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DEVELOPMENT OF A MOBILE SOLUTION WITH ARTIFICIAL VISION FOR TEACHING AND LEARNING OF WILDLIFE

DESARROLLO DE UNA SOLUCIÓN MÓVIL BAJO LA TECNOLOGÍA EMERGENTE VISIÓN ARTIFICIAL PARA LA ENSEÑANZA APRENDIZAJE DE LA FAUNA

MSc. Leidys del Carmen Contreras Chinchilla[*], Ing. Esleider Tafur Rangel[*], MSc. Jaidy Marjorie Jacome Lindarte[*]

[*] **Universidad Popular del Cesar,** Valledupar, Cesar, Colombia.
E-mail: {leidyscontreras, satafur , jmjacome}@unicesar.edu.co

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Resumen: El objetivo de este artículo es dar a conocer la importancia del desarrollo de una aplicación móvil empleando la tecnología emergente visión artificial, la cual permitió la identificación de diferentes especies animales, y la posterior presentación de información de la especie, como taxonomía, alimentación, hábitat, entre otras. Este sistema educativo inteligente, promueve un aprendizaje interactivo y didáctico, al tiempo que incentiva el turismo ecológico. Para el desarrollo de este proyecto, se aplicó un instrumento de recolección de información, que permitió realizar un diagnóstico sobre el conocimiento de la muestra de la población acerca de la fauna de la región, posteriormente, se seleccionaron las especies a reconocer por el prototipo y finalmente, se desarrolló la aplicación móvil usando la tecnología en mención.

Palabras clave: Visión artificial, fauna, turismo ecológico, enseñanza aprendizaje

Abstract: The objective of this article is to publicize the importance of the development of a mobile application using the emerging artificial vision technology, which allowed the identification of different animal species, and the subsequent presentation of information about the species, such as taxonomy, food, habitat, among other. This intelligent educational system promotes interactive and didactic learning, while encouraging ecological tourism. For the development of this project, an information collection instrument was applied, which allowed a diagnosis to be made on the knowledge of the population sample about the fauna of the region; subsequently, the species to be recognized by the prototype were selected and finally, the mobile application was developed using the aforementioned technology.

Keywords: Artificial vision, fauna, ecological tourism, teaching and learning

1. INTRODUCTION

Environmental Education (EA) seeks to create awareness worldwide, aiming at people being able to analyze and reflect critically on human evolution and the environment in which they live (Flórez, 2012). This concept is not limited to the natural, but also covers the evaluation of human behaviour in relation to everything around it: biological diversity, economy or culture; that is, the overall integral well-being of the human being in the present and in the future (Hernández, 2016).

It is for this reason that serious environmental problems were the trigger for the first recognition in 1972 of the existence of a global environmental crisis (Flórez 2012; Vélez 2016). As a result, numerous EA programs have been implemented in different countries in order to generate awareness and deeply sensitize new generations about the care of the environment, the different ecosystems and the biodiversity that compose them.

In this sense, the school is an important factor in learning about the immense value of the living beings that make up nature, the different existing species, their habitat, food and other relevant topics, which are of paramount importance in the education and knowledge of fauna (Anacona and González, 2015). In relation to the above, it is worth mentioning that according to the Humboldt Institute (Humboldt, 2017), Colombia is the second country with the highest biodiversity worldwide, being the first in birds, the second in amphibians, butterflies and freshwater fish, the third in reptiles, and the fourth in mammals. In addition, according to resolution 0192 of 2014,313 vertebrate and 74 endangered invertebrate animal species have been identified. Likewise, the vertebrate animals traded are 527 and the invertebrates 143, evidencing the rich biodiversity of the country and the challenges in its conservation.

In view of the above, it is necessary to look for new strategies to promote the preservation of species and it is there where it becomes indispensable to involve Information and Communications Technologies as a didactic and renewed way to sensitize communities in the care of the fauna, to generate criteria and responsibility with the care of the environment in general; taking into account the diversity of the flora and the ecosystems that exist in Colombia, which are conducive for various animal and plant species to inhabit.

It should be noted that ICTs have promoted a real revolution in education, making learning much more dynamic, interactive and practical. This has been fundamental for the change of roles in the educational process, where the student takes a more active, autonomous and participatory role (Jácome et al., 2017). Research shows that the use of ICT significantly favors learning in several areas, including natural sciences (Briceño et al., 2019). Active learning is closely linked to the motivation of the student, and this allows his learning both inside the classroom and outside it is permanent, continuous and led by the same (Durán and Rosado, 2020).

Education has undergone a positive transformation in didactics, tools and methodologies, which has contributed significantly to improving educational levels. ICTs have fostered different learning scenarios, closing gaps in access to information and facilitating educational inclusion (Salinas et al., 2014). Calva expresses (Calva, 2016) "Current education requires teachers to use innovative methodological resources to motivate students in a way that improves the teaching-learning process". According to this author, in terms of fauna, it is preferable to use new methodologies and interactive resources to maintain the attention and concentration of students in a homogeneous way, since traditional resources such as summaries, essays, or others, become monotonous and do not motivate students towards learning.

The Computational Vision (VC) is a technology widely used in education, and in other areas such as health, sciences, engineering, etc.; its influence on education can enhance the extraction of information and the internalization of this (López et al., 2017).

In this context, in the case of the city of Valledupar, less than 12 km away, is the Los Besotes Ecological Foundation (FUNDEBES), which, in 2002, was awarded the number one bird conservation area in Colombia; and in 2008, it received the recognition of Fauna Sanctuary, granted by the institution CORPOCESAR. Likewise, in 2013, it was recognized as a Regional Natural Park, which focuses its work on the preservation and defense of the tropical dry forest of the Upar Valley located in Cesar. In this place you can find a great variety of animal species, among which there are

variety of birds, reptiles, amphibians, butterflies, mammals, among others. (Rodríguez-Mahecha, 2008).

According to an interview with its founder Tomás Darío Gutiérrez, FUNDEBES has become the cradle of more than 10 scientific investigations that have been carried out in the park through alliances with some organizations for the protection of the biodiversity of the tropical dry forest. In addition, it has received students from several schools committed to the learning teaching process within the urban area of the city, thus showing the commitment that this has to preserve wildlife and strengthen education in this area.

This article aims to answer the research question: How can new technologies, such as computer vision, be used as didactic support to facilitate teaching and learning of fauna? To answer this question, an investigation was carried out that began with the collection of information on the knowledge that students have of the fauna of their region. Subsequently, the species that the system will be able to recognize were selected. Then, the prototype was developed using artificial vision technology, which allows an animal to be identified through the camera of a mobile, and displays information corresponding to its species, such as food, taxonomy, habitat, and other curious data. This tool seeks to enrich the educational process by providing detailed and accessible information immediately, encouraging interactive and attractive learning.

2. METHODOLOGY

This is a projective research, of a practical kind, for which a strategy was proposed that would allow a diagnosis of the needs around the problem. From this, the solution was designed and developed, taking into account pedagogical elements and learning teaching processes. The population in which this research was carried out is the student of the municipality of Valledupar, department Cesar. The selected sample is non-probabilistic, in which ninth and tenth students participated. Regarding the methodology selected for the development process, ADDIE was selected:

2.1 Analysis Phase: During this phase, a characterization of the users, their learning requirements were performed, and the resources and activities to be implemented were also selected. The diagnostic instrument was applied to the selected sample, In turn, species were chosen for prototype development and user stories were built for application functionality and development.

2.2 Design Phase: In this phase, the right learning environment, the ideal tools for the development of the application and the design of the contents were selected.

2.3 Development Phase: At this stage the process of production of the materials was carried out using different formats and tools, seeking that the student has a quality experience and pedagogically successful. The user stories were developed, considering the results of the diagnosis and the requirements of thematic wildlife experts.

3. RESULTS

3.1 Analysis phase

The designed collection instrument was applied to the chosen sample, which allowed a diagnosis of the knowledge of these different animal species in the region. Among the results, it was obtained that 63% of the students who responded to the survey, have knowledge of some typical animal species of the area they live. For their part, 85% of the student population claimed to be informed of media that provide wildlife information at the local, national and international levels. It was interesting that 99% of the respondents suggested that more strategies are needed to inform and preserve the fauna of the territory.

For the development of this phase, a set of open data provided by the Biodiversity Information System in Colombia (SIB) was used, which were organized, refined, and hosted in a database in MongoDB Community Edition, for further treatment. As a result, 889 different species that currently inhabit Valledupar or some of its districts were identified, of which 77.17% are birds, and the remaining amount is distributed among mammals, reptiles, actinopterigios, insects, amphibians, arachnids, gastropods, and bivalves as seen in Fig. 1.

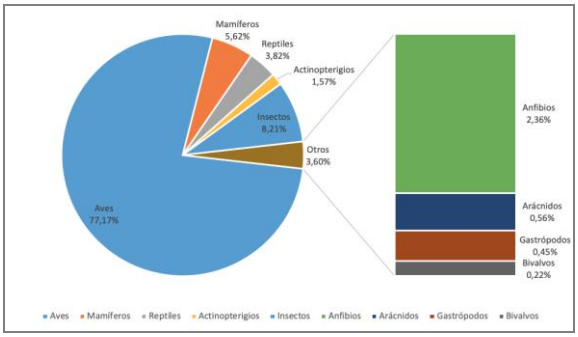

Fig. 1. Number of species in the Valledupar region. Source: SIB open data

3.2 Design Phase

Among the tools used in the design and development of the application is OpenCV, an Open Source Software library of Machine Vision and Machine Learning, which provides a robust infrastructure for applications with this emerging technology for image recognition (Fisher et al., 2014). This library has more than 2500 algorithms, which are extremely useful for working with objects, faces, human actions, videos, tracking movements, 3D modeling, finding similarity between images, decreasing red eyes, space recognition, and many other advanced features. This allows you to create sophisticated and efficient applications.

Taking into account the species to be recognized identified in the first phase, the contents to be developed in the application were defined:

•General: This option shows common names, conservation states, related species, among others.

•Identification: Here is information related to the taxonomy of the animal, such as size, colors, shapes, sounds.

•Threats: This item shows the degree of species exposure, related to logging, burning, trafficking, displacement, hunting, captivity, contamination.

•Distribution: Refers to the geographic location where a species is located, such as countries and regions, descriptive map.

•Taxonomy: Allows to name and clarify them in taxonomic ranges, such as kingdom, phylum, class, species.

3.3 Development Phase

In this phase each of the functionalities described above of the application were developed, coding user stories: identification of the animal to learn to recognize it visually, taxonomy of the animal to know what other similar species exist and their classification, distribution of the animal to know the regions and areas where I can find it, list of activities considered a threat to the animal detailed by the level of impact to learn how to identify activities that threaten the life of the species, list of foods that the animal can consume to learn more about its diet, and a list of general animal data to learn any other relevant and interesting information about the animal.

The species Aratinga Pertinax, of the bird class belonging to the Chordata phylum, was selected to later apply object detection algorithms that will give the mobile application the ability to recognize this species.

Fig. 2, 3, 4 and 5 show some developed functions: initial view, generalities, identification, threats, among others, which will allow the user to take a photo of a species, identify it first and discover a series of information about it.

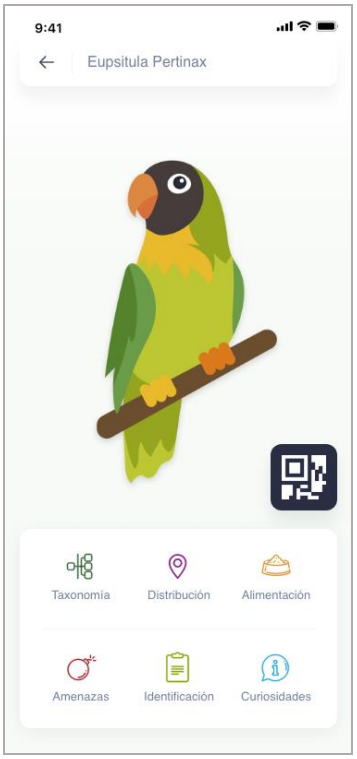

Fig. 2. Start view Source: Own production

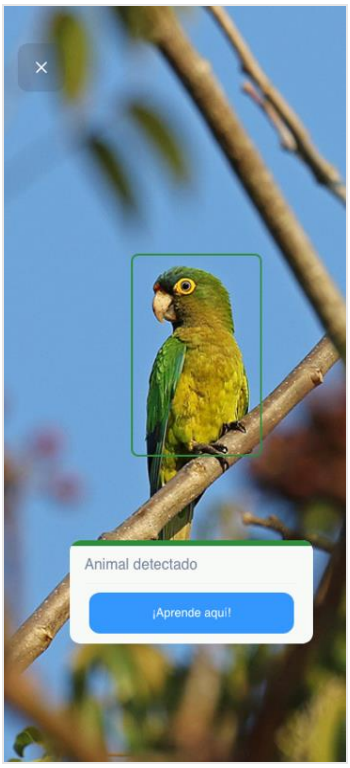

Fig. 3. Detection of the animal focused by CV.
Source: Own elaboration

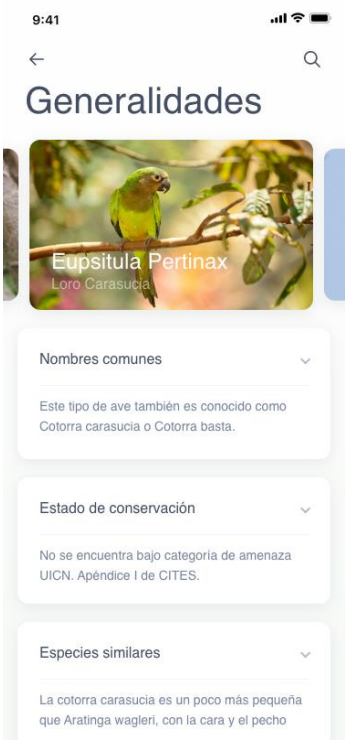

Fig. 4. Submenu generalities
Source: Own production

Fig. 5. Identification function
Source: Own production

Fig. 6. Threat function
Source: Own production

The hardware resources used were as follows: a Canon EOS REBEL T5i camera for the collection of positive and negative images of the selected species, studio lights for optimal stage lighting, a 3x5 meter Blue Chroma-key to simulate natural environments and achieve images in complex natural environments, and a Smartphone with Android as operating system to test the developed application, ensuring compatibility and functionality on mobile devices.

As for software, Android Studio 3.6.x Integrated Development Environment (IDE) used in programming the mobile application, XD for prototyping, Photoshop and Premier for editing positive and negative images collected, Git + Github for mobile application code versioning, OpenCV Computer vision library used for image processing and training in detecting the selected species.

4. CONCLUSIONS

The development of mobile solutions that promote learning is a growing trend that is revolutionizing education. Emerging technologies such as machine vision contribute to generating didactic, interactive and above all practical experiences to promote higher learning. Such solutions, in addition to informing, allow to have an experiential learning.

With regard to the results obtained in the application of the assessment tools, it is interesting to note that a large number of the population surveyed have sound knowledge of the typical species of the region, reflecting a growing interest of people in their natural environment. It was also found that people have active contact with a wide range of digital and non-digital media that provide them with information about the fauna of the region, demonstrating that they conduct exhaustive searches on various sources to learn more about different animal species, including their diet, characteristics, taxonomy and habitat.

The implementation of this application will have a significant impact on the city and the region, as it will be available for use by both local inhabitants and tourists, which will facilitate learning about the fauna in an interactive and autonomous way. In addition, it will promote the culture of bird watching in its natural environment, thus contributing to the conservation of biodiversity and promoting the dissemination of the wealth of fauna in the region.

Given the above, it is necessary to promote care for the fauna of the region and identify the critical points in environmental education, because, according to the literature reviewed, not enough resources are found to disseminate information and raise awareness on issues such as: logging, burning, hunting, animal trafficking or other threat to the ecosystem that endangers it. Also, it is notable the need to promote and publicize the natural environments that are close to the city, as a natural park, for the realization of all kinds of activities that complement the learning of fauna in Valledupar and promote ecotourism.

Based on the above, it is notable the need to provide a resource that in addition to contributing with the learning of fauna in the city, promotes the preservation of the environment and ecotourism, therefore it is proposed to develop a software solution based on the emerging technology artificial vision, for the detection of animal species, and deployment of important information of this, such as, taxonomy, food consumption, care and other relevant data that motivate learning in an interactive and dynamic way.

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