









Prototype of a web application for the promotion of tourism in the Huasteca Hidalguense

Prototipo de aplicación web para el fomento del turismo en la Huasteca Hidalguense

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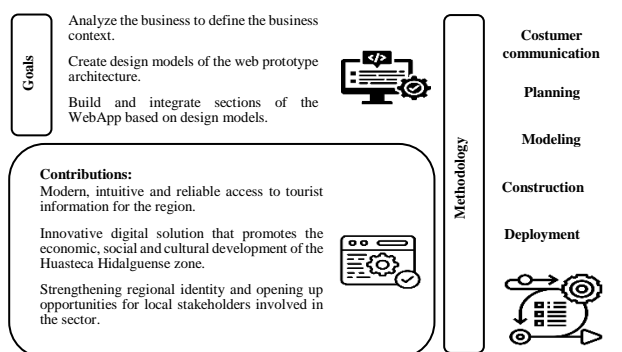


Abstract

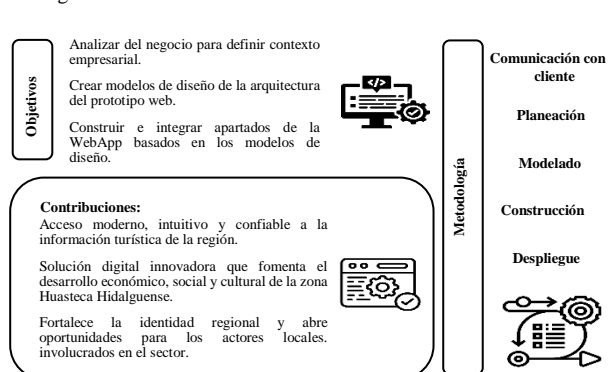
This research focuses on the design and development of a prototype web application aimed at boosting tourism in the Huasteca Hidalguense region; it integrates key information on cultural, natural, and gastronomic attractions, while also promoting local services and products for effective dissemination. The Iweb methodology was employed, structuring the process into sequential phases: customer communication, planning, modeling, construction, and deployment of the platform. The result is a functional web application that centralizes tourist data, incorporates interactive maps, and facilitates the visibility of regional offerings. This initiative addresses a current problem by offering an innovative digital solution that fosters economic, social, and cultural development in the area. By providing modern, intuitive, and reliable access to tourist information, the prototype strengthens regional identity and opens opportunities for local stakeholders involved in the sector, contributing to the growth of the Huasteca Hidalguense.

Resumen

Esta investigación se enfoca en el diseño y desarrollo de un prototipo de aplicación web destinada a impulsar el turismo en la región de la Huasteca Hidalguense; integra información clave sobre atractivos culturales, naturales y gastronómicos, además de promover servicios y productos locales para su difusión efectiva. Se empleó la metodología Iweb, que estructuró el proceso en fases secuenciales: comunicación con el cliente, planeación, modelado, construcción y despliegue de la plataforma. El resultado es una aplicación web funcional que centraliza datos turísticos, incorpora mapas interactivos y facilita la visibilidad de ofertas regionales. Esta iniciativa responde a una problemática actual, ofreciendo una solución digital innovadora que fomenta el desarrollo económico, social y cultural de la zona. Al proporcionar acceso moderno, intuitivo y confiable a la información turística, el prototipo fortalece la identidad regional y abre oportunidades para los actores locales involucrados en el sector, contribuyendo al crecimiento de la Huasteca Hidalguense.



Prototype, Tourism, Huasteca.



Prototipo, Turismo, Huasteca

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Introduction

Nowadays, the internet has become the main means of searching for information about destinations, making reservations and planning trips, because the accessibility, speed and reach of the network allow users to consult aspects such as transport, accommodation, gastronomy or recreational activities from anywhere.

A tourism website allows all relevant information about a region to be centralised, such as places of interest, accommodation, cultural activities, gastronomy and typical products. It also offers users the possibility of interacting through queries, online purchases and advance bookings, which improves their travel experience and contributes to local economic growth (Chung, et al., 2015).

Today, personalising the visitor experience through interactive interfaces, relevant content and intuitive navigation has become one of the main demands of digital tourism. The main value of this research is to offer tourists a comprehensive and dynamic web portal that allows them to consult organised information on the different tourist attractions in the Huasteca Hidalguense region, including hotels, restaurants, typical cuisine, traditional events and festivities, as well as ecotourism areas, recreational activities and the sale of handicrafts.

The information available for consultation includes: names of destinations, descriptions, images, user comments, information on products and services, events, reviews and geographical data on tourist sites.

Access to this information by domestic and international tourists will help to boost the flow of visitors and tourism in the area, which has been reduced due to the fact that the region does not have a digital platform that offers all the tourist sites of interest in the region, handicraft products, accommodation services, cultural events and festivities, gastronomy, among many others, to facilitate the stay of visitors and benefit both the best-known municipalities and less explored communities.

Together, all these tools make it possible to build an interactive platform that can be adapted to the needs of tourism promotion and artisan marketing in the Huasteca Hidalguense region.

It is hoped that the impact of this platform will not be limited to the technological sphere, but will also be reflected in the strengthening of local economies, the preservation of regional cultural identity and the consolidation of the Huasteca Hidalguense as a competitive tourist destination at the national and international level. Technology thus becomes a bridge between the cultural wealth of the peoples and the interest of global travellers.

Problem.

Despite the natural, geographical, artisanal, cultural, and gastronomic wealth that characterises the Huasteca Hidalguense, the region faces a significant limitation in the promotion and dissemination of its local tourist attractions due to the absence of a centralised and accessible digital platform that integrates up-to-date and reliable information for domestic and foreign visitors.

This shortcoming makes it difficult for tourists to plan their trips and safely access sites of interest and ecotourism, services, local products, festivities, and cultural activities, which negatively impacts the tourist experience, visibility, and economy of the host communities.

This situation also limits the possibility of organising responsible tours and experiences that avoid crowds and promote respect and preservation of the natural and cultural environment.

Likewise, the absence of a modern, accessible and up-to-date technological tool restricts opportunities for sustainable economic and social development for local service providers, as they do not have a digital space to promote their products, offer authentic experiences or market handicrafts and typical cuisine.

Similarly, it prevents visitors from having reliable information on routes, service directories, and options for safely purchasing handicrafts and typical products, thereby restricting the dissemination and responsible use of the area's cultural and natural resources.

Justification

The Huasteca Hidalguense region has enormous tourism potential due to its biocultural diversity, unique ecosystems (medium-sized forests, rivers, waterfalls, and caves), its archaeological wealth and its intangible heritage, such as the Huasteca tradition, the dance of the acrobats, the music of the Huasteca son and a nationally recognised gastronomy (Hidalgo Ministry of Tourism, 2024).

According to the UNWTO World Tourism Barometer (UNWTO, 2023), more than 80% of international travellers use the internet as their main source for planning their trips, prioritising platforms that provide up-to-date information, real reviews and georeferenced tools. In Mexico, 29% of total online purchases are related to tourism (AMIPCI, 2020), highlighting the need for responsive, easy-to-navigate web applications to serve and respond to more than 30 million tourists.

However, in the Huasteca Hidalguense region, there is currently no official or private portal that centrally integrates and permanently updates the complete tourist offer of the eight municipalities that comprise it (Huejutla de Reyes, San Felipe Orizatlán, Jaltocán, Atlapexco, Huautla, Yahualica, Xochiatipan, and Huazalingo), according to an assessment carried out by the Hidalgo State Tourism Secretariat (Secretaría de Turismo de Hidalgo, 2023).

Given the problem identified, there is an urgent need to develop a prototype interactive web application that acts as a link between tourists and local communities, providing centralised tourist information, up-to-date digital tools and promotional spaces for products and services, thus contributing to the strengthening of the regional economy and the promotion of safe, responsible, sustainable and inclusive tourism in the Huasteca Hidalguense.

This platform will help to activate the regional economy by offering promotional spaces for local businesses, promoting the marketing of typical products through a digital marketplace, and providing modern tools such as interactive tourist guides, dynamic maps, and educational content on Huasteco cultural heritage.

It also aims to reduce the region's tourism digital divide, aligning itself with the objectives of the Hidalgo State Tourism Sector Programme 2021-2027 and the National Sustainable Tourism Strategy 2020-2024 (SECTUR, 2020).

These actions will facilitate the economic inclusion of micro and small service providers (artisans, local guides, family restaurants, and ecotourism operators) through a free and permanent online promotion and marketing space, as recommended by studies on the collaborative economy applied to rural tourism (Richards, 2018).

In addition, the project lays the groundwork for future technological and tourism initiatives in the region, facilitating digital training for the communities involved and promoting an inclusive, responsible, and sustainable tourism model that favours both the preservation of heritage and the well-being of current and future generations.

Objective

To develop a prototype web application for the promotion of tourism in the Huasteca Hidalguense, through the analysis of the organisational context, the identification of participants and the integration of technology, with the aim of centralising tourist information in the region, boosting the local economy and encouraging responsible, sustainable and inclusive tourism.

Theoretical foundations

The Huasteca Hidalguense as a biocultural tourist destination

The Huasteca Hidalguense region, located in the north of the state of Hidalgo, Mexico, represents a mosaic of natural biodiversity and cultural wealth that positions it as a tourist destination with high potential for sustainable development.

This area, which covers eight municipalities in the state, is characterised by its humid tropical ecosystems, mighty rivers such as the Pánuco and impressive waterfalls, together with a Nahuatl indigenous heritage that permeates its traditions, gastronomy and crafts (León-Paniagua, et al., 2010). However, its effective promotion depends on digital tools that integrate these elements, allowing for accessible and attractive dissemination.

In this context, web applications are emerging as key platforms for centralising tourist information, encouraging interaction and supporting the local economy, in line with the demands of an increasingly digitalised and responsible tourism industry.

The evolution of tourism towards sustainability and authentic experiences.

Tourism, understood as the temporary movement of people outside their usual environment for leisure, business or cultural purposes ([Organización Mundial del Turismo, 2023](#)), has evolved towards forms that prioritise sustainability and cultural immersion.

In regions such as the Huasteca Hidalguense, where biodiversity includes medium-sized forests with endemic species and intangible heritage such as Huasteco music or zacahuil (a traditional giant tamale), cultural and ecotourism can generate income while preserving these resources ([Vázquez Solís, et al., 2024](#)).

Studies highlight that 70% of Millennial and Generation Z tourists seek authentic experiences that combine nature and culture, driving the need for digital tools that facilitate this connection ([García-Roselló, et al., 2019](#)).

Web applications for tourism promotion

Web applications for tourism promotion are defined as online platforms that integrate multimedia content, interactive features, and databases to promote a destination's attractions.

These tools centralise information on cultural sites (such as the Cristo Rey Cathedral built in 1541), natural sites (Tetixtil waterfalls), and gastronomic sites (Huasteca enchilada festivals). They also allow users to book local services and provide feedback, improving the visibility of indigenous communities ([Guzmán-Pérez & Sánchez-Cañizares, 2012](#)).

Their value lies in their capacity for personalisation; using recommendation algorithms, they adapt routes to individual preferences, reducing tourist overload in sensitive areas and promoting responsible tourism that respects environmental carrying capacity.

Interactive maps and geographic information systems in tourism.

An indispensable component in these applications is the interactive map, which combines geographic information systems (GIS) with web interfaces to offer dynamic navigation. These maps allow users to zoom in, activate thematic layers (e.g., ecological routes or Huasteca archaeological sites) and consult real-time data, such as cultural events or weather alerts ([Del Río-Arca, 2015](#)).

Academic research highlights their importance in tourism, as they facilitate spatial orientation, enrich the educational experience, and support sustainable planning, with studies in Colombia and Spain showing a 40% increase in visitor satisfaction when using interactive maps ([Valero, 2013](#)).

In the context of the Huasteca, where mountainous topography and rivers complicate mobility, these georeferenced elements can integrate biodiversity data (such as sightings of endemic birds) with cultural narratives, promoting ethno-tourism that values the biocultural memory of Nahua communities ([Gutiérrez-Santillán, 2013](#)).

Iweb methodology for the development of tourism web applications

The Web Engineering (Iweb) methodology, proposed as a systematic approach to web application development, is particularly suitable for tourism projects, as it emphasises iteration based on feedback from local stakeholders, ensuring that the platform reflects real needs, such as the inclusion of indigenous languages or mobile accessibility.

Unlike traditional software engineering approaches, Iweb incorporates principles of web usability and scalability, allowing for continuous updates to maintain relevance in a dynamic sector ([Pressman, 2010](#)). Its application in similar contexts has been shown to reduce development times by 25% while improving interactivity ([Sánchez López, n.d.](#)).

Methodology

The Iweb methodology was used for the design and development of the web application prototype for this research.

This is a systematic, structured and sequential model specifically geared towards the development of web applications, which allows for rigorous control of the project while facilitating the active participation of the client and end users throughout the process. In addition, it integrates principles of traditional software engineering with considerations unique to the web environment, such as usability, scalability, and end-user interaction.

This methodology consists of five clearly defined phases: Communication with the client, Planning, Modelling, Construction, and Deployment (Pressman, 2005):

Box 1

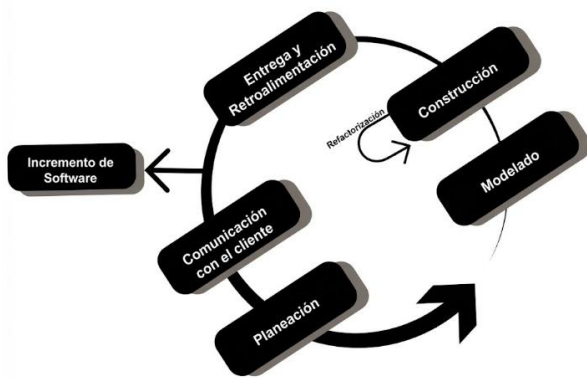


Figure 1

Iweb Methodology

The communication stage focuses on continuous interaction with stakeholders to identify and document preliminary project requirements. It includes meetings, interviews, and end-user needs analysis, with the aim of aligning customer expectations with the technical capabilities of the web application, thus laying the foundation for development focused on user satisfaction.

Planning involves drawing up a precise schedule or project plan. Here, tasks and a calendar of deadlines are defined for the period (weeks) projected for the development of the project.

Modelling encompasses the creation of abstract representations of the system, including architecture, navigation, and user interface diagrams. The overall structure of the application, interaction flows and initial prototypes are defined, with an emphasis on web usability and cross-platform compatibility, in order to anticipate possible implementation problems.

During construction, the application is implemented, integrating web development tools to produce dynamic and static pages. This phase combines architectural design with actual coding, associating navigation and interface elements to generate a functional prototype that responds to the previous models.

The deployment stage involves publishing the application in an operational environment with real users, including an evaluation period. Feedback is presented to the Iweb team and the increment is modified as required.

Development

The initial phase of communication with the client focused on establishing a permanent channel of dialogue with the main stakeholders: staff of the Ministry of Tourism of the municipality of Huejutla de Reyes, Hidalgo; staff of the College of Architects and Civil Engineers of La Huasteca A.C.; local tourism service providers (food and accommodation); artisans; tour guides, and representatives of indigenous communities in the Huasteca Hidalguense region. These meetings provided insight into local dynamics, including the most relevant aspects to be integrated into the web platform.

Among the needs identified were the lack of a centralised tourist information site, the low digital visibility of local products and services, the need for geolocation to facilitate access to tourist destinations, and the dynamic updating of content. The opportunity to strengthen regional identity and attract more visitors by having a modern and interactive tool was also identified.

As a result of this stage, the Software Requirements Specification (SRS) document was drawn up, which included the definition of functions such as the display of attractions, search by municipality, interactive map, festivities, crafts section, and services directory.

Once the requirements were validated, the general schedule and the assignment of tasks and times were defined as part of the planning process. A work plan was established with deliverables by phase and specific dates; a 14-week schedule was set, distributed across different key stages, allowing for the efficient organisation of activities.

Box 2

Table 1

Project planning

#	Activity	Prog/ Rev	Weeks													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Communication	P	█	█												
		R														
2	Planning	P			█	█										
		R														
3	Modelling	P					█	█	█							
		R														
4	Construction	P							█	█	█	█	█	█		
		R														
5	Deployment	P													█	
		R														

Own Elaboration

For the prototype modelling, the information architecture and user interface designs were created. Visual prototypes of the system were presented in the form of wireframes, showing the layout and organisation of the elements on each screen, without applying definitive styles or final graphic design; these prototypes allow the structure and navigation flow to be visualised prior to development.

The main entities were defined: ecotourism, festivities, gastronomy, crafts, and accommodation. Interactive prototypes were also designed for the key screens: home page, detailed attraction information, interactive map with thematic layers, and business directory section.

Box 3



Figure 2

Wireframe of the Ecoturismo section

All designs were validated in a second round of feedback with stakeholders to ensure usability and accessibility on mobile devices. During the construction phase, the actual prototype code was implemented. The responsive frontend was developed with Vue.js and Bootstrap 5, ensuring compatibility with mobile and desktop browsers.

Node.js and Express were used in the backend, and RESTful API routes were created for content management. In addition, a MongoDB database was used and the Google Maps API was integrated with custom markers, clusters and thematic layers (nature, culture, gastronomy) for the interactive layer.

The database was populated with initial information on 6 tourist attractions, 8 municipalities, 22 artisans, and 28 service providers, obtained from initial interviews and direct collaboration with the staff of the Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A.C. (Association of Architects and Civil Engineers of La Huasteca), who, through their active participation, provided suggestions and recommendations for the choice of colour palette and design elements, as well as for the organisational and structural architecture of the portal.

Box 4



Figure 3

Home screen of the web portal

Box 5

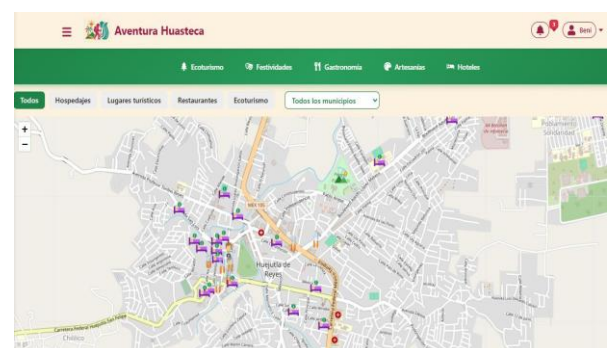


Figure 4

Interactive map

As a security measure, basic content moderation and optimised image loading mechanisms were implemented to filter the content of the information published and reduce loading times.

Box 6

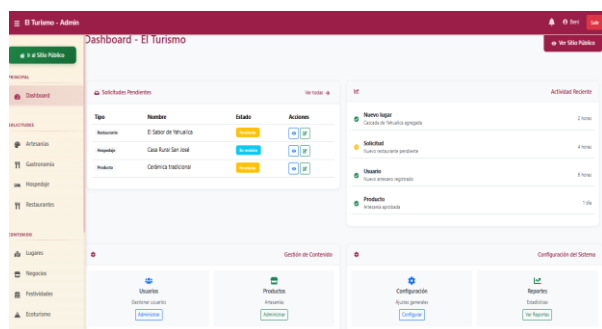


Figure 5

Review of applications for publication

Vercel was selected as the deployment service due to its native compatibility with modern technologies such as React and its support for continuous deployments connected to Git repositories. The ease of integration with full stack projects (Frontend in React and Backend in Node.js) also influenced this choice.

The backend was implemented using Node.js and MongoDB, with the database hosted on an external service (such as MongoDB Atlas), ensuring reliable and scalable storage for tourist information.

The backend was implemented using Node.js and MongoDB, with the database hosted on an external service (such as MongoDB Atlas), ensuring reliable and scalable storage for tourist, gastronomic, and cultural information.

The necessary environment variables (URIs, API keys, port configuration, and protected routes) were configured for both the frontend and backend. The operating environment was tested on different browsers and devices to ensure a consistent user experience.

Functionality, compatibility, and performance tests were conducted on different devices and connection speeds, including 3G/4G mobile networks common in the Huasteca region.

Box 7

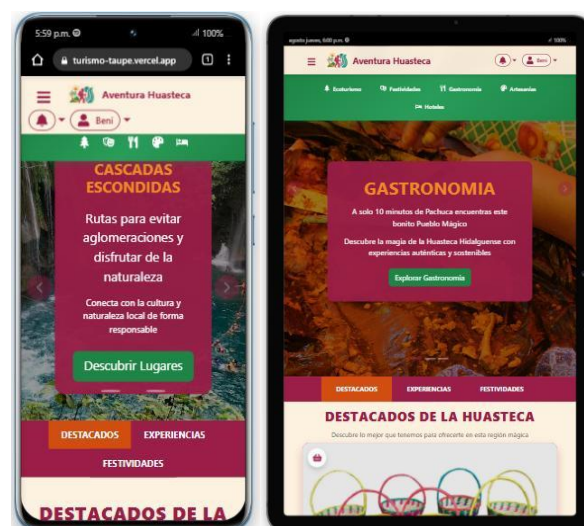


Figure 6

Mobile device testing

The prototype was made available to end users to interact with the different sections of the web portal. At the same time, active tests were carried out on the publication forms and on the interaction with the dynamic maps integrated through the Leaflet library, which allowed simulating the real behaviour of users such as artisans or hosts who wish to publish their services or products on the platform.

First, the user must submit a request for publication, which must be reviewed for security purposes by the website administrator.

Box 8

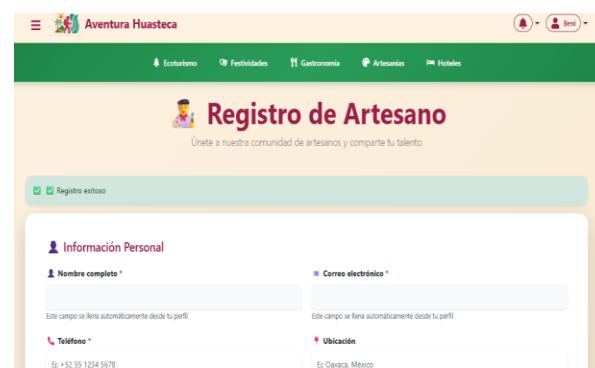


Figure 7

Test for registering as a craftsman

The next step is review by the administrator to ensure that the publication does not contain offensive or illegal content.

Box 9

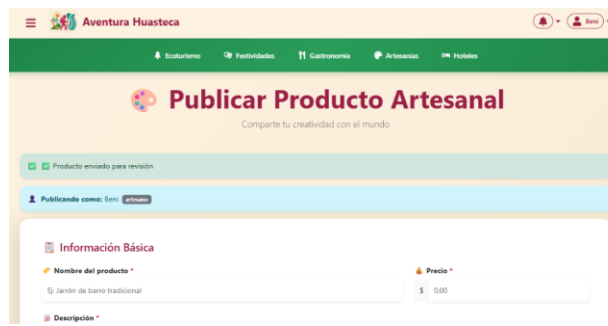


Figure 8

Test for review by the administrator

Finally, once the information in the publication request has been reviewed, it is validated and approved for disclosure on the web platform.

Box 10



Figure 9

Test for administrator approval

This process aims to validate the correct technical functioning of the system and evaluate the usability of the interface, the comprehensibility of the forms, and the navigability of the interactive map.

Finally, technical documentation and an administration manual were generated so that non-technical staff can update content in the future. The strict application of the Iweb methodology made it possible to keep the project within the established deadlines, effectively incorporate the real needs of users, and obtain a functional, intuitive prototype focused on the tourist and cultural characteristics of the Huasteca Hidalguense region.

Results

The development of the prototype web application for the promotion of tourism in the Huasteca Hidalguense region made it possible to meet the objectives set at the beginning of the project.

During the work process, a functional platform was built that includes a tourist directory with information on accommodation, festivities, gastronomy and handicrafts, an interactive map implemented with the Leaflet tool to show the location of points of interest, and a publication system so that artisans, hosts and chefs can publicise their services and products.

This result responds to the problem detected in the Huasteca Hidalguense region, where there was no centralised digital platform for promoting tourist attractions. Now, thanks to this tool, both visitors and service providers can access up-to-date information more easily, which contributes to the promotion of responsible tourism and boosts the local economy.

As for the first objective, which consists of analysing the business to define the business context, both documentary and field research was carried out. Interviews were conducted with stakeholders, which made it possible to define profiles within the system, such as administrators, artisans, hosts, restaurants and tourists, each with specific functions.

Having this structure in place from the outset facilitated the development stage because it allowed us to define everything from the design to the operation of the platform for each type of user.

For the objective of creating design models for the web prototype architecture, tools such as Balsamiq were used to develop the first sketches and wireframes, which allowed us to define the appearance of the web portal, the location of the different components (buttons, images, and texts), and how the user would move between the different sections.

These designs were implemented with Bootstrap, ensuring that the final result was as requested and planned by the end users, which also helped to make the platform more intuitive and user-friendly.

The objective defined for building and integrating the sections of the application was also achieved. Sections were created dedicated to gastronomy, where each dish includes its description, ingredients, history, and location.

To accommodation, where you can see its exact location, photos, and contact details; and to crafts, with a catalogue presenting the available products. In addition, the interactive map allows you to visually locate the different tourist spots, making it easier for visitors to plan their itinerary.

In terms of the tools used, React.js was very useful for creating a dynamic interface, Node.js and Express allowed for efficient handling of server requests, MongoDB adapted very well to the variety of data handled, Leaflet was lightweight and easy to integrate for the map, Bootstrap helped maintain a clean and adaptable design, and Vercel made deployment fast and stable.

In summary, the project fulfils the objective of creating a prototype web application that centralises tourist information on the Huasteca Hidalguense and facilitates the promotion of local products and services.

This work represents a first step towards giving the region a greater digital presence and enabling it to make better use of its tourist, cultural and gastronomic attractions, contributing to the economic and social development of the communities involved.

Conclusions

The development of the prototype web application for the promotion of tourism in the Huasteca Hidalguense region highlighted the importance of integrating technology as a tool to boost the economic, social and cultural development of a region.

The platform created brings together relevant tourist information, covering accommodation, gastronomy and handicrafts, as well as including an interactive map that facilitates the location of points of interest. This responds to the initial problem of the lack of a unified digital medium for promoting tourism in the area.

In terms of objectives, the project achieved all of those proposed. The analysis of the organisational context and the identification of the participants were fundamental to structuring the platform.

The design of profiles such as administrators, artisans, hosts, chefs and tourists allowed each user to have clear functions adapted to their needs. This order favoured the implementation of specific functionalities for each role during the construction of the application, optimising the user experience.

In terms of design, the creation of wireframes and visual prototypes with Balsamiq was decisive in aligning expectations between what was planned and the final result. The use of Bootstrap during implementation ensured a visually appealing, functional interface that could be adapted to different devices, which is essential to guarantee access for all types of users.

The construction and integration of the WebApp sections represented one of the project's greatest achievements. The gastronomic section allowed dishes to be documented with detailed information on their origin, ingredients, and location; the accommodation section provided complete and georeferenced data; and the artisan catalogue opened up a space for visibility for local products.

The connection between the frontend developed in React.js and the backend in Node.js with MongoDB was seamless, ensuring that data was handled efficiently.

Functional testing, carried out on different browsers and devices, was crucial to guarantee compatibility and the correct display of content. Adjustments to the interactive map for small screens were key to improving usability and providing a satisfactory experience for end users.

Finally, the delivery of the prototype allowed the local community to interact directly with the application, as the feedback received highlighted the usefulness of having a tool that concentrates all tourist information in one place. Similarly, users identified the platform's potential to expand the promotion of local businesses and facilitate the organisation of tourist activities. In conclusion, the project achieved its overall objective and laid the foundations for future improvements and expansions. This prototype is a first step towards the digital transformation of tourism in the Huasteca Hidalguense, promoting responsible, sustainable and inclusive tourism.

Its practical implementation can contribute significantly to strengthening the cultural identity of the region, attracting new visitors and, above all, boosting the local economy through the visibility and accessibility of its services and products.

Declarations

Conflict of interest

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

Contribution of the authors

Salazar-Casanova, Hermes contributed to the organisation and conduct of interviews with stakeholders, selection of the development methodology to be implemented, development of the prototype, research and compilation and organisation of project information, creation of the work plan and writing of this article.

Mendoza-San Juan, Luis Alberto contributed to the development of the prototype, drafting of the Software Requirements Specification (SRS), and selection of tools and technologies to be used for development.

Meneses-Flores, Arturo Élfego contributed to the development of the project, testing, presentation of the prototype to end users, and gathering feedback for the application of adjustments and adaptations.

González-González, Fabiola contributed to the organisation and conducting of interviews with stakeholders, the collection of information, suggestions and recommendations for defining the architectural and structural design of the prototype, as well as the definition of the colour palette to be used on the web portal.

Availability of data and materials

The information used in this article is available in the publications of the various authors mentioned in the references. The information included in the Software Requirements Specification (SRS) was provided by the stakeholders.

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Special recognition goes to the local tourism service providers (artisans, accommodation owners, family restaurants and tourist guides from the municipalities of the Huasteca Hidalguense region) who dedicated their time to participating in interviews and user tests, sharing their knowledge of the region's cultural, natural and gastronomic attractions, as well as their real needs for the promotion of their products and services.

Finally, we would like to extend our gratitude to the Technological University of the Huasteca Hidalguense (UTHH) and the Software Development and Management Engineering educational programme for the institutional and academic support that facilitated the development of this research, as well as to all our colleagues and teachers who, with their observations and suggestions, contributed to improving the final result of the prototype.

This work reflects the collective effort of those who believe in the tourism potential of the Huasteca Hidalguense and in technology as a tool for its sustainable and inclusive growth.

Abbreviations

ERS Software Requirements Specification

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Background

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