Critical Patient Health Monitoring System Using IoT Sensors

Nabi M
M.Tech Student
Dept of Studies in Computer Science & Engineering
University BDT College of Engineering
(A Constituent College Of VTU Belagavi)
Davangere, Karnataka, India

B N Veerappa
Associate Professor & Chairman
Dept of Studies in Computer Science & Engineering
University BDT College of Engineering
(A Constituent College Of VTU Belagavi),
Davangere, Karnataka, India

Abstract : The IOT based wireless body sensors network has emerged as a new technology for e-healthcare that allows the data of a patient's vital body parameters and movements to be collected by small wearable or implantable sensors and communicated using short-range wireless communication techniques. WBSN has shown great potential in improving healthcare quality, and thus has found a wide range of applications from ubiquitous health monitoring and computer assisted rehabilitation to emergency medical response systems. Internet of Things (IoT) enable humans to get higher level of automate by developing system using sensors, interconnected devices and Internet. Monitoring of critical Patient health is most important activity small delay in decision related to patient's treatment may cause permanent disability or even death. Most of critical Patient are equipped with IOT sensors to measure health parameters, We are proposing IOT based system which can help to monitor the patient health & transfer his health related Readings through fast communication and identifying emergency and initiate communication with healthcare staff and also helps to initiate proactive and quick treatment. This health care system reduces possibility of human errors, delay in communication and helps doctor to spare more time in decision with accurate observations.

Index Terms **– IOT(Internet of Things), WBSN(Wireless Body Sensor Network), Critical Patient.**

I. INTRODUCTION

In our aging society, mobile Healthcare (m-Healthcare) system has been envisioned as an important application of pervasive computing to improve health care quality and save lives, where miniaturized wearable and implantable body sensor nodes and Smartphone's are utilized to provide remote healthcare monitoring to people who have chronic medical conditions such as diabetes and heart disease & Critical patient. Specifically, in an m-Healthcare system, medical users are no longer needed to be monitored within home or hospital environments. Instead, after being equipped with Smartphone and wireless body sensor network (BSN) formed by body sensor nodes, medical users can walk outside and receive the high quality healthcare monitoring from medical professionals anytime and anywhere. For example, each mobile medical user's personal health information (PHI) such as heart beat, blood sugar level, blood pressure and temperature and others, can be first collected by BSN, and then aggregated by Smartphone via Bluetooth. Finally, they are further transmitted to the remote healthcare center via 3G/4G networks. Based on these collected PHI data, medical professionals at healthcare center can continuously monitor medical users' health conditions and as well quickly react to users' life-threatening situations and save their lives by dispatching ambulance and medical personnel to an emergency location in a timely fashion.

.

II. LITERATURE SURVEY

In 2015, N. Powers et al [1], presented a mobile-cloudlet-cloud architecture to perform real-time face recognition by executing this application in three distinct steps: Face Detection (FD), Projection (PJ) and Searching (S).We observed that, due to their separability, these three steps can be executed in different hardware components: Mobile device (M), Cloudlet (CL), & Cloud (C).

In 2014, A.F. Hani, I. V. Paputungan, M. [2], presented a private cloud storage design and prototype development within an organization to solve such issues. Leveraging on the ability of cloud computing is shown meet to the system requirements. The prototype is implemented on Own Cloud storage framework. The complete functionality of Own Cloud made it an ideal platform to develop and deploy this kind of cloud-based system. Own Cloud can keep images in different file formats and share such images to other.

III. METHODOLOGY

Proposed System

Mobile Healthcare system framework aims at design and development of portable primarily based Healthcare system. We also provide the security and privacy issues, and develop a user-centric privacy access control of opportunistic computing in Mobile Healthcare emergency situation. This project mainly consists of 2 modules i.e. one module will be integrated in patient android mobile, which is associated with many sensors like heartbeat measurement and sugar level management. This module frequently activates sensors via android mobile and measures various parameters of individual patient such as blood sugar level, body temperature, heartbeat, blood pressure and sends these details to hospital server, where the second module gets installed. This module receives data and suggests patients accordingly through Trusted Authority over text or voice call via mobile. And in case

of emergency it activates ambulance call to its nearest hospital. Thus, using android platform we increase the hospital service level being provided to patients.

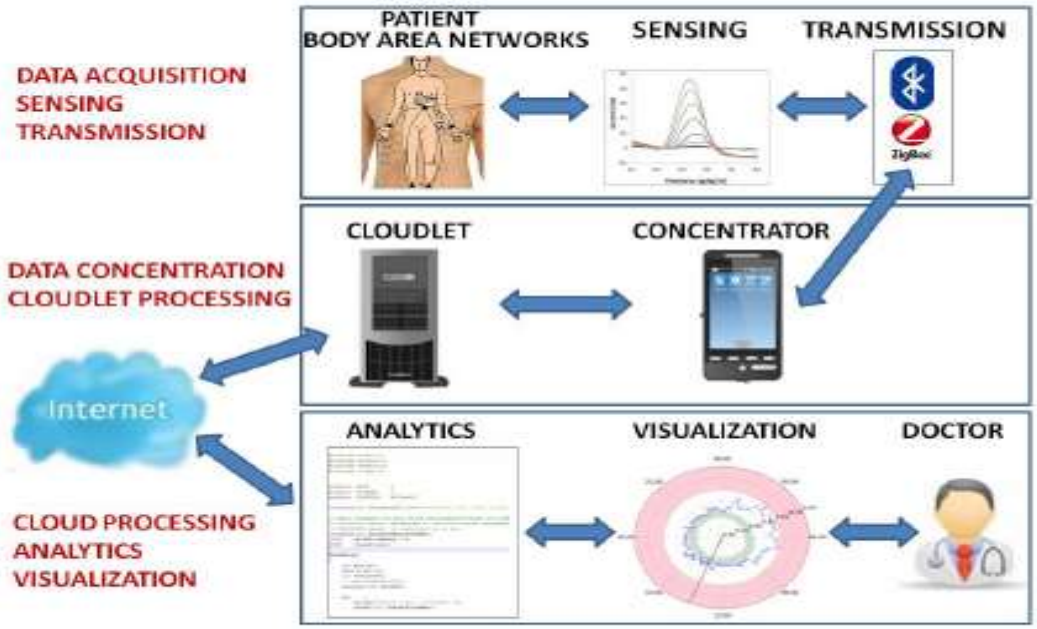
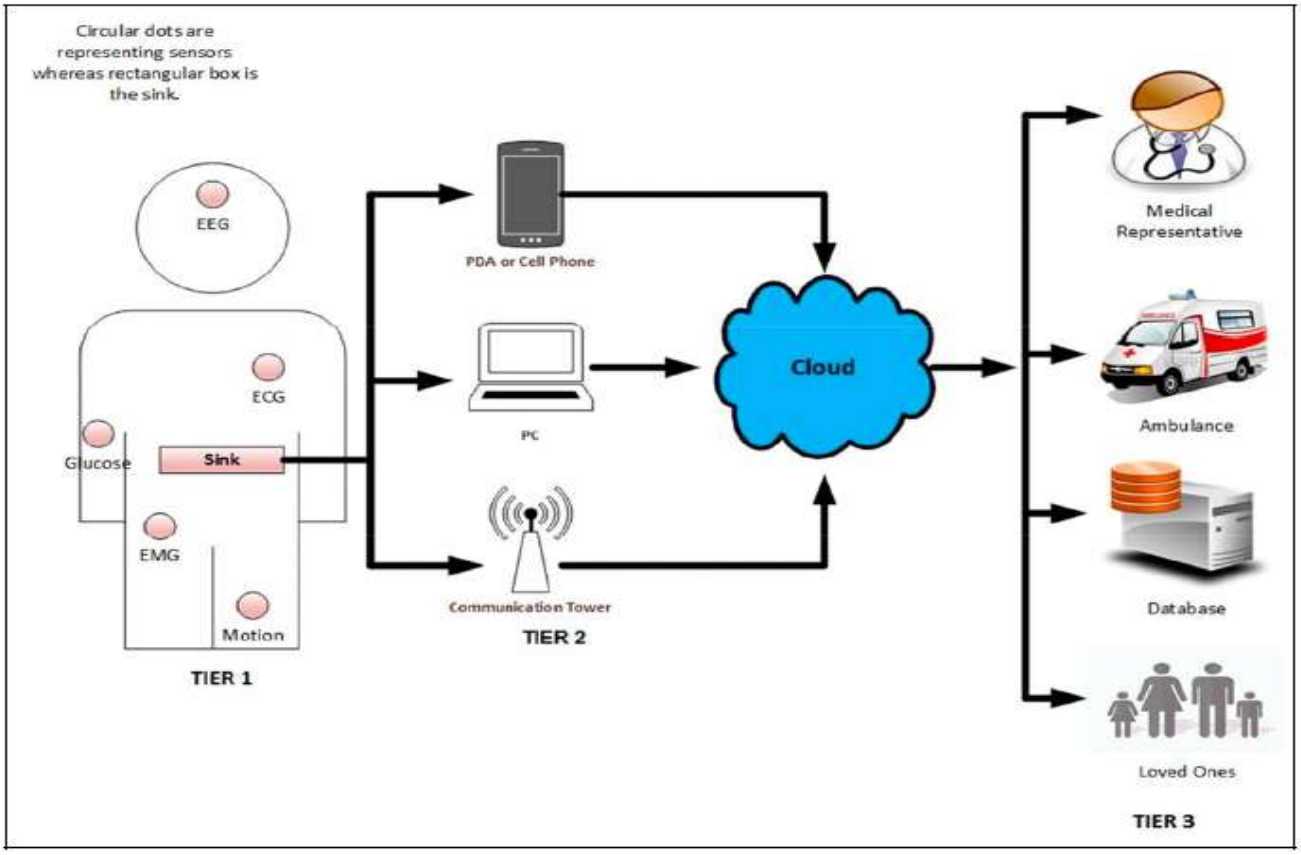


Fig. 1. Components of a remote patient monitoring system that is based on an IoT-Cloud architecture.



WBASN communication architecture.

Fig 2.ARCHITECTURE OF PATIENT HEALTH MONITORING

Architecture diagram for mobile healthcare system gives the flow of communication between patients and the trusted

Authority as shown in fig 2.The following are the steps involved:

Patient login: Raw input data is read from the various body sensors networks present in the patient's android Mobile and converted to fuzzy values. These values are then aggregated via Bluetooth. Body sensor measures Various parameters like blood pressure, heartbeat, body temperature.

Web Interface: The data collected from the patients mobile are sent to the hospital server via 3G network. The information is read by the authorized professionals and provides necessary suggestion and prescriptions based on the patient's data.

Patients Data: Data collected by the various sensors are kept in the hospital database for trusted user and Diagnose patient. The data is kept in two sections one is the normal readings and the other is critical readings.

Trusted Authority or Service Provider: The individual health information is processed in hospital server and related diagnoses are made by the particular medical professionals based on the readings. Services provided are in the form of text or voice. Patient's health information is stored in database and information is kept secure.

Data Privacy

Regardless of the type of encryption scheme, communicating parties must agree on key(s) to encrypt/decrypt messages. In the public-key cryptography, sender uses the public key of the receiver to encrypt messages and the receiver uses his/her private key to decrypt encrypted messages. Every user in the system has a dedicated public and private key pair generated by a Public-Key Infrastructure (PKI) [6]. PKI is a trusted third party such as a certificate authority that authenticates the key pairs by binding them to the identity of users.

For symmetric key cryptography, both sender and receiver must share the same secret key to encrypt/decrypt messages. Both parties perform a key-exchange protocol, such as Diffie- Hellman key exchange, to generate the secret key. Once both parties share the same key, they can use symmetric key cryptography to securely transfer the data.

AES(ADVANCED ENCRYPTION STANDARD) ALGORITHM

AES is one of the most widely used symmetric key encryption algorithms and is accepted as an industry and a government applications standard. AES is optimized for speed, low memory footprint and energy efficiency. Its low resource intensity allows AES to run on a wide range of hardware platforms ranging from 8-bit microcontrollers to high-end desktops and servers.

ALGORITHM:

```
Cipher(byte in[16], byte out[16], key_arrayround_key[Nr+1])
Begin
byte state[16];
state = in;
AddRoundKey(state, round_key[0]);
for i = 1 to Nr-1 stepsize 1 do
SubBytes(state);
ShiftRows(state);
MixColumns(state);
AddRoundKey(state, round_key[i]);
end for
subBytes(state);
ShiftRows(state);
AddRoundKey(state, round_key[Nr]);
End.
```

RANDOM NUMBER SYSTEM ENRCYPTION ALGORITHM

RNS Algorithm:

First, we have to select two primary keys.

Consider,

P1 = 11,
P2 = 13
Data N = 80

Key Generation:

M = P1 * P2 =143
A1 = M / P1 = 143 / 11 = 13
A2 = M / P2 = 143 / 13 = 11

T Value is, it can be anything

T1 = ((A1 * T) mod P1) == 1
T1 = 6

T2 = ((A2 * T) mod P2) == 1
T2 = 6

Encryption Process:

R1 = N % P1 = 80 % 11 = 3
R2 = N % P2 = 80 % 13 = 2

Decryption Process:

E = [(A1 * T1 * R1) + (A2 * T2 * R2)] mod M
E = [(13 * 6 * 3) + (11 * 6 * 2)] mod 143
E = [234 + 132] mod 143
E = [366] mod 143
E = 80.

IV. RESULTS AND DISCUSSION

After successful implementation, testing and deployment of the project the project's working in the user environment is recorded as the screen captures which gives the clear interpretation of results. The below screen shot gives the personal health information of the patient which includes pulse rate, blood sugar, temperature and blood pressure. Diagnoses are made based on these readings. The deployed system consists of two main parts, J2EE and ANDROID part. The J2EE part has two separate login for admin and a trusted login. Admin is responsible for over-all management. Doctors and hospital officials can register through the trusted login. Admin will assign a key id and credentials for all the hospital officials been registered through the portal. The patients can register themselves through the android application been installed in there smart phone. The deployed system collects the various parameters of patients such as blood pressure, sugar level and heartbeat from the sensors that are integrated with the smart phone. These data are then forwarded to the server, where the data is been analyzed and responds the patient status such as SERIOUS, NORMAL etc and also provides emergency service by forwarding the condition of patient to the concerned doctor or hospital official responsible for the patient. It also provides the provision for intimating the near by ambulance in case of emergency. The objective of the system is to provide the emergency service for the patient in critical conditions by getting the various factors of patients through sensors deployed via smart-phone. The system is tested against various patients and doctors. The system achieved an efficiency of delivering a message to doctor about patient details is quiet satisfactory .These kinds of systems can be used by hospitals or government health sectors where they can monitor each individual patient condition periodically. The database of each patient is handled separately by the server, which then can allows the hospital officials to predict the condition of patient and then allows taking necessary precautions accordingly.

Data App

VI. CONCLUSION AND FUTURE WORK

In this paper, we have proposed a mobile phone based healthcare system to monitor the patients remotely and help them in case of emergency. Authorized users monitor patients continuously by reading the data of the patients every now and then. Patient locality and health details are only visible to authorized users. If the patient/client doesn't want to be monitored by the other person then they can disable the system. If the patient is in critical health condition or the patient feels abnormal then the authorized users can give them first aid by sending the SMS to nearby hospital to dispatch ambulance. In our future work, we intend to carry on real time implementation using sensors and smart phone-based testing to verify the effectiveness of the proposed framework. In addition, we will also exploit the security issues with internal attackers, where the internal attackers will not strictly follow the protocol.

ACKNOWLEDGMENT

First and foremost, I would like to express my sincere gratitude to my project guide who has in the literal sense, guided and supervised me. I am indebted with a deep sense of gratitude for the constant inspiration and valuable guidance throughout the work.

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 smartphonebased
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
[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.