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Application Protocol adapted to Health Awareness for Smart Healthcare Service

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Abstract. Previous UHD only holds a simple function of indicating the measurement data or sending it to the server. However, if another type of UHD can exchange mutual disease information and bring about a comprehensive assessment, then an accurate feedback can be provided on the condition of the patient. Therefore, this study enabled for UHD which based on IOT to recognize the relationship and risk factors between mutual diseases and suggested a smart U-Health service model that can provide intellectualized feedback to the patient. Additionally, collaboration protocol and intellectualized processing method which exchange risk factors between IOT was suggested.

Keywords: IOT, U-Health, application protocol, metabolic syndrome

1 Introduction

Up to this point, U-Health(Ubiquitous Healthcare) service was a model in which individual biomedical data was measured by a UHD (U-Health Device) and sent to the U-Health server to provide feedback to medical experts and patients. Accordingly, most researches were focused on the function of sending the measured biomedical data to the server [1][2].

As the concept of IOT (Internet of Things) was recently introduced, researches which attempt to apply the IOT model in different fields are being progressed [3]. If IOT technique is applied to U-Health, then UHD will break away from the simple functions of indicating measured data and sending them to the server and execute autonomous information exchange with neighboring systems (UHDs, gateway, server) and provide comprehensively assessed feedback immediately to the patient.

This study suggests a smart U-Health service model that can enable UHD to recognize the relationship and risk factors between mutual diseases and provide intellectualized feedback to the patient. In addition, suggestion is made for the flow of intellectualized processing essential during the modeling procedure and network application protocol needed for collaboration.

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2 Related researches

The metabolic syndrome refers to the condition where more than 3 amongst the 5 factors (glucose, blood pressure, obesity, triglycerides, HDL cholesterol) are above standard values [4][5]. Generally, states of diseases are assessed according to the degree of error of the measurement value in comparison to the normal range. When blood pressure is taken as an example, it is assessed as stage 1 hypertension when the measured systolic blood pressure (SBP) is over 140mmHg and the diastolic blood pressure (DBP) is over than 90mmHg [4]. However, in case of patients diagnosed with diabetes mellitus or chronic kidney disease, it should be assessed as stage 1 hypertension when they are over 130mmHg or 80mmHg, so that accurate assessment takes places when the fixed range is readjusted [4].

This displays how conducting comprehensive assessment on various risk factors instead of only the measured values during the stage of diagnosing the degree of disease will provide accurate information to the patient. Due to these reasons, the assessment procedure for hypertension gives comprehensive consideration to SBP, DBP, prevalence rate following the age and gender, the current state of personal disease (diagnostic results for obesity and diabetes mellitus), and family history as Figure 1[4]. But most medical sensor devices do not give comprehensive assessment.

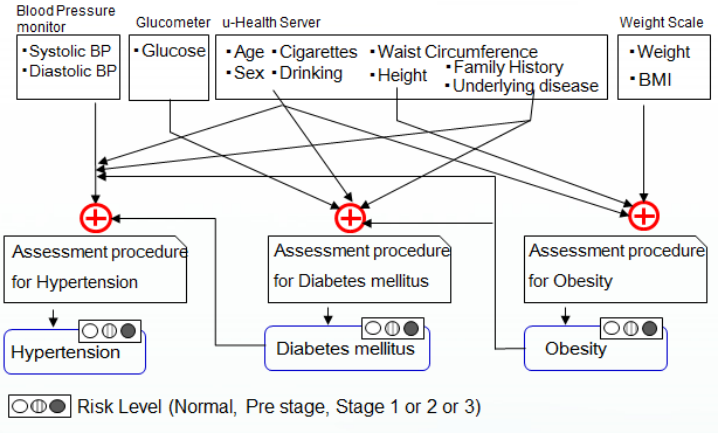

Fig. 1. Risk factors of Hypertension, Diabetes and Obesity

IOT is a conceptual model which provides service for human beings through things, which possess innate roles, maintain mutually autonomous collaboration system centered on the network and minimize human intervention [3]. IOT can be applied to different types of services, and common application service elements such as network access management, power management, identification management, and security management must be acquired [6]. Moreover, there are also specific application service elements of the thing. The service elements of device and network have recently become superior and user demands became diversified and these conditions brought the need of more intellectualized and distributed processing.

3 Intelligent application protocols adapted to awareness

Smart healthcare service model is a collaboration model which acquires risk factors needed for assessment from the network and reflects on them by real-time. Figure 2 defined the IOT based service model regarding the risk factors of 3 major metabolic syndromes. First of all, IOT_{XX} is represented as a device which enables connection to the IOT network and autonomous collaboration and the functions of each device was indicted as xx. In Figure 2, (a) is a specific representation of this. In terms of the blood pressure monitor (IOT_{BP}), only the measured blood pressure is not displayed. Instead, data on diabetes measured by the glucose meter (IOT_{GL}) and the data on obesity measured by the weight scale (IOT_{OB}) are requested to acquire the result. In addition to this, risk factors of the patient such as the gender, age, and family history are received by the u-Health server (IOT_{SVR}).

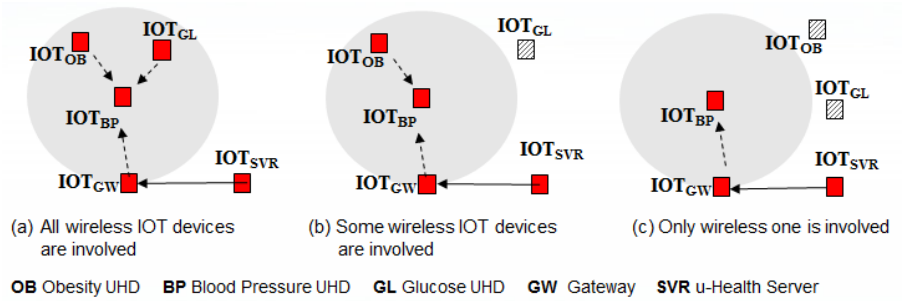

Fig. 2. Collaboration model between IOTs for the smart healthcare service

IOT_{XX} must collect essential information by real-time to effectively construct a collaboration model. In order to do so, seamless collaboration protocol is needed between each IOT_{XX} device.

The collaboration protocol is an application protocol which sends and receives risk factor information needed between IOT devices. In Figure 3, (a) displays an example of a protocol process in the case of (b) of figure 2. Once IOT_{BP} operates, Join message is broadcasted and make known to all devices in the network. During this time, IOT_{OB} and IOT_{GW} receive the Join message, but IOT_{GL} is not able to receive it. IOT_{BP} measures the blood pressure and sends the Data.Req message so that risk factors needed for assessment are gathered.

IOT_{OB} and $IOT_{GW,}$ which receive Data.Req message, send the Data.Ack message and the risk factor information of relevant patients stored by each device. In Figure 3, (b) represents the format of the messages used during the transmission process of (a). The number of message type is 5 in this protocol. 'Join' and 'Leave' were defined without 'Payload' in order to minimize the transmission overhead. In medical data type (M), classification was made between blood pressure, glucose, and obesity. The source address (S) and destination address (D) of the IOT device were defined in the message. The information collected in form of this protocol is applied to provide comprehensive consideration to the relationship between mutual diseases and risk factors.

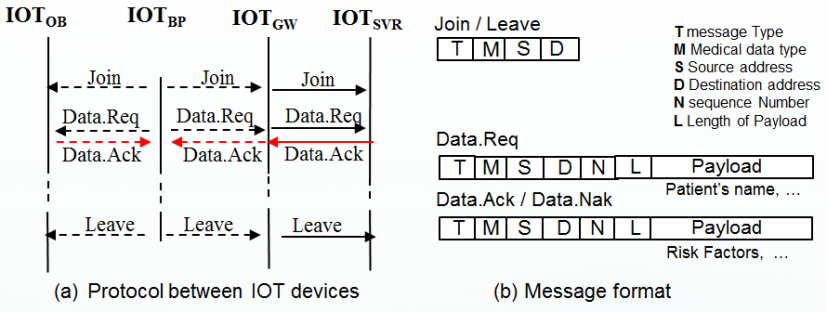

Fig. 3. Collaboration model between PHDs for the smart healthcare service

4 Conclusions

This study applied IOT technology to u-Health and suggested a smart u-Health service model where patients can immediately attain intellectualized and assessed feedback information from the device. Additionally, suggestion was made for an intelligent service model, which can give comprehensive consideration to various risk factors including the blood pressure, diabetes, and obesity data measured by the patient, as well as a collaboration protocol to give support to this. It was identified that comprehensive assessment management provide more clear information about the patient's state in comparison to simple assessment management and it was considered as an effective model applied for patients to autonomously manage metabolic syndrome.

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