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Spatio-temporal Query Processing Systems for Ubiquitous Environments

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Abstract

With the recent development of the ubiquitous computing technology, there are increasing interest and research in technologies such as sensors and RFID related to information recognition and location positioning in various ubiquitous fields. Especially, RTLS (Real-Time Locating Services) dealing with spatio-temporal data is emerging as a promising technology. For these reasons, the ISO/IEC published RTLS standard specification for compatibility and interoperability in RTLS. Therefore, in this paper, we designed and implemented Spatio-temporal Query Processing Systems for efficiently managing and searching the incoming Spatio-temporal data stream of moving objects. Spatio-temporal Query Processing Systems's spatio-temporal middleware maintains interoperability among heterogeneous devices and guarantees data integrity in query processing through real time processing of unceasing spatio-temporal data streams and two way synchronization of spatio-temporal DBMSs. Web Server uses the SOAP(Simple Object Access Protocol) message between client and server for interoperability and translates client's SOAP message into CQL(Continuous Query Language) of the spatio-temporal middleware.

Keywords: *Ubiquitous, Spatio-temporal Data Stream, Spatio-temporal Query Processing Systems, CQL*

1. Introduction

Recent development of location positioning technology, wireless communication technology, using the location services increases, and the location information of moving objects in real-time location services technology for service research has been actively conducted.

In real-time location tracking service to provide efficient services from RFID tags on the ever-reliable processing the incoming data stream is required. However, existing real-time location tracking service for application services primarily focused on features because these data streams is due to a significant increase in system load. Thus, the data stream can be processed efficiently and reliably in the data stream processing capabilities are required. And existing real-time location tracking service provides location services for a variety of space-processing needed because the lack of space, a lot of data processing operations costs occur. Thus, the real-time location tracking service to provide efficient support for a variety of space-time operator

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is required [1]. In this paper, Spatio-temporal query processing system which provides an efficient management and search about Spatio-temporal data stream of moving objects is designed and implemented.

2. Related Works

In International Standardization Organization ISO / IEC, assets or people in a given space by attaching RFID tags for real-time location and status of each moving object data, a system designed to monitor and correlate data on the heterogeneous platform to ensure interoperability standard Specification for real-time location tracking service is proposed [2].

QueryName element, defined in Query schema, specifies the name of the query to RTLS and FilerBy element specifies the search criteria. Fields element specifies the name of the TagBlink field and makes to be input to the RTLS retrieve only the necessary fields to be able to read, and SortBy element specifies the sort order of the retrieved TagBlink and decides the sort order based on the selected field from the Fields element.

OpenSession creates a new session in the RTLS, stores the searched object's status and location data in the session, and delivers the created session to the client. Finally, CloseSession is the session-based procedure which releases every resources of a session that is no longer needed for the generated session.

SQL schema, proposed in OGC "Simple Feature Specification for SQL", is a simple space via the ODBC API feature set of the storage, retrieval, query and update support to define a standard SQL schema [3].

3. System Descriptions

3.1 A. Structure of System

Figure 2 shows the entire structure of space-time query processing system for a developing ubiquitous environment from this paper.

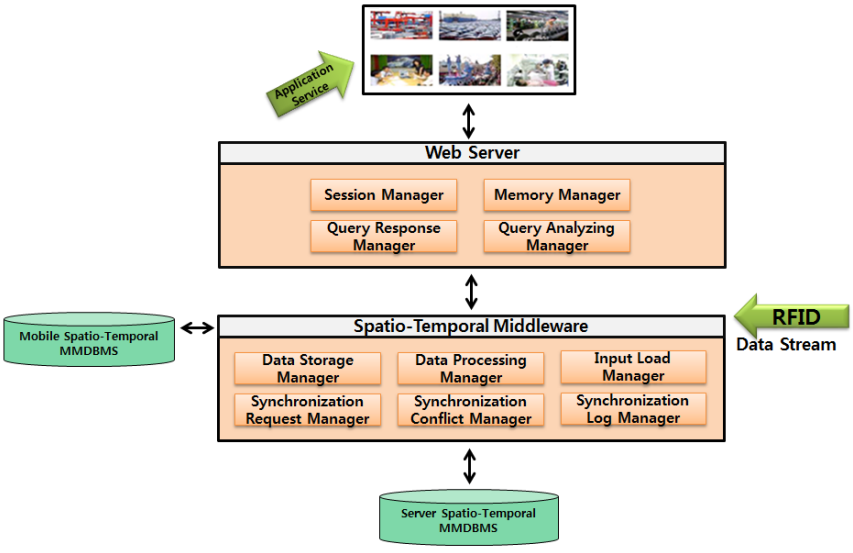

Figure 1. Structure of System

Looking at Figure 1, real-time location tracking system consists of a space-time middleware and a Web server.

3.2 B. Spatio-Temporal Middleware

The input data stream input load manager overload problem by reducing the amount of time and space to be shared by multiple objects, so that the storage space and time by managing the object ID and the reference counter of the object space and time to improve processing efficiency.

Data Processing Manager registered action plans generated by analyzing queries and performs the function of a continuous query processing and query time and space to handle the case where the operator must be included.

Data storage location determination system administrators that are converted from homogeneous or heterogeneous exchange of data between the data that is required to change the configuration of DML and location determination system for the input data stream are stored on the server MMDBMS time and space capabilities.

Request Manager to synchronize the data with the DBMS server mobile space-time space-time MMDBMS accept sync requests coming from multiple provides the ability to perform the synchronization.

When performing data synchronization conflict manager for conflicts provide the ability to identify and resolve. In case of conflicting data in accordance with established policies determine the type of data and process it to crash.

Log Manager is able to perform the synchronization of state information to perform synchronization at the end of the information recorded in the log, and provides the ability to manage. Each space-time re-synchronization request of the DBMS logs changed since the last synchronization provides a mechanism to update only part of the log to the administrator to perform the synchronization of whether the synchronization status information log that stores information, and synchronization at the end of each space-time synchronization of the DBMS to store information complete information log synchronization, each performed in time and space DBMS to store transaction information to manage the transaction log information.

3.2 C. Web Server

Query processing management administrator of the SOAP message that meets your search criteria to search for TagBlink collected, and the results are passed to the query response management administrator is responsible for. In addition, the query processing CQL management administrator to convert the SOAP message by applying the mapping rules generated CQL statement is passed to the DSMS space.

Questions and answers Administration Manager Administration Manager of RTLS query processing and session management manager receives data values from the client creates the SOAP message is responsible for the response.

Session management administrator of the client connection information and query information to store is responsible for managing the session. Session, the client queries the search criteria entered by the administrator TagBlink response management data is stored in the session manager session management memory management memory area required to ask the administrator.

Memory management, session management, managers, administrators of the search criteria in the session, the client TagBlink the memory required for storing data, is responsible for managing. Memory management, memory management for managers to use the buffer pool using vector array vector and the vector of the array used to store the time existence and vector consists of a structure.

4. System Implementation and Verification

Real-time location tracking system is mainly in a confined space, such as local and indoor positioning and location of the system. This real-time location tracking system over the space-time query processing scenarios to demonstrate the effectiveness of the system are as follows: Office staff and visitors to the real-time location data of the input data stream and can cause sudden leak confidential information of the company to respond quickly to areas of concern is security. In this paper, real-time data is entered office staff to monitor the position of the Confidential Information of the Company to respond quickly to the scenario was applied. Figure 2 shows the real-time location tracking system shows the configuration of the screen.

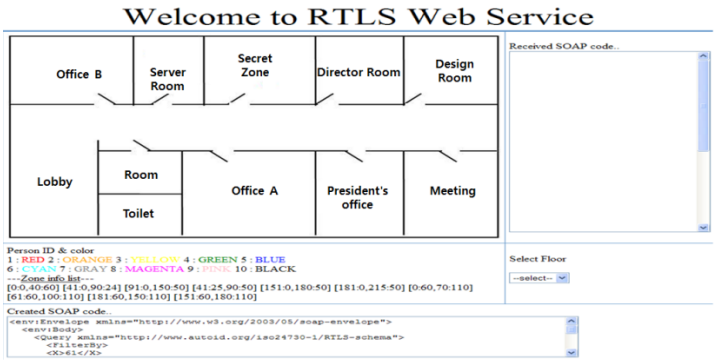

Figure2. Screen of Real-time Locating Systems

Users to enter a query FilterBy area of the office area at the bottom left, top right, enter the coordinates for the real-time location tracking system is written in the SOAP message. SOAP messages are converted to a continuous query is CQL space-time query processing middleware that is passed to the Java Applet query results that are returned are shown in the area. Figure 3 shows the results of real-time location tracking system shows the screen.

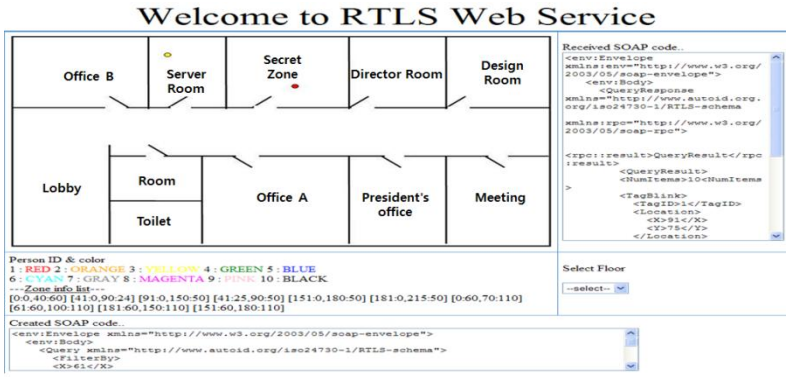

Figure 3. Result Screen of Real-time Locating Systems

Looking at Figure 3, since the search region based on the input coordinate is 'server room' and 'security zone', it shows moving objects located in the currently selected area on the screen.

5. Conclusion

In this paper, a stream of moving objects spatiotemporal data management for efficient query processing and retrieval systems that support the design and implementation of space-time was Time and space of the space-time query processing middleware system constantly coming into continuous space-time data streams in real-time processing and supports two-way synchronization between space-time DBMS. Web server interoperability between the server and the client to use a SOAP message and the client's SOAP message by analyzing the space-time middleware supports the ability to convert to CQL.

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