

# Analysis on Healthcare System using IoT

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So, people need to work for their family and their life to get more income. The lower cost devices can be provided poor people to be healthy and happy in their life. This system is IoT based healthcare monitoring system. Therefore, this proposed system makes healthcare system to be developed. IoT is connected with Node MCU by the combination of all sensors. IoT based healthcare monitoring system can transmit the data directly to the cloud using internet connection. Various habits cause diseases. Among the most common chronic diseases can be measured and monitored that are blood pressure, temperature, heartbeat and other at home. Node MCU is a microcontroller device which consist network connection and it is a small smart device. It can program in Arduino IDE like Arduino IO hardware. On the other hand, it is connected with sensors then the data to transfer wirelessly to cloud. The data can be used in SPSS to calculate the future data. Linear regression is very important method for people to predict health condition. If health condition will be known in healthcare, it can be prevented lives from unhealthy. By implementing this system, it will offer an inexpensive system for people's health monitoring.

## II. INTERNET OF THINGS

IoT devices are used in many application fields which make the users more comfortable life. Internets of Things is the emerging paradigm which contain huge amount of smart object and smart devices connected to the internet for communication with each other[6]. IoT is simply the network of interconnected devices which embedded with sensors, software, network connectivity, actuators and necessary electronics that able to collect and transmit to the

## ABSTRACT

In this research, the proposed system is to design and construct IoT based healthcare monitoring system using ESP8266 Node MCU that supports healthcare system under circumstances for people. IoT based healthcare monitoring system is evaluated for certain parameter like heartbeat and temperature. This system consists of Node MCU, Temperature Sensor, Heartbeat Sensor, IoT, SPSS, Thinger.io cloud sever and mobile phone. Node MCU board collects temperature and heartbeat data from the sensors and transfer wirelessly to IoT website via internet connection [1]. This data can be transmitted to the data set linked with SPSS software and this software can be calculated the future data for people using linear regression method. So, Mobile health system helps to know health conditions in real time to people. The aim of this system is to improve the healthcare system by using internet and easily to measure their condition of health from home.

**Keywords:** Node MCU, Temperature Sensor, Heartbeat Sensor, Internet of Things, SPSS Software

## I. INTRODUCTION

The best healthcare system is very important in every country. If the healthcare system is poor, that means the image of this country will not develop. In the developing country, people have lower income. Cost effective healthcare system has been increasing demand to use in low and middle income countries [3].

webserver. IoT provide the interaction between things and microcontroller using network.

## III. HARDWARE REQUIREMENTS

### A. Temperature Sensor (DS18B20)

Temperature sensor is a digital thermometer .It provides 9 bits to 12 bits Celsius temperature measurements. The temperature sensor communicates over a one-wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the temperature sensor can derive power directly from the data line and requiring voltage from 3V to 5.5V. Each device has a unique 64 bit serial code stored in one board ROM .It can measure temperatures ranging from -55C to +125 C (-67F to+257F) with an accuracy of + or - 0.5 C in the range of -10C to +85C.



Fig. 1 Temperature Sensor

**B. ESP8266 Node MCU**

Node MCU is an open -source firmware and development kit that helps us to prototype our IoT product within a few lua script lines. Node MCU is an also ESP8266 wifi microcontroller at 80MHz and at 3.3V logic. It is widely used in IoT applications. We can program the microcontroller using the Arduino IDE software for an easy to run Internet of Things .The features are open-source, interactive, programmable, low cost, simple, smarts and wi-fi enabled .Node MCU also like Arduino hardware IO which can dramatically reduce the redundant work for configuring and manipulating hardware code like Arduino.



**Fig. 2 ESP8266 Node MCU**

**C. Heartbeat Sensor**

Heartbeat sensor circuit comprises ITR9904, LED, Resistor, LM358, voltage regular and 12V battery. ITR9904 consists of an IR light emitting diode as the transmitter and Photo diode as the receiver .The LED needs to be of super bright intensity because maximum light passes and spreads if a fingertip placed on the ITR9904.The IR LED transmits an infrared light into the fingertip then reflected to the photo diode from the blood inside the finger arteries [8]. So, the heart rate signal can be obtained by ITR9904 device. In order to calculate the heart rate based on the blood flow to the fingertip .A heartbeat sensor is assembled with the help of LM358 op-amp for monitoring the heartbeat pulses. LM358 IC device used to be filter weak signal from receiver. This device has two low pass filters that each filter has 100gain. This gain is good enough to convert the weak signal to the heart beat signal. This heart beat sensor circuit can be measured the pulse heart rate up to 140.4 BPM because it used 2.34Hz frequency range. Heart rate is the number of heartbeats per unit of time typically expressed as beats per minutes (BPM).Heart rate can vary as the body's need to absorb oxygen and excrete carbon dioxide changes during exercise or sleep.



**Fig. 3 Heartbeat Sensor**

**IV. SOFTWARE REQUIREMENTS**

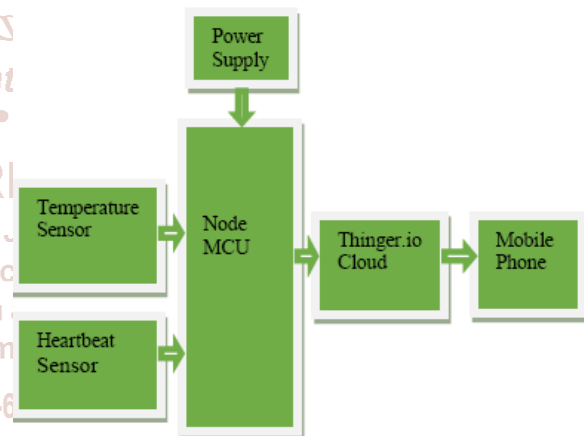
**A. Thingier.io** The thingier.io platform is an open source platform ofthe internet of things. It provides a ready to use scalable cloud infrastructure for connecting things. Users can start controlling their devices from the internet in minutes without worrying about the required cloud infrastructure. The thingier.io cloud support IoT devices with other application like web server, mobile phones or desktop

applications .Thingier.io is use to monitor the heart beat and temperature at any time.

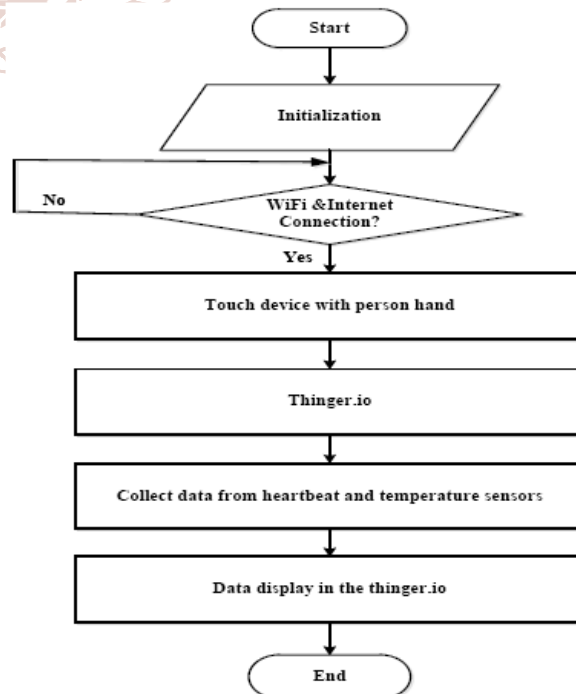
**B. Statistical Package for Social Sciences (SPSS)**Software SPSS statistics is a software package used for the analysis of statistical data. SPSS is commonly used in healthcare, marketing and education research .The types of data analysis is widely used using SPSS software. Common sources mainly include survey results, scientific research results and other files. SPSS provides data analysis for descriptive and bivariate statistics, numeral outcome predictions and predictions for identifying groups. The software also supports data transformation, graphing and prediction.

**V. BLOCK DIAGRAM OF THE SYSTEM**

The block diagram of overall system is shown in Fig. This block diagram consists of two sensors which measures heartbeat and body temperature of people which is connected with ESP8266 Node MCU microcontroller [2]. It gets 5V DC power supply from 12V battery by reducing with voltage regulator. Both temperature and heartbeat from the Node MCU are displayed in the thingier.io by using internet connection and then can be watched via mobile phone.



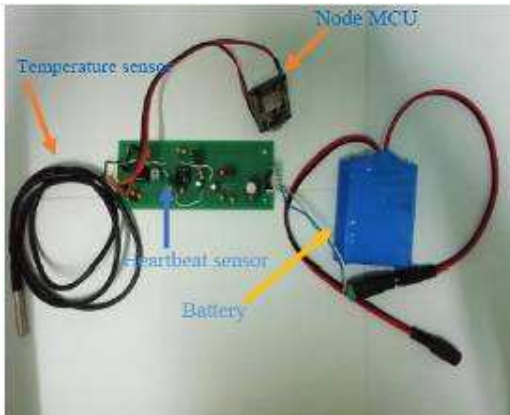
**Fig. 4 Overall Block Diagram of Proposed System**



**Fig. 5 Flow Chart of Heartbeat and Temperature Sensors**

Fig. 5 shows the flow chart of heartbeat and temperature sensors. When the system is started, it will first connect serial port. After we can be checked wifi connection. If device gets internet connection, IoT based healthcare monitoring device can be measured data by touching human's fingertip. The data from the Node MCU will send to thinger.io ( IoT platform). On the other hand, we can see that data on the thinger.io cloud using mobile phone.

**VI. TEST AND RESULT**

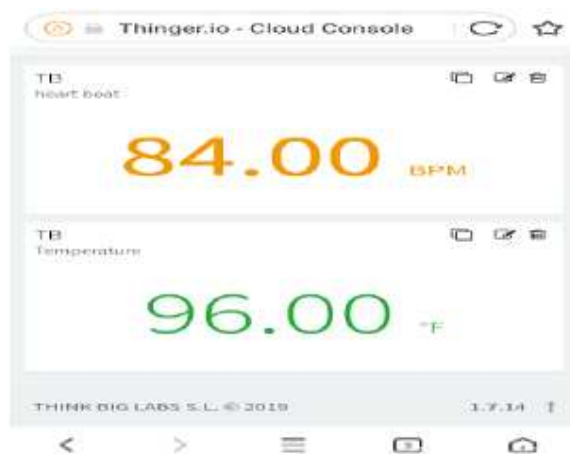


**Fig. 6 Hardware Implementation of the Proposed System**



**Fig. 7 Testing IoT Based Healthcare Monitoring System with Thingier.io Cloud**

Fig. 6 shows hardware implementation of the proposed system in my research. Fig. 7 illustrates testing IoT based healthcare monitoring system with thinger.io cloud.



**Fig. 8 Heartbeat and Temperature Show on the Thingier.io**

Fig. 8 shows heartbeat and temperature data on the thinger.io. Heartbeat is 84 BPM and Temperature is 96 °F in mobile phone.

**A. Analysis using Linear Regression Method**

Regression is a statistical technique to determine the linear relationship between two or more variables. Regression is primarily used for prediction and estimate the value of one variable based on the value of another variable. This is called linear regression analysis. Linear regression analysis is used in statistics to find the future data by using raw data in SPSS [5]. It has two linear regression methods. There are simple linear regression and multiple linear regressions. This proposed method is simple linear regression. For simple linear regression,

where,

Y=dependent variable (predicted variable)

a =intercept of Y

X=independent variable (predictor value)

b=slope of X

**TABLE 1 SAMPLE Data FOR HEARTBEAT**

Day	Date	Time	Heart Beat
1	27.2.2019	8:00AM	80 BPM
		12:00PM	88 BPM
		4:00PM	92 BPM
		8:00PM	72 BPM
2	28.2.2019	8:00AM	80 BPM
		12:00PM	84 BPM
		4:00PM	92 BPM
		8:00PM	72 BPM
3	1.3.2019	8:00AM	80 BPM
		12:00PM	84 BPM
		4:00PM	92 BPM
		8:00PM	88 BPM

**TABLE 2 SIMPLE LINEAR REGRESSION METHOD**

Variables Entered/Removed <sup>a</sup>			
Model	Variables Entered	Variables Removed	Method
1	number of day <sup>b</sup>	.	Enter
a. Dependent Variable: human heartbeat			
b. All requested variables entered.			

**TABLE 3 ANALYSIS OF VARIANCE**

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	179.788	1	179.788	7.387	.007 <sup>b</sup>
	Residual	3164.091	130	24.339		
	Total	3343.879	131			
a. Dependent Variable: human heartbeat						
b. Predictors: (Constant), number of day						

**TABLE 4 MODEL SUMMARY**

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.232 <sup>a</sup>	.054	.046	4.933
a. Predictors: (Constant), number of day				



TABLE 5 COEFFICIENTS

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Sd. Error	Beta		
1	(Constant)	83.994	.864		97.247	.000
	number of day	.031	.011	.232	2.718	.007

a. Dependent Variable: human heartbeat

The table 1 describes sample data for heartbeat during one month. Survey data insert input data in my research to be predicted future data. Input data is used to analyse in SPSS software by using linear regression method. Linear regression method can be calculated the future data using SPSS software for a person during one month

In table 2 shows simple linear regression method. This analysis chose a simple linear regression method to predict heartbeat which is based on daily record [7]. In this method, heartbeats of human are inserted on dependent variable and days are kept on independent variable because information depended on variables were calculated. In the Analysis of variance table 3, since the p value is 0.007, the relationship between heartbeat and number of days is significant. From the model summary table 4, the correlation coefficient R is 0.232. Therefore, it can be concluded that number of days is positively correlated with heartbeat and the relationship is very strong (R is positive and R has  $-1 < R < 1$ ). The table 5 shows the regression coefficients, the intercept and the significance of all coefficients in the model. The linear regression analysis estimates that the linear regression function to be  $Y = 83.994 + 0.031X$ . The coefficients table 5 provides the necessary information to predict heartbeat from day. When heartbeat is wanted to know, daily record above the linear regression equation can be inserted.

## VII. CONCLUSION

In this research, IoT based healthcare monitoring system has been implemented with IoT devices and displayed by using thinger.io and then has been analyzed with data set using linear regression method. This system is very easy to know health information for people in real time and low cost by implementation devices.

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