Health Care Monitoring System For Analysing Patient's Data Based On Message Queuing Telemetry Transport Protocol

V. Hari chandana[1], Mrs.N.Harini [2]
[1]*PG Scholar: Dept. of ECE, G. Narayanamma institute of technology and science, Hyderabad*
[2]*Assistant Professor: Dept. of ECE, G. Narayanamma institute of technology and science, Hyderabad*

Abstract - As the technology is becoming advance so do we, in this era controlling and checking the status through Internet of things (IOT) is playing a very crucial role. In many technologies environment status of an area is being monitored and controlled using IOT using Wi-Fi IEEE 802.11 which can vary according to the speed of the network connection. In this project a very light weight protocol i.e. Message Queueing Telemetry transport (MQTT) protocol is used, While there are currently a number of competing IoT technologies and protocols in play, the extremely lightweight overhead (2-byte header), publish/subscribe model, and bidirectional capabilities of MQTT are uniquely suited to meet the demands of health monitoring control systems.

In this paper Health care monitoring application is used to analyse patient health condition. Here a single board computer i.e. Raspberry pi 3 is used which has a processing speed of 1.2 GHZ with ARMv8 BCM2837 SoC processor including in built Wi-Fi and BLE (Bluetooth Low Energy) with 1GB of RAM. All the patient health monitoring values will be updated on the raspberry pi server from where the data through MQTT protocol will be published to the cloudmqtt.com which will act as the broker and the client i.e. MQTTLENS App will receive live condition of the patient and according to any abnormality and taking care of the crucial condition of the patient, message will be sent to the Doctor, Nurse or care taker accordingly their crucial condition using the Twilio API. Also a local authenticated server (MySQL Database) is made where all the patient health values will be updated and stored, which can only be authenticated by the Doctor.

Keywords:- MQTT, IOT, healthcare, WSN, WI-FI.

I. INTRODUCTION

Mobile health refers to the practice of medicine and public health supported by mobile devices. The m-health field has emerged as a sub-segment of e-Health, the use of information and communication technology (ICT), such as computers, mobile phones, communications satellite, patient monitors, etc., for health services and information. In this paper , we focus on mobile health remote monitoring system, kind of mobile health applications , include the use of mobile devices in collecting community and clinical health data, delivery of health care information to practitioners, researchers, and patients, real-time monitoring of patient vital signs. As the technology is becoming advance so do we, in this era controlling and checking the status through Internet of things (IOT) is playing a very crucial role. In many technologies environment status of an area is being monitored and controlled using IOT using Wi-Fi IEEE 802.11 which can vary according to the speed of the network connection. In this project a very light weight protocol i.e. Message Queuing Telemetry transport (MQTT) protocol is used, While there are currently a number of competing IIoT technologies and protocols in play, the extremely light weight overhead (2-byte header), publish/subscribe model, and bidirectional capabilities of MQTT are uniquely suited to meet the demands of health monitoring control systems. In this paper Health care monitoring application is used to analyze patient health condition. Here a single board computer i.e. Raspberry pi 3 is used which has a processing speed of 1.2 GHZ with ARMv8 BCM2837 SoC processor including in built Wi-Fi and BLE (Bluetooth Low Energy) with 1GB of RAM. All the patient health monitoring values will be updated on the raspberry pi server from where the data through MQTT protocol will be published to the wireless network which will act as the broker and the client i.e. MQTTLENS App will receive live condition of the patient and according to any abnormality and taking care of the crucial condition of the patient, message will be sent to the Doctor, Nurse or care taker accordingly their crucial condition will be send using the Twilio API. Also a local authenticated server (MySQL Database) is made where all the patient health values will be updated and stored, which can only be authenticated by the Doctor.

II. BLOCK DIAGRAM

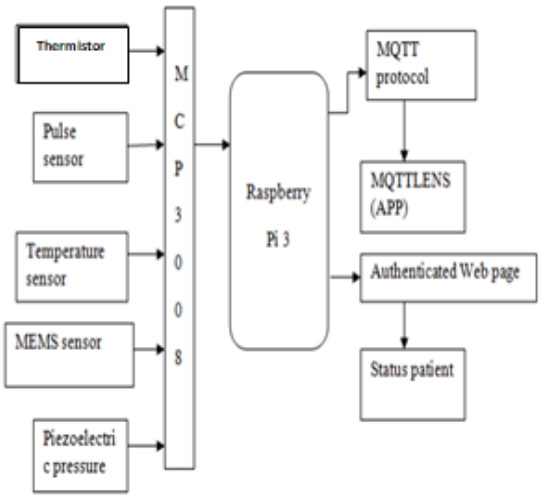

Fig 2.1 Block diagram of proposed system

The figure below shows the block diagram of the entire system to be developed where each module is being discussed in the earlier chapters. The system entirely collects the patient's data which can be stored in a web server or data base of the doctor. The live values of the patient are 24 monitored time to time so that whenever there are abnormal conditions an SMS will be sent or displays on screen from anywhere in the world.

III. HARDWARE COMPONENTS

3.1 Raspberry-pi 3

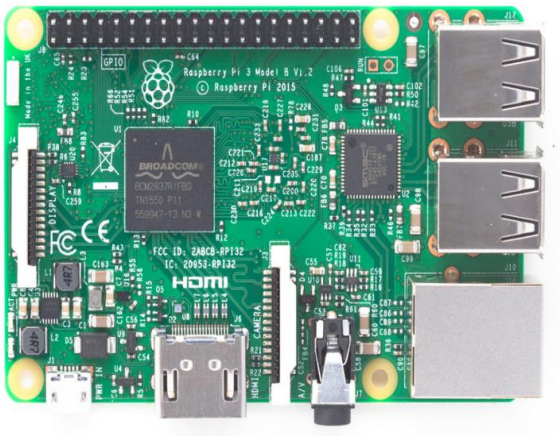

Fig 3.1 Raspberry-Pi 3

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B. Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processer, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.

3.2 MEMS SENSOR

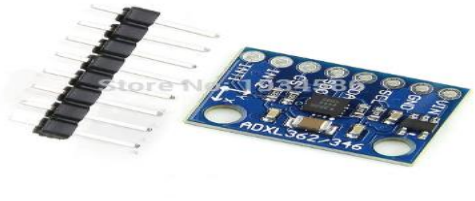

Fig 3.2 MEMS Sensor

MEMS accelerometers are one of the simplest but also most applicable micro-electromechanical systems. They became indispensable in automobile industry, computer and audio-video technology. This seminar presents MEMS technology as a highly developing industry. Special attention is given to the capacitor accelerometers, how do they work and their applications. The seminar closes with quite extensively described MEMS fabrication.

An accelerometer is an electromechanical device that measures acceleration forces. These forces may be static, like the constant force of gravity pulling at our feet, or they could be dynamic - caused by moving or vibrating the accelerometer. There are many types of accelerometers developed and reported in the literature. The vast majority is based on piezoelectric crystals, but they are too big and to clumsy. People tried to develop something smaller, that could increase applicability and started searching in the field of microelectronics. They developed MEMS (micro electromechanical systems) accelerometers. The first micro machined accelerometer was designed in 1979 at Stanford University, but it took over 15 years before such devices became accepted mainstream products for large volume applications [1]. In the 1990s MEMS accelerometers revolutionised the automotive-air bag system industry. Since then they have enabled unique features and applications ranging from hard-disk protection on laptops to game controllers. More recently, the same sensor-core technology has become available in fully integrated, full-featured devices suitable for industrial applications [2]. Micro machined accelerometers are a highly enabling technology with a huge

commercial potential. They provide lower power, compact and robust sensing. Multiple sensors are often combined to provide multi-axis sensing and more accurate data.

3.3 TEMPERATURE SENSOR

TheLM35 pin diagram is shown in the figure 2 .As a temperature sensor, the circuit will read the temperature of the surrounding environment and relay temperature to us back in degrees Celsius. 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 (centigrade) temperature. Pin 2 gives an output of 1 milli volt per 0.1°C (10mV per degree). So to get the degree value in Celsius, all that must be done is to take the voltage output and divide it by 10- this give out the value degrees in Celsius.

Fig 3.3 Temperature sensor LM35

3.4 THERMISTOR

A thermistor is a specific type of resistor that uses sensors to help regulate cold and heat. They can do more than simply regulate temperature. They are also used for voltage regulation, volume control, time delays, and circuit protection.

Fig 3.4 Thermistor

Thermistors are a class of sensitive components, divided into positive temperature coefficient thermistor (PTC) and negative temperature coefficient thermistor (NTC) according to temperature coefficient. Typical characteristics of the thermistor are temperature sensitive and exhibit different resistance values at different temperatures. Figure 2.2 shows the thermistor 102 of 1k ohm resistance.

3.5 PIEZO ELECTRIC SENSOR

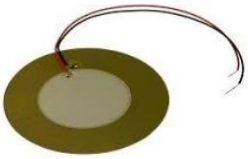

Fig 3.5 Piezo electric pressure sensor

A sensor that utilizes the piezoelectric effect, to measure changes in acceleration, strain, pressure, and force by converting them into electrical charge is called as a piezoelectric sensor. Piezo is a Greek word which means ‘presses or ‘squeeze’. Piezoelectric effect causes the occurrence of electric dipole moments in solids due to the pressure applied to certain solid materials such as piezoelectric crystals, ceramics, bone, DNA, and some proteins that generates electric charge. This generated piezoelectricity is proportional to the pressure applied to the solid 5 piezoelectric crystal materials. In this article, we will discuss about one of the most frequently used piezoelectric sensor applications, that is, piezo sensor switch.

3.6 PULSE SENSOR

Fig 3.6 : Pulse sensor

When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

IV. SOFTWARE TOOLS

4.1 Linux

Linux is a free open source working framework and it has a place with the Unix working frameworks. In reality Linux implies the piece itself which is the core of the working framework and handles the correspondence between the client and equipment. Regularly Linux is utilized to allude to the entire Linux dispersion.

Linux appropriation is a gathering of programming in view of the Linux Kernel. It comprises of the GNU-task's parts and applications. Since Linux is an open source venture, anybody can alter and circulate it.

4.2 Raspbian Wheezy

Raspbian Wheezy is a free working framework in view of Debian appropriation. It is made by a little group of designers who are enthusiasts of Raspberry Pi. Raspbian is still under dynamic advancement and it intends to enhance the solidness and execution of the Debian bundles

4.3.Python

Python is a multi-worldview programming dialect: protest arranged programming and organized writing computer programs are completely upheld, and there are various dialect highlights which bolster practical programming and viewpoint situated programming (counting by meta programming and by enchantment strategies). Numerous different standards are bolstered utilizing expansions, including configuration by contract and rationale programming.

4.4 HTTP

“Internet of Things” the word itself emphasizes, many things connected to each other by a network. So, for this interrelated communication the protocol used is HTTP (Hyper Text Transfer Protocol). For client server communication, it uses request/response architecture. Http can transfer a large number of data in tiny packets which can possibly cause large overhead. So, due to this overhead communication for IOT via this protocol can cause serious bandwidth issues.

4.5 ZigBee protocol

ZigBee is the most popular industry wireless mesh networking standard for connecting sensors, instrumentation and control systems. ZigBee, a specification for communication in a wireless personal area network (WPAN), has been called the "Internet of things." Theoretically, your ZigBee-enabled coffee maker can communicate with your ZigBee-enabled toaster. ZigBee is an open, global, packet-based protocol designed to provide an easy-to-use architecture for secure, reliable, low power wireless networks. ZigBee and IEEE 802.15.4 are low data rate wireless networking standards that can eliminate the costly and damage prone wiring in industrial control applications. Flow or process control equipment can be place anywhere and still communicate with the rest of the system. It can also be moved, since the network doesn't care about the physical location of a sensor, pump or valve

4.6 BLUETOOTH

Bluetooth is both a hardware-based radio system and a software stack that specifies the linkages between the architecture layers of the two. The heart of this specification is the protocol stack, which is used to define how Bluetooth works. The Bluetooth protocol stack is a set of layered programs. Each layer in a protocol stack talks to the layer above it and to the layer below it. Think of Bluetooth as having two well-defined layers of functionality in the stack. These layers range from the lower level hardware-based radio system, to an upper level software stack that specifies the linkages between the layers

4.7 MQTT Protocol

An MQTT system consists of clients communicating with a server often called a "broker". A client may be either a publisher of information or a subscriber. Each client can connect to the broker. Information is organized in a hierarchy of topics. When a publisher has a new item of data to distribute, it sends a control message with the data to the connected broker. The broker then distributes the information to any clients that have subscribed to that topic. The publisher does not need to have any data on the number or locations of subscribers, and subscribers in turn do not have to be configured with any data about the publishers. When a publishing client first connects to the broker, it can set up a default message to be sent to subscribers if the broker detects that the publishing client has unexpectedly disconnected from the broker. Clients only interact with a broker, but a system may contain several broker servers that exchange data based on their current subscribers' topics. MQTT relies on the TCP protocol for data transmission

V. RESULTS

The results are obtained by giving certain input values to the sensors and also by using the protocols like HTTP, ZigBee, bluetooth, MQTT different protocols we could send the sensed values to the connected devices.

5.1 EXPERIMENTAL SETUP

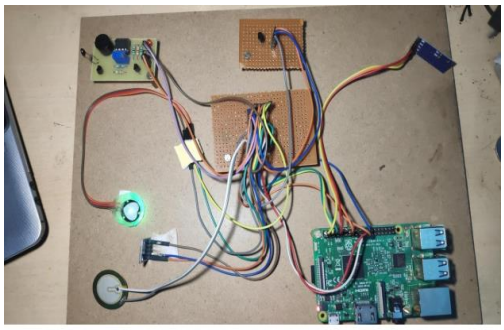

Fig.5.1 Experimental setup

5.2 HTTP result

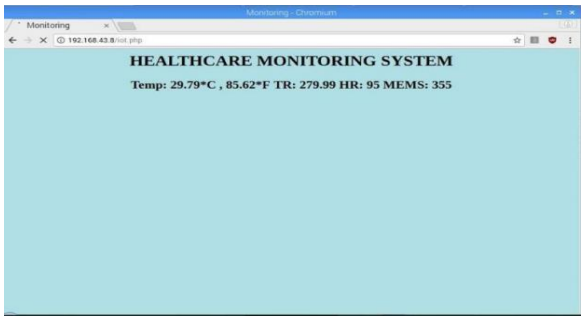

Fig.5.2 HTTP implemented result

5.3 Bluetooth result

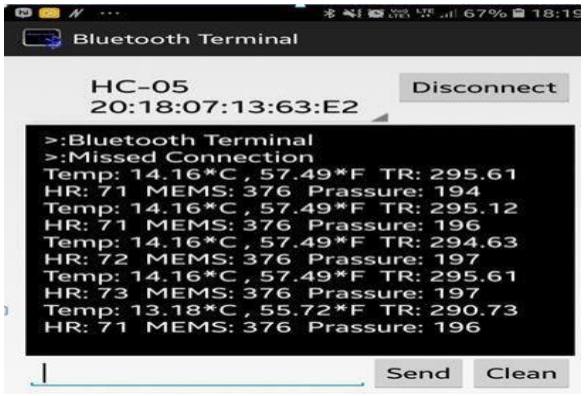

Fig.5.3 Bluetooth terminal

5.4 ZigBee Result

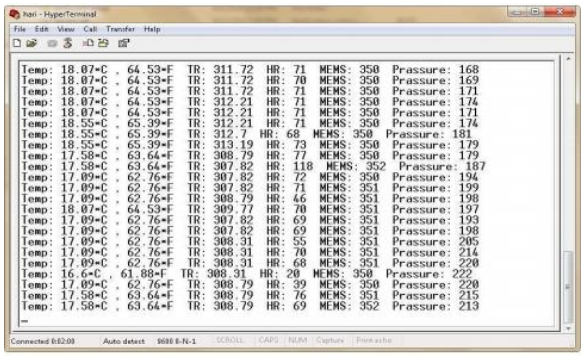

Fig.5.4 ZigBee based result

5.5 MQTT Protocol result

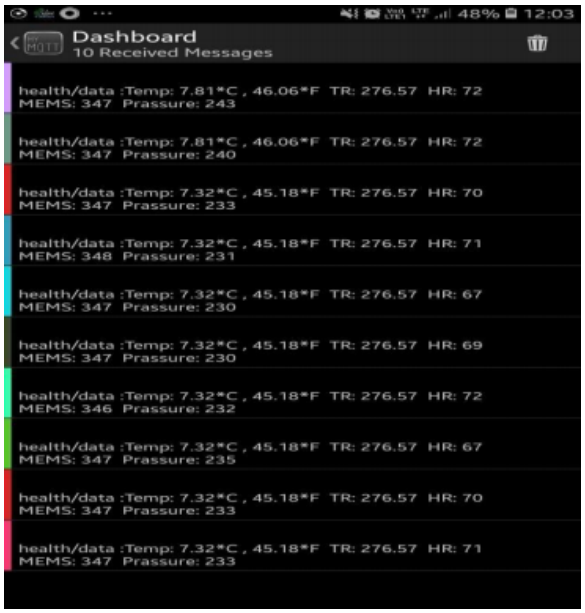

Fig 5.5 My MQTT app result

VI. CONCLUSION AND FUTURE SCOPE

In this paper, we reviewed the current state and projected future directions for integration of remote health monitoring technologies into the clinical practice of medicine. Wearable sensors, particularly those equipped with IoT intelligence, offer attractive options for enabling observation and recording of data in home and work environments, over much longer durations than are currently done at office and laboratory visits. This treasure trove of data, when analyzed and presented to physicians in easy-to-assimilate visualizations has the potential for radically improving healthcare and reducing costs. We highlighted several of the challenges in

sensing, analytics, and visualization that need to be addressed before systems can be designed for seamless integration into clinical practice. The future work of this project works on the betterment of the range, or working with a different protocol like CoAP protocol. Also in this paper the work is mostly related to the usage of internet protocol like MQTT, further we can add a simulation of network level results and also on the power consumption will be concentrated.

VII. REFERENCES

[1] Ahamad Adamu Galadima, Arduino as a learning tool, 11th International Conference on Computer and Comutaion (ICECCO), pp. 1 4, 2014.

[2] Chris Edwards, Not so Humble raspberry pi gets big ideas, Engineering and Technology magazine, pp 30 33, 2013.

[3] G P Raghudathesh, D J Deepak, G Keerthi Prasad, A B Arun, Ravitej Balekai, Vikas C Yatnalli, S H Lata, B Sampath Kumar. "Iot based intelligent poultry management system using Linux embedded system", 2017 International Conference on Advances in Computing, Communications and Informatics.

[4] Kitsguru, DHT11 temperature and humidity sensor, Kitsguru, 2016. [Accessed on: April 15, 2016] http://kitsguru.com/index.php?route=product/product&product id=452&search=dht11.

[5] Komkrit Chooruang and Pongpat Mangkalakeeree, Wireless Heart Rate Monitoring System Using MQTT, 2016 International Electrical Engineering Congress, iEECON2016, 2-4 March 2016, Chiang Mai, Thailand.

[6] Yusuf Abdhullahi Badamasi, The working Principle of an Arduino, 11th International Conference on Electronics, Computer and Comutaion (ICECCO), pp. 1-4, 2014.

AUTHOR PROFILE

1 V.Hari chandana completed her graduation from stanley college of engineering and technology for women in department of electronics and communication, now pursuing masters in technology from G.Narayanamma institute of technology and science.

2 Mrs.N.Harini working as an assistant professor in G.Narayanamma institute of technology and science in the department of electronics and communication, having an experience of about 10 years of teaching. She received her bachelor's degree from Adams engineering college and masters from Anurag engineering college.