

BSN: A Secure IoT based Modern Healthcare System using Body Sensor Network

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Abstract: This paper presents an overview on a secure IoT based modern healthcare system using body sensor network.

Keywords: IoT environment, pulse oximetry, MobiCare

1. Introduction

The last few decades have witnessed a steady increase in life expectancy in many parts of the world leading to a sharp rise in the number of elderly people. A recent report from United Nations predicted that there will be 2 billion (22% of the world population) older people by 2050. In addition, research indicates that about 89% of the aged people are likely to live independently. However, medical research surveys found that about 80% of the aged people older than 65 suffers from at least one chronic disease causing many aged people to have difficulty in taking care of themselves. Accordingly, providing a decent quality of life for aged people has become a serious social challenge at that moment. The rapid proliferation of information and communication technologies is enabling innovative healthcare solutions and tools that show promise in addressing the aforesaid challenges. Now, Internet of Things (IoT) has become one of the most powerful communication paradigms of the 21st century. In the IoT environment, all objects in our daily life become part of the internet due to their communication and computing capabilities (including micro controllers, transceivers for digital communication). IoT extends the concept of the Internet and makes it more pervasive. IoT allows seamless interactions among different types of devices such as medical sensor, monitoring cameras, home appliances so on. Because of that reason IoT has become more productive in several areas such as healthcare system. In healthcare system, IoT involves many kinds of cheap sensors (wearable, implanted, and environment) that enable aged people to enjoy modern medical healthcare services anywhere, any time. Besides, it also greatly improves aged peoples quality of life. The body sensor network (BSN) technology is one of the most imperative technologies used in IoT-based modern healthcare system. It is basically a collection of low-power and lightweight wireless sensor nodes that are used to monitor the human body functions and surrounding environment. Since BSN nodes are used to collect sensitive (life-critical) information and may operate in hostile environments,

accordingly, they require strict security mechanisms to prevent malicious interaction with the system. In this article, at first the work address the several security requirements in BSN based modern healthcare system. Then, the work propose a secure IoT based healthcare system using BSN, called BSN-Care, which can guarantee to efficiently accomplish those requirements.

A. Purpose

The body sensor network (BSN) technology is one of the most imperative technologies used in IoT-based modern healthcare system. It is basically a collection of low-power and lightweight wireless sensor nodes that are used to monitor the human body functions and surrounding environment. Since BSN nodes are used to collect sensitive (life-critical) information and may operate in hostile environments, accordingly, they require strict security mechanisms to prevent malicious interaction with the system.

B. Scope

Now, Internet of Things (IoT) has become one of the most powerful communication paradigms of the 21th century. In the IoT environment, all objects in our daily life become part of the internet due to their communication and computing capabilities (including micro controllers, transceivers for digital communication). IoT extends the concept of the Internet and makes it more pervasive. IoT allows seamless interactions among different types of devices such as medical sensor, monitoring cameras, home appliances so on. Because of that reason IoT has become more productive in several areas such as healthcare system. In healthcare system, IoT involves many kinds of cheap sensors (wearable, implanted, and environment) that enable aged people to enjoy modern medical healthcare services anywhere ,any time. Besides, it also greatly improves aged peoples quality of life.

2. Literature survey

Paper Title: An Ad Hoc Sensor Network Infrastructure for Emergency Medical Care

Author: David Malan, Thaddeus Fluor-Jones, Matt Welsh, and Steve Moulton.

We have completed an initial design of CodeBlue and prototypes of several of the components described herein. The

pulse oximetry mote has been completed and development of an ECG mote is currently underway. The work has explored the use of an adaptive spanning-tree multi-hop routing algorithm, based on the Tiny OS Surge protocol, and the work has incorporated dynamic transmission power scaling to minimize interference. A lightweight public key infrastructure based on elliptic curve cryptography is currently being tested. A sophisticated programming model using abstract regions for routing, data sharing, and aggregation has also been developed.

1) *Advantage*

It incorporated dynamic transmission power scaling to minimize interference.

It is a low-power device.

2) *Disadvantage*

Communication challenges: The first challenge is secure, reliable, ad hoc communication among groups of sensors and mobile, handheld devices.

Computational challenges: Sensor nodes have very limited computational power, and traditional security and encryption techniques are not well-suited to this domain.

Paper Title: A Programmable Service Architecture for Mobile Medical Care

Author: Rajiv Chakravorty

The vast opportunity in the 'point-of-care' access and the capture and transmission of patient information will continue to drive the healthcare industry towards increased mobility. The importance is in the shifting awareness that mobility in healthcare settings increasingly refers to – the mobility of sensor/actuator devices, the healthcare providers (health 'outsourcing') and of the patient (users) themselves. MobiCare leverages the point-of-care patient access to offer important benefits like quality healthcare, a programmable service architecture, flexible service composition and a full-scale medical systems integration. MobiCare is an ongoing project and much work remains to be done. Besides a proof-of-concept prototype, this project is also in the process of investigating other long-term, challenging research problems in MobiCare including the body sensor network security, reliable and secure sensor code updates and upgrades, the potential legal hurdles involved and the privacy issues that arise with dynamic remote code updates.

3) *Advantage*

It improves quality of healthcare, programmable service architecture, flexible service composition.

4) *Disadvantage*

It is not reliable and secure.

Paper Title: Caveat Emptor: A Comparative Study of Secure Device Pairing Methods

Author: Arun Kumar and Nitesh Saxena

We presented the first experimental evaluation of prominent device pairing methods. Results show that some simple methods (e.g., Visual Number and Image Comparison) are quite attractive overall, being fast and secure as well as acceptable by users. They naturally appeal to settings where devices have

appropriate-quality displays. HAPADEP variant seems to be preferable for more constrained devices: it is fast, error-free and requires very little user intervention. LEDButton or Vibrate-Button is best-suited for devices lacking screens, speakers and microphones.

5) *Advantage*

It is fast and secure as well as acceptable by users.

6) *Disadvantage*

User evaluation for each method is not yet done.

Paper Title: Reliable Set-Up of Medical Body-Sensor Networks

Author: H. Baldus, K. Klabunde, and G. Müschth

We realized a patient monitoring system based on wireless body-worn medical sensors. The set-up protocol designed enables fast association of multiple medical sensors to individual patients in an intuitive way. The integrated patient and clinician identification leads to safety and reliability of the overall system. Currently, each network node is pre-configured with a unique address.

7) *Advantage*

It is safe and reliable.

8) *Disadvantage*

Dynamic allocation of device addresses is not yet done.

3. Existing system

In healthcare system, IoT involves many kinds of cheap sensors (wearable, implanted, and environment) that enable aged people to enjoy modern medical healthcare services anywhere, any time. Besides, it also greatly improves aged people's quality of life. The body sensor network (BSN) technology is one of the most imperative technologies used in IoT-based modern healthcare system. It is basically a collection of low-power and lightweight wireless sensor nodes that are used to monitor the human body functions and surrounding environment. Since BSN nodes are used to collect sensitive (life-critical) information and may operate in hostile environments, accordingly, they require strict security mechanisms to prevent malicious interaction with the system.

1) *Disadvantage*

- It doesn't consider the security makes patient privacy vulnerable.
- It requires strict security mechanisms to prevent malicious interaction with the system.

4. Proposed system

A secure IoT based healthcare system using BSN, called BSN-Care, which can guarantee to efficiently accomplish those requirements. Security is one of the most imperative aspects of any system. People have different perspectives regarding security and hence it is defined in many ways. In general, security is a concept similar to safety of the system as a whole. Now, the communication in sensor network applications (like BSN) in healthcare are mostly wireless in nature. This may result in various security threats to these systems. These are the security

issues cloud pose serious problems to the wireless sensor devices. In this section, the project describes the key security requirements in IoT based healthcare system using BSN.

Advantage

- BSN-Care can efficiently accomplish various security requirements of the BSN based healthcare system.
- It is highly imperative that the system should pose all the a foresaid security requirements and eventually can resist various security threats and attacks like data modification, impersonation, eavesdropping, replaying etc.

A. Hardware requirements

- Processor : Intel i3 and above
- Speed : 2.4 GHz
- RAM : 2 GB (min)
- Hard Disk : 80 GB
- Arduino
- Pulse Sensor
- Temperature Sensor
- Motion Sensor
- Power supply
- Android Phone

B. Software requirements

- Operating System : Windows XP or newer.
- Application Server : Tomcat 5.0/6.X
- Front End : Java.
- Scripts : JavaScript.
- Server side Script : Java Server Pages.
- Database : MySQL
- Database Connectivity: JDBC.
- Android SDK
- Embedded

changes between these segments. The beginning configuration procedure of recognizing these subsystems and building up a structure for subsystem control and correspondence is called construction-modeling outline and the yield of this outline procedure is a portrayal of the product structural planning. The proposed architecture for this system is given below. It shows the way this system is designed and brief working of the system.

The Fig.1 shows the system architecture in which the data is collected from the person wearing implantable sensors by the LPU and if there are any abnormalities detected with the person, the LPU communicates with the server through internet to send an alert to family member, physician or emergency care.

A. Module 1: data collection module

The sensors connected with our body can check the body status and the details are send to the LPU. The sensor this project is using are blood pressure sensor Heartbeat sensor motion sensor and temperature sensor. The sensors are connected to an arduino board and the details of the data collected by the LPU are transferred using Bluetooth.

B. Module 2: lightweight authentication module

User of the body sensor network should register using the Android app while registering user enters user ID password name email id mobile number family details doctor details extra these details are sent to the server and the details the store in the database after this process user should authenticate the phone.To authenticate the phone user uses the IMEI number as the phone ID and send this ID to the server and services details of the LPU in the database once received the request from the LPU, generates Shadow keys, emergency keys and other parameters using the Light weight network authentication algorithm and saves the details in the server and send the details who the hell you LPU receive the details from the server to the phone.

C. Module 3: data authentication module

User should login using the Android app and server verifies the user after the authentication, the LPU Get Connected with the body sensor network using Bluetooth, after the connection the project can receive date of form the body sensor network and encrypts using the AES code block algorithm and the encrypted data is sent to the server. Server decrypts the data and checked the threshold value based on the range of the data collected, send alert to the family or to the doctor

5. System architecture

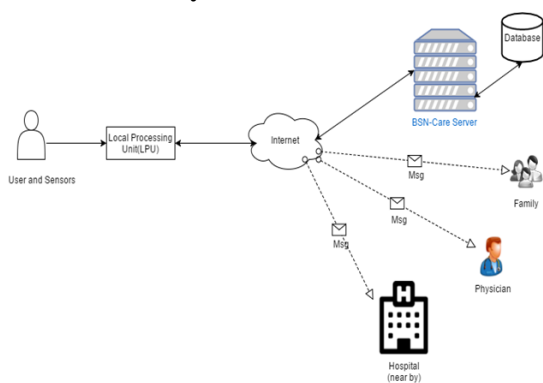


Fig. 1. System architecture

The architectural configuration procedure is concerned with building up a fundamental basic system for a framework. It includes recognizing the real parts of the framework and inter

6. Conclusion

This paper presented an overview on a secure IoT based modern healthcare system using body sensor network.

References

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