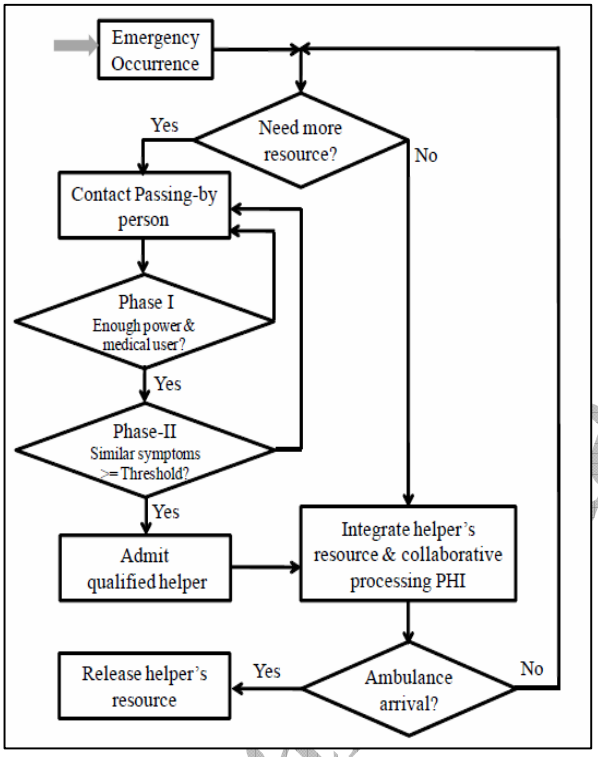
SPOC: A Secure and Privacy-preserving Opportunistic Computing Framework for Mobile-Healthcare Emergency

Abstract

With the pervasiveness of smart phones and the advance of wireless body sensor networks (BSNs), mobile Healthcare (m-Healthcare), which extends the operation of Healthcare provider into a pervasive environment for better health monitoring, has attracted considerable interest recently. However, the flourish of m-Healthcare still faces many challenges including information security and privacy preservation. In this paper, we propose a secure and privacy-preserving opportunistic computing framework, called SPOC, for m-Healthcare emergency. With SPOC, smart phone resources including computing power and energy can be opportunistically gathered to process the computing intensive personal health information (PHI) during m-Healthcare emergency with minimal privacy disclosure. In specific, to leverage the PHI privacy disclosure and the high reliability of PHI process and transmission in m-Healthcare emergency, we introduce an efficient user-centric privacy access control in SPOC framework, which is based on an attribute-based access control and a new privacy-preserving scalar product computation (PPSPC) technique, and allows a medical user to decide who can participate in the opportunistic computing to assist in processing his overwhelming PHI data. Detailed security analysis shows that the proposed SPOC framework can efficiently achieve user-centric privacy access control in m-Healthcare emergency. In addition, performance evaluations via extensive simulations demonstrate the SPOC's effectiveness in term of providing high reliable PHI process and transmission while minimizing the privacy disclosure during m-Healthcare emergency.

Architecture



Existing System

In Existing System, According to the sensex over the age of 65 is expected to hit 70 million by 2030, having doubled since 2000. Health care expenditures projected to rise to 15.9% by 2010. The cost of health care for the nation's aging population has become a national concern are important for understanding how the opportunistic computing paradigm work when resources available on different nodes can be opportunistically gathered together to provide richer functionality, they have not considered the potential security and privacy issues existing in the opportunistic computing paradigm.

Proposed System

In our proposed SPOC framework aims at the security and privacy issues, and develops a user-centric privacy access control of opportunistic computing in m-Healthcare emergency.

Advantages

- ✓ Shift from a clinic-oriented, centralized healthcare system to a patient-oriented, distributed healthcare system
- ✓ Reduce healthcare expenses through more efficient use of clinical resources and earlier detection of medical conditions

Challenges

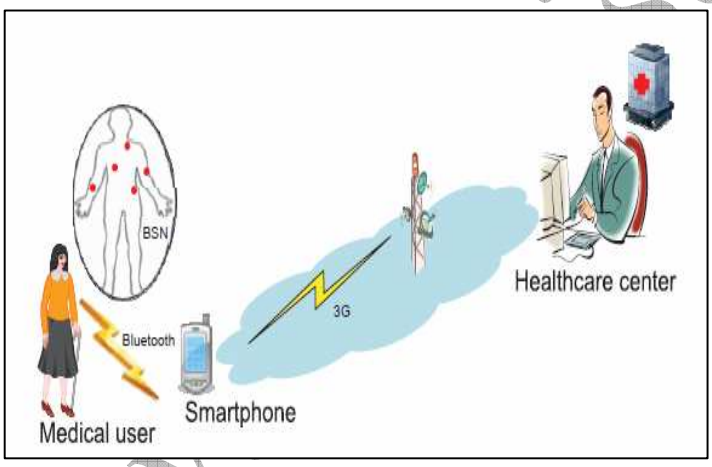
- ✓ Performance, Reliability, Scalability, QoS, Privacy, Security …
- ✓ More prone to failures, caused by power exhaustion, software and hardware faults, natural disasters, malicious attacks, and human errors etc.

Modules

1. Pervasive health monitoring in M-Healthcare
2. Body Sensor Network
3. Security Analysis
4. Performance Evolution
5. Simulation Setup
6. Report Generation

Pervasive Health Monitoring in M-Healthcare

In this module, each mobile medical user's personal health information (PHI) such as heart beat, blood sugar level, blood pressure and temperature and others, can be first collected by BSN, and then aggregated by smart phone via Bluetooth. Finally, they are further transmitted to the remote healthcare center via 3G networks. Based on these collected PHI data, medical professionals at healthcare center can continuously monitor medical users' health conditions and as well quickly react to users' life-threatening situations and save their lives by dispatching ambulance and medical personnel to an emergency location in a timely fashion.



Body Sensor Network

In this module, Body area network (BAN), wireless body area network (WBAN) or body sensor network (BSN) are terms used to describe the application of

wearable computing devices. This will enable wireless communication between several miniaturized body sensor units (BSU) and a single body central unit (BCU) worn at the human body.

- Deploy wearable sensors on the bodies of patients in a residential setting
- Continuously monitor physiological signals (such as ECG, blood oxygen levels) and other health related information (such as physical activity)

Security Analysis

In this Module to develop a secure and privacy-preserving opportunistic computing framework to provide high reliability of PHI process and transmission while minimizing PHI privacy disclosure in m-Healthcare emergency. Specifically, we

i) apply opportunistic computing in m-Healthcare emergency to achieve high-reliability of PHI process and transmission; and

ii) ii) develop user-centric privacy access control to minimize the PHI privacy disclosure.

Performance Evolution

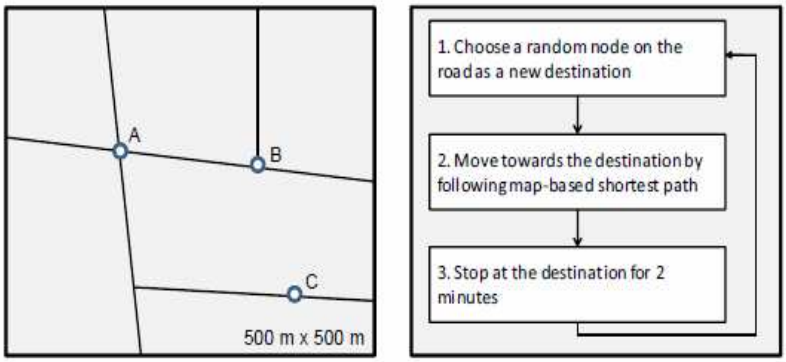
In this module, the performance metrics used in the evaluation are :

1) The average number of qualified helpers (NQH), which indicates how many qualified helpers can participate in the opportunistic computing within a given time period, and

2) The average resource consumption ratio (RCR), which is defined as the fraction of the resources consumed by the medical user in emergency to the total resources consumed in opportunistic computing for PHI process within a given time period.

Simulation Setup

In this Module, the simulator implements the application layer under the assumptions that the communications between smart phones and the communications between BSNs and smart phones are always workable when they are within each other's transmission ranges.



(a) Simulation area (b) Mobility model

Report generation

In this module, Health care center generate crystal report from the database collection for future reference.

System Configuration

Hardware Requirements

- System : Pentium IV 2.4 GHz.
- Hard Disk : 40 GB.
- Floppy Drive : 1.44 Mb.
- Monitor : 15 VGA Color.
- Mouse : Logitech.
- Ram : 512 Mb

Software Requirements

- Operating system : Windows XP.
- Coding Language : C#.Net
- Database : Sql Server 2005