DESIGN AND IMPLEMENTATION OF IOT BASED PORTABLE HEALTH ANALYSIS SYSTEM

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Abstract: Progresses in information and communication technology have guided to the evolving of IoT. In the modern health care system the usage of IoT technologies brings convenience of patients, doctors ,Engineers , since they are applied to various medical critical area (real time monitoring of physiological signals ,real time monitoring of critical parameters of medical device like input voltage, sensor output ,healthcare management). IoT based portable health analysis system consists of portable device that will be capable of reading the data of Heart Pulses and Temperature & transmit the Pulses with temperature to the Mobile Phone and to the internet. This research work highlights how heart rate sensor and temperature sensor collects heart rate and temperature data. This pulses and temperature data will be provided to the PIC microcontroller, this is an advanced microcontroller with inbuilt ADC and higher clock frequency. It will convert the pulses data and temperature data to the digital data and transmit to the mobile using serial communication with Wi-Fi. To display the data, "thingspeak.com" website is used. This website provides an API (Application Programming Interface) key and channel ID. So using this API key , data can be send on this website separately and using channel ID , data can be fetch on this website using internet from anywhere in the world.

Keywords**:** *IoT, Health analysis system, health care management*

I. INTRODUCTION

The Internet of Things (IoT) has great potential for unsettling the current Internet architecture. Estimates show that some 12 billion devices are already connected to the Internet and as per prediction this figure is expected to grow to 50 billion devices by 2020 Due to advancements in wireless technologies, the continuing fall in silicon costs and exceptional miniaturization are entirely aiding this growth. As per prediction that billions of devices will connect to the Internet and will lead to an enormous number of different IOT health applications. However there is not yet a testified solution for monitoring various technical parameter related to the status of medical device. In this paper we will discuss about the portable health analysis system which monitor critical physiological parameter like pulse and temperature and also monitor the status of medical device.

II. LITERATURE SURVEY

Ravi Kishore Kodali et.al [6] described the execution of an healthcare system based on IOT concepts by using ZigBee mesh protocol. The critical parameter of the patient can be occasionally monitor by this system. This system is empowered with IoT concept that will improve the patient care management with continuous monitoring and also cut the cost of patient care and actively involve in collection of critical data

S. V. Viraktamath et.al [5] described that patient monitoring is a important task in multispeciality as well as in district level hospitals to ensure that patients are in stable state. His concept is to make a functioning prototype which use different type of sensors for extracting information like heart beat rate, temperature of body and send it to the computer using wireless technology so that doctors can monitor and analyze the patient's health condition in any part of the hospital.
With the increasing health related problems and lack of proper solution in healthcare to monitor the patient remotely and also lack of solution to monitoring the health of medical device like critical parameter input voltage and sensor output voltage, the patient face serious problem and service engineer face problem regarding failure of medical device. To overcome these problems IoT based healthcare analysis system is proposed to monitor remotely critical clinical parameters like pulse and Temperature and also monitor remotely critical medical device parameter like input voltage and sensor output voltage**.**

III. ARCHITECTURE OF IOT BASED HEALTH CARE ANALYSIS SYSTEM

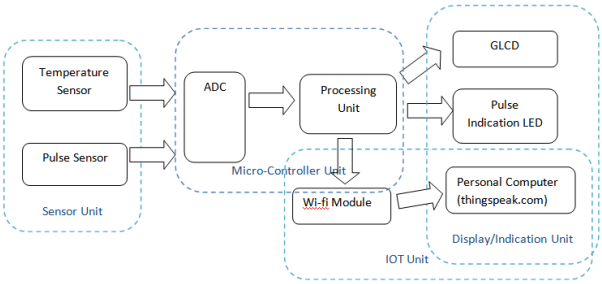

Fig 1: Block diagram of IOT based health care analysis system

IV. WORKING AND DESCRIPTION OF PROJECT WORK

There are four units:

- Sensor unit
- Microcontroller unit
- IOT unit and
- Display unit.

A. Sensor unit:

This is very important unit of this project. Sensor unit is used to sense the biomedical signal. Here we are observing two different types of biomedical signal Temperature of body and pulse rate.

To observe the temperature of our body a LM35 temperature sensor is used. It is a normal temperature sensor which is easily available in market. It proved analog data in the form of voltage and the relation between temperature and voltage is given by this sensor is 10mv variation equals to 1 degree centigrade. According to the value of sensor output we can easily calculate the body temperature. A heart bit sensor is also used in this unit of project to find the number of pulses of heart. It provides the analog data in the form of voltage. The variation of voltage is between 0 to 5 volts. So we can directly use this sensor in our project because PIC18F452 microcontroller is work in this range.

The output of sensor unit is directly provided to the microcontroller unit for further operation.

B. Microcontroller unit:

This unit has a PIC18F452 microcontroller to process the sensor unit data and provide the output to the display/indication unit. This is divided into two parts ADC and Processing unit.

ADC (analog to digital converter) is use in this unit to convert sensor unit's analog data to 10 bit digital data. In this project the reference voltage for ADC is 5 volts so step size of ADC will be 5/1024 is 4.88 mV. PIC18F452 have 8 inbuilt ADC from AN0 to AN7. In this project, AN0 AN1 and AN2 are used for heart rate sensor, temperature sensor and Input voltage on pin number 2, pin number 3 and pin number 4. Digitally converted data is provided to the processing unit for next operation.

Processing unit of microcontroller takes the digital data and process the data for display/indication unit. An internal programming is done in this project which observe the sensors readings and provide the output on the GLCD, LED and on Wi-Fi module.

C. IOT unit:

This unit has a Wi-Fi module to transmit the data on internet. ESP8266 Wi-Fi module is used in this project for this task. Microcontroller operates this Wi-Fi module using AT commands and send the data on internet.

To display the data of this project, "thingspeak.com" website is used. This website provides an API key and channel ID. So using this API key we can send our data on this website separately and using channel ID we can fetch our data on this website using internet from anywhere in the world.

D. Display/indication unit:

This is the output unit of this thesis. It is providing the number of pulses of heart (heart bits), body temperature and analog output of temperature sensor and value of input voltage using graphical LCD, LED and computer.

This unit is divided into three parts LED, GLCD and computer.

V. EXPERIMENTAL SET UP

Temperature sensor, pulse rate sensor are connected to the body and sense the data from the patient's body and send them to PIC microcontroller for processing and then to the Wi-Fi module. Wi-Fi module transmit this data to the mobile and to the website Things speak. The patient's data and critical voltage parameter of device is updated after every 45 seconds in the mobile and on the website. All parameters for last seven days can be viewed through website anywhere anytime. To evaluate the IOT based heath analysis system sample data is collected to monitor the device health and patient health .Sample data on input voltage ,sensor output voltage , body temperature , pulse rate are collected from 15 patient and are given in Table 1, Table 2, Table 3, Table 4

VI. RESULT ANALYSIS

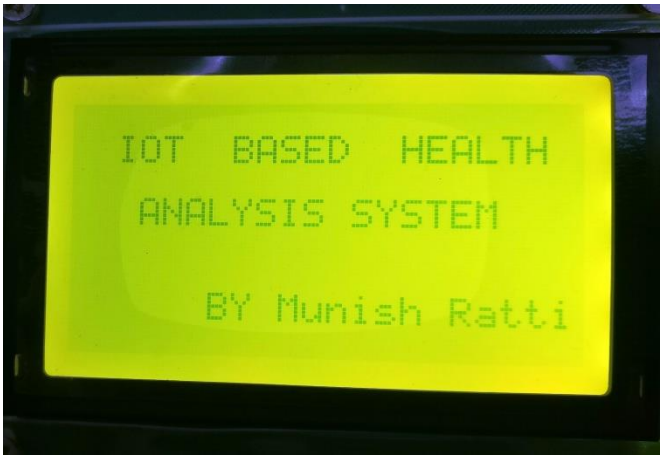

Fig 2: GLCD output

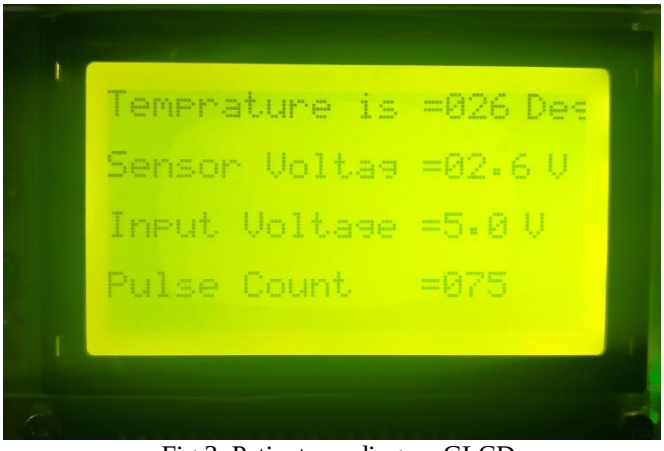

Fig 3: Patients reading on GLCD

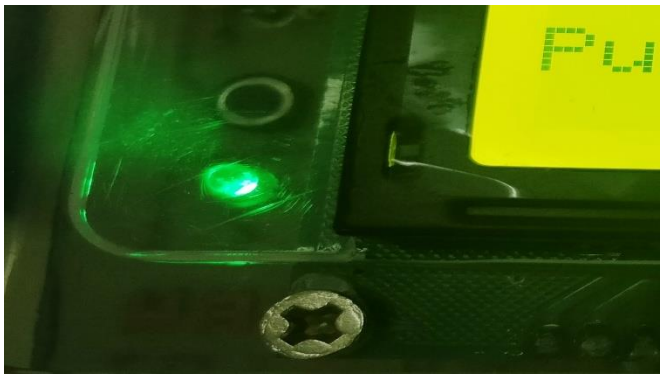

Fig 4: LED indication on Pulse behavior

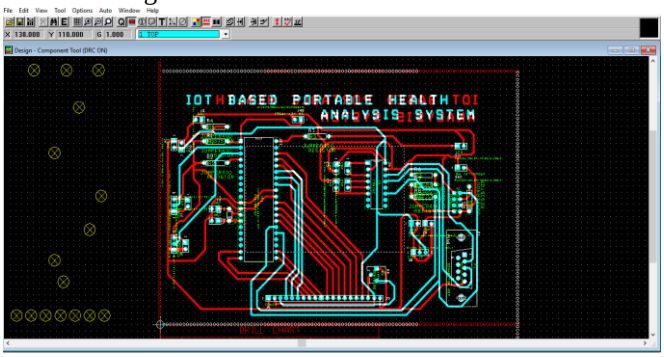

Fig 5: OrCad Layout for PCB designed

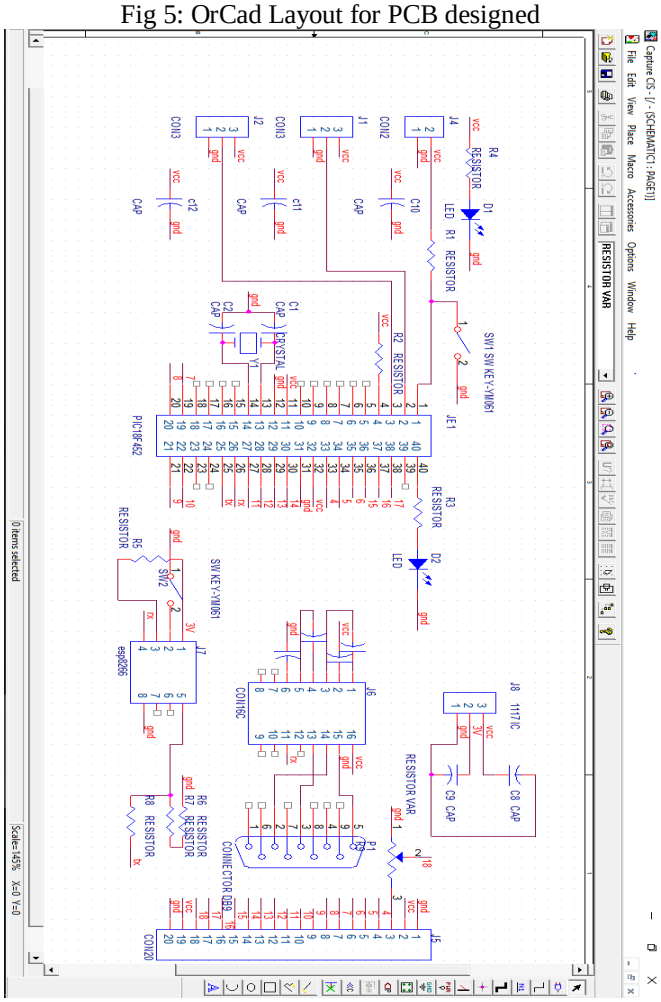

Fig 6: Schematic diagram of PCB designed

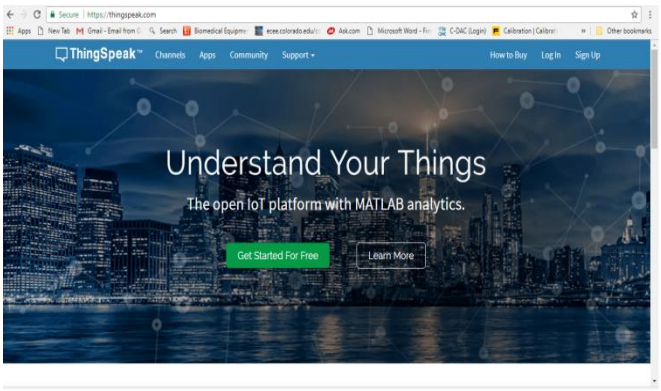

Fig 7: Website home page

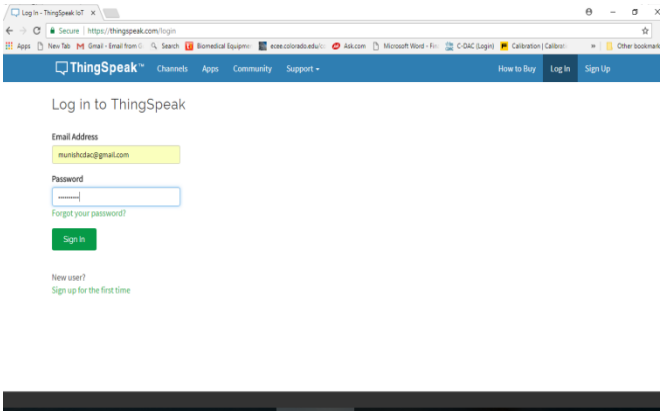

Fig 8: Website Log-In page

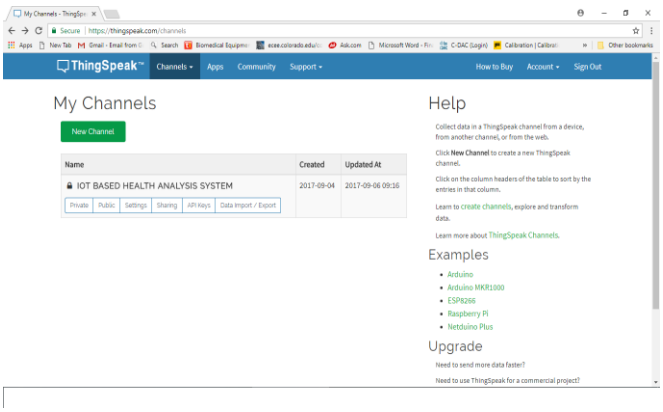

Fig 9: Channel home page for device

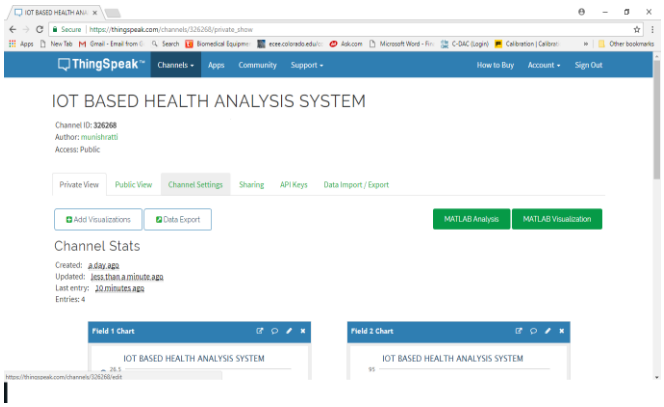

Fig 10: Channel stats page

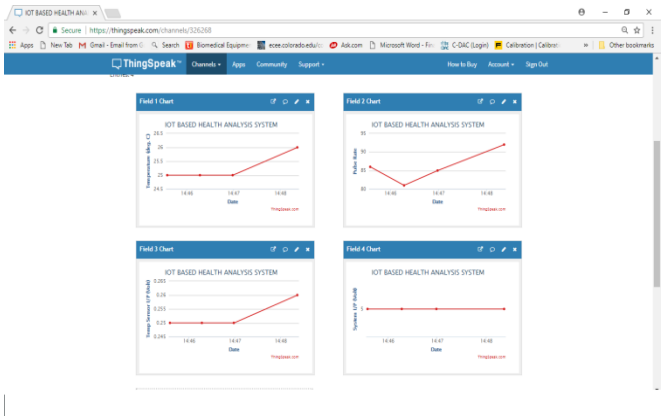

Fig 11: Patients Output on Website

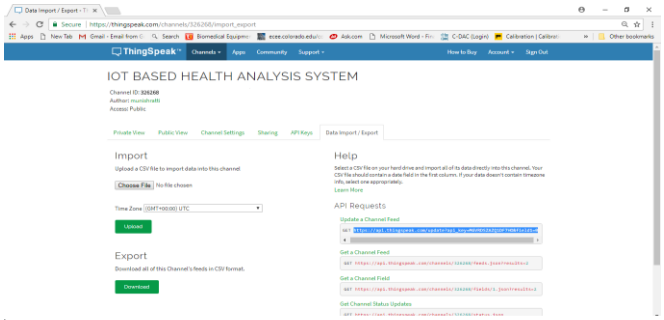

Fig 12: API key for designed Channel

Table 1: Sample Pulse Rate Data of 15 patients under observation:

S.No	Patient ID	Pulse Rate (BPM)	Status
1	0001	72	Normal
2	0002	75	Normal
3	0003	85	Normal
4	0004	83	Normal
5	0005	84	Normal
6	0006	83	Normal
7	0007	79	Normal
8	0008	80	Normal
9	0009	80	Normal
10	0010	65	Abnormal
11	0011	78	Normal
12	0012	75	Normal
13	0013	85	Normal
14	0014	83	Normal
15	0015	95	Abnormal

Table 2: Sample Temperature Data of 15 patients under observation

S.No	Patient ID	Temperature	Status
1	0001	37	Normal
2	0002	36	Normal
3	0003	35	Normal
4	0004	36	Normal
5	0005	37	Normal
6	0006	35	Normal
7	0007	38	Normal
8	0008	33	Normal
9	0009	36	Normal
10	0010	30	Abnormal
11	0011	35	Normal
12	0012	34	Normal
13	0013	38	Normal
14	0014	39	Normal
15	0015	37	Normal

Table 3: Sample temperature sensor output Voltage Data

S.No	Patient ID	Output Voltage (Volts)	Status
1	0001	3.7	Working properly
2	0002	3.6	Working properly
3	0003	3.5	Working properly
4	0004	3.6	Working properly
5	0005	3.7	Working properly
6	0006	3.5	Working properly
7	0007	3.8	Working properly
8	0008	3.3	Working properly
9	0009	3.6	Working properly
10	0010	3.0	Working properly
11	0011	3.5	Working properly
12	0012	3.4	Working properly
13	0013	3.8	Working properly
14	0014	3.9	Working properly
15	0015	3.7	Working properly

Table 4: Sample Input Output Voltage

S.No	Patient ID	Input Voltage (Volts)	Status
1	0001	5	Working properly
2	0002	5	Working properly
3	0003	5	Working properly
4	0004	5	Working properly
5	0005	5	Working properly
6	0006	5	Working properly
7	0007	5	Working properly
8	0008	5	Working properly
9	0009	5	Working properly
10	0010	5	Working properly
11	0011	5	Working properly
12	0012	5	Working properly
13	0013	5	Working properly
14	0014	5	Working properly
15	0015	5	Working properly

VII. CONCLUSION AND FUTURE WORK

An efficient IOT based Health analysis system is developed to monitor the critical parameter like pulse and temperature of patient and also to monitor critical parameter of device like input voltage and sensor output voltage and these parameter are accessible anywhere anytime. The service engineer or concerned staff member can notice any variations in the equipment's parameter in advance and fix it before it does damage. Evaluation of health analysis system has been done experimentally by collecting the data from 15 different patients and also verified the status of patients. The doctor can remotely monitor the critical parameter of patient as well as monitor the health of the patient.

The current system can be extended by adding more features like ECG, Blood pressure , Respiration parameter and also this system can be made as a wearable device by using SMD components.

VIII. REFERENCES

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