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Sensor Web based on Multiple Interface for Public Environmental Surveillance

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Abstract

The Sensor Web is an emerging trend which makes various types of web-resident sensors, instruments, image devices, and repositories of sensor data, discoverable, accessible, and controllable via the World Wide Web. Accordingly, in this paper, we present open Sensor Web using multiple interface between user and application layer using SOAP, TCP and HTTP for public environmental surveillance. The proposed Sensor Web provides support to send sensing data to users in wireless sensor network. We provide the sensor information service, data statistic area service, real time data monitoring service, and data category service.

Keywords: Environment Surveillance, Multi Interface, Sensor Web

1. Introduction

Recently, sensors have been increasingly applied such as monitoring environment for weather forecasting and wildfire detection, traffic monitoring, and earth and space observation. The Sensor Web provides to facilitate the remote gathering, sharing and analysis of physical data in sensor networks. The Sensor Web is designed to store, manage and provide sensing data on the basis of sensor network for users on the internet. A lot of effort has been invested in order to overcome the obstacles associated with connecting and sharing these heterogeneous sensor resources[1–3].

The Sensor Web standard defined by the Open Geospatial Consortium (OGC), that we call the Sensor Web Enablement (SWE)[4]. The SWE has a number of standards that define formats for sensor data and metadata as well as sensor service interfaces. SWE consists of a set of standard services to build a unique and revolutionary framework for discovering and interacting with web-connected sensors and for assembling and utilizing sensor networks on the Web.

Sensor Map is a portal web site for real-time real-world sensor data. The Sensor Map at Microsoft Research aims to address these challenges by providing a research web portal and a set of tools for data owners to easily publish their data and users to make useful queries over the live data sources[5].

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The rest of this paper is structured as follows. In Section 2, we detail the related work of the Sensor Web.

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In Section 3, we describe our proposed Sensor Web architecture.

2. Related work

The Open Geospatial Consortium (OGC) develops the geospatial standards that will make the sensor web vision a reality. OGC have been centered to research sensor web so far. The sensor web concept is at least one generation beyond the popular sensor network, which is a relatively straight forward interconnection of sensors that route measurements to a central data collection point. OGC suggests open sensor web structure in which sensor web research based on sensor network. There are five specifications suggested, and two of the specifications are sensor ML (sensor model language) and O&M (observation and measurement) in terms of XML data specification. The other three specifications suggest SCS (Sensor Collections Service), SPS (Sensor Planning Service) and WNS (Web Notification Service) in terms of behavior specification. Open sensor web structure which suggested by OGC is shown in Figure 1 below[3].

Recently, the semantic web was introduced for automated programs or agents as well as humans to read and process documents on the web and produce the knowledge from the information. Agents' understanding of a web document is quite different from that of human. Since agents such as computers have no imagination, it is impossible to teach them words expressing emotions.

3. A Proposed Sensor Web Architecture

We suggest Sensor Web architecture based on GIS for reactive environmental monitoring. Figure 2 shows how the client can be used in order to achieve real-time sensing data using search functionality. This architecture is composed with Sensor Web server, manager server, and service object clients. The Sensor Web server provides Web-based GIS using Smart client technology. And then map data is served as a form of xml for web service. We transfer map data and sensor data through the database using HTTP protocol for communicating between server and client.

Also, we provide multi-user sensor information service, time sensing data statistic, real-time sensor data information, and sensor information searching. As shown in Figure 3, we show proposed Sensor Web Interface between user and application layer using SOAP and HTTP to support multi-user for public environmental surveillance.

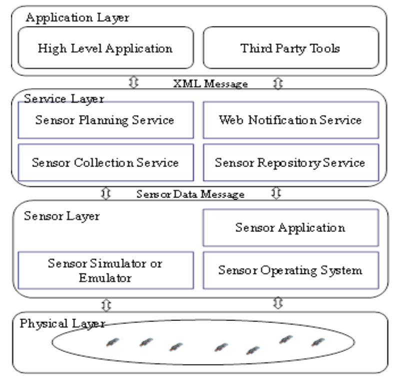

Figure 1. OGC's Open Sensor Web Structure[3].

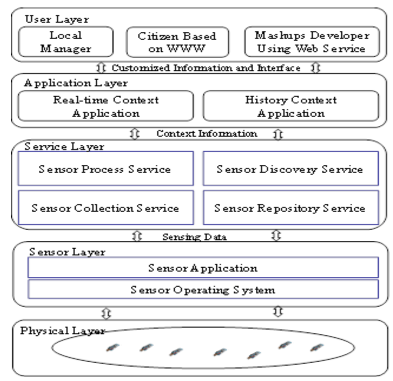

Figure 2. Proposed Sensor Web Architecture based on GIS.

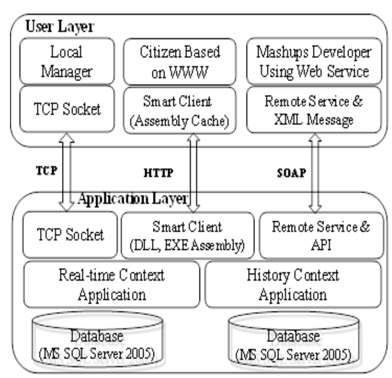

Figure 3. Proposed Sensor Web Interface using SOAP and HTTP.

4. Implementation of Proposed Sensor Web

We implement integrated sensor and actuator middleware in C# based on NET Framework. And we use MS-SQL 2005 as a database for data backup and Windows XP Professional MSMQ (Microsoft Message Queue) as a message queue. As a test environment, we implement virtual actuator control application and construct to generate control messages to actuator depending on aggregated sensing data temperature value, and sending to actuator control application. Figure 4 shows hardware of the sensor node which acquires context data. A single sensor node may have multiple hardware sensors and collects various context information.

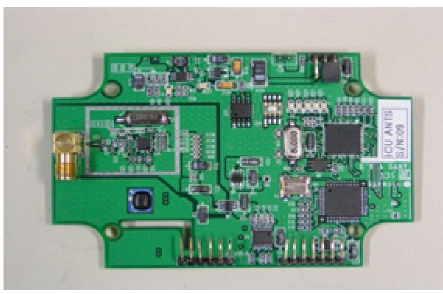

Figure 4. Hardware of Sensor Node.

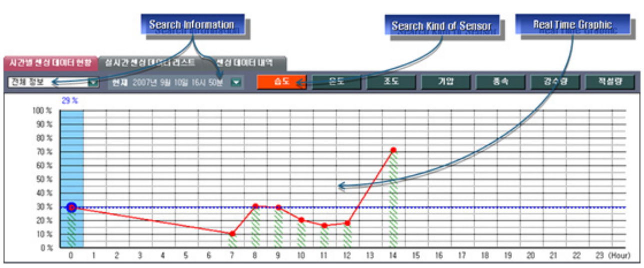

Figure 5. Hardware of Sensor Node.

Figure 5 shows an example of sensing data in sensor networks. This support the sensor information service, data statistic area service, real time data monitoring service, and data category service.The experiment resultshowdata statistic area service using context data as shown in Figure 5. These results are temperature, humanity, illumination, wind speed, air pressure in the sensor node in the graph.

5. Conclusion

Recently, sensor network is utilized to play a role in the implementation of an outdoor observation system or surveillance service. This paper presented Sensor Web using multiple interfaces between user and application layer using SOAP, TCP and HTTP based on multi-user for public environmental surveillance. Proposed Sensor Web has been implemented using. Net technologies to collect data from physical sensing devices. It can be concluded from the results that this Sensor Web can be useful for connecting physical sensor to internet in order to provide environment monitoring service.

6. Acknowledgement

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