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REVIEW ARTICLE

A SECURE IOT BASED MODERN HEALTHCARE SYSTEM BY USING BODY SENSOR NETWORK (BSN)

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ABSTRACT

Biomedical field serves as the benefit for human society. But in today's reckless running world people are casual about their health. Cases of heart attacks and deaths due to lack of help are increasing rapidly. For this purpose A secure IOT based modern healthcare system is best solution. Individuals with the heart condition who have been advised by their doctor to join in a regular exercise program would benefit from using the heart monitor so that they can be aware of their heart rate and adjust the level of intensity of their exercise to maintain a safe heart rate. Person who have been advised to exercise for weight loss or for cure of hypertension will also benefit from this device as it is a effective means of measuring progress in achieving exercise goals. Healthy person who are interested in improving their cardiovascular condition can also use the heart monitor to guide their exercise program and increase the intensity of their exercise in a controlled fashion. Thus, person who exercises regularly can benefit from the heart monitor device. The parameters to be observed in human body are Heart pulse rate, Heart pulse rate, Blood pressure, Body temperature, Body position. Day by day the usage of IOT technologies brings convenience of doctors and patients, since they are applied to different medical areas .The body sensor network (BSN) technology is one of the basic technologies of IOT developments in healthcare system, where a patient can be monitored using a collection of tiny-powered and lightweight wireless sensor nodes by doctor. However, the development of this new technology in healthcare applications without considering security makes patient privacy vulnerable. In this project, we highlight the major security requirements in BSN-based modern healthcare system.

INTRODUCTION

Internet of Things (IOT) has become one of the best communication way of the 21th century. In the IOT environment, objects in our daily life become part of the internet due to their communication and computing capabilities. IOT extends the concept of the Internet and makes it more widespread. IOT allows seamless interactions among various types of devices such as medical sensor, monitoring cameras, home appliances so on. Because of that reason IOT has become more valuable in several Areas such as healthcare system. In healthcare system, IOT involves many kinds of cheap sensors (wearable, implanted, and environment) that enable aged person to enjoy modern medical healthcare services anywhere, anytime Besides, it also greatly improves aged peoples quality of life (Parane *et al.,* 2014; Weinstein, 2005). The body sensor network (BSN) technology is best imperative technologies used in IOT-based modern healthcare system.

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It is basically assembly of low-power and lightweight wireless sensor nodes that are used to supervisor the human body functions and surrounding environment. Since BSN nodes are used to collect sensitive (life-critical) data and may operate in hostile environments, accordingly they require strict security mechanisms to avoid malicious interaction with the system. Body Sensor Network (BSN) allows the integration of intelligent, miniaturized low-power sensor nodes in, on or around human body to supervisor body functions and the surrounding environment. Generally, BSN contain in-body and on-body sensor networks. An in-body sensor network allows intercommunication between invasive/implanted devices and base station. On the other hand, an on-body sensor network allows intercommunication between non-invasive/wearable devices and a coordinator. In this project BSN architecture composed of wearable and implantable sensors. Each sensor node is integrated with bio-sensors such as Accelerometer, Blood Pressure (BP), Thermometer,etc. These sensors collect the physiological parameters and forward them to a coordinator called Local Processing Unit (LPU), which can be a portable device such as PDA, smart-phone etc. The LPU works as a router between the BSN nodes and the central server called BSN-Care server, using the wireless

communication mediums such as mobile networks 3G/CDMA/GPRS. Besides, when the LPU detects any abnormalities then it provides immediate alert to the person that wearing the bio-sensors.

Literature review

The advancement of BSN in healthcare applications have made patient monitoring more feasible. Recently, several wireless healthcare researches and projects have been proposed, which can aim to provide continuous patient monitoring, in-ambulatory, in-clinic, and open environment monitoring (e.g. athlete health monitoring). This section describes few popular research projects about healthcare system using body sensor networks

Code Blue (Malan *et al.,* 2004; Lorincz *et al.*, 2004) is a popular healthcare research project based on BSN developed at Harvard Sensor Network Lab. In this architecture, several bio-sensors are placed on patient's body. These sensors sense the patient body and send it wirelessly to the end-user device (PDAs, laptops, and personal computer) for further analysis. The main idea of the CodeBlue is straightforward, a doctor or physicians issues a query for patient health data using their personal digital assistant (PDA), which is based on a published and subscribed architecture. Besides, CodeBlue's authors acknowledge the demand of security in medical applications, but until now security is still pending or they intentionally left the security aspects for future work. BSN based healthcare system UbiMon (Ng *et al.*, 2004) was proposed in the department of computing, Imperial College, London. The objective of this project was to address the issues related to usage of wearable and implantable sensors for distributed mobile monitoring. Although Ng et al. recommended and demonstrated the ubiquitous healthcare monitoring architecture, it is generally approved that without consider the security for wireless healthcare monitoring, which is a main requirement of healthcare applications, according to government laws (Office for Civil Rights, 2011).

In 2006, Chakravorty designed a mobile healthcare project called MobiCare (Chakravorty, 2006). MobiCare provides a wide-area mobile patient monitoring system that facilitates continuous and timely monitoring of the patients physiological status. Although, Chakravorty recognized the security issues in MobiCare, but only addressing security issues are not sufficient for real-time healthcare applications. Thus, security and confidential is still not implemented in MobiCare healthcare monitoring or may have been left out for future work. Still, there are many security issues such as secure localization, anonymity, etc, have not even mentioned in MobiCare system. Recently, a system designed at Johns Hopkins University named Median, mainly designed for person's monitoring in hospital and during disaster events was reported (Ko *et al.*, 2010). It comprises many physiological monitors (called PMs), which is battery powered motes and equipped with medical sensors for gathering person's physiological health information's (e.g. blood oxygenation, pulse rate, blood pressure etc.). In their description of Median its author recommended the need for encryption for PMs, however they did not mention which crypto-system has been used for data confidential and how they have checked the integrity of the received data. The system (Ryan Green, 2013) monitor the patient's medical status by using RFID body sensor and the medical data transmitted wirelessly to a local workstation (WMSN gateway) before transmitting it to the central database server. The proposed system is designed (Amna Abdullah and Asma Ismael, 2015) to measure and monitor important data of a patient in order to accurately describe the status of her or his health and fitness such as patient's temperature, heart beat rate, BP data are monitored, displayed, and stored by their system. System measure the patient's physiological data with a very high accuracy. Proposed system comprises (Siti Sarah Meskam *et al.,* 2013) the design and implementation with subsystems. Information about patient is sent via IP to a database server containing clinical data, which can be accessed on the smart phone and can also be transmit to the doctor anytime to seek medical advice when needed. The monitoring system has the capability to monitor physiological parameters from multiple patient bodies. In their proposed system, a coordinator node has attached on patient body to collect all the signals from the wireless sensors and sends them to the base station. The attached sensors on patient's body form a wireless body sensor network and they are able to sense the heart rate, blood pressure, body temperature and so on. This system can detect the abnormal conditions, issue an alarm to the patient and send a SMS or E-mail to the doctor. Designed and developed body temperature measurement device (Tello *et al.,* 2013) that can be observe by the doctor in real time as well as history data via internet with an alarm or indication in case of emergency. The temperature sensors will continuously send the readings to a microcontroller using Zigbee.

Propose Work

BSN-Care shown in Fig. 1.It is a BSN architecture composed of wearable and implantable sensors. Each sensor node is integrated with bio-sensors such as Temperature measurement, heart bit rate, Blood Pressure (BP), etc. These sensors collect the physiological parameters and forward them to a microcontroller called arduino uno. Arduino uno forward data to Wi-Fi module known as ESP8266.Further Wi-Fi module transmits data to doctor server through antenna.. When the doctor server receives data of a person (who wearing several bio sensors) from Arduino uno, then it feeds the BSN data into its database and analyzes those data.

1. ***Arduino Uno*:** The Arduino Uno is a microcontroller. It is based on the ATmega328. It has 14 digital input/output pins. Out of which 6 can be used as PWM outputs, 6 analog inputs .It has 16 MHz crystal oscillator, a USB connection. Also it has a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller. It is simply connect to a computer with a USB cable .It is connected to AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards.It does not use the FTDI USB-to-serial driver chip.
2. ***LM 35*:** LM 35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/oC The LM35 does not require any external calibration or trimming.
3. ***Blood pressure measurement:*** The normal blood pressure of a human being is 120/80-140/90 MMHG. The sensor used in this proto type is Vernier Blood Pressure Sensor. It measures arterial blood pressure means both high and low pressure of a human being.

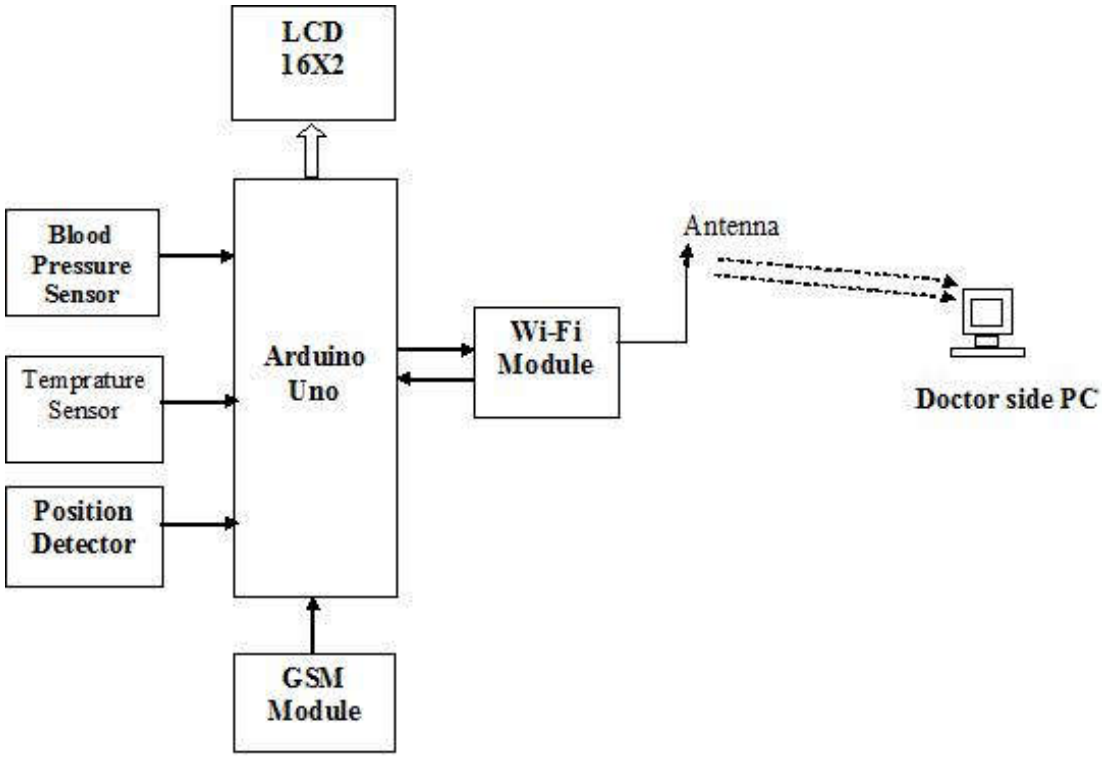

Fig. 1.

It consist of Blood Pressure Sensor, Standard adult size adjustable cuff (27 cm to 39 cm) and Bulb pump. It can measure arterial blood pressure and calculate both upper and lower blood pressure using the oscillometric method.

4. ***ESP Wi-Fi module:*** ESP-12E WiFi module is developed by Ai-thinker Team. It is a core processor ESP8266 smaller in sizes of the module encapsulates Tensilica L106 integrates industry-leading ultra low power 32-bit MCU micro, with the 16-bit short mode, Clock speed support 80 MHz and 160 MHz. It supports the RTOS, integrated Wi-Fi MAC/BB/RF/ PA/LNA, on-board antenna. The module supports standard IEEE802.11 b/g/n agreement, complete TCP/IP protocol stack. Users can use the add modules to an existing device networking. ESP8266 is high integration wireless SOCs. It designed for space and power constrained mobile platform designers.
5. LCD (Liquid Crystal Display) screen is an electronic display module. It has a wide range of applications. A 16x2 LCD display is very basic module .It is commonly used in various devices and circuits. These modules are preferred over seven segments and multi segment LEDs. LCD has low cost. It is easily programmable. It has no limitation of displaying special & even custom characters, animations and so on.

Application

1. In the future, the work can be extended from centralized health care to spread remote medication in which patient is treated by a doctor from a distance in case of emergency, but this can need presence of doctor or nurse close to patient and interacting with the doctor treating the patient.
2. IOT has many applications such as Constant Real time Monitoring, the Anti-counterfeit of Medical Equipment and Medication, Medical Refuse Information Management, Medical Information Management, Medical Emergency Management, Patient Information Management, Medication Storage Management, Blood Information Management, Telemedicine and Mobile Medical Care and Health Management.
3. It takes note of patient's health by storing, analyzing and sharing patient's medical records. It also advices patient on the smart tips and services based upon patient's health analysis. It also give patient's alerts and messages about patient's health risks.
4. This kit gather, store, and share health information of patient. Patient can sustain all health records at one place that's organized and available to online (E-Book Keeping) in case of medical emergencies, it is able to keep track of all the details of patients. It records the data once, and use it with new data to get frequent updates about patient health.

Conclusion

The main idea of the proposed system is to monitor patient's health parameter such as blood pressure, temperature, heart bit rate, etc. And provide better and efficient health services to the patients .Doctor collect all information about patient's health parameter at regular interval of time so that the doctors could make use of this data and provide a fast and an efficient solution.

The final model will be well equipped with the features where doctor can communicate to patient and examine his patient from anywhere and anytime. Emergency scenario to send an emergency mail or message or call to the doctor with patient's current status and full medical.

REFERENCES

Amna Abdullah and Asma Ismael, 2015. 'Real Time Wireless Health Monitoring Application Using MobileDevices', *International Journal of Computer Network & Communications (IJCNC),* Vol.7, No.3.

Chakravorty, R. 2006. "A programmable service architecture for mobile medical care," in Proc. 4th Annu. IEEE Int. Conf. Pervasive Comput. Commun. Workshop (PERSOMW), Pisa, Italy, Mar., pp. 531–536.

Ko, J. et al., 2010. "MEDiSN: Medical emergency detection in sensor networks," *ACM Trans. Embed. Comput. Syst.,* vol. 10, no. 1, pp. 1–29, Aug.

Lorincz, K. et al., "Sensor networks for emergency response: Challenges and opportunities," IEEE Pervasive Comput., vol. 3, no. 4, pp. 16–23, Oct./Dec. 2004.

Malan, D., T. Fulford-Jones, M. Welsh, and S. Moulton, 2004. "CodeBlue: An ad hoc sensor network infrastructure for emergency medical care," in Proc. MobiSys Workshop Appl. Mobile Embedded Syst. (WAMES), Boston, MA, USA, Jun., pp. 1–8.

Ng, J. W. P. et al., 2004. "Ubiquitous monitoring environment for wearable and implantable sensors (UbiMon)," in Proc. 6th Int. Conf. Ubiquitous Comput. (UbiComp), Nottingham, U.K., Sep., pp. 1–2.

Office for Civil Rights, 2011. United State Department of Health and Human Services Medical Privacy. National Standards of Protect the Privacy of Personal-Health-Information.[Online].Available:http://www.hhs.gov/ocr/privacy/hipaa/administrative/privacyrule/index.html, accessed Jun. 15.

Parane, K.A., Patil, N.C. Poojara, S.R. and Kamble, T.S. 2014. "Cloud based Intelligent Healthcare Monitoring System', In the proceedings of International Conference on Issues and Challenges in Intelligent Computing Techniques ICICT), February 7-8, Ghaziabad, Indian, pp. 697-701.

Prosanta Gope and Tzonelih Hwang, 2016. 'BSN-Care: A Secure IoT-Based Modern Healthcare System Using Body Sensor Network', *IEEE Sensors Journal,* vol. 16, no. 5, March 1.

Ryan Green, Mustafa Asili, and Erdem Topsakal 2013. 'Wireless Smartphone Communication for Medical Telemetry Systems', *IEEE Journal of Biomedical and Health Informatics,* Vol. 19, No. 1.

Siti Sarah Meskam, Nur Quraisyia Aqilah MohdRusl and Nasiha Sakinah Zamery, 2013. 'Body Temperature Measurement for Remote Health Monitoring System', Proc. of the IEEE International Conference on Smart Instrumentation, Measurement and Applications (ICSIMA).

Tello, J.P. Manjarres, O. Quijano, and M. Blanco, A. et al 2013. 'Remote Monitoring System of ECG and Human Body Temperature Signals', IEEE Latin American Transaction, Vol. 11, No. 1February, pp. 314-318

Weinstein, R. 2005. "RFID: A technical overview and its application to the enterprise," IT Prof., vol. 7, no. 3, pp. 27– 33, May/Jun.

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