

By E-Care Pharmacy Web Application, the Medicines Needed for Daily Human Life Can be Easily Delivered to Them

Idushan K. A. S¹, Dilshan P. G. T², Madhushan K. L. B³, Jayasundera P. S⁴, D. I. De Silva⁵ and Samitha Vidanaarachchi⁶

¹Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

²Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

³Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

⁴Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

⁵Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

⁶Department of Computer Science and Software Engineering, Sri Lanka Institute of Information Technology, SRI LANKA

¹Corresponding Author: it20118068@my.sliit.lk

ABSTRACT

This project offers knowledge on creating and putting in place a pharmaceutical management system. And here, the major objective is to increase the efficacy, efficiency, and accuracy of the drug. In today's world, management is one of the most crucial organizational components. Additionally, complexity is added when management does a certain activity in any way.

In other words, the availability of computers and advancements in information technology have made it possible for us to swiftly and effectively gather and communicate vast volumes of data on patient treatment. The pharmacy management system should be able to get prescriptions and non-prescription medications with the assistance of certified, trained pharmacists in order to provide patients with the medications they require.

Today, many of these types of pharmacy management systems are used to better manage pharmacy-related activities.

Keywords— Pharmacy Management, Framework, React, Spring, JWT

I. INTRODUCTION

The main objective of the project is to manage the administration and database of pharmacy management. This research examines how a pharmacy management system was created and put into use. Pharmacy management system is a management system developed with the aim of improving the accuracy and safety and efficiency of a pharmacy shop.

In this pharmacy management system, inventory management, each pharmacy profile management and medication management are mainly included in the three sections. With this program, in order to find a drug needed by a client, by entering the name of the drug, the customer will be shown the number of pharmacies that have that drug, and the customer can buy that drug from the pharmacy.

And if the customer needs to get the medicine only with a prescription under a specific licensed doctor, there is also the possibility of purchasing it from the pharmacy by uploading it through the relevant system. And

reports can be generated related to each management section in this pharmacy management system. In this pharmacy management system, the user can get a report within a certain period of time.

The primary purpose of the pharmacy management system is to improve the accuracy, safety and efficiency of the pharmacy at each pharmacy. And the pharmacy management system is reliable, integrated and provides technology. In case of need, the pharmacist will be able to create a report on the movement of drugs and pharmacies, get information about different types of drugs and location.

II. RELATED WORK / LITERATURE REVIEW

This is a very useful application for pharmacists and consumers. It reduces workload and helps manage all components of pharmacy like drug administration, invoicing. That is, it increases processing efficiency and increases patient comfort. And compared to the pharmacy apps we have studied while creating this pharmacy app, pharmacist and customers can create their own profile and enter, update and delete their details as needed.

Before creating this application, we studied several previously created Pharmacy websites. We used the [1]Healthguard Pharmacy website, the [2]Unique Pharmacy Online Shop website and the [3]myCare website as the pharmacy apps we studied. It was mostly seen in those applications that the application mainly provided the opportunity to upload the prescription to get the required medicine along with a prescription from a specific doctor. Most of the pharmacy websites that were studied were designed for one specific pharmacy only. Also, the admin updates and deletes only the medicines available in that pharmacy. Therefore, only the profile required by the customer was seen in the pharmacy websites that were studied.

But we have designed this application in such a way that all pharmacies can create their desired profile through the web application and users can also update and delete their profile creation. The application is not a web application that is used only for one pharmacy and users

can register for any pharmacy and several pharmacy profiles can be included in this web application.

In order to know about that pharmacy when customers/patients determine the relevant pharmacy profile, it is also possible to see the reviews given by the customers who have taken medicine in the past through the pharmacy profile that is visible to the users. Likewise, customers have been given a section in the pharmacy profile to write those reviews.

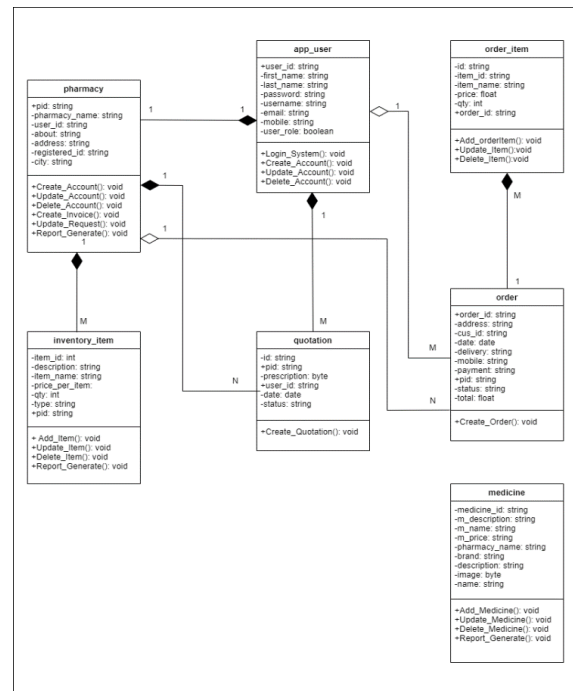
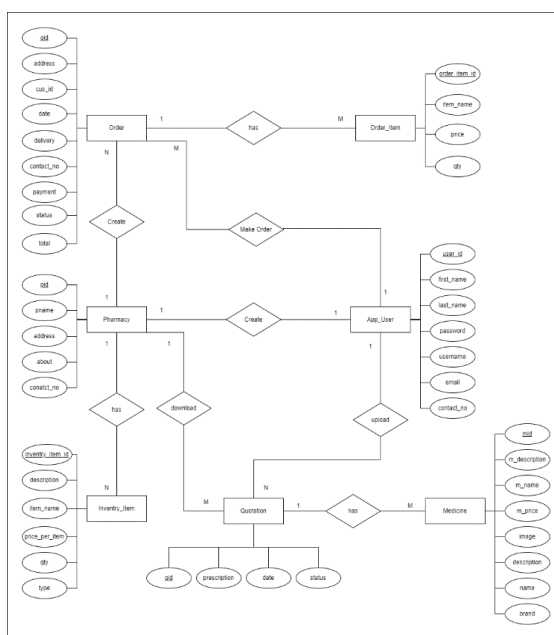
In addition, the convenience of our patients and the safety of all pharmacists and consumers are overused in this app as an underutilized feature of the pharmacy apps studied. The required reports can also be generated by the respective management departments. For example, inventory report, user order list, pharmacist order list and administrator drug list.

When getting a medicine needed by the patient, by entering the name of that medicine, all the pharmacies that have the medicine at that time will be displayed. JSON uses web token authentication to see if the user is a valid user. There, the relevant APIs are called only until the token uniquely generated by the backend expires.

Thus, none of the pharmacy websites that we studied had been created in such a way that the session expired, and therefore it is a part that has not received much attention, so it has been included as a main part of the application that we have created

III. METHODOLOGY

As the data was mastered, we began our work by conducting a comprehensive data model study (class diagram model and E-diagram). Through that model we will get the data relevant to the application we have created. It gives meaning to the data required by the application and finds data relationships.



ReactJS, Visual Studio Code IDE has been used as the frontend programming language to create this application. Eclipse is the IDE for the backend and Springboot framework is used as the framework. We used MySQL Workbench for this application as a database for data storage. In creating the Pharmacy Management web application, our team members used GitHub as a code hosting platform to add the programmed parts of each member, that is, to work together on projects.

[4]The reason for using ReactJS as a frontend is that compared to some popular frameworks like Angular and Vue, React is easier to work with. That could be one of the main reasons behind ReactJS’s rise to fame. With its help, businesses can launch their initiatives easily and quickly. As the technology or framework becomes more complex, the development program will take longer to launch. ReactJS is becoming more and more popular among developers and large businesses as it is considered the easiest framework to understand and understand. Compared to other well-known front-end frameworks like Angular & Vue, ReactJS is remarkably simple to understand. In fact, that's one of the main factors that made react so popular so quickly. It helps programmers to create them

[5]Compared to other frameworks, React is known to be incredibly versatile. Once you get it, you can use it to create better user interfaces on other platforms. React is a fantastic tool because it is only a library and not a framework. For the purpose of creating web business applications, React was created. Grid, text, label, or button are just a few examples of link process components that can act as react components.

The user experience of any mobile or online application is critical to the efficient functioning of the program and website. If the user interface is not fully

functional the website may be removed and users may not be retained. On the other hand, consumers are drawn to mobile apps with great user interfaces. As a result, they will be motivated to return sooner. So, designing suitable UI for apps can help you get good results. ReactJS is an excellent framework for front-end developers to design aesthetically pleasing user interfaces.

ReactJS components are one of the main reasons why it is so well liked. Another important aspect of this is reusability. This implies that an element can have only one definition and multiple uses. In other words, we can reuse the frontend generated by ReactJS. You can create an ideal user interface for your project using various React component frameworks. Reusable components should be used to speed up development and boost throughput. Creating websites on a large scale costs you money and time, so you can experience relaxation and peace of mind when you use the same elements in different ways.

[6]The Springboot framework, an open-source Java web development platform that is popular in the construction of microservice, was chosen for the backend. Although it is an addition to the current Spring framework, it has several unique characteristics that make the program simpler to use within its development community. It offers a pre-configured platform for creating Spring-powered applications with little XML and annotation-based configuration, making it a particularly well-liked framework for corporate application development. Spring Boot is the best option for quick application development since it allows users to begin applications with only one command.

These are some of the justifications why today's developers should choose Springboot as their first choice for backend development. A "convention-over-configuration" Spring module is what Spring Boot is called. Additionally, it guarantees "easy implementation" of stand-alone production-level web applications with minimal total Spring configuration requirements. To execute and test our web applications, it has integrated HTTP servers like Tomcat. It gives us various functions by interacting with components in the Spring ecosystem like Spring JDBC, Spring Security, Spring JPA, etc.

It makes it simple to connect to MySQL as well as several other databases and queuing services. As a result, prior to developing the application, we learned a little bit about Spring Boot by reading research papers and watching videos on YouTube. These few data demonstrate the popularity of Springboot as a framework for beginning developers.

Also, Azure DevOps cloud computing service was used to represent the contribution of members to update the daily or weekly tasks related to this application. SonarQube is a Code Quality Assurance tool has been used to analyze the code quality of the program while creating the application. In addition, Selenium tool was used to test the created web app.

[7]It was decided to use Azure DevOps to represent member contributions and to update the application's daily or weekly tasks: - Agile planning, work

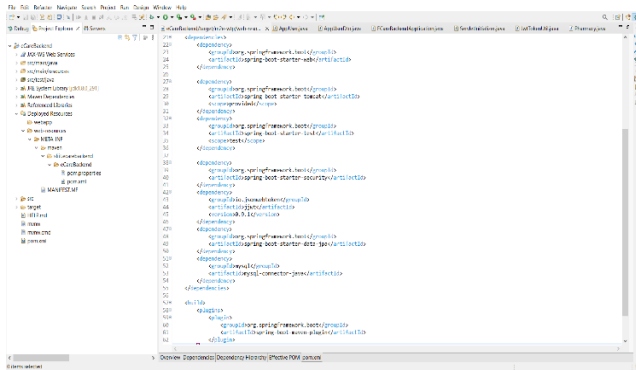
item tracking, reporting, and visualization are all included in Azure DevOps. On the backend, it provides native Scrum and Kanban support for Agile. Furthermore, it provides fully customized dashboards with integrated reporting that can be expanded to suit company requirements. For testing your application, including manual testing and continuous testing, Azure Test Plans offers a complete and comprehensive set of tools. It provides a complete answer for planned and impromptu testing. Additionally, they offer all the capabilities required for a range of test methodologies and are straightforward, browser-based test management systems.

To check the quality of the application's code, i.e. to monitor the bugs, the reasons for using the SonarQube code quality testing tool are: - [8]SonarQube is a web-based open source platform used to measure and analyze source code quality. Using code quality analysis makes your code more reliable and understandable. Sonar Source is in charge of maintenance of SonarQube. SonarQube significantly reduces software development risk in a shorter period of time. It automatically finds problems in code and notifies developers to repair them before releasing it for production use. SonarQube focuses on complex parts of the code that unit tests don't always cover. By identifying and warning developers, it reduces the chance of misunderstanding.

[9]Selenium tool is used for web application testing as it is free software and portable tool. It does not include any upfront direct costs. The tool is free to download and has free community-based support. A number of languages, including Java and others, are supported by Selenium. Despite not being restricted to just one language, it has its own alphabet. It may operate with any language that the developers and testers like. Selenium is compatible with a variety of operating systems, including Windows, Mac, Linux, and UNIX. A customized test suite may be written on any platform and then executed on another using a Selenium solution suite. For instance, you may simply develop test cases using Windows OS and execute them on a device running Linux. Multiple browsers, including Internet Explorer, Chrome, Firefox, Opera, and Safari, are supported by Selenium. When performing tests simultaneously across many browsers, this is really creative.

[10]Spring Initializr is a web-based tool provided by Pivotal Web Service. With the help of Spring Initializr, we can easily generate the structure of the Springboot project. It offers an extensive API for creating JVM-based projects. And finally, a web application that can generate a Spring Boot project structure for you. It doesn't generate any application code, but it will give you a basic project structure and a Maven or Gradle build specification to build your code.

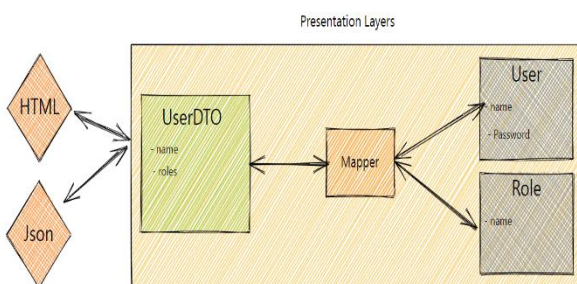
Before creating the application, some necessary dependencies had to be generated through Spring Initializr for Springboot, which was used as the backend framework. JWT web token dependency, MySQL connector dependency, and Lombok can be mentioned as a few.



[11]Annotate any field with Lombok's Getter and Setter to have Lombok automatically generate the default getter/setter. The generated receiver/setter method is public by default.

While coding the backend, we mainly used [12]DTO patterns. DTOs or Data Transfer Objects are objects that carry data between processes to reduce the number of method calls.

Here the data is mapped from the domain model to DTOs. That is, usually through a map component in the presentation or interface layer.



Another advantage of using DTOs over RESTful APIs written in Java and Spring Boot is that they can help hide the implementation details of domain objects. And exposing entities across endpoints can become a security posture problem if we don't carefully handle which attributes can be changed via which operation.

Simply put, the details to be passed to the backend will be sent through the ProcessRequestDto class as a DTO pattern class that we used. In addition, the JWT token is sent along with the bearer related to authentication in the header of the API calls. That is, the requestDto in the body and the JWT token related to authentication in the header. It is sent to the frontend after entering the ProcessResponseDto as a response related to the sent request. Then every time only two objects will be passed as request and response through the POST method. No matter what insert, update, get or delete is done, only the request object and the response object are exchanged between the frontend and backend in relation to a POST method.

Also, we included a function-related calculation section in the pharmacist profile to issue the drug price invoice related to the prescription uploaded by the pharmacists to get the required medicines from the patients.

That is, when preparing the invoice by the pharmacists, we have prepared it in such a way that when entering the types of medicine in the prescription sent by the patient, the price of the medicine will be auto-represented based on the physical condition in which it can be sold. After entering the price along with the name of the drug, when the amount required by the patient is entered, the price is automatically calculated according to the amount of the drug required by the patient.

$$a = b \cdot c$$

a: - is the price relative to the quantity of the drug required by the patient

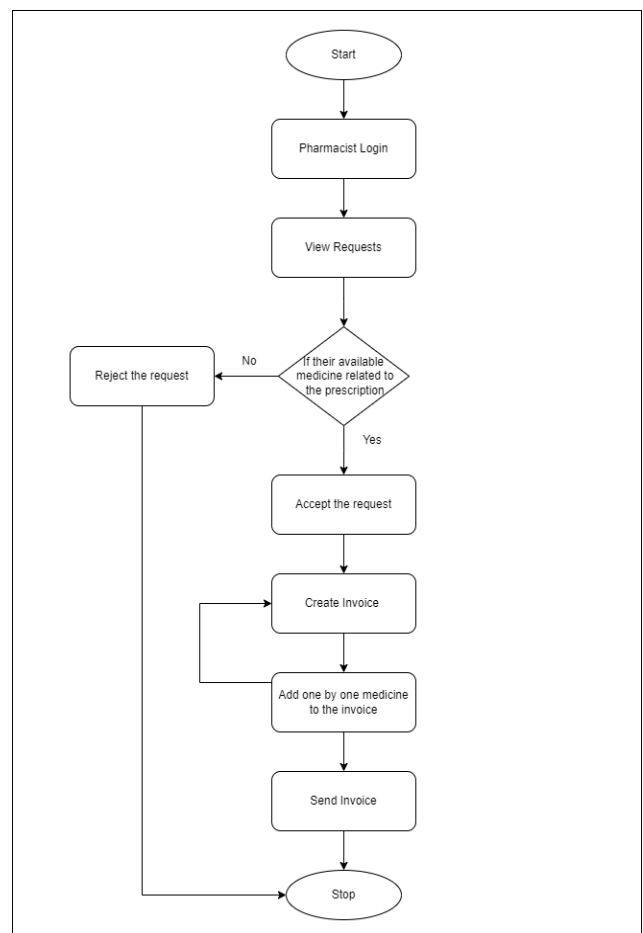
b: - is the price relative to the marketable quantity of the drug based on its physical condition

c: - is the amount of drug required by the patient

$$A = b_1 \cdot c_1 + b_2 \cdot c_2 + b_3 \cdot c_3 + \dots + b_n \cdot c_n$$

A: - is the total amount related to the prescription

Thus, if there are several types of drugs in one prescription, after setting the prices related to each of them, after setting the total cost for that prescription, the final drug price invoice will be sent to the relevant patient through the application.



Frontend and backend frameworks were used separately for this application. There is no need to use separate APIs calls in providing this as a mobile application and this backend can be used for that.

And to run this web application from the user side, you should have at least 512 MB of RAM for your basic website if you want to ensure good performance with at least the capacity required to run a normal web application. Also, on the server side, since a significant number of functions are used in this application, there should be a RAM capacity in such a way that the RAM does not overflow.

IV. PROPOSED SYSTEM

Pharmacy management system is a management system developed to increase the accuracy and safety and efficiency of the pharmacy warehouse. It has become one of the IT systems that help pharmacists to improve supply, cost, health, safety, etc. The app also handles inventory management and sales activity management.

In this eCare Pharmacy Management System, users can create their profile after registering and logging into the system. As users, patients can customize their profile according to their role. Pharmacists also have the ability to update their profile and delete information after setting up the profile. In this way, patients also have the ability to create their own profile after entering the information required to create their own profile.

Additionally, when the patient is getting a medicine, by entering the name of the medicine, the medicine will be displayed to the users through the available pharmacy application. Also, the user can check the availability of drugs in the pharmacy by tracking the required pharmacy. After checking, if the relevant drug is available in that pharmacy, the patient/customer can send a request to that pharmacy through the page displayed to the customer.

Through this application a prescription issued under a particular licensed doctor can be uploaded to the pharmacy where the medicine can be obtained from the user. The prescription uploaded in this way can be viewed by the pharmacist of the respective pharmacy by monitoring the requests through their profile. After observing the request quotation, the pharmacist can accept the request if one or more types of medicines are available in his pharmacy. Or they can reject it.

After the pharmacist observes the prescription, the price list is prepared according to the prices of the respective drugs and sent to the customer. When preparing the invoice related to the observed prescription, the sales price of the minimum sold quantity of that type of medicine in the market is usually included in the entry of each related medicine related to its physical condition (mg / 1 / pills).

After preparing the invoice related to the prescription, it is sent to the concerned patient/customer through the pharmacy application. If the acceptance is done after the customer observes the price list, then the pharmacist prepares the relevant order. Thus, the number of orders made can be tracked through the pharmacist's profile, i.e. as a list of orders.

It is also possible to view and delete requests sent by customers to the respective pharmacies. Also, the administrator has the ability to add, update and remove existing drugs in the pharmacy management system.

Regarding the security side of the pharmacy management system, Jason has used web token authentication to develop the application to ensure users' trustworthiness. After users log into the system, a unique JWT token is generated by the Springboot backend. After that, after the JWT token is passed to the frontend, a session is saved in the frontend. APIS can be called until the generated JWT token expires. After the session expires, users must enter login details again to authenticate as a valid user.

This software also has the ability to print reports. Many other features are available through the app. Its most important goal is to maintain and manage pharmacy data efficiently and easily.

V. DISCUSSION

Various suggestions, hours of coding and patience by the team members to turn the Pharmacy Management System software into a product or vision made the software the way we wanted, so the end result was worth it.

And this application is very useful for pharmacists and patients. The user interfaces designed for the application are designed to be simple and easy for users to understand. The color contrast used and the navigation bar are arranged in such a way that only the information relevant to each profile is displayed in the unique dashboard. It will facilitate tasks in a hassle-free user-friendly manner for both pharmacists and patients, as well as help avoid paper work especially for pharmacists.

VI. CONCLUSION

In short, with the advancement of information technology, this pharmacy management system is extremely easy to use and nowadays the necessity of such an application is high to manage details like regular customer records and drug stock, thus saving a lot of time. Pharmacy systems can significantly improve operational management and process streamlining.

This allows pharmacists to automate the information gathering and retrieval process, improve sales response time and inform customers/patients about the medication they need in the shortest possible time. In today's pharmacy management applications, drug supply, sales, tracking, and senior management situations are very sad and sometimes complicated. This system takes the complexity out of everything.

REFERENCES

- [1] <https://www.healthguard.lk/pharma>.
- [2] <https://www.uniquepharmacy.lk/>.
- [3] <https://mycare.lk/>.

- [4] D. Jadhav. (2021). *Why choose React for frontend?*.
- [5] "Key Reasons Why You Should Use ReactJS For Web Development," *Why should use ReactJs for web development?*.
- [6] Siddhant2020, "Why Springboot Is A Good Choice For Back-End Development," *SpringBoot*, 18 July 2022
- [7] Veritis. *What are the Benefits of Azure DevOps?*.
- [8] V. Author. (2016). *Benefits of using sonarqube for code reviews*.
- [9] C. Technologies, "10 benefits Selenium Test Automation brings for the Publishing industry".
- [10] A. mathan. (2019). *Spring boot features*.
- [11] A. Zanini. (2021). *A complete guide to lombok*.
- [12] *The DTO Pattern (Data Transfer Object)*".
- [13] B. Krebs. (2017). Automatically mapping DTO to entity on spring boot APIs. *Let's learn how ModelMapper can help us automate the mapping process of DTOs into entities on Spring Boot APIs.*.
- [14] S. VARMA.(2022). *Lombok @Getter @Setter and lazy getters examples*.
- [15] B. Sharma, H. Dubela & A. Bohra. (2021). *Pharmacy management system*, pp. 47-50.
- [16] V. V. Barapatre, R. R. Borkar, N. P. Ramteke, T. Kharbade & N. Thombre. (2022). *Pharmacy management system: A review*.
- [17] A. S. Patil, R. S. Patil, S. P. More & S. S. Sankpal. (2019). *Web application for online pharmacy*.
- [18] S. Suhirman, W. A. Saputra, S. Saifullah & A. T. Hidayat. (2021). *Website-based e-pharmacy application development to improve sales services using waterfall method*, pp. 129.