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Article

Implementation of a mobile application for the dissemination of tourism in México

Implementación de aplicación móvil para la difusión del turismo en México

Sánchez-Juárez, Ivan Rafael*[a], Paredes-Xochihua, Maria Petra[b] and Martínez-Pérez, José Randall [c]

[a] Tecnológico Nacional de México/ ITS de San Martín Texmelucan • ABW-3403-2022 • 0000-0001-8296-5532 • 493160
[b] Tecnológico Nacional de México/ ITS de San Martín Texmelucan • KVA-5814-2024 • 0000-0003-1753-2313 • 298117
[c] Tecnológico Nacional de México/ ITS de San Martín Texmelucan • KUS-4199-2024 • 0009-0004-3489-8637 • 1335486

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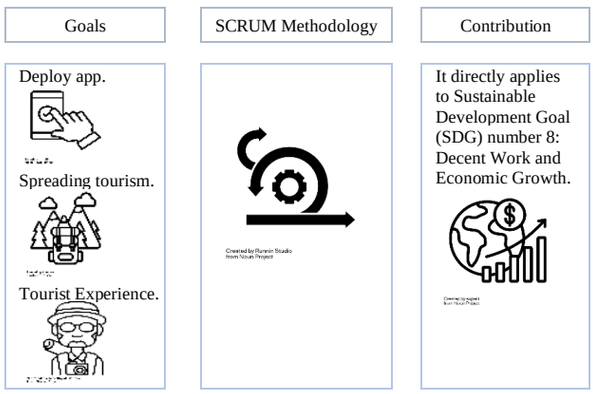
* ✉ [ivan_r.sanchez@smartin.tecnm.mx]

Abstract

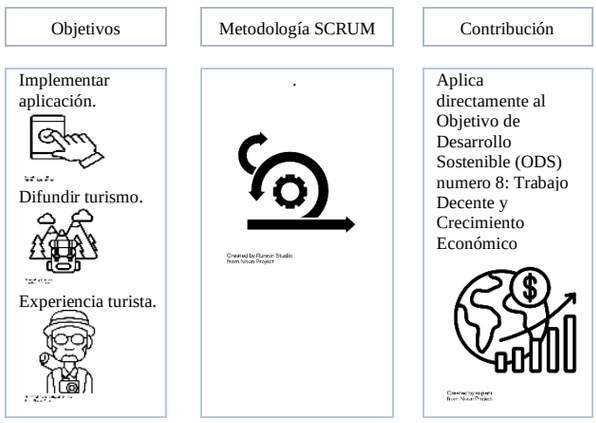
The arrival of international tourists to Mexico increased by 10% in 2023 compared to 2022, with an arrival of 42 million 153 thousand visitors in 2023 and 38 million 325 thousand in 2022, a difference of 3 million 828 thousand visitors; This reflects the growth in the tourism sector and contributing to the country's economy. The article presented below contains the implementation of a mobile application that allows the dissemination of tourist places in Mexico. The mobile application, developed for the Android operating system, has different types of users, including the owner or manager of the place and the tourist; The owner can record the information of the place such as the address, hours, services and events among others. The tourist will be able to see this information and leave comments of each place, allowing the tourist to have a better organization of the trip itinerary.

Resumen

La llegada de turistas internacionales a México aumentó un 10%, en el año 2023 con respecto al 2022, teniendo una llegada de 42 millones 153 mil visitantes en 2023 y de 38 millones 325 mil en 2022, una diferencia de 3 millones 828 mil visitantes; esto refleja el crecimiento en el sector turístico y contribuyendo en la economía del país. El artículo que se presenta a continuación contiene la implementación de una aplicación móvil que permite la difusión de lugares turísticos en México. La aplicación móvil, desarrollada para sistema operativo Android, cuenta con diferentes tipos de usuarios entre ellos están el dueño o encargado del lugar y el turista; el dueño puede registrar la información del lugar como el domicilio, horarios, servicios y eventos entre otros. El turista podrá ver dicha información dejar comentarios de cada lugar, permitiendo al turista tenga una mejor organización del itinerario del viaje.



Application, Implementation, Tourism dissemination



Aplicación, Difusión turística, Implementación

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Introduction

By 2023, Mexico was in the top 10 of the most visited countries by tourists, with the following countries on the list: France, Spain, United States, Italy, Turkey, Mexico, United Kingdom, Germany, Greece and Austria (UN Tourism. 2024). This allowed Mexico to find itself on the list of top international tourism destinations.

In 2015, world leaders adopted a set of global goals to eradicate poverty, protect the planet and ensure prosperity for all as part of a new sustainable development agenda (Nacional Monte de Piedad. 2023).

There is the national challenge for research and digitisation of tourism, which aims to: 'support entrepreneurs and new startups that contribute to the development of local tourism and support recovery'. And within the categories covered by the challenge are: Mexico's Beaches, Mexico's Archaeological Zones, Mexico's Ecotourism and Adventure, as well as Mexico's Magic Towns (UN Tourism. n.d.).

national challenge is aligned with Sustainable Development Goal (SDG) number 8: Decent Work and Economic Growth, which aims to promote inclusive and sustainable economic growth, employment and decent work for all. Since the second target states 'achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including by focusing on high value-added and labour-intensive sectors' (Sustainable Development Goals. n.d.).

There are some localities in Mexico that do not have the resources to maintain a tourist site, such as a former hacienda, an ejido or a historical monument, leaving the local population with few resources or without jobs. This is why digital tools and platforms can be used to disseminate these sites, allowing the arrival of tourists, who can have good sustainable practices, allowing the community to have a greater economy.

For this reason it was decided to implement a mobile application that can disseminate tourist sites, such as archaeological sites, ecotourism or Magical Towns. The application is designed for the following users: an administrator, site owners and tourists.

The administrator, in addition to registering the owners, will have to approve the registration of each site. If it is considered that the site should not be published, the information can be rejected and the tourist will not be able to see the site that has been tried to be added. Each site owner will register the events that will take place so that the tourist can view detailed information, the start and end date, as well as the opening hours.

The presented article has the following sections: state of the art where several works done for the tourism sector in Mexico and other countries will be described; description of the sprint planning process, in this section the activities carried out for the development of the project will be described in a general way; the third section will show a summary of the activities developed in sprint 3; the fourth section talks about the implementation of the functionalities and database in the server, finally, the fifth section describes the type of tests carried out to the application.

State of the art

This section will present an overview of different researches and works developed related to tourism, both at national and international level.

One of the works studied is 'Marketing through mobile tourism applications (m-tourism): an exploratory study' developed by the Spaniard Saura, J. R. (2017); in which an exploratory study of mobile tourism applications was developed to define how tourists use them to obtain information about their trips before, during and after their realisation.

On the other hand, it is necessary to generate in the tourism professional the possibility of creating and managing various tourism products or services through virtual agencies, meta-search engines and even the development of mobile applications, in order to generate employment opportunities in a tourism field dominated by real-time connectivity, virtual marketing dynamics and the extensive use of technological resources in all fields of tourism, especially in the field of tourism services (Castro Ricalde. 2018).

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In the work carried out by Rivera Caro (2019), a mobile application was developed for Android devices that allows showing the different tourist attractions of the Lachay National Reserve (RNL), within the attractions are natural spaces, landscapes, culture and adventure and nature activities; the application will allow tourists to show the tourist attractions of the RNL. You will have the option to view maps, image galleries and information on tourist services, allowing to increase the influx of visitors and allow them to enjoy all the attractions and tourist services offered by this geographical area. It will also make it possible to see the most representative points of interest in the reserve and their location on the map, and to observe the wildlife that exists in the NLR, grouped by fauna, flora and lichens.

On the other hand, in the work presented by Aguirre Yaure (2020), a mobile application was developed using augmented reality to promote tourism in Ecuador; the application provides tourists with the useful and necessary tools to get to know the most emblematic and representative sites of five cities in Ecuador: Quito, Guayaquil, Cuenca, Riobamba and Zaruma.

Augmented reality is used so that the user can get to know and observe the history of the site they are visiting. Among its functionalities, the tourist will be able to rate the different tour guides with whom he/she has interacted. The tourist guide will be able to visualise the ratings (valuations and comments) that he/she has obtained from tourists.

The tourist will be able to see their location on a map to guide them through the city.

Finally, the study of user experiences (UX) must be present, which is why another of the works studied is the one carried out by Vega et al. (2021) whose main objective was to design UX guides that are applicable to mobile applications for cultural tourism with AR.

The activities carried out for this research were: review, grouping and selection. Resulting in a set of UX guides for tourism applications with AR.

The category and one of the UX guides are mentioned below. Usability: Provide useful messages when the user does not know how to proceed; 2. Content: Provide up-to-date content; 3. Functional relevance: Enable location identification, in map-based applications; 4. Security: Protect users' privacy; 5. Efficiency: Minimise the weight of graphics and multimedia files; Correctness: Display the 3D model overlay correctly.

Sprint planning

This section describes the steps and activities that were carried out to organise the activities and ensure that the project objectives were achieved. In the first instance a review of the Product Backlog was made, having a total of 6 activities ordered as follows: a) Design of low fidelity screens, b) Design of high fidelity screens using XML, c) Adding functionality to the screens using Java, d) Back-end development using php, e) Functional testing of the mobile application and f) Enhancements to the mobile application. Table 1 shows the activities and some of the tasks included in the project.

Box 1

Table 1

Product Backlog Review

Activity	Task
Low fidelity display design	Design low fidelity display for the New User Registration module.
	Design low-fidelity display for the Places Section
Creation of high fidelity displays using XML	Create high fidelity display for the Employee Catalogue
	Create high fidelity display for Categories module
Adding functionality to screens using Java	Create class for the Diffusion Images module
	Create class for the Events module
Back-end development using php	Create Script for the Authentication module
	Create Script for the Categories module
Functional testing of the mobile application	Test permissions for user types
	Test report generation module
Improvements to the mobile application	Active session time
	Warning and acknowledgement messages

Source: own elaboration

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After the review of the product backlog, it was decided that each task would be assigned to a sprint and subsequently the effort it would take to complete each one of them was estimated. Sprint 1 will take 3 weeks, the second, third and fourth will take 4 weeks, the fifth sprint will take 3 weeks and the last one will take 2 weeks, making a total of 20 week (5 months approximately). One of the user stories that were elaborated is described in table 2 below:

Box 2

Table 2

Description of the user story: login

ID: HU-004
TITLE: As a registered user, I want to be able to log in with my username and password to access the application's functionalities.
DESCRIPTION: Registered users must be able to log in to the application using their username and password to access their profile and use the services offered by the application depending on the type of user (tourist, site owner or administrator).
CRITERIA FOR ACCEPTANCE: 1. The user can enter his or her username and password in the corresponding fields. 2. If the user name and password are correct, the application redirects the user to the home interface. 3. If the user name or password is incorrect, an error message is displayed stating "Incorrect user name and/or password! 4. The "Recover password" link correctly redirects to the password recovery interface where you will need to provide the e-mail address you registered with to have your current password sent to you.

Source: own elaboration

Summary of the activities carried out in sprint 2

The third sprint is related to the task: "Adding functionality to the screens using Java"; in order to make the user interact in a fluid way with the application, this must not only depend on the design of the application, but also on the coding of each screen, this coding is found in .java files classified as classes, these are directly related to the XML file.

In order for them to establish the relationship, it is necessary to identify the components that will serve as objects and to which specific functionality will be added.

Table 3 shows a portion of the source code for new user registration.

Box 3

Table 3

New user registration

```
private void MetodoInsertarUsuario(String URL){
StringRequest stringRequest = new
StringRequest(Request.Method.POST, URL, new
Response.Listener<String>() {
@Override
public void onResponse(String response) {
//Mensaje de estatus correcto en la operacion

Toast.makeText(getApplicationContext(),
"¡Operación exitosa!", Toast.LENGTH_SHORT).show();
 MetodoLimpiarCampos(); MetodoPoblarUsuarios();
}
}, new Response.ErrorListener() {
@Override
public void onErrorResponse(VolleyError error) {

Toast.makeText(getApplicationContext(),error.toStr
ing(), Toast.LENGTH_LONG).show();
}
}){
//Envio de la información necesaria para el
registro
protected Map<String, String> getParams() throws
AuthFailureError {
Map <String, String> parametros = new
HashMap<String,String>();
parametros.put("Usuario",
edUsuario.getText().toString());
parametros.put("Nombres",
edNombre.getText().toString());
parametros.put("ApePaterno",
edApellidoPaterno.getText().toString());
parametros.put("ApeMaterno",
edApellidoMaterno.getText().toString());
parametros.put("IdNivelAdministracion",
NivelAdministracion);
parametros.put("Correo",
edCorreo.getText().toString());
parametros.put("Telefono",
edTelefono.getText().toString());
parametros.put("Contraseña",
edContraseña.getText().toString());
return parametros;
}
};
requestQueue.add(stringRequest);
}
```

Source: own elaboration

The code contained in the table above has the following code blocks: private void MetodoInsertarUsuario(String URL): this is the method that performs the insertion of a user. It takes a URL parameter, which is the server address to which the request will be sent. StringRequest: this is a class of the Volley library (an Android library to optimise the sending of HTTP requests) that creates an HTTP request of type POST. It is used to send data to the external server.

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Request.Method.POST: specifies that the type of request will be POST, which means that data will be sent to the server to create a resource, in this case to the user. new Response.Listener<String>() { ... }: defines a listener to handle the response from the server when the request is successful. new Response.ErrorListener() { ... }: defines a listener to handle errors in the request. getParams(): this method sends the user data as a Map<String, String>, where each key is the name of the field that is sent to the server, and the value is the content entered by the user in the GUI. requestQueue.add(stringRequest): this line adds the request (stringRequest) to the requestQueue (Volley object that manages all network requests). The previous code allows to generate the user registration interface shown in figure 1, as you can see, it requests the user, name, father's surname, mother's surname, telephone, e-mail, password (it must be at least 8 characters long) and you can select between the different types of users to be registered.

Box 4

Figure 1
User registration interface

As a tourist, you will be able to see the different tourist sites with their general information, opening hours, services and events that will take place, and you will be able to leave a comment if you wish. Figure 2 shows the interface for the tourist, where he/she can see the name of the place, the image/s uploaded, address, entrance fee, opening hours, social networks and the option to leave a comment.

Box 5

Figure 2
Tourist information view of a tourist site

Implementation of the functionalities and database on the server

After coding the screens locally, they were uploaded to a host service so that the application could be accessed from anywhere. The folder with all the content of the project was uploaded, including the database connection files, authentications and operations for the different modules. Figure 3 shows the folder with all the files and subfolders within the 000webhost.com host.

Box 6

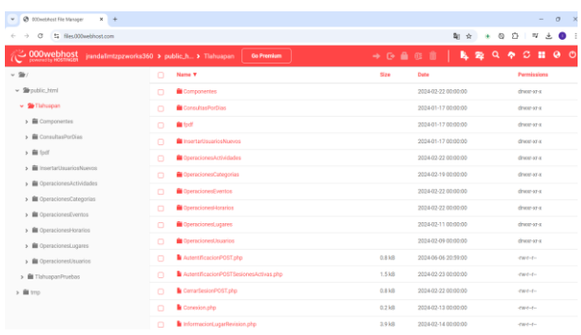

Figure 3
Project folder on the server

Inside the subfolder "InsertNewUsers" there is a file called "InsertNewUsersPOST.php", which registers the user into the database on the server. Table 4 shows the php code for the insertion of the user in the database.

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Box 7

Table 4

Inserting users into the server database

```
<?php
    include '../Conexion.php';

    $Usuario = $_POST["Usuario"];
    $Nombre = $_POST["Nombre"];
    $ApePater = $_POST["ApePater"];
    $ApeMater = $_POST["ApeMater"];
    $Telefono = $_POST["Telefono"];
    $Correo = $_POST["Correo"];
    $Contraseña = $_POST["Contraseña"];

    $query = "INSERT INTO usuarios (Usuario, Nombres,
ApePaterno, ApeMaterno, Telefono, Correo, Contraseña,
IdNivelAdministracion)
                VALUES ('".$Usuario."', '".$Nombre."',
'".$ApePater."', '".$ApeMater."', '".$Telefono."',
'".$Correo."','".$Contraseña."','1')";
    mysqli_query($Con, $query) or die
(mysqli_error());

    mysqli_close($Con);
?>
```

The above code includes the Connection file, which contains the configuration (host, username, password and database name) to connect to the MySQL database. In the same way, the input variables identified with $_POST are received, provided from a POST request coming from the mobile application. In this case we are inserting in the field IdAdministrationLevel the value of 1, which is the lowest level (level for a tourist), level 4 would be for the Administrator. In general, the workflow for the registration of a user is that the mobile application sends a POST request with the user data (through the Volley library), then the PHP script on the server receives the data via $_POST so that PHP inserts that data into the database; finally if the operation is successful, the mobile application receives a positive response and displays the message "Successful operation! To create the database on the server, go to the Database Administrator section, this allows you to see the user with which you can enter the system and must match the one registered in the file Conexión.php.

Box 8

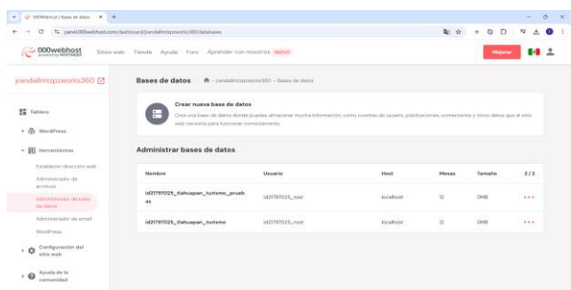

Figure 4

Implementation of the database on the server

Tests carried out on the application

The testing phase is a set of activities developed in order to detect possible errors before launching the final version of an application, within the tests that could be carried out in the development of the application are: integration, unit, system, acceptance and performance tests.

A test plan was made with the following activities: creation of test cases, selection of test data, execution of test cases and recording of results. The test case format contains the test case number, description, input data, expected output, approved (YES/NO) and remarks. In case it has not been approved, a second cycle shall be carried out in order to solve the test. Table 5 shows the test case CP007 for the registration of tourist sites.

Box 9

Table 5

Test Case CP007: Registration of Tourist Sites

Description	Registration of a tourist site in a category
Input data	Selection of the category to which it will belong, a name for the site, entry cost, address where it is located accepting string characters, outside number (required), inside number (optional), telephone and social networks.
Expected output	Add the tourist site to a selected category
Approved	Yes
Remarks	The places section retrieves the information and modifies it correctly.

Results

Based on the state of the art, where various articles related to the project were consulted, it can be identified that it is of vital importance to create mobile applications that help tourists to access information about tourist destinations through events and services offered in each place, in addition to offering updated content for tourists.

The description of the sprint planning process is a process within the SCRUM methodology, which was chosen for the development of the project, this process allowed to review the elements of the product backlog, select the highest priority activities and indicate the sprints to be performed.

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The summary presented of the activities developed in sprint 3 talks about how the functionality was added to all the screens of the application using Java, choosing this programming language because it has several tools, libraries and resources for the development of Android applications.

The implementation of the functionalities and database on the server allowed the application to be uploaded to a hosting so that tourists and place owners could interact with the application in a real way, although it has not yet been published in the Playstore, the place owners can already upload their information to the server and the tourist can see it in real time.

In the testing phase of the application, some errors were identified in the application, such as the recovery of passwords that did not send the email to the user, or when uploading images to the events, the tourist could not see them.

Conclusions

Finally, the development of the application will allow the dissemination of information to tourists about sites in the municipality of Tlahuapan, as well as events that can take place throughout the year, such as firefly sightings and the sale of Christmas pines, among others.

On the other hand, it is important to mention that the estimated effort of this project was divided into the following phases: project plan, requirements specification, analysis and design, implementation, integration and testing, and finally the closure. The time spent was 30% on implementation and 20% on integration and testing.

Declarations

Conflict of interest

The authors declare that they have no conflicts of interest. They have no known competing financial interests or personal relationships that might have appeared to influence the article reported in this paper.

Authors' contribution

Sánchez-Juárez, Ivan Rafael: Contributed to the supervision, management and training of project clients.

Paredes-Xochihua, Maria Petra: Contributed to the elaboration and execution of the test plan and test cases, as well as the revision of the product backlog.

Martínez-Pérez, José Randall: Contributed to the development and programming of the interfaces as well as the implementation of the application on the hosting.

Availability of data and materials

The data obtained are available in each of the references used and if you require further information on the results, please contact the author of this article.

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Abbreviations

HTTP: HyperText Transfer Protocol
SDGS: Sustainable Development Goals
UN: United Nations
URL: Uniform Resource Locator
XML: eXtensible Markup Language

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Background

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