SMART HEALTH MONITORING USING INTERNET OF THINGS

A.Gnana Selva Kumar[1] | M.Prabhu[2] | N.Rajesh[3] | G.Saravanakumar[4]
[1](Dept of ECE, Assistant Professor, Anna University, Chennai, India, gnanaselvakumar24@gmail.com)
[2](Dept of ECE, Anna University, Chennai, India, sivaprabhu026@gmail.com)
[3](Dept of ECE, Anna University, Chennai, India, rajeshmeen471@gmail.com)
[4](Dept of ECE, Anna University, Chennai, India, saravanaskd03@gmail.com)

Abstract—*Internet of things is a system that connects physical objects, animals and people etc to the internet by assigning an IP address (IPV6) to everything on the earth. In this paper, we propose a smart health monitoring system whereby IoT technology is implemented to monitor the health status of the patient and alert the doctor in case of emergency. We use heart beat sensor, oxygen sensor and temperature sensor to monitor patients' health. We use Raspberry Pi 3 model to collect data from various respective sensors and display them on the web page in real time. All data is graphically presented and also an automatic alert has been send to the doctor or health officer based on the sensor readings.*

Keywords—Internet of Things; Raspberry Pi 3; Patients' Health; Sensor

1. INTRODUCTION

The internet of things is the inter-networking of physical devices, vehicle, building and other items surrounded with electronics, sensor, software, and network connectivity that enable these objects to gather and swap the data. IoT exploits recent advances in software, falling hardware prices, and modern attitudes towards technology. The most important features of IoT take on artificial intelligence, connectivity, sensors, active appointment, and small device use. The artificial intelligence is used in IoT fundamentally makes virtually anything "smart", meaning it enhance every aspect of life with the power of data collection, artificial intelligence algorithms, and networks. CoAP is having three rules: courier, manager, and coordinator. The raspberry pi is a series of small single board computers developed in the United Kingdom by the Raspberry Pi Foundation to support the teaching of fundamental computer science in schools and in developing countries. The Raspberry Pi is contained on a single circuit board and features, ports for HDMI, USB 2.0, Composite video, Analog audio, Power, Internet, SD Card.

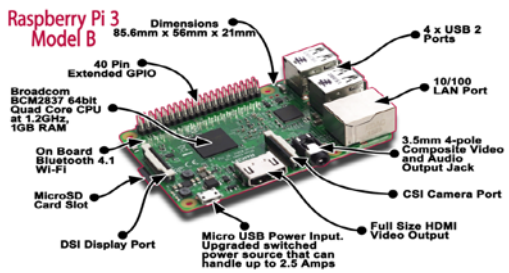

Figure1: Raspberry pi3 kit

2. RELATED WORK

The system has been designed for the measurement of health parameters of the human body. From the point of view, each patient's body we will fix the health parameter sensor to measure the health condition value in hospital. The functional description of the developed system to monitor the health condition like temperature, heartbeat and respiration etc., to measurement of health parameters is done by interfacing with fabricated sensing modules. The output signals from the sensors are integrated with microcontroller and it calculated the each sensor value. Then the every one hour microcontroller transmits the health details to an EB office web page using IOT Kit. Some drawbacks of PIC controller are Low speed communication due to low bandwidth; Chances of getting loss packets, Co channel Interference.

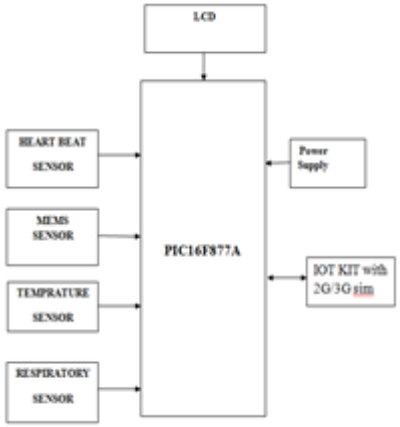

Figure2: Block diagram of Existing System

3. HARDWARE DESIGN

A. HEART BEAT SENSOR

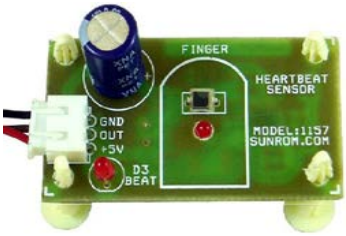

Figure3.1: Heartbeat Sensor

The sensor used for Heart beat monitoring is LED/LDR Sensor. Heart beat sensor is designed to give digital output of heart beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heartbeat. 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. Connect regulated DC power supply of 5 Volts. Black wire is Ground, Next middle wire is Brown which is the output and Red wire is positive supply. These wires are also marked on PCB. To test sensor you only need to power the sensor by connecting two wires +5V and GND. The output wire as it is. When Beat LED is off the output is at 0V.Put finger on the marked position, and you can view the beat LED blinking on each heartbeat. The output is active high for each beat and can be given directly to microcontroller for interfacing applications. This sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified and triggered through an amplifier which outputs +5V logic level signal. The output signal is also indicated by a LED which blinks on each heartbeat.

B. TEMPERATURE SENSOR

The DS18B20 Digital Thermometer provides 9 to 12-bit (configurable) temperature readings which indicate the temperature of the device. Information is sent to/from the DS18B20 over a 1-Wire interface, so that only one wire (and ground) needs to be connected from a central microprocessor to a DS18B20. Power for reading, writing, and performing temperature conversions can be derived from the data line itself with no need for an external power source. Because each DS18B20 contains a unique silicon serial number, multiple DS18B20s can exist on the same 1-Wire bus. This allows for placing temperature sensors in many different places. Applications where this feature is useful include HVAC environmental controls, sensing temperatures inside buildings, equipment or machinery, and process monitoring and control.

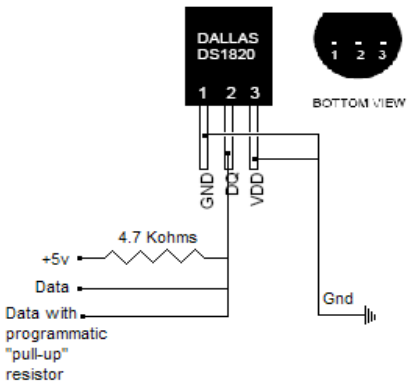

Figure3.2: Temperature Sensor

4. SOFTWARE DESIGN

A. IoT

Internet of things is creating a new world, where people can update their knowledge of their materials which they own and can manage their assets in better-informed ways. In this paper, a status of the home appliances can be analyzed by using IOT concept. The status information will automatically get upload in the cloud. If the user login into the web page, it shows the status whether the selected home appliances is under on or off condition, so the user can know the condition of the selected appliance. In this project, we are going to use a Raspberry Pi to monitor two kinds of data from anywhere in the world: the readings coming from a sensor, and the snapshots taken by a camera. Using the Raspberry Pi makes things much easier as it would be with any other platform.

B. HTML

HTML is used by web programmers to describe the contents of a web page. It is not a programming language. HTML is used to indicate what kind of text is such as, a heading, paragraph or specially formatted text. Matched sets of angle brackets are used to specify all HTML and are usually called tags. A CSS stand for Cascading Style Sheets which describes how HTML elements are to be displayed on paper, screens or in other media.CSS saves a lot of work and multiple web page layouts can be controlled at once.

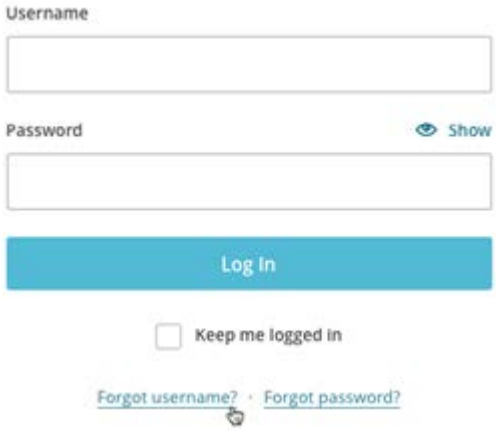

Figure 4.1: HTML Login Section

The Apache projects are characterized by a shared, consensus-based improvement process and an open software license. The Apache HTTP Server which is also called Apache. Apache is the world's mainly used web server software. Figure shows that it supports password authentication and digital certificate authentication. Because the source code is freely available, anyone can adapt the server for specific needs and the large public library of Apache add-ons is available. We can develop and modify server settings towards the necessities of the customer. Apache makes use of ASCII for the actual settings documents within. This makes most of them very easy to give since it is actually eastern in order to modify the actual documents utilizing any kind of textual content publisher. Programming languages such as PHP, Perl, and Python are supported by apache.

C. HTML interface with Raspberry pi3

Raspberry pi is connected to HTML web page by Setting up the wireless network adapter with a static IP address and a lightweight web server that is presented in this paper which is an excellent choice for the Raspberry Pi. But currently, the raspberry pi3 is can serve a web page layout to any device which contains browser on the same network as itself. A button is placed to indicate the start live updates and stop live updates, so the web page loads up. When the start button is pressed, with the intervals of one second, a JavaScript module polls a Python script on the raspberry pi3. Current time is returned by the python script on the raspberry Pi to the JavaScript and that information is displayed on the web page. It does not matter in just getting and displaying the time remotely, in addition to that, it can be expanded to send/receive data from/to the spi or i2c bus, set/clear GPIO pins etc… python can be used for any data processing and it can be done either on the server side or the processing can be done on the client side using JavaScript. The web server which is running on the Pi3 needs the authorization to access the GPIO pins, this can be done easily by adding the GPIO group to the web server web user account. By doing so, the pins can be controlled without the need of root permissions.

```
+ expand source  view plain
01. <html>
02. <body>
03. Raspberry Pi Network Interface Test
04.
05. <p>
06. <input type="button" onClick="startLiveUpdates()" value="Begin Updates">
07. <input type="button" onClick="stopLiveUpdates()" value="Stop Updates">
08. </p>
09.
10. <div id="outputarea">output area</div>
11.
12. <script>
```

Figure 4.2: HTML Interface with Raspberry pi3

D. Wi-Fi (wireless networking)

Wireless technology powers most home networks, many business local area networks and public hotspot networks. A family of new versions of Wi-Fi called sequentially 802.11b, 802.11ac 802.11g, 802.11n, and so on. Each of these related standards can communicate with each other, although newer versions bid better performance and more features. Wi-Fi can be configured in one of two modes either in infrastructure mode Wi-Fi or ad-hoc mode Wi-Fi. Nearly all Wi-Fi setups use infrastructure mode, where client devices within range all connect to and communicate through a central wireless access point. Ad hoc Wi-Fi follows uninstructed architecture that allows clients to connect directly to each other without the use of an access point.

The Web is a computer where the web content is stored. The Website is a collection of web pages while the web server is software that responds to the request for web resources. The Web server responds to the client request in either by, Sending the file to the client associated with the requested URL and Generating response by invoking a script and communicating with the database. Web Server Architecture follows the following two approaches. They are Concurrent Approach, Single-Process-Event-Driven Approach. The concurrent approach allows the web server to handle multiple client requests at the same time. Such as Multi-process, Multi-threaded, Hybrid method.

E. PYTHON

Python is an interpreted computer language that design philosophy emphasizes programmer productivity and code readability. Python is a very useful programming language for web applications. PHP is a server-side scripting language designed for web development. Now, it is used as general purpose programming language. The web server sends the resulting output to its client, usually in form of a part of a web page; for instance, PHP code can generate a web page's HTML code, an image, or some other data. PHP is also used include a command line interface capability and in standalone graphical applications. PHP can handle forms, i.e. gather data from files, save data into to a file, through email you can send data, return data to the user. You add, delete and modify elements within your database with the help of PHP. Using PHP, we can restrict users to access some pages of the website.

It can encrypt data from the front end. Five important uniqueness make PHP's practical nature possible Simplicity, Efficiency, Security, Flexibility, Familiarity.

F. PYTHON WITH RASPBERRY PI

Python is highly recommended as a language that is easy for newcomers to programming. The latest version of the Raspbian OS comes bundled with both Python 3.3 and Python 2.x tools. A Raspberry Pi GPIO Python library that is available To program the GPIO pins on Raspberry Pi with Python. The RPi.GPIO Python library allows you to easily configure and read-write the input/output pins on the Pi's GPIO header within a Python script.

```
1  import RPi.GPIO as GPIO
2
3  # to use Raspberry Pi board pin numbers
4  GPIO.setmode(GPIO.BOARD)
5
6  # set up the GPIO channels - one input and one output
7  GPIO.setup(11, GPIO.IN)
8  GPIO.setup(12, GPIO.OUT)
9
10 # input from pin 11
11 input_value = GPIO.input(11)
12
13 # output to pin 12
14 GPIO.output(12, GPIO.HIGH)
15
16 # the same script as above but using BCM GPIO 00..nn numbers
17 GPIO.setmode(GPIO.BCM)
18 GPIO.setup(17, GPIO.IN)
19 GPIO.setup(18, GPIO.OUT)
20 input_value = GPIO.input(17)
21 GPIO.output(18, GPIO.HIGH)
```

Figure 4.3: Python with Raspberry pi3 (Coding)

5. PROPOSED WORK

Health is one of the worldwide challenges for people. In the most recent decade the healthcare has drawn a considerable amount of awareness. The main goal was to develop a consistent patient monitoring system so that the healthcare professionals can observe the patients, who are either hospitalized or executing their normal daily life actions.

In recent era, the patient monitoring systems are one of the major advancements because of its enhanced technology. Currently, there is a need for a modernized approach. In the traditional approach the healthcare professionals play the major role. They want to visit the patient's ward for compulsory diagnosis and advising.

There are two basic troubles associated with this approach. Firstly, the healthcare professionals must be present on the site of the patient all the time and secondly, the patient remains admitted in a hospital, bedside biomedical instruments, for a period of time. In order to solve these two problems, the patients are given knowledge and information about sickness diagnosis and avoidance. Secondly, a consistent and readily available patient monitoring system (PMS) is necessary. In order to improve the above condition, we can make use of technology in a smarter way. In recent years, health care sensors along with raspberry pi play a crucial role.

In our system we are measuring patient's parameters (temperature, heart rate, pulse, etc) with different available sensors. This sensor collected data i.e. biometric information is given to raspberry pi and then it is transferred to the server. The biometric information gathered can be wirelessly sent using Wi-Fi. The data stored in a database and can be displayed on a website that can be accessed only by authorized personnel. The doctors, RMOs, the patient or his family members can be given the permission. The system even facilitates the doctor to view the patient's previous history from the data in memory.

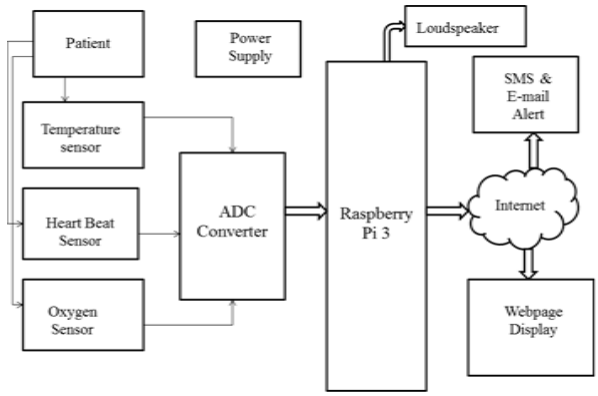

Figure5: Block Diagram of Smart Health Monitoring

6. CONCLUSION

In this paper, we review the current state and projected future instructions for combination of remote health monitoring technologies into the clinical practice of medicine. Wearable sensors, mainly those equipped with IoT intelligence, offer good-looking options for enabling observation and recording of data in the home and work environment, over much longer durations than are at present done at an office and laboratory visits. This treasure trove of data, when analyze and presented to physicians in an easy-to-assimilate visualizations have the possibility for radically improving health care and dipping costs. We decorated several of the challenges in the sense, analytics, and visualization that needs to be addressed ahead of systems can be designed for seamless integration into clinical practice.

7. FUTURE WORK

In the future, the address of patient is also stored in the server. In emergency situations, with the help of patient's address ambulance can easily find the place where the patient is located. It also informs the neighbor. When one ambulance arrives to the patient's house it will inform to other ambulance services that the ambulance is arrived at the patient. Also, it informs to the patient's relations when the patient is in dangerous condition. Further it also informs to the patient's relations after the ambulance is picked his patient. With the help of this information the relations can directly come to hospital where patient is admitted.

REFERENCES

[1] A. Dohr, R. Modre-Osprian, M. Drobics, D. Hayn, G.Schreier, "The Internet of Things for Ambient Assisted Living", Seventh International Conference on Information Technology, pp 804-809,2010.

[2] M. Wcislik, M. Pozoga, P. Smerdzynski "Wireless Health Monitoring System", IFAC (International Federation of Automatic Control) Hosting by Elsevier Ltd. pp 312–317,2015.

[3] Amir-Mohammad Rahmani, Nanda Kumar Thanigaivelan, Tuan Nguyen Gia, Jose Granados, Behailu Negash, Pasi Liljeberg1, and Hannu Tenhunen, "Smart e-Health Gateway: Bringing Intelligence to Internet-of- Things Based Ubiquitous Healthcare Systems",IEEE consumer communications and networking pp 826-834, 2015.

[4] Junaid Mohammed, Abhinav Thakral, Adrian Filip Ocneanu, Colin Jones, Chung-Horng Lung, Andy Adler," Internet of Things: Remote Patient Monitoring Using Web Services and Cloud Computing", 2014 IEEE International Conference on Internet of Things (iThings 2014), Green Computing and Communications (GreenCom2014), and Cyber-Physical- pp 256-263,2014

[5] Mohammad S. Jassas, Abdullah A. Qasem, Qusay H. Mahmoud," A Smart System Connecting e-Health Sensors and the Cloud A Smart System Connecting e-Health Sensors and the Cloud" Proceeding of the IEEE 28 th Canadian Conference on Electrical and Computer Engineering Halifax, Canada, pp 712-716,May 3-6, 2015.

[6] Hasmah Mansor, Muhammad Helmy Abdul Shukor, Siti Sarah Meskam, Nur Quraisyia Aqilah Mohd Rusli, Nasiha Sakinah Zamery," Body Temperature Measurement for Remote Health Monitoring System" IEEE International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA)26-27 November 2013.

[7] R.S.H. Istepanian , S. Hu, N. Y. Philip, and A. Sungoor," The Potential of Internet of m-health Things "m-IoT" for Non-Invasive Glucose level Sensing", 33rd Annual International Conference of the IEEE EMBS Boston, Massachusetts USA, pp 5264-5266,August 30 -September 3, 2011.

[8] K.Mathan Kumar, R.S.Venkatesan," A Design Approach to Smart Health Monitoring Using Android Mobile Devices" IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT), pp 1740-1744,2014.

[9] Karandeep Malhi, Subhas Chandra Mukhopadhyay, Fellow, IEEE, Julia Schnepper,

[10] Mathias Haefke, and Hartmut Ewald," A Zigbee-Based Wearable Physiological Parameters Monitoring System" IEEE Sensors Journal, Vol. 12, NO. 3, pp 423-430,March 2012.

[11] Subhas Chandra Mukhopadhyay," Wearable Sensors for Human Activity Monitoring: A Review ", IEEE Sensors Journal, Vol. 15, No. 3, pp 1321-1330, March 2015.

[12] Shanzhi Chen, HuiXu, Dake Liu, Bo Hu, and Hucheng Wang, " A Vision of IoT: Applications, Challenges, and Opportunities With China Perspective ", IEEE Internet Of Things Journal, Vol. 1, No. 4, pp 349-359,August 2014

[13] John A. Stankovic," Research Directions for the Internet of Things", IEEE Internet Of Things Journal, Vol. 1, No. 1, pp 3 – 9,February 2014.