Patient Healthcare Monitoring System Using Raspberry Pi

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Abstract- This paper uses the concept of Internet of Things (IOT) which is used to automate systems around us, such as smart environment, smart home, smart city, smart parking, agriculture fields and medical fields. This paper presents a novel method which helps to, monitor patient's heart-rate, body temperature, respiration rate and body movements using Raspberry pi. After connecting Internet to the Raspberry pi board it act as a server. If these parameters are goes to abnormal state, it will automatically send alert message to the doctor through the GSM module. The data send by Raspberry pi is stored on a server. The detailed information of patients and doctor is registered through website and stored on server. The website can be accessible from anywhere only for patients, it also useful for normal people to check the health status by using wearable devices with sensors.

Key Words: **Raspberry pi; Monitoring system, GSM module; sensors.**

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1. Introduction:

Health is one of the global challenges for humanity. In the last decade the healthcare has drawn considerable amount of attention. The prime goal was to develop a reliable patient monitoring system so that the healthcare professionals can monitor the patients, who are either hospitalized or executing their normal daily life activities. Recently, the patient monitoring systems is one of the major advancements because of its improved technology. Currently, there is need for a modernized approach. In the traditional approach the healthcare professionals play the major role. They need to visit the patient's ward for necessary diagnosis and advising. There are two basic problems associated with this approach. Firstly, the healthcare professionals must be present on site of the patient all the time and secondly, the patient remains admitted in a hospital, along with bed side biomedical instruments, for a period of time.

In order to solve these two problems, the patients are given knowledge and information about disease, diagnosis and prevention. Secondly, a reliable and readily available Patient Monitoring System (PMS) is required. In order to improve the above condition, latest technologies can be used in a smarter way. In recent years, health care sensors along with raspberry pi play a vital role. Wearable sensors are in contact with the human body and monitor his or her physiological parameters. With the help, sensors in the market today such

as ECG sensors, temperature sensors, pulse monitors etc. The cost of the sensors varies according to their size, flexibility and accuracy. The Raspberry pi which is a cheap, flexible, fully customizable and programmable small computer board brings the advantages of a pc to the domain of sensor network.

2. Literature survey

1. M. Wcislik et al monitors patient's body temperature, pulse rate, ECG wave and patient's body position using arm Cortex M4F micro controller. Android app is created for monitor these values. Bluetooth connection is used for connecting microcontroller and android phone. This project monitor patient's body temperature, respiration rate, heart rate and body movements using Raspberry pi board and sensors.

2. Amir-Mohammad Rahmani et al [3] monitor ECG wave using panda board. Ethernet connection is used for connecting internet to the panda board. In this paper monitor body temperature, respiration rate, heart rate and body movements using Raspberry pi board are monitored.

3. Hoi Yan Tung et al monitors body temperature, ECG, heart rate using DRZHG micro controller. A Dual Radio Zigbee Homecare Gateway (DRZHG) has been proposed and implemented to support remote patient monitoring. The idea of remote patient monitoring is to simultaneously track the status of long-term patients at home by using mobile medical sensors. The sensors collect medical data from patients and feedback the data to the doctors.

3. Problem definition

1. Problem definition of our underlying system which is basically useful for doctor's for monitoring patient's health parameter and gets the accurate result.

2. The doctors are continuously monitor the health parameter of ICU patients from any location and virtually connected to the patient through website.

3. Also through this system real time parameter values can be measured so this system is beneficial for hospitals as well as in clinic also.

4. Through this system, the doctor can able to calculate temperature, ECG, heart rate values efficiently and store data on raspberry pi temporarily.

5. The values are in form of - Temperature we are getting Celsius, heart rate in pulses, ECG in percentage shown on display as well as on website.

4. System model

4.1 System Architecture:

The interconnection between different components is explained using the architecture of system. Architecture diagram is shown in Fig. 1. The patients connect the sensors to their body and the other end of the sensors is connected to Raspberry Pi. The data acquired by sensors is stored in the Raspberry pi B+. The data values (i.e. Biometric data) are shown on LCD display and at the same time if the values exceed the normal range, the alarm triggers. The values stored are sent to server with the help of GSM. All the values are stored on the server and the most recent value is displayed on webpage. The doctor along with their login credentials can login and see the patient data. Doctors can see all previous records of a patient and suggest medicines and changes in prescription.

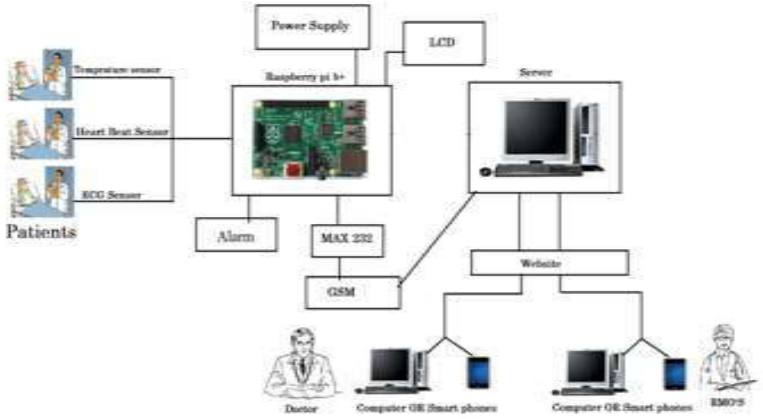

Fig. 1 Architecture diagram

5. Block diagram:

Block diagram is shown in Fig. 2. The diagram is divided into two sections: Transmitter and receiver. In the transmitter section the collected data is stored in the Raspberry Pi B+ and the data is sent to the server using GSM module. In the receiver section a web page is built and data collected is displayed on the web page.

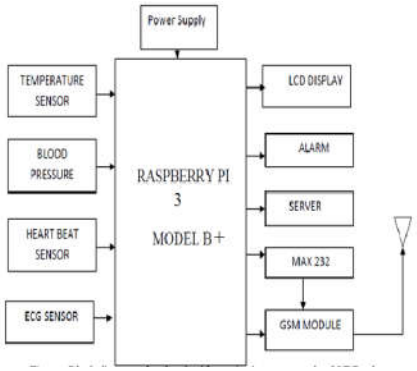

Fig. 2 Block diagram

The design of the system is divided into two parts: Hardware components and software components.

A. Hardware Components:

1. Raspberry Pi model 3 B+. 2. Temperature Sensor (LM35). 3. ECG Sensor.

4. GSM Module SIM 800. 5. Heart Rate Sensor. 6. LCD Display

B. Software Components

1. Putty Software. 2. VNC Sever

6. Flow Chart

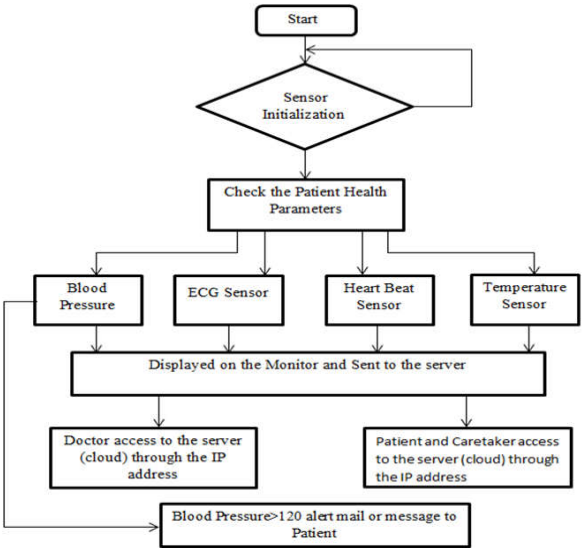

Fig. 3 System control flow.

7. Hardware Implementation of the Model.

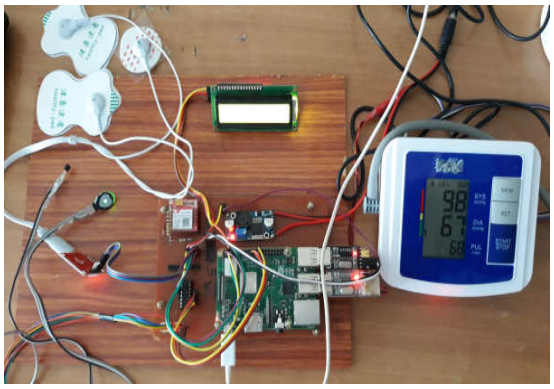

Fig. 4 Hardware Connection Setup for Patient Monitoring System using Raspberry pi

8. Result Analysis and Discussion

The IOT based health monitoring system is being deployed and tested over a patient whose personal details are entered into the web server. The patient is connected with the

health monitoring system which consists of a heart rate sensor, blood pressure sensor, ECG sensor and a temperature sensor. The data of the patient's heart rate, blood pressure and temperature is being monitored on a database server. The IOT device used here is Raspberry pi3 B+ kit.

The system of IOT based patient health monitoring system which includes a server connected Raspberry pi3 B+ board that uploads the data received by the sensors onto the database for further analysis and recording. The GSM technology helps the server to update the patient data on website. Many further improvements can be made in our system to make it better and easily adaptable such as adding more advanced sensors.

Table No.1 Parameters Tested on patient and their values.

Temparature	Heart Beat	ECG	Blood Pressure	Created
45	23	34	88	2019-05-14 01:14:46
2	23	34	88	2019-05-14 12:11:42
45	23	34	88	2019-05-14 12:11:15
45	23	34	88	2019-05-14 12:11:09
45	23	34	88	2019-05-14 12:11:02
30	23	34	88	2019-05-14 11:23:45
45	23	34	88	2019-05-14 11:23:22
45	23	34	88	2019-05-14 11:23:21
45	23	34	88	2019-05-14 11:23:01
45	23	34	88	2019-05-14 11:22:46

Table No. 2 Experimental analysis of the system.

S. No.	No. of executions	No. of executed results				Efficiency %
		Temperature	Heart beat	ECG	Blood pressure	
1	25	25	25	25	25	100
2	50	50	49	50	49	99
3	75	74	73	74	75	98.66
4	100	98	97	95	99	97.25

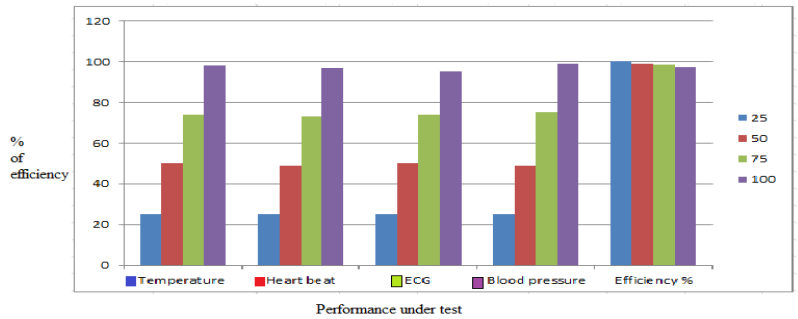

Fig. 5 Graphical representation of System efficiency.

9. Conclusion

This paper proposes a novel method for monitoring the present condition of the patient in an ICU. This paper helps the patient to be monitored by both doctors and relatives by giving them login id and password .for efficient monitoring live video streaming is also included. And also parameters are displayed in the web page. Database will give us the periodic values of the health parameters like temperature, pulse, blood pressure. If there is any unstable health situation an alert will be send to the concerned doctor.

10. Future scope

The whole health monitoring system, implemented can be integrated into a small compact unit as small as a cell phone/wrist watch. This will help the patients to easily carry this device with them wherever they go. In addition with medical applications this model can be used in industrial and agricultural application by using sensors like humidity sensors, fertility check sensor.

11. References

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