



Faculty of Computer Science and Information Technology

***APPOINTMENT MANAGEMENT SYSTEM FOR PUSAT KESIHATAN
PRIMA UNIMAS***

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Bachelor of Software Engineering with Honours

2025

UNIVERSITI MALAYSIA SARAWAK

THESIS STATUS ENDORSEMENT FORM

TITLE Appointment Management System for Pusat Kesihatan Prima

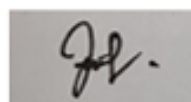
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**APPOINTMENT MANAGEMENT SYSTEM FOR PUSAT KESIHATAN PRIMA
UNIVERSITI MALAYSIA SARAWAK**

ELVISFRESLY ERICKY ANAK NALONG

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

Faculty of Computer Science and Information Technology
UNIVERSITI MALAYSIA SARAWAK

2025

**SISTEM PENGURUSAN TEMU JANJI PUSAT KESIHATAN PRIMA
UNIVERSITI MALAYSIA SARAWAK**

ELVISFRESLY ERICKY ANAK NALONG

Projek ini merupakan salah satu keperluan untuk Ijazah Sarjana Muda Sains
Komputer dengan Kepujian (Kejuruteraan Perisian)

Fakulti Sains Komputer dan Teknologi Maklumat

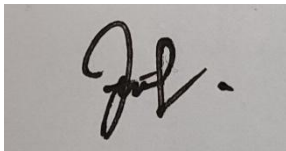
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DECLARATION

I, Elvisfresly Ericky Anak Nalong, with the matric number of 77953, hereby solemnly declare that the report titled “Appointment Management System for Pusat Kesihatan Prima UNIMAS” is prepared and completed authentically by me in partial fulfilment of the requirements for the degree of Bachelor of Computer Science with Honours (Software Engineering). This report is a record of an original work carried out by me under the supervision of Encik Mohammad Johan bin Ahmad Khiri.

I hereby affirm that the work presented in this project has not been previously or concurrently submitted for any other degree at Universiti Malaysia Sarawak (UNIMAS) or any other institutions. I declare that I have not copied or plagiarised from any other sources except for quotations and citations which have been duly acknowledged.



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ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest gratitude for the strength, perseverance, and opportunity that have enabled me to successfully complete this Final Year Project.

I would like to sincerely thank my supervisor, Sir Johan, for his continuous support, valuable guidance, encouragement, and constructive feedback throughout the development of this project. His/her advice and expertise have been extremely helpful in guiding me through each stage of this research.

I also wish to extend my appreciation to all the lecturers and staff of the Faculty of Computer Science and Information Technology (FCSIT), Universiti Malaysia Sarawak (UNIMAS) for providing me with the knowledge and skills needed to complete this project successfully.

A special thank you goes to the staff at Pusat Kesihatan Prima UNIMAS who have provided valuable insights and feedback during the development and testing of the Appointment Management System.

I would also like to thank my family and friends for their endless support, motivation, and understanding throughout this journey. Their encouragement has given me the strength to overcome every challenge and complete this project.

Lastly, I would like to thank all individuals who have contributed directly or indirectly to the successful completion of this Final Year Project. Your support is greatly appreciated.

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Chapter 1 : INTRODUCTION

1.1 Introduction

Pusat Kesihatan Prima (PKP) Universiti Malaysia Sarawak (UNIMAS) serves as the primary healthcare provider for UNIMAS, offering comprehensive medical and healthcare services to students, staff, and the surrounding community. Established as a teaching hospital, PKP UNIMAS plays a pivotal role in producing quality undergraduates and postgraduates in the medical field while meeting the healthcare needs of the community. The centre provides seamless healthcare services through collaboration with public and private healthcare providers, acting as a regional referral centre, and conducting world-class research and innovation. PKP UNIMAS also engages in community health and wellness promotion, positioning itself as a leader in clinical education, service, and research.

The current workflow for the appointment booking and scheduling at PKP UNIMAS is heavily reliant on manual processes. For follow-up appointment, the doctor will typically discuss the date and time with the patient immediately after the consultation. The discussion is based on the patient's availability. In some cases, the doctor instructs the nurse to set a follow-up appointment for the patient. This is done by writing the date and time for the next follow-up appointment on a piece of paper or on the patient's medical history card, which is then provided to the patient. In these situations, the appointment is sometimes set without discussing the patient's availability. For a patient that is needed to refer to another section, facility, or external health provider, the doctor or nurse will ask the patient to go to the referred section or facility right after the consultation if it is available at that time. If it is not available, then the nurse will inform patient that they will make a phone call to the patient if there is any available slots at the section, facility or external health provider. For a patient that has referral letter, they can bring the referral letter directly to the registration counter and proceed to the referred section or facility if it is available. Most cases, the patient still need to attend consultation or

diagnosis from the doctor at the PKP UNIMAS. This is to verify and confirm the necessity of the referral or the referral might need changes such as change on the referred section.

To streamline these workflows, this project aims to develop an Appointment Management System for PKP UNIMAS. This system will allow patients to book, cancel or reschedule appointments online, upload referral letters, and select their preferred time slots. The doctor also can book appointments for patients directly after consultations. To ensure accurate scheduling, the system provides real-time updates on the availability of sections, facilities, and specialists. Additionally, the system will send notifications to patients to remind them of upcoming appointments, notify them of any required changes, and confirm approved appointment requests. Nurses and doctors will have the capability to view and verify patient referral letters uploaded through the system. They can also approve, reject, or request changes to appointment requests based on the verification and availability of resources. By automating these processes, the system will enhance efficiency, improve communication, and provide a seamless experience for both patients and healthcare staff.

1.2 Problem statement

The current appointment scheduling workflow at Pusat Kesehatan PRIMA (PKP) UNIMAS relies heavily on manual processes, which are inefficient and prone to errors. For follow-up appointments, doctors either discuss the date and time with patients immediately after consultations or instruct nurses to set appointments without always considering the patient's availability. This often results in scheduling conflicts and patient dissatisfaction.

For referrals to other sections, facilities, or external health providers, the process becomes more complex. Nurses must communicate the availability of the referred facility to the patient, often requiring follow-up calls to confirm details. If the patient has referral letter

from external health provider and brings it directly to the PKP UNIMAS, there is no confirmation that the patient can proceed to go to the referred section or facility as not all sections or facilities operate daily or have available slots. This often resulting in wasted trips for patients unaware of the availability.

Additionally, the lack of an automated notification system exacerbates the inefficiencies. There is currently no reminder mechanism to alert patients about their upcoming appointments. Based on my interview with the healthcare staff at PKP UNIMAS, this results in a 30% probability of patients missing their scheduled appointments. This “no-show” issue disrupts the clinic's workflow, wastes resources, and increases the waiting time for other patients seeking care.

The absence of a centralised and automated system to manage appointments has created significant administrative burdens and operational inefficiencies. With the expected growth of an average of 300 patients per day at PKP UNIMAS, these issues can lead to increased workload for healthcare staff, longer wait times for patients, and reduced overall service quality. These challenges necessitate the development of a robust Appointment Management System to streamline the booking, scheduling, and verification processes while incorporating notification features to improve patient attendance and enhance the overall efficiency of healthcare delivery at PKP UNIMAS.

1.3 Aims and Objectives

The objectives of this project are:

- To develop a web-based appointment management system to simplify booking, rescheduling, and cancelling appointments.
- To automate scheduling processes to minimise manual errors.
- To provide healthcare staff with a centralised, real-time system to manage appointments and improve service efficiency.

1.4 Scope

The project will focus on developing a web-based appointment management system that can be accessed by both patients and healthcare staff. Patients will be able to register, view available appointment slots. Doctor and patient can book appointment online. Healthcare staff will be able to manage the appointments through a centralised system, enabling them to track, modify, and organise patient bookings.

1.5 Brief Methodology

For this project, the Waterfall methodology will be used to develop a web-based appointment management system for Pusat Kesihatan Prima UNIMAS. The Waterfall methodology is a sequential approach to software development where each phase must be completed before the next one begins. This model is suitable for the appointment system project due to its straightforward requirements and the need for a well-defined structure. The methodology will involve the following key phases:

1. Requirement Analysis

In this initial phase, the project requirements for the appointment system will be gathered and documented. This includes understanding the needs of both patients and healthcare staff at PKP UNIMAS. The focus will be on identifying key functionalities, such as patient registration, appointment booking, rescheduling, cancellation, and staff management of appointments.

2. System Design

Based on the requirements, the system's architecture will be designed. This phase involves creating detailed design documents that outline the system's structure, database schema, user interface layouts, and workflows. Each module, such as user

authentication and appointment management, will be specified in this stage to ensure clarity before development begins.

3. Implementation

The system will be developed according to the design documents, utilising HTML, PHP, and CSS for front-end and back-end development to create a responsive interface. The database will be configured using MySQL to securely store and manage patient, doctor, and appointment data. Code will be written for each component, starting with core functionalities such as patient account registration, login authentication, and appointment booking. This phase will integrate front-end elements for user interaction with back-end logic to process data and database operations, ensuring seamless functionality and data integrity across the system.

4. Testing

After implementation, the system will undergo comprehensive testing. This includes functional testing to ensure all features work as expected usability testing to assess user-friendliness. The testing phase ensures that the system meets all requirements and functions reliably before deployment.

5. Deployment

Once testing is complete, the system will be deployed to PKP UNIMAS. This phase includes setting up the live environment, configuring the system for production use, and providing initial training for healthcare staff.

6. Maintenance

Post-deployment, the system will enter the maintenance phase, where any issues identified by users will be addressed. Updates and improvements may be implemented over time based on user feedback to enhance functionality and user experience.

1.6 Significance of Project

The development of an appointment management system for PKP UNIMAS will have significant benefits for both patients and healthcare staff. By providing a centralised, this project will streamline appointment scheduling and reduce the time and effort spent on manual booking processes. Patients will have more control over their appointments, with the ability to book, reschedule, or cancel with ease. For healthcare staff, the system will provide a real-time overview of appointments, reduce administrative burdens, and minimise the likelihood of scheduling conflicts.

Additionally, the system's data management capabilities, including automated reminders and record-keeping, will contribute to more organised operations and improved patient satisfaction. This project will not only improve efficiency and service quality for PKP UNIMAS but will also serve as a foundation for future digital transformation initiatives within UNIMAS.

1.7 Project Schedule

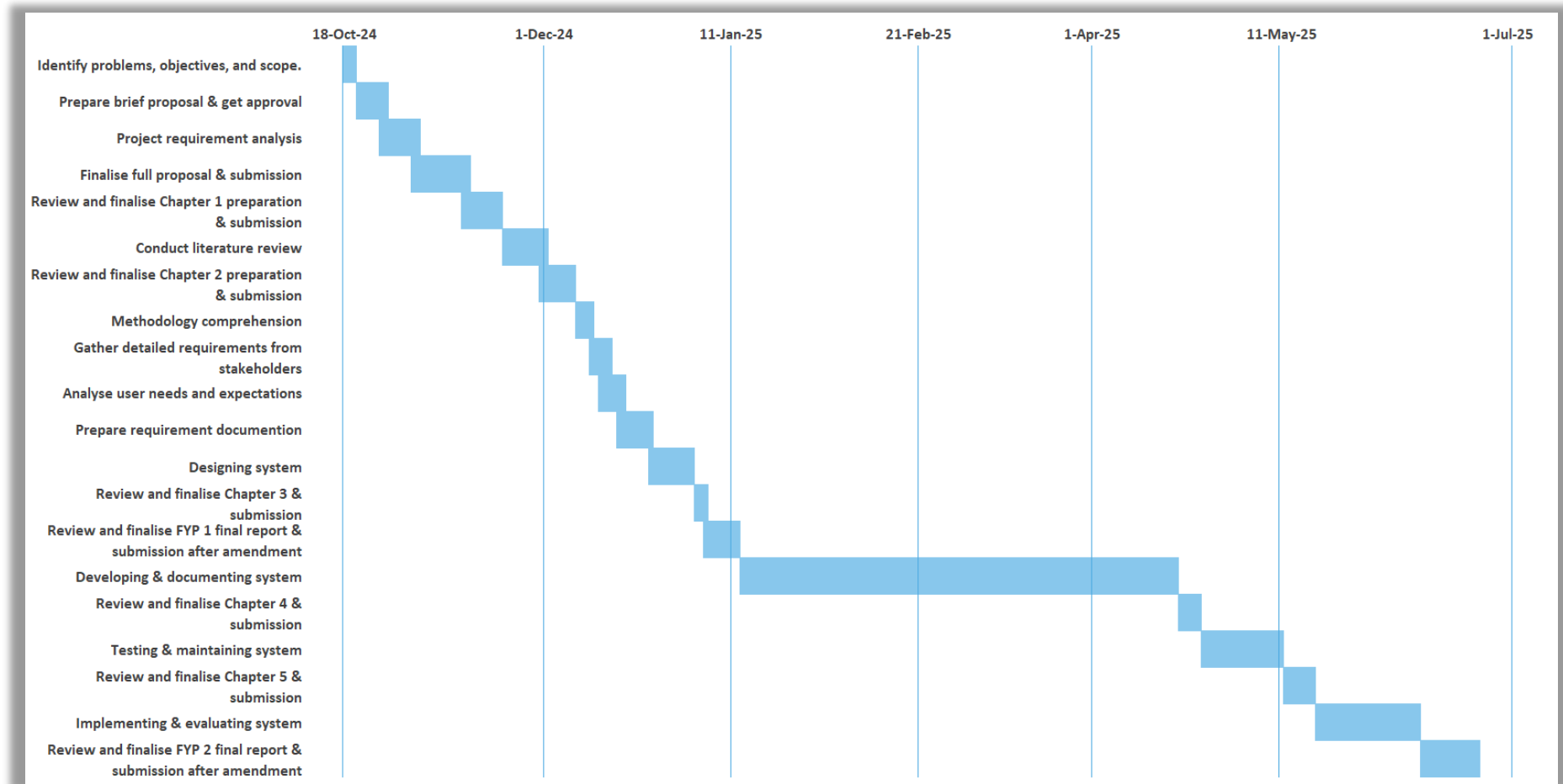


Figure 1.1. Gantt Chart of the Project Schedule.

The Figure 1.1 shows a Gantt chart outlining the timeline and key milestones for the development of the Appointment Management System project. Spanning from 18 October 2024 to 15 January 2025, the chart provides a clear depiction of the sequential phases involved in the project. It begins with identifying the problems, objectives, and scope of the project, followed by the preparation and approval of a brief proposal to formalise its initiation. Subsequently, a comprehensive requirement analysis is conducted to establish the foundation for the system. The finalised proposal is then prepared and submitted for review.

The timeline includes the preparation, review, and submission of key report chapters. Chapter 1 focuses on problem definition, while Chapter 2 highlights the literature review and contextual understanding of the project. A thorough literature review is conducted to provide theoretical support, followed by refining Chapter 2. Methodology comprehension is emphasised to ensure a structured approach, and detailed requirements are gathered from stakeholders to capture functional and non-functional needs. These requirements are analysed to align with user expectations, and a detailed requirement documentation is prepared.

The system's design phase translates the requirements into a structured architecture and interface. Chapter 3, which focuses on the methodology, is reviewed and finalised. Finally, the complete Final Year Project (FYP) report is refined after necessary amendments and submitted for evaluation.

After the submission of Chapter 3, the project progresses into the system development phase. This involves the process of coding, integrating, and documenting the system based on the requirements and design specifications. Chapter 4, which focuses on the system development, is prepared, reviewed, and finalised during this phase. Following this, the system enters the testing and maintenance stage, where its functionality, performance, and reliability are thoroughly validated to ensure it meets the predefined requirements. Any identified issues or bugs are addressed during this stage.

Subsequently, Chapter 5, which details the system's testing results and overall evaluation, is prepared and finalised. Once the testing phase is completed, the project transitions into the implementation and evaluation stage, where the system is deployed for real-world use. Feedback from end-users and stakeholders is gathered to evaluate the system's effectiveness and identify potential areas for improvement.

Finally, the second phase of the Final Year Project (FYP) report, encompassing all chapters and necessary amendments, is reviewed and finalised. The completed report is submitted for final evaluation, marking the culmination of the project timeline as outlined in the Gantt chart.

1.8 Expected Outcome

The expected outcome of this project is the development of a comprehensive, web-based appointment management system specifically designed for PKP UNIMAS. The system will prioritise patient convenience by providing an intuitive platform where patients can easily book, reschedule, or cancel their appointments. With this feature, patients will have the flexibility to cancel or reschedule appointments through the system. Patients will also benefit from real-time updates on the available slots. Furthermore, automated notifications and reminders will ensure patients are informed of their upcoming appointments which will help a lot in reducing no-shows and missed dates.

For doctors, the system will provide a centralised system, enabling them to efficiently manage patient appointments. Doctors will be able to book appointments on behalf of patients, view uploaded referral letters, and check available time slots.

As for nurses, the system will allow them to approve appointment requests from patients and access uploaded referral letters. These features will streamline their workflow, reduce administrative workload and ensuring smooth daily operations.

Ultimately, the appointment management system will deliver a well-organised, efficient, and effective solution for managing patient appointments. It will improve patient satisfaction, optimise service delivery, and provide healthcare staff with the tools needed to deliver high-quality care at PKP UNIMAS.

1.9 Summary

This chapter introduces the development of a web-based Appointment Management System for Pusat Kesehatan Prima (PKP) UNIMAS to address inefficiencies in their current manual appointment scheduling process. The system aims to streamline patient bookings, rescheduling, and cancellations while integrating features such as real-time slot availability, automated notifications, and referral letter uploads.

The problem statement highlights the challenges of the manual system, including scheduling conflicts, communication delays, high administrative burdens, and a 30% no-show rate that disrupts operations. These issues necessitate an automated solution to improve patient satisfaction and staff efficiency, especially with the growing number of patients at PKP UNIMAS.

The project's objectives include automating scheduling processes, providing a centralised appointment system, and reducing manual errors. Using the Waterfall methodology, the project will be developed in phases: requirement analysis, system design, implementation, testing, deployment, and maintenance. The significance of this project lies in its potential to

enhance healthcare service quality, reduce administrative workload, and optimise operational efficiency at PKP UNIMAS.

The chapter concludes with an expected outcome: an efficient, patient-friendly, and staff-supportive appointment system that facilitates seamless scheduling, improves patient attendance, and supports future digital transformation efforts within UNIMAS.

Chapter 2 : LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive review of literature and existing systems relevant to the development of an Appointment Management System. The focus is on identifying key features, functionalities, and limitations of comparable systems to inform the design of an efficient, user-friendly, and robust solution for Pusat Kesehatan Prima (PKP) UNIMAS. By analysing related studies and technologies, this review lays the foundation for incorporating best practices and addressing the unique needs of PKP UNIMAS. Furthermore, the chapter explores challenges in existing solutions, providing insights into areas for improvement and innovation.

2.2 Reviews on Similar Existing Systems

This section delves into similar existing hospital and appointment management systems to evaluate their strengths, weaknesses, and relevance to the proposed solution. It examines the design and functionality of systems currently employed in healthcare settings which focusing on features such as appointment scheduling, patient record management, and user experience. By identifying the approaches these systems use to solve common healthcare workflow challenges, this review offers valuable insights for designing a tailored solution for PKP UNIMAS. These comparisons also highlight opportunities to address gaps in automation, integration, and patient engagement.

2.2.1 User Interactive Hospital Management System by using Web application

Devi et al. (2021) describes a comprehensive hospital management system designed to streamline healthcare operations by incorporating various modules that cater to the needs of patients, doctors, and administrators.

The system has **Login Module** which manages user authentication by verifying credentials such as ID, username, and password against the database and directing users to their respective home pages. This module also includes an additional security feature for administrators, requiring a password to access the Admin Home page.

The **Admin Module** enables administrators to manage profiles for patients and doctors, update appointment statuses (e.g., Booked, Consulted, Cancelled), send appointment reminders via email, and handle laboratory reports linked to specific appointments. Administrators can also add or remove doctor profiles, ensuring the database remains current.

The **Patient Module** allows patients to register personal and medical details, upload profile pictures, and manage their appointments. Patients can view confirmed appointments, cancel bookings and access their medical history and lab reports through this module.

The **Doctor Module** enables doctors to update their profiles, access patient records, and review medical histories, including previous prescriptions and test results. Additionally, doctors can prescribe medications and request laboratory tests digitally, enhancing efficiency and accuracy.

The system also includes an **Appointment Booking** feature, where patients can select doctors based on specialization, availability, and timing. Automated email reminders are sent to patients before their appointments to reduce no-shows.

The **Online Prescriptions** feature allows doctors to issue prescriptions digitally, which are stored in the patient's medical history and can be accessed by patients and laboratory staff for further actions, such as conducting prescribed tests.

Finally, the **Medical History** module maintains a detailed database of patient records, including disease history, test results, and prescribed treatments. This data is easily accessible to both doctors and patients, ensuring continuity of care, accurate diagnoses, and better health monitoring. Collectively, these features make the system a robust solution for improving efficiency and effectiveness in hospital management. The block diagram of the proposed system is as figure below.

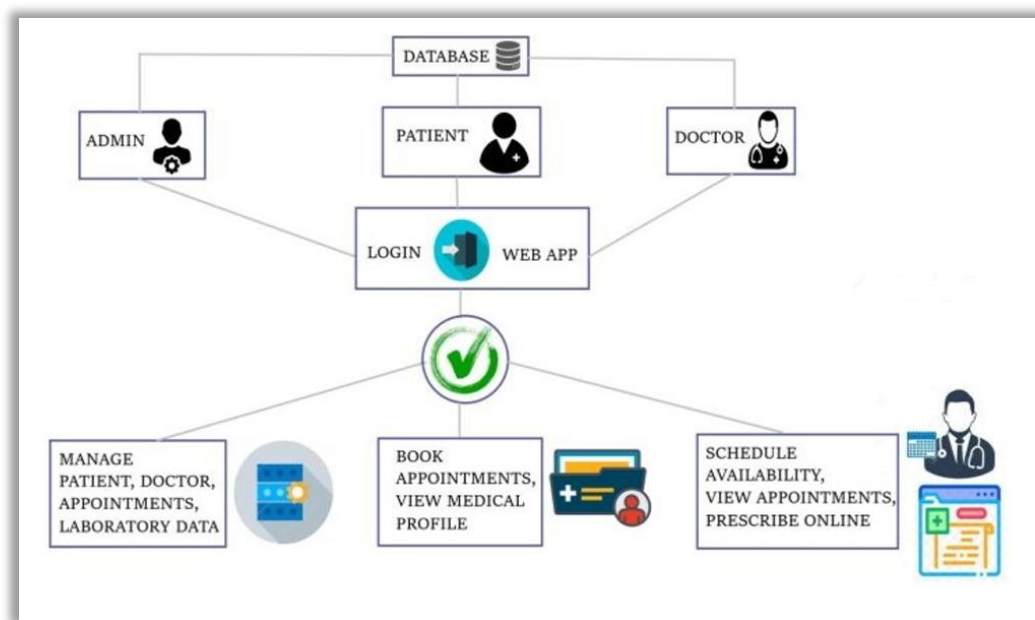


Figure 2.1. The block diagram of the proposed system (Sharmila Devi et al., 2021).

Figure 2.1 is the diagram represents the architecture and functionality of a hospital management system utilizing a web application. At its core is a centralised database that stores and manages information for three primary user roles: Admin, Patient, and Doctor. Each role interacts with the system through a login portal within the web application. The administrator oversees and manages key data, including patient records, doctor profiles, appointments, and laboratory information. Patients can access features such as booking appointments, viewing

their medical profiles, and retrieving healthcare information. Meanwhile, doctors can schedule their availability, review appointment details, and prescribe medications online. This system promotes seamless interaction among all stakeholders, ensuring efficient hospital management processes through a structured digital platform.

The web-based hospital management system described by Devi et al. (2021) demonstrates significant potential to streamline healthcare operations through its modular design and comprehensive features. While the system offers numerous advantages, certain limitations must be addressed to ensure optimal functionality and adaptability in diverse healthcare environments. The strengths and weaknesses of the system are summarised in the table below.

Table 2.1 Summary of the strengths and weaknesses of the User Interactive Hospital Management System.

Strength	Weakness
Provides appointment reminders for patient, reducing patient no-shows.	Scalability for managing large volumes of users and data is not explicitly addressed.
Facilitates contactless access to lab reports, reducing the need for physical interaction.	The system's dependency on users to input accurate data could lead to inconsistencies in records.
Supports real-time data updates, ensuring all stakeholders access the latest information.	Does not mention advanced analytics or reporting capabilities for healthcare providers.

2.2.2 Online Hospital Appointment Booking

Natarajan et al. (2024) describe an online hospital appointment booking system designed to improve the efficiency and reliability of healthcare services. This system offers various functionalities aimed at enhancing patient experience, reducing waiting times, and optimizing resource allocation. Key features include online doctor appointment booking, where

users can search for doctors based on specialization, availability, and their preferences for date and time. Patients can also make online payments for their appointments and download receipts directly from the portal. Additionally, the system provides automated email and text message reminders to patients about their scheduled appointments, minimizing no-shows.

The system also includes modules for different users: patient, doctor, and administrator. The patient module enables users to register, log in, search for doctors, book appointments, reschedule or cancel them, and communicate with doctors or hospital management via mail or phone. Patients can also access and monitor their medical records stored in the database, ensuring continuity of care.

The doctor module allows doctors to view their schedules, monitor patient records, and update availability for appointments. Doctors can also access patient medical histories stored in the system to make informed decisions during consultations.

The admin module provides full control over managing doctors' and patients' data. Administrators can add or update doctor profiles, manage appointment schedules, and oversee the database. Additionally, the system dynamically adjusts appointment slots based on cancellations, ensuring that no available slots are wasted. The web-based system is compatible with various devices such as smartphones, tablets, and computers, making it accessible to a wide range of users. This approach emphasises patient-centric care while maintaining a balance between the needs of doctors and healthcare administrators. The table of strengths and weaknesses, the flowchart and the block diagram of the proposed system are as below.

Table 2.2. Summary of the strengths and weaknesses of the Online Hospital Appointment Booking..

Strength	Weakness
Enables patients to access and monitor their medical records, enhancing continuity of care.	The system's dependency on users to input accurate data could lead to inconsistencies in records.
Facilitates efficient time slot reallocation due to late cancellations, reducing resource waste.	Lacks clarity on handling same-day appointments alongside pre-scheduled appointments.

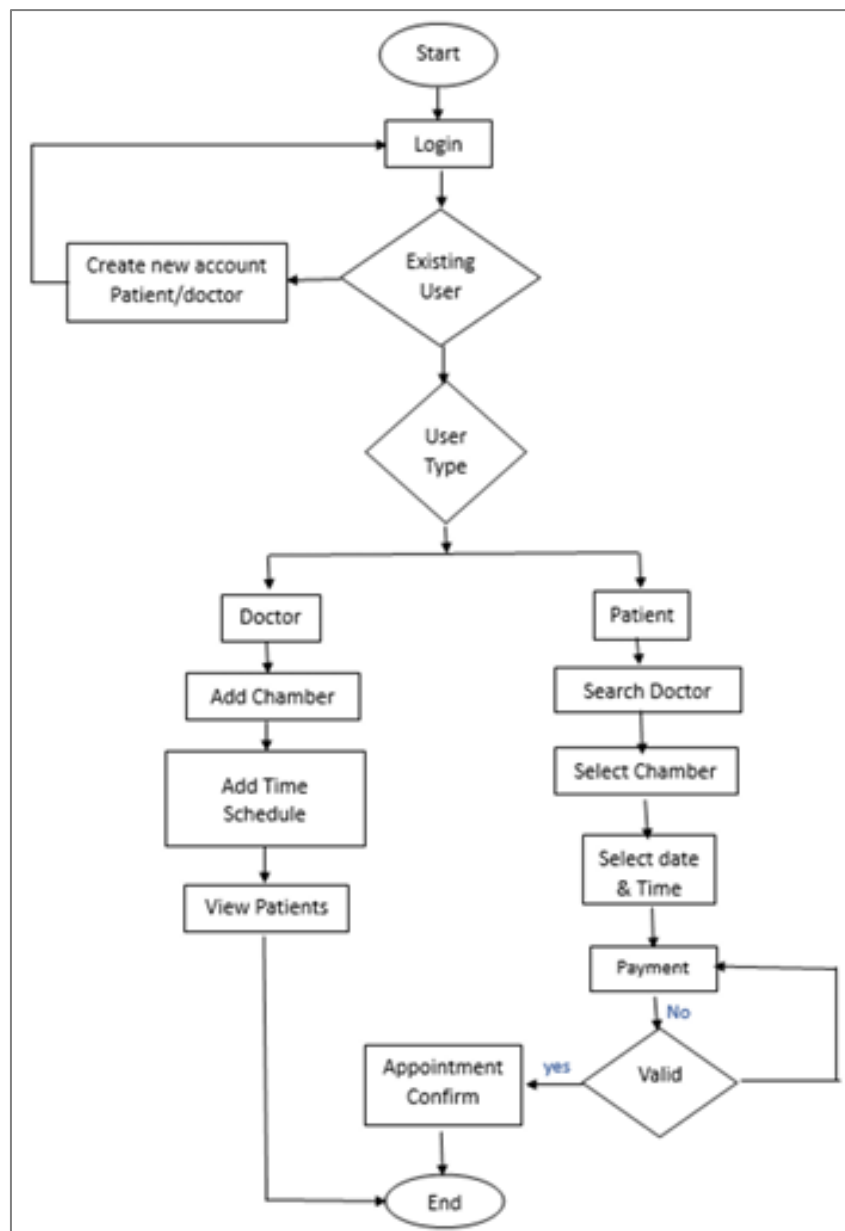


Figure 2.2. Flowchart of the proposed system (Natarajan et al., 2024).

Figure 2.2 is a flowchart illustrates the workflow of a system designed for scheduling medical appointments between doctors and patients of the proposed system by Natarajan et al. (2024). The process begins with the user logging into the system. If the user is not already registered, they are prompted to create a new account, choosing whether they are a patient or a doctor. After login, the system identifies the user type and provides options based on their role. Doctors can add chambers (locations where they consult patients), set their availability by adding time schedules, and view the list of patients. On the other hand, patients can search for a doctor, select a chamber, choose an appointment date and time, and proceed with payment. If the payment is valid, the appointment is confirmed. The process concludes with the confirmation of the appointment, ensuring a smooth interaction between the doctor and patient. This flowchart provides a clear representation of the steps involved in the appointment scheduling system.

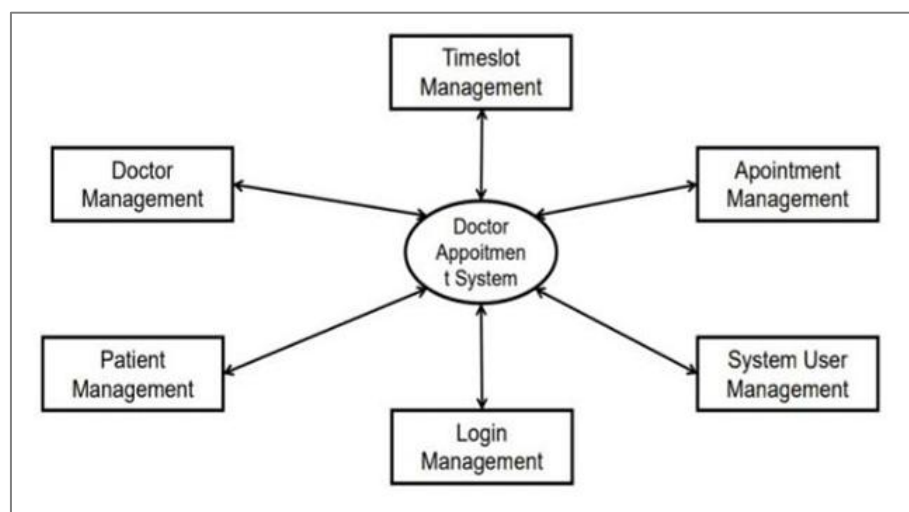


Figure 2.3. Block diagram of the proposed system (Natarajan et al., 2024).

Figure 2.3 is a block diagram represents the key components and functionalities of a doctor appointment system. At the center of the diagram is the main system, which is connected to six primary modules. These include Doctor Management, where information about doctors

is maintained; Patient Management, which handles patient details and records; and Timeslot Management, responsible for managing doctors' availability and scheduling. Additionally, there is Appointment Management, which oversees the process of booking and confirming appointments, and System User Management, which manages user accounts, roles, and access permissions. Lastly, Login Management ensures secure user authentication and access to the system. Together, these interconnected modules create a comprehensive framework for efficiently managing medical appointments.

2.2.3 Web Based Hospital Management System

Babu et al. (2023) proposes a web-based hospital management system that simplifies healthcare management by providing tailored modules for patients, doctors, and administrators. The system is designed to store and manage information related to patients, doctors, and appointments while ensuring secure access and efficient data handling.

The Patient Module allows patients to register by providing their personal and contact details, including name, gender, email, and phone number. After logging in, patients can schedule appointments by selecting a doctor based on specialization, availability, and consultation fees. Patients can also view their appointment history, including the doctor's name, appointment status, and fees. They can pay online for doctor consultations and receive an electronic receipt via email. Additionally, patients can cancel or reschedule their appointments as needed. The figures below are the Patient Registration page and the Appointment Booking page.

Figure 2.4. Patient registration page (Babu et al., 2023).

Figure 2.5. Appointment booking page (Babu et al., 2023).

The Doctor Module facilitates login credentials provided by the administrator, enabling doctors to log in and access their dashboards. Doctors can view and update their appointments, treat patients during the specified consultation times, and provide online prescriptions that are

stored in the system. The module also includes a search functionality, allowing doctors to locate specific patients or appointments using phone numbers. This feature is especially beneficial for managing real-time appointments efficiently. Below are the figures for Doctor Login page, Appointment History page and Doctor Appointment List.

Figure 2.6. Doctor login page (Babu et al., 2023).

Doctor Name	Consultancy Fees	Appointment Date	Appointment Time	Current Status	Action
Amit	1000	2023-01-13	12:00:00	Active	Cancel
Amit	1000	2023-01-13	10:00:00	Active	Cancel
Amit	1000	2023-01-29	10:00:00	Active	Cancel
Amit	1000	2023-02-05	14:00:00	Active	Cancel
Tiwary	450	2023-01-29	14:00:00	Active	Cancel
Kumar	800	2023-01-28	10:00:00	Active	Cancel

Figure 2.7. Doctor Appointment History page (Babu et al., 2023).

Hospital Management System Logout											
										Enter contact number	Search
Welcome Amit											
Dashboard											
Appointments											
Prescription List											
Patient ID	Appointment ID	First Name	Last Name	Gender	Email	Contact	Appointment Date	Appointment Time	Current Status	Action	Prescribe
4	3	Kiran	Lal	Male	kiranmishra0@gmail.com	8838483484	2020-02-19	13:0000	Cancelled by Patient	Cancelled	-
12	16	teja	varada	Male	teja@gmail.com	1234567890	2023-01-13	12:0000	Active	Cancel	Prescribe
12	17	teja	varada	Male	teja@gmail.com	1234567890	2023-01-13	10:0000	Active	Cancel	Prescribe
12	18	teja	varada	Male	teja@gmail.com	1234567890	2023-01-29	10:0000	Active	Cancel	Prescribe
12	19	teja	varada	Male	teja@gmail.com	1234567890	2023-02-05	14:0000	Active	Cancel	Prescribe

Figure 2.8. Doctor Appointment List page (Babu et al., 2023).

The Admin Module acts as the core control panel of the system. Administrators can view, add, or remove doctor and patient profiles. They can manage appointment lists, which include patient and doctor details such as names, email addresses, phone numbers, and appointment schedules. The admin has complete access to the database, enabling them to retrieve or modify patient and doctor records, view prescriptions, and monitor appointment statuses. Additionally, the admin can use a search feature to find specific doctors or patients, add new doctors with details like specialization and consultation fees, and delete doctors from the system when necessary. Below is the figure of the Admin Login page. The strengths and weaknesses of the proposed system are also displayed below.

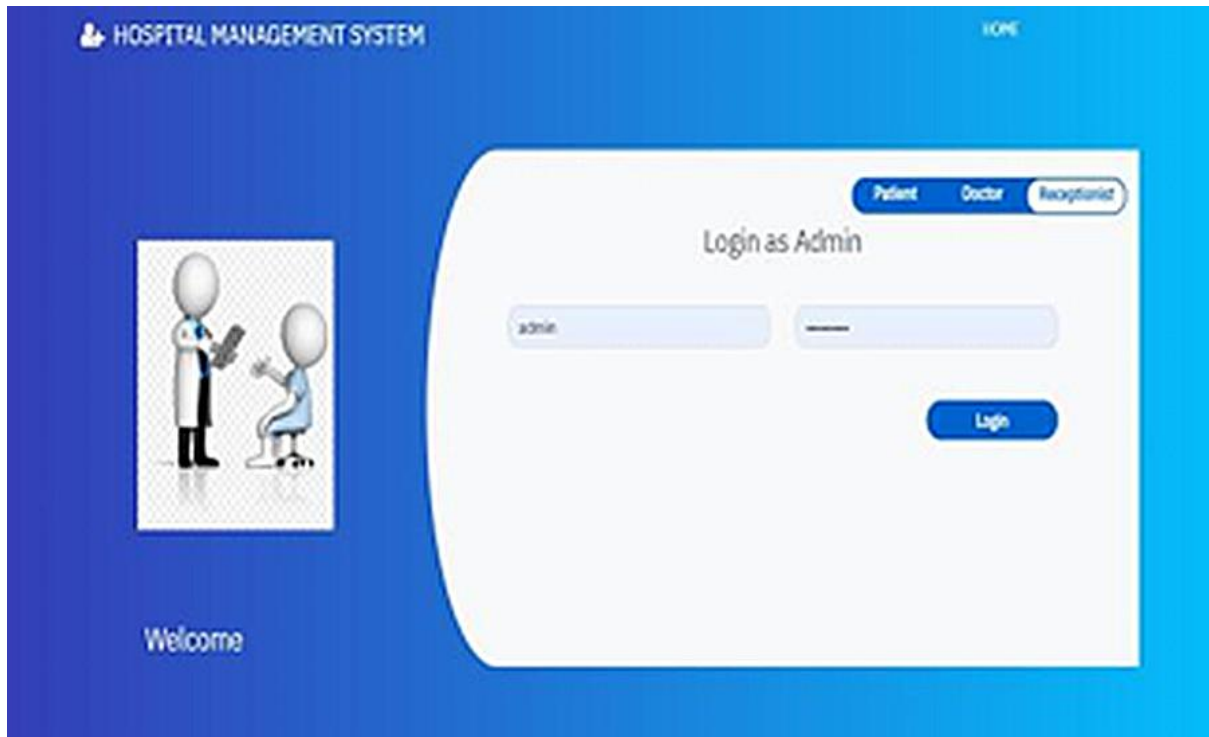


Figure 2.9. Admin Login page (Babu et al., 2023).

Table 2.3. Summary of the strengths and weaknesses of the Web Based Hospital Management System..

Strength	Weakness
Doctors and admins can efficiently locate patients or appointments by using search filters.	Managing overlapping or excessive appointments is not explicitly discussed.
Patients can reschedule appointments, while automated email notifications reduce no-shows.	No mention of tools to provide insights into patient trends or system performance.

2.2.4 Clinic Management System

The Clinic Management System (CMS) proposed by Ang et al. (2015) is a comprehensive web-based platform designed to improve the operational efficiency of healthcare clinics by automating various processes. The system addresses common challenges

in clinic management, such as manual data entry, long waiting times, and inefficient appointment scheduling. Key features of the system include:

The Appointment Module, one of the primary features of the system, allows patients to schedule appointments online or via phone. Once an appointment is booked, the system sends automatic SMS notifications to the patients, reminding them of their scheduled time and reducing the chances of no-shows. This feature helps to ensure that patients are informed and reduces the administrative burden on clinic staff.

The Registration Module integrates with Malaysia's MyKad system, which enables automated extraction of patient data such as names, identification numbers, and addresses. This integration reduces manual entry errors, speeds up the registration process, and ensures the accuracy of patient records. However, the module is limited in that it currently supports only Malaysian citizens, meaning that non-citizens or minors who do not have a MyKad would require manual data entry, adding complexity for these patient groups.

The Queue List Module is another important feature, designed to track patient waiting times and provide updates on the queue status. This module ensures that patients are served in an orderly fashion based on appointment times, which helps in reducing frustration and long wait times. The system provides real-time updates for both patients and staff, ensuring transparency. However, while this system addresses some concerns, it does not offer advanced features such as alerts for patients who have waited beyond a certain time, which could further improve patient satisfaction.

The Document Generation functionality automates the creation of medical certificates (MC) and diagnostic reports in PDF format. By automating these tasks, the system reduces paperwork for doctors, improves the speed at which documents are generated, and ensures

accuracy in the documentation. This feature significantly enhances the efficiency of clinic staff, allowing them to focus more on patient care rather than administrative duties.

The Search and Edit Functions feature allows staff to easily search for and update patient records using key identifiers such as the patient's IC number. This makes record retrieval and modification straightforward and quick, which is particularly beneficial in busy clinics. However, this module lacks more advanced features like bulk record updating or additional search filters, which could be useful in larger clinics dealing with high patient volumes.

This Custom SMS module enables clinic staff, including nurses and doctors, to manually type and send SMS reminders to patients about upcoming appointments. This feature allows flexibility in communication, as messages can be tailored for specific patient needs or appointments. However, the lack of pre-set templates can lead to inefficiencies and inconsistencies in the messaging process.

This SMS List module tracks the delivery status of SMS messages sent to patients and provides a report on the available SMS credit from the service provider. When the SMS credit runs out, the system will not be able to send further messages, which could disrupt communication with patients. This highlights the need for regular monitoring and management of the SMS credits to ensure uninterrupted service. The strengths and weaknesses of the system are summarised in the table below. The use case of the system is displayed below.

Table 2.4. Summary of the strengths and weaknesses of the Clinic Management System.

Strength	Weakness
SMS reminders help reduce patient no-shows and ensure accurate appointment information.	Relies on SMS for communication, which may be less reliable than other methods and depends on internet connectivity.
The MyKad integration streamlines registration, improving accuracy and reducing manual entry errors.	Limited to Malaysian citizens or those with MyKad; non-citizens or minors require manual data input, adding complexity.
Automates the creation of medical certificates and reports, improving accuracy and efficiency.	MyKad integration is limited to Internet Explorer due to ActiveX dependency, reducing flexibility for users.

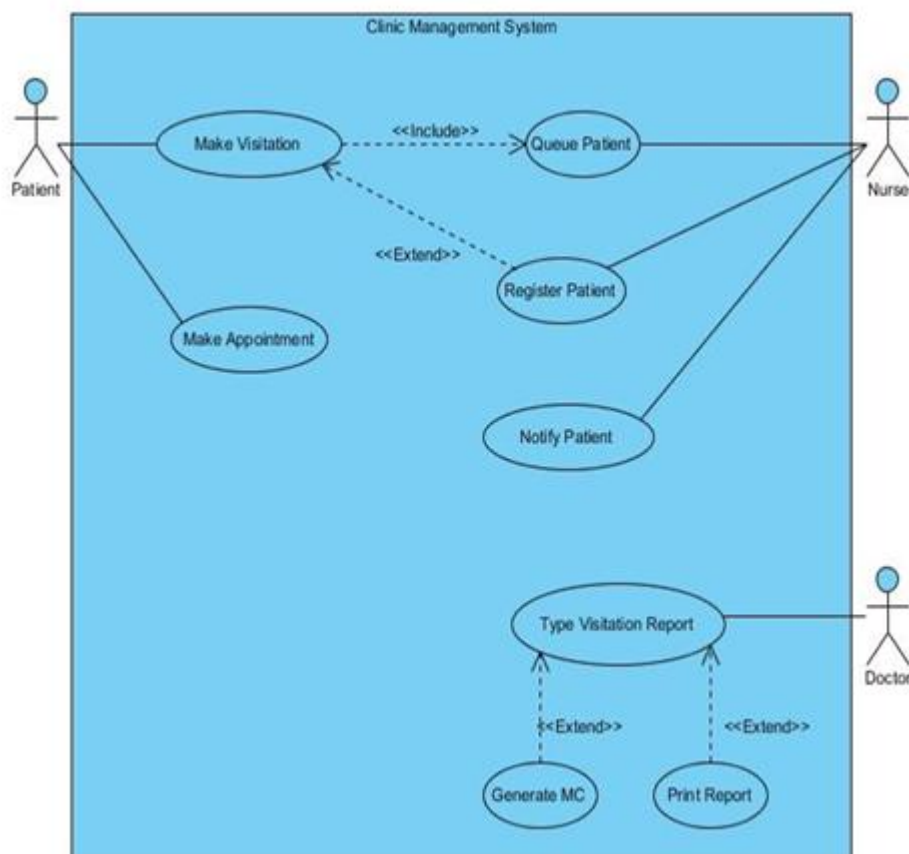


Figure 2.10. Use case diagram of the system (Ang, Kwan, & Rahman, 2015).

Figure 2.10 is the use case diagram represents a Clinic Management System, detailing the interactions between three primary actors: the patient, nurse, and doctor. The patient can interact with the system to either make a visitation or schedule an appointment. The Make

Visitation use case includes the Queue Patient process managed by the nurse and may extend to Register Patient, depending on the scenario. Nurses are also responsible for sending notifications to patients through the Notify Patient use case. Doctors interact with the system by using the Type Visitation Report use case, which involves documenting patient visits. This use case can extend to generating a medical certificate (Generate MC) or printing the report (Print Report) as needed. The diagram uses relationships such as "include" to indicate mandatory actions and "extend" to represent optional or conditional steps, ensuring flexibility in workflows. This visualization provides a clear structure for how tasks are allocated and performed within the clinic, streamlining its operations.

2.2.5 UTP Clinic Management System

The Universiti Teknologi PETRONAS (UTP) Clinic Management System, proposed by Bopabote (2014), aims to automate clinic operations at Universiti Teknologi PETRONAS. The system addresses common issues found in manual processes, such as mismanagement of patient records, data redundancy, and inefficiencies in appointment handling. Its design emphasises simplicity, accuracy, and efficiency to enhance clinic operations for both staff and patients.

A key feature is the **patient registration**, which allows patients to register their details and securely store them in a centralised database. This module eliminates the need for repetitive data entry during subsequent visits. Patients can also book appointments online by selecting their preferred time and doctor. The system offers flexibility by enabling patients to reschedule or cancel appointments when necessary and view their appointment history, fostering a user-friendly experience.

The **administrator module** provides administrators with full control over clinic operations. Admins can add, update, or remove patient and doctor records, as well as manage appointment schedules. This module includes tools to generate reports, ensuring efficient clinic management. Admins can also monitor system usage and ensure the integrity of stored data, supporting operational transparency and accountability.

The **doctor module** enhances the workflow for healthcare professionals by granting access to patient medical histories, appointment details, and diagnostic test results. Doctors can input and save prescriptions directly into the system, which patients can access for follow-up or further consultation. The module facilitates streamlined communication between doctors, patients, and administrative staff, ensuring continuity of care.

Built on a web-based platform, the system leverages technologies such as MySQL for database management and front-end tools like HTML, PHP, and JavaScript to create a responsive and user-friendly interface. Authentication mechanisms restrict system access to authorised users, ensuring data security. The system is also designed for multi-tasking, enabling staff to handle multiple operations—such as retrieving records and scheduling appointments—simultaneously, further improving efficiency. The table summarises the strengths and weaknesses of the system is as below.

Table 2.5. Summary of the strengths and weaknesses of the UTP Clinic Management System.

Strength	Weakness
Eliminates manual recordkeeping, reducing errors and time spent searching for patient files.	Does not include features like automated reminders for appointments or notifications for missed visits.
Centralised database improves data security and simplifies record retrieval.	Limited information on user feedback incorporation or usability testing.

2.3 Comparison between similar existing system and proposed system.

Table 2.6. Comparison between similar existing systems and proposed system.

Systems Features	Similar Existing System					Proposed System
	User Interactive Hospital Management System by using Web application	Online Hospital Appointment Booking	Web Based Hospital Management System	Clinic Management System	UTP Clinic Management System	Appointment Management System for PKP UNIMAS
Patient registration	✓	✓	✓	✓	✓	✓
Patient book appointment	✓	✓	✓	✓	✓	✓
Doctor book appointment	-	-	-	-	-	✓
Upload referral letter	-	-	-	-	-	✓
Appointment notification	✓	✓	-	✓	-	✓
Real time available slots updates	✓	✓	✓	-	-	✓

Table 2.6 compares similar existing systems with the proposed Appointment Management System for PKP UNIMAS. The existing systems evaluated include:

- 1) User Interactive Hospital Management System using a web application
- 2) Online Hospital Appointment Booking
- 3) Web-Based Hospital Management System
- 4) Clinic Management System
- 5) UTP Clinic Management System

The comparison focuses on six key features: patient registration, patient appointment booking, doctor appointment booking, referral letter uploads, appointment notifications, and real-time available slot updates. All systems, including the proposed one, support patient registration and appointment booking by patients. However, only the proposed system introduces the capability for doctors to book appointments and allows for the upload of referral letters. While appointment notifications are provided by some existing systems (specifically the User Interactive Hospital Management System and UTP Clinic Management System), this feature is also included in the proposed system. Additionally, real-time updates on available appointment slots are supported only by the User Interactive Hospital Management System and the proposed system. Overall, the proposed system builds upon the functionalities of existing systems by incorporating all their features while adding new capabilities, making it a more comprehensive solution.

2.4 Summary

This chapter provided a comprehensive literature review to evaluate existing hospital management and appointment systems, identifying their features, strengths, and limitations. Systems such as the User Interactive Hospital Management System, Online Hospital

Appointment Booking System, Web-Based Hospital Management System, Clinic Management System, and UTP Clinic Management System were analysed to highlight functionalities like appointment scheduling, patient record management, and automated reminders. However, these systems often lack features like real-time availability updates, doctor appointment booking, and referral letter uploads.

The review established that while existing systems address common challenges in healthcare workflows, gaps remain in automation, integration, and patient engagement. A comparative analysis highlighted the proposed Appointment Management System's improvements, including comprehensive features tailored to the needs of PKP UNIMAS. These include real-time slot availability, referral management, and enhanced user interactions for patients, doctors, and nurses. This literature review lays a strong foundation for designing an efficient and robust system to streamline appointment management processes and improve service delivery at PKP UNIMAS.

Chapter 3 : REQUIREMENT ANALYSIS AND DESIGN

3.1 Introduction

This chapter presents the detailed requirement analysis and design process for the development of the Appointment Management System for Pusat Kesehatan Prima UNIMAS (PKP UNIMAS). The purpose of this chapter is to establish a clear understanding of the system's requirements and to outline the design that addresses these requirements. The requirements were gathered using various methods, including questionnaires and interviews to ensure a comprehensive understanding of user needs and expectations. The collected requirements were then analysed, prioritised, and documented in measurable terms to ensure they align with the project's objectives. Additionally, this chapter includes the design approach, conceptual framework, and justification for the chosen design to meet the identified requirements effectively.

3.2 Requirement Gathering Process

To gather the necessary requirements for the Appointment Management System, multiple approaches were employed to ensure a thorough understanding of the current workflow and the needs of users at PKP UNIMAS.

3.2.1 Questionnaire

A questionnaire was distributed to patients who had previously visited PKP UNIMAS to gather insights into their experiences and challenges with the current appointment process. A total of 15 respondents participated and provided valuable feedback on the current appointment booking workflow. The questionnaire focused on areas such as their experience on the current booking process, brief opinion on the proposed system and preferred methods to

receive appointment reminder. The figures below are the results of each question in the questionnaire.

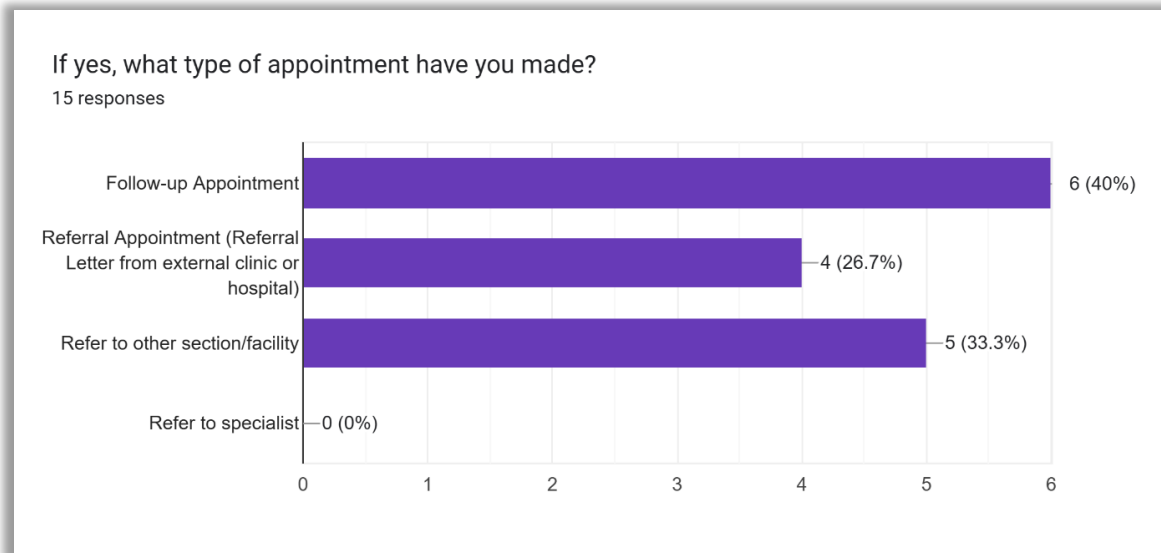


Figure 3.1. Appointment types made by respondents.

Figure 3.1 shows the bar chart of the distribution of different types of appointments have made by the respondents. The most common type of appointments was follow-up appointments, accounting for 40% (6 out of 15 responses). Meanwhile, referral appointments involving referral letters from external clinics or hospitals accounted for 26.7% (4 responses) and 33.3% (5 responses) for refer to other section/facility. Notably, no respondents reported booking an appointment to refer to a specialist.

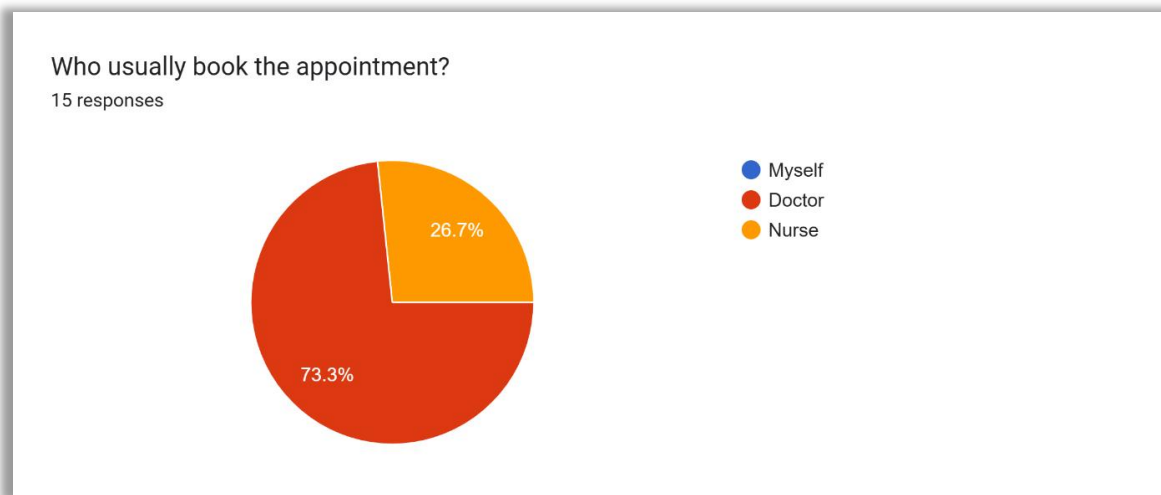


Figure 3.2. Person to book respondent's appointments.

Figure 3.2 is a pie chart illustrates who typically books appointments. Most appointments are booked by doctors, representing 73.3% of the responses, while nurses account for the remaining 26.7%. No respondents reported booking appointments themselves.

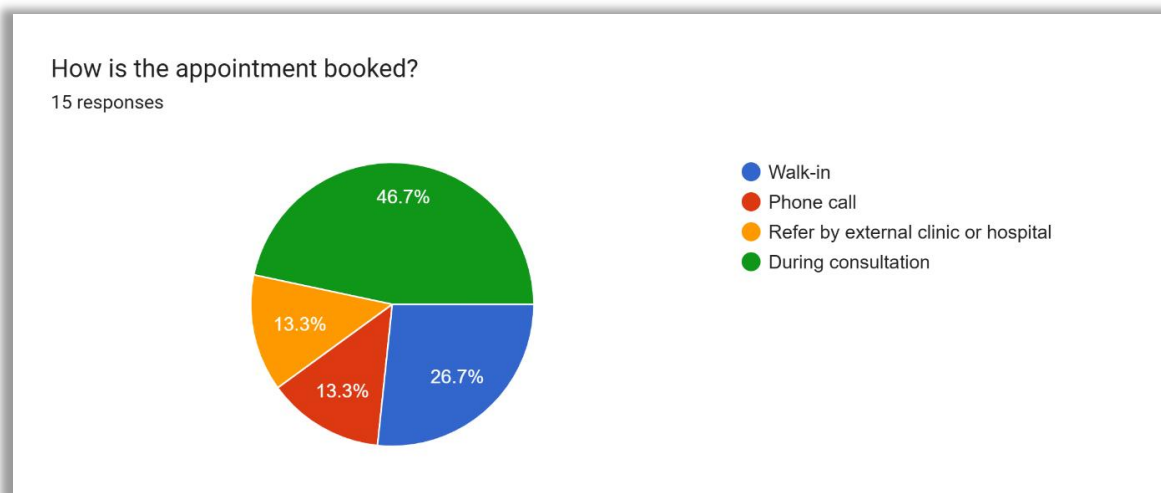


Figure 3.3. Methods of appointment booking.

Figure 3.3 illustrates a pie chart of the different methods used to book appointments, based on 15 responses. The data shows that "During consultation" is the most common method, followed by walk-in appointments. 46.7% were booked during a consultation. A significant

portion (26.7%) were walk-in appointments. Phone calls and referrals by external clinic or hospital both accounted for 13.3%.

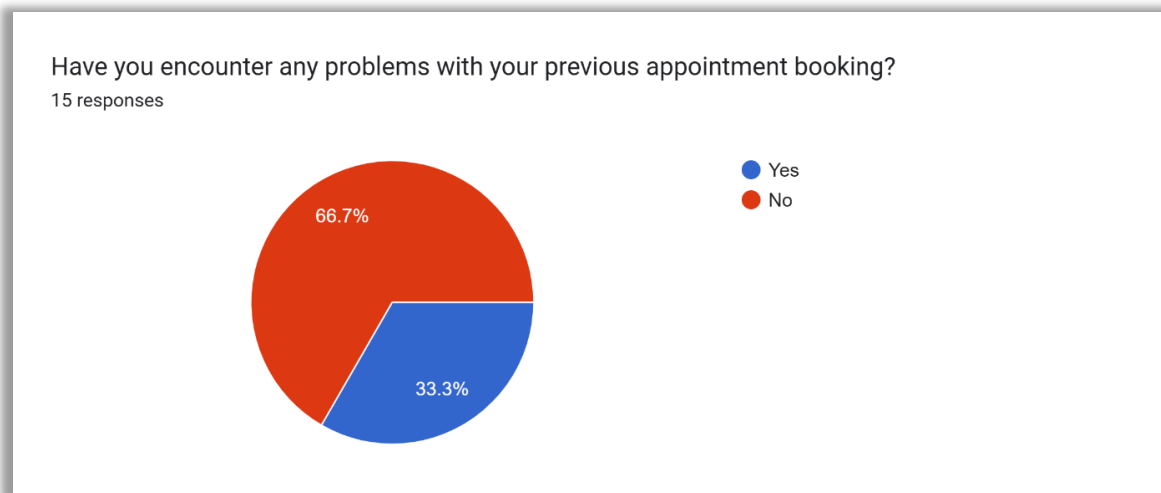


Figure 3.4. Appointment Booking Problems Encountered by Respondents.

Figure 3.4 visualises a pie chart of the results of a survey asking respondents whether they encountered any problems with their previous appointment booking. 66.7% of the respondents have not encountered any problems with their previous appointment booking while 33.3% of them have encountered problems.



Figure 3.5. Description of the problem occur in booking process.

This figure 3.5 shows responses to the question, “If yes, what is the problem?” regarding issues encountered during the appointment scheduling process. The four responses highlight common problems.

- 1) “Time is not correct” – indicates inaccuracies in the scheduled time.
- 2) “The time of my appointment was not accurate” – reiterates scheduling errors.
- 3) “Forgot the appointment date” – points to a lack of reminders or notifications.
- 4) “I go to the wrong section” – reveals issues with communication or clarity regarding appointment locations.

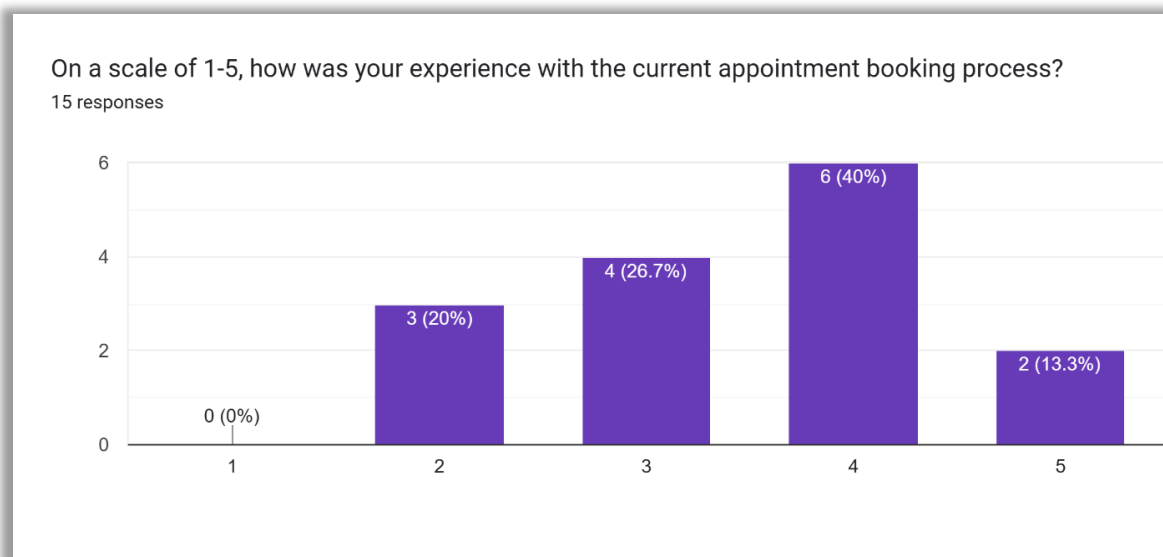


Figure 3.6. Satisfaction level of respondent on the current appointment booking process.

Figure 3.6 is a bar chart illustrating the responses to the question, “On a scale of 1-5, how was your experience with the current appointment booking process?” based on feedback from 15 respondents. The x-axis represents the scale as below:

- 1 – Very Dissatisfied
- 2 – Dissatisfied
- 3 – Neutral

4 – Satisfied

5 – Very satisfied

The y-axis shows the number of respondents and corresponding percentages. The results reveal that none of the respondents rated their experience as 1 (0%), 3 respondents gave a rating of 2 (20%), 4 respondents rated it as 3 (26.7%), another 6 rated it as 4 (40%), and 2 respondents gave the highest rating of 5 (13.3%). This distribution provides insight into the varying levels of satisfaction with the current booking process. This concludes that most respondent find the current booking process acceptable but not exceptional, with opportunities for enhancement to achieve higher satisfaction levels.

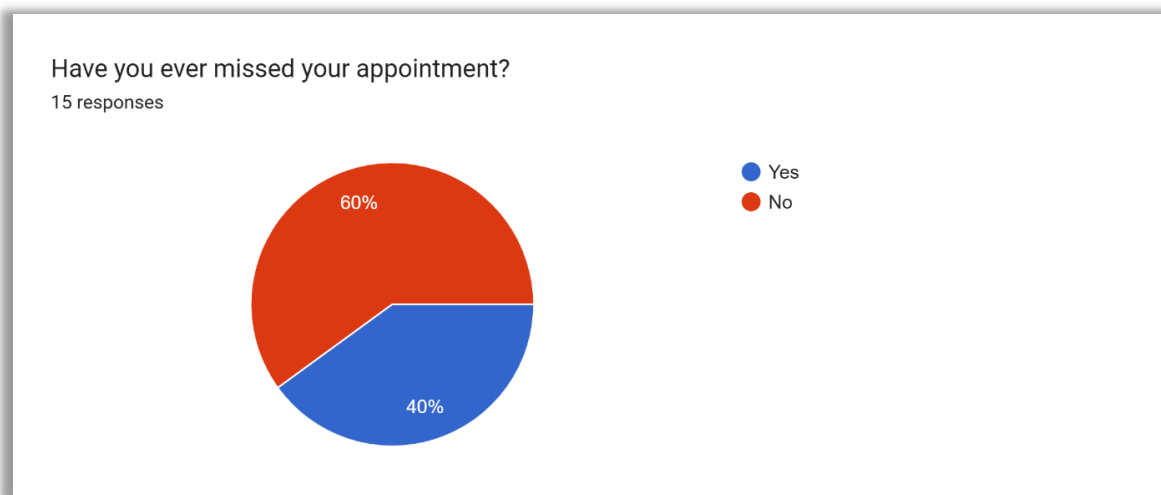


Figure 3.7. The percentage of "yes" and "no" responses given by respondents.

The figure 3.7 is a pie chart representing the responses to the question, “Have you ever missed your appointment?” among 15 respondents. It shows that 40% of respondents answered “Yes”, while 60% answered “No”. This indicates that slightly more than half of the participants have not missed an appointment.

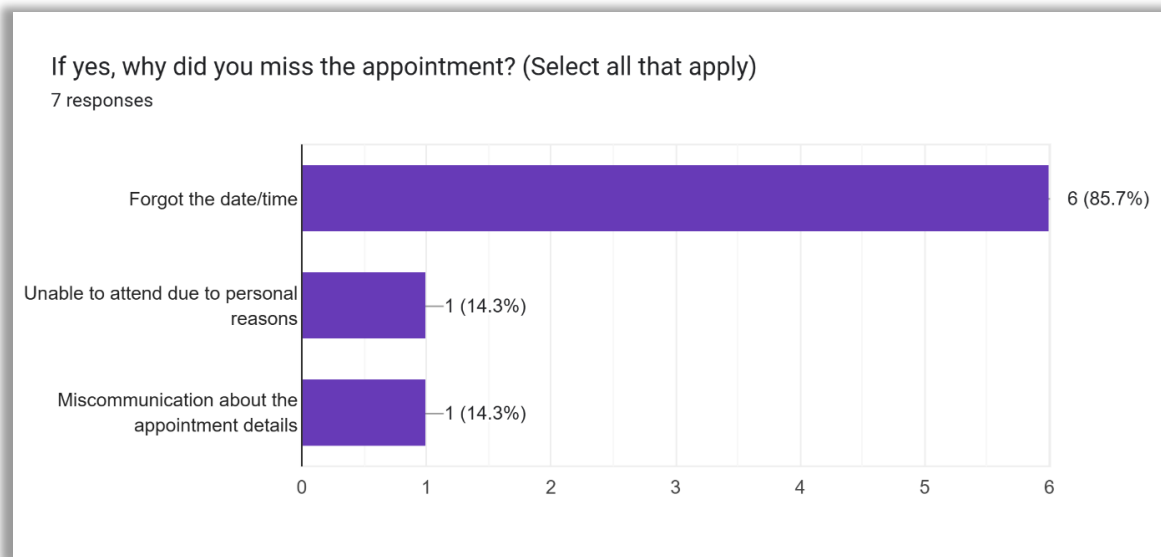


Figure 3.8. Reasons for respondents missed their appointment.

Figure 3.8 is a bar chart illustrating the reasons provided by those who answered "Yes" to the previous question. Out of 6 responses, the majority (6 responses, or 85.7%) indicated that they missed their appointment because they forgot the date or time of the appointment. One respondent (14.3%) cited personal reasons, and another (14.3%) mentioned miscommunication about the appointment details. This data highlights that forgetting the appointment date or time is the most common reason for missed appointments.

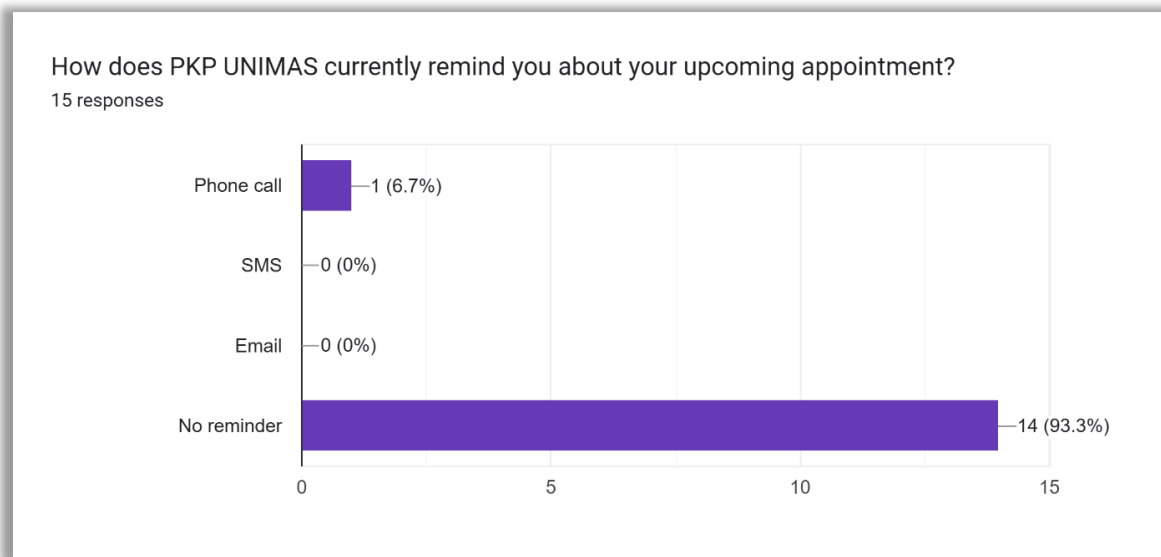


Figure 3.9. Current methods used by PKP UNIMAS to remind patient about upcoming appointments.

This bar chart displays how PKP UNIMAS reminds users of their upcoming appointments based on 15 responses. The majority (93.3%, or 14 respondents) reported receiving no reminders. A small percentage (6.7%, or 1 respondent) indicated receiving reminders via phone call. No respondents reported receiving reminders through SMS or email. This data concludes that a significant lack of reminder mechanisms for appointments.

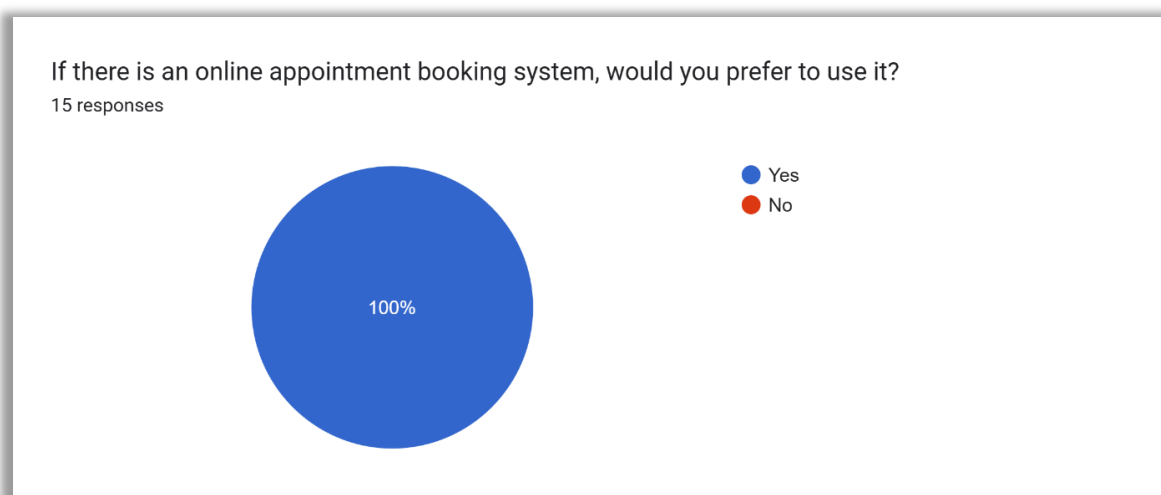


Figure 3.10. Respondents' preference on the proposed Appointment Management System.

Figure 3.10 is a pie chart illustrates the preference of respondents regarding the use of an online appointment booking system. Out of 15 responses, 100% of the participants indicated that they would prefer to use such a system. The chart uses a single blue segment labelled “Yes,” reflecting unanimous agreement, while the red segment for “No” is absent, indicating no opposing responses. This concludes that all respondents agree with the idea of using an online system to book and manage appointments.



Figure 3.11. Respondents' opinion on the real-time availability of slot feature.

Figure 3.11 is a pie chart illustrates survey results regarding the question, “Would you like to see real-time available slots while booking an appointment?”. 100% of the 15 respondents answered “Yes”, represented by a blue colour. This unanimous agreement indicates a strong preference among respondent for the ability to view real-time availability, which can enhance their booking experience.

Based on this finding, the system design incorporates a real-time slot availability feature to ensure users can easily view and select available time slots when booking an appointment.



Figure 3.12. Respondents' opinion on the automated appointment reminders feature.

Figure 3.12 is a pie chart represents the results for the question, “Would you find automated reminders for your appointments be helpful?”. 100% of the respondents answered “Yes”, highlighted in blue. This response demonstrates that all respondents agree if the system has automated appointments reminder.

As a result, the system includes an automated reminder function to notify users of upcoming appointments.

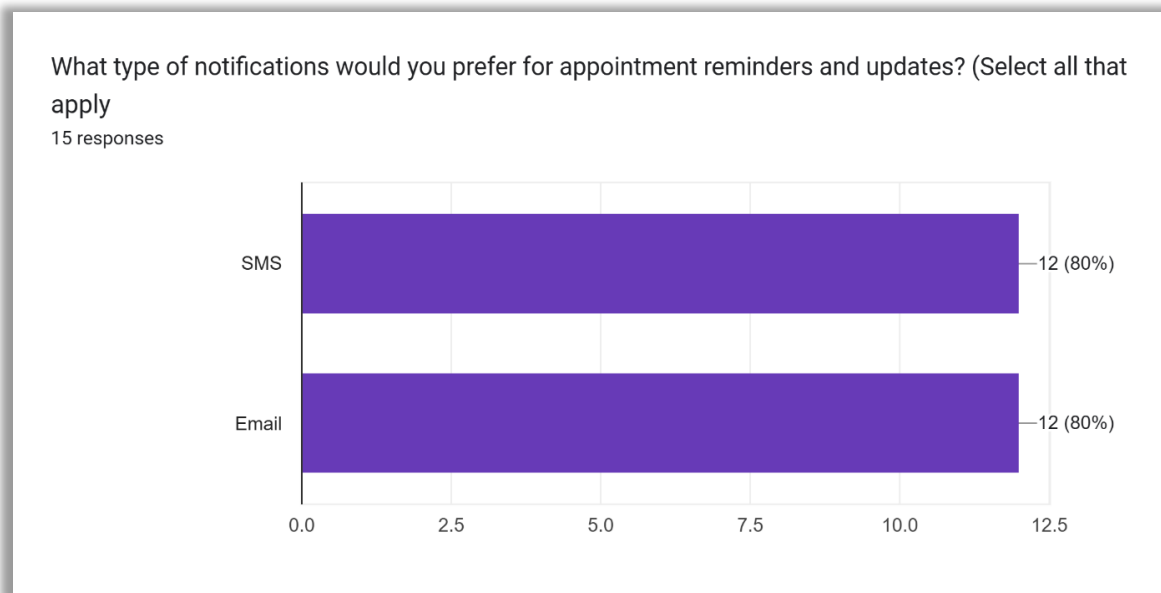


Figure 3.13. Preferred notification type for appointment reminders and updates.

Figure 3.13 is a bar chart shows respondents' preferences for notification types to receive appointment reminders and updates, based on 15 responses. SMS and email were equally favoured, with 12 respondents (80%) selecting each option.

The data suggests that implementing both SMS and email notifications could effectively meet user preferences for appointment reminders. So, the system is designed to provide multiple notification options to allow users to choose their preferred reminder method. This flexibility enhances user satisfaction and ensures they receive notifications in their most accessible format.

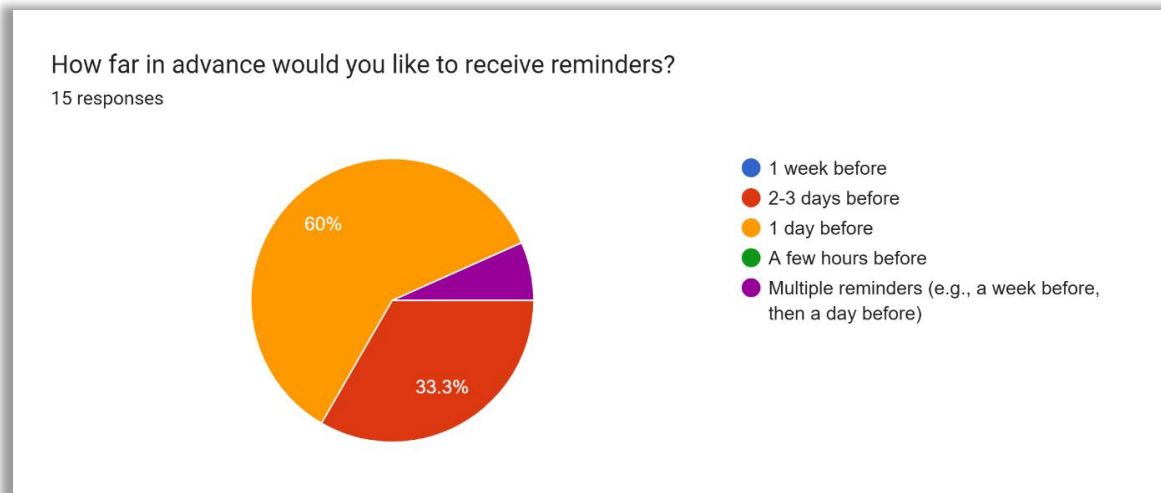


Figure 3.14. Respondents' preferences on how advance they would like to receive reminders.

Figure 3.14 shows a pie chart summarises the responses from 15 participants regarding how far in advance they would like to receive reminders. The largest proportion, 60%, preferred receiving reminders 1 day before the appointment. Another 33.3% indicated a preference for reminders 2-3 days before. A smaller segment, represented by a purple section, opted for multiple reminders at different intervals (e.g., a week before and a day before). There were no responses for options like reminders 1 week before or a few hours before. This concludes that most of respondent prefer to get reminders when it is near to the appointment date.

Based on this findings, the system is designed to send automated appointment reminders primarily 1 day before the scheduled appointment which align with the majority preference. Additionally, users may have the flexibility to set their preferred reminder timing.

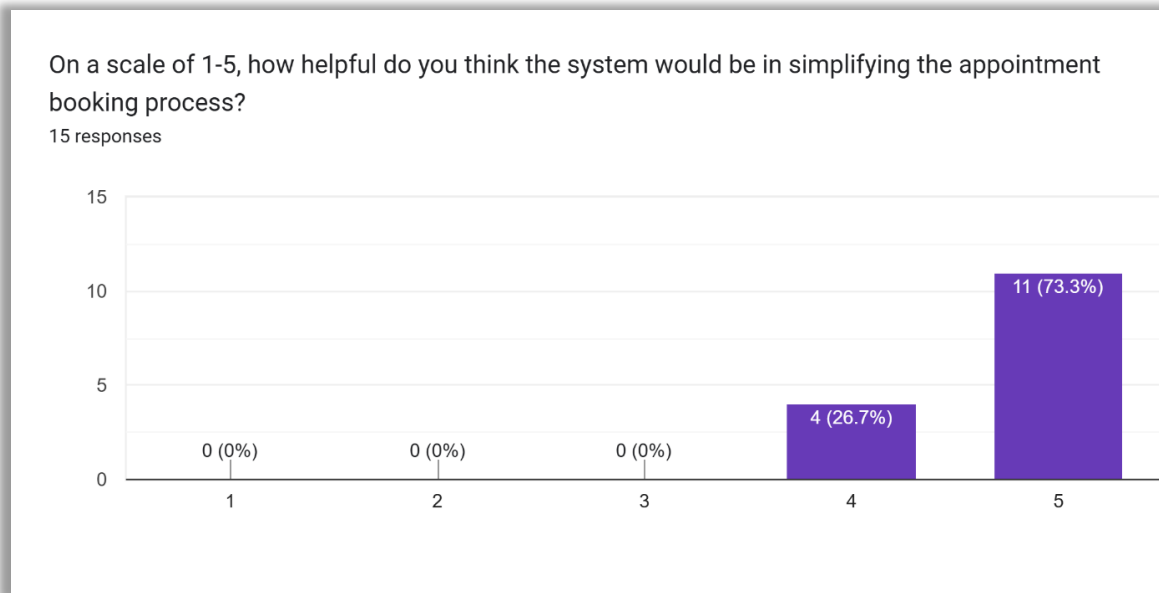


Figure 3.15. Respondents' opinion on the rating of the helpfulness of the proposed system.

Figure 3.15 is a bar chart illustrating the responses of 15 participants to a survey question rating the helpfulness of a system in simplifying appointment bookings on a scale of 1 to 5. The scale is as below:

- 1 – Not helpful at all
- 2 – Slightly helpful
- 3 – Moderately helpful
- 4 – Very helpful
- 5 – Extremely helpful

The majority (73.3%, or 11 respondents) rated the system as extremely helpful with a score of 5. Additionally, 26.7% (4 respondents) gave a score of 4. No participants rated the system with scores of 1, 2, or 3. This data suggests that the respondents find the proposed system would be helpful a lot in simplifying the appointment booking process.

Overall, the data indicate that the proposed system has received overwhelmingly positive feedback and support from the respondents. The unanimous preference for an online

booking system, coupled with the identified need for improved appointment reminders and the clear preference for SMS and email notifications, highlights the respondents' readiness to adopt and benefit from the proposed solution.

3.2.2 Interview

An interview session with Dr. Dessmon, a doctor from PKP UNIMAS was conducted to gather insights into the current appointment management workflow and identify user requirements for the proposed system. The doctor explained that for follow-up appointments, discussions about date and time typically occur immediately after consultations, with patient availability being considered. However, challenges arise when referring patients to specialists or other facilities, as the availability of these sections is often unknown. This requires follow-up calls, and some patients are difficult to contact, further complicating the process. For patients with referral letters, the doctor mentioned that the letters are reviewed first to determine if further action is needed. In most cases, even with a referral letter, patients are required to undergo consultation and diagnosis before proceeding. The transcription of the interview is available in Appendix A.

Another interview session with Madam Rogayah, a staff nurse at PKP UNIMAS, was conducted to gather insights into the current appointment workflow. According to Madam Rogayah, nurses are actively involved in booking appointments for patients, typically based on instructions from doctors. They will write the appointment details, including the section, date, and time on the patient's medical history card or a piece of paper. When managing patients with referral letters, the letters are first reviewed to ensure all details are complete and clear. In most cases, however, the doctor will also diagnose the patient before deciding on the next steps for the referral.

For instances where sections or facilities are unavailable, patients are informed, and nurses follow up with a call once the facility becomes available. Madam Rogayah emphasised the importance of having real-time updates on section or facility availability, as this would allow nurses to make bookings more efficiently and avoid delays. Additionally, she highlighted the benefits of automated reminders for upcoming appointments, which would help reduce missed appointments by ensuring patients remember their scheduled dates and times. The insights provided by Madam Rogayah underscore the need for an automated and centralised system to streamline appointment management and improve the overall patient experience. The combination of these methods provided a well-rounded understanding of the requirements, capturing the perspectives of both patients and healthcare providers. The complete transcription of the interview with Madam Rogayah can be found in the Appendix B.

An interview session was conducted also with Mr. Hazman and Mr. Zaba, Information Technology (IT) staff at PKP UNIMAS, to gain insights into the current hospital management system and gather input for the proposed Appointment Management System. They briefly explained that the existing hospital management system is strictly for internal use by staff, including doctors, nurses, and IT administrators. The system provides essential features for managing patient records and hospital operations but does not support direct appointment booking by patients or referral management processes.

Mr. Hazman and Mr. Zaba also identified several challenges in the current booking process, including delays caused by the manual coordination between departments, limited visibility of section or facility availability, and the absence of a mechanism for patients to book or manage appointments independently. Additionally, the ability of patients to request bookings and upload referral letters from their own side was discussed. This feature was proposed to address the current workflow, where patients must bring referral letters in person, requiring registration at the counter and subsequent consultation. This procedure often results

in delays. Allowing patients to upload referral letters during the appointment request process would optimise the workflow, as doctors or nurses could review the letter directly through the system, saving time and streamlining the booking process.

The discussion also covered ways to smoothen the workflow and improve the functionality of the proposed system such as the flow for patient to book appointments. Instead of directly book for the appointment, patients must request the appointment as it needs to be reviewed by the nurse first. This is to ensure right section, facility or specialist will be appoint to the patients.

3.2.3 Functional Requirements

The functional requirements of the Appointment Management System for Pusat Kesihatan PRIMA (PKP) UNIMAS are outlined in the table below. These requirements are designed to address the needs of patients, doctors, nurses, and administrators, ensuring a streamlined, efficient, and user-friendly appointment management process.

Table 3.1. Functional Requirement for all the users.

ID	Description	Priority	Actor(s)
FR001	The system shall allow patients to register using their MyKad number and create a secure account.	High	Patient
FR002	The system shall validate the MyKad number during registration against the existing database	High	System
FR003	The system shall allow patients to log in using their MyKad number and password.	High	Patient
FR004	The system shall enable patients to book an appointment by selecting a date, time, and type of appointment.	High	Patient
FR005	The system shall provide real-time updates on available appointment slots.	High	Patient, Doctor

FR006	The system shall allow patients to upload referral letters for referral-based appointments.	Medium	Patient
FR007	The system shall notify patients of appointment status updates (approved, rejected, or change requested).	High	System
FR008	The system shall allow doctors to book follow-up appointments for their patients.	High	Doctor
FR009	The system shall allow nurses to manage appointment requests, including approval, rejection, or requests for changes.	High	Nurse
FR010	The system shall allow staff to review referral letters uploaded by patients.	Medium	Nurse, Doctor
FR011	The system shall send automated reminders for upcoming appointments via SMS and email.	High	System
FR012	The system shall allow patients to view, reschedule, or cancel their appointments.	High	Patient
FR013	The system shall allow patients to view their appointment history, including past and upcoming bookings.	Medium	Patient
FR014	The system shall allow nurses to register first-time patients during their initial visit.	High	Nurse
FR015	The system shall enable patients to update their profile information, such as contact details.	Medium	Patient
FR016	The system shall enable administrators to manage staff accounts, including adding, updating, or removing accounts.	Low	Admin
FR017	The system shall restrict access to modules based on user roles (e.g., patient, nurse, doctor, admin).	High	System
FR018	The system shall provide a dashboard for patients displaying upcoming appointments, notifications, and key metrics.	Medium	Patient
FR019	The system shall allow doctors and nurses to view patient profiles and appointment details.	High	Doctor, Nurse
FR020	The system shall generate error messages for invalid login attempts or registration failures.	Medium	System
FR021	The system shall log appointment transactions for audit purposes.	Low	System

FR022	The system shall allow administrators to configure notification preferences (e.g., SMS, email).	Low	Admin
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3.3 System Design

This section outlines the design of the Appointment Management System for PKP UNIMAS. It includes the logical and physical aspects of the system design to ensure the solution addresses the identified requirements and provides a clear understanding of its functionality and structure.

3.3.1 Logical Design

The logical design focuses on the high-level representation of the system's structure and functionality. It includes diagrams and models, such as the Use Case Diagram, to illustrate the interactions between users and the system and to define how the system will operate to fulfil its objectives.

3.3.1.1 Use Case Diagram

A use case diagram is a visual representation of the interactions between users (or actors) and a system. It is a part of Unified Modelling Language (UML) used in software engineering and systems design to depict the functionality or features of a system from a user's perspective. The figure below is the use case diagram of this proposed system.



Figure 3.16. System Use Case Diagram

Figure 3.16 is the Use Case Diagram (UCD) represents the primary functionalities of the Appointment Management System for PKP UNIMAS. It identifies the key actors interacting with the system—such as patients, doctors, nurses and system administrator—and outlines their interactions with various system features. This diagram highlights the main use cases, including request appointments, register patient, manage appointment requests, book appointment and register new staff member. The diagram provides a high-level overview of how the system caters to user requirements and ensures seamless workflows. The tables below are the use case description for each use case of the system.

Table 3.2. Use case description for Request Appointment.

Use Case	Request Appointment
Brief Description	To allow patients to request an appointment.
Actor(s)	Patient
Pre-condition(s)	The patient is logged in to the system.
Post-condition(s)	The appointment is successfully booked and visible on the patient's dashboards.
Main Flow	1. The patient logs into the system and navigates to the "Book Appointment" page. 2. The patient selects the type of appointment (referral appointment or follow-up appointment). 3. The system displays available slots of the section or facility. 4. The patient selects a preferred time slot. 5. The patient submits the booking. 6. The system sends the request to the respective section or facility for approval. 7. Once approved, the patient receives a notification confirming the appointment.
Alternative Flow(s)	At step 2, the patient selects referral appointment as the type of the appointment: 2.1 The patient uploads the referral letter. 2.2 Continue to step 3.
Exception Flow(s)	

Table 3.3. Use case description for Edit Personal Details.

Use Case	View Profile
Brief Description	To allow patient to view their own profile information in the system.
Actor(s)	Patient
Pre-condition(s)	The patient is logged into the system.
Post-condition(s)	The patient's profile is updated with the new information.
Main Flow	1. The patient logs in and navigates to the "View My Profile" section. 2. The system displays the patient's details.
Alternative Flow(s)	

Exception Flow(s)	
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Table 3.4. Use case description for Register.

Use Case	Register
Brief Description	To allow patients to register and create their profile in the system.
Actor(s)	Patient
Pre-condition(s)	The patient has completed an initial physical registration at the PKP UNIMAS registration counter.
Post-condition(s)	The patient's account is successfully created, and they can log in to the system.
Main Flow	1. Patient accesses the system via the web or mobile application. 2. The system prompts the patient to provide their MyKad number. 3. The system validates the MyKad number against the database of pre-registered names. 4. If validated, the system prompts the patient to create a secure password. 5. After successfully created password, the system prompts the patient to provide a phone number or email address. 6. The system sends a One-Time Password to the provided phone number or email. 7. The patient enters the OTP in the system. 8. Upon successful verification, the system creates the account and confirms registration completion.
Alternative Flow(s)	At step 6, the verification code is not received: 6.1 The patient can request the system to resend the code.
Exception Flow(s)	At step 2, the MyKad number or name does not match the records: 2.1 The system displays an error message prompting the patient to contact the registration counter.

Table 3.5. Use case description for Login.

Use Case	Login
Brief Description	To allow users to securely access the system.
Actor(s)	Patient, Doctor, Nurse, System Administrator
Pre-condition(s)	The user has registered in the system.

Post-condition(s)	The user is logged in to the system.
Main Flow	1. The user enters their MyKad and password. 2. The system authenticates the credentials. 3. The user is redirected to their respective dashboard.
Alternative Flow(s)	At step 2, the authentication fails: 2.1 The user is prompted to re-enter their MyKad and password. 2.2 Return to step 1.
Exception Flow(s)	At step 2, the authentication fails: 2.1 The user is prompted to reset password. 2.2 The user navigates to reset password page.

Table 3.6. Use case description for View Appointment Records.

Use Case	View Appointment Records
Brief Description	To allow patients to view their past and upcoming appointment history.
Actor(s)	Patient
Pre-condition(s)	The patient logged in to the system.
Post-condition(s)	The systems display Appointment History page.
Main Flow	1. The patient logs into the system and navigates to the “Appointment Records” page. 2. The system displays a list of all past and upcoming appointments associated with the patient’s account with appointment details such as date, time, type of appointment, status. 3. The patient can filter the list by date or type of appointment. 4. The patient selects a specific appointment to view more details (e.g., doctor’s notes or attached documents).
Alternative Flow(s)	
Exception Flow(s)	At step 2, the patient has no recorded appointments: 2.1 the system displays a message indicating no appointments found.

Table 3.7. Use case description for Book Appointment.

Use Case	Book Appointment
Brief Description	To allow doctor to book appointment for a patient.

Actor(s)	Doctor
Pre-condition(s)	The doctor is logged in to the system.
Post-condition(s)	The appointment is successfully booked, and the details can be viewed from the patient side.
Main Flow	1. The doctor navigates to the “Book Appointment” page. 2. The doctor enters the patient’s MyKad number. 3. The doctor selects the type of the appointment (follow-up appointment or referral appointment). 4. The doctor selects the type of the referral (refer to specialist or refer to section or facility). 5. The doctor selects the specialist or section or facility. 6. The system displays available slots. 7. The doctor selects the preferred slot. 8. The doctor enters additional notes (if any). 9. The doctor submits the appointment booking. 10. The system notifies the patient on the appointment.
Alternative Flow(s)	
Exception Flow(s)	At step 5, if the MyKad number is not found: 5.1 The doctor will ask patient to register to the system or proceed with manual appointment booking.

Table 3.8. Use case description for Manage Appointment Requests.

Use Case	Manage Appointment Requests
Brief Description	To allow healthcare staff to approve or reject or request changes on the appointment requests.
Actor(s)	Nurse, Doctor
Pre-condition(s)	The healthcare staff is logged in to the system and an appointment booking request exists.
Post-condition(s)	The appointment is either approved, rejected with reasons provided to the patient or need changes.
Main Flow	1. The healthcare staff logs into the system and views pending appointment requests. 2. The healthcare staff reviews the patient details, referral letter (if applicable), and requested time slot.

	3. The healthcare staff approves or rejects or request changes on the appointment. 4. The system notifies the patient of the decision.
Alternative Flow(s)	At step 3, the healthcare staff rejects or request changes: 3.1 The healthcare staff provides note to state rejection reason or request changes details to patient. 3.2 Continue to step 4.
Exception Flow(s)	

Table 3.9. Use case description for Manage Available Slots

Use Case	Manage Available Slots
Brief Description	To allow nurse to set and appoint available time slots for each section, facility or specialist.
Actor(s)	Nurse
Pre-condition(s)	The nurse is logged in to the system.
Post-condition(s)	
Main Flow	1. The healthcare staff logs into the system and navigates to “Manage Available Slots”. 2. The nurse selects the section or facility or specialist. 3. The nurse selects day (Monday, Tuesday, etc). 4. The nurse select and tick the time slots that should be available on the day selected based on the availability of the section, facility or specialist. 5. The nurse save the slots into the database.
Alternative Flow(s)	
Exception Flow(s)	

Table 3.10. Use case description for Register First Time Patient.

Use Case	Register First Time Patient
Brief Description	To key in patient details into the system database during their first physical visit, enabling future self-registration for the patient.
Actor(s)	Nurse
Pre-condition(s)	The patient visited PKP UNIMAS physically for the first time.

Post-condition(s)	The patient's name and details are successfully registered in the system database.
Main Flow	1. The patient provides their MyKad and Out-Patient History Card(if any) to the nurse at the registration counter. 2. The nurse logs in to the system and navigates to "Register First Time Patient". 3. The system prompts the nurse to input patient details, including MyKad number, name, contact information, and any relevant medical records. 4. The nurse verifies the input data and submits the information. 5. The system stores the data in the patient database and confirms successful registration.
Alternative Flow(s)	
Exception Flow(s)	

Table 3.11. Use case description for Register New Staff Member.

Use Case	Register New Staff Member
Brief Description	To allow administrators to add new staff (doctor, nurse or system administrator) to the system.
Actor(s)	System Administrator
Pre-condition(s)	The system administrator is logged in to the system.
Post-condition(s)	The new staff member is added to the system and can log in.
Main Flow	1. The administrator clicks the "Register New Staff" button. 2. The administrator enters the new staff's details, including name, role, department, and contact information. 3. The administrator confirms and saves the registration.
Alternative Flow(s)	
Exception Flow(s)	

Table 3.12. Use case description for Edit Staff Details.

Use Case	Edit Staff Details
Brief Description	To allow administrators to update a staff member's details.
Actor(s)	System Administrator

Pre-condition(s)	The system administrator is logged in to the system and the staff member exists in the system.
Post-condition(s)	The staff member's details are updated in the system.
Main Flow	1. The administrator logs in and searches for the staff member. 2. The system retrieves and displays the staff member's current details. 3. The administrator modifies the necessary fields (e.g., contact information, department). 4. The administrator saves the changes.
Alternative Flow(s)	
Exception Flow(s)	

3.3.1.2 Activity diagram

The Activity Diagrams below illustrates the workflow of the Appointment Management System for PKP UNIMAS. It depicts the sequence of activities involved in appointment management, patient registration and appointment booking. The diagram outlines the roles of patients, doctors, and nurses in the system. This representation helps visualise the flow of operations and ensures the system's design aligns with user requirements and process efficiency.

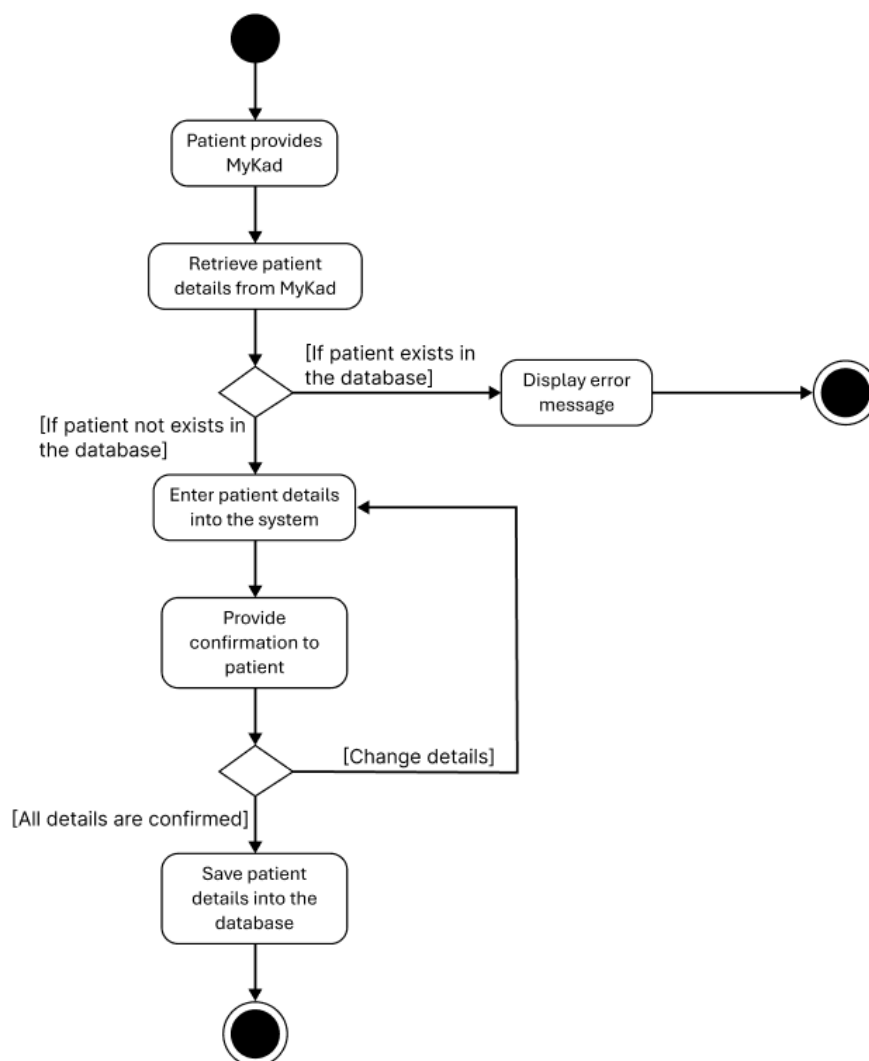


Figure 3.17. Activity diagram for Nurse Register First Time Patient.

Figure 3.17 is the activity diagram for nurse register first time patient. This will be done when the patient come for the first time to the PKP UNIMAS. The patient must register

physically first before they can register themselves into the system. This measure is implemented to ensure that only genuine patients with the intention of receiving treatment at PKP UNIMAS can register. It helps prevent unauthorised registrations from individuals, such as those from other states or countries, who do not plan to visit or utilise the facility's services. For the first time registration, the patient will provide their MyKad to the nurse. The nurse will get the patient's details through the MyKad and input the MyKad number to check whether the MyKad number has already existed in the database or not. If already existed, then the system will display an error message. If the patient's MyKad number still not exist in the database, the system will proceed to a registration form page where nurse will enter the patient's details such as full name, age, gender and address. After that, the nurse will confirm all the details to the patient. If all the details are confirmed, then the nurse save the data in the system and the system will record the data into the database. If any details are not accurate, the nurse will change it and save it to the system.

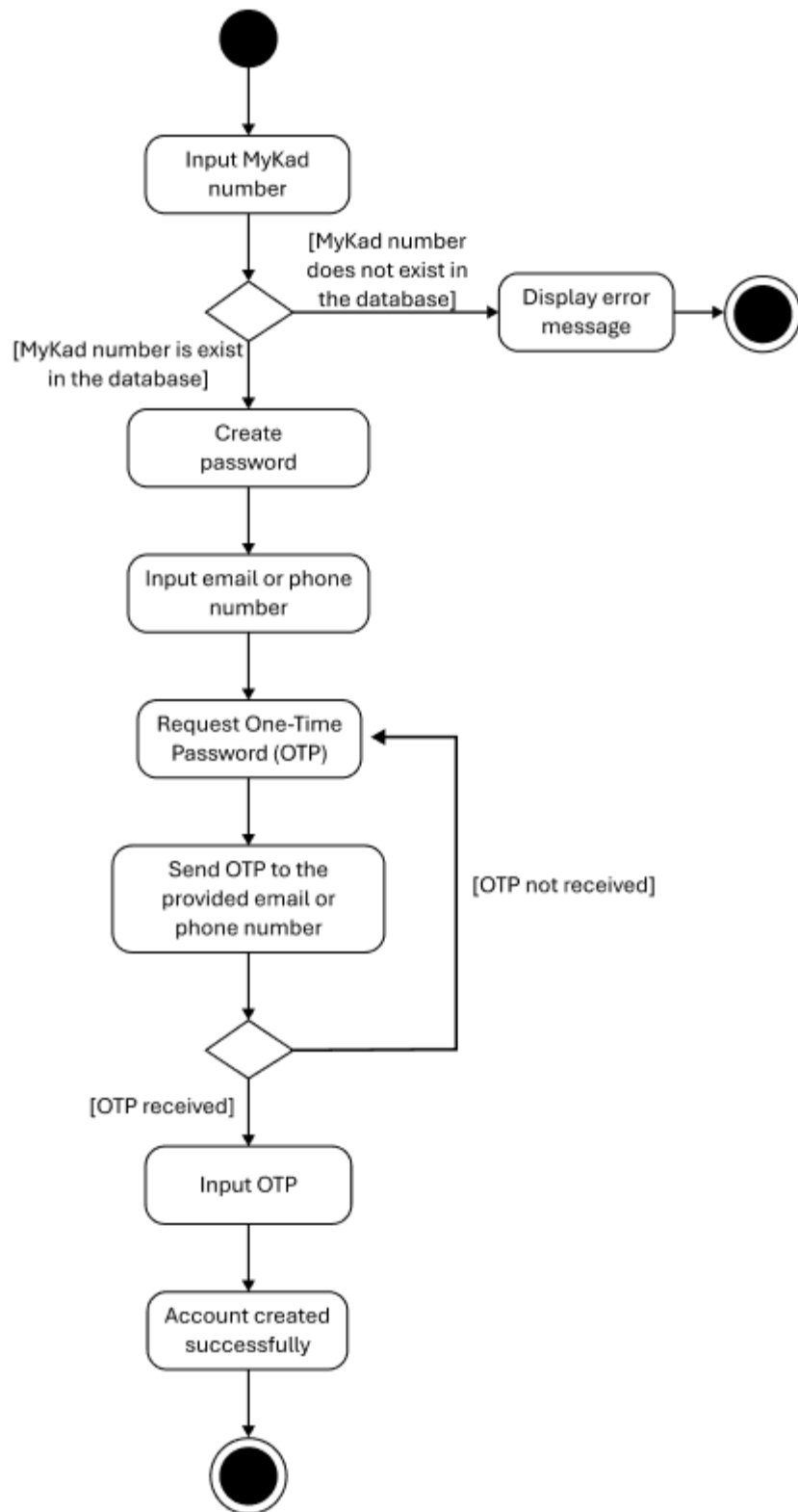


Figure 3.18. Activity diagram for Patient Registration.

The figure 3.18 is the activity diagram for patient registration. At first, the system will prompt the patient to input their MyKad number. This is to verify whether the patient has

already registered physically at the PKP UNIMAS or not. After the patient input their MyKad number, the system would check the MyKad number if it existed in the database. If existed, the system would proceed to the page where patient needs to create a secure password. If the MyKad does not exist in the database, then the system will display an error message that indicates the patient has not yet registered physically at the PKP UNIMAS. After the patient create a valid password, the system will prompt the patient to input their email or phone number. This is for verification purposes. Then, the patient can request One-Time Password (OTP) that will be sent to the provided email or phone number. The patient will receive the OTP and input the OTP to complete account creation process. If the OTP still not received after a few minutes, the patient can request a new OTP.

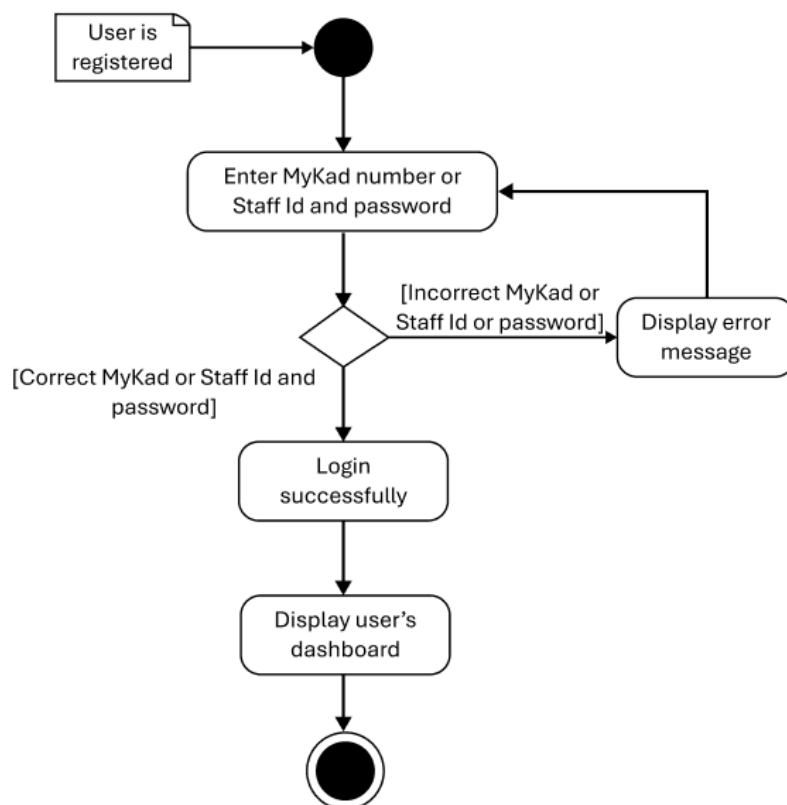


Figure 3.19. Activity diagram for Login.

Figure 3.19 is the activity diagram for login for the system user. System user includes patient, doctor, nurse and system administrator. Before the user can login, the user must already register into the system. First, the system will prompt the user to enter their MyKad number (for patient) or Staff Id (for staff) and password. If the MyKad number or Staff Id and password is correct, then the user will login successfully. If it is incorrect, the system will prompt the user to re-enter the MyKad number or Staff Id and password, or reset password. After a successful login, the system will navigate to the respective dashboard.

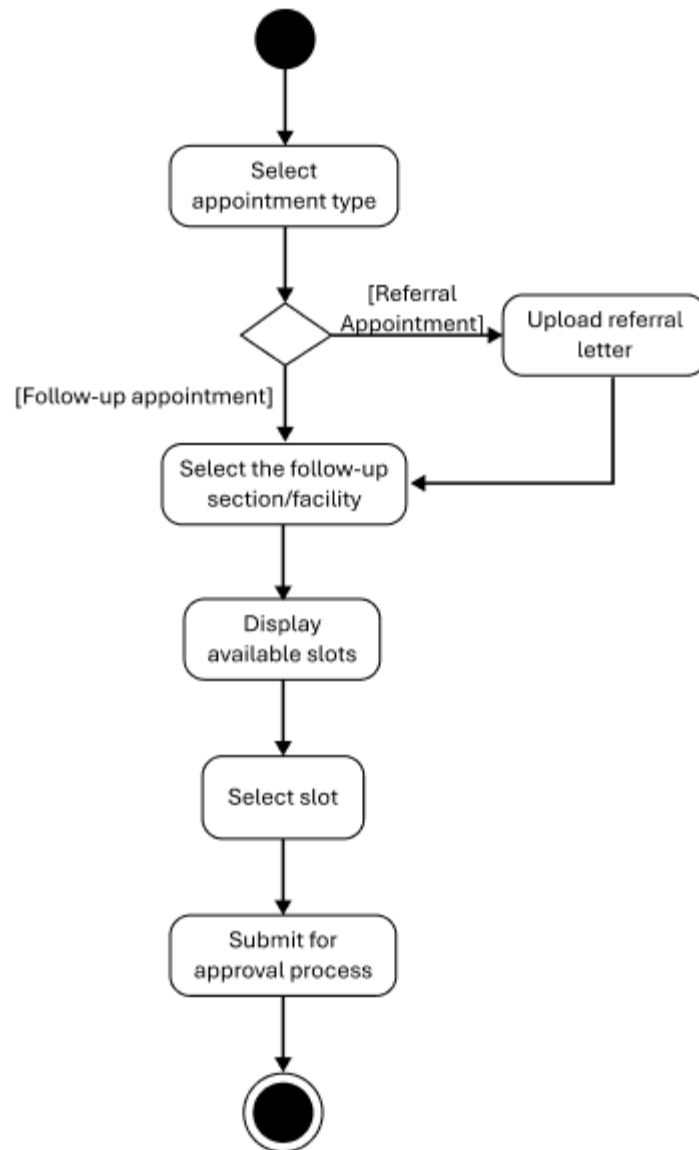


Figure 3.20. Activity diagram for Patient Request Appointment.

Figure 3.20 shows the activity diagram for patient request appointment. To request an appointment, the patient must select the appointment type first. If it is a referral appointment, the patient must upload the referral letter first. After selecting the type of appointment, the system will display the available slots. The patient then selects their preferred slot. After that, the patient will submit the appointment request for approval process from the nurse or doctor.

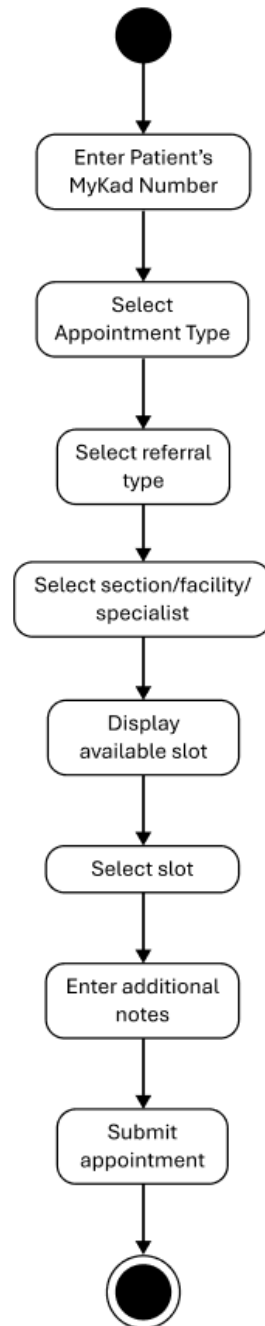


Figure 3.21. Activity diagram for Doctor Book Appointment

Figure 3.21 is the activity diagram for doctor book appointment. Firstly, the doctor must select the appointment type. Then, the doctor selects the appointment type follow by the referral type. After that, the doctor selects which section or facility or specialist. The system then, display the available slots. The doctor select slot and enter any additonal notes if any. The doctor then can proceed to submit the booking.

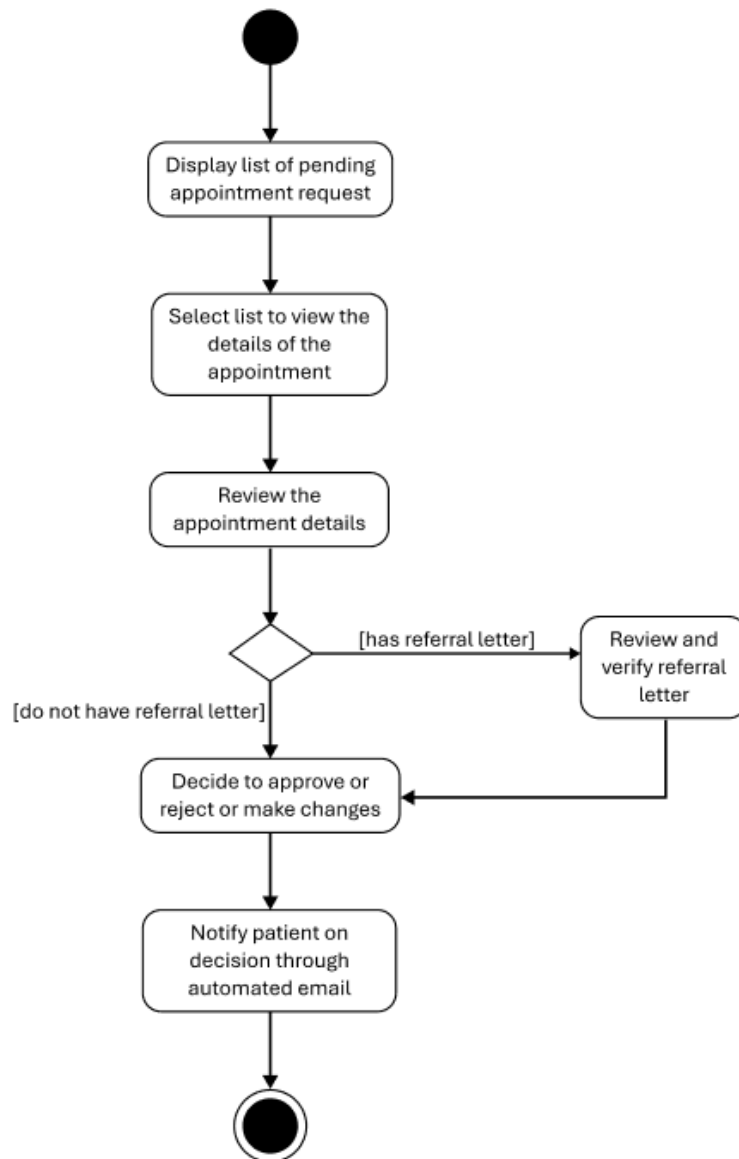


Figure 3.22. Activity diagram for Manage Appointment Request

Figure 3.22 is the activity diagram for manage appointment requests. This manage appointment requests can be done by doctor or nurse. To manage appointment requests, the user (doctor or nurse) will navigate to the “Manage Appointment Requests” page. The page will display list of pending appointment requests. The user can select the list to view the details of the appointment. then, the user will review the appointment details. If the appointment request has referral letter, the user can review and verify the referral letter. After that, the user can proceed to make decision on the appointment request. If the appointment request does not have referral letter, the user can directly decide to approve or reject or request changes on the

appointment request. After decision have been made, the system will notify patient on the decision through an automated email.

3.3.1.3 Entity Relationship Diagram

The Entity Relationship Diagram (ERD) presented below defines the database structure for the Appointment Management System. The ERD provides a clear view of how data will be organised and interconnected within the system.

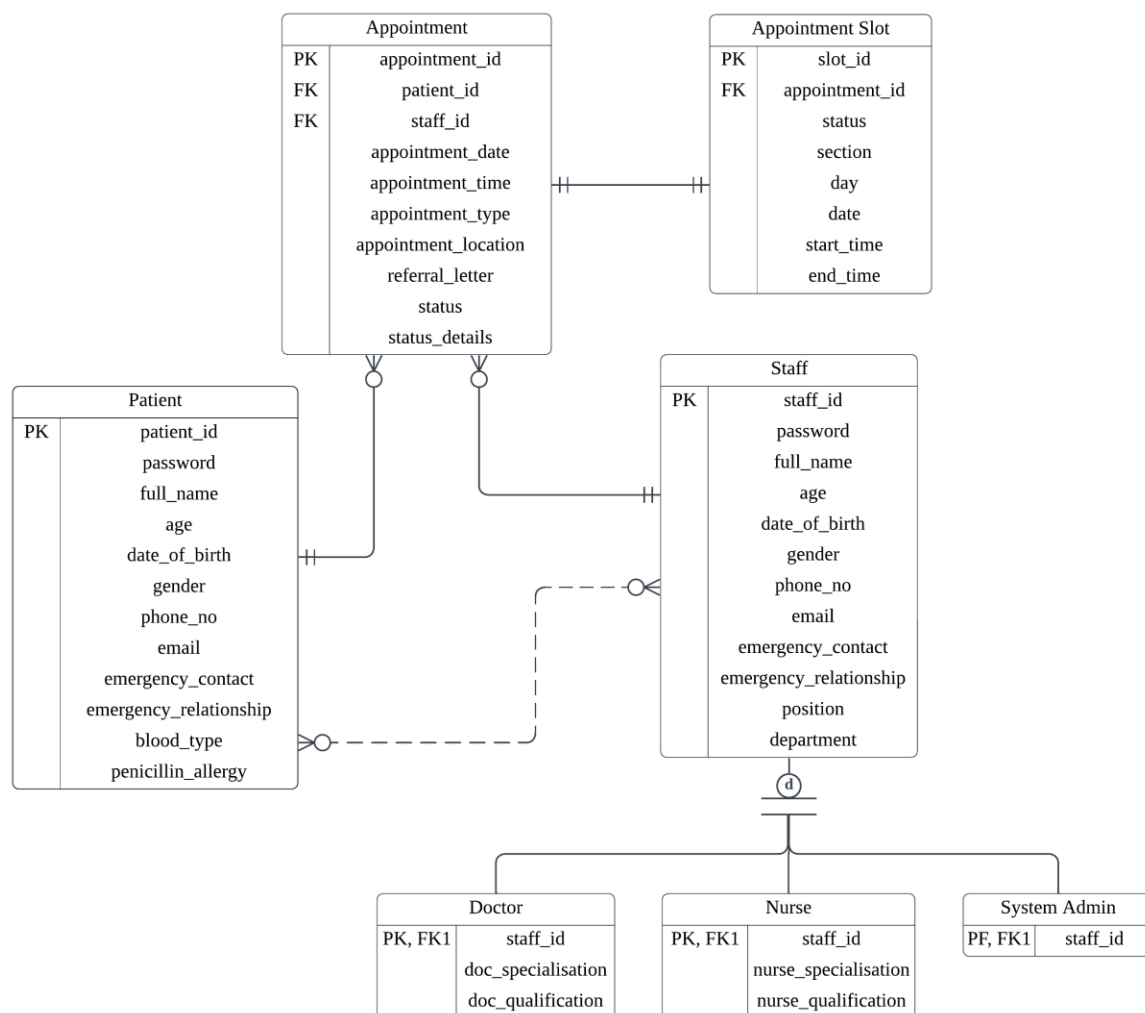


Figure 3.23. Entity Relationship Diagram of the System.

Figure 3.23 is the Entity Relationship Diagram (ERD) of the System. The ERD illustrates the database structure for the proposed Appointment Management System at PKP UNIMAS. It consists of three main entities.

First entity is Patient. The Patient table contains attributes such as `patient_id` (Primary Key), personal details like `full_name`, `age`, `gender`, contact information, and medical details like `blood_type` and `penicillin_allergy`. The database will use the patient's MyKad number as the `patient_id` which is also the primary key of this table. It also includes login credentials such as password. This entity represents all patients registered in the system.

Second entity is Appointment. The Appointment entity manages appointment details and includes attributes like `appointment_id`, `patient_id`, `staff_id`, `appointment_date`, `appointment_time`, `appointment_type`, `appointment_location`, `referral_letter`, `status` and `status_details`. The `status_details` is to store the reason of rejection or the details on the change request. This table is central to managing the scheduling and tracking of appointments. The `appointment_id` which is the primary key will use auto increment of six digit. The `patient_id` which is the primary key for patient table will be taken as a foreign key and the `staff_id` which is the primary key for staff table will be taken as a foreign key too.

Third entity is Staff. The Staff entity stores information about staff members, with attributes such as `staff_id`, `full_name`, `gender`, `address`, contact details, and their role (e.g., doctor, nurse, or admin). The `staff_id` is the primary key. It also includes login details like password. This entity has three subtypes which are Doctor, Nurse or System Admin. The Doctor table includes attributes such as `doc_specialisation` and `doc_qualification`. The nurse table includes `nurse_specialisation` and `nurse_qualification`. The System Admin table represents administrative roles, linked via the `staff_id`.

The Appointment Slot entity is designed to manage the scheduling of available time slots for appointments. It includes the primary key `slot_id`, which uniquely identifies each slot. The `appointment_id` serves as a foreign key linking the slot to a specific appointment. The `booked_status` attribute indicates whether the slot is available or booked. Additionally, the `section` attribute specifies the department or unit associated with the slot, while the `start_time` and `end_time` attributes define the time range for the slot. This entity ensures efficient handling of appointment schedules by tracking and organising available time slots.

3.3.2 Physical Design

The physical design illustrates the system's user interface and architecture through graphical user interface (GUI), showcasing how users will interact with the system in a practical and accessible manner.

3.3.2.1 Graphical User Interface (GUI)

The Graphical User Interface (GUI) is the visual interface of a system that enables users to interact with it through graphical components such as buttons, menus, text fields, icons, and visual indicators. Snapshots of the GUI designed in Figma are included below to provide a visual representation of the system's interface and its functionality. These snapshots illustrate how the system facilitates user interaction.

Create your account.
Step 1 of 4.

1 — 2 — 3 — 4

Please enter your MyKad number.

Enter your MyKad number

Enter

1

2

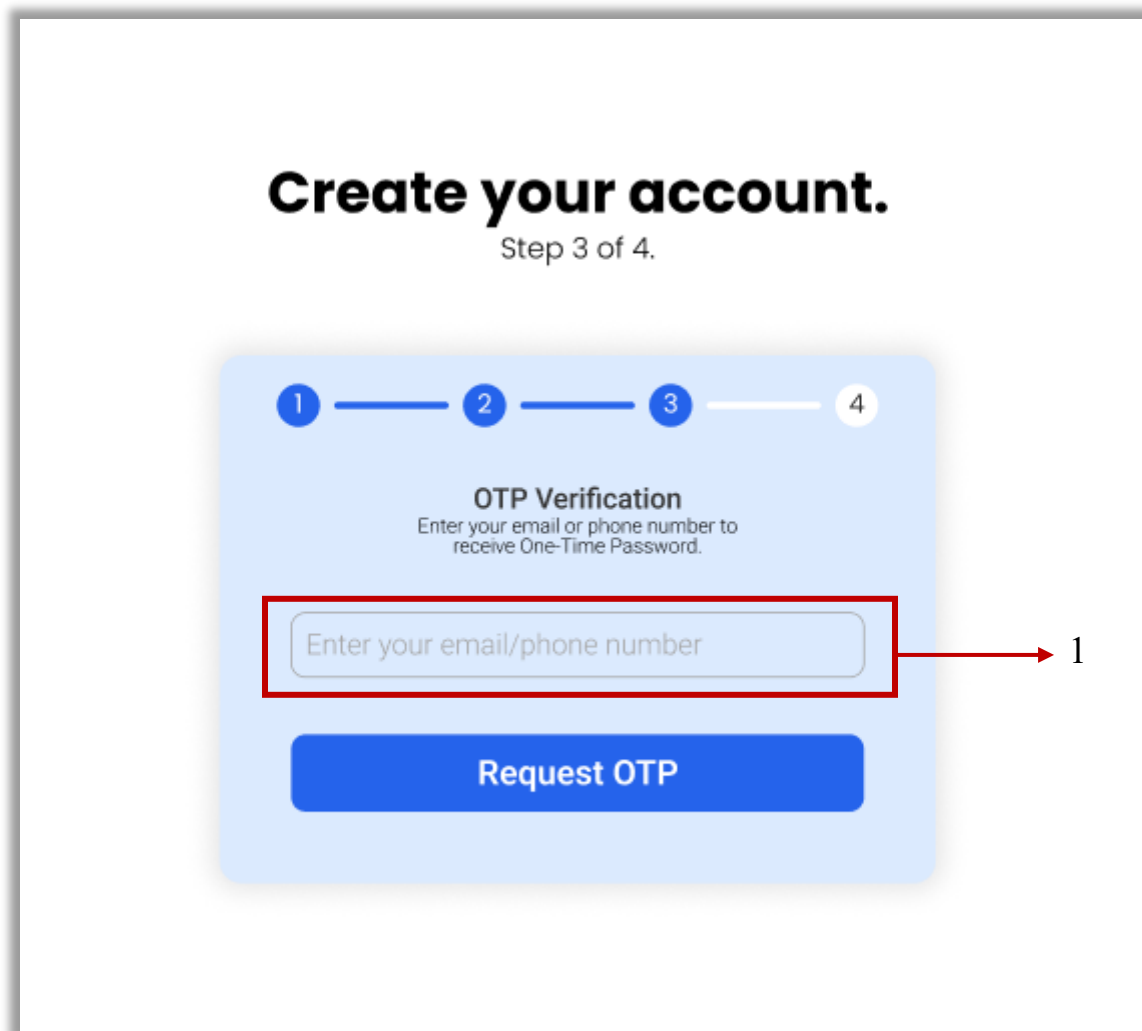
Figure 3.24. Patient registration page.

Figure 3.24 is the GUI for the first step of the patient registration page at the initial step. This is where patient must enter their MyKad number first in the input box (1). Then, the patient clicked enter (2). The system will check the entered MyKad number in the database.

The image shows a user interface for creating an account, specifically Step 2 of 4. The title is "Create your account." with the subtitle "Step 2 of 4." Below this is a progress bar with four steps: 1 (active), 2 (current), 3, and 4. The main instruction is "Create a secure password." The form contains two input fields: "New password" and "Confirm password". Both fields have a red border and a red arrow pointing to them from the right, labeled "1" and "2" respectively. Each field has a placeholder text ("Enter your new password" and "Confirm your password") and a toggle icon (an eye with a slash). Below the input fields is a blue "Confirm" button.

Figure 3.25. Patient registration page.

Figure 3.25 is the GUI for the second step of the patient registration where the system will prompt the patient to create a secure password. Patient will enter their preferred password in the input box (1). The second input box (2) is for patient to enter the similar password in the first input box. This is to prevent typing mistake when entering the password in the first input box. Then, the patient will click on Confirm button and the system will validate the password. If valid, then will proceed to the step 3 in patient registration.



The image shows a web form titled "Create your account." with the subtitle "Step 3 of 4." Below the title is a progress bar with four steps: 1, 2, 3, and 4. Steps 1, 2, and 3 are marked with blue circles and lines, while step 4 is marked with a white circle. The main heading of the form is "OTP Verification" with the instruction "Enter your email or phone number to receive One-Time Password." Below this is a text input field with the placeholder text "Enter your email/phone number". A red rectangular box highlights this input field, and a red arrow points from the right side of the box to the number "1". Below the input field is a blue button with the text "Request OTP".

Figure 3.26. Patient registration page.

Figure 3.26 is the GUI for step 3 in the patient registration. The system will prompt the patient to enter their email or phone number into the input box (1). Then, the patient must click to request the One-Time Password (OTP). The system will send OTP to the provided email or phone number.

Create your account.
Step 4 of 4.

1 — 2 — 3 — 4

Enter OTP

Enter OTP

Confirm

Change email/phone number

Did not receive OTP? Request new OTP

Figure 3.27. Patient registration page.

Figure 3.27 is GUI for step 4 of the patient registration. This is where the patient input the OTP into the input box (1). The patient can also change their email or phone number by clicking the link provided (2), if they required so. If patient does not receive any OTP at the provided email or phone number, the patient can request another OTP (3).

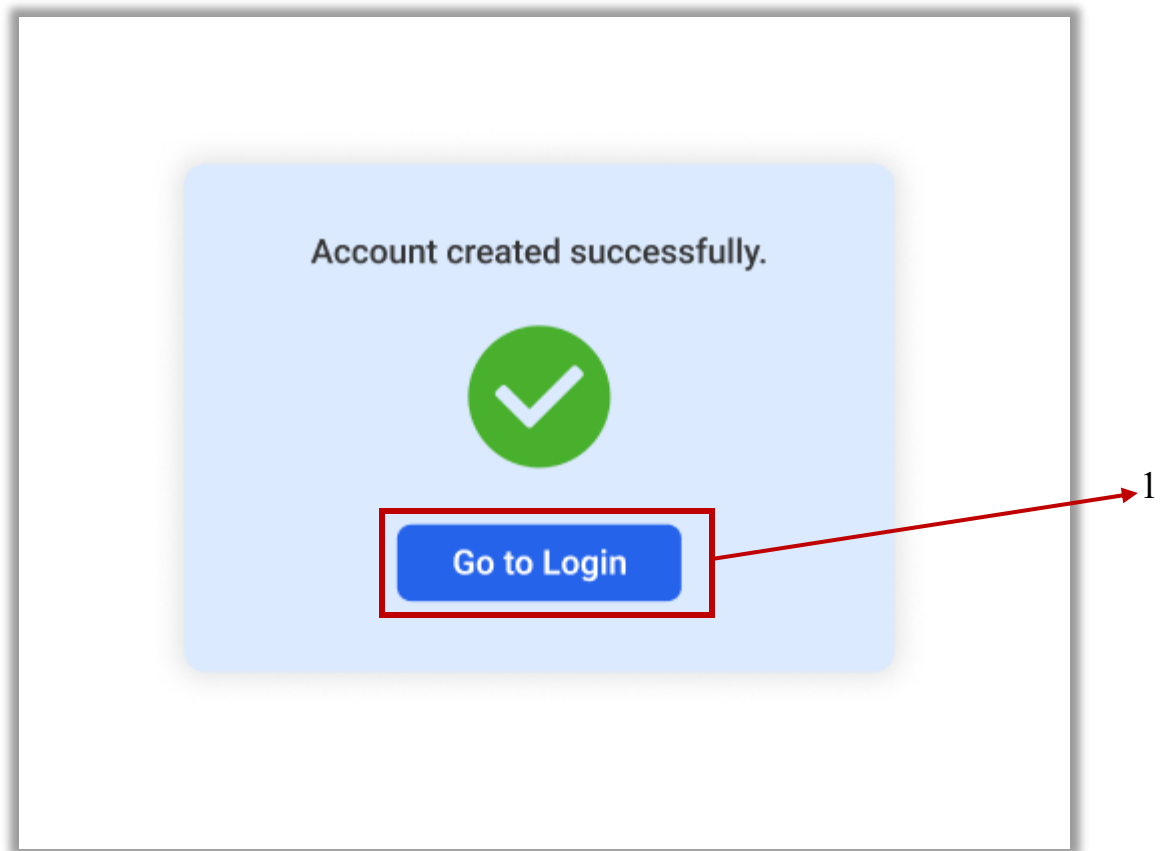


Figure 3.28. System display after patient's account created successfully.

Figure 3.28 is GUI for the system to indicate that the patient's account is created successfully. Patient can click on the "Go to Login" button (1) to navigate to the Login page directly.

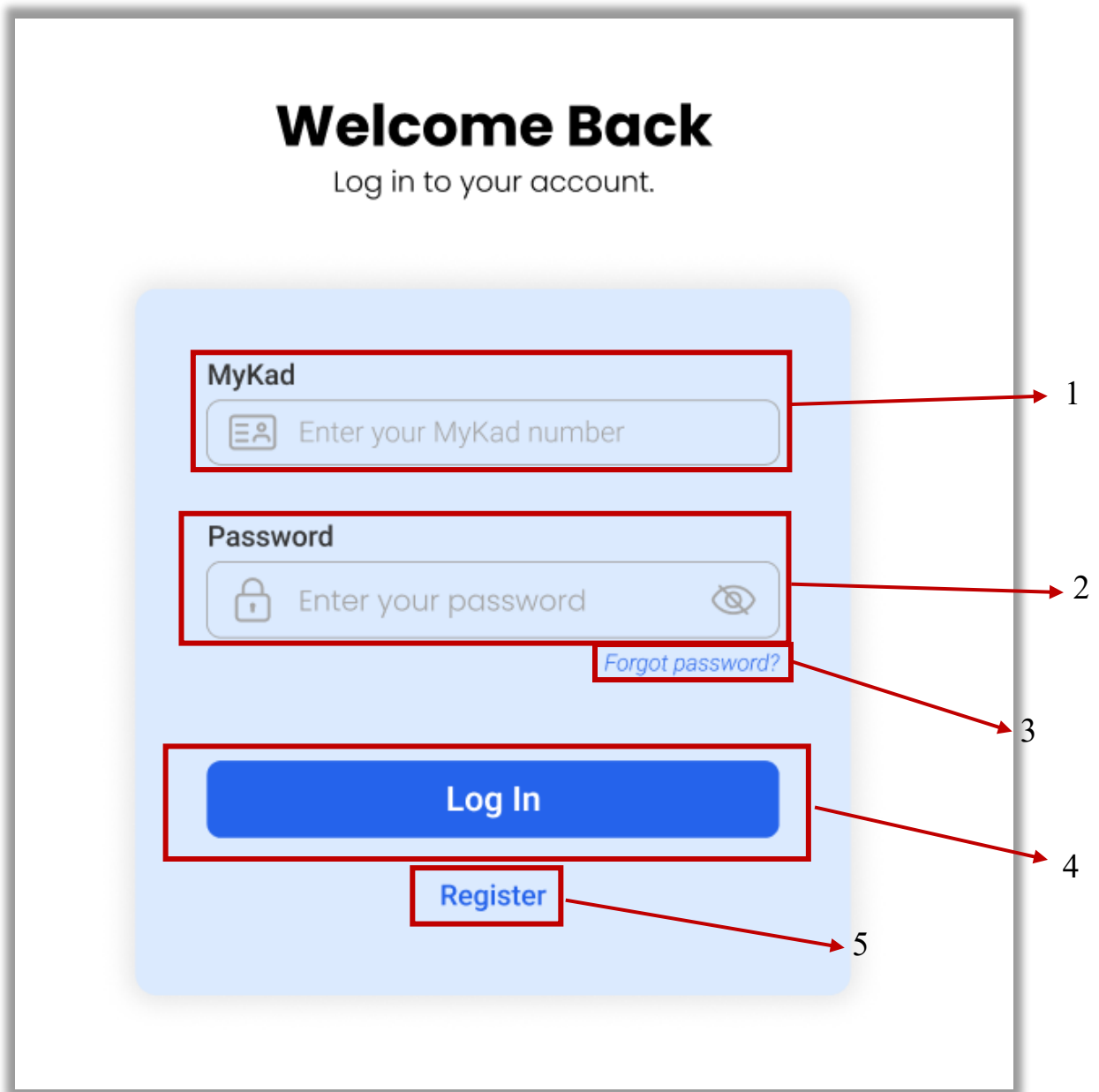
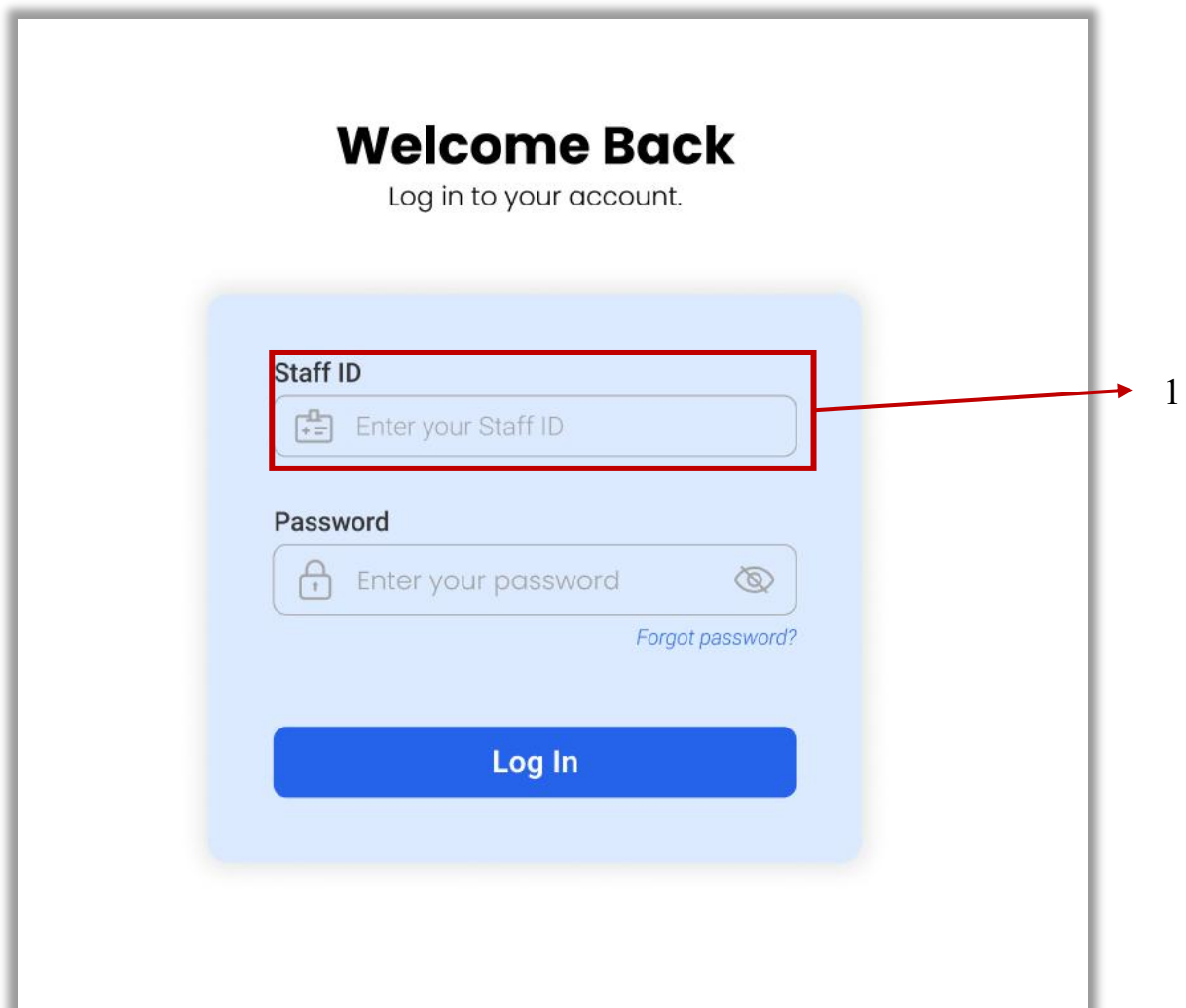


Figure 3.29. Login page for patient.

Figure 3.29 is the GUI for patient login page. There will be two input boxes. The first input box (1) with the label “MyKad” is for patient to enter their MyKad number. The second input box (2) with the label "Password" is for patient to enter their password. To log in, the patient must click the “Log In” button (4). If the entered MyKad number and password are correct, the system will navigate to respective dashboard. Else, the patient is required to re-

enter their MyKad number and password. In case, the patient forgot their password, they can click on the “Forgot Password” link (3), the system will prompt the patient to reset their password. If the patient does not have account yet, the patient can click on the “Register” (5) to navigate to the Patient Registration page.



The image shows a login page for staff. At the top, it says "Welcome Back" in bold, followed by "Log in to your account." Below this is a light blue rounded rectangle containing the login form. The form has two input fields: "Staff ID" and "Password". The "Staff ID" field is highlighted with a red border and a red arrow pointing to it from the number "1" on the right. The "Staff ID" field has a label "Staff ID" and a placeholder "Enter your Staff ID" with a small icon of a staff ID card. The "Password" field has a label "Password", a placeholder "Enter your password", a small lock icon, and a small eye icon. Below the password field is a link "Forgot password?". At the bottom of the form is a blue button labeled "Log In".

Figure 3.30. Login page for Staff.

The figure 3.30 is the GUI for staff login page. The page is very similar to the patient’s login page. The difference between the two is on the first input box (1) where on this staff login page, the first input box is for staff to enter their staff id not their MyKad number.

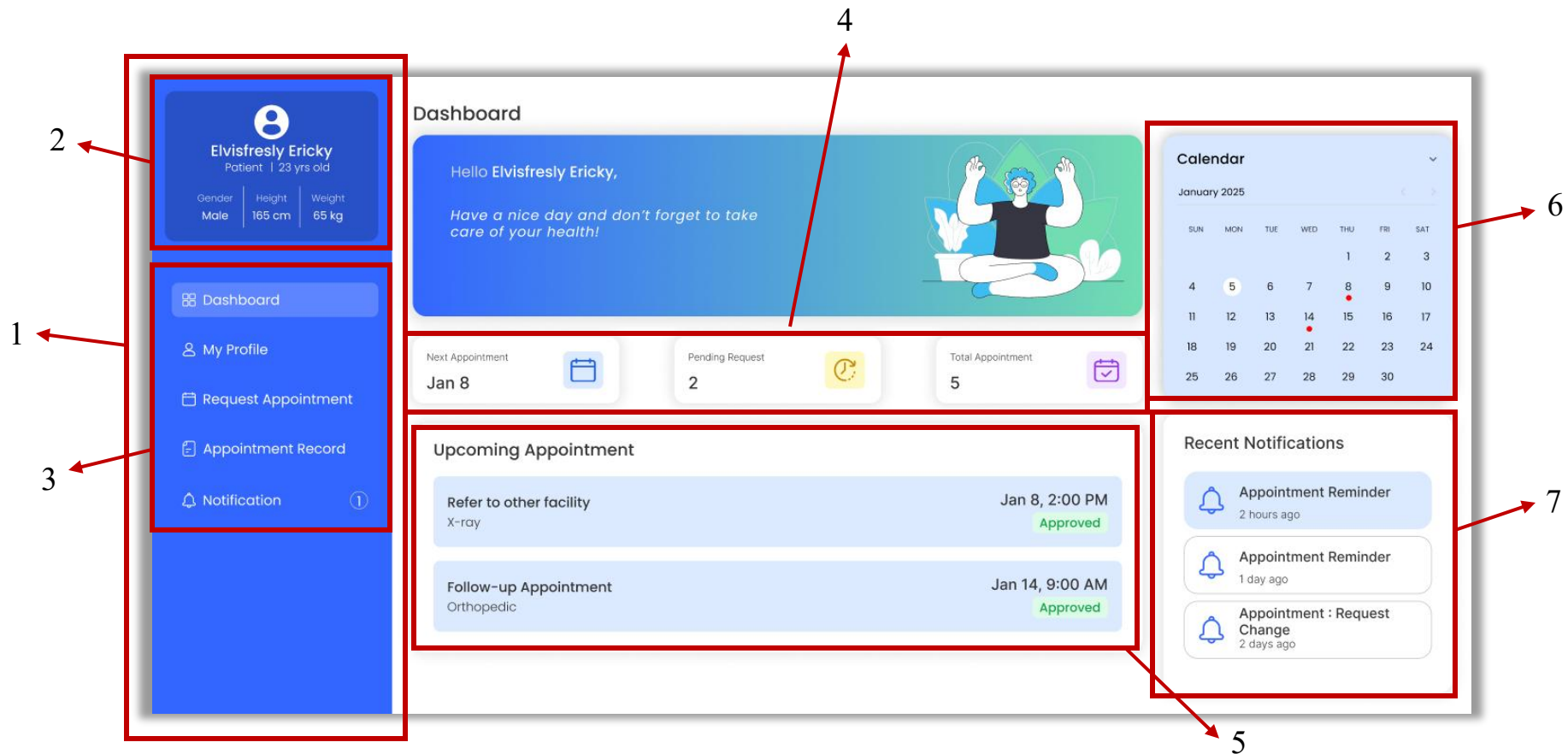


Figure 3.31. Patient dashboard page.

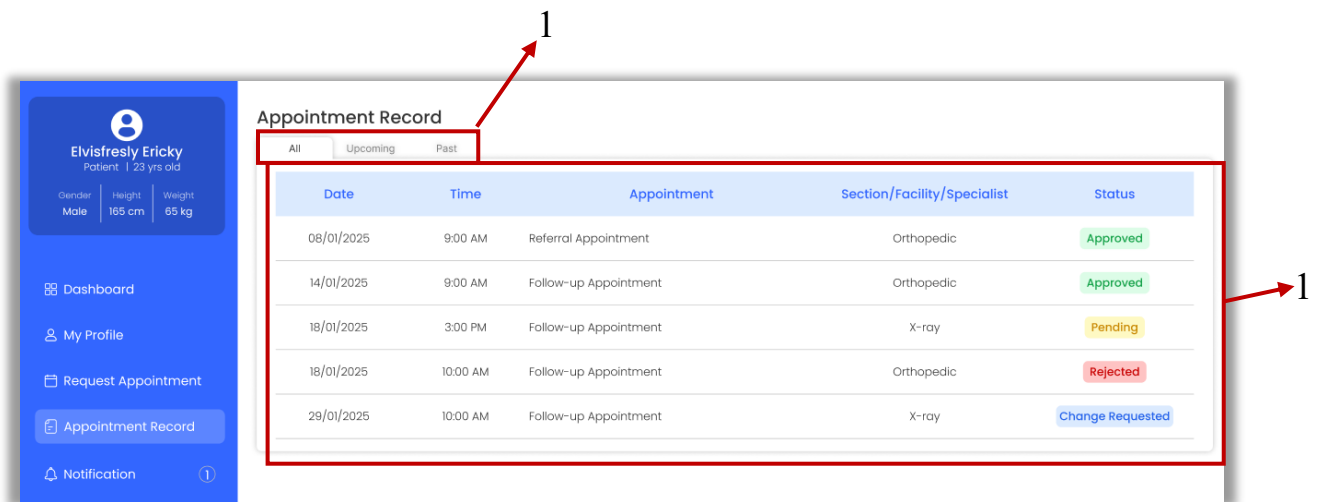
Figure 3.30. is GUI for the patient dashboard page. At the left-side of the page, there is a sidebar (1) containing the patient profile (2) and tabs (3) for each module of the patient. The patient profile will display the patient's name, age, gender, height, and weight. This sidebar (1) is visible and has the same design properties on every page except for registration and login page. The tab module is differing respect to the user's

role in the system. At the center of the page, it has three key metrics (4) which highlight the patient's next appointment date, pending appointment request and the total appointment that the patient has booked in the system. Then, there will a section (5) to list the patient's upcoming appointment with some of the appointment details such as appointment type, section or facility, appointment date and time, and the status of the appointment. At the right side of page, it has a calendar (6) which has the mark of the day's date and mark for the upcoming appointment. Below the calendar, there is a notification list (7) which will list the recent patient's appointment reminders and update.

Figure 3.32. Patient Request Appointment page.

Figure 3.31 is the GUI for patients request appointment page. First, the page has a drop-down list (1) for patients to select the appointment type. Second, it has a drop-down list (3) for patients to select the section or facility of the appointment. If the appointment is a referral appointment, an input box (2) to upload referral letter will be visible. The patient can upload referral letter in this input box by clicking the “Click to Upload” button (2) and select the file to upload. After selecting the type of appointment and the section or facility, the patient can

select their preferred date on the calendar shown (4). Pick a date and the available slots will be displayed beside the calendar (4). Then, there will be a box (5) which will display the selected date and time to make the selected date and time clearer to patients. Lastly, click the button “Submit” (6) to submit the appointment request.



Appointment Record

All Upcoming Past

Date	Time	Appointment	Section/Facility/Specialist	Status
08/01/2025	9:00 AM	Referral Appointment	Orthopedic	Approved
14/01/2025	9:00 AM	Follow-up Appointment	Orthopedic	Approved
18/01/2025	3:00 PM	Follow-up Appointment	X-ray	Pending
18/01/2025	10:00 AM	Follow-up Appointment	Orthopedic	Rejected
29/01/2025	10:00 AM	Follow-up Appointment	X-ray	Change Requested

Figure 3.33. Patient's appointment record page.

Figure 3.32 is GUI for the patient’s appointment record page. This page has a table (1) which list all the patient’s appointment. In each row, the details of the appointment such as date, time, appointment type, section or facility or specialist and status of the appointment will be displayed. The table has three tabs, “All”, “Upcoming”, and “Past” tab (2). These tabs work like a filter for the list of the appointments. When clicked on the “All” tab, it will list all the appointments. When clicked on the “Upcoming” tab, it will list all the upcoming appointments while for “Past” tab, it will list all the past appointments. Patient can click on each row of the table and the system will navigate to the page that displays the respective appointment details as shown in Figure 3.33. Different status of appointments will result in additional details and action will be shown on the appointment details page like in the Figure 3.34 and Figure 3.35.

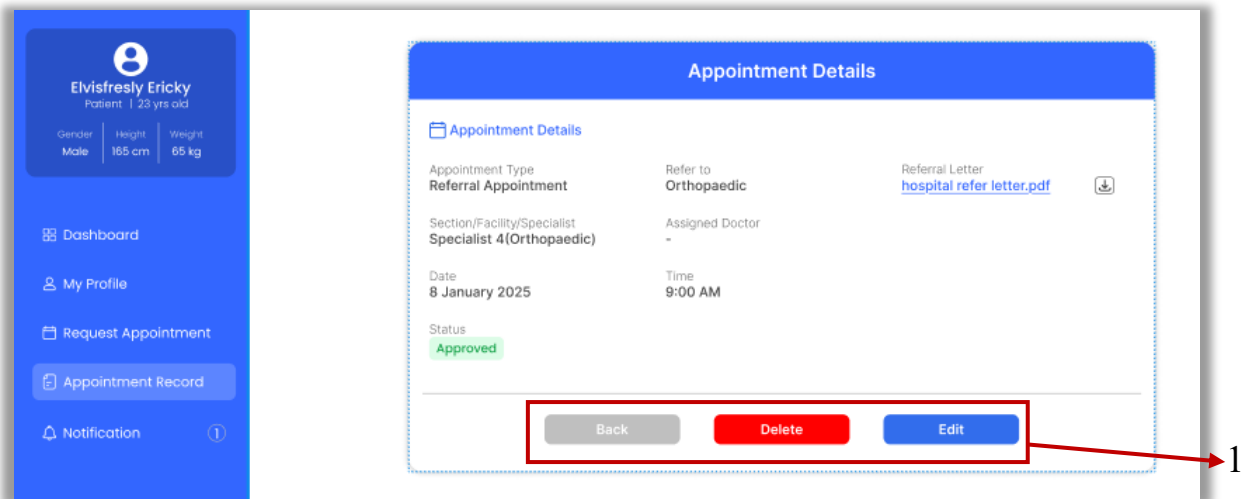


Figure 3.34. Appointment details for “Approved” appointment

As shown in figure 3.33, it displays the appointment details for an “Approved” appointment. It has three buttons which is “Back”, “Delete” and “Edit” button. The “Back” button, when clicked will navigate to the previous page which is the Appointment Record page. The “Delete” button is for patient to delete or cancel the selected appointment. After clicking the “Delete” button, the system will ask confirmation on the patient if they really want to cancel the appointment. If it is confirmed, then the system will remove the appointment data from the database. The “Edit” button is to able the patient to edit or make changes on the appointment details like the appointment type, section or facility, date and time.

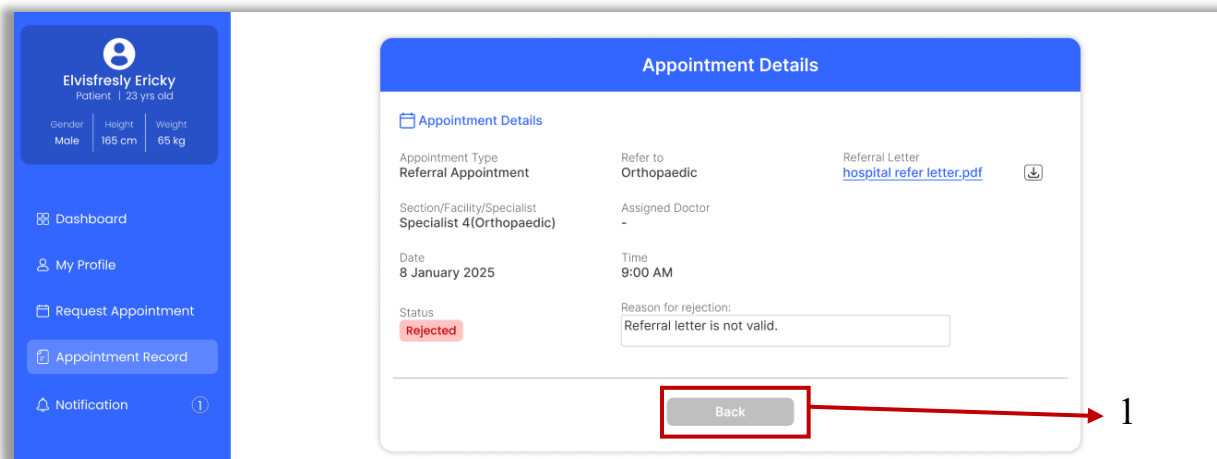


Figure 3.35. Appointment details for "Rejected" appointment.

This figure 3.34 is appointment details for “Rejected” appointment. The appointment details will include the reasons for the rejection of the appointment. It has only one action button which is the “Back” button (1).

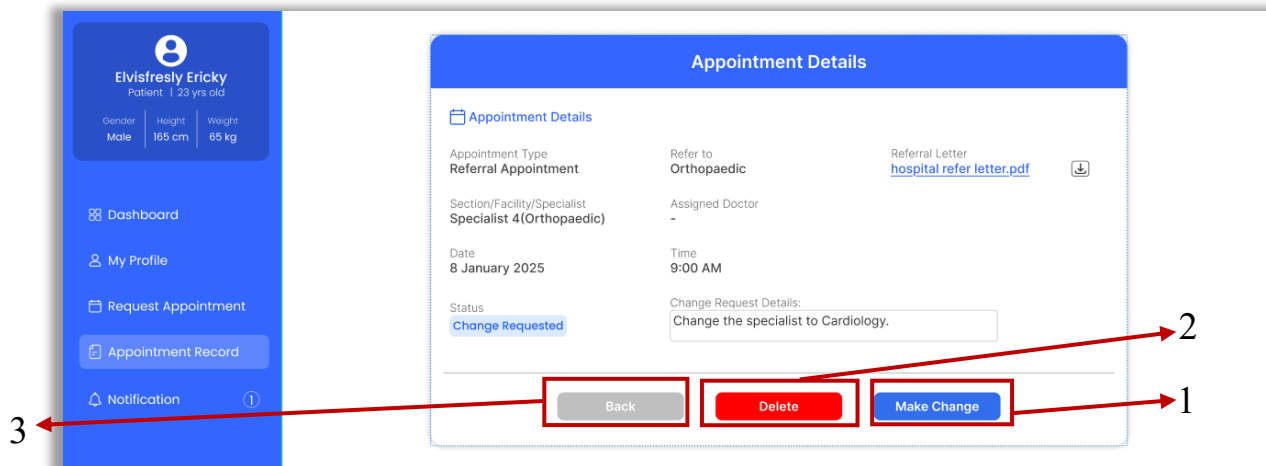


Figure 3.36. Appointment details for "Change Requested" appointment.

Figure 3.35 is the appointment details for “Change Requested” appointment. The appointment details will include the descriptions or instructions of the change request. Patient can directly click on the “Make Changes” button (1) to make changes as requested by the healthcare staff. When clicking on the “Make Changes” button, the system will navigate to the Request Appointment page where patient can request and modify their appointment. The

“Delete” button (2) is for patients to delete or cancel the selected appointment while the “Back” button (3) is for patient to go to the previous page.

The screenshot displays a mobile application interface for a patient's profile. On the left is a blue sidebar with navigation options: Dashboard, My Profile (selected), Request Appointment, Appointment Record, and Notification. The main content area is titled 'My Profile' and contains three sections: 'Personal Details', 'Contact Information', and 'Medical Information'. Red boxes and arrows highlight specific elements: (1) the 'Personal Details' section, (2) the 'Contact Information' section, (3) the 'Medical Information' section, and (4) the 'Confirm' button at the bottom right. The 'Personal Details' section shows the patient's name, MyKad number, date of birth, age, and gender. The 'Contact Information' section includes fields for phone number, email, emergency contact, and emergency contact relationship. The 'Medical Information' section displays height, weight, BMI, blood type, and a section for penicillin reactions.

Personal Details		
Full Name	Martin Odegaard	
MyKad Number	020620130789	
Date of Birth	Age	Gender
20/8/2001	23	Male

Contact Information	
Phone Number *	Email *
+60 11 1986 0199	ericky.elvis@email.com
Emergency Contact *	Emergency Contact Relationship *
+60 13 1765 5663	Mother

Medical Information		
Height	Weight	BMI
170 m	65 kg	Normal
Blood Type		
O+		
Any reaction to Penicillin? *		
Yes		
If yes, what reaction?		
Rapid onset of symptoms like difficulty breathing, rapid heartbeat, severe drop in blood pressure, and loss of consciousness.		

Cancel Confirm

Figure 3.37. Patient's profile page.

Figure 3.36 is the GUI for patient's profile page. This page will show the patient's personal details (1), contact information (2) and some medical information (3). This page also allow patient to modify some of the information such as the phone number, email and emergency contact information. Once confirmed (4), the system will save and update the current information. If no changes made, the information also will not change.

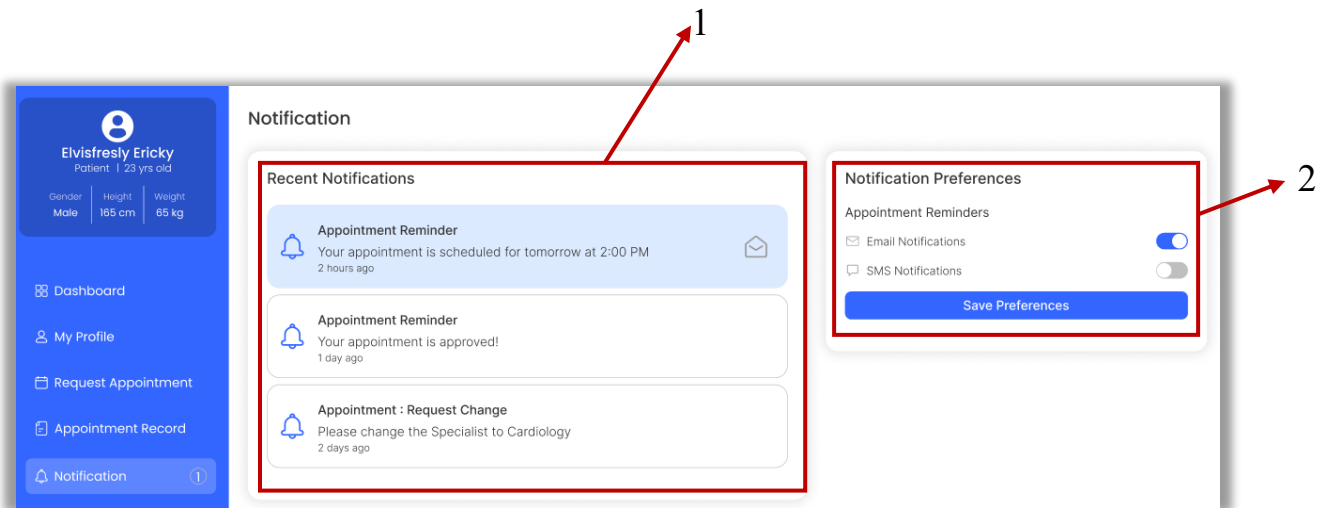


Figure 3.38. Notification page.

Figure 3.37 is the GUI for the patient's notification and preferences of notification. In this page, all the notification related to the patient will be shown here. It will sort out with the latest notification first on the top (1). Each notification contains the title of the notification, the details and the time of the receiving the notification. The notification that has not been read, its box or section will be in light blue colour. It also has an icon at the right side of the box where the patient can click on that to mark the notification as read. At the right side of the page, there is a section for the notification preferences (2) where the patient can choose which type of notification they would like to receive for the appointment reminders.

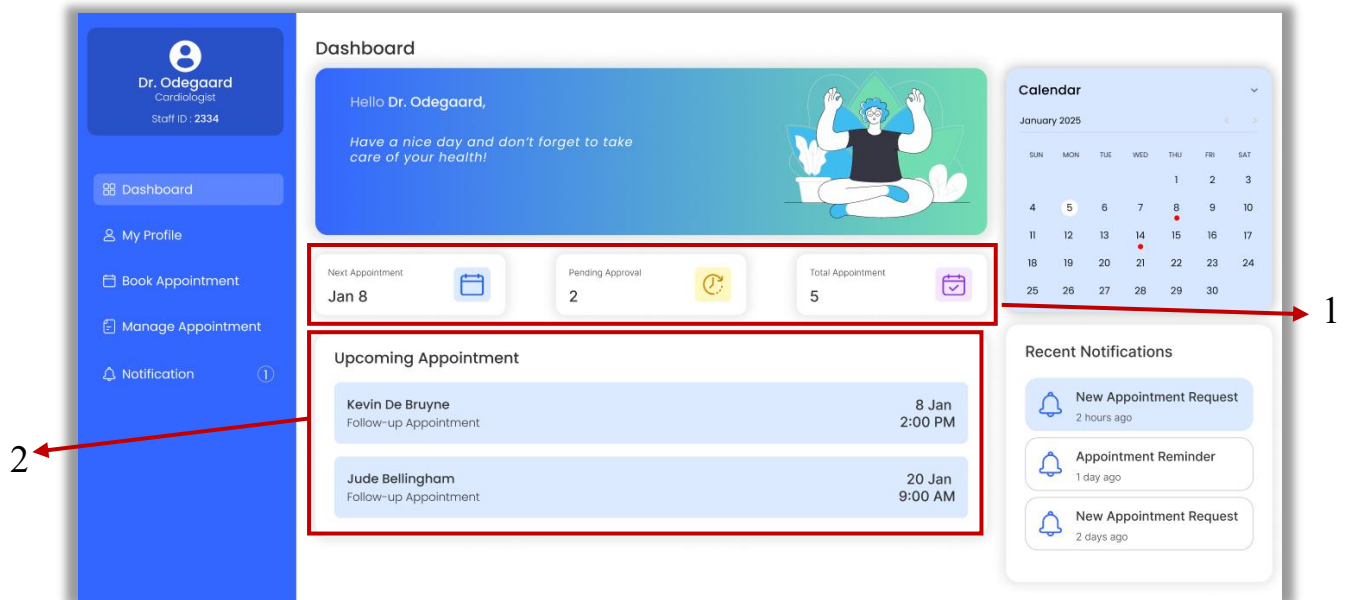


Figure 3.39. Doctor dashboard page.

Figure 3.38 is the GUI for doctor dashboard. The doctor dashboard is quite similar to the patient dashboard. The only differences are the modules at the sidebar, the key metrics and the summary of the upcoming appointment with patients for the doctor. Doctor dashboard has “Book Appointment” and “Manage Appointment” on its sidebar differ to Patient Dashboard and Administrator Dashbaord. The key metrics (1) highlight on the date of upcoming appointment with patient, the total number of pending approval on appointment and total appointment booked by the doctor in the system. The summary of the upcoming appointment (2) with patient includes the name of patient, type of appointment, the date and time of the appointment.

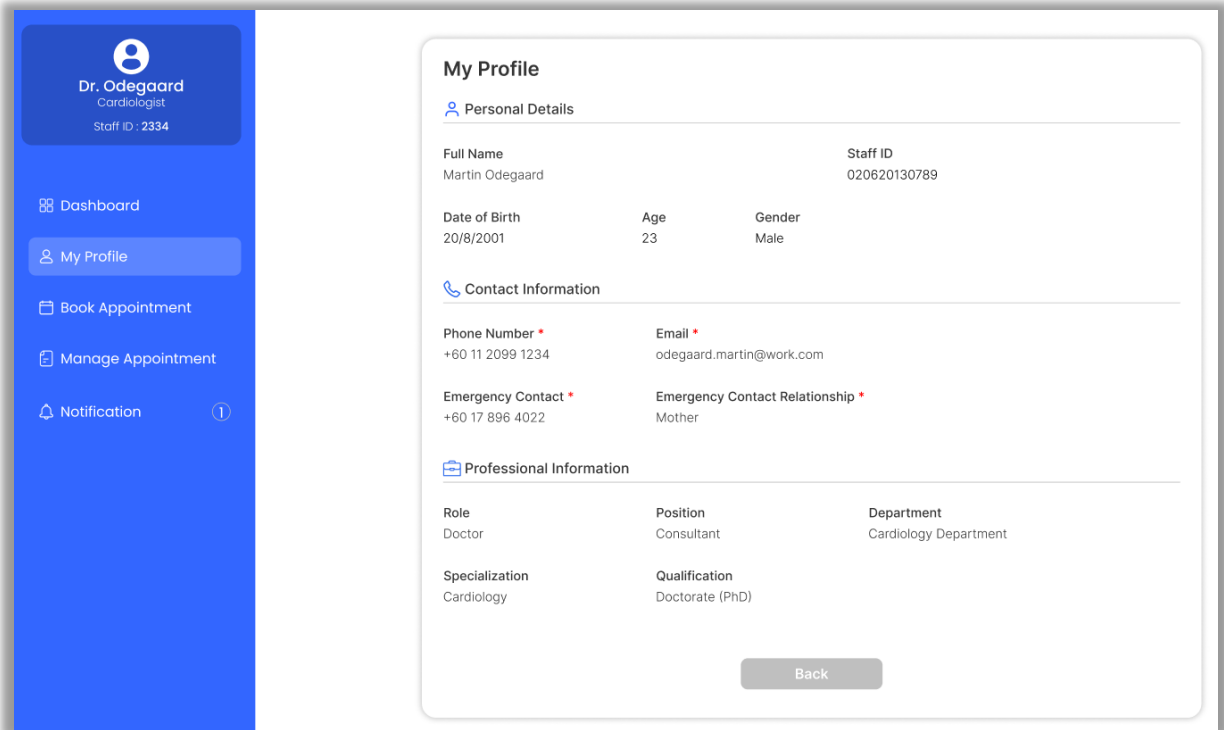


Figure 3.40. Doctor's Profile page.

Figure 3.39 is the GUI for doctor's profile page. This page shows all the information that is registered into the database and related to the doctor. The information includes the personal details, contact information and their professional information. They only can view this page but cannot modify any information on this page. Only the system administrator can edit some of their information such as the phone number, emergency contact, position and specialisation.

Book Appointment

Patient's MyKad number * : 970727-13-5067

Appointment Type * : ☐ Follow-up Appointment ☒ Referral Appointment

Refer to * : ☒ Specialist ☐ Section/Facility

Specialist * : Cardiologist

Select Date and Time *

Time zone : Kuching, Sarawak (GMT+8)

Selected : 8 January 2025 9:00 AM

Notes : Write notes here...

Cancel Submit

Figure 3.41. Book Appointment page.

Figure 3.39 is the GUI for doctor book appointment. This page includes all the information required to book for an appointment. First, the doctor must input the patient's MyKad number (1), and then select the appointment type (2). After that, the doctor selects the option under “Refer to” selection (3). Then, proceed to select the specialist or section or facility (4). The system will display available slots (5), and the doctor must pick a date and time the appointment. The doctor can add any additional notes on the provided section (6). After all required field (*) is filled in, the doctor must click on the “Submit” button (7) to complete the appointment booking.

Name	MyKad Number	Appointment	Date	Time	Section/Facility/Specialist
Dianne Russell	990106136790	Referral Appointment	12/02/2025	9:00 AM	Orthopaedic
Savannah Nguyen	990106136790	Referral Appointment	15/03/2025	8:00 AM	Specialist 2(Psychiatry)
Albert Flores	990106136790	Follow-up Appointment	20/12/2024	3:00 PM	Orthopaedic
Eleanor Pena	990106136790	Referral Appointment	07/01/2025	10:00 PM	Specialist 3(Cardiology)
Guy Hawkins	990106136790	Follow-up Appointment	20/01/2025	2:00 AM	X-ray

Figure 3.42. Appointment Request List page.

Figure 3.40 is the GUI for the appointment request list from patients. This page can be accessed by both doctor and nurse. This page displays the list of appointment requests in a table (1) that contains the column of patient's name, patient's MyKad number, the type of appointment, the date and time of the appointment and the section or facility or specialist for the appointment. Doctor and nurse can click on each row of the list to view the appointment details. After clicking on the row of the appointment, the system will navigate to the page as shown in Figure 3.4.

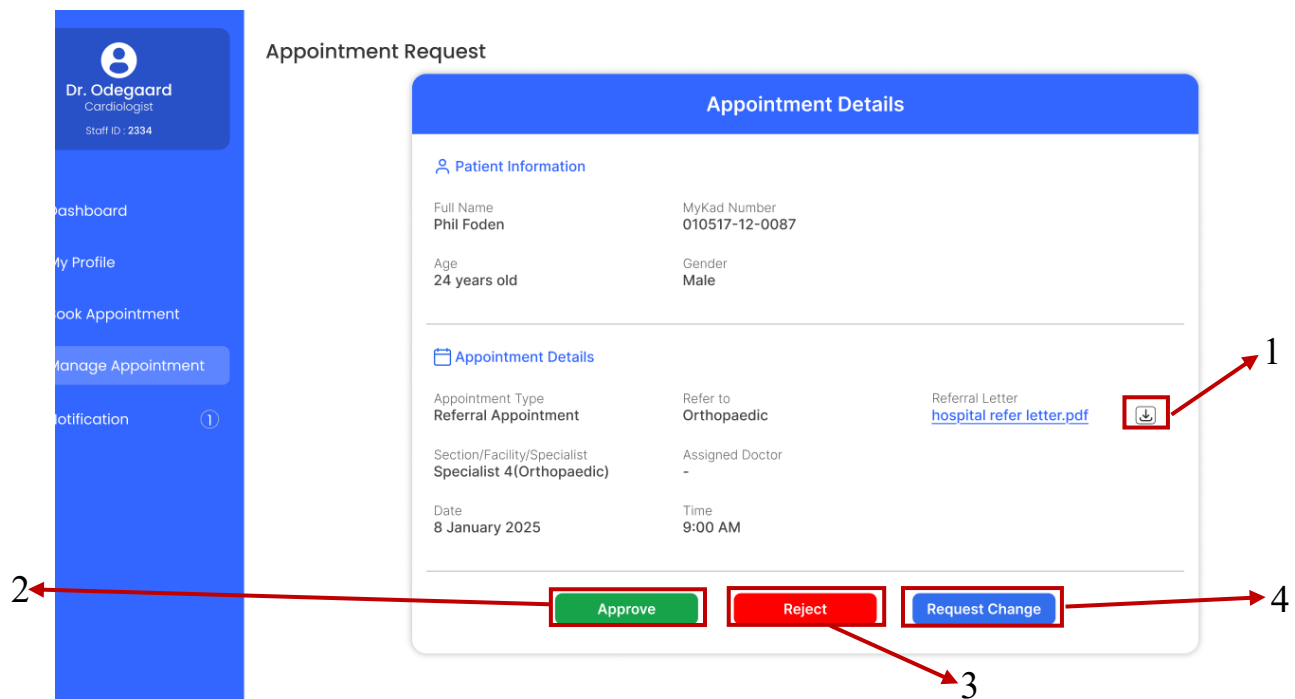


Figure 3.43. Appointment Request Details.

The figure 3.41 is the GUI for the appointment request details. The details of the appointment that will be shown is based on which row of appointment was clicked from the table as shown in Figure 3.40. This page has the details of the patient's information who requested for the appointment, the details of the appointment and action buttons for doctor or nurse to make decisions. There is also a download button (1) where doctor and nurse can directly download the patient's referral letter. The three action buttons each has different action and result. The "Approve" button (2) is for doctor or nurse to approve the appointment request while the "Reject" button (3) is for doctor or nurse to reject the appointment. When rejecting the appointment, the doctor or nurse is required to state the reason of the rejection for patient future knowledge. The page will be shown in Figure 3.42. The "Request Changes" button (4) then is for doctor or nurse to request the patient to make slight change on their appointment request. When doctor or nurse request changes on the appointment details from patient, the system will require the doctor or nurse to describe and give instructions on the changes as shown in Figure 3.43.

The screenshot displays a web application interface for managing appointment requests. The main window is titled "Appointment Request" and contains a sub-section titled "Appointment Details". Under this section, there is a "Patient Information" area with fields for "Full Name" (Phil Foden), "MyKad Number" (010517-12-0087), "Age", and "Gender". Below this, there is a date and time field showing "8 January 2025" and "9:00 AM". At the bottom of the main window, there are three buttons: "Approve" (green), "Reject" (red), and "Request Change" (blue). A modal dialog box is open in the center, titled "State reasons for rejection:". It contains a text input field with the placeholder "Write here...." and two buttons: "Cancel" and "Confirm". A red arrow points from the number "1" to the text input field in the modal.

Figure 3.44. State reason for appointment rejection.

This figure 3.42 is GUI for doctor or nurse to state reason for appointment rejection. This page will have a input box (1) where doctor or nurse will state the reason for rejection. After confirmation, the system will update the status of the appointment and notify the patient on the updates.

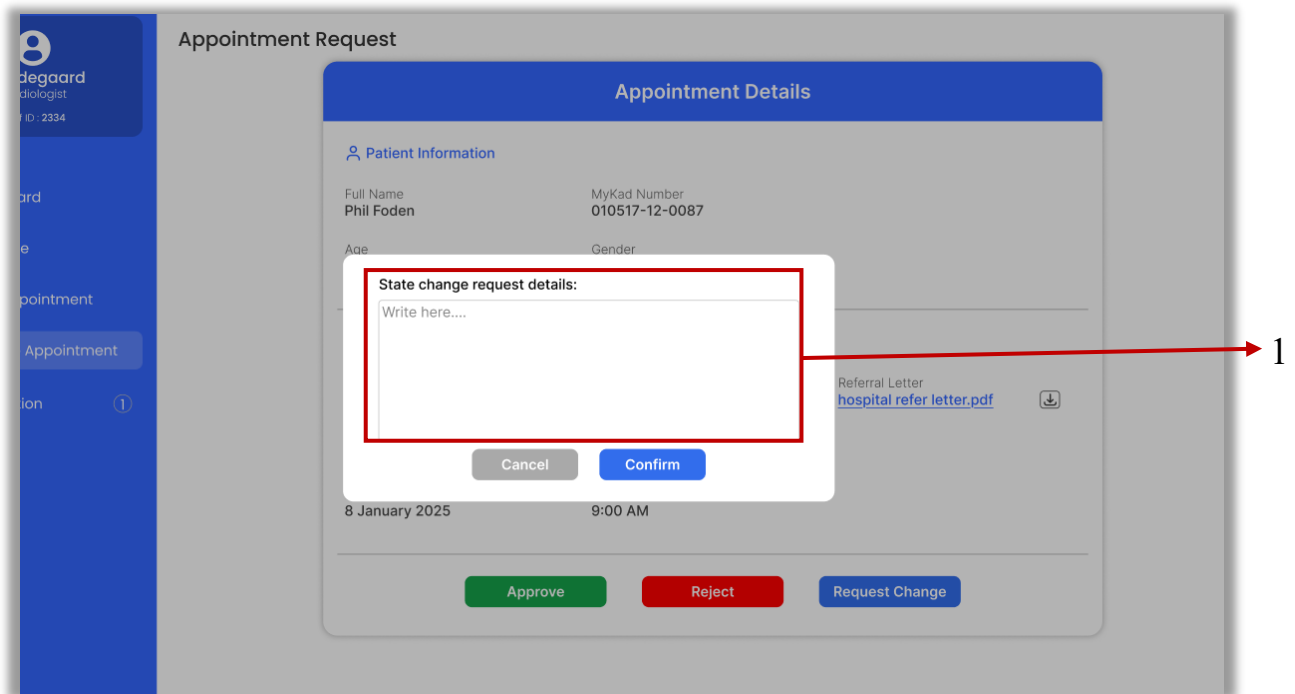


Figure 3.45. State change request details.

This Figure 3.43 is GUI for doctor or nurse to state the description and instruction of the change request. The doctor or nurse will input the description or instruction into the input box (1). After confirmation, the system will update the status of the appointment and notify the patient regarding the appointment and ask for action to make changes as requested.

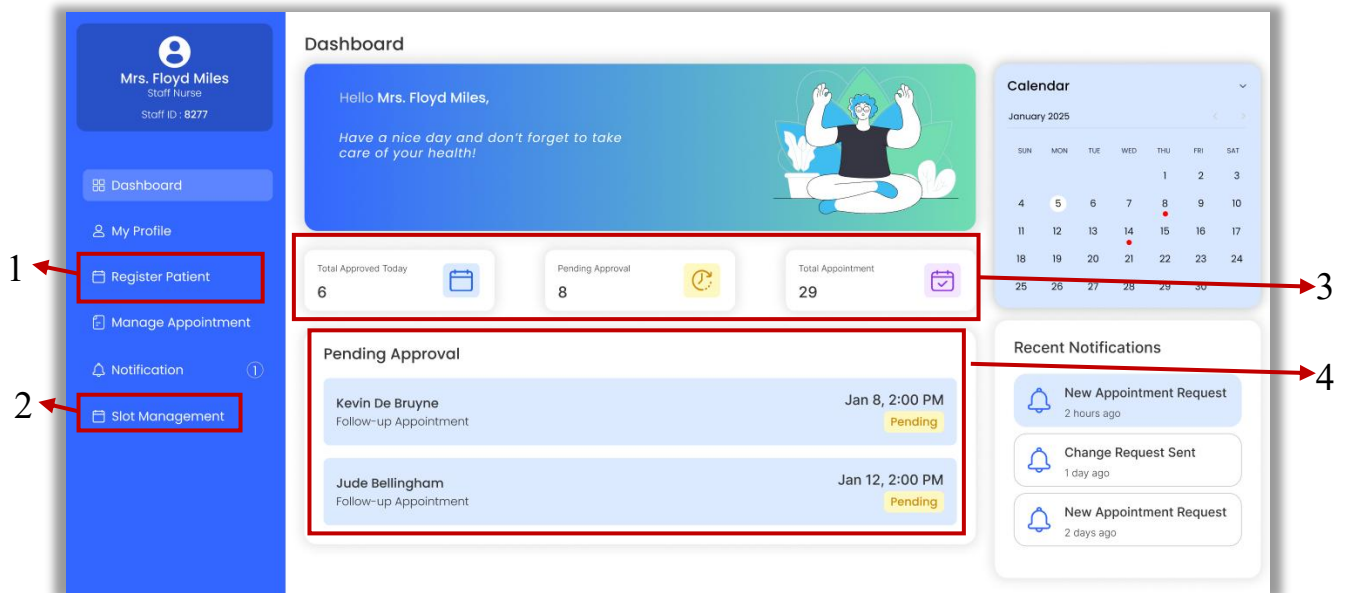


Figure 3.46. Nurse Dashboard page.

Figure 3.45 is the GUI for Nurse Dashboard. This dashboard is quite similar to the Patient Dashboard and Doctor Dashboard. Compare to others, Nurse Dashboard has slight differences on the module at the left sidebar. It has Register Patient (1) and Slot Management (2) compared to Doctor Dashboard. For key metrics (3), it highlights three, which are the total appointments approved today, the number of appointments pending for approval and the total number of appointments booked in the system. The Nurse Dashboard also has the summary of the pending approval appointment (4). The summary shows the name of the patient, appointment type, the date and time of the appointment and the approval status.

Patient First Time Registration
Please fill out all required fields(*) to complete the registration.

Personal Details

Full Name *

MyKad Number * (without "-")
020620130747 ✓

Date of Birth * Age * Gender *
Male Female

Contact Information

Phone Number Email

Emergency Contact * Emergency Contact Relationship *

Medical Information

Height Weight BMI

Blood Type

Any reaction to Penicillin? *
Yes No

If yes, what reaction?

Cancel Confirm

Figure 3.47. First time Patient Registration.

Figure 3.44 is the GUI for registration of the first time patient. The registration form required information on the patient's personal details, contact details and some of the medical information. As for the input box for MyKad number (1), it shows green and tick symbol when the MyKad number is valid and not already registered in the system. Else, the input box will be red in colour. The field with (*) beside its label must be filled out to complete the registration process. Once confirmed, the patient's data is recorded into the database which will allow the patient to register and create themselves an account in this system.

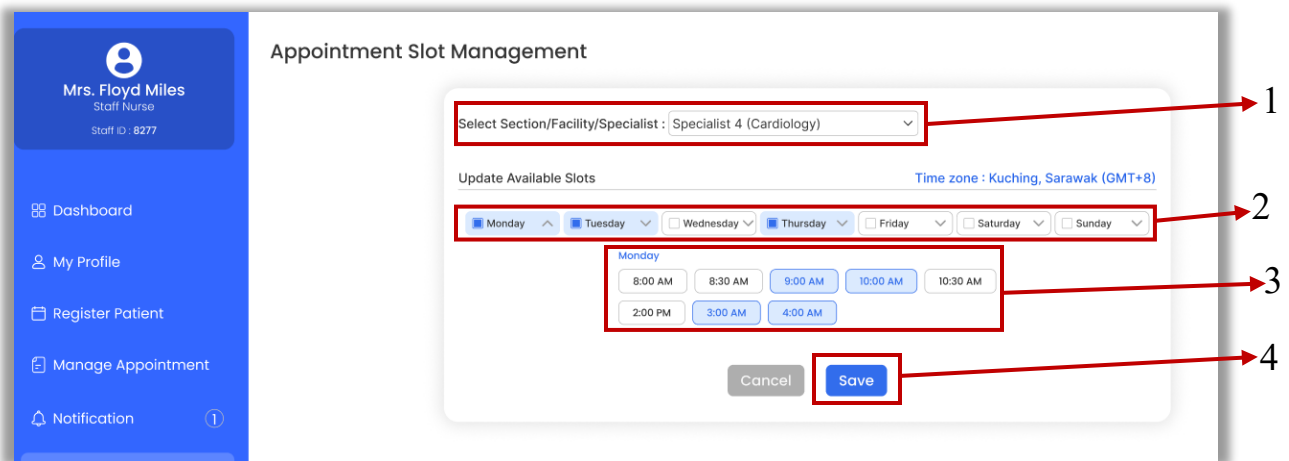


Figure 3.48. Appointment Slot Management.

Figure 3.45 is the GUI for appointment slot management. This is where nurse will set and appoint which slot will be available for each section, facility or specialist. First, the nurse must select the section, facility or specialist (1). Then, the nurse can select the day (2) and select which time slots (3) are available for that day. For example, the nurse first selects Monday. The system will displays all the time slots for Monday, and the nurse must pick which time slots should be available based on the availability of the section, facility or specialist. Each slot is for one patient. Once confirmed, the nurse must click the “Save” button (4) to update the availability of the slots.

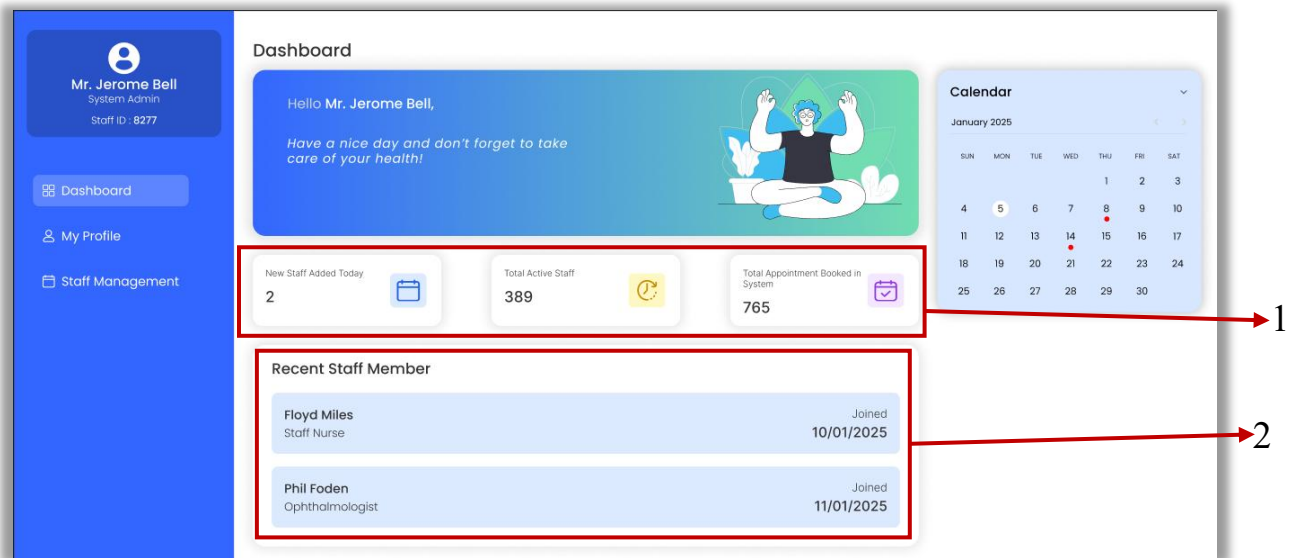


Figure 3.49. Administrator Dashboard page.

Figure 3.46 is the GUI for administrator dashboard. This dashboard is quite similar to the other dashboard. The differences are on the key metrics and the summary of the recent staff member. The Administrator dashboard highlights the key metrics (1) for the number of new staff members joined the system for that day, the number of total active staff members and the total number of appointments booked in the system. As for the summary of the recent staff member (2), it displays some information on the new staff member, which includes their name, roles and the date of their joining.

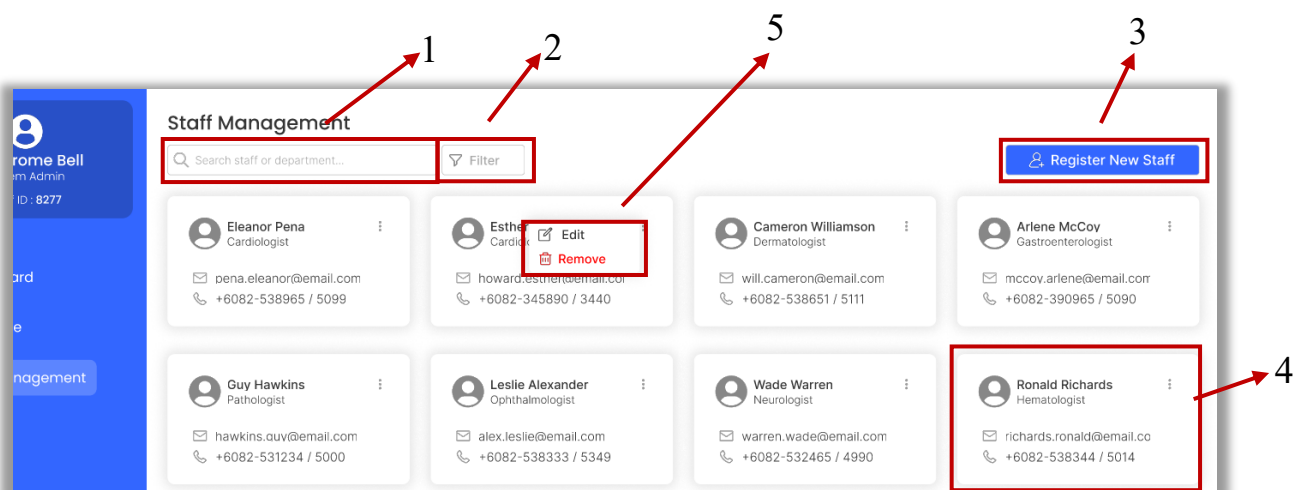


Figure 3.50. Staff Management page.

Figure 3.47 is the GUI for administrator to manage all the staff. This page has search (1) and filter (2) feature which enable administrator to find staff information more easier. There is also a “Register New Staff” button (3) which when clicked will navigate to the “Register New Staff” page. The page is for administrator to fill out new staff member information into the system. The page is as shown in Figure 3.48. This page displays the brief details (4) of each staff member. The details includes the name, position, email address and phone number. The “three dots” button, when clicked, will show option to “Edit” or “Remove” (5). The “Edit” option allows administrators to edit the selected staff information. When clicked on the “Edit” option, the system will navigate to the edit staff information as shown in Figure 3.49. The “Remove” button is for administrator to remove the selected staff data from the system, so the staff will not have any access to the system anymore.

Register New Staff
Please fill out all required fields(*) to complete the registration.

Personal Details

Full Name * Staff ID *

Date of Birth * Age * Gender * ☒ Male ☐ Female

Contact Information

Phone Number * Email *

Emergency Contact * Emergency Contact Relationship *

Professional Information

Role * Position * Department *

Specialization * Qualification *

Figure 3.51. Register New Staff page.

Figure 3.48 is the GUI for the registration of new staff. Administrator will input the required field on the staff information. The information includes staff's personal details, contact details and professional information. The field with (*) beside its label must be filled out to complete the registration process. Once confirmed with information, the administrator can click on the “Confirm” button (1) to complete the registration process. The new staff data is recorded into the database and they will have access to the system.

Staff Profile

Personal Details

Full Name * Martin Odegaard Staff ID 2389

Date of Birth * 20/8/2001 Age * 23 Gender * ☒ Male ☐ Female

Contact Information

Phone Number * +60 11 1986 0199 Email odegard.martin@work.com

Emergency Contact * +60 13 1765 5663 Emergency Contact Relationship * Mother

Professional Information

Role * Doctor Position * Consultant Department * Cardiology Department

Specialization * Cardiology Qualification * Doctorate (PhD)

Cancel Confirm

Figure 3.52. Edit Staff Details page.

Figure 3.49 is the GUI for administrators to edit staff details. This page will show the staff's personal details, contact information and some professional information. This page also allow administrator to modify (1) some of the information such as the phone number, emergency contact information, position, department, specialisation and qualification. Once confirmed, the administrator must click on the “Confirm” button (2) to save and update the information to the database.

3.4 Summary

This chapter outlined the requirement analysis and design process for the Appointment Management System at PKP UNIMAS. The requirements were gathered using questionnaires and interviews with patients, healthcare staff, and IT personnel, providing insights into the existing appointment workflow, challenges, and user needs. Key findings included the need for automated reminders, real-time availability updates, and an online referral management process to address inefficiencies in the current manual system.

The chapter also detailed the system's design, including logical and physical designs. The logical design involved use case diagrams and descriptions to define user interactions with the system, while activity diagrams illustrated workflows for critical processes such as appointment booking, referral management, and system login. The physical design showcased user interface prototypes, highlighting how the system will facilitate patient, doctor, and staff interactions. Additionally, the Entity Relationship Diagram (ERD) was developed to outline the database structure.

Overall, the analysis and design process established a comprehensive framework to guide the development of the system, addressing key user requirements and ensuring a seamless and efficient appointment management experience at PKP UNIMAS.

Chapter 4 : IMPLEMENTATION

4.1 Introduction

This chapter details the implementation phase of the Appointment Management System for Pusat Kesehatan PRIMA UNIMAS. The system was developed using a web-based architecture, incorporating both front-end and back-end technologies to fulfil the functional and non-functional requirements gathered during the earlier phases.

The system consists of three main components: the user interface for patients and staff, the server-side logic for processing appointments and managing data, and the MySQL database for storing all relevant records. The user interface was built using HTML, CSS, and JavaScript to ensure a responsive and user-friendly experience across devices. PHP Laravel was used to develop the server-side logic, connecting the interface with the database for appointment processing, authentication, and role-based access.

MySQL served as the main database system, handling the storage of user profiles, appointment records, referral letters, and system logs. To streamline development and ensure consistency, Visual Studio Code was used as the primary development environment. Git was used for version control, while Netlify hosted the codebase for collaborative tracking and backup purposes.

The implementation adhered to the Waterfall model, progressing from design to development in a structured manner. Each feature—such as appointment booking, slot management, and referral uploads—was implemented, tested, and integrated according to the design specifications.

4.2 Environment Setup

The successful development and implementation of the system required a proper environment setup that provided tools for coding, testing, and deployment. Several essential tools and platforms were used during the development phase to ensure a smooth and organised workflow. These tools include Visual Studio Code (VS Code), XAMPP, and Netlify. Each tool played a specific role in different stages of the system development.

4.2.1 Visual Studio Code (VS Code)



Figure 4.1. Visual Studio Code.

Figure above is the Visual Studio Code (VS Code) which was used as the primary code editor throughout the development process. VS Code is a lightweight yet powerful source-code editor that supports multiple programming languages, including PHP and JavaScript, which were essential for this project. Its features such as syntax highlighting, code auto-completion, integrated terminal, and extensions for Laravel and PHP development helped improve productivity and reduce coding errors. Additionally, the built-in Git integration allowed for easy version control, making it convenient to track project changes and collaborate effectively.

4.2.2 XAMPP



Figure 4.2. XAMPP.

XAMPP was used as the local development server during the backend development of the system. XAMPP provides an integrated package that includes Apache, MySQL, PHP, and phpMyAdmin, which are essential for developing and testing web applications. By using XAMPP, the Laravel-based backend of the system could be run and tested locally without the need for an external server. This setup allowed for easy database management through phpMyAdmin and ensured that the application could be tested thoroughly before deployment.

4.2.3 Netlify



Figure 4.3. Render..

Render was used as the hosting platform for deploying the frontend components of the system. Render provides continuous deployment and automated build services, making it a suitable solution for hosting full-stack applications, including static frontend resources. The project was integrated with GitHub, allowing Render to automatically detect and deploy changes pushed to the repository to ensure a smooth and efficient deployment workflow.

Additionally, background processes were enabled on Render to support scheduled or long-running backend tasks, such as sending email notifications or handling appointment reminders. This setup ensured that both the frontend and supporting backend operations were running reliably in the cloud, providing seamless access and functionality to users during development, testing, and deployment phases.

4.3 System Architecture and Technology Stack

This system is developed using the PHP Laravel framework as the primary backend technology, which provides a robust and secure environment for handling server-side logic, database operations, and routing. Laravel was chosen for its clean syntax, built-in features such as authentication and validation, and strong community support. On the frontend, the system utilises a combination of HTML, CSS, and JavaScript to build interactive and responsive user interfaces. CSS is used to style the components consistently, while JavaScript handles client-side interactivity such as forms validation and dynamic content updates.

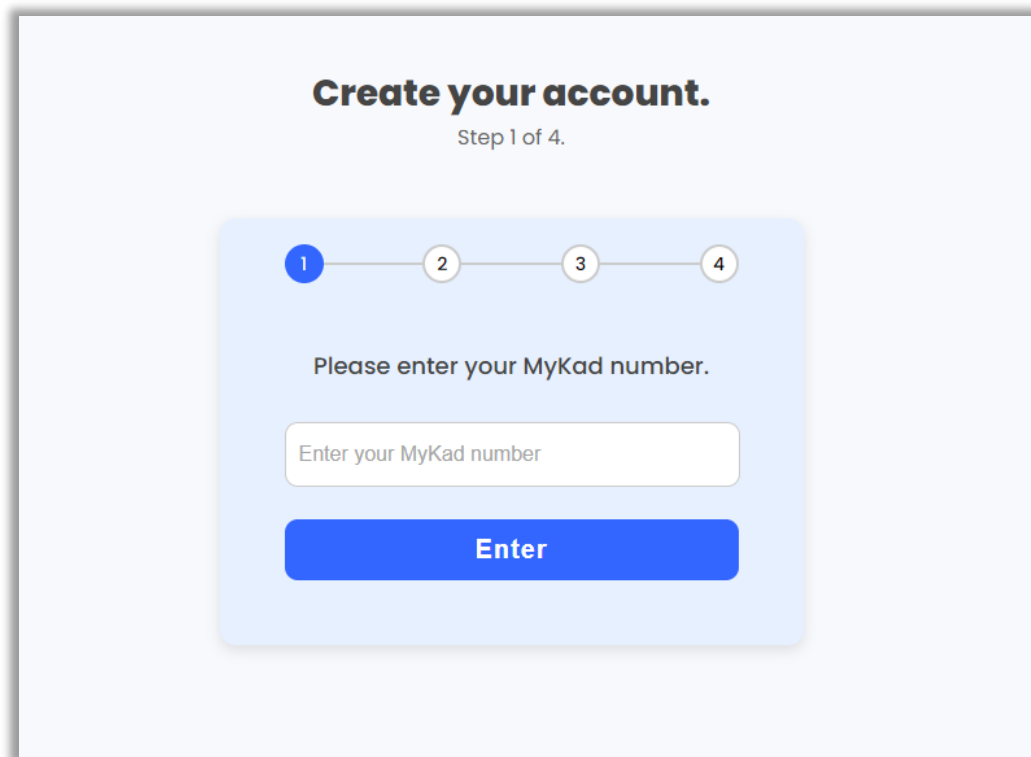
The implementation follows the Model-View-Controller (MVC) architectural pattern, which helps separate the application logic, user interface, and data management. The Model layer handles data interaction and database queries, the View layer is responsible for presenting data to users, and the Controller acts as an intermediary between the Model and View, processing user requests and updating the user interface (UI) accordingly. This approach promotes organised, modular, and maintainable code throughout the development of the system.

4.4 User Interface Design

The user interface of the Appointment Management System is designed with a focus on simplicity, clarity, and user accessibility. It provides a responsive and intuitive experience for patients and staff which enable them to navigate the system with ease. The layout follows a consistent structure, with a fixed sidebar on the left that allows quick access to essential modules such as Dashboard, My Profile, Request Appointment, Appointment Record, and Notification. The interface uses a calm and professional colour scheme that aligns with the healthcare environment, and icons are used throughout the system to help users quickly identify the purpose of each section. Cards and widgets are utilised to display information in a clear and visually appealing manner to ensure users can easily view appointment details, notifications, and personal information briefly. The design ensures responsiveness across various screen sizes, making it accessible on both desktops and tablets.

4.4.1 Patient Module

4.4.1.1 Create Account



Create your account.
Step 1 of 4.

1 — 2 — 3 — 4

Please enter your MyKad number.

Enter your MyKad number

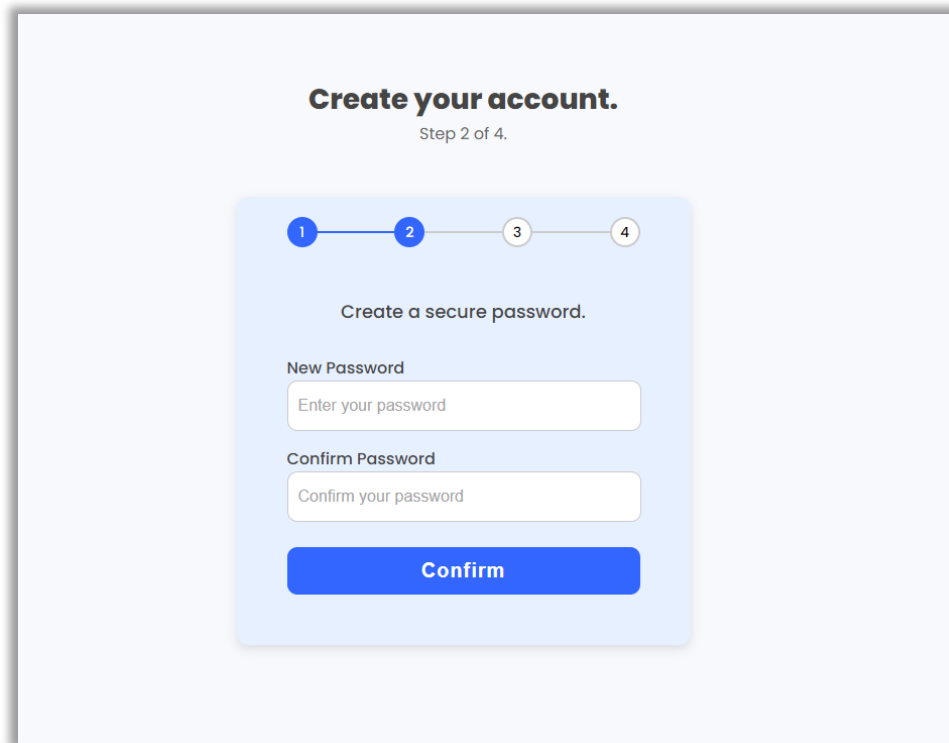
Enter

Figure 4.4. Step 1 - Create Account page.

The figure 4.4 illustrates the Create Account page for patients within the system. This page serves as the initial step for patients who wish to register and create their own accounts. However, only patients who have physically registered at Pusat Kesihatan Prima (PKP) UNIMAS are allowed to register in the system. This requirement ensures that only verified individuals with existing records at PKP UNIMAS can gain access to the online system.

To begin the registration process, the patient is required to enter their MyKad number into the designated field on the page. Once the MyKad number is submitted, the system will perform a verification process by checking the entered number against the existing records in the system database. This step confirms whether the patient has already completed the physical registration process at PKP UNIMAS.

If the MyKad number is valid and matches an existing record, the system will allow the patient to proceed to the next step of the account creation process, as shown in Figure 4.5. This approach ensures that only eligible patients are granted access to create an account, enhancing the security and integrity of the system.



Create your account.
Step 2 of 4.

1 — 2 — 3 — 4

Create a secure password.

New Password

Confirm Password

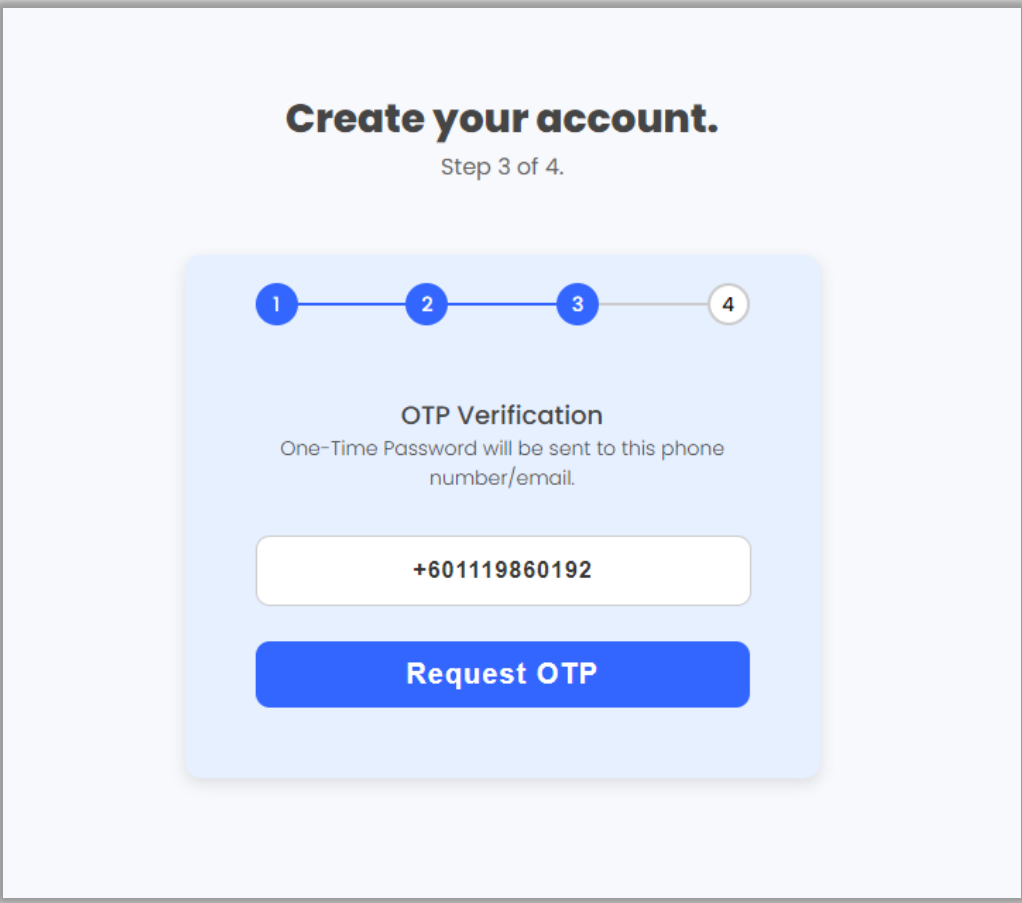
Confirm

Figure 4.5. Step 2 - Create Account page.

The figure 4.5 illustrates Step 2 of the Create Account process for patients, which follows the successful verification of the patient's MyKad number on the initial registration page. After the system confirms that the entered MyKad number is valid and the patient has physically registered at PKP UNIMAS, the patient is directed to this page to complete the next step of account creation.

On this page, the patient is prompted to create a password for their account. This password will be used for secure login to the system in the future. The page typically includes

fields for entering and confirming the password to ensure accuracy and prevent typing errors. This step is essential for establishing secure access to the system, protecting the patient's personal information, and ensuring only authorised users can log in. Once the password is successfully created, the account registration process is completed, and the patient can proceed to log in and access the system.



Create your account.
Step 3 of 4.

1 — 2 — 3 — 4

OTP Verification
One-Time Password will be sent to this phone number/email.

+601119860192

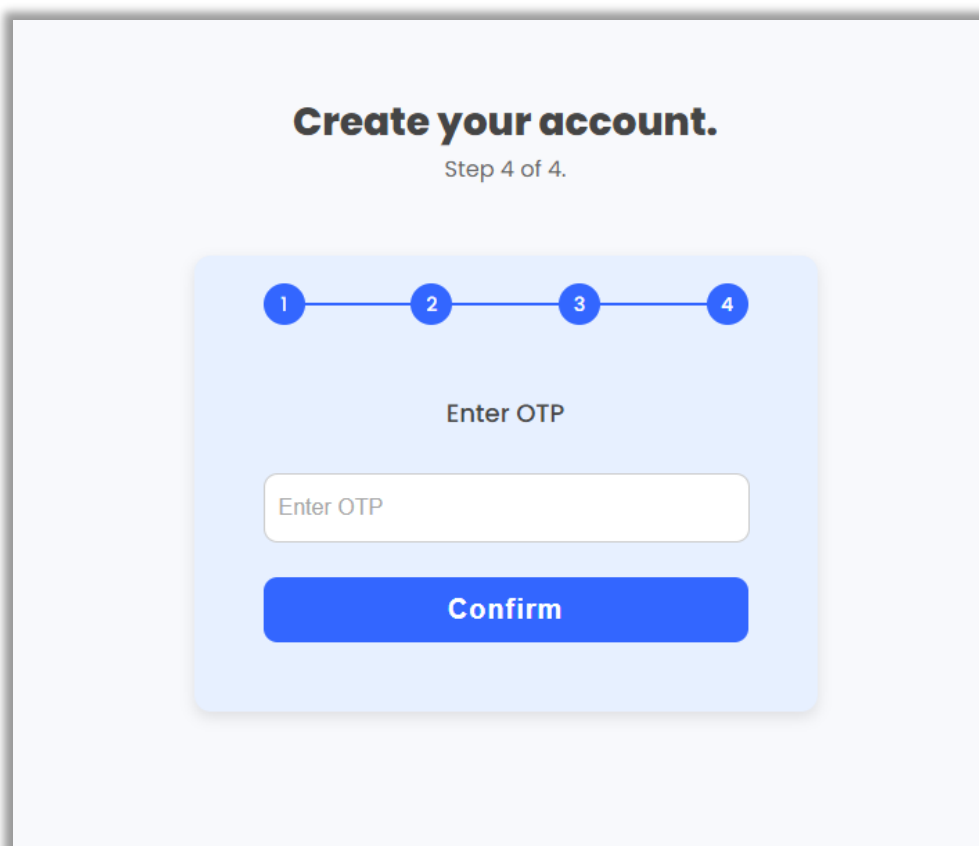
Request OTP

Figure 4.6. Step 3 - Create Account.

The figure 4.6 illustrates Step 3 of the Create Account process for patients, which occurs after the patient has successfully set their password in the previous step. This page is designed to perform an additional layer of verification to ensure the authenticity and security of the registration process.

On this page, the system displays the patient's registered phone number or email address, which were retrieved from the existing records in the system during the MyKad verification step. The system is configured to prioritise the phone number for sending a One-Time Password (OTP). If the phone number is not available in the patient's records, the system will automatically use the registered email address instead.

To proceed, the patient is required to click the “Request OTP” button. Once clicked, the system will send an OTP to the displayed phone number or email address. This OTP serves as a verification code that the patient must enter in the next step to confirm their identity and complete the account creation process.



Create your account.
Step 4 of 4.

1 — 2 — 3 — 4

Enter OTP

Enter OTP

Confirm

Figure 4.7. Step 4 - Create Account.

The figure 4.7 illustrates Step 4 of the Create Account process for patients, which is the final step in verifying the user's identity and completing the registration. After the patient has requested the One-Time Password (OTP) in the previous step, they are directed to this page to enter the received code.

On this page, the patient is provided with an input field to enter the OTP that was sent to their registered phone number or email address. Once the OTP is entered, the patient clicks the “Confirm” button to submit the code for verification.

The system will then check the entered OTP for correctness and validity. If the OTP is correct and has not expired, a success message pop-up box will appear on the screen, informing the patient that the account has been successfully created.

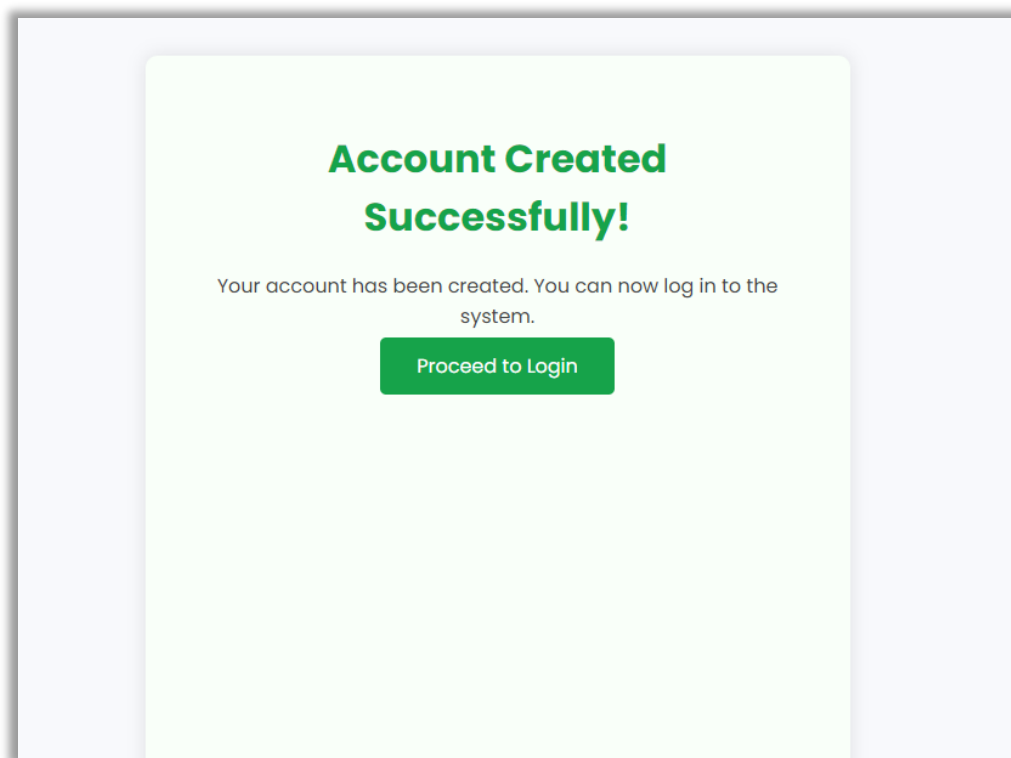
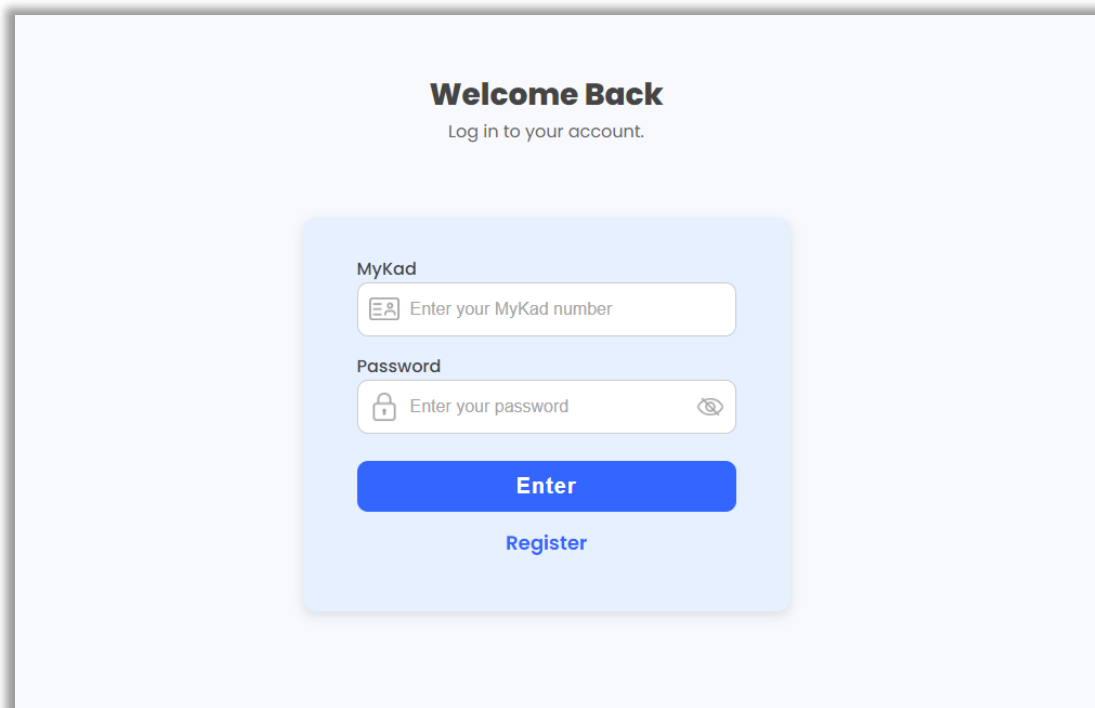


Figure 4.8. Patient Login page.

The figure above shows the pop-up message box that appears after a patient has successfully completed all steps of the account creation process. This pop-up serves as a confirmation to inform the patient that their account has been created successfully and that the registration process is complete.

The message clearly states that the account has been created, providing reassurance to the patient that their information has been verified and stored in the system. Within the pop-up, there is also a “Login” button. By clicking this button, the patient is redirected to the login page, where they can enter their MyKad number and the password they created earlier to access their account. This final step ensures a smooth transition from account creation to system access.

4.4.1.2 Patient Login



The image shows a login interface with a light blue background. At the top, the text "Welcome Back" is displayed in bold, followed by "Log in to your account." in a smaller font. Below this, there is a light blue rounded rectangle containing the login fields. The first field is labeled "MyKad" and has a placeholder text "Enter your MyKad number" with a small icon of a card. The second field is labeled "Password" and has a placeholder text "Enter your password" with a small icon of a lock and a toggle eye icon. Below the password field is a blue button labeled "Enter". At the bottom of the light blue rectangle is a link labeled "Register" in blue text.

Figure 4.9. Pop up message upon successful OTP verification.

Figure 4.9 shows the login page for patients. This page is designed exclusively for patients who already have an account in the system. To access their dashboard, patients are required to enter their registered MyKad number and password. The system will authenticate these credentials by checking against existing records in the patient database. If the credentials are valid, the patient will be granted access; otherwise, an error message will be displayed. This login mechanism ensures that only authorised and verified patients can log into the system.

4.4.1.3 Patient Forgot and Reset Password

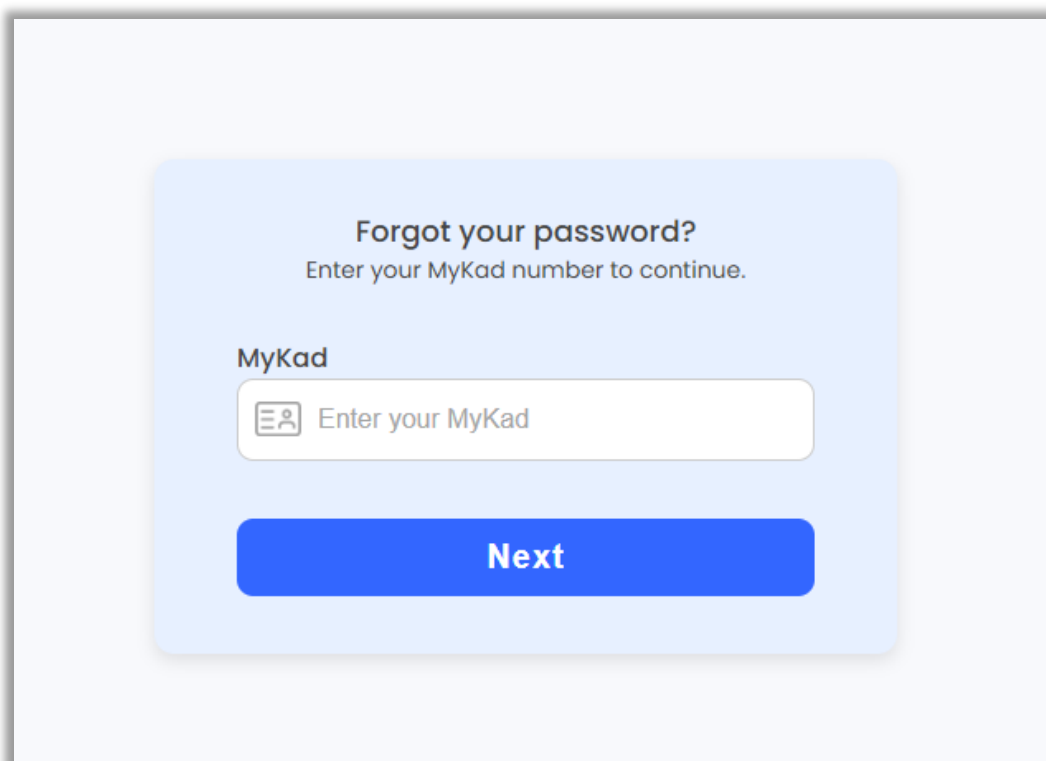


Figure 4.10. Input for MyKad in forgot reset process.

Figure 4.10 illustrates the “Patient Forgot and Reset Password” page. This page is accessed when a patient clicks the “Forgot Password” link on the login page. Upon arriving at this page, the patient is prompted to enter their MyKad number. The system uses the MyKad

to retrieve the corresponding registered email or phone number from the database. This verification step ensures that only the account owner can initiate a password reset process.

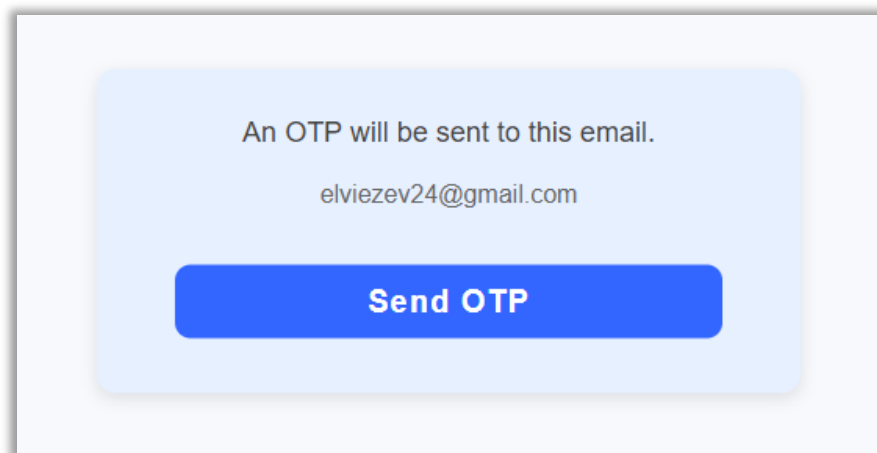


Figure 4.11. Display of patient's email where OTP code will be sent.

Figure 4.11 continues the password reset process from the previous “Forgot Password” page. After the patient enters their MyKad number, the system successfully identifies their record and displays a page showing the email address or phone number where the OTP (One-Time Password) will be sent. This step allows the patient to confirm that the displayed contact information is correct before proceeding. It enhances security by ensuring the OTP is sent only to the verified contact details associated with the patient’s account. The patient can then click the button to send the OTP and continue to the next step in resetting their password.

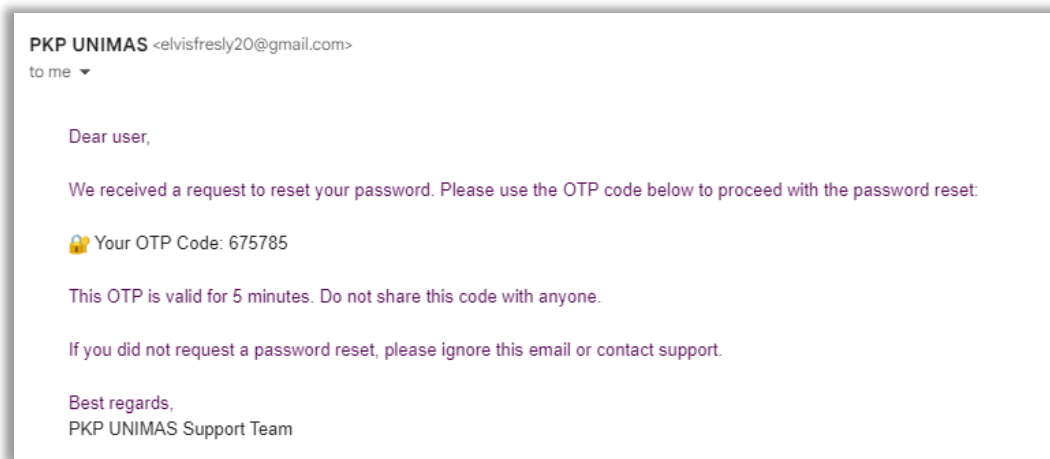


Figure 4.12. Email received from system with OTP code.

Figure 4.12 shows a snapshot of the email received by the patient during the password reset process. This email is sent to the registered email address after the patient requests an OTP code. The content of the email includes a unique OTP (One-Time Password) code, which the patient must enter on the system to verify their identity before proceeding to reset their password. This step ensures that only the legitimate account owner, with access to the registered email, can complete the password recovery process. The email serves as a secure and essential part of the system's authentication mechanism.

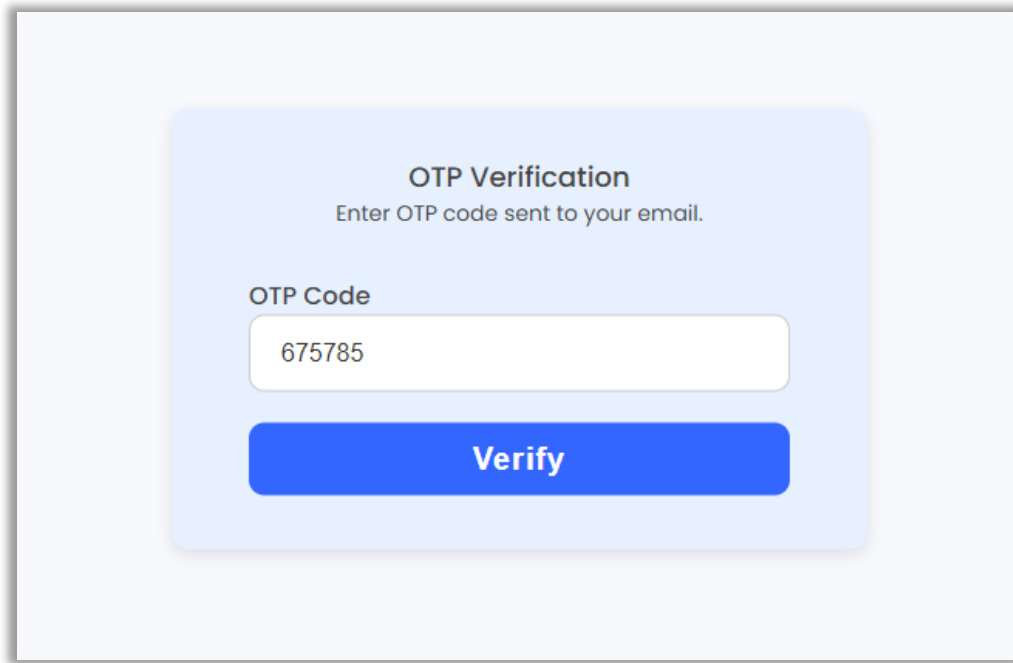
The image shows a web form for OTP verification. It has a light blue background with a white rounded rectangle in the center. Inside the rectangle, the text "OTP Verification" is at the top, followed by "Enter OTP code sent to your email." Below this is a label "OTP Code" and a text input field containing the number "675785". At the bottom of the rectangle is a blue button with the text "Verify" in white.

Figure 4.13. OTP Code verification.

Figure 4.13 displays the OTP verification page that follows the patient receives the OTP code via email. On this page, the patient is prompted to enter the OTP code received in their registered email. After filling in the code, the patient clicks the “Verify” button to proceed. The system then checks if the entered OTP matches the one that was sent. If the verification is successful, the patient will be allowed to continue to the next step to reset their password.

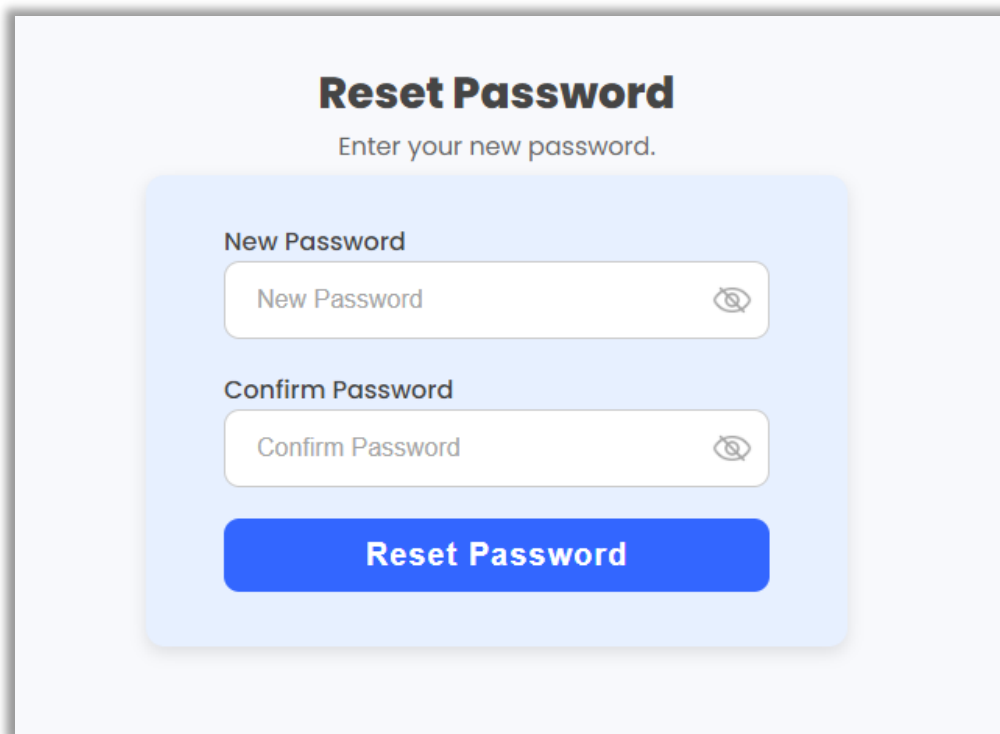
A screenshot of a web form titled "Reset Password" in bold black text. Below the title is the instruction "Enter your new password." in a smaller, regular font. The form is contained within a light blue rounded rectangle. It features two input fields: the first is labeled "New Password" and the second is labeled "Confirm Password". Both fields have a light gray placeholder text matching their labels and a small eye icon to the right of each field. Below these fields is a solid blue button with the text "Reset Password" in white, bold, sans-serif font.

Figure 4.14. New password creation.

Figure 4.14 shows the crucial step in the password reset process, where the patient is prompted to create a new password. On this page, the patient must enter their new password and then confirm the password by typing it again in a separate field. This double-entry approach helps ensure accuracy and prevents typing mistakes. Once both fields are filled in correctly, the patient can submit the form to successfully update their password. Upon completion, the system replaces the old password with the new one, and the patient can then log in using their updated credentials.

The image shows a login interface on a light gray background. At the top, the text "Welcome Back" is displayed in a bold, dark font, followed by "Log in to your account." in a smaller, regular font. Below this, a green message states "Password successfully reset." in a bold font. The login form is a light blue rounded rectangle containing two input fields: "MyKad" with a person icon and "Password" with a lock icon and a toggle eye icon. A blue "Enter" button is positioned below the password field, and a blue "Register" link is at the bottom. A blue link "Forgot your password?" is located to the right of the password field.

Welcome Back
Log in to your account.

Password successfully reset.

MyKad
Enter your MyKad number

Password
Enter your password [Forgot your password?](#)

Enter

[Register](#)

Figure 4.15. Login page and successful message after a complete password reset.

Figure 4.15 illustrates the final stage of the password reset process. After the patient successfully creates and confirms a new password, the system automatically redirects them to the login page. At the top of the screen, a success message is displayed, informing the patient that their password has been updated successfully. This confirms the completion of the reset process and allows the patient to immediately log in using their new credentials.

4.4.1.4 Dashboard

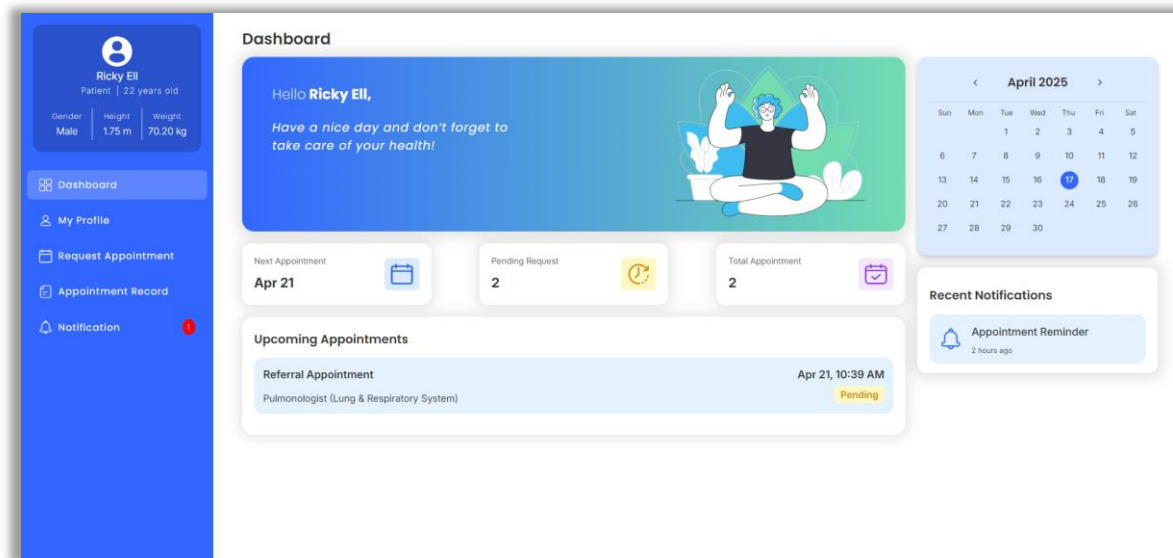


Figure 4.16. Patient Dashboard page.

The figure 4.16 shows the patient dashboard which serves as the main landing page after a successful login and offers an overview of the patient's health profile and appointment-related activities. On the left panel, the patient's basic information is displayed, including name, age, gender, height, and weight. A warm greeting message appears at the center-top of the dashboard, accompanied by a motivational note encouraging users to prioritise their health. Key details such as the date of the next appointment, number of pending appointment requests, and the total number of appointments are presented using clearly labelled information cards. Below these cards, the system displays upcoming appointment details, including the type of appointment, department involved (e.g., Pulmonologist), scheduled time, and status, such as "Pending". On the right side of the interface, a calendar widget shows the current month. This allows users to visually track dates, while a notification panel beneath it highlights recent alerts like appointment reminders. This comprehensive layout ensures that patients can access critical information conveniently and stay updated on their medical schedules.

4.4.1.5 Profile

My Profile

Personal Details

Full Name	MyKad Number	
Ricky Eli	020620130745	
Date of Birth	Age	Gender
20 June 2002	22 years old	Male

Contact Information

Phone Number	Email
+60119860192	elviezev24@gmail.com
Emergency Contact	Emergency Contact Relationship
01987520192	Mother

Medical Information

Height	Weight	BMI
1.75 m	70.20 kg	22.9 (Normal)
Blood Type		
O+		
Any reaction to Penicillin?	If yes, what reaction?	
Yes	Allergy	

[Save Changes](#)

Figure 4.17. Patient Edit Profile page.

The figure 4.17 above is the “My Profile” page, where a patient can view their personal, contact and medical information. While all data fields are visible for reference, only designated input boxes are editable to ensure critical identification details like the MyKad number remain secure and unalterable. The page also includes a “Save Changes” button at the bottom to save the current changes on their information.

4.4.1.6 Request Appointment

Request Appointment

Appointment Type :

Referral Letter :

[QnnVnpyTqf58yff3c9csoXQ82hVlfmnlAbFlfgL4.pdf](#)

Section/Facility :

Select Date and Time Time zone : Kuching, Sarawak (GMT+8)

25 July 2025

08:00 AM 10:00 PM

10:00 AM

July 2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Figure 4.18. Request Appointment page.

Figure 4.18 shows the “Request Appointment” page, which serves as the main interface for patients to request appointments. The page includes a dropdown menu where users can specify the appointment type, such as follow-up or referral, and select their preferred section or facility. For referral cases, the system provides a file upload option, restricted to PDF format only to ensure consistency and compatibility for supporting documents. An interactive calendar is featured to allow patients to easily pick their desired appointment date. Dates marked in red indicate public holidays, on which no appointments can be scheduled. This helps to prevent invalid requests. The calendar also displays the local time zone (Kuching, Sarawak, GMT+8) to ensure clarity for patients when choosing appointment times. Once all required fields are filled in, the patient can click the “Request Appointment” button at the bottom of the page to submit their appointment request to the system.

4.4.1.7 Appointment Record List

The screenshot displays the 'Appointment Record' page for a patient named Ricky Eli, 23 years old, male, 1.75 m tall, and 70.20 kg. The page features a sidebar with navigation links: Dashboard, My Profile, Request Appointment, Appointment Record (selected), and Notification (21). The main content area shows a table of appointments with columns: Appointment, Section/facility/specialist, Date, Time, and Status. The table includes tabs for 'All', 'Upcoming', and 'Past', and a 'Filter' button. The appointments listed are as follows:

Appointment	Section/facility/specialist	Date	Time	Status
Referral Appointment	Cardiologist (Heart & Blood Vessels)	07 November 2025	10:00 AM	Approved
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	25 August 2025	10:00 AM	Approved
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	01 August 2025	10:00 AM	Change Requested
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	28 July 2025	10:00 AM	Approved
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	21 July 2025	10:00 AM	Approved
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	30 June 2025	08:00 AM	Pending
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	30 June 2025	10:00 AM	Approved
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	30 June 2025	10:00 AM	Approved
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	30 June 2025	10:00 AM	Approved
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	30 June 2025	10:00 AM	Approved
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	30 June 2025	10:00 AM	Rejected
Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	30 June 2025	10:00 AM	Approved

Figure 4.19. Appointment Record page.

The figure 4.19 shows the “Appointment Record” page. This page allows patients to view their appointment list and history. Tabs at the top of the table (All, Upcoming, Past) help filter the appointments based on their timeline, allowing users to focus on relevant information. Next to the tab list, there is also a Filter button that provides more advanced filtering options to help users quickly locate specific appointments.

When the Filter button is clicked, the user can filter the appointment records based on several criteria, including appointment status (such as Approved, Pending, Change Requested), appointment type, location/section/facility, and date (as shown in Figure 4.14). This additional filtering feature allows users to narrow down their search and view only the appointments that match their specific requirements.

In the main content area, the system presents a table listing each appointment's type, specialist section, date, time, and status. The dates and times of the appointments are clearly stated, and each appointment's status is color-coded for easy recognition: green for Approved, blue for Change Requested, and yellow for Pending.

This intuitive layout allows users to easily track upcoming and past appointments, manage changes, and stay informed of their healthcare activities. Additionally, when the user clicks on one of the rows in the table, the system will navigate to the Appointment Details page as shown in Figure 4.14. This page displays all the detailed information for the selected appointment, allowing the user to review the appointment thoroughly or take further actions such as cancelling it. Overall, this page supports efficient health service management by ensuring that patients can access, filter, and manage their appointment information quickly and clearly.

Filter Appointments [X]

Status

☒ Pending ☐ Approved ☐ Rejected ☐ Change Requested

Appointment Type

Follow-up appointment

Location

Cardiologist (Heart & Blood Vessels)

Appointment Date

06/23/2025

Reset Apply Filters

Figure 4.20. Appointment Record filter function.

Figure 4.20 shows a snippet of the filter section that appears when the “Filter” button is clicked on the Appointment Management page. This filter panel allows users to narrow down appointment records based on multiple criteria, including status, appointment type, location

(section/facility), and appointment date. Users can apply more than one filter simultaneously to offer flexibility in viewing specific sets of appointment data. After selecting the desired filters, clicking the “Apply” button will refresh the appointment list and will display only the records that match the selected criteria. This feature is especially useful for nurses and doctors to efficiently locate and manage relevant appointments without scrolling through the full list.

4.4.1.8 Appointment Details

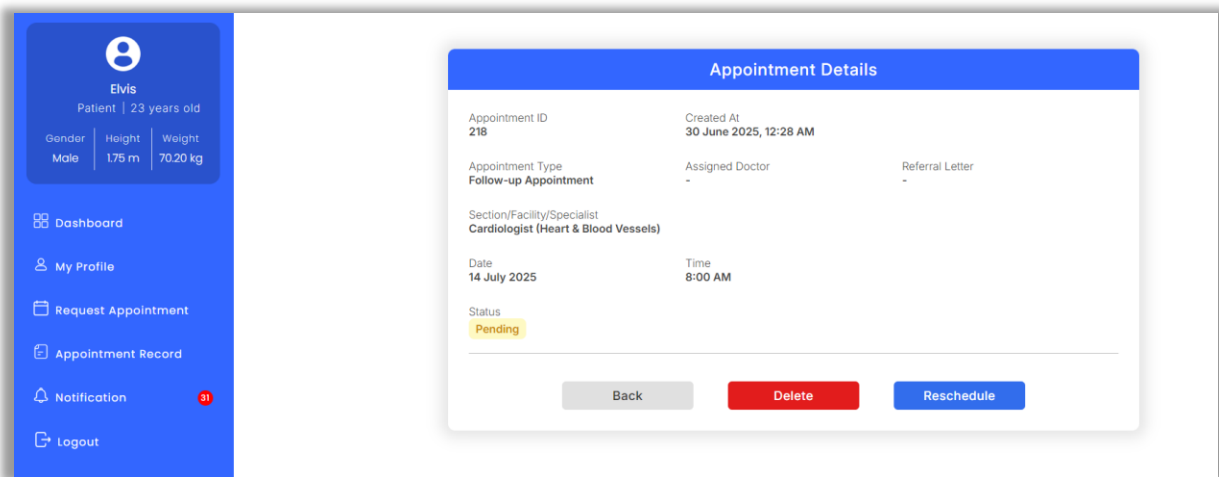


Figure 4.21. Appointment Details page.

Figure 4.21 shows the “Appointment Details” page, which displays comprehensive information about a specific appointment selected by the user from the Appointment Record page. This interface provides a clear and detailed overview of the appointment to allow the user—typically a patient—to view all relevant information in one centralised view.

The details shown on this page typically include the appointment date, time, location, attending doctor, appointment status, and any additional notes or remarks. This level of detail ensures that patients have complete visibility of their appointment. This enables them to confirm or review the information as needed.

For greater flexibility, if the appointment is in a Pending or Approved state, the patient is allowed to reschedule the appointment. In such cases, the system permits changes to only the appointment date and time, while keeping all other details such as appointment type and section fixed. This controlled approach ensures data consistency and prevents unnecessary re-entry of appointment details.

At the bottom of the page, there are two action buttons. The “Back” button allows the user to return to the Appointment Record page without making any changes, while the “Cancel” button enables the patient to cancel the appointment entirely if they no longer require it. These actions support patient autonomy and provide convenient options for managing their bookings within the system.

4.4.1.9 Appointment Reschedule

Reschedule Appointment

Appointment Type : Follow-up Appointment

Section/Facility : Cardiologist (Heart & Blood Vessels)

Select Date and Time Time zone : Kuching, Sarawak (GMT+8)

July 2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Previous Date and Time:
14 July 2025, 8:00 AM

25 July 2025

08:00 AM 10:00 PM

10:00 AM

Reschedule Appointment

Figure 4.22. Appointment Rescheduling page.

Figure 4.22 displays the “Reschedule Appointment” page, which allows patients to modify the date and time of an existing appointment. This page is part of the appointment

management feature and is accessible only for appointments that are in Pending or Approved status. On this page, the patient is allowed to reschedule the appointment by selecting a new date and time, while all other appointment details remain unchanged.

To prevent unauthorised modifications, the fields for appointment type and section/facility are disabled to ensure that only the original booking context is preserved. Additionally, the page displays the current scheduled date of the appointment, providing patients with a clear reference before choosing a new schedule. This feature promotes flexibility while maintaining control and consistency in the appointment records.

4.4.1.10 Notification

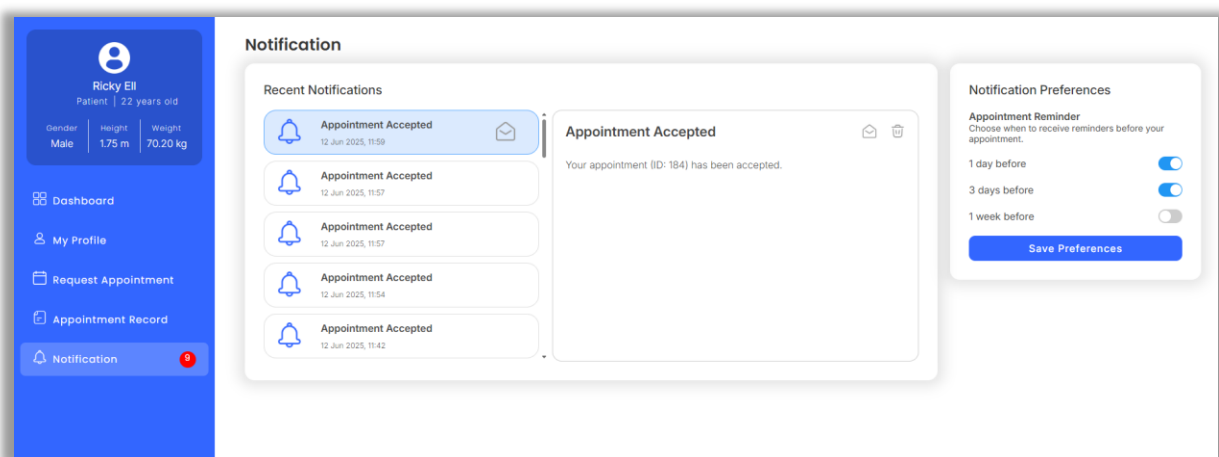


Figure 4.23. Patient Notification page.

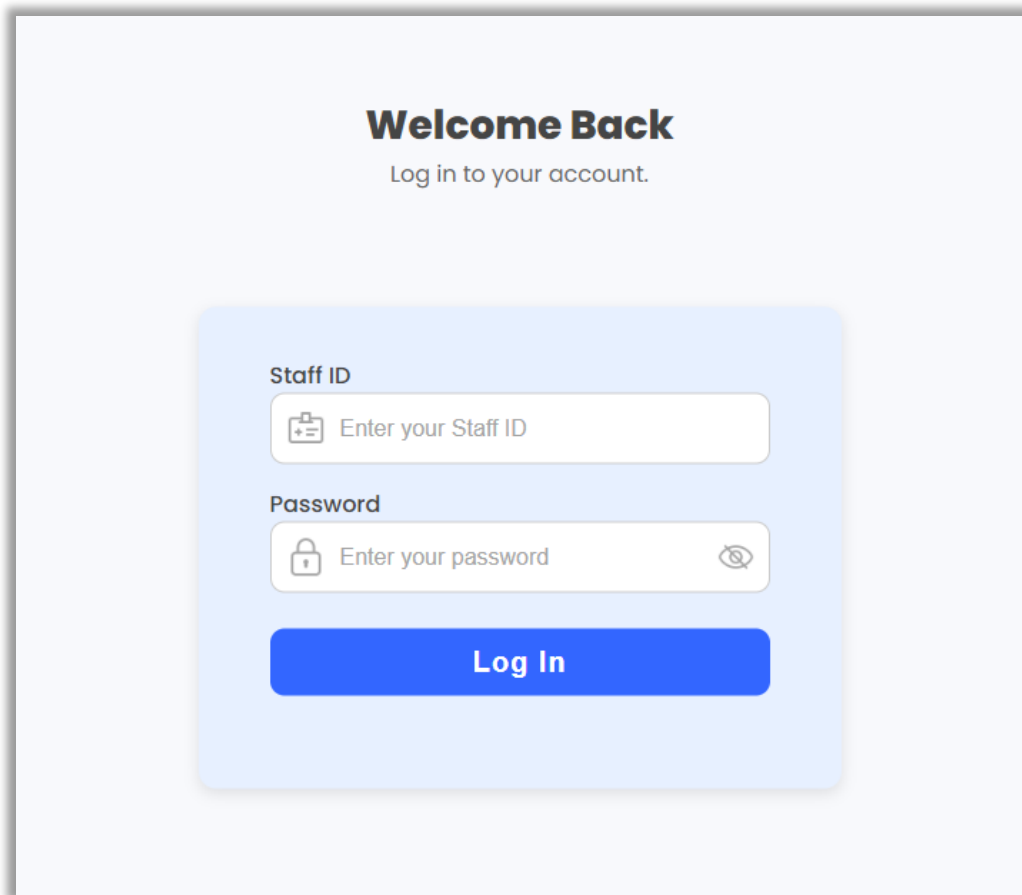
Figure 4.23 displays the Notification section of the Appointment Management System for Pusat Kesehatan PRIMA UNIMAS (PKP UNIMAS). The main content of this page consists of a list of notifications on the left and the selected notification details on the right. The list is sorted by the latest received notifications to ensure that users can easily view the most recent updates first. Each notification entry allows the patient to quickly identify appointment-related actions, such as approvals or changes.

To enhance clarity, unread notifications are visually distinguished from read ones. Unread notification boxes appear in a light blue colour, while read notifications appear in the default background, helping users easily identify which alerts they have not yet reviewed. Additionally, each unread notification includes a “mark as read” icon which allow users to acknowledge the alert manually. When this icon is clicked, the notification is marked as read and visually updated accordingly. The right side of the page displays detailed content of the selected notification. This offers full context and any important instructions. This design supports a real-time notification experience to help patients stay informed and take timely action on their appointments.

At the most right-side of the page, the “Notification Preferences” section allows users to customise their appointment reminder settings. Patients can choose to receive reminder 1 day before, 3 days before, or 1 week before their scheduled appointments to ensure they never miss a booking. A “Save Preferences” button enables users to confirm their selections, personalising the system to their needs

4.4.2 Nurse Module

4.4.2.1 Login



The image shows a login page with a light blue background. At the top, the text "Welcome Back" is displayed in a bold, dark font, followed by "Log in to your account." in a smaller, regular font. Below this, there is a light blue rounded rectangle containing the login form. The form has two input fields: "Staff ID" with a calendar icon and "Password" with a lock icon and a toggle eye icon. A blue "Log In" button is positioned at the bottom of the form.

Welcome Back
Log in to your account.

Staff ID
Enter your Staff ID

Password
Enter your password

Log In

Figure 4.24. Nurse Login page.

The figure 4.24 illustrates the Login Page for Nurse, which follows the same design and functionality for all other staff roles, including doctors and administrators. This unified login interface ensures consistency and simplicity across different user groups within the system.

To log in, staff members are required to enter their Staff ID and password into the provided input fields. The system uses the unique Staff ID to identify the user, and the password is used to authenticate their identity. Once the correct credentials are provided, the system grants access to the staff portal based on the user's assigned role. This role-based access ensures that each staff member only has access to features and pages relevant to their responsibilities within the system.

4.4.2.2 First-time Patient Registration

Patient First-Time Registration

Personal Details

Full Name * MyKad Number *

Date of Birth * Age Gender *

mm/dd/yyyy years old ☐ Male ☐ Female

Contact Information

Phone Number * Email

Emergency Contact * Emergency Contact Relationship *

Medical Information

Height * Weight * BMI

m kg

Blood Type *
Select blood type

Any reaction to Penicillin? * If yes, what reaction?

☐ Yes ☐ No Describe the reaction...

Confirm

Figure 4.25. Register First-time Patient page.

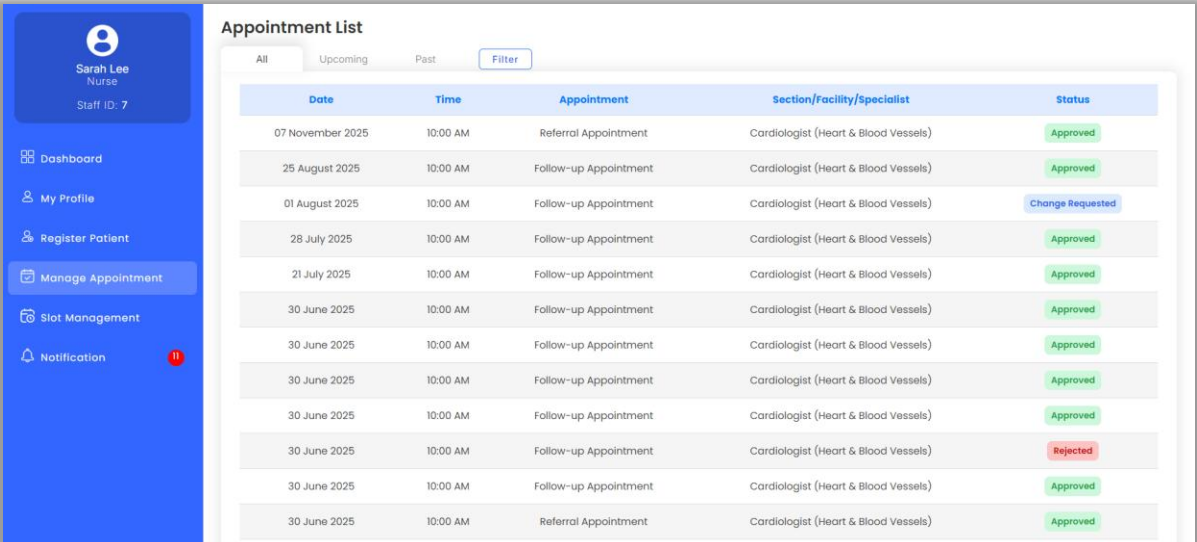
The figure 4.25 displays the Patient First-Time Registration interface of the PKP UNIMAS Appointment Management System, designed to streamline the onboarding process for new patients. The form is strategically divided into three key sections to collect comprehensive patient information efficiently. In the Personal Details section, mandatory fields such as the patient's full name, MyKad number (Malaysian national identification), date of birth, age, and gender are included to establish accurate demographic records.

The Contact Information section captures the patient's phone number (required) and optional email address, along with critical emergency contact details including the contact person's number and their relationship to the patient. The Medical Information section gathers vital health data, including the patient's height and weight (with an auto-calculated BMI field), blood type (selected from a dropdown menu), and penicillin allergy status (with an additional field to describe any adverse reactions if applicable). The form's clean, intuitive layout

emphasises user-friendliness, with clearly marked mandatory fields and logical grouping of related information.

A prominent “Confirm” button at the bottom enables nurse to submit the details and complete the registration process. This well-structured interface effectively addresses the project's objectives of reducing administrative burdens, minimising manual data entry errors, and ensuring healthcare providers have immediate access to essential patient information. The inclusion of critical medical data like allergies and blood type upfront demonstrates the system's focus on patient safety and quality of care from the very first interaction.

4.4.2.3 Appointment List



The screenshot displays the 'Appointment List' page. On the left is a blue sidebar with a user profile for Sarah Lee (Nurse, Staff ID: 7) and navigation links: Dashboard, My Profile, Register Patient, Manage Appointment (highlighted), Slot Management, and Notification (with a red badge). The main content area has a title 'Appointment List' and tabs for 'All', 'Upcoming', and 'Past', along with a 'Filter' button. Below is a table with columns: Date, Time, Appointment, Section/facility/specialist, and Status.

Date	Time	Appointment	Section/facility/specialist	Status
07 November 2025	10:00 AM	Referral Appointment	Cardiologist (Heart & Blood Vessels)	Approved
25 August 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
01 August 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Change Requested
28 July 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
21 July 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
30 June 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
30 June 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
30 June 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
30 June 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
30 June 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Rejected
30 June 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
30 June 2025	10:00 AM	Referral Appointment	Cardiologist (Heart & Blood Vessels)	Approved

Figure 4.26. Appointment List page.

The figure 4.26 illustrates the Nurse Appointment Record page, which is designed for nurses to view and manage appointment records within their assigned section or facility. This page is visually and functionally like the Patient Appointment Record page but with a key difference in the information displayed.

While the patient version shows only the appointments related to the logged-in patient, the Nurse Appointment Record page lists all appointments that are related to the nurse's working section or facility. This allows the nurse to have an overview of all scheduled appointments under their responsibility which ensure they can monitor, manage, and prepare for upcoming patient visits effectively.

The page includes familiar features such as tabs at the top (All, Upcoming, Past) to filter the appointments based on their timeline, along with a Filter button that allows filtering appointments by status, type, section/facility, and date. The main table presents appointment details such as the type, specialist section, date, time, and status, with status color-coded for quick recognition (e.g., green for Approved, blue for Change Requested, yellow for Pending).

This page provides nurses with a clear, organised view of all appointments within their section, supporting efficient workflow management and ensuring smooth healthcare operations.

4.4.2.4 Appointment Details

The screenshot displays the 'Appointment Details' page for a nurse named Sarah Lee (Staff ID: 7). The left sidebar contains navigation links: Dashboard, My Profile, Register Patient, Manage Appointment, Slot Management, and Notification (with a red badge showing '11'). The main content area shows the details for a patient named Ricky Eli. The appointment is a 'Follow-up Appointment' scheduled for 30 June 2025 at 8:00 AM, with a status of 'Pending' (highlighted in yellow). The assigned doctor is Dr. John Smith, and the section is Cardiology (Heart & Blood Vessels). At the bottom, there are four buttons: Back, Reject, Accept, and Request Change.

Appointment Details		
Patient Name Ricky Eli	MyKad Number 020620130745	
Date of Birth 20 June 2002	Age 23 years old	Gender Male
Appointment ID 206	Created At 23 June 2025, 12:25 PM	
Appointment Type Follow-up Appointment	Assigned Doctor Dr. John Smith	Referral Letter -
Section/Facility/Specialist Cardiologist (Heart & Blood Vessels)		Approved By -
Date 30 June 2025	Time 8:00 AM	
Status Pending	Status Details -	

Back Reject Accept Request Change

Figure 4.27. Appointment Details page.

The figure 4.27 illustrates the Appointment Details page, which displays comprehensive information about a specific appointment selected from the Appointment Record page. At the top of the page, the system presents brief details of the patient, including their name, MyKad number, age, and gender. This allows the healthcare staff to quickly verify the identity of the patient associated with the appointment. Below the patient information, the full details of the appointment are shown, including the appointment type, section or facility, date, time, status, and any other relevant information.

At the bottom of the page, there are several action buttons available to manage the appointment. The Back button allows the user to return to the previous page. The Reject button will trigger a pop-up dialog box, where the nurse is required to state the reason for rejecting the appointment. The Accept button displays a confirmation pop-up to ensure that the appointment is approved intentionally. Additionally, the Request Change button allows the nurse to request modifications to certain appointment details, such as the section or facility. When clicked, a pop-up dialog box appears, requiring the nurse to specify what details the patient needs to change. This information will be sent to the patient through both in-system notifications and email. Overall, this page provides a clear and structured layout for healthcare staff to thoroughly review appointment details and take the necessary actions to manage the appointment efficiently.

4.4.2.5 Appointment Slot Management

Date	Day	Description	
1 Jan	Wed	New Year's Day	✕
29 Jan	Wed	Chinese New Year	✕
30 Jan	Thu	Chinese New Year's Holiday	✕
18 Mar	Tue	Nuzul Al-Quran	✕
31 Mar	Mon	Hari Raya Aidilfitri	✕
1 Apr	Tue	Hari Raya Aidilfitri's Holiday	✕
18 Apr	Fri	Good Friday	✕
1 May	Thu	Labour Day	✕
12 May	Mon	Wesak Day	✕
1 Jun	Sun	Hari Gawai	✕

Figure 4.28. Appointment Slot Management page.

The figure 4.28 illustrates the “Manage Available Slot” page for nurses, which allows them to manage and update the available appointment slots for each section or facility in the system. This page is designed to give nurses control over scheduling and to ensure that appointment slots are accurately allocated based on availability.

At the top of the page, there is a dropdown selection that enables the nurse to choose the specific section or facility they want to manage. After selecting the desired section, the nurse can then select the day of the week (e.g., Monday, Tuesday) for which they want to view or update the available slots.

Once a day is selected, any existing available slots for that section and day will be displayed on the page. To add a new time slot, the nurse can select a time using the time picker and click the “Add” button. The newly added slot will then appear in the list for that specific day. Each slot includes a minus icon (“-”), which the nurse can click to remove the slot if it's no longer available.

In addition to managing daily slots, this page also includes a dedicated section where nurses can insert specific holiday dates or other dates when PKP UNIMAS is closed. These

dates are marked as holiday dates in the system, and the corresponding dates will be disabled from appointment booking on the patient’s end. This feature ensures that appointments cannot be scheduled on days when services are unavailable to help maintain accurate and conflict-free scheduling.

4.4.3 Doctor Module

4.4.3.1 Profile

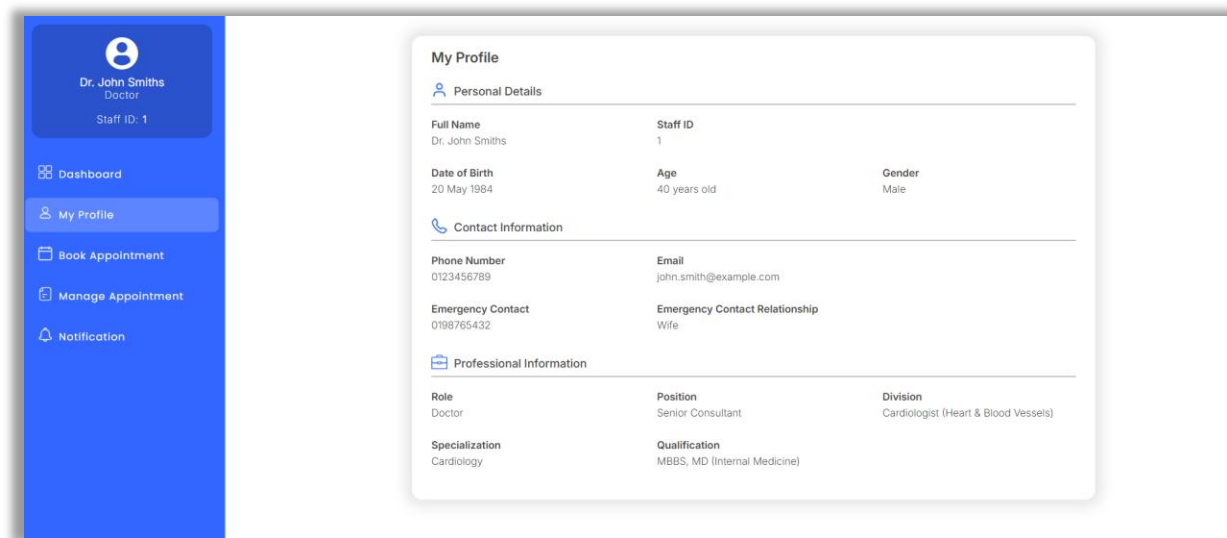


Figure 4.29. Doctor Profile page.

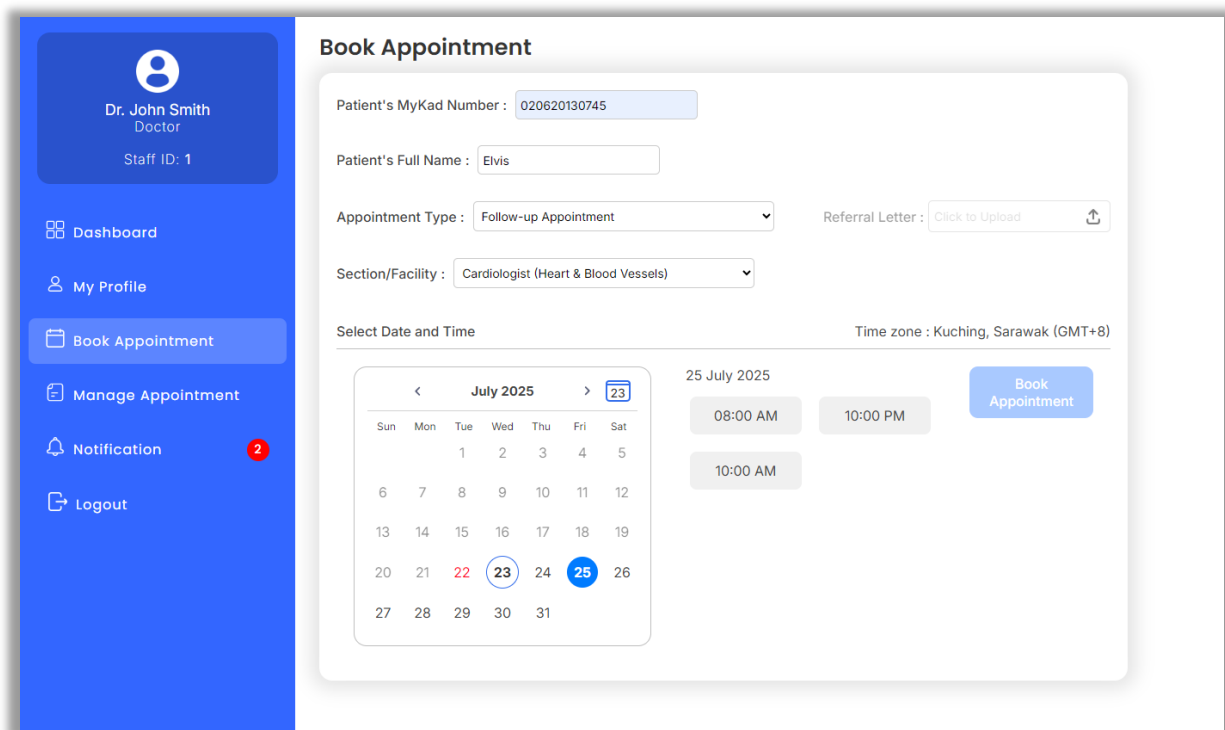
The figure 4.29 illustrates the Doctor Profile page, which is designed to display comprehensive information about an individual doctor within the system. This page is structured to present the doctor’s details in an organised layout to allow easy access to key information.

The profile page is divided into several sections. The personal information section includes basic details such as the doctor’s full name, gender, and staff identification number. The contact information section provides the doctor’s phone number and email address to enable direct communication if needed. Lastly, the professional information section displays

the doctor's area of specialisation, current division or section, and other relevant professional credentials or experience.

This page helps maintain transparency and ensures that accurate information about each medical professional is readily available for system users, such as administrative staff or patients. It also supports better coordination and management within the healthcare system.

4.4.3.2 Book Appointment



Book Appointment

Patient's MyKad Number : 020620130745

Patient's Full Name : Elvis

Appointment Type : Follow-up Appointment

Referral Letter : Click to Upload

Section/Facility : Cardiologist (Heart & Blood Vessels)

Select Date and Time

Time zone : Kuching, Sarawak (GMT+8)

25 July 2025

08:00 AM

10:00 PM

10:00 AM

Book Appointment

Figure 4.30. Doctor Book Appointment page.

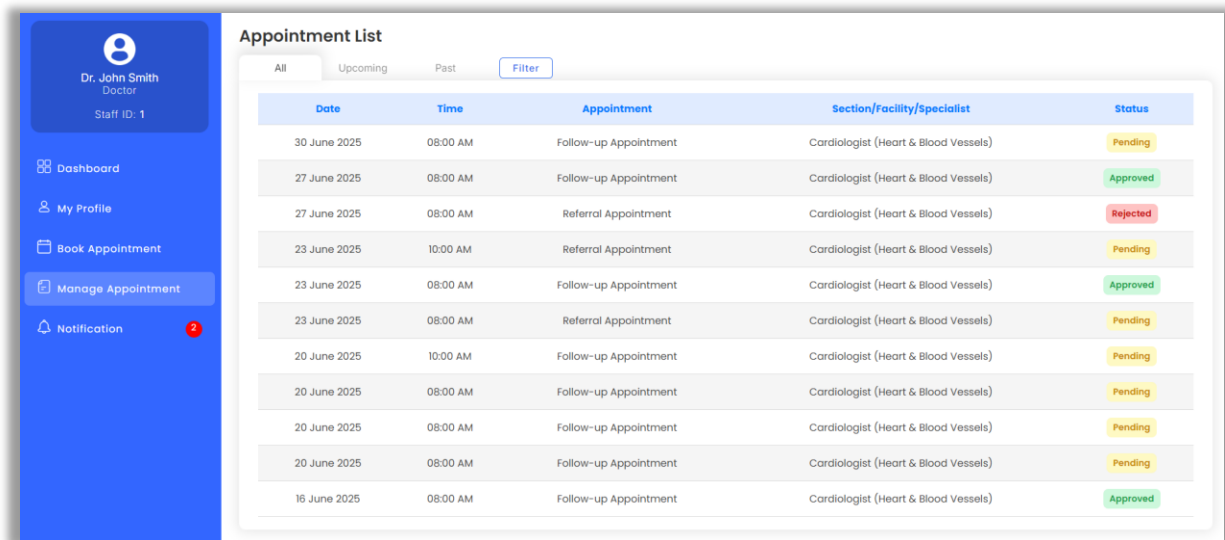
The figure 4.30 illustrates the Book Appointment page designed for doctors to schedule appointments for patients. This page allows doctors to directly handle appointment bookings which will make sure accurate patient information and streamlined scheduling within the system.

At the top of the page, there is an input field where the doctor is required to enter the patient's MyKad number. Once the number is entered, the system will automatically verify whether the MyKad exists in the system database. If the MyKad number is valid and matches an existing patient record, the system will automatically display the patient's name in the designated input field. This name field is non-editable so that the information remains accurate and consistent with the registered patient data.

After the patient's identity is confirmed, the doctor can proceed to fill in the required details for booking the appointment. These details may include selecting the appointment section, appointment type, and other relevant information. For referral appointments, an additional option is provided where the doctor can upload a referral letter to support the appointment request.

To finalise the booking, the doctor can select a preferred date and choose an available time slot from the system. This structured approach ensures that appointments are scheduled accurately and efficiently, reducing the risk of errors and enhancing the overall appointment management process.

4.4.3.3 Appointment Management



Date	Time	Appointment	Section/Facility/Specialist	Status
30 June 2025	08:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Pending
27 June 2025	08:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
27 June 2025	08:00 AM	Referral Appointment	Cardiologist (Heart & Blood Vessels)	Rejected
23 June 2025	10:00 AM	Referral Appointment	Cardiologist (Heart & Blood Vessels)	Pending
23 June 2025	08:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved
23 June 2025	08:00 AM	Referral Appointment	Cardiologist (Heart & Blood Vessels)	Pending
20 June 2025	10:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Pending
20 June 2025	08:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Pending
20 June 2025	08:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Pending
20 June 2025	08:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Pending
16 June 2025	08:00 AM	Follow-up Appointment	Cardiologist (Heart & Blood Vessels)	Approved

Figure 4.31. Appointment List page.

The figure 4.31 illustrates the Doctor Appointment Record page, which allows doctors to view and manage appointments that they are directly assigned to. This page follows a layout and structure similar to the Patient Appointment Record and Nurse Appointment Record pages, providing a consistent and familiar interface across user roles.

The key difference on this page is that the appointments listed are specifically those where the logged-in doctor is assigned. This ensures that each doctor has quick access to view, track, and manage only the appointments they are responsible for, helping them stay organised and prepared for upcoming consultations.

Similar to the other versions of the appointment record page, this page includes tabs at the top (All, Upcoming, Past) to filter appointments based on their timeline. There is also a Filter button, allowing the doctor to further filter the appointments by status, type, section/facility, and date.

The main table displays key details for each appointment, such as the appointment type, section/facility, date, time, and status, with color-coded status indicators for easy identification (e.g., green for Approved, blue for Change Requested, yellow for Pending).

This page provides doctors with a clear and organised view of their assigned appointments, supporting efficient scheduling, preparation, and patient management within the healthcare system.

4.4.4 System Administrator Module

4.4.4.1 Staff Management

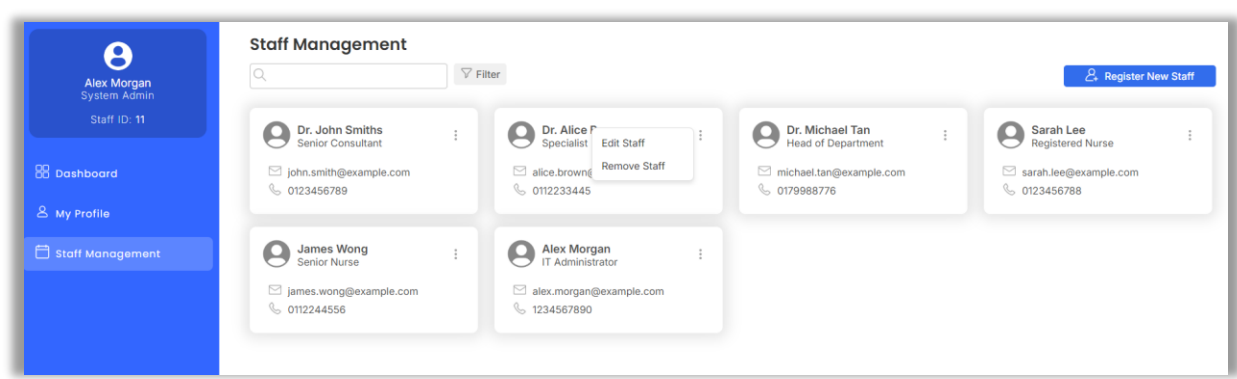


Figure 4.32. Staff Management page.

The figure 4.32 illustrates the Staff Management page, which is accessible by the system administrator to manage all staff members registered in the system. This page displays a list of staff in the form of individual profile cards, where each card presents essential details such as the staff member's name, email, section or division, and contact information. This card-based layout provides a clear and organised view, making it easy for the admin to quickly identify and manage staff members.

At the top of the page, there is a search bar and filter option that allow the admin to search for staff by typing any relevant keyword or applying specific filters to narrow down the search results, making it convenient to locate a particular staff member.

Each profile card also features a three-dot button (⋮) that provides additional options when clicked. The admin can choose to Edit Staff, which will navigate to the Edit Staff page (as shown in Figure 4.25) where staff information can be updated, or Remove Staff, which triggers a confirmation prompt to ensure that the staff member is only removed after deliberate confirmation. This helps prevent accidental deletions.

In the top right corner of the page, there is a Register New Staff button. When clicked, the system navigates to the Register New Staff page (as shown in Figure 4.27), where the admin can add new staff members to the system by providing the necessary information. Overall, this page provides a user-friendly and efficient way for administrators to manage staff records within the system.

4.4.4.2 Edit Staff Profile

The screenshot shows the 'Edit Profile' page for a system administrator. The left sidebar is blue and contains the user's name 'Alex Morgan', title 'System Admin', and 'Staff ID: 11'. Below this are links for 'Dashboard', 'My Profile', and 'Staff Management'. The main content area is white and titled 'Edit Profile'. It is divided into three sections: 'Personal Details', 'Contact Information', and 'Professional Information'. Each section contains input fields for staff details. A 'Save Changes' button is at the bottom right.

Personal Details		
Full Name	Staff ID	
Dr. John Smiths	1	
Date of Birth	Age	Gender
05/20/1984	40	Male

Contact Information	
Phone Number	Email
0123456789	john.smith@example.com
Emergency Contact	Emergency Contact Relationship
0198765432	Wife

Professional Information		
Role	Position	Division
Doctor	Senior Consultant	Cardiologist (Heart & Blood V
Specialization	Qualification	
Cardiology	MBBS, MD (Internal Medicine)	

Save Changes

Figure 4.33. Admin Edit Staff Profile page.

Figure 4.33 displays the “Edit Staff Information” page in the system. This interface allows administrators to update existing staff details and is divided into three main sections: Personal Info, Contact Info, and Professional Info. Each section contains input fields that are pre-filled with the staff’s current information, enabling administrators to easily review and modify the data as needed.

All input fields are editable, allowing changes to details such as name, phone number, email, and job role. Once any updates are made, clicking the “Save Changes” button triggers a pop-up confirmation box (as shown in Figure 4.26), which clearly lists all the fields that have been modified. This confirmation step helps ensure accuracy and gives the admin an opportunity to review the changes before finalizing the update.

4.4.4.3 Confirmation on Changes

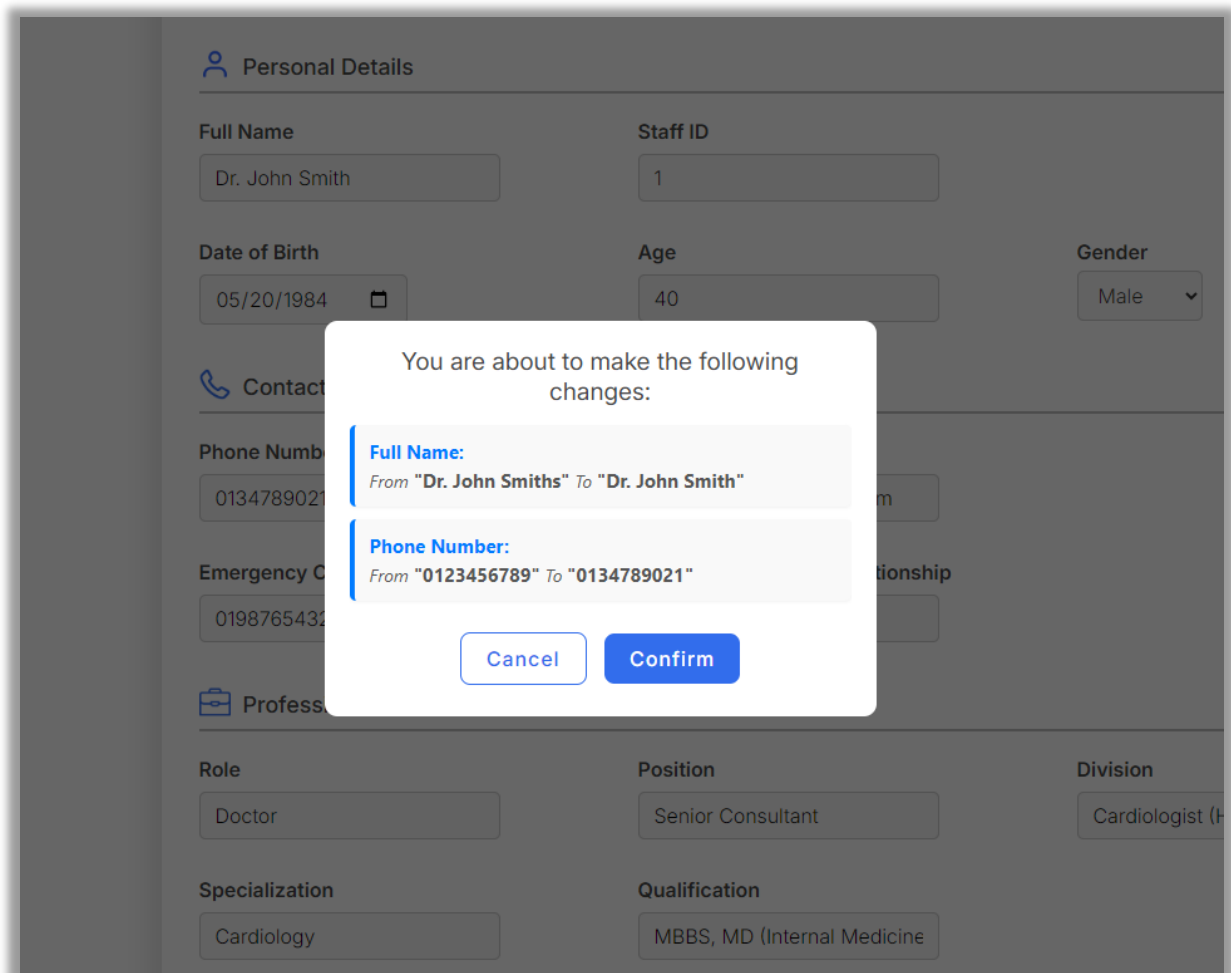


Figure 4.34. Changes confirmation pop up.

Figure 4.34 shows the confirmation pop-up that appears after editing staff information. This pop-up is displayed when the administrator clicks the “Save Changes” button on the Edit Staff Information page. It provides a summary of the fields that have been modified which allow the system administrator to review the changes before they are applied.

For each field that is being updated, the pop-up shows both the original (current) information and the new value entered by the system administrator. This ensures transparency and helps prevent accidental changes. Once the admin confirms the listed changes by clicking the “Confirm” button, the system will proceed to update the staff information in the database accordingly.

4.4.4.4 Register New Staff

The screenshot shows a web application interface for staff registration. On the left is a blue sidebar with a user profile for 'Alex Morgan, System Admin, Staff ID: 11' and navigation links for 'Dashboard', 'My Profile', and 'Staff Management'. The main content area is titled 'Patient First-Time Registration' and contains three sections: 'Personal Details' with fields for Full Name, Date of Birth, Age, and Gender; 'Contact Information' with fields for Phone Number, Email, Emergency Contact, and Emergency Contact Relationship; and 'Professional Information' with dropdowns for Role and Section, and text fields for Specialisation and Qualification. A 'Confirm' button is at the bottom right.

Figure 4.35. Admin Register New Staff page.

Figure 4.35 displays the “Register New Staff” page used by administrators to add new staff members to the system. The form is organised into three sections: Personal Information, Contact Information, and Professional Information. Each section contains input fields for relevant details such as full name, MyKad number, phone number, email, role, and department or section.

Once the administrator has filled in all the required information, clicking the “Confirm” button at the bottom will complete the staff registration process. Upon confirmation, the new staff member’s details will be saved into the system and added to the staff list for further access and management.

4.5 Summary

In this chapter, the implementation of the Appointment Management System for PKP UNIMAS was carried out. This involved developing the user interface and system functionalities for four key user roles: patients, nurses, doctors, and system administrators. Each module was implemented according to the system requirements and design specifications. The Patient Module enables appointment request, registration, and referral letter uploads. The Nurse Module allows staff to manage appointment requests, register first-time patients, and set available time slots. The Doctor Module facilitates appointment bookings on behalf of patients and allows review of referral details. The Admin Module supports staff registration and profile management. This chapter documents the actual system development based on the earlier design and requirements phase.

Chapter 5 : TESTING

5.1 Introduction

This chapter discusses the testing phase conducted to ensure that the system functions as intended and meets user requirements. The testing activities are divided into functional and non-functional testing. Functional testing focuses on validating specific features, while non-functional testing evaluates performance attributes such as reliability, usability, and system behaviour under various conditions. The goal is to identify and fix any issues before deployment.

5.2 Functional Testing

Functional testing involves verifying that each feature of the system works according to the defined requirements. Each function was tested by providing appropriate inputs and checking whether the output matched the expected results. Features tested include user registration, appointment request, login authentication, notification display, and role-based access. This ensures that all system functionalities operate correctly and consistently

Table 5.1. Functional testing for Create Account.

Module	Create Account							
Test Objective	To verify that only physically pre-registered patients can create an account by validating their MyKad number against the system database.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F001	To check if a registered patient can create an account	1) Patient enters valid MyKad 2) Click “Register” 3) System matches MyKad in database 4) Prompt to set password	Valid registered MyKad	System allows patient to continue registration	As expected	Pass	None	
F002	To check if system rejects unregistered MyKad	1) Unregistered patient enters MyKad. 2) Click “Register”	Invalid MyKad(not in database)	System shows error: “Please register physically at PKP UNIMAS”	As expected	Pass	None	

Table 5.2. Functional testing for Patient Login.

Module	Patient Login							
Test Objective	To verify that patients can log in using valid MyKad and access their dashboard.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F003	Login with correct credentials	1) Enter valid MyKad & password 2) Click “Login”	Valid login	Redirected to dashboard	As expected	Pass	None	
F004	Login with wrong credentials	1) Enter incorrect password 2) Click “Login”	Invalid login	Error message shown	As expected	Pass	None	

Table 5.3. Functional Testing for Request Appointment.

Module	Request Appointment							
Test Objective	To test the appointment request functionality							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F005	Patient requests follow-up appointment	1) Login 2) Select follow-up appointment 3) Choose slot 4) Confirm	Valid info	Appointment request sent	As expected	Pass	None	
F006	Patient uploads referral letter	1) Select referral appointment 2) Upload PDF 3) Submit	Valid file	File uploaded & request submitted	As expected	Pass	None	

Table 5.4. Fucntional testing for View Appointment Records.

Module	View Appointment Records							
Test Objective	To verify patient can view their appointment records							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F007	View appointment records	1) Login 2) Go to appointment record page	User session	List of all, past & upcoming appointments	As expected	Pass	None	

Table 5.5. Functional testing for Edit Profile.

Module	Edit Profile							
Test Objective	To ensure patients can update their contact details							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F008	Update contact information	1) Login 2) Go to profile 3) Edit and save	New email/phone	Profile updated in database	As expected	Pass	None	

Table 5.6. Functional testing for Receive Notifications.

Module	Receive Notification							
Test Objective	To verify that notification messages are correctly delivered to the respective users (patient, nurse, doctor) in the system and through email.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F009	To check in-system notification when patient request an appointment.	1) Patient logs in. 2) Fill in appointment details. 3) Submit appointment request.	Valid appointment request	Nurse receives notification in system				
F010	To check in-system and email notification when appointment is approved	1) Patient submits appointment 2) Nurse approves it	Valid appointment request	Patient receives: 1) Notification in system 2) Email confirmation	As expected	Pass	None	
F011	To check in-system and email reminder before appointment	1) Appointment is scheduled 2) Wait for reminder trigger (e.g., 1 day before)	Valid patient information and appointment date	Patient receives reminder via email.	As expected	Pass	None	
F012	To check notification content accuracy	3) Generate sample status (e.g., "Change Requested")	Status: "Change Requested"	Email and in-system message match status and include reason	As expected	Pass	None	

Table 5.7. Functional testing for Staff Login.

Module	Staff (Doctor, Nurse, System Administrator) Login							
Test Objective	To verify that only physically pre-registered patients can create an account by validating their MyKad number against the system database.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F013	Login with valid staff credentials	1) Enter valid staff ID and password 2) Click “Login”	Valid staff credentials	Redirected to correct dashboard (based on role)	As expected	Pass	None	
F014	Login with incorrect credentials	1) Enter wrong credentials 2) Click “Login”	Invalid staff credentials	System shows error.	As expected	Pass	None	
F015	Login with inactive staff account	1) Use staff ID flagged as inactive	Inactive account	System shows error.	As expected	Pass	None	

Table 5.8. Functional testing for Book Appointment.

Module	Book Appointment							
Test Objective	To check if a doctor can book appointment for a patient							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F016	Doctor books appointment	1) Login 2) Enter patient MyKad 3) Select follow-up appointment 4) Select section or facility 5) Select available slot 6) Confirm	Valid info	Appointment created	As expected	Pass	None	

Table 5.9. Functional testing for Manage Appointment Request.

Module	Manage Appointment Request							
Test Objective	To verify that the nurse can view, approve, reject, and manage appointment requests.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F017	To check if nurse can view appointment requests in their section	1) Nurse logs in. 2) Navigate to the appointment management page.	Section ID	Only requests from that section shown.	As expected	Pass	None	
F018	To check if doctor can view appointment list that is assigned to them.	1) Doctor navigates to the appointment request list.	Staff ID	Only appointment that is assigned to the doctor shown.	As expected	Pass	None	
F019	To check if nurse can approve appointment request	1) Nurse opens appointment request 2) Click "Approve"	Status=Approved	Appointment status updated to "Approved" and notification sent to patient in-system and through email.				
F020	Nurse rejects appointment with reason	1. Click Reject 2. Enter reason 3. Submit	Valid reason	Status: Rejected, Patient notified	As expected	Pass	None	

Table 5.10. Functional testing for Register First Time Patient.

Module	Register First Time Patient							
Test Objective	To verify nurse can register new walk-in patients							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F021	To check if nurse can register a new patient	1) Login 2) Navigate to patient registration page 3) Enter required patient information 4) Submit	Full name, MyKad, gender, date of birth, phone number, email, emergency contact, emergency contact relationship, height, weight, blood type, penicillin allergy and reaction.	Patient information saved in the database. Patient now eligible to create account in the system.	As expected	Pass	None	
F022	To check validation for duplicate MyKad	Nurse tries to register a patient with existing MyKad	Existing MyKad number	System shows error message: "Patient already exists"	As expected	Pass	None	

Table 5.11. Functional testing for Manage Available Slots.

Module	Manage Available Slots							
Test Objective	To verify that nurses can add, view, and remove available appointment slots for section and day.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F023	To check if nurse can add available slots	1) Go to slot management 2) Select section and day. 3) Add time slot 4) Save	Valid section, date, time slot	The available slot for that section is updated in the database.	As expected	Pass	None	
F024	To check if nurse can view existing slots	1) Go to slot management 2) Select section and day.	Valid section and day.	Existing time slots are displayed.	As expected	Pass	None	
F025	To check if nurse can delete an available slot	1) Go to slot management 2) Select section and day. 3) Click remove button.	Valid section and day.	Slot removes from database.	As expected	Pass	None	

Table 5.12. Functional testing for Register New Staff.

Module	Register New Staff							
Test Objective	To allow admin to add a new doctor, nurse, or admin							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F026	Admin registers staff	1) Admin logs in 2) Go to registration form 3) Enters required staff information 4) Submit	Valid staff information	Staff information saved in database.	As expected	Pass	None	
F027	Admin removes existing staff	1) Select staff or search for staff ID 2) Click "Remove".	Valid staff ID	Staff contract marked as expired.				

Table 5.13. Functional testing for Edit Staff Profile.

Module	Edit Staff Details							
Test Objective	To verify admin can update staff information							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
F028	Admin edits staff	1) Login 2) Open staff list 3) Edit information 4) Save	Updated staff data	Data saved into the database.	As expected	Pass	None	

5.3 Nonfunctional testing

Non-functional testing focuses on evaluating how the system performs rather than what it does. This includes tests for reliability, usability and efficiency. These tests ensure the system is stable, user-friendly, and capable of functioning under different conditions without failure or data loss.

5.3.1 Reliability testing

Reliability testing assesses the system's ability to perform its functions without failure over a specific period. The system was tested for consistent behaviour under repeated actions, such as multiple appointment bookings, login attempts, and notification handling. The results showed that the system maintains stability and data integrity throughout, with no crashes or unexpected behaviour observed during extended use.

Table 5.14. Reliability testing on Patient and Staff Login.

Module	Login (Patient and Staff)							
Test Objective	To verify that the login functionality for patients and staff consistently accepts valid credentials, rejects invalid ones, and maintains system stability under repeated.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R001	To verify patient login can handle multiple consecutive login attempts.	Perform 10 logins with valid and invalid MyKad	Valid and invalid MyKad number	All valid logins succeed, invalid ones show error	As expected	Pass	None	
R002	To verify staff login can handle multiple sessions from different users.	Login repeatedly with different staff ID	Staff ID	Sessions handled correctly without error	As expected	Pass	None	

Table 5.15. Reliability testing on Request Appointment.

Module	Request Appointment							
Test Objective	To ensure that patients can make up to 5 active appointment requests reliably, and that the system prevents and handles excessive or malicious requests with appropriate error handling and user guidance.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R003	To verify that patients can book up to 5 appointments without issues	Patient logs in and submits 5 valid appointment requests (one after another).	Valid appointment request details.	All 5 appointments saved in the system successfully	As expected	Pass	None	
R004	To verify that the system blocks malicious booking beyond 5 active appointments	Patient tries to request a 6th appointment while 5 are still pending/approved	Valid appointment request details.	System blocks request and shows error pop-up: "Too many active appointments. Please contact PRIMA."	As expected	Pass	None	

Table 5.16. Reliability testing on Book Appointment.

Module	Book Appointment							
Test Objective	To ensure that doctors can reliably book appointments for patients and the system maintains data integrity across multiple entries.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R005	To verify that doctors can book multiple appointments for different patients	Doctor logs in and books 10+ appointments	Valid appointment request details and patient MyKad.	Appointments stored with correct doctor-patient linkage	As expected	Pass	None	
R006	To verify that doctor bookings update system availability properly.	Book same slot for multiple patients (conflict test)	Valid appointment request details.	System prevents overlapping booking and shows error.	As expected	Pass	None	

Table 5.17. Reliability testing on Manage Appointment Request.

Module	Manage appointment request							
Test Objective	To validate that nurses can manage a high number of appointment requests (approve, reject, assign) without system issues or data corruption.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R007	To verify the nurse can approve and reject multiple appointment requests in a session	Process 20+ requests under one section	Appointment request.	Each request handled without failure	As expected	Pass	None	
R008	To verify status updates, function reliably under repeated nurse actions	Perform repeated approvals/rejections on multiple patients	Appointment request.	Status updates consistently in DB	As expected	Pass	None	

Table 5.18. Reliability testing on Receive Notification.

Module	Receive Notification							
Test Objective	To confirm that the system reliably generates and displays notifications for users and updates read status correctly, even under repeated or simultaneous activity.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R009	To verify the system can generate and display a high volume of notifications	Trigger 50+ notifications across patient, nurse, doctor		All notifications appear and read flags work	As expected	Pass	None	
R010	To verify simultaneous notifications are correctly delivered to staff roles	Trigger notification to nurse and doctor through patient request → approval	Appointment request.	Notifications delivered based on role logic	As expected	Pass	None	

Table 5.19. Reliability testing on Manage Available Slot.

Module	Manage Available Slot							
Test Objective	To ensure that nurses can reliably manage time slots — including adding and removing them — repeatedly without creating overlaps, losing data, or affecting appointments.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R011	To verify the nurse can add and delete multiple time slots without issue.	Perform 30+ add/delete slot actions	Section ID, day and time slot.	Slot list updates correctly each time	As expected	Pass	None	
R012	To verify slot integrity during concurrent operations	Book an appointment while editing slots	Section ID, day and time slot.	System processes both correctly	As expected	Pass	None	

Table 5.20. Reliability testing on Register First-time Patient.

Module	Register First-Time Patient							
Test Objective	To ensure that the nurse can register multiple first-time patients reliably, and that the system prevents duplication based on MyKad.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R013	To verify that the nurse can register multiple first-time patients without failure	Nurse logs in and registers 10 different patients with valid MyKad numbers	Section ID, day and time slot.	Each patient is saved successfully in the database	As expected	Pass	None	
R014	To verify that the system prevents duplicate patient registration	Nurse tries to register the same MyKad twice	Section ID, day and time slot.	System blocks second attempt and shows error message	As expected	Pass	None	

Table 5.21. Reliability testing on Create Account.

Module	Create account							
Test Objective	To ensure that only pre-registered patients (added by nurse) can create accounts, and that account creation is consistently successful when valid MyKad is provided.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R015	To verify that a pre-registered patient can create an account using their MyKad	Patient enters valid MyKad that exists in the database	Section ID, day and time slot.	System allows patient to create account and sets login credentials	As expected	Pass	None	
R016	To verify that unregistered patients cannot create an account	Patient enters MyKad not found in database.	Section ID, day and time slot.	System blocks account creation and shows error message	As expected	Pass	None	

Table 5.22. Reliability testing on Register New Staff.

Module	Register New Staff							
Test Objective	To verify that the staff registration module can consistently handle valid and invalid input over repeated attempts without crashing or data corruption.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
R017	To verify the system can handle multiple consecutive staff registrations with valid data	Perform 10 consecutive staff registrations with unique valid data	Valid name, role, email, phone number, department	All 10 registrations succeed without error	As expected	Pass	None	
R018	To verify the system rejects incomplete or invalid data during registration	Attempt staff registration with missing or incorrect data (e.g., empty name, invalid email)	Invalid name, invalid email format, missing role	System displays appropriate error messages and prevents registration	As expected	Pass	None	

5.3.2 Usability Testing

5.3.2.1 Usability Testing for Patient

Table 5.23. Usability testing for Patient.

Test ID	Test Case Description	Test Procedure	Expected Result	Actual Result	Status
PAT-UT001	Patient account creation process	1) Access account creation page 2) Enter MyKad 3) Create password 4) Receive OTP 5) Enter OTP 6) Submit form	Patient completes registration without confusion or needing assistance	As expected	Pass
PAT-UT002	Patient login process	1) Access login page 2) Enter MyKad & password 3) Submit	Patient logs in smoothly and navigate immediately to their dashboard	As expected	Pass
PAT-UT003	Request appointment	1) Login 2) Navigate to appointment page 3) Request an appointment 4) Submit request	Patient successfully requests appointment easily without hesitation.	As expected	Pass
PAT-UT004	Upload referral letter	1) Select referral appointment 2) Upload file 3) Submit	Patient uploads referral letter confidently and understands file selection process.	As expected	Pass

PAT-UT005	View notifications	1) Patient logs in. 2) Go to notification page.	Patient sees clear and understandable notifications about appointment status	As expected	Pass
PAT-UT006	Update profile	1) Go to profile page. 2) Update contact information.	Patient easily updates profile with no confusion	As expected	Pass
PAT-UT007	View appointment record and details	1) Patient logs in. 2) Navigate to “Appointment Records” . 3) Click to view appointment details.	Patient views appointment records easily with clear information on date, time, section, and status.	As expected	Pass

5.3.2.2 Usability Testing for Doctor

Table 5.24. Usability testing for Doctor.

Test ID	Test Case Description	Test Procedure	Expected Result	Actual Result	Status
DOC-UT001	Doctor login process	1) Access login page 2) Enter Staff ID and password 3) Submit	Doctor logs in smoothly and reaches the doctor dashboard without confusion	As expected	Pass
DOC-UT002	Book appointment for patient	1) Navigate to "Book Appointment" 2) Enter patient MyKad 3) Select appointment type, section/facility, date, and time 4) Submit	Doctor books appointment easily with clear steps and confirmation	As expected	Pass
DOC-UT003	View referral letters	1) Open pending appointment list 2) Open uploaded referral letters	Doctor views referral letters clearly without loading issues or display errors	As expected	Pass
DOC-UT004	View appointment records of patients	1) Search patient by MyKad 2) View full appointment history	Doctor sees complete and accurate appointment record of patient with details	As expected	Pass
DOC-UT005	View notifications	1) Doctor logs in 2) Navigate to notification panel	Doctor sees clear and informative notifications related to appointments and approvals	As expected	Pass

DOC-UT006	Manage appointment requests (approve, reject, change requested)	1) Doctor logs in 2) Navigate to pending requests 3) Review referral & appointment details 4) Select action: approve, reject, or request changes	Doctor manages appointment requests easily with clear options for each action	As expected	Pass
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5.3.2.3 Usability Testing for Nurse

Table 5.25. Usability testing for Nurse.

Test ID	Test Case Description	Test Procedure	Expected Result	Actual Result	Status
NUR-UT001	Nurse login process	1) Access login page 2) Enter Staff ID and password 3) Submit	Nurse logs in successfully and reaches nurse dashboard easily	As expected	Pass
NUR-UT002	Approve appointment request	1) Open pending appointment requests 2) Review appointment details 3) Click “Approve”	Nurse approves appointment successfully with clear confirmation	As expected	Pass
NUR-UT003	Reject appointment request	1) Open pending appointment requests 2) Review appointment details 3) Click “Reject” 4) Provide rejection reason	Nurse rejects appointment successfully with proper reason entry	As expected	Pass

NUR-UT004	Request changes for appointment request	1) Open pending appointment requests 2) Review appointment details 3) Click “Request Changes” 4) Provide change details	Nurse requests changes with clear instructions to patient	As expected	Pass
NUR-UT005	Manage available slots	1) Navigate to "Manage Available Slots" 2) Select section/facility 3) Select available time slots 4) Save changes	Nurse manages available slots easily with clear interface	As expected	Pass
NUR-UT006	Register first-time patient	1) Navigate to "Register First-Time Patient" 2) Input patient MyKad and details 3) Submit	Nurse registers new patient smoothly with no confusion	As expected	Pass
NUR-UT007	View notifications	1) Nurse logs in 2) Open notification panel	Nurse views all relevant appointment notifications clearly	As expected	Pass
NUR-UT008	View appointment records and details	1) Navigate to appointment records page 2) Search patient 3) View appointment history and details	Nurse views complete and accurate appointment records easily	As expected	Pass

5.3.2.4 Usability Testing for System Administrator.

Table 5.26. Usability testing for System Administrator.

Test ID	Test Case Description	Test Procedure	Expected Result	Actual Result	Status
ADM-UT001	Admin login process	1) Access login page 2) Enter Staff ID and password 3) Submit	Admin logs in successfully and reaches admin dashboard easily	As expected	Pass
ADM-UT002	Register new staff	1) Navigate to "Register New Staff" 2) Input staff details (name, role, department, contact) 3) Submit registration	Admin registers new staff smoothly without confusion	As expected	Pass
ADM-UT003	Edit staff information	1) Search staff profile 2) Edit staff details 3) Save changes	Admin updates staff information easily with proper confirmation	As expected	Pass

5.3.3 Efficiency Testing

Table 5.27. Efficiency testing on Patient Login.

Module	Patient Login							
Test Objective	To test the response time of login process.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E001	Check response time of login	1) Enter valid MyKad and password 2) Click login button	Valid login credentials	System will load dashboard within 3 seconds	As expected	Pass	None	

Table 5.28. Efficiency testing on Patient Edit Profile.

Module	Edit Profile							
Test Objective	To test the response time when updating patient profile details.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E002	Check response time of editing profile	1) Navigate to profile page 2) Edit fields 3) Click save	Updated profile info	Changes saved and confirmation shown within 3 seconds	As expected	Pass	None	

Table 5.29. Efficiency testing Staff Login.

Module	Staff Login							
Test Objective	To test the response time of login process.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E003	Check response time of staff login	1) Enter Staff ID and password 2) Click login button	Valid login credentials	System authenticates and loads staff dashboard within 3 seconds	As expected	Pass	None	

Table 5.30. Efficiency testing on Request Booking.

Module	Request Booking							
Test Objective	To test the time required to submit an appointment request							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E004	Check response time for appointment request submission	1) Select appointment date, time, section 2) Submit request	Appointment details	System processes and submits request within 3 seconds	As expected	Pass	None	
E005	Check upload time for referral letter	1) Select referral file (~1MB PDF) 2) Upload file	Referral letter (PDF file)	System uploads file within 5 seconds				
E006	Handle multiple concurrent bookings	Simulate 20 patients booking simultaneously	20 concurrent requests	System handles requests without crash or slowdown				

Table 5.31. Efficiency testing on Receive Notification.

Module	Receive Notification							
Test Objective	To test notification delivery time							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E007	Check time taken to send notification	1) System triggers appointment reminder 2) Observe email delivery	10 reminders triggered	Notifications delivered within 60 seconds	As expected	Pass	None	

Table 5.32. Efficiency testing on Appointment Records.

Module	Appointment Records							
Test Objective	To test retrieval speed of appointment records							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E008	Check loading time of appointment records	1) Patient logs in 2) Navigate to appointment history	Appointment data (50+ records)	Appointment history loads within 3 seconds	As expected	Pass	None	

Table 5.33. Efficiency testing on Register First-time Patient.

Module	Register First-time Patient							
Test Objective	To test the response time of patient registration							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E009	Check response time of patient registration	1) Access registration page 2) Fill in MyKad and personal details 3) Submit form	Valid patient data	Registration is processed saved into the database in 2 seconds.	As expected	Pass	None	

Table 5.34. Efficiency testing on Create Account.

Module	Create Account							
Test Objective	To test the response time of patient account registration.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E010	Check response time of patient registration	1) Patient enters valid MyKad 2) Click “Register” 3) System matches MyKad in database 4) Prompt to set password	Valid registered MyKad	System allows patient to continue registration process.	As expected	Pass	None	

Table 5.35. Efficiency testing on Edit Staff Details.

Module	Edit Staff Details							
Test Objective	To test the response time of updating staff profile by admin.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E011	Check response time for editing staff details	1) Search for staff 2) Edit details 3) Click save	Updated staff info	Staff details updated within 3 seconds	As expected	Pass	None	

Table 5.36. Efficiency testing on Manage Appointment Request.

Module	Manage Appointment Request							
Test Objective	To test the response time for approving or rejecting appointment							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E012	Check response time of managing appointment requests	1) Open request 2) Click approve/reject 3) Submit	Appointment request with patient info	Request processed and feedback sent within 3 seconds	As expected	Pass	None	

Table 5.37. Efficiency testing on Manage Available Slot.

Module	Manage Available Slot							
Test Objective	To test the response time of saving available slots.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E013	Check response time for saving available slots	1) Select section 2) Choose day and time slots 3) Save	Section and slot data	Slots saved to system within 3 seconds	As expected	Pass	None	

Table 5.38. Efficiency testing on Booking Appointment.

Module	Booking Appointment							
Test Objective	To test the response time of the doctor's appointment booking process							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E014	Check response time of booking appointment	1) Enter patient MyKad 2) Select type and time slot 3) Submit booking	Valid appointment data	Appointment booked and confirmation shown within 3 seconds	As expected	Pass	None	

Table 5.39. Efficiency testing on Register New Staff.

Module	Register New Staff							
Test Objective	To test the response time of registering a new staff member.							
Test ID	Test Case	Test Procedure	Input Data	Expected Result	Actual Result	Status (Pass/Fail)	Summary of Defect	Comment
E015	Check response time of registering new staff	1) Navigate to staff registration page 2) Fill in staff details 3) Click register	Valid staff details (name, ID, department, role, contact info)	Staff successfully added within 3 seconds	As expected	Pass	None	

5.4 User Acceptance Testing (UAT)

User Acceptance Testing (UAT) was conducted to evaluate the system's readiness for deployment by validating its functionalities from the end users' perspective. The main purpose of UAT is to ensure that the system meets user requirements, works as intended in real-world conditions, and is user-friendly for all types of users involved in the system.

The UAT was carried out using scenario-based testing, where actual users from different roles — patients, nurses, doctors, and administrators — were asked to perform a set of tasks simulating real usage of the Appointment Management System. These tasks cover the complete workflow of the system including patient registration, appointment booking, referral upload, appointment approval, staff management, and other key functions.

The testing scenarios were delivered through a Google Form, where participants followed detailed instructions for each task. After completing each scenario, participants indicated whether they successfully completed the task (Pass/Fail) and provided comments or identified any issues encountered.

The purpose of conducting UAT is to:

- Verify that the system meets all functional requirements.
- Identify any remaining issues from the users' perspective.
- Ensure that the system is ready for operational use.
- Gain feedback for further system improvement if necessary.

This approach allowed systematic collection of feedback directly from users which ensure that the Appointment Management System functions as intended and provides a positive user experience.

5.4.1 Respondent

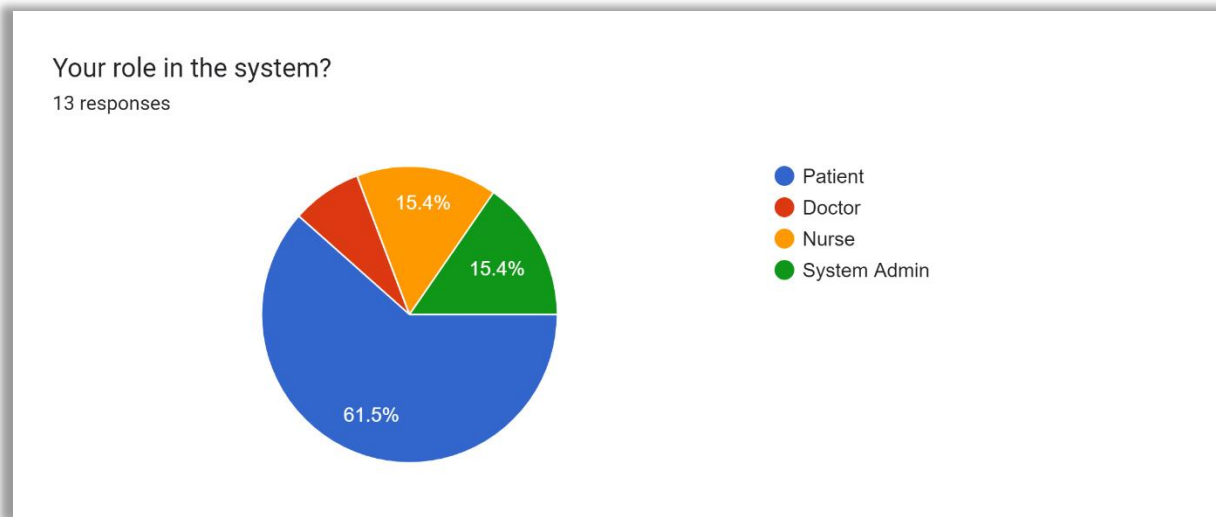


Figure 5.1. Pie chart of the distribution of user roles who participated in the User Acceptance Testing (UAT).

The figure 5.1 illustrates the distribution of user roles who participated in the User Acceptance Testing (UAT) for the Appointment Management System, based on a total of 13 responses. Eight patients, two nurses, two system administrator and a doctor consist of the respondents. This balanced involvement from various user roles ensures that the system was evaluated from multiple perspectives, including those who manage, use, and administer the system.

5.4.2 Test Scenario

Table below shows the test scenario conducted during the UAT.

Table 5.40. Test scenario list for the UAT.

Scenario ID	Test Scenario	Test Step	Google Form Question
P1	Register Account	If you are a physically registered patient, try to create your account in the system using your MyKad.	Did you successfully create your account?

P2	Login to System	Login using your MyKad and password.	Did you successfully login?
P3	Request Appointment	Request an appointment by selecting section, date, and time.	Did you successfully request an appointment?
P4	Upload Referral Letter	Select Referral Appointment and upload your referral letter when requesting an appointment.	Was the referral letter uploaded successfully?
P5	View Appointment Records & Details	Go to Appointment Records and view details.	Were the records displayed clearly?
P6	View Notifications	Check your notification page	Were the notifications displayed clearly?
P7	Update Profile Information	Update your contact information (phone number or email).	Was your profile updated successfully?
N1	Login to System		Did you successfully login?
N2	Approve Appointment Request	Review and approve pending appointment requests.	Were you able to approve appointments easily?
N3	Reject or Request Changes	Reject or request changes for an appointment request.	Were the options clear and easy to use?
N4	Register New Patient (Physical Registration)	Register a new patient by entering MyKad and personal details.	Was patient registration successful?
N5	Manage Available Slots	Add or edit available appointment slots for a section.	Were you able to manage slots successfully?
N6	Scenario N6: View Notifications	Check your notification panel.	Were the notifications displayed clearly?
D1	Login to System		Did you successfully login?
D2	View Referral Letter		Were the referral letters displayed clearly?

D3	Book Appointment for Patient	Book a follow-up appointment for a patient.	Was booking successful and easy to complete?
D4	Manage Appointment Requests (Approve/Reject/Request Change)		Were you able to manage appointment requests easily?
D5	View Notifications		Were the notifications displayed clearly?
A1	Login to System		
A2	Register New Staff	Add new staff profile into the system.	Was staff registration successful?
A3	Edit Staff Information	Search and update existing staff details.	Were staff details updated successfully?

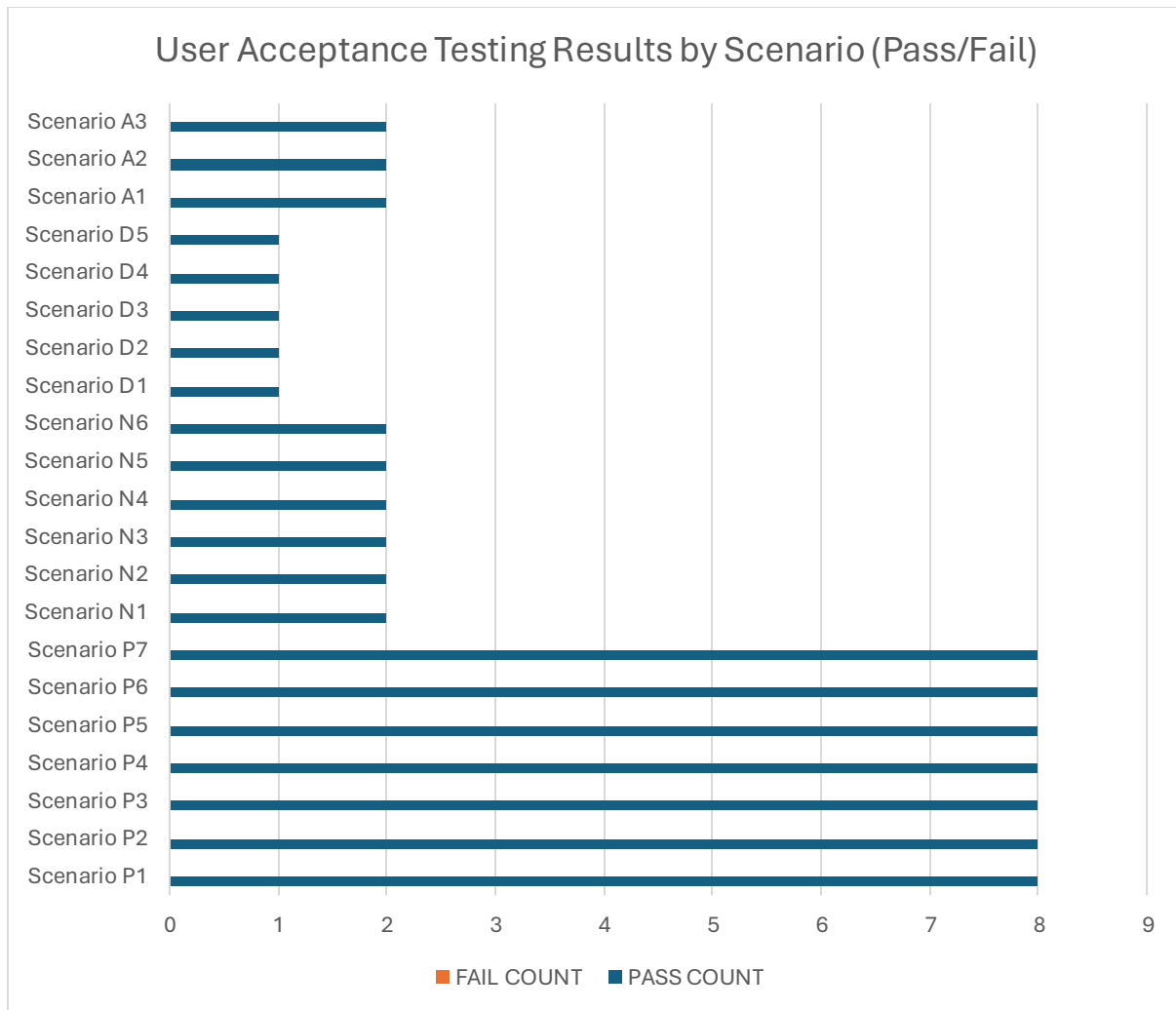


Figure 5.2. UAT result by Scenario(Pass/Fail).

The figure 5.2 shows bar chart titled “User Acceptance Testing Results by Scenario (Pass/Fail)” presents the outcome of scenario-based testing conducted during the user acceptance testing phase. The Y-axis displays the various test scenarios, while the X-axis represents the number of occurrences for each result category, namely Pass Count and Fail Count. The chart uses blue bars to indicate the number of times each scenario was successfully passed and orange bars to show any recorded failures.

From the chart, it is evident that all scenarios tested were successfully passed, as reflected by the presence of Pass Count bars across all scenarios. Additionally, there are no visible Fail Count bars, indicating that no failures were recorded during the testing process.

This demonstrates that the system's functionalities, as defined by each scenario, operated as intended during the user acceptance testing. The chart provides a clear visual summary, offering stakeholders a quick understanding of the positive testing outcomes achieved across all tested scenarios.

5.5 Summary

This chapter covers the testing phase of the system to ensure its functionality and performance meet the project objectives. Functional testing was conducted on all system modules to verify that each feature works as expected with valid and invalid inputs. Non-functional testing was also performed, including reliability testing to check system stability during repeated use, usability testing to assess user-friendliness, and efficiency testing to measure how quickly the system responds to user actions. In addition to these tests, User Acceptance Testing (UAT) was carried out to evaluate the system from the perspective of actual end users, including patients, administrative staff, and doctors. During UAT, users performed specific tasks based on real-world scenarios to determine whether the system met their expectations and requirements. Feedback from UAT participants was positive, with all scenarios tested successfully passed, indicating that the system is functioning correctly, performs reliably, is user-friendly, and is ready for deployment.

Chapter 6 : CONCLUSION AND FUTURE WORK

6.1 Introduction

This chapter summarises the overall project outcomes, highlights the contributions made, addresses limitations encountered during development, and proposes possible future enhancements. It reflects on how well the system met its goals and provides suggestions for continuous improvement.

6.2 Project Achievement

The project successfully fulfilled the key objectives set out during the planning phase. A fully functional Appointment Management System was developed for Pusat Kesihatan PRIMA UNIMAS, allowing patients to book appointments, while staff (nurse, doctor, admin) manage bookings, users, and time slots efficiently. The system also incorporates email and in-system notification features, role-based access, and validation controls.

Table 6.1. Achievement from the Project Objective.

Project Objective	Achievement
To develop a web-based appointment management system to simplify booking, rescheduling, and cancelling appointments.	Successfully developed a responsive web-based system allowing patients and staff to book and cancel appointments easily. Rescheduling was handled through cancellation and rebooking.
To automate scheduling processes to minimise manual errors.	Implemented structured workflows, slot management by nurses, and validation rules (e.g., max 5 appointments per patient) to reduce errors.
To provide healthcare staff with a centralised, real-time system to manage appointments and improve service efficiency.	Created role-based dashboards for nurses, doctors, and admins to manage patient appointments in real time, with in-system and email notifications.

6.3 Contribution

This project contributes to enhancing the operational efficiency of appointment management at Pusat Kesehatan Prima UNIMAS. By digitising the appointment process, the system reduces the dependency on manual scheduling methods, such as walk-ins and phone calls, thereby minimising administrative workload. It improves the patient experience by providing a self-service platform for booking and monitoring appointment status. For staff, it centralises appointment data which allow nurses and doctors to manage appointment in real time. This results in faster response times and better service coordination. Additionally, the system introduces role-based access and dual notification methods (system and email), which support transparency and accountability in managing patient care.

6.4 Project Limitation

Despite achieving its core objectives, the project has several limitations. Firstly, the system restricts patients to a maximum of five active appointments at a time to prevent misuse, which may inconvenience users in specific medical situations. Secondly, appointment rescheduling is handled manually through cancellation and rebooking, as there is no dedicated reschedule function. The system also lacks features such as medical history tracking, prescription records, and consultation notes, which could further support healthcare operations. Additionally, email notifications depend on a stable server and internet connection; no backup communication method like SMS is currently implemented. Finally, the system is designed for a single clinic setup and does not support multi-location or multi-branch healthcare operations.

6.5 Future Work

To enhance the system's functionality and scalability, several improvements are recommended for future development. A rescheduling feature could be added to streamline appointment changes without requiring cancellation. Integration of electronic medical records (EMR) would allow staff to access patient history and prescriptions during appointment handling. Real-time calendar views and drag-and-drop interfaces could be introduced for a more user-friendly experience, particularly for staff managing high volumes of appointments. Additionally, incorporating SMS or WhatsApp notifications would provide a more reliable alternative to email, especially in areas with limited internet connectivity. A mobile application version of the system could also be developed to improve accessibility and convenience for both patients to enable on-the-go appointment request and real-time notifications. Furthermore, integrating the appointment system with the existing PRIMA Information System would allow seamless data sharing, reduce redundancy, and ensure better coordination between administrative and medical operations within the clinic.

6.6 Conclusion

In conclusion, the Appointment Management System developed for Pusat Kesehatan PRIMA UNIMAS meets the primary objectives by streamlining the appointment flow and improving user experience across patients and staff. The project provides a solid foundation for future healthcare-related system enhancements at the university clinic level.

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APPENDIX A : INTERVIEW QUESTIONS WITH DOCTOR

Interview date: 8th January 2025

Interview location: Pusat Kesehatan Prima UNIMAS

A (Interviewer): Elvisfresly Ericky

B (Interviewee): Dr. Dessmon (Doctor at PKP UNIMAS)

A: Have you ever made an appointment booking on behalf of a patient? If yes, can you describe the process and any challenges you faced?

B: Yes, I have. For follow-up appointments, I usually discuss the date and time with the patient immediately after the consultation, considering their availability. If the patient needs a referral to another section, like X-ray, I ask the nurse to arrange it for them. If the section is available, the patient can proceed directly to the facility. However, if it is unavailable, the nurse will later inform the patient by phone once it becomes available. A significant challenge arises when referring patients to specialists, as we often do not know the specialist's availability. This requires making phone calls to inform the patient when they can see the specialist. Additionally, some patients are difficult to contact, which complicates the process.

A: How do you manage patients with referral letters in the current workflow?

B: If a patient has a referral letter, we review the letter first. If no further action is required, the patient can go directly to the referred section or schedule an appointment. In most cases, however, we still conduct a consultation and diagnosis, even if the patient has a referral letter.

A: If a patient wants to change their appointment date, what is the current process for handling this request? Are there any challenges involved?

B: Patients can call us to request a change in their appointment date. However, it is often challenging to communicate with them effectively to rearrange the appointment.

A: Do you think allowing patients to book appointments online through a dedicated system would be helpful in improving the efficiency of the current appointment process? Why or why not?

B: Yes, I believe it would be very helpful. It would simplify and clarify the appointment process, making it more efficient.

A: Would a feature allowing patients to upload referral letters and select appointment slots directly benefit your workflow?

B: Yes, this feature would be very helpful. It would allow us to review referral letters immediately and save patients time and effort by eliminating the need to visit us without knowing whether the procedure can be done immediately or if they need to wait.

A: Do you encounter cases where patients fail to attend their scheduled appointments? How is this managed?

B: Yes, we do encounter such cases. When patients fail to attend their appointments, the nurse follows up with a phone call to remind them.

A: Do you think automated reminders and notifications for upcoming appointments would help reduce missed appointments? Why or why not?

B: Yes, automated reminders and notifications would be very helpful. They would serve as a timely reminder for patients about their appointments and reduce the likelihood of missed appointments.

APPENDIX B : INTERVIEW QUESTIONS WITH NURSE

Interview date: 7th January 2025

Interview location: Pusat Kesehatan Prima UNIMAS

A (Interviewer): Elvisfresly Ericky

B (Interviewee): Puan Rogayah (Staff Nurse at PKP UNIMAS)

A: Do you ever involve in booking an appointment for patient? If yes, what is the process?

B: Yes, we are involved in booking appointments for patients. Typically, we wait for instructions from the doctor. Once instructed, we write down the appointment details, such as the section the patient should go to, along with the date and time

A: How do you manage patient with referral letter?

B: When managing patients with referral letters, we first review the referral letter. If everything is complete and clear with no further action required, the referral can proceed. However, in most cases, the doctor needs to diagnose the patient first, after which the doctor decides on the referral process.

A: How do you communicate with patients when sections or facilities are unavailable?

B: If sections or facilities are unavailable, we inform the patients about the unavailability and let them know that we will call them once the section or facility becomes available.

A: How important would it be to have real-time updates on the availability of sections or facilities?

B: Real-time updates on the availability of sections or facilities are very important. This allows us to quickly book appointments and check availability immediately, making the process more efficient.

A: Do you think automated reminders for upcoming appointments would help reduce missed appointments?

B: Automated reminders for upcoming appointments would be extremely helpful. They would ensure that patients remember their appointment dates and times, reducing the likelihood of missed appointments.

APPENDIX C : TURNITIN REPORT

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