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Development of Online Booking System for Medical Clinic

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Abstract: Recently, increasing number of clinics has been an obvious trend in many countries. This is mainly because the needs to providing medical services to increasing patients due to various forms of diseases. Such scenario needs careful attentions from the clinic's management in order to provide appropriate services to patients. One of the important tasks to ensure efficient health care services is booking for medical appointment. With increasing number of patients, a systematic appointment booking is crucial in order to provide an accurate and fast medical treatment to patients. Conventional way of booking appointments time consuming since it requires patients to go to the clinic, in which eventually resulting in an increase in cost and effort. To overcome such problem, the appointment booking system can be made online via the Internet. With an internet-based booking system, appointment booking can be done from anywhere and at any time without having to go to clinic, therefore is time- and cost-effective. This study develops an online booking system for First Scan Clinic in Yemen. The system has developed using PHP and HTML programing and prototype models to achieve the objectives. The system will facilitate the patient to book an appointment easily by entering their information and choosing the appropriate time for visiting the doctor. Therefore, this system also will help with time scheduling to avoid crowds inside the clinic by receive a limited number of patients per day. In addition to that, the website will provide an advices and guidance about health awareness for patients.

Keywords: Frist Scan, Web-based Booking System, Yemen.

1. Introduction

An online booking system is at the simplest, software that allows a prospective patient to book via the website for an operation or service. That ensures that everything is done electronically from the moment a patient chooses they want to book to select a date, choose a time for the booking, drastically minimizing the burden on your employees and avoiding the potential for double bookings. Both primary health centers, as well as hospitals, use appointment scheduling services to control access to healthcare providers. Appointment managers will have a significant effect on the organization's success; they deserve due consideration, therefore. To maintain and optimize clinic income, ensuring that patients are scheduled consistently and efficiently is important. While the biggest patient requirement remains outstanding quality treatment, health care customers are also increasingly seeking support services such as appointment management that suit their expectations.

First Scan Clinic nowadays are still use the manual booking system, which leads both the clinic staff and clinic's patients to face some problems, like difficulties on managing appointments for the secretary office and wasting a long time for patients in waiting to book an appointment. Therefore, with the highly impacts of online booking system, an interactive and effective approach should be applied to build web-based system to provide and manage the booking process. The system will respond in real-time and easy to be managed.

Hence, First Scan Clinic is the name of one of the famous clinics in Sana'a (Yemen), which it specialized in diagnostic radiology. So many patients come to the clinic per day. then, the website will help clinic to optimized clinic services for patients.

In First Scan Clinic due to the unpleasant circumstances in the past 10 years, many of the professional doctors in First Scan Clinic have leaved their jobs searching for better places to live and work in. while in the anther hand, the doctors who still in are overworking because of receiving patient in numbers more than normal. That's leads to difficulty on finding an appointment for patents. In another hand, the reception office in First Scan Clinic are troubled in managing this huge number of patients while they using the manual system for making appointment. The secretary needs to add the date and time for every single patient, which make it difficult for both workers and patients.

Nowadays people tend to make their lives easier and convenient. Appointment booking website is one of the popular issues that rose with the development of technology in Yemen. The aim of this project is to develop an appointment booking website for First Scan Clinic.

To achieve the project, aim the system has to be designed in a simple and efficient way to make the booking process less consuming for time and effort. The system has been developed using Prototyping Model to make sure the system will be built and work as expected. The system will be tested to ensure that all the functions on the system are worked correctly.

The rest of the paper is organized as follows: Section 1 describes the problem statement for this project and the main objective for this application. Section 2 de-scribes the related work on profiling and classification models such as The Medical Departures, The Red Clinic, Ultrasound Plus Clinic and the explanation for proposed system. Section 3 presents the methodology Prototyping model for the Appointment Booking System for First Scan Clinic and use the Software Development Life Cycle (SDLC) to develop the proposed system. Section 4 shows the analysis and design for the system also Section 5 will show the Context Diagram, Entity Relationship Diagram and the Database Specification for the system. while section 6 discusses the Result and Discussion. Finally, Section 7 shows the Design Interface for the application.

2. Related Work

2.1. The Medical Departures (URL: https://www.medicaldepartures.com/treatments)

Medical Departures and its sister site Dental Departures are the world's leading online destinations for patients seeking high-quality, affordable medical and dental treatment anywhere in the world. With more than 100,000 bookings and 35,000 verified patient reviews, Medical Departures' network of 8600 providers in 40 countries has helped hundreds of thousands of patients worldwide save nearly a billion dollars in care. Established in 2010, based in Bangkok and privately held, the company was founded by Paul McTaggart, a former Expedia executive with a vision of becoming a leading force in connecting patients in need of affordable healthcare to high-quality facilities anywhere in the world. Built into the patient services platform are options for convenient 24/7 online booking and customer service, financing and insurance, accommodations partnerships, our Best Price Guarantee, COVID-ready clinics and more.

2.2. The Red Clinic (URL: https://theredclinic.com/)

The Red Clinic is built on the simple idea that good outpatient healthcare services should be affordable and accessible to all, regardless of gender, race or nationality.

The Red Clinic, located in Petaling Jaya, Selangor, Malaysia. Their focus and expertise are spread across many procedures, with 20 procedures available to patients across 1 specialty. The Red Clinic is a little limited in its offerings, and is more catered towards domestic patients, offering only English as a spoken language by its staff. There are many specialists available at the Clinic, with 7 in total, and they are not accredited by any recognized accreditations institutes.

2.3. Ultrasound Plus Clinic (URL: https://www.ultrasoundplus.co.uk/)

Ultrasound Plus was established as a private clinic to offer glowing expectant parents the intimate experience of seeing their baby in stunning lifelike vision. They did this using the latest ultrasound technology, and over the years we have gradually expanded to provide a wide and varied range of different healthcare ultrasound scanning services.

Ultrasound Plus works to provide a friendly and welcoming ultrasound experience for expectant parents or those who would like a healthcare check-up in our private clinic. There private healthcare and pregnancy clinics can be found across the UK, including London, Essex, Hertfordshire and Birmingham.

2.4. The proposed System

The proposed system called First Scan Clinic Online Booking System. Which can be used by PC or Phones. It helps patients to book appointments without wasting time on waiting inside the clinic.

To book an appointment, patient can browse the website easily and find the preferable doctor. Moreover, the system has booking module, chatting module and searching module.

The patients can choose the doctor and which type of diagnostic radiology they want. Also, it allows patients to choose the day and time they prefer for the appointment. Patients can use the chat module to ask information or location. The secretary (admin) of the clinic can set the appointments time and day or create new one. The admin also, should be able to replay the cat massages. Lastly the Administrator also allowed to access all the appointments and change in them, also, can manage the users.

Table 1: Comparison between Existing Systems and Proposed System

Features/System	Medical Departures	The Red Clinic	Ultrasound Plus Clinic	First Scan Clinic
Login Module	Has login module for all users.	Dose not have login module.	Dose not have login module.	Has login module for Doctor, Assistant, Stuff and Admin
Menu and Attractive user interface	Attractive user interface	Attractive user interface	Attractive user interface	Attractive user interface
Booking module	The patient can book an appointment easily	Has a sample Booking module	Has an effective Booking module	Patient can book an appointment in efficient and effective way.
Chat module	Has a modern chat module between patent and admin	Has a modern chat module between patent and admin	Dose not have a chat module.	Has a modern chat module between patent and admin
Search module	User can search for the doctors.	User can search for the doctors.	User can search for the doctors.	User can search for the doctors.

3. Methodology/Framework

The methodology used in the Systems development life cycle (SDLC) to use a prototype model is being used for the implementation of this system. Prototype technique is an approach that encourages system users to specifically communicate with the system as a system test ground. The principal purpose of the prototype model was selected for the purpose of developing a system so it can be repeatedly phased to satisfy users' demands over time, while continually refining the components of the project. The prototype model can be referenced in figure1 below.
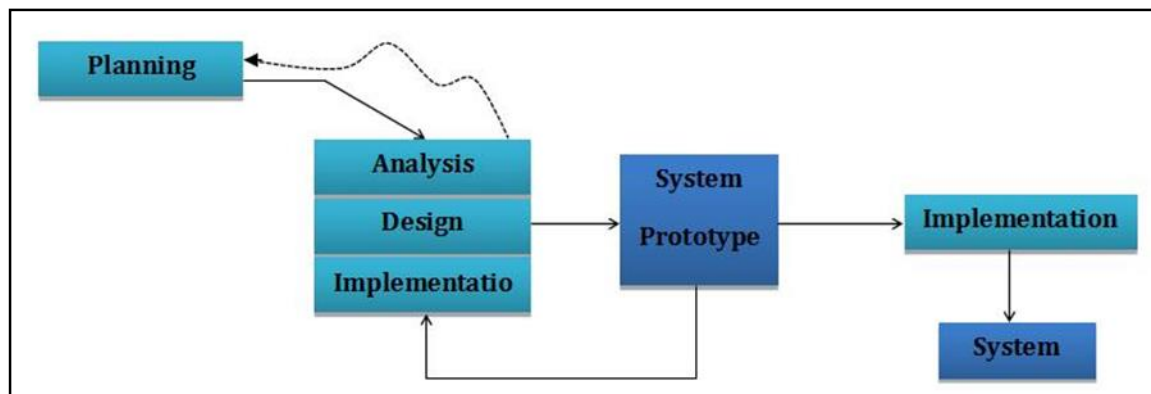

Figure 1: Systems Development Life Cycle

The Figure 1 shows the four phases of Systems development life cycle that show (SDLC) development methodology provides a structured way for developers to develop any software. Since it provides a specific plan for each step of the development process, it helps prevent resources from being wasted and reduces unexpected development costs.

Table 2 below indicates the phase used as a starting point for all projects and operations to be conducted within the prototype model. The outcome of the system operation that the system creator does during the process of system creation is seen by the performance.

Table 2: Software Development Activities and their Task

Phase	Task	Output
Planning phases	☐ Selection and determination of project titles.	☐ The problems that First Scan Clinic is facing led to develop First Scan Online System.
	☐ Identifies project objectives, problem statement and project scope.	☐ Produce system objectives and system scope.
	☐ Presents the project plan for the Coordination Panels project.	☐ Obtain authorization and approval of the requested title.
	☐ System implementation preparation and preliminary assessments to define current system problems, benefits and weaknesses.	☐ Gantt chart generated
Analysis phases	☐ Analysis information obtained	☐ Gather information about the clinic and study the current system problems to be solved by the new system.
	☐ Analyse Hardware and Software requirements.	☐ List the type of hardware and software used to build the system.
	☐ A literature review was undertaken in order to compare the existing system.	☐ System comparisons will be believed to improve and user-friendly the system to be built and to set need goals.
	☐ The web-based information system programming language.	☐ Using PHP programming, SQL and JavaScript.
	☐ Methodological selection	☐ Using prototype model methodology.
	☐ Logical structure analysis such as flow chart, data flows diagram (DFD) and diagram of entity relationships (ERD)	☐ Provide flows chart, Data flow diagram (DFD) and Entity relationship diagram (ERD)
Design phase	☐ Creation of a web-based information system, system interface design and database design.	☐ System and database interface will be created.

Implement ation phase	☐	Displays the systems and process examination.	☐	Full systems and document processing system test documentation can be produced.

4. System Analysis and Design

The aim of system design workflow is to show how the system will be understood in the implementation phase. System design is the phase that illustrates the system prototype using some of the software tools.

Web base development requires a specific method to implement in such a way that would guide and facilitate to us accomplishing project successfully. In this application a specific architecture is adopted. It implements for First Scan Clinic.

The web-based structure is developed in term of many components that interface with each other such web server, PHP language and SQL database. The web server is connected to the Internet network to interchange the menu data. The database can be accessed by the user across the server. Moreover, the database fetches the clinic information from the web server and allows the user to access it.

At the end of the system requirements collection, several relevant diagrams have been generated in order for the preparation of system model design. The design phase activities include the design of project architecture and graphical user inter-faces, develop relational databases, business logic and file specifications.

4.1. System Analysis

The analysis is the process of studying and researching all the data gathered by the built framework. The goal of this phase is to provide a thorough understanding of the system environment developers, to provide an alternative system to make the system more effective through using a computer system, and to define the needs of the system to be built through evaluating a system that explains the system in detail by Data Flow Diagram (DFD), Entity Development Chart (ERD), Database design as well as user interface design are also used in the device analysis and design process.

4.2. Context Diagram

The context diagram is a diagram that consists of process and describes the scope of a system, the context diagram is the highest level compared to Data Flow Chart which represents the entire input to the system or output from the system. Based on the figure show in Appendix 1 the context diagram gives on overview of the entire web-based information system. Context Diagram shows the main process which is First Scan Online Booking System and the five main entities in the process which are User, Doctor, Assistance, Stuff and Admin as well shows the flow of data in general on the system.

4.3. Data flow diagram

The data flow diagram describes in detail the process and the entities involved in First Scan Online Booking System. Based on the data flow diagram show in Appendix 2. there are five entities namely as User, Doctor, Assistance, Stuff and Admin. The data flow diagram describes each entity and its process in the web-based First Scan Online Booking System.

4.4.   Entity Relationship Diagram

The diagram for the entity relationship describes the entities and attributes involved in the First scan online booking system. The entities and attributes involved in the entity relationship diagram are shown in detail in Appendix 3. There are five people involved with this system, such as User, Doctor, Assistance, stuff and Web Administrator, each of which is connected to each other.

5. Implementation and Testing

This section discusses the implementation of the system development phase according to the system specification and design that have been discussed and specified in section 4. While the testing phase can be divided into two, namely alpha testing by system developer and alpha testing by system users. The testing phase is an important phase to ensure system users are able to evaluate system flow and system functionality according to the system requirements set by user.

The design implementation process has been developed for First Scan Online Booking system based on the design that was identified early on this project. Software such as Bracket, Xampp, and Google Chrome are used to display system interface. The programing language used to develop the system are PHP and HTML while MySQL is used as a database.

The booking module acts as the main module for this system as users can make an appointment with the chosen doctor by entering the required information into the system. All appointment information and availability dates will be displayed in calendar provided in the system. Whenever a user book an appointment, the information entered will be stored and recorded in the database. Figure 2 Shows partial of the code section of bookings an appointment module.

Figure 2: Partial Coding for Bookings an Appointment

System testing is one of the processes that need to be done once the system development is complete. Testing of this system is intended to test the functionality and identify any errors that may occur in the system operation. There are several tests done namely module testing and system testing. Module testing refers to the process of testing that has been performed on the modules that have been developed in this system.

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The function of the test is to perform the inspection of the system function. This includes tests for User interfaces, Booking, Login Interface, Administration Interface, Doctor Interfaces, Assistant Interfaces, staff Interfaces, and Chatting module. The result is a display in the table and pie chart showing the result status. The table 3 shows the test result for login page.

Table 3: Test Result for Login Page

No	Test Case	Description	Expected Result	Result	100(%)
1.	Test_101	The workers must login before they enter to the system.	Workers can explore the system and manage the appointments.	successful	100%
2.	Test_102	The system will display the login page for the workers.	The system can display workers login in this page.	successful	100%
3	Test_103	The worker is required to choose a type of users.	The worker can choose the right type of user.	successful	100%
4.	Test_104	The worker is required to enter a valid username.	The worker can enter a valid username and the login process is successful.	successful	100%
5.	Test_105	The worker is required to enter a valid password.	The worker can enter a valid password and the login process is successful.	successful	100%

This table below shows the booking process test in the system. In this process the user can choose the preferable doctor. Then can book an appointment provided by the doctor depending on the available time.

Table 4: Test Result for Booking Page

No	Test Case	Description	Expected Result	Result	100(%)
1.	Test_201	The user can choose the preferable doctor.	To ensure that user can choose the preferable doctor and choose the suitable time.	successful	100%
2.	Test_202	The user can book an appointment.	To ensure that user can book an appointment by entering the requested information.	successful	100%

Overall, all the modules and functions in this system succeeded as expected. Table 5 shows the overall results for all functions.

Table 5: Overall Results for all Function

No	Module Testing	Result	(%)
1.	User Interface	successful	100%
2.	Booking Interface	successful	100%
3.	Login Interface	successful	100%
4.	Admin Interface	successful	100%
5.	Doctor interface	successful	100%
6.	Assistance Interface	successful	100%
7.	Stuff Interface	successful	100%
8.	Chatting Module	successful	100%

6. Results and Discussion

In this section also discuss the user interface in proposed system. Users are allowed to explore the system, find the appropriate doctor, explore and reed the daily blogs, and contact with the recaption using email or WhatsApp.

6.1. User Interface

First Scan Online Booking System has developed to facilitate many things for patients. Users can enter to the website easily to see clinic information, types of services that provided on clinic, doctors information, medical blogs which updated daily, and contact us which show the ways how user may contact clinic's reception. Figure 3 Shows the user interface page.
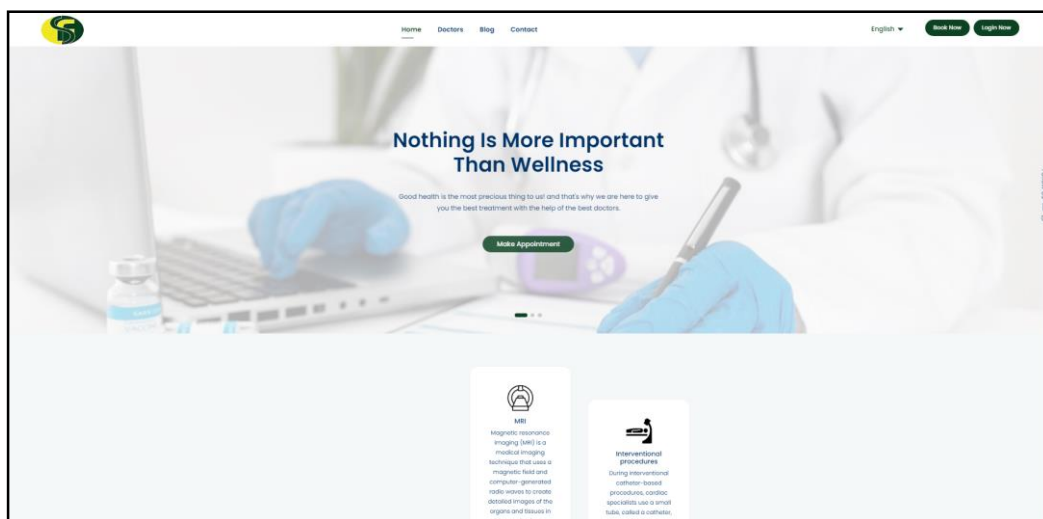
Figure 3: User Interface Page

6.2. Booking Module

This module acts as the main module for this system as users can make an appointment with the chosen doctor by entering the required information into the system. All appointment information and availability dates will be displayed in calendar provided in the system. Figure 7 Is the interface to the user to book an appointment. Whenever a user book an appointment, the information entered will be stored and recorded in the database. Figure 4 Shows the booking page.
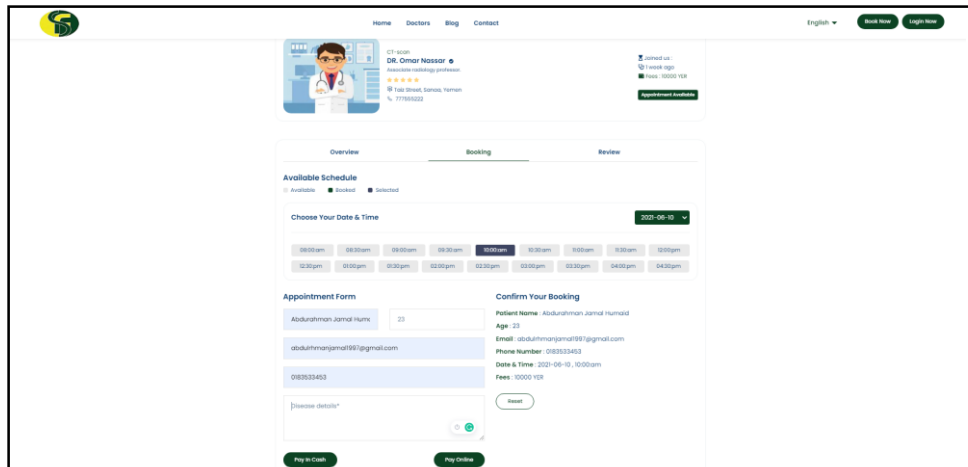

Figure 4: Booking Page

6.3. Doctor Interface

This page gives Doctors some authority of the system. Doctors are able to create an appointment, delete an appointment, manage the schedule of the appointments, edit the profile image, and adding any information or experiences. Figure 5 shows the doctor's appointment page.
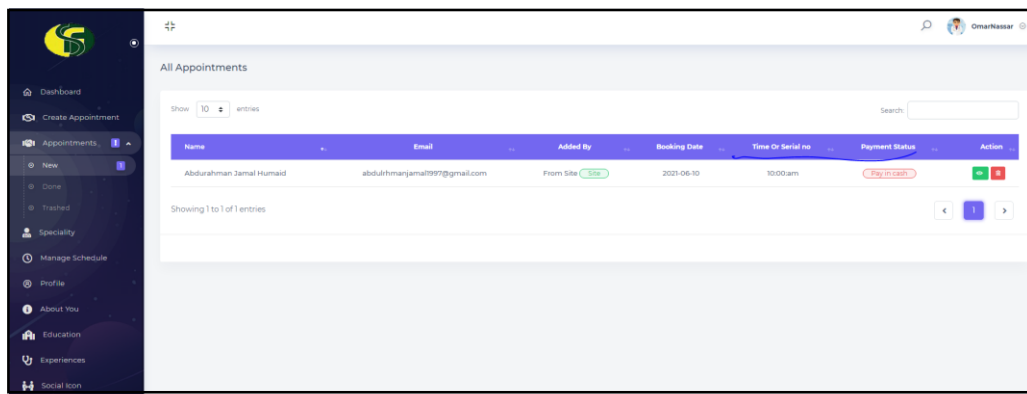
Figure 5: Doctor's Appointment Page

6.4. Assistance and Stuff Interfaces

System gives access for Assistance and Stuff to create, done or trash appointments by logging into their own accounts. The figure 6 shows the interface for Assistance, while figure 7 shows the interface for Stuff.
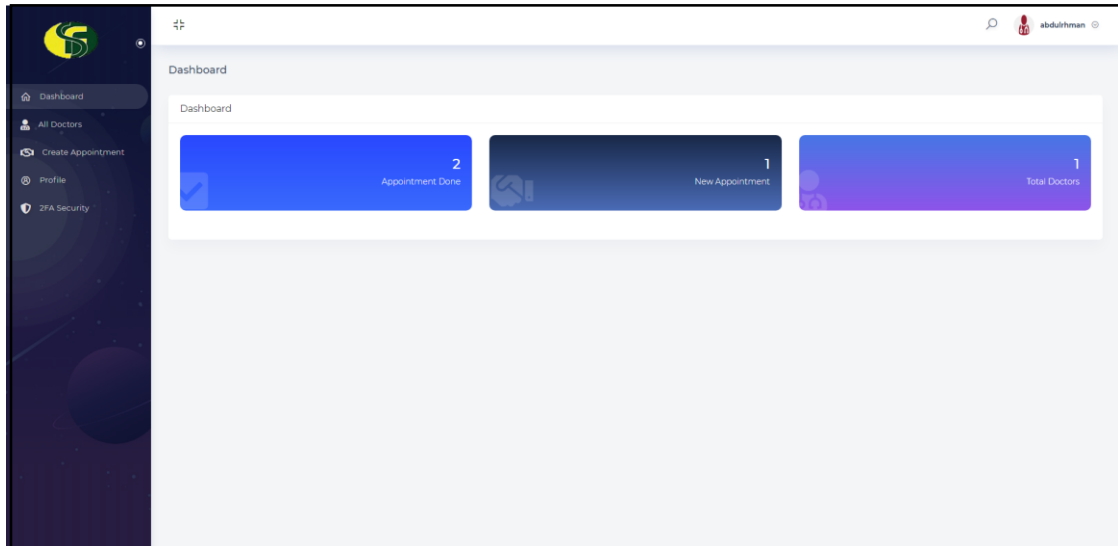

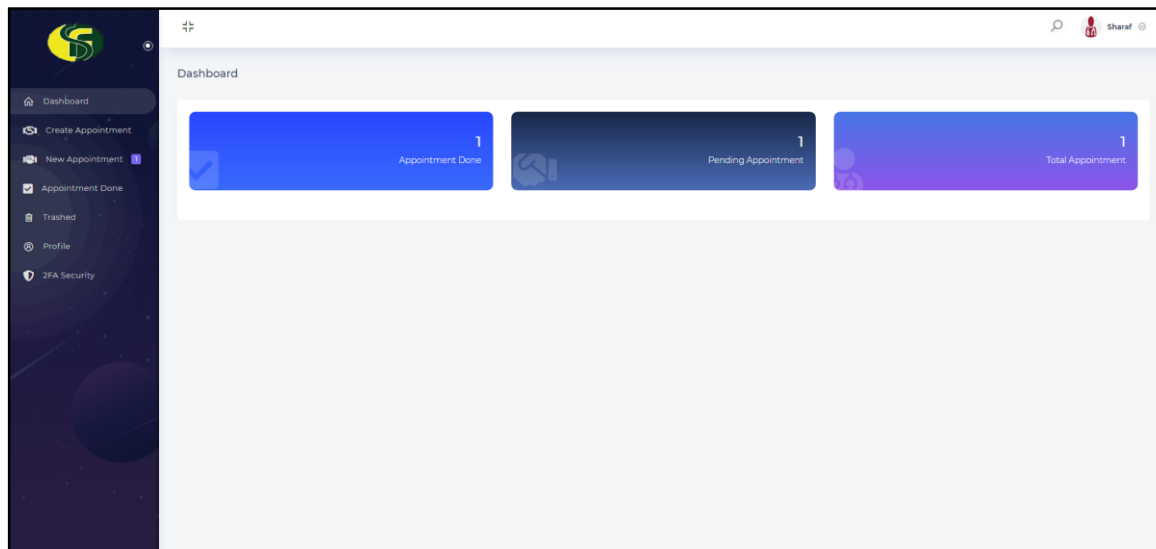**Figure 6: Interface for Assistance**

Figure 7: Interface for Stuff

6.5. Administrator Interface

For the Administrator of First Scan Clinic Online Booking system is allowed to explore and manage the System, add or change the sectors of the clinic, add or change the locations of the clinic. Also have the bower to (add, banned or change) doctors or the workers of the clinic. Furthermore, the Admin can create and view appointments of the clinic and reply to user massages. The figure 8. shows the interface for the Administrator.
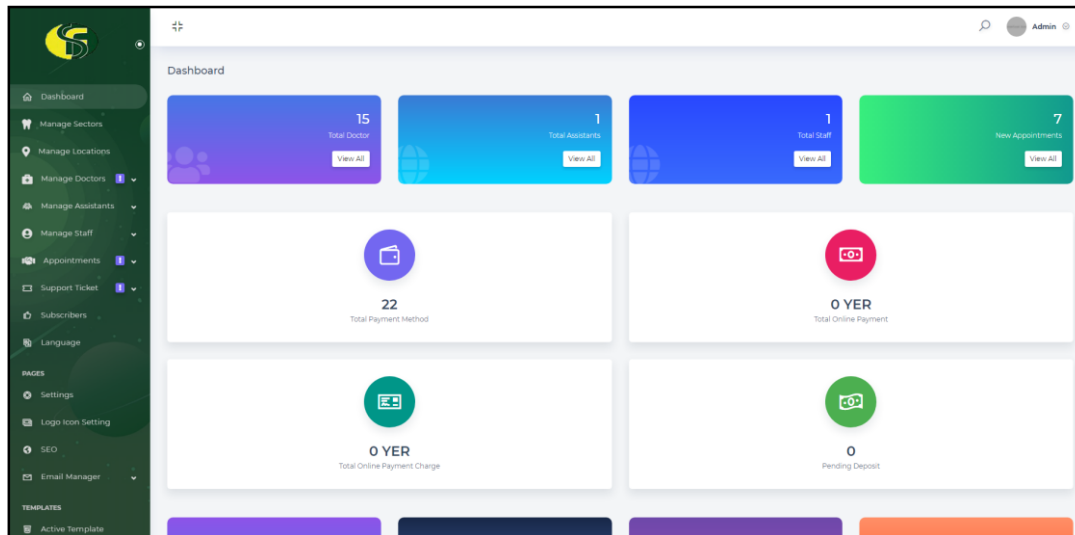

Figure 8: Interface for Administrator

7. Conclusion

The first Scan Clinic Booking System is a system developed specifically for booking appointments at First Scan clinic. The purpose of the system was addressing the problems happening with management of the clinic will booking appointments. The users who are allowed to use the system are patient, doctors, assistant, and staff. As a result, system has been tested all modules and all of them worked well. This system successfully solved all the problems encountered compare to the existing manual system.
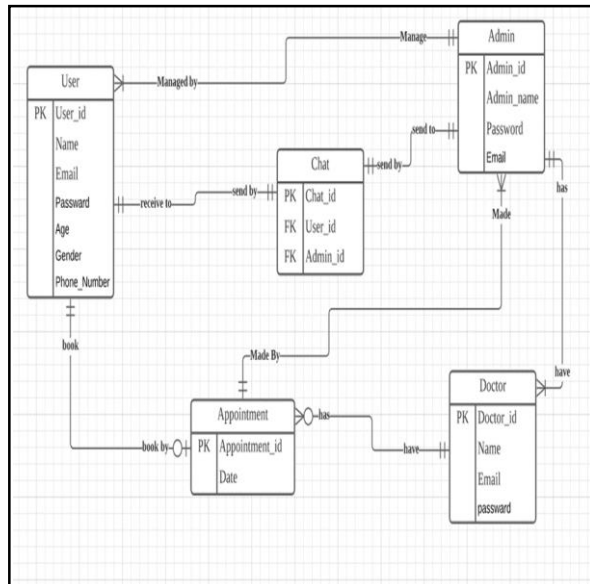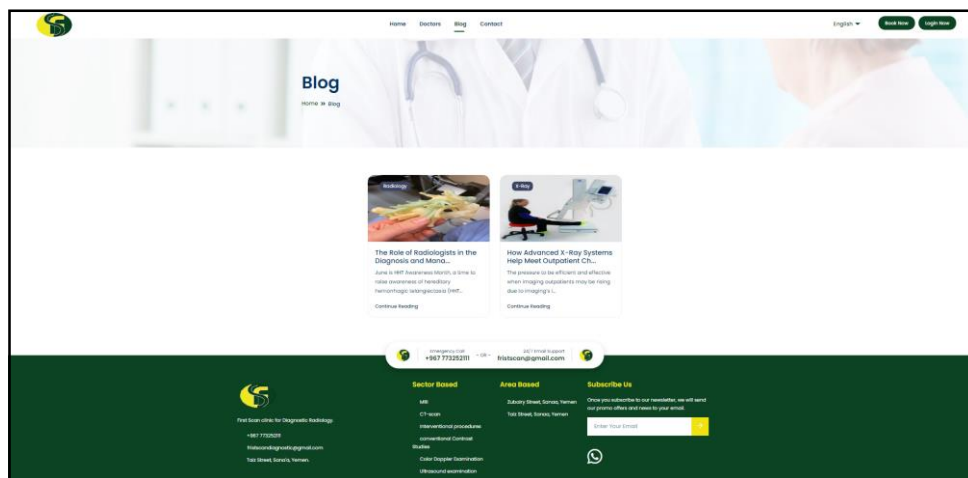
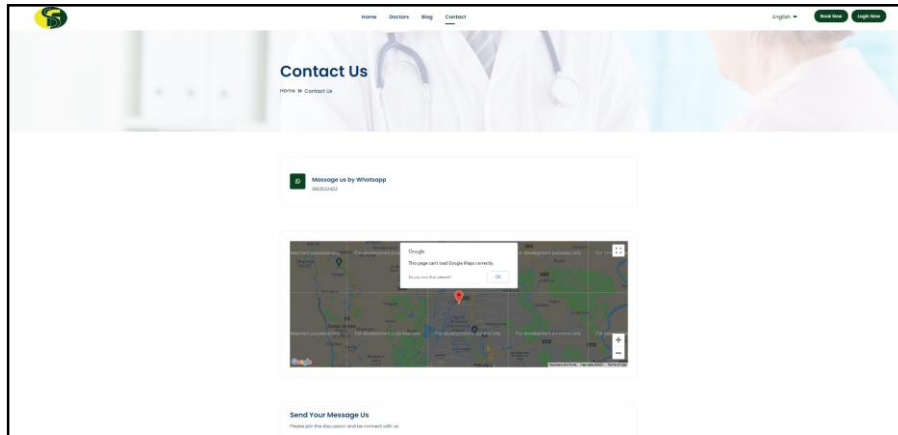**APPENDIX**
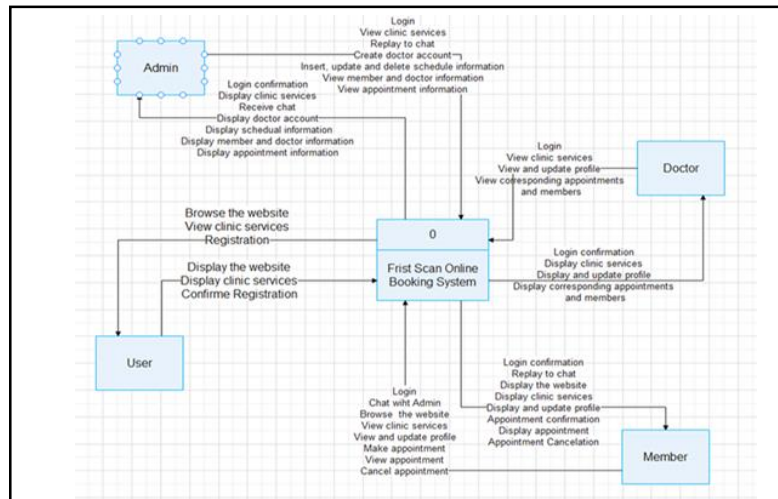
Appendix 1: Context Diagram
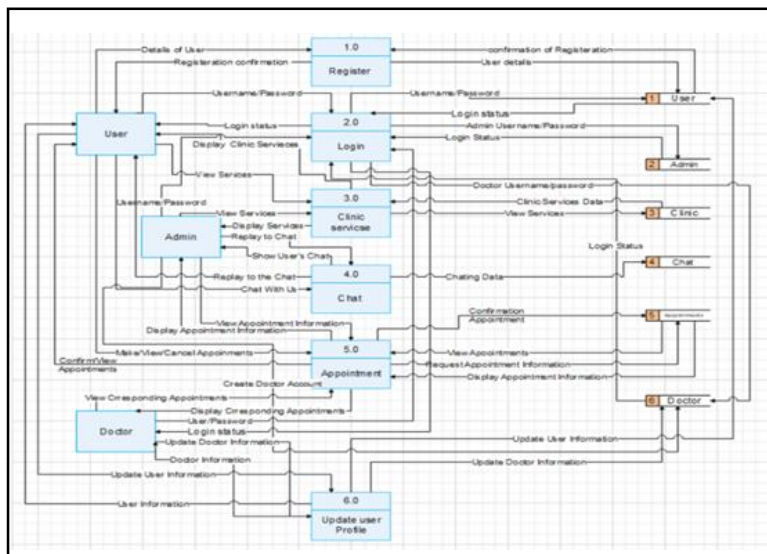
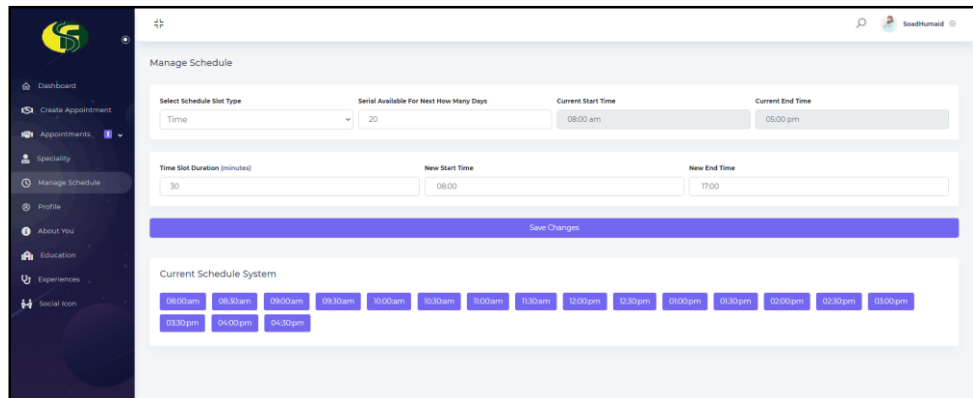**Appendix 2: Data Flow Diagram**
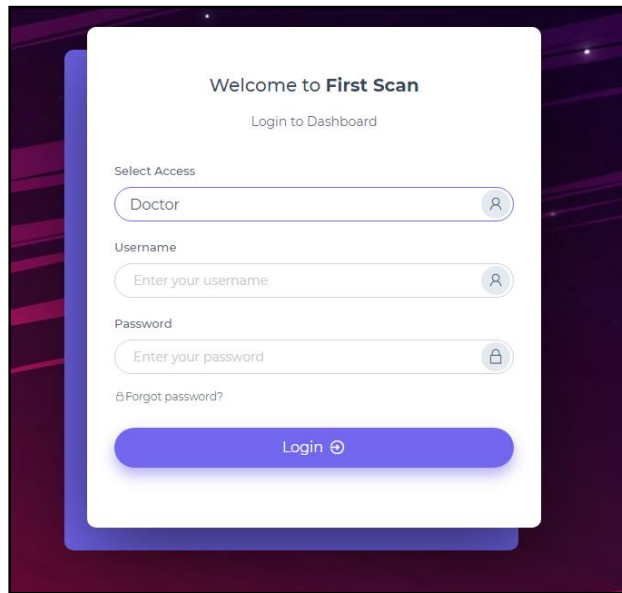
Appendix 3: ERP

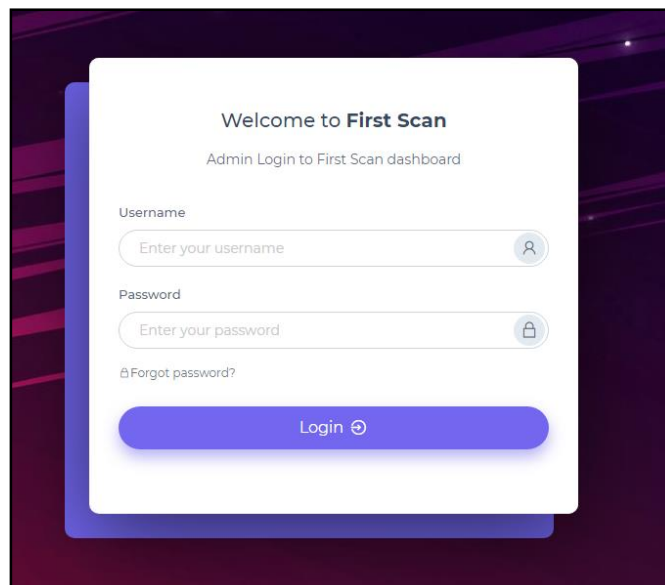**Appendix 4: Blog Page on User Interface**

Appendix 5: Contact Us Page on User Interface

Appendix 6: Manage Appointments page om Doctor Interface

Appendix 7: Login for Doctor and Workers

Appendix 8: Admin Login

References

[1]   Fernandes C, Daya M, Barry S, Palmer N (1994). Emergency department Patients who leave without seeing a Physician: The Toronto Hospital experience. Ann. Emer. Med., 24: 1092-1096.

[2]   14. Klassen, K. J., T. R. Rohleder. 2004. Outpatient appointment scheduling with urgent clients in a dynamic, multi-period environment. Internat. J. Service Indust. Management 15(2) 167–186.

[3]   Alex Chaffee (2000-08-17). "What is a web application (or "webapp")?". Retrieved 2008-07-27.

[4]   James Duncan Davidson, Danny Coward (1999-12-17). Java Servlet Specification ("Specification") Version: 2.2 Final Release. Sun Microsystems. pp. 43–46. Retrieved 2008-07-27.

[5]   AP Idowu, OO Adeosun… - International Journal of 2014.

[6]   Lv, Z., Jun, Y., Huang, J., 2018. How do sellers use live chat to influence consumer purchase decision in China. Electron. Commer. Res. Appl. 28, 102–113.

[7]   Mero, J., 2018. The effects of two-way communication and chat service usage on consumer attitudes in the e-commerce retailing sector. Electron. Mark. 28 (2), 205–217.

[8]   Go, E., Shyam Sundar, S., 2019. Humanizing Chatbots: the effects of visual, identity and conversational cues on humanness perceptions. Comput. Hum. Behav. https://doi.org/10.1016/j.chb.2019.01.020

[9]   Chattaraman, V., Kwon, W.S., Gilbert, J.E., Ross, K., 2019. Should AI-based, conversational digital assistants employ social or task-oriented interaction style? A taskcompetency and reciprocity perspective for older adults. Comput. Hum. Behav. 90, 315–330.

[10]   W.D. Lia, *, S.K. Ongb,1, A.Y.C. Neeb, "Computer-Aided Design," A Web-based process planning optimization system for distributed design, vol. 37, pp. 921-930, Sept.2004.Available.

[11]   The University of Texas, Dallas. Client-Server Architecture. Retrieved October 2010, from http://www.utdallas.edu/~chung/SA/2client.pdf .

[12]   Paul Stanley Software (2011). Advantage of Web Applications. Retrieved October 2010, from http://www.pssuk.com/AdvantagesWebApplications.htm .

[13]   Hyde Technology, School. Advantages and Disadvantages of using a network compared to stand alone computer, s. Retrieved October 2010, from http://www.ictgnvq.org.uk/unit10/advantages_and_disadvantages.htm .

[14]   Christopher Heng (2010).PHP Vs Perl. Retrieved October 2010, from http://www.thesitewizard.com/archive/phpvscgi.shtml .

[15]   gbdirect.com.Active Web Sites and Comparison of Scripting Languages. Retrieved October 2010, from http://training.gbdirect.co.uk/courses/php/comparison_php_versus_perl_vs_asp_jsp_vs_vbscript_web_scripting.html

[16]   Answer Corporation (2011).What are the advantages and disadvantages of HTML Retrieved October 2010,from http://wiki.answers.com/Q/What_are_the_advantages_and_disadvantages_of_using_HTML

[17]   Hiroshi (2007-2011). Advantages and Disadvantages of XML. Retrieved October 2010,from http://www.techmynd.com/advantages-disadvantages-of-xml/

[18]   https://www.medicaldepartures.com/treatments

[19]   https://theredclinic.com/

[20]   https://www.ultrasoundplus.co.uk/

[21]   (Pane, 2020)

         https://doi.org/10.37385/jaets.v2i1.166

         https://journal.yrpipku.com/index.php/jaets/article/view/166

[22]   (Riehle, 2019)

         https://doi.org/10.30844/aistes.v4i1.10