

UOB-IEASMA-107: Arduino Based Health Monitoring System Simulation

Pandimadevi. GANESAN

University of Technology & Applied Sciences, Nizwa, Sultanate of Oman

Pandimadevi.ganesan@nct.edu.om

Amani SHERIQI

University of Technology & Applied Sciences, Nizwa, Sultanate of Oman

Kawther AL-ISMAILI

University of Technology & Applied Sciences, Nizwa, Sultanate of Oman

Zuliakha AL-HINAI

University of Technology & Applied Sciences, Nizwa, Sultanate of Oman

Abstract

With an improvement in technology and miniaturization of sensors, there have been attempts to utilize the new technology in various areas to improve the quality of human life. One main area of research that has seen an adoption of the technology is the healthcare sector. The people in need of healthcare services find it very expensive this is particularly true in developing countries. As a result, this project is an attempt to solve a healthcare problem currently society is facing. The main objective of the project was to design a remote healthcare system. It's comprised of three main parts. The first part being, detection of patient's vitals using sensors, second for sending data to cloud storage and the last part was providing the detected data for remote viewing. Remote viewing of the data enables a doctor or guardian to monitor a patient's health progress away from hospital premises. In Phase 1, we have simulated the health monitoring system in Proteus Software with help of Arduino Program. The sensors used are DHT11, DS18B20, Heartbeat Sensor, Vibration Sensor. All the sensors working condition were tested in the simulated environment individually and then combined together to test the health monitoring system.

Keywords : Arduino, Sensor, DHT11, HeartBeat ,Health monitor.

Introduction

As we see in this time, almost a thousand people die every month because of neglect of their health due to heavy workload. Upon that, we decided to do our project as health care in an easy way. We have decided to use IOT (Internet of Things) in it. AS we know, IOT makes our life easier, and by using it the project will provide for people all information about their health & they can check their historical health data. The best part of our project is that it can be used by everyone and make our health management easier than available systems. Also, the IOT based health care system is the cheapest health care device for patients & doctors. Also we have decided to use

"THINGSPEAK" cloud service is one part of our project, used for storing all data in the cloud & it provides security & facility of accessing all the parameters at any time which is very useful for the doctors at time of treatment. This project mainly depends on Arduino and some different sensors. In Phase1 we have implemented the monitoring system as a simulation with help of Proteus and Arduino Software.

Literature Survey

Development is happening in all areas. We did a literature survey to know about the works related to our project. Many researchers have done Projects using IOT. Some produced health monitoring system by using different sensors or by monitoring different parameters of human body or by using IOT or any other technologies for communicating the results with concerned patients or with hospitals or with doctors. We had given some of the related works regarding our project. In a project names GSM-based Cellular IOT Home Automation, they developed a device to control the home electronic devices automatically. In some other IOT projects, they controlled the noise production in any area. In medical science, researchers used IOT to monitor the patients' health. The below section gives an outline of the work related to IOT in medical field.

The researcher Tamilselvi (2020) proposed a basic health monitoring device to monitor heart rate, oxygen level, body temperature, eye motion with help of IOT. In that they designed the device, but they didn't do any performance analysis. Second researcher Acharya (2020) developed a healthcare monitoring system which run in IOT platform. They also monitored the heart rate, temperature and respiration. They used raspberry pi as the processing unit. The collected data were given to raspberry pi and then communicated to IOT network. They didn't provide any visual representation of the measured values.

A noninvasive technique based pulse rate detection was developed by Banerjee (2016) Plethysmography process is used and the measured value is displayed as digitally. It is better than the invasive method . smartphone-based heart rate monitoring system was introduced by Gregoski (2012) They measured the cardiac output based on the blood flow. Also they transmitted the measured pulse to a computer to hear the pulse. But it is a good design. With this kit, we cannot monitor the heartbeat continuously. Cardiovascular disease sensing system had developed by Oresko (2010). In their design they used a smartphone. But the prototype didn't detect the cardiac disease and not track the heart beat rhythm. An Arduino based surveillance system were proposed by Trivedi(2017) In that research work, the sensor measured values are collected and given to Arduino board. The demerit is that it couldn't cover a large area. A safety monitoring device using IOT was developed by . Kumar (2017). The architecture of the device had three layers. Name or the layers are control, transmit and system layer. Human body temperature was measured by a Ds18b20 Sensor and a pulse measurement was done by the pulse sensor. The measured data were communicated form the Arduino to the cloud network with help of a WIFI module. Since they used

Arduino Uno they couldn't use many sensors with that board. A wireless sensor network was suggested by Desai et al. It detected the smart home and the heartbeat. They used Spartan3 and FPGA. The results were displayed with help of a LCD module.

Block Diagram

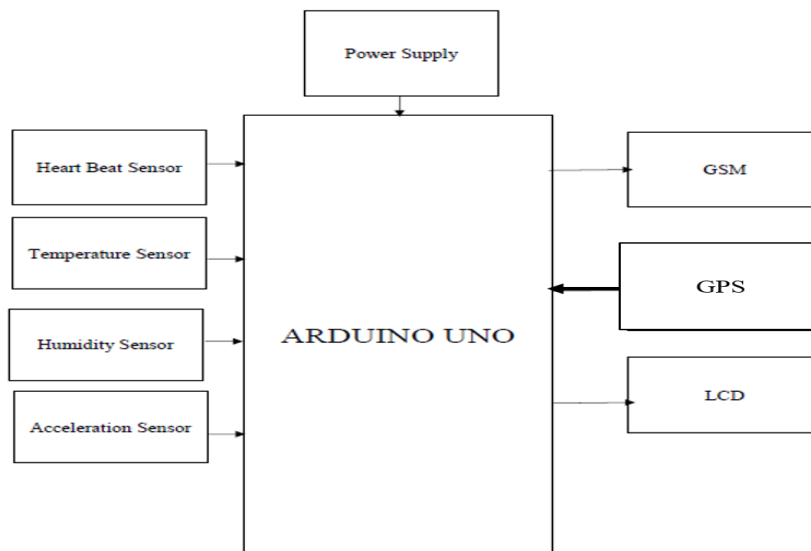


Fig 1. Block Diagram

The Block diagram consists of power supply, Arduino UNO, Many sensors like (Heart Beat Sensor, Temperature Sensor, Humidity Sensor, and Acceleration Sensor), two module which are GSM module & GPS module. Also consist of LCD. Our project uses an Arduino Board, Temperature sensor, Humidity sensor, Vibration sensor, Heart beat Sensor and GSM, GPS modules. The sensor modules will work one after the other in a specific time interval. The DHT 11 sensor will measure the surrounding temperature and humidity level. These measured data are communicated to the Arduino board. The Arduino board is connected with a LCD module to display the measurement. The second sensor DS18B20 sensor measures the body temperature and then it will have sent to the Arduino board. The same will be displayed in the LCD. Next heartbeat sensor will measure the BPM and the measured value will be shown in the LCD with help of the Arduino board. Similarly, the vibration sensor will detect the vibration or acceleration and it will be indicated by the LCD display unit. The GPS will identify the location of the person and transmit the same to the Arduino board. Finally, the GSM will send the measured parameters value to the mobile number stored in the GSM program unit. The circuit operation will be simulated in Proteus software with help of the Arduino program and library files. The values can be stored in cloud and can access at the required time.

Results & Discussion

The Arduino based health monitoring system is implemented in Proteus simulation with help of Arduino program. This chapter discuss about the implementation of our project. First, testing of individual components are presented. Combined components outputs are explained followed by the individual testing. Finally, the implementation of health monitoring system with Arduino uno presented with the output.

DHT 11 Sensor

We connect data output pin to digital pin 8 of Arduino. Then we connect the pin numbers 2 to 7 of Arduino to pin numbers 14 to 11 and then to 6 and 4 of LCD module. After arranged everything in the Proteus schematics, we opened the Arduino and typed the program. The written program is compiled and the copy of the file path is taken .We again open the schematics and we added the path for the program file in Arduino board. Finally, we ran the simulation by pressing the run button of proteus software.

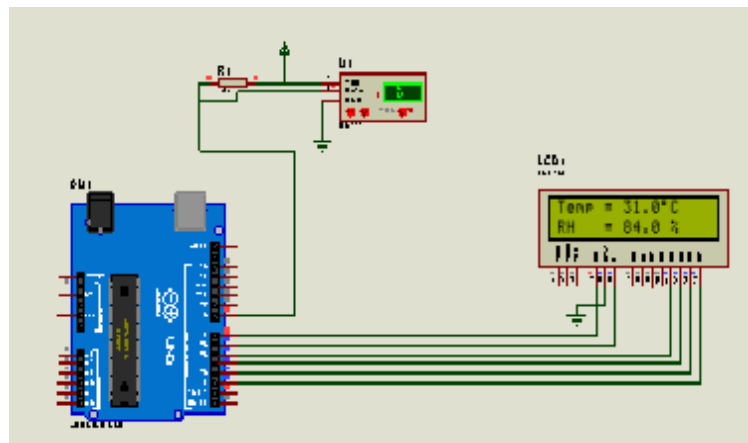


Fig 2. DHT Simulation

DS18B20 Sensor

This module has 3 pins. Connect Vcc to 5V and GND to GND. The DQ pin returns the measured value of body temperature to pin 10 of Arduino board. Then we connect the pin numbers 2 to 7 of Arduino to pin numbers 14 to 11 and then to 6 and 4 of LCD module. After arranged everything in the Proteus schematics, we opened the Arduino and typed the program. The written program is compiled and the copy of the file path is taken. We again open the schematics and we added the path for the program file in Arduino board. Finally, we ran the simulation by pressing the run button of proteus software.

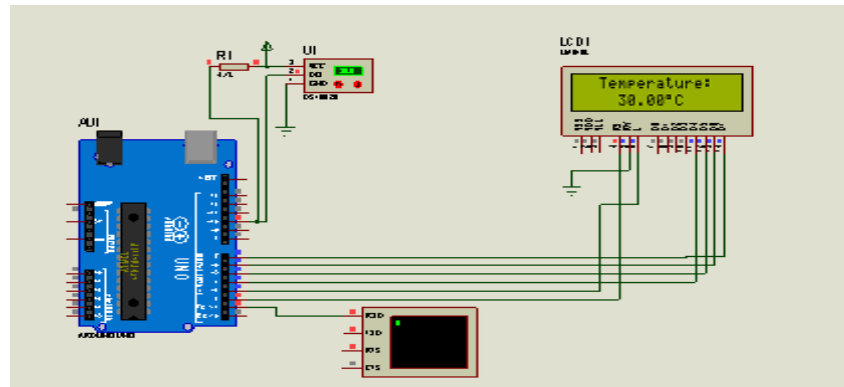


Fig 3. DS18B20 Simulation

Heart Beat Sensor

This module has 3 pins. Connect Vcc to 5V and GND to GND. The DQ pin returns the measured value of body temperature to pin 10 of Arduino board. Then we connect the pin numbers 2 to 7 of Arduino to pin numbers 14 to 11 and then to 6 and 4 of LCD module. After arranged everything in the Proteus schematics, we opened the Arduino and typed the program. The written program is compiled and the copy of the file path is taken. We again open the schematics and we added the path for the program file in Arduino board. Finally, we ran the simulation by pressing the run button of proteus software.

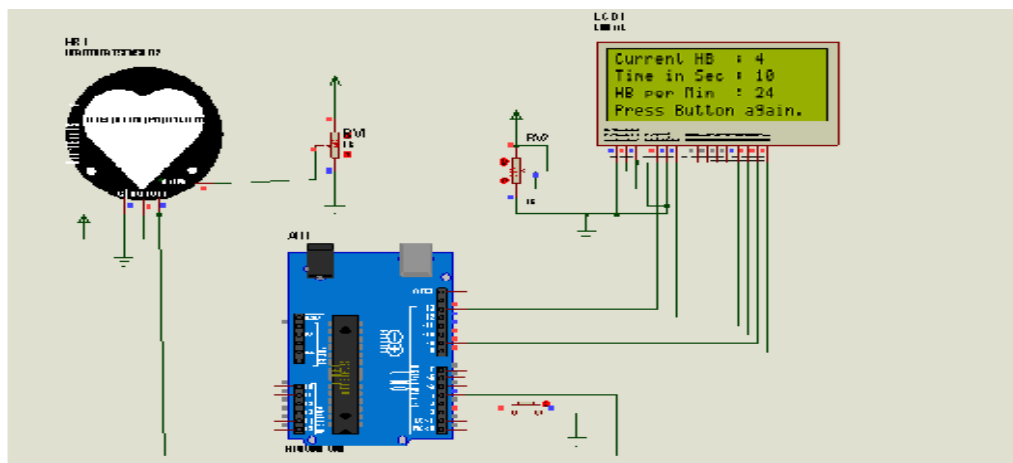


Fig 4. Heartbeat Sensor Simulation

Vibration Sensor

Vibration sensor modules are available as analog module and digital module. For our Simulation we used the analog sensor module. We have downloaded the vibration library sensor module and added in the Proteus Library. The Arduino code were written in the Arduino IDE. We used a LED at pin number 13 to indicate that if the vibration sensor output is high or low. We pasted the hex file path in the Arduino edit

component window. And then we added the hex file for the vibration sensor module. Once the settings were over, we have simulated the schematics by pressing the play button.

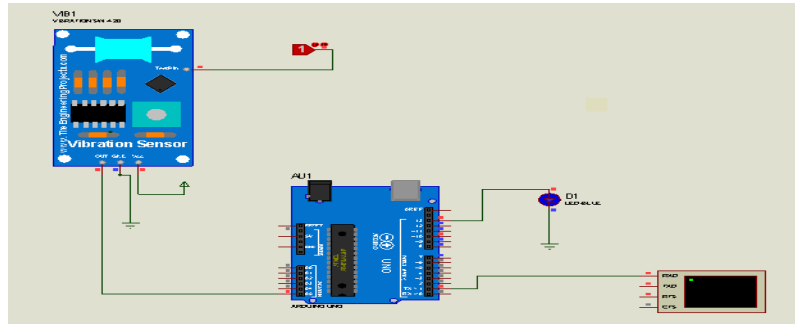


Fig 5. Vibration Sensor Simulation

Final Schematics of Project

We assembled all the sensors and other components in Proteus to complete the design of health monitoring system.

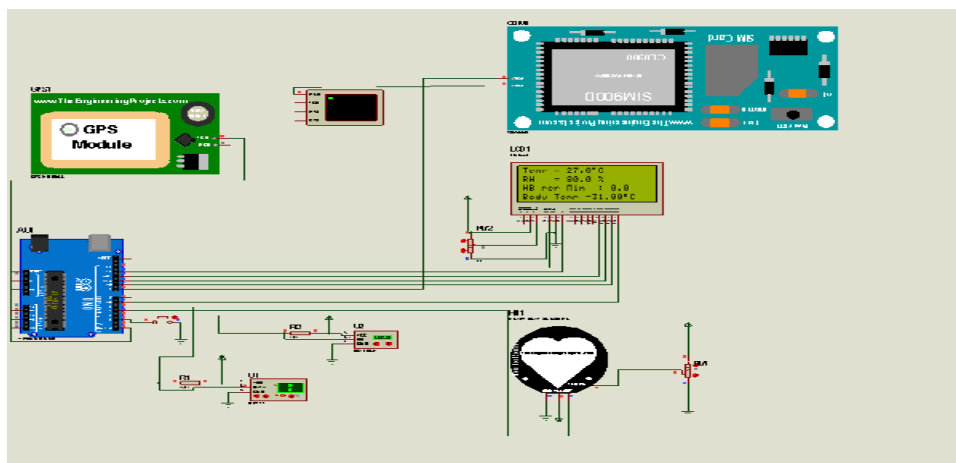


Fig 6. Final Circuit Simulation Without Vibration Sensor

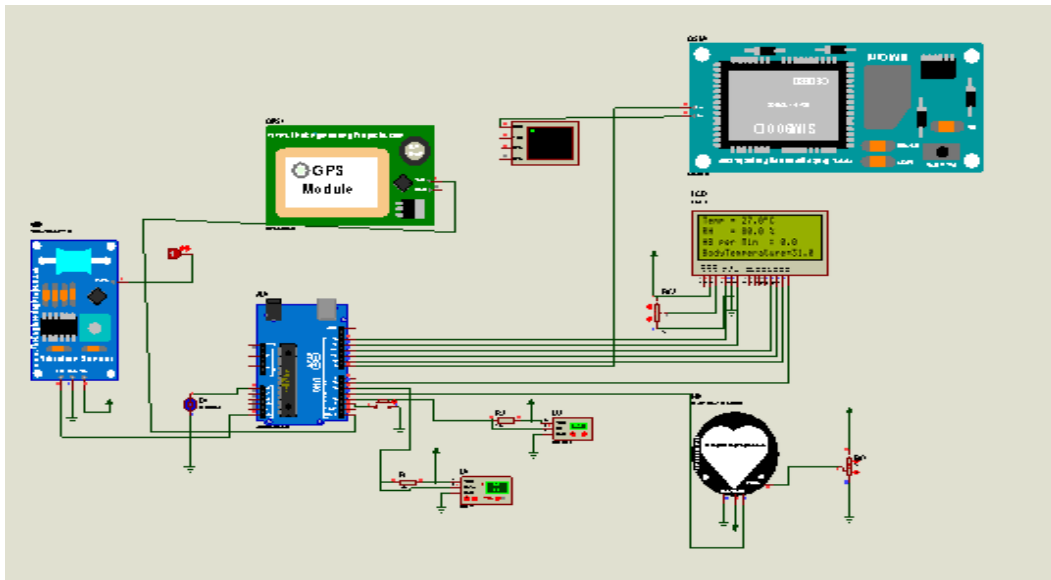


Fig 7. Final Circuit Simulation With Vibration Sensor

Conclusion

The Arduino based health monitoring system was implemented and simulated successfully with help of Arduino IDE and Proteus Software. We first checked the working of components by using Arduino Uno. Then we assembled all the components together and simulated. The project is working fine and displays the values in the LCD and the Virtual Terminal.

Future Scope

The project can be implemented as a hardware and a prototype can be developed. Also, we can send the data to Thinspeak server and we can share that with the Doctors or the responsible persons.

Acknowledgement

The authors would like to thank University of Technology and applied Sciences, Nizwa for the given support to complete the project successfully.

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