

Web prototype as a consultation tool to identify and report works that represent a risk to the integrity of citizens

Prototipo web como herramienta de consulta para identificar y reportar obras que representen un riesgo a la integridad de los ciudadanos

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Abstract

This research aims to develop a web prototype as a consultation tool that allows the identification and reporting of works that represent a risk to the integrity of citizens in the city of Huejutla de Reyes, Hidalgo. In Mexico there are urban problems; potholes in streets and avenues top the list with 73.2%, this is reflected by the low investment in construction and remodeling of public spaces that directly affect citizens to carry out daily activities efficiently and impedes the economic growth of the country (INEGI, 2021). The development used the Web Engineering (Iweb) methodology, made up of 5 phases: communication with the client, planning, modeling, construction and deployment. The result is a dynamic multi-platform application that works on any device, using information provided by users to report urban infrastructure problems. The College of Architects and Civil Engineers of the Huasteca A.C. (CAIH) was an important collaborator, since, as a civil association, it is interested in the registration and management of the mentioned problems, to evaluate the actions in the follow-up and solution with the corresponding authorities.

Prototype, Web, CAIH

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Resumen

Esta investigación tiene por objetivo desarrollar un prototipo web como herramienta de consulta que permita identificar y reportar obras que representen un riesgo a la integridad de ciudadanos en la ciudad de Huejutla de Reyes, Hidalgo. En México existen problemas urbanos; los baches en calles y avenidas encabezan la lista con 73.2 %, esto se refleja por la poca inversión en construcción y remodelación de espacios públicos que afectan directamente a la ciudadanía para desarrollar actividades diarias de manera eficiente e impide el crecimiento económico del país (INEGI, 2021). El desarrollo utilizó la metodología Ingeniería Web (Iweb), conformada por 5 fases: comunicación con el cliente, planeación, modelado, construcción y despliegue. El resultado es una aplicación dinámica multiplataforma funcional en cualquier dispositivo, empleando información proporcionada por los usuarios para el reporte de problemas de infraestructura urbana. El Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A.C. (CAIH) fue un importante colaborador, ya que, como asociación civil, está interesado en el registro y gestión de los problemas mencionados, para evaluar las acciones en el seguimiento y solución con las autoridades correspondientes.

Prototipo, Web, CAIH

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Introduction

This research proposes to develop a web prototype that mainly provides users with a tool to generate reports of road and urban infrastructure problems (potholes, water leaks, advertisements and poles in poor condition, faulty lighting, pruning of trees or shrubs, removal of material or abandoned vehicles, clearing of drainage, among others), generating through these actions a link with the College of Architects and Civil Engineers of the Huasteca A. C. (CAIH) for the attention of the requests made by the citizens of the municipality of Huejutla de Reyes, Hidalgo for their attention by the corresponding authorities.

The importance of this research lies in facilitating a means through which citizens can make notifications about the inconvenient state of urban infrastructure to the competent authorities to deliver information and generate first-hand reports on the problems that directly affect society as a whole.

With the implementation of this prototype, the aim is to create a relationship of constant communication between society and the authorities, where requests can be answered and a relationship of trust is created between the parties involved.

This is why the Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A.C. (CAIH) can be an efficient intermediary for the management and processing of citizen complaints so that they can be dealt with by the corresponding authorities.

The characteristics of the web prototype include the following profiles: an administrator who will manage the content generated by the collaborators; a collaborator, a user who is part of the CAIH, who will be able to generate publications in the web application such as articles or professional projects, as well as information corresponding to his/her professional profile; and a general user who does not require registration in the WebApp, who can make reports and have access to read the information published in it.

The creation of this instrument will facilitate citizen participation to report any problem associated with road or urban infrastructure; in turn, it will allow the CAIH to serve as an intermediary for the resolution of such notifications to the competent authorities and will provide an informative means for society to have access to the publications that this civil association makes with interest in urban development and land use planning in the Huasteca Hidalguense.

The article is composed of the following sections: Problem, in this section the approach and dimension of the problem to be solved are indicated; theoretical framework, it is dedicated to support with theoretical bibliography related to the subject, which will support the interpretation; methodology, it is focused to express the way in which the activities were carried out within the investigation; the results, consist of the analysis of the obtained data supporting the hypothesis with the proposed theory; the conclusion, has the purpose to expose in a concise way the results and the discussions that will allow to determine the fulfilment of the objective of the study; the conclusion, it has the purpose to expose in a concise way the results and the discussions that will allow to determine the fulfilment of the objective of the study.

The conclusion is intended to concisely present the results and the discussions that allow us to determine the fulfilment of the project's objective; and the references, where all the bibliography used in carrying out this work is listed.

Problem statement

Citizen reporting is an instrument that is gaining more interest nowadays. The Government of the State of Hidalgo points out that this concept refers to any service offered for any person to report any fact, act or omission that results in a situation of danger or emergency for the general population (Gobierno de Hidalgo, 2022).

In Mexico, there are currently many urban and road problems that are not known and therefore not addressed. This situation means that these deficiencies cannot be satisfactorily resolved.

Currently, in Huejutla de Reyes, Hidalgo, there is no practical instrument to expedite the reporting of urban infrastructure problems that put the integrity of citizens at risk, and which, in turn, serves as a means of information between society and the Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A.C. (CAIH), whose objective is to work actively on urban-architectural intervention proposals in collaboration with governmental or autonomous organisations, with the aim of improving the experience and habitability of the population in this municipality and the region.

Theoretical framework

In recent years we have witnessed a revolutionary expansion of information and communication technologies (ICT), led by the Internet, which have proved to be factors responsible for great social change.

Due to the universalisation of these new resources, more and more people use the internet to disseminate, interact and get involved in positions and practices, which has enabled a new form of social participation in a new online context (Calvo, 2016).

In turn, the last two decades have seen the emergence of a global trend of considerable interest: the growing participation of civil society in the collection, verification, analysis, sharing and dissemination of data, for information purposes, using ICTs, in particular mobile technologies.

Citizen engagement is a new type of information production based on the conscious and voluntary participation of thousands of citizens generating large amounts of data (Finquelievich and Fischnaller, 2014).

The city is a dynamic and complex entity in which daily activities (economic, social, cultural, educational and leisure) take place in which these activities are interrelated and coexist, so its role is decisive in the health of the population. Their physical environment, as a natural space adapted and modified by society, determines people's lifestyles and ways of life, and is not always favourable (Llorca, et al., 2010).

The urban layout of a city can influence both vehicular and pedestrian mobility, affecting both drivers who need to move along the roads from one place to another, and pedestrians who need to engage in physical activities, among others.

Public pedestrian (squares, pavements, pedestrian streets, etc.) and cycle space (cycle paths) and parks are some of the main drivers for the direct promotion of physical activity for collective mobility (Schmid, Pratt and Howze, 1995).

There are several factors within the aforementioned urban infrastructure that can cause accidents that threaten the integrity of people, among which we have, pavements in poor condition, unusable traffic lights, fallen trees or poles, broken lights, abandoned obsolete vehicles, potholes, water leaks, damaged walkways and bridges, among others.

On some occasions, the authorities pay attention to repairing or adapting these defects, such as traffic lights, but in most cases these needs are not attended to due to a lack of awareness of the existence of these problems.

It is in this sense that citizen participation in the reporting of these harmful elements becomes redundantly important, since it is society that is mainly affected by their presence on busy roads.

Generally speaking, there is a deficit of citizen participation. However, some important distinctions need to be made in order to better understand the participation deficit. Cunill (Cunill, 1997) distinguishes four types of participation: social, community, political and citizen.

Also, Marshall McLuhan wrote *Understanding Media: The Extensions of Man*, a book in which he already pointed out that (new) technologies should be understood as extensions of the human being (McLuhan, 1994, "The Extensions of Man").

Today, the understanding of the tools available to us, understood in terms of the effects produced by the use of technology, but also in terms of the forms of dialogue, collaboration and social action that they facilitate, is transforming the way of being, thinking and acting in society.

In this new phase of digital culture there is a set of tools (understood as categories for problem solving, but also as technologies for action) that are serving as a catalytic mechanism for the change of social, economic, political, democratic and cultural structures (Magallón, 2014).

Methodology

In order to carry out this research, it was necessary to use the Web Engineering methodology (Pressman, 2006), as follows:

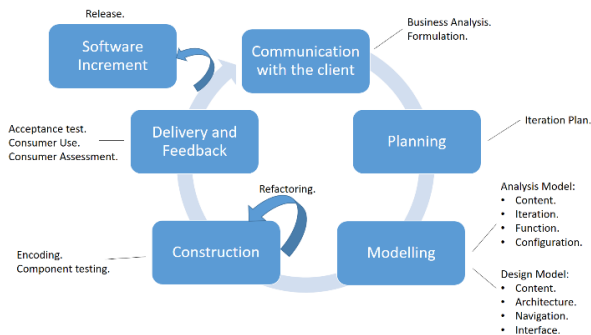


Figure 1 Web Engineering Methodology (IWeb)

Communication with the client.

Within the IWeb process, the communication with the customer was characterised by two main tasks: business analysis and formulation.

In the business analysis, the business-organisational context for the WebApp was defined. Furthermore, the participants were identified, and the integration between the WebApp and databases and functions was defined.

The application falls into the category of "dynamic", they use databases to load the information and the contents are updated every time the user accesses the WebApp. They usually have an administration panel (called CMS) from which the contents (news, posts, images, video) are administered, created and published. This prototype is designed to be informative, mainly through the reporting of problems in the urban infrastructure, as well as the registration of tours, publication of projects and the registration of affiliates (CAIH).

The main function, problem reporting, is aimed at notifying any type of incident that is related to poor infrastructure conditions in the city.

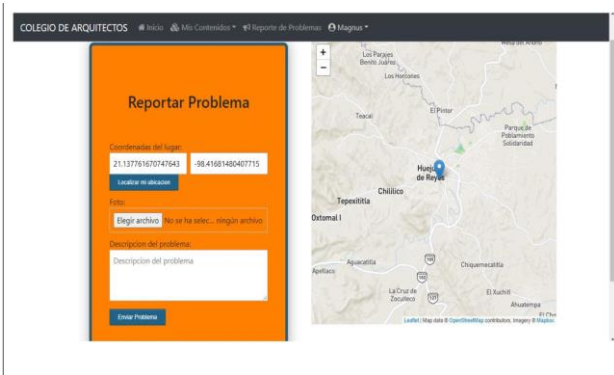


Figure 2 Problem report

Another complementary function is the tourist routes, which allows you to create a record on the google maps map; its objective is to show the tourist sites that exist in the city.

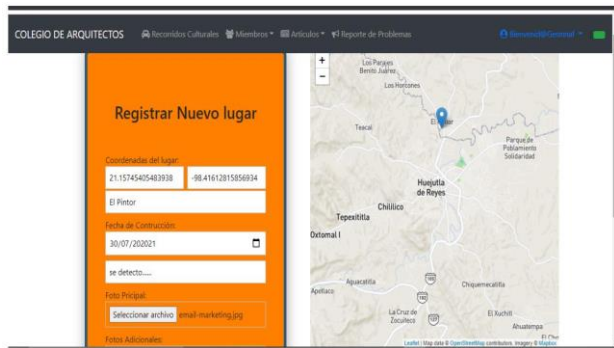


Figure 3 Tourist site registration

This web application also has the functionality to register architectural projects elaborated by CAIH members, this information can be published and consulted online so that it can be consulted by any interested person.

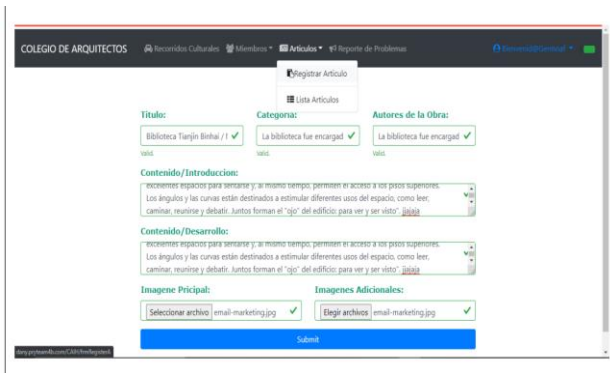


Figure 4 Project registration

The section for the registration of members was also integrated to create a space for collecting information requested by the CAIH for the inclusion of new members to the college so that they can obtain an account and use the functions contained in the application.

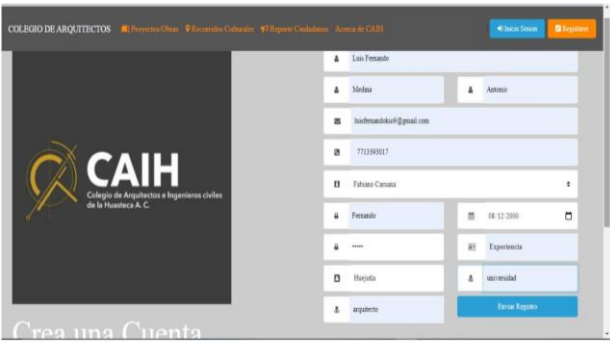


Figure 5. Register of members

In the About section, you can find relevant information about the Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A. C.

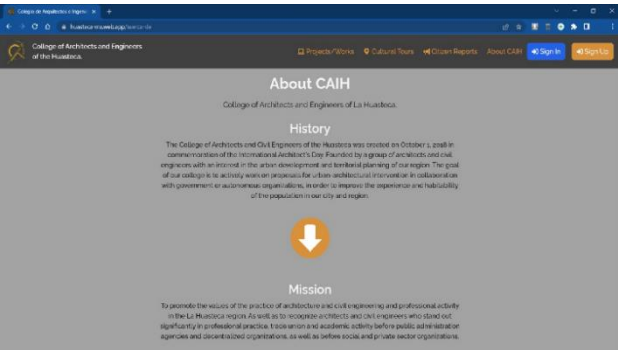


Figure 6 About section

In terms of participants, there are 4 types of users including the unregistered, each with different roles and functions.

Rol	Functions
Unregistered	You can only view the page and perform the registration of urban infrastructure problems.
user.	It can generate content such as projects and problem reports.
Common (content generator).	It helps to manage published content and registered users to facilitate the work of the administrator.
Contributor.	It is in charge of managing all the flow of information that goes through the website, its objective is to maintain an order of users and published contents.

Table 1. Participants and functions.

The integration of the different elements that make up the web prototype is shown below:

Application	Justification
NoSQL database.	Non-relational databases allow
GitHub.	Store application information without affecting scalability, which allows software to grow exponentially.
Firebase.	It allows the source code to be stored in a repository in the cloud, which facilitates teamwork.
Firebase	Its services, such as authentication, database and hosting, help in the development of the application, reducing work time and production costs.
Google Maps API.	It allows the application to be developed in components, so that many of these components can be recycled, which reduces work time and improves the performance of the application.

Table 2 Applications integrated in the WebApp

In the formulation, requirements gathering was carried out involving all participants: Implementing technologies based on JavaScript (React JS), database queries (NoSQL), navigation with google maps, validations (logs), authentications (Password recovery) and Hosting.

Planning

The project plan for the augmentation of the WebApp was created. The plan consisted of the definition of tasks and a schedule of deadlines for the period (usually measured in weeks) projected for the development of the WebApp augmentation.

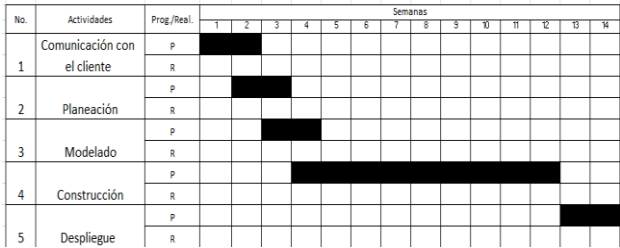


Figure 7 Activity planning.

Modelling

Conventional software engineering analysis and design tasks were adapted to the development of the WebApp, blended and then integrated into the IWeb modelling activity. Design models were made that defined the requirements in different sketches and at the same time represented a prototype that met the needs.



Figure 8 WebApp colour palette

In the same way, use case diagrams were created to facilitate the development of the web application where the different functions that users can perform can be observed.

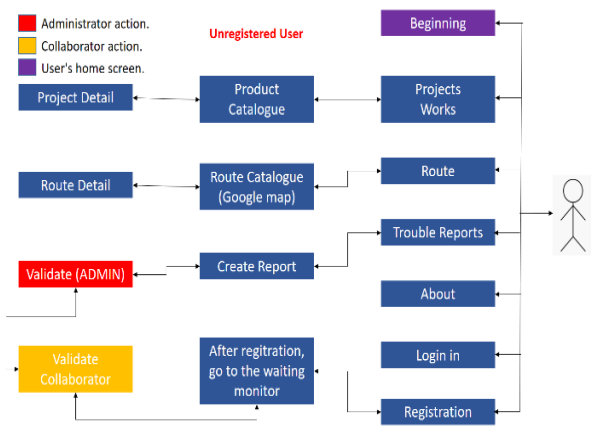


Figure 9 Unregistered user use case

Construction

The IWeb tools and technology were applied to build the WebApp that was modelled.

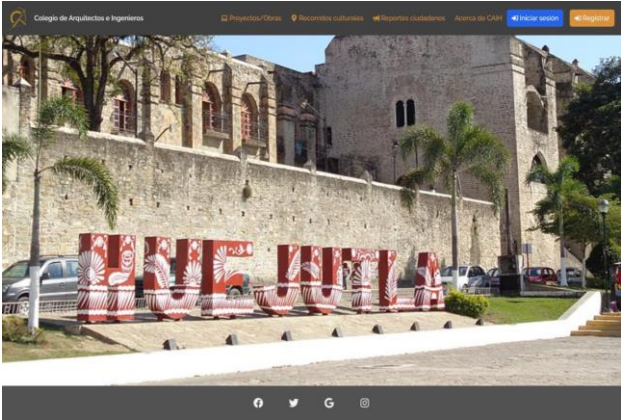


Figure 10 WebApp homepage

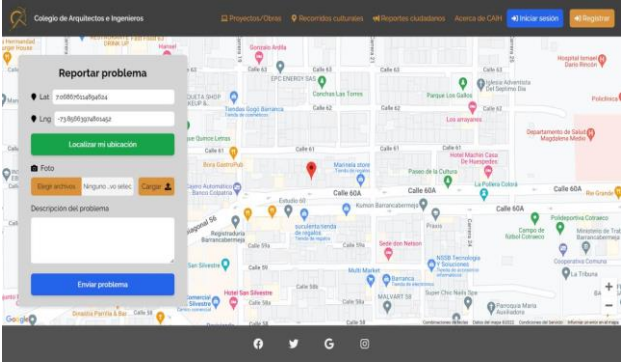


Figure 11 Urban infrastructure problem report form

Deployment

The WebApp was configured for its operational environment, delivered to end users and then an evaluation period was conducted. Feedback on the evaluation was presented to the IWeb team and the enhancement was modified according to requirements..

Principle	Complies		Area of opportunity
	Yes	No	
Visibility	X		NA
Adaptation to requirements	X		NA
User control and freedom	X		NA
Consistency and standards	X		NA
Error prevention		X	It does not have autocomplete auto-complete functions to help the user prevent errors.
Element recognition	X		NA
Flexibility and efficiency	X		NA
Aesthetics and design	X		NA
Error recognition, diagnosis and recovery	X		NA
Help and		X	Documentation would help users to understand the functionality of the application.

Table 3 User feedback

Results

From the beginning of the project, functional, technical and operational requirements were collected in order to give a simpler understanding for the development of the application.

In the functional requirements part, information was collected on any activity that the web application should perform, in other words, the behaviour or function. These included functions performed by specific screens, descriptions of the workflows to be performed by users.

The information provided by the CAIH members allowed a better analysis and determination of the functions of the system, which was of utmost importance for the development team as it saved time in the development.

In the technical requirements, the types of users that interact were analysed, which helped to determine the roles that each user would play. For this purpose, use cases were applied to provide a more specific description of the activities that users must perform to carry out a process.

For the operational requirements, an analysis of the local version was carried out to determine its performance and thus find defects that would affect the interaction of the user or the administrators.

According to all the requirements gathering, the quantified and documented needs and expectations of the stakeholders were documented and converted into prototype requirements to deliver a compliant application.

Before starting the planning phase, the tasks to be executed by the system and the desired scope were clearly defined. The communication phase with the client helped to understand these factors for the elaboration of a good project planning. Working in a development team was necessary for a correct distribution of means, time and resources.

In the means and resources, the necessary tools were defined for the elaboration of the project, this was related to the definition of the times for a good distribution of the tasks that were used by means of a chronogram that indicates the exact times of attention for each phase of the project, for each phase of the web engineering methodology.

The allocation of resources and means was a fundamental stage in the planning of this research. In order to define the materials and technology to be used, as well as the personnel indicated to carry out each task, the skills of each of the team members were taken into account, as well as their experience and knowledge of a task.

Having all of the above in place increased the likelihood that the project would be completed as planned.

Acknowledgements.

Thanks are extended to all the members of the Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A.C. (CAIH) located in the city of Huejutla de Reyes, Hidalgo, who contributed important elements and provided detailed feedback in the development of this prototype, with the intention of being implemented as the main intermediary between society and the competent authorities.

Conclusions

The aim of this work was to develop a web prototype for the Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A.C. (CAIH) using React JS, NoSQL and Firebase technologies to generate a consultation tool to identify and report risks of works that could affect the integrity of citizens.

Although this research met all expectations, it is important to mention some proposals that could complement the usability of the WebApp.

The application could be improved in the requests, to be more specific in the prevention of errors by applying it in the search bar found in the projects section so that the user avoids making a mistake when searching for a specific project; to do so, it is contemplated to add a collection to the database called "categories".

Each published project would be linked to a category, so that suggestions could be implemented in the search bar for quicker access to the projects being searched for, thus saving time in queries and optimising a function of the system itself.

Similarly, in the project, route and problem record sections, it is proposed to add a shortcut to undo the record, in order to avoid adding a project with the wrong characteristics, allowing the user to edit the record correctly in a fast and efficient way.

Another possibility for improvement is to be able to include documentation that facilitates the use of the WebApp for people with little experience in the use of this technology.

This research arose from the collaboration and coordinated work between the Colegio de Arquitectos e Ingenieros Civiles de la Huasteca A.C. (CAIH) and teaching staff of the Universidad Tecnológica de la Huasteca Hidalguense (UTHH).

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