Development of a Web Application for the Management of Reserves of Sports Scenarios

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Abstract: Actually, jobs schedules and personal occupations limit the free time that each person has; which consequently restricts the activities that they can carry out throughout the day. In order to contribute to a decrease of sedentary lifestyle, and to offer a mechanism that allows the reservation of sports spaces in an easy and fast way, there was considered the development a web application that calculates the user's location, a list of the nearest available stadiums; saving time and money. For this, it has been considered to structure the application under a client-server architecture, following the principles of a REST web service and methodology Scrum. After the development of the application, we concluded that the HTTP protocol provides a quickly mechanism for the exchange of information in a web environment; likewise, it was possible to determine that a client server model is suitable for a web environment that has to ensure availability, security and performance.

1 INTRODUCTION

According to the United States Department of Health and Human Services, physical activity is the movement of the body that requires the work of different muscles (NIH, 2014). Likewise, this institution say that the main benefits of regular physical practice, are: strengthening of the heart and lungs, risk reduction of coronary heart disease and heart attacks (NIH, 2015). By June 2016, the World Health Organization (WHO) reported that approximately 80% of the world's adolescent population does not maintain a correct physical activity level; because of the sedentarism, which mentions that it is accentuated especially in urban areas, and proposes as main causes to the overpopulation, the poverty and criminality increase, the traffic jam, the air quality, and the lack of sports facilities (OMS, 2016).

Conscious of this growing reality, and in order to increase the sport practice level, there was considered the development of a mechanism that facilitates the promotion, localization, reservation; as well as the proper administration of sports spaces.

By 2015, the 32% of Ecuadorian households had Internet access; an index that indicates a growth of more than 10% since 2012; In the same way, this institution reported that the use of Internet within the country has shown a remarkable growth, from a 17% registered in 2012 to a 33% registered in 2015; an increase of approximately 16% in 3 years (INEC, 2015), (Enciso et al., 2016b). These values show that, as time goes on, there is greater access and use of the Internet by the Ecuadorian population; so the solution to be considered should be oriented to a web environment.

Today, the industry has led the emergence of Global Distribution Systems (GDS); which at their most general level, provide automated mechanisms that facilitate the process of management of reserves through computer systems. The main applications of this type of software are automated booking systems for airlines (Kelly, 2016), inventory control programs, hotel reservation management, cars,trains (Coza, 2014) and pharmacies (Enciso et al., 2016a).

These systems have found support within the different programming languages, database systems and servers that allow to carry a service to a web environment.

By January 2017, PHP has shown a strong presence in the web application market; being cataloged as the sixth most used programming language (TIOBE, 2017). For (Martín, 2012), PHP stands out

because of:

- Totally free and open language.
- Low learning curve.
- Development environments are fast and easy to configure.
- Easy deployment: fully self-installing packages that integrate PHP.
- Easy access to databases

In the same order, one of the database management systems that is widely used is mysql. According to (Quezada, 2012), this manager has its own specifications that gives you:

- High scalability.
- Excellent performance.
- Wide range of availability.
- Flexibility.
- Being an open source platform, it facilitates the introduction of improvements.

The guidelines that guide the present investigation are:

- Investigate the advantages and disadvantages associated with using the HTTP protocol for a web service.
- Propose an architectural model to ensure availability, safety and performance for the application.
- Analyze and develop a web application that allows the proper management of reserves of stadiums of the city.

The first part of the paper provides a description of the central topics of related projects. The second section deals with the theory of the work that follows. The third part provides a deep description of the system developed. The fourth section presents the results of the research carried out, and finally, the fifth part presents the conclusions to which we have arrived once the investigation has been completed.

2 RELATED WORK

One of the applications based on the location is Uber; which offers taxi requests services. In this app, anyone can join as a partner: either as a taxi driver or user. This application has had a wide demand in many countries; So developers have had to pay attention to the scalability of the system. That's why, Uber has been developed under a multilayer architecture,

where each layer is implemented in a different server. For this, it was considered the use of the Ringpop system; which implements a membership protocol that allows the different nodes to discover the other nodes, disseminate information quickly, and maintain a consistent view of the different nodes that are part of the application cluster. Ringpop uses a variation of the SWIM (Scalable Weakly-consistent Infection-style Process Group Membership Protocol) protocol, in order to diffuse state changes made by different member servers, which are contained within a specific cluster (Hoff, 2015).

George Denezis, after executing a test program for the analysis of web security, implementing communication through the HTTP protocol, concludes that through the HTTP protocol, it is possible to carry out a series of attacks; Even with the use of the security transport layer (TLS); that's why he invites the use of advanced protocols, with integrated security mechanisms, such as the SSL Protocol, or HTTPS (Danezis, 2012).

For José Sánchez Roldán, the technological lack associated with the sport practice, such as the difficulty in consulting the nearest stadiums, making reservations and the respective payment, causes the offer of low quality services that require the user mobilization to the offices. For that reason, there was proposed a system for the management of sports spaces that allows the correct administration of the stadium reservations, their users, and the sports that are practiced in the campus. The application has a mobile and web version; and was developed under the REST infrastructure (Sánchez Roldán, 2013).

For Iván García, the importance of maintaining a reservation management system lies in the ease of administration of sport spaces and reserves. For this reason, there was proposed a web and mobile solution, that allows the owners and customers to manage and register reservation requests with just one click; In addition, the system provides a secure payment platform, which means that the customer should not travel to make their payments. Likewise, a friendly graphical interface that allows users to locate the nearest stadiums. As part of the management component, the system informs the owner about the reservations registered in the month. Finally, the system offers social network functions, allowing interaction between users of the application. The web application has been built based on a model view control architecture; while the mobile application has been structured with a layered model (García, 2014).

Daniel Wilches and Pablo Figueroa present an AR application (Augmented Reality) for mobile devices from conception to evolution. This application ma-

nipulates and shows data in 3D (Three-dimensional image), georeferenced in iPhone to allow its users to buy information from geo-referenced buildings stored in a database against the real information seen through the device camera with the aim of contrast the information of what should be built in a sector of the city against what is actually built (Descamps-Vila, 2011).

GIS-based groundwater identification software and a client-server architecture that has been developed to identify vulnerable areas in a regional level with the use of pesticide models. The area investigated is divided into polygons with homogeneous environmental characteristics and the pesticide transport is modeled with the PELMO model in each polygon. The software is used by the Lombardy and Italy regions for PPP risk management purposes. VULPES has been designed and implemented to transfer scientific knowledge in terms of pesticide risk assessment to risk assessors. Allows to apply consolidated models methodologies used in the standardized scenarios for pedological, meteorological and agronomic data (DiGuardo and Finizio, 2015).

3 THEORETICAL FRAMEWORK

3.1 Smarthphones

Below we present a description of the main themes that structure the present investigation:

Hypertext Transfer Protocol: It is a protocol for the exchange of distributed, collaborative, and hypermedia information. It is a generic, global protocol that can be used for many tasks, such as Distributed Object Management Systems servers, through request methods, error codes and headers (Fielding et al.,). In the main characteristics of HTTP we find the typification and negotiation of the representation of data; which allows its construction independently of the type of information that will be transferred (Fielding et al.,).

Client - Server Architecture: It is one of the most popular types of network architecture; whose utility stands out because of its use within the Internet; for which it makes use of various communication protocols, such as the hypertext transfer protocol (HTTP). Briefly, you can define a server as any computer or system that answers requests made by a client computer or subsystem. In a client / server environment, the PC or workstation is usually the client. The model can be visualized in the figure 1; which presents an application that divides the execution of a work unit between the activities initiated by the end user (client) and the responses of resources (services)

to the activity request. The Client / Server architecture shows a type of cooperative processing between devices that are physically separated, and interconnected through a network (Held, 2000).
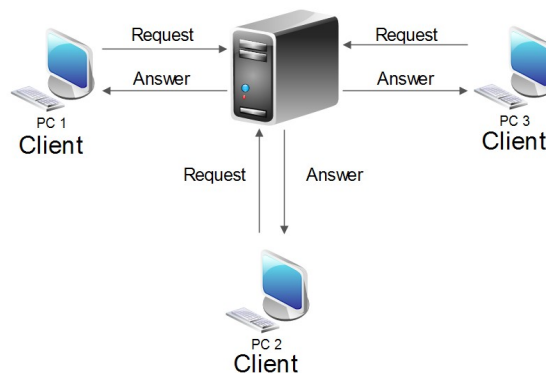

Figure 1: Client - server architecture.

Web Service: According to the World Wide Web Consortium (W3C), a web service is a set of applications or technologies that interoperates on the Web. This institution says that this type of systems can interchange data with each other, with the aim of offering services; for which, providers offer their services as remote procedures and users request a service by calling these procedures through the Web (Consortium, 2014).

(Navarro, 2016) mentions that in the last decade three different types of web services have been popularized, which are:

- Remote Procedure Calls (RCPs): When the web services provides a remote procedure call interface and distributed functions; however, its implementation forces the direct call of specific functions and methods that limits the efficiency and scalability of these systems.

- Service Oriented Architectures (SOA): The communication unit is the message, and allows the execution of procedures as a sequence of services specific to the application.

- REST: They intend to emulate the procedures provided by the hypertext transfer protocol (HTTP); Providing an interface composed of a group of function calls.

Also, (Navarro, 2016) indicates that REST defines a set of principles for the design of software architectures oriented to a networked environment; providing an interface that allows the transmission of data over the HTTP protocol; without requiring a defined service layer; unlike SOAP.

According to (Da Palma et al., 2008), the main advantages of implementing the REST architecture within a web application are:

- Simplicity to implement components.
- Reduce the complexity of connector semantics.
- Improve efficiency of performance optimization.
- Increase scalability of server components.

Web Server: It is any system or device that receives, processes and answers to requests made by a client. To establish communication, it uses protocols such as HTTP, HTTPS, or whatever it requires, depending of the communication type (Hino, 2012).

Taking advantage of the technologies presented, we propose the development of a web oriented software that allows the stadium owners advertise and manage the reserves of their scenarios in an easy and fast way. Likewise, this solution proposes to help to all those athletes who wish to reserve an available field near his/her location; providing information of the stadium, such as its schedule, phone number, number of fields and services offered; besides information specific to each field, for example, its dimensions, material, sport category, rates and information of stands.

For the implementation of the proposal, we used free access software and tools. Because the application is a web site, the graphical user interface will be based on interaction through web pages coded and designed under the HTML and CSS language, respectively. The layout and coding of the program will be done using the editor "Sublime Text". The server application will be coded in the PHP programming language. The management and storage of the application information will be done through the MySQL database manager.

Scrum: It is an Agile development methodology(Séguin et al., 2012), (Roche, 2013), which has a more human-oriented approach to problem solving, which instead of wasting time in creating cumbersome and confusing documentation, gives the team a quick start in coding. Likewise, the Agile methodology considers the inputs of the client during the entire development cycle, as opposed to the traditional methodologies in which the requirements are collected only at the beginning of the cycle (Dimes, 2015). That is why this methodology of development was chosen for project.

4 METHODOLOGY

4.1 Analysis

The correct development of software requires a scheme of systematic implementation, not exces-

sively rigid. Quality and compliance must go hand in hand (Dimes, 2015).

For the development, a methodology is used that constitutes a reference frame called Scrum, which according to Dimes, Troy, allows to create complex software and deliver it on time in a easy way. First, a product stack is created, then this stack of product assimilates to a list of requirements for the development of the application. Being a prioritized list, you work on the most important elements of the product stack. Ensuring features less indispensable leaving aside the most important. That is why Scrum proposes to do the work in short iterative cycles, from a week to a month. The result of each iteration must be a ready-to-deliver product. The team reviews the final product and submits it to stakeholders for feedback, given feedback, the team can update the entire product stack or iterations (Dimes, 2015).

Based on the results, the agile framework, especially the Scrum, proved to be a viable option as a project management approach (Azanha et al., 2017). Agile methodologies are a group of incremental and iterative methods that are more effective, and have been used in project management. Kanban and Scrum are two powerful Agile project management approaches in software development. The objective of Scrum and Kanban is achieved by optimizing the development process by identifying the tasks, managing time more effectively, and setting-up teams (Lei et al., 2017).

Once considered the case; as well as the different problems and limitations associated with the manual reservation of stadiums, we propose the development of a web application that allows different users to locate the sport places nearest to their geographical position; and at the same time, provide administrators a mechanism that allows them to easily advertise and manage the reservations of fields made by their clients.

The figure 2 describes the overall operation of the system. Because the application is a web-oriented software, the user is free to use it in the hardware / software platform that he/she prefers; However, it is necessary to have an active connection to the Internet.

In order for a user to be able to view the closest stadiums to his/her location, his/her terminal device must send a routing request to the application servers. On the other side, the server will process the request, and based on its IP address, will consult the location of the user through the geolocation service provided by Google maps. Subsequently, the system will evaluate and show the sports establishments closest to the user's location; Who will finally select the stadium with the desired schedules. In case of no availabil-

ity conflict, the application will show a reservation confirmation message; Otherwise, the user will be informed about the inconvenience.

Once the reservation is confirmed, the stadium manager will receive a notification from the application, who will be able to view details of the reservation, such as the date, time and place of entry; As well as information about the client, such as his/her first and last names, email, contact number. The administrator will be able to cancel the reservation, at any time. In this case, the system will send a notification to the user who registered the reservation.

4.2 Architecture

For the construction of the application, it is necessary to use an architecture that gives an adequate level of security, ensures availability and performance; So the client-server architectural style has been considered; which is made up of two main subsystems: a client and a server. According to (Somasegar et al., 2009), the main advantages of this architectural style are:

- High level of security: Because access to the system databases is managed directly by the application server; Which runs on a different layer than the client.
- Centralized Information: All system information is stored in the application databases; Which facilitates the access and maintenance of the same.
- Ease of maintenance: The functions of a system are distributed in several servers interconnected with each other; Which isolates the user from server repair and relocation operations.

The figure 1 describes the architectural schema client - server, in which the information is centralized. The requests are made by terminal equipment, and at the other end, a server program receives and processes them to subsequently send a response to the client. The architectural model presented is suitable for a web environment that has among its interests to ensure availability, security and performance. The proposed model allows to ensure the availability of the system by virtue of dividing the application into two; one client application and another server. Likewise, security and business are managed within the server layer; Which proved to provide a higher level of safety and performance.

4.3 Data Modeling

According to (Silberschatz et al., 2002), the normalization process involves the modeling of different tables, and their relationships, adhering to standards that are designed to avoid redundancy of data; as well as dependencies between them; for this reason, the database design of the application has been carried out following the normalization process in three levels, and has resulted in the model shown in the figure 3. The model of the figure suggests that a owner can have 1 or more stadiums; while a stadium may belong to a single owner. Also, a stadium may have one or more fields, which will be assigned one or more prices, depending on the time of use; With this, the system allows to realize discounts, according to the time of reservation. In the same way, a stadium can offer on one or several services, and each one of them can be established to one or more sport scenarios. Finally, a client can reserve one or several fields; at the time that the reservation of a certain set of loaves, for a same date, can be realized by a single client.

4.4 Development

The application will be structured in two parts: a client and a server. The server application will be written in the PHP programming language, and will be responsible for, among other things, the handling of data access components; Which is done by the code 1:

Listing 1: Database connector.

```
public function connect($host, $user,
$pass, $database){
$con = mysql_connect($this->host,
$this->user,
$this->pass) or die("The app could not
connect to the database");
mysql_select_db($this->database,
$con) or die ("The app could not connect
to the database");
return $con;
}
```

The code 2 describes the algorithm followed by the application for instance a new connection object; by means of which you can consult, add, update and delete information from the database.

Also, one of the main functions of the application lies in the suggestion of the sports scenarios closest to the user's location. For this, after an analysis process, it has been decided to use the haversine algorithm; which is described in the code

Listing 2: Haversine algorithm.

```
function distanceCalculation($lat_point1,
$long_point1, $lat_point2, $long_point2){
// Distance calculation using the
Harversine algorithm
$degree = rad2deg(acos((sin(
deg2rad($lat_point1))*sin (deg2rad
```

```
($lat_point2))) + (cos(deg2rad($lat_point1))
*cos(deg2rad($lat_point2))*cos
(deg2rad($long_point1-$long_point2)))));
$distance = $degree * 111.13384;
Conversion from degrees to kilometers,
considering that in each degree, there are
111.13384 kilometers.
}
```

5 RESULTS

As a result, it has been possible to develop a position-based application, oriented to a web environment; which allows to visualize the different sports complexes; as well as their information; which can be seen in the figure 4(a):

Once selected the sports complex of preference, the user must select the field to use; As shown in figure 4(b).

Finally, the user must enter his information in order to register the reservation; which is done in the form shown in the figure 4(c). In the figure 4(d), is shown the registered reservation.

6 CONCLUSIONS

Through the present investigative work, we have been able to determine:

That the HTTP protocol is an excellent mechanism for the rapid exchange of information within a web environment; however, it offers limited security services.

Likewise, it was possible to determine that a client server model is suitable for a web environment that has among its interests to ensure availability, security and performance. The proposed model allows to ensure the availability of the system by virtue of dividing the application into two; one client application and another server. Likewise, security and business are managed within the server layer; Which proved to provide a higher level of safety and performance.

All this process allowed to raise a web software that allows to promote the different sports scenarios near the location in which the users are; as well as the management of the reservations made.

Also, it was possible to evaluate the different tools of codification, web design and server emulators; From which we conclude that the editor used for coding and web design presented remarkable performance; therefore, it never stopped working or experienced bugs when using it; however, to visualize the changes made within the code, it was necessary to

save the changes, and refresh the page; which easily becomes a tedious task that causes delays and problems with the buffer of web browsers.

We tested the performance of the XAMPP emulator, which has a well-known portability and installability feature; It is possible to install and run it from any operating system (Windows, Linux). Also, during the development of the application proved to be a robust system; As it was possible to handle exceptions properly by always being operational. Likewise, it denoted wide efficiency and performance in trial time and execution of the application.

In the same way, the different mechanisms of geo positioning did not show major disadvantages to perform the geo positioning of their equipment; However, the web browser used (Firefox) showed drawbacks to remember the user's location preferences; which generated problems for the system to obtain the exact position of the user on more than one occasion.

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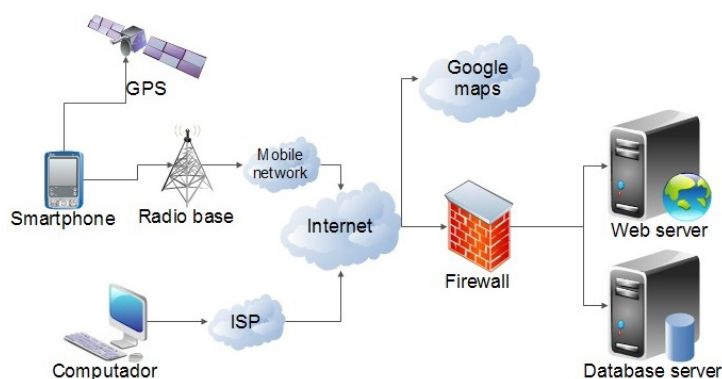
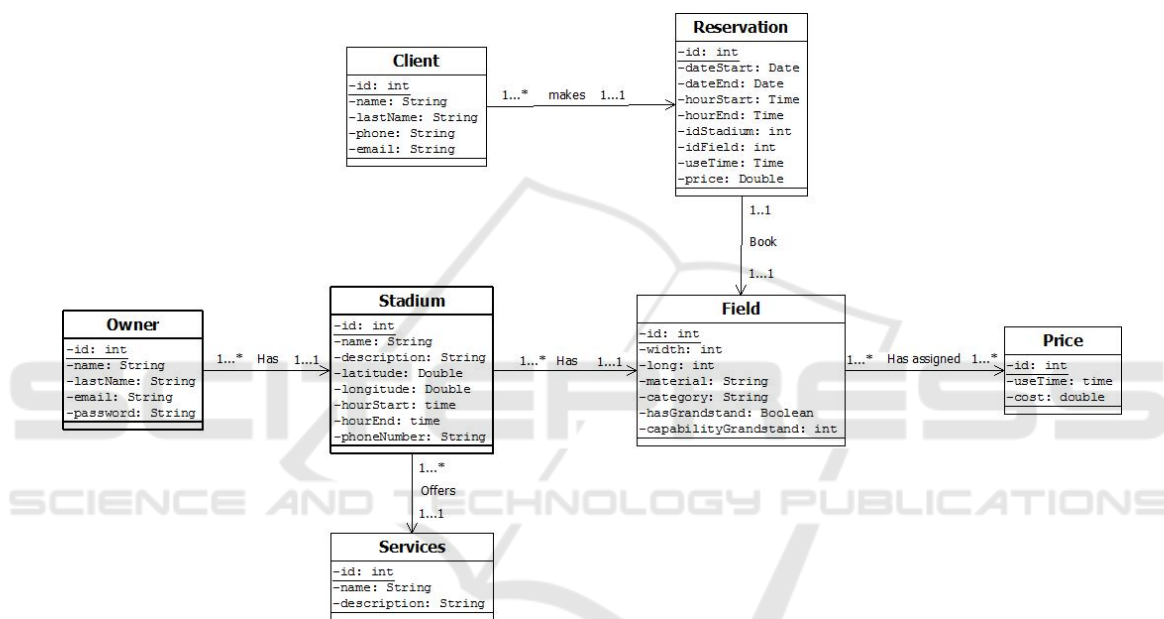Figure 2: Operational model of the application.

Figure 3: Entity - Relationship diagram.

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(a) Sports complex selection.

(b) List of sport fields.

(c) Register of reservation.
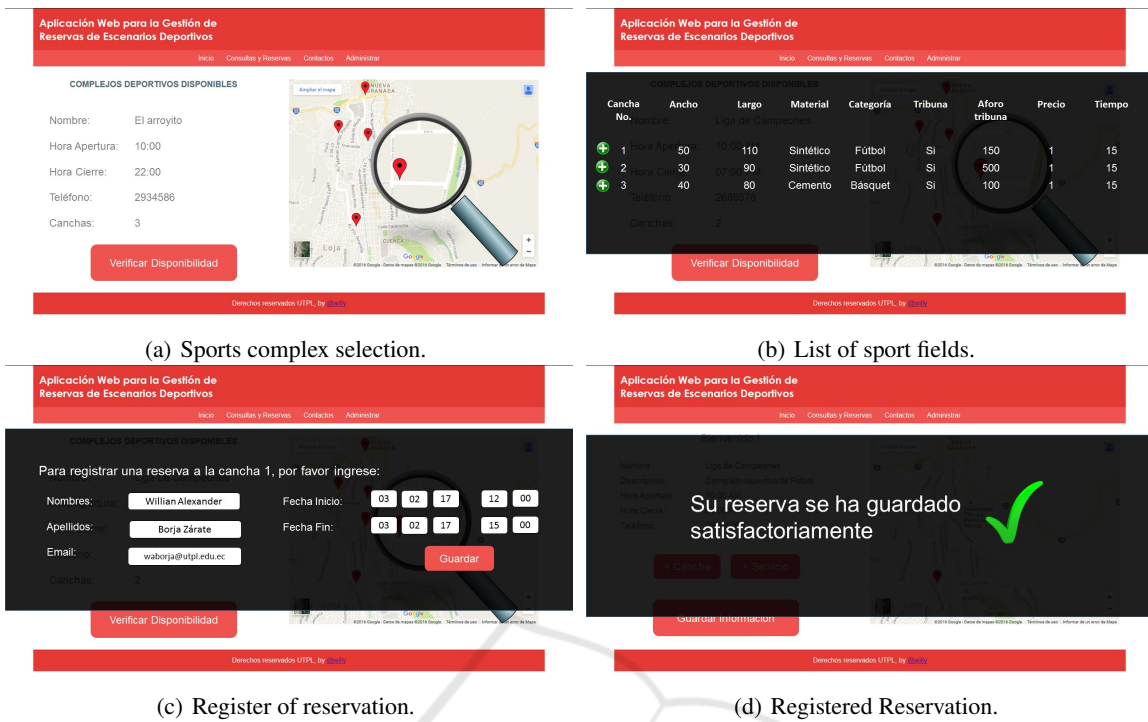
(d) Registered Reservation.

Figure 4: Software Application for reservation of sport complexes.