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A REVIEW ON - IOT BASED PATIENT ACTIVITY RECOGNITION USING WEARABLE SENSORS

Sonali Narayan Salve[1], J. N. Mohite[2]

[1]ME Student – E&TC Department, MSSCET, Jalna, (India)

[2]Assistant Professor–E&TC Department, MSSCET, Jalna, (India)

ABSTRACT

In the wake this time, the rising technology empowering answers for make human way of life exceptionally agreeable and shrewd, the forward stride of improvement is Internet of things (IOT). Wireless Sensor Networks (WSNs) formed by wireless sensors can be designed to interact continuously with the real world. WSNs help in communicating accurate real time information and have proliferated from the areas of industrial processing and environmental monitoring to science and healthcare. In this project, we describe the implementation of a patient activity monitoring system using wearable sensors. Patient activities are classified as sleeping, sitting, walking, Temperature and Heartbeat using a lightweight, low latency algorithm. Our approach features a unique sensing technique and facilitates cost effective and energy efficient solution for healthcare.

Keywords: Internet of things (IOT), Wearable sensor, Wireless Sensor Networks, Temperature, Healthcare.

I. INTRODUCTION

Today's healthcare systems are facing two serious challenges: rapid growth in adult population and sever ensuring shortage. As per United Nations (UN) statistics, the number of people in the world aged 60 years and above are expected to increase from 605 million to 2 billion by 2050. Nursing shortage has been identified as a global crisis since 2002and India has a nurse density per thousand population of 0.80.These statistics suggest a urgent need for automated monitoring systems to aid the healthcare industry. It is most challenging aim that, this service should be impact the complete lifestyle of human being. The Internet of Things (IOT) is concept, which objects devices are always stay connected by the mean of physical parameter to real virtual world. Here for medical and health care system the Internet of Things (IOT) helps to monitor patient and its physiological parameters .The Internet of Things (IOT) has various services like advance manufacturing, smart transport, best media control, environment monitoring, and many more such applications can be developed. The IOT is a technological revolution that represents the future of computing and communications.

II. LITERATURE SURVEY

The reviews from different papers are taken and studied. A some of them are given below. In Kaleem Ullah, MunamAli Shah [1] presents the model named as 'k-Healthcare' makes use of four layers, sensor layer, network layer, internet layer and service layer. 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.

In Punit Gupta, Deepika Agrawal [2] presented the proposed system is enough intelligent to monitor 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 which are 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 X amp based data base server used for patient's timely record.

In Prosanta Gope and Tzonelih Hwang [3] paper presented 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.

In Abhilasha Ingole, Shrikant Ambatkar [4] 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.

In Augustus E. Ibhaze, MNSE, Francis E. Idachaba [5], it is important to measure basic health parameters for aged people often to reduce 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 Arduino microcontroller sensors 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.

In 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.

[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 aremote 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.

In Won-JaeYi, Oishee Sarkar, Thomas Gonnot [8], presents architecture of fall detection system paired with the Wireless Intelligent Personal Communication Node (W-iPCN) and Android smart phone 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.

In Sufian Kaki Aslam and Jaffar Umar Thalib Saniie [9] discusses the design flow and 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. TFTLCD display has 480x272 pixel size with capacitive touch screen capability. STN32 platform makes really easy to upload the program.

III. PROPOSED SYSTEM

We are proposing the system according to the study of literature survey. Temperature detector converts the analog readings into digital by using analog to digital converter. Blood pressure detector detects blood pressure level i.e. systolic and diastolic blood pressure ranges of the patient's body. Arduino 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 ASP.net and show on web page.

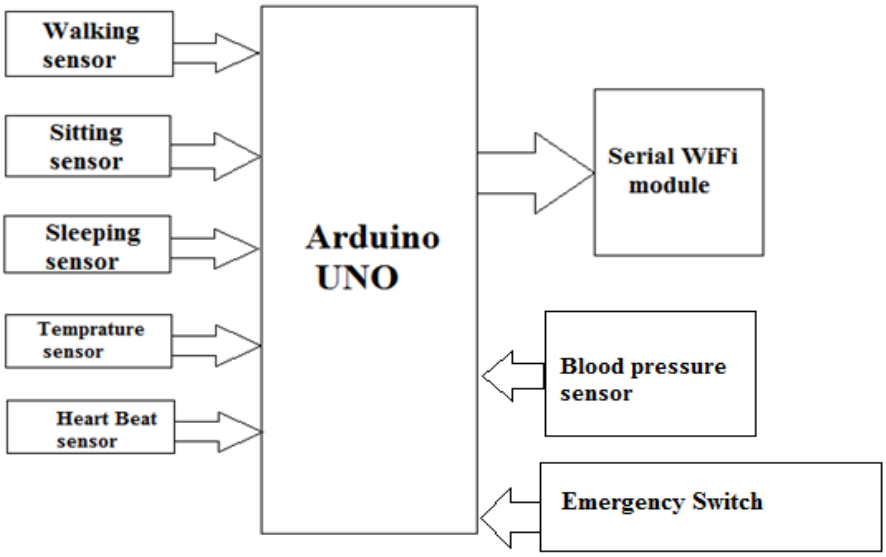

Fig. 1 IOT based patient activity recognition system

The proposed system used the two sections one is transmitter section and one is monitoring unit. Above figure has shown the IOT based patient activity recognition system in which we have used the flex sensor to monitor whether the patient is sleeping, walking and sitting and also we have used the temperature, blood pressure and heartbeat sensor.

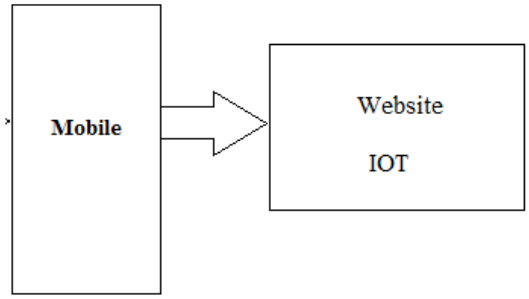

Fig. 2 Wireless monitoring section (WMS)

In above figure we have shown the wireless monitoring unit using Website which contain an application which is connected to WSN by using the Wi-Fi.

3.1 Arduino UNO:

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. Arduino UNO module processor is ATmega328P. It has frequency of about 16MHz.

3.2 Flex Sensors:

The Flex Sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value.

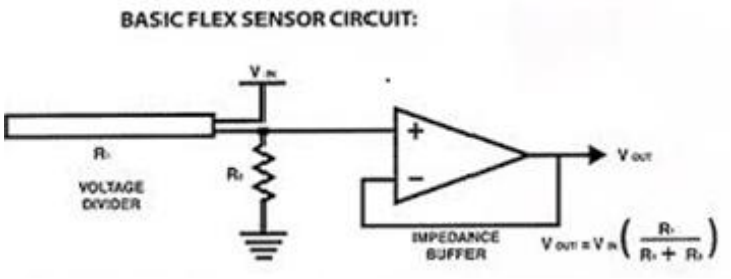

Fig. 3 Basic Flex sensor circuit

3.3 Temperature measurement:

Body temperature of the patient can be calculated using LM35 sensor. It can operate on for full −55°C to 150°C range with accuracy of ±0.2°C. The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C).It can measure temperature more accurately than a using a thermistor.

3.4 Heart Beat Sensor:

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

3.5 Blood Pressure Sensor:

It can be done with the help of two distinct technique which are technique of Auscultator and Oscoillometric technique. In Auscultator, technique is acquiring of Korotkoff sound which gets created by body during the blood pressure measurement.

3.6 Serial WIFI module:

ESP8266 Wi-Fi module which is having TCP/IP protocol stack integrated on chip. So that it can provide any microcontroller to get connected with Wi-Fi network. ESP8266 is a preprogrammed SOC and any microcontroller has to communicate with it through UART interface. It works with a supply voltage of 3.3v. The module is configured with AT commands and the microcontroller should be programmed to send the AT commands in a required sequence to configure the module in client mode. The module can be used in both client and server modes. Once it gets connected in a Wi-Fi network, we'll get one IP address which is accessible in its local network. The module is additionally having 2 GPIO pins alongside UART pins. It is also having inbuilt SPI protocol by using the two pins of UART as data lines and by configuring the two GPIO pins as control lines and clock signal. It is also having 1MB on-chip flash memory. Internally it is having power management unit with all regulators and PLLs. ESP8266 12E Wi-Fi module acts as a communication module between C8051F380 and web server.

IV. 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 survey, we have been able to use mobile devices and can be implemented in a global network with the help of the IOT and Arduino. The objective of system is to monitor and intimate critical surveying patient's health directly to doctor and Emergency contact number to save patients life.

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