Applied Information Technology And Computer Science Vol. 5 No. 1 (2024) 960-977

AITCS

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/aitcs
e-ISSN :2773-5141

Swift Remedy Pharmaceutical Management System for Clinic Mediviron Seapark

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DOI: https://doi.org/10.30880/aitcs.2024.05.01.054
Received 24 June 2023; Accepted 18 June 2024; Available online 30 August 2024

Abstract: The pharmacy department in hospitals and health facilities provides comprehensive pharmacological care to patients. It oversees sales, drug inventory, and patient information. However, during busy times, overcrowding becomes a problem, resulting in longer wait times and discomfort for patients. To address this issue, an automated pharmaceutical management system called Swift Remedy was developed. Swift Remedy automates various procedures involved in pharmaceutical management, improving workflow efficiency and reducing crowds. It offers new features such as virtual waiting times, mail-order pharmacies, drug inventory management, and medical record monitoring. The creation of Swift Remedy involved object-oriented analysis and an incremental process methodology, utilizing the Visual Studio Code IDE. Swift Remedy is an advanced automated system that has the potential to enhance the efficacy and effectiveness of pharmaceutical care, empowering users to better manage their pharmaceutical activities.

Keywords*: Pharmaceutical Management, Automated System, Workflow Efficiency*

1. Introduction

Pharmaceutical departments provide healthcare by preparing, storing, compounding, and dispensing medicines. Pharmaceutical care is provided through ambulatory care and in-patient care, as well as effective pharmacy practice to ensure optimal individualized pharmaceutical care [1]. A modern pharmaceutical management system, used by Mediviron Seapark Clinic, a case study in this project, is in place to guarantee the timely and safe distribution of pharmaceuticals to patients. The system is overseen by a team of experienced pharmacists who work closely with doctors and nurses to ensure that patients receive the correct medications in the correct doses. The system uses a computerized database to track patient records, drug inventories, and sales. This allows pharmacists to access information quickly and easily about a patient's medical history, and current medications. It also allows pharmacists to monitor drug supplies and ensure that there are always enough medications on hand to meet patient needs.

The current method of handing over drug prescriptions to patients is efficient, but it can be challenging during peak hours when there are many patients waiting to receive their medications. This can lead to long wait times for patients, which can be inconvenient for both the patients and the clinic.

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There may occasionally be a backlog in the waiting area with patients leaving without consulting because of this. Additionally, since outpatients only buy medication from pharmacies, the existing system does not hold records for them. It takes time to inquire about the illness, and the pharmacist will prescribe the appropriate medication. Also, there is no information indicating if any of the patients on the list have relocated to a different hospital or branch or have taken their prescribed medications. Therefore, it is essential to upgrade the current method for implementing data management processes to meet these requirements.

The swift remedy pharmaceutical management system that automates the workflow can be used to lessen crowds and enable a more ordered approach. The new developed system requires patients to register and scan QR codes to wait virtually. In this case, patients who want to consult a doctor must wait for their turn remotely. A pharmacist checks the patient's prescriptions and prepares medicines according to the changes made in the system by the doctor. Patients collect their medications, and the system ends. Outpatients who visit the clinic for the first time must register with the system and scan a QR code. In order to purchase medicines, they need to wait remotely until the pharmacist inquiries about their illness and prepares appropriate medication. Out-patients pick up the medication at the dispensing area and leave. For regular patients who get refills every month, their medicines will be reviewed by a pharmacist and their prescriptions will be mailed to them. The patient's records will be updated in the system. The patient can update the pick-up schedule if he or she cannot pick up the medication on the given date. The system allows pharmacists to keep track of patient records and drug inventory. Virtual queuing and mailing solutions are the next wave of technology for businesses, providing numerous ways to be more efficient and helpful, allowing patients to have better and more pleasant wait times.

This paper is organized into five sections. Section 1 provides background information on the project. Section 2 discusses related work. Section 3 describes the methodology used in the project. Section 4 summarizes the results of the project. Section 5 provides concluding remarks.

2. Related Work

Pharmaceutical services relate to the duties and chores involved in purchasing, dispensing, distributing, controlling, and storing all medications used inside the facility as well as keeping track of patients' drug therapies [2]. Pharmacists are in charge of making sure that the medications provided to patients are suitable, giving patients advice on how to use their medications, including any possible side effects, and responding to their inquiries. The pharmaceutical system should be strengthened by considering numerous systems, connections, and interactions that support access and responsible use of safe, effective, and high-quality medications [3]. It is essential that pharmaceutical systems are strengthened to address several remaining issues surrounding increasing access to and responsible use of medications and services.

The healthcare sector, including public hospitals, has become increasingly dependent on information technology (IT) [4]. The information system has been found to play a significant role in improving patient care. Prescriptions at Hospital Selayang [5], are processed through a computerized system. Computerized system that includes software, operating system software, and supporting documentation for automating prescription management [6]. There are many potential benefits to utilizing an electronic health record over traditional paper records, such as cost containment, error reduction, and improved compliance through real-time data. There are also a number of services offered, including mail pharmacy, drive-thru, appointment cards, and integrated drug dispensing system, SPUB [7], which are related to the developed system. In Hospital Kuala Pilah, the MyUBAT application [8] provides patients with faster and easier access to their medications than ever before. It was developed to make it easier for patients to apply pharmacy value-added services through their smartphones rather than heading to the pharmacy counter. MyUBAT offers pharmacy value-added services, tracking

medication parts (Medicine by Post service), and follow-up medication supply date tracking. Table 1 summarizes the comparison.

Table 1: System's Comparison

System / Features	Take-A-Number Queue Management System	Drug Inventory Management and Patient Record Systems	Drug Inventory Management and Patient Record Systems	Swift Remedy Pharmaceutical Management System
Registration	Uses patient card	Patient's records are registered in the system	Patient's records are registered in the system	Registries will be maintained digitally for in-patients and out-patients
Login to the system	Not available	Staff username and password	Staff username and password	Login with a username and password for both patients and staff
Patient Management	Manually recorded in a card for each patient	Records are updated in the system periodically	Records are updated in the system periodically	The system updates record periodically, pharmacists can track them, and patients can check them
Drug Inventory Management	Manually recorded	The system records the inventory of drugs	The system records the inventory of drugs	The system records data more clearly in a form of table, including the expiration date
Dispensing Queue Type	Take-a-number system	Take-a-number system	Take-a-number system	Scan a QR code and wait digitally
Medication Refill Services	Mail pharmacy, Drive-thru, and Appointment cards	Mail pharmacy, Drive-thru, Appointment cards, and Sistem Pendispensan Ubat Bersepadu (SPUB)	Not available	Mail pharmacy and appointment cards will be digitalized

Given the circumstances, it is deemed crucial for the hospital to utilize the resources provided by modern digital technology, which substantially facilitate data management and can subtly enhance service quality. By utilizing a mix of computer technology, information systems, databases, and Internet technology, the efficiency of the data storage process in the hospital pharmacy department can be increased [9]. Service time is one of the subjects addressed. As a result, in this project, a web-based information management system was implemented to manage the process of data management to assist medical collection by the patients and report production for the hospital's pharmacy department. Web-based information systems deliver information and services over the Internet to users and other systems [10]. Hypertext-based software allows publishing and maintaining data through hypertext functions. The components of a web information system include web applications, functionally oriented components, information components, and other non-web components. Web browsers are used as the front-end of most applications, while databases are used as the back end. The implementation of web-based solutions streamlines Clinic Mediviron Seapark's business processes by speeding up decision-

making and improving quality. For instance, the health information systems (HIS) are systems focused on health-related data collection, distribution, and use that provide information at regular intervals [11].

The use of web-based technologies enables individuals to connect with each other over networks accessible over the internet [12]. Web-based applications used to be very limited in functionality. However, advances in technology, security, and internet speeds have greatly increased the potential scope of web-based systems. Web-based technology allows anyone to access a web-based system wherever they have an internet connection, a web browser, and the appropriate login credentials. As a result, users have easy access to the data they need. A web-based technology allows Clinic Mediviron Seapark to share data and collaborate much more easily [13]. The data is stored in one central location, which allows users to share and collaborate on works. The integration of web-based technology is also simpler than that of isolated desktop applications. Swift remedy's web-based technology allows patients to scan QR codes from their smartphones.

The above-mentioned feature is critical in today's world of digital technology when all information must always be accessible. Taking this into consideration, it is essential for pharmaceutical departments in hospital to participate in the advancement of its data management capabilities using cutting-edge technology. A web browser system and a database are needed to improve the current process implementation in Clinic Mediviron Seapark. This will improve the clinic's ability to manage business operations, task distribution, and workforce efficiently. Three similar systems were also investigated and compared with the proposed system. The results of this study are important for identifying good features that can be implemented in a new system.

3. Methodology

The Swift Remedy Pharmaceutical Management System uses the incremental process model in its system development and lifecycle (SDLC) methodology. This model is chosen because it provides a comprehensive overview of the entire project, including the required tasks, budget estimates, and timelines. The incremental process model consists of five phases: planning, analysis and design, implementation, testing, and integration.

The level of requirements details could be classified into two types which are functional and nonfunctional requirements [15]. Functional requirement is defined as a main basic action or feature that must be included in a system to support the pharmaceutical management system activities. Non-functional requirement is defined to present the tasks performance in term of the overall system [16]. The functional requirements are summarized in Table 2, while the non-functional requirements are summarized in Table 3.

Table 2: Functional requirements.

	Modules	Function
1.	Login and Register Account Module	• The system should allow users to login into the system through a username and password. • The system should direct valid users to the main page, and an error for invalid users. • The system should allow only new users (patients) to register with the system. • The system should allow the doctor and pharmacist with full access privileges.
2.	Patient Information Management Module	• The system should allow administrator to access all patient records. • The system should allow administrator to make changes to patient data. • The system should allow patients to update their information.

3.	Virtual Queue Management Module	• The system should be accessible when a patient scans a QR code. • The system should allow patients to wait for their turn remotely. • The system should allow patients to see the number of their turn. • The system should allow administrator to manage patient flow through the virtual queue system. • The system should always provide real-time analytics to administrator. • The system should allow the administrator to send notifications to patients.
4.	Manage Patient's Medical Record Module	• The system should allow the doctor to record the patient's medical record as well as prescriptions. • The system should allow the pharmacist the ability to check prescription details and alter them if necessary. • The system should allow the patient to view their medical record.
5.	Drug Inventory Management Module	• The system should allow the pharmacist to keep track of their drug inventory at any time. • The system should allow the pharmacist to manage drugs information. • The system should allow the pharmacist to check the status of drug stocks. • The system should allow the pharmacist to verify a drug's expiration date.
6.	Manage Pick-Up Medication	• The system should allow the pharmacist to set up a schedule, reschedule medication dates for patients, as well as edit the schedule if necessary. • The system should allow the pharmacist to verify whether follow-up prescriptions have already been collected by patients. • The system should handle the notification process if a patient/caregiver does not pick up medication three days before and three days after. • The system should allow the patient to reschedule the drug pick-up date.
7.	Medication Refill Services (Mail Pharmacy) Module	• The system should allow patients to apply for refill medicines by mail. • The system should notify the patient if their application has been accepted. • The system should provide the pharmacist with the authority to approve mail pharmacy applications. • The system should allow the pharmacist to track the medication records of their patients.

Table 3: Non-functional requirements.

No.	Requirements	Description
1.	Operational	• The system should be user-friendly. • The system should be easily maintained and updated. • The system should be able to work on most web browser.
2.	Usability	• The system's interface has to be user-friendly and easy to use.
3.	Performance	• The system should be available 24 hours per day. • The system should be accessible over the Internet easily. • The system load time should not exceed 10 seconds for users with excellent internet connections.
4.	Security	• Users can only access their own account with username and password. • Only authorized users can view the patient's personal information and medical status. • The system shall maintain data integrity by keeping backups of all updates to the database for every record transaction.
5.	Reliability	• The system should be able to operate at a specified moment or interval of time, for example when scanning QR codes, inputting data and receiving output.

6.	Maintainability	• The system should be able to easily modifiable.
7.	Scalability	• The system should be able to handle an increasing volume of work.
8.	Availability	• The fraction of the time that the system is usable. • A user with access to the data should be able to update it at any time throughout the day. During unplanned downtime, all features will be available within one working day.

User requirement analysis is essential to discover and list out the user requirements. The description of requirements might be the functions or settings that will support the system's operation. The requirements could be in terms of organization, usability, or function mapping [17]. User requirements are listed in **Table 4**. These are the functionality expectations from the users.

Table 4: User requirements.

No.	User Requirements
1	The patient should be able to login to the system by entering a username and password.
2	New patient should be able to register with the system.
3	Patients should be able to submit personal information during registration.
4	Patients should be able to scan the QR code and wait virtually for their turn.
5	It should be possible for patients to see the number of their turn.
6	Patients should be able to apply for mail pharmacy services and receive notification about the approval status of the application.
7	The patient should receive a notification for mail pharmacy application.
8	The patient should be notified three days before and for pending pick up medication.
9	The patient should be able to reschedule the drug pick-up date.
10	The patient should be able to log out of system.
11	The doctor and pharmacist should be able to login using admin's (authorized) username and password.
12	A doctor and pharmacist should have access to all patient records.
13	A pharmacist should be able to handle patient flow through a virtual queue system.
14	A pharmacist should be able to keep track of how many patients are waiting in line using real-time system analytics.
15	The doctor should be able to add and update a patient's medical status and prescription.
16	A pharmacist should be able to access a patient's medical status in preparation of a drug.
17	A pharmacist should be able to update a patient's prescription by coordinating with the doctor if necessary.
18	A pharmacist should be able to access a list of prescription recipients.
19	A pharmacist should be able to verify whether patients have already collected their follow-up prescriptions.
20	The pharmacist should alert patients who have not yet picked up their refill prescriptions.
21	The pharmacist should be able to check on drug cancellation.
22	A pharmacist should be able to track their drug inventory at any time.
23	The pharmacist should be able to add drugs to a list, update them, and delete them.
24	The pharmacist should be able to search drug data.
25	The pharmacist should be able to check the status of drug stocks.
26	The pharmacist should be able to determine when a drug is at risk of running out.
27	A pharmacist should be able to verify the expiration date of a drug.
28	A pharmacist should be able to set up a schedule, reschedule medication dates for patients, and edit the schedule if necessary.
29	A pharmacist should be able to handle the notification process if a patient or caregiver does not pick up medication three days before and three days after.
30	A pharmacist with the authority should be able to approve mail pharmacy applications.
31	The pharmacist should be able to track a patient's medication records.

32	The doctor and pharmacist should be able to log out of system.

A use case diagram from object-oriented approach is used to present the system requirements with use cases, identify the actors and illustrate the interactions between actors and use cases. Figure 1 shows the use case diagram of the developed system with three actors: Patient, Pharmacist, and Doctor. There is a total of 9 use cases.

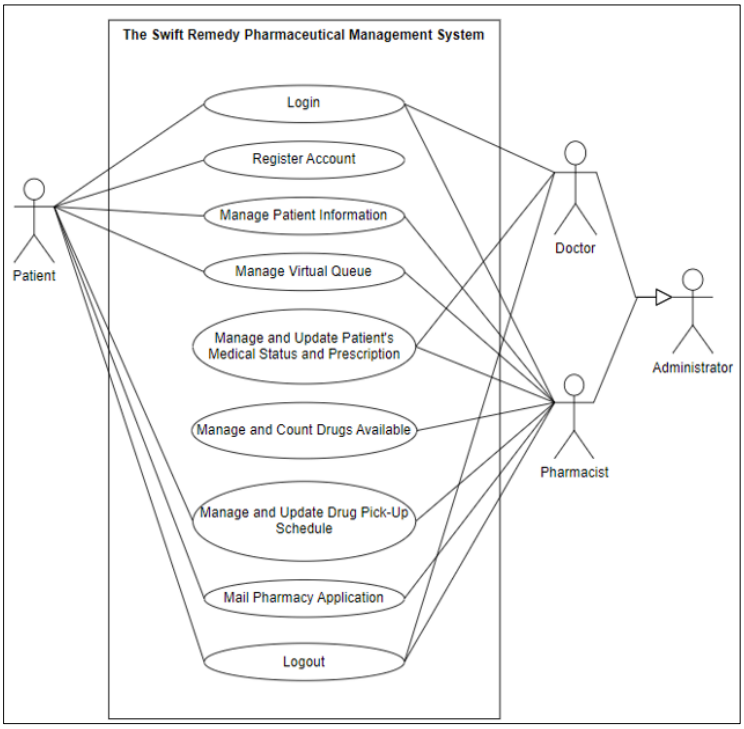

Figure 1: Use case diagram

Class diagram is an overview of system's attributes and functions that specified in classes and the relationship between the classes [18]. Figure 2 shows the class diagram for the system with a total of eight classes present, with two classes as generalizations of the user. These two classes are from new patient to patient and admin that derived from the pharmacist and doctor.

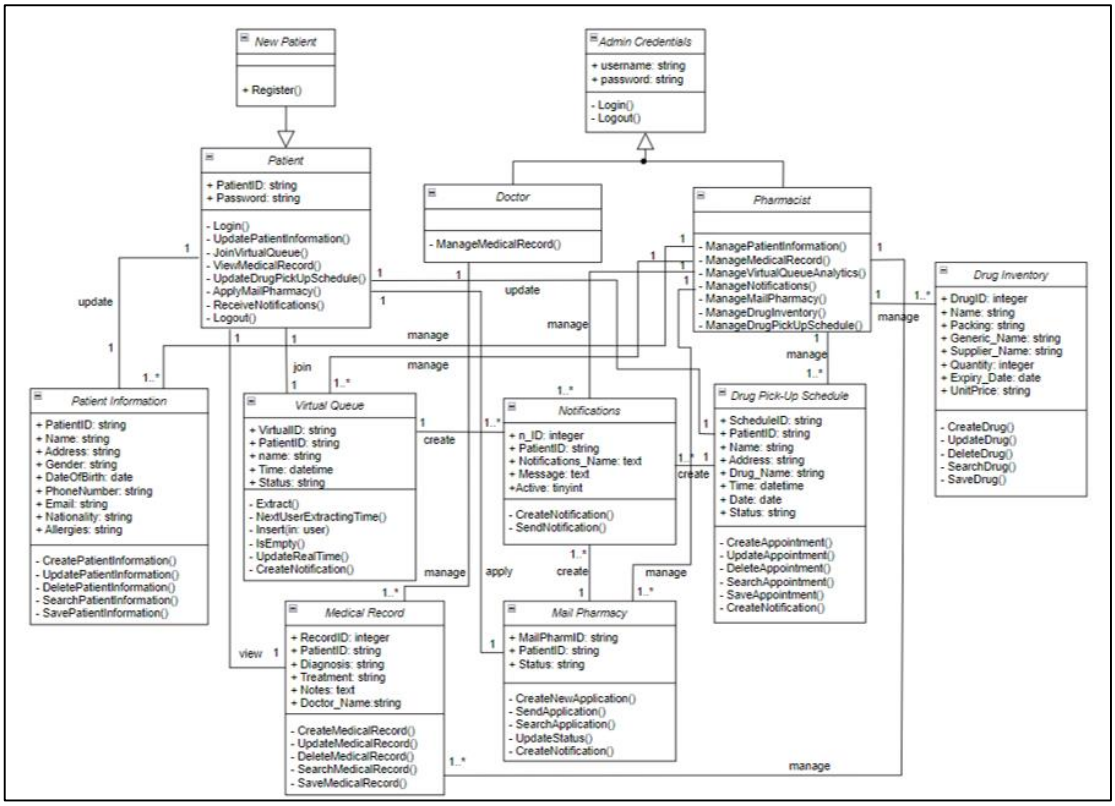

Figure 2: Class diagram

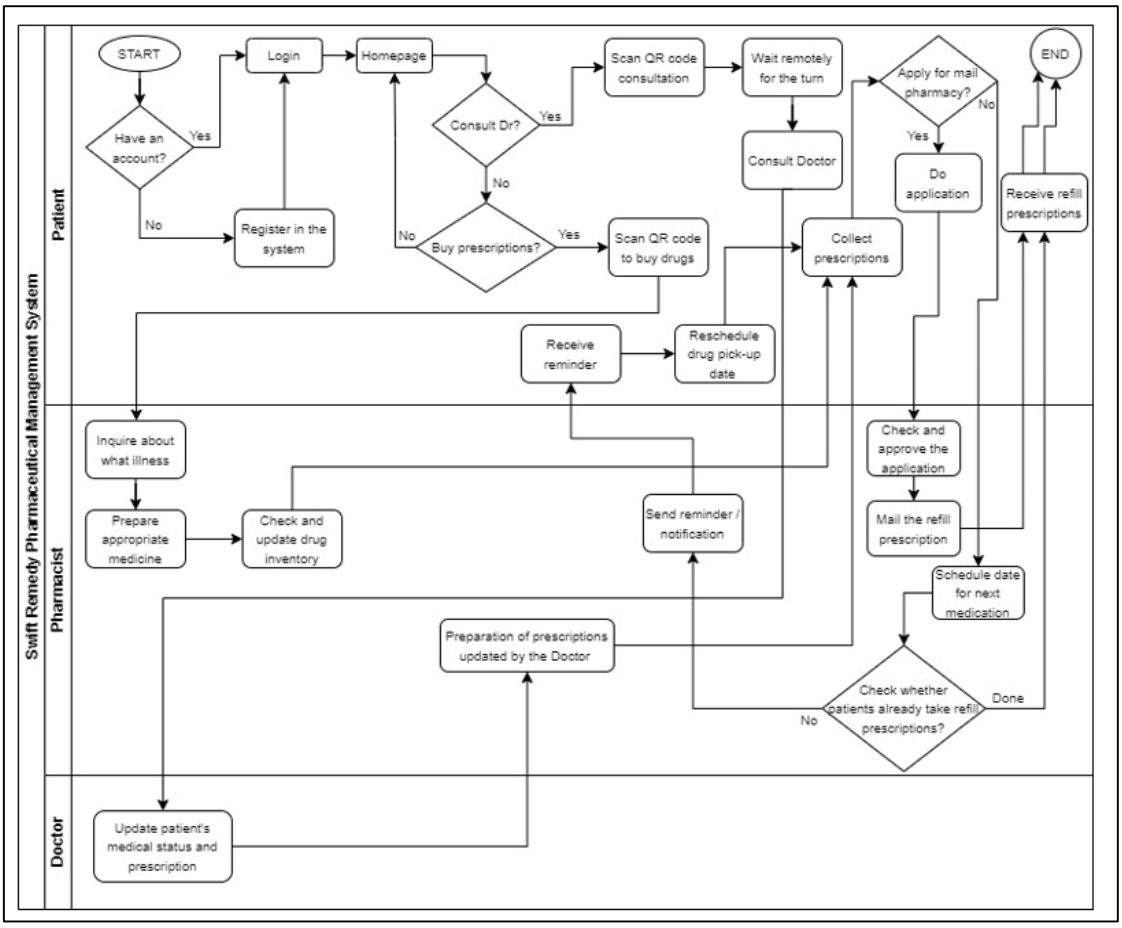

Figure 3: To-Be Diagram

Figure 3 depicts the operation of swift remedy pharmaceutical management system. The patient should register an account for the system and during that process, they will provide some personal details. In the next step, the patients will be given the option to consult a doctor or purchase medication. Once they have chosen, they must scan the QR code and wait remotely for their turn. In case of consultation with a doctor, the prescription will be updated in the system by the doctor. The pharmacist will refer to it and give the medicines to the patient. Mail pharmacy applicants must register in the system if they want to take advantage of the service. Outpatients can also register for mail pharmacy services. The pharmacist then will view the patient's report to mail the prescription to their doorstep accordingly. The pharmacist will schedule the date in the system. There is also the ability in the system for patients to reschedule the pick-up date for their prescriptions.

The designs are created according to the requirements information gathered at analysis phase. The multi-layered architecture is a client-server software architecture pattern in which the user interface (presentation), process logic ("business rules"), storage and access to data are developed and maintained as independent modules, most often on separate platforms [19]. A multi-layered architecture allows for upgrades and replacements of any of the three tiers in response to changing requirements or technology. Figure 4 depicts the basic multi-layer system architecture for the mobile and web-based Swift Remedy Pharmaceutical Management system.

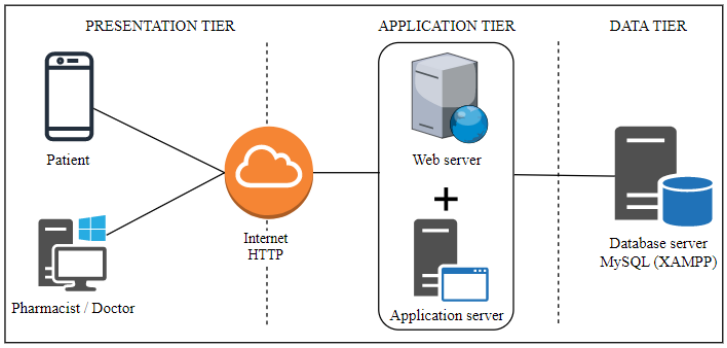

Figure 4: System Architecture

Database schema is listed in the following:

i. `Patient (PatientID = Username, Password)`
ii. `Admin Credentials -> Pharmacist&Doctor (Admin_Username, Admin_Password)`
iii. `Patient_Information (PatientID, Name, Address, Gender, DateOfBirth, PhoneNumber, Email, Nationalty, Allergies)`
iv. `Virtual_Queue (VirtualID, PatientID, name = QueueType, Time, Satus)`
v. `Drug_Inventory (DrugID, Name, Packing, Generic_Name, Supplier_Name, Quantity, Expiry_Date, UnitPrice)`
vi. `Drug_PickUp_Schedule (ScheduleID, PatientID, Name, Address, Name, Drug_Name, Time, Date, Status)`
vii. `Mail_Pharmacy (MailPharmID, PatientID, Status)`
viii. `Medical_Record (RecordID, PatientID, Diagnosis, Treatment, Notes, Doctor_Name)`
ix. `Notifications (n_ID, PatientID, Notifications_Name, Message, Active)`

Patient access to virtual queues and mail pharmacy applications is shown in Figure 5 to Figure 8. The designs are developed as web browsers, which are applications for accessing websites [20]. Patients can request a web page from a specific website, which the browser will retrieve from a web server and display on their smartphones (mobile-based view). In the case of pharmacists and doctors, the system is used on desktop computers (web-based UI).

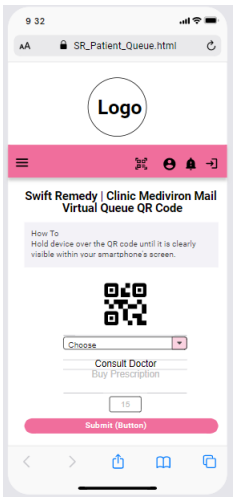

Figure 5: QR Code

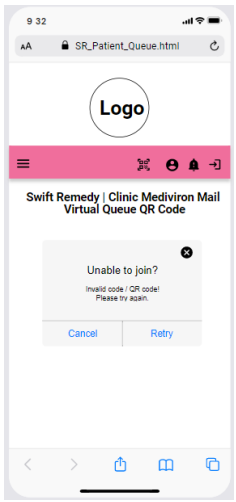

Figure 6: No access to QR Code

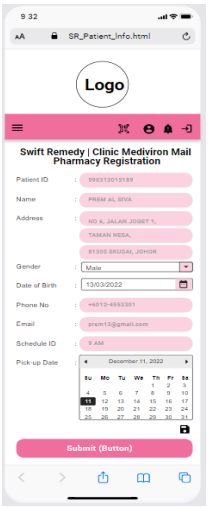

Figure 7: Mail Pharmacy Registration

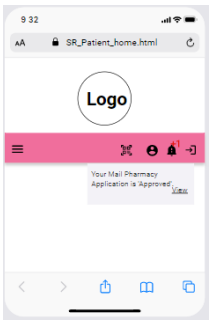

Figure 8: Approved Application

The administrator (a pharmacist and doctor) handles QR codes, drug inventories, patient information, prescription schedules, and patient medical records through a user interface depicted in Figures 9 through 14.

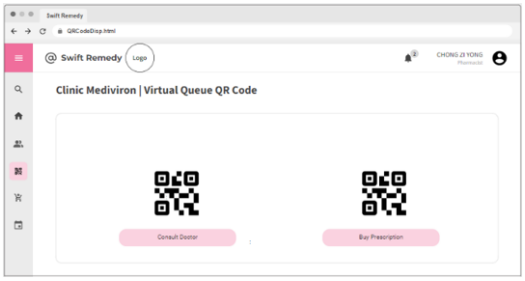

Figure 9: QR Code Generator

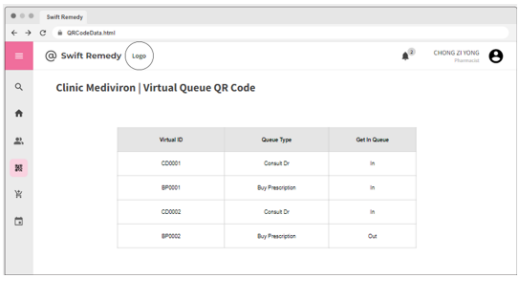

Figure 10: Virtual Queue List

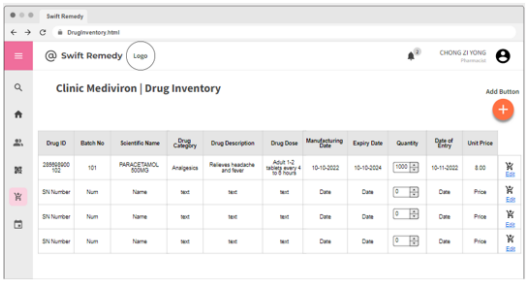

Figure 11: Drug Inventory

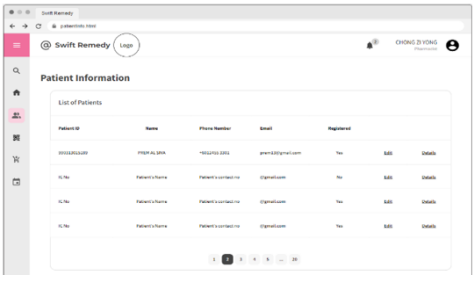

Figure 12: Patient Information

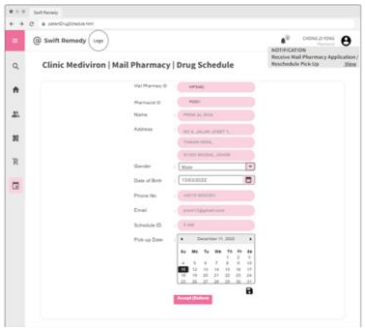

Figure 13: Drug Pick-Up Schedule

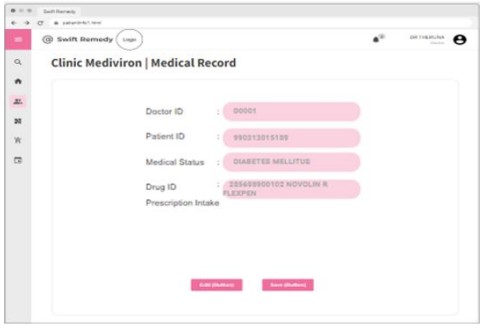

Figure 14: Patient's Medical Record

4. Results and Discussion

The programming process to put the designed module into practice is summarized in this section. The coding languages HTML and CSS are used to create websites. While JavaScript is used for some tasks, PHP is used as the programming language. The results of user testing are explained in the other subsection.

4.1 Module Implementation

(i) `Login and Account Registration` Module

Administrators (pharmacists and doctors) and common users (patients) are the two distinct categories of users in this system. The main page of the system offers login and registration options to manage user access. The user interface has been created to be user-friendly and simple to navigate. Upon clicking "Patient" button in system main page the `patient ()` function is invoked and redirecting the user to the login page. Patients will be required to log in using their IC number as a username, and their password. A SQL query constructed to SELECT rows from the "patients" table where the "PatientID" column matches the assigned "username", and the "password" column corresponds to the hashed password to login.

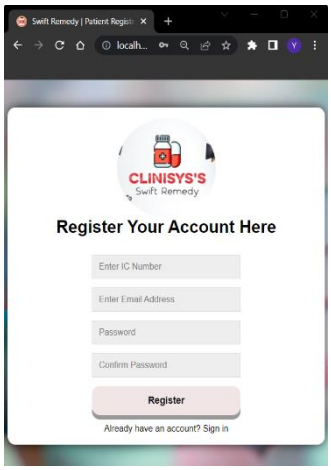

Figure 15: Account Registration

```php
if ($_SERVER["REQUEST_METHOD"] == "POST") {
  $username = $_POST['username'];
  $password = $_POST['password'];
  $confirm_password = $_POST['confirm_password'];
  $address = $_POST['address'];

  if($username==""||$address==""||$password==""||$confirm_password=="")
  {
      echo "<script>alert('Please fill up the form correctly');</script>";
  }
  else if($password!=$confirm_password)
  {
      echo "<script>alert('Password not matching');</script>";
  }
  else {
    $password = md5($password);

    $sql_u = "SELECT * FROM patients WHERE PatientID='$username'";
    $res_u = mysqli_query($db, $sql_u);

    if (mysqli_num_rows($res_u) > 0) {
        echo '<script>alert("Sorry, the Patient ID exists already")</script>';
    }
    else{
      $sql = "INSERT INTO patients (PatientID,Password,Address)
      VALUES ('$username','$password','$address')";
      $db->query($sql);
      header("Location: SR_Patient_Login.php");
      exit();
    }
  }
```

Figure 16: Account Registration Code Segment

Registration for new users is as shown in Figure 15. The "patients" table is updated with the patient's registration details, including username, hashed password, and address, using an INSERT query as shown in Figure 16.

(ii) `Patient Information Management` Module

This module gives users the ability to make changes to patient information. Figure 17 shows the retrieved form values for updating patient's fields for a specific patient identified by their "PatientID". Figure 18 shows the SQL query to UPDATE the corresponding record in the "patients" table. Figure 19 shows the list of patients on the administrator system. Figure 20 shows different actions that can be performed on the list, such as updating, deleting, or searching. The values for these actions are passed through GET requests.

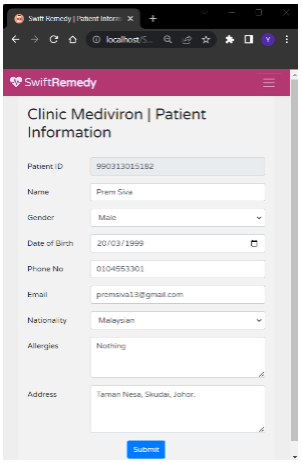

Figure 17: Patient – Update Patient Information

Figure 18: Update Patient Information Code Segment

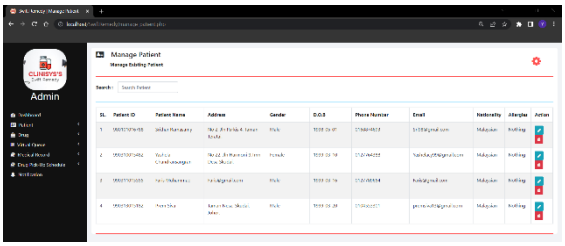

Figure 19: Administrator – Manage Patient Information

Figure 20: Manage Patient Information Code Segment

(iii) `Virtual Queue Management` Module

This module offers a function to manage virtual queues. Patients can scan a QR code to view queue details, and administrators can manage virtual queues. Patients scan the QR code, and the results are displayed in Figure 21. Figure 22 shows that the QR code has been successfully scanned, and the QR code message appears in the "result" input field.

When a patient is added to a queue, a new entry is added to the logs table. The entry includes the patient's ID, name, the current time, and the patient's queueing status. Figure 23 shows the list of queues from the administrator's view, along with the queue status notifications that have been sent to patients.

Figure 24 shows the various actions that can be performed on queues, such as updating, deleting, and searching. These actions are passed to the application through GET requests. The application retrieves the patient ID, notification name, and message from the GET parameters. If the action is "message", a new record is inserted into the notifications table.

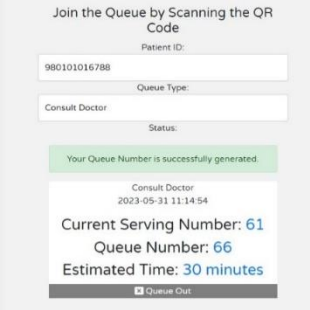

Figure 21: Patient – Queue Management

Figure 22: Queue Management Code Segment

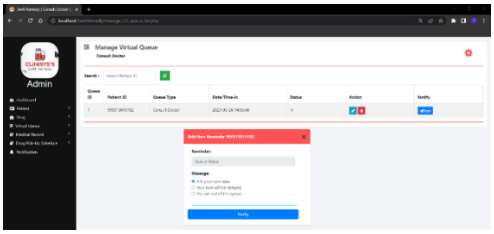

Figure 23: Administrator – Manage Virtual Queue

Figure 24: Manage Virtual Queue Code Segment

(iv) `Patient's Medical Record and Prescription` Module

An administrator can generate and maintain medical records and prescriptions using this module's management feature, and patients can examine their own medical records. Figure 25 shows the hyperlink for adding medical records on the administrator's side of the system, along with the patient's list. In Figure 26, various actions such as inserting, updating, deleting, and searching are shown, and the values are passed through GET requests.

This module allows administrators to create and manage medical records and prescriptions, and patients to view their own medical records. Figure 25 shows the hyperlink for adding medical records on the administrator's side of the system, along with the list of patients. Figure 26 shows the various actions that can be performed on medical records and prescriptions, such as inserting, updating, deleting, and searching. These actions are passed to the application through GET requests.

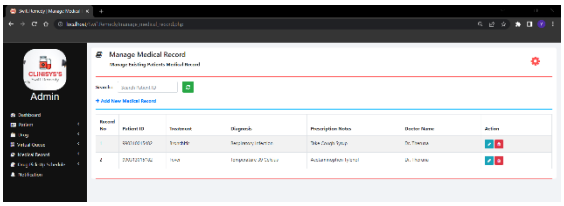

Figure 25: Administrator – Manage Medical Record

Figure 26: Manage Medical Record Code Segment

The GET requests contain the following information: The action to be performed, The ID of the medical record or prescription to be affected, and the new value for the medical record or prescription (if applicable). The application uses this information to perform the requested action.

Figure 27 depicts the system's search and pick-up medication schedule check and, if necessary, medication schedule modification on the patient's side. The SQL query to look up the corresponding record in the "medical_record" table is shown in Figure 28.

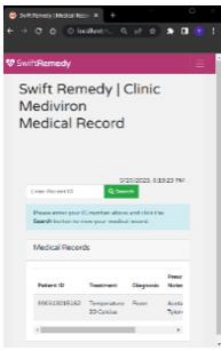

Figure 27: Patient – Search Medical Record

```
<form method="post" class="form-inline">
    <div class="input-group">
        <input class="form-control" type="search" placeholder="Enter Patient ID" aria-label="Search"
        onkeyup="searchMedicalRecord(this.value);" id="patient_id" name="patient_id">
        <div class="input-group-append">
            <button class="btn btn-success rounded-0" type="submit" id="patientid" name="patientid">
                <i class="fa fa-search"></i> Search
            </button>
        </div>
    </div>
</form>
```

Figure 28: Search Medical Record Code Segment

(v) `Drug Inventory Management` Module

Only the administrator has access to the medicine inventory management feature offered by this module. Figure 29 shows the hyperlink for adding drug (medicine) on the administrator's side of the system, along with the drug inventory list. In Figure 30, various actions such as inserting, updating, deleting, and searching are shown, and the values are passed through GET requests.

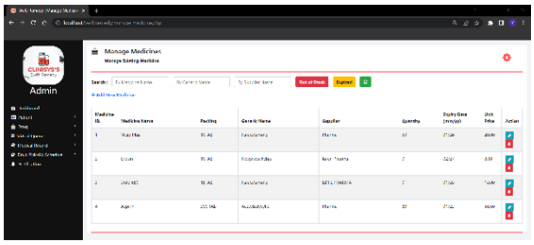

Figure 29: Administrator – Manage Drug Inventory

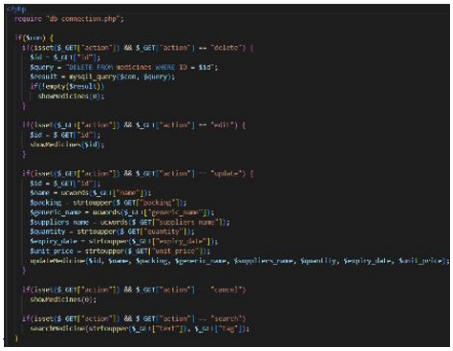

Figure 30: Manage Drug Inventory Code Segment

(vi) `Manage Pick-Up Medication` Module

This module allows administrators to manage medication pickup by sending online notifications to patients with reminders and pending pickup information. Patients can then check their pickup dates and reschedule if necessary. Figure 31 shows the hyperlink for adding pick-up medication on the administrator's side of the system, along with the list of drug pick-up schedules. In Figure 32, various actions such as inserting, updating, deleting, and searching are shown, and the values are passed through GET requests. It retrieves the patient ID, notification name, and message from the GET parameters and INSERT a new record into the "notifications" table if the action is "message".

Figure 33 shows the patient's medication schedule being searched and checked, and if necessary, altered on their side. Figure 34 shows the SQL query to UPDATE the corresponding record in the "pick_up" table.

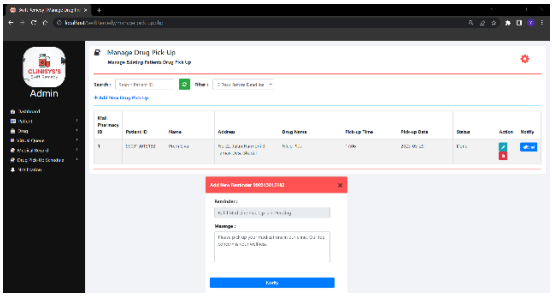

Figure 31: Administrator – Manage Pick-Up Medication

Figure 32: Manage Pick-Up Medication Code Segment

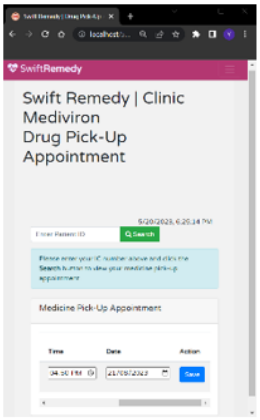

Figure 33: Patient – Search Pick-Up and Reschedule

Figure 34: Search Pick-Up and Reschedule Code Segment

(vii) `Medication Refill Services (Mail Pharmacy)` Module

This module allows patients to request medication refills. The administrator reviews the requests and approves or denies them. The administrator sends an online notification to patients to let them know the status of their request. Figure 35 shows the application for mail pharmacy services on the patient's side of the system. Figure 36 shows an SQL INSERT query is prepared to insert a new row into the "mailpharm" table, with the "PatientID" column set to the value of "$sessionUsername".

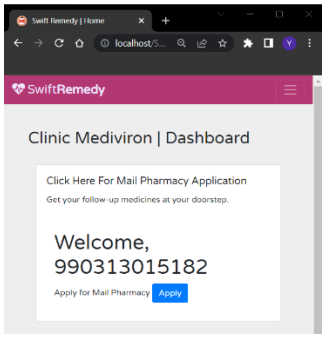

Figure 35: Patient – Apply Mail Pharmacy Services

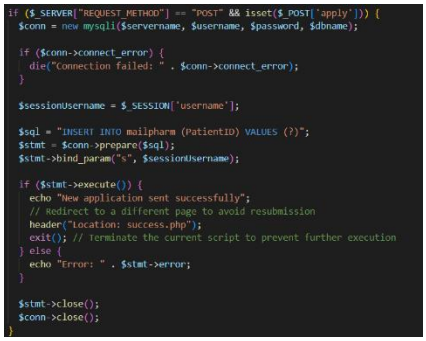

Figure 36: Mail Pharmacy Application Code Segment

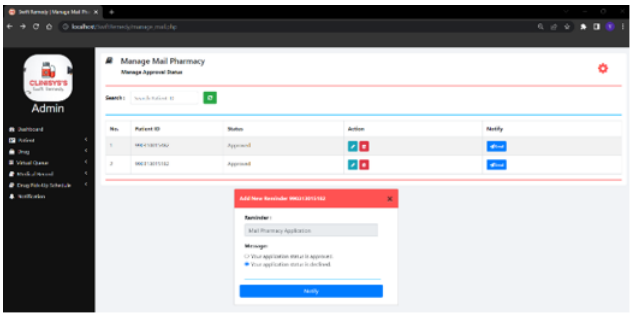

Figure 37: Administrator – Manage Mail Pharmacy

Figure 38: Manage Mail Pharmacy Code Segment

Figure 37 shows the list of mail pharmacy applications and update approval status and sending notifications to patients on the approval status on the administrator's side of the system. In Figure 38, various actions such as updating, deleting, and searching are shown, and the values are passed through GET requests. It retrieves the patient ID, notification name, and message from the GET parameters and INSERT a new record into the "notifications" table if the action is "message".

4.2 User Testing

The UAT (User Acceptance Testing) for the Swift Remedy Pharmaceutical Management System was conducted with a total of 20 test cases across different modules. The testing included login and account registration, managing patient information, virtual queue management, updating medical status and prescriptions, counting drugs available, managing drug pick-up schedules, mail pharmacy application schedules, and logout. All test cases were successfully passed, indicating that the system's main features are functioning as intended. The testing results are summarized in Table 5. The overall testing result, obtained from each test case module, is depicted in a pie chart. Additionally, the pie chart indicates that 100% of the tests have passed. This information is specifically presented in Figure 39.

Table 5: Testing Results

Summarization (Test Design for Swift Remedy Pharmaceutical Management System)			
Test Case ID	Main Features	Total Number of Test Cases	Pass / Fail
TC-01-001	Login and Account Registration Module	5	Pass
TC-02-001	Manage Patient Information Module	3	Pass
TC-03-001	Manage Virtual Queue Module	2	Pass
TC-04-001	Manage and Update Patient's Medical Status and Prescription Module	2	Pass
TC-05-001	Manage and Count Drugs Available	2	Pass
TC-06-001	Manage and Update Drug Pick-Up Schedule Module	2	Pass
TC-07-001	Manage Mail Pharmacy Application Module	2	Pass
TC-08-001	Logout	2	Pass

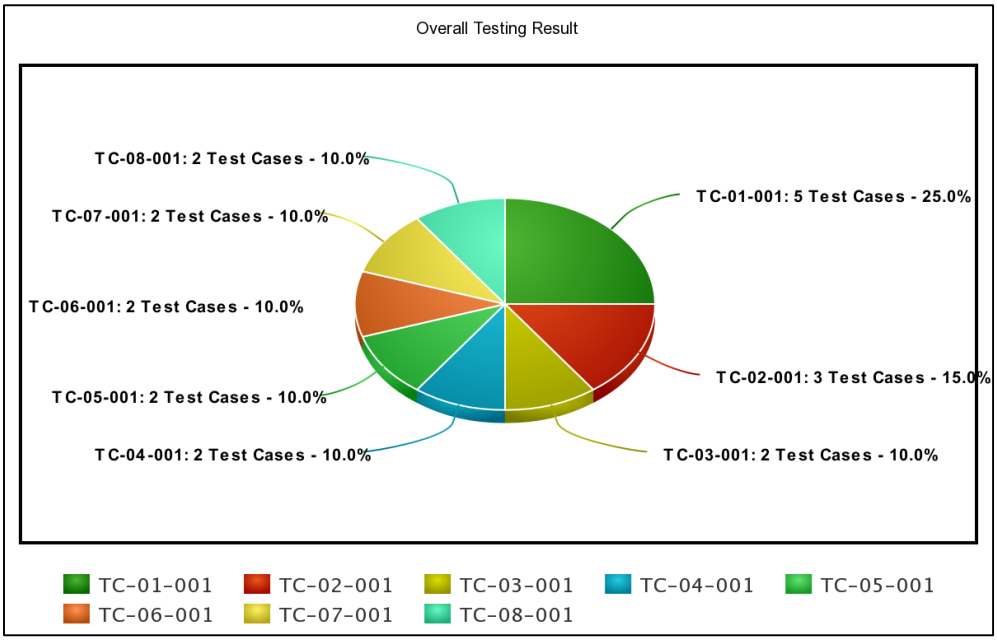

Figure 39: Pie Chart for Overall Testing Result

5. Conclusion

As a result of the development and design of the system, Clinic Mediviron Seapark is able to benefit from it. After analysing pharmaceutical management issues, several modules are proposed and designed as solutions. The users of the system are divided into three categories: patients, pharmacists, and doctors. In accordance with the development, the Swift Remedy Pharmaceutical Management System possess six modifications from the current system, which include the registries will be kept digitally for in-patients and out-patients, the patients and staff can log on using usernames and passwords, the system updates records periodically, pharmacists can track them, and patients can check them, the system records data more clearly in the form of a table, including the expiration date, scan a QR code and wait digitally, incoming and outgoing notifications, and finally mail pharmacy applications.

Acknowledgment

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

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