

IOT based Patient Health Monitoring System

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Abstract - This paper gives us the development of a microcontroller based system for wireless heartbeat and temperature monitoring using Wi-Fi module. By this we can easily provide real time information available for many users and can send them alert in critical conditions over internet. In India many patients are dying because of heart attacks and reason behind this factor is that they are not getting proper help during the period. To give them timely and proper help first we want to continuous monitoring of patient health. The fixed monitoring system can be used only when the patient is lying on bed and these systems are huge and only available in the hospitals in ICU. The system is developed for home use by patients that are not in a critical condition but need to be timely monitored by doctor or family. In any critical condition the SMS is send to the doctor or any family member. So that we can easily save many lives by providing them quick service.

Key Words: Embedded Systems, AVR Microcontroller, Internet of Things, Patient Health Monitoring, Sensors.

1. INTRODUCTION

With the development of world, Health monitoring system is used every field such as hospital, home care unit, sports. This health monitoring system use for chronicle diseases patients who have daily check-up. Normally it is difficult to keep track on abnormalities in heartbeat count for patient itself manually. The average heartbeat per minute for 25-year old ranges between 140-170 bpm while for a 60-year old it is around between 115-140 bpm and body temperature is 37degree Celsius or 98.6 Fahrenheit. Patients are not well versed with manual treatment which doctors normally use for tracking the count of heartbeat. There are various instruments available in market to keep track on internal body changes. But there are many limits in maintenance part due to their heavy cost, size of instruments and mobility of patients.

So, researchers design a system as portable device. Researcher designed different health monitoring system based on requirement. Different platform like Microcontrollers are used

to design the system based on this performance. Different biomedical sensors like temperature sensor, heart rate sensor, blood pressure sensor are used for monitoring the health condition which is integrated on single system on-chip. If any varied change takes place it is notified. This notification would help to take an appropriate action at an instance of a time. This would save patients from the future health problem which would arise. This would also help patient's concern doctor to take an appropriate action at proper time.

2. Wireless Sensor Network

A wireless sensor network (WSN) is a wireless network which consists of structurally distributed autonomous devices that use sensors to monitor physical or environmental conditions. These autonomous devices, or nodes, combine with routers and a gateway to create a WSN system. Sensor networks are the key to gathering the information needed by smart environments, whether in buildings, utilities, industries, home, ships, transportation systems automation, or elsewhere. Recent terrorist and guerrilla warfare countermeasures require distributed networks of sensors that can be expanded and have self-organizing capabilities. In such applications, running wires or cabling is usually impractical. A sensor network is required that is fast and easy to install and maintain. The smart gateway is designed to enable WSN and public communication networks to access each other with seamless internetworking. In this design, the gateway consists of central control unit, database (DB), WSN module, WLAN AP, and GSM module.

Structure of Gateway The distributed measurement nodes communicate wirelessly to a central gateway, which provides a connection to the wired world where the data can be collect, process, analyze and present your measurement data. To extend distance and reliability in a wireless sensor network, you can use routers to increase an extra communication link between end nodes and the gateway. The gateway includes three external communication modules (ECM): WSN Module, WLAN AP, and GSM Module. WSN module, on one hand, is basically used for receiving data packages from the core of the WSN; on the other hand, it is used to send commands to the WSN or specific sensor nodes.

It implements the protocol translation and provides the physical mechanism between gateway and WSN. In this design, a MIB520 USB Interface Board attaching with the sink node in WSN is used as the WSN module. A GSM module is needed when sending SMS to the subscribers using GSM networks, or sending data to remote server through GPRS if necessary. GT64 is an intelligent GSM/GPRS control terminal which puts together GSM networks with the 1800/1900 MHz RF bands. The communication can be realized via SMS over GSM or SMS over GPRS using standard AT commands. WLAN AP has two tasks. First, in order to connect to the internet, it acts as a client PC and accepts the IP address assigned by the internet server. Second, it sets up an ad-hoc network for subscribers and system maintainers so that they can connect to the smart gateway with laptop or PDA easily.

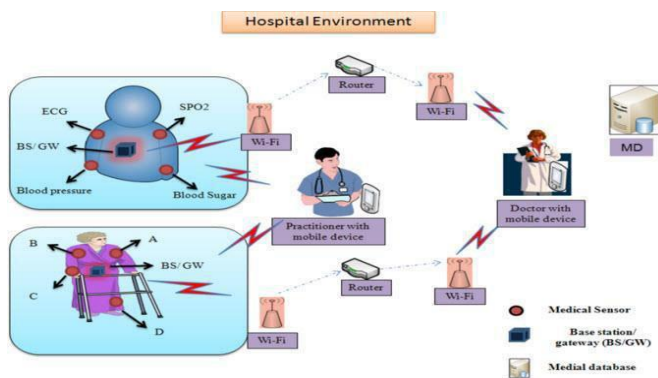


Fig -1: Sensor and IOT connection in a Hospital Environment

In this paper we discussed through various researches what development has been done in Patient Health Monitoring System and our proposed work regarding the following paper.

3. LITERATURE SURVEY

A number of reviews on the subject of Wireless Sensors techniques were done in the past either as part of research papers/technical reports on iot based Health Monitoring System.

(a) First System Here, researcher designed health monitoring system using ATmega8 microcontroller with Wireless Body Area Sensor Network (WBASN). In this work, the sensors which are used here are Temperature sensor, Blood pressure sensor, Heart beat sensor. These sensors are placed on human body which are helps to monitor the health condition without disturbing the daily schedule of the patient and these health related parameters are then forwarded to physician’s server using long range wireless technology GSM. Health monitoring system consists of sensors, microcontroller, LCD display and GSM modem to transmit or receive health related data to or from the doctor. Similarly, at hospital same GSM modem is used. Hence, GSM modem helps in the establishment of network between

patient’s server and doctor’s server. LCD(Liquid Crystal Display) display is providing to show the instant result to the patient. Here researcher used LM34 as temperature sensor, IR LED and red LED is used for heart rate monitoring and Pressure transducer or the sensor based on piezo-electrical material is used to measure the systolic BP and diastolic BP. Microcontroller reads data as given by the temperature sensor, blood pressure sensor and heart rate sensor and processing it gives the output in the form of digital and it gets directly display on LCD or it gets transmitted to the doctor’s server through GSM modem. This system gives exact and instant result with high accuracy which gets directly display on LCD. It takes max 4-5 sec to monitor the doctor’s server using GSM wireless technology .This system takes small amount of time to know the health condition of patient and then delivers the report to the doctor.

(b) Second System using same system, health parameters are send by using RFID reader, Bluetooth, GSM and UMTS. This system gives facility to monitor the blood pressure of patient. The health parameter directly sends to the doctor using GSM and UTMS. Here, video guide is used. This video guide feature serves the patients age and his blood pressure correctly. This system consists of three parts: Touchpad, remote server and reading of the Tag ID and BPM. For reading the Tag ID and BPM, use a microcontroller unit (MCU) as a kernel. The client touchpad receive the blood pressure measurement (BPM) data a RFID through Bluetooth. Client touchpad send the data to the the health parameter. Also, these health parameters are directly send to remote data center and remote data center to the doctor using GSM and UMTS wireless technology. Data gets transmitted in the form of the packets. This system helps to store previous data. Similarly, it takes less time to monitor the blood pressure of the patient.

(c) Third System shows the blood pressure monitoring system using microcontroller. This system includes motor control unit, Microcontroller ATmega328, LCD display. The pressure sensor is directly connected to the cuff, which is inflated or deflated via a motor and valve . ON and OFF switches of motor are controlled by the microcontroller at correct time. Due to changes in the ON and OFF switches of the motor, the wrist cuff gets inflated and deflated, this pressure is measured by the pressure sensor. Pressure sensor generates the health parameter in the analog sensor. The processing of analog sensor is done with the help of the microcontroller and gives digital output which is displayed on the LCD or on the Personal computer using RS232. Magneto resistive RAM (MRAM) stores the value of systolic and diastolic blood pressure and is directly connected to the microcontroller. Similarly, here no need of pump the cuff by hand, all the system is controlled by the microcontroller. It is not required to calculate or observe blood pressure manually. Time consumption is very less compared to old system.

4. WORKING OF CIRCUIT

Heart Beat Monitor with microcontroller ATMEGA16 (AVR). Heart Beat Monitoring circuit using LM358 The use of microcontroller is in every field even we can use it in the design and fabrication of biomedical equipments. An example is given here. The microcontroller AT89S51 (8051) is here used for development of a heartbeat monitoring system. By placing your finger in between, a LED and photo resistance, person can easily detect the pulses of heart, the analog voltages are further processed with an operational amplifier LM 358, this chip has two built in Op-Amps. The TTL pulses or digital pulse are then feed to the external interrupt of AVR microcontroller. By using a software counter in the code, they can count the pulses, and the result the process is displayed on an LCD (2 line 16 characters).

$$HB = 5184/t$$

Where t is average of time delay between 2 consecutive pulses here use of first 5 pulses for calculation of HB.

TEMPERATURE SENSOR (LM35) - This series consist of precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 does not require any external calibration or trimming to provide accuracies of (+/-)1/4 degree Celsius at room temperature and (+/-)3/4 degree Celsius over a full -55 to +150-degree Celsius temperature range. Less than operates from 4 to 30 volt. Less than 60uA current drain.

HEAR BEAT MONITORING SENSOR - It is designed to give digital output of heat beat when a finger is placed on it. Operating voltage is +5V D regulated, operating current 100mA, output data level 5V TTL level, the heart beat detection is indicated by LED and Output High Pulse, Light source 660nm Super Red LED.

ECG SENSOR - (piezoelectric sensor) It is device that operates on the phenomenon "piezoelectric effect" to measure pressure, acceleration, strains or force by converting them to an electrical signal. Modes of operation can be distinguished: transverse, longitudinal, and shear.

Working of ADC - Micro controller sends the address of port to the ADC. For example, 000 for channel 0. μ c gives high pulse to ALE (Address Latch Enable) to latch the address into the ADC. After the above process, it sends SOC(Start of Conversion) pulse, so that ADC starts performing successive operations for digital conversion on the selective channel. ADC starts to process the input channel for data information in digital form. When the data is available on the port, it sends EOC (End of Conversion) pulse to the μ c. μ c continuously monitors the EOC pulse. When it goes low, it uses the data provided from ADC. LM 555 is connected externally to the ADC in Astable mode to give clock pulse

LCD 16x2 - It is called Liquid Crystal Display. There is a use of 16x2 characters LCD. This will be connected to microcontroller. The function of LCD will be to display all the system generated messages coming from the controller. LCD will provide interactive user interface.

Wi-Fi Module - ESP8266 offers a self-standing Wi-Fi networking with TCP/IP protocol stack which provides Wi-Fi connection to any microcontroller.. ESP8266 when connected on-board it has storage and processing capabilities hence can be easily connected to the sensors based on the application. The main reason to use ESP8266 as Wireless Module is due to it's compact size and high performance.

5. CONCLUSIONS

As per paper work, health monitoring system design is based on researcher idea that meets to the patients need. As per consideration of conventional system, this system still in use from their manufacturing but it is very bulky to handle individually and size and cost are also more compared to the advance system and also it take more than 1minute for getting the exact result.

As per consideration of advance system, each system has its own advantage. Each health monitoring system has different specification as per patient's requirement. This system provides more medical instrument facility on single system on-chip compare to conventional system. This system takes less than 1 minute to calculate result related to health condition. Size also reduces compared to the conventional system because of integration of number of medical instrument on single chip. So, size, cost and complexity also reduce.

As consideration of microcontroller like ATmega(AVR), PIC controller there is need to connect external peripheral for signal conditioning. Therefore, size, cost and flexibility are more. Hence, as external peripheral increases cost and size also increases. Researchers designed health monitoring system as per patient's requirement. Because of wireless data transmission over internet, health related data will be send to doctor's personal computer or on his mobile. So, need to go hospital every time and sending message to the doctor gets immediate remedy related to the health condition.

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