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PATIENT HEALTH CHECK UP USING WIRELESS MONITOR

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ABSTRACT: ***This paper describes the development of a wireless temperature monitoring system based on a microcontroller at a reasonable cost with great effect. Most monitoring systems that are in use in today's world works in offline mode but it is of great need that a system must be designed so that patient can be monitored remotely in realtime. The paper consists of sensors which measures body temperature of a patient which is controlled by the microcontroller. The readings are displayed in LCD monitor. Wireless system is used to transmit the measured data to a remote location. The temperature sensor measures the temperature and the data is sent to the microcontroller for transmission to receiving end. Finally, the data are displayed in the LCD at the receiving end.***
Keywords: Microcontroller, Body temperature, Remote Monitoring, Temperature sensor

I. INTRODUCTION

In today's world, the maximum use of resource is always complimented. So, the use of wireless technology is enhanced to meet the need of control and monitoring. Patient Monitoring (PM) is a technology that enables us to monitor patient outside of clinic or hospital without having to visit a patient. It may increase access to health services and facilities while decreasing cost. Patient Monitoring saves time of both patient and doctor, hence increasing efficiency and reliability of health services. Body temperature is the major sign that are routinely measured by physicians after the arrival of a patient. Normal body temperature varies from person to person and changes throughout the day. The body temperature is lowest in the early morning and highest in the early evening. The normal body temperature is about 37° C or 98.6° F. However, it can be as low as 36.1°C (97° F) in the early morning and as high as 37.2 °C (99° F) and still be considered normal. Thus, the normal range for body temperature is 97 to 100 degrees Fahrenheit or 36.1 to 37.8 degrees Celsius Temperature can be measured by using different types of sensors. These sensors come in different forms such as thermocouples, thermistors, resistance temperature detectors (RTD), and integrated circuit (IC) sensors. The temperature sensor produces analog output voltage which is proportional to the temperature. The temperature sensor requires analog to digital (A/D) converter so that the analog output voltage can be converted to digital form. The output of the temperature sensor is connected to the Port A of microcontroller. The microcontroller processes this data and displays it in LCD as well as sends it to the receiving end for displaying at the place. This paper describes the design of a very low-cost patient monitoring system which measures body temperature of a patient and sends the data to a end where the data will be displayed and physician or doctor will be able to examine him/her. This device will be much needed during emergency period or for saving time of both patient and doctor

II. SYSTEM HARDWARE

The device consists of two microcontroller- one for the measuring and transmitting end while other for the receiving end. For measuring temperature, the device uses LM35 IC.

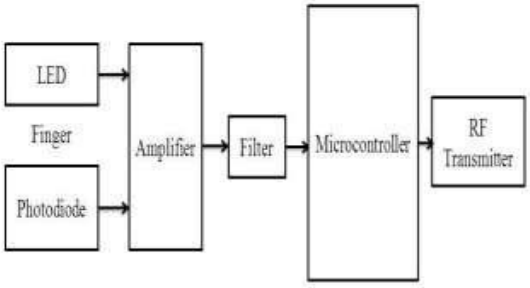


Fig. 1: Block diagram showing temperature measuring and transmitting system

The device measures temperature of the body and transmits it wirelessly with the help of RF transmitter/ buzzer and the data is received at the other end, and finally the data is displayed on the LCD. Figure 1 and figure 2 shows the block diagram of the device of transmitting end and receiving end respectively.

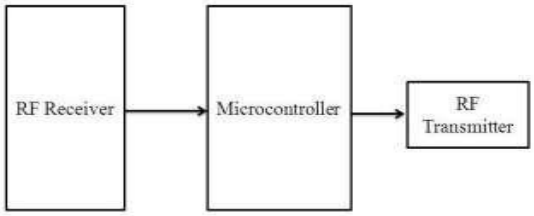


Fig. 2: Block diagram of receiving end showing display.

Temperature Sensor:

The LM35 series are precision integrated-circuit temperature sensors. The output voltage of LM35 is linearly proportional to the celsius or centigrade temperature. The other temperature sensors are calibrated in Kelvin. LM35 provides more accuracy of ±¼°C at room temperature and ±¾°C over a full -55°C to +150°C temperature range than other temperature sensors without the need of any external calibration. Thus, LM35 has an advantage over other sensors. LM35 has very low self-heating of less than 0.1°C in still air as it draws very less current (60μA) from supply. This temperature sensor has linear output, low output impedance and provides accurate inbuilt calibration so that the control circuit is becomes easy. Only single power supply is needed to operate this temperature sensor. It is rated to operate over a temperature range of -55°C to +150°C [8]. Since, the temperature sensor LM35 does not have moving

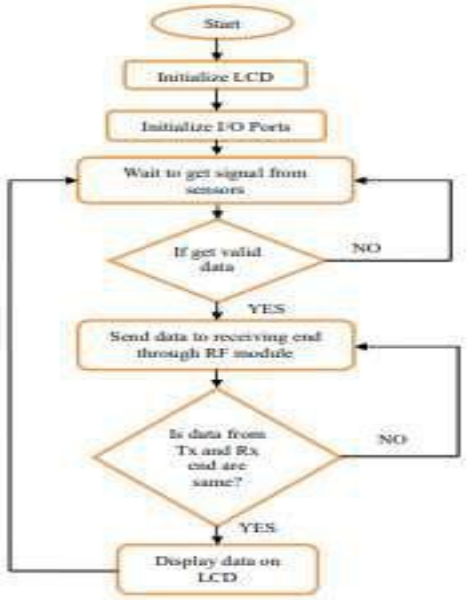
parts, it is accurate, does not require calibration, works under many environmental conditions and is consistent between readings. It is cheap and easy to use. This unit consists of a temperature sensor to measure the temperature of a patient which is connected directly to the microcontroller.. The temperature sensor used in this project is LM35, which is an analog sensor. The LM35 produces analog voltage which is directly proportional to the temperature sensed by it. The analog voltage produced by LM35 is fed to Analog to Digital Converter (ADC) to convert it into digital form so that the digital equivalent of the voltage can be used by the microcontroller for further processing. The microcontroller receives the data in analog form and converts it into digital form then sends it to the RF transmitter so that the data can be sent to the remote end. At the receiving end, RF receiver receives the data and sends it to microcontroller. The microcontroller does the processing and finally the data is displayed on the LCD along with the data of heartbeat.

Temperature sensor LM35

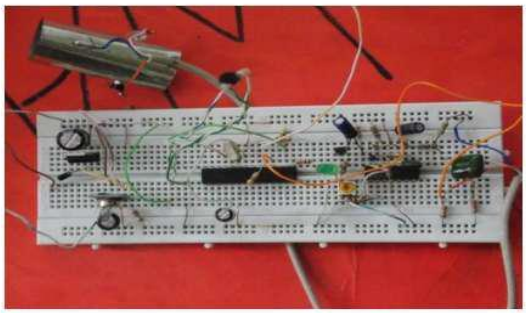
For measuring body temperature, the left pin of LM35 is connected to the power (5V) and the right pin is connected to the ground. The middle pin will give us an analog voltage that is directly proportional (linear) to the temperature as shown in Fig. 5. The analog voltage is independent of the power supply. Thus, the middle pin is connected to the microcontroller at port A (pin 2) for further processing. The scaling factor for LM35 is 0.01V/°C. Body temperature is measured by holding LM35 with finger and corresponding change in temperature is converted into analog voltage which is then fed to microcontroller by the middle pin of LM35. The microcontroller has ADC in it and it does further processing and sends the measured data to the remote end via RF transmitter. At the remote end, the RF receiver receives the data and sends it to the microcontroller which then processes and displays the data in the LCD.

System Flow-Chart:

The flowchart of the system is shown in Fig. 8. The system is started by initializing the LCD and input/output ports of the microcontroller. Then, the system waits for the signal, which is to be received from the sensors (heartbeat sensor and temperature sensor). When the system receives a data, it checks if the data is valid. If the data is not valid then the system waits for another signal. But, if the received data is valid, the data is sent to the receiving end through RF module. The system then checks whether the data from the transmitting and receiving end are same. If the data is not same, the data is sent again. If the data is same, then the received data at remote end is displayed on the LCD.



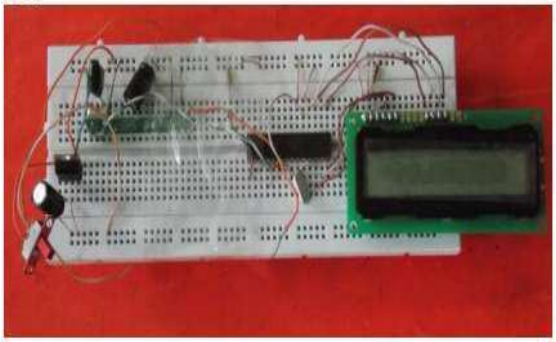
Circuit Implementation:



Transmitting end: fig 1

The implemented circuit is as shown in figure 1 and 2. Figure 1 shows the transmitting end circuit which consists of the measuring and transmitting devices. The use of this device is very simple. At first, the device at the transmitting and receiving end is connected to the power supply and the both ends are switched on by turning on the switch. Wait until the display on the LCD shows the message “Please put your finger”. Insert your finger into the arrangement after the message is displayed and the device will start measuring heartbeat. The device will show the heartbeat after 15 sec on LCD at the receiving end. Figure 2 shows the implemented circuit at receiving end. The body temperature and heartbeat of a patient were found out to be 37°C

Receiving end: fig:2



FUTURE WORKS:

- The device can be connected to PC by using serial output so that measured temperature can be sent to PC for further online or offline analysis.
- Warning for abnormalities of health condition can be displayed.
- Sound can be added to the device so that the device makes a sound each time a pulse is received and alarm is started for abnormal health condition.
- The output can be sent to mobile phones by using GSM module or Bluetooth module for further analysis
- More parameters (like blood pressure) can be added to the device.

III. CONCLUSION

Simple operational amplifier with inverting and non-inverting configurations was used to amplify and filter the signal from sensor which narrowed the detecting range of temperature. Better configuration of instrumentation amplifier and other filters like Butterworth and Chebyshev filters with higher order can be used for better signal conditioning compromising to the complexity of the amplifier and filter circuit. Microcontroller contains in-built Analog to Digital Converter (ADC). So, extra Analog to Digital Converter device is not necessary. RF transmitter and receiver were preferred over IR transmitter and receiver as RF transmitter and receiver is superior over infrared device in many ways. The temperature was measured by using precision integrated temperature sensor LM35. The data were processed in the microcontroller and sent to the remote end wirelessly by using RF transmitter and received at the remote end by using RF receiver. The received data was processed in the microcontroller and the data measured was displayed successfully with the help of LCD at the remote end. The wireless communication was preferred because it gives greater mobility to the sensor equipment and reduces the cost.

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