IoT based Patient Health Monitoring using ESP8266

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Abstract - *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.

1. INTRODUCTION

In the recent years wireless technology has increasing for the need of upholding various sectors. In these recent years IoT have grabbed the most of industrial area specially automation and control. Biomedical is one of recent trend to provide better health care. Not only in hospitals but also the personal health caring facilities are opened by the IoT technology. So, having a smart system various parameter are observed that consumes power, cost and increase efficiency

In addition, Doctors play a very important role but the process of check-up is quite lengthy like first a person need to register then he/she will get the appointment and then later on the check-up reports are generated. Due to this lengthy process working people tend to ignore the checkups or postpone it. This modern approach reduces time consumption in the process.

Medical scientists are trying in the field of innovation and research since many decades to get better health services and happiness in human lives.

This contribution towards the society will be very worthy. Because people can detect the abnormal practice of the body before getting into any serious disease. The person who is worried more about any other loved person can take care and keep the track of his health by sitting in any corner of the world with the help of IOT.

The body temperature, heart rate, blood pressure, respiration rate are prime parameters to diagnose the disease. This project gives temperature and heart rate values using IoT.

2. MOTIVATION

In the rural areas as of my survey there is a lack of proper health treatment of the people. And they don't find proper quality of treatment. So many people get the treatment after the disease or fever gets too critical. As of considering the cost of treatment as well many of the rural people cannot afford for it. So, to make the first step of treatment process easier this project is planned. As this project is designed to give a prime parameter to diagnose the disease.

In developing countries there is lack of resources and management to reach out the problems of individuals. A common man cannot afford the expensive and daily check-up for his health. For this purpose, various systems which give easy and assured caring unit has been developed. This system reduces time with safely handled equipment.

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3. 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 application protocols that are being used to transfer data is Hyper Text Transfer 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

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location, which causes the problem of complexity of network control.

3.1 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 programed 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.

4. 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

At cloud server, each patient is defining with unique address. So, data at cloud can authenticate the right patient and provide the required request.[1] Telemonitoring system via WBAN is evolving for the need for home based mobile health and personalized medicine. WBAN can able to collect the data acquired from sensor and record the output. This output results sent to controller wirelessly to health monitoring system. In this paper, Zigbee is used to in WBAN technology due to its guaranteed delay requirement for health telemonitoring system. Zigbee used in the communication.[2]

Ayush Bansal, Sunil Kumar, Anurag Bajpai, Vijay N. Tiwari, Mithun Nayak, Shankar Venkatesan, Rangavittal Narayanan focuses on development of a system which is capable of detecting critical cardiac events. Using an advanced remote monitoring system to detect symptoms which lead to fatal cardiac events [3]

Hamid Al-Hamadi and Ing-Ray Chen gives trust-based health IOT protocol that considers risk classification, reliability trust, and loss of health probability as design dimensions for decision making. Comparative analysis of trust-based protocol and baseline protocols to check feasibility.[4]

Muthuraman Thangaraj Pichaiah Punitha Ponmalar Subramanian Anuradha." Digital hospital" term is introduced for hospital management. It enables automatic electronic medical records in standard. Also discusses with the implemented real-world scenario of smart autonomous hospital management with IOT.[5]

5. COMPONETS

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 esp8266.	1
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 temperature sensor	Gives an analog output to Arduino.	1
5.	2x16 line LCD display	Displays temperature and pulse rate.	1
6.	Cloud i.e. thing speak	Records all the data send from Arduino through Wi-Fi module	1 (API key)

6. SYSTEM AND OVERVIEW
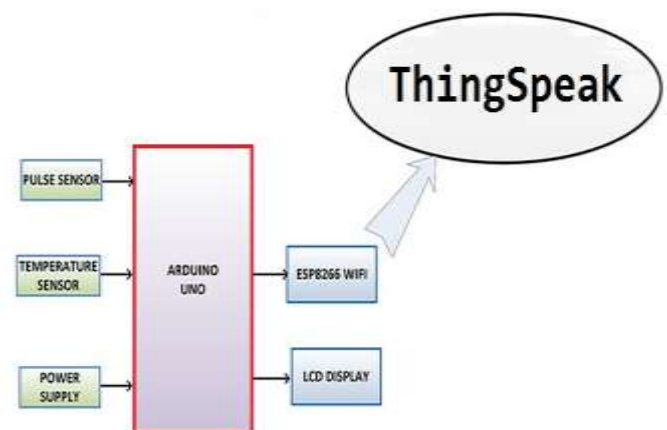
Fig-1: Block diagram of the system

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.

A. 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.

B. 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 ATmega 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.
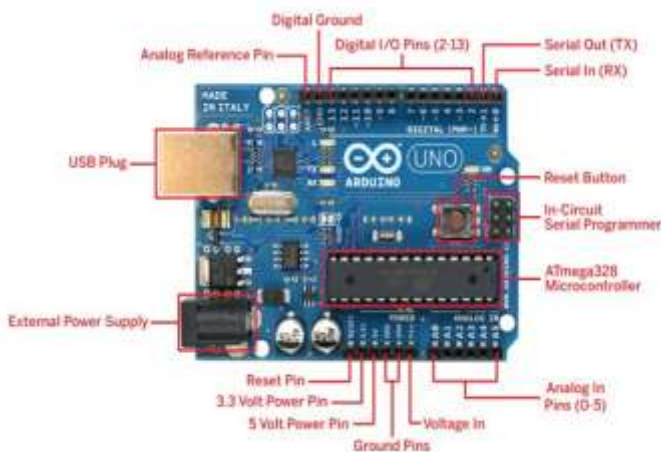

Fig-2: Arduino uno

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°C over a full −55°C to 150°C temperature range.
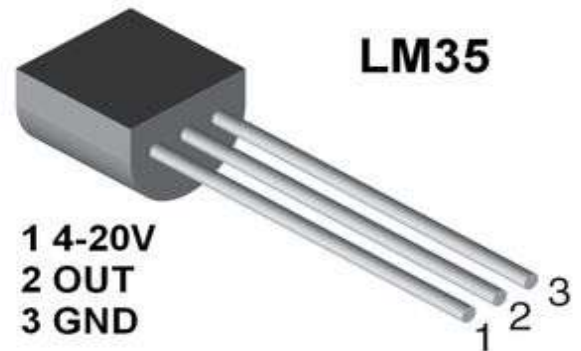

Fig-3: LM35

3. 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

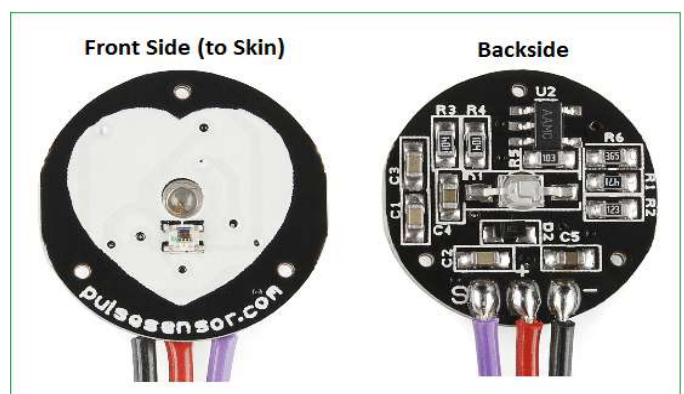The pulse sensor has three pins: VCC, GND & Analog Pin.

Fig-4: Pulse sensor

4. 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
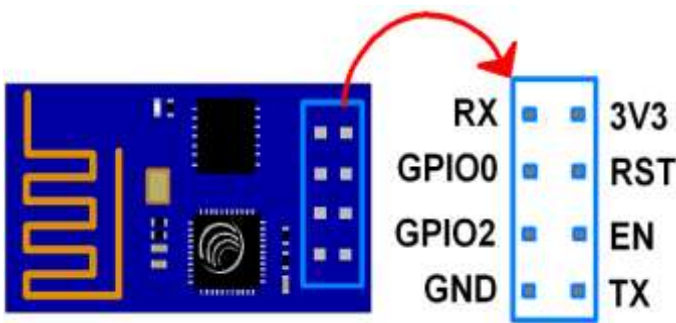
Fig-5: ESP8266

5. IoT 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-time data and unlock the value of your data through visual tools.

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, analyze, 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).
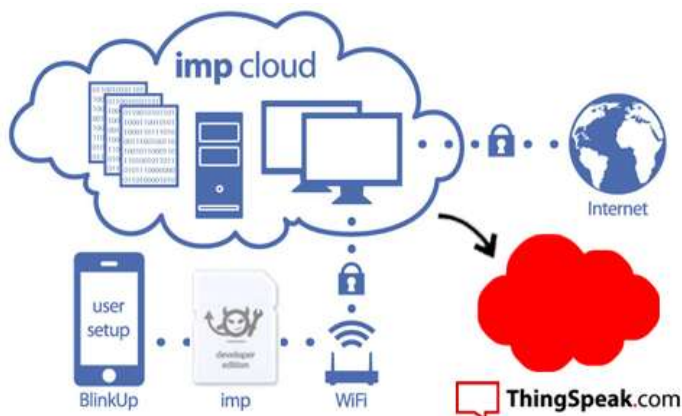

Fig-6: overview of Thing speak

C. Circuit Diagram and Connections

For designing IoT Based Patient Health Monitoring System using ESP8266 & Arduino, assemble the circuit as shown in the figure below.
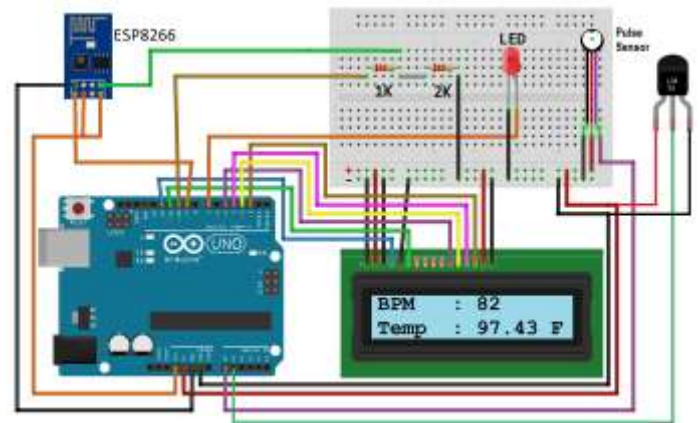

Fig-7: Circuit Diagram

1. Connect Pulse Sensor output pin to A0 of Arduino and other two pins to VCC & GND.

2. Connect LM35 Temperature Sensor output pin to A1 of Arduino and other two pins to VCC & GND.

3. Connect the LED to Digital Pin 7 of Arduino via 220-ohm resistor.

4. Connect Pin 1,3,5,16 of LCD to GND.

5. Connect Pin 2,15 of LCD to VCC.

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

7. 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.

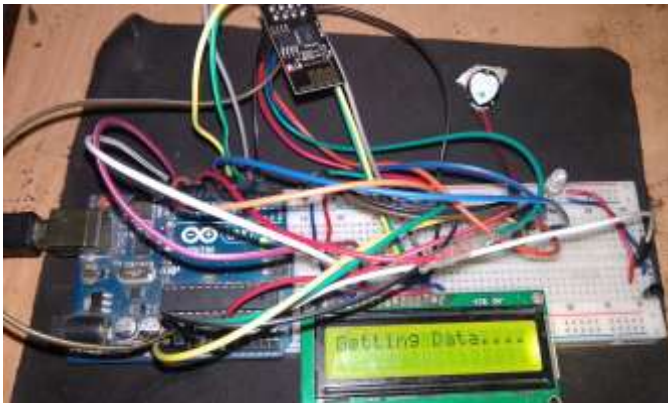8. Connect the TX pin of the ESP8266 to the pin 9 of the Arduino.

D. Results

Fig 8: Interfacing of LCD and sensors with Arduino

Fig 9: Setup of System

Fig 10: Result displayed on 2x16 LCD

Fig 11: Graphs of sensor output on the thing speak

ACKNOWLEDGEMENT

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BIOGRAPHIES

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