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SIMULATING A REAL TIME INTERACTIVE TELEMEDICINE IN A TYPICAL NIGERIAN HOSPITAL

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Abstract: Telemedicine involves the provision of health care and sharing of medical knowledge using telecommunications technologies. Diagnostic, patient education health can be provided via telemedicine. Due to the shortage of medical experts, hospitals coupled with geographic isolation and lack of opportunities, delay in the system, and cost of transportation, it important to develop a robust system that will improve and change the present state of health care and delivery services. In this research work, interactive service telemedicine is designed to provide tools for overcoming the unequal distribution of health care. The proposed system also provides opportunities for patients to gain easy access to medical personnel. The methodology used for this research work is the Dynamic System Development Method (DSDM). As a result of this research medical personnel, have real homes. Telemedicine is the future of health care.

Keywords: Time; Real; Simulating; Interactive; Telemedicine;

I. INTRODUCTION

Telemedicine is an evolving field in the intersection of medical informatics, public health and business, referring to health services and information delivered or improved through the internet and associated technologies in a wider sense, the term characterizes not only a technical development, but also a state-of mind, a way of thinking, an attitude and a commitment for networked, global thinking to improve health care locally, regionally and worldwide by using information and communication technology [6].

As telemedicine technologies has advanced and cost has declined over the past decade the growth of telemedicine has been relatively steady. Reference [12] reviewed evidences that describe telemedicine as not only a clinical benefit but also as cost-effective. Telemedicine is made up of three main types: store and forward, remote monitoring and real time interactive services. Store-and-forward telemedicine surpasses the need for the medical practitioner to meet in person with a patient. Instead, data such as medical images or bio-signals can be sent to the specialist as needed when it has been acquired from the patient. This practice is common in the medical fields of dermatology, radiology and pathology [11]. Remote monitoring, also known as self-monitoring or self-testing, uses a range of technological devices to monitor health and clinical signs of a patient remotely. This is extensively used in the management of chronic diseases such as cardiovascular disease, diabetes mellitus and asthma. Benefits of remote monitoring include cost effectiveness, more frequent monitoring and greater patient satisfaction [11]. Real Time Interactive Service can provide immediate advice to patients who require medical attention.

There are several different mediums utilized for this purpose, including phone, online and home visits. A medical history and consultation about presenting symptoms can be undertaken, followed by assessment similar to those usually conducted in face-to-face appointments [11]. A real time interactive service is the remote diagnosis and treatment of patients with the aid of telecommunications technology. The main aim for interactive services was to provide medical care for patients from a distance, thereby reducing the problem of shortage of available medical practitioners. In the rural areas, the problem of getting immediate medical attention is a huge problem due to the lack of means of transporting the medical professionals. Real time interactive services helps to solve this problem as the patient can receive medical attention regardless of where the specialists might be. With the aid of real time interactive services, medical practitioners can train the physicians on ground and this encourages the use of natural herbs to treat various health problems and diseases[1].

II. RELATED WORK

Reference [10] stated that Telemedicine arrived in Nigeria via a pilot project launched at Lagos University. This interactive electronic mode of teaching, research and provision of medical services has been embraced by lecturers, students and patients. Its efficiency and cost-savings have encouraged other universities to consider partnerships with IT companies that provide telemedicine infrastructure. Professor Akin Osibogun, the then Chief Medical Director of the Lagos University Teaching Hospital, said telemedicine employed modern technology to improve medical education and would also be used for communication between medical experts in Nigeria and abroad.

Telemedicine applications have successfully improved the quality and accessibility of medical care by allowing distant providers to evaluate, diagnose, treat, and provide follow-up care to patients in less-economically developed countries. They can provide efficient means for accessing tertiary care advice in underserved areas. By increasing the accessibility of medical care telemedicine can enable patients to seek treatment earlier and adhere better to their prescribed treatments and improve the quality of life for patients with chronic conditions [9]. Reference [7] described the remarkable growing of telemedicine implementations around the world that allow users to enjoy better health services by increasing attention, patient comfort and opportunities to achieve good diagnosis among other advantages. This is achieved by using web-based applications including Modern Medical Informatics Services which is easier, faster and less expensive. Reference [4] purported the use of electronic health medical records could pose a potential ethical and confidentiality breach, which providers must address.

Successful implementation of telemedicine shows that telemedicine increases access to general and specialized healthcare services, delivers medical care to rural areas, offers health care providers greater flexibility in scheduling, and saves patients' time and money in seeking care. These successes were amply illustrated in a recent study conducted in the US Department of Veterans Affairs which found that delivering health care through telemedicine saves the patient an average of 145 miles and 142 minutes per visit according to [5]. Reference [8] surveyed four rural hospitals as part of the data collection technique. Questions included planning, implementation, disaster recovery, and adequacy of telemedicine. The results of a response rate of 50% showed telemedicine is a viable solution for bridging the gap in a variety of specialty care facilities between geographic location and patient access.

Physicians used telemedicine to evaluate patients residing in Baton Rouge, Louisiana while the examining neurologist connects through a secure, remote server in Pittsburgh, Pennsylvania. Physicians helped 450 patients using telemedicine technology during the first year of operation and doubled the on-site visits. Telemedicine is a practical model for neurology care delivery [2]. Interactive telemedicine which is a real-time interaction between patients and doctors can be conducted in a nursing home or at the patient's house via a video-conferencing system. Interactive telemedicine can be more convenient for patients, than to obtain health care with a caretaker in person. Interactive telemedicine occurs when a patient consults a medical doctor in real time from the comfort of his home through the phone, video conferencing or using chat services. Interactive telemedicine can also occur when a patient consults a doctor with other doctors from all over the world in attendance trying to review the patient's case. This occurs mainly though video conferencing. Real time interactive telemedicine is becoming increasingly necessary because many wealthy Nigerians are finding it difficult to obtain visas for medical treatment in Western Europe or North America. So with real time interactive telemedicine, the patient can consult the doctors abroad and the doctors can proffer advice to the doctors here in Nigeria, tests can also be done by the patient and uploaded to the doctors abroad. All these happen through the use of the Internet. However, Internet-based networks are congested with many users which may be a bottleneck but in all real time interactive telemedicine is a better alternative.

III. MATERIALS AND METHOD

A. SERVICE OVERVIEW

In this paper, a real time interactive service was proposed. The model is aimed at providing a real time interactive service for patients wishing to consult the medical personnel where they can sit in the comfort of their homes and consult these medical doctors by way of phone calls and chat sessions which occurs through the internet. The patient consults a doctor from the comfort of his home and the doctor attends to the patient wherever he is. Further investigation can be carried out as directed by the doctor and the patient is able to upload the results of such investigations such as laboratory investigations, x-rays, scans etc.

The doctor in turn makes diagnosis and prescriptions. A real time interactive service is achieved because the doctor attends to the patient in real time, offers his medical advice, makes diagnosis and prescriptions in real time.

B. THE SYSTEM ARCHITECTURE

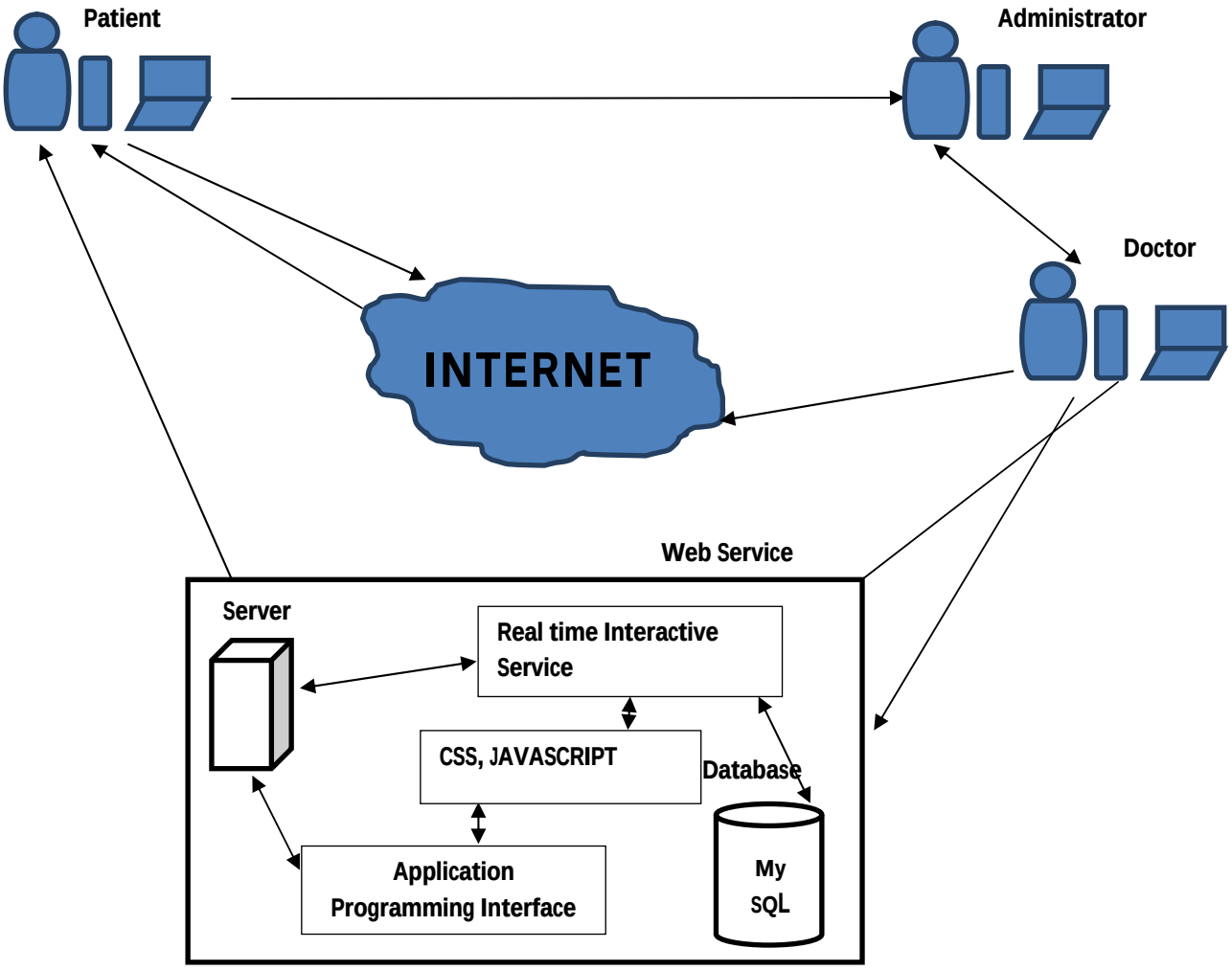

Fig.1: The System Architecture

Fig. 1 above shows the system architecture. The patient with his mobile phone or laptop can log into the hospital application through the Internet. When the patient logs into the application and requests for a service, the administrator who also logs into the system application with his mobile phone or laptop can approve of the service for the patient or reject it if the services are all occupied. One of such services the patient can request for is to book an appointment with a doctor. The patient is at liberty to choose any doctor of his choice to have an appointment with. The administrator can approve for the patient to see that particular doctor or any other doctor depending on the availability of the doctor the patient is requesting for. The doctor on the other hand can also log into the system with his mobile phone or laptop and will approve the appointment requested by the patient before the patient can have access to him. The doctor can also reject the appointment if he does not have time to see the patient and can refer the patient to another doctor or can suggest to the patient any other time he will be less busy if the patient is willing to wait for him.

When the appointment is approved by the doctor, the patient can then consult with the doctor in real time. This consultation can be done through the use of the mobile phone for either voice call or video call or through video conferencing. The doctor does the consultation with the use of the real time interactive service system domiciled in the server to attend to the patient. The doctor can send the patient for further investigation if the need arises and the patient can upload the results of such investigations to the hospital website where the doctor can access it to make his diagnosis and prescriptions. Thus the patient consults the doctor in realtime in the comfort of his home and still gets the required services. It is pertinent to note that the real time interactive services is very vital in this COVID-19 era when movement is restricted and where people can easily contract the virus when they move about from place to place. So it will be of great use during this time so as to limit the movement of people especially in hospitals.

C. SERVICE MODEL ARCHITECTURE

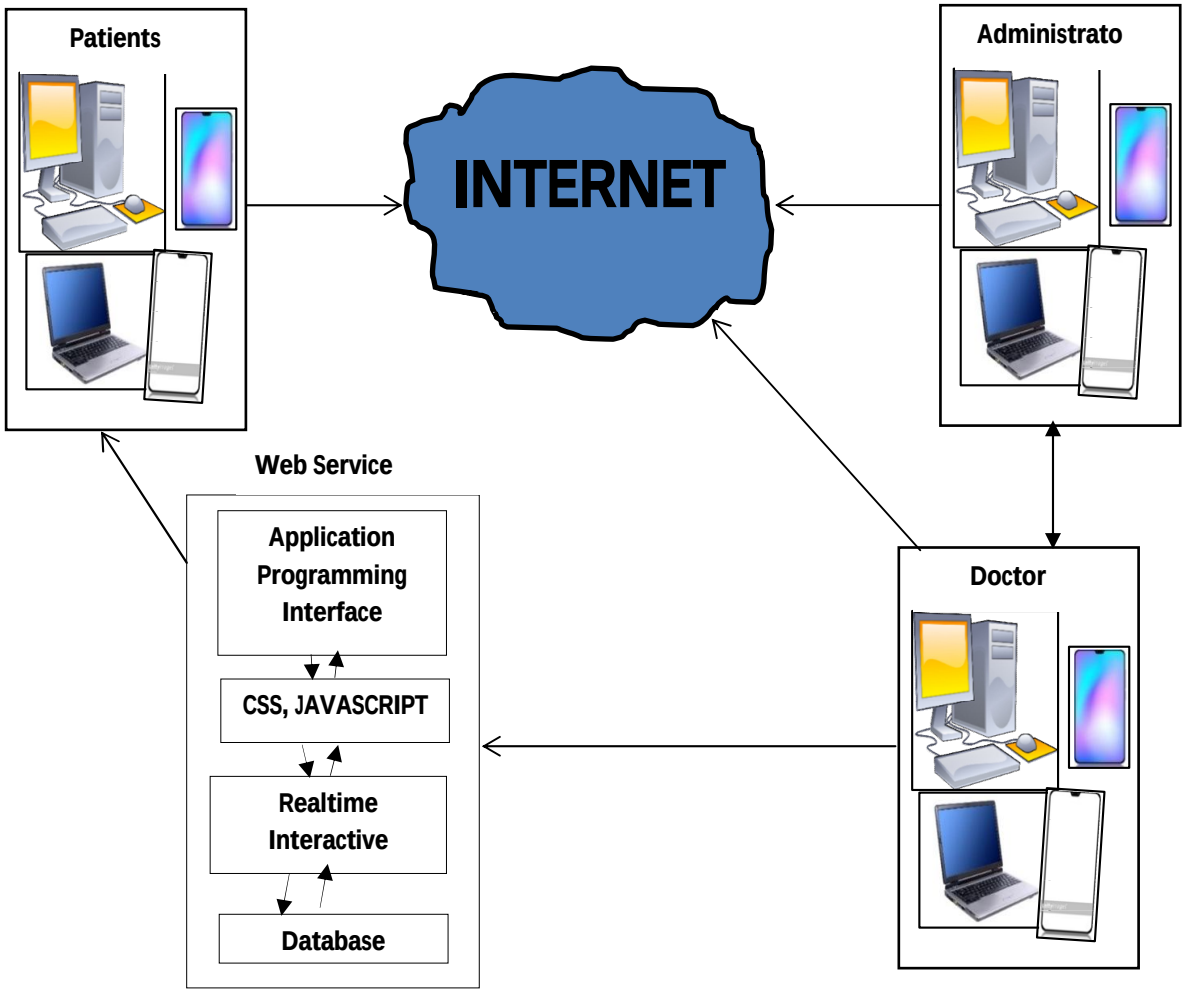

Fig.2: Service Model Architecture

The fig. 2 above shows arrows indicating the flow of hypertext Transfer Protocol (HTTP) request and response. The patients are the different patients in their homes, offices or wherever they may be who can use their desktop computers, laptop computers or their mobile phones to connect through the internet to the hospital website for interaction with the doctors. The administrator receives the requests from the patients and assigns them to a doctor by booking an appointment with the doctor. The patients can specify which doctor they want to see and get appointment with that doctor or they may request to see any doctor and will also get appointment with any doctor. The doctors on the other hand also through the internet and using their computers or mobile phones attends to the patients, sends the patients for further investigation in the laboratory, for x-rays or scans as the need arises, makes diagnosis and prescriptions. The patient goes to the laboratory for further investigations, goes for x-rays or scans if there is need for that and then uploads the results to the doctor for further analysis by the doctors. Hence there is a real time interaction between the patients and doctors without physically being present at the same place.

D. WEB SERVICE

Web of service refers to message based design frequently found on the web and in enterprise software. The web of services is based on technologies such as HTTP, XML, SOAP and others. Web service is defined as a means a means to connect services together [3]. A service is a software that performs some computing functions and has some type of underlying computer system. Web services allow various applications built with different technologies or platform to communicate and share data with each other through an acceptable standard. The web service applies the use of the cascading style sheets (CSS) and java scripts in the development of the real time interactive services algorithm.

The patients' records are stored in the database for new and for the existing patients, their information is retrieved from the database and sent to the Application Programming Interface (API) which in turn returns it to the doctors.

The real time interactive services algorithm was designed with the following tools:

1) **Front end:** The front end of the website is the visible part which the user can interact with. The programming languages used to design the structure of the front is HTML, CSS and JAVASCRIPT.
   - **Html:** The HTML which means hypertext Mark-up language is the standard mark-up language for creating web pages. Html describes the structure of a web page. This was used to design the structure of the front end.
   - **CSS:** CSS stands for cascading style sheets and it describes how HTML elements are to be displayed on screen, paper, or in other media. It was used for styling the front end of the program.
   - **JavaScript:** JavaScript is among the most powerful and flexible programming languages of the web. It powers the dynamic behavior on most website. It is used for interaction between the front end and the back end.
2) **Back end:** The back end of a website is the aspect of the website that the user cannot see. It is responsible for ensuring that everything on the client-side actually works. The backend communicates with the front-end on what to be displayed as a web page. The programming language used in this aspect is PHP.
   - **Php:** Php is a general-purpose scripting language that is specially suited to web development. It is fast and flexible, Php powers everything from your blog to the most popular website in the world. It was used for the backend of the program.
3) **Data base:** A database is an organized collection of data, generally stored and accessed electronically from a computer system. The database was designed using MySQL.
   - MySQL: MySQL is a relational database management system based on SQL- structured query language. The application is used for the purpose of web database.

The model has three users, the patient, the medical personnel and the administrator. The administrator manages the system and is responsible for approving any medical personnel that registers into the system. When medical personnel are approved by the administrator, the medical personnel's name is displayed on the dashboard where the name is visible to patients. When a patient logs in into the system, he sees the medical personnel available and he can book an appointment with the doctor. When the doctor approves the appointment, he can then interact with the patient in real time.

IV. RESULTS AND DISCUSSIONS

The Interactive system enables patients to have easy access to medical personnel, have a real time interactive chat session with the medical personnel right from the comfort of their homes. My SQL is used for the data base while the wamp server or Xamp server is used to activate the database. Only the administrator can access the database.

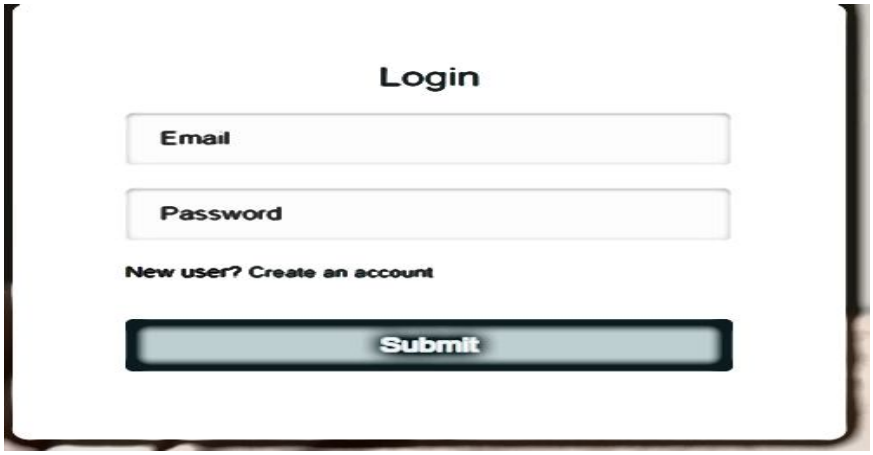

Fig. 3: The login page

Fig. 3 above shows the mobile login from where the user will login into the application. While the create account button allow new user/patients to be registered into the system. A new user clicks on create an account and fills the form which pops up to have an account created for him. An old user will simply enter his email address and password to login into the system.

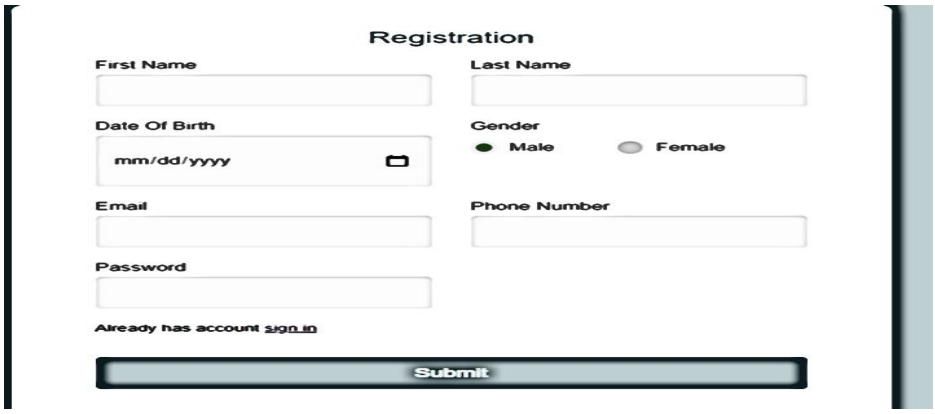

Fig.4: Registration page

Fig. 4 shows the image of the registration page where users fill in their details in order to gain access into the system. It consists of name, date of birth, gender, etc. The registration page allows a new user to register with the system so as to have access to the service.

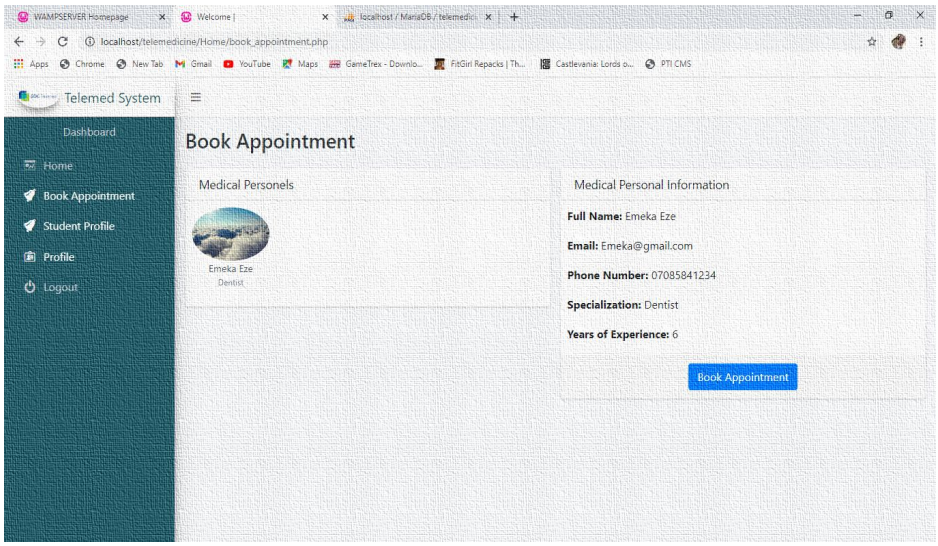

Fig.5: Book Appointment Page

Fig.4 above enables the patient to book an appointment with any medical personnel of their choice from the clinic. When a user logs in into the system, he can book an appointment with any doctor of his choice on this page. The doctor in turn will have to approve the appointment before it can be valid. At the appointed date and time, the patient logs in and consults the doctor in real time.

Fig.6: View Appointment page

Fig.6 is the medical personnel page which shows the doctor the patients that has booked an appointment with him/her. The medical personnel has the privilege to either approve booking or reject booking. My appointment page shows the doctor at a glance all the appointment he has. He can approve the ones he wishes to approve and can direct the patient to book appointment with any other available doctor.

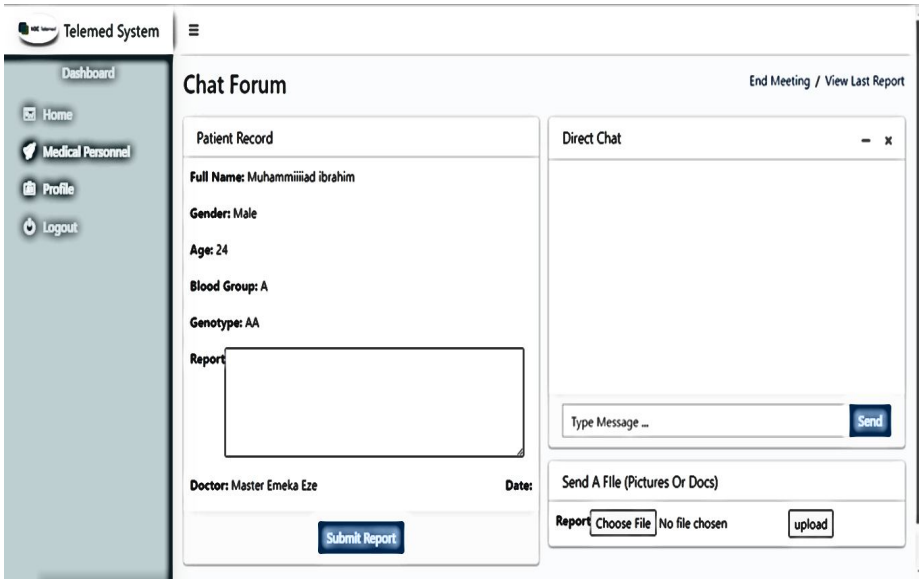

Fig.7: chat forum

Fig. 7 is the chat forum which allows interaction between the patient and the medical personnel. Patients can also send pictures to the medical personnel in this aspect. The chat forum is the page where the patient can consult with doctor through chatting. The patient can also upload images of his tests to the doctor from here.

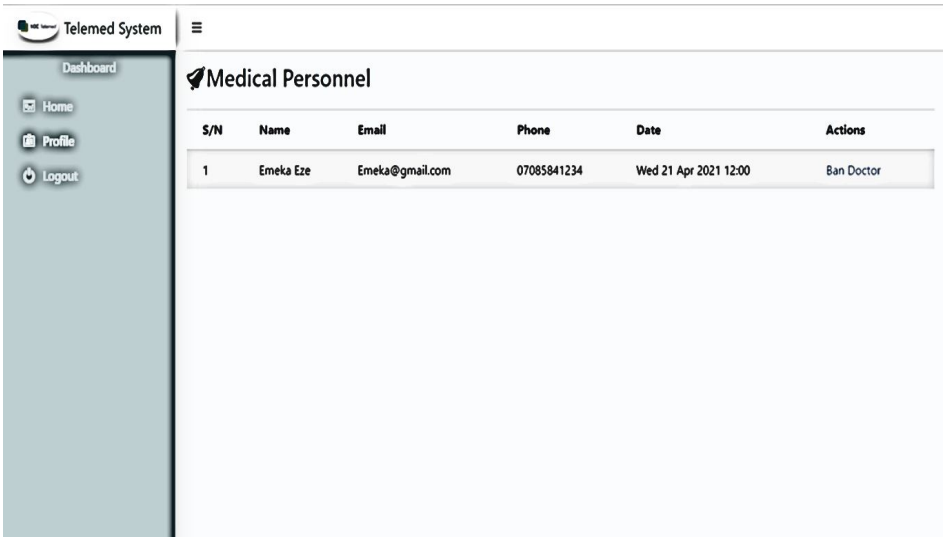

Fig.8: Administration Home Page

Fig.8 is the page of the administrator where the approval of medical personnel takes place. The administration page is the page where the administrator approves doctors for patients. This happens before the doctor gets to see the bookings where he can confirm the bookings or cancel or refer the patients to other doctors.

V. CONCLUSION AND FUTURE WORK

The interactive service application is an application that will enable patients to book appointments with medical personnel. This study is a work in progress that has the ability to provide communication from distance by providing an interactive platform where they can consult the medical personnel without physical appearance in the clinic. It aids in the reduction of patients waiting time.

Despite the fact that the application has been able to bridge the gap between technology and medicine by being able to communicate from a distance, it is limited to the android platform and thereby has some issues with portability. Further research and work should be carried out to ensure better accessibility and the study of how modern technologies are affecting the world of medicine.

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