Intelligent transportation systems and parking management with approaches to IPv6 protocol and Services Oriented Architecture

Natalia Pineda-Tarazona, Luis Felipe Herrera-Quintero
Catholic University of Colombia
Bogotá D.C, Colombia
{jnpineda88, lfherrera}@ucatolica.edu.co
ITS Colombia

Abstract *-- The problems arising from the gap between demand and supply of parking spaces are becoming increasingly acute in most towns and cities. These difficulties are noted mainly in more densely populated areas that are poorly served by public transportation facilities and where the planning and use of existing areas is inadequate. The importance of controlling parking spaces as an integral element of the traffic and trip demand management process. This paper presents a methodological procedure that was done to parking management and the different technologies that was used for the same, for example, ipv6 protocol and Service Oriented Architecture. This procedure includes the development of a logic architecture for processing and transferring data and information. The results expected through the implementation of the proposed system indicate that the resulting benefits would include possibly lower levels of traffic congestion in the area under consideration, while also reducing air pollution.*

Key words: *DMS, APMS, ITS, IPv6, SOA, parking management*

INTRODUCTION

The goal of intelligent transportation systems (ITS) is to improve the effectiveness, efficiency, and safety of the transportation system. Long range planning for the deployment of ITS technologies depends in part on the knowledge of which technologies are most effective. Thus, it is important to understand the benefits of emerging and existing technologies.

The objective or purpose of ITS is give response to the needs of transport, by applying ICT (Information and Communications) and other new paradigms and technologies focused services . Its scope is very large and has acquired remarkable development in all modes of transport (air, rail, sea, land) . However, it is the road area where applications are more varied, which can offer greater benefits and where they will achieve the expected results of greater social and economic impact. The ITS arise as a solution to the growing demand for mobility, mainly in urban areas.

The ITS focus on various solutions and applications, however one that will be addressed in this paper grade is to manage the parking area of the cyclical ITS that provides mobility in cities and it is of great relevance to them. In this paper will be detected to find viable solutions to the problems encountered in the cities due to heavy traffic is carried and long distances traveled to get a parking space and significantly improve certain problems that are caused by this, for example, mobility, reducing travel times, traffic reduction, pollution reduction; this will be done and will be done by making use of new technological tools like the ipv6 protocol and indisputable and already remarkable growth service-oriented architectures.

Many areas have seen explosive growth in the number of visitors and patrons as the result of urban revitalization, suburban development, and the general trend of ever-increasing mobility. Parking is increasingly becoming an important aspect of transportation planning.

As stakeholders set out to address parking management issues, they often consider Intelligent Transportation Systems. ITS applications involving APMS (Automatic People Mover) have been employed in Europe and Japan for several years and are beginning to be deployed in the U.S. Advanced parking management systems maintain real-time parking space inventories across a set of participating facilities. These data are used to generate parking availability messages that are distributed to travelers through several different means. Such data also help facility owners track demand. In some cases, the information is provided for pre-trip use to travelers seeking information on the Internet. In other cases, it is provided to motorists on roadways by dynamic message signs (DMS) located at key decision points along routes to a desired destination.

Advanced parking management systems help travelers find parking spots quickly, thereby reducing frustration and enhancing a visitor's overall experience. Advanced parking management systems include elements from traditional

traveler information systems, as well as specialized parking management applications. Advanced parking management systems offer a wide range of applications, from pre-trip Web-based information systems to navigation systems that provide turn-by-turn directions all the way to an individual parking space.

Among advanced parking management systems currently deployed or being considered, there are common elements that can be identified.

This paper discusses common parking problems, defines the stakeholders and their interests, and examines the range of APMS technologies in use within Colombia today.

I. BACKGROUND

Parking has been a component of air and rail travel since the early days of automobile and air travel. Change-mode parking has been in use at transit stations for over 70 years, with the first records of operating lots being those operated at gas stations along a Detroit transit line in the 1930s. By the 1960s similar lots were in use in major cities throughout the United States. Since travel to and from the transit station lots was primarily work-oriented, they became known as "commuter lots." The lots originally developed for many of the same reasons they are chosen for implementation today, including:

- Improving transit operating efficiency
- Attracting new riders to transit/HOVs
- Providing alternatives to highway travel in congested corridors
- Reducing energy consumption, and air pollution
- Addressing the transportation needs of special events

In recent history, the lots have become an important component of management plans designed to increase the effectiveness of urban transportation systems. Interest in parking increased as cities developed transportation systems management (TSM) plans.

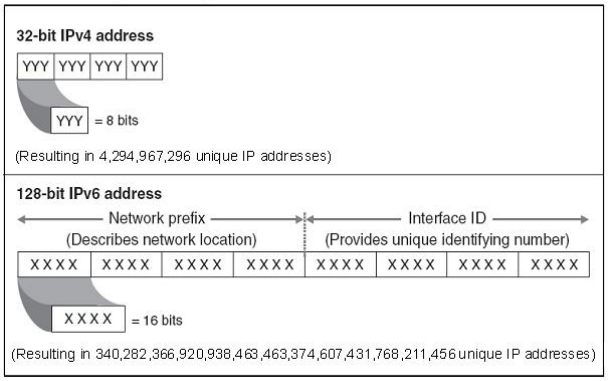
These were efforts to develop low cost improvements that would enhance the operation of transportation systems. Metropolitan areas are now incorporating change-mode parking facilities into transportation demand management (TDM) programs, which also aim to enhance the operation of transportation networks, but do so by trying to control the demand for travel (Turnbull, 1995: 6-7). Turnbull summarized the characteristics of various change-mode parking facilities associated with urban transportation systems in North America. Table 1 shows estimates of the size and range of utilization levels at various types of facilities.

IPv6

Is the latest version of the Internet Protocol (IP), the communications protocol that provides an identification and location system for computers on networks and routes traffic across the Internet. IPv6 was developed by the Internet Engineering Task Force (IETF) to deal with the long-anticipated problem of IPv4 address exhaustion.

In order to connect devices over the Internet, each device must have an Internet protocol (IP) address. The current IP system is Version 4 (IPv4), which makes available over four billion IP addresses. However, the huge increase in Internet users and devices worldwide means that IPv4 addresses are running out. IPv6, the next-generation protocol, provides approximately 340 *undecillion* IP addresses, ensuring availability of new IP addresses far into the future, as well as promoting the continued expansion and innovation of Internet technology.

Figure 1: Comparison of IPv6 and IPv4 Address Scheme



Source: GAO.

SOA

Is a software design and software architecture design pattern based on discrete pieces of software providing application functionality as services to other applications. This is known as service-orientation. It is independent of any vendor, product or technology.

A service is a self-contained unit of functionality, such as retrieving an online bank statement. Services can be combined by other software applications to provide the complete functionality of a large software application. SOA makes it easy for computers connected over a network to cooperate. Every computer can run an arbitrary number of services, and each service is built in a way that ensures that the service can exchange information with any other service in the network

without human interaction and without the need to make changes to the underlying program itself.

SOA is based on the concept of a *service*. Depending on the service design approach taken, each SOA service is designed to perform one or more activities by implementing one or more service operations. As a result, each service is built as a discrete piece of code.

This makes it possible to reuse the code in different ways throughout the application by changing only the way an individual service interoperates with other services that make up the application, versus making code changes to the service itself. SOA design principles are used during software development and integration.

SOA generally provides a way for consumers of services, such as web-based applications, to be aware of available SOA-based services. For example, several disparate departments within a company may develop and deploy SOA services in different implementation languages; their respective clients will benefit from a well-defined interface to access them.

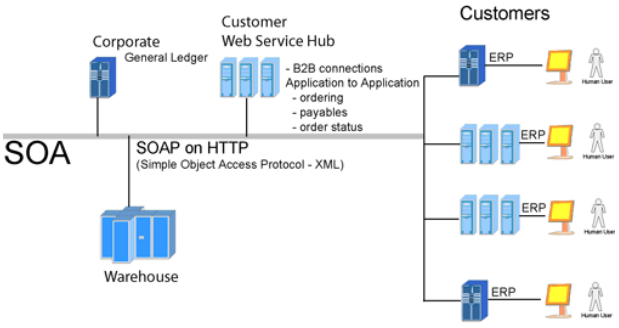


Figure 2. SOA

II. PROPOSAL

The contribution of this work is to research to generate a simulation of a system of parking management for Intelligent Transportation Systems and emphasizing use of new technologies, for example, the new Internet protocol IPv6, which has supported Somehow or other service-oriented architectures.

Given that the great cities of the world have an ITS and Bogotá DC one of the problems to be solved consists in the handling and management of spaces to facilitate the location and parking of vehicles at origin and destination, for it takes minimal space and enough facilities to reach it. For many years they have been designed and implemented to inform the user of the availability of seats.

Given these conditions, this research raises among its purposes the simulation of a system of control and management of parking spaces to facilitate users to the closest location each of these depending on the area in which find located; and thus improve the different mobility problems that occur in the city; as an alternative that allows the city and present solutions Colombian industry high quality and reliability.

For the realization of this project will follow a methodology hypothetical - deductive, which part of the creation of a hypothesis to explain a problem, that deduction will bring consequences, proposals, solutions, verification of results and conclusions.

To carry out the full implementation and development of this project are to perform and complete the following steps:

- Identification of needs and requirements
- Analysis of system requirements
- System Architecture
- Implementation of the system
- Analysis of results
- Conclusions

The simulation system consists of an application that manages the parking spaces, access to them of users and modules of the proposed solution.

Then we proceed to give a detailed explanation of the modules that were developed and implemented in the application.

Server Module

This module may be modified, deleted, enter and view entities database , for example, bays, vehicles, parking, users, rates and types of vehicles.

Customers Module

This module system users are invited to check, modify and delete your personal data and your vehicle to make use of other system tools.

Management Module

In this module all corresponding to the google maps library will be managed. In this module, users can scroll through maps, where there are parking spaces available for your vehicle, and managing time entry and exit of vehicles will also manage to identify when a bay is busy and when it empties.

Users access

All system users can access the tool via the Internet. The system basically have two profiles , the first is the system administrator who has privileges to create users on the system and allocate roles, and other functions of the system configuration and parameterization, the second, or stakeholder profile system user, who can register their data, the vehicle and the display of various system modules to interact with it.

III. IMPLEMENTATION

The system will design and implement a simulation of the management and control of parking. This system will allow users to record, access, create, modify and delete all types of information regarding the data are recorded by them in the system.

The system will have different modules in which users can see all the information relating to parking, registration of vehicles and users, bays that are available in the parking lots, etc.

For the development of the system was necessary to carry out the design and implementation different phases of software engineering approaches that were used to collect relevant information requirements and system stakeholders.

The figure below shows the system interaction with the user is displayed with other mechanical systems or manuals, or any existing corporate data bases and the process used for the management of requirements with system software that was implemented for this purpose.

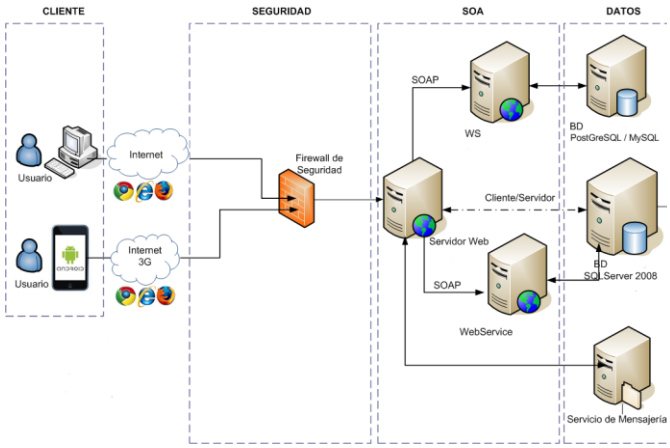


Figure 3. System design

The requirements analysis is the task that asks what the system should do to meet the business needs and user requirements. Therefore at this stage the emphasis is on what the system should do and not on how to do it.

For this phase the following activities:

• Recognition of the problem, defining the basic elements of the system as perceived by the user. Thus the context of the system comprises, besides the set needed for the analysis of the problem, with the indispensable contribution of user communication.

It will distinguish between the scope of the system, you must specify briefly and from the objectives, the business functions to be machined, and the general context of the system showing the system interaction with the user, other mechanized or manual, or any existing corporate data base systems.

The goal of the implementation phase of the system is to identify possible architectural solutions that satisfy both user requirements and possible design constraints. To perform this process, possible solutions are defined, and select the most suitable to be developed and implemented.

For this phase the following activities:

• Identify alternatives for application development, both hardware and software. Importantly, the fact that continually will distinguish between hardware elements needed to develop the proposed system and hardware elements to be used for the simulation of this system.

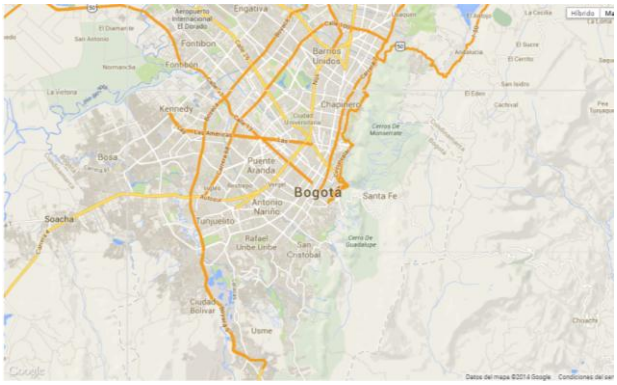
• In the study of the possibilities for the necessary software will refer to operating systems, platforms, database managers, etc.

• Election within those alternatives hardware and software architecture that will support the application.

V. CONCLUSIONS

This paper presents a new web service for users who use certain types of applications to locate parking spaces there are close to where they are located and validate the status of the same, for example, validate through a web service if the parking spaces are occupied or free to make use of them.

This system can significantly reduce the various problems encountered in the time to get a free parking space, as the decrease in travel time, decreased pollution, improved mobility, decreased traffic, etc.



VII. REFERENCES

[1] Hendricks, Susan and Maren Outwater. "Demand Forecasting Model for Park-and-Ride Lots in King County, Washington." Transportation Research Record 1623; Transit, Bus, Paratransit, Rural, Intermodalism, Rail, Commuter and Intercity Rail, Light Rail. Washington, D.C.: Transportation Research Board, 1998.

[2] ITS Deployment Analysis System. Build 1. Computer Software. Cambridge Systematics, Inc., 1998.

[3] Kavak, F.C. and M. J. Demetsky. "Behavioral Modeling of Express Bus Fringe Parking Decisions." Transportation Research Record 534: Travel Behavior and Values. Washington, D.C.: Transportation Research Board, 1975.

[4] Kelton, W. David, Randall P. Sadowski, and Deborah A. Sadowski. Simulation with Arena. Boston: WCB McGraw-Hill, 1998.

[5] Kerzner, Harold. Project Management: A Systems Approach to Planning, Scheduling, and Controlling. Sixth Edition. New York: John Wiley and Sons, Inc.: 1998.

[6] Khattak, Asad and John Polak. "Effect of Parking Information on Travelers' Knowledge and Behavior." Transportation. Vol. 24 No. 4, 1993. pp. 373-393

[7] Kopp, J. Christopher and Mark E. Pitstick. "Evaluating Multimodal Access to Transit." Proceedings of Transportation Research Board 79th Annual Meeting (Preprint CD-ROM). 9-13 January, 1999. Washington, DC: Transportation Research Board, 2000.

[8] Liu, Rongfang, Ram M. Pendyalu, and Steven Polzin. "Simulation of the Effects of Intermodal Transfer Penalties on Transit Use." Transportation Research Record 1623: Transit, Bus, Paratransit, Rural, Intermodalism, Rail, Commuter and Intercity Rail, Light Rail. Washington, D.C.: Transportation Research Board, 1998.

[9] McCants, Douglas M., Larry G. Richards, and Michael J. Demetsky. Decision Procedures in Transit Station Design. USDOT Report (DOT-1-83-56). Washington, DC: May, 1981.

[10] Miller, Mark A. and Camille Tsao. "Passenger Intermodal Operations and Services: A Synthesis of the Challenges and Opportunities for Successful Implementation."

[11] Proceedings of Transportation Research Board 79th Annual Meeting (Preprint CD-ROM). 9-13 January, 2000. Washington, DC: Transportation Research Board, 2000.

[12] GÁLVEZ SERNA, JULIANA ANDREA - HINCAPIÉ, ROBERTO CARLOS. Las Redes Inalámbricas Ad-Hoc En La Comunicación Vehicular.

[13] FLEMMING GANNETT. Sistemas Inteligentes de transportes. Citado en internet: < http://www.calymayor.com.mx/website/documentos/its.pdf>

[14] AWDUCHE, DANIEL O. Beneficios de IPv6 para las empresas. Citado en internet: < http://www.verizonenterprise.com/resources/whitepapers/wp_beneficios-de-ipv6-para-las-empresas_es_xg.pdf>

[15] <http://ipv4to6.blogspot.com/p/caracteristicas-y-beneficios-de-ipv6.html>

[16] Nadal Estrada, Jordi. El arte del parking: manual del diseño, construcción y gestión del aparcamiento. Difusión Jurídica Y Temas De Actualidad. Madrid, 2009

[17] Barranco de Areba, Jesús. Metodología del análisis estructurado de sistemas. 2ª edición. Universidad Pontificia Comillas. 2001

[18] Hawryskiewycz, I.T. Introducción al análisis y diseño de sistemas con ejemplos prácticos. Anaya Multimedia. 1990

[19] Glover, Hill y Bhatt, Himanshu. RFID essentials. Reilly & Associates. USA, 2006

[20] Lehpamer, Hervey. RFID Design Principles. Artech House Publishers. USA, 2007

[21] Martin Sierra, Antonio J. Programador certificado Java 2. Ra-Ma. Madrid, 2007

[22] Froufe Quintas, Agustin. Java2: Manual de usuario y tutorial. Ra-Ma. USA, 2008

[23] Página de soluciones en control de accesos y seguridad <http://www.accesor.com/esp/art2_query.php?sol=13>