Sri Lanka Institute of Information Technology

Information Technology Project (IT2080)
Clinic Management System
Project Proposal

Group ID: ITP_WD_B07_G03

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Contents

Client and Background

Client: Statistical Department, District General Hospital, Gampaha

District General Hospital, Gampaha is the home for thousands of patients from all over Sri Lanka. This hospital has been the only remedy innocent people who has low incomes and who cannot afford the comfort of a private medical centers. Most of these people rely on drugs and medications which are provided free of charge by the government. Diabetes, Hearts Diseases and Kidney failures are the most found diseases among people. It is relief to say, clinics that are conducted by the hospital is being an immense help for the people who are suffering from economical and health issues. But there is an unseen side of this government hospital which should be resolved.

According to Dr. Mahesh Jayasinghe from Statistics Department of the hospital, hospital conducts clinics for more than 1000+ patients daily. Patients from all 16 divisions of Gampaha district are attending to these clinics. So, there is a huge crowd in a small space of the clinic daily. As the crowd is big and space is too small, there is a possibility of spreading covid 19 among patients as well. Also, existing process is a manual one and they want to automate some processes to make them efficient. As previously mentioned, there are many more challenges the hospital face.

Problem Statement

- **Long Queues**

  According to the information collected from our client, queues are the main problem faced by the patients now. As there is no proper order for checking the patients, they must wait in queues for lengthy periods of time to attend the clinics. Considering that most of the patients attending the clinic are old, it is not friendly to keep them waiting in queues all day.

- **Poor use of physical space**

  As observed, the clinical premises of Gampaha hospital is a confined space and it is a total disaster when the patients arrive at the clinic hours. As the patients have no clear idea of the time they will get treated, they usually tend to arrive as early as they can. This creates an unusual traffic within the premises resulting the patients into further trouble. As a result, many patients even don't have a place to sit as they are leaning onto walls or sitting on stairways.

- **Manual record keeping**

  By visiting the hospital premises, we came clear about the existing system of keeping patient information by the hospital. The patient information is currently stored as physical documents and is almost unable to access treatment records of a specific patient. In the meantime, physical databases and manual controlled systems are becoming less efficient and outdated gradually as they are lacking security and privacy.

- **Poor time management**

  It has been noted that, both patients and doctors are having trouble with effective time utilization because of lacking a proper system for the clinical patients. Most patients attend the clinic way before their due time as they do not have a proper schedule to check before

attending. A huge proportion of the day is wasted because of this unnecessary traffic caused by this. That is why this is such a crucial aspect to be addressed as soon as possible.

- **Rapid advancement in technology**

  As Sri Lanka develops into a technologically capable nation, both our business and labor workforces must adapt to the changes and make use of new technologies. Despite having a little understanding of technology, Sri Lanka must stop itself from going deeper and deeper down a rabbit hole.

Solution Statement

- ✓ **Appointment System for patients**

  This is the main approach that we are implementing as the solution to the key problem that the clinical patients are currently facing. We are introducing an online appointment system for the patients which include their expected visiting date and time along with a proper clinical schedule. The patients are expected to be treated considering the appointment number that they hold. Through this we are expecting to minimize the unnecessary traffic causing at the clinical premises.

- ✓ **Introducing a unique QR code**

  It is expected to introduce a unique QR code to each patient so that, each and every detail of the patients can be acquired through the QR, including their treatment history. This will also be a great relief to the doctors too, as it will be unnecessary to go through piles of books in search of a specific patient record, once this QR system is introduced.

- ✓ **Automation of clinical services**

  As a fact, we all know that automated processes provide more efficient results comparative to manually controlled systems. That is the exact same approach that we are trying to implement to this clinic system by having touches of automation in every aspect possible. That will make the processes more concise and effective while sparing so much more valuable time to all the parties engaging in the process.

Aims & Objectives

- **Objectives**
    - To enhance efficiency and productivity by automating routine administrative tasks, streamlining clinical workflows, and reducing errors and duplication.
    - To improve patient care by providing accurate and up-to-date patient information and facilitating effective treatment.
- **Aims**
    - Enhancing employability skills and gaining practical project-management experience.
    - Bridge the gap between theoretical knowledge gained in the classroom and practical application in the real world.
    - Collaborate with industry partners and potentially lead to job opportunities after graduation.

Benefits of This System

- **Secure**

  Over the past couple of years, we have seen a considerable increase in the number of security breaches in systems, primarily because of a lack of understanding about the sensitive information that users have provided. Data and privacy protection is more critical than anything else.

- **Accessible**

  When data is admitted at a high rate, management can review and improve upon the system's procedures much more quickly and cost-effectively than if they had to wait months before receiving useful information.

- **Fast and Reliable**

  The System can reduce the amount of time and effort required by employees to carry out their everyday tasks and responsibilities. This system is technically flawless, with no bugs or faults, and its dependability is exceptional.

- **Usability**

  For anyone who is interested in optimizing their user usability experience, using an enterprise solution such as this can be a significant benefit. Because of the automation, staff are seeking for a consistent experience, and even ensuring that back-end functions are as streamlined as possible, according to the report. With only a little understanding of technology, anyone may easily navigate via this application without any difficulty.

- **Expansion**

  For more than three decades, these types of automated devices were exclusively available within the confines of the Colombo metropolitan area. These types of automatic devices were available only in certain urban limits of city.

System Overview

According to the figure 1, which is at the bottom of this page, Patient will not use the system directly. They will have to access the system through the doctor, staff members, pharmacist and laboratory assistants. Also, system administrator and inventory officer have direct access to the system.

The application server will be used to manage all the components in this system. Primary functions of this system can be mentioned as follows. [1]

1. Patient Management
2. Appointment Management
3. Pharmacy Management
4. Laboratory Management
5. Doctor Management
6. Staff Management
7. Clinic Management
8. Inventory Management

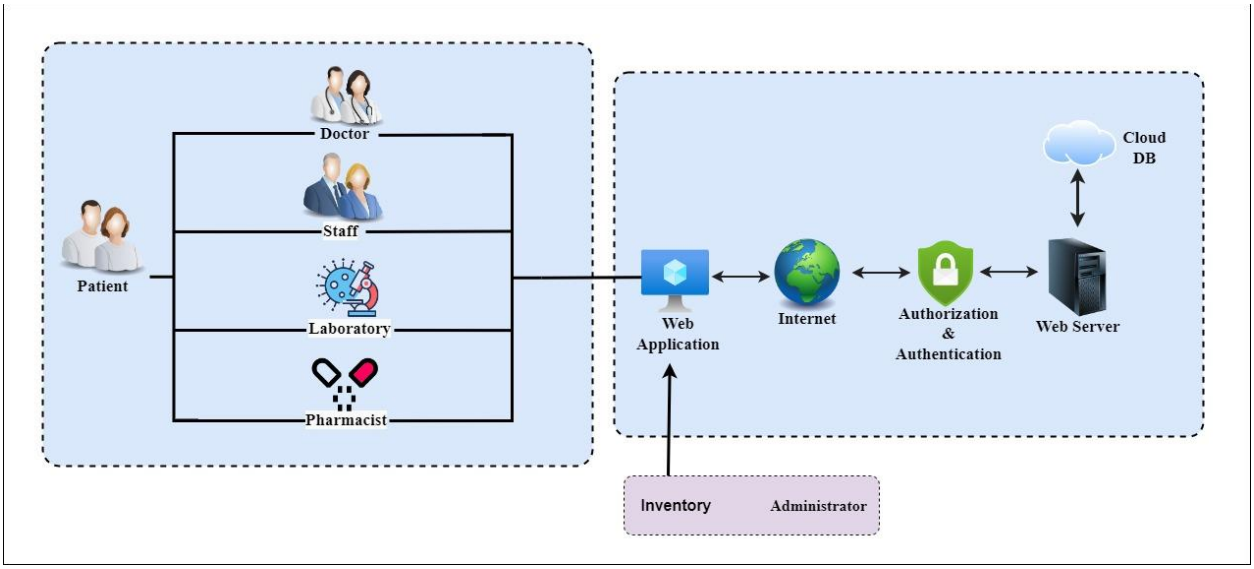


Figure 1 - System Overview

Onion Diagram

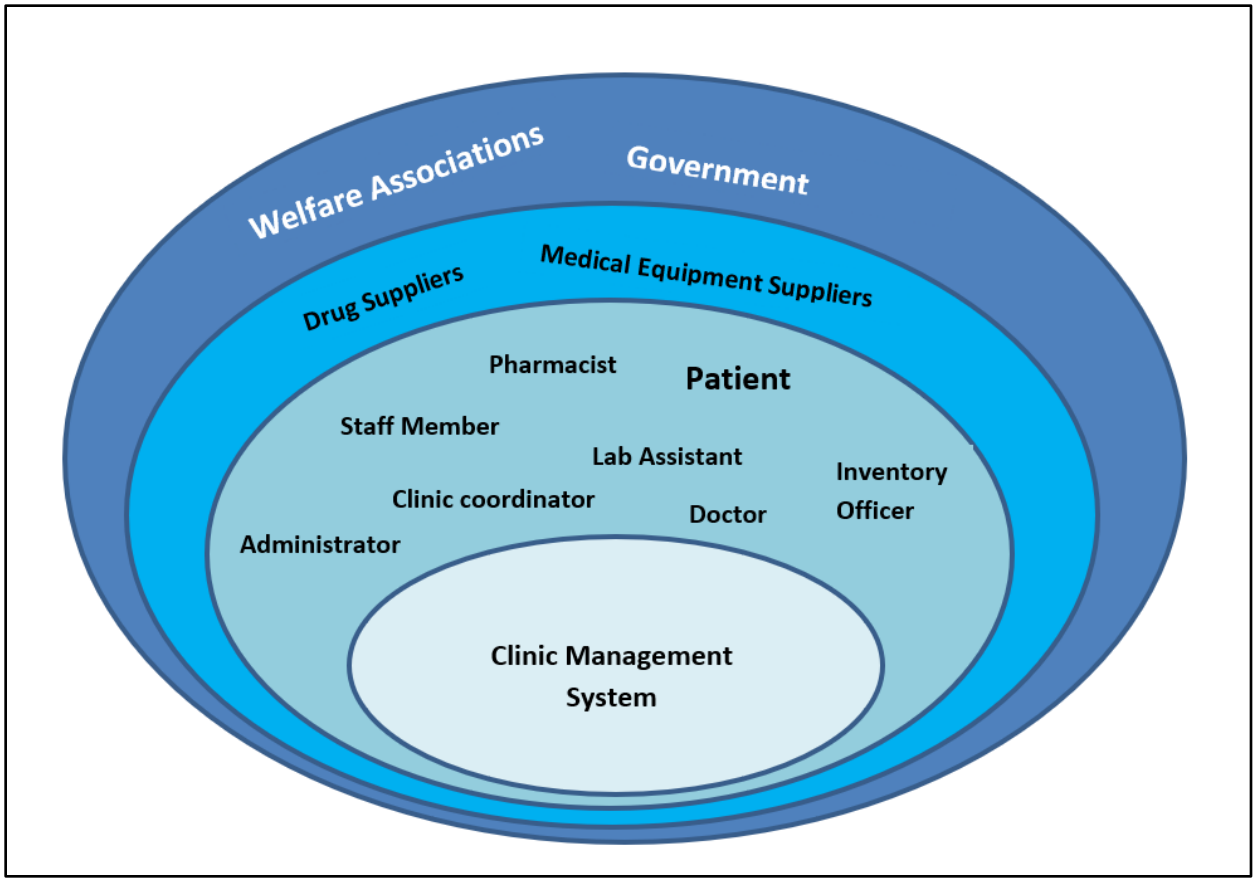


Figure 2 - Onion Diagram

Use Case Diagram

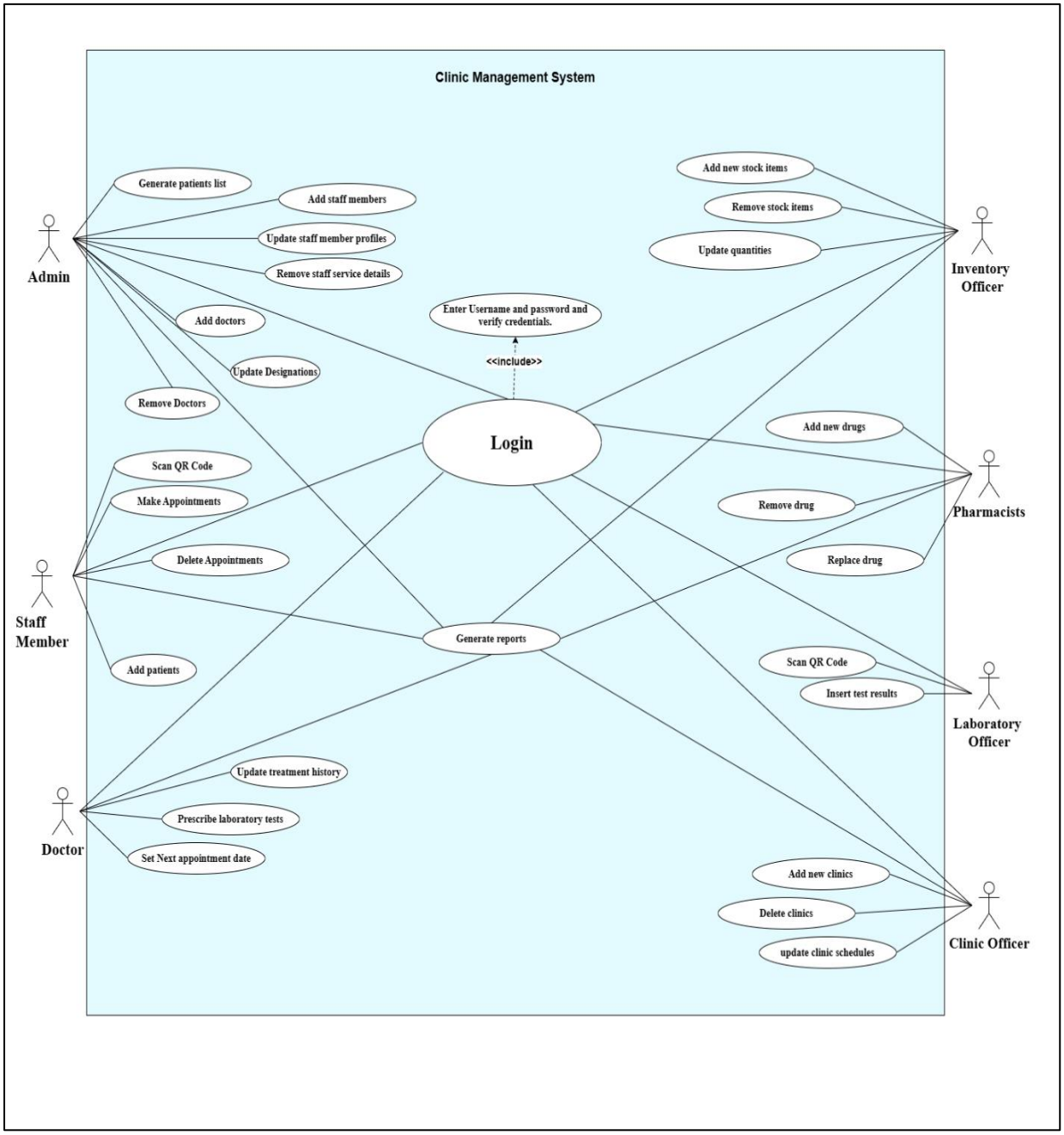


Figure 3 - Use Case Diagram

Features of The Proposed System

Patient Management

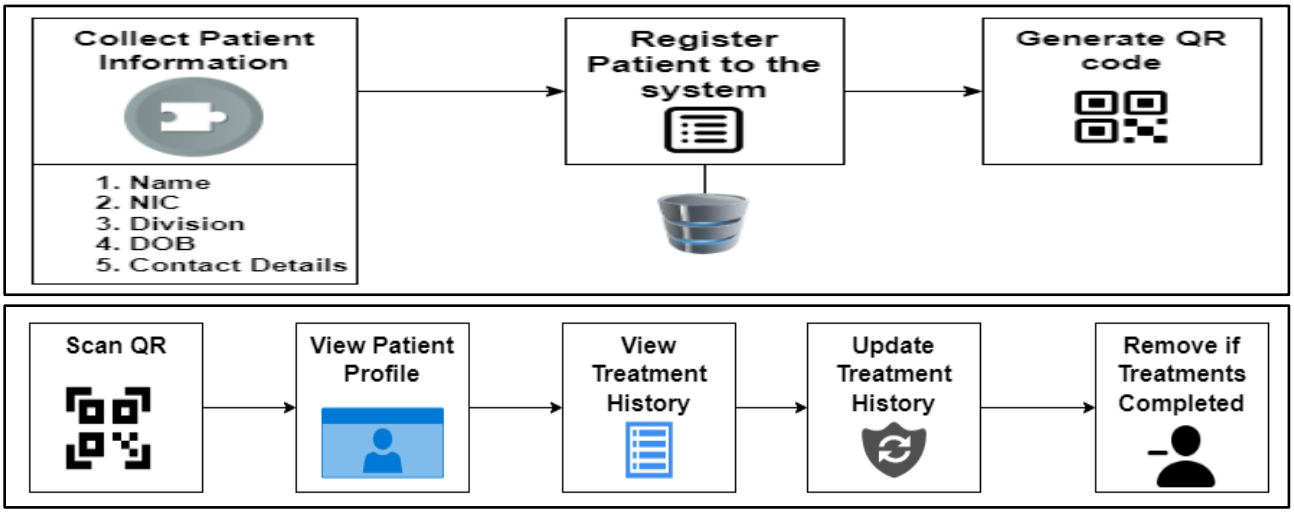


Figure 4 - Patient Management

Patient can be called as the main stakeholder in a clinic management system. Without a patient there won' t be any hospitals or medical center in the world. In Gampaha Hospital, patients are the mainly affected community by the above-mentioned problems.

Patient who is coming to the clinic for the first time must provide his/her details as mentioned in above figure. This function ensures the security of patients' data that are currently in physical databases. The registration process **(Create)** will be completed by a staff member and QR will be generated automatically. [2]

After receiving the QR code, patient will be directed to the doctor. Doctor can scan patients QR code and will be able to view **(Retrieve)** patient profile which contains patient's previously used medications and treatments history. In comparison to manually updating profiles, doctors can **update** patients' treatment histories with the drugs and lab tests they advise.

After completing treatments, patient will be removed **(Delete)** from active patients list and will be added to past patients list. If a patient lost the QR code, the hospital would provide a copy of previous QR code which is generated according to registration number.

Appointment Management

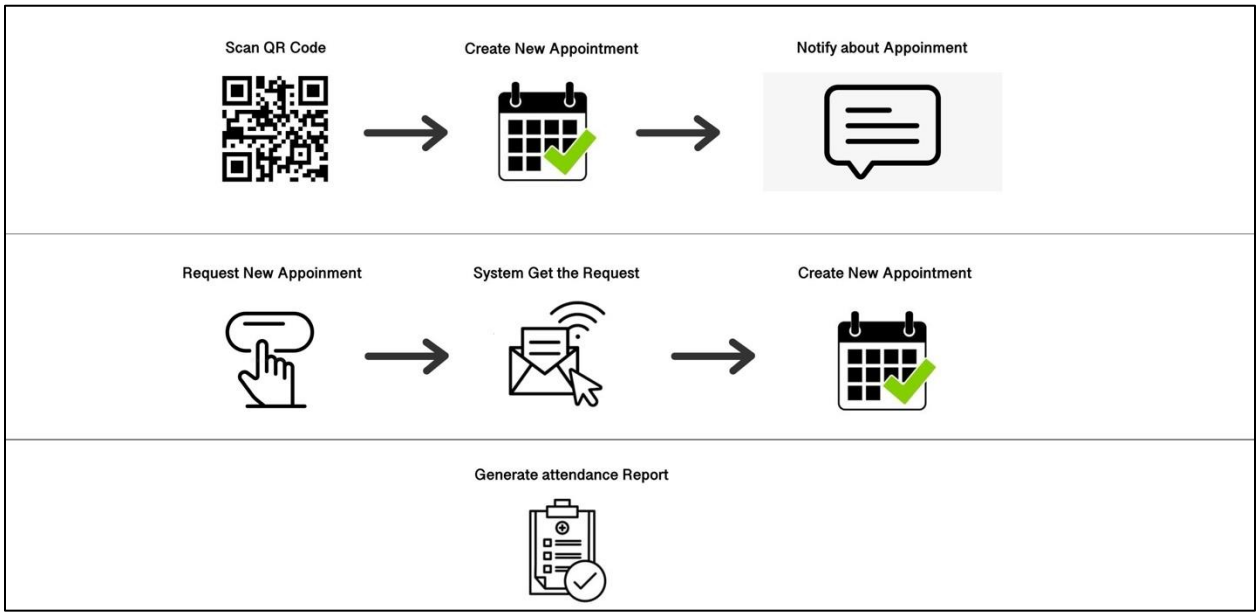


Figure 5 - Appointment Management

Patient's QR code will be scanned by the receptionist and then receptionist can see patient's profile which contains after how long patient should come.

Then receptionist can assign a new date and time to the patient for the next clinic date by using **'Set new Appointment'** button. By clicking this button receptionist can assign new appointment date and time and station. When appointment **created**, Patients will be notified about their appointment through a message. It includes Patient's Name, Appointment Date, Appointment Time, Station Number, and clickable link as well. [3]

If the patient cannot come on that day, they can just click the link in the message. Then the system will get the request and send another date and time to him/her like mentioned in the above figure. Also, receptionist can **delete** and **update** the appointment details listing in patient's account.

At the end of the day, admin can generate a report on patients' attendance. It will include all details about patient's attendance of day.

Pharmacy Management

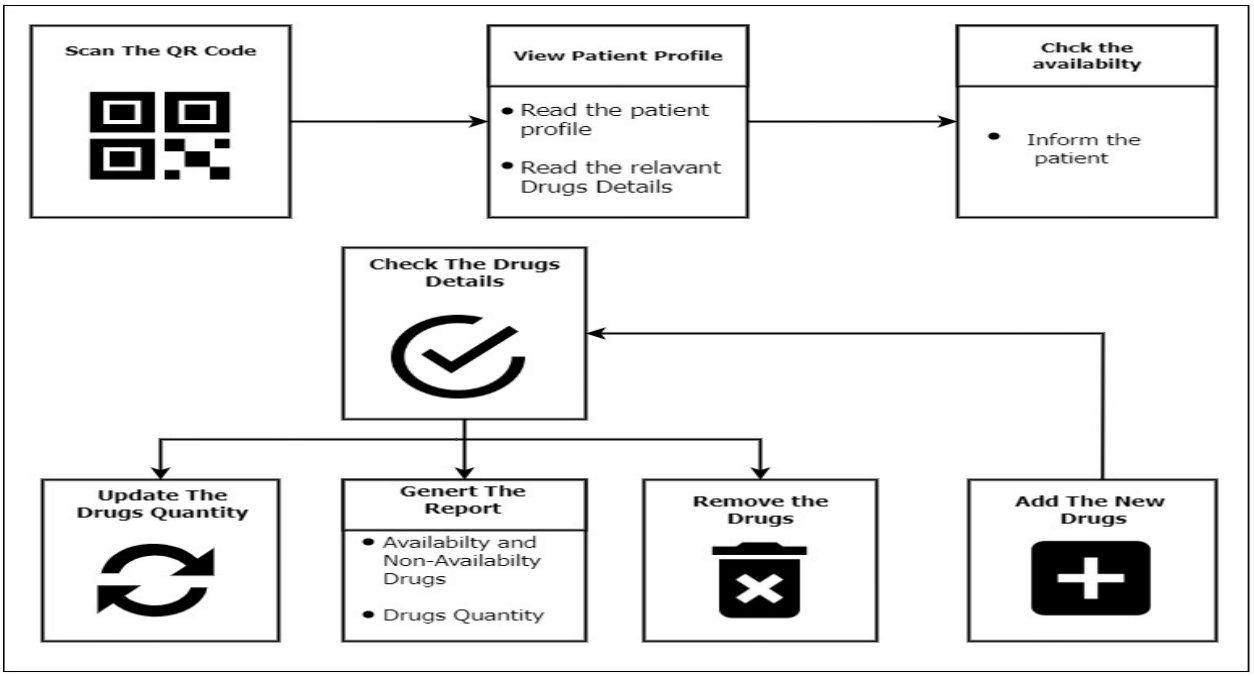


Figure 6 - Pharmacy Management

Pharmacy is a valuable part of the hospital. Patients who come to take medicine through the pharmacy is very high. This pharmacy management system increases efficiency of the hospital staff and the patients. When patient arrives, the pharmacy assistant asks for the patient's QR code and scans it with the scanner, then all the details of the patient can be viewed on the computer screen. The profile contains the medicines recommended by the doctor.

This system has the ability to **enter** the new medicines into our system by entering all the details such as the name of the medicine, expiry date etc. If the drugs available in the pharmacy are about to run out, pharmacist will be notified through a message to the drug providers. Later, when we receive the types of medicine that we requested, system can be **updated** with the amount of that type of medicine. And when new medicines are replaced for the old medicines, system has provided the ability to update them as well.

The medicine has expired in our pharmacy. And over time, pharmacist can eliminate **(Delete)** drugs that are banned from system all at once. In any case if our pharmacy assistant needs to get information about any type of medicine, he can get **(retrieve)** all the details after entering the name of the relevant type of medicine.

Laboratory Management

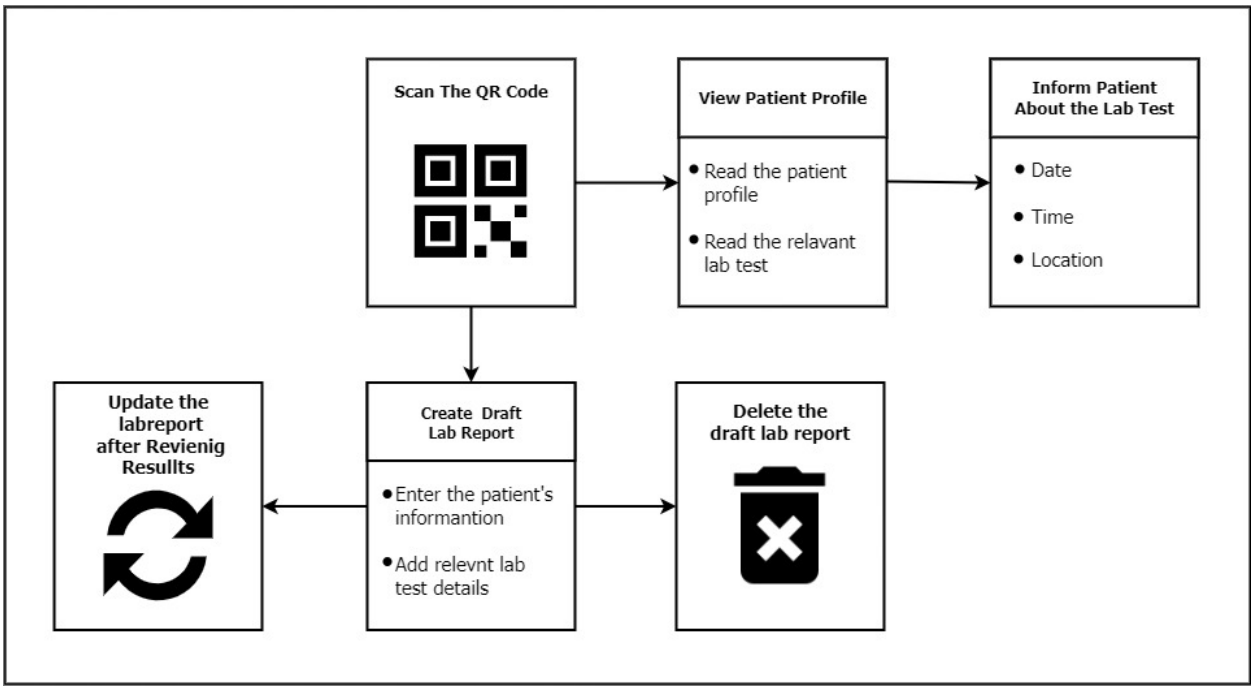


Figure 7 - Laboratory Management

Laboratory officer can **view** patients' profile and identify recommended lab tests by scanning patient's QR code. Then patient will be given a date to complete tests with the mentioned details in the figure.

A lab report related to the patient will be **created**. Also, issuing a lab report specific to each clinic will be done for research purposes. In addition to this process, all the details related to the patient's lab test are entered in the patient's profile in the correct manner and status of the report can be updated in the profile.

After completing all the related tests, the results of all the tests are returned to the lab office and patient will be notified via a text message. Then the previous report of the patient can be **updated** after considering the new results.
If the patient is hospitalized, the report will be **removed** from the system as it will be inserted into the system by the nursing officers at the ward.

Doctor Management

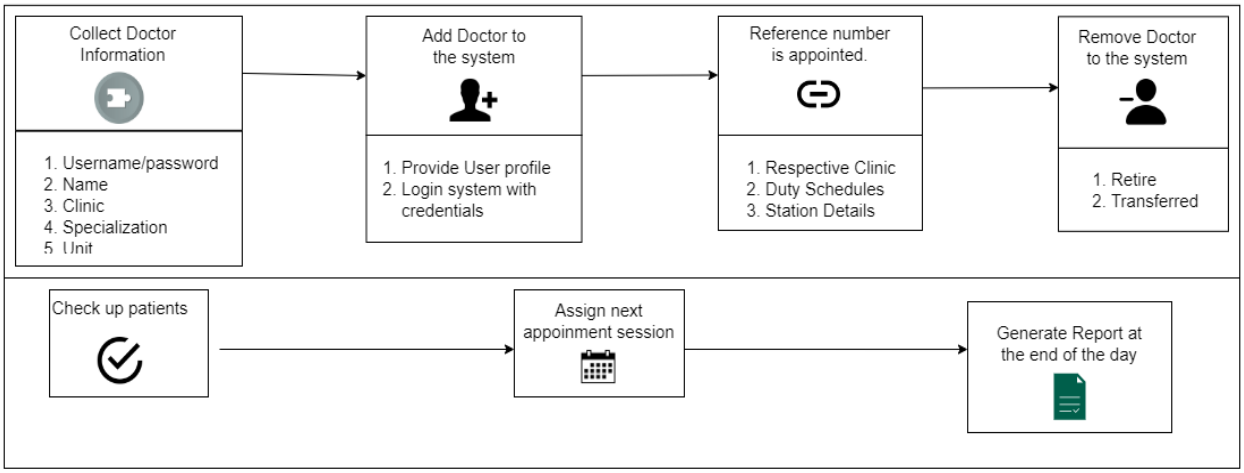


Figure 8 - Doctor Management

This function manages all interactions with the doctors at the clinic. This function allows to **add** doctors, **remove** doctors, **update** designations, and keep records about the doctors. An automated approach for managing doctors will improve the precision of several crucial hospital operations. Doctors will be able to manage their responsibilities and become more productive with the help of this technology.

Currently there are a considerable number of doctors working at the Gampaha district general hospital and there are about six clinics conducting currently in a particular schedule. Usually, a doctor is unique to a particular station, but some doctors will be working in more than one station. The system will be updated in case of a change in the appointed station or a change in the clinic of a particular doctor.

Doctors will be checking up patients in specified time slots, and the duration of a time slot can be varied according to the type of the patient. If a doctor is promoted or specialized, the details of the doctor will be updated with the new changes to the designation.

Since the patient and doctor records should be saved and updated frequently, the availability and reliability aspects can be identified as non-functional requirements. Desktop with internet access and a printer to print all the generated reports are required to satisfy the technical requirements.

Staff Management

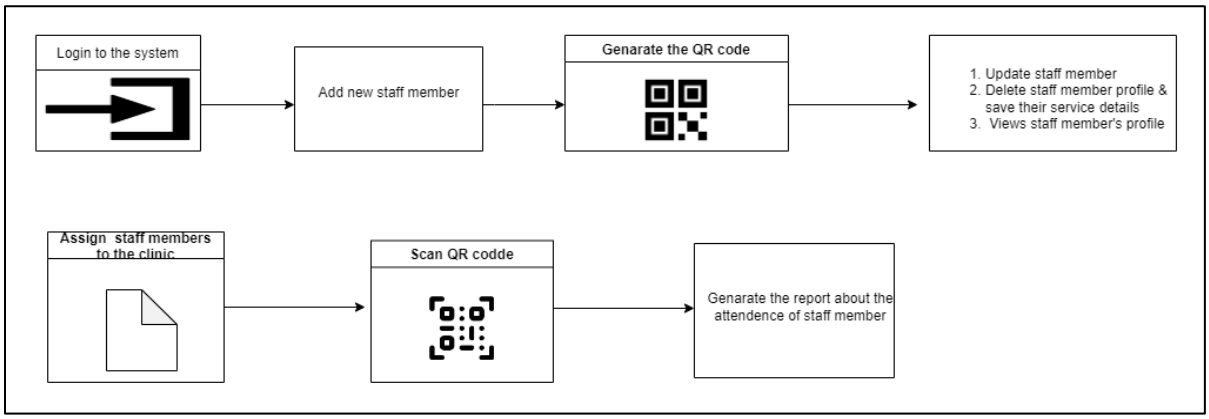


Figure 9 - Staff Management

The staff management functionality is an essential component of any organization, and the healthcare industry is no exception. This functionality allows the healthcare facility to keep track of all the necessary information related to the staff members.

Add Staff Members allows administrators to **add** new staff members to the database, generate the QR code & **update** profiles, **remove** retired or transferred staff members, and save service details. Staff management functionality allows administrators to assign staff members to clinics according to clinic schedules, ensuring they are available when needed.

Firstly scan the QR code, at the end of the day, admin will be able to generate **(Retrieve)** reports about the attendance of staff members. These reports provide insights into the attendance and punctuality of staff members, making it easier for administrators to manage their workforce effectively.

In summary, the staff management functionality is an essential tool for healthcare facilities. It allows administrators to manage staff records, assign staff members to appropriate duties, and generate reports about their attendance. With this functionality, healthcare facilities can ensure that they have the right staff members in the right clinics, providing the best possible care to patients.

Clinic Management

Currently the hospital hosts eye clinic, orthopedics clinic, Urogenital clinic, diabetes clinic, cancer treatment clinic, cardiology clinic and clinics for so many diseases found in Sri Lankan community. So having coordination between clinics will be useful as well.

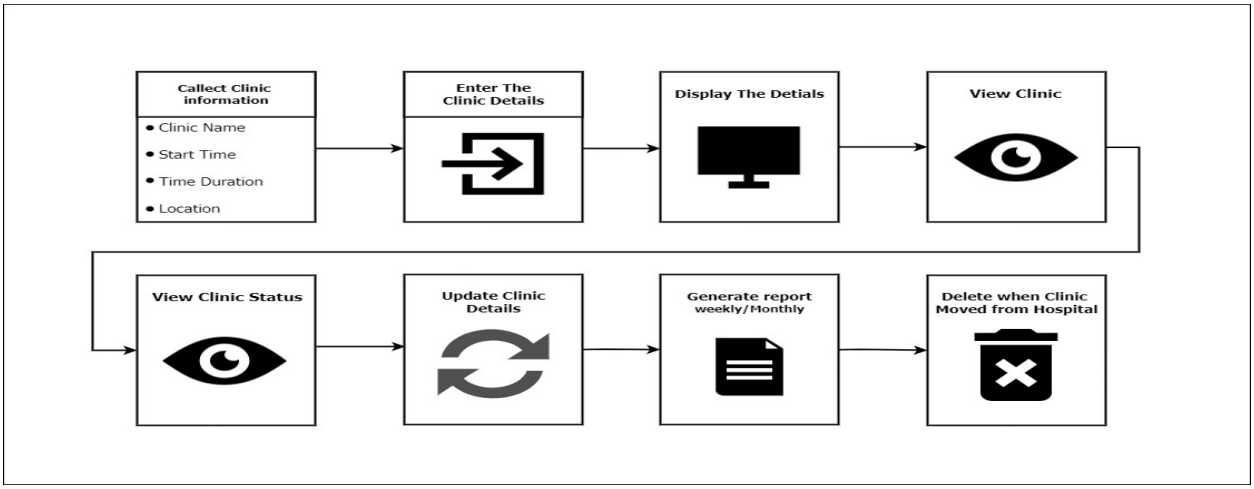


Figure 10 - Clinic Management

This function manages clinic schedules and displays clinic-specific information as mentioned in above figure. The system would provide a dashboard for each clinic, displaying the clinic's current day's schedule. Clinic staff, doctors, and administrators would be able to view their clinic's schedule as well as the schedules of other clinics within the hospital.

The clinic officer could **add** (create) new clinics to the clinic's schedule by either selecting an available time slot or manually entering the clinic details. Administrator would be able to update the details if there any changes of the schedules. The clinic officer would have the authority to **remove**(delete) clinics from the schedule, and the system would ask for confirmation before deleting them. The system would also **update** the clinic's status (in progress/completed) automatically and change clinic details such as time and location.

The system should generate(**retrieve**) reports for each clinic. The number of patients related to each divisional secretariat division should be mentioned separately in the report. It helps to identify the diseases that are more prevalent in each area and to take required steps to control the spread of diseases. The reports would be filterable, allowing clinic staff to view specific data sets based on their needs. The reports would provide valuable insight into clinic operations.

Inventory Management

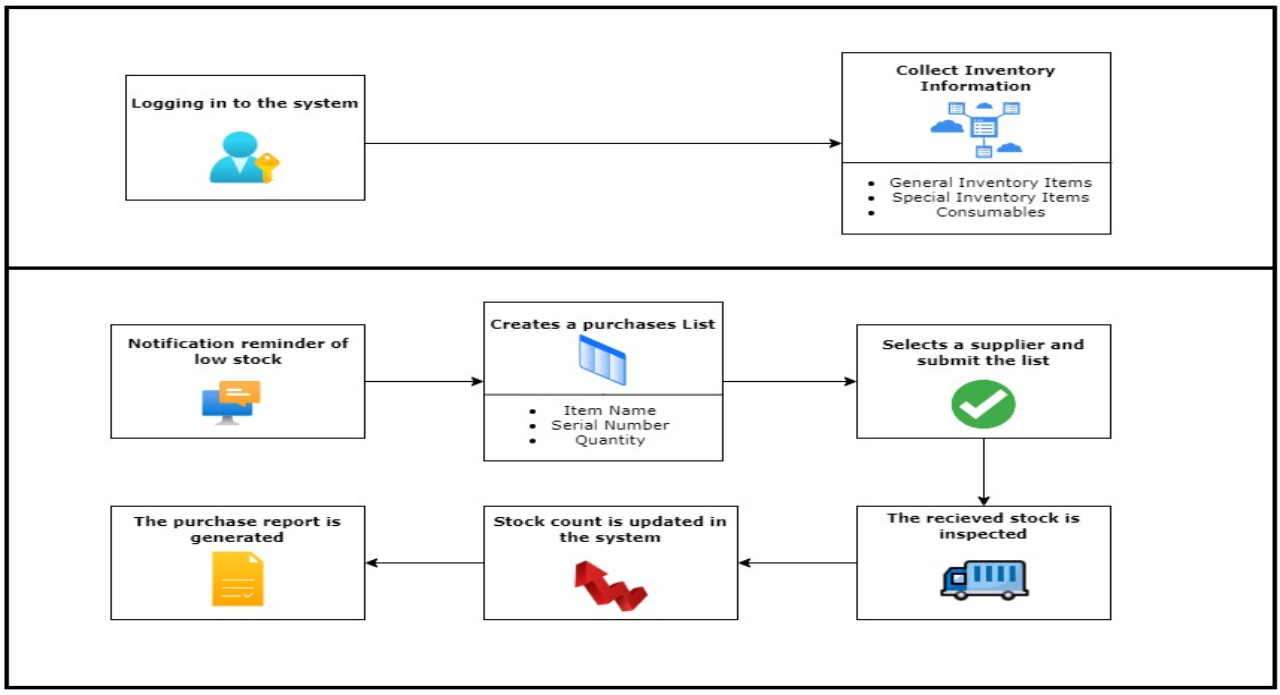


Figure 11 - Inventory Management

The main goal of inventory management is to cope with items required for clinical purposes. An inventory officer is assigned to manage all the purposes related to the inventory. The inventory officer has permissions to add and remove inventory items from the system and update stock quantities.

Inventory items are consisting of three main categories as general inventory items, medical inventory items, and consumables. When new items are **added** to the system which are not currently available, the system should be updated with the relevant information. Afterwards, the item will be available for clinical purposes. The vendors also can be added to or removed from the system by the inventory officer. Once a vendor is added to the system, the system should be **updated** with vendor details. The purchases history of each vendor and the payment status can also be **viewed** in the system. If a stock is expired or unusable, those items are **removed** from the system. A **report** which includes daily usage summary of items is generated at the end of each day.

The system should be fast, accurate and reliable in transactions. So, performance, reliability and accuracy should be maintained at an elevated level.

Tools & Technologies

We use different types of tools and technologies for our project. UML diagram was very important thing to our project, and we used Draw.io to draw UML diagrams. We can make a variety of diagrams using drow.io for free software, including flowcharts and UML diagrams. Additionally, we created and edited papers using MS Word. It is frequently used to compose proposals, reports, and letters. Also, we made our PowerPoint slides using MS PowerPoint. It was effortless to use and helpful to us.

We selected **Mock flow** as the wireframing tool for our project. **Mock flow** is an online wireframing tool. We were able to build wireframes quickly and easily with its help. After that, we used **Figma** as our user interface design tool. It enabled us to create interactive user interfaces. Also, we used **Adobe XD** to design user interfaces.

We selected **Visual Studio Code** as our text editor. The well-liked and potent text editor Visual Studio Code provides many helpful features for programmers, including syntax colouring, code completion, and debugging tools. It also has a large community of developers who create and share extensions to enhance its functionality. So, because of that, we decided to use Visual Studio Code as our text editor.

As a tool for version control and increased collaboration, we used **GitHub**. Version control for software development is offered by the robust platform GitHub, which also has communication tools that facilitate teamwork on projects. We can quickly manage various versions of our code, collaborate with other team members, and track changes to our code over time by using GitHub.

We used **MERN stack** for our project. The MERN stack is a popular technology stack for building full-stack web applications. MERN stands for **MongoDB, Express.js, React, and Node.js**, which are open-source technologies.

A brief description of each element of the MERN stack is given below:

MongoDB: A NoSQL database. It's flexible and scalable, making it a great choice for web applications.

ExpressJS: A web application framework for Node.js that provides a set of features for building web applications, such as routing, middleware, and HTTP utilities.

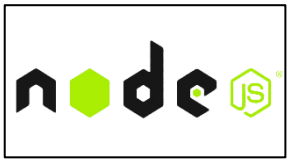
ReactJS: A JavaScript library for building user interfaces. It's a popular choice for building front-end components in web applications.

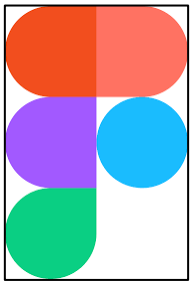
NodeJS: A JavaScript runtime environment that allows developers to run JavaScript on the server-side. It's used to build scalable and high-performance web applications.

Using the MERN stack allows us to build full-stack web applications entirely in JavaScript, which can be beneficial for development speed and code maintainability.







Gantt Chart

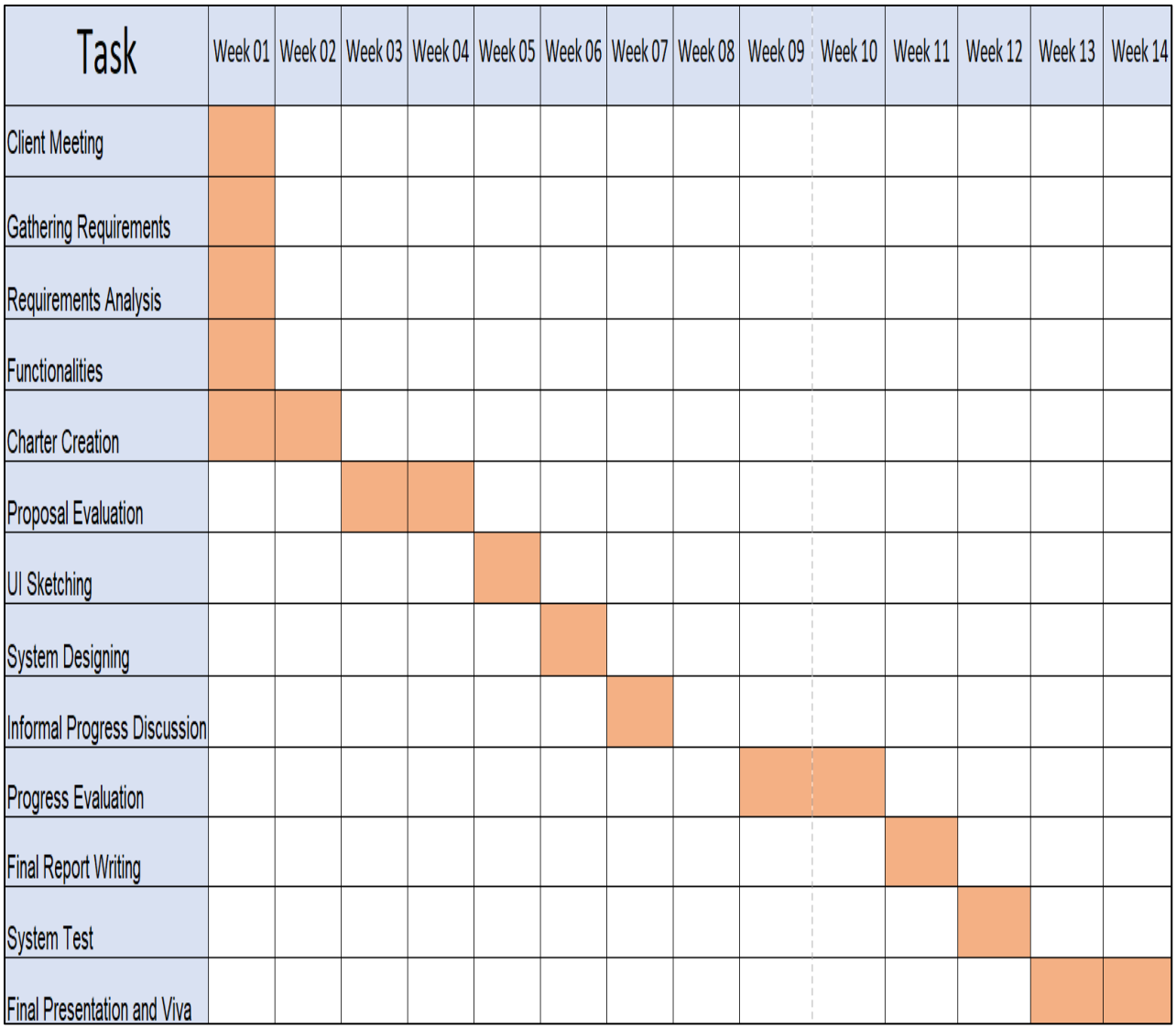


Figure 12 - Gantt Chart

[4]

Literature Review

Our project will be pertaining to the requirements while providing a better optimized and a user friendly environment for managing the clinical purposes, in contrast to the current manual system which has been already deployed by the hospital. The main concerns and problems identified with the current system are productively addressed by the system that we are proposing. The clinical processes will be able to handle more effectively and precisely with the online web hosted platform that we are integrating. The current system deals with heaps of manually entered records, to cope with an instance of finding details of a particular patient or a drug. Moreover, there is not any mechanism to capture important notifications or messages to be conveyed to specific parties engaged in the clinical system, while both these drawbacks are resolved by our system. Real-time updates to the database, notification alerts and auto generated messages will make our system more efficient and less time-consuming with the processes.

Table 1 - Literature Review

Proposed system	Current System
Separate functionalities have been introduced for each section, and the tasks are sorted out and managed accordingly.	Tasks are congested as there is no proper management within sections of the clinic.
Patient details are hosted on a web platform so that they will be easily accessible and fast.	Patient details are stored in a physical database and lacking security, confidentiality, and ease of access.
The appointment system is the prime concern of our system which will assist in more efficient time management for the patients.	The patients must wait for long hours to have their session as a result of not having a proper system for appointments.
Retrieving patient data and checking up past medical reports is made easy with the QR code system integrated in our system.	Independent checking of a single patient file is not practical at all with the existing manual record keeping system.

Evaluation Methods

The Clinic Management System is a web based solution that helps hospital management in managing their clinics centers efficiently. The system has various features, such as patient management, appointment management, pharmacy management, laboratory management, staff management, doctor management, clinic management, and inventory management. Evaluation of these features is critical to ensure that the system meets the client’s needs and provides an efficient solution for managing their operations. [5]

User testing includes evaluating the system's features by observing how users engage with the system. Doctors, staff members, laboratory officers, pharmacists, inventory officers, and administrators are the primary users of this system. User testing can be used to assess the system's usability, efficiency, and user interface. User testing can be done by creating scenarios that replicate real-world system usage and asking users to accomplish tasks using the system. The user feedback can be used to enhance the features of the system.

The process of evaluating the system's performance in terms of response time, resource usage, and scalability is known as system performance testing. The system's response time can be examined by measuring the time taken by the system to execute a particular task, such as scheduling an appointment. The system's memory usage, CPU utilization, and network utilization can all be measured throughout peak usage periods to determine resource utilization. Scalability can be evaluated by simulating multiple users accessing the system at the same time and evaluating performance. Also, the security of data can be increased by using cloud servers as well.

This report's evaluation techniques can be used to evaluate the system's usability, functionality, performance, and cost-effectiveness. The evaluation reports can be used to improve the system's features and ensure that it meets the needs of hospital administration.

Work Distribution

Table 2 - Work Distribution

IT Number	Name with Initials	Work Allocated
IT21207822	Senarathne H. A. T. S.	Implement Patient Management
IT21175466	Harshana W. C.	Implement Appointment Management
IT21353284	Priyawansha N. G. D.	Implement Pharmacy Management
IT21203558	Shamindi H. M. H.	Implement Laboratory Management
IT21209666	Nisalasara W. N. N. A.	Implement Doctor Management
IT21207686	Liyanaarachchi L. A. I. T.	Implement Staff Management
IT21208294	Mudalige T. N.	Implement Clinic Management
IT21204470	Kahawevidana H. D.	Implement Inventory Management

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List of figures