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Design of a WEB application to create a repository of medicinal plants used by the Nahuas of the Huauchinango region

Diseño de una aplicación WEB para crear un repositorio de plantas medicinales usadas por los nahuas de la región de Huauchinango

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Abstract

The communication problem that the Nahua population of the state of Puebla currently have about medicinal herbs and alternative therapies is increasingly complicated, given that several cultural values are being lost, so it is an important opportunity to use digital media to rescue some remedies. The objective of this project is to develop an application to create and maintain a data repository that contains information on the medicinal plants used by the Nahua communities of the Huauchinango region. This project was born out of the need to communicate to future generations about the knowledge that is currently practiced in the Nahua communities about the properties of medicinal herbs in the region. The research work is carried out with the specialists of traditional peasant medicine with whom the diversity, use and management of medicinal plants classified by specialists of the Nahua peoples that they use to solve multiple diseases within their communities are documented. By having the system finished, the end user will be able to make queries about the medicinal plants, as well as the formula or recipe of the remedies. The administration of the repository can be done from a progressive WEB application.

Application, Repository, Medicinal plants

Resumen

La problemática comunicacional que tienen actualmente la población nahua del estado de Puebla sobre las hierbas medicinales y terapias alternativas, está cada vez más complicado, dado que se están perdiendo varios valores culturales, por lo que es una oportunidad importante usar medios digitales para rescatar algunos remedios. El presente proyecto tiene como objetivo desarrollar una aplicación para poder crear, y dar mantenimiento a un repositorio de datos que contenga información sobre las plantas medicinales usadas por las comunidades nahuas de la región de Huauchinango. Este proyecto nace por la necesidad de comunicar a las generaciones futuras sobre el conocimiento que actualmente se practica en las comunidades nahuas sobre las propiedades de las hierbas medicinales en la región. El trabajo de investigación se realiza con los especialistas de la medicina tradicional campesina con quienes se documenta la diversidad, uso y manejo de plantas medicinales clasificadas por especialistas de los pueblos nahuas que usan para resolver múltiples enfermedades dentro de sus comunidades. Al tener el sistema terminado el usuario final será capaz de poder realizar consultas sobre las plantas medicinales, así como a la fórmula o receta de los remedios. La administración del repositorio se podrá realizar desde una aplicación WEB progresiva.

Aplicación, Repositorio, Plantas medicinales

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Introduction

Who of us has never suffered from an upset stomach, a sore throat or perhaps a slight scratch, and when that happened, usually an older relative would run to the kitchen and prepare a home remedy for us, whether it was a tea, an infusion or an ointment. Medicinal plants, whether crushed for plasters, macerated in a spirit for tonics, stewed for vaporizations or prepared in teas and infusions, roots, barks, fruits, seeds, bulbs and peels offer remedies to alleviate, cure or maintain physical, emotional, mental or spiritual health, improve our quality of life at a lower cost, and even provide great longevity (Secretaría de Medio Ambiente y Recursos Naturales, 2021).

Medicinal plants are the cultural heritage of diverse peoples (Lindholm et al, 2019). This heritage is the result of a close link with nature, expressing a way of life (Vargas, 2010) that has been inherited between generations through oral transmission and is part of their collective memory (Ward, 2016). In recent years, this cultural heritage has become a research priority for the scientific community (Whitehorn et al, 2019), on the one hand, due to the pharmacological importance of medicinal plants against both existing and emerging diseases, and, on the other hand, due to the risk of their loss due to land use change, deforestation, poverty, and migration (Herrera, 2018).

Herbal medicine is a basic resource of folk medicine, but our knowledge of it is scarce and imprecise. We are far from ensuring a proper rescue of this flank of culture, as mentioned in the study "Conocimiento y uso de las plantas medicinales en la zona metropolitana de Guadalajara" (Knowledge and use of medicinal plants in the metropolitan area of Guadalajara).

The current problem is that over the years these customs and botanical knowledge have been lost little by little and nowadays it is difficult to find a reliable source of knowledge of this type of remedies in a simple way. Although there are countless recipes on various websites, many of them are not so reliable and do not have any way of guaranteeing their veracity, nor is there a reliable database to support the information published.

According to the Ministry of Health, 90% of the Mexican population has opted for one of the 4,500 medicinal plants found in Mexican territory at least once in their lifetime (Secretaría de Medio Ambiente y Recursos Naturales, 2021). Roberto Campos Navarro, an academic from the Faculty of Medicine of UNAM, mentions that our country occupies the second place worldwide in this type of documented flora.

Botany has been the most accessible and effective medicine for the peoples and communities of Mexico. The pre-Hispanic Codex de la Cruz-Badiano, chronicles and other documents of the colony and countless modern exhaustive investigations developed by prestigious universities and other national and foreign centers of knowledge account for the knowledge of national medicinal plants and their use in towns and cities.

For example, the National Commission for the Knowledge and Use of Biodiversity (Conabio) mentions the Mexican Social Security Institute's registry of 3,000 species of plants with medicinal attributes, of the 4,000 estimated to exist in Mexico, representing 15% of the total Mexican flora (Secretaría de Medio Ambiente y Recursos Naturales, 2021). It specifies that pharmacological analysis has only been carried out on 5% of the total number of these plants. Of this universe, 250 are commercialized on a daily basis, 85% are extracted from the wild without sustainable management plans, and 80% of the Mexican population has made use of them.

Thus, the need has arisen to create a repository of medicinal plants used by the Nahua communities of the Huauchinango region. Having as objectives to document the diversity of plants among the specialists of traditional medicine of the Nahua communities and to understand the system of categorization by systems of the human body. The application will allow us to add the medicinal plants used by the Nahua people of the Huauchinango region, as well as their classification, description, preparation, storage and use for each of the plants. In this way, by feeding the repository of medicinal plants, users will be able to access each of its parts and make detailed queries of each of the medicinal plants that are registered there.

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The development of this project is divided into the following sections:

1. Methodology: The steps followed for the development of the project are described.
2. Results: This section analyzes the results to determine whether the aforementioned objective has been achieved.
3. Acknowledgments: We would like to thank the people and institutions that allowed the development of this research.
4. Conclusions: The objectives satisfactorily achieved are discussed.

Methodology

The region of Huauchinango is located in the northwestern part of the state of Puebla, in the Sierra Madre Oriental. Figure 1 shows the location of the municipality, i.e. it is located in the northwestern part of the State of Puebla (Plan de Desarrollo Municipal, 2018).

Figure 1 Geographic location of the municipality of Huauchinango in the state of Puebla
Source:https://planeader.puebla.gob.mx/pdf/Municipales 2020/Huauchinango.pdf

The Nahua group of the Huauchinango region is one of the ethnic groups with the largest population of speakers of the three indigenous languages present in the region: Nahua, Totonac and Otomi.

In recent years, the percentage of speakers of some indigenous language in the region has been decreasing, among the main causes that have decreased the population is migration for work, family, education, insecurity, among others. Table 1 shows the population of 5 years and older who speak an indigenous language in the municipality of Huauchinango (INEGI, 2020).

Year	Total population (Inhabitants)	Population 5 years old and over speaking an indigenous language in the municipality of Huauchinango	Percentage of the population aged 5 years and older speaking an indigenous language in the municipality of Huauchinango
1995	75000	18933	25.24%
2000	83537	20781	24.87%
2005	90846	19878	21.88%
2010	97753	21934	22.43%
2020	103946	19579	18.83%

Table 1 Decrease in the number of indigenous language speakers in the municipality of Huauchinango
Source: Own Elaboration

The present project consists of presenting a design of a progressive web application to create, consult and maintain a data repository containing information on medicinal plants used by the Nahua people of the Huauchinango region, using information technologies, the diversity of medicinal herbs, as well as the knowledge of specialists in traditional medicine of the Nahua people of the Huauchinango region.

A. Use of medicinal plants

There is a different and special preparation for each herb, since each one activates its healing potential with different procedures. Among the most common types of preparation, within the herbs, we find the infusion, decoction, syrup, vaporization and baths, being the most used the infusion, for its convenience, speed of preparation and ease of consumption. There are many methods through which we can use medicinal plants, but it is important to emphasize that most medicinal plants are ingested and the digestive system is involved.

Decoction: It consists of maintaining the boiling point so that the active principles of hard, woody plants or roots are released; it is important in this method that the cooking is adequate so that the components do not deteriorate.

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Infusion: One of the most known and used methods is to heat the water, once it is at boiling point, soft plants, flowers, leaves should be added.

*Syrup***:** It consists of dissolving mainly water with honey or sugar, put it on the fire until the water evaporates and then add the medicinal plants.

Vaporization: It consists of adding a fistful of the plant (eucalyptus, pennyroyal, menthol, basil or camphor) to a liter of boiled water, cover and let stand ten minutes. Cover the person's head with a towel and uncover the preparation; this method is effective to decongest the respiratory tract and expel phlegm, the temperature change should be taken care of. After the vaporizations, the water can be used for bathing.

Baths: It consists of adding the plants and letting them boil in a large pot with water; wait until the water is warm and take a bath, they can be immersion in a bathtub or in a bath with a jug.

B. Selection of the most popular medicinal plants

In order to select the most popular medicinal plants, we considered the plants known and used by the majority of the Nahua population, that is, those that are most deeply rooted in the culture and customs of the people of the region, and therefore are easily accessible and consumed.

In order to obtain relevant information regarding herbs, infusions, herbal treatments, descriptive images, benefit or cultivation information, a small study was conducted consisting of the following activities:

– Visit of the adults of the Nahua population.

– Interviews with adults in the region.

– We interviewed farmers in the region.

– A field study was conducted in the town of Tenango, Huauchinango, Puebla.

– The plant markets of Tenango de las Flores and Colonias de Hidalgo, belonging to the municipality of Huauchinango, were visited.

For this study, specialized literature on popular herbs was not taken into account, since when talking specifically about this topic, the - information we can find is very extensive, complete, detailed, scientific and deep. They explain at a professional level, and talk about all kinds of herbs and seasonings.

C. Requirements of the graphical interface for the application

The graphic interface was created for a web application in which a repository of the most used medicinal plants was developed. In Table 2 we see an example of a medicinal plant "Siempreviva (Tetzmitl)" with the following information: description, uses, forms of preparation, routes of administration, scientific evaluation and a photograph of the medicinal plant, with the objective of making known and giving more credibility to this type of medicinal alternatives, approaching the general public and the Nahua group. For this it is necessary to generate the appropriate channels of information and dissemination, solving the existing communication problems in the Nahua community in the region. The application is a visual tool to identify and distinguish the most popular medicinal plants.

Siempreviva (Tetzmitl)	
Description	Small plant between 30 and 50cm high, with juicy, thick and brittle stems and yellowish-greenish leaves, has yellow flowers and nuts.
Uses	Meaty and clean eyes.
Forms of preparation	Extract in drops
Route of administration	One drop is applied directly to each eye
Scientific evaluation	Correa Arzate et al. (2015) mentioned that one of the plants used in traditional medicine to treat cold sores is S. dendroideum and studied the effect of the aqueous extract on the cell proliferation of gingival fibroblasts, obtaining that certain concentrations of the extract increase cell apoptosis and recommends a detailed analysis of the effects of each component.
Image	

Table 2 Main medicinal plant information.
Source: Own Elaboration

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D. Requirements of the graphical interface for the application

For the realization of this project we used the Waterfall methodology which consists in the sequential development of the project. This methodology consists in the fact that each of its phases are executed one after the other, that is to say, we do not move to another phase without finishing the previous one, this methodology promotes the step by step philosophy.

1. System and software requirements analysis:
– Based on the consultations with the Nahua people, requirements were established for the creation of records for the design of the database, hardware to be acquired, as well as the scope of the application.
– The software requirements specification document was created.

2. Design:
– Application flow diagrams.
– Sequence diagram.
– Entity-relationship diagram of the database.
– The system has a content manager to be able to make modifications to the design of the progressive web application, without the need of modifying the code and resorting to the additional expense of hiring a programmer for this task.
– The system has an administrator user with which you can perform CRUD operations to the plant repository.
– The system has a user that can be used to make queries to the repository; this user will be the default user to access the application.

3. Implementation and unit testing:
– All the elements that make up the developed software were integrated and the recurrent connection to the database was verified.
– Unit tests were developed for each of the modules created in the development of the system to verify their optimal operation.

4. System integration and testing:
– The system and the connection to the database were tested to verify its operation.
– System tests were performed on different devices to verify the performance of the application.

5. Maintenance:
– After the installation and start-up of the system, the errors reported by the users were verified in order to resolve them and leave the system in optimal conditions.

Results

Finally, for the design of the web application, an image alluding to the theme of medicinal plants (in Nahuatl tlazol patli) was considered. Figure 2 shows the image of the logo, the word patli was chosen in the Nahuatl language, which means medicine, and the colors are characteristic of nature.

Figure 2 Logo of the web application "Patli"
Source: Own Elaboration

Within the web application, the main screen shows the specific contents taken from the requirements of the graphic interface for the application: description, uses, forms of preparation, routes of administration, scientific evaluation and photograph of the medicinal plant. The web application displays a list of images showing the name of the plant, as well as its name in Nahuatl, as shown in Figures 3 and 4.

Figure 3 List of plants in the repository
Source: Own Elaboration

Figure 4 Plant name in Spanish and in Nahuatl language
Source: Own Elaboration

Clicking on the image shows a detailed general description of the plant (see Figure 5), as well as its use and instructions for use

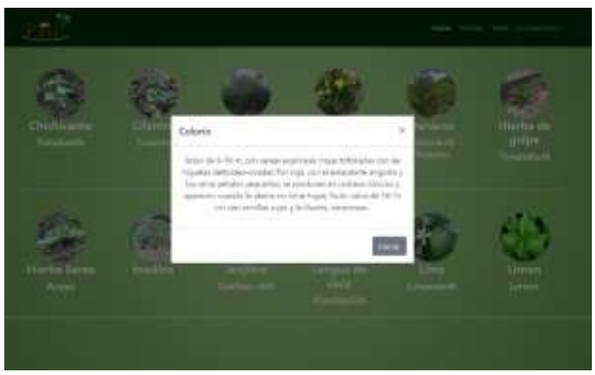

Figure 5 Description of the medicinal plant
Source: Own Elaboration

In Figure 6, Patli shows a quick reference table of medicinal plants showing the disease they can help alleviate

Figure 6 Quick reference table for medicinal plants
Source: Own Elaboration

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Conclusions

From the beginning, the ideas to define the Patli repository were generated thanks to a research on medicinal plants. In this process, field studies, interviews to farmers, surveys to people from the Nahua group and visits to plant markets located in the region of Huauchinango were carried out.

Patli is a web repository, which shows the medicinal use of plants used by the Nahua people of the region, the creation of this repository allows transmitting knowledge to future generations about the knowledge that is currently practiced in the communities of this ethnic group about the medicinal properties of plants. The information contained in the repository has been compiled with specialists in traditional medicine who have provided knowledge on the use and management of medicinal plants. These have been carefully classified to treat various diseases such as: stomach aches, kidney, headaches, eye ailments, among others.

The project can generate a great impact, as it encourages the Nahua ethnic group to join to participate and cooperate with the knowledge they have about medicinal plants. In addition to encouraging the general population to use medicinal plants.

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