

Health Monitoring System of Patient

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Abstract

Patient-monitoring systems became an important topic and research field today. Research on health monitoring were developed for many applications such as military, homecare unit, hospital, sports training and emergency monitoring system. Patient monitoring systems are gaining their importance as the fast-growing elderly population demands for caretaking. These systems use wireless technologies to transmit vital signs for medical evaluation. This technique presents a system to upgrade existing health monitoring systems in the hospitals by providing monitoring capability and thus a better cure.

Keywords: Pulse sensor, LM35 Temperature sensor, Arduino, Zigbee network, Wireless Monitoring

I. INTRODUCTION

Recently, wireless sensor networks are used to structure home-care system in many researches. Wireless sensor networks application for physiological signals communication transmission has many technologies. Such as the Infrared, Bluetooth and ZigBee etc. Because the angle limit problem of the infrared transmission, and the infrared have not be used for Physiological signal transmission. Although Bluetooth is better than ZigBee for transmission rate, but ZigBee has lower power consumption. Hence, ZigBee is generally used for 24 hours monitor of communication transmission systems. Compared to Bluetooth, ZigBee provides higher network flexibility and a larger number of nodes, and a better transmission range with low power consumption. Large number of nodes enables the expansion of such systems. Recently, ZigBee-based wireless networks were tested in various applications. The proposed patient monitoring system would be beneficial for medical practitioners to do proper and better treatment; also it would be useful for health care providers to improve disease management. The patient is monitored from ICU and the data transferred to the PC is wired. This kind of patient health monitor reduces the workload of staff. As sensors are used for measuring health parameters there will not be any human errors involved.

II. OBJECTIVE

The main objective of the project is monitoring health parameters of patient wirelessly. The parameters include temperature and heart beat rate of the patient. These parameters are continuously monitored and displayed on the doctor's pc using zigbee. This helps the doctor to have the updated information of the patient. The features of the whole system is as follows.

- The system is easy to use and access the parameters.
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- The parameters are transmitted to the doctor's pc wirelessly.
- Input to the system is given by the sensors that are connected to the arduino.
- The parameters measured through the sensors are transmitted to the doctor's pc wirelessly.

III. METHODOLOGY

Initially LM35 temperature sensor and Pulse sensors are interfaced by connecting their OUTPUT pins to the ADC pins of Arduino mega 2560 microcontroller[7]. Meanwhile these two sensors are connected to the Patient body. And they will sense the Human Body temperature as well as Heart Beat respectively. The sensed Human health parameter Data is the analog output and that analog signal is given to the ADC pins of arduino for converting it to digital signal. Both sensors are wrapped to the Patient Hand with the help of wrist band.

The LM35 temperature sensor will gives the calibrated output interms of Degree Celsius by comparing the Room temperature with Human body temperature[3]. So we don't need to calibrate the output from degree kelvin to degree Celsius as in other type of sensors.

Whereas Pulse sensor will gives the Patient Heart Beat details in BPM(i.e., Beats per minute). It works in a simple manner i.e., while Heart pumps(Beats) blood will circulate to the whole body through blood vessel[4]. And when the blood flows through the vessel, Pulse sensor will consider it as one beat and gives the pulse output with a peak value of 2.5v. So to get the heart beat in BPM we have to keep the sensor for 1 minute. After that it will gives the exact value of Heart Beat. These sensors output are controlled by the flow of PROGRAM, which is uploaded into the Arduino microcontroller[5]. And meanwhile sensors outputs are updated to every 2ms. The Human Heart beat rate based on Age are shown in the Table 1.

Table – 1
Heart rate based on Age

HUMAN CATEGORY	HUMAN AGE IN Years/Months	HEART BEAT IN BPM
New born	0-3 Months Old	100-150
Infants or Babies	3-6 Months	90-120
Infants	6-12 Months	80-120
Children	1 – 10	70- 130
Children & Adults	10 +	60- 100
Well-trained Adult Athletes		40- 60
Adult	20 – 29	99-165
Adult	30 – 39	94-160
Adult	40 – 49	89-151
Adult	50 – 59	84-143
Adult	50 – 59	79-134

Next part is Communication, which is again split into two parts, called sending End and Receiving End. And at each side separate ZIGBEE's(wireless transmitter/receiver) are used for Transmitting and receiving the sensors data[6]. The transmitter zigbee which is connected to the arduino is called the "Co-ordinator zigbee" and the other zigbee which is connected to the doctors PC using zigbee module through USB cable is called the "End Device AT".

At the sending End side Sensors outputs are received by the Rx pin of co-ordinator Zigbee through the Tx pin of Arduino. And again the same Data received is transmitted to the End device via Wireless. The data sent by the co-ordinator Zigbee is further Received by the End device, which is connected to the doctors PC using zigbee module through USB cable.

These two will identify each other by having the same PAN ID. And for sharing the data among two Zigbee's we need to enter the "Destination Low" and "Destination high" address of one Zigbee to the other while programming the Zigbee module. To monitor the received Patient Health parameters in the Doctors PC, open the Terminal window of X-CTU Zigbee software[6]. And to monitor it we need to do some initial settings in the software. i.e., Go -to "Pc settings" ↵ "Test/Query" later it will test the COM Port and if any data present in the serial port then it will generate a dialogue box of "communicating with com port is ok" then click on ok. This indicates that COM Port is ready for receiving the data. Again Go to "Modem configuration" and enter the modem name as mentioned on the Zigbee. Similarly enter the function set as "End device AT". Now the received data is ready to monitor.

The working block diagram of the system is shown below.

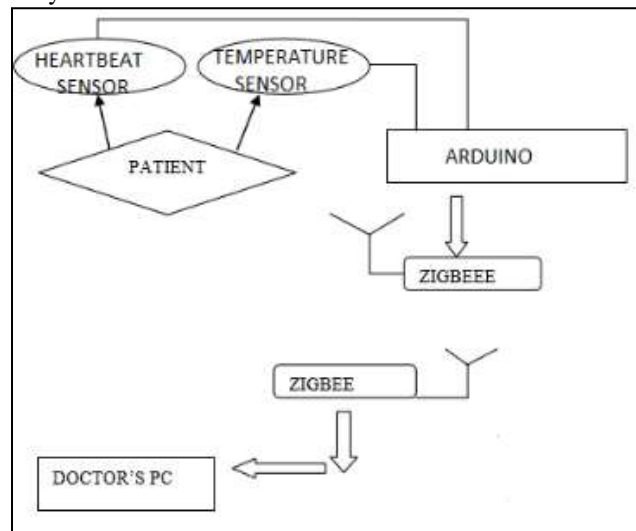


Fig. 1: Block diagram of patient Health monitoring system

IV. RESULTS AND DISCUSSION

This technique presents a system to upgrade existing health monitoring systems in the hospitals by providing monitoring capability and thus a better cure. This system is based upon wireless technology i.e. Zigbee providing low cost effective solution. As it is wireless device, the cost of cables is reduced here. This intelligent monitoring system provides long term monitoring capability useful for the staff in the hospitals and reduces their workload. By our project we were able to measure human body temperature as well as heart rate and monitored in a remote pc.

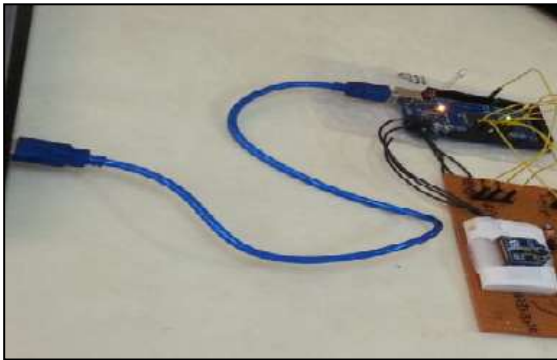


Fig. 2: Connection of co-ordinator zigbee

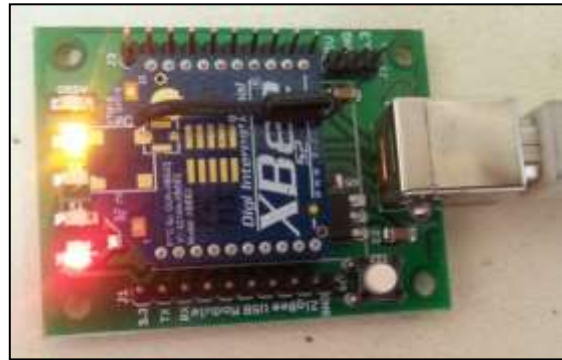


Fig. 3: End device zigbee connected at doctor's PC

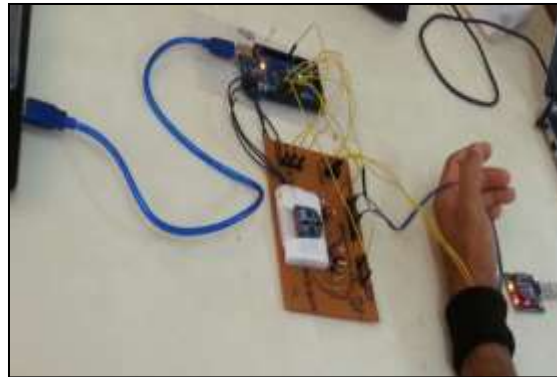


Fig. 4: Pictorial representation of the whole setup

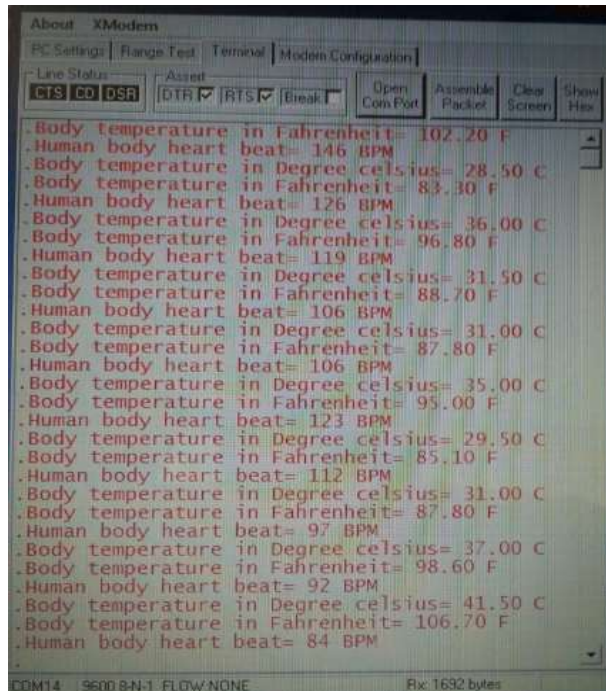


Fig. 5: Data monitored in doctor's pc

V. CONCLUSION

Using ZigBee for wireless network reduces power consumption. The interfacing of sensors to the arduino is very easy as the arduino contains a inbuilt ADC. Once the interfacing is done the next part is to program arduino. When compared to other embedded systems, programming of Arduino is easier. The obtained data from arduino serial communication port is given to transmitting zigbee. The health parameters are transmitted wirelessly and monitored in doctor's pc after following some procedure in X-CTU application. The data is monitored in terminal window of X-CTU application.

VI. FUTURE SCOPE

The future scope of this health monitoring system is very wide. Many sensors can be connected to arduino such as ECG, BP, along with heart beat and temperature and monitored in doctor's pc of many patients. Along with zigbee a GPS system can also be adopted as whenever the health parameter exceeds a predetermined value a SMS go to the doctor so that immediate action can be taken. If not, store all the data in doctor's pc using zigbee . Such that the stored data can be viewed at any time the doctor wants. The doctor can observe health parameters of many patients in his pc.

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