Development and Implementation of Web Service for Logging and Retrieving Real Time Train Location Information

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Development and Implementation of Web Service for Logging and Retrieving Real Time Train Location Information

Mohd Shoab, Kamal Jain, M Shashi

Abstract— Global Positioning System (GPS) is widely used for vehicle tracking, navigation and also used for tracking Trains. Transmitting the location information of a moving train is challenging work. In this paper a Web Service is proposed to store location and navigation information in to a central server for monitoring the trains. Remote GPS device call this web service for transmitting location and navigation information to the central server. This web service is a bidirectional web service by which you can send and receive train location and navigation information. Remote GPS device can be a PDA, Smartphone or a dedicated GPS device. This web service is developed in c# .net using Visual Studio 2010.

Index Terms— GPS, Navigation, Web Service.

I. INTRODUCTION

Developments in Information and Communication Technology allow all business entities to reconsider their planning and operations procedures in order to improve their efficiency and productivity. The need for integration of all information and business processes makes imperative the creation of interoperable software systems. This can be further enhanced with continuous monitoring and possible real time feeds from all business sections and activities. [3].

In the industrial and public transportation industry railway is the commonly used by people. Reliability, Availability, Maintainability, and Safety are key factors in transportation system. In the transportation industry geographic analysis is the key to make better decisions. Whether monitoring rail systems and road conditions, finding the best way to deliver goods and services, tracking fleet vehicles, or maintaining transportation networks, understanding these issues from a geographic perspective is crucial to deploying or spending resources wisely [4]. Considering several parameters such as transferring huge amount of goods and passengers with a high level of security and saving of fuel as well as less environmental impacts have been considered by decision makers and transportation experts and Indian Railways is the largest rail network in Asia and the world's second largest under one management. Crisscrossing the country's vast geographical spread, Indian Railways are a multi-gauge, multi-traction system covering over 1 lakh track [1].

GPS measurements of location and navigation information is used in tracking the remote GPS device which is mounted on a train. Transmitting the location information of a moving train is challenging work. The only way to achieve this is by wireless communication either GSM, CDMA or any other

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wireless radio communication. We are using web service approach for transmitting train location and navigation information to a central server for analysis and monitoring. Also a client who want to track the train, can retrieve train location by this web service.

II. WEB SERVICE

A web service is a software module performing a task or set of tasks that can be invoked over a network especially over the World Wide Web. The client can invoke web services through remote procedure calls (RPC) or a messaging service that provide applications logic. The architecture of web service contains three type of roles 1) provider, 2) requester and 3) broker. Provider makes web service available to that client who want to use it. Requester is the client who consume the web service. Broker provides a way between provider and requester of the web service to interact. Provider, requester and broker interact with each other through operations of publish, find and bind [7].

According to w3schools.com web services are:

1) Web services are application components.
2) Web services communicate using open protocols.
3) Web services are self-contained and self-describing.
4) Web services can be discovered using UDDI.
5) Web services can be used by other applications.
6) XML is the basis for Web services [6].

Unlike traditional client/server models web services do not provide the user with a GUI. Web services instead share business logic, data and processes through a programmatic interface across a network. The applications interface, not the users. Developers can then add the Web service to a GUI (such as a Web page or an executable program) to offer specific functionality to users. Web services allow different applications from different sources to communicate with each other without time-consuming custom coding, and because all communication is in XML, Web services are not tied to any one operating system or programming language. For example, Java can talk with Perl, Windows applications can talk with UNIX applications [10]. Figure 1 shows a typical web service.
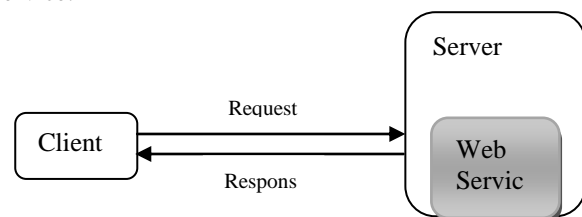

Fig 1. A Typical Web Service

The basic web services architecture defines an interaction between software agents as an exchange of messages between

service requesters and service providers. Requesters are software agents that request the execution of a service. Providers are software agents that provide a service. Agents can be both service requesters and providers. Providers are responsible for publishing a description of the services they provide. Requesters must be able to find the descriptions of the services [9]. Figure 2 shows the basic architecture of a web service.
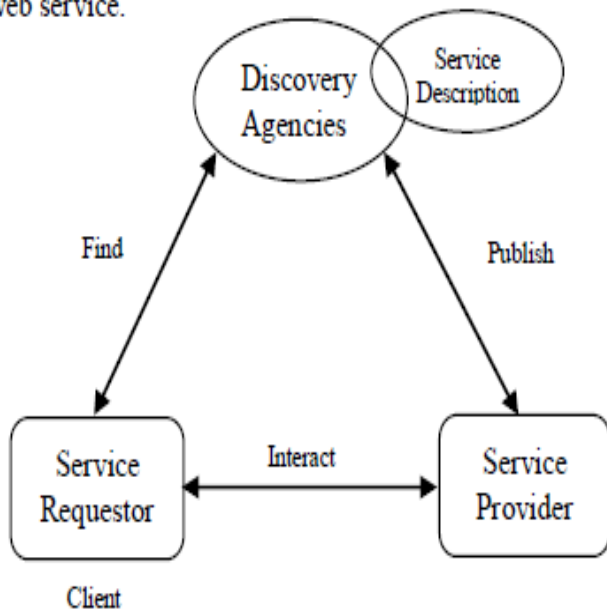

Fig 2. Basic Architecture of a Service Oriented Web Service [9].

The most well-known types of web services are RPC, SOA, and REST.

The Remote Procedure Call (RPC) web services is a service familiar to a variety of developers. It represents a distributed function call interface. The most well-known operation of RPC is WSDL. It is the first web service that was widely implemented, and therefore it is very wide deployed and supported.

The Service-oriented architecture (SOA) concept is also widely used. In contrast with RPC, the basic unit of communication between the client and server is the messages, rather than the operations. This is very often called "Message-oriented service". The majority of software vendors and industry analysts support this web service because in SOA, loose coupling is more probable, as the main focus is not on the implementation details, but this is on the "contract" that WSDL provides.

The last type of web-services are the REST type. They represent an effort of emulation of HTTP and other similar protocols, but by constraining the initial interface to a small set of well-known operations, standard for the industry, such as GET, PUT and DELETE. In such a way, the web-service is interacting with stateful resources, instead of working with messages or operations [8].

III. MATHODOLOGY

We developed this web service in c#.net using visual studio 2010. The .net framework of this web service is 3.5. Simple Object Access Protocol (SOAP) is the architecture of this web service. SOAP is designed for decentralized and distributed environment which utilize internet and XML to transfer information between requester and provider. SOAP is a platform independent and transport independent web service

architecture.

The major requirement of a GPS Locator is the use of Location Based Services (LBs) such as GPS. The GPS Locator allows several operations such as user can get your own current location (latitude, longitude and altitude) and can transmit their location to a central server using web service [2]. Figure 3 shows the architecture of our web service.
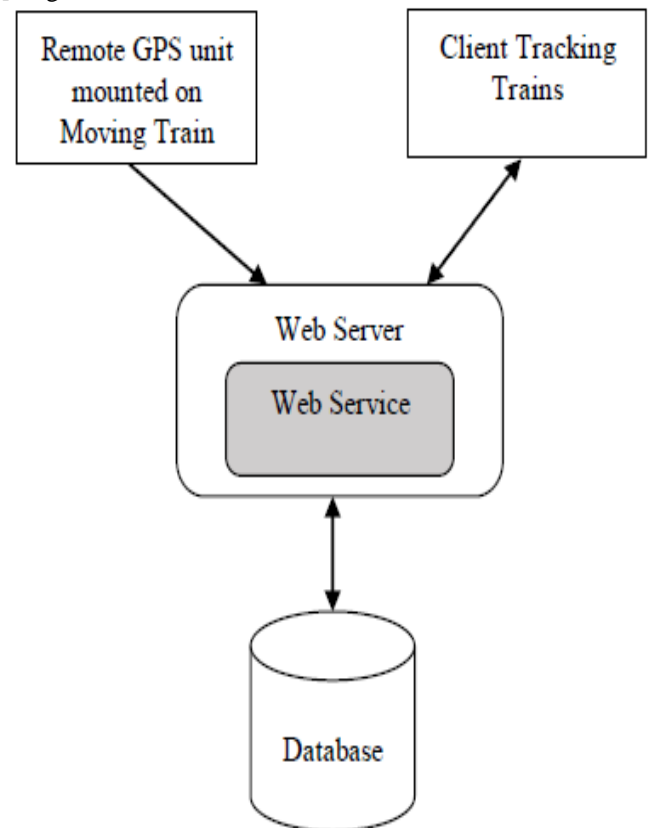

Fig 3. Architecture of Web Service Receiving and Sending Train Location Information.

This web service contain two methods 1) LocInfoInsert 2) GetLocInfo. The method LocInfoInsert is developed for remote GPS unit to insert location information to central database. This method get the location information string from remote GPS unit and split this string and insert individual values to database using sql stored procedures. The method GetLocInfo is developed for retrieving train location information from central database. When a client invoke this method, it return a location information string of a train.

The remote GPS unit which is mounted on train transmits its location information to central server and database by invoking this web service using wireless network. A wireless network can be GSM/CDMA or any other wireless network. When GPS unit call this web service and insert a string of location information about train the web service invoke a method LocInfoInsert. This method split location information string and insert values to central database. When a client wants to get the location information of a train, the web service invoke a method GetLocInfo. This method require train number to return location information. Figure 4 shows the data flow of our web service.
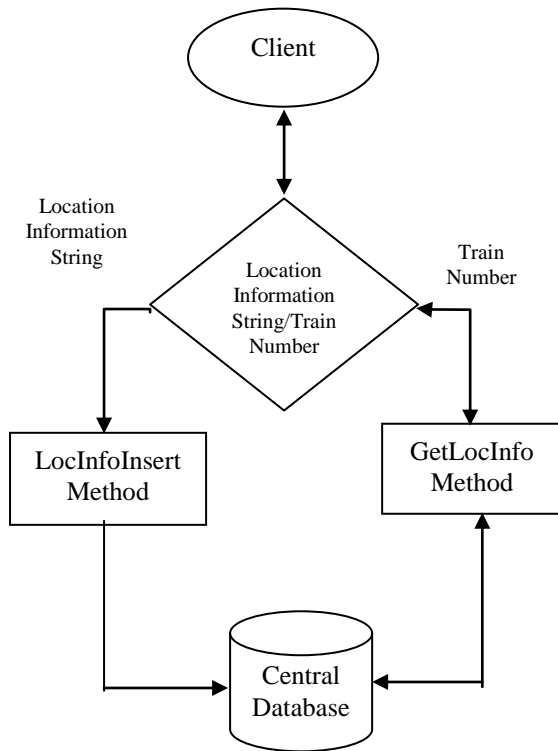
Fig 4. Data Flow of Web Service for Logging and Retrieving Location Information.

Database is created by Microsoft Sql Server 2005. We can divide location information string into six segments. Each segment contain information about the running train. Structure of a location information string is shown below.

TNxxxx,xx:xx,xx.xxxxxx,xx.xxxxxx,xxx.xx,xxx.xx

```
 1     2      3          4         5     6
```

Description of each segment is shown below.
1 shows: TN+Train Number
2 shows: Time
3 shows: Latitude
4 shows: Longitude
5 shows: Elevation
6 shows: Speed of Train

LocInfoInsert method split location information string into six segments, first segment is the table name and remain five segment are the information about train. All these segments passes through the sql stored procedure and stored in database in desired table.

Code of this method is shown below.

```
String[] strLocInfo = locationInfo.Split(',');
SqlParameter[] arrParam;
    arrParam = new SqlParameter[6];
    arrParam[0] = new SqlParameter("@tblName",
strLocInfo[0]);
    arrParam[1] = new SqlParameter("@datetime",
Convert.ToDateTime(strLocInfo[1]));
    arrParam[2] = new SqlParameter("@lat",
strLocInfo[2]);
    arrParam[3] = new SqlParameter("@lng",
strLocInfo[3]);
    arrParam[4] = new SqlParameter("@elev",
strLocInfo[4]);
    arrParam[5] = new SqlParameter("@speed",
strLocInfo[5]);

SqlHelper.ExecuteScalar(AppConfig.GetConnectionString()
```

```
,                              CommandType.StoredProcedure,
"AddLocationInformation", arrParam);
```

GetLocInfo method retrieve the location information of a train. When passing the train number in this method, it return location information according to the train number. This method return the last inserted location information from the table.

Code for this method shown below.

```
oLocIno obLocInfo = new oLocIno();
    obLocInfo =
oLocIno.LocationInfoManager.GetLocationInformation(trai
nName);
 return Convert.ToString(obLocInfo.IntId) + "," +
Convert.ToString(obLocInfo.DateTime) + "," +
obLocInfo.StrLat + "," + obLocInfo.StrLng + "," +
obLocInfo.StrElev + "," + obLocInfo.StrSpeed;
```

IV. RESULTS AND DISCUSSIONS

The monitoring process includes acquiring history reports of the remote GPS device movements or real-time tracking of its location [5]. This paper presents a web service which can log the location information about the train as well as we can retrieve the train location information for tracking. The location information insert method is LocInfoInsert method. By invoking this method and pass a location information string to this method we can log train location information to the central server. Figure 5 shows the LocInfoInsert method.
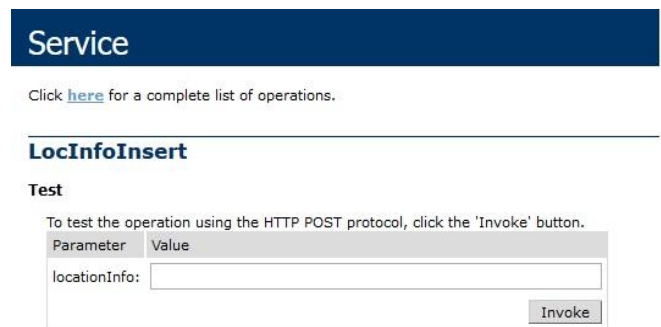

Fig 5. LocInfoInsert Method for Inserting Train Location Information to Central Server

We can retrieve inserted location information of a train by invoking GetLocInfo method. This method return location information string which contains id, time, latitude, longitude, elevation and speed. Figure 6 shows the GetLocInfo method.
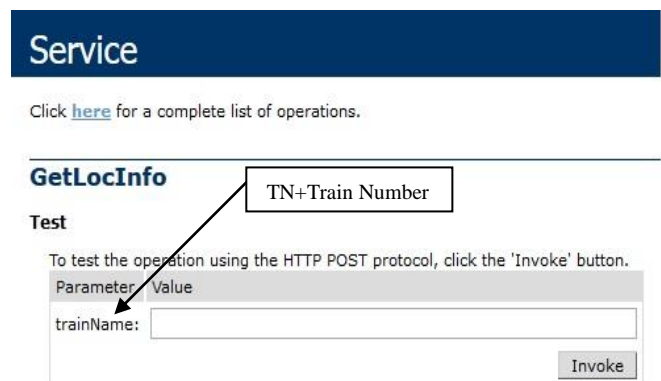

Fig 6. GetlocInfo Method for Retrieving Train Location Information.

V. CONCLUSION

With the rapid development of internet, wireless communication, 3G technologies and the formulation and standardization of related protocols, the integration of GPS, and GSM technologies have been applied in many fields to provide various users with location information. A web service is a very useful tool for sending and logging the train location information. By this information railway authority can take the essential decision if any accident or disaster happen. This service provides the facility to retrieve the train location information for tracking.

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