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Health Monitoring System using Cloud Computing

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Abstract: ***Internet of Things is an emerging technology that connects billions of smart devices and sensors to internet with an efficient, secure and convenient way. The development of the Internet of Things causes a revolution in modern technology, which makes our life easier and automated. Due to a busy schedule and irregular lifestyle, health hazard is not an age-dependent factor in the recent era. Under these circumstances, Internet of Things has provided a much easier solution for remote real-time health monitoring of patients from the hospital as well as home. One such healthcare application is to monitor the patient health status Internet of Things makes medical equipments more efficient by allowing real time monitoring of patient health, in which sensor acquire data of patient's and reduces the human error. The significant challenges in the implementation of Internet of Things for healthcare applications is monitoring all patient's from various places. Thus Internet of Things in the medical field brings out the solution for effective patient monitoring at reduced cost. The purposed work will be explain the concept of monitoring of patients health using microcontroller and different sensors and the reports are accessible through the mobile application.***

Keywords: Heart rate, Blood pressure, SpO2, Body temperature.

I. INTRODUCTION

"Internet of Things" is the combination of embedded systems, sensors, software and this can be also referred to as internet of everything .Internet-connected devices are acquiring vast potential as it pushes our daily life forward towards automation, and the rapid drop in price for typical IoT components allows people to innovate new products. As health is one of the most important issues nowadays, IoT could be utilized in the health industry as a continuous health monitoring system. At the same time, the internet is now easily available for mobile technologies, which makes remote observance in everything more popular. When a patient gets admitted to a hospital or in other location under observation of medical assistant, the relatives of the patients are anxious about his/her health situation throughout all the time.

The combination of Microcontroller and IoT has solved this situation by a new innovative technology in healthcare system through which it is also possible to monitor the health condition of the patient remotely. Microcontroller is a platform which offers a complete a tiny platform at a very low cost, and it also permits interfacing services and actuators through the general purpose I/O pins. In this system, patient's heart rate, blood pressure, oxygen saturation level in blood, body temperature, are measured. Instant conveyance of the health information of the patient to the relatives will make the hospital management more responsible and liable for their works.

Hospital management typically uses huge machines to measure the health data of the patients. On the other hand, we are able to measure the health data using e-Health Sensor Platform in Microcontroller. Moreover, it will additionally decrease the cost of health observance and the space of the room.

We are developed a health monitoring system to acquire the data and share the information with the health units and relatives by remotely monitoring through the internet. In order to do this, Microcontroller collects the health data of the patients from the sensors and stores in the cloud and it is displayed on the website or through application. For the security and safety issues, a role-based user authentication system is also available in the system to access the information.

A. Body Anatomy

1) Measuring body temperature is very important in medicine. A number of diseases are characterized by a change in body temperature. With other illnesses, the course of the disease can be followed by measuring body temperature. This allows the doctor to analyze the effectiveness of treatments based on body temperatures.

2) Blood oxygen saturation level (SpO_2) is a measure of the amount of oxygen carried in the hemoglobin. SpO2 is expressed as a percentage of the maximum amount of oxygen that hemoglobin in the blood can carry. Since hemoglobin accounts for over 90% of oxygen in blood, SpO2 also measures the amount of oxygen in blood. SpO2 for a normal healthy person at sea level should be at or above 94%.

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3) The heart circulates oxygen and nutrient-rich blood throughout the body. When it's not working properly, just about everything is affected. A normal heart rate is usually stated as 60 to 100 beats per minute. Slower than 60 is bradycardia ("slow heart"); faster than 100 is tachycardia ("fast heart"). But some experts believe that an ideal resting heart rate is closer to 50 to 70. Regardless of what is considered normal, it's important to recognize that a healthy heart rate will vary depending on the situation.

4) Blood pressure is important because the higher your blood pressure is, the higher your risk of health problems in the future. If your blood pressure is high, it is putting extra strain on your arteries and on your heart. Normal blood pressure 120/80, Pre-high blood pressure ranges 120-140, high blood pressure 140-190 and low blood pressure 70-80mmHg.

Blood pressure calculated by formula :

Maximum arterial pressure =H.R+(SBP-DBP)

Where,

H.R = Heart Rate

SBP = Systolic Blood Pressure

DBP = Diastolic Blood Pressure.

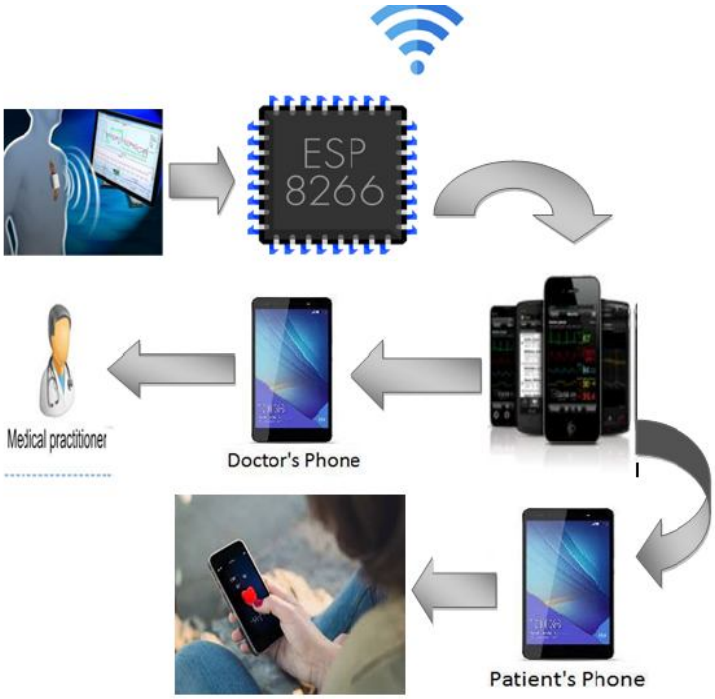


Fig 1 : Basic Working Of Patient Monitoring.

II. LITERATURE SURVEY

Ananda Mohan Ghosh et al. [1] Demonstrated a health care system for hospital management to allow relatives and doctors to remotely monitor the health condition of a patient via internet using Arduino Uno connected with E-health sensor shield kit and Phidgets interface kit. The health parameters are Body Temperature, Accelerometer, Environment sensor , ECG .

R. Kumar et al. [2] This paper has proposed a raspberry pi controlled patient monitoring system where heartbeat, respiration, temperature and body movement of the patient is being measured using sensors and displayed on the screen using the putty software IoT came into existence because, without human interaction, mobiles were able to access data from objects and devices, but it was aimed at, to overcome the limiting factors of human entered data, and to achieve cost, accuracy and generality factors.

A person’s heartbeat was generally measured personally by connecting patch cord on their chest. This created a problem to keep a tab on patient’s health and provide treatment in case of emergency. Lately, measurement of Heartbeat and Temperature is done with the help of stethoscope and thermometer which require personal visit. To overcome these limitations the paper has proposed a system to enable remotely monitoring the health parameters. Here the Android Mobile Application is used for the communication with doctor ,through that the doctor can monitor the patient.

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III. DESIGN METHODOLOGY

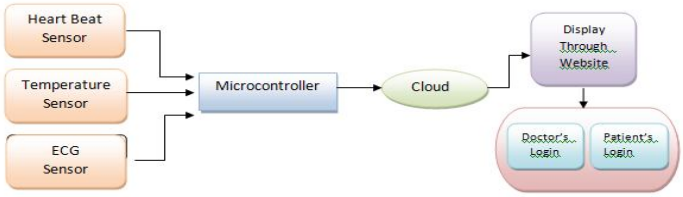


Fig 2: Health Monitoring System

The development of Internet of things (IoT) technology makes it possible for connecting various smart objects together through the Internet and providing more data interoperability methods for application purpose. Monitoring programs can collect a wide range of health data from the point of care, such as blood pressure, blood oxygen levels, heart rate, and electrocardiograms. wireless health monitoring system used to overcome this problem like easy to use, small in size, light weight and portable. This device uses a heartbeat sensor to track the patient's heart beat count. health monitoring system is used to measure patient's body temperature , oxygen saturation level, blood pressure and heartbeat by using embedded technology. The proposed system uses the sensors like heartbeat sensor and temperature sensor. These sensors mainly involves in monitoring the condition of the patient.

Various types of sensors (Heart rate, temperature) are interfaced with microcontroller in order to make the system smart. When the respective sensors sense the body parameter, the respective value and sensor data is being sent to the microcontroller. The microcontroller having a WiFi module which is used to communicate between cloud server and microcontroller. There is an mobile APP is designed to access this information at doctor's side and patient's side.

So the following components are to be used in this project:

A. Temperature Sensor (LM35)
B. Heart Beat Sensor
C. Microcontroller

1) *Temperature Sensor:* The LM35 series are a precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin, the conversion of degree centigrade to Fahrenheit (X°**C** × 9/5) + 32 = 32°**F .**
2) *Heart Beat Sensor:* This is the MAX300100 breakout board that reads heart rate or pulse oximetry. The chip has an integrated optical sensor that derives its reading from emitting two wavelength of light from the two LED's then measures the absorbance of pulsing blood through a photo detector. The signal is processed by a low noise analog signal processing unit and communicated to the Microcontroller through the i2C Interface. The MAX30100 operates from 1.8v and 3.3v
3) *Microcontroller:* The sensed data from sensor will be sent to microcontroller for further processing such as signal conditioning, filtering if required. The microcontroller will then send the data to the android device when requested by the user with the help of wired or wireless connection. The microcontroller will then send the data to the android device when requested by the user with the help of wired or wireless connection. ATMEGA328P is high performance, low power controller from Microchip. ATMEGA328P is an 8-bit microcontroller based on AVR RISC architecture with program memory of 32 Kbytes ATMEGA328P, with advanced RISC architecture.
4) *ESP8266:* It can also fetch data from internet using API's hence your project could access any information that is available in the internet, thus making it smarter. Another exciting feature of this module is that it can be programmed using the microcontroller IDE which makes it a lot more user friendly.
5) *Cloud:* Cloud computing is a subscription-based service where you can obtain networked storage space and computer resources. The cloud makes it possible for you to access your information from anywhere at any time.
6) *Private Cloud:* The private cloud is used by large organizations to build and manage their own data centers for specific business and IT needs/ operations. The private cloud provides more control over customizability, scalability and flexibility, while improving security of assets and business operations. This sort of infrastructure can be built on premises or outsourced to a third party service provider – either way, it has the ability to maintain the hardware and software environment over a private network solely for the owner.

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Illustration of Above Hardware is shown in below flowchart

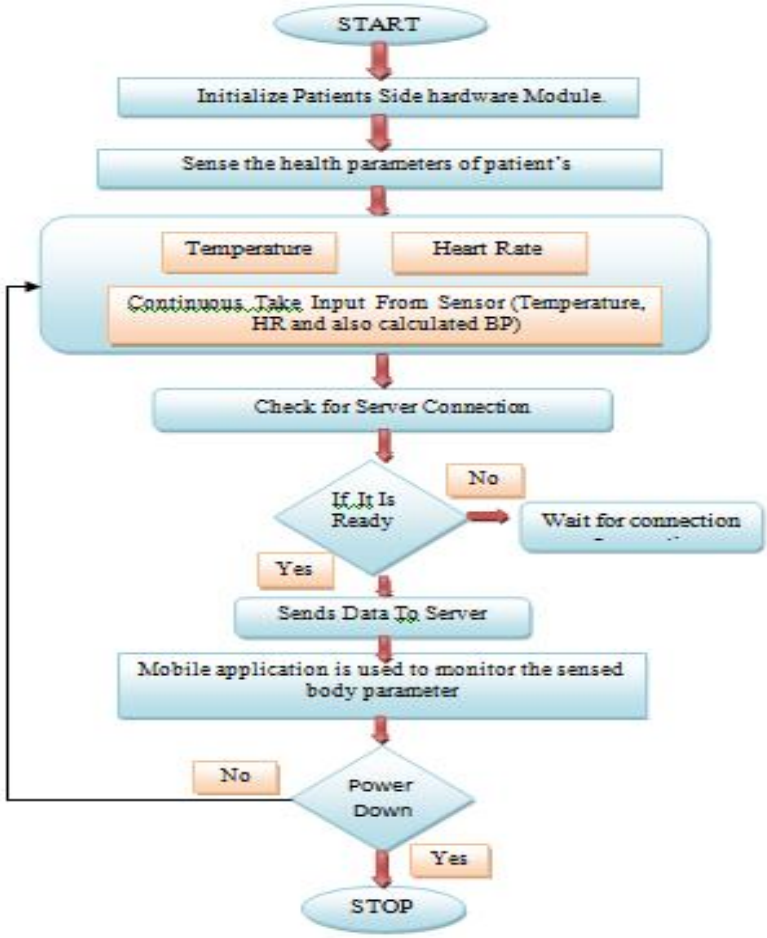


Fig 3 : System Implementation

IV. RESULT

The paper shows monitoring of patients physical parameters like the body Temperature, Heartbeat, oxygen saturation level and blood Pressure .The embedded system will consider the inputs, it has received from these three sensing devices and those are MAX30100, LM35 and blood pressure is calculated from the formula of heart rate and generate an outcome with respect to the predefined software calculations.

A. Hardware Output

1) Step 1: Heart Beat sensor, Temperature sensor, ESP8266 & LCD display are interfaced with microcontroller



Fig 4: Interfacing of sensors with Microcontroller

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B. Software Output

1) Step 1: Login credentials of mobile application for monitoring patient's body parameters. There are different login credentials used at doctors side and at patients side for monitoring. For security purpose only the login credentials are included.

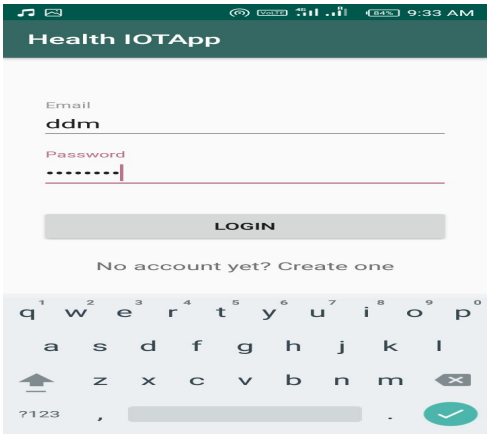


Fig 5: Screenshot of Mobile App Login Credentials

2) Step 2: After login successfully, by using doctor's login credentials Doctor can view the following list of the patient's and concern give to the respective patient .

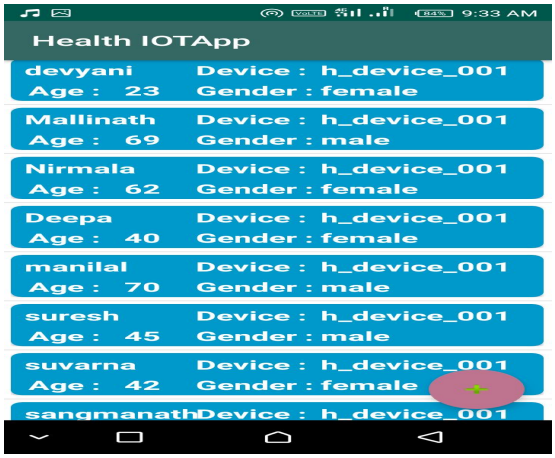


Fig 6: Screenshot Patients list in mobile APP at doctor side

3) Step 3: After login successfully, by using patient's login credentials patient can view his/her body parameters using mobile app, and the same display is at doctors side while monitoring respective patient body parameters, if needed get concern from doctor from remote place only. The following image shows the body parameters of patient

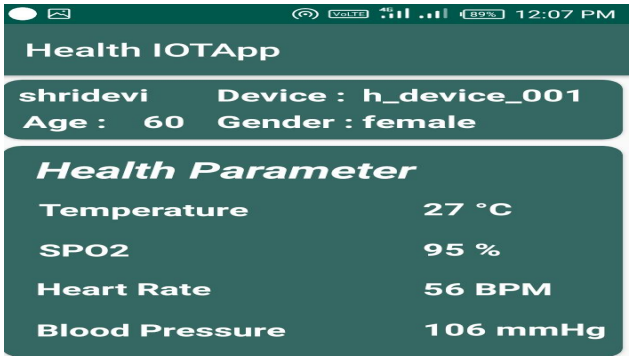


Fig 7: Screenshot of Patients Body Parameters in mobile phone

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V. CONCLUSION

This system is used to remotely monitor health of the patients by using IOT and Microcontroller. This system help the doctor to monitor the health condition of patient from any location and necessary action could be taken during semi major ailment. The proposed system will be portable, mobile, compact and interactive. Also Doctors can work from distances in case of emergency and eliminates the need of utilization of expensive facilities.

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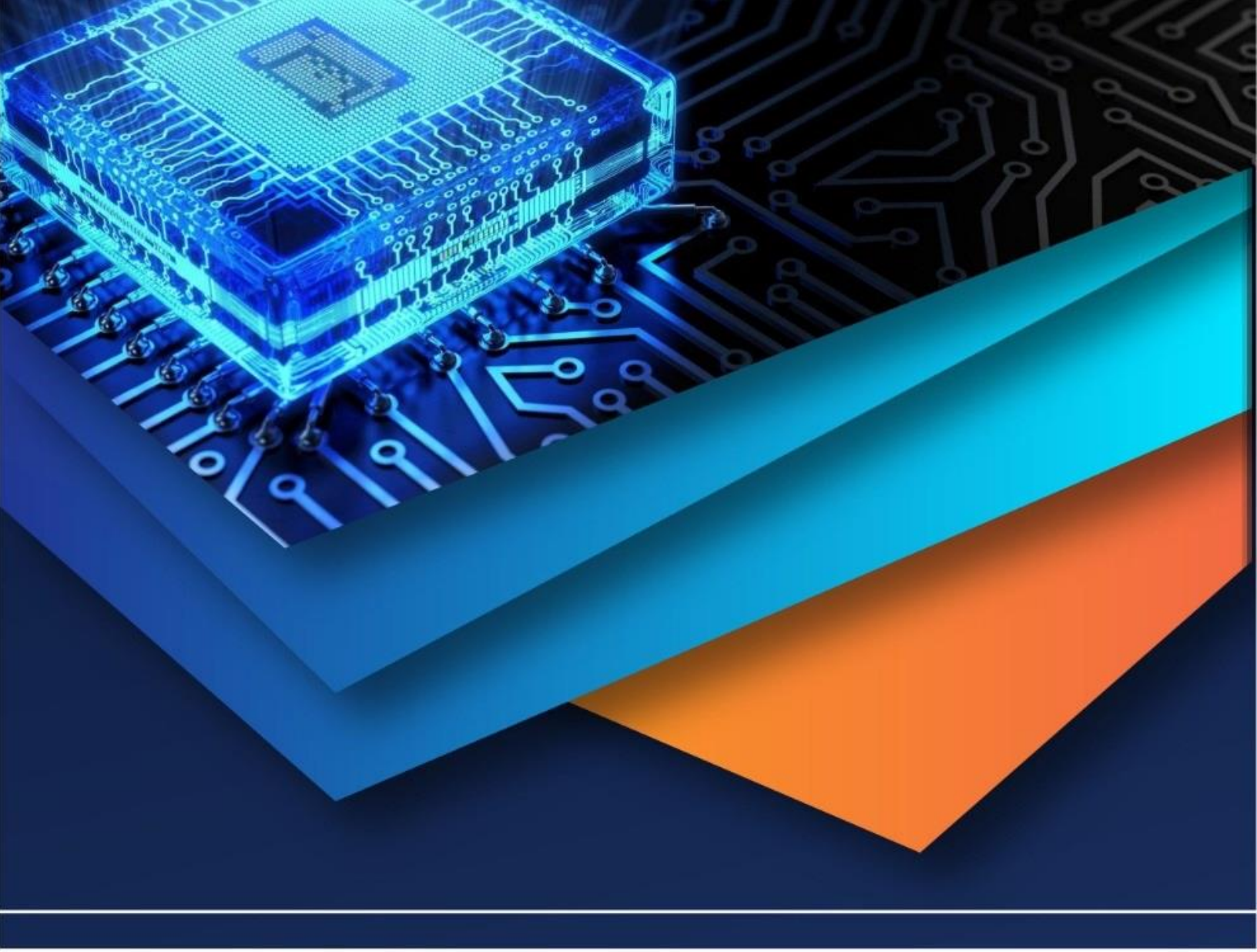
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