

Medication Record Management System for Klinik Tweedie

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Abstract: Medication Record Management System is a software that assists medical staff members such as doctors, nurses, and clinic assistants in better managing their clinic, increasing clinic efficiency, integrating clinic operations, limiting clinic expenditure and staff manual work, and ultimately providing better care to patients. It is proposed for Klinik Tweedie after the clinic finds that there are several problems with the management of its medication records such as manual recording of the medicines using paperworks, no proper records are registered, and the management of the medications cannot be performed in various ways such as arranging the information chronologically or alphabetically. The objective of the project is to design a web-based medication record management system that records and manages medication data for Klinik Tweedie in order to efficiently manage the medicine information. This project involves three users namely administrator, doctor and staff respectively. Medication Record Management System for Klinik Tweedie is developed using structured approach and waterfall model development. The web-based system is cost-effective and energy-saving, also improves documentation and record keeping of medical information.

Keywords: Medication Record, Web-Based System, Inventory Management System

1. Introduction

A medication record management system is used in a clinic that helps automate the clinic's workflow. Reviewing doctor prescriptions and preparing medications, maintaining inventory and creating medicine orders, handling invoicing and insurance, finding incompatibilities, and more are all duties that must be completed by the clinic while adhering to legal norms and compliance issues (Editor, 2021).

Medication Record Management System is a software that aids medical staff members such as doctors, nurses and clinic assistants in better managing their clinic, enhancing clinic efficiency, standardising clinic operations, identifying relevant claims for patients, minimising clinic expenditure and staff manual work, thus providing better care to patients (Editor, 2021). It is proposed for Klinik

Tweedie after the clinic finds that there are several problems with the management of its medication records.

Klinik Tweedie was established in 1997. The founder of the clinic is Dr Balakumaran Sinnasamy. Located at 20 Jalan Ipoh, 31100 Sungai Siput (U), Perak, the clinic provides a general practitioner's consultation and treatment. The clinic is accountable in keeping all of the medication records. A separate record of which prescription was dispensed on each occasion must be kept in the clinical record (Prescription record keeping requirements for pharmacists, 2021). The prescription reference number, the amount issued, the date of dispensing, and the clinic's name and address must all be included (Prescription record keeping requirements for pharmacists, 2021). The original prescription must be kept while the document is still in use. However, the medication records need to be manually kept by the doctor and staff in paperwork or written documentation (Prescription record keeping requirements for pharmacists, 2021). Hence, this project aims to develop a medication record management system for Klinik Tweedie.

This paper is organized in five sections. Section 1 explains the background of the project. Section 2 describes the related work. Section 3 briefs about the methodology. Section 4 describes about the results and discussions and section 5 concludes the project.

2. Related Work

2.1 Case Study

Klinik Tweedie was founded in 1997. Dr. Balakumaran Sinnasamy is the clinic's founder. The clinic, which is situated at 20 Jalan Ipoh, 31100 Sungai Siput (U), Perak, offers general practitioner consultation and treatment. The clinic is responsible for maintaining all medication records. The clinical record must keep a distinct record for each prescription dispensed.

2.2 Web-based Application

A web-based application is any programme that is accessible over HTTP over a network connection rather than being stored locally on a device (Atnafu & Balda, 2018). The majority of web-based applications operate in a web browser. Web-based apps can also be client-based, in which a tiny portion of the programme is downloaded to a user's desktop but processing is done on an external server through the internet. Web-based applications are also known as web apps. Web-based applications are easier to create and more beneficial to the users, easier to set up, maintain, and easier to expand as business grows.

2.3 Inventory Management

Inventory management is described as a framework used by businesses to manage their inventory. It entails keeping track of stock levels, projecting future requests, and deciding when and how to make arrangements (Atnafu & Balda, 2018). The commodities and products that pass through a company will undoubtedly get into disorder if there is no inventory management system in place. An inventory management system allows a corporation to keep a centralized record of every asset and item under its control, giving a single source of truth for data such as item location, vendor and supplier information, specifications, and the total quantity of items currently in stock (Atnafu & Balda, 2018).

2.4 Comparison with the Existing Systems

A few similar software applications have been chosen to identify their features that can be applied to the proposed system. Three existing software applications with diverse functions and different methods are presented. The results of this comparison will be implemented in systems development at Medication Record Management System for Klinik Tweedie. The three existing systems that will be

compared are Winpharm (Bourdoules et al., 2022), PrimeRx (Software Advice, 2021), and PioneerRx (Pharmacy System | PioneerRx - Top Pharmacy Software System, 2021).

A thorough comparison is carried out on similar systems. Subsequently there are some differences and similarities identified. **Table 1** shows a comparison between similar systems and the proposed system.

Table 1: Comparison analysis among similar systems

Features / System	Winpharm (Bourdoules et al., 2021)	PrimeRx (Software Advice, 2021)	PioneerRx (PioneerRx, 2021)	Medication Record Management System For Klinik Tweedie
Login Module	Yes	Yes	Yes	Yes
Registration Module	Yes	Yes	Yes	Yes
Inventory Module	Yes	Yes	Yes	Yes
Report generator	Yes	Yes	Yes	Yes
Internet Requirement	Yes	Yes	Yes	Yes
Use Case	Small Business	Small Business	Small Business	Small Business
Platform	Web-based & Android application	Web-based & Android application	Android application	Web-based

Based on **Table 1**, all the systems have various features but most of them have the same features which are the login module, inventory module, and report generator. All of the systems have a login and registration module. Next, all systems have the ability to generate a report and statistics of the inventory. Additionally, all the systems require an Internet connection in order for the system to run. All the systems are small-scale enterprise systems. Finally, Medication Record Management System For Klinik Tweedie is a web-based system while PioneerRx runs on an Android application. Winpharm and PrimeRx can run on either both web and Android app.

3. Methodology/Framework

The waterfall model is a software development life cycle model which was originally defined by Royce in 1970's (Wazlawick, 2014). The waterfall method was like a series of logical phases in which the progress use to flow from one phase to another (Wazlawick, 2014). The basic assumption was like the requirements must be defined upfront for the software to be designed, build, and tested (Westland, 2021). The waterfall methodology is a linear project management strategy in which stakeholders and customer requirements are gathered at the start of the project, and a sequential project plan is then designed to satisfy those requirements. The waterfall model gets its name from the way each phase of the project cascades into the next, like a waterfall. It's a thorough, structured methodology and one

that's been around for a long time, because it works. Some of the industries that regularly use the waterfall model include construction, IT and software development (Westland, 2021).

3.1 Planning Phase

In this first stage which is the planning phase, a meeting with the client is held to better understand their needs. This is the most important step since any miscommunication or misconception (at this point) could affect the quality of the software being built. The process of defining clear, identifiable tasks and the work required to complete each activity within such a specific project is the major element of project planning. The outcome of this phase is a Gantt Chart that presents the planned activities, duration and resources.

3.2 Analysis Phase

The second phase is the analysis phase. This phase examines the software and hardware required to complete the project properly, based on the requirements. During this phase, features such as the computer language should be used to design the software and the database system that can be used to ensure the product's project's smooth operation are decided. Functional, non-functional requirements, flowchart, use case and class diagram are produced in this phase. The functional requirements are shown in **Table 2**, whereas the non-functional requirements are shown in **Table 3**. **Table 4** lists the user requirements.

Table 2: Functional requirements of the proposed system

No	Module	Description
1.	Admin Module	<ul style="list-style-type: none"> The system should enable the admin to register account by name, username, password. The system should enable the admin to login the system using username and password. The system should enable the admin to reset password. The system should enable admin to add, update or delete all the information regarding medicine such as item info, purchase info, sale info, customer info, vendor info. The system should enable the admin to search a particular medicine in the system. The system should enable the admin to generate basic report of medication.
2.	Staff Module	<ul style="list-style-type: none"> The system should enable the staff to register account by name, username, password. The system should enable the staff to login the system using username and password. The system should enable the staff to reset password. The system should enable staff to add, update or delete all the information regarding medicine such as item info, purchase info, sale info, customer info, vendor info. The system should enable the staff to search a particular medicine in the system. The system should enable the staff to generate basic report of medication.
3.	Medicine Module	<ul style="list-style-type: none"> The system should allow the user to store all the information regarding medicine such as item details, purchase details, vendor details, customer info, sale info. The system should allow the user to search or generate report of medication records stored in the system.
4.	Backup Module	<ul style="list-style-type: none"> The system should be able the user to generate a basic report of the medication records stored in the system

Table 3: Non-functional requirements of the developed system

No	Requirements	Description
1.	Performance	The system should be usable at all times.
2.	Compatibility	The system should function well when other applications are running.
3.	Security	The system should be protected to prevent unauthorized access.
4.	Reliability	The system should operate well even after extensive use.

Table 4: User requirements of the developed system

No.	User Requirements
1.	All users must be able to enter a valid username and password to enter the system.
2.	Admin should be able to register account by name, username, password.
3.	Admin should be able to login the system using username and password.
4.	Admin should be able to reset password.
5.	Admin should be able to add, update or delete all the information regarding medicine such as item info, purchase info, sale info, customer info, vendor info.
6.	Admin should be able to search a particular medicine in the system.
7.	Admin should be able to generate basic report of medication.
8.	Staff should be able to register account by name, username, password.
9.	Staff should be able to login the system using username and password.
10.	Staff should be able to reset password.
11.	Staff should be able to add, update or delete all the information regarding medicine such as item info, purchase info, sale info, customer info, vendor info.
12.	Staff should be able to search a particular medicine in the system.
13.	Staff should be able to generate basic report of medication.

Figure 1 shows the Context Diagram for Medication Record Management System For Klinik Tweedie. The context diagrams show the overview of how Medication Record Management System for Klinik Tweedie works. Context diagram is the top levels view that shows the boundary of the system, it is the first DFD in each process. Data storage is not shown in the context diagram unless it is owned by another information system because data storage is the internal components of the system.

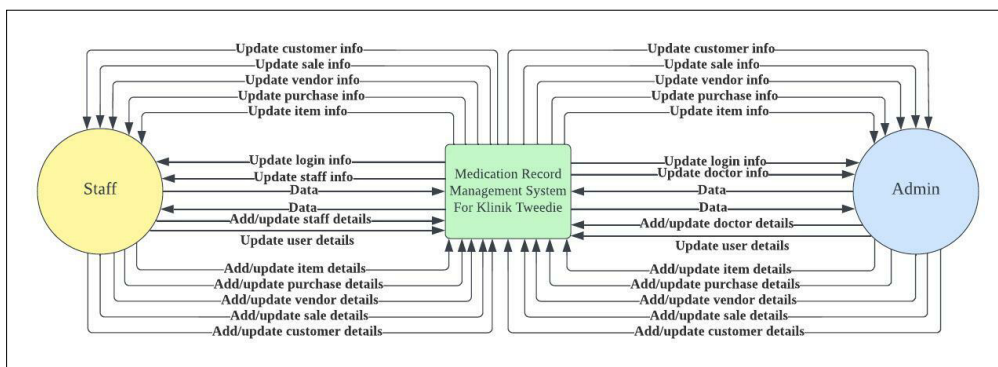


Figure 1: Context Diagram of Medication Record Management System for Klinik Tweedie

A data flow diagram (DFD) is a graphical or visual representation of a business or organisation through transmitted data that uses a defined set of symbols and notations (Yao, 2008). **Figure 2** shows DFD Level 0 for Medication Record Management System for Klinik Tweedie.

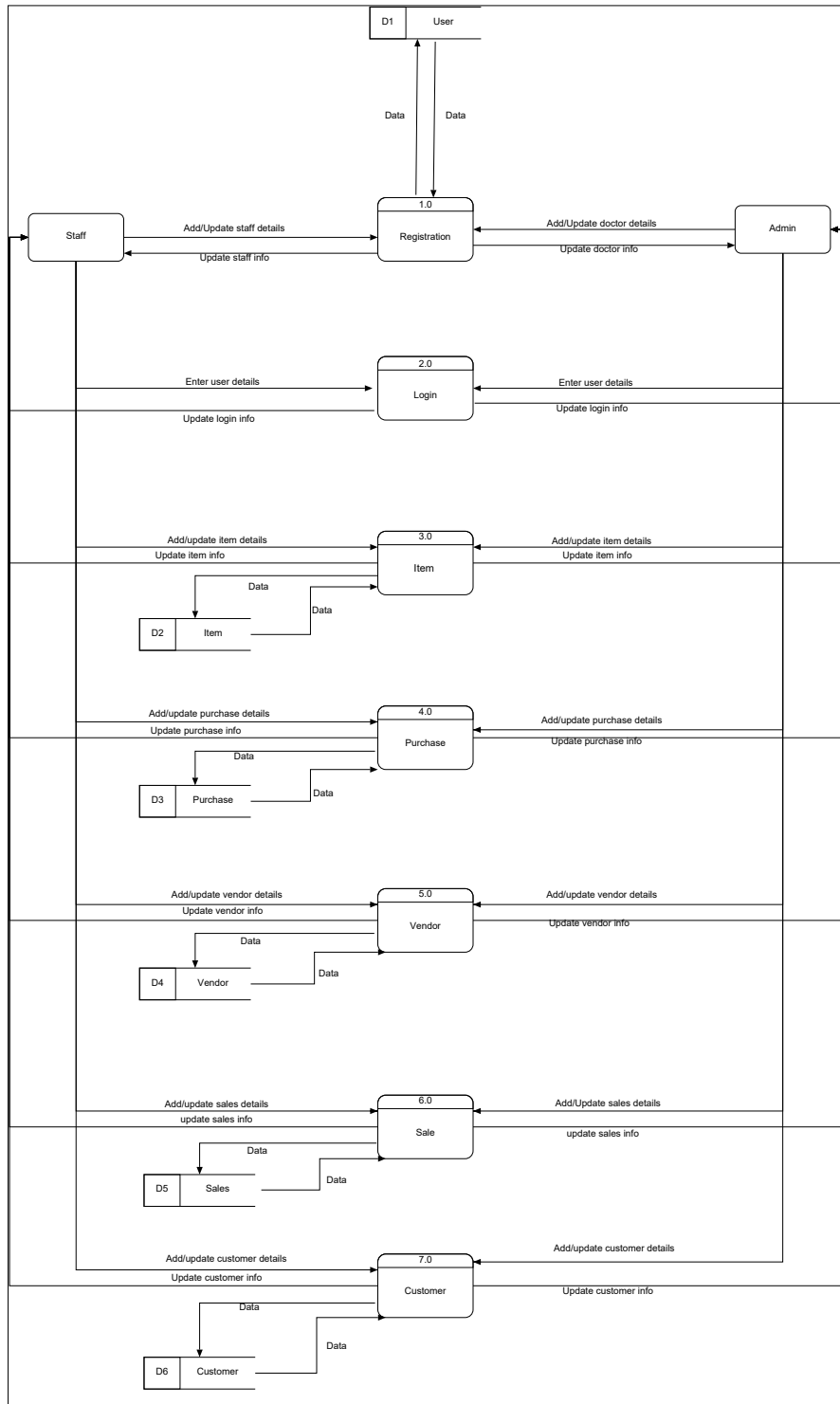


Figure 2: DFD Level 0 for Medication Record Management System for Klinik Tweedie

A flowchart is a symbol-based representation of a movement system that must be followed. **Figure 3** displays the Medication Record Management System for Klinik Tweedie's flow from start to end.

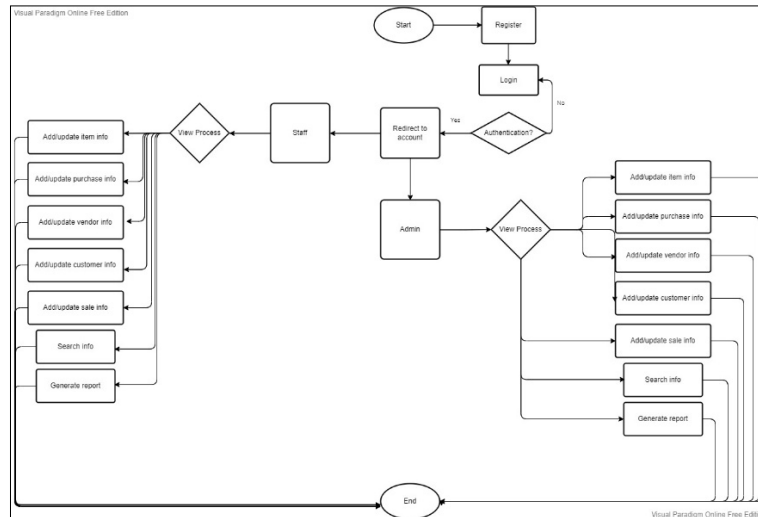


Figure 3: Flowchart of Medication Record Management System for Klinik Tweedie

Appendix A shows the entity relationship diagram for the system where there are a total of nine classes each with their corresponding attributes and operations.

3.3 Design Phase

The design phase, which is the third phase in the waterfall model, is the groundwork for real programming and implementation takes place. The requirements acquired in the preceding phase are split down into logical parts, making the software development process easier to implement. This is the stage at which the software, as well as hardware components for each unit, are determined. The designs would then be created accordingly.

The system architecture defines the structure of the software system, which is depicted in **Figure 5**. The users (admin//staff) will go through the web interface where the modules are settled, which are admin module, staff module, medicine module, and backup module. The modules' data are linked to database.

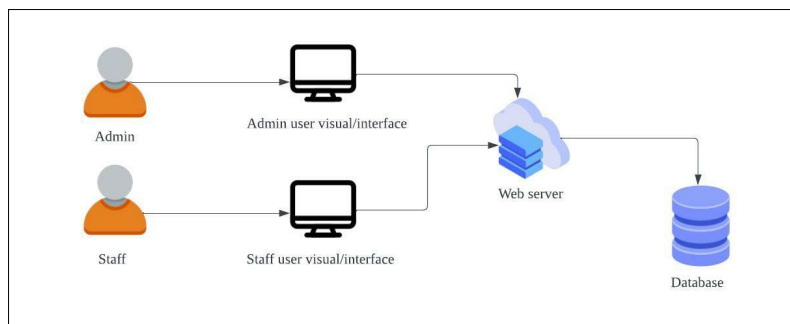


Figure 5: Medication Record Management System for Klinik Tweedie's system architecture

Relational schema for this system is listed in the following:

- i. Registration (user_id, fullname, username, password, status)
- ii. Login (user_id, username, password, status)
- iii. Admin (user_id, username, fullname, password, status)
- iv. Staff (user_id, username, fullname, password, status)
- v. Item (itemNumber, product_id, itemName, discount, stock, unitPrice, imageURL, status, description)

- vi. Purchase (itemNumber, purchaseID, purchaseDate, itemName, unitPrice, quantity, vendorName, vendorID)
- vii. Vendor (vendorID, fullName, email, mobile, phone2, address, address2, city, district, status createdOn)
- viii. Sale (itemNumber, saleID, customerID, customerName, itemName, saleDate, discount, quantity, unitPrice)
- ix. Customer (customerID, fullName, email, mobile, phone2, address, address2, city, district, status, createdOn)

The followings are the interfaces that have been designed based on each process in **Figure 6, 7, 8,** and **9**. They are designed by using MockFlow (Produle, 2021).

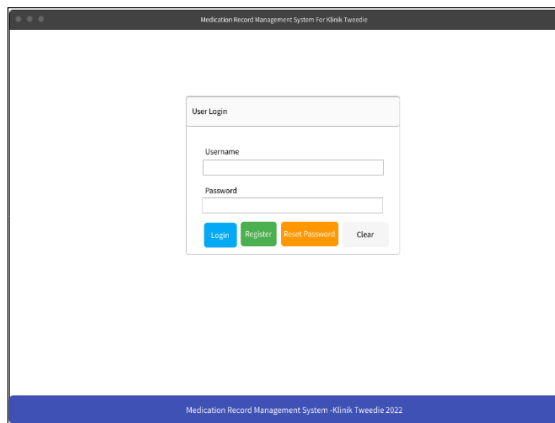


Figure 6: User login Interface

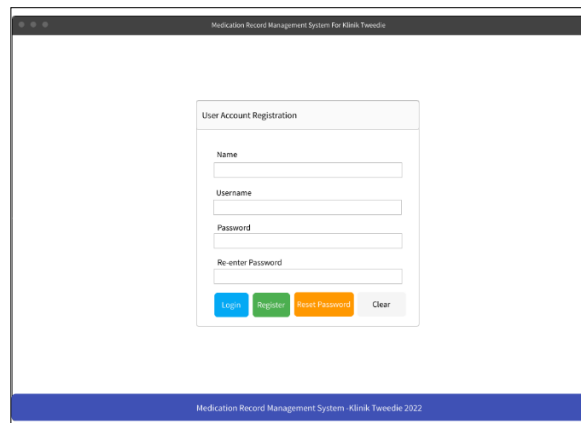


Figure 7: User account registration Interface

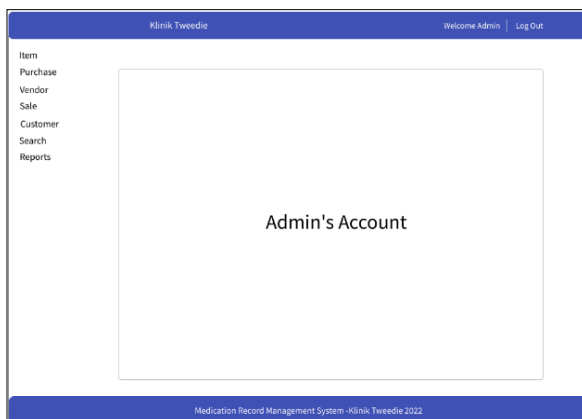


Figure 8: Admin account Interface

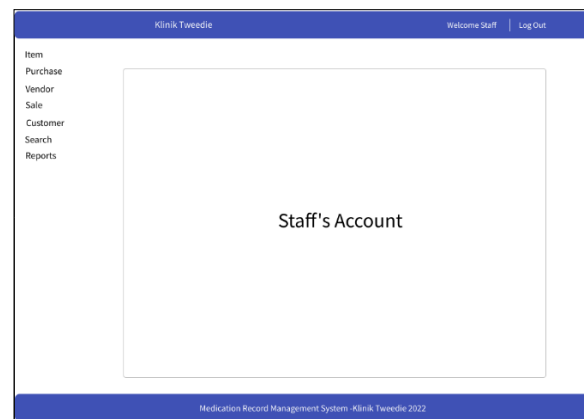


Figure 9: Staff Interface

3.4 Implementation Phase

The actual software development takes place at the implementation phase. This stage is often referred to as the coding and verification stage. A software application is constructed based on the algorithms created in the preceding phase. Programming code is composed then validated for each component to ensure that the correct output is received.

3.5 Testing Phase

Following the completion of the application's coding, the written code must now be tested. Testing determines whether the designed developed software has any defects and if it has been designed according to the listed specifications. This stage's phase's successful design assures that the customer who is interested in the developed software will be satisfied with the final result. If any problems are discovered, the problems are recorded, analysed and the software development process must should be restarted at the design stage if the problems are severe.

3.6 Maintenance Phase

This completes the waterfall model's final phase, in which the software is structured on the client's end after extensive testing. After the software has been deployed, routine maintenance is carried out. If the customer requests any modifications or upgrades after the software has been deployed, the entire process must will be repeated but at the specific parts of the software.

4. Results and Discussion

In this section, user testing case will be discussed. A test will be carried out to assess the functionality of each module. A Questionnaire of User Interface Satisfaction, QUIS, (Upton et al., 2020) method is utilized to perform testing.

This section depicts the results of the QUIS method conducted with three selected users, Doctor, First Staff (Staff1) and Second Staff (Staff2). There are total of 5 Parts for this user test case, which are Part A: Interface, Part B: Terminology and System Information, Part C: Learning, Part D: System Capabilities and Part E: General Impressions. The purpose of this user testing case is to verify whether the selected users are able to access the system, use the system, and evaluate the system according to their satisfactory. The QUIS method uses a scale system, with the lowest score being 0 whereas the highest score is 10.

Figure 10 shows the graph of user test case results, Part A: Interface. The first element of the interface which is characters scored 9 of overall rating on average. Highlighting on the interface has an overall rating average score of 9. Interface layouts has an overall rating average score of 9 from Doctor, and average score of 8.8 from Staff 1 and Staff 2. Subsequently, Sequence and Easy to Select elements have overall rating average score of 9.

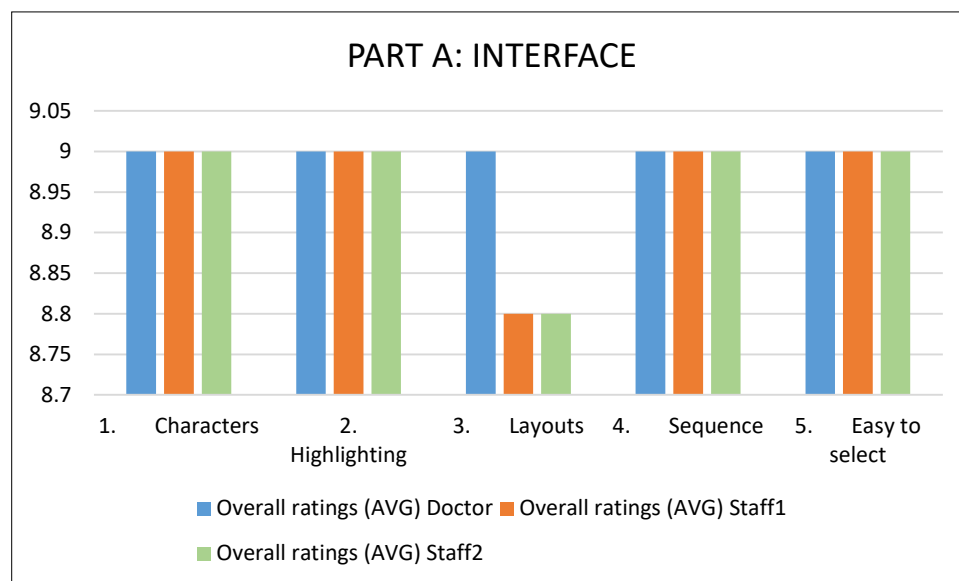


Figure 10: Part A: Interface

Figure 11 depicts graph results of user test case which is Part B on Terminology and System Information. All of the elements have the highest overall rating average score of 9 from three users, Doctor, Staff1 and Staff2.

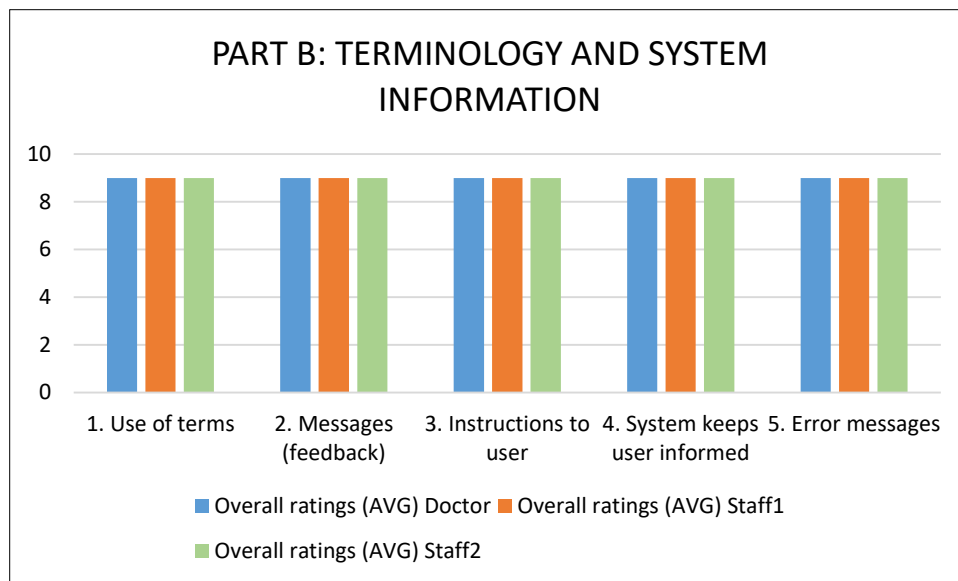


Figure 11: Part B: Terminology And System Information

Figure 12 illustrates the graph results of user test case, on Part C: Learning. Learning to operate the system, Exploration of features, Help messages on the interface have an overall rating score of 8.8 from the three users. Meanwhile, Remembering terms and use of conditions scored about 8.8 from Doctor, and a score of 9 from both staffs. The users have rated highest scores for both elements which are Tasks can be performed in a straightforward manner and Reference materials.

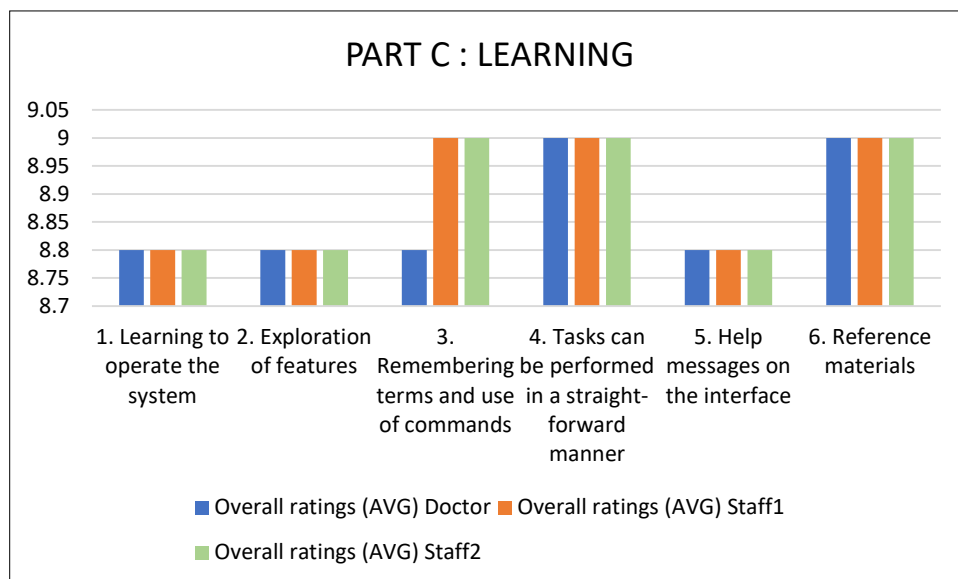


Figure 12: Part C: Learning

Figure 13 depicts the graph results of user test case, on Part D: System Capabilities. All of the elements have the highest score of overall rating by average, which is 9, except for the second element, system sound, is not applicable (NA) in the system.

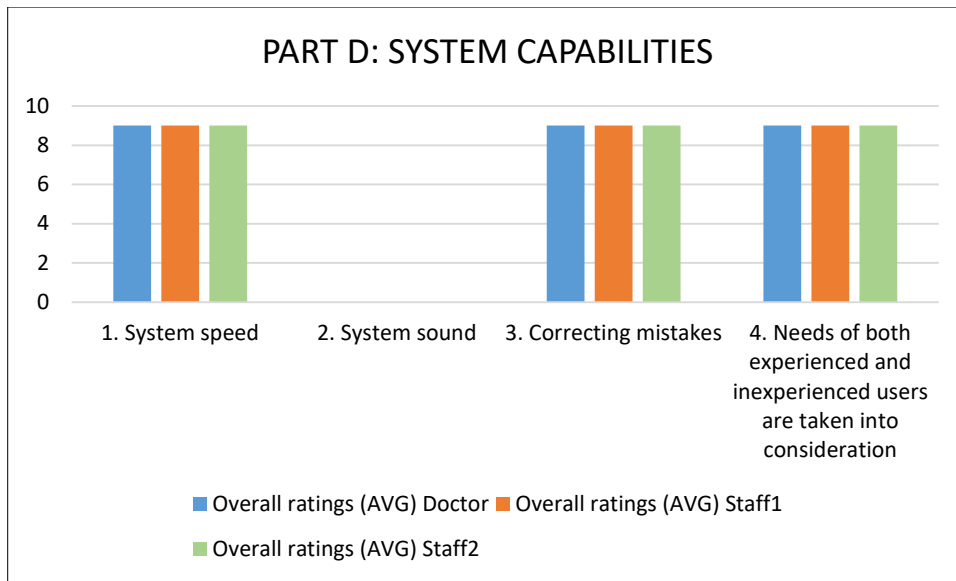


Figure 13: Part D: System Capabilities

Figure 14 shows the graph results of the user test case, on Part E: General Impressions. All of the elements have been rated with highest scores of 9 by the users, Doctor, Staff1, and Staff2.

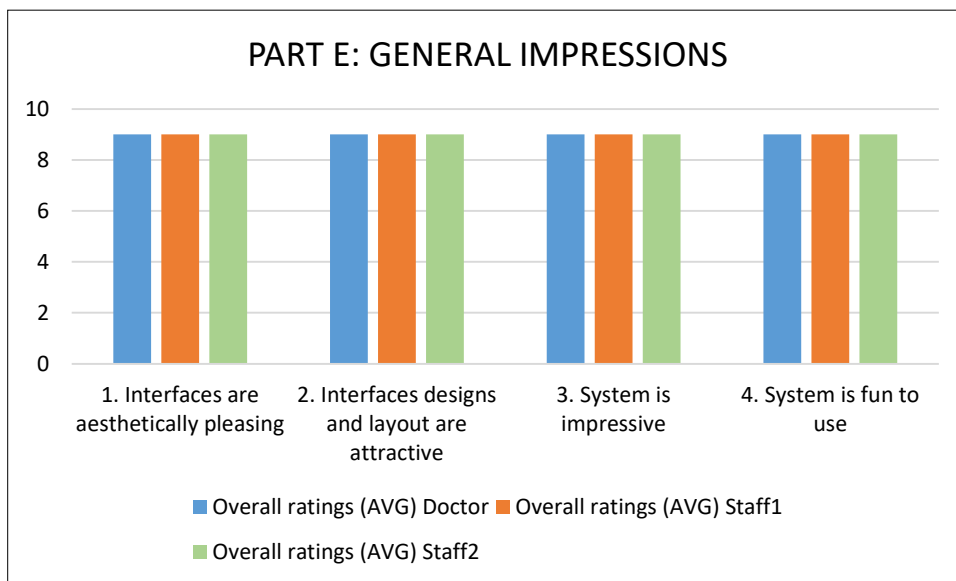


Figure 14: Part E: General Impressions

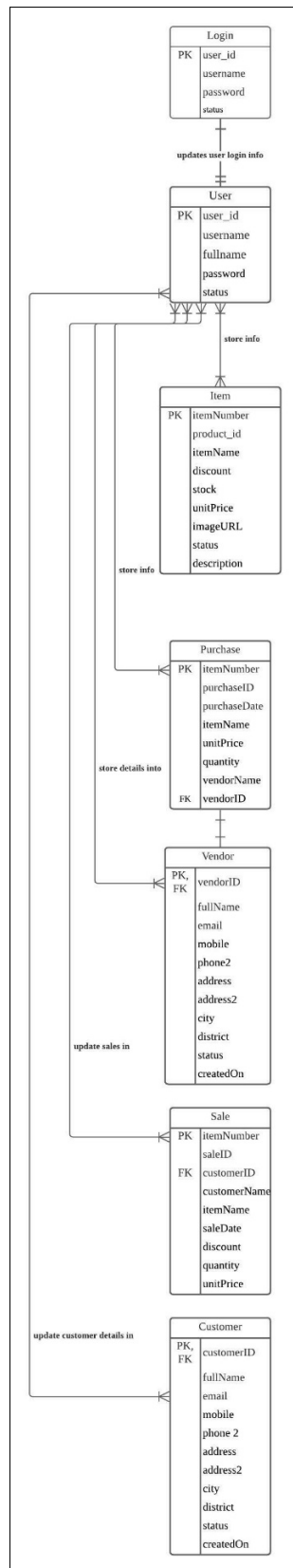
5. Conclusion

This project proposed and developed a web-based medication record management system according to the user’s requirements from Klinik Tweedie. Based on the user testing, the system has met the user’s requirement. The system is responsible to make the tasks easier for the doctor and staff working at Klinik Tweedie. It is hoped that the system can also be useful to other clinics that experience similar problems like Klinik Tweedie.

Acknowledgment

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Appendix



Appendix A: Entity Relationship Diagram for Medication Record Management System for Klinik Tweedie.

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