Design and Development of Online Health Assistance System

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Abstract: The Health is one of the major important factors of human life. Often it happens that we don't get an appointment of doctor. It is very difficult to take elderly people or very sick person to doctor's place. We may require the consultation of a expert doctor from any part of the world. In this work we have developed a system that will help one to connect with the doctor very easily. Not only that, this system has the ability to measure the necessary vitals that are required for primary diagnostics. The basic prototype developed by us has the capability to measure heart rate and body temperature and display that information to the web page of one's consultant doctor. By observing the primary vitals the doctor will be able to suggest what should the patient do or what medicine should the patient take. The system has also the facility for conversation with the doctor. It can be further be extended according to needs of measurement and for live video conference with the doctor.
Keywords: Arduino UNO R3; ethernet shield; DS18B20; KG011.

1 INTRODUCTION

Human do everything for being healthy and not to be affected by any external parasites or diseases. But there is no escape from that. We all suffer from diseases and have to visit doctors. In that situation when we are affected by any disease, it becomes difficult to visit doctor or to get an appointment. This system will help one to easily consult with doctor and to take the necessary steps.

The system has been developed based on the concept of Internet of Things (IOT). That means, anyone from anywhere in this world can access the system through internet. When any patient wants to consult with doctor, he must connect the sensors to his body and then he has to connect with the doctor to whom he wants to communicate in the web page. The web page will display the sensor readings that will also help the doctor as well as the patient to see the readings. The patient will have a conversation box in the web page by which he can chat with his doctor about the problem that he is facing.

This paper is organized as follows: In section II, Internet of Things (IoT) is described in brief. Section III describes the design and operation of the system. In section IV, we have described the technical details of the developed prototype system. In section V, the applications of the system are described.

2 INTERNET OF THINGS (IOT)

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By the name one can easily define IoT as 'Things' which are connected to internet. Here 'Things refer to the devices and everyday objects, from small ones (like wrist watch) to really big ones (like robots, cars). No matter what definition one may find about Internet of Things, the main concept behind every IoT technology and implementation is the same: devices are integrated with the virtual world of internet and interact with it by sensing and monitoring objects and their environment (Fig. 1).

The features of a device that can act as an IoT are as following:

- Collect information by sensing the environment and transmit those data to a different device.
- It can be programmed to control other devices.
- It must be able to receive information from the network it belongs to.

It must assist in communication between other nodes of the same network.

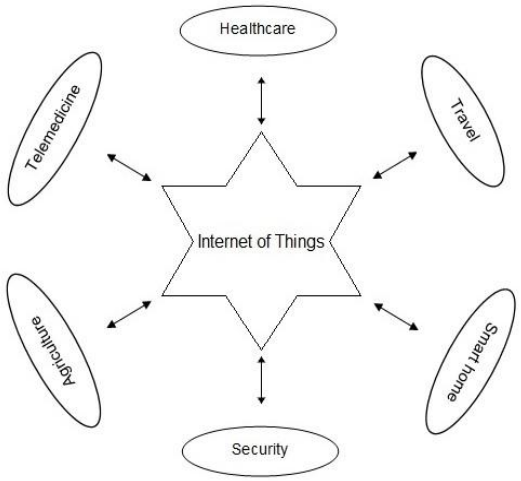

Fig. 1. Internet of things.

3 DESCRIPTION OF THE SYSTEM

In our primary designed prototype, there are two sensors, KG011 (Heartbeat sensor) and DS18B20 (Body Temperature sensor). The block diagram of our developed system is shown in Fig. 2. And flowchart in Fig. 3. The KG011 sensor senses heartbeat rate and gives the data input to the CPU of the system. The DS18B20 sensor senses body temperature and provide the necessary data input to controller. These data are then processed by the CPU and converted into its suitable form that human understands. With the processed data, HTML code for the web browser is sent to the internet using Ethernet shield. Now if one opens the link for the system in web browser, it will display the readings of the sensor according to formatted output defined by the HTML code. Thus the patient as well as the doctor will be able to get the vitals from any part of the using internet connection and the link for the system.

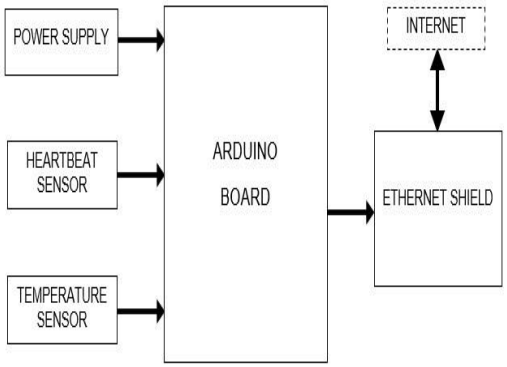

Fig. 2. Block diagram of the system.

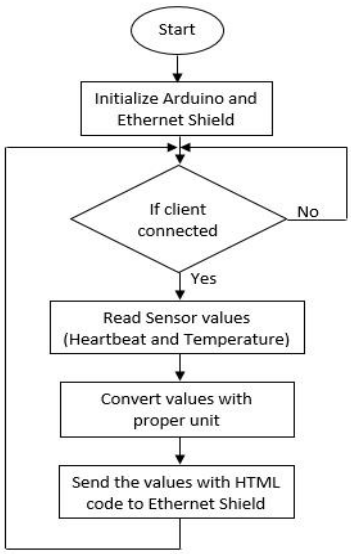

Fig. 3. Flowchart.

A. Working Principle

- When the power is on, the system initialize itself by setting the configurations of ethernet shield, serial communication interfaces.
- Then the system waits for connection originating from a client.
- If it finds any client connected with the system, then it starts to read data from the sensors from analog and digital ports of the Arduino.

- Now it converts that values coming from the sensors into human understandable form (with proper unit).
- When the data are ready, it sends these data with the HTML code for displaying data on web browser, to ethernet shield.
- The ethernet shield now sends the HTML code along with the data to the web browser of the connected client.
- Now the patient will have to make a connection with doctor.
- When he is connected with doctor, they can use the conversation box for communication.
- The page will automatically refresh itself after 1 seconds to display the current read data.

4 IMPLEMENTATION OF THE SYSTEM

To implement the basic prototype of this system, we have used Arduino UNO R3 development board, Ethernet shield, heartbeat and temperature sensors. The basic building block diagram of the system is already shown in Fig. 2. The coding of this system has been done in Arduino IDE (C Language) and for the coding of HTML, notepad++ has been used.

A. Arduino UNO R3

Arduino [1] is an open source platform for developing project prototypes. It has ATmega328p microcontroller as CPU. This board is capable of handling both analog and digital devices and it features serial communication interfaces, including Universal Serial Bus (USB) for loading programs from personal computers. The block diagram of the development board is shown below (Fig.4).

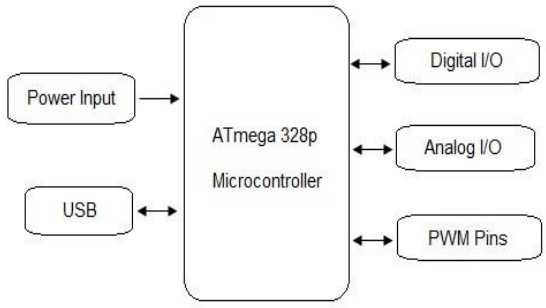

Fig. 4. Arduino UNO R3 board.

Specifications:

- On board voltage regulator
- Operating voltage is 5V
- Operating frequency 16 MHz
- 14 digital I/O pins, of which 6 are PWM pins
- 6 ADC channel (10 bits)
- 32KB flash memory (0.5KB for boot loader)
- 2 KB SRAM memory
- 1KB internal EEPROM
- Programmable Serial USART
- Master/Slave SPI Serial interface
- I2C interface
- Programmable watchdog timer with separate on-chip oscillator.

B. Ethernet Shield

The Arduino Ethernet Shield [2] allows an Arduino Board to connect to the internet. It is based on the Wiznet W500 ethernet chip with 16K buffer. The Wiznet provides a network (IP) stack capable of both TCP and UDP. The shield (Fig. 5) has a standard RJ45 connector. It communicates with Arduino using the SPI bus. The latest version of the shield has on board micro-SD card slot. The on board reset button resets both Arduino and ethernet shield. The shield contains a number of informational LEDs:

- PWR: indicates that the board and shield are powered.
- LINK: indicates the presence of network link and flashes when the shield transmits or receives data.
- FULLD: indicates that the network is full duplex.
- 100M: indicates the presence of a 100 Mbps network connection (as opposed to 10 Mbps)
- RX: flashes when the shield receives data
- TX: flashes when the shield sends data
- COLL: flashes when network collisions are detected.

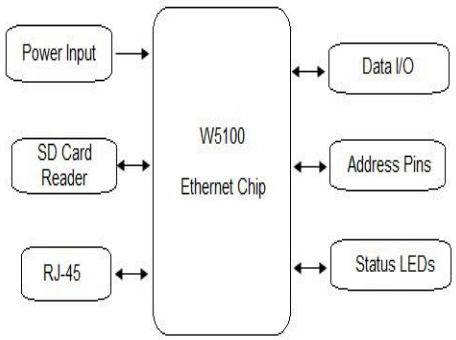

Fig. 5. Ethernet shield.

C. KG011

The KG011 [3] sensor is a pulse sensor and used to measure heartbeat rate. On the front side of the sensor there is an LED which shines through from the back and there is also a little square just under the LED. The square part is an ambient light sensor. The LED shines light into our skin which passes through capillary tissue and the sensor reads the light that bounces back. It has three connections Vcc, Gnd and Signal as shown in Fig. 6.

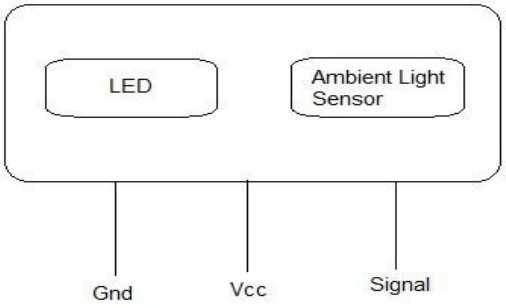

Fig. 6. Pulse sensor

D. DS18B20

The DS18B20 [4] is a digital temperature sensor and mainly used as a thermometer. It provides 9-bit to 12-bit Celsius temperature measurement. This sensor has an amazing capability of communication through a single data line (1-Wire bus) with a central microcontroller. Not only that, it has potential to derive power directly from the data line if wired correctly. It is able to measure temperature in the range -55° C to +125° C. The sensor has three pins; Vcc, Gnd and Data as shown in Fig. 7.

E. Notepad++

It is a very flexible platform to write HTML code for designing webpages. The web page of our prototype system

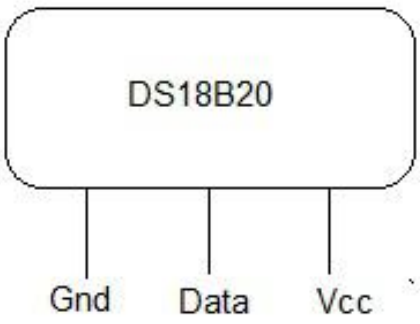

Fig. 7. Temperature sensor.

has been designed using notepad++. Having the basic knowledge of web development, one can easily design the basic web page for displaying data on it. For the update of data, read by the sensors, the refresh rate of the page has been kept 1 sec.

F. Arduino IDE

Arduino IDE (Fig. 8) provides an integrated development environment for writing C language especially for embedded system developed with Arduino boards. Since it supports C language, one can easily develop the code with having the basic knowledge of C Programming Language. One can also use the header files for the ease of development. The syntax and programming procedure is almost similar to C. Our developed system reads the analog values (using the library function analogRead (channel)) of the sensors from the ADC channel of Arduino which provides digital data. Then these digital data are translated into voltages using mathematical calculation. Finally these values voltages are converted into a form of information (percentages) that human can easily understand. With all these information, the HTML code for the webpage is sent to Ethernet shield which then transmit all to internet.

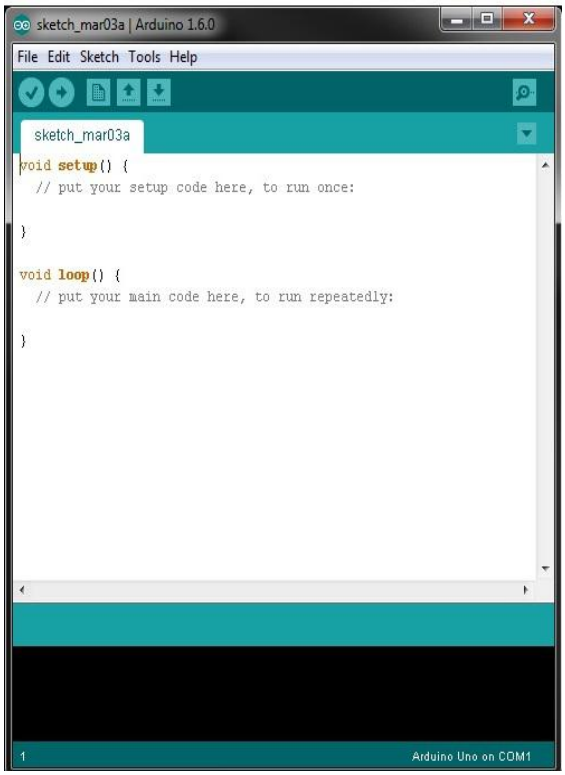

Fig. 8. Arduino IDE.

5 APPLICATIONS OF THE SYSTEM

Since this system provide immediate health assistance it can be very useful for human. One can easily consult with his doctor even without going to any medical center or to his doctor from his home just by opening a browser tab. This will help a patient from the trouble of getting an appointment

and also the time. Not only that, one who has the basic knowledge of treatment, he can easily monitoring those data and take immediate steps

6 FUTURE PROSPECTIVE

The system above shown is a very basic prototype. It can be further developed for the following facilities.

Fig. 9. Photograph of the developed system..

- More sensors that are required for primary diagnostics.
- Listing the available doctors with different categories.
- Video conference facility.
- Displaying proper graphs for Heartbeat, ECG, EEG etc. on the web page.
- Making a small portable system with Wi-Fi facility.
- And more other facilities can be included according to the needs.

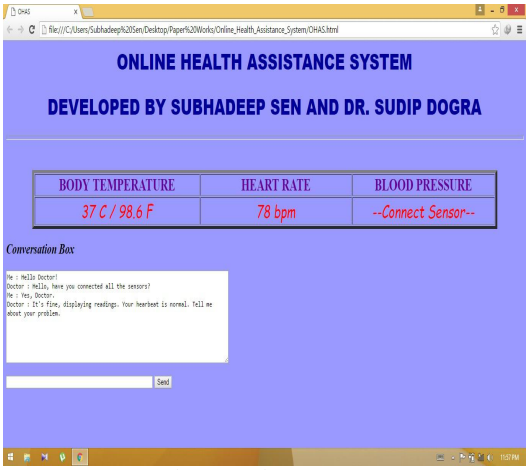

Fig. 10. Web page.

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