

**Proposal for an animatronic to promote the teaching of the nahuatl language in the Huauchinango region****Propuesta de un animatrónico para el fomento de la enseñanza de la lengua náhuatl en la región de Huauchinango**

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**Abstract**

Today the indigenous groups of the Sierra Norte de Puebla no longer want to practice their mother tongue, due to the discrimination and aggressions they suffer in the street, school, city, work, etc., they prefer to communicate in Spanish. Communication in the indigenous language of the region is very minor, that is, it is only spoken by adults, it is also mixed with words from the Spanish language. The present project aims to develop a proposal for a prototype based on an animatronic puppet to support the learning of the Nahuatl language, through practical activities such as greeting, numbering, parts of the human body, everyday words, sentences, stories, legends, stories and dialogues, so that any infant or young person interested in learning the language in a dynamic way. The animatronic is presented with indigenous features and clothing, as well as movements such as the head, mouth, and eyes. With the development of this project, it will contribute to the rescue, dissemination, preservation, development, teaching and learning of the Nahuatl language of the region.

**Animatronic, Nahuatl, Huauchinango region****Resumen**

Hoy en día los grupos indígenas de la Sierra Norte de Puebla, ya no quieren practicar su lengua materna, debido a la discriminación y agresiones que sufren en la calle, escuela, ciudad, laboral, etc., prefieren comunicarse en español. La comunicación en lengua indígena de la región es muy minoritaria, es decir solo lo hablan las personas adultas, además está mezclada con palabras del idioma español. El presente proyecto tiene como objetivo desarrollar una propuesta de un prototipo basado en un títere animatrónico para apoyar el aprendizaje de la lengua nahuatl, mediante actividades prácticas como el saludo, numeración, partes del cuerpo humano, palabras cotidianas, oraciones, cuentos, leyendas, historias y diálogos, para que cualquier infante o joven interesado en aprender el idioma de una manera dinámica. El animatrónico estará caracterizado con rasgos y vestimenta indígena, además tendrá movimientos como la cabeza, la boca y los ojos. Con el desarrollo de este proyecto contribuirá en el rescate, difusión, preservación, desarrollo, enseñanza y aprendizaje de la lengua nahuatl de la región.

**Animatrónico, Náhuatl, Región de Huauchinango**

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## Introduction

In Mexico, 364 linguistic variants are spoken, grouped into 68 groupings and 11 linguistic families according to the National Institute of Indigenous Languages (INALI) Chiapas, Oaxaca, Veracruz, Puebla, Yucatán, Guerrero, Quintana Roo, Hidalgo, Campeche and San Luis Potosí are the states with the largest number of speakers of indigenous languages: Nahuatl, Mayan, Mixtec, Tzeltal, Zapotec, Tzotzil, Otomi, Totonac and Mazatec. This means that it is one of the countries with the greatest linguistic diversity in the American continent. Making Mexico one of the most linguistically diverse countries in the Americas, it has a cultural heritage that we all have the task of caring for and promoting.

The current diagnosis is worrisome, because the 364 variants of the national indigenous languages are in danger of disappearing. The languages at risk are characterized mainly because they suffer a progressive reduction of the status of mother tongue, a decrease in the absolute and relative number of speakers from one generation to the next, the number of speaking localities tends to be reduced, the reduction of spaces for public and private use of the language, among others. The risk levels are: very high, 64; high, 43; medium risk, 72; and not immediate risk, 185. The disappearance of a language is an irreparable cultural loss, since different ways of thinking, the culture that expresses a language, identity and diversity of the world are lost. Each language embodies the unique cultural wisdom of a people. The disappearance of indigenous languages seems to be an inevitable situation, and census statistics seem to prove it, at present, speakers of indigenous languages have the need to be able to continue speaking their languages, and the difficulty for speakers to teach their children or grandchildren do not know how.

There are indigenous communities that have already accepted the disappearance of their language and think that part of their culture will be dispersed and that they will only be able to communicate in Spanish. However, others wish to reverse this trend of the disappearance of their languages and are fighting to preserve and strengthen them in many different ways.

Faced with this problem, INALI has implemented various strategies to prevent their extinction, such as standardization, which is the rescue of the language spoken in each village to put it in a position similar to the dominant language, in this case Spanish. Another project carried out by INALI for the defense and promotion of Mexican indigenous languages is the launching of a compact disc with popular music translated into 12 indigenous languages: otomí, zapoteco, totonaco, paipai, tsotsil, zoque, mayan, náhuatl, huichol, seri, mixteco and purépecha.

During the last few years there have been several proposals that try to reverse this trend of the disappearance of Mother Tongues in our country. In 2016 researchers from the Universidad de la Sierra Juárez in the state of Oaxaca proposed a system for Learning Native Languages (ALMA), which consists of a collaborative web application to collect, preserve and promote the use of native (or mother) languages of the regions of the State of Oaxaca in the medium term. In 2017, researchers from the National Institute of Astrophysics, Optics and Electronics (INAOE) designed a collection of dolls for learning native languages among girls and boys from indigenous communities. The dolls are aimed at children between 2 and 4 years old with various types of games. When turned on, the dolls wave and begin to interact. In 2021, engineers from the Instituto Tecnológico Superior de Acatlán de Osorio created an electronic doll to disseminate the mixtec language and safeguard the cultural heritage of the lower mixtec region of the State of Puebla.

Landing in the region of the Sierra Norte de Puebla, it was observed that in the Instituto Tecnológico Superior de Huauchinango (ITSH), there is a population of 17.5% of students who speak the three languages that are present in the region (Nahuatl, Totonaco and Otomi) and in recent years there has been a decrease in the number of students who express themselves in their native language. In order to raise awareness of this problem, the present project is proposed, with the objective of revitalizing the native languages from the perspective of the speakers themselves, involving the population that speaks this language.

This project aims to develop a proposal for a prototype based on an animatronic to support the learning of the nahuatl language, through practical activities such as greetings, numbering, parts of the human body, everyday words, prayers, stories, legends, stories and dialogues in order to contribute to the rescue, preservation and dissemination of this indigenous language of the Sierra Norte de Puebla.

The development of this paper 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 obtained to determine if the objective has been achieved.

## 3. Acknowledgements

We would like to thank the institutions that allowed the development of this research.

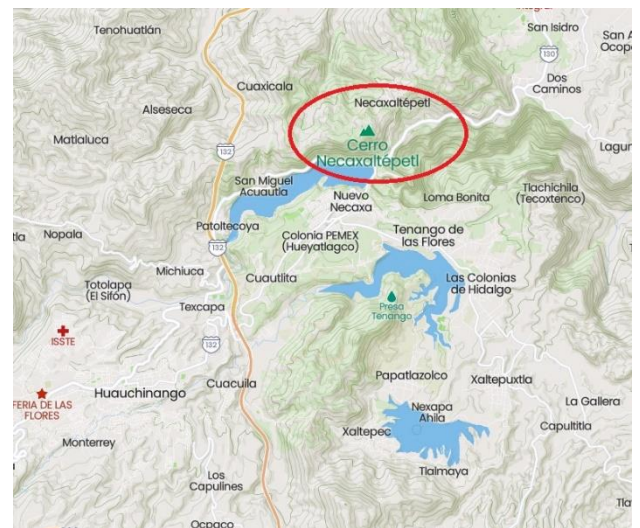
## 4. Conclusions

The objectives successfully achieved and how this work contributes to the promotion of the teaching of the nahuatl language in the region of Huauchinango are discussed.

## Methodology

This project was implemented in the region of Huauchinango, located in the Sierra Norte of the State of Puebla, with the main objective of contributing with an animatronic to promote and disseminate the nahuatl language. For this purpose, a nahuatl-speaking community was chosen to identify the activities carried out to promote the nahuatl language, as well as to conduct surveys and interviews to learn about the factors involved in the process of language loss. The locality of Necaxaltepetl was chosen (See Figure 1), this community belongs to the indigenous peoples of Mexico according to the catalog of national indigenous languages: Linguistic variants of Mexico with their self-denominations and geostatistical references.

This community was populated when the old town of Necaxa was forced out in 1909, when the construction of the Necaxa Dam began (today it is the Necaxa Dam). The old residents vacated the area: the indigenous people that inhabited the place went to the high part of the hill known as Necaxaltepetl (which means Necaxa Hill) and the mestizos, went to Jacksonville, known today as Nuevo Necaxa; while the families of the employees of the hydroelectric plant founded another town (Necaxa Canaditas).



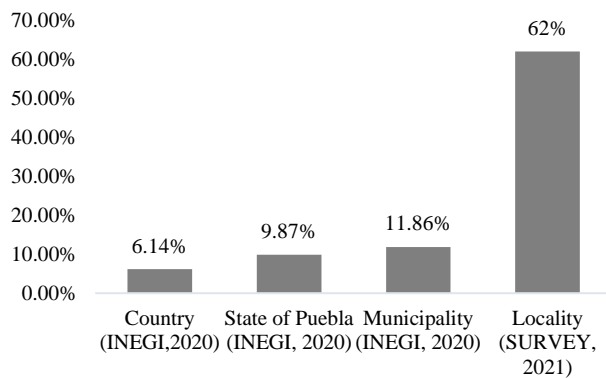
**Figure 1** Location of the town of Necaxaltepetl, municipality of Juan Galindo, Puebla

Source <https://mapcarta.com/es/30529964>

Necaxaltepetl is located in the municipality of Juan Galindo in the state of Puebla. According to the 2020 population census, the population is 1113 inhabitants. The technique and instruments for data collection were the interview and the survey, from which the following results were obtained 62% speak the nahuatl language, 21% do not know it and 17% only understand the language. Making a comparison with the data provided by INEGI (INEGI, 2020), the following results were obtained (Graph 1), which shows a comparison of percentages of indigenous population in the locality, compared to its municipality, with the percentage in the State of Puebla, and in the country as a whole.

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**Comparison of percentages of the population aged 3 years and older speaking indigenous language**



**Graphic 1** Comparison of percentages of indigenous population in the locality, municipality, state and country  
Source: Own elaboration

The product development methodology described by Ulrich was used to design the animatronic.

#### A. Conceptualize

In this stage, through brainstorming, preliminary concepts were generated so that the animatronic would meet the following characteristics: eye-catching, easy to build and easy to implement, as well as the necessary requirements for its feasibility and viability. In this stage, the dimensions of the animatronic were defined, the hardware and software were determined, the electronic components to be used, research of the most common words of the nahuatl language in the region, the clothing and the recording of the words, sentences, stories and legends.

#### B. Proposed design of the animatronic

For the design of the animatronic we thought of the shape of an indigenous child from the region of Huauchinango (See Figure 2), which is a child dressed in local attire, with indigenous features and clothing, in order to approach the children of the region, whose name is "Ocelotl" whose meaning is panther, this is because of the name of the mascot of the institution.



**Figure 2** Proposed animatronic "Ocelotl"  
Source: Own elaboration

This device will support the inductive learning of the nahuatl language in the formal and non-formal modality and will promote its autonomous and socialized study through practical activities. With this animatronic it will be possible to learn the nahuatl language at a basic level, which is divided into 5 levels of teaching-learning:

Level 1: numbers, colors, fruits, family, human body, clothes and places.

Level 2: animals, objects.

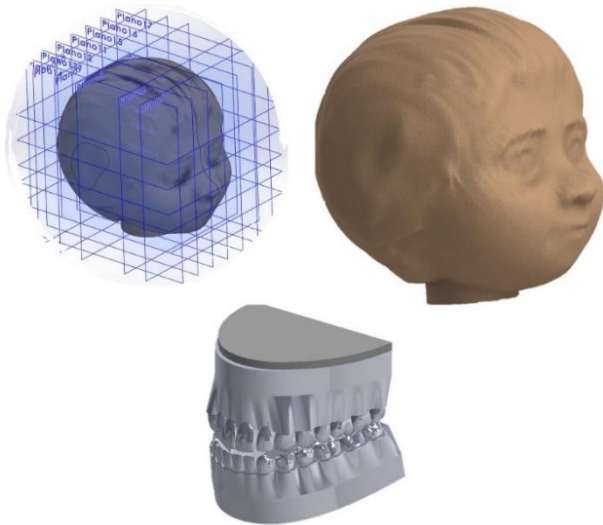
Level 3: adjectives, adverbs.

Level 4: emojis, moods, chores, greetings, short sentences and conversation.

Level 5: Little stories, legends and everything necessary to begin to immerse the child in the language.

From the general analysis it was defined that the animatronic will be composed mainly by the head in which it will contain control systems and sound, which will be placed on a base (the body). Also the animatronic will have the following main movements, eyes, jaw, and neck. And to make the animatronic more striking, it was decided that it will have the ability to perform a synchronized movement of the jaw with the sound, simulating that the animatronic is talking.

Having defined all the characteristics of the animatronic, the design proposal was divided into three parts: mechanics, electronics and control. We proceeded to make the necessary designs for the eye, mouth, head and support structure mechanisms; all this was developed using SolidWorks software, see Figure 3.



**Figure 3** Sketches of the animatronic "Ocelotl"  
Source: Own elaboration

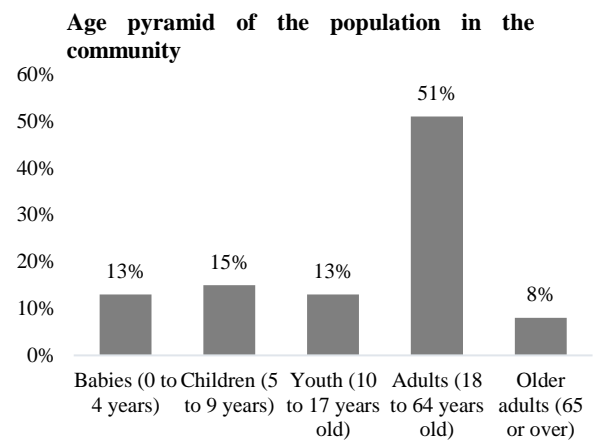
Afterwards, the electronic design and PCB boards for the control of the movements were developed using Proteus software. For the control part, a flowchart of the animatronic behavior was developed and programmed through the Arduino integrated development environment (IDE).

### C. Simulation

Once the designs were developed, the simulations were carried out for the operation. The mechanical simulations were performed in SolidWorks software. For the operation simulations, the electronic and control design was tested through the Proteus software, using the Atmega328p microcontroller of the "Arduino nano" development board, representing each of the components of the animatronic

### D. Evaluation

At this stage, an analysis of the simulation results was carried out to detect any relevant error in order to make the necessary adjustments to the design. These analyses made it possible to correct some electronic and control design details.



**Graphic 2** Data from the age pyramid of the population of the community of Necaxaltepetl

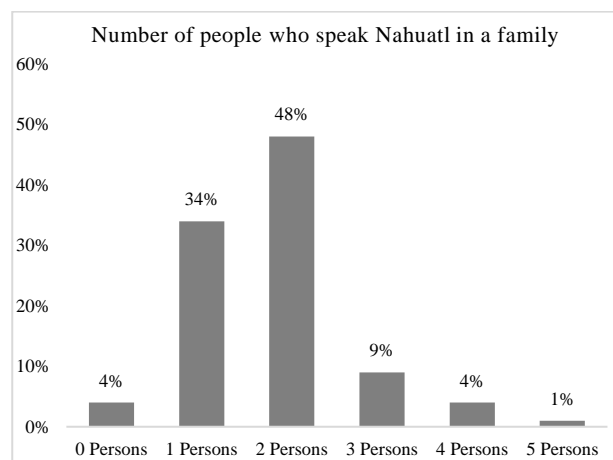
Source: Own elaboration

## Results

This project analyzed the existing problem of the disappearance of the nahuatl language in the Sierra Norte of the State of Puebla, specifically in the region of Huauchinango. For this purpose, a detailed analysis was made of the results obtained in the community of Necaxaltepetl. This community was chosen because it has a similar characteristic to the other nahuatl-speaking towns in the Huauchinango region in terms of the nahuatl spoken and the characteristics of its population. This community maintains an age structure of its inhabitants, which can be seen in Graph 2, with data from 2021, in which we can analyze how the future of the nahuatl language will be in the population of this locality.

This research was based on determining what ages (by age group) speak and understand the language, how many members of each family speak it and what are the main factors involved in the disappearance of the language. According to the study developed in the survey, the following was identified: Graph 3 shows the number of people who speak nahuatl per family, this graph shows that 48% of the families only speak two members, 34% only speak one member, 9% speak 3 members, 4% speak 4 members, 4% speak 4 members, 4% speak no members and only 1% speak 5 members per family.

According to these results it is very worrying to see that the majority of the families only speak the language of the elders, that is, 48% of the parents, and 34% speak only one member per family (some of the parents), which means that the language is no longer being inherited as a culture of the people. Therefore, the tendency is that fewer and fewer people speak nahuatl per family.



**Graphic 3** Percentage of nahuatl speakers by family

Source: Own elaboration

A survey of the entire population of the community was conducted to identify the percentage of older adults, adults, youth and children who speak the language, understand the language and if they do not speak or understand the language, as shown in Table 1.

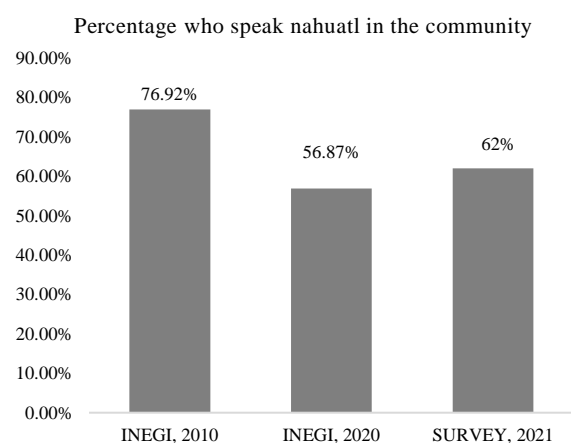
Age groups	Age	Speak	Understand	Do not speak or understand
Older Adults	From 65 to 85 years of age or older	91%	6%	3%
Adults	18 to 64 years old	85%	7%	8%
Teenagers	10 to 17 years old	41%	44%	14%
Children	5 to 9 years old	43%	52%	39%
	0 to 4 years old	10%	10%	80%

**Table 1** Classification of age groups that speak, understand and do not speak or understand

Source: Own elaboration

According to Table 1, 91% of the older adults, 85% of the adults, 41% of the young people, 43% of the children (5 to 9 years old) and 10% of the children (0 to 4 years old) speak nahuatl.

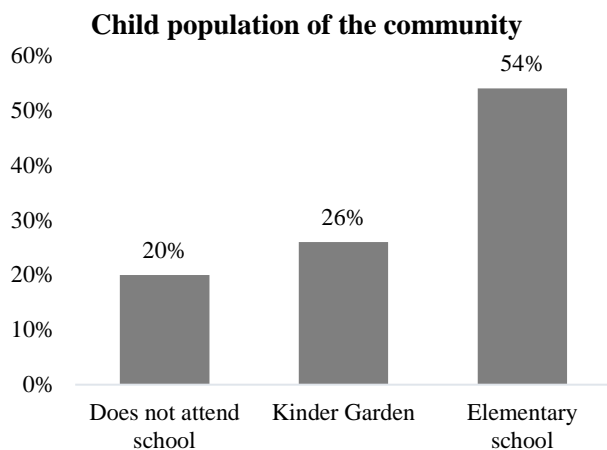
According to the data shown, it is also observed that most of the young people only understand it, that is, they no longer speak it, and as for the children, a large percentage no longer speak or understand the nahuatl language, so it can be concluded that in a few years this language will no longer be spoken as the main language of the region, as shown in Graph 4, where it is observed that in 10 years there was a decrease of 20% of the population of those who speak nahuatl.



**Graphic 4** Percentage of nahuatl-speaking people in the community

Source: Own elaboration

In addition, it was identified that adults and older adults are no longer inheriting the language because when they talk, converse, run errands, tell stories and tales with the youth and children, it is in Spanish. Some adults are concerned about what is happening with the loss of this language and consider that it is important to recover it as a culture of the people. In this community there is a preschool that is beginning to teach basic language words to children from 3 to 6 years old, which corresponds to 26% of the entire child population (See Graph 5). Therefore, it can be concluded that the vast majority are not practicing the language, which represents a problem for the conservation of the language in the community.



**Graphic 5** Distribution of the child population

Source: Own elaboration

As for the design of the animatronic, the following was considered: it should be the size of a child between 8 or 9 years old, with a height of approximately 1.20 meters to promote the teaching and learning of the nahuatl language.

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### Conclusions

The data from the survey conducted in the community of Necaxaltepetl, show that children are less and less speak the nahuatl language, this is because adults and older adults are no longer encouraging the teaching of the language, ie when communicating with their children, grandchildren use the Spanish language.

In addition, the language is only practiced between adults and older adults in the community, although there is also a bilingual preschool that is promoting the nahuatl language with its own resources.

To conclude, an animatronic design was obtained with aspects of an indigenous child of the region, achieving that the mechanisms recreate certain movements, it was also possible to design a control by means of electronic systems, these mechanisms with the development of control and programming cards, so that the animatronic proposal is an excellent support tool for the promotion of language teaching.

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