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Mobile Cloud System based on EMRA for Inbody Data

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Abstract

Inbody is a tool for measuring health information with high reliability and accuracy to analyze body composition. Unlike the existing method of storing/processing and outputting data on the server side, the health information generated by InBody requires accurate support for health sharing and data analysis services using mobile devices. However, in the process of transmitting body composition measurement information to a mobile service, a problem may occur in data transmission/reception processing. The reason for this is that, since the network network in the cloud environment is used, if the connection is cut off or the connection is changed, it is necessary to provide a global service, not a temporary area, focusing on the mobility of InBody information. In addition, since InBody information is transmitted to mobile devices, a standard schema should be defined in the mobile cloud environment to enable information transfer between standardized InBody data and mobile devices. We propose a mobile cloud system using EMRA(Extended Metadata Registry Access) in which a mobile device processes and transmits body data generated in the inbody and manages the data of each local organization with a standard schema. The proposed system processes the data generated in InBody and converts it into a standard schema using EMRA so that standardized data can be transmitted. In addition, even when the mobile device moves through the area, the coordinator subsystem is in charge of providing access services. In addition, EMRA is applied to the collision problem due to schema heterogeneity occurring in the process of accessing data generated in InBody.

Keywords: *Inbody, Mobile Cloud, Extended Metadata Registry Access,0 Schema*

1. INTRODUCTION

Inbody is a tool that measures health information with high reliability and accuracy for analyzing body composition [1]. This health information generated by the inbody are unlike the existing method of storing / processing and outputs the data to the server side is needed to support accurate health data analysis and sharing service using a mobile device [2]. However, in the process of transmitting body composition measurement information to a mobile service, a problem may occur in data transmission/reception processing. In this case, because the network network in the cloud environment is used, the connection is disconnected or the connection is changed. Then, inbody information should be provided globally, not in a temporary area centered on mobility. In addition, inbody information is transmitted to the mobile device. For this reason, in the mobile cloud environment, it is necessary to define a standard schema and transfer information between standardized Inbody data and mobile devices [3]. In particular, two methods are used: linking through the Inbody cloud server and linking directly to the customer's system from the Inbody device. However, the system for grasping

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body information using Inbody has the following problems. First, body information collected through inbody from numerous users is transferred and analyzed in real time from each mobile device to a cloud server. In this case, since a large amount of body information is simultaneously processed, a traffic problem may occur. In the case of a mobile cloud associated with the mobile device, the wireless network is disconnected or changes may occur away from the transmitting and receiving of the physical information. In addition, inconsistency in processing or format of body information may occur due to performance problems of different mobile devices. A standardized service environment should be provided to solve this problem. In this paper, we propose a mobile cloud system using EMRA [4] in which a mobile device processes/transmits body information generated in the inbody, and internally manages the body information of each local organization with a standard schema. The components of this proposed system are as follows. It processes the body information received in the inbody environment and converts it into a standard schema using EMRA so that standardized data can be transmitted. This is a coordinator subsystem that manages mobile devices locally and stores the sensed body information. It also supports data transmission between local coordinator subsystems and manages user information, sensor information, and coordinator information. It is composed of mDBaaS system that supports standard schema of mobile device application and coordinator subsystem. Even when a mobile device moves across an area, information processed by the mobile device can be transmitted and stored in a standard format with the coordinator subsystem and mDBaaS system. Chapter 2 describes the system proposed in this paper, and Chapter 3 describes the application cases. Chapter 4 compares it with other systems, and finally, Chapter 5 describes the conclusion.

2. PROPOSAL SYSTEM

2.1 System Overview

Figure 1 of the system proposed in this paper is connected to the coordinator subsystem located in the moved area rather than the previous coordinator subsystem when the data generated in InBody is transmitted to the mobile device, that is, when mobility occurs.

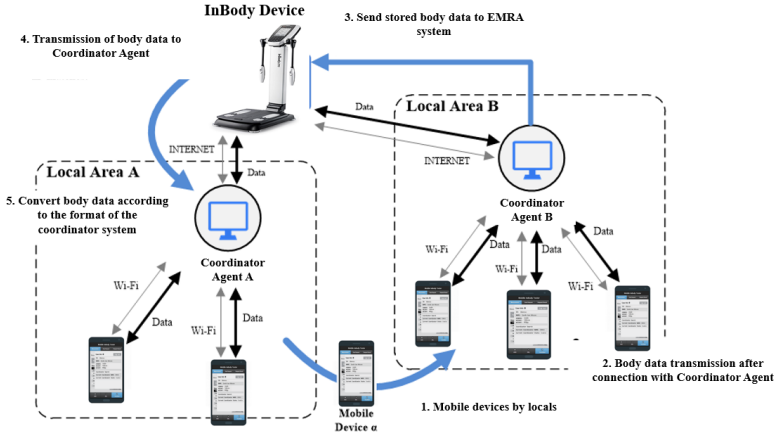


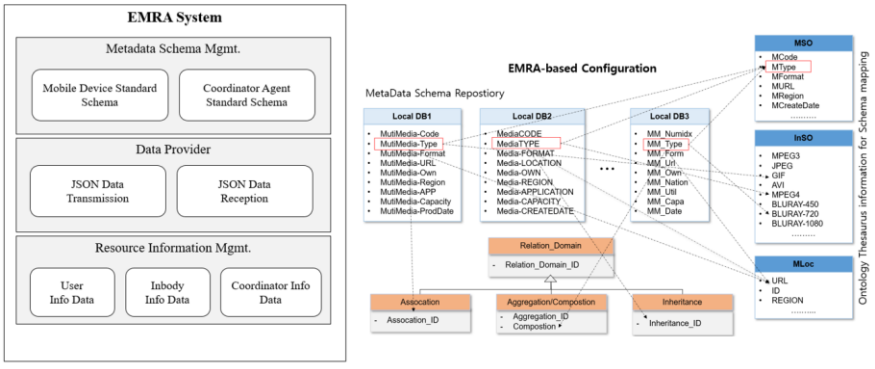
Figure 1. Proposal System Overview

Thereafter, the body data generated in the inbody was configured to be transmitted and received. In addition, the connected coordinator subsystem and EMRA system use the sensing data measured in the inbody, the sensor type, the received time, and the received coordinator subsystem ID as the coordinator subsystem in which the mobile device was registered. In addition, the user can receive a service with the moving path of the mobile device and the sensor type and measurement value used while moving. The proposed system of this paper provides an environment that can standardize the body data sensed by each inbody. Body data is collected

from a sensor measuring device attached to the body through the inbody, and filtering processing such as noise reduction is performed. And it converts to document-oriented data using DBaaS-based schema standard. The processed body data is transmitted to the coordinator subsystem for each region using Wi-Fi. The coordinator sub-system manages local mobile devices and monitors and stores body data transmitted to the mobile devices temporarily. Thereafter, the temporarily stored body data is transmitted to the proposal system so that it can be returned to the corresponding coordinator subsystem. The format in which transmitted body data is temporarily stored is defined in EMRA-based standards. During this process, the coordinator subsystem ID of the information registered in the mobile device matches the ID of the currently located coordinator subsystem. And it stores body data in the coordinator subsystem. The proposal system stores user information, sensor information, and the coordinator subsystem identifier of the registered location in the process of registering the mobile device. In addition, in order to solve the problem of heterogeneity in the structure of DB schema between heterogeneous sensor devices and organs of body data, an internally standardized schema format is defined and distributed to the application. In this paper, a mobile cloud-based EMRA system, a coordinator subsystem, and a series of processes using mobile devices are defined as a platform, and PaaS and DBaaS services will be available.

2.2 EMRA Components

The proposed system in this paper registers each mobile device to process the data generated in the inbody, and provides distribution and update of files for installation. In addition, it supports transmission and reception of body data using JSON type, and relays body data transmission between coordinator subsystems. In addition, it supports the standard schema required for registration of new mobile devices and coordinator subsystems. In this paper, using EMRA (Extended Metadata Registry Access), Figure 2 (b) applied to the inBody Interworking System, processes can be efficiently operated in collaboration in the intelligent cloud. The concept defined in the existing XMDR-DAI [5, 8] does not consider the relationship between classes, and only the mapping definition type corresponding to each schema heterogeneous conflict is provided. In other words, since it does not reflect various relationship information between classes defined in XMDR-DAI, additional cost is required when users want to access data from various classes. Figure 2 EMRA is a metadata model that includes classes defined in XMDR-DAI and inheritance relationships of classes. MSO_Item inherits MetadataSchema_Item, and InSO_Item and MLoc_Item are subclasses of MSO_Item. As such, various relationship information is defined in XMDR-DAI. However, in XMDR-DAI, the concept element of the meta-model, that is, the class is mapped (imagined) to one user-defined type, but the method of handling the relationship between classes was not designed. EMRA is designed by adding nested structure type and association-relationship processing in the existing XMDR-DAI.



(a) EMRA system component (b) EMRA configuration

Figure 2. EMRA System Components

Figure 2 (a) is the configuration diagram of EMRA system. This proposed system consists of Resource Information Mgmt, which manages information of mobile devices and coordinator subsystems, BNS Data Provider, which manages relay between coordinator subsystems, and Metadata Schema Mgmt., which manages registration of mobile devices. The functions of the components are as follows.

- Resource Information Mgmt. Resource Information Mgmt: Manages body information of mobile devices, inbody information used, and coordinator information. It manages the coordinator ID and location information of each user necessary to return the body data in JSON format received from the local coordinator subsystem to the registered coordinator subsystem.

- InBody Data Provider. The physical data relay role between the local coordinator by the subsystem. The body data in JSON format received from the coordinator subsystem is returned to the registered coordinator subsystem using the coordinator ID of Information Management.

- Metadata Schema Mgmt. Manages registration of mobile devices and coordinator subsystems. It supports distribution and update of application installation files for new mobile devices. Provides the standard schema required for the construction of a new coordinator subsystem. In the process of requiring registration of a new mobile device and coordinator subsystem, it is possible to build an environment using this standard schema of Metadata Schema Mgmt.

- Inbody Data Provision. It manages the transmission and reception of body information, inbody information, and coordinator information database stored in Information Management.

- User Info Data. Stores mobile device user information. This is a data format that is stored in the process of registering a mobile device in Registration Management. user_id is the ID of the user and is defined as a unique key, android_id is the Android ID of the mobile device, coord_id is the ID of the registered coordinator subsystem, and sensor_id is the ID for sensor information. coord_id is defined as a foreign key of coordinator information, and sensor_id is defined as a foreign key of sensor information. Finally, user_name consists of the user name. The stored data type is a character string.

2.3 Principle of Operation System

Figure 3 is the overall operation process of Inbody Data Management. As a core component of the coordinator subsystem, it manages body data in JSON format received from mobile devices. And when the mobile device that has moved to the area transmits body data, the transmitted data is registered as a temporary file and transmitted to the EMRA system according to the request. The description of the operation process is as follows.

(1) The body data created in InBody is transferred to Provison Manager and stored in Data Storage. (2) is collected in Collection when body data in JSON format is transmitted from an application of a mobile device. The branch is divided by identifying the registered coordinator subsystem ID of the collected JSON format body data. (3) saves BSN data in JSON format in which the registered coordinator subsystem ID does not match in a temporary file. (4), (5) adds the ID of the coordinator subsystem where the JSON-formatted BSN data stored in the temporary file is received and is transmitted to the EMRA system, and the transmitted body data is the registered coordinator subsystem ID and the coordinator subsystem stored in the EMRA system. It is returned to the corresponding coordinator subsystem using the information. If the registered coordinator subsystem ID and the coordinator subsystem ID of the received location match, (6), (7), and (8) convert body data in JSON format using metadata into local data format. And the converted local data is stored in the data storage of the coordinator subsystem. (9) provides services to users with local data stored in the data storage of the coordinator subsystem.

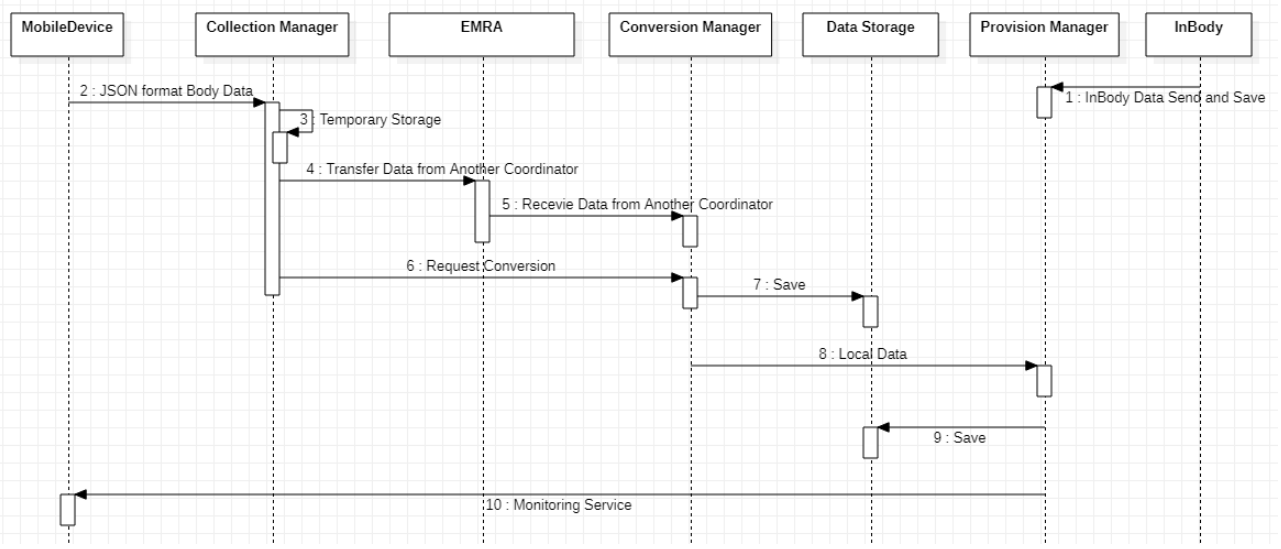


Figure 3. Sequence Diagram

3. RESULTS

InBody measurement information for people's health management is as follows. The service function of the mobile device interface for the subject's health management is as follows. The first interface of Figure 4 is the appearance of outputting and checking the processed inbody data as a list. In the list, inbody sensor type, measured value received time, and inbody sensor unit are recorded, and they are sorted in descending order based on the received time. If you click the list button in the upper right corner, information about the person who has logged in is displayed. In addition, it is possible to check whether the mobile device is connected to the coordinator subsystem and information on the currently connected coordinator subsystem. The second interface is the user information confirmation and connected coordinator information screen. You can see that the user of the current khy0770 is connected in the CD002 area.

Figure 4. Apply Interface

4. COMPARISON WITH OTHER SYSTEMS

Table 1 shows the qualitative comparison and evaluation of our proposed system with similar proposed systems, BodyCloud [6] and Mobile Cloud [7].

Table 1. Comparative Evaluation of The Proposed System and Other Systems

Compare	BodyCould	Mobile Cloud	Proposal System
Data Interoperability	XML standard schema definition and same interface provided	XML standard schema definition and metadata schema provided	JSON format meta schema definition based on mXMDR-DAI
Device Mobility	Sensor data collection possible through mobile devices	Sensor data collection possible through mobile devices	Data collection and processing between mobile devices using a location-based coordinator agent
Cloud Configuration and Service Method	Provides monitoring service to information processed by integration in the sensor data server to smart devices	Provides monitoring service to information processed by integration in the sensor data server to smart devices	Sensor data processing through location-based coordinator subsystem and integrated sensor data service between coordinator agents in mXMDR-DAI server

5. CONCLUSION

In this paper, we proposed a mobile cloud system using EMRA in which a mobile device processes and transmits body data generated in InBody, and manages the data of each local organization with a standard schema. The proposed system processes the body data generated in InBody and converts it into a standard schema using EMRA so that standardized data can be transmitted. Even when a mobile device moves through an area, the coordinator subsystem is in charge of providing access services, and ERMA is applied as a solution to schema heterogeneity occurring in the process of accessing data generated in InBody. In addition, the body information received in the in-body environment is processed and converted into a standard schema using EMRA so that standardized data can be transmitted. This is a coordinator subsystem that manages mobile devices locally and stores sensed body information, supports data transmission between local coordinator subsystems, manages user information, sensor information, and coordinator information, and is a standard for applications and coordinator subsystems of mobile devices. It is composed of an EMRA system that supports the schema. By using this, even when the mobile device moves locally, the information processed by the mobile device can be transmitted and stored in a standard format through the coordinator subsystem and the EMRA system. However, environmental infrastructure that can provide standardization process and monitoring in terms of large-scale inbody data, that is, big data, has not been provided. In the future, there is a need for research on technologies that process inbody big data and provide analysis and services in a cloud environment.

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