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IMPLEMENTATION OF HEALTH MONITORING SYSTEM FOR COVID-19 PATIENTS

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Abstract: During the ongoing COVID-19 pandemic, Internet of Things- (IOT-) based health monitoring systems are potentially immensely beneficial for COVID-19 patients. This project presents an IOT-based system that is a real-time health monitoring system utilizing the measured values of body temperature, pulse rate, and oxygen saturation of the patients, which are the most important measurements required for critical care. This system has a liquid crystaldisplay (LCD) that shows the measured temperature, pulse rate, and oxygen saturation level andcan be easily synchronized with a mobile application for instant access. The proposed IOT-basedmethod uses an Arduino Mega- based system, and it was tested and verified for five human testsubjects. The results obtained from the system were promising: the data acquired from the system are stored very quickly. The results obtained from the system were found to be accuratewhen compared to other commercially available devices. IOT- based tools may potentially be valuable during the COVID-19 pandemic for saving people's lives.

KEYWORDS: Arduino Mega, LCD display, Wi-Fi module, ECG module.

Introduction:

A Patient Health Monitoring System is an extension of a hospital medical system where a patient's vital body state can be monitored remotely. Traditionally the detection systems were only found in hospitals and were characterized by huge and complex circuitry which required high power consumption. Continuous advances in the semiconductor technology industry have led to sensors and microcontrollers that are smaller in size, faster in operation, low in power consumption and affordable in cost.

Objective:

Patient Health Monitoring can provide useful physiological information in the home. This monitoring is useful for elderly or chronically ill patients who would like to avoid a long hospital stay. Wireless sensors are used to collect and transmit signals of interest and a processor is programmed to receive and automatically analyse the sensor signals. In this project you are to choose appropriate sensors according to what you would like to detect and design algorithms torealize your detection.

The objective of the project was to come up with a system that can monitor and provide physiological information remotely in the home. The monitoring system would be useful for elderly or chronically ill patients who would like to avoid a long costly hospital stay. Wireless sensors would be used to collect and transmit signals of interest and a microcontroller was programmed to receive and automatically analyse the sensor signals.

Proposed Methodology:

MEASUREMENT OF RESPIRATORY RATE:

Thermister is used for the measurement of body temperature and respiratory temperature. We have arranged the sensor in the potential divider circuit. This sensor exhibits a large change in resistance with a

change in body temperature. The temperature sensor part is attached to the patient whose temperature has to be measured, which changes the values and thus the corresponding change in the temperature is displayed on the monitor graphically.

HEART BEAT MONITOR:

The patient's heart beat rate is monitored using photoelectric sensor which can sense the patient's pulse rate. This method of tracking the heart rate is more efficient than the traditional method which derives the same from ECG graph.

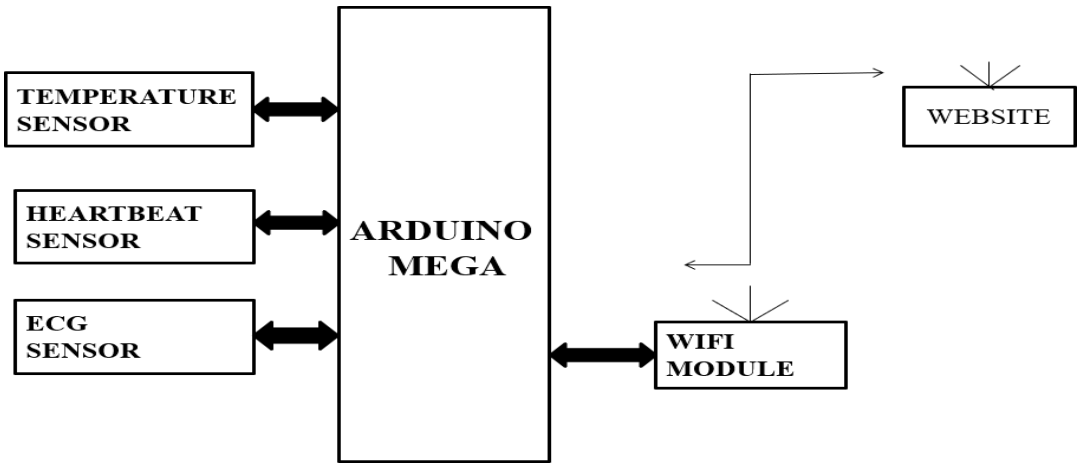
ECG SENSOR :

ECG SENSOR (piezoelectric sensor) is device that 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.

MEASUREMENT OF BODY TEMPERATURE:

Temperature sensor (DS18B20) series are precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

Block Diagram:



Hardware Tools:

Arduino Mega 2560 : The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog, inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

Fig 1: Arduino Mega

Wi-Fi Module: ESP8266 is Wi-Fi enabled system on chip (SOC) module developed by espress if system. It is mostly used for development of IOT (Internet of Things) embedded applications.

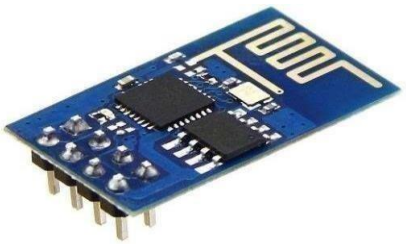


Fig 2: Wi-fi Module

Heartbeat Sensor: Heartbeat sensor provides a simple way to study the function of the heart which can be measured based on the principle of psycho-physiological signal used as a stimulus for the virtual reality system. The amount of the blood in the finger changes with respect to time. The sensor shines a light lobe (a small very bright LED) through the ear and measures the light that gets transmitted to the Light Dependent Resistor.

Fig 3: Heartbeat Sensor

ECG: ECG records the electrical activity generated by heart muscle depolarization, which propagation pulsating electrical waves towards the skin. Although the electricity amount is in fact verysmall, it can be picked up reliablywith ECG electrodes attached to the skin.

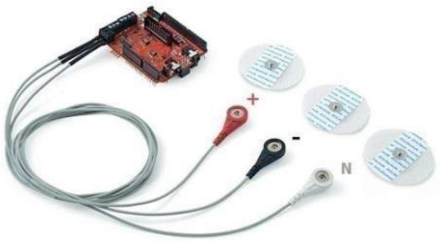


Fig 4: ECG

ECG Module: The AD8232 is an integrated signal conditioning block for ECG and other bio potential measurement applications. It is designed to extract, amplify, and filter small bio potential signals in the presence of noisy conditions, such as those created by motion or remoteelectrode placement.

Fig 5: ECG Module

Temperature Sensor (DS18B20): The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with non-volatile user- programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply.

Fig 6: Temperature Sensor

Hardware Implementation:

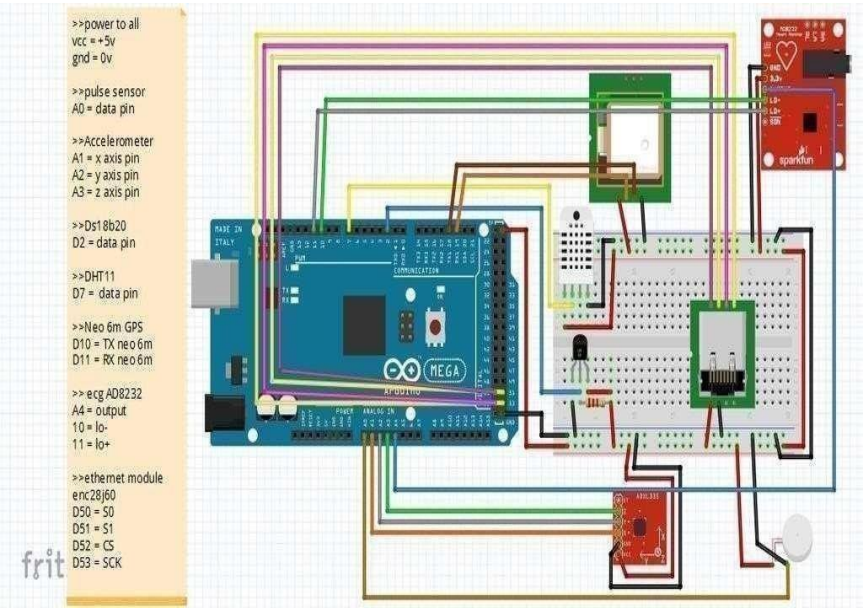


Fig 7: Circuit Diagram

For this system we required two types of power supply 5V or 3.3 V because of some components are operated in 3.3 V. All the sensors, which generates the analog output is connected to an analog pin of Arduino's analog pins. And Digital sensors like (Temp, Humidity) there are connected to digital pins. The Ethernet Shield (HANRUN) issued in this system for internet connectivity. It can be replaced by GSM or Wi-Fi module also. The analog/digital data are processed by Arduino and with the help of internet connectivity all the monitored data sent to the cloud (Here we have used (Thing Speak). Thing Speak cloud provides the MATLAB Visualization or MATLAB Code.

Results:

This system can be used to transmit the patient vital parameter information in real-time to remote location and can be seen by the care taker. The sensors are connected to the Arduino Mega board. The sensed values are transmitted wirelessly to the Arduino board receiver which is connected to the central station personal computer.

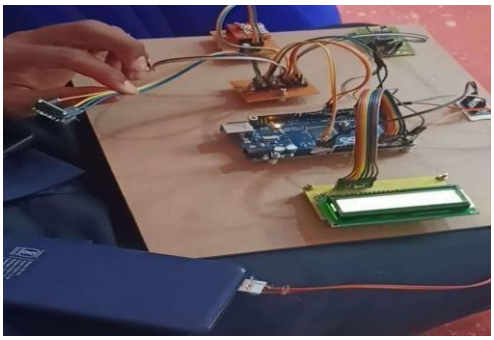


Fig 8: Result 1

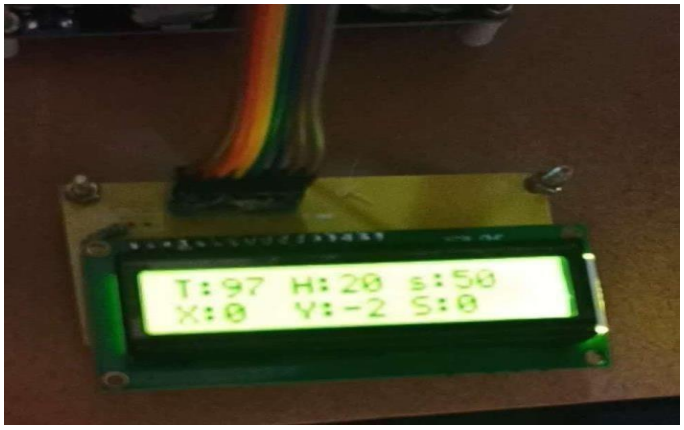


Fig 9: Result 2

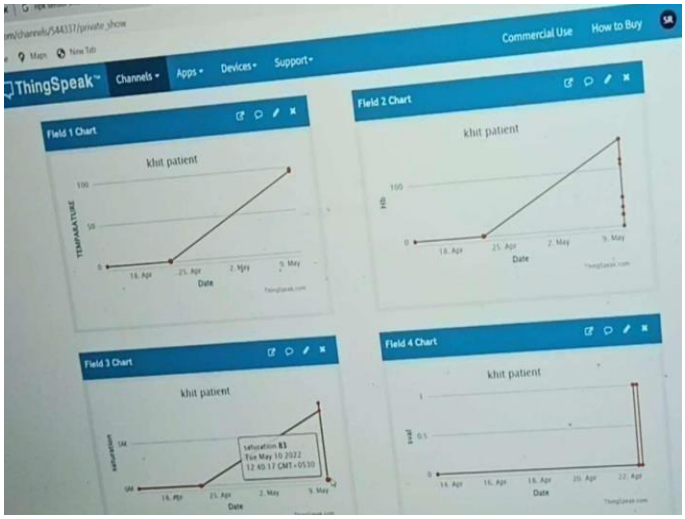


Fig 10: Result 3

Conclusion:

The whole health monitoring system, which we have proposed can be integrated into a small compact unit as small as a cell phone or a wrist watch. This will help the patients to easily carry this device with them wherever they go. The VLSI technologies will greatly come handy in this regard. For the patient side, a home based Arduino IDE application which is embedded in home PC is required. In future this work can be extended by adding the Blood pressure sensors to the existing set-up. This work is done based on single person's data collection and in future this can be extended to multiple people.

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