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A Web-Based Baby Health Record System

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Abstract: Babies and Children's health record book (RKK book) is a child health record that keeps all the examination results conducted by medical staff to observe a baby's growth development. During the implementation of the manual record book record, some issues identified include its exposure to damage by natural disasters and its inefficient process of managing the record book. A system was developed by using a structured approach with prototype methodology to encounter issues faced by its users before. The potential users of the system were the administrator, medical staff, and baby guardians. HTML, PHP, CSS, and JavaScript were used for the system development. While the database record of the system will be kept in MySQL using the XAMPP server. Upon completion, it met most of the functions and requirements as planned, but there were still a few limitations identified to be improved in future works.

Keywords: Health Record System, Healthcare, Web-based System, Structured Approach

1. Introduction

A medical record is a detailed description of treatment information such as test results or immunization records which is usually written by physicians, nurses, or other medical staff [1]. Babies and Children's health record book (RKK book) or also called the pink book is a child health record that keeps all the examination results conducted by medical staff to monitor a child's growth. By tracking and monitoring the child's growth, physicians can assess and diagnose if any abnormalities are occurring in the child [2].

Therefore, any child's guardian must keep the health recordbook in proper condition as it records and can prove the child's immunization and health condition [3].When the record book is implied, some issues were identified including its exposure to damage by natural disasters and its inefficient process of managing the record book. Besides, the process of retrieving the book is also very time-consuming and inconvenient as the guardian needs to go to the clinic just to retrieve it back.

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The paper will discuss the development of a children's health record system for children and babies that will be used by the child's guardians and medical staff. Therefore, to achieve the targeted aim of the system, a few objectives have been set, which are as follows:

1. To design a children's health record system using a structured approach
2. To develop a children's health record system using a web-based approach
3. To perform alpha and beta testing for the developed model/system

Some modules or functions have been identified to guide the project toward its objectives. The 6 main modules in the system are the login module, profile module, appointment module, immunization record module, and report module. One of the modules is a login module for the targeted user to be able to access and use the system. Then, the biodata module will contain information about the child and their guardian while the appointment module will be used by the guardian to view and check appointments that they must attend.

The system will also have a record of all the vaccinations that are compulsory to be taken by the child such as BCG and MMR in the immunization record module. Guardians can also read the guidance on how to care for a child from the guide provided in the guardian's guide module. The last module is the report module which will contain graphs on the child's body mass index (BMI) and head circumference. All these modules are necessary to monitor child growth development.

2. Literature Review

2.1 Definition

A health record is a documentation that is used to help track and manage a person's healthcare and can be used to make informed decisions about their treatment and care [4]. In recent years, there has been a shift towards electronic health records (EHRs). EHRs have become increasingly widespread in recent years, with many countries implementing systems to store and manage health records electronically [4]. In Malaysia, to improve the efficiency and effectiveness of the healthcare system the Ministry of Health has implemented the National Electronic Health Record (NEHR) but it does not include the health record for children [5].

As for the web-based system, it is typically a system hosted by a server and can be accessed by multiple users simultaneously[6]. While a web-based health record system is a platform that allows healthcare providers to access and manage a patient's medical records over the Internet using a web browser. These systems are designed to be used by healthcare professionals and may include features such as electronic medical records.

2.2 Reviewing Existing System

This section will discuss the technique, platform, and approach implemented to develop the Baby Health Record System. The process of reviewing the chosen paper will be compared and discussed on different papers to get a better idea of the proposed system. This chapter is also done to help understand previous systems with a similar domain to the developed system. By comparing other systems with the system that will be developed, it may help to create a better design and functions of the system by determining and finding better solutions for any flaws or shortages fromthe previous systems. For this project, the myBayi application [7], the eRedBook platform, and the HealthHub application [8] had been chosen to be analyzed and compared.

2.2.1 myBayi application

A mobile application named myBayi had been developed for a private clinic that has its own child's health record book. The previous manual record had been integrated from a traditional health record book into a mobile application which consists of 3 main users: guardians, doctors, andadministrators. The application can be accessed via the Android operating system 24 hours every day by a different user whether it's the medical staff, guardian, or administrator. Some basic functions hadbeen developed into the system, for instance, the user information, health report, and check-up appointments since it prioritized creating a simple application that does not confuse its user with the unnecessary module.

2.2.2 Health Hub application

Health Hub is a Singapore government digital platform that its citizens can only admit. The system is very convenient as their user can access it via both mobile applications and web portals. The platform provides users can view information on their current health assessment including their familyif the individual is under user supervision. Some transaction processescan be executed from the platform, including making appointments and refilling medication. By having notification functions, users will not have to worry if they may forget their appointment to get a vaccination or health check-up when the platform will remind users a few days before the appointment date.

2.2.3 eRedBook

eRedBook is a system that had been integrated from the manual record system into an electronic record. This system also can be accessed by guardians and medical staff to view and update information about the baby's health assessment and development. The system has the basic information needed for health records such as immunization records, baby's development, and health assessment. This system also has notifications for guardians to remind them if they need to attend the baby's monthly or yearly health screening.

2.3 Comparison Between the Proposed System And The Existing System

To find any lack in the proposed system, a comparison between an existing system with the proposed system was carried out. For this comparison, the chosen previous system; myBayi, HealthHub, and eRedBook is compared by their features or modules, such as the appointment module and biodata module shown in Table 2.

Based on Table 2, displays that all three systems have authentication to protect their user's confidential information from being exposed and misused by other individuals. Moreover, all the systems also permit their use to edit their information in the user and their child's information. Despite that, compared to the other existing system, the proposed system had better functions as it has a module or functions that can generate reports and produce graphs for users to view. By having these features, users can easily understand their child's growth development without hassling to understand the data.

Table 2: Comparison of the system

System / Features	myBayi	Health Hub	eRedBook	Proposed System: Baby Health Record System
Authentication	Need login to access	Need login to access	Need login to access	Need login to access
Notification	Not available	Available	Available	Available
Record and report	Generate report only	Create graph only	Creates graph only	Generate report and graph
Information and data	User able to update information	User able toupdate information	User able to update information	User able to update information
Self-growth assessment	Not available	Growth assessment only	Not available	Growth assessment
Baby care guideline	Available	Not available	Available	Available

3. Methodology/Framework

3.1 Prototyping Model

The main purpose of choosing methodology is to facilitate and improve the productivity and workflow of an organization, especially for a big project with many teams involved. Various methodologies can be chosen to suit the number of team members, cost, and goals for instance Agile Model, Waterfall Model, and Scrum Model. For this project, a Prototyping Model had been chosen and discussed in detail. It is slightly differentfrom the waterfall model where a prototype of the system will be built and presented to the client beforecompleting the entire system.

This model works best for this project as its requirements are not detailed and have proper system requirements. 6 phases needed to be completed when implementing the prototyping model. As displayed in Figure 1, those phases are, the requirement gathering initial requirement phase, quick design phase, built prototype phase, user evaluation phase, refining prototype phase, implementation, and maintenance phase. The cycle of the built prototype, user evaluation phase, and review will keep going on until the client is satisfied with the system.

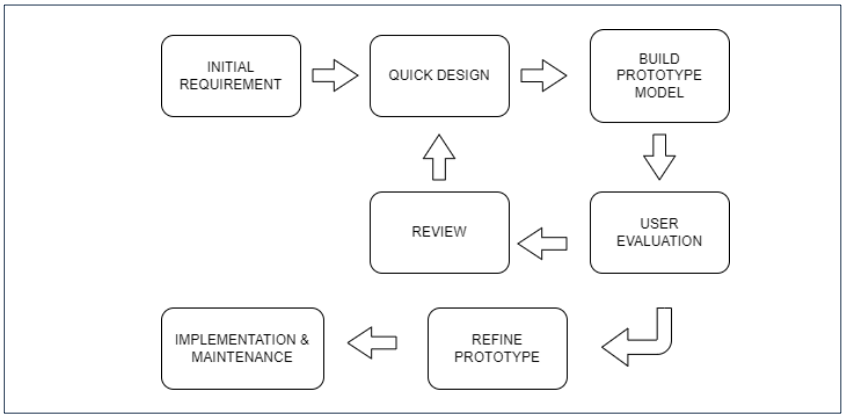


Figure 1: Prototyping System Model

3.2 Functional Requirement & Non-functional Requirement

The functional and non-functional requirements of the Baby's Health Record System are listed in Table 4.1 and Table 4.2. A functional requirement of the Baby's Health Record System in Table 4.1 will be listed on every feature that must be workingin the system based on the module that had been determined such as login, immunization module, and appointment module. As for the non-functional requirement in Table 4.2, it will describe the performance and behavior of the system that needed to be implemented so that the system can work efficiently. This requirement can help improve the user experience when using the system.

Table 4.1 Functional requirement

No.	Module	Description	Users
1.	Login	• The system should allow the userto access the system via login and password • The system only allows the user tolog into the system if both id and password are valid • The system may notify the user if there is any invalid value inserted • The system directly be on thehomepage when the user had access to login into the system	Guardian Staff Admin
2.	Growth Assessment	• The system will allow admin and staff to create, delete, update, and read the assessment • The system should allow the guardian to be able to view theassessment report only	Guardian Staff Admin
3.	Immunization	• The system will allow staff and admin to create, delete, update, and read the immunization record • Guardian able to view theimmunization report	Guardian Staff Admin

No.	Module	Description	Users
4.	Appointment	• The system will allow staff to create, delete, update, and read the appointment record • The system will only give the guardian ability to only view the appointment date • The system may be able to give a notification to the guardian regarding the checkup appointment	Guardian Staff Admin
5.	Biodata	• The system will allow all users tocreate, delete, update, and read their biodata • The system should allow the admin to create, delete, update, and read other user biodata • Staff only able to access certain data from the patient information	Guardian Staff Admin
6.	Report	• The system should give access toboth users to view the report generated • The system will be able to generate reports	Guardian Staff Admin
7.	Growth Development	• The system will allow the guardian to fill up the growth development progress of their baby • The system should allow staff to ew the baby's development from the system	Guardian Staff Admin

Table 4.2 Non-functional requirement

No.	Module	Descriptions
1.	Performance	• The system will respond in less than 3 seconds for every process
2.	Security	• The system must be secure enough as it had theauthorization to access the system • The system should allow users with an account to access the system if they entered a valid id and password
3.	Operation	• The system must be able to open the system, especially the common ones such as Google Chrome and Mozilla Firefox

4. Result and Discussion

A system must have its requirements that must be followed before it can be developed and continue with the implementation phase. Even though there were a variety of models of life cycle development, it will still carry out the same flow during the system analysis and design phase. Those activities that will be worked on during this phase were, analyzing requirements needed, data flow diagram, and system design [6]. Data flow diagrams, context diagrams, entity relationship diagrams, and data flow diagrams are constructed to easily understand how the entity and data related to each other.

4.1 Flowchart

A flowchart is commonly used to graphically display the Children's Health Record System workflow process steps. Basically, to access the system, all users are required to insert a valid id and password. Then, when they gain access, they will be able to do some of the functions that are accessible to them such as updating their profile. Appendix A, Appendix B, and Appendix C have different flows of the process since it's been used by different users and so do their interfaces.

4.2 Data flow diagram

A data flow diagram is an illustration of a diagram that displays the correlation between entities and data. The data flow diagram consists of 2 main levels: level 0 and level 1. A context diagram is also included under the data flow diagram.

4.2.1 Context Diagram

Figure 2 illustrates the context diagram for Baby's Health Record System with 3 main entities that will use the system: medical staff, guardian, and administrator. Some of the processes that can be done by medical staff were making appointments, health assessments, and recording immunization. As for guardians, they will be able to fill up the baby's information details including theirs. The guardian will also need to fill up the development of the baby. A few things that they can view are the baby's immunization details, appointments, and reports generated by the system. For the last entity of the system, the administrator will be able to view all the other entity data with reports generated by the system.

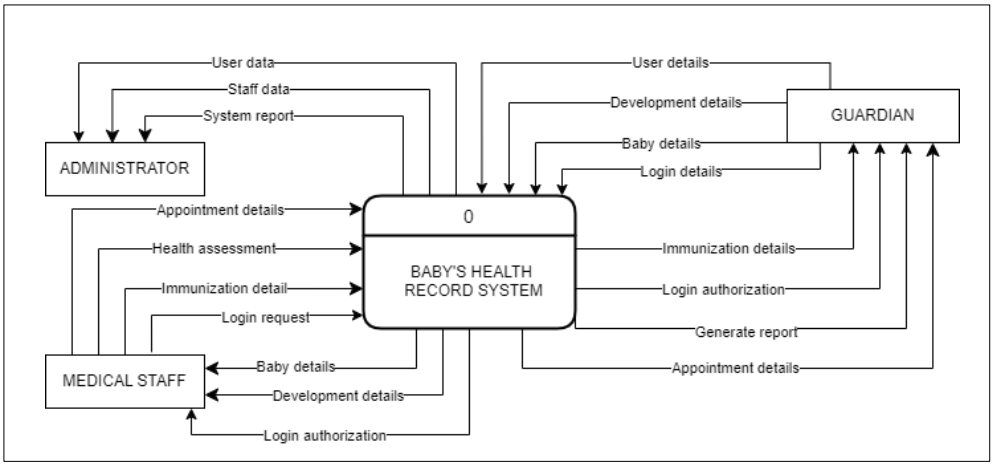


Figure 2: Context Diagram

4.2.2 Data Flow Diagram Level 0

The data flow diagram level 0 is used to display all the main processes that occur in the Baby's Health Record System. From Figure 3, 7 main processes of the system are detailed in their relationship with the entity of the system, for instance, login, update assessment, update immunization, update appointment, update biodata, generate a report, and update development. While the entity in the diagram was the administrator, staff, and guardian. The data flow diagram also included the database that will be integrated into the system such as user information, growth assessment data, immunization data, appointment, and growth development data.

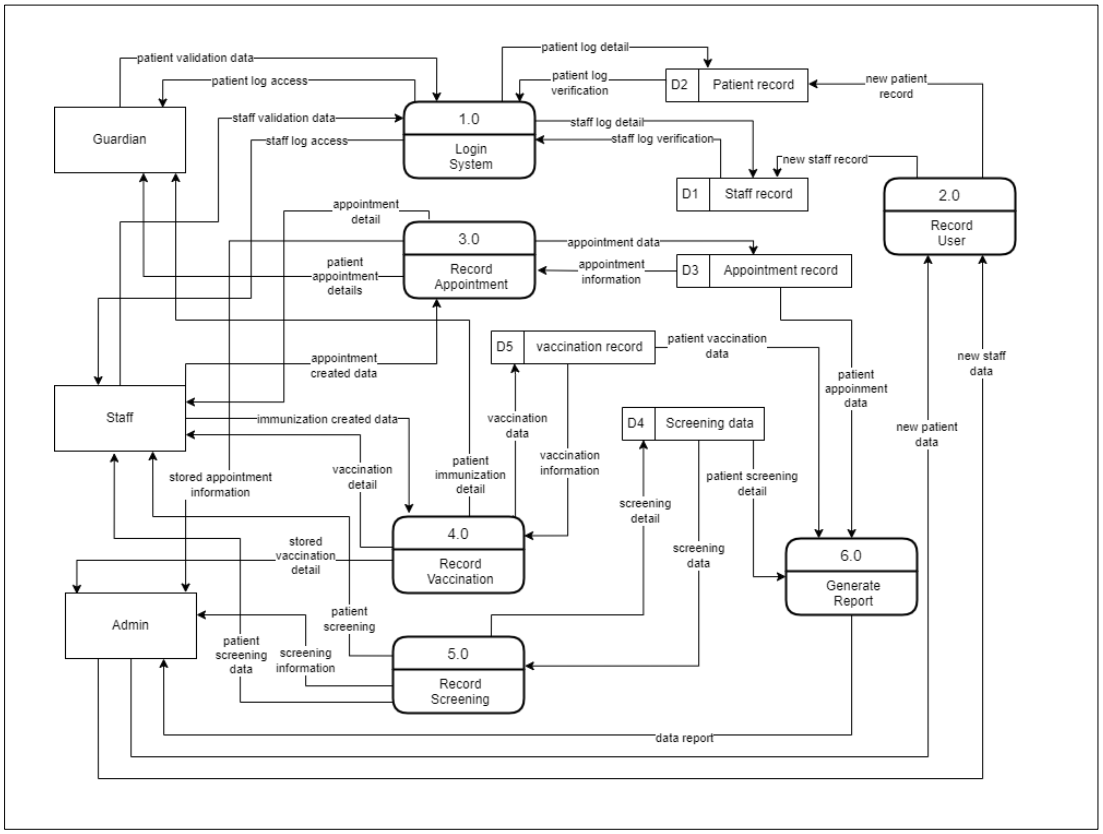


Figure 3 Data Flow Diagram Level 0

4.3 Interface design

The user interface design is used to assist the developer in creating the interface of thesystem. A wireframe will be made to give a sketch of positioning all buttons, tables, and icons that will be used in the system. The Baby's Health Record System will have 2 different interfaces suiting the process that is determined for them. The interface for this system is made differently for administrators, medical staff, and guardians.

Some of the interfaces designed for the staff such as the profile interface, report interface, and user list interface will be the same as the admin interface as shown in Figure 7. But there were a few functions that will be unavailable for medical staff to use such as the staff and patient list in Figure 8 and Figure 9 where staff can only view the list but not update, create, or delete it.

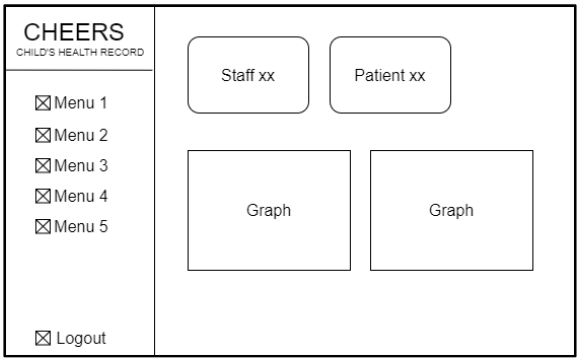


Figure 7 Admin and Staff Homepage Interface Wireframe

The interfaces that will be developed for the guardian are the homepage, biodata, immunization, appointment, development, and report pages. The highlight of the wireframe was the homepage pages as shown in Figure 8 where the user can pick any pages that they wanted to go and the interface also will be much more stylized compared to the staff and admin interface suits with its intention to be more engaged and simple to use for its user.

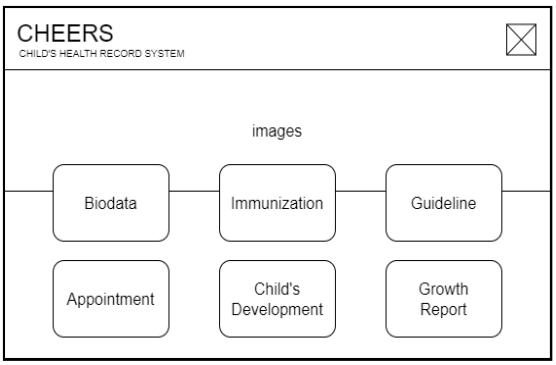


Figure 8 Homepage for Guardian Interface Wireframe

4.4 Implementation

System implementation of the Baby Health Record system is described in this section. It includes some of the partial code of the HTML, PHP, CSS, and JavaScript used for the development among the explanation of the system implementation. The interface of the system was executed and displayed using Google Chrome as its browser since it is widely used on different devices. While the database record of the system will be kept in MySQL using the XAMPP server. The main interface developed for the system were a dashboard, login, appointment, vaccination, screening, patient list, staff list, and health screening. Some of the interfaces will be depicted as follow.

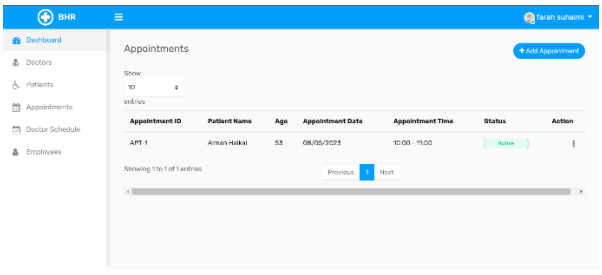


Figure 9 Appointment Interface

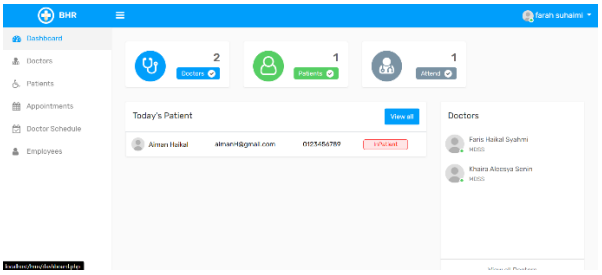


Figure 10 Dashboard Interface

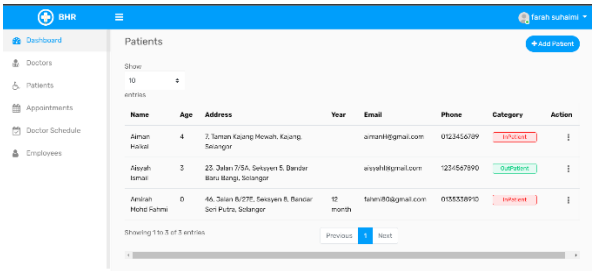


Figure 11 Patient Interface

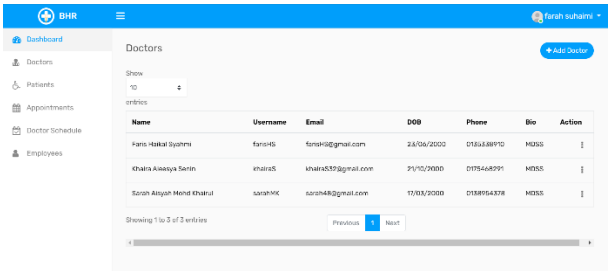


Figure 12 Staff Interface

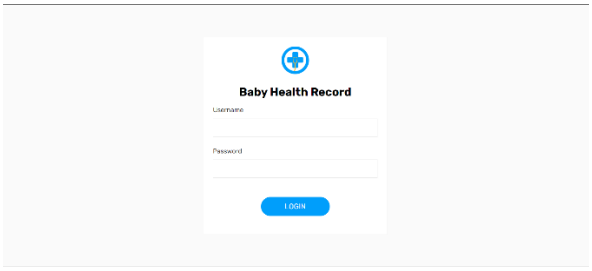


Figure 13 Login Interface

4.5 User Acceptance Testing

User acceptance testing was conducted by using an online platform via Google Forms. Generally, the aim of the feedback form received was to evaluate and discuss specifically user satisfaction and improvements that can be made to the developed system in the future. The questions will be divided into three sections following the main three interfaces developed: admin interface, staff interface, and patient interface. The complete feedback form for admins, staff, and patients is accordingly in Appendix X.

5. Conclusion

The Children's Health Record meets its expectations to be able to be used and adopted by the clinic as it can help them increase the productivity of the clinic by minimizing the manual process of data entry. If the system works well with proper maintenance for the long term, it may be integrated into the mySejahtera application with other functions that are related to using health data and information such as vaccination certificates and blood donor cards.

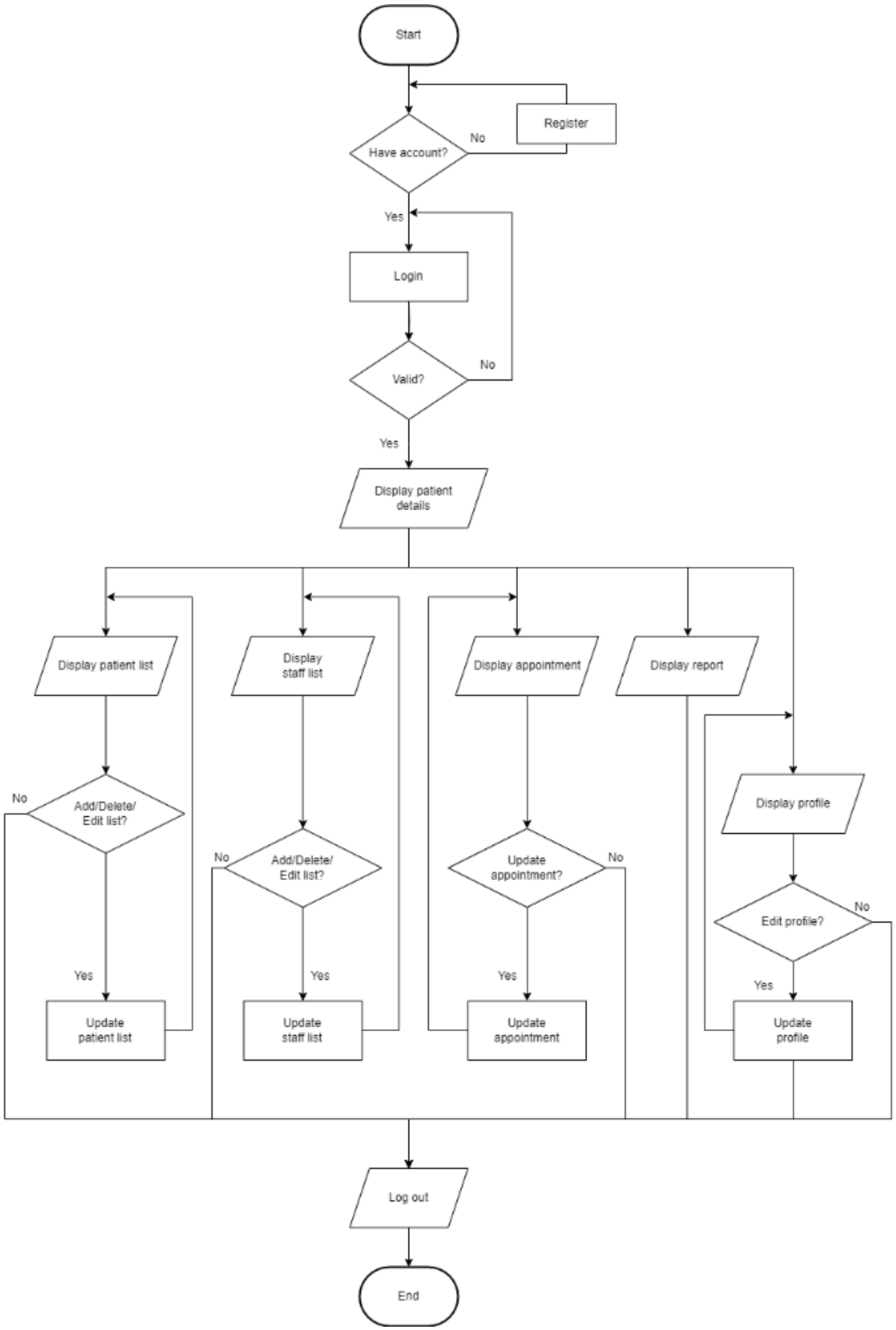
The system design will be simple and user-friendly to be used by a variety of ages. When the useruses the system, they may not face any difficulties or confusion since the user interface and experiencedesign will be considered and prioritized during the development of the system. Since the system willbe available online as it is a web-based system, in the future each guardian does not need to worry aboutlosing the record or leaving it at home every time they attend the health screening. Thus,

when the record is a digital platform, it can also help the guardians keep their child's health information for the long term. The data stored also can be used to analyze and make predictions on the healthy developmentof a community.

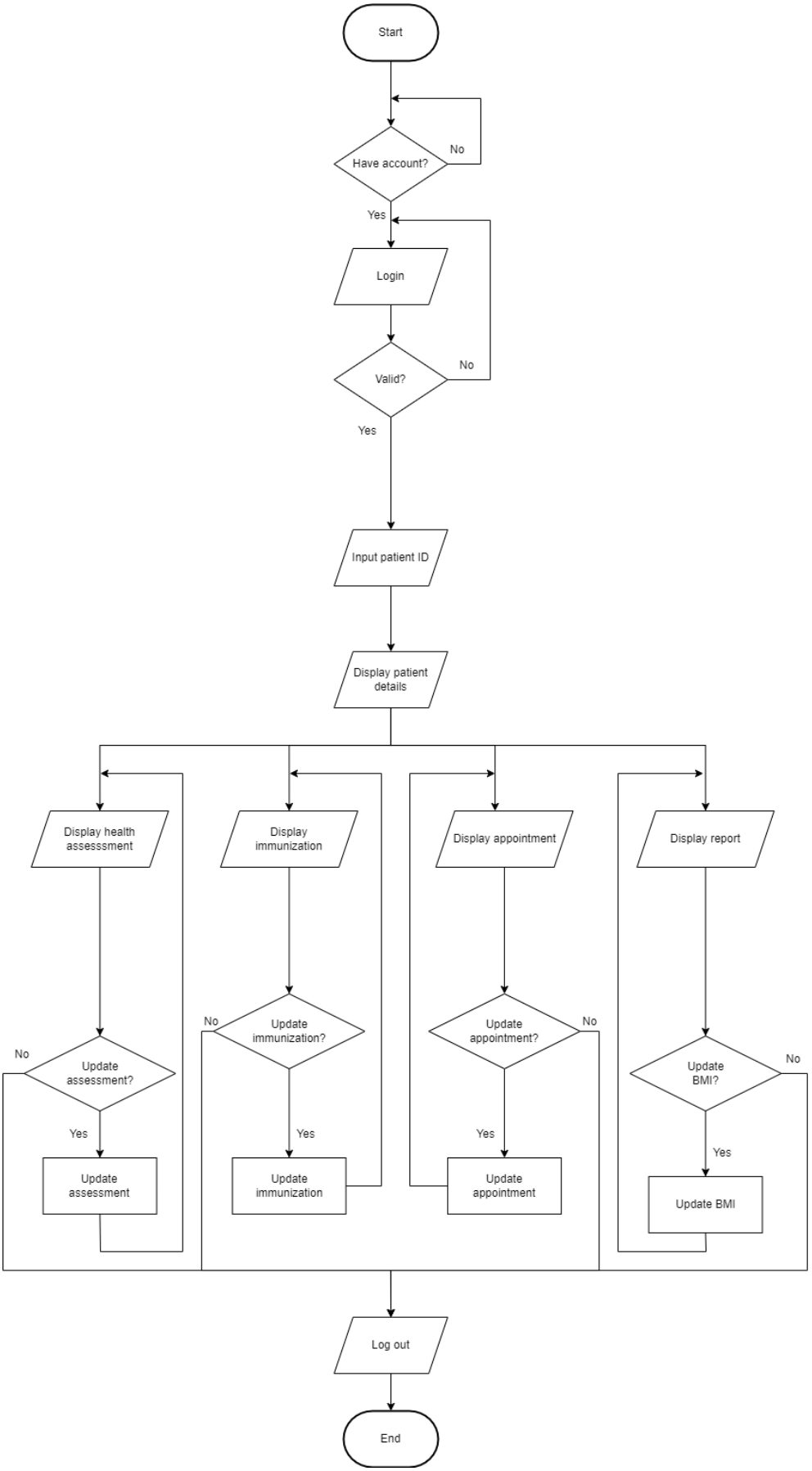
Acknowledgment

The authors would like to thank the Faculty of Computer Science and Information Technology, Universiti Tun Hussein Onn Malaysia for its support

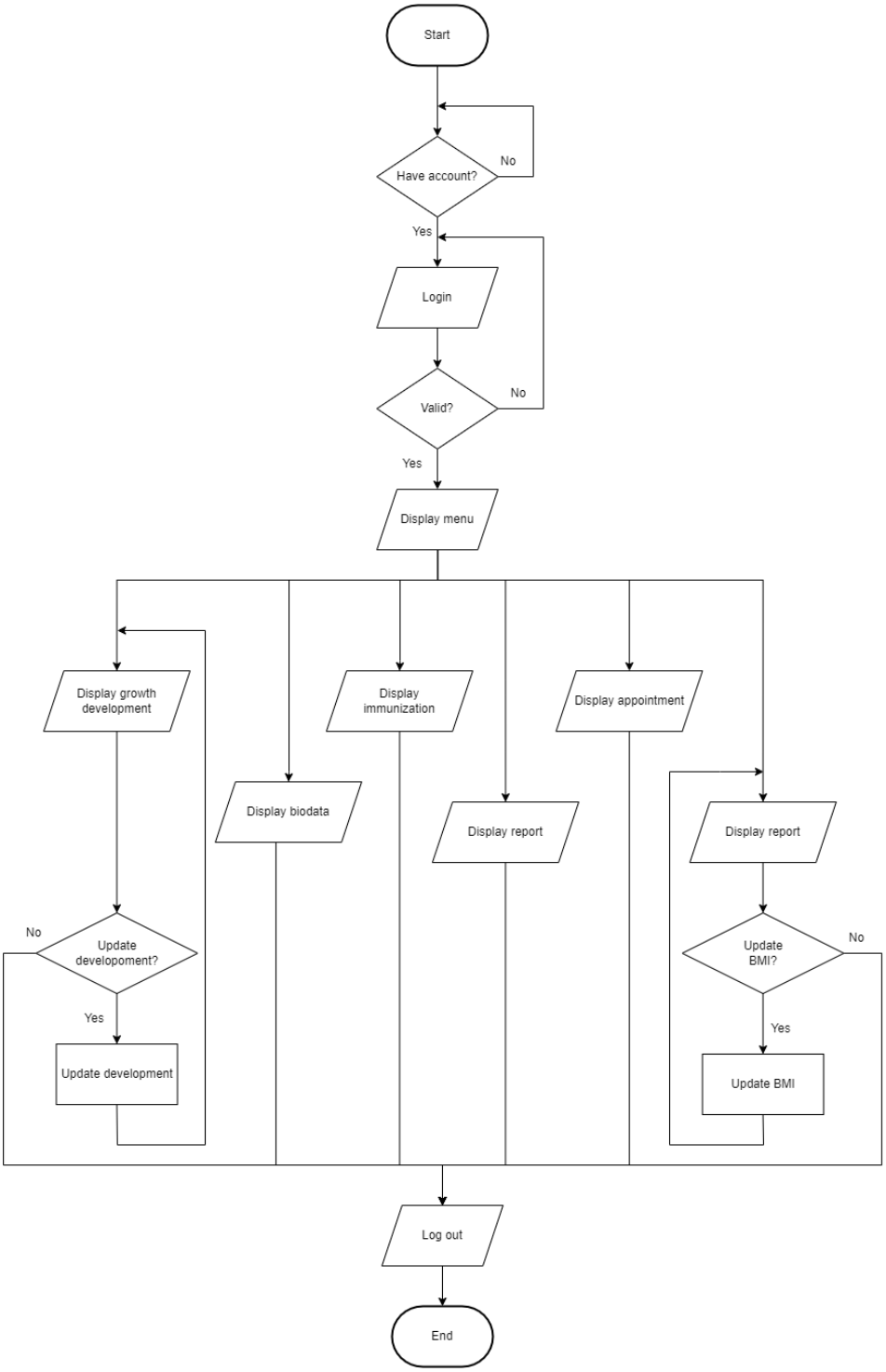
Appendices



Appendix A: Flowchart for admin



Appendix B: Flowchart for staff



Appendix C : Flowchart for guardian

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