A Secured E Health Architecture using the Internet of Things

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Abstract - The Healthcare industry brings up new trends each year regarding up gradation of the technology in various devices used by them. They help in developing not only sensory devices, but also communication, recording and video devices. Monitoring the various medical parameters by the officials from distant places has been of growing concern and is very important. The IoTplatform has grown rapidly in all the essential fields and has become a primary requirement. In this Project, the Arduino Uno is used to connect multiple sensors such as temperature sensor and pulse oximeters. The Arduino collects data from each sensor and passes it to the cloud through a Wi-Fi internet module and makes it accessible for doctors. The data could be accessed anytime by the doctor. The security and confidentiality of the required data is a major concern and should not be misused by anyone. The data which is sent from one end to the other should be transmitted in a secured manner. For that purpose a Wi-Fi internet module is being used to send data to the prescribed web server which could be protected by a password. Not only that the data could be available to the doctor anytime, it could also be accessed anywhere at a few distance near to where the patient is. At the time of any extreme situation, alert is being sent to the doctor and hence quick medication could be carried out. The system consumes less power and is efficient.
Index Terms - DS18B20 sensor, GSR sensor, SPO2 Pulse oximeter, Arduino Uno, ESP8266 12E, Cloud Communication.

I. INTRODUCTION

Over the years, healthcare industry has contributed a lot to the needs of individuals through their quality services. The healthcare services has improved and come up with growing technologies each year. The benefits of today's healthcare industry is that it comes up with innovative and reliable technologies to provide services to the public, and it has been a lot more helpful to the people who require it, that they can cover the services even by sitting at different places.Health care with good quality services are important for increasing people's quality of health, by preventing disease and disability.Around the time you feed yourself to the sensors, they would continuously record signals related with your physiological parameters and pass the resulting output data to a database linked to the health records.

The objects which are interconnected collect data between intervals, analyzed and initiates required action, providing a network for planning and making decisions. This is what is called the Internet of Things. The IOT is creating a brilliant invisible network which could be sensed and programmable.

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The previous papers and works related to this field have merely been about how the data from the patient has been captured and sent through cloud to the destination. It does not specifically describe about how far the destination could be nor does the security of the data. [1] Discusses the e health architecture to be used as a communication media between different architecture hardware. That system provides the medical specialists with several advantages, like flexibility and scalability. [2] Discusses a home based intelligent platform, Health Iot using an intelligent medicine box based on an open platform. They also discussed about intelligent packaging in pharmaceutical industry with communication enabled by passive RFID technology. [3] Studies the implementation of Iot with e Health to manage and monitor the health of students. One of IoT's most used technologies in healthcare is the Rfidtechnology. Here an E Health solution known as Electronic Medical Records (EMR) for managing the health information of students is implemented using RFID.[4] They highlightthe opportunities and challenges for IoT in realizing this vision of the future of health

care.[5] Studies a machine learning-based technique for identifying and detecting traffic on mobile e-health applications. These mobile e-health applications can be improved by providing a multi-classification technique to determine traffic generated by its users. [6] Uses JADE as an agent–oriented framework for building e-Health system, and points out that the adding of agent features allow the e-health system to be more flexible and intelligent.

II. PROPOSED SYSTEM

The idea and the purpose of the designed system are to continuously monitor the health conditions of a patient using the internet. The architecture of the proposed system is given below. The model consists of Arduino Uno, Temperature sensor (DS18B20), Pulse Oximetry Sensor(SPO2), Galvanic Skin Response (GSR) Sensor, Wi-Fi Internet Module ESP8266, Regulated Power Supply.

The sensors as mentioned, measure the respective parameters. The DS18B20 sensor measures the body temperatures of the patient and sends the information through the cloud. And the Pulse Oximetry sensor calculates the heart rate of the patient and also the amount of oxygen present in the blood. Likewise the GSR sensor measures the sweat coming out from the patient's skin, thus evaluating the emotions of the patient, like the sleep. A Wi-Fi internet module ESP8266 12E is employed here for capturing the data that is given out from the sensor, and to pass it to a cloud. The Wi-Fi module creates a new webpage or a server, which could be accessed to the relevant doctor by using a password. Entering the password gives you access to the web server and analyze the given data by the doctor, sitting at a far place.In that way, the security of the model could be preserved and the doctor could give required medication to the patient. The Arduino provides information to the doctor when the heart rate is say for example, greater than 90 or less than 60 and when the temperature comes in the range of around 20-35.

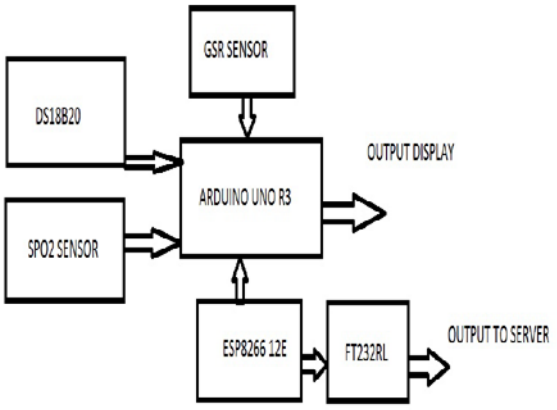

Fig. 1. Block diagram for the proposed healthcare system.

The Architecture primarily consists of two processes. I) Data sensing and acquisition and II) Cloud Processing

A.Data Sensing and Acquisition

By wearing certain unique devices on your body the sensor could sense your physiological data, based on the parameters that are measured. A little preprocessing is done before actually accessing it.The virtue of the data could also be put to test when it is operating in low power and the data is captured in terms of signal to noise ratio. The recent designs in the different flexible type of sensors could be installed on your body and checked. This technique is particularly an attractive one compared to the other alternatives, because the sensor has direct skin contact with your body.Sensor mechanisms that has more energy efficiency, was studied of a lot during the recent times. This sensor network is utilized to measure the physical phenomenon in the body in a more apportioned way.

The sensor deployment in the body is a more complex one than those deployed before; a Wireless Sensor Networkcould also be used here.

B. Cloud Processing

Data collected or received from the system should be stored or located somewhere, so that it could be accessed. Sending the processed data through the cloud benefits you with a few benefits like high accessibility and scalability. This could in turn be accessed directly by the clinic as well as the patients. Cloud processing could reduce cost and is a more efficient one. Here, we mention the architecture of the smart healthcare system with cloud processing

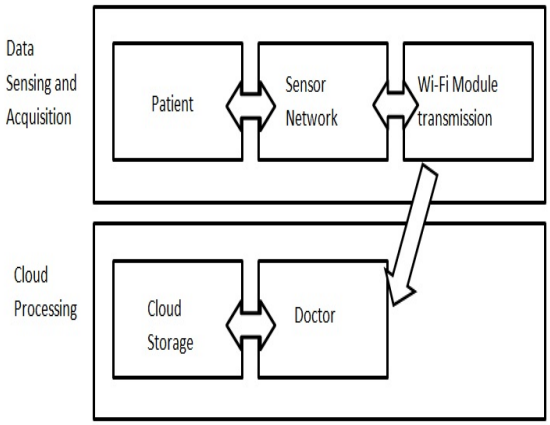

Fig 2.Data Acquisition and sensing used for e health architecture.

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III. IMPLEMENTATION

A. HARDWARE DESCRIPTION

i) Arduino Uno

Arduino Uno is a hardware development board based on the ATmega328P microcontroller. It also has 6 analog inputs, a 16MHz quartz crystal, a USB, a power jack, a digital pin configuration consisting of 14 input/outputs, an In Circuit Serial Programming (ICSP) header and a reset button. Arduino uno has everything needed to form a microcontroller. "Uno" means "one" in Italian and was chosen to mark the release of Arduino Software.

ii) ATmega328P microcontroller

The ATmega328P is an 8 bit microcontroller based on the AVR enhanced RISC architecture. By providing good and quality instructions in a single clock cycle, this microcontroller is able to achieve a good throughputat round 1 MIPS per MHz. Thus the power consumption could be optimized by the designer, as a tradeoff with the speed of the process.

iii) DS18B20 Digital Thermometer

The DS18B20 digital thermometer gives temperature measurements in Celsius in therange of 9-bit and 12-bit and contains an alarm function comprising of stable user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that requires one data line and one ground line for communicating with a central microprocessor. In addition, the DS18B20 can derive power, known as parasite power, directly from the data line, thus eliminating the need for an external power supply.

iv) SPO2 Sensor

The SPO2 sensor is a pulse oximeter sensor used for measuring the proportion of molecules that carry oxygen in the blood, and to see how much proportion of it is really carrying oxygen in it. When all the hemoglobin in the blood is saturated with oxygen, then the pulse oximeter shows one hundred percent oxygen saturation. Apart from pulse oximetry, this sensor could be used for other applications also, like heartbeat sensor, plethysmograph etc.

v) Galvanic Skin Response Sensor (GSR)

The GSR Sensor measures the conductance in the skin. The emotion people feel simulates the nervous system, thus producing more sweat from

the body. The GSR employs two electrodes to the fingers and measures the sweat in the body, thus analyzing the emotions of the body, such as sleep conditions.

vi) ESP 12E Wi-Fi Module

The ESP8266 12E is a UART to Wi-Fi module which is used for applications like, IOT and mobile. It is a technology which consumes low power. This module allows the user to connect the required device to the wireless network, thus accessing the files or data from the cloud.

vii) FTDI Serial Driver (FT232RL)

The FT232RL board is a USB to serial driver (or) interfacewhich generates a clock generating output if optional. The external memory location, a simple clock circuit, and a set of USB resistors have been integrated in a form to further simplify the USB-serial connection using FT232RL.

B. SOFTWARE DESCRIPTION

i) Arduino IDE

The Arduino Integrated Development Environment (IDE) is an open source software that At first, the thermometer DS18B20 is interfaced with the Arduino board, and the code is run into that. The following results are obtained from the Arduino IDE serial monitor.

is used with the Arduino Development board, for writing codes and uploading it to the board. This software helps the Arduino in interfacing different sensors to the board and run the codes on it. This software runs on Windows, Linux and Mac OS too. Any kind of Arduino board is suitable to this.

Embedded C

Embedded C programming is the extension for the C program. The Embedded C Programming was developed in order to correct the issues arising out of the C programming and the extensions.

IV. RESULTS

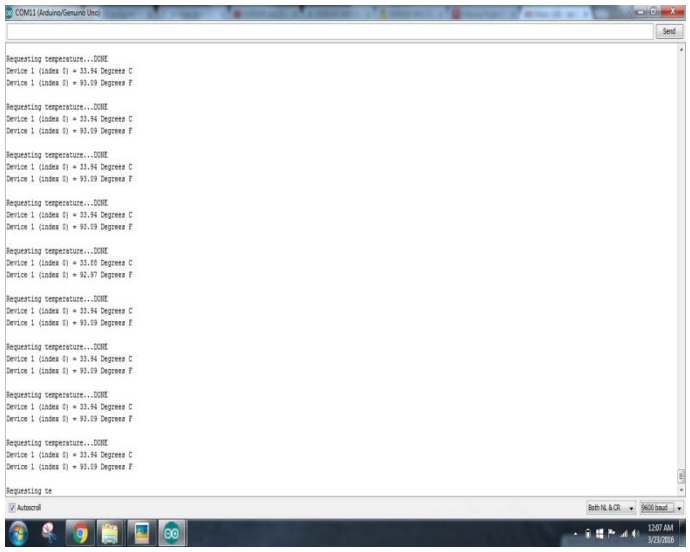

Fig 3.DS18B20 temperature sensor output.

The displayed data is accessible to the doctor at an unspecified location far from the patient. The doctor could watch the progress of the data streaming at check out that if there's an error or discrepancy somewhere, denoting that the body

temperature of the patient is not normal, and needs to check on immediately.

Here is another output from the Arduino through the ESP Wi-Fi module, coming from the Galvanic Skin Response (GSR) sensor, denoting the amount of sweat from the skin, which depicts the current condition of the patient in emotions, such as sleep.

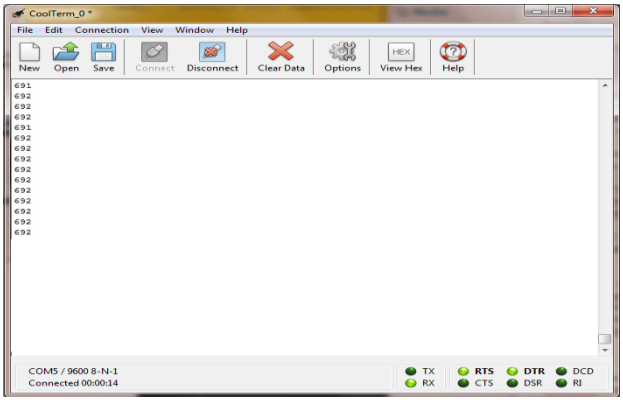

Fig 4.Output of the GSR sensor through the CoolTerm serial monitor.

V. CONCLUSION AND FUTURE WORK

Internet of things is expected to rule the world in various fields but more benefit would be in the field of healthcare. In this paper, we reviewed the ongoing technologies and the future work for integrating remote healthcare monitoring technologies with the medical practicing in clinics.Here the present work is carried out to design and implement an IOT based smart healthcare system using an Arduino Uno. In this work the SPO2 based Pulse oximeter will be used and DS18B20 temperature sensor is used to read the temperature and heartbeat of the patient and the microcontroller picks the data up and will send it through ESP8266 internet protocol. The doctors can view the sent data by logging in to the html webpage using the unique IP and page refreshing option is given so continuously data reception achieved. Hence continuous monitoring system for patient could be designed.

The ESP Wi-Fi module is used to transmit the received data through the cloud and the recipient could get the data in the web server. The received information could be password protected. Thus providing security to the data you access.

The future work to be carried out is to provide an extension to the Iot used here, by extending the range of the ESP8266 Wi-Fi module. So the doctor could access the medical informationof the patient sitting at around 20 to 25 kilometers away from the patient.

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