Web Page Design for Patient Monitoring System

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Abstract: **-** Rapid growth occurred in mobile deviceshave enabled the implementation of monitoring systems based on Wireless Body Area Network (WBAN). In Iraq, the need for such system is essential for continuous patient monitoring inside or outside the hospital because of the lack of the medical staff and the mitigation of them outside the country; therefore, the stress have increased on the medical staff. Such system would reduce the time that doctors spend in touring so offers more time for doctors to deal with more important issues. Such system would also give the patients timely and proper help. Web pages are used in this proposed system because they are available on all portable and computer devices, they are friendly used since it is based on Graphical User Interface (GUI), and MySQL database is used to create database and tables for information storage.

Keywords: - Monitoring System, Wireless Body Area Network (WBAN), Web pages, Graphical User Interface (GUI), and MySQL Database.

I. INTRODUCTION

Wireless Body Area Network (WBAN) is a special type of Wireless Sensor Networks (WSNs). It is composed of sensor nodes and other electronic devices that work together to implement a complete monitoring environment [4]. WBAN is not only used for monitoring applications, but it can be also used for tracking, controlling, etc.

WBAN (i.e. sensor nodes and Wi-Fi) utilizes 2.4 GHz Industrial, Scientific and Medical frequency band, and this made it suitable to be used in hospitals where data is collected from several sensor nodes. Composing such network topology with these components reduces the interference; thus the coexistence of sensor nodes with other network devices will be increased [5].

Fast progress in wearable and implanted health technologies has an essential role to change the future of health care services for patient monitoring toward ubiquitous monitoring [1]. Because of the remarkable increase in WSN applications and the small size of biomedical devices, WBAN have been enabled in health monitoring to collect patient physiological parameters and transmit these vital signals to the sink node [2].

Heart rate, SpO_2, blood pressure and temperature are the most important parameters that are measured. Usually, it is difficult for the patient to keep track on these measurements manually; for example heart rate for elderly people is different form heart rate for young people and babies [3].

In this research, biomedical sensor nodes which are used to monitor patients' parameters are temperature (Tem-36 sensor) and Pulse rate sensor. These sensors are used for online data collection and are transmitted to the base station. Medical staff can access patient's vital signs by using their personal device. Other parameters such as blood pressure, SpO2 are measured offline.

This paper is arranged as follows: section II will discuss the related work, biomedical sensor nodes will be discussed in section III, while in section IV the proposed solution will be discussed. Then at the end of this paper, the conclusion will be discussed in section V and in section VI future work will be discussed.

II. RELATED WORK

In this paper wireless patient monitoring system web pages and database are designed and implemented. This type of research has been implemented in different manners in some other researches. Some of these researches have been explained here. The research in reference [9] aims to develop a complete system for measuring four signals and simultaneously producing synchronous signals on a WBSN; this system is expected to be very useful in telemedicine and emergency rescue scenarios and also analyzing mutual effects among body signals.

Authors in reference [10] developed a system that gives information of heart rate and body temperature simultaneously acquired on the portable device in real time and shows it through the connected Android application. The proposed system has the benefit of reducing the cost as compared to other developed devices due to the use of easy available Arduino UNO and smart phone (Android device).

The thesis in reference [11] designed and implemented a

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portable, smart body sensor device to allow anyone to get the necessary vital data anytime and anywhere (i.e. continuous monitoring); this approach could be considered as a solution to the lack of family doctors in US.

In paper of reference [12], the aim was to propose a health monitoring services using WBAN to provide online health monitoring to the patient so as to help in saving the time of doctor and patient. Reference [13] produced a proposal to help the medical staff to control the overall state of monitored patients in autonomous, real-time and remotely way. Thesis in reference [14] has to objectives which are the cost-effective design of a real-time home healthcare tele-monitoring system based on mobile cloud computing, while the second approach was to implement a simulation environment to produce robust evidence for cost-effectiveness of a tele-monitoring system so as to explore technology choices in different settings prior to moving to full-scale trials on a more scientific basis.

III. BIOMEDICAL SENSOR NODES

Body sensor nodes that are used in medical applications (called biomedical sensor nodes) should be small size, light weight, miniature, and portable so that patients could feel more comfort when they wear these sensor nodes. These electronic devices are used to measure patients' vital signs and transmit them to the base station so that the medical staff keep stack with the update of patients' state [6].

-Heart Rate Sensor

Heart rate is defined as the number of heart beats per minute (bpm). Heart rate refers to peoples' emotional speed and its indicator to the cardiac function state [7]. As mentioned earlier the heart rate is different from one person to another, according to gender, age, state of the person, health, etc.

-Temperature Sensor

Temperature sensor is an integrated circuit, light weight, small size. It can be used to measure the patient's temperature with accurate higher than the thermistor. The TMP36 is a low voltage, precision centigrade temperature sensor. It provides a voltage output that is linearly proportional to the Celsius temperature. It is also doesn't require any external calibration to provide typical accuracies of ±1°C at +25°C and ±2°C over the −40°C to +125°C temperature range[8].

IV. PROPOSED SOLUTION

The proposed Graphical User interface (GUI) helps doctors and medical staff to have flexible biomedical feedback, the patients' personal information and physiological parameters' are stored in tables. At first, the database system will be explained and then web pages that are used will be discussed.

1. Database System

The database for this system is based on MySQL database server since it supports webpages. The proposed system is based on one main database that contains all tables used for information storage. These tables and their relations are discussed below.

a. Tables

- Address Table: used to store address information such as country, city, state, etc.
- Allergy table: contains allergy type that the patient may has (e.g. allergy from ampicillin).
- Bed table: this table contains bed information (e.g. bed number 12 is in the second floor, medicine ward, Room number 8).
- Blood group table: contains blood group that the patient may be has (e.g. A+, B- etc.).
- Medical table: this table contains patients' medical information such as chief complain and present illness. This would help doctors to easily retrieve patient's history.
- Doctor table: has all the information related to all doctors, such as names, genders, passwords, etc.
- Drug table: contains the trade name of all drugs that are available in the hospital.
- Gender table: contains gender type and connected with other tables by primary and foreign keys to achieve information redundancy.
- Image table: contains patients' ID as Foreign key and images name to store ECG images.
- Notes table: this table contains the patient ID, the doctor ID, the date field for the notes and the note field where the doctor could write notes for the patient.
- Patient table: stores the entire patient's personal information such as name, age, gender, address blood group etc.
- Prescription table: contains the patient ID, doctor ID, drug ID and date of the prescription fields, so doctor could write the prescription for the patients.
- Sensor table: this table contains the temperature, pulse rate, SpO2 and blood pressure fields, besides to the patient ID, time and date fields.

b. Relational Database

Relational database explains the connections and the relations among the tables in the database as sown in figure 1.

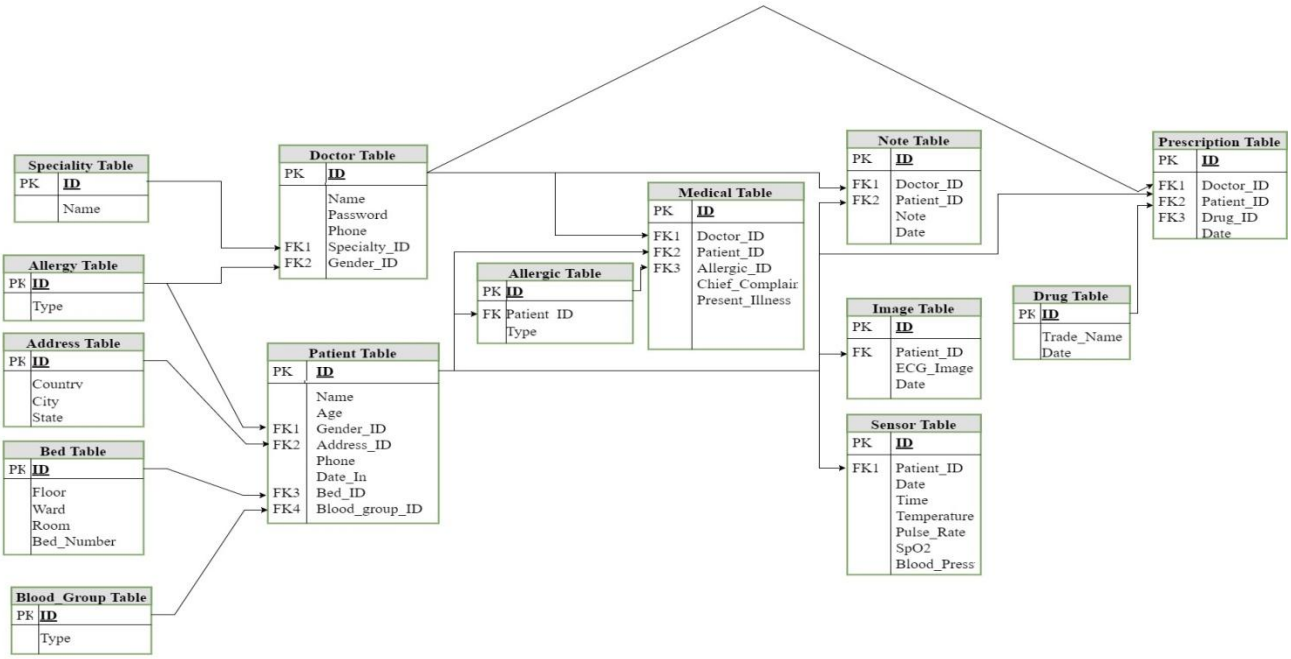

Figure1: Relational Database

2. Web Pages

Web pages are designed and implemented using HTML, PHP, and CSS, to help doctors to restore patient's history and make the monitoring process more flexible for medical staff. At first, we start with the login page, as shown in figure 2. Therefore, each doctor has user name and password to make the system more secure. Monitoring webpages are classified into many tabs: home page, patient profile, biomedical parameters, medical history, and prescription page.

Figure 2: log in form

- Home page: as welcome page and has the open tab that contains about us, contact us and help pages see figure 3.
- Patient profile: when the doctor select the patient name, the patient's personal information will be displayed, such as age, gender address, blood group etc., see figure 4.
- Sensory data: this page will display all the physiological parameters that are measured by sensors for selected patient name, see figure 5.
- Clinical table: used by doctors either to display the medical history or to insert medical information of the selected patient. This is determined by the display, insert tab, see figure 6.
- Prescription page: this page also contains tab either to display patient's prescriptions or to insert prescription information for the selected patient, and this action is determined by the doctor, see figure 7.

Figure 3: Home page firstly appear to the doctor

Figure 5: Physiological parameters measured by sensor

Figure 4: Patient profile page which display patient'sinformation

(a) Display tab which display clinical information

(b) Insert tab to insert patient clinical information
Figure 6 (a, b): Patient clinical history tab

Figure 7: Prescription tab

V. CONCLUSION

In this paper, webpages have been designed and implemented to help the medical staff for easy monitoring and restoring for the patient's state. Database is also designed and implemented for information storage and the relationship among the tables in the database is also explained.

VI. FUTURE WORK

In the future additional tables and web pages such as admin could be added to manage patients and doctors information. Also for nurse, tables could be added to monitor patients and follow drug times that are written and determined by doctors.

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