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A Study of Data Interoperability System using DBaaS for Mobility Handicapped

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Abstract

As the number of "Mobility Handicapped" increases, the incidence of "Mobility Handicapped" traffic accidents is also increasing. In order to reduce the incidence of traffic accidents in the "Mobility Handicapped", a service providing system for "Mobility Handicapped" is required. Since these services have different data formats, data heterogeneity occurs. Therefore, the system should resolve the data heterogeneity by mapping the format of the data. In this paper, we design DBaaS as a mobility handicapped system for data interoperability. This system provides a service to extend the flashing time of the traffic lights according to the condition of "Mobility Handicapped" on the occurrence of a fall or a crosswalk in a crosswalk where there is a risk of a traffic accident. These services can reduce the incidence of traffic accidents in "Mobility Handicapped".

Keywords: *DBaaS, Cloud Computing, Smartphone, Mobility Handicapped, Sensor*

1. Introduction

Recently, the number of "Mobility Handicapped" has been increasing due to the aging of Korea[1,2]. In general, "Mobility Handicapped" means a person who is restricted from moving for physical, institutional, or social reasons. "Mobility Handicapped" is slower than ordinary people, and the incidence of traffic accidents is higher than that of the general public. In 2014, about 50% of the fatalities of pedestrian traffic accidents are elderly and children[3]. In order to reduce traffic accidents in such "Mobility Handicapped", it is necessary to provide a system for providing service for "Mobility Handicapped".

In Korea, "Wireless Marker", "RFID tag" and "Voice Guide for Visually Impaired People" are services for "Mobility Handicapped"[4,5]. "Green Plus" in Singapore and "Pedestrian Detectors" in the United States are examples of offshore cases[6]. In this case, only the service specified by each system is provided. Therefore, a system for overseeing these services is needed.

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However, since the type of database managed by each institution differs, it is necessary to rebuild the database in order to link other institutions[7]. This requires a lot of time and money. In addition, interoperability, security, and data heterogeneity can occur[8]. To minimize this, we propose a data interoperability system based on DBaaS(Database as a Service).

As defined in this paper, "Mobility Handicapped" is elderly person, physical disability person, infant. We propose a collaborative system to extend the pedestrian 's pedestrian signal for the "Mobility Handicapped" and detect the danger signal such as falls, and to transmit the medical condition and medical condition information to the emergency center. In this system, Fog Server is installed in the traffic lights of the crosswalk to provide sensor data, confirmation of "Mobility Handicapped", traffic lights, and Geofencing Service. The "Mobility Handicapped" data is registered in the database before the service is provided. Sensor data of "Mobility Handicapped" is stored in the database by the DBaaS Mediate Manager. Mediate Manager has data access, sharing, extraction, and store functions. DBaaS also has mapping data by requesting schema information and instance information of each medical institution and emergency center. When the system detects a fall or a danger signal, DBaaS maps the transportation weak information to the emergency center and the nearby hospital in the HL7 format, which is a medical information standard, to resolve heterogeneity and interoperability problems.

The composition of this paper is as follows. Section 2 describes DBaaS and Geofencing Service as a related study. Section 3 describes the overview and flowchart of the proposed system. Section 4 describes the system application examples. Section 5 describes the conclusions and supplements of the system.

2. Related Works

2.1 DBaaS

In order to develop a system for collaboration among multiple companies, it is necessary to reconfigure the database[7]. However, reconfiguring the database is expensive and time-consuming. To solve this problem, DBaaS is proposed as one of cloud computing technologies[8]. This effectively uses a database that is designed differently for your application. In other words, there is no need to reconfigure the database or system again, reducing time and money.

2.2 Geofencing Service

Geofence is a compound of "Geo" and "fence" with the meaning of "earth" and "soil"[9]. Geofences divides a specific area and provides services to users in that area[10]. Since Geofences provides services based on the user's location, it requires to collect sensor data such as GPS data and locate the user. The main application area of the geofence service is notification service such as event notification using IoT.

3. Design of Proposed System

3.1 System Overview

Figure 1 shows the architecture of the proposed system. Client Layer, MoH(Mobility of the Handicapped) Layer, DBaaS Layer, and Service Provider. The Client Layer consists of devices that collect sensor data for use in this system. MoH Layer consists of ADL Manager which collects and classifies sensor data, and MoH Manager which distinguishes MoH. The MoH Layer collects the acceleration sensor and GPS sensor data when it reaches the acquisition range, and at the same time confirms the "Mobility Handicapped Code". In

the case of "Mobility Handicapped", the signal light controller extends the walking signal according to the "Mobility Handicapped Class". The ADL Manager uses accelerometer data and GPS sensor data to recognize falls in "Mobility Handicapped". If a fall is recognized, it is stored in the database via DBaaS. Mediate Manager stores, extracts, accesses, and shares data from the database. Data Integrate Manager resolves the conflict between metadata information and sends it to the service provider. Service Provider provides services according to data.

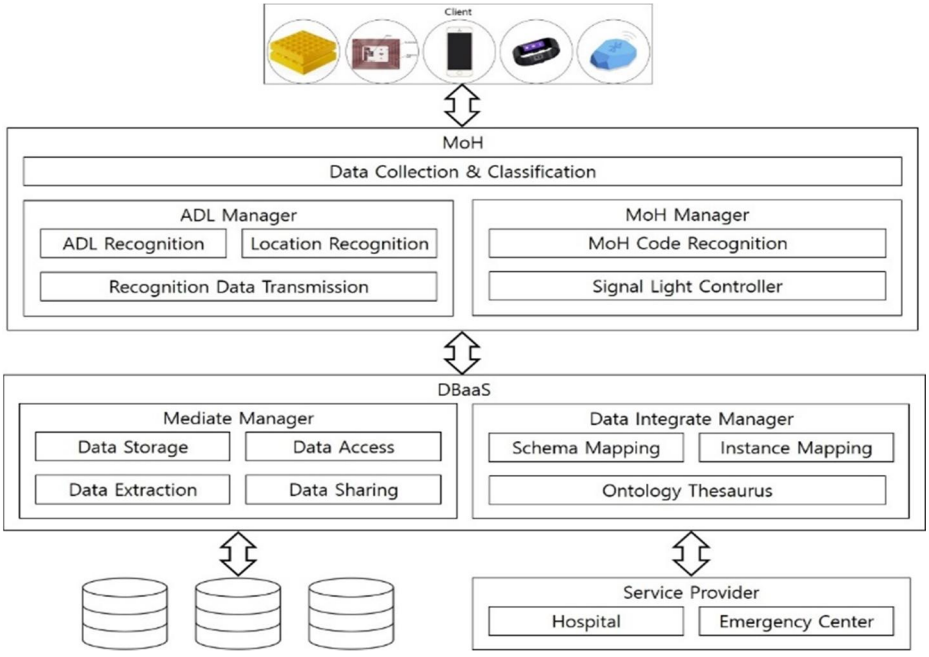

Figure 1. System Architecture

3.2 System Flow

3.2.1 Data Processing & Storing

The system collects and processes smartphone, wearable device sensor data and mobility handicapped information to provide mobility handicapped service. Figure 2 shows the operation of the client-layer sensor data stored in the database and extending the walking signal. ① is the process of collecting sensor data. ② is the process of transmitting collected data to Collected Data Classification to sort according to sensor type. ③ is the process of transmitting classified data to ADL and MoH. ④ is the process of requesting DBaaS Data Sharing to check whether the information confirmed by MoH is stored in database. ⑤ is a process of requesting data access to access data, and ⑥ is a process of accessing and responding to a database. ⑦ is a process of requesting Signal Light Controller to extend the walking signal according to the grade when it confirms "Mobility Handicapped Code". ⑧ is the process of filtering fall data only in the behavior data and location information recognized in ADL Recognition and Location Recognition. ⑨ is the process of requesting Data Sharing to store Falling data in database. ⑩ is the process of requesting data storage. ⑪ is the process of making an access request to store the transferred data in the database, and ⑫ is the process of storing it in the database.

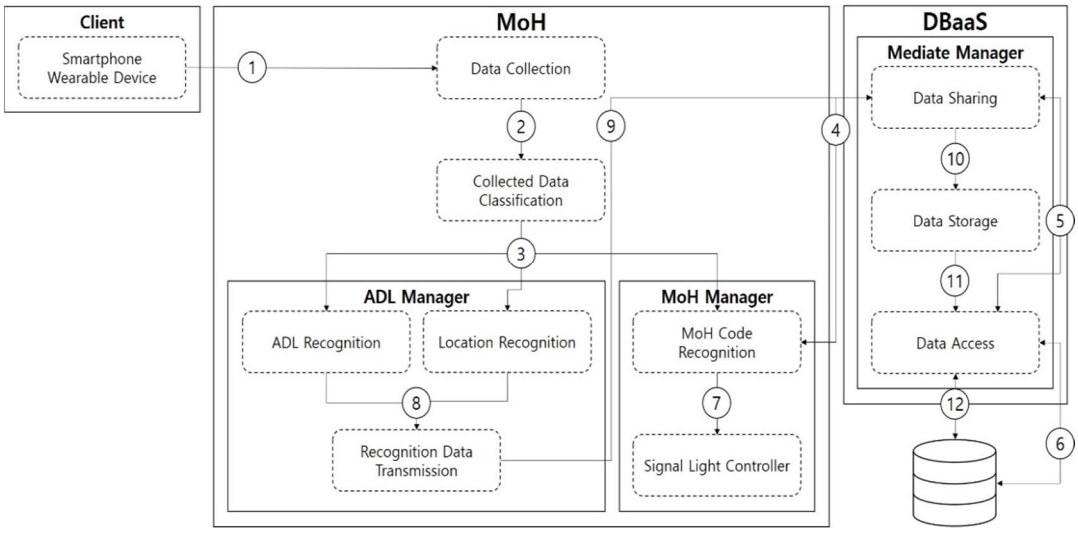

Figure 2. System Flowchart Ⅰ

3.2.2 DBaaS Flowchart

Figure 3 is a flow chart of the data stored in the database processed by DBaaS and transferred to the service provider. ① and ② are the process of requesting and responding to the schema standard and instance standard data to the Data Mapping Manager. ③ is the process of sending a request to access the data. ④ is a process of accessing database and requesting data. ⑤ is the process of extracting requested data and sending it to Data Extraction. ⑥ is the process of sending the requested data to Data Sharing to share. ⑦ is the process of transmitting the mapped data to the service provider.

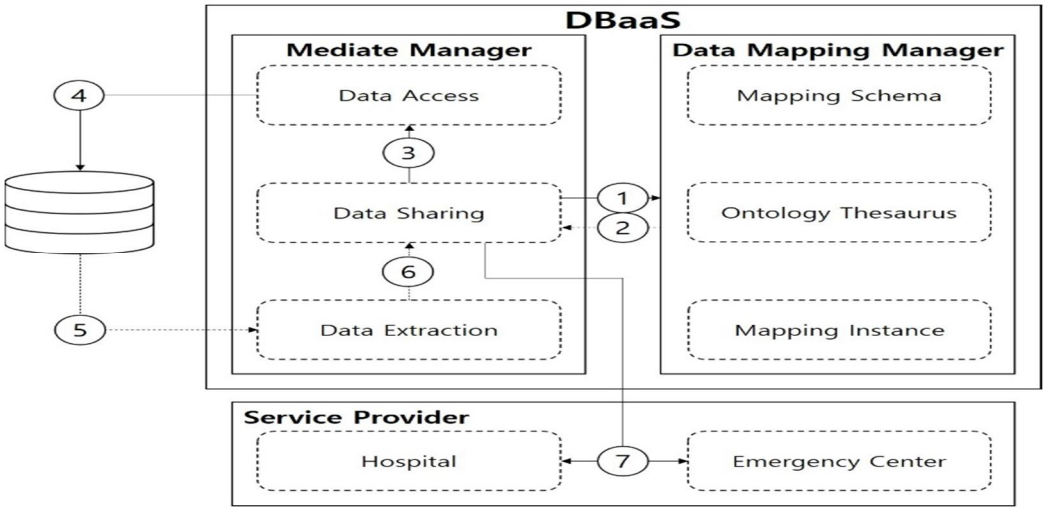

Figure 3. System Flowchart Ⅱ

4. Example of Proposed System

4.1 System Scenario I

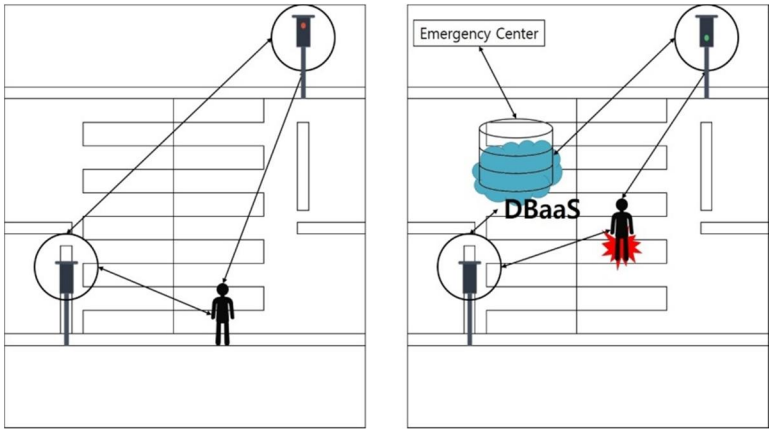

Figure 4. Example of System I

Figure 4 shows an example of the application scenario of the proposed system in this paper. This system is divided into Client Layer, Fog Server and DBaaS Layer. The Client Layer refers to a smartphone of Mobility Handicapped. Fog Server consists of Raspberry PI and MoH Layer. The DBaaS Layer refers to the server. Each traffic light serves as a Fog Server and collects Mobility Handicapped information and sensor data via Bluetooth. When the mobility handicapped is near the pedestrian crossing, it extends the walking signal according to the state of the mobility handicapped. In Fog Sever, the walking signal is extended by calculating the extension time according to the Mobility Handicapped Code. Also, if the Mobility Handicapped falls on the pedestrian crossing, the mobility handicapped information and fall data stored in the database are mapped to the medical standard HL7 through the DBaaS, and the notification message is transmitted to the nearest emergency center and the hospital.

4.2 System Scenario II

Figure 5 shows the scenarios in which the vehicle is notified when the signal of the traffic lights is extended. The notification service uses the geofencing service in the Fog Server to broadcast to the operator's navigation or smartphone within the service area. This facilitates traffic flow by informing the driver before delaying the walking signal.

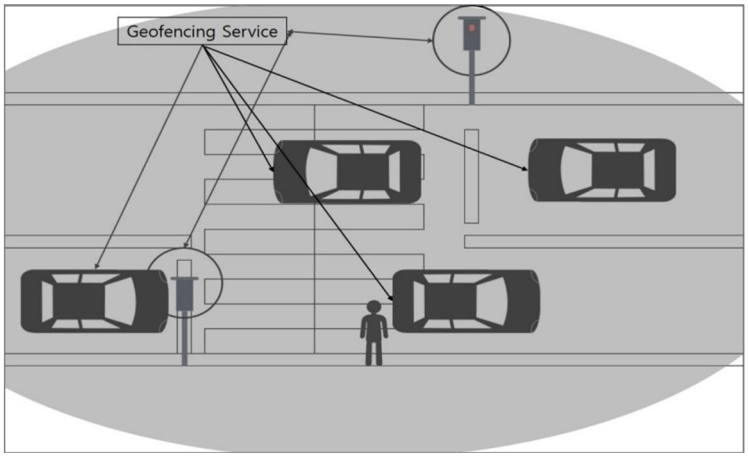

Figure 5. Example of System II

5. Conclusion

In this paper, we propose Mobility Handicapped System to prevent traffic accidents on crosswalks and to provide a notification service in case of a dangerous situation because the walking speed of Mobility Handicapped is slower than that of the general public. In Mobility Handicapped systems, when sending notification messages to emergency centers and hospitals, data heterogeneity problems arise because of the different schema and instance data formats for emergency centers and hospitals. To solve this problem, we designed a data interoperability system based on DBaaS. DBaaS maps the data stored in the database to medical standard HL7 and transmits it. This saves the cost and time to modify and reconfigure the database for each institution.

In the future, we will study the falling algorithm for more accurate fall recognition. Also, we will expand the system so that traffic flows smoothly by introducing deep learning.

Acknowledgement

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