DETECTION OF PATIENT VITAL SIGNS WITH WEARABLE SENSORS USING IOT

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***Abstract*:** Technology plays a major role in healthcare. It is made easy to monitor the medical parameters through Healthcare communication method using Internet of Things. IOT serve as the catalyst for the healthcare and plays a vital role in wide range of healthcare applications. In this paper the ATMEGA328 is used as a gateway to communicate to the sensors. The microcontroller picks up the sensor data and sends it to the network through Wi-Fi and hence provides real time monitoring of patients. The data can be accessed only by the authorized user (doctor) through password protected Wi-Fi module.

Keywords: *ATMEGA328, Wi-Fi, Sensor, IOT.*

1. INTRODUCTION

Health is one of the global challenges for humanity. Today internet has become one of the important parts of our daily life. The new trend of internet is "Internet of Things". Objects can sense, communicate and share information. Over a private internet protocol or public networks. The IOT is connecting objects to internet and that connection is used for controlling of those objects. IOT is creating invisible network which can be sensed, controlled and programmed. It includes embedded technology which allows them to exchange information and wireless patient monitoring system[7],[8]. The modern healthcare system provides better healthcare services to people at anytime and anywhere.

2. RELATED WORK

The underlying approach is the traditional approach. In this approach there are two basic problems. Firstly, the caretaker must be on site of the patient all the time. Secondly, the patient remains admitted in the hospital for a period of time. In the existing systems vehicular Ad Hoc networks [1] is used, but only limited number of devices can be connected. But the proposed technique uses IOT which enables to connect more number of devices. Alexis Bell and Paul Rogers proposed wireless patient monitoring using ZigBee [2] protocol but it covers only short coverage area. Using IOT this demerit is eliminated as the devices are connected to the internet. The architecture consists of ATMEGA328 microcontroller, temperature sensor, pulse oxy meter sensor, LCD(16x2), piezoelectric buzzer, Wi-Fi module, MEMS

accelerometer, and regulated power supply. It covers a very large area. Also a patient oriented approach is used. The key element of the approach is a reliable and readily available patient monitoring system (PMS)[3]. The proposed modern PMS acquires, record, display and transmits a physiological data from patient body to a remote location at any time. For more efficient medical care the PMS was also incorporated with an alarm system. In order to alert the patient and the caretaker incase the monitored data going out of normal ranges. An active database system should be provided. All patient data are stored in a single server. By using necessary firmware and software the server can be connected to an open communication network through TCP/IP protocol. Existing and widespread mobile networks can assist in this regard. The mobile healthcare system[4] is the matured idea. Smartphone supported with high speed data services, has revolutionized healthcare by playing the role of a powerful medical device for monitoring the patients health. Smart phones enable patients to take a more active role for the betterment of their own health.

3. PROPOSED SYSTEM

The main idea of the designed system is to continuous monitoring of the patients through internet. The proposed system architecture for IOT healthcare is shown below. In this system the ATMEGA328 microcontroller collects the data from the sensors and sends the data through Wi-Fi protocol. The protected data sent can be accessed anytime by the doctors by typing the corresponding unique IP address in any of the Internet Browser at the end user device (eg: Laptop, Desktop, Tablet and mobile phone).

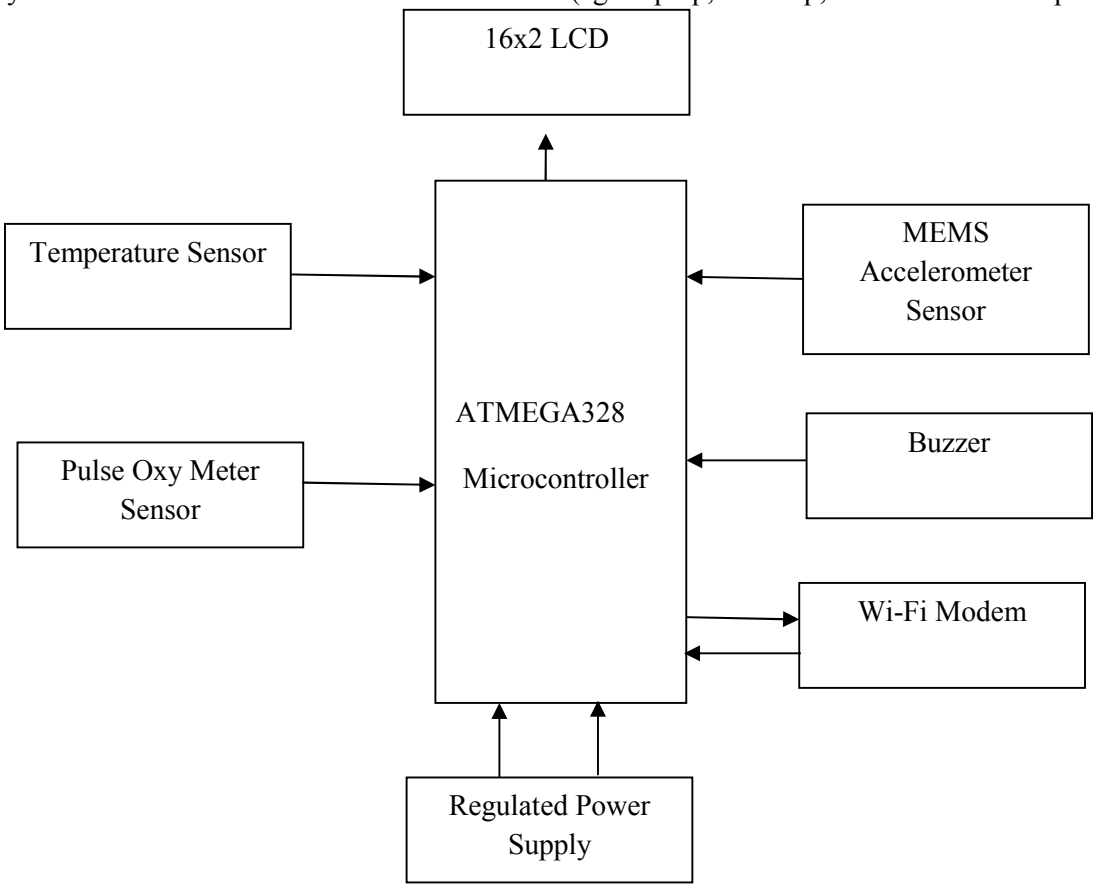

Figure 1: Block Diagram

The microcontroller is connected to IOT modem which provides information to doctor when the heart rate is greater than 90 or less than 60 and when the temperature is less than 20 or greater than 35. During this time the buzzer turns on and alerts the caretaker. LCD is connected to microcontroller to display the transaction process and healthcare data. The user interface html webpage will automatically refresh for every 15 seconds hence the patient health status is continuously sent to the doctor. Hence continuous monitoring of patient data is achieved.

4. HARDWARE DESCRIPTION

ARDUINO: It is an open-source electronics prototyping platform. The arduino Uno can be programmed wih the arduino software IDE. The ATMEGA328 on the arduino Uno comes preburned with a bootloader that allows to upload new code to it without the use of an external hardware. We can also bypass the bootloader and program the microcontroller through the ICSP (In- Circuit Serial Programming) header. Arduino IDE works on windows, linux as well as Mac lion platforms.

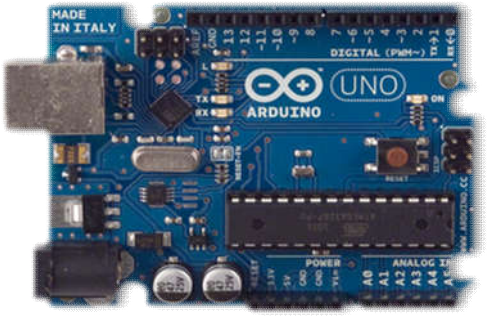

Figure 2: Arduino Board

LIQUID CRYSTAL DISPLAY (LCD): It is a very important device in embedded system. It is very common for screen industry to LCD replacing Cathode Ray Tubes (CRT). An LCD[11] is connected with arduino at 7th, 6th, 5th, 9th, 3rd, and 8th pins to display the reading of various sensors.

WI-FI MODULE (ESP8266): The ESP8266 Wi-Fi module[12] is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to the Wi-Fi network.

TEMPERATURE SENSOR: Thermistors are inexpensive, easily obtainable temperature sensors. It is adaptable and easy to use. These are temperature sensitive resistors. All resistors varies with temperature but thermistors are constructed of semiconductor material with a resistivity that is especially sensitive to temperature. The resistance of a thermistor decreases with increasing temperature. The resistance is found by thermistor and it is converted to temperatuSre using the formula,

$$T=1/[A+B*\ln(R)+C*\ln(R))^3] \quad (1)$$

PULSE OXY METER SENSOR: The pulse sensor is a Plug-and-play heart-rate sensor for arduino**.** It essentially combines a simple optical heart rate sensor[5],[6],[10] with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. It takes only 4mA current and 5V voltage so it is good for mobile applications. Clip the pulse sensor it into 3 or 5 volt arduino and it is ready to read the heart rate to the patient earlobe or finger tip and plug.

MEMS ACCELEROMETER SENSOR: Micro-Electro-Mechanical Systems, or MEMS is a technology can be defined as miniaturized mechanical and electro-mechanical elements that are made using the techniques of micro fabrication. This sensor is used to find whether the patient is fall[9] or not and the fall direction can be determined.

5. SOFTWARE DESCRIPTION

EMBEDDED C PROGRAM: The language extension of C programming is Embedded C, which was developed in order to address the common issues between C extensions for different embedded systems.

6. ALGORITHM

Step 1: Start

Step 2: Connecting three sensors that is pulse oxy meter, temperature and MEMS accelerometer sensor

Step 3: Data is uploaded in cloud that is thingspeak.com

Step 4: Thingspeak data is uploaded the data to thing view and python server

Step 5: Thing view is used for continuous monitoring of the patients health

Step 6: If threshold level, temperature is high python server will send the alert

Step 7: Alert will send to twitter app

Step 8: Feedback will be send to the google gauge measuring tool

Step 9: Stop

7. EXPERIMENTAL RESULTS

When the power supply is given, the temperature from thermistor, heart rate from pulse oxy meter and fall detection from accelerometer sensor is determined. Same information is uploaded to thingspeak cloud which is the database of the patient. That information into thing view app which is useful for patient for monitoring his/her results. If any abnormal condition occurs, it displays on LCD, temperature is high and heart beat rate is high and same information into python server at same time from thingspeak. If any abnormal condition occurs, python server itself updates the status of the patient. At the doctor's twitter account. After status reached to twitter account, updates and send message.

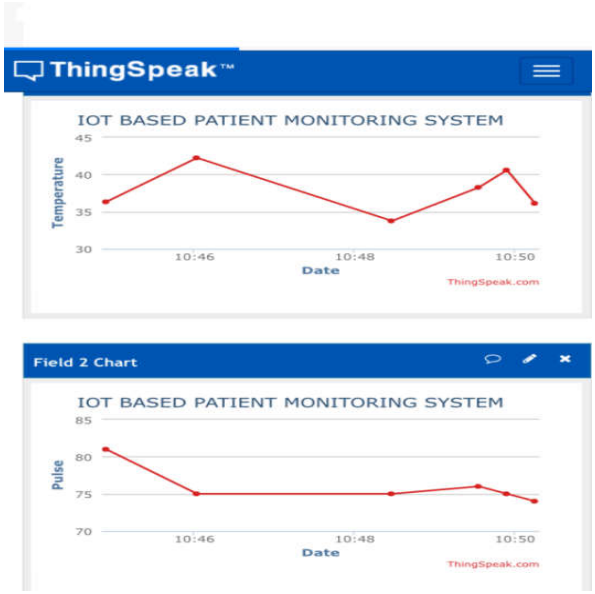

Figure 3: Screenshot of Patient Parameters updated in thingspeak

8. CONCLUSION

This current designed system provides low complexity, low power consumptions and highly portable for health care monitoring of patients. It can eliminate the need of expensive facilities. The doctor can easily access the patient's information at anywhere with the help of web server. In future, we can develop a big database of all patients of any hospital and these can be monitored continuously, and also the information is uploaded to the hospital server. These servers keep the information of the patients in the database, and doctors can have the access of patient's history, when any further consultancy happens with the doctor.

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