

An Internet of Things Architecture for Elderly Home Healthcare

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Abstract

Today, the “Internet of Things” (IoTs) is used in many of parts of medical technology, research and development, and worldwide industry. In this paper presents a novel approach for an IoT architecture for elderly home healthcare that IoT architecture to achieve connectivity with the patient, sensors and everything around it. The objective of this article is: 1) to design and implement an architecture for intelligence elderly home healthcare utilizing IoT, 2) to incorporate current technology platforms to optimize cost savings, 3) comprehensively spread technology and information to worldwide populations already available through IoT. The development of elderly home healthcare system to be capable of efficient operating with four layers of IoT architecture: 1) system architecture, 2) data model architecture, 3) management architecture, and 4) cloud architecture. The result suggest that an innovative solutions includes benefits of mobile, cloud computing, big data analytics, and IoTs make both the elderly life easier and the healthcare process more effective.

Keywords: IoT architecture, ICT, elderly, disable, home healthcare

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Introduction

The world population is rapidly ageing: the number of people aged 60 and over as a proportion of the global population will double from 11% in 2006 to 22% by 2050. By then, there will be more old people than children (aged 0-14 years) in the population for the first time in human history (Commission of the European Communities, 2009). The population of Thailand is getting old. At the present time, just under 11% of the Thai population is over 60 years of age and the trend is rapidly rising. The proportion of older persons in the total population is expected to reach 14% in 2015, 19.8% in 2025 and nearly 30% by 2050. Driving the trend is a combination of falling fertility rates and improvements in health especially of women and infants (World Health Organization, 2012).

Information and communication technology (ICT) should be able to improve the quality of elderly life and healthcare. However, the progress is very limited comparing to other ICT related application areas, such as business, education, entertainment, etc (Steg, H. et al., 2006). There are some identified barriers based on some studies in the field of healthcare.

- 1) Lack of health information sharing system (Steg, H. et al., 2006).
- 2) Lack of sustainable monitoring and preventive management of health indicators (Cortes, Ulises et al., 2007).
- 3) The existing healthcare system cannot integrate the multiple needs of healthcare (Magrabi, Farah et al., 2001).
- 4) ICT technologies for intelligent health management are difficult to use (Kühner, Daniel., 2007).
- 5) Problem of security and privacy (Pinsker, M., et al., 2008).

Today, the “Internet of Things” (IoTs) is used in many of parts of medical technology, research and development, and worldwide industry. This article proposed applies a novel approach to IoT by utilizing a robust intelligence elderly home healthcare architecture. Current available technologies include the benefits of mobile, cloud computing, big data analytics, and IoT. IoT is the key element- it enhances and improves data availability and is a “force multiplier” when used in the decision-making process leading to elderly home healthcare management.

The IoT is a technological phenomenon originating from innovative developments and concepts in information and communication technology associated with: Ubiquitous communication, Pervasive computing and ambient intelligence (International Telecommunication Union., 2005). Additionally, the IoT will be a key part of the future Internet, which will be made up of the Internet of Services and the Internet of Things (A. J. Jara; M. A. Zamora and A. F. G. Skarmeta., 2009.). Based on characteristics of health care filed, healthcare IoT can be viewed from following three aspects:

- a) "Things" is physical objects, that is, doctors, patients, and medical device etc.
- b) "Of" can be explained as Connecting, it is information exchange. The networking standard defined objects are perceivable, can be interactive, can be controlled.
- c) "Internet" is the process. The concept of IoT in healthcare must be based on standardized medical procedures. The concept of IoT must be elevated to a process.

In the traditional model of health care services, the patients are hospital-centered, while the service of doctors and nurses shall be based on information system software in the hospital (Takács, Barnabás, and Dávid Hanák., 2007). Therefore, "difficulty and costliness" has troubled the patient for a long time. Under the internet of things model, IOT-based intelligent healthcare management system focuses on the patients and the medical resources including doctors, nurses and medicines target at the patients. This innovative solutions includes benefits of mobile, cloud computing, big data analytics, and IoTs make both the elderly life easier and the healthcare process more effective.

Purposes of the study

The objectives of this study are as follows:

1. To design an architecture for elderly home healthcare utilizing IoT.
2. To incorporate current technology platforms to optimize cost savings.
3. To comprehensive spread technology and information to worldwide populations already available through IoT.

Proposed Methodology

Our experimental, including any new technologies or tools to be developed. The plan involve:

- 1) On-line/off-line web and smart mobile applications with image notation, include more local dialects, as well as all other major foreign languages, all with a clear understanding of differing educational levels. This has the potential to encourage people to identify and elderly home healthcare,
- 2) Incorporate comprehensive interoperability intelligence healthcare management development support software tools,
- 3) Maintain data collection from personal health data in mobile devices, e-health data in personal, family folder, treatment history, demographics, and specialization of diagnosed cases with geolocation for health officers within different health center levels,
- 4) Tools for exchange and transfer data from IoTs to cloud and big data analytics, and
- 5) Real-time data analysis with big data analytics.

New information technology and computer design comprises information analysis and design. These will be used, such as IoTs architecture of intelligence elderly home healthcare management system interoperability with object oriented design, UML and XML, new relational and non-relational database systems for data analysis utilizing current cloud computing models, and machine learning for big data analytics. We will use IoTs architecture of intelligence elderly home healthcare management which encompass system architecture, data model architecture, management architecture, and cloud architecture with four layers of interoperability and robust data analysis for data collection.

Comprehensive and efficient elderly home healthcare databases from data model architecture in cloud and existing databases that currently store all individual health information, including personal health data stored in mobile devices, e-health data stored in health centers in the area, and related data will be available. The new intelligence elderly home healthcare systems with big data analytics for elderly home healthcare in cloud including web and mobile applications, interoperability intelligence surveillance development support software tools, e-health database with geolocation, tools for exchange and transfer data, and real-time data analysis will be promised.

The next step will be involved in evaluating the performance of the first phase to improve the algorithm, more advancement in big data analytic techniques and cloud computing.

The following plan will also develop intelligence elderly home healthcare to be capable of efficient operating with four layers of IoTs of intelligence elderly home healthcare architecture: 1) system architecture: sensors and medical devices, home appliance such as mobile devices, televisions, office equipment, etc. can be used in remote diagnosis and home health care for patient and vulnerable groups to transfer data and connect to the system via the internet, 2) data model architecture: to be redesigned to accommodate data from new more system architecture, 3) management

architecture: to manage the data and complex systems is durable, flexible and connecting as well as a single system, and 4) cloud architecture: architecture on the top of the system will be involved in evaluating the performance of the first phase to improve algorithm, more advanced in big data analytic techniques and cloud computing.

Four layers of IoTs architecture for elderly home healthcare

The development of intelligent healthcare management to be capable of efficient operating with four layers of IoTs architecture for elderly home healthcare:

1) System architecture: sensors and medical devices, home appliance such as mobile devices, televisions, office equipment, etc. can be used in remote diagnosis and home health care for patient and vulnerable groups to transfer data and connect to the system via the internet,

2) Data model architecture: to be redesigned to accommodate data from new more system architecture,

3) Management architecture: to manage the data and complex systems is durable, flexible and connecting as well as a single system, and

4) Cloud architecture: architecture on the top of the system will be involved in evaluating the performance of the first phase to improve algorithm, more advanced in big data analytic techniques and cloud computing.

So that covers four layers of IoTs architecture for elderly home healthcare.

Discussion and Conclusion

In conclusion, Internet of Things is supposed to be a novel way to approach elderly home healthcare management that will involve a comprehensive development of cloud computing, data management and big data analytics. In this paper presents a novel approach for an IoT architecture for elderly home healthcare that of IoT architecture to achieve connectivity with the patient, sensors and everything around it. The development of intelligence elderly home healthcare system to be capable of efficient operating with four layers of IoTs architecture: 1) system architecture, 2) data model architecture, 3) management architecture, and 4) cloud architecture. It will also involve exchange and transfer of data to all areas, as well as new technology and access to information, comprehensive medical and health data stored in a digital cloud, which is currently stored fragmented at all levels, and in all sectors, and most importantly, using data mining algorithms to handle healthcare big data with big data analytics. This innovative solutions includes benefits of mobile, cloud computing, big data analytics, and IoTs make both the elderly life easier and the healthcare process more effective.

In the future work we will mainly work on implementing a prototype of the approach and evaluated by different methods. Some artificial intelligent techniques for diagnosis can also be used in this framework to make people home healthcare easier and more effective.

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