

## Touristic Virtual Environment of Tungurahua Province

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### Keywords

*virtual environment; geolocation; georeferencing; cultural tourism; promotion; management.*

### Abstract

Tourism and the advances that technology has had over the years have turned into useful instruments that are used to develop platforms and virtual touristic environments that can help in its management and positioning promotion-wise. The objective is to design a virtual touristic environment that will promote service providers, cultural activities, routes and touristic attractions that are found in the province of Tungurahua, and which include natural resources and historical sites that have not been exploited yet. The virtual environment's goal is to integrate relevant information for tourists in the area, plus destinations and locations using a map, geolocation and georeferencing functions. The goal is to increase the flow of national and foreign visitors by using audiovisual archives or files. The validation of the goals was based on studies about the characteristics and the behavior of the tourists and information obtained from national public companies that are primarily related to tourism.

### 1. Introduction

The Province of Tungurahua – Ecuador, is a touristic point of interest in the country and worldwide due to its geographical location, climate and natural resources (Ministerio de Turismo, 2016). It is divided into nine counties and each one has its own parishes with many natural attractions and variations of climate. It is easy of access makes the province an ideal destination to visit any time of the year, making this one of its most important economic activities (Honorable Gobierno Provincial de Tungurahua, 2016). This region can't and won't stay behind in anything regarding the evolution and development of new technology (Valles, 2000). The implementation of ICT, Information and Communication Technology, in the category has evolved due to the different stages of computerization and informationalization of society. The administration of a touristic destination should authorize the development of an ecosystem that generates income through crafts, gastronomy, cultural and many other products. This activity should be structured as a product that can manage the offer and route the demand. E-tourism is the way that is necessary for the tourist to explore and live a different type of experience (Blanco, 2011). This can be done with texts, images, audio, and video and with the help of technology. It is possible to design and integrate a system of internal management and external positioning that will allow geolocation in all the locations that the tourists or users wish to get to know and would like to access. More and more often, it has become frequent for a tourist to prepare his own route or roads that they will take on their trip, with the help of virtual touristic environments or touristic web platforms, which will focus on a personalized route, with places of interest, providers, accommodations, transportation and leisure and pleasure activities. The tourist must also have the comfort to have this virtual environment on their electronic device with internet access.

Considering that the construction of a touristic destination relies not only on the development of the territory, it must be noted that it also relies on the interaction that the tourist has in this environment. In Tungurahua, you can find a great amount of touristic information, providers and establishments that offer specialized services, not centralized but accessible, which means, that the information of interest for the tourists can be shown on a graphic chart online. There is an extensive labor in order to find this information and design the products, with the adequate instructions so it can be useful for visitors.

The virtual environment in the management and positioning of Tungurahua has a goal that is to carry out the touristic management and positioning in the province, centering all the information about the institutions, agencies,

natural resources, and routes, in just one platform. It should also offer a system of georeferencing and geolocation. The tourist can access it through a device with an internet connection to search for any information he/she may need.

## 2. Background

There are many assignments that are related to touristic platforms, which combine technology with tourism. The advances that there has been in computing programming due to the growing popularity of tourism is an international deal, based on the need for quick communications that are also reliable and secure. This allows the promotion and merchandising of the places of interest for the tourist. In addition, it has been confirmed that the users in the leisure department have a necessity to access tools that demonstrate and promote these places and that are based on images and audiovisual means which nowadays are getting more flexible and attractive (Oriol, 2006).

Nevertheless, all the touristic platforms mentioned, are designed in a particular way for a specific enterprise or place, but there is not a tool that will centralize all the information into a virtual environment, one that tourists or user can access and manage easily. Projects that come from ICT and are applied to tourism, are being developed based upon many lines of action (Valles, 2000), multiple studies and authors who agree with the construction of infrastructures and the consolidation of Information Systems and Reserves, where Reserve Stations, Touristic Information Systems, Multimedia Databases and specialized Networks meet and communicate in between all of the above components (Castellanos, 2013).

Many studies about the tourist's behavior suggest that virtual platform users prefer to look for and see all the information about the place and the service providers in one site, (Garcia, Morales, & Díaz, 2011) (Sanz, 2007) (González, Sanchez, & Sanz, 2010). The design and construction of a virtual environment that groups all of the information about tourism in the province of Tungurahua, will let exploit touristic and commercial activities at the same time that the tourists will use a generalized virtual environment.

## 3. Proposed Solution (

The virtual environment, in management and touristic positioning in the province of Tungurahua, with the name *Tungurahua Turístico*, is an online platform that includes all the information about the touristic places and the service providers. It includes a positioning system, a geolocation, and georeferencing system, where the users can visualize the exact location that he/she wants to visit. It can also detect the user's location and map out the routes that the user can use to get to a specific destination, and referencing all the information that has been collected and centralized.

The virtual environment of *Tungurahua Turístico* consists of two parts: the first one has interfaces that the user or tourist can observe and the second has to do with the administration of the platform. In figure 1, a fragment of a relational model of *Tungurahua Turístico* can be observed.



Figure 1 Exemplar design of data of a virtual environment

By means of this virtual environment, all the information about service providers and natural resources in the counties are meant to be centralized. The information is divided into sections that are classified into counties and parishes. The main page in the virtual environment has subsections with general information about the province; a subsection with multimedia where audio-visual files can be enjoyed, based on each county. The user can find information about different places under the tab cantons (counties) where a list of activities is found and it shows what can be done and also one can see some references to natural resources and service providers that can be found in each canton (county). Also, the user will be able to find an exact location of every registered establishment into

the platform by using a map that shows with marks on the location of the establishments or natural resources that are registered into the platform and can use the geolocation to draw routes and get to the desired destination. The map of the places in each canton contains sections where the user can visualize a description with basic data about each service providers such as accommodation, alimentation, transportation, and others. If any of the places are off the tourist's interest, he will be able to access more detailed information about the place in a tab.

### 3.1 Resource Management

For the development of this Project, there have been some restrictions and characteristics that the platform must consider. The diagrams are defined as being representations of the management process, the activities that the users can perform according to their designated roles. To obtain information for the platform about the province, cantons, and parishes, there has been a collaboration between many public entities, such as the municipalities (GAD) of each canton. For instance, Baños de Agua Santa was taken into consideration for the pilot run of the collection of information that will build and be presented in the virtual environment *Tungurahua Turístico*. The information that was requested to the different public establishments was given in diverse formats which had to be processed. In the virtual platform, images can be observed, also, texts, videos, and maps. The maps were created based on the different Excel documents that were provided by the public establishments. The list of Touristic Service Providers was obtained thanks to the municipality of Baños de Agua Santa.

### 3.2 Analysis of the evaluation and information process

Through the study of the lists of service providers in Baños de Agua Santa and its natural attractions that are a part of the touristic attractions, it was established that the missing information and data needed to be included into the platform. It was necessary to keep in mind the characteristics of the tourist. Knowing the characteristics of the tourist, we considered it is useful for tourism because this way there can be a better pacification and development of the products and specialized services that can serve and comply with the necessities of the visiting population (Centro de Estudios Superiores en Turismo SECTUR, 2016), as much as the activities that are accomplished and are planned while on a trip. The activities are found in table 1.

Table 1: Service Providers

Establishment	Classification/Type
Travel agency	Operators Duality
Accommodation	Hotels Inn Hostels Residential Hostels Pensions
Alimentation	Restaurants Cafeterias Soda
Leisure and recreation	Bars Clubs Campsites Extreme sports Galleries Museums Crafts Churches/temples

	Pools Natural attractions
Transportation	Touristic transportation Urban transportation Taxis

The paths and streets around and through the city have to be taken into account as much as the information in table 2.

Table 2: Paths and main streets

Path	Classification
Path	Main Secondary
Street	Second order Service

### 3.3 Geo-localization and Geo-referencing

The virtual environment *Tungurahua Turistico* has a section designated for the placement of a map where the user can visualize with precision the exact location of the destination or establishment just by using a system of reference points. This coordinate system refers to any point on the face of the earth, which uses two angular coordinates, latitude (North or South) and longitude (East or West) (negi.org, 2016).

QGIS was used in the management and creation of maps. It is a Geographical Information System with an Open Code and a GNU (General Public License) type license. QGIS is an official project from Open Source Geospatial Foundation (OSGeo) that works with Linux, Unix, Mac OSX, Windows y Android, and supports various formats, vector data functionalities, raster data and databases (qgis.org, 2016). The representation of the maps or layers are carried out by points and lines, the vector data is where the geographic data is described, they can be connected with lines and polygons, the layers used in the project are polygon shaped, lines and dots. Table 3 describes the types of layers.

Table 3: Types of layers in the project

Layer	Type
Entertainment establishments	Point (X,Y)
Accommodations	Point (X,Y)
Alimentation	Point (X, Y)
Tour operators	Point (X, Y)
Transportation	Line
Paths	Line
Streets	Line
Province	Polygon
Cantons	Polygon

Parishes	Polygon
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### 3.3.1 Coordinate System

QGIS manages various coordinate systems with the help of Coordinate Reference Systems (CRS). Any point on earth can be defined by using three numbers called coordinates; in general, CRS can be divided into projected coordinates and a geographical coordinate reference system (qgis.org, 2016). The reference coordinate system used in this project corresponds to South America, to Ecuador in particular, which means that the coordinate system is SC:WGS84: S17. The reference code belonging to Ecuador is EPSG4326.

### 3.3.2 Processing of information and creation of layers

For the creation of layers in QGIS, one must work with shape o .shp o file shape archives and files, which are vector data storage formats from ESRI used to store locations and the form and attributes of geographical entities. They are saved as a collection of related archives and files that contain an entity (qgis.org, 2016).

To be able to generate the layers in the project, a norm was applied to standardize the information collected in the Excel sheets, while items such as X and Y (latitude and longitude) were augmented. It was classified based on the field Type, which stores the type of geometrical shape. In the case that the establishment is of an alimentation sort, the layer needs to be specified with dots; in the case that they are paths and streets, the layer is specified with lines, and for the province's cantons (counties) and parishes there will be a layer of polygons. To locate this information in the X and Y fields, it was necessary to geo-codify each direction with the help of API and Google Maps.

Google offers the possibility to use and create function through an enormous set of APIs, one of them being Google Maps Geocode, which allows the user to consult the physical coordinates of an address on a map, returning to a latitude and longitude detail (qgis.org, 2016).

By using a Visual Basic function called GeoCoding, geographic coordinates and addresses of food establishments in Baños de Agua Santa can be obtained. Table 4 shows a fragment of the codification function.

Table 4: Fragment of the codification function

```

objHTTP.Open "GET", URL, False
objHTTP.setRequestHeader "User-Agent", "Mozilla/4.0
(compatible; MSIE 6.0; Windows NT 5.0)"
objHTTP.send ("")
If InStr(objHTTP.responseText, ""lat""") = 0 Then GoTo Error
ValorTemporal = Right(objHTTP.responseText,
Len(objHTTP.responseText) - InStr(objHTTP.responseText, ""lat"" : ")
- 7)
lat = Split(ValorTemporal, ",")(0)
ValorTemporal = Right(objHTTP.responseText,
Len(objHTTP.responseText) - InStr(objHTTP.responseText, ""lng"" : ")
- 7)
lng = Replace(Split(ValorTemporal, "})(0), " ", "")
GEOCODIFICAR = lat & " ; " & lng
Exit Function
    
```

This function was taken out of the code displayed on lines and created by Daniel Cedeño Urbina. The dots were obtained by applying latitude and longitude analysis of every registered establishment on the list. The Excel document was saved with a .csv extension, in other words, the document was delimited by commas, which were later imported by QGIS with a predetermined connection where the tools used generated layers of dots and lines. These layers were exported to a database, enabled with extensions towards geographic data about accommodation.

### 3.3.3 Integration of maps in a virtual environment

To integrate the maps in a virtual environment, it is necessary to create a map server and to transform it into layers in an online map service.

The architecture and the layout of the Project are made up by the layers that build the streets of Baños de Agua Santa (the main and secondary streets) which will be converted into map files while the layers of dots which will be maintained in its original format. Mapfile is a file that MapServer configures and it is used to convert geospatial data into images or other vector data. Its purpose is mainly to define the layers that can be generated, such as how to obtain the necessary information and how to draw it (qgis.org, 2016).

For the georeferencing function of the virtual environment, a Google Maps –API- was used to incorporate Google Maps and web pages or virtual environments from external developers by using a JavaScript interface. It is designed to function on mobile devices and in navigator applications on traditional desktop type computers. The API includes a location and geo-codification. The API Google Maps clients can access these API HTTP services through a secure connection (HTTPS) (excellentias.com, 2016).

The maps are images that have been combined with an HTML code, the virtual environment runs petitions through AJAX technology, its API is made up by a set of JavaScript files that contain the types, methods, and properties that are used to run the functions of these maps while the user navigates through the map section. API sends information about the new coordinates and levels of zoom by utilizing AJAX (excellentias.com, 2016).

To activate the visualization of the maps in the virtual environment *Tungurahua Turístico*, it is necessary to first obtain a Google ID, identification that is proportioned by Google Analytics to register petitions made by the user when he consults or navigates through maps virtual environment and then can obtain the statistics of number of visits made to the site. All of the registered data in Google Analytics, make up part of the administrative section.

The insertion code of maps into the virtual environment is developed according to the object placed. For georeferencing the locations of touristic interest, markers were used and can be visualized on the map with the help of APIs that locate it on the map when it is being aimed at the cantons (counties) borders. In order to do so, it is necessary to add the Google ID so that the maps can be seen correctly. For the geolocalization function, a code that can detect and access the virtual environment must be programmed (Google Maps, 2016). Figure 1 shows the location of the dot of the establishments of Baños de Agua Santa with its markers.

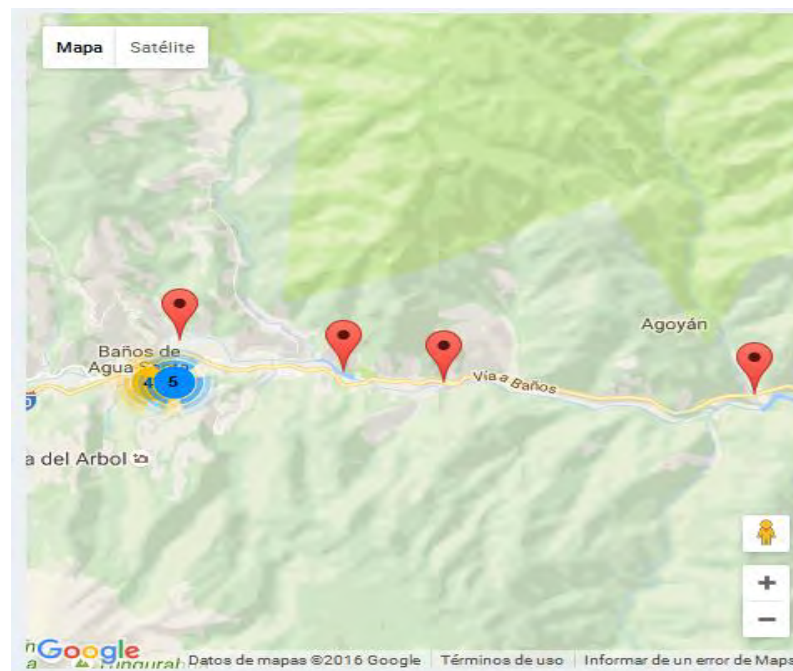


Figure 1 A look of the map with dots to locate the establishments and Tour Operators of Baños de Agua Santa in the province of Tungurahua

### 3.4 User Administration

The virtual environment *Tungurahua Turístico* has or manages three types of users:

- Administrator: a user with privileges of the administrator has to access to all the information on the platform and can establish processes such as insertions, selections, editions and the elimination of information.
- User / Tourist: is a user that can visualize any information of interest through the interphases in the platform.
- User / Establishment: the user that can visualize and upload information to the profile of the touristic establishment to the platform.

The User – Establishment register is made by a verification process with simple requirements. First: register the user legally in a list of service providers of public establishments that regulate this type of situations. Second: send a formal email to the administrator of the virtual environment *Tungurahua Turístico*, asking for the creation of a

new user. The administrator must prove the existence of the establishment in the list and that it has all rights up to date in order to proceed with the creation of a user.

The activities that can be made by the user Establishment are: change the establishment's picture, run the commentary section, the working hours, and others.

### 3.5 Information about the virtual environment TungurahuaTurístico feedback

The information uploaded to the platform has been obtained in diverse lists of different municipalities in each canton (county) in the province of Tungurahua. For the development of tests, the establishments that were registered on the list of the pilot county of Baños of Agua Santa, an interphase that was able to prove the functionality of the virtual environment was created.

It is worth mentioning that the platform is based on the information that has been provided by the users of the type *establishment* that manages a profile interphase where it is possible to post information about every spot on their property. In figure 2, the different tabs in the user *establishment* can be viewed.

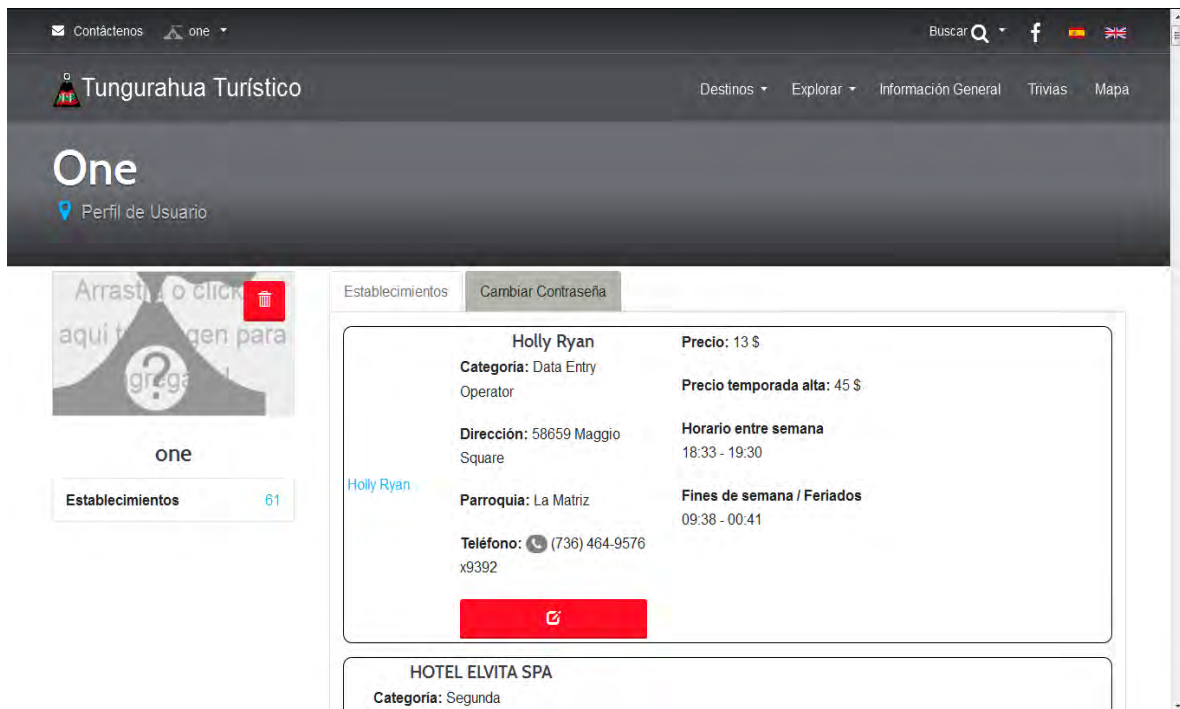


Figure 2 A look at the profile of a user and his establishments.

### 3.6 Statistics consultation

Through the virtual environment, *Tungurahua Turístico*, the members under *Administrator* are able to consult the statistics that are available in geolocationing and georeferencing. The statistics are generated by Google Analytics, a free system created by Google that allows the user to see the information about the users and the number of visits he makes on the online site (Google Analytics, 2016). The administrator can also find out how many visits the site receives and from which part of the world the virtual environment is being accessed.

To register the virtual environment *Tungurahua Turístico*, it was important to provide basic information about the platform to be able to obtain a code for the platform which will be in charge of monitoring the record of visits and the user's activities. Google Analytics is in charge of presenting the information as statistic reports in the administrative part of the virtual environment. In figure 3, a statistic report about the visits that *Tungurahua Turístico* has gotten to date can be seen.

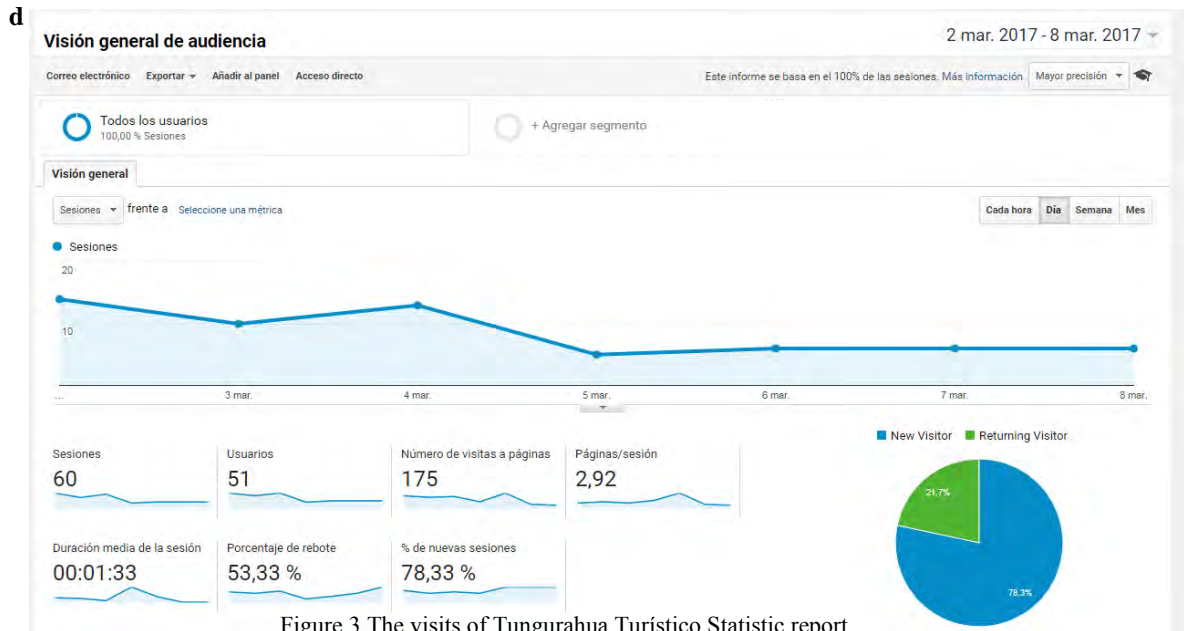


Figure 3 The visits of Tungurahua Turístico Statistic report.

#### 4. Conclusions

The development and construction of the virtual environment *Tungurahua Turístico* guarantees the management and development and touristic placement in the province of Tungurahua through this tool. Feedback on the information from the platform happens through the service provider registering process. It also allows evaluating numerically the impact of the touristic flow that gets into the province.

The tourist obtains all the information in one site, in other words, all the information that may be of interest to the tourist is centralized, making the consultations about the destinations as user-friendly and easy to use as possible.

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