LOCATION BASED SERVICE: A CASE STUDY OF NICARAGUAN SYSTEM OF ADDRESS USING TECHNOLOGY ACCEPTANCE MODEL

適地性服務：以科技接受模式探討尼加拉瓜定址服務系統

By

Abraham Moisés Galeano Cárcamo (亞伯漢)

9977594

Adviser:

Dr. Jyun-Cheng Wang (王俊程)

Master Thesis

Presented to the

College of Technology Management

National Tsing Hua University

Hsinchu, Taiwan R.O.C.

In Partial Fulfillment of the Requirement for the

Degree of International Master in Business Administration

IMBA

June 08th 2012

ACKNOWLEDGEMENT

First of all, I want to thank God Almighty for giving me the strength and letting me complete this important challenge in my life, to my whole family, especially my parents Mr. Carlos Galeano and Mrs. Socorro Cárcamo, who I love, will always be my inspiration and the reason I can continue growing as a professional and as human being.

Thanks to my advisor Professor Jyun Cheng Wang (王俊程), his knowledge and experience shared, were the key to successfully complete my thesis. My sincerest appreciation also to Professor Soumya Ray, whose recommendations contributed to my thesis' culmination. To all the staff at National Tsing Hua University, my respect and gratitude because of them we all students have the opportunity to follow our dreams and become better professionals. From each concierge, member of the department of Division of General Student Affairs, the lovely and helpful staff of IMBA department to each of my professors who enlighten me with their advices and experiences, to all of them 謝謝您們.

I am so proud of being part of Tsing Hua University and I will keep in my heart every moment I spent in this lovely university. My MBA is not the only treasure I will amass at the end of these two years but the friendship I have developed with special persons from different part of the world, among them many Taiwanese who I appreciate a lot and of course all my dear classmates of the IMBA.

Time here helped me to realize how much my friends from my lovely NICARAGUA mean to me; they stayed by my side when I needed it, helping me to collect data for my thesis and many other assignments I required their help. My sincere gratitude to my friends Osman Gutierrez and Inti Luna, to Pilar, my friends from 5t3, Eddy and Elias among many others.

Thank you Taiwan to open your arms to me, I will never forget each moment I have lived here which I consider now my second home. Their humble people and their culture has teaching me valuable lessons and will accompany me the rest of my life.

"The woman laughed. She said, 'The yellow car is always there.' "[1]

[1] A City of 2 Million Without a Map, Oakland Ross, World Press Review, July 2002

ABSTRACT

The system of address is part of any society information infrastructure and due to its simple logic has become an important component of Location Based Services (LBS). LBS is today one of the most useful information services in a variety of context such as point of interest search, entertainment, work and personal life, largely due to the advance and fast adoption of internet connections and mobile devices.

The aim of this study is focused on Location Based Service in Nicaragua, analyzing a well-known service that is already in the market which is Google Map and determining how useful this service is for Nicaraguan citizens. This empirical study makes use of an experiment involving 60 participants from Nicaragua and the use of Technology Acceptance Model (TAM) to model perception of usefulness from participants' responses. It is important also for the purpose of this study to expose how the addressing system works in Nicaragua. Unlike most of the countries which based their addressed on identifiers, Nicaraguan people have the peculiarity that they express their addresses in a very unconventional way, difficult for foreigner but so common for local people at such level that is considering part of their cultural identity. In this study we will describe how addresses in Nicaraguan are expressed, based on "reference points" from where new instructions are given to locate a place. This peculiar quality helps to understand how difficult would be to implement a LBS system based on the findings of this research and what would be the alternatives that will facilitate the adoption of LBS system in that country or any other with similar characteristics.

Keywords: Location Based Services; Nicaraguan System of Address; Technology Acceptance Model.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Introduction

The wide variety of technologies, especially those related with mobile communication technology and computing resources has allowed the development of a numberless of new services. Before last decade, tasks related with data transmission in wireless networks was a serious challenge, until the development of new technologies and standards, e.g. PHS, GSM, GPRS, CDMA, Bluetooth and the set of standard 802.11 among others (Zhu, 2009). The new applications emerging allow mobile users, for example to query their environment and monitor and track remote objects (Schiller, 2004). User now demand services that provide them with accurate information related with almost any topic and among the most important is location. The famous phrase coined by Lord Harold Samuel "There are three things that matter in property: location, location, location" (Safire, 2009), represents the paramount important of location in our daily lives. Or even a harsher example of the importance of location could be the Google Map platform[2] which display the Embassies Accepting injured Iranians in Tehran published by the American news website Huffington Post in 2009 (Parr, 2009).

The behavior of a person when he meets in an unfamiliar environment is quite predictable as also his needs, no matter if it happens in his own country or abroad, on foot or vehicle. A person needs to find a place to eat, or locate a pharmacy, perhaps a supermarket, an ATM machine and so on. Even more requirements can arise when someone is abroad: local tourist attractions, foreign exchange places and hotels. In such situation a person without the right information can wastes a lot of time, not to mention money (Dru et al. 2001). Therefore in mobile valued-added services: Location Based Service becomes one of the most important services of mobile computing. Xinyan Zhu (Zhu, 2009) defines Location Based Service (LBS) as a platform that provides information services based on the current or a known location, supported by the electronic map platform. The location information (latitude and longitude

[2] Service provided by Google Inc.

coordinates) of mobile end-user can be obtained through the mobile communication network or the Global Navigation Satellite Systems (GNSS) (Schiller, 2004).

1.2 Problem Statement and Research Objectives

The system of addresses is part of any society information infrastructure; an address is a collection of information, used to describe the position of a place (Wikpedia). Two well-known systems in geography to identify a point in an area are the system based on co-ordinates and the system based on identifiers. The system based on identifiers is the one where addresses belongs (Lind, 2001); Different characteristics and properties facilitates the use of this last system, which contribute to avoid dealing with coordinates when an address is given or tried to localize. Since system of addresses is easy to understand, because of its simple logic, it has become an important component of GIS product and Location Based Service (LBS). LBS as explained before, is an information or entertainment service, accessible with mobile devices through the mobile network and utilizing the ability to make use of the geographical position of the mobile device. With the advances and fast adoption of internet connection and mobile devices, LBS has become very useful in a variety of context such as: indoor object search, entertainment, work and personal life among others.

Since this research is going to work with addresses to locate "Point Of Interest" (POI), a GIS terminology which refers to all the geographical objects which can be represented by points, especially those geographical entities closely related to people's lives (Zhu, 2009); and since it has been already expressed addresses are the basic component of LBS, it is important to expose how the address system works, and more important how addressing system works in Nicaragua, country of study for this research. Unlike most countries' system of address which use identifiers to locate places, Nicaraguan people have the peculiarity that they express their addresses in a very unconventional way, very hard to use for foreigner but so common for local people because it is rooted in their autochthonous culture (Revista de la Academia de Geografía

e Historia de Nicaragua, 2007). It will be described how addresses in Nicaraguan are expressed, based on “reference points” from where new instructions are given to locate a place.

The aim of this study is focused on Location Based Service in Nicaragua, specifically on POIs localization, measuring the usefulness of a well-known LBS service that is already in the market which is Google Map[3]. The research pretends to determine how useful that platform is for Nicaraguan and foreigner people who visit such country to find POIs. Knowing that the system of address in Nicaragua has its peculiarities, is the purpose of this study to determine what features are needed in order to provide a useful platform for that country or any others with similar characteristics in case it can be proved Google Map does not fulfill user demands. A basic LBS platform has been constructed named Xtool using Google Map API[4] with specific variants and taking into consideration Nicaragua system of address to compare it with Google Map features in order to prove or disprove this research findings.

The research question arising from previous objectives are:

- Does Google Map fulfill Nicaraguan people needs of locating POIs with its LBS platform?

- What would be the changes needed in a LBS platform to locate POIs in Nicaragua, considering the unconventional system of address used in such country.

The importance of this study is that it will share a new approach of finding POIs in a LBS platform. Although the case study is focus in Nicaragua and its particular system of address, the findings can contribute to the development of new solutions in order to identify points in a map which is one of the most important LBS features.

[3] Service provided by Google Inc.
[4] Service provided by Google Inc.

CHAPTER 2: LITERATURE REVIEW

There are many studies related with Location Based Service (LBS) which present different perspective of the topic, using different names; therefore is the purpose of this review to create a common knowledge base of LBS in order to have a better understanding of this research objectives. Section 2.1 presents a description of what LBS is, its components and taxonomy. Besides, section 2.2 will expose what are the benefits or goals users pursuit when they plan to use LBS services. While, section 2.3 will conclude with OpenLS, a standard for managing LBS systems.

2.1 Location Based Services (LBS)

Researches about Location Based Service (LBS) are widespread and there many implementation of such service in the market, an example of this is tourist information systems (Zhu, 2009), but still there are some issues in the industry that need to be clarified as well as standards that need to be developed (Schiller, 2004). This study covers only issues of LBS related with those goals set in previous chapter, letting aside other topics, which also important are beyond the scope of this research, like pricing, privacy, data availability and security.

Positioning system, several years ago, typically consisted of a device with the help of a satellite system GPS. The Global Positioning System (GPS), technology developed by the U.S. Department of Defense back in the 1970s, was released to be used freely for other industries in the 1980s (Schiller, 2004), since then, many companies took the opportunity of accessing positioning data through GPS in order to develop and enhance new services. Nowadays, if someone wants to take dinner in a restaurant, queries on internet can be constructed by him, nevertheless with the purpose of getting faster and more accurate results, he can restrict the search by adding criteria like his position, the kind of restaurant he likes and the actual time. Searches like these which involve position and time can be done by use of Location Base Service.

LBS emerged therefore, as intersection of three technologies (Steiniger et al. 2006): from New Information and Communication Technologies (NICTS) such as the mobile telecommunication system and personal devices, from Internet and from Geographic Information Systems (GIS) with spatial databases fed by GPS data (See Figure 1).

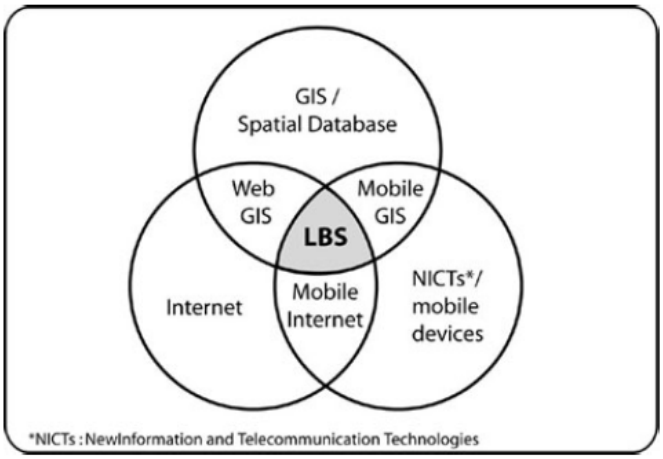


Figure 1 LBS as a result of the intersection of three technologies
Source: (Steiniger et al. 2006)

It is important to remark nevertheless that location based information is not completely a new service; positioning specific information has been also transported from person to person, using post-it notes or graffiti (Steiniger et al. 2006). Poster and traffic signs are also methods to transmit location information to mass-audience. But those method of communications, most of the time, are one way communication method which is a significant different with LBS that give the possibility of two way communication (Steiniger et al. 2006). Users can send to the service provider information their location and preferences and inquiry what information they want to know, which give the possibility to the provider to send back tailored information to the final user, saving time and increasing the accuracy of the information given.

Now that the importance of LBS has been explained, is the purpose of these following three sections to describe the components of LBS, its taxonomy and the categories of LBS applications.

2.1.1 LBS Components

In order to use Location Based Service the following components are needed (Steiniger et al. 2006):

- Mobile Devices: Is the tool to request information needed by the user. PDA's, Laptops, Mobile Phones, car navigation units are among the possible devices.

- Communication Networks: The mobile network is the component which transfers data requested and information between user and service provider.

- Positioning Component: The user position can be obtained by GPS or using the mobile communication network, WLAN is now becoming an alternative to obtained user position. It is important to mention that is the position is not determines by any of those system or technology, this one can be specified by the user manually.

- Service and Application Provider: The service provider is responsible for the service request processing, request made by the user. They can offer the calculation of the current position; they can find routes or POIs among other services.

- Data and Content Provider: The service provider is not necessarily the same which stores and maintains the information requested by users. Location information and geographic data base can be requested from the provider which supports those databases (yellow pages, mapping agencies, etc.).

2.1.2 Taxonomy of Location Based Service Application

The classification of LBS applications can be made considering whether they are person-oriented or device oriented (Schiller, 2004):

Person-oriented LBS: This classification is focused on positioning a person or to use the position of a person to enhance a service. Friend finder application is an example of this service where the person located can control the service.

Device-oriented LBS: Although this approach can focused on the position of a person; an object or a group of people (car or fleet for example) can also be located. Another important different with the previous category is that in this kind of application, object or person does not control the service (e.g. car tracking).

Besides the first kind of classification, there are also two LBS application designs that need to be distinguished according with the level of interaction with the user, those are (Steiniger et al. 2006):

- Pull service: in this design, user receives information directly requested by him, which means he actively uses an application. Therefore it is said that he "pulls" information from the network (Schiller, 2004). Example of this service is "where can I find the nearest supermarket?"
- Push service: in this design the information is delivered to the user without having actively requested it. This service is in most of the cases activated by an event which could be trigger by a timer or by entering a specific area (e.g., news service subscription containing event information of the city where the user is entering). Push services are more complex to establish because are not bound on previous user interaction (Steiniger et al. 2006).

2.2 Users Goals on Location

There are five basic mobile actions with respect to user needs on geographic information according with Reichenbacher (2004). *Location*, which defines where the user himself is located, is one of them. *Searching* for objects or person represent the second one. For those searched objects or person, some people want to know how to go to such location where they are, which consist of *navigation*. Properties of a location are cover by *identification* and finally the action of looking for events in an area or to determine the state of something is called *checking*. In Table 1 can be observed the relationship between those actions mentioned before and the kind of question those users are trying to respond, beside the geospatial operations used to complete the action (column 3).

Table 1 User activities

	Action	Questions	Operations
	**orientation & localisation** locating	where am I? where is {person|object}?	positioning, geocoding, geodecoding
	**navigation** navigating through space, planning a route	how do I get to {place name| address| xy}?	positioning, geocoding, geodecoding routing
	**search** searching for people and objects	where is the {nearest | most relevant | &} {person | object}?	positioning, geocoding, calculating distance and area, finding relationships
	**identification** identifying and recognising persons or objects	{what | who | how much} is {here | there}?	directory, selection, thematic/ spatial, search
	**event check** checking for events; determining the state of objects	what happens {here | there}?	

Source: Reichenbacher (2004)

In the figure mentioned above, the column of Operations covers what is called network-accessible services (core services), which are part of the standard will be discussed now for LBS, developed to ensure that all devices and technologies (as mentioned in section of LBS Components) can work together and interact with clear interfaces and descriptions.

2.3 OpenGIS Location Services (OpenLS)

The standard for LBS was developed by the Open Geospatial Consortium (OGC) under the ISO 19119 and ISO 19101 where descriptions of general service framework and classification of geographic services are specified (Bychowski et al. 2008).

The OpenLS 1.1 specifications which define the core services include five service types:

- Directory Service (spatial yellow pages)
- Gateway Service
- Location Utility Service (Geocode/ Reverse Geocode):
- Presentation Service
- Route Service

This scope of this research is only intended to work with the first service which is Directory Service; Route Service also will be discussed but only for the purpose of this research experiment. The Directory Service, as the standard explains, provides subscribers with access to directories to find a specific place or at least the nearest. This service allows answering question like: “Where are Indian Restaurants?” or “Where is the nearest Indian Restaurant to my hotel?”. The standard describes two cases for finding a particular point of interest corresponding to the Directory Service request (Bychowski et al. 2008):

1) By some properties of Point of Interest (e.g., name, description, unique identifier, direction, phone number).

2) By location (e.g., Nearest to where I am).

Then, what is a Point of Interest?

2.3.1 Point of Interest (POI)

The Point of Interest or POI is the primary output from a Directory Service. It contains name, type, category, address, phone number, and other directory information about the place, product and/or service. This "Yellow Pages" - Directory Service - uses business and landmark information that has been compiled into POI databases (Schiller, 2004) that together with map databases creates a detailed, digital representation of the business services available along the road network. The POI databases as it can be noticed contain the kind of data found in most phone directory, adding value to the map databases' geographic content. The source of information that feed POI databases can be collected from vendors, creating a single, comprehensive data set. Each record of POI databases are geocoded (Zhu, 2009), which means they are assigned a latitude/longitude coordinates. The integration of map database with POI database produces a detailed, digital representation of the road/street network with the accuracy and coverage needed for high-quality LBS (Schiller, 2004).

With this important topic about POIs it is concluded the introduction to LBS definition and taxonomy. Beside it have been described LBS components; now the reader knows what are the mobile actions or objectives that users pursuit when they deal with geographic information. The next chapter will focus on Nicaraguan System of Address, its characteristics and peculiarities and it will try to deploy why it is so different to system of address used in most of the world.

CHAPTER 3: NICARAGUAN SYSTEM OF ADDRESS

This chapter will start introducing the system of address which is used in most of the world. Although this research has found no official standard or universal convention so far referring to addressing system due to some variations in its structure in accordance to country and language; the findings cited in this study contribute to expose a general view of some components and properties of addresses that can be seen as a single system. This set of properties and features will form for this research a unique system of address which from now on this study will refer to it as standard system of address or worldwide convention. In the case of Nicaragua, it is intended to describe such system of address with the purpose that the reader can comprehend the significant differences between that country system of address and the worldwide convention. The next part of the chapter will expose how Google Map, the Location Based Service system of this study fits the needs of identifying POIs within the standard system of address. The last part of this chapter will cover the research method, in which will be explained what methods were employed to answer research questions presented in first chapter.

3.1 System of Address

It was mentioned in previous chapters that the system of addresses is part a society infrastructure, and that there are two reference systems in the geographical world: reference system based on identifier and references system based on coordinates (Lind, 2001). System of

address belongs to the system based on identifiers. This address for instance: “No. 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan” identifies a particular location which haven’t required the use of geographic coordinates to locate the place. Those identifiers are structured hierarchically commonly formed from the most specific to the most general peace of information and consist of a series of “names” and/or numbers like: country, region, town, district, street name and house or door number (Lind, 2000). With this system, coordinates are not needed to find a place, since place’s names form a corresponding name-based reference system, as each place name match with a particular locality or area. It is important to clarify also that East Asian addressing system use the opposite order to describe an address when it is written in their native scripts (Wikipedia), such as the following example 新竹市光復路二段 101 號 where city is written first, followed by street name and other more specific details. It is out of the scope of this research to determine which format is more efficient (most specific to general or vice versa) instead this study will focus on the logical structure of the address. The format of addressing system will be delimited in this research to most western countries format which is also followed by those East Asian country when their addresses are written in Latin alphabet (Wikipedia).

A public address system that is well structure contributes to the physical infrastructure of modern societies and allows people and postal services among others to navigate without coordinates. Figure 2 represents an example of the difference between coordinates and identifiers.

Figure 2 Example system of address based on identifier, not based on coordinates
Source: Lind, M. (2001)

According to Lind (Lind, 2000), address system meets spatial properties which distinguishes it from other name-based reference system. Those properties are:

- It is well-known and widespread: addresses are the most used method of localization either for a business or a person.

- It is practical and logical: This property is related with the hierarchical structure of addresses, organized with town name, road name and house numbers. Written in order from most specific to general (Wikipedia). Example of address' format could be:

Table 2 Example of address' format

Example	Format
Mr. I.M. A. Payne	*Name*
ARAMARK Ltd.	*Company Name*
30 Commercial Rd.	*Street*
Fratton	*City Area/District*
PORTSMOUTH	*City/Town/Village*
Hampshire	*County*
PO1 1AA	*Postal Code*

Source: Wikipedia, http://en.wikipedia.org/wiki/Address_(geography)

- It is suitably detailed: Details of addresses are fair enough to get to almost any place with the aid of a road name and a house number.
- It is visible: Road names, signs and house numbers are a combination of symbols and characters needed to read and interpret to trace paths around address systems. Lind (Lind, 2000) remarks that visibility and logical structure are perhaps the most special and valuable property of the address system.

The simplicity of these properties emphasizes the importance of addresses as a central component of GIS services as it is also for LBS. Since using addresses as a way of communication implies that "… we speak a language which people understand and can relate to" (Lind, 2001). Then Point-Of-Interest (POI), presented in last section, reflects this relationship between system of addresses and LBS. POI which is primary output of Directory Service is composed of name, telephone as well as address, such properties of POI represents a way to find a particular point according with OpenLS standard. Another contribution of system of addresses for LBS, is that addresses can operates as potential "geographical keys" that can link records in different

databases and transform hundreds of thousands of text-based records into spatial information which is useful to complete POIs databases that need to be geocoded. Nicaraguan system of address then, should fulfill these properties and functions already explained; nevertheless the following section will describe the difficult variants that such country system of address represents for geocoding and manipulation of POIs.

3.1.1 Nicaraguan System of Address

In order to have a clear understanding of the Nicaraguan System of Address, the research limits the scope of this review to the capital city, Managua. Managua is an urban area of more than 2 million people (ALMA, 2004), who deal with an unorthodox system of address, sometime bothersome for residents but especially confusing for outsiders (Darling, 2000). There are among others, two important factors that have determined such situation in the capital (Ross, 2002): The first one is that Managua, (See Figure 3) is located in a position where the shore of the Xolotlán Lake creates a natural delimitation into the north part of the city. The second reason is based on an historical event and that is the earthquake occurred in 1972 with a magnitude of 6.2 on the Richter scale (Earthquake Hazards Program, 2010) which destroyed the center of the city including street and avenues which at that time, had names. These two conditions were the main reason that people in the capital started to use a new system of address based on references and cardinal points that until today still remains and is used for every citizen on that city.

Figure 3 Map of the City of Managua
Source: Wikipedia. http://es.wikipedia.org/wiki/Managua

The following findings and statements about the system of address in Managua are based on a research conducted in 1994 by Dr. Karl Ille, a member of the Department of Romance Studies from the University of Vienna, Austria (Ille, 1994). His study is a social-semiotic analysis of the addressing system in Managua obtaining interesting results about the Nicaraguan culture. The experiment dealt with a sample of 180 people, from where Dr. Ille formed 23 sub-groups, based on 6 criteria: Sex, Age, Time to live in Managua, Education, Profession and Political View. The interview involved questions about their exact addresses, nomenclature of the road where interviewers live and definitions of some key words related with the cardinal points. Based on the results of the question and grouping formed, the study obtained 30 dependent variables and 23 independent variables. The finding of that research will be summarized based on a list of addresses, all of which were obtained by me from internet search on different Nicaraguan web

pages (See Table 3); these are real addresses that pinpoint personal houses, private companies and government or not government institutions. These addresses were picked as models of the peculiar characteristics of Nicaraguan system of address because of their structure and composition which help to understand Dr. Ille findings. Each address will be written in Spanish first as a form of keeping intact the original structure since the official language of Nicaragua is Spanish and then a translation to English will be provided. Names will be presented in bold in order to avoid confusion with the instruction itself.

Table 3 Scheme of address in Nicaragua

1) Esquina del Pali de Linda Vista 2 al lago, casa amarilla con verjas negras • **Linda Vista**, from Supermarket **Pali**, 2 blocks toward the lake, yellow house with black railings.
2) De donde fue el cine cabrera 3 c arriba 20 varas al sur, mano derecha • Where it was **Cabrera** Cinema, 3 blocks up, 20 var.[5] south, right hands.
3) Rpto. Sta Margarita, sorbetería Don Bosco 1c lago, 1c arriba, detrás Don Bosco, contiguo a casa de varios colores. • **Santa Margarita** allocation, from the ice cream shop **Don Bosco**, 1 block toward the lake, 1 block up, behind **Don Bosco** Park, next to a house with several colors.
4) Calle 14 de septiembre, de donde fue la p del h 2 ½ c al este, mano izquierda • **September 14** Street, where it was **P del H,** 2 ½ blocks east, right hands.
5) Detrás del Edificio Pellas, frente a Farmacia Familiar • Behind **Pellas** building, in front of **Familiar** Pharmacy.
6) Rotonda El Güegüense 350 metros al sur, frente a edificio de las naciones unidas • From **El Güegüense** roundabout 350m south, in front of **United Nation** building.

[5] Var: Abbreviation from Spanish measure of unit vara. http://en.wikipedia.org/wiki/Spanish_customary_units

7) Col. 10 de Junio, cruz roja Don Bosco 2c lago, 1c abajo casa B-30 • **June 10** colony, from Red Cross **Don Bosco**, 2 blocks toward the lake, 1 block down, House: B-30.
8) Km. 4, carretera a masaya, donde fue lacmiel 1c al sur, ½ c al oeste contiguo a la alianza francesa. • Km 4, **Masaya** Highway, where it was **Lacmiel**, 1 block south, ½ block west next to **French Alliance.**
9) Colonial Los Robles Casa No132 • **Los Robles** Colony, House No. 132
10) Bo. santa ana, del arbolito 2c al s 75vs al oeste. • **Santa Ana** neighborhood, from little three 2 blocks south, 75var. west
11) Km. 4 1/2 carretera a Masaya, de la óptica matamoros 2c. al oeste, 1/2c. al norte. • Km. 4 ½, **Masaya** Highway, from **Matamoros** optician, 2 blocks west, ½ block to the north.
12) Iglesia el carmen, 50 varas al sur • **El Carmen** church, 50 var. south.
13) Colonia Américas Dos, en el grupo C, andén 4, casa C-97A • **Americas Two** Colony, group C, sidewalk 4, house No. C-97A

The first thing to notice in the structure of these addresses is the composition from a macro to a micro space which significantly helps to the coherence of their structure. Based on the research by Dr. Ille, can be noticed two different structures of the addresses: First, Addresses as lists (Case 9 and 13) where there is an absence of grammatical cohesion. Second, addresses describe as itinerary (Case 2 and 3 and almost the rest) where some grammatical and syntactical elements of cohesion are presented. Among the characteristic of these address' structures the most remarkable is that almost all of them based their orientation sense on one or more reference points, establishing two kind of relationship with the reference: a directional

relationship (Case 1) and a locative relationship between the reference points and the objects which has to be located (Case 5). These reference points or landmarks which create a relationship either locative ("in front of", "next to") or as starting point ("from x point", "where it was x point") could be any kind of place as long as they count with social relevance (e.g. supermarkets, parks, pharmacy, hospitals, cemetery etc.). A significant particularity of this system of address is the fact that some of these reference points are associated with places that physically no longer exists, instead they are preserved in the memory of their residents, who as Freeman (Freeman, 2010) states is a "form of resistance to imposition", people for whom the use of a former name are a reflection of their historic consciousness (e.g. Cases 2, 4 and 8). Other feature discovered in this system is that the house numbering system in many cases is replaced by the description of it or its environment, like Case 1: "…yellow house with black railings…" or Case 3: "next to a house of several colors". Finally, this last section explores how cardinal points are used in Nicaragua system of address. According with Dr. Ille research there are seven different subsystems which coexist with or without topographic reference related with cardinal points. Among them, more than 90% of the sample, uses the term "toward the lake" as a substitution of north because of the city position with respect to Xolotlán Lake (Case 1 and 3) and more than 80% (beside the use of "toward the lake") also uses the terms "up" and "down" to represent east and west respectively, reason related with ancestral Nicaragua history (Case 2, 3 and 7) (Freeman, 2010). The peculiar way of calling cardinal point recalls us a phrase from Seattle Times which states "… in Managua, - down - may actually be up a hill…" On the other hand "south" keep almost intact in the use of cardinal points. But as the research clearly states there are other variants in Nicaragua where some

addresses are written using the common names for cardinal point as the reader know them. *East* used in Case 4, *West* used in Cases 8, 10 and 11 and finally Case 11 again that uses "north" instead of "toward the lake". This last address (Case 11) coincidentally, corresponds to The Republic of China (Taiwan) Embassy in Nicaragua[6].

These thirteen addresses given are not isolated example of addresses in such country but a common representation of the way Nicaraguan people give instruction and established their addresses to reach a location either by oral or written form. As it was stated at the beginning of this chapter, the purpose was to show the difference between Nicaraguan system of addresses and Standard system of address. Now the reader can easily notice that the system based on identifiers which consist of a series of "names" like district, street name and house or door number are "rarely" or not presented at all in Nicaraguan system of address, instead they are replace by descriptions or references located nearby the place that has to be located. It is stated "rarely", because a few Managua streets do indeed have names, and some houses have numbers but its citizens do not use them (Ross, 2002), except for a few cases (e.g. September 14 Street in Case 4 or house number No. C-97A) On the other hand, the last property exposed in the section of Standard System of Address about visibility of information (Road names, signs and house numbers) has been replaced in this unorthodox system by the location of references like the main priority to identify, in order to locate the final destination. Either as locative or directional relationship, the reference point plays a key role to almost any location for this country system of address and therefore to find any POIs in an LBS system.

[6] Republic of China (ROC) embassy in Nicaragua
http://www.taiwanembassy.org/ct.asp?xItem=54170&CtNode=4205&mp=337&xp1=

3.2 Google Map Tool

Google map tool is a location based service (Google, 2012) classified as Person-oriented LBS and according with its level of interaction with the user was designed to offer Pull services because its information provided is directly requested by the user. Although this platform provides most of the services from the OpenLS, does not expose such standard interface (Shek, 2010). Google Map fulfills people needs of locating places using standard system of address because of two reasons:

- Google Map allows users to interact with its Directory Service, one of the services of OpenLS standard that is in charge of providing POIs. Google Map pulls such POIs with its information that can be found in most phone directory along with geographic content, this last means, the drawing of the point on the map in certain latitude and longitude coordinates.
- The second component of the success of Google Map when a user is trying to locate a POI, is related with the second chapter of this research, the system of address based on identifiers. The icon displayed on the map (See Appendix E) with the address provided "No. 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan" can be easily identified for any user who is searching that POI. The identifiers in this address are structure hierarchically and the information goes from the most specific to most general, as it was explained

before about the standard system of addresses. Properties of the system of address like logical structure also contribute to the understanding of the location. The street signaling system infrastructure in Taiwan (Wikipedia), in this example, contributes to fulfill the property from the standard system of address called Visibility which is related with country condition like road names and a combination of symbols.

Google Map has been selected as the LBS for this research since it is one of the most complete LBS, accomplishing most of the user goals on location mentioned in previous chapter, especially search and navigation that would be later tested in the experiment. Navigation, represented in Google map by the function "Get Direction" provides addresses to guide the user through streets when he tried to reach a Destiny POI from an Origin POI. It is within this functionality where the experiment will measure how well Google Map fulfills Nicaraguan people needs of finding POIs.

3.3 Research Method

An intrinsic case study (Harling, 2002) has been chosen as method for this research since it is focus on a unique phenomenon which is the Nicaraguan System of Address. Furthermore the main purpose of this study is to provide an insight into this peculiar way of forming addresses and certainly because the research does not intend to build any theory (Baxter et al. 2008). Two sources of evidence of the six possible define by Stake (1995), and Yin (1994) for case study has been used in this research such as documents, especially those about Nicaraguan addressing

system and survey, this last to illustrate the gap between system of address of Nicaragua and the standard system of Address. But also an experiment has been conducted which try to pursue a main objective which is, to try to answer the research questions set out in chapter one. First to confirm whether Google Map can fulfill Nicaraguan people needs of finding POIs and locate them and second to identify features needed for the purpose of providing a useful LBS platform for Nicaragua or any others country or region with similar characteristics.

3.3.1 Participants

Participants were Nicaraguan citizen, 60 in number who performed an experiment and completed a survey within the same assignment which was conducted for one month from April 2, 2012 to May 3, 2012. The mother tongue of all participants is Spanish and their ranging in age from 23 to 44. The experiment along with the survey were assigned both to each participant but randomly in the city of Managua, the capital of Nicaragua. Among the sample, 78% were engineer related with computer science field, 10% electrical engineer, 8% undergraduate students and 4% from other professions.

3.3.2 Survey Design and Procedure

The survey consists of four polar questions without the use of any map. The four questions started with the following query “Do you have an approximately idea where this address is in Managua? Do you think you can get there with the instruction given?” Follow immediately by each address (See APPENDIX A). Among those four addresses two of them, were presented as the standard system of address proposes and were taken from official government institutions

sources[7] without any modification. The other two addresses were displayed as Nicaraguan system of address suggests, after and intense search in different non-governmental web pages without any modification. To avoid bias, the four addresses where displayed randomly. It is also important to mention that without participants awareness those four addresses represented, instead of four different location, only two, because each pair of addresses represent the same place but with different structure; Nicaraguan style to represent addresses and standard system of address.

3.3.3 Experiment Design and Procedure

The experiment consist of two exercises which try to fulfill two of the five basic mobile actions define in the topic about User Goals on Location explained in Chapter two. These actions related with POIs are *search* and *navigation*. Those two exercises take place in two different platforms, one is Google Map and the other is a prototype platform developed for this research called Xtool, which will be described later. Both exercises asked participants to locate two POIs previously given by the experiment assuming that one of this POI is an Origin point from where the participant will navigate toward the second POI, considered as Destiny point. Participants does not need to commute physically to those places, the exercise could be carried out in a computer or tablet, expecting that the participants immerse themselves in such hypothetical situation of trying to go from Origin to Destiny. Therefore it was expected that the participant complete two actions. First search those POIs, and then navigate from Origin point to Destiny point. To avoid bias the two exercises where assigned in random order. The participants would

[7] Ministry of Foreign Affairs Nicaragua http://www.cancilleria.gob.ni/ongjunio07/htmldocs/nicaragua.html

form then a personal perception of usefulness from both platforms, valuable information to response this research questions. Nevertheless, since usefulness is a quality hard to measure, this research has decided to work with a measurement model called Technology Acceptance Model in order to gain a better understanding of participants' perception of usefulness.

Technology Acceptance Model (TAM) (Davis, 1989) in the field of Information System is a theory focused in two factors to determine how users accept and use a technology. Such factors are perceived usefulness and perceived ease of use, this research only pays attention to the first factor with the purpose of evaluating how participants react to the use of Google Map and Xtool. Perceive usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Wikipedia). Using a questionnaire as an instrument proposed by Davis to measure perceive of usefulness, a total of four statements per platform were asked to each participants (See Appendix B and C), asking them to rate the extent to which they agree with such statement, selecting an option among these seven "Strongly disagree", "Disagree", "Slightly disagree", "Neutral", "Slightly agree", "Agree", "Strongly Agree". From this result the research only focus on frequency distribution of the data obtained to acquire a general perception of participant response and be able to answer both research questions exposed in first chapter.

CHAPTER 4: SYSTEM DEVELOPMENT AND RESULTS

4.1 XTOOL

Xtool is a prototype LBS platform developed for this experiment using Google Map API. Taking into consideration Dr. Ille analysis' about Nicaragua System of Address and differences with standard system of address, it was needed to develop a tool that instead of working with identifiers (like district, name of street, number of houses), works with references, since it was stated in previous chapter that reference points are the fundamental element to locate POIs in Nicaragua. The platform has been designed as Pull service and is classified as Person-oriented LBS, offering two mobile actions, search and navigation. This tool does not give instruction or address as Google Map does when a route between two points are query, instead it displays in the map public references along the navigation route, so that the user can be guided through elements he observes on the street.

4.1.1 Modules of the prototype system

The structure of LBS prototype can be observed in the figure bellow, the functionality of the tool works based on Browser/Server model. The client who has the web page of the platform requests POI which are managed by POI request module and then a Positioning module, is in charge of displaying the icon on the map. Furthermore, to use the map which has to be loaded from the beginning is accomplished through the interaction with Google Map API to visualize

the map on the browser. Routing module is in charge of the request of POI Origin and POI Destiny in order to display on the map a route based on references.

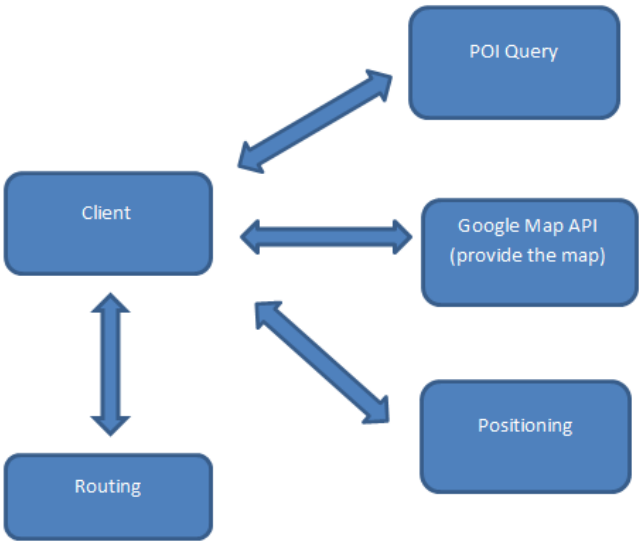


Figure 4 Modules of the Xtool prototype tool

4.1.2 Functionalities

Every reference is drawn in the map with a personalized icon according to the type of element it represents, which help the user to identify those POIs (bank, public park, school, cemetery, etc.) and also has associated a number that is displayed on the map which represents the distance between such reference and the destiny point. Just like Google Map and following the OpenLS standard about POI, each reference displays the kind of data found in most phone directory. Other function of Xtool is the use of layers as a way of providing references which help to guide the user through the map when he is searching for a POI. Layers are groups of POIs that represent specific types of element in the map (i.e. roundabouts). Last, is the *where it*

was function which display places that do not exist physically anymore in a city (in this case Managua). Those are represented in this platform as a layer, considering the importance of this characteristic mentioned in Dr. Ille findings (Ille, 1994) about the system of address of Nicaragua. See APPENDIX E for more details about the internal structure of platform.

4.2 RESULTS

4.2.1 Survey

Two of the four addresses presented in the survey were asked using standard system of address while the other two were asked based on Nicaraguan system of address. From the first pair, 13% (Address 1) and 2.5% (Address 2) of participants responded "Yes", which means they could reach those locations given or have an approximately idea of where those addresses are located with the addresses provided. While from the second pair 92% (Address 3) and 89% (Address 4) answered "Yes" to the same question. As it was stated, the location with 13% and 92% represents the same place (Address 1 and Address 3) as well as the other pair of addresses (2.5% and 89%).

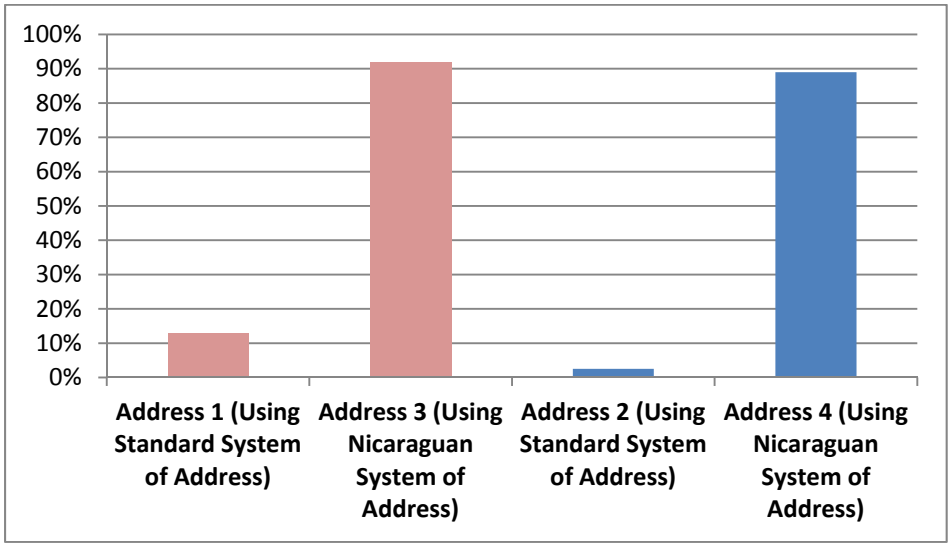


Figure 5 Bar chart people who responded "Yes" to the survey.
Representing people who affirm they could reach the location, with the addresses given.

Table 4 Results of the Survey.
Total number of people who affirm or deny they could reach the location, with the addresses given

	No. of persons Response Yes	**No. of persons Response No**
Address 1 (Using Standard System of Address)	8	52
Address 2 (Using Standard System of Address)	2	58
Address 3 (Using Nicaraguan System of Address)	55	5
Address 4 (Using Nicaraguan System of Address)	53	7

4.2.2 Experiment

Based on TAM theory, the perceive usefulness factor was evaluated through two exercises in the same experiment, one using Google Map platform and the other using Xtool. After finishing such exercises, four statements were rated about the goal set out in each platform and that is, trying to go from point Origin to point Destiny. The following results were obtained:

Google Map tool:

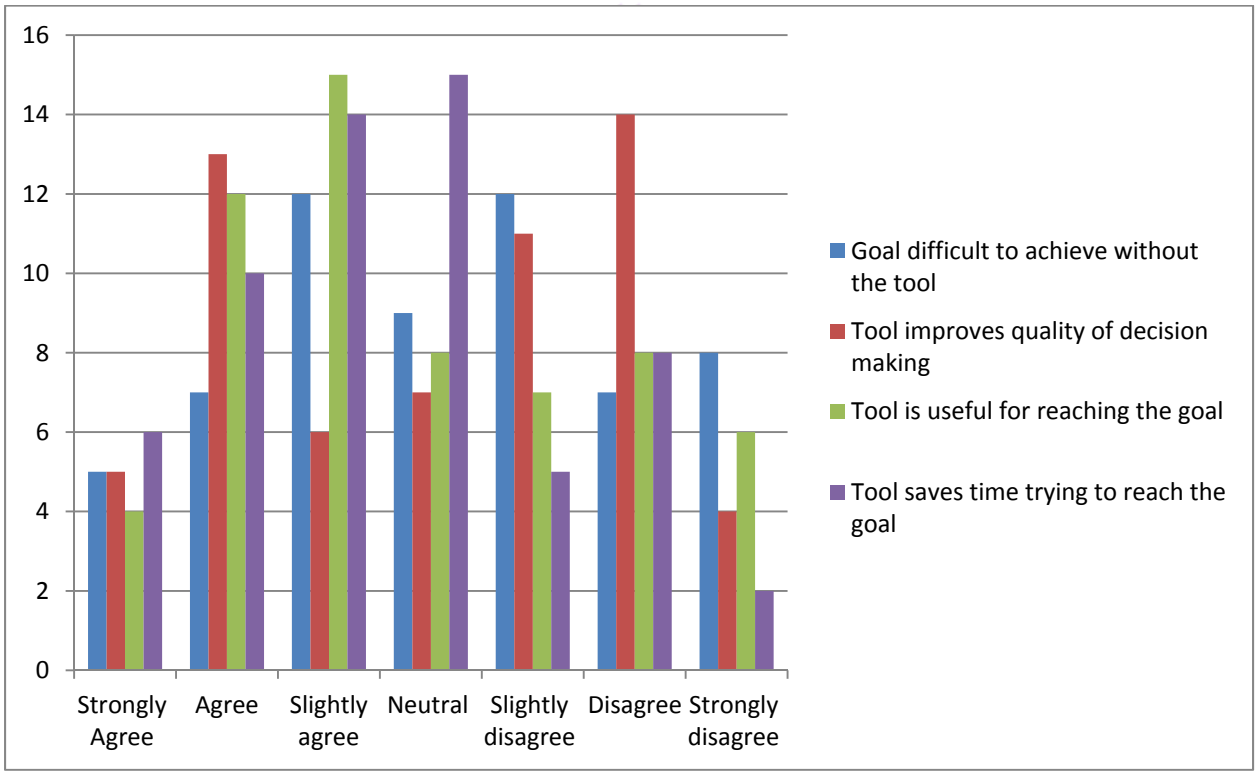


Figure 6 Distribution of perception of usefulness for Google Map tool

Table 5 Results of the Technology Acceptance Model Questionnaire for Google Map tool
Total number of people rating their level of agreement regarding each statement

	Strongly Agree	Agree	Slightly agree	Neutral	Slightly disagree	Disagree	Strongly disagree
Goal difficult to achieve without the tool	5	7	12	9	12	7	8
Tool improves quality of decision making	5	13	6	7	11	14	4
Tool is useful for reaching the goal	4	12	15	8	7	8	6
Tool saves time trying to reach the goal	6	10	14	15	5	8	2

Xtool:

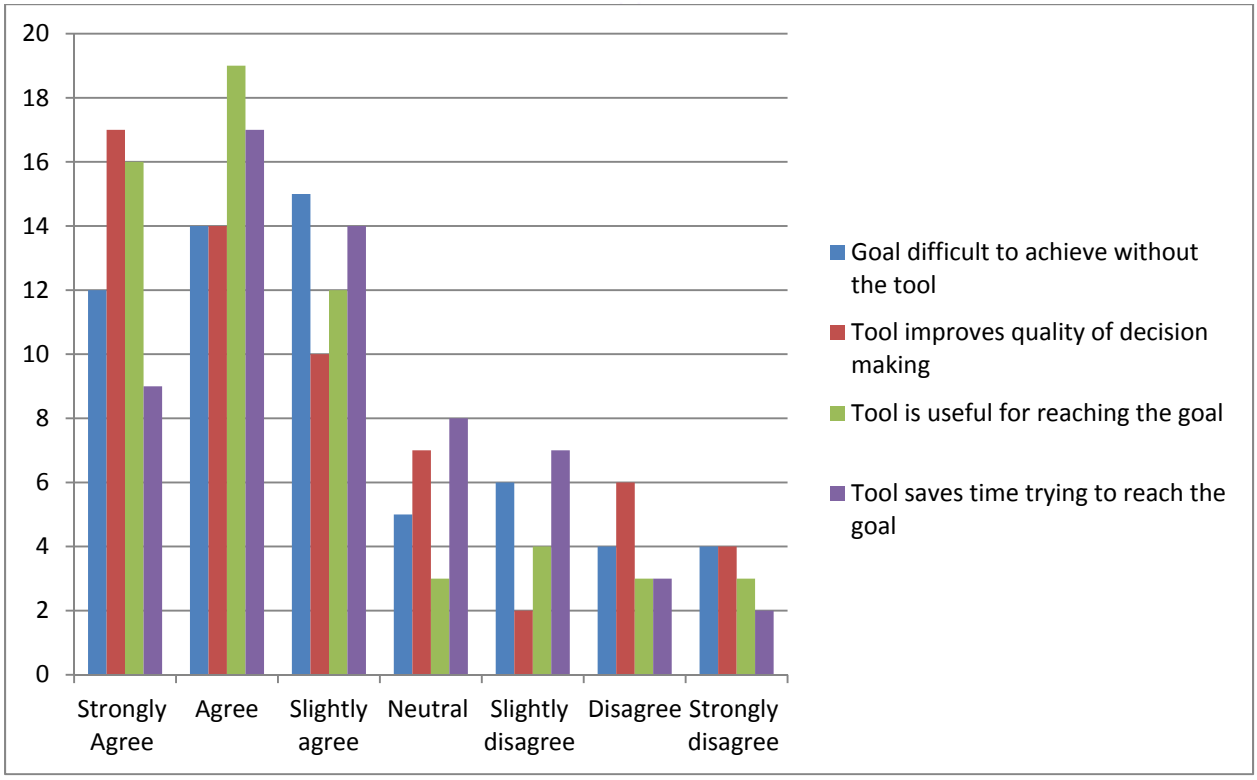


Figure 7 Distribution of perception of usefulness for Xtool

Table 6 Results of the Technology Acceptance Model Questionnaire for Xtool platform
Total number of people rating their level of agreement regarding each statement

	Strongly Agree	Agree	Slightly agree	Neutral	Slightly disagree	Disagree	Strongly disagree
Goal difficult to achieve without the tool	12	14	15	5	6	4	4
Tool improves quality of decision making	17	14	10	7	2	6	4
Tool is useful for reaching the goal	16	19	12	3	4	3	3
Tool saves time trying to reach the goal	9	17	14	8	7	3	2

In order to verify the tendency of the participants for the two platforms, a value was assigned to each of the seven options from Strongly Agree (value assigned 3) subtracting minus one to each option which means Neutral with get 0 value, until reach Strongly Disagree (value assigned -3). With this weight assigned to each of the four statements, an average value could be computed per exercise for each participant. Calculating the mean from such results independently for Google Map and for Xtool, values of 0.0916 and 1.6458 were obtained respectively, which represent the tendency of participants' perception of usefulness per platform with a positive results for Xtool and more disperse answer for Google Map tool, this last according to the graphic, with a tendency closer to Neutral (0). This finding can also be supported through the calculus of Skewness of the two distributions which give more positive skewed distribution for Xtool (0.515204772) than for Google Map tool (0.430774384).

CHAPTER 5: GENERAL DISCUSSION

5.1 Discussion and Conclusions

The main objective of this research is to analyze the Location Based Service in Nicaragua, measuring the usefulness of the LBS Google Map in order to identify Point Of Interest based on Technology Acceptance Model.

- Two research questions arose from previous objective and both of them were answered through the use of different source of evidences, which include a sample of Nicaraguan people who this research worked with. The findings confirm that the LBS Google Map does not fulfill Nicaraguan people needs of locating POIs, answer corresponding to the first research question posed. Assertion sustained also because, as the survey showed there is a significant difference between how Nicaraguan people perceive what the research defines as Standard System of Address and how they have adjusted to their own particular Addressing System. The survey clearly demonstrated that Nicaraguan people are not familiar with system of address based on identifiers, becoming difficult to implement any LBS which such characteristics that are part of the Standard System of Address.
- Location Based Service system as it works today have proved its important contribution to people lives, finding the nearest Indian restaurant or the closest ATM that belongs to certain bank, for example. In the case of Google Map, this LBS has become one of the most used solutions in the world for its capabilities and usefulness and it will continue using

street names and other identifiers as the main tool to find POIs and to guide the user from an origin POI to a destiny POI.

- It is necessary to remark also that the success of LBS depends largely on the significant presence of spatial properties in a system of addresses of any country, stated by Lind (2000), mainly logical structure of the addresses and visibility (road names and house numbers among others).
- According with the findings of the experiment, the changes needed in a LBS platform to locate POIs in Nicaragua were not enough or were not well adapted enough in the prototype tool (Xtool) developed to successfully locate POIs in that country. Indeed, references play an important role to locate POI, however results demonstrated that the way this prototype tool handled them, was just slightly rated positively by participants which means more work need to be done to fulfill considerably user needs.
- From system of address in Nicaragua about *references*, based on this research and supported by Dr. Ille (1994) findings, can be highlight that two kind of relationship can be established: a directional relationship and a locative relationship between the reference point and the objects which has to be located (POI).
- It is also fair to state that what this research was trying to accomplish at the moment of defining a Standard System of Address was with the only purpose of having a single system to compare with Nicaragua System of Address, since as it was stated, there are too many variants per country. Therefore the Standard System of Address proposed in this research cannot be seen as a strict rule since such standard does not exist. Just as it was stated about

East Asian countries (Wikipedia), addresses start from the most general to the most specific peace of information contrary to many western countries.

- Finally, those peculiarities of Nicaragua system of address should not look at it in its entirety as a cluster of inefficiencies or mistakes; rather its uniqueness represents the identity of a nation that could harmonize with technology and advance systems with the right implementation and good willingness of stakeholders.

5.2 Limitation of study

The most important limitation of the study was the lack of literature related with the system of address of Nicaragua, counting with just some article about the topic and a few formal studies, which let not much literature to be reviewed. The research also has to establish the System of Address of comparison which represented a real challenge taking into consideration that many variants can be presented because of countries' idiosyncrasy. Furthermore an approach like the one proposed in this research for Location Based Service has been never taken into consideration, because system of address based on identifiers, specially based on street names, are taken for granted when LBS system are going to be implemented in a country, therefore this research count with no reference about the matter. The last limitation encountered was related with the extent of the experiment, the results could count with greater value if the participants could have tried the two platforms under real conditions, so they could have realized the significance differences between the two tools, instead the result count in part with the subjective assumptions of the participants regarding usefulness of the platform.

5.3 Future Research

The different variants presented in Nicaraguan System of Address exposed in this study can initiate discussion and future related studies in Location Based Service field. It can be seen as an opportunity to develop new paradigms for LBS, developing new hybrid system of address; *references,* for instance could co-exists with identifiers, since street names and number of houses are not always the most efficient way to locate a POI, instead references can give user a new and faster perspective of how to locate a place. References can become a type of point that plays the role of hints, guiding the user perhaps even faster to the POI he or she is looking for.

REFERENCES

Alcaldía de Managua, ALMA (2004). Datos Generales de Managua [General Data of Managua]. Retrieved on March 10, 2012, from http://www.managua.gob.ni/index.php?s=2001

Baxter P. and Jack S. (2008). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. The Qualitative Report, Volume 13.

Darling, J. (2000) Addressing a problem in Nicaraguan city. The Seattle Times, extracted on March 02, 2012, from http://community.seattletimes.nwsource.com/archive/?date=20000917&slug=4042891

Davis, F. (1989). Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly.

Denzin N. & Lincoln Y. (2000). Handbook of Qualitative Research. 2nd ed. pages 435-454 of Chapter 16 by Robert Stake titled "Case Studies". SAGE Publications

Dru, M-A., Saada, S. (2001). Location-based mobile services: The essentials. Alcatel Telecommunications Review, first quarter, 71-76.

Earthquake Hazards Program, (2010). Historic Earthquakes. U.S. Department of the Interior, extracted on May 15, 2012, from http://earthquake.usgs.gov/earthquakes/world/events/1972_12_23.php

Freeman, J. (2010), From the Little Tree, Half a Block Toward the Lake: Popular Geography and Symbolic Discontent in Post-Sandinista Managua. Antipode Foundation. 42: 336–373. doi: 10.1111/j.1467-8330.2009.00750

Google Inc. Location-based services, extracted on February 26, 2012, from http://support.google.com/maps/bin/answer.py?hl=en&answer=1725632

Harling, Kenneth (2002). An Overview of Case Study. Wilfrid Laurier University, extracted on May 04, 2012, from http://www.farmfoundation.org/news/articlefiles/284-1_harling.pdf

Ille K (1994) Análisis sociosemiótico de textos de direcciones managüenses [Sociosemiotic analysis of texts of Managuan addresses]. In GWotjak and KZimmermann (eds) Unidad y Variación Léxicas del Español de América [Lexical uniformity and variation in American Spanish]. Vervuert Iberoamericana (pp 217–232). Vervuert: Iberoamericana.

Lind, M., (2000) Addresses and Address Data Play a Key Role in Spatial Infrastructure. National Survey and Cadastre, Copenhagen, Denmark

Lind, M. (2001). Developing a System of Public Addresses. National Survey and Cadastre, Copenhagen, Denmark.

Parr, B. (2009). Useful Google Map: Embassies Accepting Injured in Iran. Mashable Social Media Retrieved on February 18, 2012, from http://mashable.com/2009/06/20/google-maps-iran/

Reichenbacher, T. (2004). Mobile Cartography - Adaptive Visualisation of Geographic Information on Mobile Devices. Technical University, Munich.

Revista de la Academia de Geografía e Historia de Nicaragua (2007). Managua en el tiempo [Managua through time]. Alcaldía de Managua, pp. 35-50.

Ross, O. (2002) A City of 2 Million Without a Map, World Press Review, extracted on March 14, 2012, from http://www.worldpress.org/Americas/592.cfm

Safire W. (2009). Location, Location, Location. The New York Times, extracted on March 07, 2012, from http://www.nytimes.com/2009/06/28/magazine/28FOB-onlanguage-t.html

Schiller, J. and Voisard A. (2004), Location-based Services. Morgan Kaufmann Publishers.

Shek, S. (2010). Next-Generation Location-Based Services for mobile devices. Computer Sciences Corporation.

Stake, R. (1995). The Art of Case Study Research. SAGE Publication.

Steiniger S., Neun, M. and Edwardes, A.(2006). Foundations of Location Based Services. Cartouche Press.

Wikipedia contributors (2004). Address. Wikipedia, The Free Encyclopedia. Retrieved on March 10, 2012, from http://en.wikipedia.org/wiki/Address_(geography)

Wikipedia contributors (2004). Highway system in Taiwan. Wikipedia, The Free Encyclopedia. Retrieved on March 10, 2012, from http://en.wikipedia.org/wiki/Highway_System_in_Taiwan

Wikipedia contributors (2004). Technology Acceptance Model. Wikipedia, The Free Encyclopedia. Retrieved on April 20, 2012, from http://en.wikipedia.org/wiki/Technology_acceptance_model

Yin, R. (1994) Case study research: Designs and methods. Beverly Hills: SAGE Publication.

Zhu, X. and Zhou, C. (2009). POI Inquiries and data update based on LBS. IEEE press.

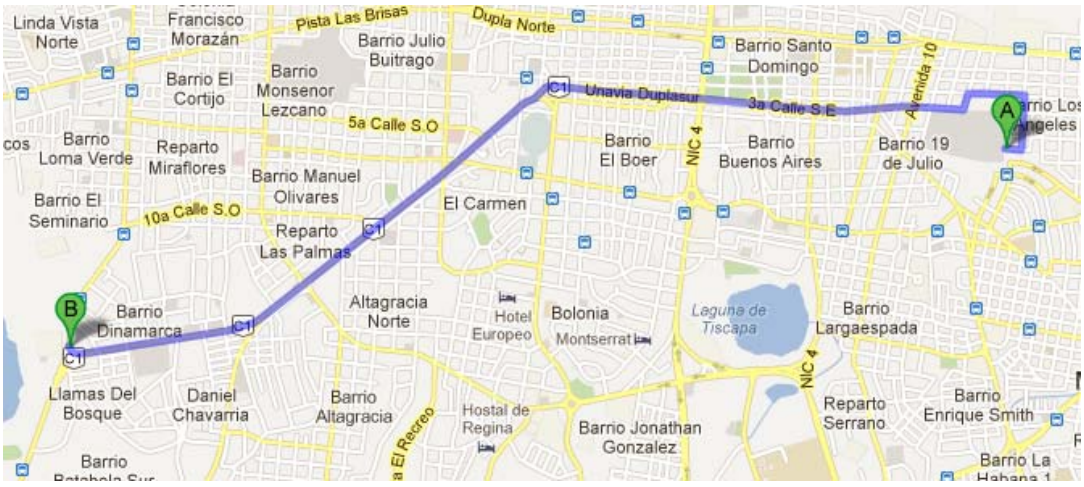
APPENDIX

A – Questions of the Survey

Do you have an approximately idea where this address is? Do you think you can get there?

- □ Address 1: Prado Ecuestre Street No. 100, Las Colinas. (Yes/ No)
- □ Address 2: Sixth St. Southwest No. 675, District 2 (Yes/ No)
- □ Address 3: Las Colinas, from Embassy of Spain 3 blocks up. (Yes/ No)
- □ Address 4: From the statue of Monsignor Lezcano, a block south, 10 varas down (Yes/ No)

B – Partial image of the experiment using Google Map and its respective Technology Acceptance Model Questionnaire



Google Map tool, property of Google Inc.

Technology Acceptance Model Questionnaire

Age: _____ Profession: _____

Circle the response that closest fits your opinion:

1. Trying to go from point A to point B would be difficult to achieve without GOOGLE MAP - Strongly disagree ___ - Disagree ___ - Slightly disagree ___ - Neutral ___ - Slightly agree____ - Agree __ - Strongly Agree ___	**3. With the information provided, I would find GOOGLE MAP useful when I try to go from point A to point B** - Strongly disagree ___ - Disagree ___ - Slightly disagree ___ - Neutral ___ - Slightly agree____ - Agree __ - Strongly Agree ___
2. GOOGLE MAP improves the quality of decision making about how to go from point A to point B - Strongly disagree ___ - Disagree ___ - Slightly disagree ___ - Neutral ___ - Slightly agree____ - Agree __ - Strongly Agree ___	**4. GOOGLE MAP enables me to identify how to go from point A to point B more quickly, saving me time.** - Strongly disagree ___ - Disagree ___ - Slightly disagree ___ - Neutral ___ - Slightly agree____ - Agree __ - Strongly Agree ___

C – Partial image of the experiment using XTool and its respective Technology Acceptance Model Questionnaire

XTool prototype tool developed for the experiment

Technology Acceptance Model Questionnaire

Age: _____ Profession: _____

Circle the response that closest fits your opinion:

1. **Trying to go from point A to point B would be difficult to achieve without XTOOL**

- Strongly disagree ___
- Disagree ___
- Slightly disagree ___
- Neutral ___
- Slightly agree____
- Agree __
- Strongly Agree ___

2. **XTOOL improves the quality of decision making about how to go from point A to point B**

- Strongly disagree ___
- Disagree ___
- Slightly disagree ___
- Neutral ___
- Slightly agree____
- Agree __
- Strongly Agree ___

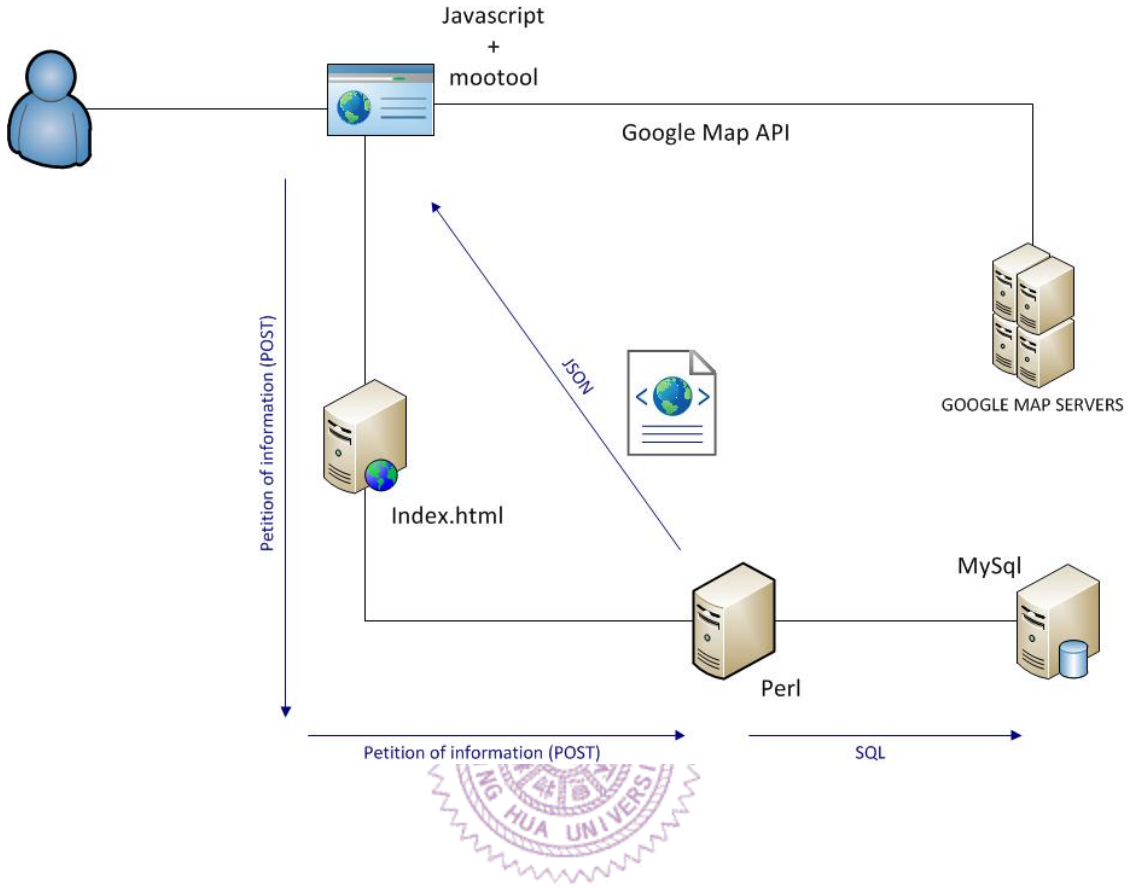
3. **With the information provided, I would find XTOOL useful when I try to go from point A to point B**

- Strongly disagree ___
- Disagree ___
- Slightly disagree ___
- Neutral ___
- Slightly agree____
- Agree __
- Strongly Agree ___

4. **XTOOL enables me to identify how to go from point A to point B more quickly, saving me time.**

- Strongly disagree ___
- Disagree ___
- Slightly disagree ___
- Neutral ___
- Slightly agree____
- Agree __
- Strongly Agree ___

D – Deployment diagram of the XTool prototype



E – Example of POI displays in Google Map tool