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E-Pharmacing and Online Medical Laborotary System

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ABSTRACT

Pharmacies are not exempt from the changes taking place in the healthcare sector. Web-based application designed to manage tasks in medical laboratories, pharmacies, and the users. It is possible to find the causes and problems of all the illnesses occurring in the customer's body and to perform all the necessary medical tests. Users can get all the details about the available drug counts and inventories using a prescription scanner. There is also an artificial intelligent virtual medical bot providing 24/7 service.

Emergency patient can easily learn about the medicine and how to use it and can also know the details needed to contact a nearby hospital. A chat bot is like a virtual human that is used after having a relationship with the user. This study's main goal is to demonstrate how these technologies are employed, as well as their benefits and significance.

A new feature introduced here is the creation of a delivery tracking system. This way you can get information about delivery update status from home and can promote a nature friendly environment.

A new feature we are introducing here is the creation of a barcode card number by itself. The ccd method is used to create this barcode number.

Keywords— Chat Bot, AI, Online Pharmacy, Delivery Tracking, Barcode, Prescription Scanner, Online Laboratory, JWT, Appointment

I. INTRODUCTION

Growing public expectations and managing massive medical information systems are crucial in a wide range of healthcare service domains where computer technology have advanced. A pharmacy has never only been a place to fill prescriptions. Patients viewed pharmacists as advisors who might assist them pick an over-the-counter medication or understand the dosage and instructions on a prescription. They were always willing to help, but they seldom knew enough about a person's health history, allergies, or treatment options to provide more detailed advice. But things are altering here. Pharmacies are not exempt from the changes taking place in the healthcare sector. [1] Medical laboratories are also part in the pharmacy now a days. And most medical laboratories conform to the International Quality Standards, specifically ISO 15189 for medical laboratories and ISO/IEC/17025 for any other diagnostic testing laboratories. [2] Thus having both pharmacy and medical laboratory at the same place is a great convenience for a patient and the most important advantages can be obtained. Here, the web application that we are going to propose and improve has been done in such a way that the customer wants to use it when he sees it. Also, it is our primary aim to point out through this research that it is possible to find the causes and problems of all the illnesses occurring in the customer's body and to perform all the necessary medical tests very easily.

Under the current situation of covid-19, people are encouraged to do things online in large numbers, but suddenly it became difficult for them to get the service in a satisfactory manner. The online pharmacy and laboratory service is also the same. Having to go and buy the necessary medicines for the disease is a certain difficulty and even going to do a medical lab test while standing in queues with people with various diseases is a big difficulty. In the same way, the lack of knowledge of the types of medicines and the difficulties in using them are also the same. Therefore, people would like to find solutions to these issues due to the reasons of travel and spending money. For these reasons, we can introduce the web application that we are going to improve as a solution to it.
This web-based application designed to manage tasks in medical laboratories, pharmacies, and the users. These underlying factors a variety of modules, including the inventories of the medical lab and pharmacy that the lab scientist, pharmacist, and patient uses to perform lab tests, patient registration, making appointments for laboratory tests, producing appointment evidence, generating patient

lab tests results reports. You can get all the details about the available drug counts and inventories, by providing a prescription for the types of drugs a patient needs using a prescription scanner and user can easily get clear details with drugs, the ability to easily buy the drug prescription and the ability to bring it home through a delivery tracking system is also available here and user can track the driver and see delivery time and way also, and great facilities are provided in making payments using barcode system to get discounts and grab more chances.

Moreover, here the patient's disease history, his allergies and treatments and the appointment details he has made for the medical lab test can be viewed easily from the relevant person's profile. There is also an artificial intelligent virtual medical bot providing 24/7 service and an emergency patient can easily learn about the medicine and how to use it and can also know the details needed to contact a nearby hospital or doctor in an emergency. This is designed in a way that is different from other web applications and it is possible to do the medical tests, all pharmacy services, and patients 'services that we need very easily.

Here, under our online pharmacy and laboratory system concept, we mentioned that we use an artificial intelligence Chat bot. It is doing a huge role in our concept. A Chat bot is like a virtual human that is used after having a relationship with the user. It is a software application that can be used by a user after having a conversation online as a message to message. According to Alan Turning's famous article, the first Chat bot was made by MIT Professor Joseph Weizenbaum in 1960.[3] It has already succeeded in making a huge revolution in technology. As a result, chat bots are currently becoming very prevalent in the health sector also. In research conducted by a group of doctors in the United States, it has been suggested that this chat bot will be widely useful to the health industry for providing drug information to schedule medical appointments and finding health centers.[4]

The tracking system, scanner use, and chat bot with artificial intelligence all have aspects that make jobs easier for the user and more effective. This study's main goal is to demonstrate how these technologies are employed, as well as their benefits and significance.

II. RELATED WORK

According to Sadiya Fatima's E buying of medicines 'Trends and factors influencing online pharmacy' study, pharmacy and laboratory system is one of the most important industries and it is mentioned that it is developing in a web-based way and globalization has no limits in this era and people often first wear clothes. Clothes, accessories, and other things were bought online and now they are inclined to buy medicine.[5] And also make online appointments for lab tests and even consult with the help of AI powered bots. Chat bot is currently working as an essential function for diagnosis. The chat bot can present patients' medical history, symptoms, and then provide diagnoses and recommend next steps.

Microsoft has introduced a healthcare bot to study the patient. Premera Blue Cross and Aurora Health Care has introduced a bot to reduce calls to medical centers and check symptoms using Microsoft Stage. When a bot can't answer a question, Quest Diagnostics also employs Microsoft technologies to help locate local locations and connect them with real representatives.[6]

One of Sri Lanka's largest chains of medical laboratories is Ceymed Laboratory. It is constructed of laboratory cells supported by an interconnected cloud-based computing system to manage greater sample computation, and it is designed to operate at peak effectiveness. They also offer pharmacy services all over.[7]

In Sri Lanka, AI-powered chat bots are infrequently employed in pharmacy and laboratory systems, thus in the web application we intend to develop, a chat bot that interacts with users like a virtual doctor with a large database of patients is used. It is used in a way that allows the user to get all the information they require. The same way, customers may schedule appointments for lab tests and obtain further lab reports using an appointment booking system and there is a notification system also for get new alerts. We intend to build this in such a way that the required medications can be conveniently delivered to the home through a delivery tracking system. Another benefit is the simplicity of using a prescription scanner to acquire medications. We are creating this service because there are currently few options in Sri Lanka to obtain all these services in one location.

III. METHODOLOGY

For the development of the system, it is proposed to be developed in MERN Stack (Mongo DB, Express JS, React JS, Node JS). The methodology we used is the SCRUM method. Accordingly, due to this fast-paced environment, the methodology related to the project allows those involved to interact continuously through sprints. Also, the azure board makes it possible to assign the relevant task at the right time. And that way we can know how much the process of our work is with the help of charts. And by assigning tests related to each task, you can know whether they are completed correctly and the time it takes for that.

This time, the system architecture clearly demonstrates that the designed backend server will be utilized to process the data that has been sourced from the client application and deliver the processed data back to the client application. The server side consists of two parts: the web service and the database. The web service, which includes several features to process data from the database and generate output That can be accessed by the application using the URL methods GET, POST, PUT, and DELETE, uses the REST API structure. All the data from the online medical laboratory system's components, including user

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information, appointment information, data on lab reports of patients, and information on the medical lab's inventories, are stored in the database. Clerical work and display of the server's processed data are the responsibilities of the client.

The back-end relevant component use of Mongoose and Node.js Express to communicate with the MongoDB database using JWT Authentication & Authorization. Developers must remember to implement safe authentication into their designs because every web application needs to be secure. According to figure 1, server provides an authentication technique called JWT (JSON Web Token). When a user logs into a web application using his username and password, the authentication server normally creates and sends back JWT. This JWT is then sent together with the succeeding API request to the server. JWT remains effective until it expires, or the user logs out of the application.

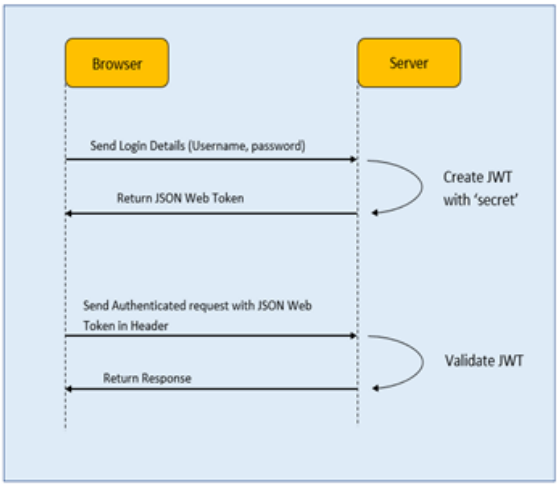

Figure 1: Authentication diagram

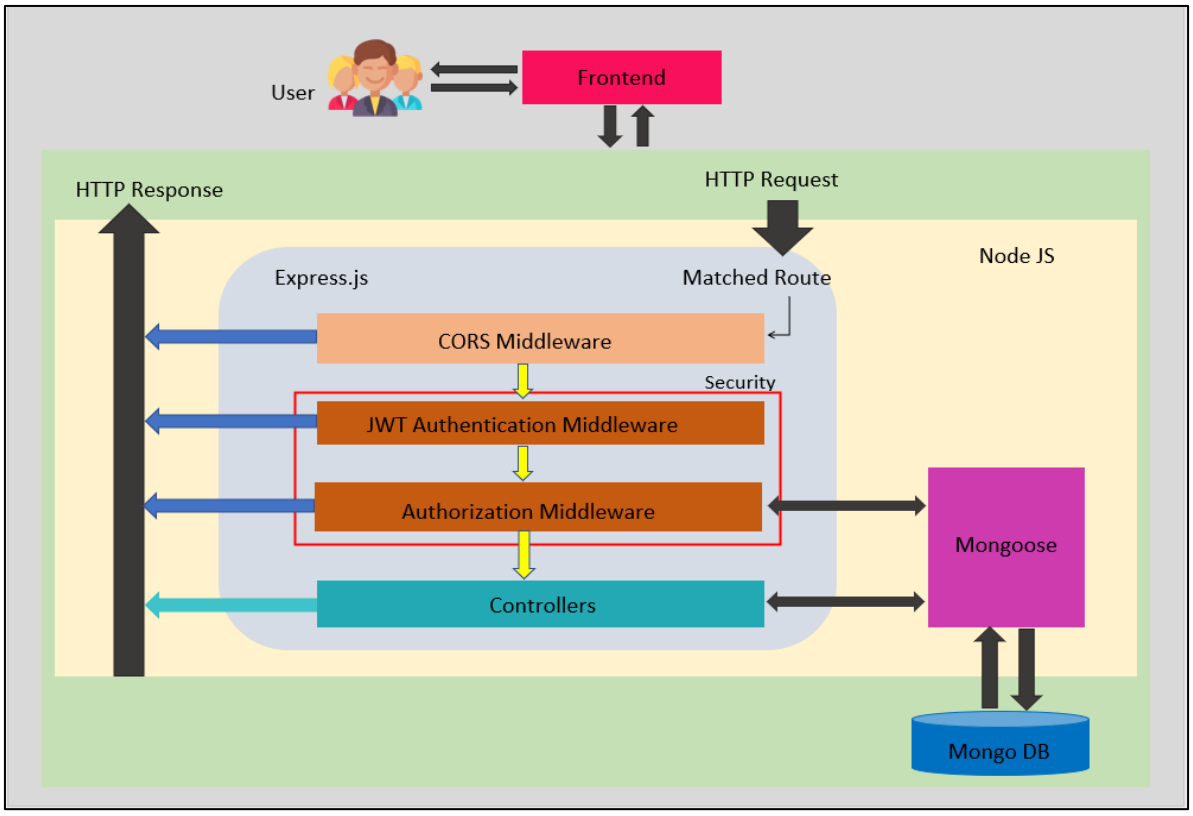

Figure 2: High level Architecture

According to figure 2, through Express routes, CORS Middleware will examine. HTTP requests that match a route before they reach the Security layer. Security measures comprise:

- Verify Signup and Token with JWT Authentication Middleware
- Check User's Roles with Record in MongoDB Database using Authorization Middleware

When the middleware throws any errors, an error message will be given to the client as an HTTP response. By using the Mongoose library, controllers communicate with the MongoDB database and send HTTP responses (tokens, user data, data based on roles, etc.) to the client. [11] With React, React Router, and Axios, the front-end will be built. Additionally, we'll validate forms and apply Tailwind CSS.

The potential to create this in a different way than a normal online medical laboratory system is huge. In other words, we suggest many important ideas to create this in such a way that the user can get higher and more satisfactory results than he or she thinks. This is a system that can be created to an advanced level beyond the

technical hand. Accordingly, we are introducing several new features that are not available in other medical laboratory systems.

According to figure 3, what we are mainly proposing here is to create an Artificial Intelligence based Chat bot that can quickly and instantly know the special matters that the patient needs. A chat bot is a computer program that mimics human conversation in its natural form. The main technologies behind the chat bot feature are Machine Learning and Natural Language Processing (NLP), which means that this is processed using several complex algorithms that need to try to understand what the user is saying to the chat bot. This will generate an appropriate response related to what the chat bot understands. Here the chat bot is created as follows. First, the JS app file for this should be created in the backend. Then the relevant dependencies should be installed for that. Then the relevant code should be hosted. By making it like this, it is possible to send normal text and string messages to the API available in this system. It can respond to queries expressed in natural language. And reacts to this like a real man. Its responses are based on a mix of predefined scripts and machine learning technologies. When a query is posed to it, the chatbot will reply using the knowledge base that is now at its disposal. It works like a virtual doctor.

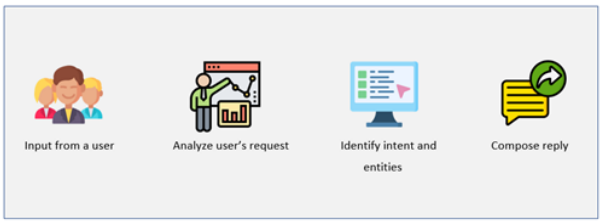

Figure 3: How an AI chat bot works

And the patient can upload his prescription through this website through the e-pharmacy method that we introduce here as a feature. In this way, the prescription scanner that is expected to be added to this system will scan and show the types of medicines, the quantities to be taken, and how many days they will be taken. That way the patient can easily order their medicine from home. In Germany, electronic prescriptions—which have been subject to testing since July 2021—will be required starting in January 2022. The prior paper forms will therefore be rendered useless. To provide their consumers with secure and convenient means to redeem their digital prescriptions, online pharmacies must adapt for this upcoming digitalization stage of Germany's telematics infrastructure.[12] Natural Language Processing (NLP) and Blockchain Technology are used to implement the prescription scanner.

Another feature introduced here is the creation of a delivery tracking system to know the location of the order when the medicine ordered by the patient is delivered to his home. This way you can get information about delivery update status from home and can promote a nature friendly environment. I think that Linux/UNIX command line is the finest language to utilize for tracking IP or other network traffic. And JavaScript is used to implement the delivery tracking system. Writing a central web server to communicate the location between the two is the simplest solution. Directions I would achieve this by adding a pin to Google Maps and allowing the phone's maps software to handle the labor-intensive task of providing turn-by-turn directions. The location information on the tracked phone is accessed via JavaScript, and it is then sent to your site in JSON format. The other phone polls the server every few seconds and receives the most recent position as JSON data. A map pin can be added as one of the formats. It should work, in my opinion. I would need to do some research on the map pin bit to determine whether that was feasible and how. [13]

Accordingly, when a patient creates an account, an auto barcode is generated for him or her. By the generated bar code, every time he or she uses this system, several points will be added. In this way, points are added according to the number of the generated barcode card. Accordingly, all the points collected here will be calculated at the end of a year. Based on the number of points calculated in this way, he or she will be given special offers or discounts, free delivery etc. Accordingly, as a new feature we are introducing here is the creation of a barcode card number by itself. Accordingly, the CCD method is used to create this barcode number. In this technique, light impulses are transformed into electric signals by a semiconductor called a CCD (Charge Coupled Device). A built-in light is part of the CCD technique bar code scanner. This light is directed towards a bar code by a scanner, and the reflection is collected by a CCD for reading.[14]

IV. PROPOSED SYSTEM

Our system has two parts. They have the option to log in separately as users and lab scientists. By entering a valid email address and password, the user can access the app if he already has an account. If the user has never used this app before, he must register to create an account. And our system has four functions. If they are patient management, appointment management, medical lab report management and inventory management. Part of patient management includes actions such as registering for their account, viewing their information through user profiles, updating them if necessary, and deleting them if necessary. Here, by logging in separately as a lab scientist, he can view user lists and user accounts as well as download that list. He can also delete the user account if needed. In the appointment management section, there are processes such as checking whether there is space to reserve a date and time that the patient needs, and if not, reserving another time that suits them. And here the user can update and delete their appointment if needed. Here, by logging in separately as a lab scientist, he can view appointment lists and as well as download that list. Also, lab scientist can

approve or decline the appointment request like figure 4 all appointment details table.

The inventory management section deals with the supplies required for the laboratory. To do these you must first log in as a lab scientist. He can then enter the details of the newly purchased items, update their details, delete them, and download the inventory list if required. Lab scientist enters the unit price and quantity, total price will auto calculate like figure 5.

The medical lab report management section deals with lab scientist and patient. He can add patients' medical lab record details, update them, and delete details. Patient can download their lab report and view their report details. Dynamic fields used to implement the medical tests records according to figure 6.

We hope to implement an artificial intelligence (AI) chatbot for our system. It helps for assistants allow business to provide customer care when live agents aren't accessional, cut down on overhead costs, and make better use of support staff time. And it can always talk to customers and provide general answers to their sickness and health problems related to body diseases. It enables us to boost sales or service productivity. Another specialty here is that if they are unable to provide an answer or description for the patient's health problem, they provide details about the doctors related to that problem. This makes it possible to reserve an appointment for doctors at that moment. Typically, chatbots also can hand off a conversation to a human service agent once it becomes too complex.[15]

And the following can be taken as the unique advantages here.

- Able to carry out multiple conversations at once.
- Cost-effective.
- Reduces time.
- Proactive client engagement.
- Analyzes and keeps track of consumer data.
- Simplifies scaling to international markets.
- Increases the customer base.

According to figure 5, we are also hoping to set up a pharmacy facility and delivery tracking for our system. In this way, the customer can scan his own prescription through the system and get details about the medicine in it. There, the names of the medicines and the number of milligrams is shown and if we have the medicine, it is also possible to order the medicine at that moment.

This enables the customers to save money and time and get their medicines delivered to their homes at minimal charges through delivery tracking. And one of the special features of this delivery tracking is that from the moment the medicine pack is sent from the pharmacy until it arrives at patients' home, he can track its location and the time it takes to get it to his home. Also, the customer can pay after receiving the medicine at his home and if he does not need the medicine at that moment, he can pay only the delivery amount and return it back.

We expect customers to accumulate a certain number of points at the time of availing services through our system. After a year, we will offer concessions such as discounts or free delivery on the value of these points. Also, the customer's pre-entered prescriptions are also stored in the bar code.

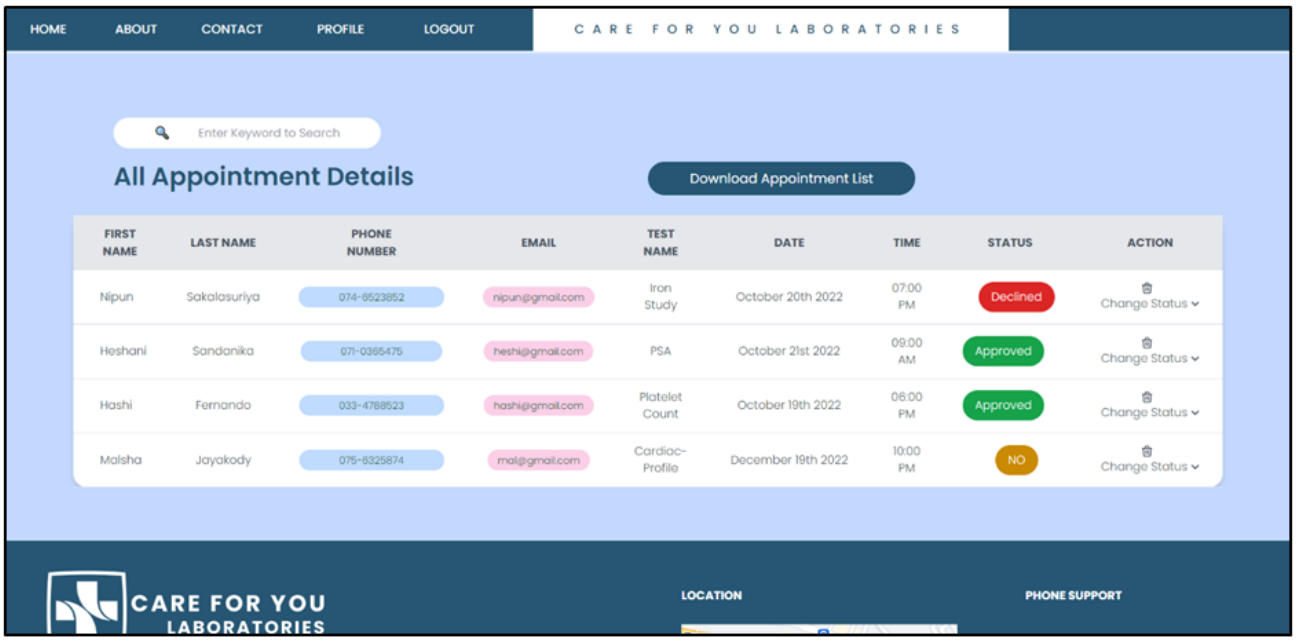

Figure 4: All appointment details table

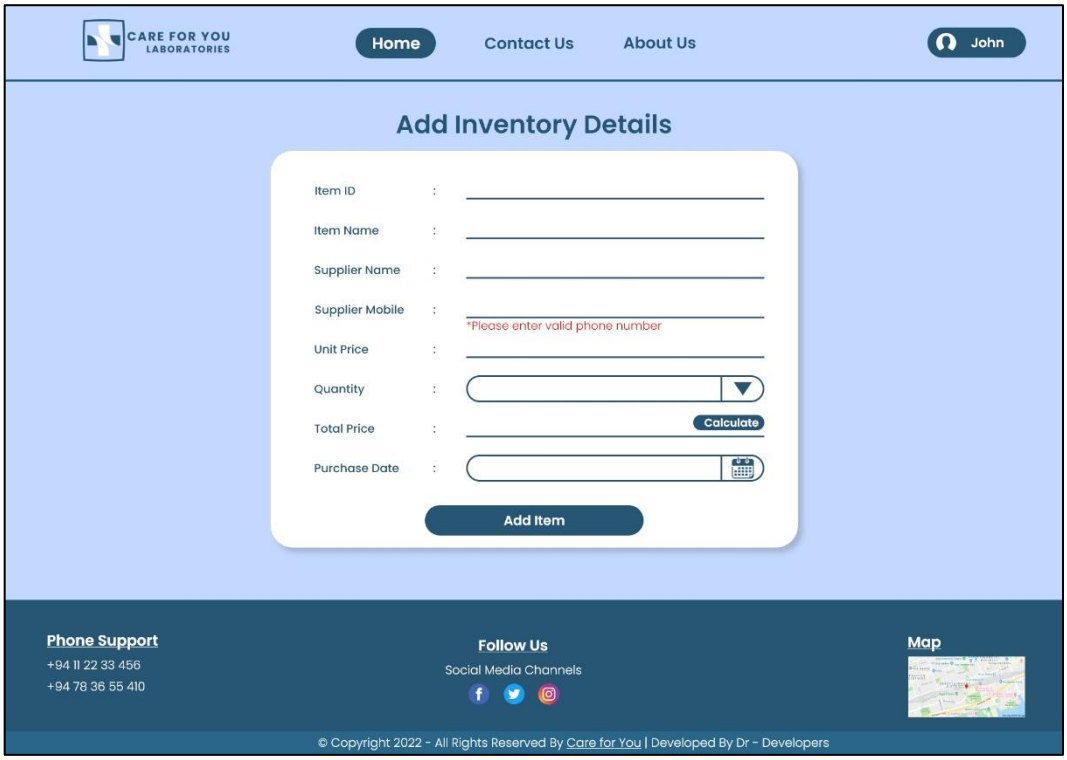

Figure 5: Add Inventory Details

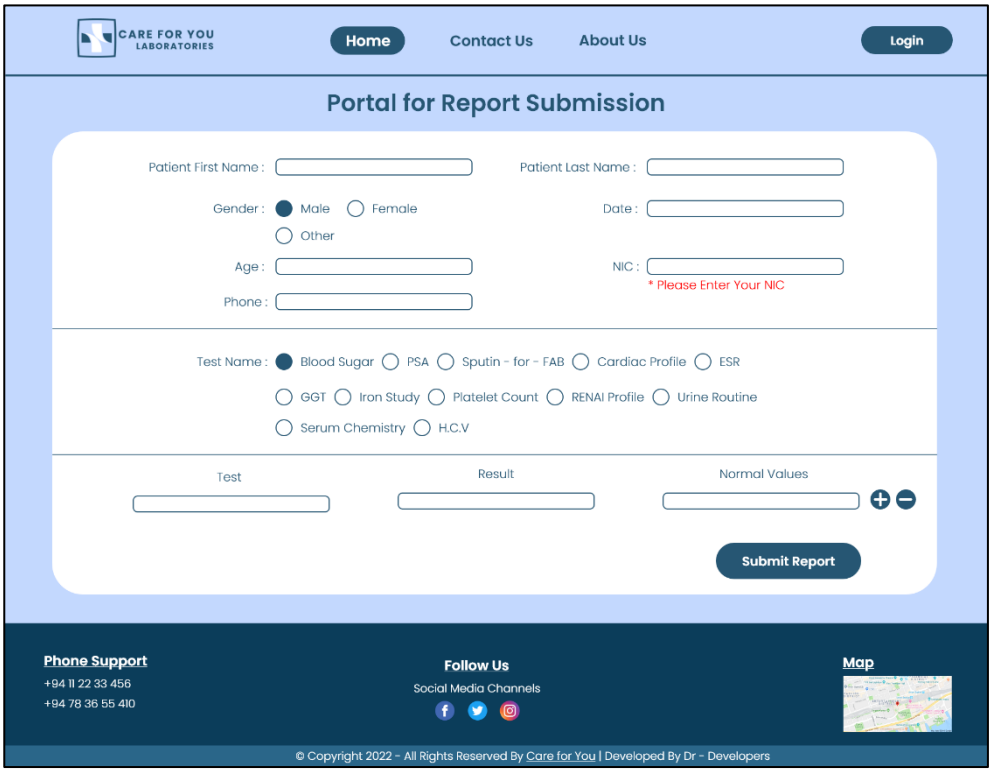

Figure 6: Portal for report submission

Perceived benefits of health care chatbots to patients.

Perceived benefits of health care chatbots[a]	Strongly agree, %	Somewhat agree, %	Neither agree nor disagree, %	Somewhat disagree, %	Strongly disagree, %
Help patients better manage their own health	7	47	26	17	3
Improve quality of patient care	8	27	36	21	8
Help provide more personalized treatment	7	21	36	27	9
Reduce travel time to health care provider	20	32	30	12	6
Prevent unnecessary visits to health care providers	11	38	28	19	4
Patients may disclose more information to chatbots compared with health care providers	12	29	36	15	8
Increase patient privacy	8	19	40	20	13
Improve access and timeliness to care	15	38	32	12	3
Average across variables	11	31	33	18	7

[a]For simplicity, as there were exactly 100 participants in the study, only percentages have been reported, unless otherwise stated.

Figure 7: Perceived benefits of health care chat bots to patients

Perceived logistical benefits of using chatbots for patients.

Perceived logistical benefits of using chatbots[a]	Yes, %	No, %	Do not know or not sure, %
Locating health clinics or health care providers in a specific area	76	11	13
Scheduling doctor appointments	78	13	9
Monitoring patient calls to the reception desk of health clinics	49	22	29
Processing medical invoices or bill payments	48	28	24
Assessing emergency triage in hospitals	30	48	22
Reminders for medication/treatment compliance	76	11	13
Renewing medication prescriptions	56	25	19
Gathering health insurance information	65	16	19
Answering medication frequently asked questions	70	15	15
Providing medication side effects and drug interactions	68	15	17
Providing medication use or misuse instructions	71	12	17
Average across variables	62	20	18

[a]For simplicity, as there were exactly 100 participants in the study, only percentages have been reported, unless otherwise stated.

Figure 8: Perceived logistical benefits of using chat bots to patients

Perceived challenges associated with using health care chatbots for patients.

Perceived challenges associated with using health care chatbots[a]	Strongly agree, %	Somewhat agree, %	Neither agree nor disagree, %	Somewhat disagree, %	Strongly disagree, %
Patient data privacy and confidentiality	17	31	39	11	2
Chatbots cannot understand or display human emotion	36	36	23	4	1
Chatbots lack the intelligence or knowledge to accurately assess patients	19	39	27	11	4
Chatbots offer poor health-related advice	12	28	47	13	0
Chatbots cannot effectively care to the full extent of the patients' needs	43	33	17	7	0
Chatbots take too much time to use	6	24	48	20	2
Most of my patients do not have access to the necessary technology for chatbots services	15	35	26	18	6
Average across variables	21	32	32	12	2

[a]For simplicity, as there were exactly 100 participants in the study, only percentages have been reported, unless otherwise stated.

Figure 9: Perceived challenges associated with chat bots to patients

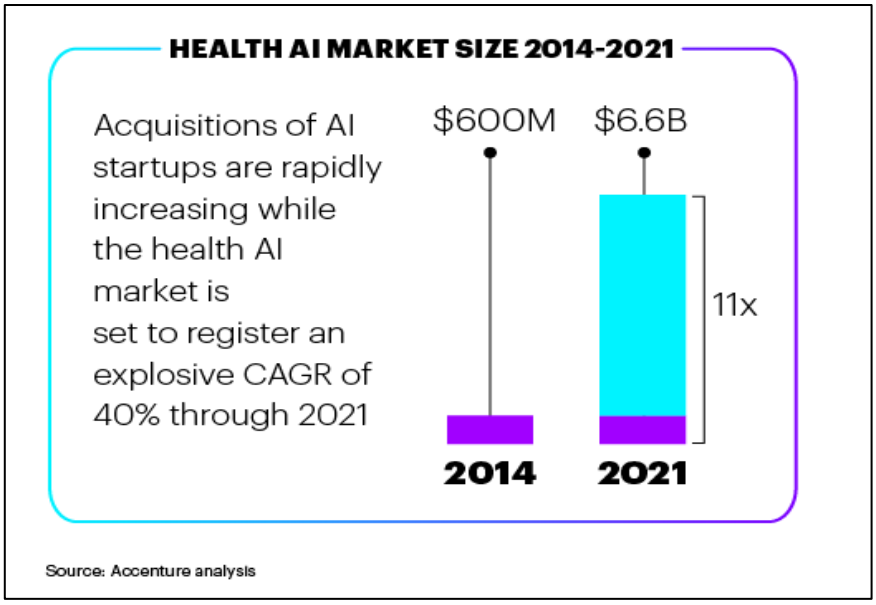

Figure 10: Health AI market size 2014-2021

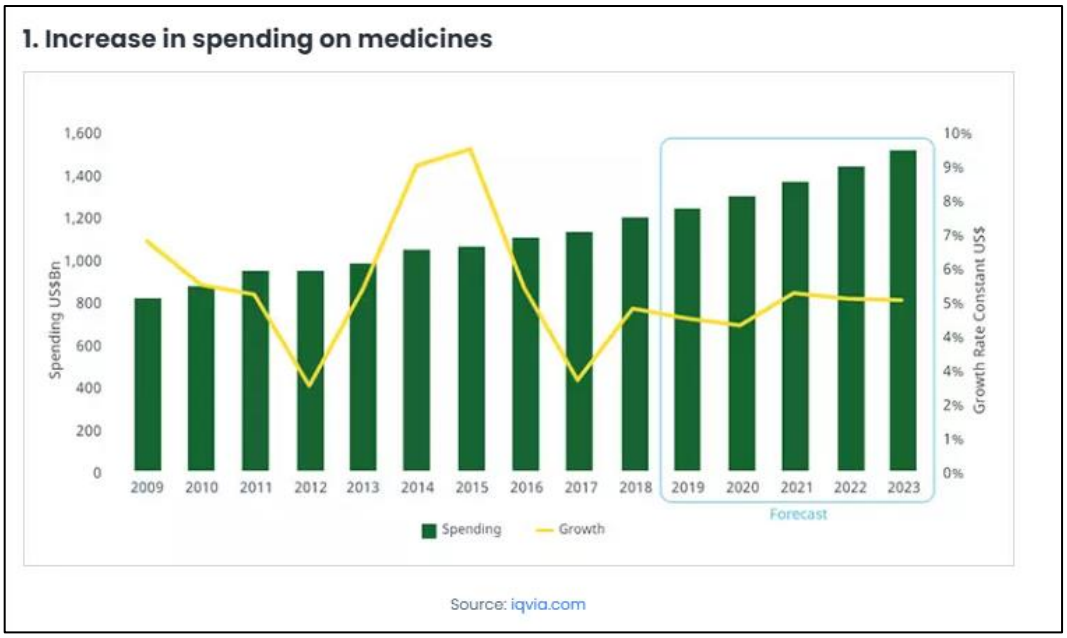

Figure 11: Increase in spending on medicine online ordering system

V. DISCUSSION

According to figure 7, as we said above, the chat bot does a great job in this system and one can think whether this is 100% practical. A chat bot can give reports as a doctor and think they are correct. You can imagine how practical the benefits are. The table below shows how successful or unsuccessful this is. This is the result of a research conducted by Adam Palanica on using 100 people.[8]

Also, according to figure 8 study, the majority (62%, 62/100) have believed in the benefits of using chat bots for healthcare services for patients. Accordingly, it has been mentioned that many physicians are practical to make an appointment, know the nearest clinic locations, find out about the treatment compatibility, get advice on the use of medicines, and answer the questions asked. But they also seem to believe that it is impractical for emergency assessments.[9]

Also, according to figure 9, more than half of the physicians agreed in various applications, while another group did not agree to this. Most of them believe that a chat bot cannot properly focus on the user and because a chat bot cannot understand human emotions, it is stated in that study.[8]

However, figure 10 showed that doctors have a wide range of opinions on using chat bots in healthcare,

with just minor skews to one side or the other in terms of become through to various attributes. Nearly half of the doctors said that health care chat bots were crucial for patients, particularly for assisting patients in better handling their own health.[8] As a result, by the year 2021, there will be a marked increase in the demand for chat bots. The pandemic season has made this issue better. The survey estimates that the market for healthcare chat bots will surpass US$ 314.63 million by 2024 at a CAGR of 20.58%, and it is abundantly obvious that there is a huge need for pharmacies.[9]

With the covid-19 pandemic, there has been a huge increase in the online purchase of medicines. Several reasons can be pointed out for ordering it online. They pay more attention to this because of the ease of access, as well as the fact that they can save the time in queues and travel expenses by bringing it home, and they can get various discounts from online pharmacies. Therefore, the online pharmacy and laboratory system will gradually increase in the future and there will be a high demand.[10]

In addition to figure 11, the user can also use a prescription scanner to buy the necessary medicines. After the relevant prescription is scanned, the user can see the drugs included in it and the required quantities and can easily buy them. In addition to this, a barcode is automatically generated when a user registers in the system, and every time the user uses this web application, several points are added to the user's account and later, he can get various discounts. Also, through the laboratory system, you can easily take care of your medical reports.

VI. CONCLUSION

This web application will help in the convenience of everyday people as their lifestyle is complicated. You can easily save time and get a unique and reliable service with many advantages through a single system. Through the new features here, you can get instant answers when you have an urgent need, and the customer gets a lot of benefits. And here we introduce a new feature. It is to create a chat bot that acts as a virtual doctor. It will be very useful for the user of this system.

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