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Melaka Tourism Location Based Service

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Abstract- This paper presents a Location Based Service framework application deployed in Melaka urban area. The Melaka Tourism Location Base Service is delivered to support tourist activity to find any nearby venue around their current location. The program is specifically designed for mobile phone which supports MIDP 2.0 profile and CLDC 1.1 configuration to run JSR 179 Java Micro Edition Location API due to its capability handling networking activity in handled device.

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Melaka Tourism Location Based Service

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I. Introduction

1) *Background and Related Work*

Melaka is world known for its long history, historical sites, cultures and cuisines where it has charmed millions of visitors since its founding in the 15th century. This historical city received the popular recognition of World Heritage Site by UNESCO in 2008.

The Development of mobile technology has made a significant impact on services and other human related activity more reliable. The comprehension of tourism market opportunity and the increasing of demands toward mobile activity create new phenomenon of localization technique. The prevalence of mobile devices with personally identifiable location-based information is top concerns for 2011, say experts from Proof point, Inc.

The basic idea of location based service is to answer Where am I? What is around me? Where is it?. When individual find themselves in new environment they are not familiar with, their needs and behavior are easily predicted. People need to find somewhere to stay, where to eat, or to withdraw money from ATM. As the tourism sector is heterogeneous, the diversity of information services for mobile users is clearly a usability issue. How can information be delivered based on their needs?

LBS technology is served in between of some major technology. It is intersection between three technologies. It is created from New Information and Communication Technologies (NICT) such as mobile telecommunication system and hand-held devices from Internet and Geographic Information System (GIS) with spatial database.

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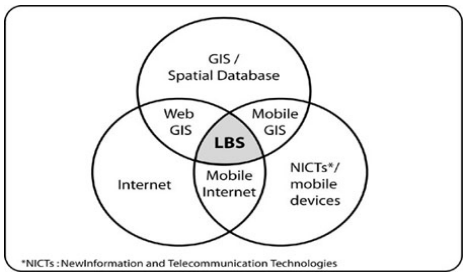

Figure1 LBS as an intersection of Technologies (Brimicombe 2001)

Despite of its popularity of the technology, it is not being efficiency utilized especially for tourism industry. Theoretically tourism world can intrinsically benefit from the use of mobile technology which provides services to travelers on the move since tourism is always identical with location.

Melaka Tourism Location Based Service is deployed using a client server environment in projection of the whole system. The client act as system component who requests service and data provided by server, who has resources to be utilized. As the system architecture can be represented as below.

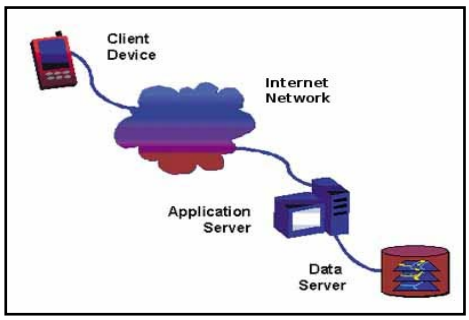

Figure2 LBS System Architecture

Several frameworks has been successfully developed such as The Location Based Mobile Tour Guide Services Towards Digital Dunhuang, LBS application implemented for Dunhuang Mogao Grottoes a world cultural heritage by the Chinese Academy Sciences of Beijing China. The system is deployed for a specific urban area having the same characteristic with the system this project is developed for. Both system similarities happens in the system architecture for using J2ME technology as multi threading mechanism, MIDP network programming, and JSR 179 Location API. University New South Wales also has developed the same framework deployed in university campus usage

enabling the 3D rendering capability for indoor navigation.

2) *Paper Organization*

This whole paper is consisted of 3 sections and organized as follows: Section 1 gives a brief explanation about the LBS technology and its implementation towards Melaka Tourism. Section 2 listing any research frame methods using in developing the system. Section 3 detailing the various features available in the system while the last section summarize the whole paper.

II. Research Frame

1) *JSR 179 Location API*

The Location API is compact and generic Java Micro Edition API producing information about the device present location to Java applications. It was developed under Java Community Process as JSR 179. The Location API for J2ME (Java Micro Edition) specifications defines an optional package, javax.microedition.location which enables developers to write wireless location based application for limited devices like mobile phone (Mahmoud, Q.2004).

JSR 179 requires the Connected Device Configuration (CDC) or version 1.1 of the Connected Limited Device Configuration (CLDC) since the CLDC version 1.0 is not capable enough to support floating point numbers, which API uses to represents coordinates. Meanwhile MIDP (Mobile Information Device Profile) version 2 is required to let writing a downloadable applications and service for network connectible mobile devices. The MIDP 2.0 delivers an enhanced user interface, greater connectivity, over the air provisioning, and end to end security to mobile information devices (Sun Developer Network). According to the Motorola Developer Network, there are three main features provide by JSR 179 Location API described as follow:

- Obtaining information of device location.
- Possibility to create, edit, store, and retrieve landmarks.
- Capability to obtain the device orientation

Below are some main classes available in JSR 179 Location API:

Class	Description	Usage notes
LocationProvider	Represents a source of the location information, starting point of location request.	
Criteria	Used for the selection of the location provider.	
Location	Represents the standard set of basic location information. This includes the time-stamped coordinates, accuracy, speed, course, etc.	The implementation has a limit for the maximum number of location read requests that can be sent simultaneously.
Coordinates	Represents coordinates as latitude-longitude-altitude values.	
LocationListener	Listener that receives update events associated with a particular LocationProvider.	
ProximityListener	Receives updates based on terminal crossing into a defined radius around a coordinate.	The implementation has a limit for the maximum number of proximity listeners that can be added simultaneously.
Landmark	The Landmark class represents a landmark, such as a known location with a name (such as a monument).	The implementation has limitations such as maximum number of landmark store categories, landmarks in landmark store, etc.
LandmarkStore	The LandmarkStore class provides methods to store, delete and retrieve landmarks from a persistent landmark store.	The implementation may only support default landmark store and not support creating and deleting LandmarkStore methods.

Figure 3 JSR 179 Location API Main Classes (Motorola Developer Network)

The Location API supports the conversion of string representation of coordinates into double representation and vice versa and the calculation of distances. Furthermore, an application can make use of so-called landmark stores for storing, deleting, and retrieving landmarks from a persistent database inside the mobile devices. A landmark can be used to represent points of interest and it contains fields for specifying coordinates, address information, a name, and a description[1].

2) *Haversine Formula*

Calculating the distance between points locations is often an important component of many forms of spatial analysis in business and research. The haversine formula is preferred to be used in GIS application for common case to minimize rounding errors. It assumes a spherical earth and ignores ellipsoidal effects.

In order to calculate distance between two earth coordinates as demonstrated in figure 4, the following algorithm is used:

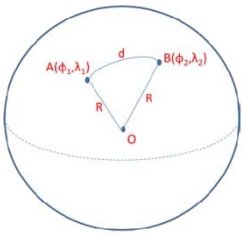

Figure4 Distance between two coordinates on sphere

Given: two coordinates A (φ1, λ1) and B (φ2, λ2), sphere radius R, and distance (between A and B) d,

$$haversin\left(\frac{d}{R}\right) = haversin(\Delta\varphi) + \cos\varphi_1 \cos\varphi_2 haversin(\Delta\lambda)$$

φ1 is the latitude of A, λ1 is the longitude of A, φ2 is the latitude of B, λ2 is the longitude of B,$\Delta\varphi = \varphi 2 - \varphi 1$, $\Delta\lambda = \lambda 2 - \lambda 1$, and haversin(θ) = sin2(θ/2).
So, d can be obtained by:

$$d = 2R \times \arcsin\left(\sqrt{haversin(\Delta\varphi) + \cos\varphi_1 \cos\varphi_2 haversin(\Delta\lambda)}\right)$$

Finally

$$d = 2R \times \arcsin\left(\sqrt{sin^2\left(\frac{\varphi_2 - \varphi_1}{2}\right) + \cos\varphi_1 \cos\varphi_2 sin^2\left(\frac{\lambda_2 - \lambda_1}{2}\right)}\right)$$

3) *Connection String*

Tourism Location Based Service use HttpConnectiom string to provide communication link between client and server since j2me programming language have not support JDBC connection to access the database server, the behavior HttpConnection is one that combines InputStream and an OutputStream and exactly one InputStream. The order in which the streams

are used as important as well. The OutputStream, if used, must be used before the InputStream. Once the streams have been used the connection should be closed and new HttpConnection should be opened to continue communication if necessary. This follows the HTTP request-response paradigm (David Hemphill, Using HttpConnection). Mainly there are three states to do a HttpConnection:

1. Setup Connection
2. Connected
3. Closed Connection

4) *Map Retrieval and Reverse Geocoding*

Google Static Maps API is an easy way to provide a map when user doesn't have Javascript available. It is not as powerful as the full Google Maps API but still, it can provide a basic map containing both markers and paths. The basic concept is to generate image by adding URL parameters to the querystring of the URL. The Google API Maps parameters are certain value separated using ampersand (&) character. The basic Google Static Map URL must be in the following form to complete the API request:

"http/maps.google.com/maps/api/staticmap?
parameters"

There are several parameters available to be used on the API to customize the map item:

- Location Parameters (centre, zoom)
- Map Parameters (size, format, map type, `language)
- Feature Parameters (markers, path, visible, type)
- Reporting Parameters (sensor)

Figure5 Google Static Map Image

Other Google service implemented in the system is Google Reverse Geocoding API via HTTP request. Reverse Geocoding is a method to convert geographic coordinates into an address. The Geocoding API supports reverse geocoding directly using the latlang parameter.

"http://maps.googleapis.com/maps/api/geocode/json?latlng=x,y&sensor=true_or_false"

Where x is latitude coordinate, and y is longitude coordinate. The query will result a JSON (Javascript Object Notation which later will be parsed into php file to return a specific address of current location.

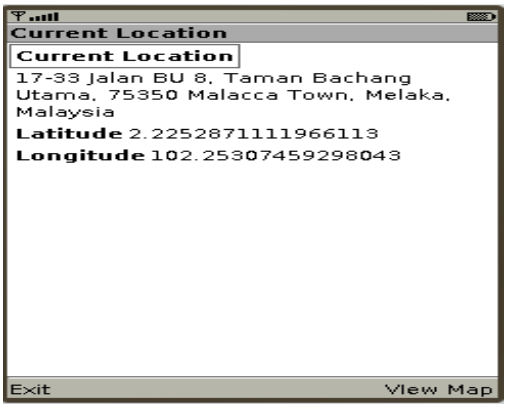

Figure6 Google Reverse Geocoding

5) *Routing Direction*

One of features implemented in Melaka Tourism Location Based Service is routing capability to a specific point of interest from current detected location. The routing functionalityis applied using Bing Map REST Services Application Programming Interface (API) provides rrepresentational State Transfer (REST) interface to preform task such as creating map with puhpins, geocoding an address, retrieving imagery data, or creating route.

In order to display a static map route the following URL format must be sent.

"http://dev.virtualearth.net/REST/v1/Imagery/Map/Road/Routes&wp.0=a,b&wp.1=c,d&key=bingmapkey"

wp.0 is the current coordinates, wp.1 is the destined coordinates, and bingmapkey is the api map registered on the bing service.

Figure 7 Routing Direction

III. Variegated Melaka Tourism Location Based Service

The Melaka Tourism Location Based Service consists of various forms of service available to the user interacting with the system. The use case diagram below describing set of services available in the system

both Client and Admin. The Client service covered services such as retrieve current location using Global Positioning System, view location map, finding nearby point of interest, view its detail, and retrieve walking direction from the current coordinate. While the admin side able to add, edit, and delete the existing POI in the database.

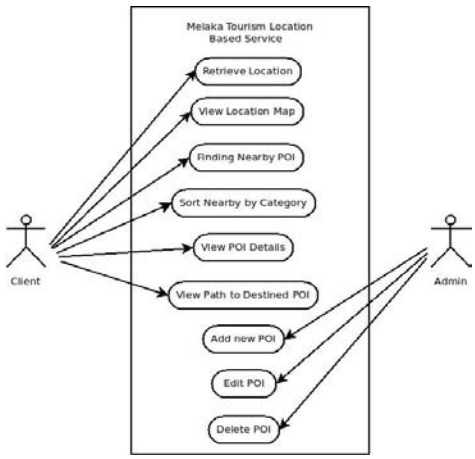

Figure 8 System Use Case Diagram

IV. Conclusion

Melaka Tourism Location Based Service paper proposed a system integrating tourism information service with location based technology. It is easy to implement and require low operation overhead. The identification of location is using the JSR 179 Location API technology. It is discussed the implementation plan and design to overcome the current problem occurs in tourism world by providing a comprehensive information and services to the traveler. The system ables to show user location in coordinates, geographical address as well as map view. Any nearby point of interest is listed based on its category within the radius coverage.

The objectives of the project is successfully achieved to design a reliable model of Melaka tourism location based service by converting user information into information services. At the end, may this project become a door to open another advance research regarding tourism location based service.

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