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Health Care System Using Raspberry Pi

Garigipati Vijay Kumar¹, Pallikonda Jashuva²

Asst. Professor, Department of ECE, NVR College of Engineering and Technology, Tenali, India¹

Asst. Professor, Department of ECE, Vijaya Institute of Technology for Women, Vijayawada, India²

ABSTRACT: Devotion towards own body is one of the important factor considered in this era. The equipments which provide results at run time and also accuracy maintained are provided by the electronic engineers. With the help of new technology of Raspberry Pi, health care system can be monitored. In this type of technology we have to monitor multiple persons using the different type of sensors and prevent the spread of covid. Wireless communication is done through Bluetooth module which provides flexibility and extendibility. In this paper basic parameters like body temperature and distance between the surrounding people is monitored and is transferred on wrist band to make it visible for those people who are infected by the covid.

KEYWORDS: Health care systems, Raspberry Pi, Bluetooth module, Wireless Network.

I. INTRODUCTION

The technology provides ease in life by providing facilities. To measure the health parameter for every patient every time is not possible manually. So to keep the health sound and maintained, different technologies are used which provides facilities. To overcome such type of delay in measuring the temperature, if we connect an electronic device with patient body which reads physical quantity that is temperature and sense it to monitor. Earlier the health care system was working on analogue input system and output taken from the signal is displayed on CRO or any computer screen. That output data maybe in analogue form or in digital form. For this type of input and output data's the converter like ADC and DAC are required. Also systems were relied on wired network. This network is formed with the help of RS232 and RS485. After that the communication is done through the protocol like TCP/IP. These protocols were developed further like I2C bus protocol [1]. The wired network has to pass stationary cable connectivity and extension of the system to under some critical condition was not possible. Also the wired network link cost more than wireless network. Also the connectivity can be extendable with the use of wireless network, it provides flexibility too [2]. To monitor the patient there is a computer system required in earlier health care system but according to latest technology of Raspberry pi which itself is a mini computer which overcomes this problem. Single kit can manipulate the multiple persons are monitoring and those are healthy and those are having the common symptoms of covid. In this paper the actual system overview is mentioned.

II. SYSTEM OVERVIEW

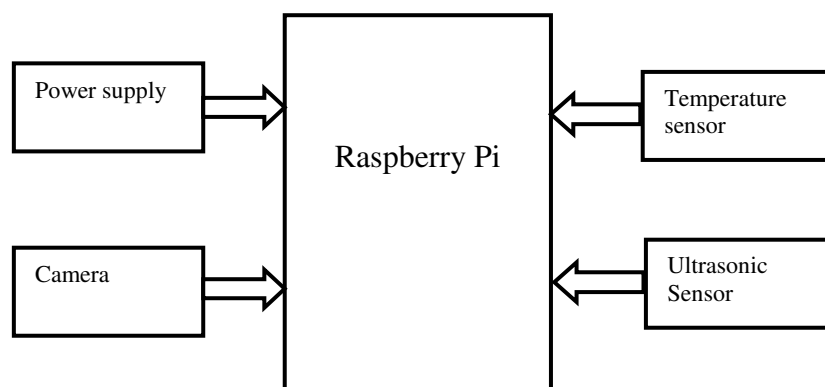


Fig. 1 Design of health monitoring system using raspberry pi (TX)

Nowadays, more attention is focused on the prevention and early detection of diseases as well as on optimal management of chronic conditions. These functions are often augmented by new location-independent technologies. The system is design to read the body temperature and distance of patient at run time. The system mainly focused on

collecting the physical parameter and then that information is made available for multiple users. The results or the collected information is sent to multiple users who share same area network. Once the user operates his system he will receive the information which is updated automatically since, the program is a user interface. As the collected data is made available for user, one can refer that data to determine the health condition of patients. Since the system is automatically updated after particular time span the data is refreshed and if any abnormality arises that may be detected and it could be updated in wrist band.

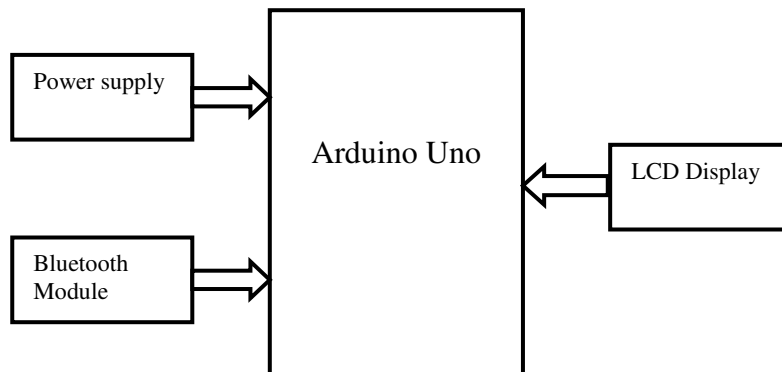


Fig. 2 Design of health monitoring system using raspberry pi (RX)

III. SYSTEM IMPLEMENTATION

The Raspberry Pi is a mini computer (consist of processor, graphics card, and memory in a single package). These model was developed in UK ,it is about the size of a credit card. The board is developed for the users who wanted to use the system without using the computers and any other operating device. Using this board the whole system can be operated only the power source is required for Raspberry Pi board. The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARMI176JZF-S 700 MHz processor, Video Core IV GPU, and onboard the 256 megabytes of RAM is available. This model is later upgraded (Model B & Model B+) to 512 MB. It does not contain a built-in hard disk but it uses an SD card for booting and storage.



Fig. 3 Raspberry Pi Board

The Model B+ uses a Micro SD which is the advance feature of this era [3]. The SD card must contain the operating system (Linux), programs and the data needed to run the Raspberry Pi. Raspberry Pi has the functioning according to the operating system. Managing the programs and handling the inputs, these things are manage by the operating system. This model has features like HD (high-definition) quality video playback. Also it has sports high quality audio and 0 has the ability to play 3D games. This device uses the ARM processor. The health care system consists of Raspberry Pi B+ model which can interface with different parameters measuring units. The Raspberry Pi works only on digital values. In this paper, basic health parameters are considered and monitored.

Ultrasonic Sensor:

The ultrasonic sensor HC-SR04 has a transmitter and receiver. It uses sonar to calculate the distance from a physical objects. It has an excellent range of object detection from 2 cm to 400 cm (13 feet) with high accuracy. The ultrasonic sensors calculate the physical object's distance by transmitting ultrasonic wave and then detects its reflection wave. The working principle of ultrasonic sensor is demonstrated in Fig. 4. Ping is input ultrasonic waves which are transmitted at the velocity of 340 m/s and Echo is reflected output of sensor which is used to determine the distance. In proposed work ultrasonic sensor is used for the measure the distance in between the person to person it will sends the information to the lcd display. It measure the distance of healthy person to virus infected person and gives its report on screen using Bluetooth technology.

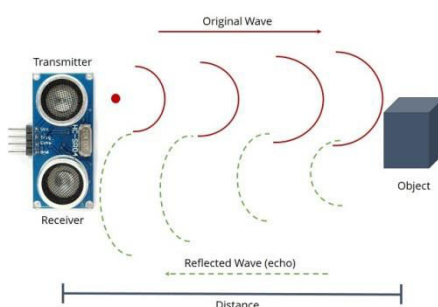


Fig. 4 working principle of ultrasonic sensor

Temperature Measurement unit:

The MLX90614 is an infrared thermometer for non-contact temperature measurements. Both the IR sensitive thermopile detector chip and the signal conditioning ASIC are integrated in the same TO-39 can. Integrated into the MLX90614 are a low noise amplifier, 17-bit ADC and powerful DSP unit thus achieving high accuracy and resolution of the thermometer. The thermometer comes factory calibrated with a digital SMBus output giving full access to the measured temperature in the complete temperature range(s) with a resolution of 0.02°C. The user can configure the digital output to be pulse width modulation (PWM). As a standard, the 10-bit PWM is configured to continuously transmit the measured temperature in range of -20 to 120°C, with an output resolution of 0.14°C.



Fig. 5 Infrared Temperature Sensor

Features and benefits:

- Factory calibrated in wide temperature range: -40 to 125°C for sensor temperature and -70 to 380°C for object temperature
- High accuracy of 0.5°C over wide temperature range (0..+50 C for both Ta and To)
- Medical accuracy of 0.1°C in a limited temperature range available on request
- Measurement resolution of 0.02°C
- SMBus compatible digital interface for fast temperature readings and building sensor networks
- Customizable PWM output for continuous reading
- Available in 3V and 5V versions
- Simple adaptation for 8 to 16V applications
- Different package options for applications and measurements versatility

Arduino Uno microcontroller:

It is a single-chip microcontroller. It contains a modified Harvard architecture 8-bit RISC processor core. It also has a 32kb ISP flash memory with read-while-write capabilities. Other than this, it includes one kB EEPROM, 2 KB SRAM, 23 general-purpose I / O lines, 32 general-purpose operating registers, three versatile timer / compare modes, inner and external interrupts. It is embedded in Arduino UNO which works on an operational voltage of about (1.8-5.5)V. It is a very low-cost micro-controller, thus, making it very effective easily available and very common to find in day to day appliances. The Arduino Uno is an ATmega328-based microcontroller board. It has 14 digital I/O pins, six analog inputs, 16MHz ceramic resonators, USB connection, ICSP header, a power jack, and reset button. It involves all the assistance the microcontroller requires. It can simply be linked with a USB cable to a laptop. To get started, it can be powered by an AC to DC adapter or battery. The Uno varies from all previous boards because to serial driver chip it does not use the FTDI USB. Rather, it features the Atmega16U2 programmed as a USB to serial converter (Atmega8U2 up to version R2). The Integrated Development Environment (IDE) of Arduino is a Java-written cross-platform application. It involves a code editor with characteristics such as highlighting syntax, brace matching, and automatic indentation and is also able to compile and upload programs with a single click to the board. An Arduino program or code is called a "sketch".



Fig. 6 Arduino Uno microcontroller

Bluetooth module:

Bluetooth module HC-05 is used for wireless communication between Arduino Uno and Raspberry Pi Module. HC-05 is a slave device and it can operate at power 3.6 to 6 volts. It has 6 pins: State, RXD, TXD, GND, VCC and EN. For serial communication connect TXD pin of Bluetooth module HC-05 with RX (pin 0) of Arduino Uno and RXD pin with TX (pin 1) of Arduino Uno. Connection diagram of Arduino and Bluetooth (BT) module is illustrated in Figure.

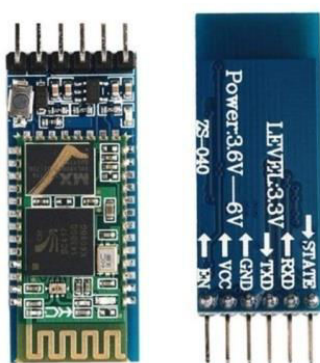


Fig. 7 Bluetooth module

OLED display:

In this project a 0.96 inch monochrome OLED display from Geekcreit is connected or interfaced to an Arduino. Libraries are then installed and some example programs run which show how to use the display in an Arduino sketch. The display connects to Arduino using only four wires – two for power and two for data, making the wiring very simple. The data connection is I2C. At the very lowest level, the Arduino Wire library is used to communicate with the display. Libraries are available that make it easy to start using the display right away to display text and graphics. In this display we have to display the distance and body temperature of the person.

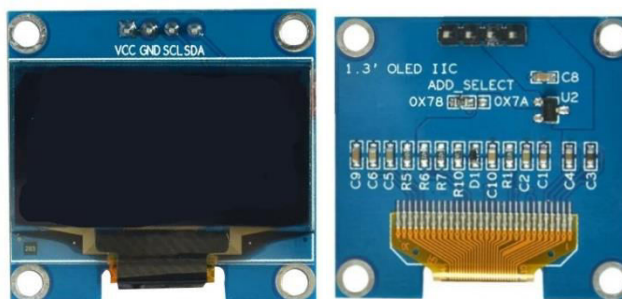


Fig. 8 OLED display

The detected values should be available OLED display for every time it is updated, for this the detected values should be made local by uploading them on particular information in to lcd display. Ultrasonic sensor and temperature sensor continuously monitor the distance and person body temperatue values are refreshed in every second which shows detected values at runtime. It will contain the basic information of the patient and the determined values of body temperature and distance of the infected person(which are refreshed at every second). The python code is written for creating list of the persons who are masked/unmasked. Figure 10 shows the output image of the person wear the mask or not. For restarting and stopping the program the commands in LX Terminal can be operated and manually stopping the program is possible. For controlling the GPIO pins Wiring Pi C is used. Interfacing of different measurement units with Raspberry Pi Python is used. Since the programming in Python is similar to that of C language and also user friendly library is available. To share the same area network VNC viewer is used. In this VNC viewer the IP address of Raspberry Pi model is shared by maximum 4-5 users at a time. Figure shows the output images of the person health parameters with patients' information. The value of temperature is displayed up to two decimal digits. The parameters are updated after every second. The abrupt occurring abnormality can be detected from the previous value. This paper is based on basic parameter monitoring without using any bulky system. Only the credit card sized board supplied with power is placed beside the patient's bed and the results are seen on the computer screen which is in same area network.

IV. EXPERIMENTAL RESULTS



Fig. 9 Person not wears the mask



Fig. 10 Person wears the mask

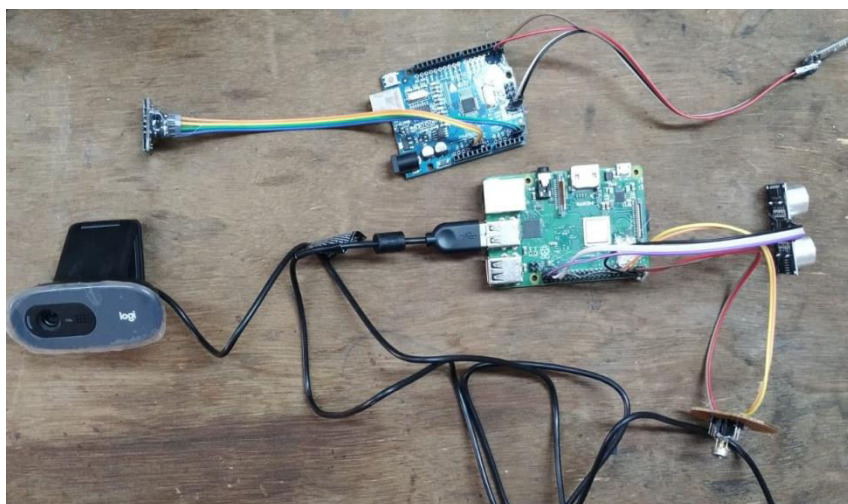


Fig. 11 Hardware Kit

V. CONCLUSION

A wireless health-care monitoring device can be managed without using the computer system. Further different parameters can be monitored and this system can be made commercially useful in hospitals. A single Raspberry Pi board can process multiple patients data at run time and manually recording the readings can be avoided. The space required for such system is very less. With comparison with other board Raspberry pi is more advanced in terms of cost, speed, features etc. In the highly developing era, where directly or indirectly, everything is dependent on computation and information technology, Raspberry Pi proves to be a smart, economic and efficient platform for implementing the health monitoring system. With the use of comfortable wearable sensors in global areas, the proposed healthcare system promises to improve the flexibility and scalability of healthcare applications. In addition, an Android mobile healthcare application can be deployed on mobile devices, such as smartphones, tablet PCs, and laptops to monitor biomedical signals in realtime for healthcare services. We can also conclude that with the evolution of network integration and the management of embedded devices operating multimodal tasks, a more precise and universal healthcare service scheme can be realized.

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