Implementation of ICU Patient Monitoring System Using IoT

Mr. P. B. Shelke[1], Ms. Vijayshri D. Bopte[2], Ms. Payal R. Pankar[3], Mr. Akshay N. Wagh[4]
Department Of Electronics and Telecommunication Engineering PLIT & MS Buldana
Email: vijayshribopte21@gmail.com.

Abstract- Internet of Things (IOT) is the emerging paradigm, which contains huge amount of smart object and smart devices connected to the internet for communicating with each other. IOT devices are used in many fields which make the users day to day life more comfortable. These smart devices are used to collect temperature, Heart rate, Respiration, Sweat etc., which are used to evaluate the health condition of the patient. Communicating the collected information to the doctor, making accurate decision on the data collected and notifying the patient is the challenging task in the IOT. In this paper, the architecture of the Patient Health Monitoring System (PHMS) using IOT devices is proposed to collect the required parameters and evaluate the data obtained from the IoT devices.

Keywords- Internet of Things, ATmega328 microcontroller, PHMS, Sensor, esp8260 wifi module, Buzzer.

1. INTRODUCTION

 In recent years, the growth of internet is tremendous and has been further extended to connecting things through internet. IOT devices are used to collect, monitor, evaluate and notify the patient with the information. From the development of technologies (Internet of Things) is changing the human life into a new level. IOT is change the normal human life to smart life with new technology level. There are several process such as smart home, smart city, health monitoring systems are monitor using Internet of Things. Internet of Things is used for monitor all patients in any level. In this paper, patient's heart rate, body temperature, breathing rate and body movements are monitoring using atmega328.It is an AVR based 8 bit microcontroller. it has 1KB electrically erasable programmable read only memory(EEPROM).Its excellent features include the cost efficiency, low power dissipation programming lock for security purposes, real timer counter.

2. LITERATURE SURVEY

A number of reviews on the subject of Wireless Sensors techniques were done in the past either as part of research papers/technical reports on iot based Health Monitoring System.

[a] Ashlesha A. Patil focus on review of iot based smart healthcare system. The main objectives of this proposed system is to transmitting the patients health monitoring parameters through wireless communication. These input data are uploaded in cloud server and transmitted to the computer and mobile for family and doctor's reference.

[b] Aruna Devi. S developed the architecture of patient health monitoring system (PHMS) using iot device. PHMS also notifies the patient with possible precautionary measures to be practiced by them. This system suggest the patient with medical care and next step to be follow in case of critical situation.

[c] Pooja Navdeti designed a system which is used in hospital for measuring and monitoring various parameters like temperature, ECG, heart beat etc. the result can be recorded using raspberry pi displayed on a LCD display. Also the result can be send to server using GSM module. Doctors can login to a website and view those results.

[d] R. Kumar developed a system which monitor patient's heart rate, body temperature, respiration rate and body movements using raspberry pi. After connecting internet to the raspberry pi board it acts as a server. Then the server is automatically send data to the web server. Then this parameters are monitor using webpage anywhere in the world using laptops, smart phone etc. if these parameters are goes to abnormal, it will automatically send alert message to the doctors.

3 SYSTEM DESIGN

 In this paper we have temperature, respiration, sweat and heart beat reading are monitoring using ATmega328. These sensors signals send to the microcontroller via amplifier circuit and signal conditioning unit (scu). After connecting internet to the AVR microcontroller it act a server. Then the server automatically sends data to the website. Using IP address anybody can monitor the patient's health status anywhere in the world using laptops, tablets and smart phones. After full hardware completion process, then PHP server is used for run the webpage coding. After creating web page coding saved it on

microcontroller desktop. After installing PHP server webpage is run.

Fig.1 System design diagram.

Fig.1 gives the schematic of Patient Health monitoring system using ATmega328 based on IoT which consist of ATmega328 mc, heart rate sensor, temperature sensor, sweat sensor, respiration sensor, signal conditioning circuit, Buzzer, LCD display, power supply, Reset resistors, Clock circuit and webpage

3.1 *ATmega328 microcontroller*

Fig 2 shows the high performance micro-chip 8 bit AVR based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working register, 3 flexible timer/counters with compares modes, internal and external interrupts, serial programmable USART, a byte-oriented2 wires serial interface, SPI serial ports, 6 channel 10- bits A/D converter(8 channels in TQFD and QFN/MLF packages), programmable watchdog timer with internal oscillators, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

Fig 2 : ATmega328 microcontroller

3.2 *Temperature sensor*

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature as shown in fig. The LM35 device does not require any external calibration or trimming. The device is used with single power supplies, or with plus and minus supplies.

Fig 3: Temperature Sensor

3.3 *Heart rate sensor*

The heart rate sensor is based on the principle of photo phlethysmography as shown in fig. It measures the variation in the volume of blood through any regions of the body which causes a change in the light intensity through that region(a vascular region). when the index finger is placed on the heart beat sensor , the variation in an optical power takes place when the light falls on the index finger is scattered or absorbed during the path through the blood as the change in heartbeat.

Fig 4: Heart beat sensor

3.4 *Respiration sensor*

Fig 4 shows Water flow sensor consists of a plastic valve body, a water rotor and a half effect sensor. when water flows through the rotor, rotor rolls. Its speed changes with different rate of flow.

Fig 5: water flow sensor

The hall- effect sensor outputs the corresponding pulse signal. Water flow sensor consists of a plastic valve body, a water rotor and a half effect sensor. Its speed changes with different rate of flow. The hall effect sensor will then output a pulse width signal, connect it to a microcontroller.
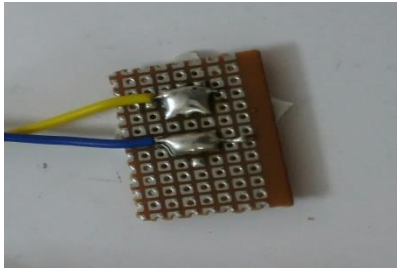
3.5 *Sweat sensor*

Fig 6: PCB sweat sensor

Sweat diagnostics is an emergency non invasive technique use to provide insight to the health of human body. The PCB sweat sensor is used as shown in fig. It requires 5 V dc supply. It is designed to collect capture and analyze sweat.

3.6 *Wifi module*

ESP8266 is an impressive, low cost wifi module suitable for adding wifi functionality to an existing microcontroller project via a UART serial connection.

Fig 7 : 8266 wifi module

The module can even be reprogrammed to acts as standalone wifi connected device-just add power. the hardware connection required to connect to the ESP8260 module are fairly straight-forward but there are coupe of important items to note related to power as shown in fig.

3.7 *LCD display*

Liquid crystal display a type of display used in digital watches and many portable computers. It is used to display the measured data. We have used 16 x 2 Alphanumeric Display which means on this display we can display two lines with maximum of 16 characters in one line.

Fig 8: LCD Display

3.8 *Buzzer*

Musical buzzer ranging from 3V to 24V. It is used in alerting/alarming circuit. This is an external which is operates in wide range of voltage. Most commonaly used in at 9V and 12V.
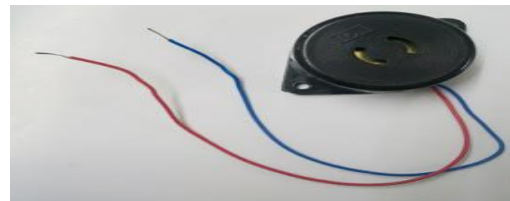

Fig 9: Musical buzzer

4 SOFTWARE

4.1 *PHP:*

PHP server is used for run the webpage coding. After creating the webpage coding saved it on the microcontroller desktop. after installing PHP server webpage is run.

4.2 *Arduino software*

After full hardware completion process, the arduino software is used for completion of full project. Arduino is a pro type platform based on easy to use hardware and software. It consist of a circuit board. Which can be programmed and ready mate software called arduino IDE which is used to write and upload the computer code to the physical board. Arduino provides the standard form factor that breaks the function of microcontroller into a more acccible package.

5. WORKING OPERATION

Iot based ICU patient monitoring system is a atmega328 based system which collect patients information with help of few sensor which are temperature sensor, heart rate sensor, sweat sensor and respiration sensor. It uses 8266 wifi module to communicate this information to the internet. The sensor electrically connected to the system and physically to the patient's body. It require 12v battery supply, After turn on the power supply the sensor senses the signal and send it to the microcontroller. All

sensors require 5v power supply except wifi module, it require 3v power supply and for that shift resistors are used. After getting value from patients body, it display on the LCD and by using the wifi module the data from the LCD display transfer to the web page by using PHP server. Thus the doctor can get the message of patient health parameter on mobile.
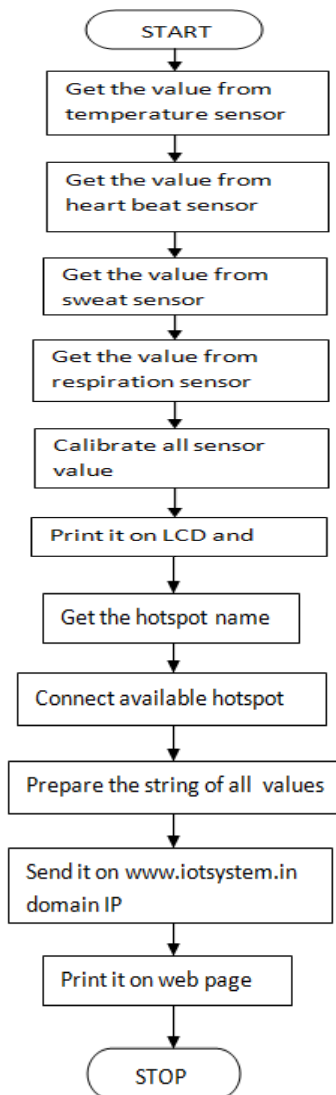
5.1 FLOW CHART

Fig 10: flow chart

6.RESULT AND ANALYSIS

The Figure shows the Implemented board. It consists of atmega328 microcontroller board, LM35 Temperature sensor, Heart Rate sensor, Sweat sensor, water flow sensor, ESP8260 wifi module, LCD display and buzzer.
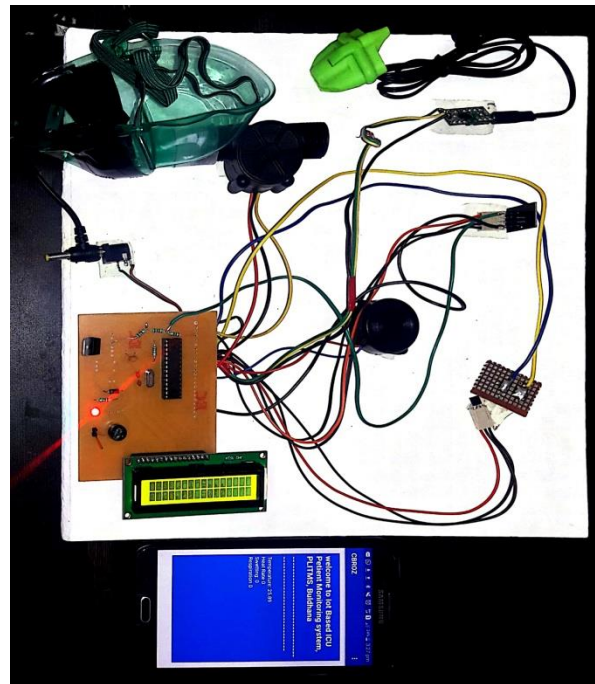
Fig 11: Implemented board

The Figure 11 shows the Implemented board. It consists of atmega328 microcontroller board, LM35 Temperature sensor, Heart Rate sensor, Sweat sensor, water flow sensor, ESP8260 wifi module, LCD display and buzzer.

Following process goes on step by step when hardware is powered as shown in fig.

[a] After getting power supply give the input to the system. The inputs from all sensors like temperature sensor, heart beat sensor, sweat sensor, respiration sensor.

[b] Calibrate all the sensors value.

[c] All the calibrated value print on LCD display.

[d Get the hotspot name to the system and connect to the available hotspot and by using the program prepare the string of all values.

[e] All the measured parameters of the patient then send it on www.iotsystem.in domain IP, by using arduino software.

[f] Interfacing arduino with PHP server by using this web page is run and get the value of string on webpage.
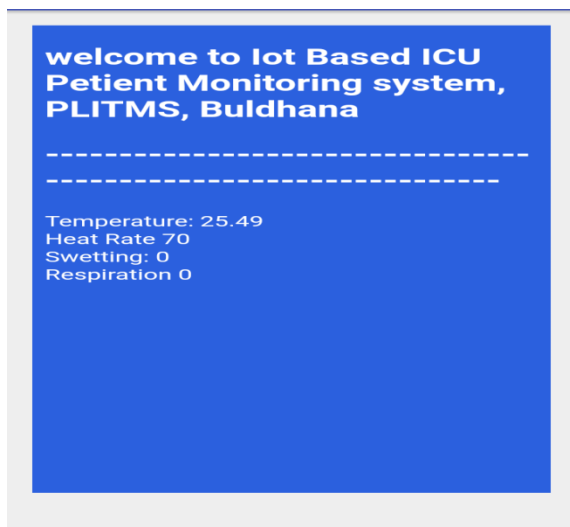
Fig 12 : Message obtained to the mobile.

The Figure 12 shows Message obtained from the PHP server to the web page. The result which is displayed on the mobile is current temperature and heart rate condition of the patient measured parameters. which include temperature, heart rate, sweating and respiration.

7 CONCLUSION AND FUTURE WORK

With the wide use of internet this work is focused to implement the internet technology to establish a system which would communicate through internet for better health. Internet of things is expected to rule the world in various fields but more benefit would be in the field of healthcare. Hence present work is done to design an IOT based ICU patient monitoring system using atmega328 microcontroller. In this work the Temperature, flow sensor is used for the respiration,0PCB sensor is used to measure the sweat and also heart rate sensor is used to measure the pulse. microcontroller picks up the data and send it through ESP8266 Wi-Fi protocol. The data is also sent to the LCD for display so patient can know his health status. During extreme conditions to alert the doctor warning message is sent to the doctor's cell phone. The doctors can view the sent data by logging to the webpage using unique IP. Hence continuous patient monitoring system is designed.

The Future work of the project is very essential in order to make the design system more advanced. In the designed system the enhancement would be connecting more sensors to internet which measures various other health parameters and would be beneficial for patient monitoring i.e. connecting all the objects to internet for quick and easy access. Establishing a Wi-Fi mesh type network to increase in the communication range

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P.B.ShelkeS received his B.E degree in Industrial Electronics Engineering in 1992 and M.E degree in Electronics Engineering in 2007 from Sant Gadge Baba Amravati University, Amravati (India) in 2007. He received his PhD degree in Electronics Engineering from Sant Gadge Baba Amravati university, Amravati(India) in 2016.He is currently working as a Professor and Head in Electronics and Telecommunication Engineering at Pankaj Ladhad Institute of technology management studies, Buldana. His research interests include video and Image processing, computer vision etc.

Email: pb_shelke@rediffmail.com