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Automatic Patient Monitoring System Using Raspberry Pi-3

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ABSTRACT: In India, everyday many lives are affected because the patients are not timely and properly operated. Also for real time parameter values are not efficiently measured in clinic as well as in hospitals. Sometimes it becomes difficult for hospitals to frequently check patient conditions. Also continuous monitoring of ICU patients is not possible. To deal with these types of situations, our system is beneficial. Our system is designed to be used in hospitals for measuring and monitoring various parameters like temperature, ECG, heart beat etc. The results can be recorded using Raspberry Pi displayed on a LCD display. Also the results can be sent to server using GSM module. Doctors can login to a website and view those results.

KEYWORDS: Raspberry–PI-3, Monitoring system, GSM module, Sensors.

I. INTRODUCTION

Health is one of the global challenges for humanity [1]. 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 [2]. 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, bedside 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 is required [4]. In order to improve the above condition, we can make use of technology in a smarter way. In recent years, health care sensors

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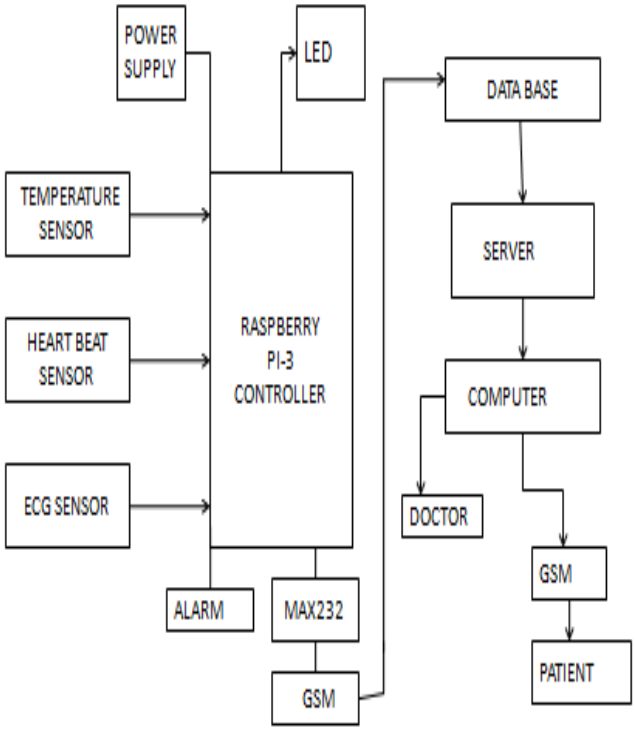

Figure.1: block diagram

along with raspberry pi play a vital role. Wearable sensors are in contact with the human body and monitor his or her physiological parameters. We can buy variety of 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 [6]. 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 [5]. In our system we are measuring patient's parameters (ECG, temperature, heart rate, pulse, etc)different available sensors. This sensor collected data i.e. biometric information is given to raspberry pi and then it is transferred to server. Biometric information gathered can be wirelessly sent using different options available such as Wi-Fi, 3G, GSM, Bluetooth, 802.15.4 depending on the application [5]. The data stored in a database and can be displayed in a website that can be accessed only by authorized personnel [3]. The doctors, RMOs, patient or his family members can be given authorization. The system even facilitates the doctor to view the patient's previous history from the data in memory.

II. ARCHITECTURE

The architecture contains three phases; they are collection phase, transmission phase, utilization phase. Body Area Network (BAN) is constructed to collect the required data from the patient. The parameters used to diagnose the disease may vary from one disease to another. Therefore each parameter is sensed by separate IOT devices which are

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connected to the patient. All the devices connected in the body of the patient are known as BAN in the data collection phase. Blood pressure module, heart rate monitor, temperature etc. are the basic devices used to collect the blood pressure, heart rate and temperature of the patient. The data collected in the collection phase is communicated to the doctor to evaluate the parameter for diagnosis. The doctors, attend of the patient (authorized to view) and the patients can view the details using the mobile application or through the web. The mobile application is accessed by doctors through their user name and password. The doctors can view all the details associated with their patients. Information such as body temperature, blood pressure, heart rate etc is updated in the server for every 60 seconds. If the doctor wants to access any of his patient's data he can request to send the current status of the patients and retrieve the data from the IOT devices to their mobile devices after updating with the server. If patients or caregivers of patients' want to access the details of the patient they have to use the patient identification number/Registration number to login and view the details. The mobile application automatically shows the risks in red color to warn the patient if the temperature is high, blood pressure level increases and the heart rate is not in the normal pulse.

III. PARAMETERS

As shown in the block diagram the part is the sensors part that consists of different health sensors like as.
1. Heartbeat sensor
2. Temperature sensor
3. Position sensor

Sensors are the wearable sensors are placed at the patient's body. Sensors sense the patient body parameters like heartbeat, temperature. The sensed data from the sensors send to the sensor node.

TEMPERATURE SENSOR (LM35):
It is a sensor used to measure Temperature. The LM35 series are precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It measures temperature more accurately than thermistor. It is sealed and does not undergo oxidation. It does not require output voltage to be amplified.

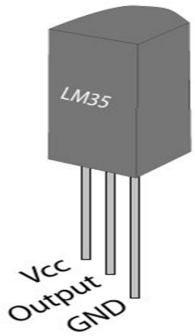

Figure.2: Temperature sensor (LM 35)

HEART RATE SENSOR:
The sensor gives the digital output of heat beat when a finger is placed on it. When the sensor starts, the LED flashes in union with beat. The output generated is in Beats per Minute (BPM) rate.

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Figure.3: heart rate sensor

POSITION SENSOR:

Within the miniature chip is the processing circuitry to provide outputs in absolute SSI, incremental, linear voltage, tacho and UVW formats with resolutions to 12 bit. The zero position can also be selected at point of installation.

Programming is possible over the two wire interface (TWI), which is compatible with the I^2C protocol. The TWI allows to interconnect up to 128 individually addressable devices using only two directional bus lines. The chip can operate with either 3 V or 5 V power supply and can be put into a power down state designed for battery powered applications.

Figure.4: position sensor

RASPBERRY-PI-3:

The digital signals from the PIC are received at the Raspberry pi. Raspberry pi cannot process analog signal .Raspberry pi does not have in built ADC so that analog signals from the sensors are converted into digital signal using PIC controller and then sent to the Raspberry pi. Raspberry pi send the received signals data to mobile devices through E-mail. It is a small, powerful, cheap, hack able and education-oriented computer board introduced in 2012. This credit card-sized computer with many performances.

IV. EXPERIMENTAL SETUP

The IOT devices like temperature sensor (LM35CAZ), Wireless Blood Pressure Monitor, and Heart beat monitor are connected to the body of the patient to form the BAN. The devices sense the data from the patient's body and send them to the local system through the wireless sensor devices. Mobile application is designed for the benefit of doctors and patients. The health status of the patient is updated in the application for every 60 seconds after the update in the server. The data collected from the IOT devices to the system is huge and the information only for last three days can

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be viewed in mobile application. All parameters for the last three days can be viewed through the mobile application anywhere any time.

V. RESULT ANALYSIS

The system takes the data from the IOT devices for every sixty seconds and update in the database connected to the server. The doctor can view the patients' health condition every sixty seconds. The system gets the blood pressure data and check with the Table to evaluate the status of the patient. Similarly the pulse rate is compared with the Table. For temperature the average temperature falls above 98.6°F (37°C) is considered as abnormal temperature. The data collected from the patients and its evaluation by the application, showed that the observed data is updated correctly.

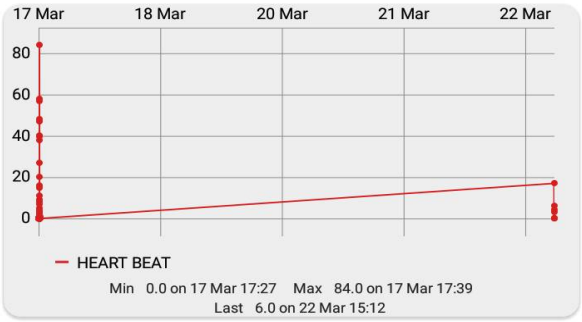

Figure.5: heart beat characteristics

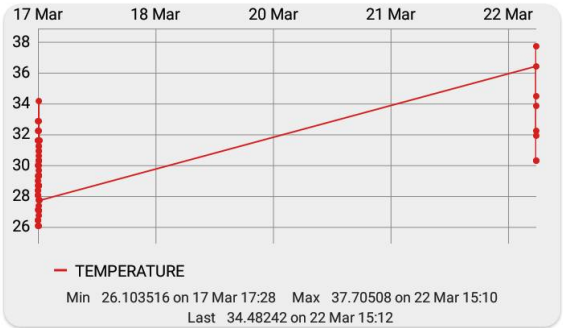

Figure.6: temperature characteristics

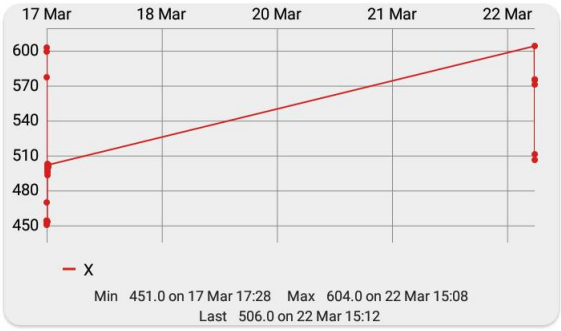

Figure.7.1: x position characteristics

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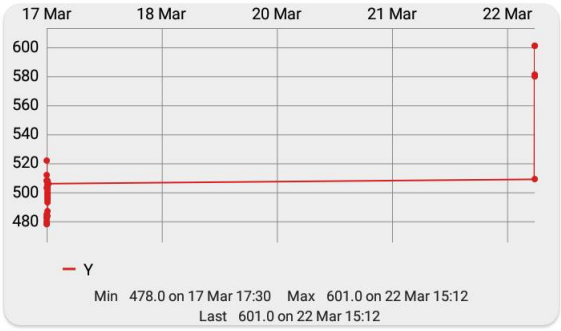

Figure.7.2: y position characteristics

VI. CONCLUSION AND FUTURE WORK

An efficient process is developed to monitor the up to date status of the patient irrespective of the presence of the doctor. The system collects information like temperature, blood pressure and pulse rate of the patient the same to the doctor. The system is evaluated experimentally and collected the sample data of ten patients to verify the status of patients. The doctor can monitor the progress of patients' health now and then to advise them about their health. The system can be extended by adding more features to the mobile application like linking the ambulance services, leading doctor's list and their special. Hospital and their special facilities etc., Doctors can create awareness about diseases and their symptoms through the mobile application. From the evaluation and the result obtained from analysis the system is better for patients and the doctor to improve their patients' medical evaluation. A wireless healthcare monitoring system using the mobile devices can be implemented in a global network with the help of the Raspberry-Pi. PIC microcontroller having some advance features then other series of microcontrollers like 8051. One is the speed that is fast in comparison and can also be interface USB through it. PIC controller having inbuilt ADC which is the most advanced advantage of PIC which makes system less complex by avoiding extra ADC in system. The Raspberry pi is a single computer board with credit card size that can be used for many tasks that your computer does. 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 smart phones, tablet PCs, and laptops to monitor biomedical signals in real time 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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