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Health Care System Using Embedded System and IOT

Mohd Parvez Ali, S Shiva Kumar, S Bhavani, M Vijaya Bhargavi, S.V. Altaf
Electronics and Communication Engineering, Lords Institute of Engineering and Technology, Hyderabad, Telangana, India

ABSTRACT

The Internet of Things (IoT) provides an efficient and new life to the healthcare field. It also has a rapid development of many fields. But the more important are real in the field of Medical. One of the better ways the doctors are capable to certainly and quickly have right to use the relevant patient information's and including the patient medical history. The project gives an experimental idea of patient's health condition and monitor vital conditions and controlling. The main objective of the paper is to use "RFID and Sensor technology which enable computers to observe identify and understand the world without the limitations of human-entered data." The information collected through sensors and RFID will be analyzed by Arduino. In emergency medical services, to improve the quality of healthcare services, delivering clinic information of patient at the point-of-care to physicians is critical. In this system, clinic data of patient is sent to the website through ethernet thereby providing access to the people related to patient or to doctor and nurse. The quick development of electronic gadgets, advanced mobile phones and tablets which can be imparted physically or remotely has turned into the principal device of day by day life.

Keywords: Internet of Things (IoT), RFID, Sensors, Arduino, Ethernet

I. INTRODUCTION

The Internet of things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, a ctuators, and connectivity which enables these objects to connect and exchange data. Internet of Things is the primary technology for interconnecting all the medical resources of the rehabilitation systems. Also to combine the Networking technologies that enables a wide range of applications, devices or things to interact and communicate among themselves. It is envisaged that the future healthcare system should be preventive, predictive, personalized, pervasive, participatory, patient-centered, and precise, i.e., health system. Health informatics, which is an emerging interdisciplinary area to advance health, mainly deals with the acquisition, transmission, processing, storage, retrieval, and use of different types of health and biomedical information. The two main acquisition technologies of health information are sensing and imaging. This paper focuses on sensing and RFID technologies.

RFID and sensors are interfaced with Arduino which forms the embedded system. Arduino MEGA analyses the data received from the RFIDs and the sensors connected to it. The sensors are connected to the patient. Heart rate sensor can be connected to the ear which collects the information about the functioning of heart and it monitors the flow of blood through ear lobe. Temperature sensor monitors the patient's body temperature. The blood pressure sensor measures the BP levels of the patient when it is connected to the arm of the patient. And the water levels are measured using the saline sensor. The values of the sensors will be set to a predetermined level if any of the sensors value exceeds the predetermined level then the

information will be sent through ethernet on to website which is analyzed by the Arduino. In healthcare service, doctors, patients, physicians play a major role and they also involved in an entire servicing. Doctors have to access the patient record from anywhere by storing it in a distributed manner. The subsystems used in the paper are discussed in the below sections in detail.

II. BLOCK DIAGRAM

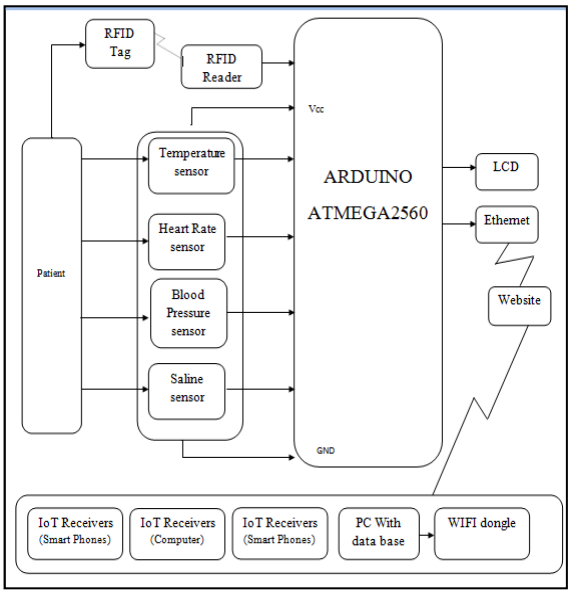

Figure 1. Block Diagram

III. DESCRIPTION

A. ARDUINO:

Arduino is an open source microcontroller which can be easily programmed, erased and reprogrammed at any instant of time. Introduced in 2005 the Arduino platform was designed to provide an inexpensive and easy way for hobbyists, students and professionals to create devices that interact with their environment using sensors and actuators. It is also capable of receiving and sending information over the internet with the help of various Arduino shields. Arduino uses a hardware known as the Arduino development board and software for developing the code known as the Arduino IDE (Integrated Development Environment). The hardware consists of a simple open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller.

This development board can also be used to burn (upload) a new code to the board by simply using a USB cable to upload. The Arduino IDE provides a simplified integrated platform which can run on regular personal computers and allows users to write programs for Arduino using C or C++.

Types of Arduino Boards:

Arduino boards are available with many different types of built-in modules in it. Boards such as Arduino BT come with a built-in Bluetooth module, for wireless communication. These built-in modules can also be available separately which can then be interfaced (mounted) to it. These modules are known as Shield. Some of the most commonly used Shields are:

- **Arduino Mega2560:**

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 microcontroller. 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. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

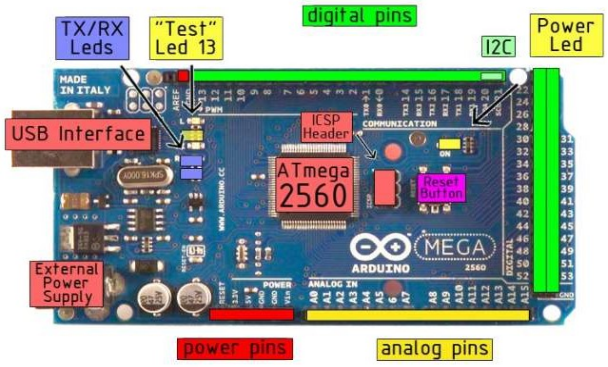

Figure 2. Arduino Mega2560

ATmega2560:

Features

- The high-performance and low-power Microchip
- 8-bit AVR RISC-based microcontroller
- CPU Speed (MIPS) is 16
- 256KB ISP flash memory
- 8KB SRAM
- 4KB EEPROM
- Operates between 4.5-5.5 volts.

Figure 3. ATmega2560 Microcontroller

Arduino Ethernet shield: It that allows an Arduino board to connect to the internet using the Ethernet library and to read and write an SD card using the SD library. It is based on the Wiznet W5100 ethernet chip. The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous socket connections. It uses the Ethernet library to write sketches which connect to the internet using the shield. The ethernet shield connects to an Arduino board using long wire-wrap headers which extend through the shield. This keeps the pin layout intact and allows another shield to be stacked on top. The shield adds a micro-SD card slot, which can be used to store files for serving over the network. It also includes a reset controller, to ensure that the W5100 Ethernet module is properly reset on power-up. Arduino communicates with both the W5100 and SD card using the SPI bus (through the ICSP header). This is on digital pins 50, 51, and 52 on the Mega. On the Mega board, pin 10 is used to select the W5100 and pin 4 for the SD card.

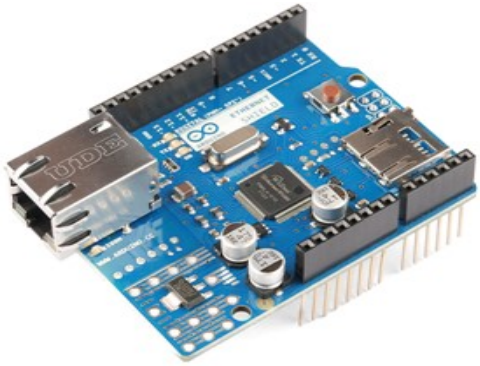

Figure 5. Arduino Ethernet shield

B. SENSORS:

Heart Beat sensor:

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through ear lobe. As the heart forces blood through the blood vessels in the ear lobe, the amount of blood in the ear changes with time. The sensor shines a light lobe (small incandescent lamp) through the ear and measures the light that is transmitted. The clip can also be used on a fingertip or on the web of skin between the thumb and index finger. The signal is amplified, inverted and filtered, in the box. By graphing this signal, the heart rate can be determined, and some details of the pumping action of the heart can be seen on the graph. Blood flowing through the earlobe rises at the start of the heartbeat. This is caused by the contraction of the ventricles forcing blood into the arteries and by shutting of the heart value at the end of active phase.

Temperature sensor:

The temperature sensor in the circuit will read the temperature from the surroundings and shown the temperature in Celsius (degrees). The LM35 is a low voltage IC which uses approximately +5VDC of power. This is ideal because the Arduino's power pin gives out 5V of power. The IC has just 3 pins, 2 for the power supply and one for the analog output. The output pin provides an analog voltage output that is linearly proportional to the Celsius temperature. Pin 2 gives an output of 1millivolt per 0.1°C (10mV per degree).

Blood Pressure sensor:

The Blood Pressure Sensor is a non-invasive sensor designed to measure human blood pressure. It measures systolic, diastolic and mean arterial pressure utilizing the oscillometric technique. Monitoring blood pressure at home is important for many people, especially if you have high blood pressure. Blood pressure does not stay the same all the time. It changes to meet your body's needs. It is affected by various factors including body position, breathing or emotional state, exercise and sleep. It is best to measure blood pressure when you are relaxed and sitting or lying down.

Saline sensor:

Saline monitoring is the process of monitoring the level of saline solution in the saline bottle used for the patient. When the level goes below a preset value [finishing stage], information is passed on to the centralized computing center for further actions like changing to a new bottle or stopping the flow permanently For saline level monitoring, infrared emitter and detector are used which are placed in such a way that the saline bottle passes between them. They are placed near the neck of the saline bottle. As long as saline solution is present, the path of the infrared rays is blocked and the infrared detector is blocked from collecting infrared rays from the infrared emitter. And so the output will be a logical low. When the saline level drops, the output will be a logical high. The software is developed to give an alarm when the logical high output is attained and given to the DSPIC Processor. A differential voltage comparator LM 339 is used to compare the voltages produced in the circuit. It is a very high precision comparator, which can even compare to a precision of 1mV and produce sufficient output.

RFID:

Radio-frequency identification (**RFID**) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC). RFID tags are used in many industries, for example, an RFID tag attached to an automobile during production can be used to track its progress through the assembly line; RFID-tagged pharmaceuticals can be tracked through warehouses; and implanting RFID microchips.

RFID Tags:

A radio-frequency identification system uses *tags*, or *labels* attached to the objects to be identified. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response. RFID tags can be passive, active or battery-assisted passive. An active tag has an on-board battery and periodically transmits its ID signal. A battery-assisted passive (BAP) has a small battery on board and is activated when in the presence of an RFID reader. A passive tag is cheaper and smaller because it has no battery; instead, the tag uses the radio energy transmitted by the reader. However, to operate a passive tag, it must be illuminated with a power level roughly a thousand times stronger than for signal transmission. That makes a difference in interference and in exposure to radiation. RFID tags contain at least three parts: an integrated circuit for storing and processing information that modulates and demodulates a radio-frequency (RF) signals; a means of collecting DC power from the incident reader signal; and an antenna for receiving and transmitting the signal. The tag information is stored in a non-volatile memory. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively.

Figure 6. RFID Tags

RFID Reader:

RFID systems can be classified by the type of tag and reader. A **Passive Reader Active Tag** (**PRAT**) system has a passive reader which only receives radio signals from active tags (battery operated, transmit only). The reception range of a PRAT system reader can be adjusted from 1–2,000 feet (0–600 m), allowing flexibility in applications such as asset protection and supervision. An **Active Reader Passive Tag** (**ARPT**) system has an active reader, which transmits interrogator signals and also receives authentication replies from passive tags. An **Active Reader Active Tag** (**ARAT**) system uses active tags awoken with an interrogator signal from the active reader. A variation of this system could also use a Battery-Assisted Passive (BAP) tag which acts like a passive tag but has a small battery to power the tag's return reporting signal. Fixed readers are set up to create a specific interrogation zone which can be tightly controlled. This allows a highly defined reading area for when tags go in and out of the interrogation zone. Mobile readers may be hand-held or mounted on carts or vehicles.

Figure 7. RFID Reader

Ethernet:

Ethernet is a family of computer networking technologies commonly used in local area networks (LAN), metropolitan area networks (MAN) and wide area networks (WAN). Systems communicating over Ethernet divide a stream of data into shorter pieces called frames. Each frame contains source and destination addresses, and error-checking data so that damaged frames can be detected and discarded; most often, higher-layer protocols trigger retransmission of lost frames. As per the OSI model, Ethernet provides services up to and including the data link layer. Ethernet is the most popular physical layer LAN technology in use today. It defines the number of conductors that are required for a connection, the performance thresholds that can be expected, and provides the framework for data transmission. A standard Ethernet network can transmit data at a rate up to 10 Megabits per second (10 Mbps). Other LAN types include Token Ring, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Fiber Distributed Data Interface (FDDI), Asynchronous Transfer Mode (ATM) and Local Talk. Ethernet is popular because it strikes a good balance between speed, cost and ease of installation. These benefits, combined with wide acceptance in the computer marketplace and the ability to support virtually all popular network protocols, make Ethernet an ideal networking technology for most computer users today.

Figure 8. Ethernet Cable

LCD:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties

of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs are used in a wide range of applications including computer .Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smart phones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks.

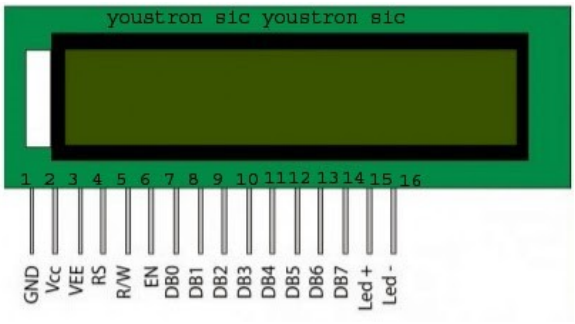

Figure 9. LCD

Wi-Fi Dongle:

It's a small device that plugs into a spare USB Port on your computer. It has a Wi-Fi transmitter/receiver built-in, and it allows your computer to talk to a nearby wireless router.

Figure 10. WIFI Dongle

Handheld devices:

Here the handheld devices used are laptops and smart phones. A handheld computer is a computer that can conveniently be stored in a pocket (of sufficient size) and used while you're holding it. Today's handheld computers, which are also called personal digital assistants (PDAs), can be divided into those that accept handwriting as input and those with small keyboards. If the device is a phone/tablet, the external hardware design will have a touch screen providing a virtual keyboard and buttons (icons) on-screen, and will include physical sound volume buttons and sometimes a home button. It will also include a USB port and jack port. It will usually include front and rear-facing cameras, along with a microphone.

Figure 11. Handheld Devices

IV. IMPORTANT COMPONENTS:

- ✓ Arduino MEGA 2560
- ✓ Arduino Ethernet Shield
- ✓ RFID Tag and Reader
- ✓ Temperature Sensor
- ✓ Heart Rate Sensor
- ✓ Blood Pressure Sensor
- ✓ Saline Sensor
- ✓ LCD

V. SOFTWARE TOOL

Arduino IDE (Integrated Development Environment):

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application. It includes a code editor with

features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. A program written with the IDE for Arduino is called a sketch. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

VI. ADVANTAGES

This system provides the health parameters of the patient like temperature, heart rate, BP levels and the water levels in the body.

- It is cost effective
- The power consumed will be less

VII. APPLICATIONS

- It can be used mainly in hospitals.
- This system can also be used for the elderly patients who stay in home.

VIII. CONCLUSION

Now-a-days Internet of Things plays a major role in day to day life. It is used in many fields like consumer and home appliances, smart infrastructure, etc. IoT is also used in health care industry where the information can be transferred to the users about the patient in a less amount of time. If patient require any medical assistance immediately then the doctor and nurse would receive the information and the situation can be handled as soon as possible. This project provides the smart health care system which could be used not only hospitals but also in homes. Using this system patient's health condition can be monitored and necessary medication can be provided if necessary.

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