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Development of a WEB prototype based on JSON and REST technology to manage progress in the physical and psychological rehabilitation of people with cognitive disability

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Abstract

The vulnerable population with motor and cognitive disabilities in our country confronts daily to endless number of situations that transgress its rights and possibilities to carry on a dignified life. The governmental and private agencies in charge of knowing the current situation and also of establishing an adequate registry and control of the people who present some of the disabilities, work different procedures and processes, managing information that is often not reliable, is not integrated, updated or it does not cover certain sectors of the population, which allows us to establish that said information it is not truthful, reliable and successful its entirety. In addition to having basic information about patients with some type of cognitive disability, it is necessary to know some treatments that they have received, and which one have been their progress with the aim that the doctors or specialists in the topic can check the advance in the recovery physical and psychological of the patient.

On the other hand, it would increase the possibility that a disable person, who has reached a degree of progress in their treatment previously established, may be linked to the labor force,

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performing some job chord with your capabilities and abilities physical and mental. In conclusion, we find in the face of a population that suffer discrimination by part of your fellow citizens and by governmental and private agencies, who see them more than a load that as people with feelings and specific needs. By the reasons previously exposed, it can be established the importance of prototype a web application's development, through the utilization Ajax's technologies with the aim to avoid overloads and response times in the remote server and allow to include in your architecture essential aspects of information management like: the reliability, speed and veracity of the information, beside to can integrate and store the basic information of the patients, treatments performed and progress made By the reasons previously exposed, it can be established the importance of a web application's development, through the utilization JSON and REST technologies with the aim to avoid overloads and response times in the remote server and allow to include in your architecture essential aspects of information management like: the reliability, speed and veracity of the information, beside to can integrate and store the basic information of the patients, treatments performed and progress made in the rehabilitation of population with different kind of disabilities motor and cognitive, with the aim to design later programs an projects to get better the quality life of these people in aspects of vital importance for your development like a member of society.

Keywords: Disabilities, cognitive, rehabilitation, Web, JSON, REST

1. Introduction

According to statistical data from the National Administrative Department of Statistics (Dane) [1], in Colombia there are 2'624,898 people with some type of disability, equivalent to 6.3% of the population.

However, the Register of Location and Characterization of Persons with Disabilities (RLCPD) created by the Ministry of Health and Social Protection presented in August 2014, that in the country only about 1'121.274 have been registered with a disability in banks of data. According to these governmental data on disability issues, it can be inferred that they are almost 50% far from reality and that they are far from reliable, since neither the same governmental entities of national and municipal nature know exactly how many people

disabled exists in the country and much less in the city under study, in addition to factors of great importance such as: The conditions in which they are, recovery treatments they have received and progress made, for these factors is that the importance of the project is makes it so obvious, since it will allow to unify and consolidate key information in an online system that can meet the search and query requirements of relevant information of the disabled population by governmental and private entities that allow to know the reality of these people and based on the results found design policies and programs for to improve their quality of life [2].

Complementing the above, to know the situation of people with cognitive disabilities through the prototype of a Web application using Ajax technologies, will optimize response times and avoid server overload, since only the requested information will be supplied without using non-essential resources such as all the load of the page, in addition the fact that the site is hosted in the cloud will allow its total availability at any time and day that a consultation is necessary.

Therefore, consulting updated, reliable and truthful information from public and private organizations is essential, since it would allow public and private policies focused on the disabled population to be more effective and allow them to have a better quality of life, from projects or strategies of inclusion and coverage in mobility, education, sports, work and health [3].

2. Research methodology

2.1. Research approach

This research work is based on two parts, the methodological or investigative part complemented with the disciplinary part. The first part is established under the following parameters:

1. Selection of the research topic
2. Design of information gathering tools
3. Application of information gathering tools
4. Processing of information
5. Description, analysis and interpretation of the data collected

Regarding the disciplinary part, we have the following stages or phases:

1. Analysis stage: Establish the functional and non-functional requirements of the prototype.
2. Design stage: Architectural design of the prototype
3. Stage of software development: Routines for programming modules and interfaces
4. Maintenance stage: Modification of components and correction of errors

2.2. Compilation of information

The development of the proposed prototype is carried out in the rehabilitation institution called "Reina Sofia Foundation" of the city of Ibagué (Tolima), where the institution works with patients with cognitive disabilities (especially patients with Down syndrome, autism and cerebral palsy).). For the collection of information, the problem was addressed from several aspects, among which the following stand out:

- The psychological (Psychologist of the foundation)
- The cognitive (Special education graduate)
- The physical or motor (Physical Therapist)

Once the technical requirements have been determined, it is necessary to apply the criteria established by Wright [4], to obtain the "what", "how" and "why" of the proposed research in order to carry out the software application.

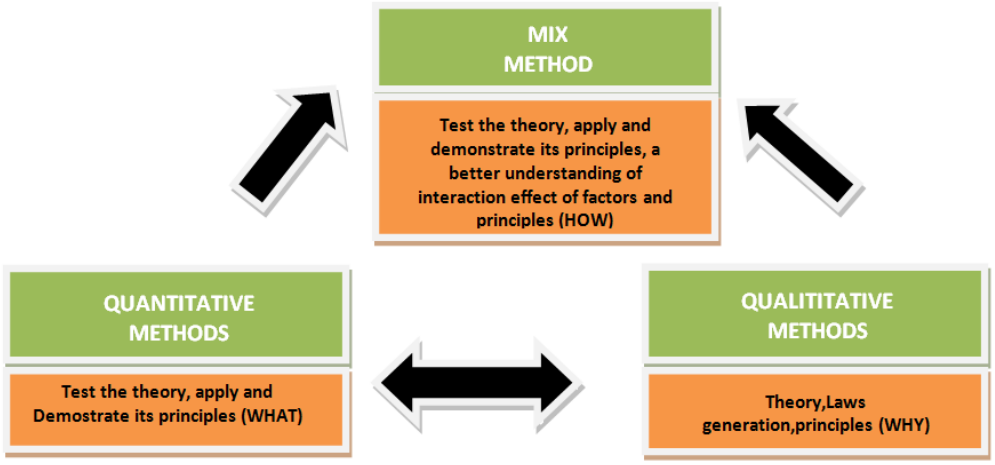

Figure 1. Research methodology applied

2.3. Processing of information

The development of this point will focus on the 3 aspects dealt with at the information collection point, since based on the information provided by the professionals interviewed, we have an information survey according to the planned objective.

- **Psychological aspect:** By conducting the interview with the psychologist of the foundation we could establish that the management of this type of population is quite complex, since there are different types and degrees of disabilities, often these pathologies are innate or acquired. The cognitive development of this type of people is slow and sometimes they regress, losing all the advanced terrain.
- **Cognitive aspect:** Through the interview conducted with the graduate in special education, we were able to determine that patients with Asperger syndrome are people who are too intelligent but who have difficulties communicating. There are three types of disability: low, medium and high.
- **Engine aspect:** By conducting the interview with the physical therapist we could establish that children with Down syndrome have spinal problems, their neck is very short and can be easily injured, they should handle activities such as: running, but not spinning or anything similar, and other pathologies such as hypermobility, which consists of the exaggerated increase in mobility in the joints, reaching this type of patients to a greater degree of flexibility than the rest of the population.

2.4. Application architectural design

In terms of software engineering, one of the most important and important phases is design because it allows answering the question of what is the system going to do?

Therefore, it is vital to develop a design methodology that allows us to visualize the interaction between the different components of the system, for this purpose we have opted for the object-oriented methodology [5], since it allows us to have a global vision of the system and in a more detailed way obtain a more specific view of key components of the system and the relationships between them.

The design have two phases:

• Architectural: It focuses on the representation of the structure of the components, properties, relationships and interactions of the software.

• Design data: Where we facilitate the representation of the data components of the architecture.

In addition, it is important to determine the advantages and importance of this phase in the software development process, as follows:

• Facilitate communication among stakeholders in the different stages of system development.

• Determine the first design decisions that will have a profound impact on all software engineering work.

• It is an integral model of how the system is structured and how its components work together.

The architectural design is an ideal scenario for the use of UML (Unified Modeling Language) [6], since among its main advantages we have: It is a standard language for building plan software, in addition to allowing us to visualize, specify, build and document the artifacts of the system.

2.4.1. Functional requirements

In this section, we will describe the most important functional requirements of the prototype of the proposed application.

Table 4. Functional requirements of the prototype

No.	Requirement:	Description:
RF-1	Register users	The administrator of the system will be in charge of registering the different types or levels of users.
RF-2	Modify and inactivate users	The system administrator can modify the level of access or restriction for a particular user.
RF-3	Register patients	The system operator must register each of the patients with their respective basic data (names, surnames, registration date).
RF-4	Modify and inactivate patients	The system administrator should be able to modify or update patient information, as well as inactivate a patient if necessary.
RF-5	Register disabilities	The system operator must enter the types of disabilities from two broad categories: Cognitive or motor.
RF-6	Modification and inactivation of disabilities	The system administrator should be able to modify or update information on the types of disabilities recorded, as well as inactivate a particular disability.
RF-7	Register treatments	The operator of the system must enter the different types of treatments applied to a patient, as well as the degree of progress or response to the treatment.
RF-8	Modify and inactivate treatments	The system administrator must be able to modify or update information on the types of

		registered treatments, as well as inactivate a special treatment.
RF-9	Generate reports	The operator must be able to generate a patient report that includes: Basic data, type of disability, response, and progress in treatments between certain dates ranges or through other parameters such as the patient's identity document or type of disability.

2.4.2. Component diagram

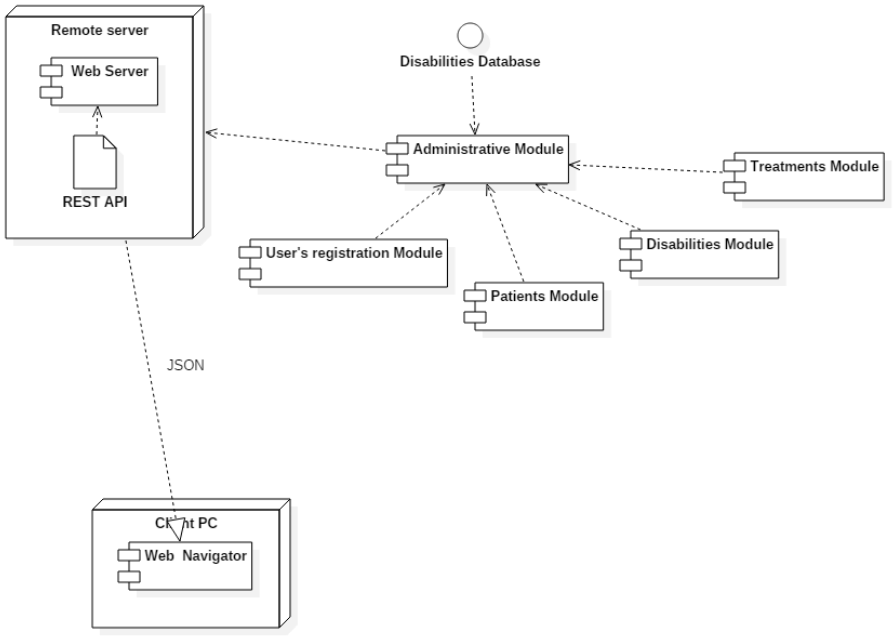

Figure 2. Diagram of web prototype components

The definition of a component is "a modular, deployable and replaceable part of a system, which includes the implementation and exposes a set of interfaces" [8], the components form the architecture of the software and, consequently, play a role in the achievement of the objectives and the requirements of the system that is going to be built. As the components are found in the software architecture, they must communicate and collaborate with other components and with entities (other systems, devices, people, etc.) that exist outside the software's borders. Next, we present the component diagram of the proposed prototype.

2.4.3. Web Architecture

The term Representational State Transfer or REST was introduced and defined in the year 2000 by Roy Fielding in his doctoral thesis. Fielding is one of the main authors of the Protocol of hypertext transfer (HTTP) versions 1.0 and 1.1. For the development of the architecture of the proposed application a brief description of the components is made [9], let's see:

- PHP, as a server-side development language
- MYSQL, as a database engine, to store information.
- JSON, as a format for sending information.
- REST, as an architecture to manage the services and elements described above.

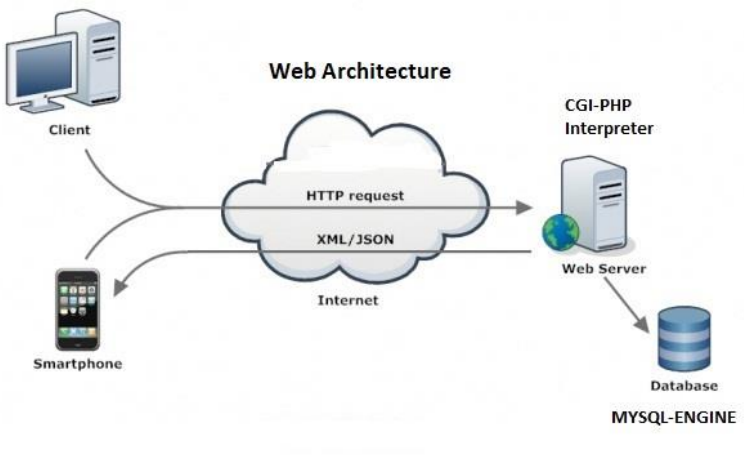

Figure 3. Web architecture of the application

3. Results

The low efficiency of the state agencies in the handling of the figures on disability in the country was established, nor the agencies in charge really know the real figures on disability, this situation allows us to establish the clear abandonment and forgetting of the state for with the disabled population, which is reflected in the absence of programs and projects that support the disabled population.

On the other hand, it could be established that the management of the disabled population is quite complex and requires an interdisciplinary group of professionals so that this work obtains truly significant results. The different types of disabilities (Down syndrome, Asperger syndrome, Rett syndrome and cerebral palsy, among others) vary markedly in the treatments applied, but all have in common that they are complex, expensive and time-consuming and the total availability of the patient's family, the group of professionals and the patient as an essential component of said work.

It was evidenced the little use of technology as support for play activities aimed at obtaining some kind of progress in patients with pathologies such as Down Syndrome and cerebral palsy.

It was determined that special education institutions such as the one under study are just beginning to develop and implement some type of computer system [10] that allows them to keep a record of their patients, the treatments applied and the progress obtained with each one, from them.

It is necessary to establish that in terms of Web technologies, apart from REST, the SOAP architecture exists, but it is considered more efficient and lightweight REST architecture with JSON components for it sent information. A feature of great importance in the REST architecture, in relation to the HTTP protocol, is the fact that it has a uniform interface for all WEB resources.

4. Conclusion

We can affirm that the true figures of disability in our country are not known in their true dimension by the state organisms in charge of their management, since among them there are discrepancies by the true figures. In addition, the latest statistics are three or four years ago which does not allow to clearly show a truly reliable figure.

Cognitive disability occurs in several ways, in some cases occurs shortly after birth or in certain cases such as Down syndrome occurs from birth, disability occurs in three phases or types: mild, medium and high, Through the study it was established that the interaction with this type of population is complex and the results of the treatments are perceived in the medium and long term, often the patients involute and the treatments applied are not effective or produce few results. There is a need to support this type of population by developing applications that allow the patient to interact with activities that stimulate their auditory, tactile and visual senses.

The use of the technologies that make up Ajax, allow to reduce considerably the overload of the servers and also load a page only the necessary information, becoming an excellent alternative for the development of lightweight and fast Web applications.

5. Acknowledgments

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