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IoT based Patient Health Monitoring System

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ABSTRACT-

Health monitoring is the major problem in today's world. With tons of new healthcare technology start-ups, IoT is rapidly revolutionizing the healthcare industry. In this project, we have designed the **IoT Based Patient Health Monitoring System using ESP8266 & Arduino**. The IoT platform used in this project is Thing Speak. Thing Speak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. This IoT device could read the pulse rate and measure the surrounding temperature. It continuously monitors the pulse rate and surrounding temperature and updates them to an IoT platform.

***Key Words*: Health monitoring system, controller, pulse sensor, temperature sensor, IOT on the platform of things speak.**

INTRODUCTION-

In today's fast pace of life ,it is difficult for people to be constantly available for their near ones who might need them while they are suffering from a disease or physical disorder. Continuous monitoring of the patient's body parameters such as pulse and temperature becomes difficult to know the patient's condition, when the patient is under observation in the hospitals, it is really not being monitored continuously by the doctors/experts, therefore there must be a system that continuously monitors the patient and communicate the specific data to the doctor in real time, also if critical situation occurs, the concern alarms also to be sent to the doctor to handle the situation to prevent the mishap.

Patient monitoring is essential when the case of ICU and patient monitoring system plays important role in health monitoring of patient by monitoring different parameters.

It is not possible every time doctor may present near to the patient and even ward boy or nurse. Here we have proposed the system which helps the doctor to understand the patient's health at every point of the time and easily diagnose and give the medicine whenever required.

The Pulse sensor, temperature sensor are connected to the patient and monitor the patient's condition. This work consists of the design of a system for collecting the different biomedical parameters via different sensors. The proposed system will process and analyze sensor data and communicate the data in real time through the cloud to the doctors. In any critical condition occurs the alarm messages will be sent to the concern doctors, and the preventive measures can be provided to the patients.

PROBLEM DEFINITION-

In hospitals, where patients status needs to be regularly monitored, is usually
done by doctors or other paramedical staff by
constantly observing some important parameters ,such as body temperature, heart beat rate etc. thus, this task becomes tedious after sometime. Hence it can cause problems However, there are many researchers have attempted before to solve it in many different ways, but the earlier methods in several cases either SMS will be sent using GSM or RF module will be used to send patients data from sender device to receiver device .Moreover, in the earlier cases the history of the patient cannot be displayed, only current data is displayed

LITERATURE SURVEY-

Tyagi [8] presented the various applications of IOT and also mentioned some important parameters and functionalities of each of the applications in IOT. They mainly concentrated on the roles and features of IOT in healthcare. Also discussed on the technologies that make this IOT possible in healthcare. In this paper, they have even proposed how cloud is also used for healthcare industry.

Darshan, K. R [9] addressed the various uses of IOT in the healthcare system and also explained the challenges faced by IOT in the healthcare. They have also performed a review on various works done in the research area of this field. They have explained how to detect any disorders at the early stage and the necessary medical aid to be taken before hand. They have provided the status of IOT in some of the various well-known technology firms like how Google, Microsoft, Intel, IBM, cisco and the government sector are using IOT for healthcare. Yeh, Kuo-Hui [11] introduced how security is implemented in IOT based on healthcare system. They succeeded it by using BSN (Body Sensor Networks). In these infrastructures, they have used two processes of Authentication that satisfies the security for IOT in securing the healthcare. They have developed this model using the raspberry pi-2 development platform. They say that the system efficiency can be further enhanced if the crypto-has - modules are replaced by SHA-2 techniques. They have proved the robustness of their methodologies.

Gupta [12] developed a health monitoring system that is robust and intelligent to monitor the patient's health and collect the information like blood pressure, heartbeat rate and ECG using IOT. The patient or users can send these data to the doctor rather than visiting the doctor directly in the hospital. The hardware used by them is 2nd generation Intel Galileo board. This is an Intel quark based single board. It is an embedded board and Arduino certificated. This is an embedded system as it is designed to act as hardware and software and also pin compatible.This Intel Galileo board provides a Linux platform and supports SD card. The details are transferred to the database server. This data can then be accessed from any part of the world.

Jimenez [13] discussed on building an ad-hoc extensible monitoring system of patient's health. They have used low cost sensors and also used existent IOT technology as a platform for establishing a communication. They developed this monitoring system concerning to help elderly people. Their system is mainly on alerting patient's guardian or the physician if the any aged people is in need of medical aid. Also, they performed performance testing if the system is capable of handling multiple request at a time and also if the number of sensors are increased.

Xican [14] reviewed on new advancements in radar sensors design system that offers low power healthcare, indoor real time positioning and different applications in IOT. To improve the detection accuracy, detection range and power consumption they have proposed different radar frontend architecture and digital processing methods. Some of the recent developments are beam forming and duty cycle. They say that CMOS technologies are used for low power and low cost radar sensors that can further studied for developing applications using IOT and WSN. They have compared the different radar architectures.

Moosavi [15] implemented two architectures based on IOT for remote monitoring. The developed these two architectures with two different wireless technologies. One is using WI-FI and the other is by using Zig-bee. Their goal is to find the advantages and disadvantages of these systems. In zig-bee, the system contains

different set of sensor nodes. The data is read from different medical sensors and processes it by sending through zig-bee to the server. The WI-FI sensor system accessed the bio-medical signals and updates the database in the server. In both the test cases, the servers collect the data and update the database. This database can be accessed and displayed in a web page for remote access.

Existing System -

In a hospital, either the nurse or the doctor has to move physically from one person to another for health check, which may not be possible to monitor their conditions continuously. Thus, any critical situations cannot be found easily unless the nurse or doctor checks the person's health at that moment. This may be a strain for the doctors who have to take care of a lot number of people in the hospital. Also, when medical emergencies happen to the patient, they are often unconscious and unable to press an Emergency Alert Button. One of the protocols that are being used to transfer data is Hyper Text Transfer

application Protocol (HTTP) for general communication over Internet. However, when HTTP is applied to communication in IOT, protocol overhead and resulting performance degradation is a serious problem. Moreover, IP addressing depends on physical location, which causes the problem of complexity of network control.

Proposed System-

Our system continuously monitoring patient's vital signs and sense abnormalities. The monitored data is delivered to medical staff. Upon encountering abnormalities, the system alerts the medical staff about the abnormal parameter. Thus, reduces the need for manual monitoring done by the medical staff.

Our proposed system uses Arduino with esp8266 to send data from sensors to cloud platform that is thing speak. Arduino has been programmed with esp8266 module which includes the API key provided by on the things peak site. Any number users can see the medical record recorded on the thing speak using the thing speak access key.

Related Work-

Modern health care system introduces new technologies like wearable devices or cloud of things. It provides flexibility in terms of recording patients monitored data and send it remotely via IOT. For this connection, there is need of secure data transmission. To transmit the data with privacy is the Moto of this paper. The proposed system introduces security of health care and cloud of things. System works in two major parts viz. storage stage and data retrieving stage. In storage stage, data is stored, updated for future use. In data retrieving stage, retrieve data from cloud. The cloud server can share with authenticated user as per request. A patient with wearable devices continually updates his record every 5 or 10 min. In emergency mode, it updates for every 1min.The wearied device will send results to phone using Bluetooth connection or NFC technology. This can able to give to cloud server using GSM and 3G

Components -

Table -1: Component and specification

Components used in the project			
Sr. no	**Name of the component**	**Roll of component**	**quantity**
1.	Arduino uno	Read the data from the sensors and send data to cloud through	1

		esp8266.	
2.	Esp8266 wife module	Connects to internet using Wi-Fi and sends data from Arduino to cloud.	1
3	Pulse sensor	Gives a digital output to Arduino when figure is placed on it.	1
4	LM35	Gives an analog output to Arduino.	1
5	LCD Disply 16*2	Gives an analog output to Arduino.	1
6	Cloud i.e., thing speak	Records all the data send from Arduino through Wi-Fi module	1

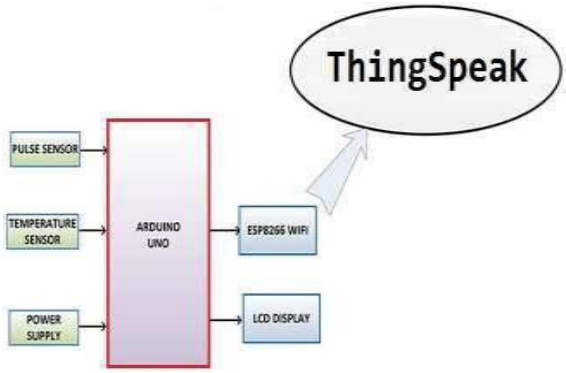
Fig-1: Block diagram of the system

Fig 1 shows the proposed system. The health monitoring sensors are used to collect health related data i.e., for data acquisition. Communication can be done by controller for sending data on internet wirelessly. Data processing has been done at server. All data collected and aggregated at server point. To get health related information in understandable format it can be shown on web page i.e., data management.

Objective -

- To develop health monitoring system i.e. it measures body temperature and heart rate.
- To design a system to store the patient data over a period of time using cloud.
- To do analysis of collected data of sensors.

SYSTEM AND OVERVIEW-



Detailed Description of Component -

1. **Arduino uno:**

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.Simulation is done on Arduino IDE software. The AT mega 16U2 provides serial data to the main processor and has a built-in USB peripheral. Arduino Uno power

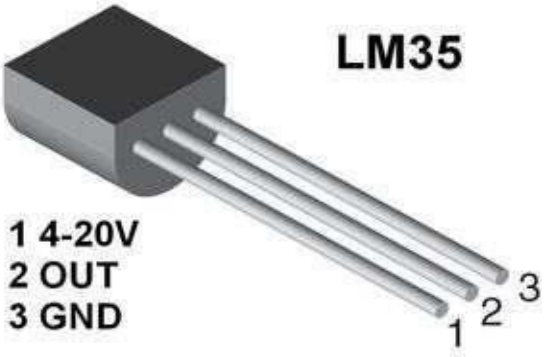
cable Standard A-B USB cable. It has 14 digital I/O pins.

2. Temperature Sensor:

The **LM35** series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required

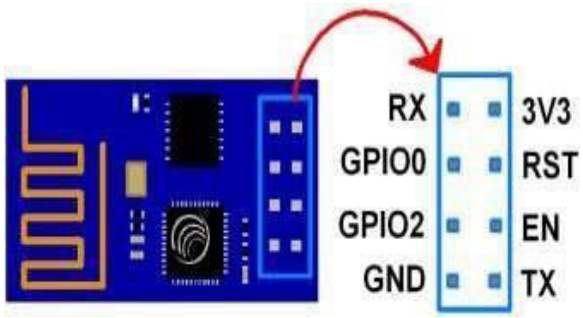
to subtract a large constant voltage from the output to

obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°Cover a full −55°C to 150°C temperature range.



3. Wi-Fi Module:

The ESP8266 wi-fi module is a self-contained SOC with incorporated TCP/IP protocol stack that can offer any controller access to wi-fi network. It uses 802.11 b/g/n protocols. Standby power consumption is less than 0.1mW

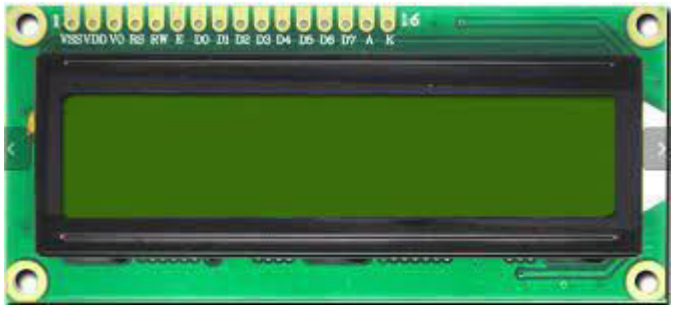


4.Pulse Sensor:

The **Pulse Sensor** is a plug-and-play **heart-rate sensor for Arduino**. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects. The essence is an integrated optical amplifying circuit and noise eliminating circuit sensor. Clip the **Pulse Sensor** to your earlobe or fingertip and plug it into your Arduino, you can ready to read heart rate. Also, it has an Arduino demo code that makes it easy to use

The pulse sensor has three pins: VCC, GND & Analog

5.LCD Display:



- The liquid crystal display (LCD) panel is designed to project on-screen information of a microcomputer onto a larger screen with the aid of a standard overhead projector, so that large audiences may view on-screen information without having to crowd around the TV monitor.

6.Platform (thing speak):

a) Use the Think speak platform to send data to the cloud from any Internet-enabled device.

b) You can then configure actions and alerts based on your real- your data through visual tools. time data and unlock the value of

c) Use the Think speak offers a platform for developers that enable them to easily capture sensors data and turn it into useful information

d) **Thing Speak server** is an open data platform and API for the Internet of Things that enables you to collect, store, analyse, visualize, and act on data from sensors.

e) Thing Speak is available as a **free** service for non-commercial small projects (<3 million messages/year or ~8,200 messages/day). Thing Speak is bought in units, where one unit allows 33 million messages to be processed and stored in a one-year period (~90,000 messages/day). **Fig-6:** overview of Thing speaks

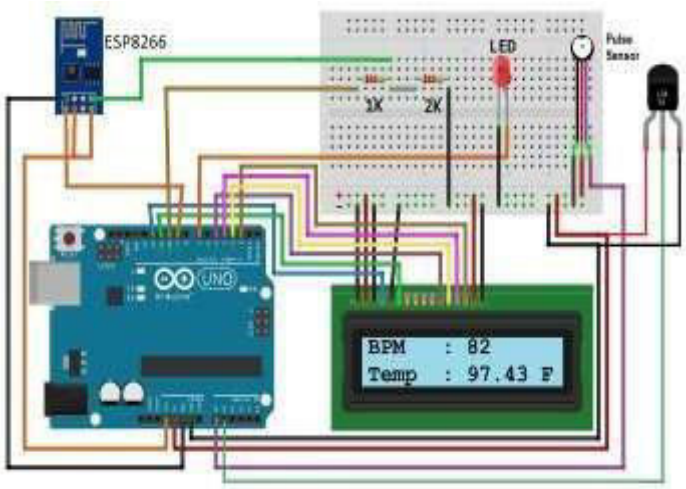
Circuit Diagram and Connections-

1. Connect LM35 Temperature Sensor output pin to A1 of Arduino and other two pins to VCC & GND.
2. Connect the LED to Digital Pin 7 of Arduino via 220- ohm resistor.
3. Connect Pin 1,3,5,16 of LCD to GND.
4. Connect Pin 2,15 of LCD to VCC.

5. Connect Pin 4,6,11,12,13,14 of LCD to Digital Pin12,11,5,4,3,2 of Arduino.

6. The RX pin of ESP8266 works on 3.3V and it will not communicate with the Arduino when we will connect it directly to the Arduino. So, we will have to make a voltage divider for it which will convert the 5V into 3.3V. This can be done by connecting 2.2K & 1K resistor. Thus, the RX pin of the ESP8266 is connected to the pin 10 of Arduino through the resistors.

7. Connect the TX pin of the ESP8266 to the pin 9 of the Arduino.



OBSERVATION TABLE-

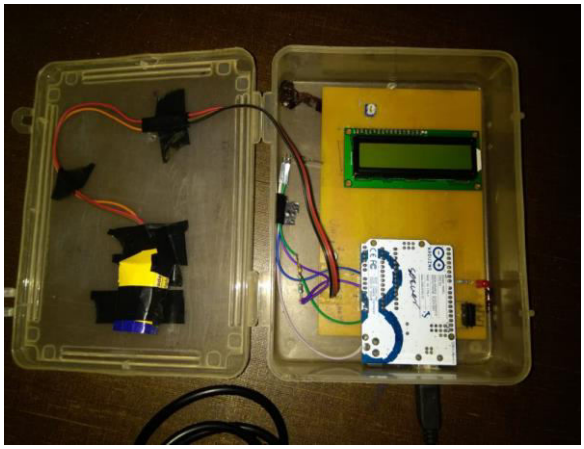
1.HEART BEAT RATE -

1. Children heart beat rate - 75 to 115 BPM
2. Adults heart beat rate – 60 to 100 BPM
3. Senior Citizen heart beat rate(60 years above) – 80 t136BPM
4. Female heart beat rate -78 to 82 BPM
5. Male heart beat rate – 70 to 72 BPM

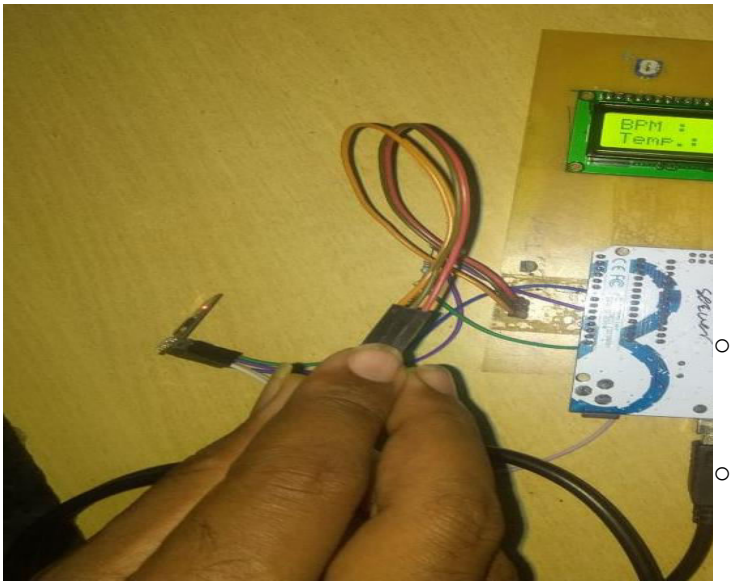
2.HUMAN BODY TEMPRATURE RANGE –

1. Children body temperature- 36c & 97F to 99F
2. dults body temperature- 37.2c & 98F to 99.2F
3. Senior Citizen body temperature – 37c & 98F

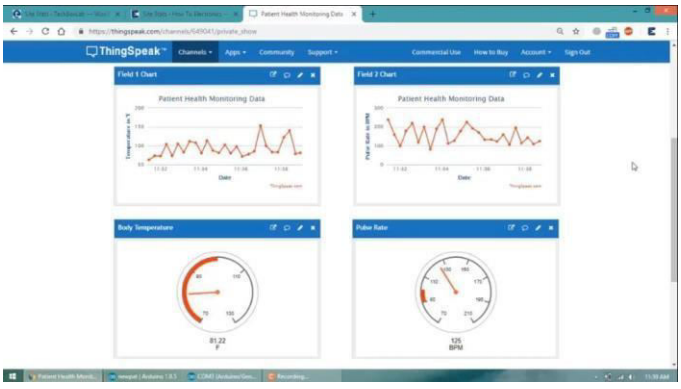
RESULTS-



Hardware figure



Reading Figure



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