Smart Mobile IT Convergence for U-Healthcare Development

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Abstract

This study aims to develop a IT-medical convergence technologies including u-health, which is the health management anytime and anywhere, life-care, which leads healthy life by management of daily life, point-of-care, which makes on-site diagnostic, genetic analysis, which predicts genetic diseases, IT based new diagnosis and treatment system and components of medical devices.

Keywords: IT Convergence, U-Healthcare, Medical Convergence, Convergence Model

1. Introduction

With an ICT (Information Communication Technology) paradigm shift toward ubiquitous technology, homes and cities we are living in are transforming into U-Home (Ubiquitous Home) and U-City (Ubiquitous City); and our surroundings and objects including administration, transportation, environment, education, culture, tourism, healthcare, and medicine are evolving with the aid of ubiquitous technology [1, 2]. This ubiquitous paradigm applied to various fields is introduced to the healthcare and medical sector in the name of U-Healthcare as well.

Smart technology creates new business in each industry and will be the role of continuous development. Commonly call the modern society as “digital convergence”. This digital convergence combines existing industry with IT to create new values and even industrial structure [3]. Especially, mobile, smart, cloud computing can be called core technologies of the large technological direction of convergence that “smart” is receiving spotlight as convergence is deepening[4].

The technologies related with information communication are progressing continuously. These technologies are converged with different industries rapidly in today. Therefore, we commonly call the modern society as “digital convergence”. Digital convergence includes three core factors such as mobile, smart, cloud. Smart is receiving spotlight as convergence is deepening.

2. Related Work

The medical industry will prosper the flower called smart healthcare due to sensing technology and fruits called smart grid will be made by power network and sensing of devices. In recent years, interests in health have been increased according to changes in lifestyle and environment. Also, interest in U-Healthcare, which monitors one’s health and provides specialized healthcare services whenever and whatever it is needed, has increased. U-Healthcare services provide medical and healthcare services continuously and generally for healthy life of customers.

A. Innovation in Healthcare

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Innovation in healthcare continues to be a driving force in the quest to balance cost containment and health care quality. Healthcare innovation can be defined as the introduction of a new concept, idea, service, process, or product aimed at improving treatment, diagnosis, education, outreach, prevention and research, and with the long term goals of improving quality, safety, outcomes, efficiency and costs [4].

The conceptual framework for innovation in healthcare is as shown in Fig. 1. The healthcare organizations serve six distinct purposes – treatment, diagnosis, prevention, education, research and outreach. In serving these purposes, healthcare organizations must manage quality, costs, safety, efficiency and outcomes. At the very core of healthcare innovation are the needs of patients and the healthcare providers who deliver care. Healthcare innovation focuses mainly on three areas– a) how the patient is seen, b) how the patient is heard, and c) how the patient’s needs are met.

![Figure 1 A Conceptual Framework for Innovation in Healthcare [5]](image)

**B. Healthcare Engineering**

The use of systems-engineering tools leads to innovation in health care. These engineering-information technology based tools have been used in a wide variety of applications to achieve major improvements in the quality, efficiency, safety or customer-centeredness of processes, products, and services in various manufacturing and services’ industries. However, the healthcare sector as a whole has been very slow to embrace them, even though they have been shown to yield valuable returns to the growing number of health care organizations (Fone et al.,)

**C. Smart Technology**

Smart technology does not mean that the technology itself is smart, but can be said that individuals and industry has become smarter. Smart technology providing individualized products and service to quickly correspond, sensitively analyze, predict occurring situations have the five features of sensing, intelligence, mobility, elasticity, and integration.

**D. Smart healthcare**

Using smart healthcare, simple medical service can be possible without visiting the hospital in the future. Through bio sensors attached to our bodies, our heart rate and ECG is monitored by real-time throughout our everyday life. Through this monitoring process, strange symptoms in our body will immediately be detected to send necessary messages.
E. A Smart Device

Any instrument, apparatus, appliance, material or other article (whether used alone or in combination, and including the software necessary for its proper application) intended, by the person under whose name it is or is to be supplied, to be used for human beings for the purpose of one or more of the following:

1. diagnosis, prevention, monitoring, treatment or alleviation of disease;
2. diagnosis, monitoring, treatment, alleviation of or compensation for an injury or disability;
3. investigation, replacement or modification of the anatomy or of a physiological process;
4. control of conception;
5. and that does not achieve its principal intended action in or on the human body by pharmacological, immunological or metabolic means, but that may be assisted in its function by such means.

F. Digital Convergence

Digital convergence is a certainty of future. Among hoards of other benefits that it offers one of the striking features of this technology is lower storage cost of digital data. Also, it offers enhanced quality of digital content and an assurance of quality improvements in future along with low cost and high bandwidth transmission of digital content between any two places.

In the age of digital convergence, integrated media will be useful to engage consumers with sufficient opportunities to strengthen their know-how of healthcare and create awareness about risk, cost and benefits of specific procedures.

3. A Conceptual Model for Smart IT Convergence for U-Healthcare

One of the key benefits of smart medical tools is fostering a sense of patient efficacy. For medical professionals, more data is useful when helping a patient make informed health care decisions. Using smart phone medical application that checks other symptoms provides physicians with a wealth of clinically useful information. This is why medical monitoring application is one of the most important technological tools to promote ‘self-care’ and prevention of disease.

Figure 2. IT Convergence for U-Healthcare
Smart mobile can perform actions such as communicating with other devices, storing information, and retrieving online documents shown in Fig 2. If we consider a typical mobile user for example, an agent might operate on their smart phone or PDA, monitor the user’s behavior in an autonomous fashion, react to any perceived changes in the user’s status, and proactively anticipate what the user’s future behavior will be.

A. Smart U-Healthcare Application Model

Smart devices and their services play a significant and mounting part in a global world of computing. Software infrastructure that construct and establish application functionality, unified passage of reasoning among mobile devices and other environment, mobile devices software modeling, and scalability of the results should be transpire in order to create a quality of software infrastructure for mobile device. There is no standard model or rule to design and develop mobile u-healthcare applications. In order to support the medical specialists such as doctor, physician and therapist for developing personalized mobile u-healthcare applications, an application model for the mobile u-healthcare applications should be defined prior to the implementation of the workbench.

Ministered by the explosion of smart phones and wireless technology, the u-health revolution has helped people become more personally accountable for their lifestyle choices. Mobile applications (apps), engage people in a way that enables them take better care of themselves and manage ailments. The electronic or digital data gathered in real time is useful to motivate, inspire, track progress and reward effort, which is crucial to success. These gadgets and new app technologies have become more slim and lightweight to accommodate the longest run or walk around the park.

4. Software Framework

It is designed and implemented as software framework to be able to provide a set of generic functionalities that can be selectively utilized by application developers, thus providing application specific software focusing on monitoring of different health problems. As part of the framework, it offers a software library providing application
programming interfaces (APIs).

**Figure 4. Software Framework for Smart U-healthcare**

Data Service manages record between platform and devices get the records used for retrieving patient records from personal devices, which could be health information systems or medical application servers. Medical services provide diagnosis and medication for all the symptoms given by the user generated from the health information system and medical application platform. Health information system provides information pertaining to the symptoms or disease given by the user. Personal self-monitoring and remote physicians provided proper medical assistance to the user.

**A. Convergence System Components for U-healthcare Service**

Using smart healthcare, simple medical service can be possible without visiting the hospital in the future. Through this monitoring process, strange symptoms in our body will immediately be detected to send necessary messages. This will prevent losing opportunity of therapy time. Also, real-time monitored data will be analyzed based on medical information for simple diseases to be cured without going to the hospital.

**Figure 5 Convergence System Components**
Medical data of patients will continuously be accumulated and managed. Based on this collected data, the condition of patients will comprehensively analyze with medical records from the past until today.

![Diagram of Patient-Specific Healthcare Platform]

**Figure 6. Development of the Patient-Specific Healthcare Platform**

### 5. Conclusion

Advancements in ubiquitous technology ushers us into a new world. This study is expected to help ensure an excellent workforce and new technologies in the healthcare sector using smart phones, and to help reduce medical expenses by improving the health of citizens. Smart mobile have been rapidly penetrating into the everyday life with various applications. With the advancement of communication and computing technologies, the smart devices are evolving toward the convergence with other industry sector. Healthcare is one such beneficiaries by the IT convergence.

In the future, U-Healthcare will be further integrated into our daily lives such that we will not perceive its presence consciously, and it will allow us to monitor our health status naturally and continuously. However, even the most highly developed technology can be neglected by consumers if it is not user-friendly. Therefore, u-healthcare needs to fully reflect the required services to obtain maximal participation and behavioral change. U-Healthcare market will be reorganized as healthcare device and platform in the near future.

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