IoTBased Elderly Health Monitoring System

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Abstract — The objective of the proposed work is to design a hardware model which would constantly monitor the health parameters such as pulse rate, oxygen content, temperature, sweating, blood pressure and falling of the patients. These parameters are sensed by the respective sensors and it is then transmitted wirelessly over the internet to a Database using IoT technology which would be accessible to the patient's family and doctors. It focuses on monitoring especially the elderly patient's vitals anywhere and at anytime. The system also alerts the necessary authorities when there is an emergency. This would help the doctors to monitor and attend multiple numbers of patients at ease.

Keywords—IoT;Wireless Health monitoring; Arduino mega; Bio-Sensors;

I. INTRODUCTION

The remote monitoring of various vitals in ambulatory patients is called as bio-telemetry. It involves wirelessly transmitting sensor data which is implanted on the patient's body to the concerned hospitals to be viewed by the doctors.Recent technological advances in wireless networking, microelectronics integration and miniaturization, sensors, and the Internet allow us to fundamentally modernize and change the way health care services are deployed and delivered. Focus on prevention and early detection of disease or optimal maintenance of chronic conditions promise to augment existing health care systems that are mostly structured and optimized for reacting to crisis and managing illness rather than wellness[1].Wearable systems for continuous health monitoring are a key technology in helping the transition to more proactive and affordable healthcare. They allow an individual to closely monitor changes in her or his vital signs and provide feedback to help maintain an optimal health status[2]. One of the main applications of IOT is health monitoring that would help doctors keep in track of their patient's health and also treat them from anywhere and at any time. The proposed system uses sensors, Arduino board and IOT for ubiquitous monitoring of elderly patients health conditions [3]. The system helps in maintaining the records of the patients in the database that would help the doctors in providing effective treatment at emergency conditions.

II. PROPOSED SYSTEM

The schematic of the proposed system is shown in Fig.1 and each module is described below.

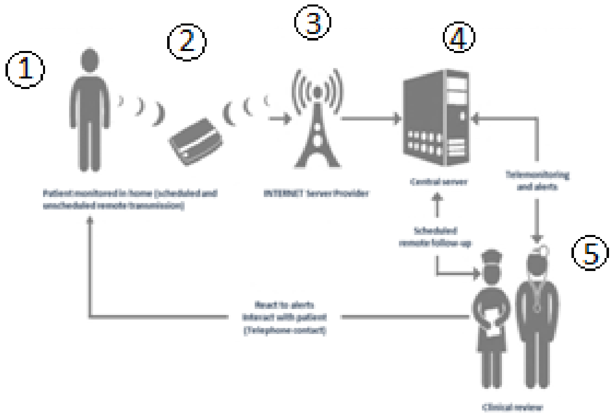

Fig.1 Schematic diagram of IOT based health monitoring system

1. The wearable sensor nodes are responsible for acquiring the physiological data and transmitting it to the base-station. The sensor nodes are designed to be tiny in size and consume low operating power to reduce battery size which can last for longer durations [6].
2. The Hardware prototype is designed to collect the sensor data and process it for wireless transmission over the internet. It consists of the Arduino micro-controller and GPRS module.
3. The internet carries all the transmitted data to the database created in an IP address.
4. Utilizing a cloud based medical data storage, the health monitoring system allows online accesses of the sensor data and patient's details [4].
5. These details can be accessed by the doctors and guardians for providing effective treatment.

Thereby the design of the proposed system starts with the selection of the sensors to measure various vital parameters, interfacing the sensors with the processor, transmission of the collected data to the database, getting access to an IP, designing the webpage and the database for multiple patients to store their data.

III.DESIGN LAYOUT

The various steps involved in the proposed system are shown as a flow chart in Fig 2.

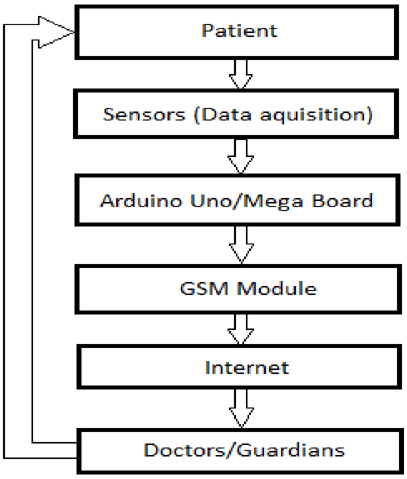

Fig.2 Flow chart

- The patients under monitoring are placed with respective Bio-medical sensors which will be used to acquire various parameters like temperature, pulse rate etc. from their body.
- All this sensor data will be collected and processed within the microcontroller embedded inside the Arduino board.
- By activating the GSM module the sensor data is wirelessly transmitted to the online database. This database stores all the patient's details. The database is then linked to the main website and here the patient's conditions are displayed ubiquitously.
- Another added feature is when one or few of the sensors data cross a specified threshold value the GSM module will start to call and message about the severity of the patient's conditions along with their location to their corresponding guardians/doctors.

IV. HARDWARE DESIGN

A. Arduino Mega

The Arduino Mega 2560 It has 54 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 .

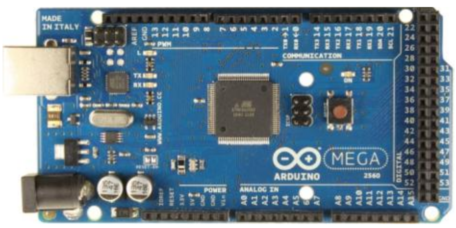

Fig. 3 Arduino Mega

It consists of everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery.

B. GSM module

SIM808 module shown in Fig 4 is a complete Quad-Band GSM/GPRS module with a combination of GPS technology for satellite navigation. The compact design integrates GPRS and GPS in a single module.

Fig. 4 SIM808 GSM module

Featuring an industry-standard interface and GPS function, allows variable assets to be tracked seamlessly at any location and at anytime with signal coverage.

C. Temperature Sensor-(DS18b20)

DS18B20 shown in Fig 5 is the latest temperature sensor. It is a 1-Wire digital temperature sensor,with an output range ofwith 9 to 12-bit precision [5].

Fig. 5Temperature sensor – DS18b0

Each sensor has a unique 64-Bit Serial number etched into it and allows a huge number of sensors to be used on one data bus. Thermometer resolution is user-selectable from 9 to 12 bits.

D. Tri-axis Accelerometer-(ADXL335)

The ADXL335 shown in Fig 6 is a triple axis MEMS accelerometer with extremelylow power consumption.

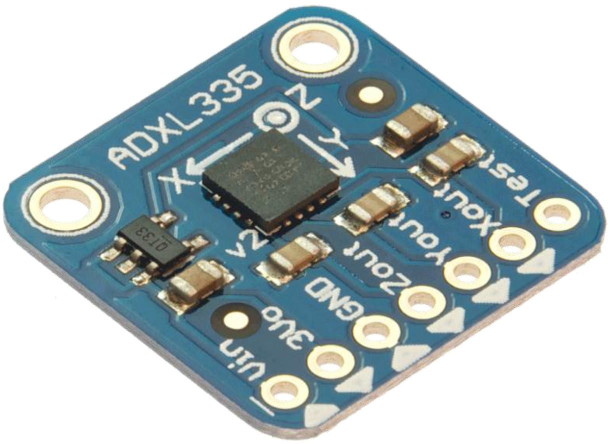

Fig. 6 Tri-axis accelerometer – ADXL335

The sensor has a full sensing range of +/-3g. The power should be between 1.8 and 3.6VDC. The included 0.1uF capacitors set the bandwidth of each axis to 50Hz [7].

E. Pulse Sensor

The Pulse Sensor shown in Fig.7 is a photoplethysmograph, which is used for non-invasive heart rate monitoring. The heart pulse signal that comes out of a photoplethysmograph is an analog fluctuation in voltage.

Fig. 7 Pulse-Amp sensor

The depiction of the pulse wave is called a photoplethysmogram, or PPG. Pulse Sensor Amped, amplifies the raw signal of the previous Pulse Sensor, and normalizes the pulse wave around V/2 (midpoint in voltage). Pulse Sensor Amped responds to relative changes in light intensity.

F. Sweat sensor-(Galvanic skin response)

Skin conductance, also known as galvanic skin response (GSR) shown in Fig 8 is used to measure the electrical conductance of the skin, which varies with its moisture level. The amount of sweat released from the body change the electrical resistance of the skin. Skin conductance is used as an indication of sweating.

Fig. 8 Sweat sensor

The device measures the electrical conductance between 2 points and is essentially a type of ohmmeter.

G. SPO_2-(Pulse oximeter)

A pulse oximeter shown in Fig 9 is a medical device that indirectly monitors the oxygen saturation of a patient's blood (as opposed to measuring oxygen saturation directly through a blood sample) and changes in blood volume in the skin. Using two sets of led (a red one and IR one) it can determine the RBCs Oxygen content within the blood.

Fig. 9 SPO_2 sensor – Pulse oximeter

Pulse oximetry is particularly convenient for non-invasive continuous measurement of blood oxygen saturation. In contrast, blood gas levels must otherwise be determined in a laboratory on a drawn blood sample

V. UI DESIGN

The Website is created using a free web hosting online server. A database has also been created to maintain the patients login details and different parameter values as shown in Fig 10 and Fig 11 respectively.

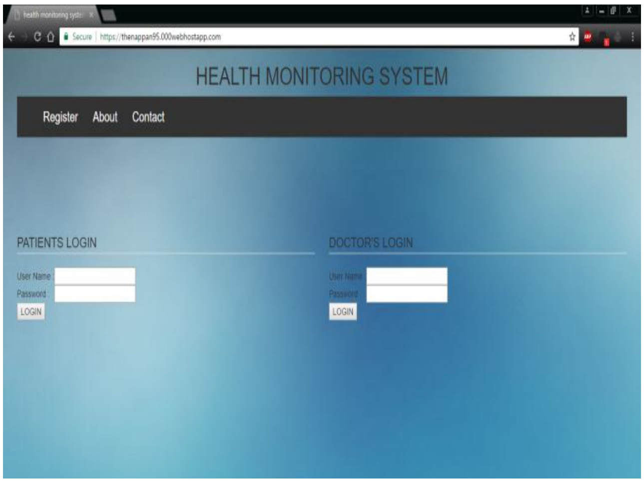

Fig. 10 Website main page

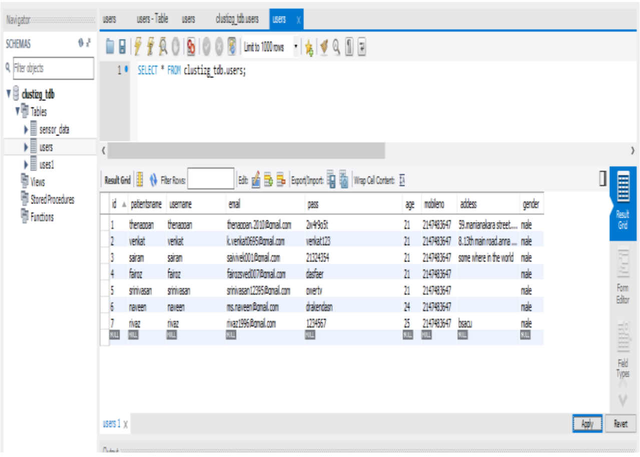

Fig. 11 Database of sensed data

VI. RESULTS

The sensor data from various sensors interfaced with the module is plotted in the website and the values are also stored in the database. Fig.12 shows the result of the temperature sensor by placing it at different body temperature. The Y-axis represents the body temperature ranging from values of 82F to 98F over a period of time.

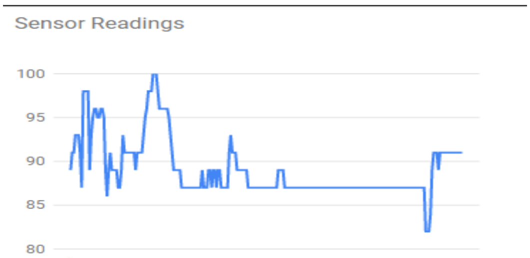

Fig. 12 Temperature sensor reading chart

The data collected and displayed can be accessed by the concerned doctors/guardians of the patient for further treatment.

VII. CONCLUSION

The proposed system will help the elderly patients those who require continuous monitoring or periodic monitoring of their health conditions. The doctors or care takers can also easily monitor the patient's health condition and provide them with the necessary treatment. This system also leans towards making the sensors as mobile and wearable as possible [8]. As a future work a compact module will be designed for ubiquitous health monitoring that will further reduce power consumption.

VIII. ACKNOWLEDGMENT

The author/s thankfully acknowledges the financial support provided by The Institution of Engineers (India) for carrying out Research & Development work in this subject.

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