Design Requirements for IoT Healthcare Model using an Open IoT Platform

Byung Mun Lee

Dept. of Computer Engineering, Gachon University,
Seongnam, GyeongGi-Do, Korea,
bmlee@gachon.ac.kr

Abstract. Most IoT platforms have been developed in an effort to be universally appied to various services and applications. However, critical success factor of IoT is an explosion of demand for services. Therefore the goal will be achieved if the service and the application are reflected their characteristics for each use case. Hence I presented an IoT platform for healthcare and suggested to configure it with 5 components in this paper. Moreover this paper introduced REST APIs as an interface in the platform for interoperability with any service and device.

Keywords: IoT platform, healthcare, REST API, medical sensor device

1   Introduction

IoT (Internet of Things) is a currently advanced concept of ICT(information communication technology), in which all devices and services are collaborating while reducing human intervention for better human life [1]. The Gartner which is one of market research firms expected that IoT has been ranked in the top future promising technology. In addition, healthcare service is making the application and development of the currently most active IoT technologies [2][3]. Mobile healthcare service is currently more popular since healthcare service with computer was started using ubiquitous computing, but now, it will be paid attention to the next healthcare with wearable computer [4][5].

Current research of IoT technology, as shown by the case, such as Google Fit, is focused on the open IoT platform and its embedded device including sensors [6]. However, critical success factor of IoT is an explosion of demand for services. Therefore it is very important to develop a health service that provides a number of customized services to users on the open IoT platform [7]. In addition, Medical sensor devices such as glucose meter, and virtual medical sensor such as diabetes meter should be provided to users on the same platform.

Thus I propose the requirements for the design of the healthcare model to be offered on the open IoT platform as the healthcare service are provided to users or patients. Chronic diseases - hypertension, diabetes, obesity, etc - are necessary to effectively manage by using healthcare service application [8][9].

2 Requirements for Open IoT platform for healthcare

Google google fit, Apple healthkit, and Samsung SAMI are healthcare platforms. However, they are offering services differently each other, because there is no any standard specification for the IoT, as well as the direction to pursue each platform are different. This paper proposes the IoT Platform for healthcare as a suitable self-management model for chronic disease such as hypertension, obesity, diabetes, as shown as Figure 1. The proposed platform is comprised of 5 components. The first element is a medical sensor device to measure and send the medical data, and the second element is a virtual medical sensor which is a software sensor having an intelligent diagnosis algorithm and mashup data from various physical medical sensors and server. And the next component is a mobile application that is browsing medical data about patient or user from medical IoT device as well as using for self-management. The last component is a platform and its manager that enables all components to communicate with each other by using unified API.
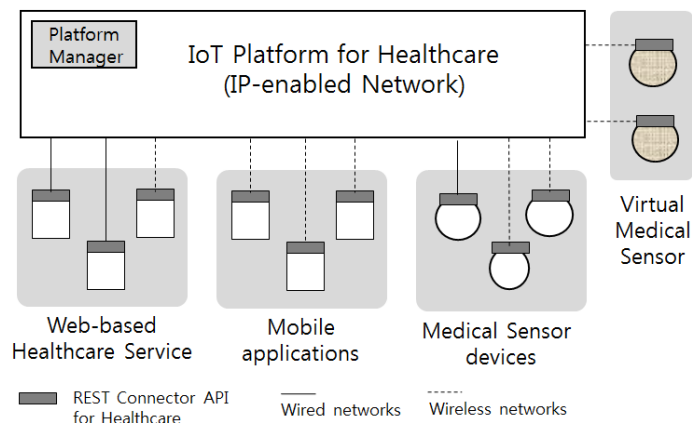

Fig. 1. IoT Platform architecture for healthcare service

2.1 Medical sensor device and virtual medical sensor

Medical sensor device such as blood pressure monitors and glucose meters connects physically to IP-enabled network by using IPv4 or IPv6 in order to use at home or medical office. In addition, mobile application is connected to any other devices and services using the REST (Representational State Transfer) API [10] on the platform. Identification and authentication are very important for a family to share and use medical sensor devices at home. NFC (Near Far Communication) is an outstanding network solution for authentication between user and device. Moreover, In order to support the mobility of the devices and services, it is more effective way that they connect directly to the IP network rather than connect to Zigbee gateway or Bluetooth gateway. New virtual medical sensor, such as virtual sensor for diabetes, increases the demand

for services. Virtual sensor is a kinds of software-based sensor on IoT platform [11]. For example, a doctor diagnose a patient' disease exactly after many risk factors are reviewed like gender, age, blood pressure data, glucose data, cholesterol, waist circumstance, HbA_{1c}, etc. These intelligent services can be available on the open IoT platform for healthcare because that they need to acquire and use some risk factors from devices and server.

2.2 Mobile application and service application

Mobile application provides a significant role of the user interface of the medical sensor device as well as information indication channel from the server at hospital. Service application provides information with a doctor to analyze and diagnose patient's disease as well as providing information with patient to inform his health condition. However, all medical information is stored in his own mobile device and hospital data server specified by the user, but not cloud server. Most users do not want to store their medical information in the cloud server because of privacy, as shown as the failed case, Google health service.

▪2.3 Platform manager for healthcare and REST API

It is very important for a platform to provide an open API as a unified manner to a number of devices and services, regardless of what network they have. However, IoT platform uses REST API as an interface as there is no standard for them to access to the platform. All devices and services including mobile applications access to the platform by REST API. It is a light weight interface of transferring information over reliable https network protocol in the IP-enabled network, so that small sized devices can use the API even if they have some constraints like low computing power and small memory capacity. In addition, the platform has functions which have service discovery, resource registration, access control, and authority control by platform manager.

3   Conclusions

It means that user can manage his own disease by himself as access to healthcare services in the platform for healthcare by using medical device after purchasing it at a market near his home. In order to provide the service more effectively, the IoT platform for healthcare is needed. Therefore, the paper presented the design requirements for the model to the platform. Several crucial components were identified and researched.

   A further study for virtual medical sensors in the platform and REST API to the devices and services will be carried out as the next step of research, and extension of the platform to provide how to access to other platform for interoperability will be developed.

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