Design and Implementation of Location Utility Service for LBS

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Abstract: A location-based service or LBS in a cellular telephone network is a service provided to the subscriber based on his current geographic location. This position can be known by user entry or a GPS receiver that he carries with him, but most often the term implies the use of a function built into the cell network that uses the known geographic coordinates of the base stations through which the communication takes place. One implication is that knowledge of the coordinates is owned and controlled by the network operator, and not by the end user. Location utility service provides two kinds of functions, geocoder and reverse geocoder. Geocoder converts an address into a coordinate and reverse geocoder changes a coordinate into an address. Because location utility service is the first step to progress LBS, various servises such as directory, routing, presentation, and etc require to access that. In this paper, we will describe the architecture of LBS platform and the concept and the role of location utility service.

Keywords: LBS, Geocoder, Reverse geocoder

1. Introduction

Recently, the interest of LBS is rapidly increasing. LBS are considered as the killer application to boom information technology like CDMA. LBS provide a service to user with mobile device such as mobile phone and PDA based on his location through mobile communication. The first step to implement LBS is to detect user's location. The common method to acquire the location is to use GPS. But, the location from GPS is unaccustomed to people because it displays latitude and longitude coordinate of the user by digit. For people want to know their location as something such as address, and building name, so the converter between a coordinate and an address is necessary to improve the application of LBS. We call the converter as location utility. It consists of geocoder and reverse geocoder. Geocoder transfers an address to a coordinate and reverse goecoder transforms a coordinate to an address. In this paper, we design and

implement two converters that are core services of LBS. All of them are network-accessible services. They expose standard WSDL defined by OpenLS as an interface with other services[1].

We described an address structure in chapter 2. Geocoder was explained in chapter 3 and reverse geocoder was presented in chapter 4.

2. Address

Address ADT contains address information for a geographic place. Addresses reference and uniquely identify particular points of interest and can serve as the basis for aggregating data for that location. The Address ADT consists of a street address (or intersection), place name (e.g. country, municipality, etc.), postal code, street locator, building locator, and supplemental address information. As used here, addresses are the means of referencing primarily residences and buildings (of all types, where a subscriber may conduct business).

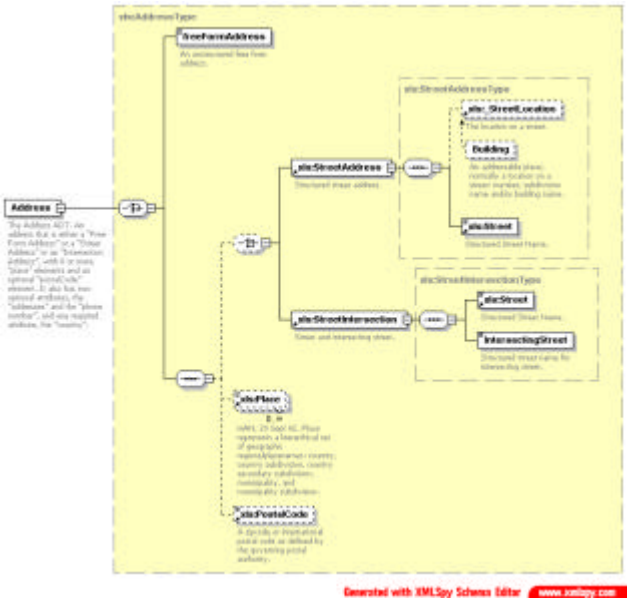

Fig 1. Address ADT

Fig1 showed the address structure defined by OpenLS. There are two kinds of addresses, free form address and street address. Street address is suitable in USA or western countries. The free form address is useful in other countries including Korea, Japan, etc.

However, LBS Forum of Korea defines another address structure that is suitable in Korea. It is called FormAddress[2]. Table 1 presented the structure of FormAddress.

Table 1. Structure of Form Address

Category	Meaning
LargeAddress	Metropolitan
MiddleAddress	Municipality
SmallAddress	Municipality Subdivision
EtcAddress	Other
Number	Address number

3. Geocoder Service

A network-accessible service that transforms a description of a location, such as a place name, street address or postal code, into a normalized description of the location with a Point geometry

Once a Geocoder Service determines a position from a partial or complete address, then the pertaining information element becomes a location-based resource that can be readily exploited by another service, like Directory or Route Determination.

3.1 Use Case 1 – Given an Address, Find a Position

A company has a database with a list of its customers and addresses. They want to geocode their database and have a geometry (Point) attached to the addresses. This will then be used to display the locations of customers on a mobile device.

3.2 Use Case 2 – Drive to an Address

A motorist wishes to drive from home to an address in Busan Harbor region, Busan. The address is geocoded and its location used as a destination within in a route planning application.

3.3 Use Case 3 – Given a Place / Street Name, Find its Position and Display it on a map

An user wants a map to his new dwelling place. He only knows part of the address: “BEXCO”, ”Haewondae gu” and enters it into the geocoder server. The partial address is fed into a Geocoder Service that determines the complete normalized address and position of BEXCO. This in turn is fed into a Route Determination Service that calculates the route from user’s current position to BEXCO. The result is a map.

3.4 Use Case 4 – Given a Jurisdiction, Find all Addresses and their Positions within the Jurisdiction

A postman is using a GPS-enabled mobile device to plan his delivery route. He uses a Geocoder Service to find the location of all the addresses in Busan (a known SearchArea: polygon). Once a Geocoder Service determines these locations, he can chart his delivery route.

4. Reverse Geocoder Service

A network-accessible service that transforms a given position into a normalized description of a feature location (Address with Point), where the address may be defined as a street address, intersection address, place name or postal code.

4.1 Use Case 1 – Given a Position, Find an Address

The Reverse Geocoding Service is normally requested by an application that merely needs to determine the address for a given position. The application sends a Position ADT to the Reverse Geocoder, which returns the Address of the position.

4.2 Use Case 2 – Where am I?

A mobile phone user is walking down a road and wants to know the address of the building that he is standing outside.

The returned address information returned may be displayed for the subscriber, used to generate a voice command or otherwise used by the OpenLS applications.

4.3 Use Case 3 – Provide Location Context

A user needs an answer to the question "Where Am I?" based on their current location. They desire expanded "location context", e.g., street, place, jurisdiction. The application sends the Position ADT to the Reverse Geocoder Service, which returns the expanded location information for that position. The application can then extract the location information corresponding to the required context "street address", "place" etc.

5. Request and Response Parameters

This section specifies the primary request and response parameters for the Geocoder and Reverse Geocoder Services. Fig 2, Fig 3, Fig 4, and Fig 5 show parameters. They are passed between client and server through SOAP messaging method.

Table 2. Primary GoecodeRequest parameters

Name	Mandatory	Data Type
Address	Y	Address ADTs

Table 3. Primary GoecodeResponse parameters

Name	Mandatory	Data Type
numberOfAddresses	Y	Integer
Point	Y	Point
Address	Y	AddressADT

Table 4. Primary ReverseGoecodeRequest parameters

Name	Mandatory	Data Type
Position	Y	Position ADTs
SearchArea	N	AOI ADT

Table 5. Primary ReverseGoecodeResponse parameters

Name	Mandatory	Data Type
Address	Y	Address ADT
Point	Y	Point
SearchCenterDistance	N	Float

6. Conclusion

In this paper, we described geocoder and reverse geocoder service in order to determine the correct position of user. This provides web service, so other services such as route determination, directory, presentation, etc could access this service on the Internet at the first step of providing their service.

We have to do more study about more suitable address to apply for Korea's address system.

References

[1] Open GIS Consortium, Inc., 2002, OpenLS Location Utility Services

[2] LBS Forum, 2003, Standard Interface Specification for Location Utility Services