

Design and implementation of heterogeneous sensor set-top box system using embedded middleware

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Abstract. This paper developed a heterogeneous sensor set-top box which processed data collected in heterogeneous sensor and RFID reader as the development of information transmission media relating to RFLD/USN. It was made possible to be promptly applied to a client by reporting data in a user-defined format after accumulating and filtering data collected in a heterogeneous sensor and RFID reader.

Keywords: RFID, middleware, embedded middleware, set-top box, terminal, heterogeneous sensor

1 Introduction

Interoperability technology in home network means a technology that enables mutual recognition•control•monitoring between arbitrary home network devices which exist in the home. At present, with regard to home network, various sensor networks such as entertainment network and appliances control network coexist with heterogeneous networks and devices in the environment where various technologies thrive. We need a technology that can integrate these in an actual condition of an increase in needs for providing interoperability between devices based on these heterogeneous networks and middleware [1].

Middleware controls various sensors and collects data, using various protocols from sensor. Besides, collected and unprocessed data, and shall basically carry out a function of transmitting the information to application service [2, 3]

Data collected in heterogeneous sensor and RFID reader can be promptly applied a client by reporting the accumulated and filtered data in a user-defined format in this system regardless of what hardware generates the data and how the data is processed.

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2 Related studies and technologies

2.1 RFID/USN software technology

We need a middleware function that can connect RFID/USN hardware to application or enterprise system, that is to say, RFID/USN software technology in order to easily establish an ubiquitous application service[4].

RFID/USN middleware shall have ability to filter a large amount of data collected in a large number of heterogeneous RFID/sensor devices, and to process event data, and then to summarize meaningful information, and to transmit the information to a service system[4].

The following is required in order that RFID/USN technology is effectively utilized in application field. We shall organically establish RFID tags attached to things in order to identify each thing, a RFID reader to recognize these, and RFID/USN software that can provide useful information service to an application after processing the data collected from sensor devices [5].

2.2 RFID/USN middleware

Sensor Edge Server[6] of Oracle is a sensor-based service integration platform which supports functions such as data collection, event handling, and data dispatching. It is possible to extract data which an application requires by using a filter in advance. And in case of intending to process more complicated data, it is possible to prepare a logic filter personally.

TagsWare[7] of CapTech consists of links to send RFID tag data to applications, drivers as a standard interface between RFID devices and applications, and base components which enable application to use links and drivers.

UBiCore system of ERTI is a XML-based middleware system, and controls various sensors, and provides a XQuery-based continuous query language called XQueryStream.

3 Design of suggested system

3.1 System configuration

An embedded middleware system designed in consideration of scalability and stability was mounted so as to effectively collect data from RFID reader and various heterogeneous sensors. It is possible to more easily connect diverse information with a service provided for an administrator by using this system. And it is possible to control sensors and devices without any difficulty by making the system equipped with various communication protocols and external interfaces.

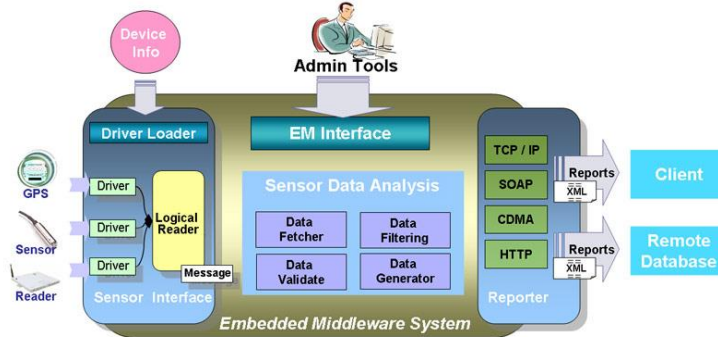


Fig. 1. Embedded middleware system configuration

4 System implementation

4.1 Major interface window

4.1.1 Development of heterogeneous sensor and RFID reader control module in the form of GUI

First of all, a reader shall be physically connected in order to register the reader. Functions are implemented so that reader can be registered in the middleware in the following order as shown in <fig.2> and <fig.3>.

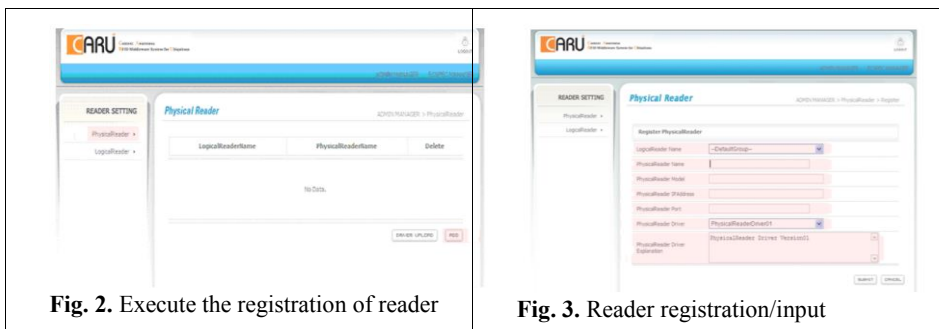


Fig. 2. Execute the registration of reader

Fig. 3. Reader registration/input

4.1.2 Data collection standard protocol and processing module development

- We decided that collected data standard should be XML format, and standardized data, and implemented a function of defining the collected information so as to be standard.

Table 1. Standard XML format

```
<EdgeMessage>
  <Tag> <SensorID>111</SensorID><Antenna>0</Antenna>
  <ReadTime>2013-04-2211:08:40.343</ReadTime>
  <TagID>0000 0000 0000 0000 0000 ABCD</TagID></Tag>
  <Tag><SensorID>222</SensorID><Antenna>0</Antenna>
  <ReadTime>2013-04-2211:08:40.399</ReadTime>
  <TagID>0000 0000 0000 0000 0000 ABCD</TagID></Tag>
</EdgeMessage>
```

- It is function of defining the connected RFID data in advance so as to process the data in order that the collected RFID data can be utilized as diverse information in the middleware core. And we implemented the function so as to enable the easy use of the collected information required in various applications.

5 Conclusion

This paper developed heterogeneous sensor set-top box system which processed data collected in heterogeneous sensor and RFID reader as the development of information transmission media relating to RFID/USN. It was made possible to promptly apply data collected in heterogeneous sensor and RFID reader to a client by reporting the accumulated and filtered data in a user-defined format in this system regardless of what hardware generated the data and how the data was processed

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