Telemedicine System for Bed Sore Diabetes Patients

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ABSTRACT

Remote health care services are growing fast in the contemporary society. Chronic skin disease patients are living under more traumatic and there is difficulty of taking the patient to the hospital for the treatment in urban as well as the rural areas. Problems detected in the current healthcare diagnosis system for bed sore diabetic patients and emergency situations are taken into thought in the development of a telemedicine system, which is proposed in this paper. Taking as an implication the user requirements and the client–server architecture, a framework is suggested. Particular consideration is focused towards the methodology applied and the design of a user friendly interface well-suited with the current widespread clinical practices. The system is based on a Windows environment, communications are implemented by using TCP/IP protocol and further it has the opportunity for the data storage in cloud environment. The system proved to be reliable and also provides a solution the present telehealthcare system

Keywords

Bed sore patient, client-server architecture, telemedicine, cloud.

1. INTRODUCTION

Telemedicine are enchanting an essential role in the evolution of the health care services, improve the quality of healthcare and reduce its cost by faster communication of medical information between physicians and patients. It is committed to provide improved healthcare services in remote areas or urban areas and where the doctors or health care takers, or health administrators require opinion from the experts for diagnosis. Telemedicine has also been successfully applied to monitoring chronic patients who do not need to be brought to the hospital for treatment [4]. The main concern about the development of a telemedicine platform is the integration of information communication technology to meet the requirements of the application [9]. Telemedicine applications need to run in heterogeneous computing environments. Data integration, vendor locking and interoperability are of major concern in telemedicine applications now a days[6].The infrastructure taken into consideration is the use of public network i.e. internet, and is intended to be a worldwide public telecommunication network. An example of a patient whose circumstances are not normal in the ordinary systems of care is the bed sore patient with diabetes. Bed sores, also known as pressure ulcers, pressure sores or decubitus ulcers are skin lesions which can be caused by friction, humidity, temperature, medication, shearing forces, age and unrelieved pressure. Any part of the body may be affected; bony or cartilaginous areas, such as the elbows, knees, ankles and sacrum are most commonly affected.

Bed bound patients are most at risk of developing bed sores on their: Ankles, Back of the head, Breasts (female patients) ,Elbows, Genitals (male patients) ,Heels,Knees,Rims of the ears, Shoulder blades,Shoulders,Toes. Diabetes is a destructive disease that makes possibility of getting cardiac failure and the risk of kidney failure. It can also cause serious health complications. If diabetes is managed effectively, these complications can be eliminated. However, these patients need to be continuously monitored to enable the initiation of treatment. Now telemedicine allow patients in remote areas to have x-rays, MRIs and other diagnostic tests closer to their homes[5] .The general public and physicians with the help of telemedicine can access informative websites to obtain information about specific medications and their interactions [21] .This research work takes care of such situations by the design of a telemedicine system that helps the patients to regain their independence and return to an active work schedule, thereby improving their psychological well being. When the bed sore patient's requires treatment from home, the current procedure followed is based on an initial investigation performed by the care taker who is not an expert in bed sore diseases. When it is measured appropriate, the image of the skin is captured and the results of the diabetes test or blood test or urine test is started from the home to the hospital. By these means, the remedial measures related to an immediate treatment are established. Both the lack of experience of the initial home care in the area of skin diseases, diabetes and the difficulties derived from a telephonic description of the diseases have vital repercussions on the diagnosis of the patient. The paper utilizes the current information and communication technologies to meet the healthcare needs at any place, any time with much better qualitative levels and at lower costs.

2. METHODOLOGY

For the development of telemedicine platform for the hospital, heavy planning and the application of a careful methodology was adopted. As an initial step in the development, we interviewed the medical expert in the field of dermatology, endocrinology and pathology. The objectives was to gather the user requirements, present technology infrastructure and the scope of the present work and following issues with the help of the medical team: The application was developed for the hospital keeping view the remote health care from home or remote places. The primary health care centre or the home care centers involved have access to the Internet. When a patient is suffering from bed sore diseases, the patient's skin images are captured through the digital camera and the diabetes test are being conducted. These data are entered to the website and is forwarded to be stored in the hospital server. In the hospital , where an expert makes an image-based diagnosis and determines the most appropriate treatment in a continual dialog with the remote patient or physician or health care taker. The hospital server sends a sms to the mobile to the concerned doctor and also the details of the patient diseases is sending in email to the concerned doctor. The doctor gives the prescription for the diseases which is stored in the hospital server. From the hospital server the care taker or the health administrator send sms to the

patient or give consultation through the telephone. The medical team has stated the following functional requirements:

- To design a flexible and user friendly interface for managing health care information.
- The system must be compatible with the current protocols and communication standards.
- The system must be capable of integration with cloud for the data storage and backup facility.
- The solution must be a cost-effective strategy in the treatment of patients, especially in case of emergency situations.
- Storing, querying and retrieving medical images, patient health records and patient-related medical data.
- Data may reside at a distributed Cloud Storage facility, initially uploaded/stored by medical personnel.
- Communication and data exchange has to be performed through non-proprietary, open and interoperable communication standards.

With all this information, the following framework fig 1, was designed that best fits the objectives with user requirements within the available resources.

A distributed database was designed which contains the information related to patient and doctor. There are storage and retrieving services in each remote location, where data are acquired and updated. The hospital database server keeps a backup of the whole database to prevent loss of data. There is a server application which stores and makes available the incoming skin images from the patients. The client, in its turn, is health administrator monitors their patients using the server application. Also, data can be exported to XML files. Therefore, the server side was developed with the purpose of receiving, storing and distributing the vital sign data from patients. It was developed under Java technology too. Basically, the server is composed of a Java application and a relational database (MySQL). The application offers the features: a) List of doctor/patients; b) Information about patients; c) visualization of skin images; and d) data storage. UML methodology was used in designing the system.

3. DATABASE STRUCTURE

Information about the doctor, patient, health care taker or administrator was stored in the database. Information about a patient has been classified into the following groups:

• Patient Personal data.• Doctor Personal data.• Image files.• Prescription files.• SMS.

Whenever a patient is examined in a remote location, the data about the patient is captured. Taking into the proposed framework, the image file was compressed by an algorithm to reduce transmission time delays. DICOM-3 standard was used for transmitting the image in this format.

4. IMPLEMENTATION OF THE PLATFORM

In order to meet the user requirements connected to a user friendly interface, we have developed a Microsoft Windows based platform. Because of the ability of java programming tools to build simple and powerful applications, we use java in our development. Each patient data are stored in the patient table. There are different type of information associated with patient's personal data was diseases history, compressed images, treatments, and messages. MySQL was used in the backend where the table i.e. patient, doctor, prescription and, messages was created. The image of the skin was captured and loaded through a module which loads and display the image. The SMS module and Email module takes care of sending the sending SMS and the email to the doctor. Further for the interoperability of the application, the data was converted to XML format and from the XML the data can be stored into the database.

5. RESULTS

The application developed will show the images previously recorded, taken from the patient. The desired part of the body can be selected from the patient unit by clicking on the appropriate check box. In order to evaluate the platform, we have performed the user acceptance testing i.e. concerns the design of the user interface. Further the evaluation was prepared so that the medical team can express their opinion. As a result, the user interface has been reported to be easy to manage and compatible with the prevailing clinical practices. After the platform has been integrated within the current hospital information system, it was tested to see how the transmission of compressed images was stored and transmitted for testing the accuracy of the image-based diagnosis with the opinion of several dermatology experts. The set of images captured where as per the American teledermatology standards. The use of these images has been approved to be ensure confidentiality and privacy of the information.

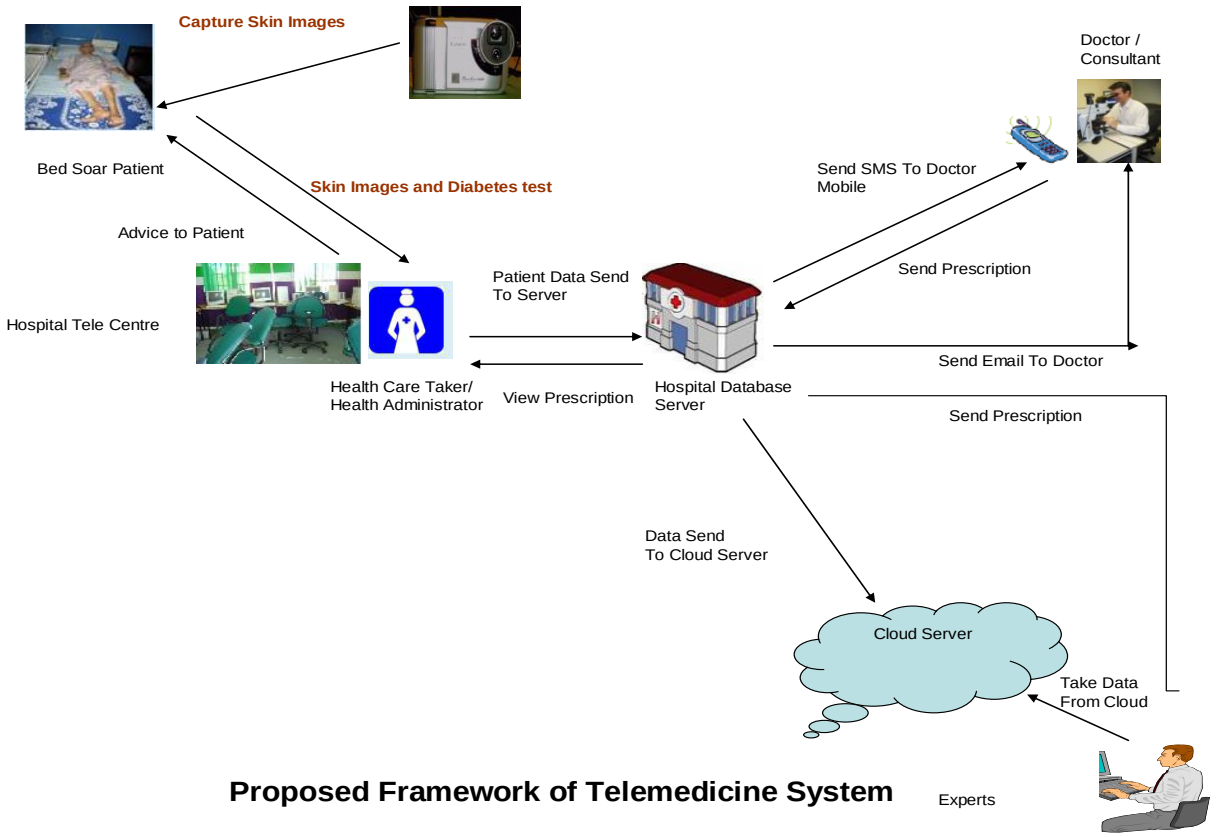

Fig-1 Proposed framework of Telemedicine System

6. CONCLUSION

The physicians had shown a great deal of interest in the implementation, since its potential use has been validated and accepted to be cost-effective and represents innovative solution for the bed sore patients. As future works, we intend to validate the proposal in a real world setup to assess the benefits of the solution in large scale scenarios. In addition, we intent to implement several services enhancements of security and management with interaction of thirty-party infrastructure service provider. Cloud computing is a new discipline to exploit the virtual environment over the internet for applications.

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