

A Hospital Management System Suitable for Every Hospital as a Solution to the Problems of the Hospital Industry in Sri Lanka

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ABSTRACT

This paper is based on the concept of creating a management system for a hospital, related functionalities and other learning of it in order to make the process efficient, fast and safe. This study aids in increasing the productivity of a hospital by decreasing the time wastage which was identified with the manual process. The system is proposed after identifying the problems in patients and the hospital staff to cover areas of human resources, marketing and finance. One of the main goals is to provide a system which can automate a manual process that is used in day-to-day life. The proposed system which is known as "Hospital MS" is a web application which contains the necessary functionalities of the stakeholders of this system. Mainly this system can manage the patient, doctors, recipients, lab assistant and the system administrator to maintain and manage the system. Since we can provide a platform to every person who is interacting with this system, there are lots of advantages for everyone. Another aim of this system is to provide the patient with a way of interacting with the hospital. With this proposed system a particular patient can make the appointments to a doctor, and once the appointment is completed, the patient can keep the interaction with the doctor by sharing information like prescriptions. One of the other concerns that this system is going to look after is the centralized database to manipulate the data in a more reliable and efficient way.

Keywords– Hospital, Doctor, Patient, Management, Finance

I. INTRODUCTION

Health care services play a major role in a nation because they can play a crucial role in affecting the development of the country. When we talk about the health care services, hospitals are the key area that we need to focus on it. Hospitals mainly can be differed as private and public. In this article we are going to talk about the management of those hospitals in terms of productivity and the efficiency of the services.

When we consider the management of the hospitals mainly, we have identified that most of them are still following a manual system for their day-to-day work which can lead to many disasters. It's not only about the productivity and the efficiency of the services, but also the from the cost wise the traditional or the manual process can lead to many problems. Some of those disadvantages of a manual health care system can be listed as follows [1].

1. Maintenance problems
2. Data handling problems
3. Lack of ability to convert data into information
4. Coordination problems
5. Accessibility issues with the data
6. Time wastage

The common and the usual way that we can see some hospitals is the manual procedures that are continuing for a long time. The proposed system is to automate the usual procedure of a hospital while keeping the core concept of the manual system. The main advantage of this kind of a system is that we can duplicate the performance of a manual system while having lower maintenance costs. Other than that, with the use of this kind of computer-based information system we can keep and increase user interaction through the system. Furthermore, it can provide the solution for the problem of data handling since it is a very crucial point in a hospital. Other than that, we can list other advantages as follows.

1. Data availability
2. Low maintenance cost
3. High scalability
4. Can turn data into information quickly
5. Less number of physical resources is required
6. Easy migration to other systems

After the information gathering process of this system, that information was divided into six main categories as doctor management, patient management, laboratory management, receptionist management and system

administration. Based on those deferent departments of management each and every individual task was classified into those departments. Based on those classifications and categorizations decisions were taken to select what kind of technologies and other related issues.

Hospital MS is a computer-based hospital management system to manage different aspects of a hospital with an automated system providing a common platform for all the users of this system. After the investigations, the idea is pitched to build a web application with the identified stockholders which are patient, doctor, lab assistant, receptionist and the system administrator. The reason for building up a web-based solution is, it is not complicated and easy to understand to users and the availability of the systems through the internet. In the proposed system there are different managements based on the role of the user. For example, the doctor has his own functionalities, the lab assistant has his or her own management etc.

The normal flow of this system starts with the registration and then they can log in to the system. Based on the authentication process each user will be redirected to the relevant pages. As the patients, they can mainly send an appointment to the doctor and keep that communication with doctors. So that the drawbacks of wasting time on remaining in the queues will be fewer. On the other hand, the doctor can send prescriptions for a particular patient. As an additional functionality doctor can add the sessions mentioning the times and the dates, he or she is available so that the patient can send their appointments based on those available time slots and also the doctor can send notes to the system regarding a patient. The other role is the laboratory or the lab management where we can get the results of the lab reports and relevant activities.

The proposed system is developed using the "MERN" stack. As the server-side technologies, this system uses NodeJS and Express JS. Since this proposed system contains many input and output operations NodeJS is more suitable for those kinds of environments. With the use of that we can overcome the drawback of time wastage and use of physical resources like paper of the manual system. React JS library is used to implement the client side which provides lots of opportunities to build best user interfaces with better user experience. As the database of this system, we are going to use Mongo DB, which is a cloud-based database. With the use of a cloud-based database, we can have many advantages for a system and some of those advantages are mentioned below [2].

1. Flexible solutions
2. Mobile access
3. Availability
4. Scalability
5. Disaster recovery
6. Safety and security

Looking back at the above-mentioned drawbacks, we can overcome most of them with the use of this kind of database.

Going through the sections of this paper will provide the necessary information about each process and steps of this system. This section provides an introduction to the paper while giving a basic idea of the scope by talking about the problem and the solution related things. In the upcoming sections will talk about the how observations and prioritizations were made and the methodologies that are used for this proposed system and a discussion about the system taking all of the factors in to one place with the conclusion.

II. LITERATURE REVIEW

Throughout this paper talk about how the computer-based information system can help and affect a hospital to increase the productivity of the works and the drawbacks of the traditional way of using the manual system. The proposed system is the Hospital MS offering solutions and a common platform for all the users.

There are systems that focus on this matter providing online solutions for the relevant matters [3]. Those systems contain most of the functionalities this paper discusses. Among them both the proposed system and the available system have common functions like staff and user management and prescription offered by the doctor which is also known as "ePrescription". But in the proposed system the doctor has the ability to send his or her available time slots for the bookings of the patients.

Automating the system has lots of benefits for the staff as well as the outside users like patients. For example, once the patient logs in to the system, they can simply search the doctor's name and the date, available time slots will be displayed, and the patients can make an appointment for those time slots.

III. METHODOLOGY

A. Tools and Technologies

In this research project for hospital management system, we have used MERN technology stack to implement our solution. React framework is used to implement the frontend parts of our solution and backend is developed using Node JS and express framework. For storing data and information we have used a Mongo DB database [4]. Both frontend and backend technologies we have used are based on JavaScript. Which gave us an excellent interoperability between frontend and backend because we have implemented them as two separate projects so that in future, we can use our research project's backend for any kind of frontend for example, a mobile solution frontend. In this research project for hospital

management system, we have used git as our version controlling technology. As a project management tool, we have used azure DevOps from the beginning of the project

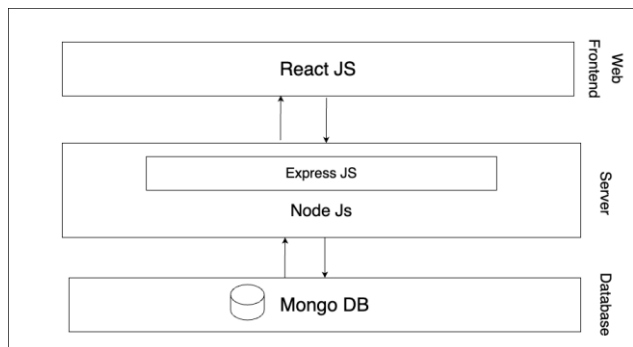


Figure 1: Mern Stack Architectural Diagram

As in the above diagram React is the first user level entry point. React is a JavaScript library to develop user interface. Which is widely used in current software industry due to many reasons. One of the main reasons is its component-based architecture which makes UI components reusable and loosely coupled. Also, React uses a Virtual DOM which gives a great performance boost for our hospital management application [5].

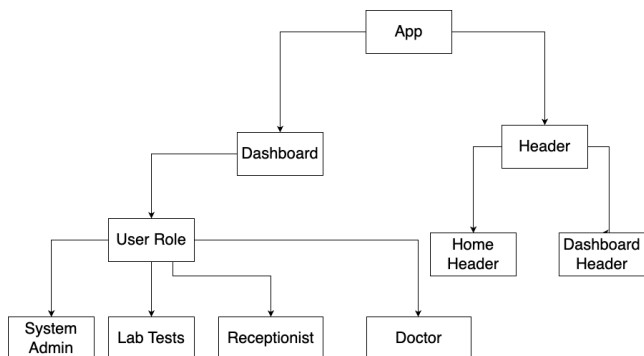


Figure 2: React Component tree

For the backend we used Node JS and Express. Node JS is a runtime environment which allows us to do server-side development. It is open source and cross-platformed as well. From Node JS we can achieve the same benefits as reusability and high performance like in React. While Node JS runs as a runtime environment, Express JS will run on top of Node JS. From Express we can handle web requests easily.

In our hospital management project, since we are dealing with a lot of data and information, we need a place to store them. MongoDB can help with this since it allows JSON documents created by our React.js front end to be forwarded to the Express.js server for processing and, if they are valid, we can store them in a MongoDB collection for future use.

B. Back-end processes related to the main function

In this research project, one of the main backend features is authentication and authorization. In the first step, the client sends a login request to our backend server. From there, according to the user role, a session ID is generated. This session ID is used in the application to authorize the user accordingly.

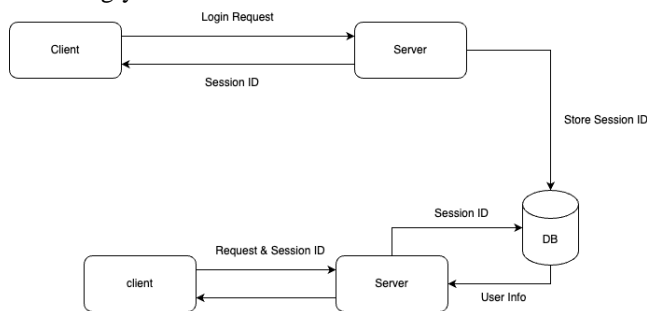


Figure 3: Authentication and Authorization backend process

Another important feature in the backend is to create a record. This feature is used widely in all user roles. In this process, the browser requests a page which contains a form. This is a GET request to the server. After the user submits the form, the system sends a POST request to the backend server. The server then validates the data. If the data is valid, it performs relevant actions and provides a success message to the user. If the validation fails, the system generates an error message and sends the form back to the browser with the error message [7].

IV. PROPOSED SYSTEM

The proposed hospital management system consists of many very usable functions to carry out mini-hospital or large-scale hospital tasks.

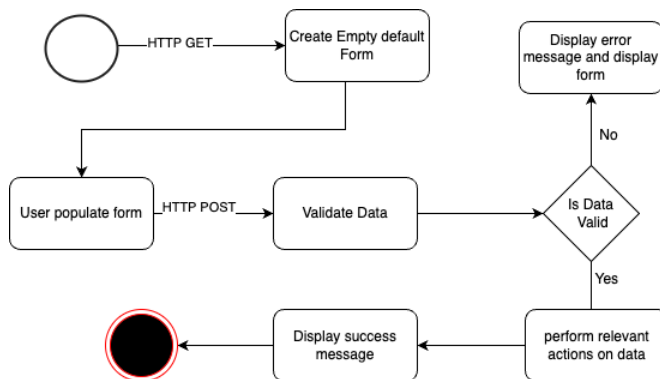


Figure 4: Create record backend process

Mainly this hospital management system is going to use by doctors, patients, hospital administrators and lab assistants. We came up with this batch of group because each hospital consists with this user group to carry out their tasks.

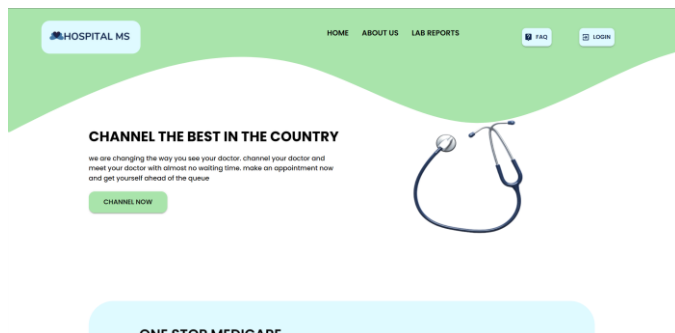


Figure 5: Hospital MS Home Page

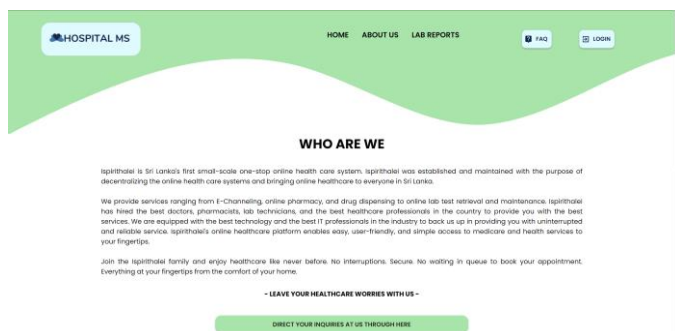


Figure 6: Hospital MS about page

All the secure user handling like proper authentication and authorization also implemented in this proposed system.

For each user this proposed system will enable more automated features to ease their tasks in hospital environments. Doctor is one of the main actors in this hospital management system and he or she will get more automated features to ease their daily hospital tasks. For an example to get all the patient appointments for his or her channeling time this system has the option for retrieve all the patient appointments when each valid user log in. like that retrieve patient prescriptions, add prescriptions, add notices, retrieve notices, update notices, update prescriptions, generate prescriptions as pdf, delete prescriptions, filter notices by their status and retrieve counts of the prescriptions and notices for the dashboard are the main features that in the proposed system.

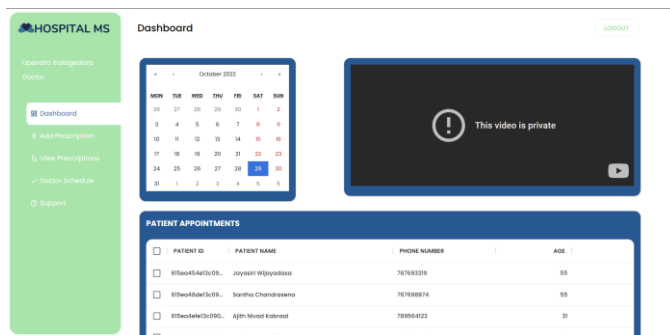


Figure 7: Doctor dashboard

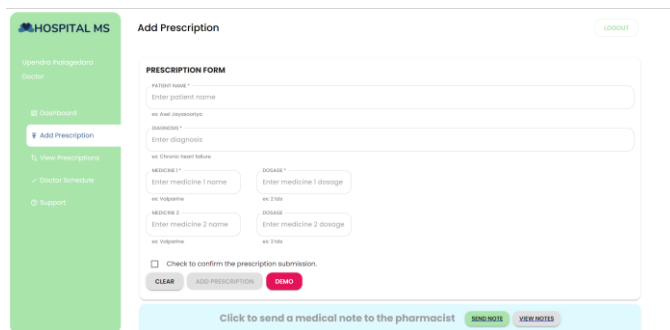


Figure 8: Doctor add prescription

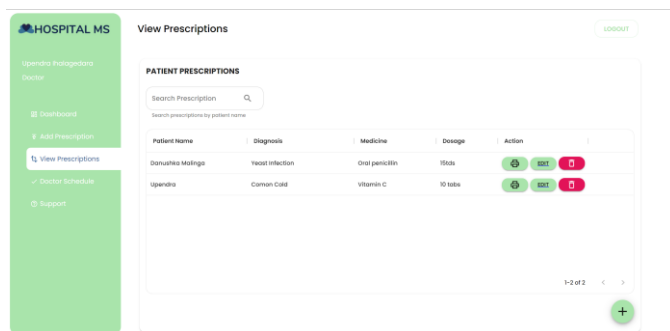


Figure 9: Doctor view prescription

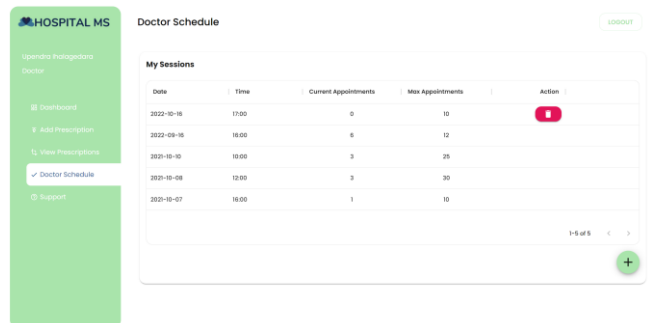


Figure 10: Manage doctor schedules

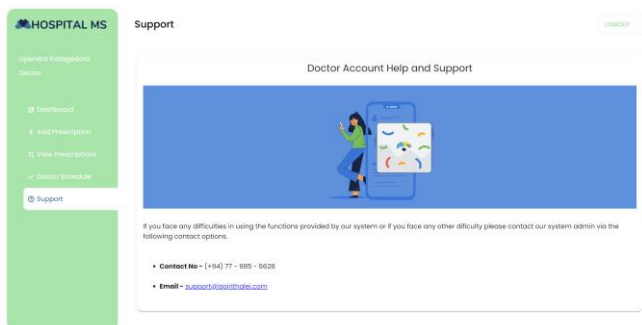


Figure 11: Doctor support view

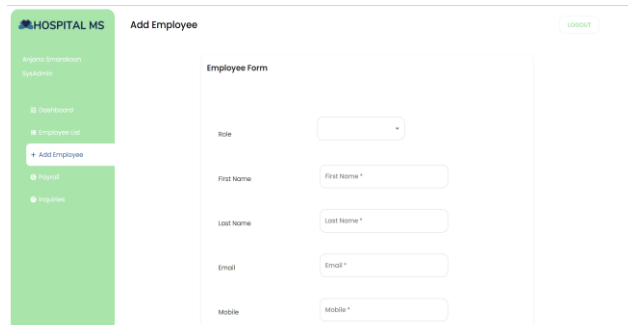


Figure 14: Add new employee view

Hospital administrator is the next main user in this hospital management system because to run a successful hospital environment the need of administrator is must. In this proposed system basic admin features like add staff members to system, view all the summarized hospital staff and their registration data, view all the mandatory staff details, generate staff report function, update staff member function, update doctor status and get lab assistant status like many basic features are in this proposed system.

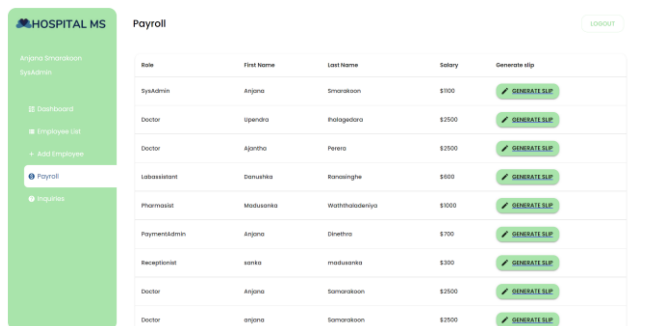


Figure 15: Admin payroll view

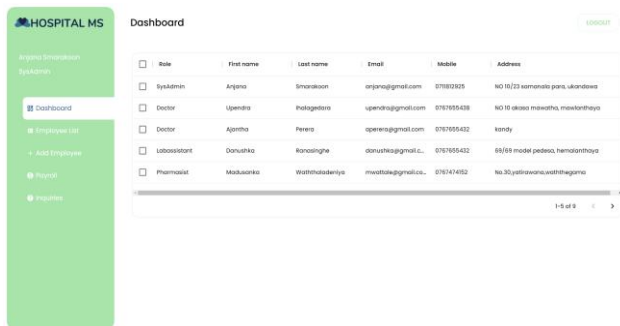


Figure 12: Admin dashboard

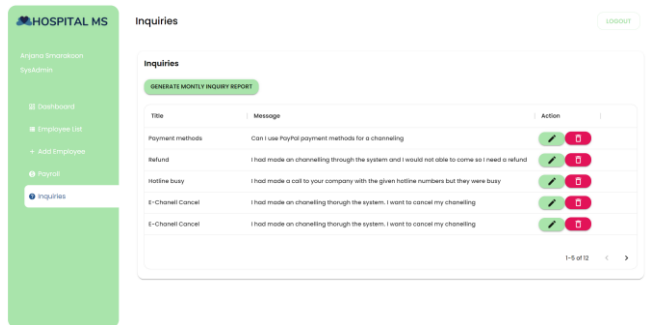


Figure 16: Admin inquiries view

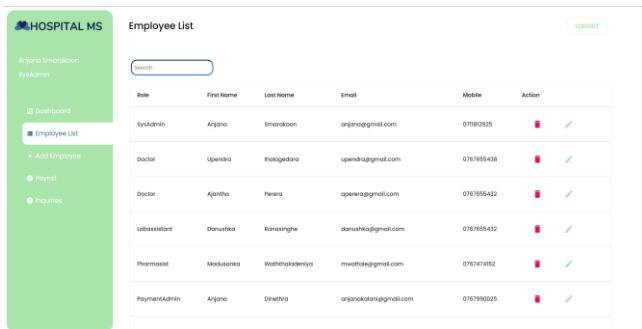


Figure 13: Manage employee view

Not only the staff of this hospital but also the patients that are coming to hospital to fulfill their needs also address in this proposed system. Patients' tasks like patient registration to hospital, retrieve patient details and appointments, make appointments, edit appointments, view all patient appointments, and delete patient appointments are the main features in this proposed system.

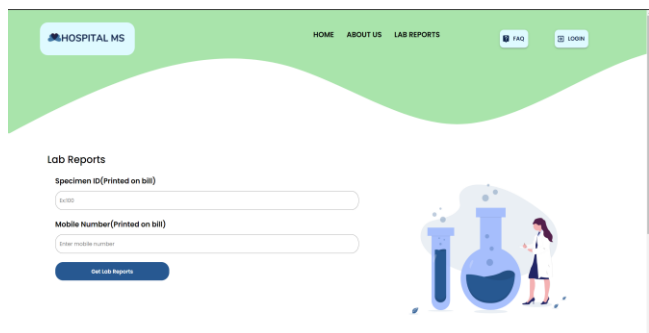


Figure 17: Patient lab report search

Laboratory management is also one of the main tasks in every hospital management system. Since covid hits laboratory management in every hospital got more complexed. This hospital management system consists with fully fledged lab report and laboratory management system. Create lab test form for each specimen, assign each specimen to a lab staff to test, insert final lab results to the lab detail form, delete lab test, update patient details, view all lab tests according to status, view all patients, full summary report in laboratory current work. Download lab test reports and search lab tests are the features in this proposed laboratory system.

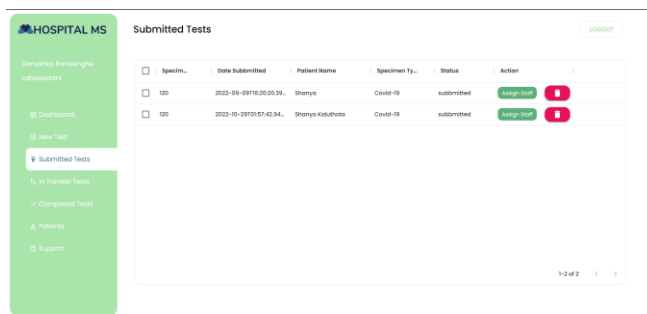


Figure 20: View submitted and assign staff view

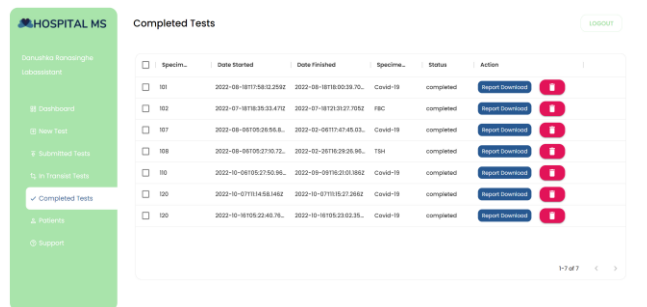


Figure 21: View completed tests

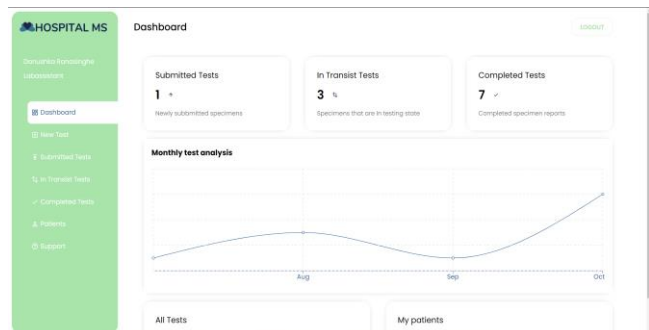


Figure 18: Laboratory dashboard

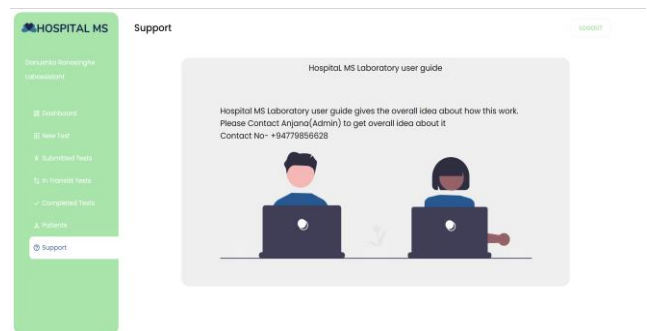


Figure 22: Laboratory support view

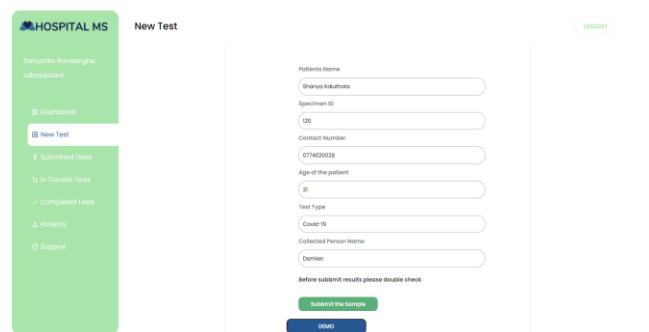


Figure 19: Add new specimen view

V. DISCUSSION

This application's major goal is to manage hospitals more quickly than usual. Staff cannot manage the hospital without a proper management system. So, when running the hospital in a normal way, the management board faces lots of problems. However, because it has been in use for so long, both staff and patients are accustomed to it. There are several areas that face problems when running the hospital, the normal way. Patient detail management, inventory management, prescription management, and doctor session management are the normal sections in the hospital management system. When gathering information from a patient, it must be written on paper and prescriptions must be written on paper. But if someone wants to get the details of a patient or patient's prescription, they want to check all the papers one by one. It is not easy to get details of patients

in the normal system. Likewise, medicine stock details have to be written on paper and the other sections are used in the same way to collect information. Therefore, it is not a good method for gathering data. Data handling, data cannot be reproduced if it is burned, and it is not easy to convert it to information, e the several problems the management board faces when running the manual hospital management system.

Using a computerized management system is more useful than the normal management system. because it is a good solution with lots of advantages, low maintenance cost, and is faster than the manual system. Data can be stored in databases systematically when using computer-based management systems, and with a proper backup, data cannot be easily corrupted. So, this product was developed based on the requirements of hospitals. It is more efficient and simpler to maintain data when using this application by the management board than it is when doing things, the normal way. So, this system was developed for several sections like appointment management, doctor's session management, laboratory, and system admin. Using this system, patients can easily channel a doctor according to their convenient time. With the current hectic schedule, it will be extremely simple for people. Also, patients are able to check their lab reports without going to the hospital. So, this system makes it simple to complete many of these tasks.

VI. CONCLUSION

Nowadays, some hospitals are managed in a normal way. Future-proofing the data collection and management process of the normal management system is not possible. So, in this paper, we investigate a manual hospital management system procedure. And we gathered all the advantages and disadvantages of a normal system. We realized the normal way of managing hospitals is not easy and data can be easily corrupted. So, this application is implemented based on the normal procedure of the hospital management system. Users can easily use this application without any doubt. This system makes handling data simple, and data cannot be easily corrupted with proper backup. Also, information about patients can be checked by management more quickly than in the past. So, the Hospital MS application is the best solution to solve problems with the manual management system. The project was a higher learning approach for the entire team because it exposed them to a real-world problem and contributed to resolving the problem with the proper solution.

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