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Secured Health Monitoring System Using IOT

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ABSTRACT

Internet of Things (IOT) is one of the most promising technologies in the healthcare environment. Patients are facing difficulties in staying hospitals for a long period because of the expense. The work presented in this paper is especially for monitoring the bed rest patients who can stay in their house. Doctors and relatives of patients can monitor the patient remotely through Internet. It uses remote sensing to keep track of certain parameters like heartbeat, temperature and acceleration. This system uses heartbeat sensor, temperature sensor and accelerometer. All thesensors are wired over the body of the patient. The sensors output values will be uploaded to a centralized cloud server. A threshold value is assigned for each sensor and in case of any abnormal means, it warns immediately to the user interface end. On the other end the sensors will be connected to the PIC microcontroller and this microcontroller is in turn interfaced to a LCD display for the offline monitoring phase.

KEYWORDS: Internet of Things (IOT), Sensors, Remote health monitoring, private cloud

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INTRODUCTION

In the last few years, the growth of electronic devices like smart phones, vehicles and smart home appliances that can communicate with each other wirelessly has been tremendous. In 1999, Kevin Ashton introduced the term Internet of things (IOT) to describe this phenomenon. It refers to a network of physical devices and other such electronics embedded with sensors and actuators that can collect and exchange data[1] via certain media such as the Internet or wired connections. The Internet of Things is associate in Nursing rising topic of technical, social, and economic significance. The term IOT generally refers to things where network property and computing capability extends to things, sensors and everyday things not usually thought about computers, permitting these devices to come up with exchange and consume knowledge with borderline human intervention[2]. There are millions of people all around the world, especially those living in densely populated countries, who do not have proper timely access to medical facilities. In such situations, IOT - based solutions can help. Small, wearable sensors help in overcoming the challenges that are faced by trained medical professionals when they want to monitor a patient's health. This is also a cost-effective method which is an added benefit. Cloud computing, in this regard, helps in storing, processing and analyzing data obtained remotely from such sensors. A large number of passive sensors are already being used in the healthcare industry to constantly monitor patients' vital signs. The collected data is then stored in the cloud or shared with medical professionals[3].The most commonly assessed health parameters are a person’s BPM (the number of times a heart beats in a minute), body temperature and acceleration of the patient. These parameters help to deduce important health factors in general. Often, IOT devices come inbuilt with outdated and un-patched software which that cannot be updated frequently. Some devices also come with passwords that are not changeable. Even if the password can be changed, users may not be able to input a strong enough password for their security. As a result, management of several devices with different passwords becomes a challenge of its own. There have been several instances of devastation already, caused by hackers who infiltrated the IOT devices connected systems. IOT embedded systems will monitor the vital signs of a patient in real time and supplement visiting nurses and doctors so that there is less margin for error.

LITERATURE SURVEY

To monitor more patients efficiently and save working time this paper proposes a wireless IOT device that collects ECG, respiratory airflow and blood oxygenation of patients and sends these data to a central server[4]. Secured SDLC can save the losses which could have incurred if any of the known vulnerabilities in the Health Monitor had been exploited by malicious user after the application was deployed in production environment[5]. The algorithm used is Rule Induction to find accuracy and relationship of data. After that, the rule is model. To provide basic health recommendation to users via mobile and web application. The system could help the users to monitor their health information and use the recommendation from the system for their healthy in daily life[6]. Continuous real time monitoring of patient parameters ensures security throughout medical history of patients including medical records can be accessed at any time since they are being stored onto the cloud network which is really helpful for remote patient monitoring[7]. In particular, the hardware module for a secure connection to the cloud service has been developed. The cloud service was selected taking into account the requirements of the Health Insurance Portability and Accountability Act (HIPAA)[8]. The aim of WE-Safe project is to provide early warnings for people working in extreme and harsh environment when they are not in the safe zones[9]. The system assembles the information like heat, circulatory strain and pulse rate of the patient and refreshes the similarity to the specialist[10]. Keeping in mind the privacy of the patients, a fingerprint scanner has been added which uniquely identifies each and every patient. This makes the process more secure and hassle-free[11]. Because of wireless Sensor network and data transferring over the internet. From this all the health related data and information of the Patients will be easily accessed on doctor's smartphone[12].

PROPOSED METHODOLOGY

In today's social Health Insurance structure where patients stay at home after Operations they are monitored by a medical caretaker or a family member. Many people nowadays who work full time are facing a problem of monitoring their loved ones especially old age patients. So to overcome this problem we are using this secured health monitoring system using IOT. This Uses sensor technology with micro-controller help the user monitor their loved ones.For some patients who needs bed rest for a long period in hospital are more expensive. As well as somebody needs to visit hospital regularly for checking their heartbeat rate needs to pay more in the hospitals.For the hospitals, the patients details are storing in public cloud are not much secured. Because hackers can easily get the hospital's sensitive data easily and can be misuse it. Also hospitals can shift the bed rest patients to their house for reducing the rush in the hospital.

A low cost, light weighted, low power, health monitoring system is proposed here. Data acquisition and sensing is processed by using various sensors which determine physiological parameters such as body temperature, pulse rate and body movement. The measured parameters are then connected to a private cloud network through internet. Data transmission component in the system are responsible for transferring the measured parameters of the patient at any location to the health monitoring center. The data transferring is highly secured because of the use of private cloud. The recorded information is transferred to a server which accounts for assisting the availability of such records from everywhere through the Internet. The cloud possesses similar functionality with a normal server. But it can be accessed from anywhere. Cloud service provider is monitoring this process. This provides an extensiveset of facilities including data storing, data. In addition the cloud servers are efficient than physical servers. It does not possess any hardware issue[13].

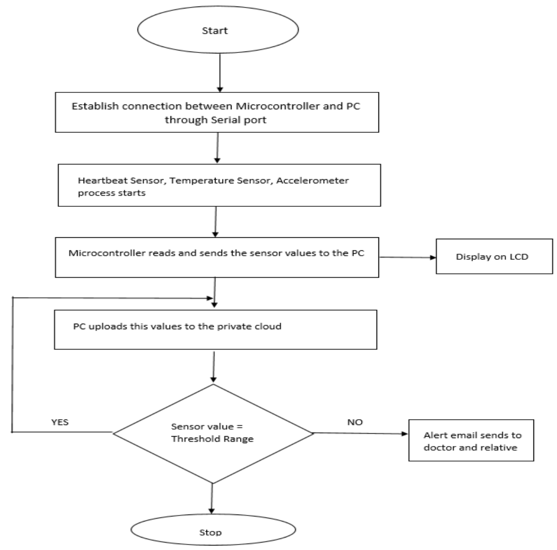


Figure1. Secure Health Monitoring System

SYSTEM ARCHITECTURE

In the hardware design, all the hardware portions which have the sensors which are connected to the PIC microcontroller. With the power supply all the measured sensor values will be converted in to the machine language and transmitted to the PC through the USB port with the help of RS232 data logger installed in the PC.

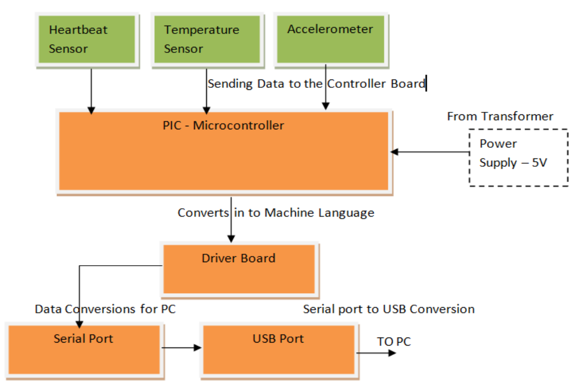


Figure2. Hardware Design

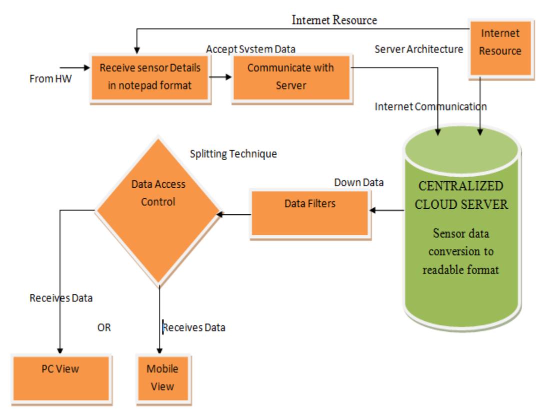


Figure3. Software Design

From the hardware, all the sensor values will be stored to the PC. With the help of internet connection these all the values will be stored in the centralized cloud server through the Visual Studio. From there all the data will be transmitted to the readable format and data filtering will be takes place according to each sensors. Through the created URL, user can access these sensor data with the computer interface or through the mobile interface as shown in the figure3.

SYSTEM COMPONENTS

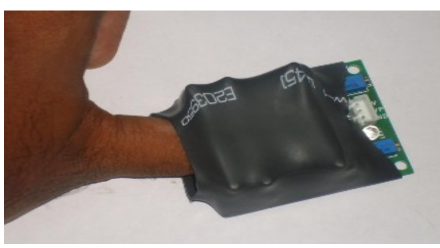
PIC Microcontroller

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC16F877A. Originally developed by General Instrument's Microelectronics Division. The name PIC at first observed "Programmable Interface Controller". Microchip declared on February 2008 the cargo of its six billionth PIC processor.

Figure4. PIC16F877A Microcontroller

Heartbeat Sensor

The re-creation uses the TCRT1000 reflective optical device for icon plethysmography. The output pulse may be fed to either associate ADC channel or a digital input pin of a microcontroller for additional process and retrieving the guts rate in beats per minute (BPM).The following Figure6 shows a basic reflectance PPG probe to extract the pulse signal from the fingertip. A subjects finger is lighted by associate infrared diode. More or less light-weight is absorbed, depending on the tissue blood volume. Consequently, the mirrored candlepower varies with the pulsing of the blood with heart beat. The heartbeat ranges of normal person are as given below in the Table-1[10].



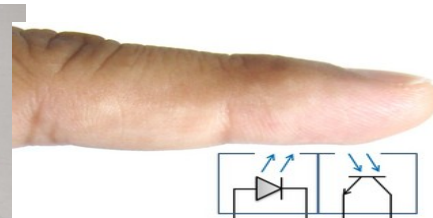


Figure5.TCRT1000 Heartbeat Sensor **Figure6.Sensing Heartbeat**

Table1. Heartbeat Chart

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

Temperature Sensor

The Lm-35 arrangement are exactness incorporated information preparing Lm-35 thermal-sensors, whose yield volt-age will be straightly relational of the temperature for Celsius scale (Centi-grade). It cover a range of -55 to +150°C temperature go. The normal anatomy temperature vary is usually explicit as thirty six.5–37.5 °C (97.7–99.5 °F).

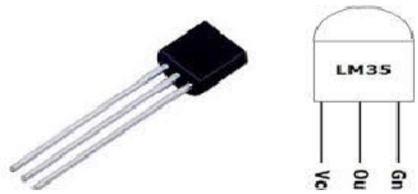


Figure7. LM-35 Temperature Sensor

Acceleration

Triple Axis Accelerometer Breakout - ADXL335. Breakout board for the three axis ADXL335 from Analog Devices. Board comes totally assembled and tested with external parts put in. The enclosed zero.1uF capacitors set the information measure of every axis to 50Hz and onboard regulator 3.3volts. It will be set as 0 for no mobility, and if the patient have any movement if turns to the value-1.

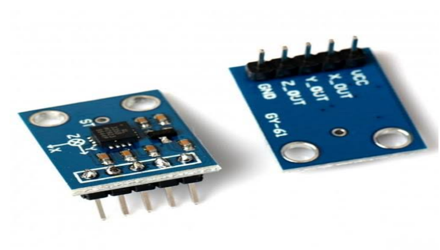


Figure8.ADXL335 Accelerometer

LCD Display

A liquid crystal display or LCD attracts its definition from its name itself. It is a mixture of 2 states of matter, the solid and therefore the liquid.LCD uses a liquid to provide a noticeable image. Liquid crystal displays squaremeasure super-thin technology monitor that's typically employed in laptop computer screen, TVs, cell phones and portable video games.LCD’s technologies permit displays to be a lot of dilutes when put next to beam tube (CRT) technology.

COM Port

COM port is meant as communication port. This module interface hardware unit with PC. The communication has been done through RS232 tool. RS232 is a system interface tool which efficiently works with converting machine language into system language. Using hyper terminal the data from the sensor unit will be sent to PC. Data will be split sensor wise while transferring into PC.

WORKING PRINCIPLE

The system that we have designed has 3 parts to it. As shown in the figure1. Its first part consists of all the sensors. The second part is responsible for analyzing the data and storing the data in the cloud server through internet connected PC. The third part is mainly responsible for displaying the analyzed and processed data. This is also responsible for alerting medical authorities and concerned ones in case of any abnormalities found in the data that requires immediate medical attention.

The Sensory Unit

The first part or the sensory unit consists of all the sensors used- the heartbeat sensor (TCRT100) which measures heartbeat rate; the temperature sensor (LM35) which measures body temperature; the accelerometer sensor (ADXL335) which identifies the body movement. All these sensors are attached to the PIC16F877A. As shown in the figure2. Give power supply and all the sensor values will be transmitted to the PC which is connected through RS232.

The Analyzer Unit

The incoming data from the sensors is then stored against that particular patient ID in the cloud from the PC through Visual Studio. It is simultaneously analyzed and processed for abnormal values which may indicate serious issues. First the heart-rate is checked for abnormally high or for abnormally high or low values (as defined by medical professionals), then body temperature is checked for abnormally high or low values (as defined by medical professionals), finally, the acceleration will be checked every 10 seconds for abnormal values (as defined by medical professionals). If such a situation is detected, it immediately transmits the necessary information via the interaction unit to medical professionals and concerned ones. As shown in the figure3.

The Interaction Unit

This unit consists of smart phones or other Internet enabled devices that interact with the information sent from the analyzer unit through the URL. In case a patient has not registered into the database, he or she must create a unique profile so they can receive a unique patient ID with reference to all the data (raw and processed) that is stored. It is also the medium through which medical professionals and concerned ones will get alerts through email in case of any emergencies.

EXPERIMENTAL RESULTS

The following figures are some of the experimental screenshots while working with the Secured Health Monitoring System Using IOT. It includes the Login process, setting ranges for each sensors, parameter reading of the sensors while connected with the patient, the chart wise diagrammatic representation and the email receiving process.

Reading Parameter Values: Chart:

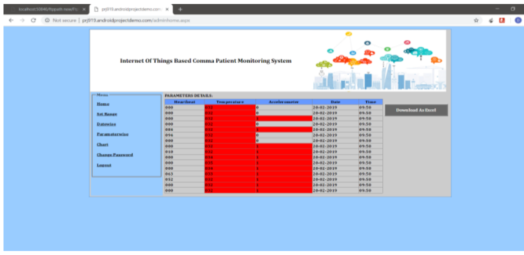
 

Figure10. Parameter valuesFigure11. Parameter Chart

CONCLUSION

In this paper, a Secured Health Monitoring System that remotely monitors parameters like body temperature, heart-rate, and acceleration which are useful in determining the health status of a patient is presented. The system is established for home use by patients who are not in a life-threatening situation but need timely observation by doctor or family. This system is cost-effective because of the use of PIC microcontroller. This helps to monitor a patient's health no matter where he or she is, and also provides real-time alerts to concerned people and medical professionals about any situation that requires immediate attention. Keeping in mind the privacy of the patients, private cloud is used along with a username and password which uniquely identifies each and every patient. This makes the process more secure and hassle-free. Doctors will also have to provide their user credentials when they want to view the medical history of a patient, and that makes this process reliable. The experimental results prove that this system improves the overall accessibility and provides on-time care to those who need it the most through an IOT based solution.

Next step in the research will include Disease Predication and Sleep analysis along with location tracking of the patient.

REFERENCES

1. Brown, Eric ,"Who Needs the Internet of Things?". Linux.com. Retrieved 23 October 2016.
2. Vermesan, Ovidiu; Friess, Peter, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems (PDF), 2013 Aalborg, Denmark: River Publishers. ISBN 978-87- 92982-96-4.
3. Mohammad Pourhomayoun, Nabil Alshurafa, Foad Dabiri, Ehsan Ardestani, Ahsan Samiee, Hassan Ghasemzadeh, Majid Sarrafzadeh, "Why Do We Need a Remote Human-Health Monitoring System? A Study on Predictive Analytics for Heart Failure Patients", JOMS, June 2011a.
4. Kazi Abu Zilani1, Rubyea Yeasmin2, Kazi Abu Zubair2, Md. Redwan Sammir1 and Samia Sabrin1, "R3HMS, AnIoT Based Approach for Patient HealthMonitoring",2018, 01-04
5. Avelet Maria Fernandes, Anusha Pai, Louella M. MesquitaColaco "Secure SDLC for IoT Based Health Monitor" (ICECA), 2018;1236-1241

6. Siriwan Kajornkasirat, Napat Chanapai and Benjawan Hnusuwan "Smart Health Monitoring System with IoT" 978-1-5386-3527-8/18/$31.00 ©2018 IEEE, 206-211
7. ShaninF,Aiswarya Das H A,Arya Krishnan G,Neha LS,Nimitha Thaha Aneesh R P+,Sreedharan Embrandiri+,Jayakrishan S "Portable and Centralised E-Health Record System forPatient Monitoring using Internet of Things(IoT)", 2018 International CET Conference on Control, Communication, and Computing (IC4) | July 05 – 07, 2018 | Trivandrum, 165-170
8. Ivan Medvediev, Oleg Illiashenko, DmytroUzun, AnastasiiaStrielkina, "IoT Solutions for Health Monitoring: Analysis and Case Study", 978-1-5386-5903-8/18/$31.00 ©2018 IEEE, 163-168
9. Fan Wu_, Christoph R¨udigery, Jean-Michel Redout´e_ and Mehmet Rasit Yuce_, "WE-Safe: A Wearable IoT Sensor Node for Safety Applications via LoRa" , 978-1-4673-9944-9/18/31:00 © 2018 IEEE, 144-148
10. G. Vijay Kumar, A. Bharadwaja, N. Nikhil Sai, "Temperature and Heart Beat Monitoring System Using IOT" 978-1-5090-4257-9/17/$31.00 ©2017 IEEE, 692-695
11. Sayan Banerjee, Souptik Paul, Rohan Sharma , Abhishek Brahma, "Heartbeat Monitoring Using IoT" 978-1-5386-7266-2/18/$31.00 ©2018 IEEE, 894-900
12. 1D.Shiva Rama Krishnan, 2Subhash Chand Gupta, 3Tanupriya Choudhury 1,2Amity University, " An IoT based Patient Health Monitoring System", 978-1-5386-4485-0/18/$31.00 ©2018 IEEE, 01-07
13. Y. Li and W. Wang, "The unheralded power of cloudlet computing in the vicinity of mobile devices," in IEEE Globecom Workshops (GC Wkshps), Dec 2013, pp. 4994–4999. Senior Member, IEEE.
14. Karakitsos D, Karabinis A (September 2008). "Hypothermia therapy after traumatic brain injury in children". N. Engl. J. Med. 359(11): 1179–80. doi:10.1056/NEJMc081418. PMID 18788094.