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Research on a Service Model for an Internet of Things-based Intelligent Smart Care System

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Abstract

Currently, IoT (Internet of Things) technology actively and intelligently connects several physical objects in our daily lives to each other through the internet using data communications and mutual recognition for interested individuals. This connectivity is employed for various events such as accidents, disasters, and environment, etc. There is a necessity to prepare alternatives to these uses for not only health screening, nursing, and housekeeping service for assisting the recovery of social relationships and ability in daily living, but also for the creation of content for providing necessary information to individuals. This paper reports on a study of smart care service model that focuses on prevention and diagnosis, and is equipped with portability and miniaturization. This smart care service provides a caring service for the elderly and people in need of care by monitoring their health status. It combines various contents including the status recognition module, experiencing module, and sensory module. This is accomplished by using commercial smartphone applications under the IoT environment, transitioning from a medical facility centered service to a user-centered smart care service.

Keywords*: IoT, Smart Care, Human Care, Bluetooth Wireless System, Service Model*

1. Introduction

With an aging population, communities are in need of self-recovery within their human and material resources in the social relationships for the elderly who have not covered by the social safety net [3,6]. The effects of forming a social relationship net are various sympathetic nervous system activities and the smart care service system for the elderly and people in need of care [8]. Human care contents and services for combining various contents through widely used smartphone applications for health management in the IoT environment are required.

This study is composed of five chapters. In chapter 2, we examine studies on both IoT and u-Health. Chapter 3 describes a service model for smart care. In chapter 4, we describe the design and implementation of a service model for IoT-based intelligent smart care based on the service model described in chapter 3. Chapter 5 concludes the description of the proposed service model and describes the limitations of this study.

2. Relevant Studies

2.1. IoT (Internet of Things)

The object common network forms intelligent relationships like sensing, networking, and information processing by mutually cooperating without human intervention [1]. This is accomplished with regards to distributed environment factors such as human, object, and service, and has evolved into intelligent communication network among the objects

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through sensing technology, wireless and wired communications, network infrastructure technology, and service interface technology [9].

In order to establish a consistent information delivery method between the objects, the MQTT protocol was proposed to replace HTTP and the OASIS (Advancing open standards for the information society) uses the MQTT as a standard protocol of IoT.

2.2. u-Health

u-Health is a health management service that provides services related to health care, including prevention, diagnosis, treatment, and follow-up of diseases such as those shown in the Table 1. It functions without constraints of time and space by connecting IT technologies to healthcare technologies [4-5].

Table 1. Healthcare Combined with IT Technologies (ETRI Leader Academy Ubiquitous Life Care with IT Tech. 2007.8)

Items	Contents	Remark
Hospital Care	Biosignal measurement, X-ray, ultrasound, MRI, *etc.*	
Telemedicine	Home health monitoring, telemedicine, *etc.*	
E-Healthcare	Portable, wearable, *etc.*	
U-Healthcare	Continuous care, remote care, *etc.*	

u-Health, which consists of u-Medical, u-Silver, and u-Wellness, is a health management service based on the status information of the user, primarily focusing on disease prevention and follow-up management, that meets the increased interests in health and wellness and mitigates the issue of medical cost [6-7].

2.3. Bluetooth Wireless System

The Bluetooth wireless system uses the ISM (Industrial Scientific and Medical) frequency bandwidth of the range 2400–2483.5 MHz. In total, 79 channels between 2402–2480 Hz are available in order to prevent interference among different systems. ISM is the frequency allocated for industrial, scientific, and medical usages [2]. It is widely used for personal wireless devices with low power because a user does not need permission to use radio waves. Because many different systems use the same frequency, there exists concerns about radio interferences among the systems [10].

In order to prevent this issue, Bluetooth adopted the frequency hopping method, which synchronizes Bluetooth devices for communication.

3. Smart Care Service Model

3.1. Smart Care Service

As life expectancy increases in line with the formation of the IoT-based healthcare market, the remote and customized medical services as well as self-health management become paramount. The self-health measures and supply of health information through smart devices, along with medications, may bring about improved lifestyles. Through this, the improvements in therapeutic effects are viable with the methods rather than a simple medication [3]. Figure 1 is a block diagram of the smart care service. It will also help to

improve the effective management and treatment of chronic diseases such as diabetes, hypertension, and metabolic syndrome.

Figure 1. Smart Care Service

3.2. Service Model

The smart care service is required in various services such as self-testing, health measurement, supply of health information, and medication management for biorhythm applications. It is also applicable in health management, chronic disease management, smart care service, main disease management center, and digital hospitals that require the target service. Table 2 shows that the smart care service model appears to be effective in improving the lifestyles and administration of medication through its relevant services.

Table 2. Smart Care Service Model

	Target Service	Application Service	Others
Self-testing	Health management, chronic disease management	Smart care service	Improved lifestyles
Health Measurement	Health management, Smart care service, chronic disease management	Digital hospital	Chronic disease management
Providing health information	Median disease management center, health management	Smartphone application	
Medication management	Digital hospital	Push service	
Other management	Video and voice call consulting, health report		

4. Smart Care System

4.1. System Operation

The system transmits the information obtained from various sensors to the smart devices via wireless communication modules and receives data from the smart devices. It is then linked to the smart care system to monitor the health condition and collects service data from the sensors (Figure 2) that enable medical treatment through personalized data

in the hospital's database. Upon a personal request for service, diagnostic and therapeutic services for patients and smart care through the information from smartphone applications are available. Figure 3 is a description of the Part of Sensing Data Program.

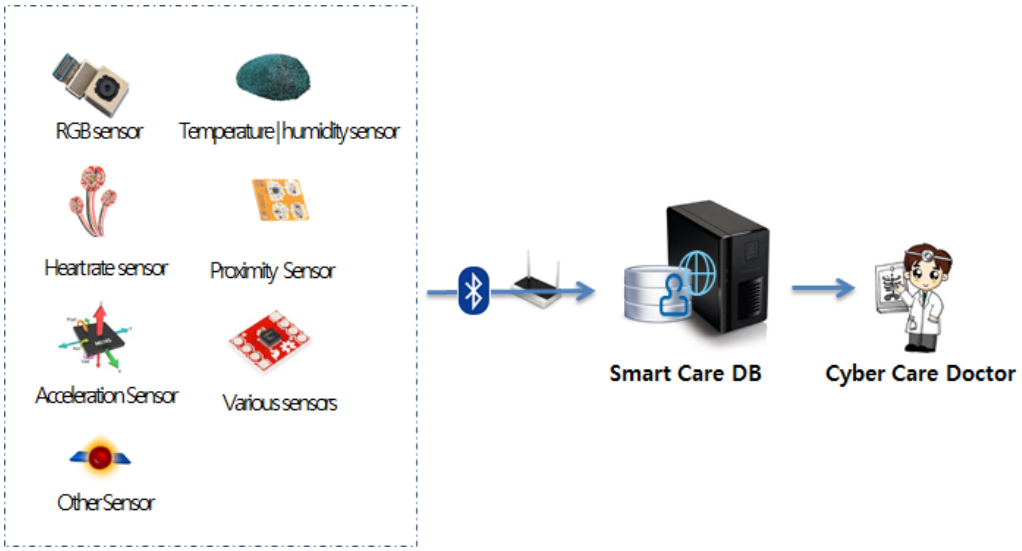

Figure 2. Collection of Service Data From Sensors

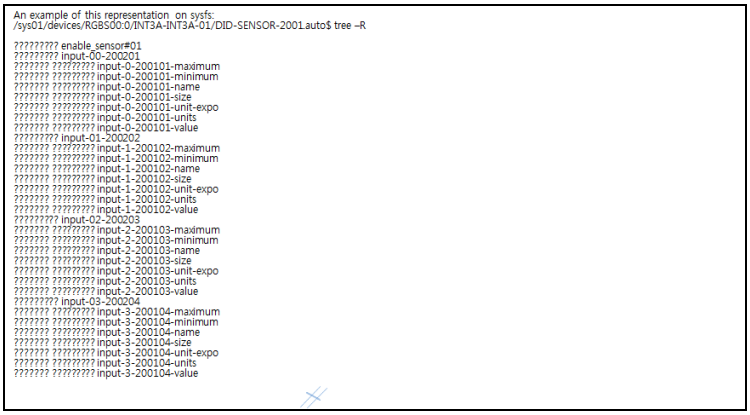

Figure 3. Part of Sensing Data Program

4.2. Smart Care Service System

The smart care service allows miniaturization and portability for modules combined with status recognition, experiencing, and sensor modules in the IoT environment. It is a smart care service for monitoring the health condition of the elderly and people who need care by combining various contents using smartphone applications. The smart care service system, using smart devices with wireless communication, is designed as described in Figure 4. The real-time health condition of users is monitored with biosignal monitoring of information collected at various centers through various status recognition, experiencing, and sensor modules.

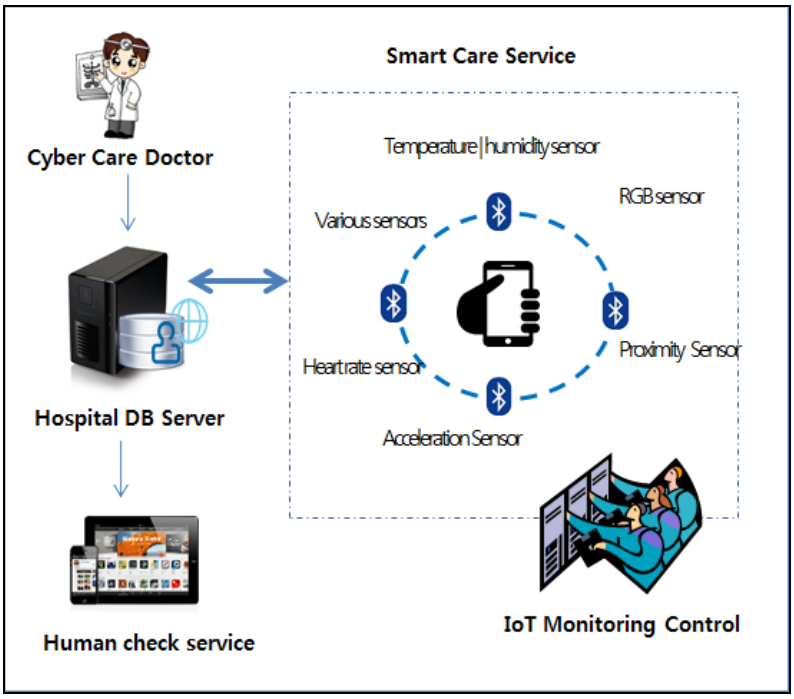

Figure 4. Proposed Design of Smart Care Service System

5. Conclusion

As a smart care system that allows the miniaturization and portability of modules combined with status recognition, experiencing, sensor modules in IoT environment, the smart care service for monitoring health conditions of the elderly and people who need care is constructed by checking and utilizing the visualized data at the external system. This data are expressed and collected from the combination of various contents of widely used smartphone applications. This system service model will help to improve the effective management and therapeutic effects of chronic diseases like diabetes, hypertension, and metabolic syndrome.

In future, it is expected that we will design the smart care service system and implement the system such that it can be linked to the hospital information.

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