ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijareeie.com

Vol. 6, Issue 6, June 2017

A IoT Based Health Care Monitoring System

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Abstract: Pulse oximetry sensor count oxygen saturation level pulses by python and also read serial blood pressure data. Taking care of own body is one of the important factor considered here. The devices which give results at run time and accuracy maintenance are provided by the electronics engineers. By using the new technology of Raspberry Pi, health care monitoring system can be developed. In this type of technology multiple users can share same area network which helps in monitoring. Wi-Fi which provides flexibility and extendibility can use for Wireless communication. In this paper basic parameters like body temperature, heart beats and pulse oxymetry are monitored and the required data transferred on webpage to make it locally visible for users. Healthcare management is one of the most promising applications of information technology. In the last decade there is a considerable attention of the Researchers on the healthcare monitoring systems. The primary goal is to develop a reliable patient monitoring system so that the healthcare professionals can monitor their patients easily.

KEYWORDS: Health care systems, Raspberry Pi, ADC, IOT, AES Algorithm

I. INTRODUCTION

A healthcare system should give better healthcare services to people anywhere in an affordable and patient comfortably manner. Recently, the healthcare system is going to change from a old approach to a new patient centered approach. In the old way the doctors perform the main role. For necessary diagnosis and advising they need to visit the patients. The two basic problems related to this approach, very first the doctors compulsory should present at place of the patient for 24 hours and second, in the hospital, the patient remains admitted, wiring connected biomedical instruments to bedside, for long period of time. The patient friendly approach has received to solve these two problems. In this theme, the patients are aware with knowledge and information to play a more active role in disease diagnosis, and prevention. The important element of this second approach is a reliable and readily available patient monitoring system (PMS). Health is the globally challenging thing for human beings [6]. According to the compositions of World Health Organization (WHO) the highest achievable standard of health is a important right for a single. One can secure his lifetime income by maintaining his health. Healthy persons can also reduce pressure on the already overloaded hospitals, clinics, and medical professionals and decrease the workload on the public safety charities, governmental or non-governmental centers and networks. To human being healthy, a readily easy going modern healthcare system is essential [6].

II. MOTIVATION

By 2050 India will become home to one out of six older persons. The elderly population is growing at a fast rate in India and in the world, only China having larger number of older people, estimates United Nations Population Fund. A report given by this organization says that about 90 million elderly persons lived in India in 2015 and is expected to grow upto 173 million till 2026. In such scenario there is going to be huge increase in the medical assistance and healthcare needs for this elderly population. A comprehensive and separate health care to senior citizens would be in much demand sooner. Hence it is very necessary that the health care system in India must reach a level to provide accessible and affordable health care to elderly particularly to offer treatment and diagnostic services for the management of chronic diseases.

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III. OBJECTIVES

Wearable IoT devices have more demand in the market, due to the availability of Internet for a decent price and well accessibility. Following are some important objectives of healthcare monitoring system[10].

a) To get the information about human health in real time via IoT wearable device.

b) Analysis and Prediction of chronic disorders in primary stage through the data mining techniques which gives the methodology useful for decision making.

c) Preprocessing of data acquisitioned about human (if necessary).

d) To bring IoT-based healthcare monitoring solutions, anywhere, anytime.

IV. LITERATURE SURVEY

The reviews from different papers are taken and studied. A some of them are given below.

Kaleem Ullah,MunamAli Shah [1] This presents the model named as 'k-Healthcare' makes use of four layers, sensor layer, network layer, internet layer and service layer. There are number of sensor used like RTX-4100,Aurduino,Raspberry Pi, pulse oximetry and smart phone sensors. Communication between layers is done through IEEE 802.15.4, 802.15.6, IEEE 802.11/b/g/n, Zigbee etc. For data storage management the system used cloud storage. The proposed system support different protocols and like HTTP, HTTPs, RESTful and Javascript web services.

Punit Gupta,Deepika Agrawal [2] The given system is enough intellegent to monitore the health parameters of patient. In the hardware they used 2nd generation Intel Galileo, a 32-bit Intel Pentium processor system on chip. It is considered as the brain of the given model. As it provides Linux platform with high processing and computer power, it prefers over Arduino. This collects the data from all the sensors, connected to the patient and upload this data on the web page through Ethernet. Here they used XD-58C pulse sensor for measuring heart beats, it takes +3.5v to +5v at VCC, 50Hz to 60Hz frequency. For temperature calibration they have used LM-35 temperature sensor and Xampp based data base server used for patient's timely record.

Prosanta Gope and Tzonelih Hwang [3] This paper presents a
BSN i.e body sensor technology. It consists of wearable and implementable biosensors like EMG (Electromyography), ECG(Electrocardiogram), Blood pressure etc. BSN care server used wireless communication using 3G/GPRS/CDMA. Here they mentioned key security requirements like data integrity, data privacy, data freshness etc. To achieve security requirements here they proposed a lightweight anonymous authentication protocol and to get data security requirements, used OCB i.e. offset codebook (OCB) authenticated encryption mode.

Abhilasha Ingole, Shrikant Ambatkar [4] This paper based on basic health parameter monitoring without using heavy or bulky system. The credit card size minicomputer placed beside the patient's bed with power and results can see on the screen of computer which is in the same area network. It provides readings of body temperature and heart beat. For temperature monitoring system used DS18B20 sensor and for heart beat, it works on the principle of light modulation by blood flow through finger at each pulse. The detected values uploaded on the webpage. This web page created by written the code in HTML. As the Python is user friendly, used to interface different measurement parameters with Raspberry Pi. One can see the actual status of the system on LX Terminal.

Augustus E. Ibhaze, MNSE, Francis E. Idachaba [5] It is important to measure basic health parameters for aged people often to reduced the risk of ill of falling and dying. So the microcontroller based system is designed to monitor the both heart rate and temperature. This system sends the text message to the mobile phone. When the readings are not normal or increased beyond the threshold level, the device makes used of the sim808 GPRS/GSM/GPS to send the reports of patient's health and the location to a doctor's and caretaker mobile phone. By using Aurduino microcontroller sensors

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Vol. 6, Issue 6, June 2017

attached to the finger of patient for measuring temperature and heart rate. Also it is designed to recognize the location of the patient. This device takes 9v powered battery.

Abdullah, Asma Ismael, Aisha Rashid, Ali Abou-ElNour [6]
Here authors used Arduino shield to connect different sensors like temperature LM-35 sensor, blood glucose sensor and blood pressure sensor. By using LabVIEW software one can take reading of different parameters from the patient's body. The updated data displayed on LabVIEW front panel using Data Dashboard application. This collected biometric information sent wirelessly via ZigBee.

NgoManh Khoi, Saguna Saguna [7] This paper proposed as well as evaluated an architecture called as IReHMo. It is capable to operate many types of home automation sensors and health care IOT devices from the sensing layer. For IOT communication protocols such as HTTP, MQTT, CoAP used. CoAP reduced the bandwidth requirements and volume of generated data. It reduces nearly 56% of the required bandwidth for a remote health monitoring system. The author gave qualitative analysis by comparing IOT protocols like HTTP, MQTT, CoaP, AMQP according to architecture, security mechanism, QoS schemes and communication pattern.

Won-JaeYi, Oishee Sarkar,Thomas Gonnot [8] This paper presents an architecture of fall detection system paired with the Wireless Intelligent Personal Communication Node(W-iPCN) and Android smartphone is presented. Data received from accelerometer and gyroscopes for falls detection through the W-iPCN. Bluetooth consumes more battery power. To overcome this problem, W-iPCN is introduced. 6LoWPAN is based on IEEE 802.15.4 MAC layer which gives flexibility with another packet switched network like internet. In the process they used one accelerometer on the patient's thigh i.e ADXL345 and a combination of one LSM303 accelerometer and one L3GD20H gyroscope on his chest. These sensors data can access by W-iPCN to check whether the patient is fallen , lying down, sitting down or upright.

Sufian Kaki Aslam and Jaffar Umar Thalib Saniie [9] This paper discusses the design flow and an architecture of a Tele-Health observation (THM). It uses effective usage of the computation and different inbuilt peripherals of STM32 microcontroller. This design is classified in three stages namely Biometric Data Acquisition; Data Processing and communication; Notification Panel and User Interface. Here they are using STM32F746NGH6 microcontroller, the discovery board gives Ethernet, 4.3 inch LCD-TFT, MicroSD card, MEMS digital microphone, USB host etc. TFT-LCD display has 480x272 pixel size with capacitive touchscreen capability. STN32 platform makes really easy to upload the program.

V. SYSTEM DESIGN

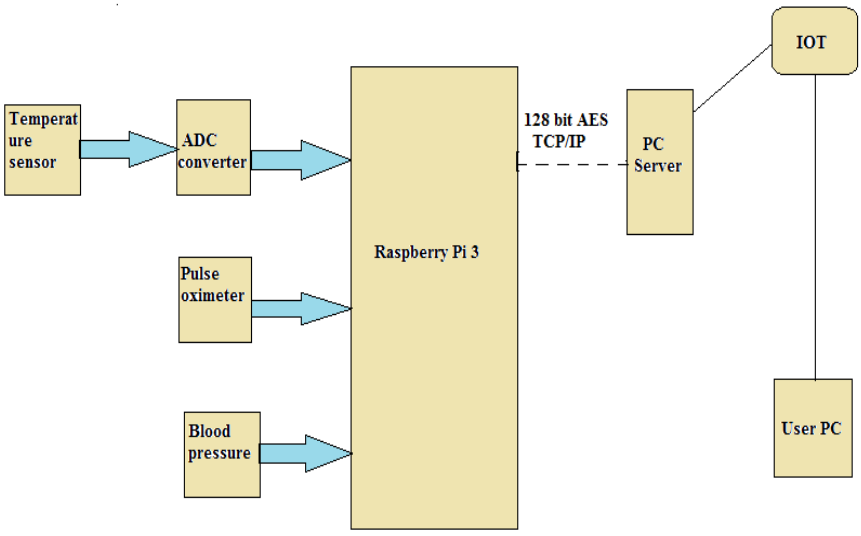

Fig1: Diagram of planned design

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Vol. 6, Issue 6, June 2017

Temperature detector converts the analog readings into digital by using analog to digital converter. By using python based pulse oxymetery detector count pulses as well as oxygen saturation level in the blood. Blood pressure detector detects blood pressure level i.e. systolic and diastolic blood pressure ranges of the patient's body. Python sends all information to the computer through the TCP/IP protocol. This data is encrypted with the help of AES 128-bit algorithm. Computer then decrypted the information and store at data base. All the information brows by PHP and HTML and show on web page.

VI. METHODOLOGY USED FOR SECURITY

This section provides the scope of the usage of AES i.e Advance Encryption Standard Algorithm for IoT in health care system:

AES is a symmetric block cipher like DES. Hence, it uses the same key for both decryption and encryption. AES and DES are quite different from each other in a number of ways. The algorithm Rijndael allows a different block and key sizes, not like DES which just allows the 64 and 56 bits block and key size. The key and block can in fact be chosen independently from 128,192,256 bits and need not to be the same. The AES standard states that the algorithm can only accept a block size of 128 bits and a choice of three keys - 128,192,256 bits.

The name of the standard is modified depending on which version is used, like AES-128, AES-192 or AES-256 respectively.

Rijndael was designed to have the below features:

- Resistance against all known attacks.
- Code compactness and Speed on a wide range of platforms.
- Simplicity in design.

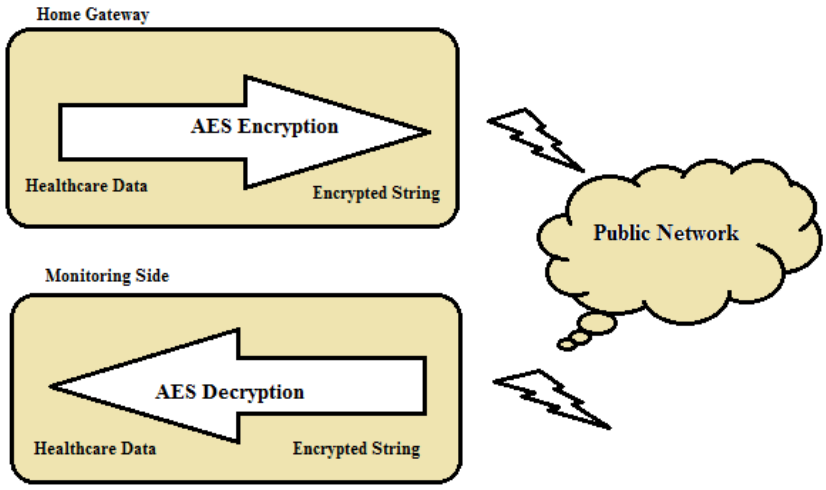

Fig 2: Encryption Process

Inner Workings of a Round like the algorithm starts with an Add round key stage followed by 9 rounds of four stages and a tenth round of three stages. This applies for both encryption and decryption with the exception that each stage of a round the decryption algorithm is the inverse of it's counterpart in the encryption algorithm. The four stages are as follows:

1. Substitute bytes
2. Shift rows
3. Mix Columns
4. Add Round Key

The tenth round simply leaves out the Mix Columns stage.

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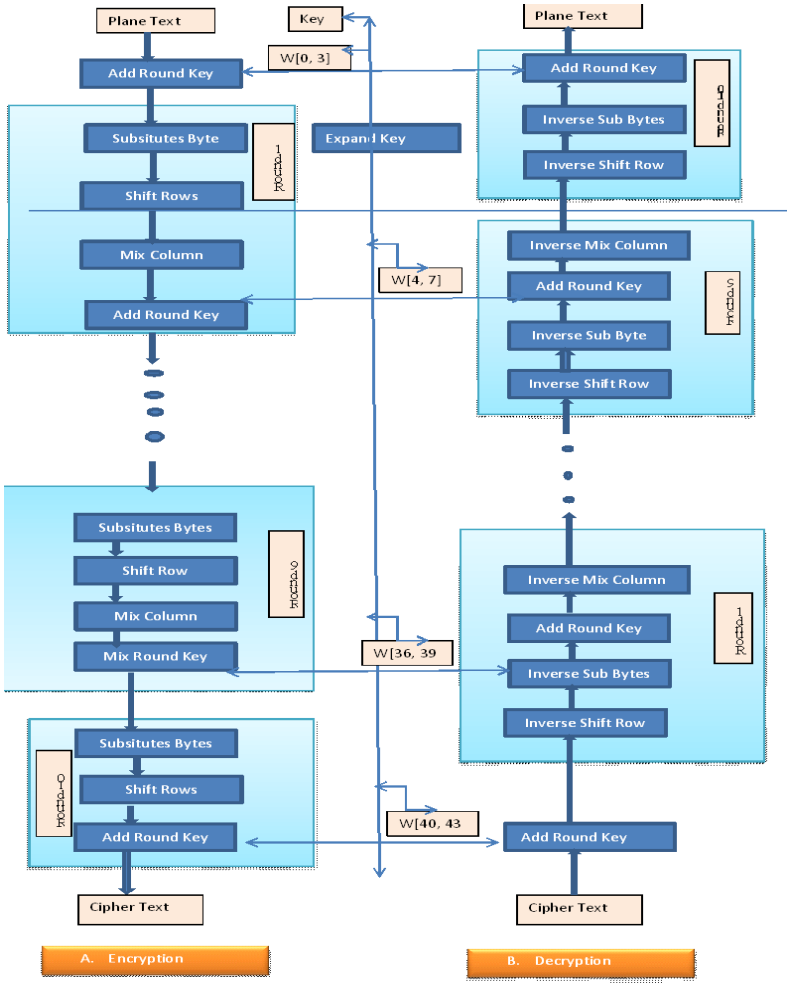

Fig 3: Overall structure of the AES algorithm.

The first nine rounds of the decryption algorithm consist of the following:
1. Inverse Shift rows
2. Inverse Substitute bytes
3. Inverse Add Round Key
4. Inverse Mix Columns

Again, the tenth round simply leaves out the Inverse Mix Columns stage. This type of function performed by the system for the security of the data.

VI. EXPERIMENTAL RESULTS

Here we plot graph of data for sensors. Here we consider time from 9 to 9:30, take reading for every 10 minutes and show on GUI. The physical parameters like Temperature, blood pressure (BP) and **pulse oximeter** measurement analysis given below. All physical data converted into digital format by python. Here we use 10 bits resolution ADC MCP 3204 and finally whole data will store in database for permanent records.

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TABLE NO.1
PARAMETERS ANALYSIS

TIME	TEMP	BP	PULSE OXIMETER
9.00	28	90	98
9.10	26	110	90
9.20	29	98	94
9.30	30	120	95

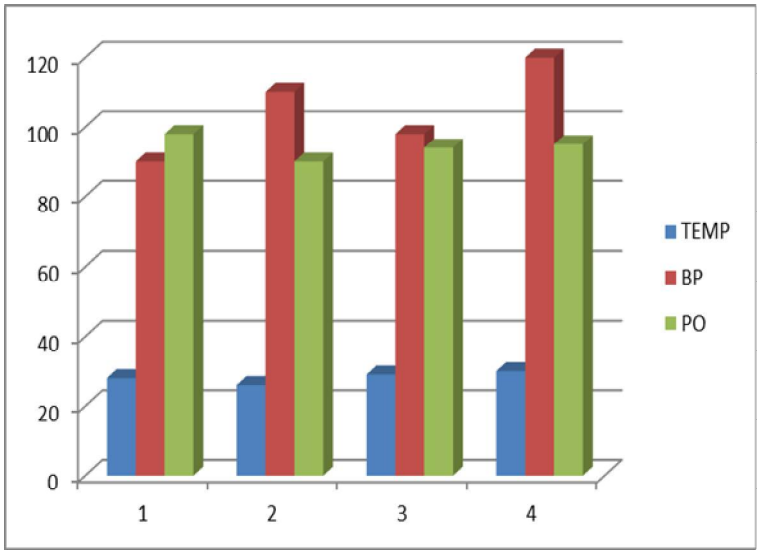

Fig 4: Performance benchmarking based on analysis.

VII.CONCLUSION

The health monitoring system proposed in this paper is developed to provide much needed patient health history in the real time to the doctors. The primary need of our paper is to monitor the system using wireless sensor system with high accuracy and security. Based on the work, we have been able to use mobile devices and can be implemented in a global network with the help of the Raspberry-Pi.

VIII.ACKNOWLEDGMENT

I express my gratitude and sincere regards to my guide Prof. S. D. Mali. His timely guidance and helpful discussions has supported me immensely in selecting a new proposal and completing project work.

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