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Continuous SPO2 and Heart Rate Monitoring of the Patients Towards IOT Connected Healthcare Applications

A.Abirami
Department of Computer Science and Engineering
Gnanamani College of Technology
Mail ID : thanabi612@gmail.com

Dr.R.Umamaheshwari Ph.D
Head of the Department
Department of Computer Science and Engineering
Gnanamani College of Technology
Mail ID : umait1978@gmail.com

Abstract- The Internet of Things (IoT) is inter communication of embedded devices using networking technologies. The IoT will be one of the important trends in future, can affect the networking, business and communication. This system monitor vital parameters such as body temperature, spo2 level, heart rate level of the patient and this information is transferred to their guardians. The other advantage is the programmability of alarm conditions can alleviate any inaccuracy through a normal sensor. The sensing data will be continuously collected in a database and will be used to inform patient to any unseen problems to undergo possible diagnosis. Experimental results prove the proposed system is user friendly, reliable, economical.

Keywords: IOT, SPO2, Health care.

1. INTRODUCTION

Hospitals always need better management. The database of all patients should be handy enough. But also, there should be data prevention. Also the patient data should be kept private in case. Healthcare is the most important concern of many countries in the world. Improving the lives of patients especially in the weaker parts of the society which include the elderly, physically and mentally disabled as well as the chronically ill patients is the major factor to be improved. In existing system, the data is recorded in the form of paperwork or on general storage server. But generally that data is accessible to all the staff and doctors. Hence we are proposing a new way where patient and

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doctors able to communicate through mobile application and web application.

In hospitals there are provisions for continuous monitoring of patients. Their heartbeats are continuously monitored. There is no provision to check the parameters when they return to home. And hence there is a chance that the disease may return again. Patient's data (temperature, SPO2, heart rate, position) will be frequently measured and sent to server. Period of sending (say every 3 min) can be set. Monitoring person learns patient specific threshold. Say the regular body temperature of a patient is 37?c whereas one person feels feverish if his body temperature is 37.0°c. By employing an averaging technique over a relatively long time, Observer can learn these thresholds for patients. Using Android Application in doctor's smart phone, doctor can view his patient's health status. When any of the parameter goes beyond the threshold value he will get an alert notification.

2. LITERATURE SURVEY

1. A Heartbeat and Temperature Measuring System for Remote Human-Health monitoring using Wireless Body Area Network

Nowadays, remote patient health monitoring using wireless technology plays very vigorous role in a society. Wireless technology helps monitoring of physiological parameters like body temperature, heart rate, respiration, blood pressure and ECG. The main aim of this paper is to propose a wireless sensor network system in which both heart rate and body temperature of multiple patients can monitor on PC at the same time via RF network. The proposed prototype system includes two sensor nodes and receiver node (base station). The sensor nodes are able to transmit data to receiver using wireless nRF transceiver module.The nRF transceiver module is used to transfer the data from microcontroller to PC and a graphical user interface (GUI) is developed to display the measured data and save to database. This system can provide very cheaper, easier, and quick respondent history of patient

2. Remote Human-Health monitoring System through IoT

Remote health caring of patients at home is increasing with the popularity of various nature of mobile devices that has developed to enable remotely caring. The cloud as well as IoT (Internet of Things) and the mobile technologies

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make it easier to monitor the patients health conditions by sharing the health information to health care teams such as doctors, nurses and specialists. However the guardians of the patients can be anxious about their patients when they are in work. By ensuring guidance awareness about the patients, it can bring more liability of the hospital management. We have demonstrated a health care system for hospital management to allow guardians along with doctors to remotely monitor health conditions of patients via internet. Remote monitoring and guidance awareness by sharing information in a authenticated manner are the main focus

3. Sensor Based Healthcare Information System

Over the last few years, the convincing forward steps in the development of Internet of Things (IoT)-enabling solutions are spurring the advent of novel and fascinating applications. Today's healthcare system is the lack of security and real time monitoring. In the wake of this tendency, this paper proposes a novel, IoT-aware, smart architecture for automatic monitoring and tracking of patients from their home itself. Staying true to the IoT vision, we propose a Automation Healthcare System (AHS). The proposed AHS is to investigate advanced home health care services. Data produced in AHS shared with doctors and patients through IoT. The system utilizes IoT telemetry to transmit data from sensors to a remote monitor. This paper discusses recent advances in wearable sensors healthcare system to monitor temperature, heart rate and the energy efficient routing. The system provides the security and real time monitoring.

4. BSN-Care: A Secure IoT-Based Modern Healthcare System Using Body Sensor Network

Advances in information and communication technologies have led to the emergence of Internet of Things (IoT). In the modern health care environment, the usage of IoT technologies brings convenience of physicians and patients, since they are applied to various medical areas (such as real-time monitoring, patient information management, and healthcare management). The body sensor network (BSN) technology is one of the core technologies of IoT developments in healthcare system, where a patient can be monitored using a collection of tiny-powered and lightweight wireless sensor nodes. However, the development of this new technology in healthcare applications without considering security makes patient privacy vulnerable. In this paper, at first, we highlight the major security requirements in BSN-based modern

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healthcare system. Subsequently, we propose a secure IoT-based healthcare system using BSN, called BSN-Care, which can efficiently accomplish those requirements.

3. EXISTING SYSTEM

In existing system, the data is recorded in the form of paperwork or on general storage server. But generally that data is accessible to all the staff and doctors. After, we use active network technology network various sensors to a single PMS(Patient Monitoring System). Patients' various critical parameters are continuously monitored via single PMS and reported to the Doctors or Nurses in attendance for timely response in case of critical situations. The sensors are attached to the body of the patients without causing any discomfort to them. But this System is activated without indication.

Disadvantages:

- Record Maintaining is hard because of using paper for patient details.
- Lack of Regulation

4. PROPOSED SYSTEM

The introduced Human-Wellbeing checking/watching system includes patients, Human-Wellbeing observing units, cloud for information maintenance and secure with the assistance of some equipment units, different sensors and gadgets with web association. The figure 1 shows the complete architecture of proposed system. The system functionality is divided into major Six modules.

ADVANTAGES:

1) IOT Monitoring proves really helpful when we need to monitor & record and keep track of changes in the health parameters of the patient over the period of time. So with the IOT health monitoring, we can have the database of these changes in the health parameters. Doctors can take the reference of these changes or the history of the patient while suggesting the treatment or the medicines to the patient.

2) Hospital stays are minimized due to Remote Patient Monitoring.

3) Hospital visits for normal routine checkups are minimized.

4) Patient health parameter data is stored over the cloud. So it is more beneficial than maintaining the records on printed papers kept in the files. Or even the digital records which are kept in a particular computer or laptop or memory device like pen- drive. Because there are chances that these devices can get corrupt and

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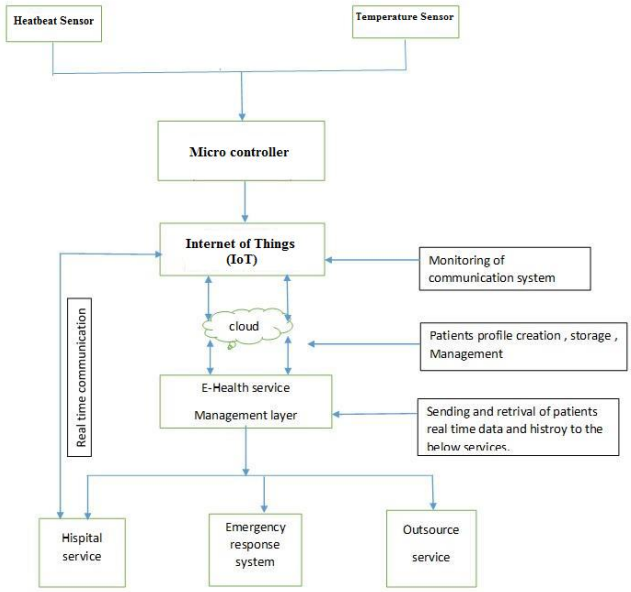
data might be lost. Whereas, in case of IOT, the cloud storage is more reliable and does have minimal chances of data loss.

The Block diagram of the System architecture is shown in figure. The sensors Temperature, SPO2 and Heartbeat are connected to the Arduino board. The values from the Microcontroller are given to the Web Server using IoT. The parameter values can be viewed by doctors using Website.



IOT CLOUD

Cloud offers a platform for developers that enable them to easily capture sensor data and turn it into useful information. Cloud platform is used to send data to the cloud from any Internet-enabled device. We can then configure actions and alerts based on our real-time data and unlock the value of our data through visual tools. Cloud offers a REST API that allows you to read and write data to the resources available: data sources, variables, values, events and insights. The API supports both HTTP and HTTPS and an API Key is required. The variables are created and unique variable ids are assigned to it. The values are plotted in a graph with the date and time in X axis and the values in the y-axis. All the values are displayed to the user with the corresponding date and time and hence the values can be viewed at any time by the user. The threshold values can be set on the Cloud platform an email or sms or call can be sent to the user when the threshold levels are met. Hence Cloud is an Inter of Things platform which helps in monitoring all the parameters and displays the values to the user. A threshold values are also set to take corrective actions. The API key which is generated in Cloud should be added in the Arduino code to connect to the cloud. An APIkeyisthe “Master Key”; a unique and immutable key that is used only to generate

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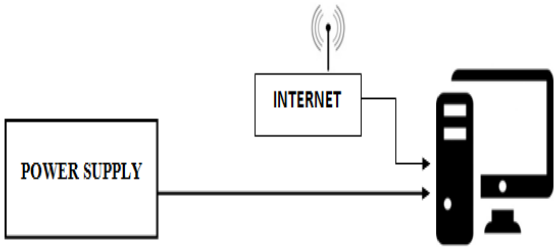
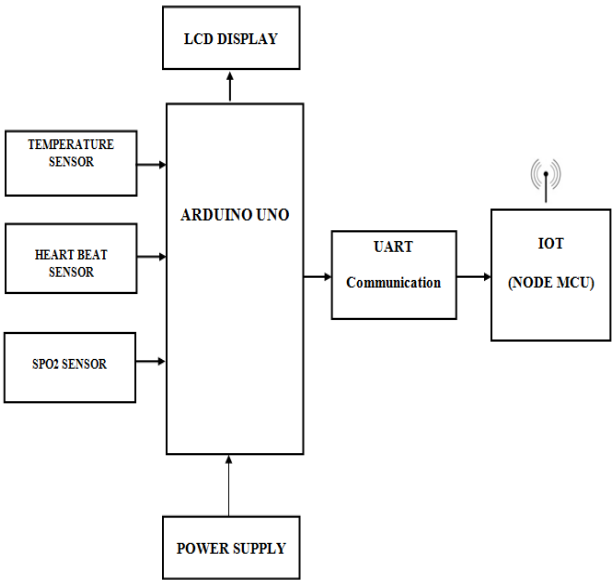
our account's tokens. A token is a temporary and revocable key which is to be used in our API request. It gets created ones an account is created in Cloud. Tokens created in our account profile will never expire

5. SYSTEM BLOCK DIAGRAM

MONITORING SECTION:



PATIENT SECTION

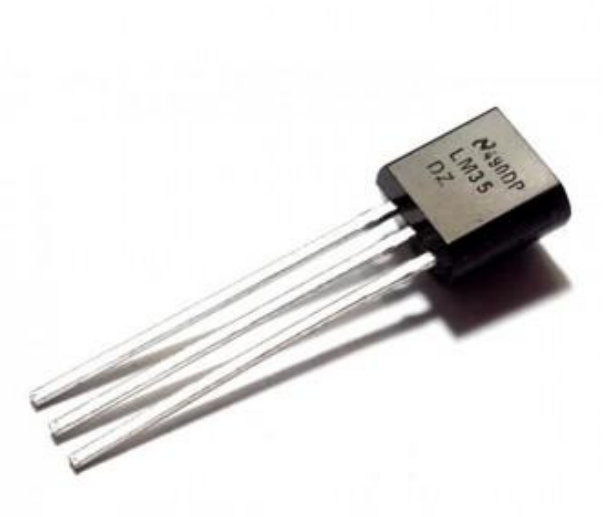


6. IMPLEMENTATION

PROCESSING UNIT:

In our system Arduino Uno Board is used. The microcontroller is connected with all other hardware units in the module. This module takes analog parameters from the sensors attached to patient, Process it and convert them in digital output. This module also contains IoT device which sends the sensors converted data to the Cloud.

THE LM35TEMPERATURE (THERMO) SENSOR:



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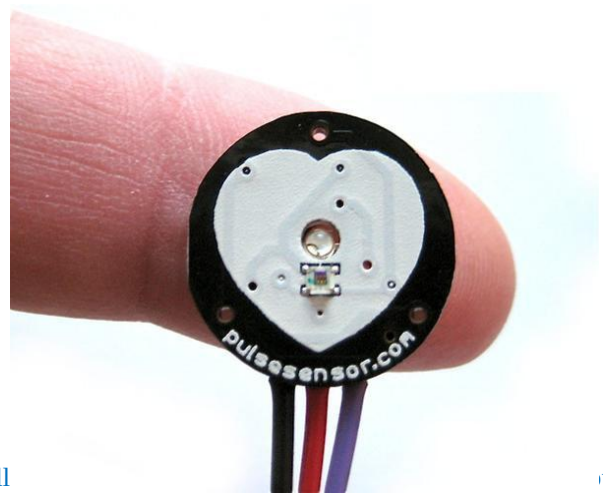
The LM35 series are precision integrated circuit LM35 temperature sensors, whose output voltage is linearly proportional to the temperature in Celsius (Centigrade). The LM35 sensor thus has an advantage over linear temperature sensors, calibrated in °Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient centigrade scaling. The LM35 sensor does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°Cover a full -55 to +150°C temperature range. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

HEARTBEAT SENSOR:



Heart beat sensor is designed to give digital output of heat beat when a finger is placed inside it. This digital output can be connected to Arduino directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger each pulse. IC LM358 is used for this sensor. Its dual low power operational amplifier consists of a super bright red LED and light detector. One will act as amplifiers and another will be used as comparator. LED needs to be super bright as the light must pass through finger and detected at other end. When heart pumps a pulse of blood through blood vessels, finger becomes slightly more opaque so less light reach at the detector. With each heart pulse, the detector signal varies which is converted to electrical pulse.

SPO2 SENSOR

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SpO2 stands for peripheral capillary oxygen saturation, an estimate of the amount of oxygen in the blood. SpO2 is an estimate of arterial oxygen saturation, or SaO2, which refers to the amount of oxygenated hemoglobin in the blood. Hemoglobin is a protein that carries oxygen in the blood.

Hemoglobin is a protein that carries oxygen in the blood. It is found inside red blood cells and gives them their red colour.

SpO2 can be measured by pulse oximetry, an indirect, non-invasive method (meaning it does not involve the introduction of instruments into the body). It works by emitting and then absorbing a light wave passing through blood vessels (or capillaries) in the fingertip. A variation of the light wave passing through the finger will give the value of the SpO2 measurement because the degree of oxygen saturation causes variations in the blood's color.

This value is represented by a percentage. If your Withings Pulse Ox says 98%, this means that each red blood cell is made up of 98% oxygenated and 2% non-oxygenated hemoglobin. **Normal SpO2 values vary between 95 and 100%**.

Good blood oxygenation is necessary to supply the energy your muscles need in order to function, which increases during a sports activity. If your SpO2 value is below 95%, that could be a sign of poor blood oxygenation, also called hypoxia.

MONITORING THE PATIENT'S DATA:

In this module Doctor can remotely track both Heartbeat, SPO2 and temperature sensor values of the patient. Connecting healthcare devices with patients to central IoT platforms monitor by using cloud server. The Doctor can track the patient's record both numerical and graphical data. By using the graphical data, doctor can easily diagnose the patient's health condition. In this cloud server the patient's health record is storing from the beginning time of the Sickness. So that, whenever the doctor wants to see the patient's old data, he/she can easily track the record which is stored in the cloud server.

DOCTOR'S PRESCRIPTION MODULE:

In this module, the doctor can set the threshold value for the patient's heart beat,

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SPO2 and temperature data after diagnosing the patient's health condition. If the patient temperature/heartbeat/SPO2 levels are crossing the threshold value, the medicine information will be automatically send to patient's guardian and nearby medical center, so that the patient can receive and intake the medicine whenever they need. The doctor can change the medicine information and medical center number and threshold values of the patient's health data whenever he wants.

7. APPLICATIONS:

. This is an important sensor based project which has the latest technology implemented in it. And it has many applications & advantages as mentioned below.

1) IOT Healthcare is the most demanding field in the medical area. This project is for, elderly person in our home. Also for the senior citizen living alone or living with 1 or 2 members. This project really proves helpful when family members need to go out for some emergency work.

2) Disable patients can use this project. Disable patients who find it really difficult to go to doctors on daily basis or for those patients who need continuous monitoring from the doctor.

8. CONCLUSION

Developed a system that measures and detect Human Heartbeat, SPO2 and body temperature of the patient, sends the data to user or server end by using microcontroller with reasonable cost and great effect. Use two different sensors and these are mainly under the control of microcontroller. For Human Heartbeat measurement and SPO2 use fingertip, it's in bpm (beats per minute). These calculated rates will have stored in server by transferring through Wi-Fi module via internet. liquid crystal display (LCD) has been used to display the calculated human heart beat rate. To measure the human body temperature, use LM35 sensor, the measured data is given to transmitter module, it interns transfer these data to server through wireless system due to this notice avoided use of wires. Finally, the stored data in server will be displayed for further analysis by physician or specialist to provide better aid. From Experimental results, proposed system is user friendly, reliable, economical. Further research work can be carried out for the following issues.

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9. FUTURE WORK

- In future, a portable Human-Health monitoring system can be designed using Arduino.

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