A Portable ECG Device for Diabetic Patients' Telemedicine

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Abstract — *Some of the diabetic patients have impaired cardiac function; therefore they need regular monitoring their heart electrical activity to prevent heart failure. Many attempts were done to remote monitor the diabetic patients' ECG. In this project we want to know Cardiac abnormalities Function in Diabetic Patients with design and implement a telemedicine system to collect ECG signals in a Database. We have designed a Portable ECG Device as a sample and we have observed the algorithms of ECG abnormalities in diabetic patients in our signals processing program to diagnosis the heart abnormalities function in diabetic patients. In according to scientific research about rhythm and frequency sinus rhythm, P-R Interval, QRS Complex Duration, Ventricular depolarization S-T segment wave and Q-T Interval Diagnosis The result was valid and reliable. The main goal of this work is to develop an ECG with self-diagnosis functionality in diabetic patient. An experimental setup was designed*[1].

Keywords — Portable ECG Device, Diabetic patient, Telemedicine, Telecare

I. INTRODUCTION

Some of the Diabetic patients with apparently normal cardiac function indeed have impaired cardiac function. About one third of acute myocardial infarction patients have diabetes mellitus. Diabetic patients need regular monitoring to prevent heart failure. (1)

In the other hand, in most of the instances, the cause for prolonged stay of patient in the hospital is not that the patient in reality needs proper medical attention. The reason for a patient to be hospitalized is for continuous monitoring.(2) So, for those patients who need to be under observation shouldn't necessarily stay in the hospital and by doing so more space will be available for those who needs immediate medical care. One of the most common health concerns for patients is chronic heart failure which is one of the major causes of mortality, hospitalization and overall healthcare related cost.

The term telemedicine refers to the utilization of telecommunication technology for medical diagnosis, treatment and patient care. (3)

The use of technology to provide Tele-care may offer an effective supplement for patient care services like emerging technology for continuous monitoring of ECG, Tele ECG monitoring system.(5)

Researchers and engineers employ advanced concepts and techniques from the field of electrical engineering, computer science, biomedical engineering and medicine to collect ECG signal via smart and advanced monitoring system using wearable technology. (6)

So, in this project we want to know Cardiac abnormalities Function in Diabetic Patients with designing and implementing a monitoring system device to collect ECG signal in a Database. This signal is widely adopted to diagnose and asses diabetic patient health risks and chronic cardiac diseases.

II. METHODOLOGY

We Design and Implement A Portable ECG Device for Diabetic Patients's Telemedicine. At Our designed Portable Tele Diabetic ECG Monitoring system, communication module has two parts, first is to transmit signal from data acquisition unit to base station, second is to receive the signals and then transmit it to the hospital server.

The ECG signals from patient home are constantly transmitted to the hospital through GPRS. Special software is designed which will collect and store up the ECG signal in database. Monitoring software visualizes the actual ECG signal on the computer hospital side. There are three main parts at hospital side which are ECG server, database for storing ECG and ECG visualization and processing software.

ECG signal receiving server software is intended to take delivery of signals from patient's home directly to hospital via an internet connection. The software designed is based on real time interaction between client and server application and is based on TCP/IP protocols. The ECG receiving server is implemented using Microsoft C#.

The program used to trace ECG signals like an oscilloscope, reads data from the Packets received at defined short interval then these traces are drawn on the screen using data received. The sole function of the ECG application software is to collect and save the ECG signal without losing the data packets. The other task is to handle the TCP/IP connection.

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The database of Portable Tele Diabetic ECG Monitoring system is a collection of interrelated ECG data of Diabetic patients and a set of programs that allow users to access and modify these data. A major purpose of Portable Tele Diabetic ECG Monitoring database system is to provide users with an abstract view of the ECG data. The primary goals of DBMS are to provide a way to store and retrieve database information that is both convenient and efficient and then to retrieve information from and store new information in the database.

Portable Tele Diabetic ECG Monitoring system Database system is designed to manage large bodies of diabetic patient's information.

The used is MySQL. The configuration of ECG signals arranged in the MySQL have three tables are instanced.

In the patient's table, all the personal information like patient ID, patient name, age, gender, description, medical history, email address, doctor code, and mobile number is stored.

In the Doctor's table, information like Doctor ID, Doctor Name, email address, and mobile number are stored.

In the ECG table, information like patient ID, Monitor date ,Monitor time, ECG signal, ECG interpret result of system, ECG interpret result of Doctor, order is sorted.

The ECG signal table displays all information regarding ECG with date and times and Signal process result is recorded. At any instant of time, the ECG record of the patient can be viewed by entering the patient details in the ECG signal table.

For displaying ECG signal received through internet in a web environment, ECG visualization software is needed to ease access of information from the patient side. To display this, a web browser and internet is needed which should assure a secured and reliable access of the data and the information stored on the server. The ECG visualization software is designed using ASP (Active Server Pages).

The ECG visualization software is used to examine and visualize the recorded ECG signals.

III. Findings

The prototype of the Portable ECG Device is designed successfully. At a prototype stage has been tested for acquiring and transmitting ECG signal to to Database on remote medical server through cellular networks with using GPRS network.

Software used for displaying ECG on Laptop and Acquiring is successfully done.

In according to scientific research (8-30) about rhythm and frequency sinus rhythm, P-R Interval, QRS Complex Duration, Ventricular depolarization S-T segment wave and Q-T Interval Diagnosis, we were able to evaluate the sample and we use the real ECG data form MIT-BIH Database Distribution of

Harvard-MIT Division of Health Sciences and Technology (30) to simulate real diabetic patients's ECG signals and transfer to the sample portable monitoring device to process them.The result was valid and reliable.

IV. Discussion

This paper proposes the design and implementation of a wireless telemedicine system, in which an ECG monitoring system whose goal is to provide an anywhere and at any time assistance to Diabetic patients to detect heart diseases in real-time and reduce communication costs. ECG signals are acquired and transmitted to Database on remote medical server through cellular networks with using GPRS network. Then ECG signals are analyzed with Application software running on remote medical server and the use of the system constitutes a valuable support for ECG-based clinical diagnosis.

Also the proposed system presents friendly web based interface for Doctor to observe immediate Diabetic patient's ECG signals and their analyses for remote treatment.

Application software running on remote medical server functionality can also be boosted by adding several algorithms of diagnostic capabilities, which would check abnormalities in the ECG waveform and thus assist medical stuff.

The clients only need to have a PC with a Web browser installed and a network connection. This interface facilitates the installation, update, and management of the software which is done in a centralized way, without running programs on the local stations.

The database of this system, where all the data of Diabetic patient's ECG signals and their analyses are centralized and real-time, gives Doctors and other health care professional's continuous insight information of the disease and the medical care dynamics. This helps in reporting statistics to the ministry of health and highlighting the problem areas for the action plan. This action plan may include preparation of national guidelines for the management of diabetes patients, and preparation of training and educational programs for improving the lifestyle of the people.

This system will improve the mobility of patient so patient could do his/her daily activities during monitoring. Also the proposed system provides an ability to continuously monitor Diabetic patient's ECG signals instead of the discrete measurements. In other hand this system reduces the unnecessary stay of the patient in the hospital and indirectly saving their quality time and precious money and would lead to the conclusion that this will reduce the mortality rate of Diabetic patients due to heart diseases.

The current system has already been implemented, validated with the ECG database and offer accurate results.

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