

Mommies Pink Book: Rekod Kesihatan Ibu Digital

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Abstract

The Mommies Pink Book System addresses the challenges faced by traditional maternal healthcare record-keeping methods, such as manual systems prone to errors, limited accessibility, and physical book deterioration. This project proposes a digital solution to revolutionize maternal health records, emphasizing the shift from conventional practices to an Electronic Health Records (EHRs) system. The objective is to design and develop an innovative digital maternal health record system, overcoming the limitations of manual record-keeping. The scope includes login and registration modules, patient's profiles, a digital Pink Book for health data recording, appointment scheduling, educational resources, and health summary reports. The expected results encompass a more organized and accessible maternal health record system, enhanced data accuracy, increased patient engagement, and reduced missed appointments. The methodology adheres to the waterfall approach, focusing on structured development phases, sequential progression, and milestone-based reviews. The application of this system is aimed at Malaysian maternal healthcare, contributing to a more efficient and sustainable healthcare system. The anticipated outcome is a user-friendly, tailored solution that meets the unique needs of healthcare providers and patients, ushering in a new era of digitalized maternal healthcare records.

1. Introduction

There are many challenges in maternal health record keeping such that traditional maternal healthcare has long relied on manual record-keeping systems that involve a book and pen, which unfortunately, causes issues such as lost or forgotten books, human errors, and limited accessibility. Moreover, some individuals have reported that the physical Pink Book tends to deteriorate due to frequent use during appointments with clinics or hospitals [1]. These challenges bring inconvenience to patients and healthcare providers as well as affect the quality of care offered and the integrity of healthcare data. Simultaneously, insights from recent findings stress the importance of Electronic Health Records (EHRs) in advancing healthcare. According to a reputable source [2], EHRs, with their ability to provide accurate, up-to-date, and complete patient information at the point of care, contribute significantly to coordinated and efficient healthcare delivery. Hence, a digital solution is essential. In today's digital age, the need to transition from conventional manual record-keeping to a secure and efficient digital system is more crucial than ever. The Mommies Pink Book is a modern digital tool that modernizes how pregnancy health records are managed in the healthcare of Malaysia. It ensures important medical information of patients is reliable and easy to access. The proposed system is aimed to enhance maternal healthcare records by overcoming the issues associated with the traditional maternal healthcare system.

2. Related Work

This section explains the traditional physical record book, digital solution in healthcare, and mobile device technology.

2.1 Physical Record Book

In Fig 1 (a)-(c) below, shows the traditional Pink Book that is currently being used in the healthcare system. This Pink Book is specifically for recording maternal health records only.

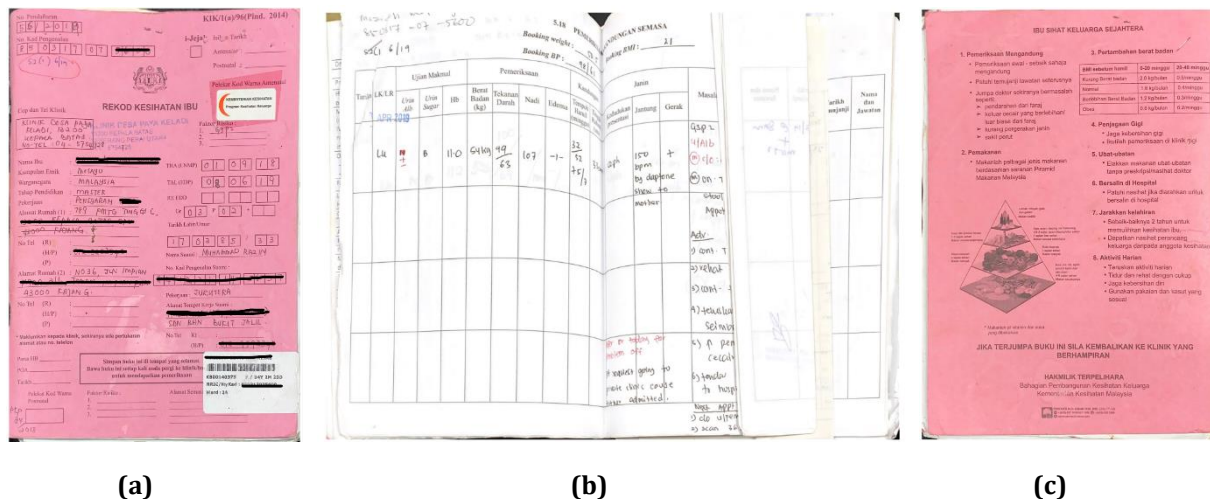


Fig.1 Traditional Pink Book

The traditional Pink Book system has long been fundamental in maternal healthcare, recording essential health information manually in physical records. However, this method faces challenges such as human error, limited accessibility in different healthcare settings, and physical wear and tear over time. Relying on paper records complicates data retrieval and sharing, jeopardizing data integrity and patient care continuity. These drawbacks highlight the urgent need for a modernized approach to maternal health records that goes beyond traditional methods.

2.2 Digital Maternal Health Records

The concept of "digital maternal health records" in the context of the Mommies Pink Book system pertains to the transformation of traditional maternal health record-keeping into a streamlined digital format. This innovative approach involves the comprehensive digitization of patient's health information, ensuring accuracy, accessibility, and efficiency throughout their pregnancy journey. In the Mommies Pink Book system, maternal health records are securely stored and managed in a digital platform, replacing the conventional Pink Book. This digital repository includes essential information such as the patients' personal details, contact information, and crucial health records. By mirroring the format of the traditional Pink Book template, the system ensures an accurate representation of the patient's information within a digital framework.

This transition to a digital maternal health reco system addresses the challenges associated with manual record-keeping, such as lost or forgotten books, human errors, and limited accessibility. Patients and healthcare providers can benefit from a more efficient and reliable platform, allowing quick access to vital health information during antenatal visits. The digital maternal health records module is designed to empower patients by providing a user-friendly interface to view and manage their health information. Simultaneously, healthcare providers can seamlessly record and update maternal health details after each antenatal visit, fostering a more proactive and collaborative approach to prenatal care. Hence, to create healthcare systems that promote and support informed decision-making, it is crucial to ensure that all necessary data is available to healthcare professionals [3]. This forward-looking system ensures that maternal health records are not only accurate but also easily accessible, contributing to an improved and modernized healthcare experience for patients in Malaysia.

2.3 Study of existing related system

An in-depth examination of three current systems, namely Sistem Pemantauan Ibu Mengandung (SPIM), Pregnancy App and Buku Pink App has been conducted to extract valuable insights for the development of the Mommies Pink Book system. This analysis allows the system developer to gain a comprehensive understanding of the strengths and weaknesses inherent in the existing systems. Consequently, this knowledge serves as a foundation for crafting an enhanced system featuring exceptional design, improved user experience, and advanced functionalities in future development. Based on Table 1, there are certain features that are not similar at all to existing systems but there are also similarities between the existing systems and the proposed system. All of the systems have a login and registration module. However, in the Patients Profile module, only Buku Pink App and Mommies Pink Book offer this feature, presenting detailed information about patients, unlike other systems that provide a simplified overview. Moving on to the Pink Book module, it's noteworthy that existing systems, namely SPIM, Pregnancy App, and Buku Pink App, do not integrate the digital pink book, resulting in the absence of clinical health records. In contrast, the proposed Mommies Pink Book will seamlessly integrate this module. Shifting to the Appointment Scheduling & Management module, all systems, except Pregnancy App, incorporate this feature. For the Educational Resources module, only the proposed system, Mommies Pink Book, will introduce an integrated digital library, whereas SPIM and Pregnancy App offer general pregnancy information without a dedicated section. The Health Summary Report module will be exclusively implemented in the proposed system, summarizing health records for patients.

Table 1 Comparison of existing systems

System/ Specification	Sistem Pemantauan Ibu Mengandung (SPIM)	Pregnancy App	Buku Pink App	Mommies Pink Book
Register and Login	Yes	Yes	Yes	Yes
Patient Profile Module	No	No	Yes	Yes
Pink Book Module	No	No	No	Yes
Appointment Scheduling & Management Module	Yes	No	Yes	Yes
Educational Resources Module	No	No	No	Yes
Summary Report Module	No	Yes	Yes	Yes

3. Methodology

The Waterfall Model was selected for the development of the Mommies Pink Book system due to its structured and sequential approach, which suits the project's scope and academic requirements. The Waterfall methodology employs a sequential approach, making it inherently stable [4]. These defined phases are Planning, Analysis, Design, and Implementation. Each phase is completed before the next one begins, ensuring a systematic and disciplined development process. The Waterfall Model is advantageous for this project as it provides a clear roadmap with specific deliverables at each stage, allowing for thorough documentation and progress tracking. This structured approach ensures that each phase's outputs serve as inputs for the subsequent phase, facilitating a well-organized and manageable development lifecycle.

3.1 System Workflow

There are a total of four major phases from the waterfall model. As shown in Table 2, each phase has its own assignment and output that need to be produced during the entire project development. Besides that, the output was completed within the specific days that have been given.

Table 2 Phases during development

Phase	Task	Output
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Planing	<ul style="list-style-type: none"> Proposed the project’s title. Determine the project schedule, activities and output. 	<ul style="list-style-type: none"> Proposal Gantt Chart UML Diagram Class Diagram ERD Diagram
Analysis	<ul style="list-style-type: none"> study existing system and its problem identify enhancements. 	<ul style="list-style-type: none"> Database design User interface design Functional module design
Design	<ul style="list-style-type: none"> create high-level design. design interfaces for each module 	<ul style="list-style-type: none"> Design specification System architecture
Implementation	<ul style="list-style-type: none"> software programming using php connect PHP to MySQL module testing 	<ul style="list-style-type: none"> User feedback Test plan User Acceptance Testing form

Requirements Analysis is integrated within the Analysis Phase of the Waterfall model. During this phase, all project requirements are thoroughly analyzed and documented in a specification document, and a feasibility analysis is conducted to determine the validity of these requirements [5]. This process involves determining user expectations for the new or modified system, including functional and non-functional requirements, user requirements, and hardware and software requirements. This detailed analysis guides the subsequent design and implementation phases, ensuring the developed system meets the specific needs of both healthcare providers and patients.

Table 3 outlines the functional modules of the Mommies Pink Book system where the system consists of 6 modules for both main roles which are the healthcare providers and patients.

Table 3 *Functional requirement for the proposed system* (1)

No	Module	Function	User
1.	Login and registration module	allow users to securely register an account and log in to access the system	Healthcare providers, patient, head doctor
2.	Patient Profile Module	To record and display the personal information of patients	Healthcare providers and patient
3.	Digital pink book module	allowing healthcare providers to record and update maternal health information after each antenatal visit and patient to view their records	Healthcare providers and patient
4.	Appointment scheduling and management module	allow healthcare providers to manage appointment dates of patients and reschedule appointments if needed.	Healthcare providers and patient
5.	Educational resources Module	access to a virtual library of articles, videos, and FAQs on prenatal care, nutrition, exercise, and common pregnancy-related issues	Healthcare providers and patient

6.	Health summary report Module	Healthcare providers generate and view summarized health details of the patients. Patients view the report.	Healthcare providers and patient
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Table 4 outlines the non-functional requirements of the proposed system, including performance, operational characteristics, and security measures. These requirements aim to ensure reliable system performance, dependency on internet connectivity, and robust security measures to protect user data and access.

Table 4 *Non-functional requirement for the proposed system*

No	Requirement	Description
1.	Performance	<ul style="list-style-type: none"> The system should respond to user actions within 2 seconds.
2.	Scalability	<ul style="list-style-type: none"> The system should handle a minimum of 200 concurrent users.
3.	Security	<ul style="list-style-type: none"> User data should be encrypted during transmission and storage.
4.	Usability	<ul style="list-style-type: none"> The user interface should be intuitive, and user actions should be easy to understand.
5.	Compatability	<ul style="list-style-type: none"> The system should be compatible with popular web browsers (Chrome, Firefox, Safari).

4. Results and discussion

4.1 Use-case Diagram

A use case diagram illustrates the business processes executed within the system [6]. Hence, the use case diagram for Mommies Pink Book in Fig. 2 illustrates the various actions they can perform, including logging in, registering new staffs, generate report and others.

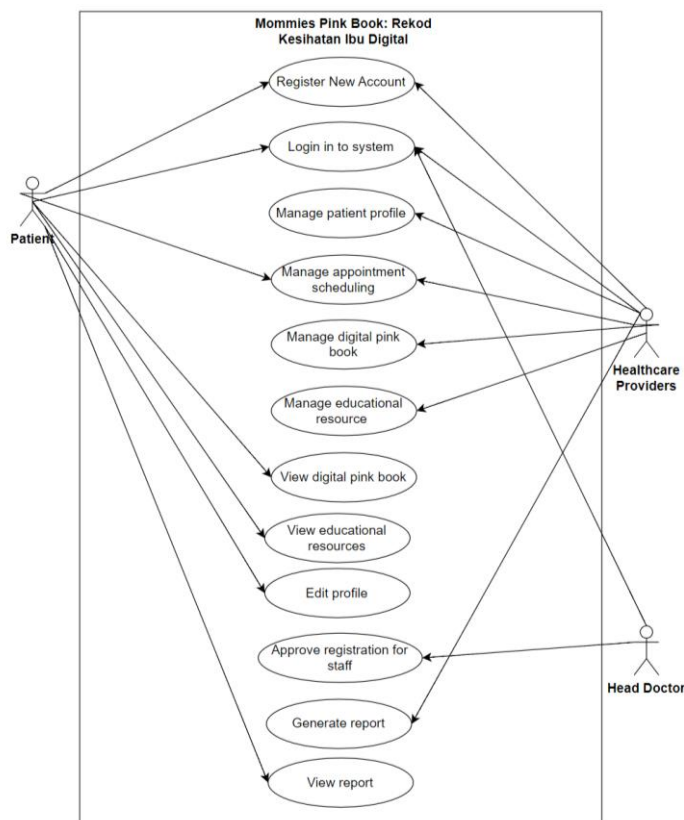


Fig. 2 Use case diagram.

There are three actors within the system, which are the patient, healthcare providers and head doctor. Each actors have their own specific role in the system. As for patients, they can register new account, log in to system, manage appointment scheduling, view digital pink book, view educational resources, edit profile and view report. Healthcare providers can also register new account, log in to system and manage appointment scheduling but they also have the accessibility to manage patient’s profile, manage educational resources, manage digital pink book and generate report. Ultimately, the head doctor has to approve staff’s registration.

4.2 System Flowchart

The system flowchart depicted below illustrates the comprehensive structure and functionality of the Mommies Pink Book digital maternal healthcare record system. This visual representation outlines the interconnected modules and processes designed to streamline maternal health record-keeping, enhance accessibility, and ensure data accuracy. It encompasses key functionalities such as login and registration, patient profile management, digital Pink Book for health data recording, appointment scheduling, access to educational resources, and generation of health summary reports. The flowchart serves as a visual roadmap, demonstrating how each component integrates to facilitate efficient and user-friendly management of maternal healthcare records.

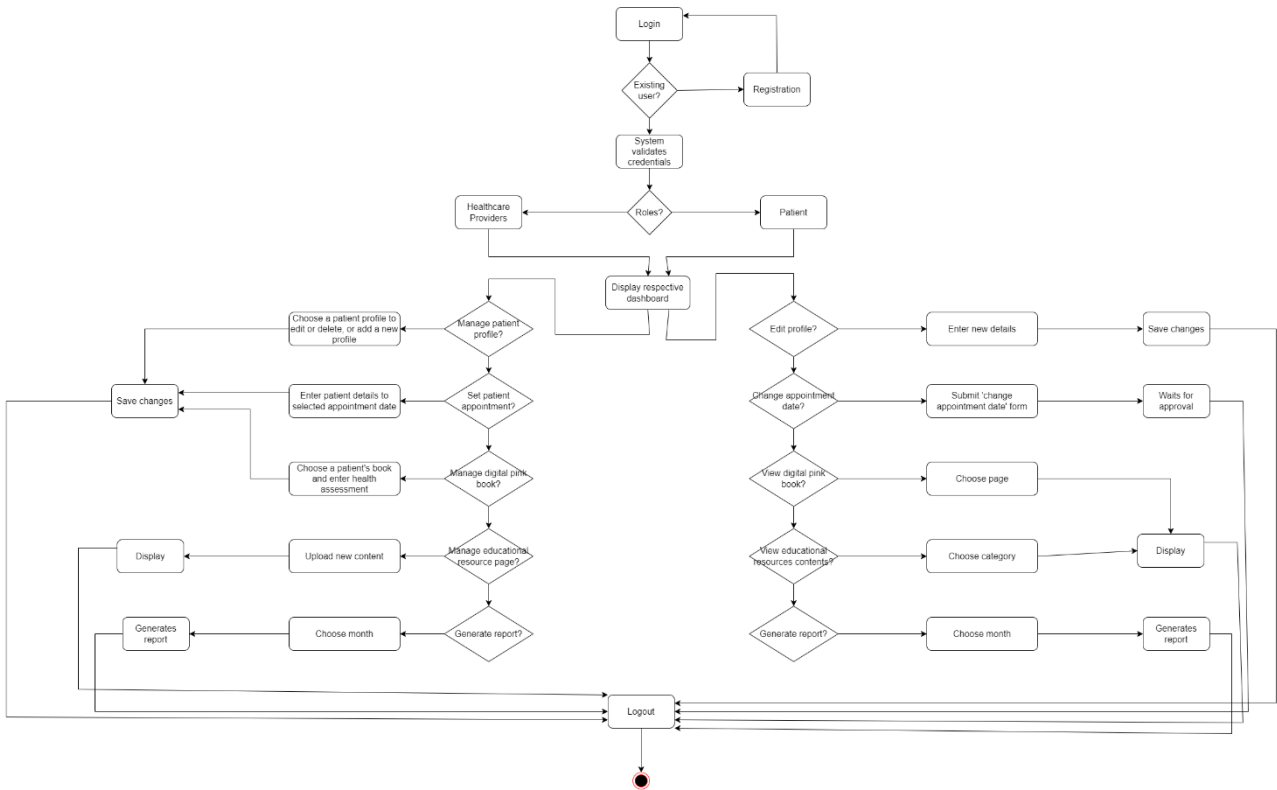


Fig.3 System Flowchart

4.3 System interface design

In this section, shows the interface design for the proposed system. There will be the login and registration page that will direct to each dashboard based on the user’s role. In each dashboard, there will be a navigation bar and side bar to help user navigate to different pages. As for the contents, Fig. 6 and Fig. 7 is how the system will display each module for both users.

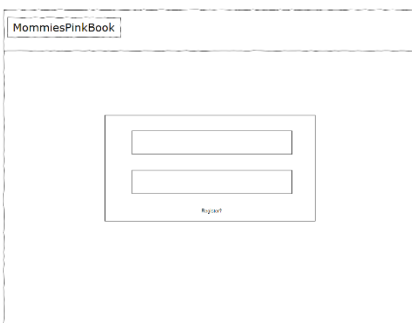


Fig. 4 Registration page

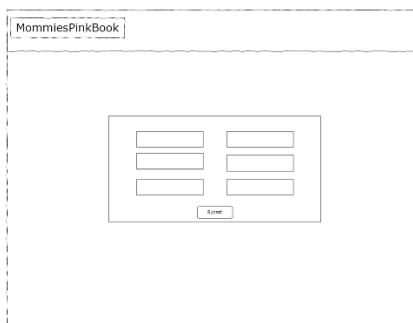


Fig. 5 Login page

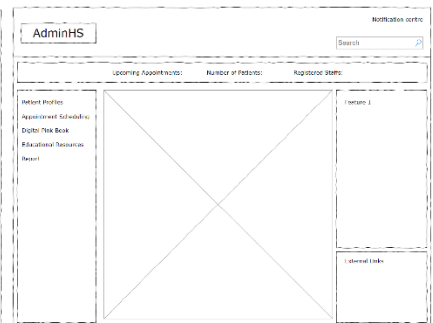


Fig. 6 Staff's Dashboard

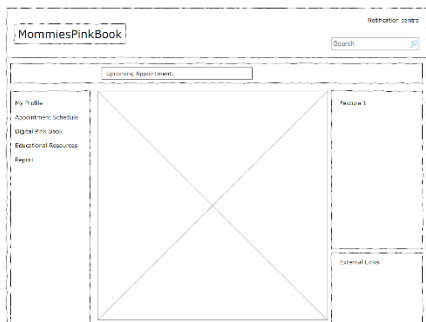


Fig. 7 Patient's Dashboard

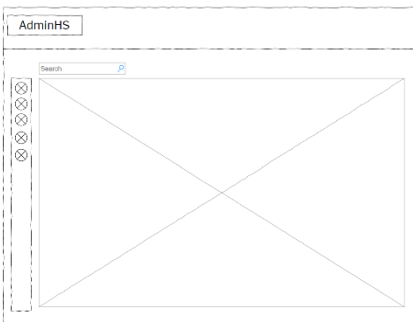


Fig. 8 System's Content

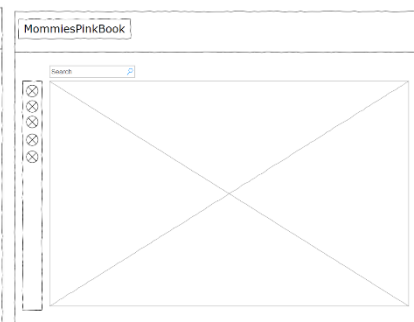


Fig. 9 System's Content

The system interface design detailed in this section emphasizes user-centricity and functionality for both patients and healthcare providers. Featuring login and registration pages that direct users to tailored dashboards, each equipped with intuitive navigation tools like a navigation bar and side bar, the design ensures seamless access to various system modules. Fig. 8 and Fig. 9 exemplify clear and accessible module displays, supporting efficient maternal health record management and fostering a cohesive user experience. This approach underscores the system's commitment to enhancing healthcare management through intuitive digital interfaces tailored to user needs.

4.3 Implementation

This section provides a detailed account of the implementation phase of the Mommies Pink Book digital maternal healthcare record system. It outlines the practical steps taken to transform theoretical concepts into a functional software application designed to revolutionize maternal health record-keeping. The implementation process encompasses software development, integration of various modules, user interface design considerations, and backend functionality deployment. Each aspect of the system's architecture and design is meticulously addressed to ensure seamless operation and user-friendly experience. The following subsections delve into specific components of the system, accompanied by screenshots that illustrate key interfaces and functionalities. These visuals serve to highlight the practical application of theoretical frameworks discussed earlier, demonstrating how they translate into tangible benefits for healthcare providers and patients alike.

4.3.1 Login and Registration

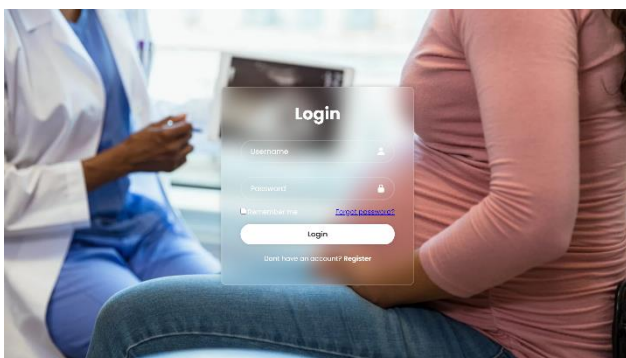


Fig. 10 Login form

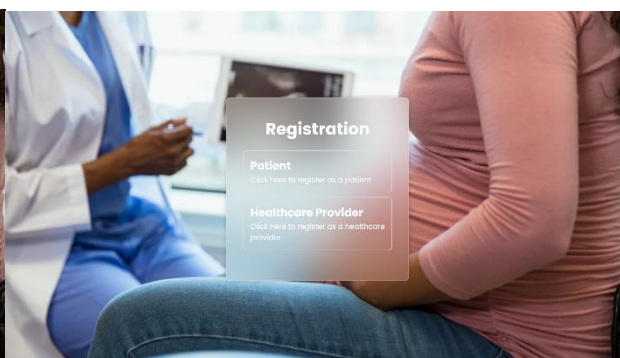


Fig. 11 Registration role options

The Login Page of the Mommies Pink Book system provides users with access to the digital maternal health records platform. It features a clean and intuitive design with key components such as Username and Password Fields, a Remember Me Option, a Forgot Password Link, a Login Button, and a Register Link. The background image depicts a consultation between a pregnant woman and a healthcare provider, reinforcing the system's focus on maternal health. Overall, the interface is user-friendly and professional, guiding users through the login process efficiently. The Choose Role Page streamlines registration for the Mommies Pink Book System. Users select their role from clear options like healthcare provider or expecting mother, aided by informative icons.

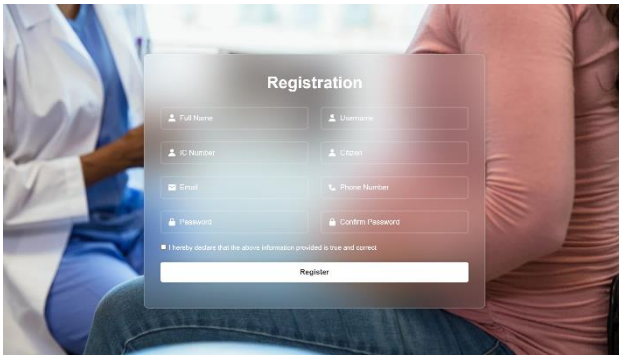


Fig. 12 Patient's registration form

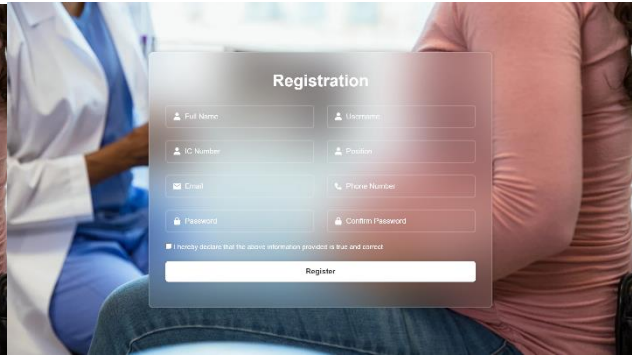


Fig. 13 Healthcare Provider registration form

The Patient Register Page in the Mommies Pink Book System simplifies account creation. Users input essential details, create a secure password, agree to terms, and register. This process ensures a seamless adoption of the system, empowering patients to manage their healthcare journey effectively. The Healthcare Provider Registration Page in the Mommies Pink Book System streamlines registration for professionals. Key features include input fields for professional details, password creation, terms acceptance, and a register button. Its user-friendly design ensures seamless integration into the system, empowering providers to deliver optimal care.

4.3.2 Patients Modules

Below in Fig. 14, Fig. 15 and Fig. 16 are some of the Mommies Pink Book interfaces for patients. Firstly in Fig. 14, is the dashboard where patients will be redirected to once they successfully log in to the system. Then, there is a navigation bar at the top that consists of multiple icons where patients can click to go to. For example, in Fig. 15, the patients profile module where it displays patients full profile. In Fig. 16, is the appointment scheduling and management module where patients can view their upcoming appointments date and request to change their appointment date.

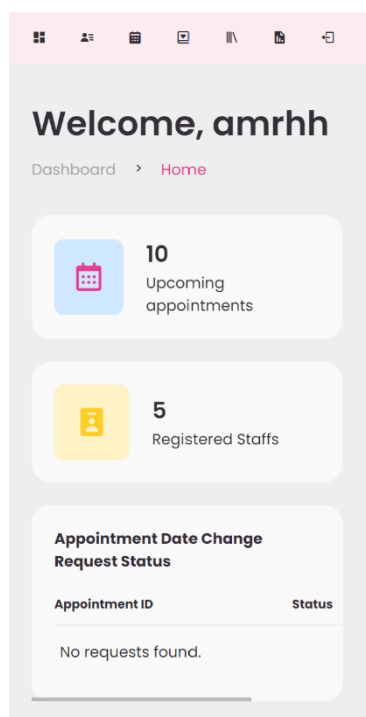


Fig. 14 Dashboard

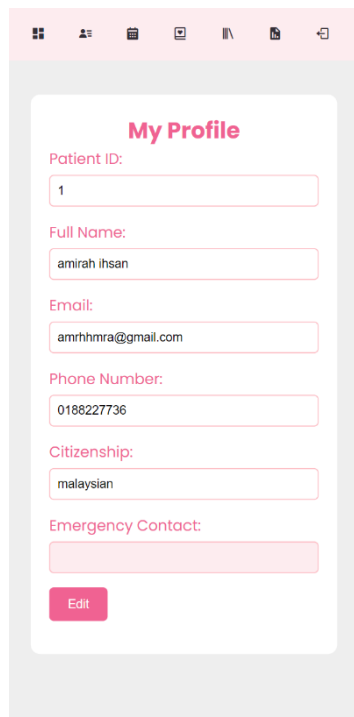


Fig. 15 Profile page

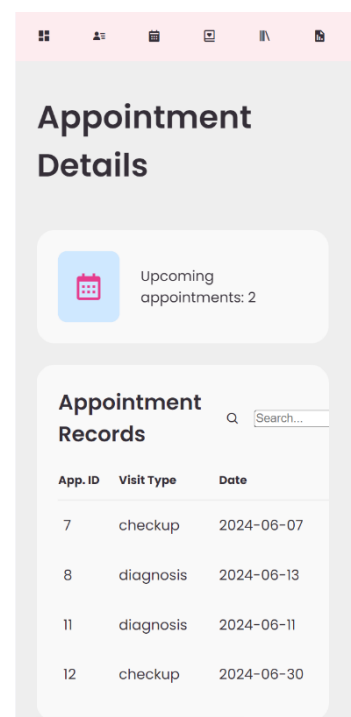


Fig. 16 Appointment page

As for Fig. 17 and Fig. 18 are the digital pink book module and the health summary report module. Within these two module, patients are able to view their health records with ease. In Fig. 19, patients are equipped with the educational resources to help them through out their pregnancy. The contents are uploded and provided by the healthcare providers.

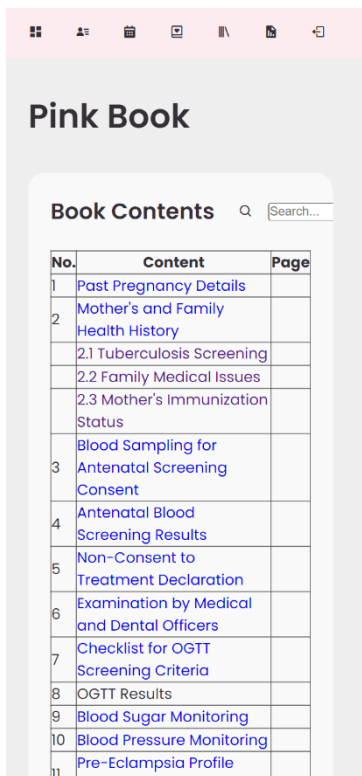


Fig. 17 Pink Book



Fig. 18 Report page

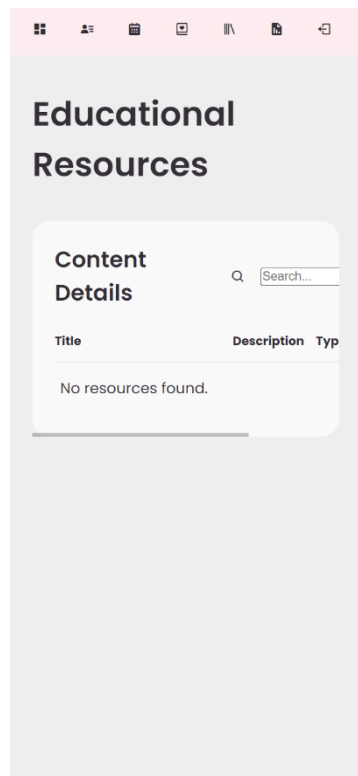


Fig. 19 Resources page

4.3.3 Healthcare Providers Modules

In this section, shows the interfaces for healthcare providers that were implemented per modules. Each of the modules can function as described in previous sections. Firstly in Fig. 20 is the dashboard where healthcare providers will be redirected to once log in to the system. In Fig. 21, is the patients profile module where healthcare providers have a list of patients and can click to view any of their full profile.

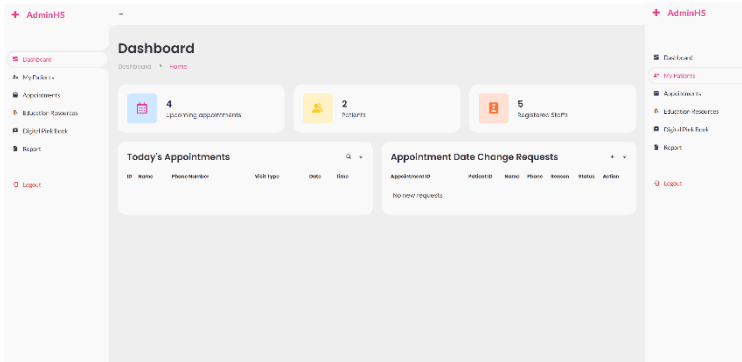


Fig. 20 Homepage

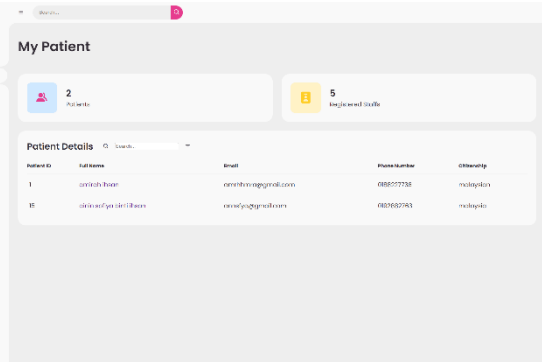


Fig. 21 Patients list

In Fig. 22 is the appointment scheduling and management module where healthcare providers oversee their upcoming appointments for the day. Also, they have the ability to insert new appointments. As for Fig. 23, is the educational resources module where healthcare providers can upload contents for patients to self-learn.

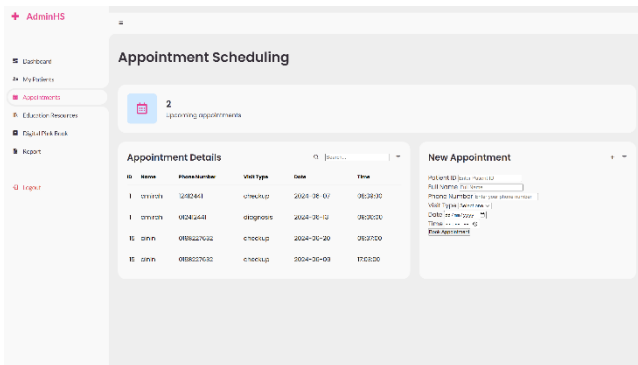


Fig. 22 Appointment management

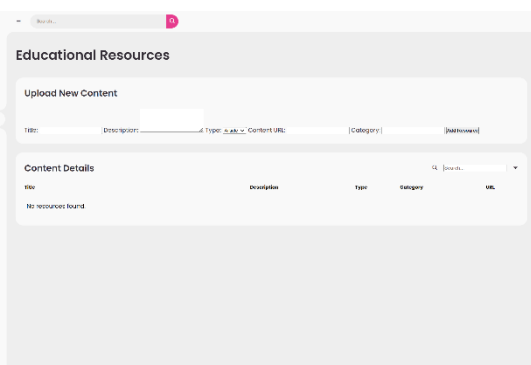


Fig. 23 Educational resources content

The 2 last modules are the digital pink book and the health summary report module. For healthcare providers, the digital pink book module allow them to oversee each patients health record. They can also view the pink book default contents as well. For health summary report module, healthcare providers can generate a summary report for each patients and view it for quick access.

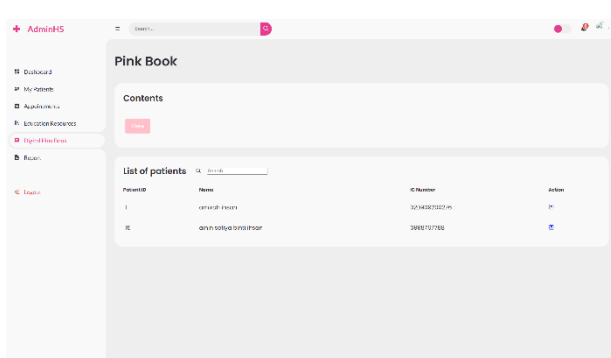


Fig. 24 Pink Book management

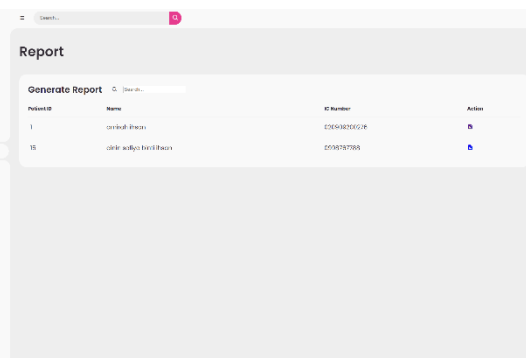


Fig. 25 Report generation

4.5 Testing

The testing phase is a vital concluding step in the development of the Mommies Pink Book. It aims to rigorously test all system functions to uncover and address any issues. This phase is critical for ensuring that the system aligns with the project's goals and fulfills user requirements effectively.

4.5.1 Test cases

A test case outlines the steps necessary to confirm that a software application meets the client's specifications [7]. The test cases for Mommies Pink Book are based on the functionalities identified in the test scenarios during development. Table 5 provides a detailed list of test cases designed for the system.

Table 5 Test Cases

Functional Module	Test Case	Description	Expected Result	Test Result (Pass/Fail)
Login and registration module	Successful Registration	Ensure user can register with valid details	Registration is successful, and the user is redirected to the login page or dashboard.	Pass
	Enter invalid user login credentials	Enter invalid username and password in the login form.	Upon unsuccessful login, the system shall display a warning message indicating invalid input	Pass
Patient Profile Module	Viewing profile after account creation	Ensure patients can view their profile after creating an account and healthcare providers can view all the patients profile.	The patient's profile information should be displayed correctly, showing all the personal details entered during profile creation.	Pass

Digital pink book module	Viewing Recorded Maternal Health Information	Ensure patients can view their maternal health records after healthcare providers have recorded information.	The maternal health information recorded by healthcare providers is displayed accurately for the selected antenatal visit, including details such as visit date, health status, tests performed, and others.	Pass
	Recording Maternal Health Information by Healthcare Providers	Ensure healthcare providers can record health information for a patient after each antenatal visit.	The maternal health information is successfully recorded and saved, and a confirmation message is displayed. The new record should be available for viewing by the patient.	Pass
Appointment scheduling and management	Viewing Scheduled Appointments	Ensure patients can view their scheduled appointments.	The list should display all scheduled appointments with details such as date, time, and healthcare provider.	Pass
	Scheduling Appointment Providers	Ensure healthcare providers can schedule a new appointment for a patient.	The new appointment is successfully created. The appointment should be visible in both the provider's and patient's appointment lists.	Pass
Educational resources	Viewing Educational Resources	Ensure patients can view the list of educational resources, including articles, videos, and FAQs on prenatal care, nutrition, exercise, and common pregnancy-related issues.	The list of educational resources should be displayed, showing all available articles, videos, and FAQs. Each resource should be accessible via a URL.	Pass
	Adding Educational Resource Providers	Ensure healthcare providers can add new educational resources, including articles,	The new educational resource is successfully added to the library, and a	Pass

			videos, and FAQs, to the virtual library.	confirmation message is displayed. The resource should be visible in the list of educational resources for patients.	
Health summary report	Generate Summary for Patient	Health Report Selected	Verify that clicking the report icon generates and displays the health summary report for the selected patient.	The system redirects to the health summary report page, displaying the summarized health details for the selected patient.	Pass
	View Own Health Summary Report	Health Report	Verify that patients can view their own health summary report.	The system displays the patient's own health summary report accurately.	Pass

4.5.2 User Acceptance Testing

User Acceptance Testing (UAT), commonly known as beta testing or end-user testing, is a phase in software development where the software undergoes testing by its intended audience or business representatives in real-world conditions [8]. This phase aims to validate that the system meets user requirements, functions as expected, and is ready for deployment. By soliciting feedback directly from end-users, UAT ensures that any issues or usability concerns are identified and addressed prior to full-scale implementation, thereby optimizing user satisfaction and system effectiveness.

4.5.2.1 Patients

The user acceptance testing phase provided valuable insights into the functionality and usability of the Mommies Pink Book digital maternal healthcare record system from the perspective of its intended users. Participants were asked a series of structured questions aimed at evaluating various aspects of their interaction with the system. Firstly, all participants reported successful login into their Mommies Pink Book accounts without encountering any issues, demonstrating robust system performance in terms of authentication and access control. Moreover, every participant confirmed that the system allowed them to access their maternal health records effortlessly, indicating effective data retrieval mechanisms and intuitive navigation within the application.

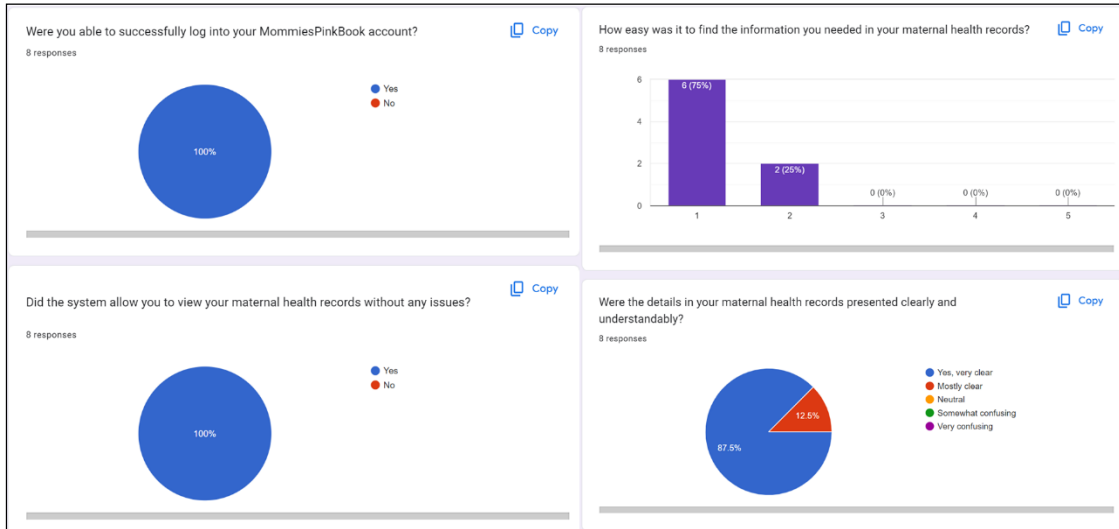


Fig. 26 Results for patients user acceptance testing

When asked about their experience with information retrieval within their maternal health records, the majority (71%) found it very easy to locate the information they needed, while the remaining 29% found it mostly easy, with none reporting difficulties in finding information. This positive feedback underscores the system's clarity in presenting health data, contributing to a favourable user experience. Additionally, a significant majority (86%) found updating personal information to be very easy, with the remaining participants finding it easy, affirming the system's user-friendly interface for managing personal details.

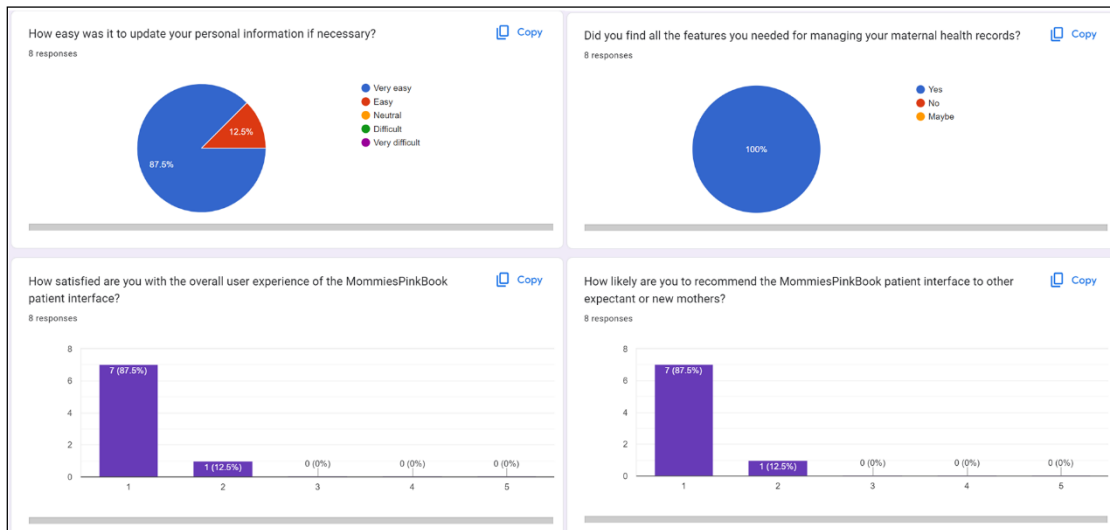


Fig. 27 Results for patients user acceptance testing

In terms of overall user experience, the vast majority (86%) expressed very high satisfaction, emphasizing the system's ease of use, clarity of information, and intuitive design as key factors in their positive assessment. Importantly, all participants confirmed finding all necessary features for managing their maternal health records within the system, reinforcing its comprehensiveness and utility. Furthermore, 100% of participants indicated a likelihood to recommend the MommiesPinkBook patient interface to other expectant or new mothers, highlighting its perceived value and effectiveness in improving maternal healthcare management.

4.5.2.1 Healthcare Providers

Based on the responses from healthcare providers during User Acceptance Testing (UAT), the following insights were gathered. Participants were consistently able to successfully log into the healthcare provider dashboard without encountering any issues, indicating robust system authentication and access controls. They also confirmed that the system allowed them to view and edit patient maternal health records without errors, demonstrating effective data management functionalities. Adding new patient records was reported to be smooth and straightforward across all responses, highlighting the system's efficiency in patient data entry.

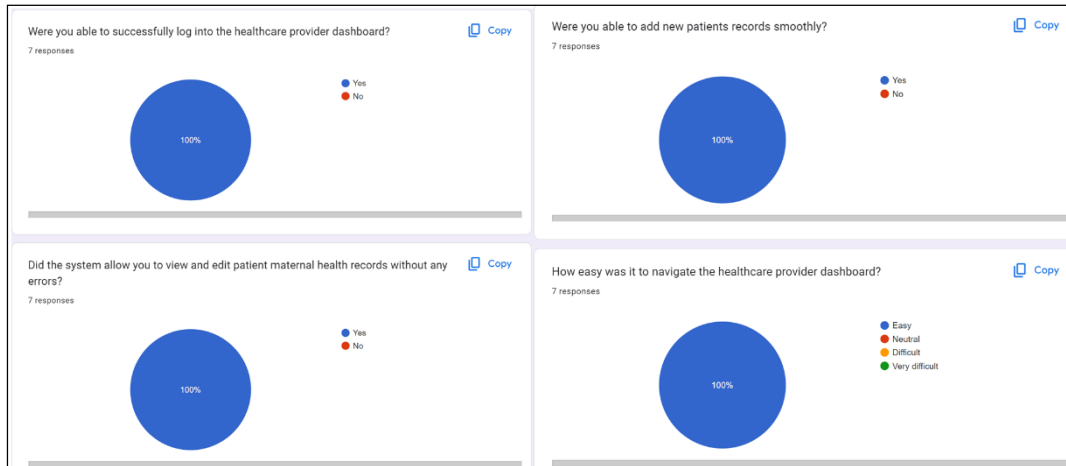


Fig. 28 Results for Healthcare Providers user acceptance testing

Navigation within the healthcare provider dashboard was universally described as easy, reflecting intuitive design and user-friendly interface elements. Feedback regarding the clarity and usability of forms for adding or editing patient information was predominantly positive, with most respondents finding them very clear and easy to understand.

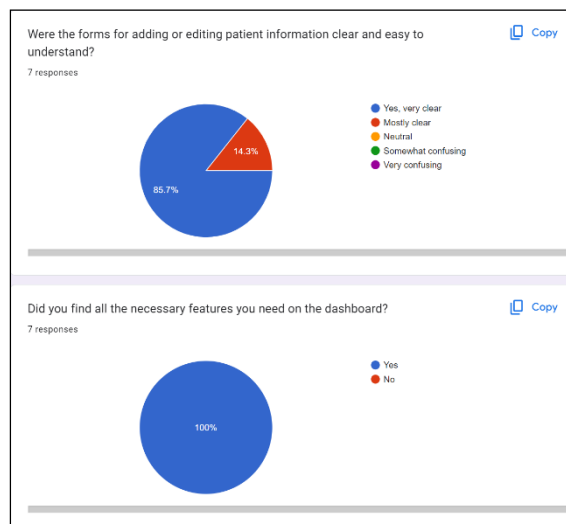


Fig. 29 Results for Healthcare Providers user acceptance testing

Participants unanimously confirmed finding all necessary features they needed on the dashboard, underscoring the comprehensiveness of the system in meeting healthcare providers' operational requirements. Overall user experience satisfaction was consistently high, with all participants expressing very high satisfaction levels with the healthcare provider side interface. In conclusion, the User Acceptance Testing (UAT) conducted for both patients and healthcare providers has provided compelling evidence of the Mommies Pink Book digital maternal healthcare record system's efficacy and usability. Patients consistently found the system easy to access and navigate, with high satisfaction regarding the clarity of health records and overall user experience. Healthcare

providers similarly praised the system for its seamless functionality in managing patient records, user-friendly interface design, and comprehensive feature set. These positive UAT results validate the system's readiness for implementation, emphasizing its potential to significantly enhance maternal healthcare management by improving accessibility, efficiency, and user satisfaction across all user roles.

5.0 Conclusion

In conclusion, the Mommies Pink Book System marks a transformative step in maternal healthcare record-keeping. By addressing the limitations of traditional manual methods, the system offers a secure, efficient, and user-friendly platform for patients and healthcare providers. From login and patient profiles to the Digital Pink Book and educational resources, each module contributes to a comprehensive and accessible maternal health record system. The adoption of a Prototyping approach ensures iterative refinement, aligning the system with the evolving needs of stakeholders. As it advances toward deployment, the Mommies Pink Book System holds the promise of revolutionizing maternal healthcare, fostering better communication, and enhancing the overall experience for both patients and healthcare providers.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: study conception and design: Amirah Humaira binti Ihsan, Mazidah Binti Mat Rejab; data collection: Amirah Humaira binti Ihsan, Mazidah Binti Mat Rejab; analysis and interpretation of results: Amirah Humaira binti Ihsan, Mazidah Binti Mat Rejab; draft manuscript preparation: Amirah Humaira binti Ihsan, Mazidah Binti Mat Rejab. All authors reviewed the results and approved the final version of the manuscript.

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