Patient Health Monitoring System and Management using Internet of Things

Swapnil Mishra[1], Siraj M.Tamboli[2]
[1, 2] SENSE Department
[1, 2] Vellore Institute of Technology University, INDIA

Abstract- *Internet of Things (IoT) is the rising paradigm, which incorporates big amount of clever object and clever devices connected to the internet for communicating with each other. IoT gadgets are used in many fields which make the users' day to day lifestyles greater at ease. These clever devices are used to accumulate temperature, blood pressure, sugar stage etc., which might be used to evaluate the fitness condition of the affected person. Communicating the gathered information to the medical doctor, making accurate decision on the records amassed and notifying the affected person is the tough mission in the IoT. In this paper, the architecture of the Patient Health Monitoring System and Management (PHMSM) using IoT gadgets is proposed to collect the required parameters and examine the records received from the IoT gadgets. PHMS additionally notifies the patient with possible precautionary measures to be practised by means of them. This device suggests the patient with medical care and next step to be accompanied in case of critical situation. The PHMSM machine is evaluated for positive parameters and the selections made at the records obtained from the source are assumed to assess the machine. The simulated results experiments the correctness and effectiveness of the proposed system.*

Keywords- Healthcare, Internet of Things, Wireless sensor, Body Area Network, Pulse charge.

I. INTRODUCTION

In recent years, the boom of net is first rate and has been in addition extended to connecting things through internet. All devices are related to each other with various clever technologies to create worldwide ubiquitous community known as Internet of Thigs (IoT). The development of technologies such as IoT generates massive quantity of statistics, results in new age of statistics. Data generated by using the IoT devices are used for evaluation and selection making process [1]. The packages of IoT can be grouped into area like:

- Transport and logistics
- Health care
- Smart Environment
- Personal and Social

The roles of IoT in these kind of domains are remarkably high. In Transport and logistics automobile identity, car to automobile communique, visitors verbal exchange etc. Are the most important improvements inside the field of IoT. Nowadays Government focuses on growing clever towns to apply all the emerging technologies and growing the country to compete across the world. Each and everyone is surrounded by clever devices, that's used to connect with the 3G/4G community, social networks and other clever technologies. The power of IoT is its high effect on each person's day nowadays life such as amusement, work, communication, etc.

The key allowing factor of IoT is in clinical and health care. IoT gadgets are used to gather, screen, evaluate and notify the affected person with the records. According to Borgia [2], the penetration of IoT devices in medical and fitness care is:

- Remote monitoring scientific parameters
- Diagnostics
- Medical Equipment monitoring
- Secure and get entry to the indoor surroundings
- Smart medical institution offerings
- Entertainment services

The remote tracking of a patient with the aid of the medical doctor remains a hard venture. To analyse the fitness situation of the affected person, diverse clinical parameters are needed about the patient. Collecting the parameters and communicating them to the physician via the right networking channel is every other challenging challenge.

II. RELATED WORK

Gennaro et. Al. [4] advanced a private fitness prognosis based totally on the symptoms of the patient. A large amount of accrued information is used to analyse the disease and hazard of the sufferers. Franca mentioned that the innovations of the new era systems are the development of continuous tracking capabilities for the patient and the improvement of workflows and productiveness of scientific private. He also emphasized the diverse wi-fi technology and

the advantages of using those technology for faster communique [5].

Tao et. Al advanced a wearable sensor system to screen the actions of the patients. The machine turned into calibrated to a threshold stage less than 5% with the aim of minimizing the mistake charge of the captured facts[6]. Stefano et. Al[7] proposed a detection device to display the movements of patients which recognizes a fall and mechanically sends a request for help to the caretakers.

Security is a key subject inside the IoT gadgets management. The four recognized requirements are [9] (i). Secure authentication and authorization, (ii).Secure bootstrapping of items and transmission of facts, (iii).Security of IoT information, (iv). Secure get right of entry to to information by means of legal persons. Mohammed discussed that the key distribution is needed to at ease the e-fitness packages. He modelled a protocol for key management which lets in the captured statistics to be transferred in a secured channel [8]. An IoT deployment in healthcare wishes more safety because the facts of any sufferers is greater sensible and it need to no longer be misused with the aid of any horrific factors within the society. Debiao and Sherali mentioned the security requirements and authentication schemes for RFID based on elliptic Curve Cryptography (ECC)[12].

Cristina et. Al [10] evolved an technique to hold health care statistics of a patient accumulated in unique geographic places. The information is to be had to docs, hospitals, laboratories and so on., to test the scientific history of the sufferers. Jieran et al. [11] developed a Radio Frequency Identification technology and intelligent structures, which stumble on the disinfected articles and signals the medical body of workers to wash the fingers after the touch with the disinfectant articles.

IoT techniques may be used to promote healthcare in a higher way. The fitness related records could be interacted with medical doctors who're in emergency. Even within the absence of the physician close to the affected person or within the clinic, the health practitioner can realize the sufferers' status in order that the doctor's advice is given in critical cases. Brian Blake commented that the human customers can be alerted proactively based totally on their health and ancient medical or genetics history [12].

Data sensed and transmitted via the wireless devices are obtained inside the nearby device that needs to aid getting access to of records in heterogeneous codecs, can be beneficial in constructing real time packages and to be updated within the cellular software of the medical doctor as well as the person (sufferers or caregiver). Boyi et. Al. Presented IoT based system for imparting guide to emergency medical offerings via demonstrating how IoT information can be accrued and integrated for interoperability[13]. Long et. Al. Mentioned the necessary and necessities info of the software program for healthcare and proposed an structure for healthcare and IoT. He has taken the parameters like ECG, blood oxygen, respiratory, temperature and so on, [14].

With the growing fitness related issues and lack of proper answer in healthcare to screen the patients within the absence of medical doctor, the sufferers face serious issues and misplaced existence in essential situations, Hence to triumph over these troubles the new Patient Health Monitoring System and Management (PHMSM) is proposed to reveal and evaluate the popularity of each patient through the doctor even in their absence in health center or close to the patient.

III. PORPOSED SYSTEM AND ARCHITECTURE

The structure of PHMS carries three stages; they're series phase, transmission phase, utilization phase. Body Area Network (BAN) is built to gather the required facts from the affected person. The parameters used to diagnose the ailment may vary from one sickness to some other. Therefore every parameter is sensed by means of separate IoT devices which can be related to the patient. All the gadgets related in the body of the affected person are called BAN within the facts collection phase. Blood pressure module, coronary heart fee display, temperature and so on. Are the basic devices used to gather the blood strain, heart rate and temperature of the affected person. The facts accumulated within the series phase is communicated to the medical doctor to evaluate the parameter for diagnosis.

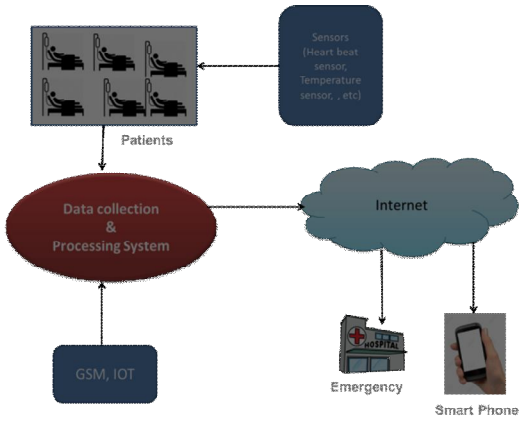

Figure 1. Block Diagram of PHMSM

The accrued statistics is communicated to the health practitioner through distinct communication channel rely on the patient’s role. The transmission tool used inside the

transmission levels are WiFi or Bluetooth devices. All records accrued from the IoT gadgets are communicated to the nearby machine which contains the software program to test the threshold stages of parameter.

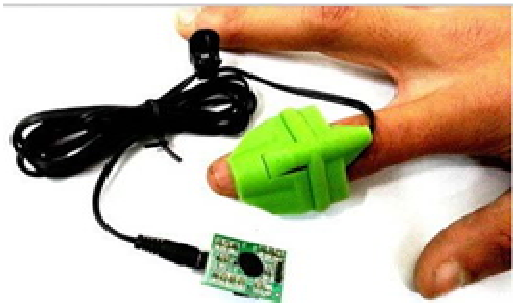

Figure 2. Heartbeat sensor

The normal minimum and maximum of blood strain for every age category is proven in Table.1. The average of regular body temperature for the human being is 98.6°F (37°C). This can be measured through the temperature sensor and transmitted to the monitoring machine thru the wi-fi device. The temperature extra than ninety eight.6°F (37°C) can be considered as odd. The heartbeat sensor which is linked with 8051 microcontroller is used to display the heartbeat of the patient as shown in Figure.2. The amassed records is updated within the PHMSM. Circuit diagram and designed PHMS shown in Figure 3 and Figure 4.

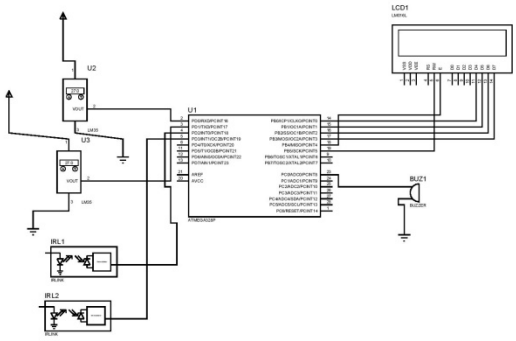

Figure 3. Circuit for PHMSM

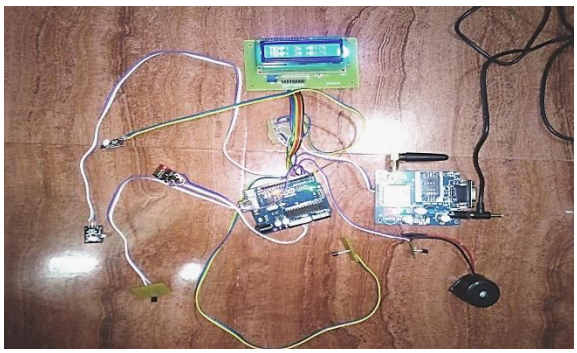

Figure 3. Circuit for PHMSM

The doctors, attender of the patient (authorized to view) and the patients can view the information the use of the mobile utility or through the net. The cell application is accessed with the aid of medical doctors via their consumer name and password. The medical doctors can view all of the info related to their patients. Information such as frame temperature, blood pressure, coronary heart rate and so forth is up to date within the server for each 60 seconds. If the medical doctor desires to get admission to any of his patient's statistics he can request to send the modern-day status of the patients and retrieve the facts from the IoT gadgets to their mobile gadgets after updating with the server. If patients or caregivers of patients' want to get admission to the information of the patient they need to use the patient identification wide variety/Registration number to login and view the information. The cellular utility robotically suggests the risks in pink shade to warn the affected person if the temperature is excessive, blood strain stage increases and the coronary heart rate is not within the normal pulse. The everyday coronary heart charge is in Table.2.

Table 1 Blood Pressure Values in Normal Condition

Age Group	Gender	**Min/Max (mmHg)**
<18	Male	80/120
18 to 20	Male	80/125
21 to 40	Male	85/135
40 and above	Male	85/135
<20	Female	80/123
21 to 40	Female	85/133
40 and above	Female	85/133

Table 2 Range of Pulse Rate

Status	BPM
Rest / Normal	60-100
Sleeping	40-50
Tachycardia	>100

IV. RESULTS AND DISCUSSIONS

The gadget takes the facts from the IoT devices for each sixty seconds and replace inside the database related to the server. The medical doctor can view the patients' health condition every sixty seconds. The machine gets the blood stress to assess the popularity of the patient. Similarly the heart beat rate. For temperature the average temperature falls

above 98.6°F (37°C) is considered as extraordinary temperature. The statistics gathered from the sufferers and its assessment by using the utility. The patient's data shown in Figure 5 and Figure 6.

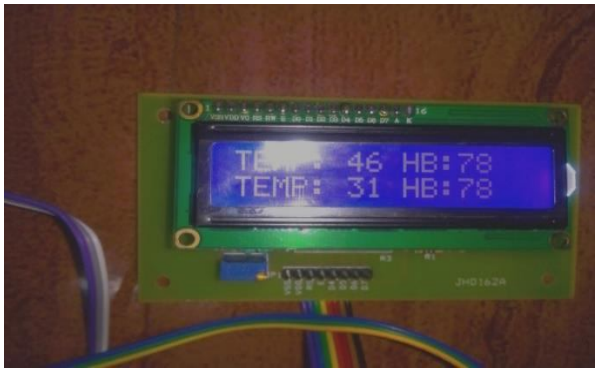

Figure 5. LCD displaying the received Values Heart Rate and Temperature

Figure 6. Values Received in Android App

V. CONCLUSION

The PHMS is advanced to display the up to date popularity of the patient irrespective of the presence of the doctor. The device collects records like temperature, blood pressure and pulse price of the affected person and updates the equal to the doctor. The machine is evaluated experimentally and gathered the sample information of ten sufferers to verify the fame of patients. The physician can reveal the development of patients' health now after which to recommend them approximately their fitness.

The gadget may be extended through adding greater functions to the cellular application like linking the ambulance services, leading medical doctor's list and their specialities, hospitals and their unique facilities and so on., Doctors can create cognizance about diseases and their signs through the mobile utility. From the assessment and the result obtained from evaluation the device is better for patients and the physician to enhance their sufferers' medical evaluation.

REFERENCES

[1] Luigi Atzori et al, "The Internet of Things: A survey", Computer Networks, Vol.54, pp. 2787-2805, 2010.

[2] Eleonora Borgia, "The Internet of Thigs vision: Key features, application and open issues", Computer Communication, Vol.54, pp. 131, 2014.

[3] https://www.elprocus.com/wp-content/uploads/2014/07/heartbeat-sensor.jpg

[4] Gennaro Tartarisco, Giovanni Baldus, Daniele Corda, Rossella Raso, Antonino Arnao, Marcello Ferro, Andrea Gaggioli, Giovanni Pioggia, "Personal Health System architecture for stress monitoring and support to clinical decisions", Computer Communications Vol.35, pp.1296–1305, 2012.

[5] Franca Delmastro, "Pervasive communications in healthcare", Computer Communications Vol.35, pp.1284–1295,2012

[6] Tao Liu , Yoshio Inoue, Kyoko Shibata, "Development of a wearable sensor system for quantitative gait analysis", Measurement Vol. 42, pp.978–988, 2009.

[7] Stefano Abbate, Marco Avvenuti, Francesco Bonatesta, Guglielmo Cola, Paolo Corsini, Alessio Vecchio, "A smartphone-based fall detection system", Pervasive and Mobile Computing Vol. 8,pp.883–899 , 2012.

[8] Mohammed Riyadh Abdmeziem, Djamel Tandjaoui, "An end-to-end secure key management protocol for e-health applications", Computers and Electrical Engineering Vol.44, pp.184-197, 2015.

[9] Eleonora Borgia, "The Internet of Things vision: Key features, applications and open issues", Computer Communications Vol .54 ,pp. 1–31, 2014.

[10] Cristina Elena Turcua, Cornel Octavian Turcua, "Internet of Things as Key Enabler for Sustainable Healthcare Delivery" , Procedia - Social and Behavioral Sciences Vol. 73, pp. 251 – 256, 2013.

[11] Jieran Shi, Lize Xiong, Shengxing Li, Hua Tian, "Exploration on intelligent control of the hospital infection -the intelligent reminding and administration of hand hygiene based on the technologies of internet of things", Journal of Translational Medicine, Vol.10., No.2, pp.55, 2012.

[12] M. Brian Blake, "An Internet of Things for Healthcare", IEEE Internet Computing, pp.4-6,2015.

[13] Boyi Xu, Li Da Xu, , Hongming Cai, Cheng Xie, Jingyuan Hu, and Fenglin Bu, "Ubiquitous Data Accessing Method in IoT-Based Information System for Emergency Medical Services", IEEE Transactions on Industrial Informatics, Vol. 10, No. 2, May 2014.

[14] Long Hu, Meikang Qiu, Jeungeun Song, M.Shamim Hossain and Ahmed Ghoneim, "Software Defined Healthcare Networks", IEEE Wireless Communications, Vol. 22 No. 6, pp. 67-75, December 2015.