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SCIENTIFIC ARTICLE

THEME: MOBILE APPLICATION FOR THE DETECTION OF PARKING SPACES AT THE TECHNICAL UNIVERSITY OF THE NORTH, DEVELOPED FOR ANDROID DEVICES.

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***Summary.** The present titling project details a prototype of intelligent parking using networks of photoelectric sensors.*

In the first chapter, the problem of the number of vehicles currently entering the university is raised, and therefore requires new methods for managing mobility, both in traffic control and in the management of parking spaces. The second chapter details the theoretical framework in which sensor networks are specified as an important tool for disseminating information about the state of the parking lot.

The development of the system is done with Basic4Android and is detailed in the third chapter, where the previous analysis allows to know the deficiencies, both in the analysis of the delay of the system, and the benefits of its implementation; Which are the objectives of this work and thus provide recommendations for future work in real time. For the tests three sensors were placed in the parking spaces located in the central parking lot of the university, this information is collected and sent to the application installed on the mobile devices of the users through WiFi; In this way, users can observe the location of the parking spaces and their availability in real time.

The impacts taking as a starting point the substantial improvement in the economic, environmental and social aspect are detailed in the fourth chapter.

***Keywords:** University, mobility, parking spaces, sensor networks, Basic4Android, real time, mobile devices, WiFi.*

1. Introduction

Mobile applications have been developing since the early 90's, their evolution opened up in WAP and EDGE technologies allowing the development of cell phones. In today's society mobile technology has allowed a great advance in communications and educational development.

Apple launches the iPhone and along with it come many more smartphone proposals, including Android, the largest competition in the iPhone operating system. It is here that the boom of applications, games, news, design, art, photography, medicine starts all in your hands thanks to the revolution of mobile applications.

The UTN involved since its inception in these technological advances, has allowed university students to be immersed in this field.

The explosion of mobile devices is causing an increase in the use of mobile applications. This high adoption of mobile applications is reflected in the high demand for tablets and smartphones, so people spend much more time on their mobile devices.

Applications have inspired a new class of entrepreneurs. These innovators have turned their mobile phones and tablets into tools to discover, organize and control the world, awakening a multi-million dollar virtual industry.

Android with its store being an open source platform allows more freedom, and with this come cheap smartphones. The sale of smartphones has surpassed that of normal phones. Currently people of all ages and status use applications, and that is why these devices are gradually becoming essential, and would be nothing without the abundant and varied ecosystem of applications that exists for all platforms.

The complete implementation of this application at the Technical University of North will serve to facilitate the parking for the users who enter the institution.

In the future implement this application in the city of Ibarra, will avoid the parking fee and will grant pay parking time, through any mobile device.

2. Materials and Methods

The following is a description of the tools and methodology used for the development of the system, giving concepts of frameworks, database, web server, languages and development methodology.

2.1 Development Tools

The development tools used to create the system are the following:

BASIC4ANDROID

It is better known by its abbreviation: B4A, a comfort for the lovers of the code in Basic and that allows us to quickly and effectively realize small jewels for our devices. [1]

MYSQL

It is a relational database management system that stores the data in separate tables instead of putting all the data in one place. [2]

PHP

PHP is a general-purpose server-side code programming language originally designed for dynamic content web development. [3]

ARDUINO

It is a free hardware company and a technological community that designs and manufactures computer hardware and software development boards, composed respectively of printed circuit boards that integrate a micro controller and a development environment (IDE), where each board is programmed. [4]

HTML 5

It is the fifth major revision of the basic language of the World Wide Web, HTML. New features continue to be introduced to help web application authors.

HTML5 sets a number of new elements and attributes that reflect the typical use of modern websites. [5]

CSS3

Cascading style sheet is a language used to define the presentation of a structured document written in HTML or XML. The specification of CSS3 comes with interesting novelties that will allow to make webs more elaborate and more dynamic, with greater separation between styles and contents. It will support many needs of the current webs, without having to resort to designer tricks or programming languages. [6]

JSCRIPT

Also known as JS object-oriented, prototype-based, imperative, weakly typed and dynamic.

It is mainly used in its client-side form, implemented as part of a web browser allowing improvements in the user interface and dynamic web pages. [7]

JQUERY

Quick, small, feature-rich JavaScript library. It does things like HTML touring and document manipulation, event management, animation and Ajax.

It works through a multitude of browsers. [8]

AJAX

AJAX, an acronym for Asynchronous JavaScript And XML (asynchronous JavaScript and XML), is a web development technique for creating Rich Internet Applications (RIA) applications. These applications run on the client, that is, on the users browser while maintaining asynchronous communication with the server in the background. [9]

2.2 Development methodology

The SCRUM methodology used for software development is agile and flexible; Is based on a constant, iterative and incremental work process.

Program Design

Document describing the activities aimed at achieving a specific objective of research, development and innovation of technology in a defined time and cost interval, besides specifying the scope, justification, beneficiaries among other aspects related to the system to be developed.

Roles

There are two fundamental aspects to differentiate, actors and actions:

a) Actors

ProductOwner.- Is the person responsible for transmitting the vision, knows the requirements and marks the priorities of the project or product.

Scrum Master.- Is the person who ensures the monitoring of the methodology guiding the meetings and helping the team in their tasks within the project.

ScrumTeam.- Are the people responsible for developing and delivering the product.

Users or Customer.- Are the final beneficiaries of the application to be developed.

b) Actions

Definition of the project (ProductBacklog): It is a document that collects the set of requirements that are associated with the project. It is a high level document, containing generic (not detailed) descriptions, and subject to modifications throughout development.

Sprint Definition (Sprint Backlog): A subset of requirements, which come from ProductBacklog, is the document that describes the tasks that are required to perform the subset of requirements.

Pedagogical Design

It describes the most relevant issues of the mobile application for the detection of parking spaces, the

objectives and tools that are proposed for the detection of parking.

The status of each place is revealed in real time, the administrator who controls each of the parking lots and a daily and annual statistics of how many vehicles occupied each seat.

User manual

Document focused on the end user, which describes in detail the operation of the system. Each module fulfills a different function for each user.

Technical manual

Document focused on system experts; In which the system architecture, installation, configuration, requirements and other technical data are described.

Term of Projects

Document where it is announced that the development of the application has been completed and is approved by the people who are given the project.

3. Results

The impact of the application on the population is described below; In addition to the development and operation of the software following the process established by the SCRUM methodology.

3.1 Impact analysis

Impacts are the traces, signals and positive or negative aspects that the project's implementation provoked or provoked in different areas or aspects (economic, social, environmental, educational), which for a better understanding are analyzed on the basis of a Matrix of impacts.

For this the following analysis was carried out:

IMPACTO ECONÓMICO							
Indicador	Niveles de Impacto						
	-3	-2	-1	0	1	2	3
Generación de microempresa (costo mínimo del software)							X
Implementación del Proyecto en la Universidad					X		
Ahorro de combustible							X
Reducción del tiempo de espera							X
Total							10
							Σ 10

Table 1: Economic impact

The economic impact is expected to be highly positive, not only because it will simplify the search

for a parking space, but also because the reduction of waiting time will save fuel.

IMPACTO SOCIAL							
Indicador	Niveles de Impacto						
	-3	-2	-1	0	1	2	3
Reducción del nivel de estrés							X
Cambio en el estilo de vida							X
Disminución de las sensaciones de cansancio							X
Total							9
							Σ 9

Table 2: Social impact

The social impact is expected to be highly positive, not only because it reduces the level of stress, but also because it decreases feelings of tiredness; Which improves the lifestyle.

IMPACTO AMBIENTAL							
Indicador	Niveles de Impacto						
	-3	-2	-1	0	1	2	3
Emissiones de CO2							X
Tráfico congestionado							X
Se elimina el ruido							X
Total							9
							Σ 9

Table 3: Environmental impact

The expected environmental impact is highly positive, not only because it reduces CO2 emissions, but also because it reduces noise emissions; Which improves the conglomerate of vehicles.

3.2 System Architecture

The software architecture includes the most significant static and dynamic aspects of the system, in addition it is a complete design view with the most important features highlighted, leaving the details aside.

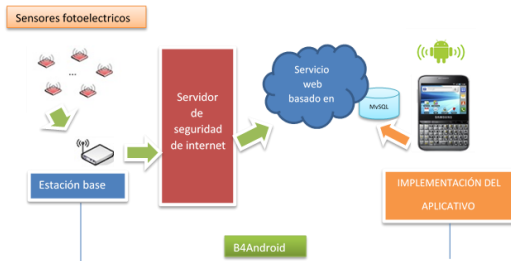


Figure 1: System Architecture

For this phase the following activities will be carried out:

- Identify alternatives for developing the application, both hardware and software. A distinction must be made between the hardware elements to develop the system

and the possibilities for other necessary software such as: operating system, platform, web services, etc.

- Choice within the hardware and software architecture alternatives that the application will support.

3.3 System Development

The system is based on a main architecture, so that it is more manageable and allows us to obtain a unique presentation and access, since it has an administrator who controls the central parking.

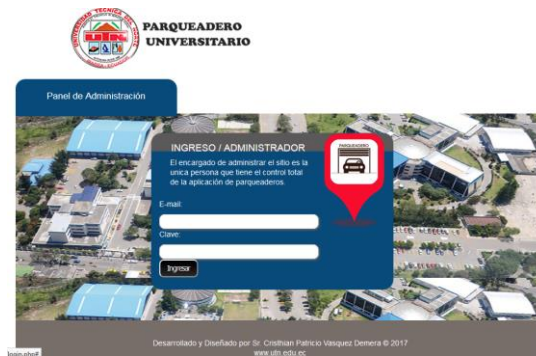


Figure 2: Mobile Application Manager

Administrator: The admin user has access to all parking spaces and can block them if required. You can block users so that they can not visualize which parking places are available, in addition you can see daily and annual reports to know how many vehicles have accessed the parking lot.

Mobile app

The application allows you to visualize in real time that parking space is available.



Figure 3: Mobile app

3.4 System Experimentation and Validation

The development of the application had two failed attempts because the WiFi module did not meet the requirements to send the information to the mobile. After that it was realized that the ESP8266MOD module was the optimum to realize the system.

Subsequently, the physical implementation of the electronic devices (which mainly verify non-functional aspects) and acceptance, where the users validate that the system does what they really expected (without forgetting that the limits are established by the models previously made And which must have been validated).

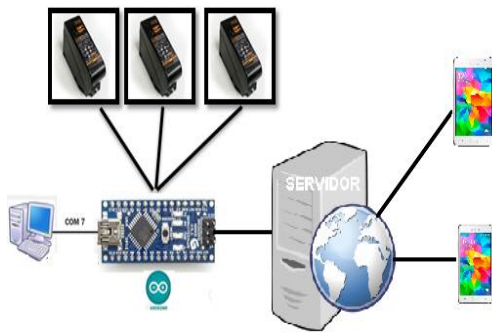


Figure 4: Physical connection of devices

4. CONCLUSIONS

- ✓ The mobile application benefits teachers, students and administrators who are part of Universidad Técnica del Norte, as it allows parking to improve its accessibility, helping the user to go to the exact parking available, which has also improved Their mobility, reducing the time in which vehicles circulate.
- ✓ It has caused a very beneficial economic impact in terms of fuel savings, which according to the analysis made it possible to save \$ 13.92 during the semester; Cost that is reflected if a user attends twice a day, since if he attends more times the cost would be higher.
- ✓ Emissions of CO2 decrease in quantity, which allows to take care of the ozone

layer that is being deteriorated every day by pollution.

- ✓ Considering one of the most important impacts is the reduction of the stress levels that are caused when looking for a free place and all those factors that cause health damages such as: tiredness, anxiety, back pain, neck pain, humor changes.
- ✓ This application gives the opportunity to create a microenterprise dedicated to the parking of vehicles in any institution or company in the whole country where the agglomeration of vehicles is enormous.

REFERENCES

- [1] José Ángel. (2013). Programa tu Android en BASIC. Recuperado de <http://www.diverteka.com/?p=1258>.
- [2] Witigo. (2015). Instalación de mysql. Recuperado de <http://www.witigos.es/wp-content/uploads/2014/12/MySQL-Database.png>.
- [3] Wikipedia, « PHP » 17 de febrero de 2017. [En línea]. Available: <https://es.wikipedia.org/wiki/PHP>
- [4] Wikipedia, « Arduino, » 01 de marzo de 2017. [En línea]. Available: <https://es.wikipedia.org/wiki/Arduino>.
- [5] Wikipedia, « HTML5, » 17 de octubre de 2016. [En línea]. Available: <https://es.wikipedia.org/wiki/HTML5>.
- [6] Ecured, « Hojas de estilo en cascada, » 27 de octubre de 2016. [En línea]. Available: <https://www.ecured.cu/CSS>.
- [7] Wikipedia, « JAVASCRIPT, » 1995. [En línea]. Available: <https://es.wikipedia.org/wiki/JavaScript>.
- [8] Diego Ortiz, « J-QUERY Y SUS FUNCIONES, » 26 de febrero de 2015. [En línea]. Available: <https://prezi.com/xpezigayonvg/copia-de-current-event/>.
- [9] Wikipedia, « Ajax, » 02 de septiembre de 2016. [En línea]. Available: <https://es.wikipedia.org/wiki/AJAX>.