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Health Monitoring System Using Arduino UNO

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***Abstract*—** An android application has been designed in order to easily see the patient's information by their doctors and family members. The objective of this proposed approach is to design an automated wireless health monitoring system. The aim is to monitor the patient's body temperature which should be displayed to the doctor using RPM (Remote Patient Monitoring) technology. In hospitals, the health of patients is monitored by hospital staff members and patient relatives. The patient's body temperature are continuously checked and recorded on smart mobile phone.

I. INTRODUCTION

By using the system the healthcare professionals can monitor, diagnose, and advice their patients all the time. The health parameters data are stored and published online. Hence, the healthcare professional can monitor their patients from a remote location at any time. Our system is simple. The Future work of the project is very essential in order to make the design system more advanced. In the designed system the enhancement would be connecting more sensors to internet which measures various other health parameters and would be beneficial for patient monitoring i.e. connecting all the objects to internet for quick and easy access. Establishing a Wi-Fi mesh type network to increase in the communication range The LM35 series are precision integrated circuit LM35 temperature sensors, whose output voltage is linearly proportional to the temperature in Celsius (Centigrade). The LM35 sensor thus has an advantage over linear temperature sensors, calibrated in °Kelvin, as the user is not required to subtract a large constant

voltage from its output to obtain convenient centigrade scaling. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°Cover a full -55 to +150°C temperature range. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

II. COMPONENTS USED

A. ARDUNIO UNO

The Arduino Uno is a microcontroller board based on the AT mega 328.The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. The Arduino Uno has a number of facilities for communicating with a computer, another Arduino or other microcontrollers. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The Arduino Uno can be programmed with the Arduino software.

B. LM35 TEMPERATURE SENSOR

The LM35 series are precision integrated-circuit LM35 temperature sensors, whose output voltage is linearly proportional to Celsius temperature. The LM35 sensor thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.

C. ARDUINO IDE

Arduino consist of both a physical programmable circuit board (microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino software (IDE) contains a text editor for writing code, a message area, a text console, a tool bar with buttons for common functions and series of menus.

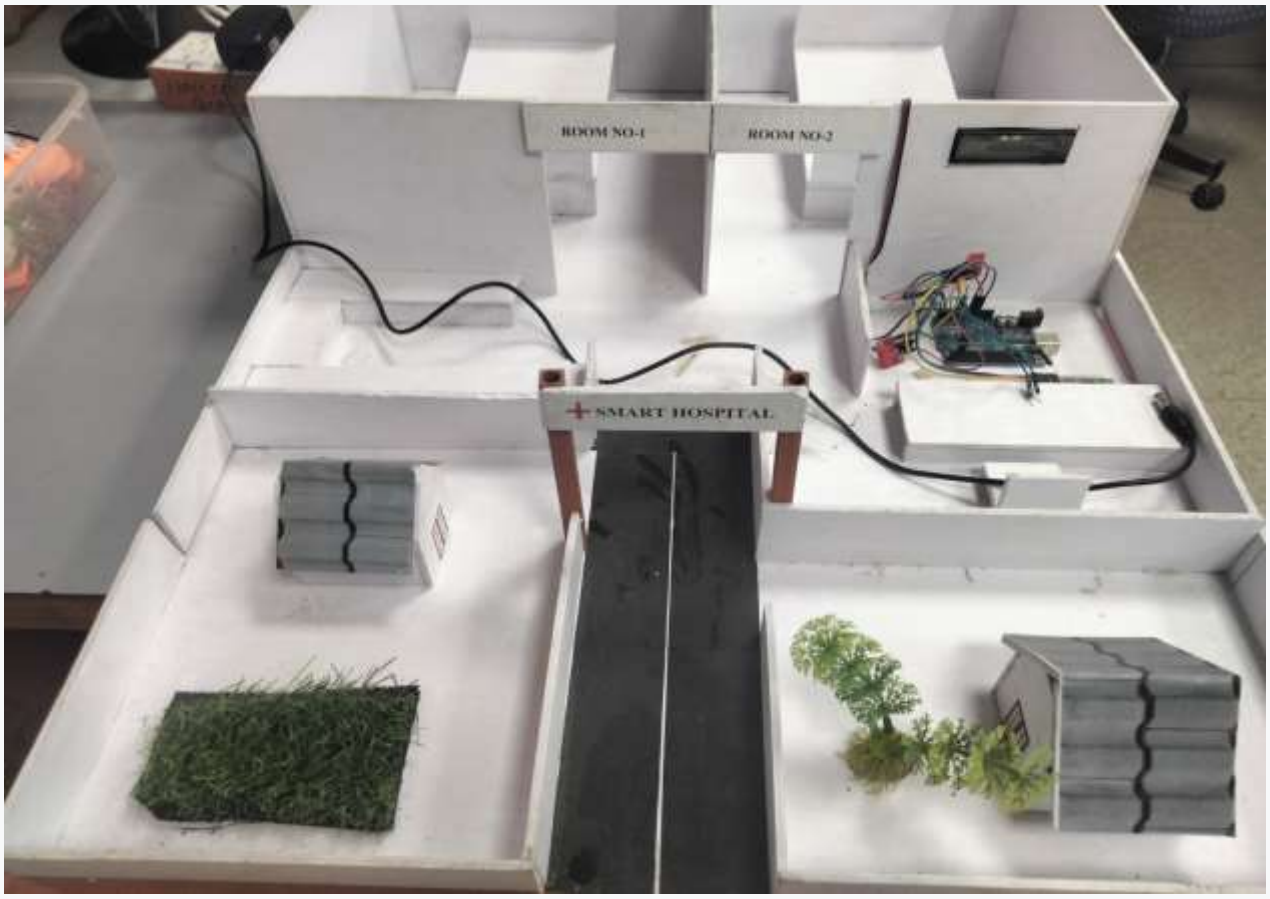
D. HC-05 Bluetooth

HC-05 is a Bluetooth device used for wireless communication with Bluetooth enabled devices (like Smartphone). It communicates with microcontrollers using serial communication (USART). Default settings of HC-05 Bluetooth module can be changed using certain AT commands. Now we are ready to connect the Smartphone to the Bluetooth module and the Arduino.

With many new healthcare technology start-ups, Arduino is rapidly revolutionizing the healthcare industry. In this project we have designed an Arduino based patient health monitoring system using Arduino. In today's world, maximum utilization of resources is always appreciated. Therefore, the use of wireless technology is increased to meet the need for remote control and monitoring. Remote Patient Monitoring (RPM) is a technology that helps us to monitor the patient even when the patient is not in the clinic or hospital.

It can increase access to health services and facilities while reducing costs. Remote patient monitoring saves both patient and doctor time, thereby increasing the efficiency and reliability of health services. Heart rate and body temperature are the main signs that are routinely measured by physicians after the patient's arrival. Heart rate refers to the number of times the heart contracts and relaxes per unit of time (usually per minute). Heart rate varies for different age groups. For human adults aged 18 or older, the normal resting heart rate is about 72 beats per minute (bpm). If the heart rate is low when the patient is at rest, the heart function is said to be efficient. Infants have a much higher proportion than adults, around 120.

We have analyzed a wireless patient health monitoring system of human temperature and heart rate using nRF24L01. Heart rate was measured using a photodiode and bright LED while temperature was measured using a precision integrated temperature sensor LM35. Both data were processed in Arduino Uno and sent wirelessly to remote end using nRF transmitter and received at remote end using nRF receiver. The acquired data was processed in Arduino Uno and the measured data was successfully displayed using LCD at the remote end. Wireless communication was preferred because it offers greater mobility and lower cost to sensor equipment that has multi-transmitting sections.



The necessary components used in this system include a power supply, an ATmega328 microcontroller, a temperature sensor, an RF TX, RX module and an LCD display. An ATmega328 microcontroller is used as the CPU to monitor the patient's body temperature. The working of this proposed health monitoring system can be explained with the help of block diagram. This block diagram includes a power supply block that supplies power to the entire circuit, and a temperature sensor used to detect the patient's body temperature and heart rate. The circuit diagram of the automatic wireless health monitoring system mainly consists of a transmitter section and a receiver section. In the TX section, temperature and heart rate sensors are used to detect the body temperature and heart rate of the patient and the data sensed by the sensor is sent to the ATmega328.

A remote health monitoring system consists of three main components namely data sensing module, data processing module and data communication module. The data sensing module includes a temperature sensor and a heart rate sensor that sense changes in relevant physiological parameters. The information is then delivered to the PIC microcontroller of the data processing module.

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sensor and a heart rate sensor that sense changes in relevant physiological parameters. The information is then delivered to the PIC microcontroller of the data processing module. The data processing module analyzes the input signals. The noise signals are filtered and if the processed value exceeds the normal value, the medicine given to the patient as first aid is displayed on the personal computer using a GUI. The communication module is used to transfer data between the person and the equipment. It has basic components like message, sender, receiver, medium and protocol through which the message is sent to the doctor through the mobile phone through the information gateway to seek treatment.

CONCLUSION

Smart Healthcare is important for people who need continuous monitoring which cannot be provided outside hospitals. It is also important at rural areas or villages where nearby clinics can be in touch with city hospitals about their patient's health condition. This work presents a smart health monitoring system that uses biomedical sensors to check patient's condition and uses internet to inform the concerned. The biomedical sensors here are connected to Arduino UNO controller to read the data which is in turn interfaced to an LCD display/serial monitor to see the output. Data is uploaded to the server to store and converted it into JSON link for visualizing it on a Smartphone. An android application has been designed in order to easily see the patient's information by their doctors and family members.

In India, near about 20% of the total population loses their lives due to interrupted health monitoring system i.e. in most of the hospitals, doctor visits patients either in morning shift or in evening shift or in both shifts. What happens if patient's health becomes critical in between that interval or when a doctor is not available with a patient? The answer is; a patient may lose her\his life. So to avoid this critical situation; we are proposing a smart embedded system device which monitors patients health continuously. This system monitors patient’s heart rate, body temperature and saline liquid level (if any). If any of the above parameters goes beyond the threshold value, this smart device informs doctors or care taker and ask for corrective actions to save patients life.

Arduino UNO based patient health monitoring system is a generic term given to any medical equipment that has internet capability and can measure one or more health data of a patient who is connected to the device such as heartbeat, body temperature, blood pressure, ECG, steps etc. The equipment can record, transmit and alert if there is any abrupt change in the patient’s health.

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