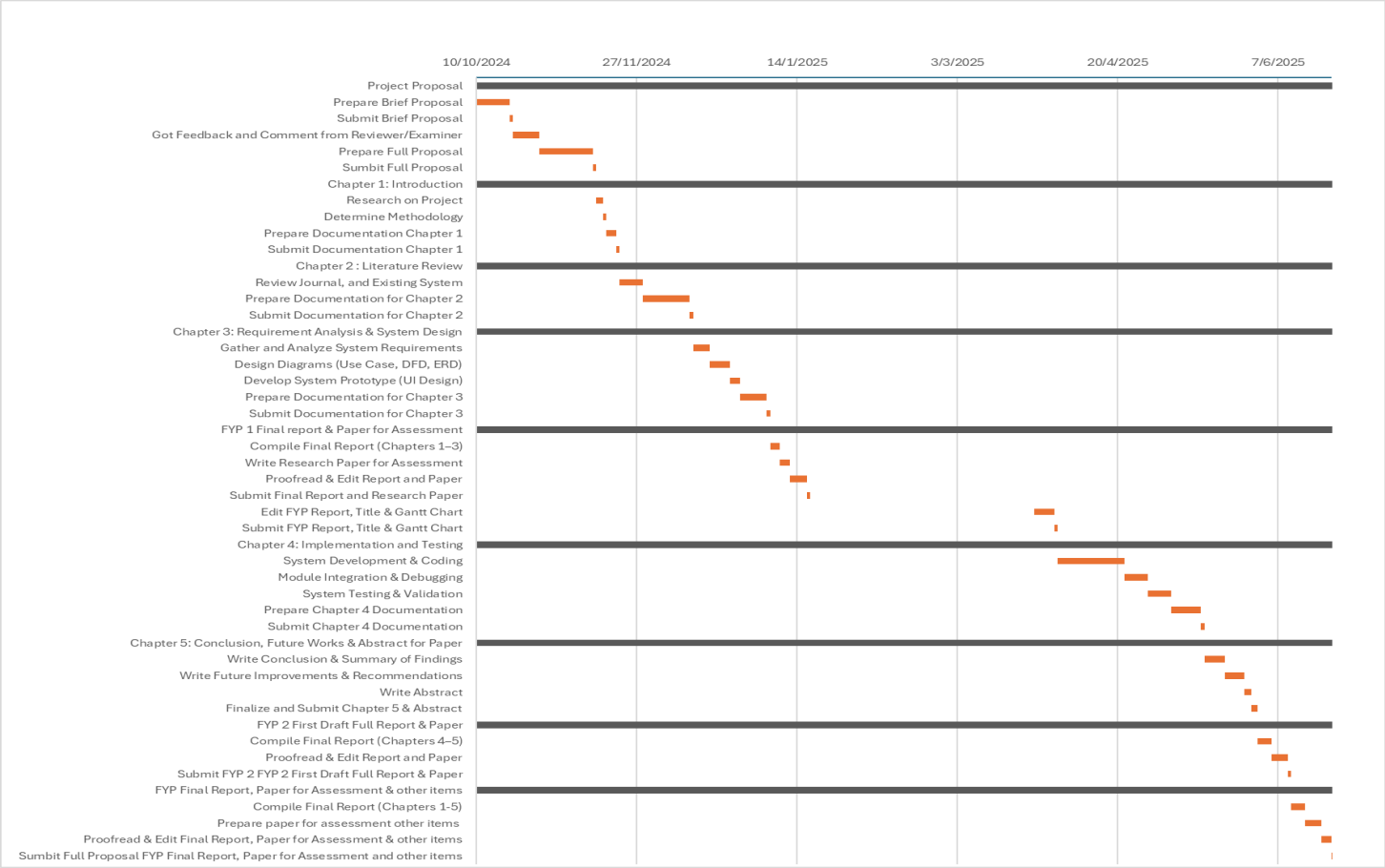
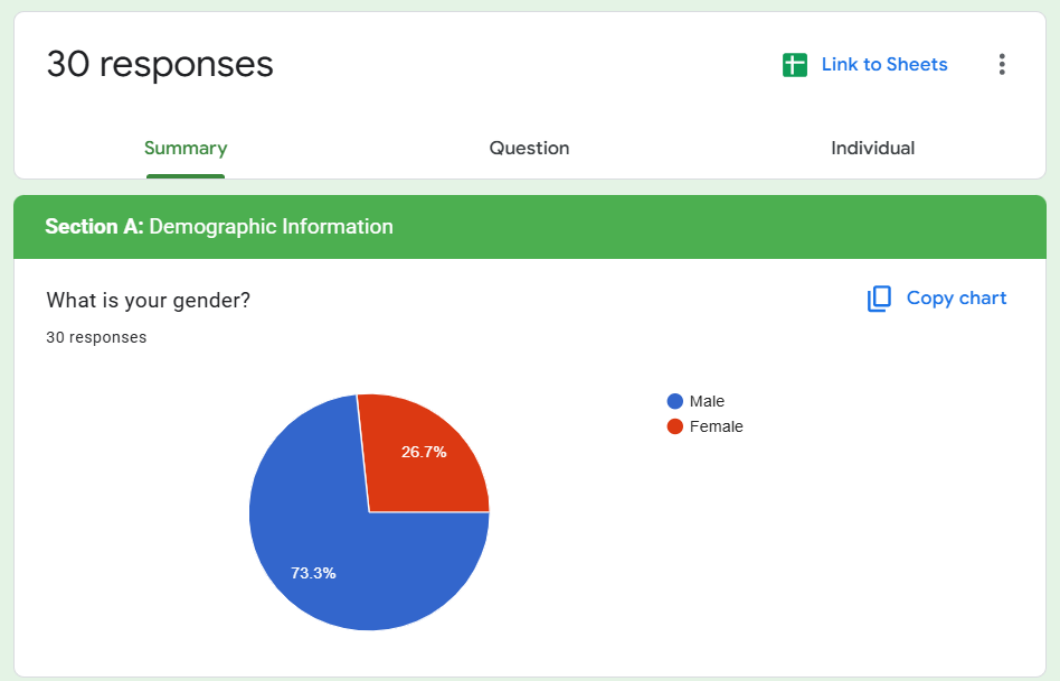
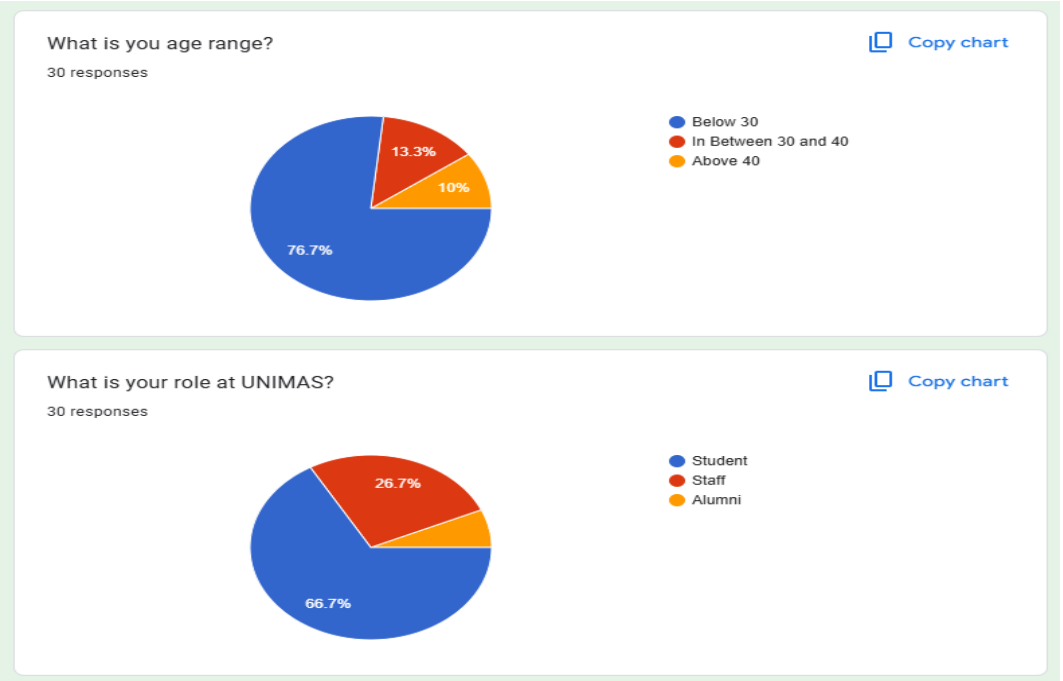
Appendices

Appendix A: Gantt Chart Project



Appendix B: Questionaires Responses for Requirement Analysis

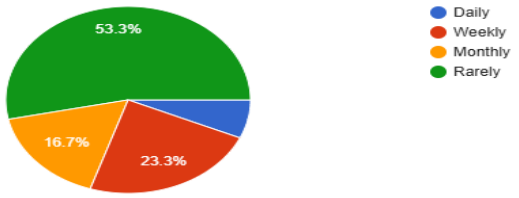




How often do you use the badminton court?

Copy chart

30 responses



What is your most preferred time to book a court?

Copy chart

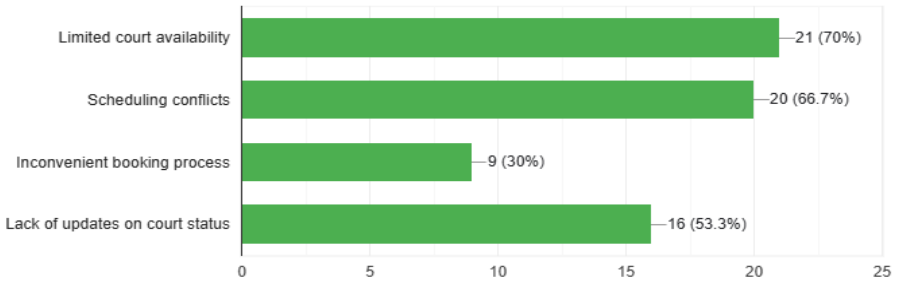
30 responses

Section B: Current Challenges

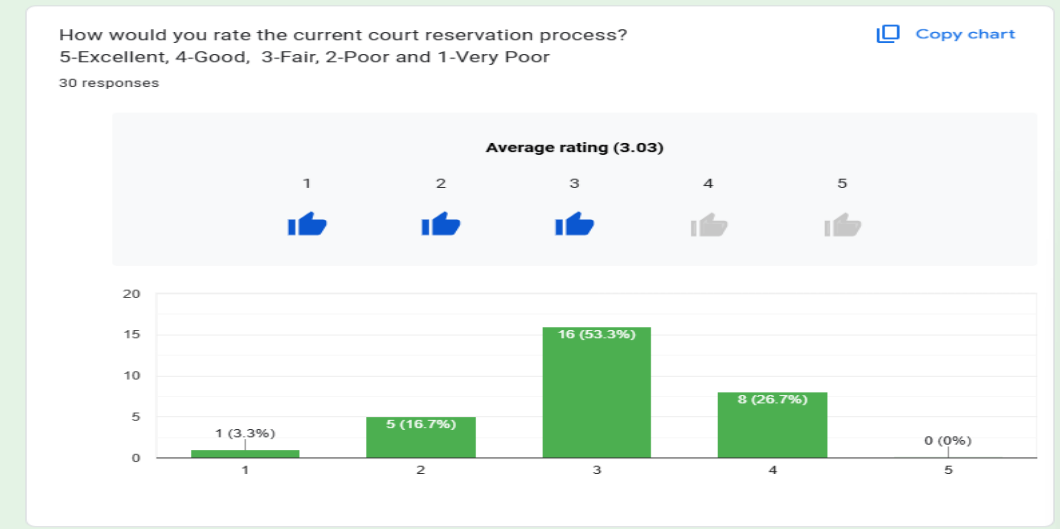
What challenges do you face with the current court reservation system? (Select all that apply)

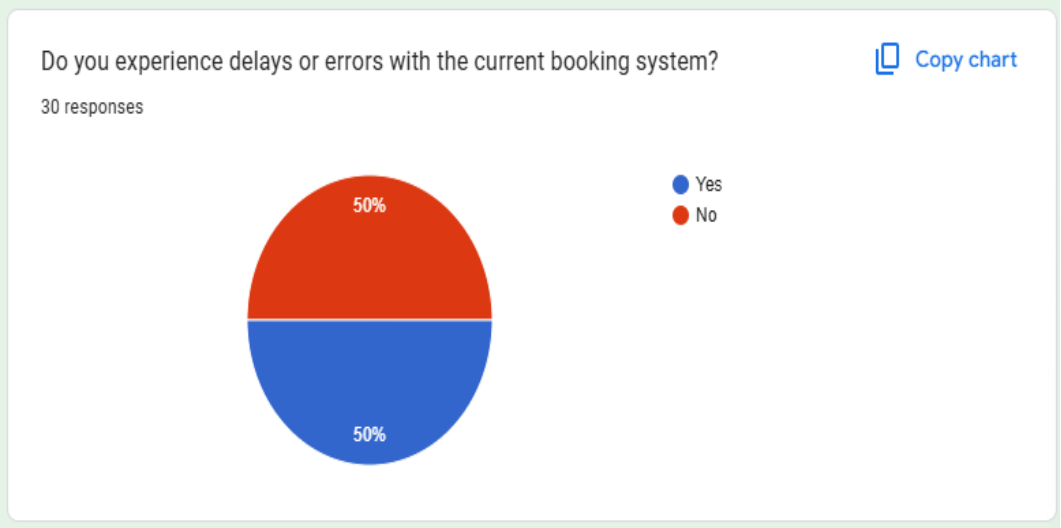
Copy chart

30 responses



How accessible is the current reservation process for you?
5-Very accessible, 4-accessible, 3-Somewhat accessible, 2-Not accessible and 1-Very not accessible
30 responses
Copy chart
Average rating (3.13)
1
2
3
4
5
20
15
10
5
0
2 (6.7%)
2 (6.7%)
18 (60%)
6 (20%)
2 (6.7%)
1
2
3
4
5


How would you rate the current court reservation process?
5-Excellent, 4-Good, 3-Fair, 2-Poor and 1-Very Poor
30 responses
Copy chart
Average rating (3.03)
1
2
3
4
5
20
15
10
5
0
1 (3.3%)
5 (16.7%)
16 (53.3%)
8 (26.7%)
0 (0%)
1
2
3
4
5

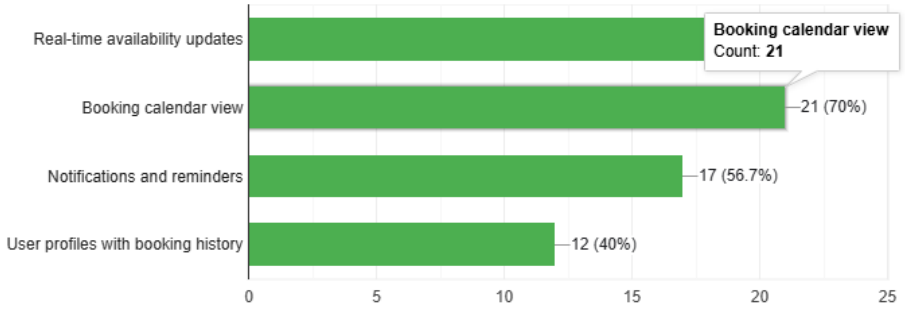

Do you experience delays or errors with the current booking system?
30 responses
Copy chart
50%
50%
Yes
No

Section C: Feature Preferences

Which features would you find most useful in an online booking system? (Select all that apply)

Copy chart

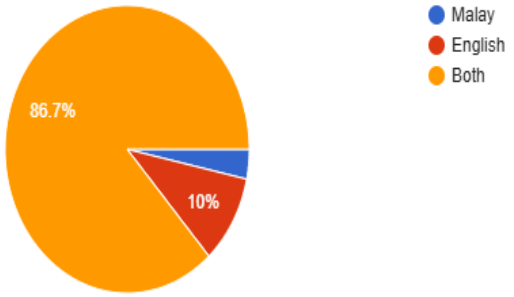
30 responses



Which language should the system support?

Copy chart

30 responses

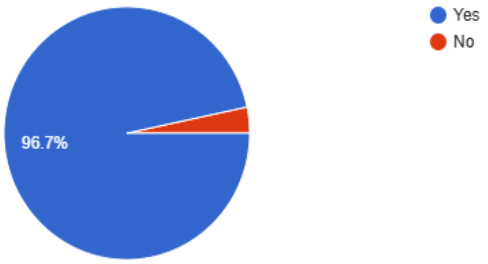


Section D: Accessibility and Security

Are you comfortable using your UNIMAS credentials for logging in?

Copy chart

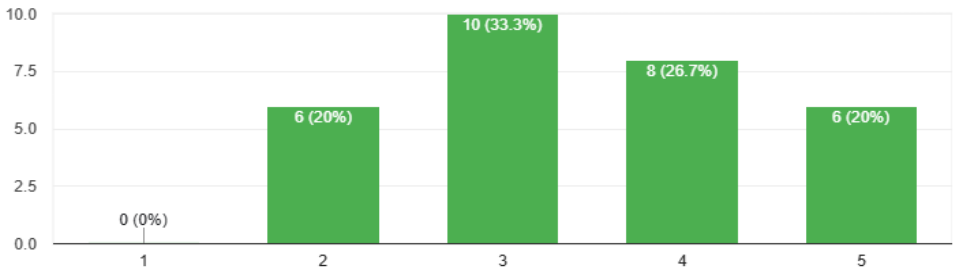
30 responses



How important is it for the system to automatically log you out after inactivity? 5-Very important, 4-important, 3-Somewhat important, 2-Not important and 1-Very not important

Copy chart

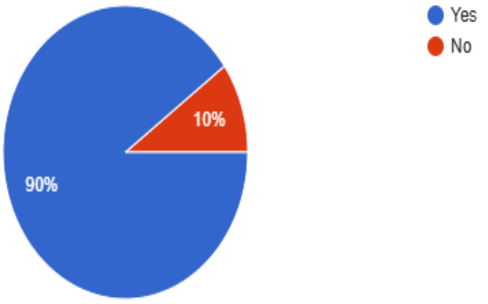
30 responses



Do you have concerns about how your data will be stored and used?

Copy chart

30 responses

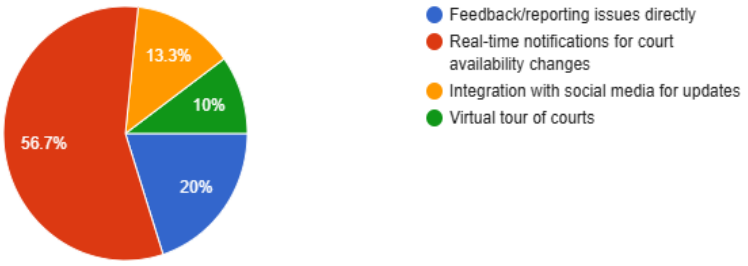


Section E: Suggestions for Improvement

What additional features would you like in the eArena system?

Copy chart

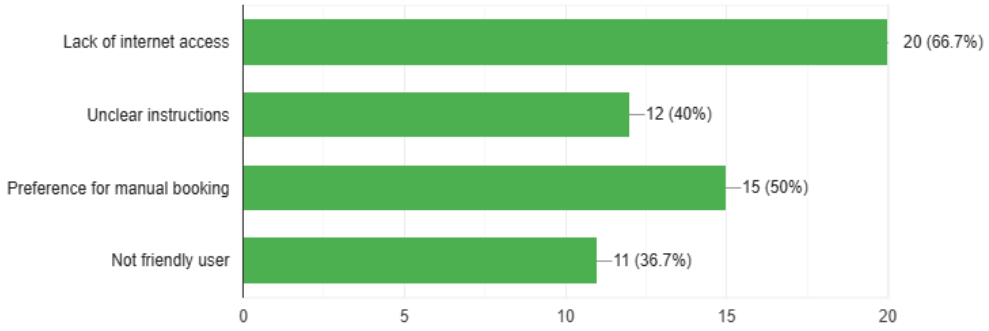
30 responses



What might prevent you from using the eArena system? (Select all that apply)

Copy chart

30 responses



How can the booking process be improved to suit your needs?

6 responses

online booking

No

More buttons less text

Simplify booking process

Show real time booking

Reduce the number of steps and forms required to complete a booking. Use clear and concise language

What ideas do you have to encourage students and staff to use the eArena system?

6 responses

Merit for utilizing eARENA

Engagement Through Technology

Add a notification feature to remind users of upcoming bookings or available time slots.

Introduce a leaderboard feature for activity tracking or competition results.

Shows court availability and display status of booking

Gamification

None

Provide comprehensive and user-friendly tutorials and documentation.