Tool design with augmented reality for the reactivation of regional museums

Diseño de herramienta con realidad aumentada para reactivación de museos regionales

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Abstract

Museums always motivate users to observe and analyze past situations with which circumstances that gave way to current or future events are evoked, from them future scenarios are analyzed in addition to offering a service to society that currently knows the heritage that is protected in them. Currently, with the pandemic caused by COVID-19, daily activities were restricted, and people stayed inside their homes, this brought with it the impossibility of carrying out activities such as attending events, and visiting places far from the local area, among others. All this caused some activities such as visits to museums to be restricted and therefore some had to close their doors permanently or suffered from budget cuts for their maintenance, which is why the design of a tool that promotes remote assistance is sought. towards some regional museums, to be profitable and not disappear due to lack of resources, in addition to trying to maintain the current facilities and improve the quality of service, to achieve greater dissemination of its exhibitions, conservation, and future works.

Resumen

Los museos siempre motivan a los usuarios a observar y analizar situaciones del pasado con las cuales se evocan circunstancias que dieron paso a los eventos actuales o futuros, a partir de ellos se analizan panoramas futuros además de ofrecer un servicio a la sociedad con el fin de conocer el patrimonio que en ellos se resguarda. Actualmente con la pandemia provocada por el COVID-19, se restringieron las actividades diarias y se permanece dentro de los hogares, esto trajo consigo la imposibilidad de realizar actividades como asistir a eventos, realizar visitas a lugares lejos del ámbito local, entre otros. Todo ello causó que algunas actividades como visitas a los museos fueran restringidas y por ende algunos tuvieron que cerrar las puertas de forma definitiva o sufrieron de recortes presupuestales para su mantenimiento, por ello es que se busca el diseño de una herramienta que promueva la asistencia remota hacia algunos museos regionales, con el fin de ser rentables y estos no desaparezcan por falta de recursos, además de tratar de mantener las instalaciones actuales y mejorar la calidad del servicio, para así lograr una mayor difusión de sus exhibiciones, conservación y trabajos futuros.

Augmented reality, Innovation, Legacy   **Realidad aumentada, innovación, patrimonio**

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Introduction

The world has undergone significant changes in recent years, from the way we live together, the educational model, the way we work, among others. That is why some activities that were carried out on a daily basis have been modified, as indicated by Pacheco (2020), "we could not imagine the transformation in living, thinking, acting, taking care of ourselves, distancing ourselves, that we would have since the beginning of the year 2020. All this as a result of the appearance of a compound of proteins and nucleic acids that requires living cells to reproduce, a coronavirus related to other known coronaviruses that have caused health problems and deaths in the world." In order to continue to coexist with the new normal brought about by the SARS-CoV-2 virus, daily activities had to be modified, such as how to work remotely with access to computer units from home, attend local and even global events virtually, among others. These changes brought about transformations in the economy of the entire world, in addition to redirecting economic resources towards elements related to health, leaving aside the distribution of capital that was allocated to the areas of recreation and leisure, in order to ensure available resources for doctors, medicines, hospitals, among others.

According to Román (2020) "the economic dimension of culture in Mexico has been relegated, basically, to the number of cultural infrastructure available, the source of financing and the consumption of goods and services. Factors such as the income it generates and the contribution it makes to the country's economy, and even more, the level of contribution to people's productivity, when developing their activities or the creation of others, have been left aside, although there are indicators that attest to this. Therefore, it is important to emphasize that the culture sector has a potential for the economic growth and development of the country. In recent years, the social and cultural dynamics have changed, so it is important to know in detail the cultural sector in Mexico", it is not enough, only to know what and how much is spent, but also how and for what, in addition to the economic and cultural flows that are favoring, so it is necessary to investigate the various activities that generate economic resources and are used in the cultural sector.

As part of the cultural heritage are museums, in which historical elements are stored on their walls, are preserved with the greatest amount of care to be visited by people of different ages, in order to inform and show both recent and past events, also these have had internal and external modifications to attract the attention of the public, as indicated by Colman (2022), "museums throughout history have undergone changes, they have gone from being a place of deposits of objects to a more educational place. In this sense, the link between museums and education is still in the process of being linked to the different levels of the educational system. Even in this XXI century it is in constant change to respond to the specific needs of students, teachers and the educational community", that is why part of the history, recognitions and events are stored in them and serve to give a basis to modernity, however, it is necessary to identify their economic bases and the way in which these sanctuaries full of history can be protected, in which traces of the past can be found and allow reflection on the future.

According to Unesco (1980) "the museums in Mexico depend mostly on the federal government, since by law the cultural, archeological and historical heritage, and in some cases artistic, is property of the State", since 1980 the economic resources administered by the museums come from the federal and state governments, on both depends the survival, opening and management of the museums in Mexico.

From the above, questions arise: Where do recreational activities such as museums get their economic resources if nobody visits them?, Is it necessary to have a certain activity to receive economic resources?, Are scientists still in charge of making discoveries if nobody can visit them?, How did the pandemic affect this type of places in terms of visits?, Have museums carried out some activities to raise funds or have they closed their doors permanently?

According to Inegi (2021), 70.8 % of the museums had public resources for their operation (37.3 % with resources of municipal origin; 34.7 %, state, and 28.0 %, federal); 12.6 % operated with private resources; 5.3 %, with mixed resources and 11.3 %, with self-generated resources. In 2020, the percentages were similar, which is why the resources granted by the government are fundamental for the implementation of these museums, in addition to taking into account the self-generated resources from new research.

Based on the above data, Inegi (2021) mentions: "the health contingency due to the COVID-19 pandemic caused the closure of most of the museums for some months in 2021. Of the 1248 museums considered in the directory of informant sources for the 2021 edition, information was only collected from 1046 museums that year. Considering the above, in August of that year only 650 (52%) were open. By February 2022, a total of 849 museums were open (68%). In 2020, 1003 museums provided information on the overall number of visitors. In 2021 the figure rose to 1,046 museums, i.e., 43 more museums. By geographic location, 13 states registered less than 20 museums, six registered between 20 and 29, another six states are home to 30 to 44 museums and the remaining seven states have more than 45 museums.

It should be noted that according to Longhi, Quezada, & Cappello (2021) indicate that, "between 90% and 95% of the 60,000 museums in the world remained closed as a result of the pandemic by COVID-19, given this problem, they appealed to different ways to maintain contact with their audiences, being digital technologies the ones that have reported the best achievements".

All the above gave rise to further research on what were the main reasons why visits increased in some sites, while in others the influx of users was lower, since by imitating the actions of museums that had a substantial increase in visits, could be replicated in regional museums and thus increase the number of visits, Based on this, the data provided by Ingei was analyzed and we sought to analyze the reason why visitors were interested in attending certain museums when the restrictions caused by the pandemic ended, from which it was found that the most frequent means by which visitors learned of the existence of the museum were: through friends, relatives or acquaintances (28. 5 %) and through the Internet (14.2 %). Having learned about it through teachers, fellow students or textbooks occupied the fifth position, with 10.4 % (in 2020, this option occupied the sixth position, with 7.7 % of the responses. In 2019 it occupied the second position, with 17.5 %).

For all the above, it was verified that one of the tools by which the visit to the sites increased is through the diffusion that the museum has on the internet, in addition to the talks between families, which are carried out by electronic means such as smartphones, which is why we analyzed a way to merge both elements and that could provide a considerable increase in visits to regional museums and make known the elements that they contain for their dissemination in all fields, not only in the scientific field, but also for the general public, as Celorrio (2015) indicates, "society has evolved and cultural institutions in general, and museums in particular, need to adapt to new media and communicative supports to remain integrated and, in the long run, avoid oblivion or disappearance. Nowadays it is common for museum institutions to have their own website or manage different profiles on social networks, but it is not so common for them to comply with the dialogic dimension of the Web.

Therefore, part of the hypothesis is based on the assumption that museums need to assume to a greater extent the participatory dimension of the Web and consider their target audience not as a mere passive consumer, but as an active part of the social and cultural environment of the institution, which is why some applications implemented by museums were verified, from resources such as virtual tours, to 360° views of the place.

Based on the above, we proceeded to indicate which regional museums are most affected by the pandemic, in addition to analyzing the various options that could be offered to increase the number of visits, for which the museum on the Rincón Colorado paleontological zone was selected to implement new technological tools and thereby increase the number of visits, Both in person and virtually, since this area presents a particular problem, since in addition to showing the elements inside the museum, they are exposed outdoors and this has caused some of the elements to be affected by the weather and especially by the people who frequently come to view the footprints, bones and elements of the dinosaurs that existed in this region.

The Rincón Colorado Paleontological Zone is the first paleontological site in the country adapted for public visitation: Rincón Colorado, located in the municipality of General Cepeda, in the southeast of the state. Rincón Colorado, where traces of the Cretaceous period beaches are preserved and a large concentration of herbivorous dinosaur remains, called hadrosaurids, have been discovered, offers a trip to the past of the Earth 72 million years ago, along the shores of the ancient inland sea of North America, whose signs remain in the desert, in the rocks and quarries rich in marine, plant and insect fossils, in addition to the vestiges of hadrosaurids.

In this paleontological site there are only faithful reproductions of the bone remains of the original hadrosaurs for conservation reasons, as well as their reservation for research of most of them, the site offers the opportunity to enter a natural space of 72 million years where you can see geological elements of the Cretaceous, the last period of the Mesozoic era, visible with the help of informative and didactic brochures.

With this, we sought a way in which technologies could help preserve these elements or at least minimize damage from users, since these elements, being outdoors (Figure 1), could suffer unintentional damage from visitors. In addition, it is not possible to avoid visits by the various users, since, as previously indicated, it is necessary for the survival of this museum, since, although admission to it is free, it obtains its income from the government, which, from the visits, provides the resources for its conservation.

Therefore, when analyzing the options, it was indicated that the tool that could support the increase of visits could be an augmented reality application, which would expose the dinosaurs, environments and elements that could be found in the time in which they existed according to the discoveries made and the footprints left, in addition to locating the context of the types of fur or plumage that some animals had at that time.


Figure 1 Exterior exposure of dinosaur remains
Source: Mexican cultural information system (2022)

**Methodology to be developed**

In the first instance, guided visits were made to the area, to delimit the actions that could be carried out, in addition to locating the site and analyzing the current situation, all this in order to execute an action plan according to the needs, this was done by a group of 5 project participants, of which 2 people are project administrators and 3 elements that will execute the relevant actions in the development of the activities.

Based on the visit, a situational analysis was made, in which it was verified who were the people who mostly attended this place, taking as a reference the month of January, since in this month the activities in the museum were reactivated, with the proper sanitary measures; The analysis was developed in order to know their schooling (Graph 1), their ages (Graph 2), as well as their place of residence (Graph 3), all of this in order to know the type of population to which the project will be directed, as well as to identify the characteristics of the population, since this will be the basis for promotional campaigns and the detection of needs.
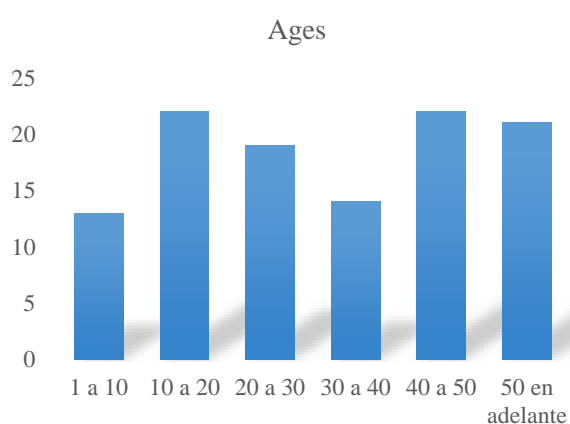
Article
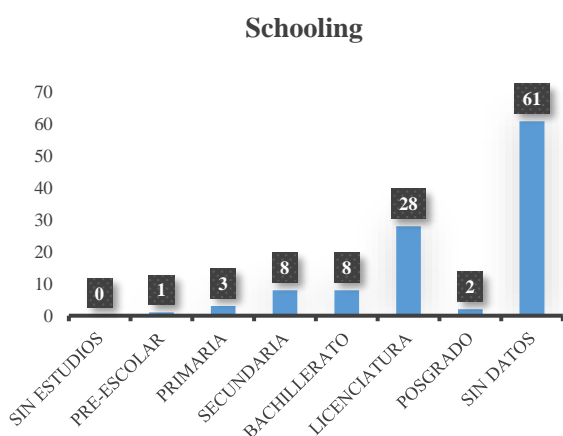
Schooling

Graphic 1 Schooling of visitors
Source: Rincón Colorado Paleontological Zone
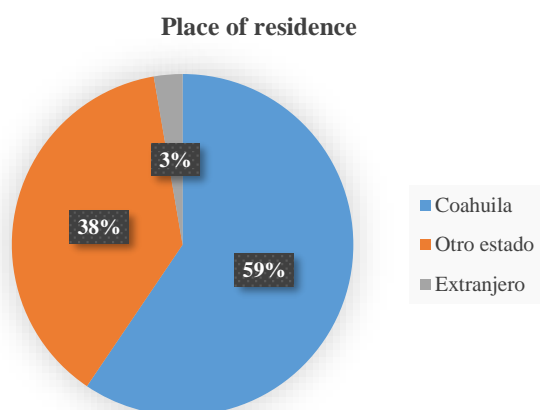
Place of residence

Graphic 2 Place of residence
Source: Rincón Colorado Paleontological Zone

Ages

Graphic 3 Age range
Source: Rincón Colorado Paleontological Zone

Based on the above data, a comparison was made of the information obtained in general visits to museums in the year 2021 in the area of Coahuila, where the museum is located, which was 6,338 visitors to museums throughout the region, in comparison, the museum received 111 visitors at the beginning of the year in the facilities.

After carrying out the situational analysis, a team meeting was held, through which a pertinent option was sought for the development of the proposal, in addition to identifying the profiles of the creators of the project, the scopes were indicated and the limitations that they could have when elaborating the project proposal were recognized, in this meeting there were personnel in charge of the paleontological zone, as well as elements of the Polytechnic University of Gomez Palacio (UPGOP), which will be in charge of carrying out the project in its entirety and Lic. Rosario Pedroza García, representative of the civil association Morelear, which will carry out promotion and liaison activities between the museum and the UPGOP.

Once the previous meeting was held, we proceeded to create a chronogram, in which the activities to be carried out were detailed, the type of knowledge necessary for the realization, in addition to identifying the necessary characteristics for its development, promoting time management using agile development methodologies.

The development of the project was selected to be carried out in augmented reality taking into account the fact that most people have a mobile device for different daily activities, as indicated by the National Survey on Availability and Use of Information Technologies in Households (ENDUTIH) 2020, in Mexico there are 84.1 million internet users and 88.2 million cell phone users.

In Mexico, in 2020, an estimated population of 84.1 million Internet users, representing 72.0% of the population aged six years or older. The survey estimates that 78.3% of the population located in urban areas are users, while in rural areas the proportion is 50.4%.

In 2019 users in urban areas were estimated at 76.6 percent and in rural areas the estimate was 47.7 percent, which is why by identifying these characteristics there is a relevant motive in employing augmented reality as a tool to exhibit the pieces inside and outside the museum, in addition to preserving the pieces in an integrated way by drawing users away from the archaeological zone and showing the dinosaurs in a didactic way for all ages.

The development team is made up of 13 students from the Animation and Visual Effects Engineering (IAEV) major, one student from the Information Technology Engineering (ITI) major, as well as 3 project managers managed by the institution and participants in the university's majors.

After creating the work team, the activities to be carried out were assigned, which consisted of the creation of sketches, modeling, dinosaur design, application of effects and textures, and implementation of QR code visualization.

All the design and modeling activities of the dinosaurs are carried out by different students of the IAEV career, since the specialty they are studying allows them to know in depth the tools for the realization of the different designs.

As part of the design of the tool, paper models of the three dinosaurs that are known to have inhabited the region, Velafrons coahuilensis or duckbill (Figure 2), ornithomimidae (Figure 3) and another dinosaur similar to tyrannosaurus rex (Figure 4), were made in the first instance, These were presented for subsequent modeling using tools such as Maya and Unity software, for the realization of the figures were used models provided by the museum, in addition to an exhaustive research on the internet about the types of dinosaurs and characteristic features.

Figure 2 Duck-billed dinosaur
*Source: Mariana Escamilla IAEV student*

Figure 3 Dinosaur ornithomimidae
*Source: Rosa Avalos, IAEV student*

Figure 4 Dinosaur of the tyrannosaurus rex family
Source: IAEV students

Once the sketches were finished, we proceeded to verify the models from some images available on the Internet and in the museum, in order to give an approximation to what we wanted to create, in addition to including another hadrosaur, the latirhinus to the list of figures to be made (Figure 5).
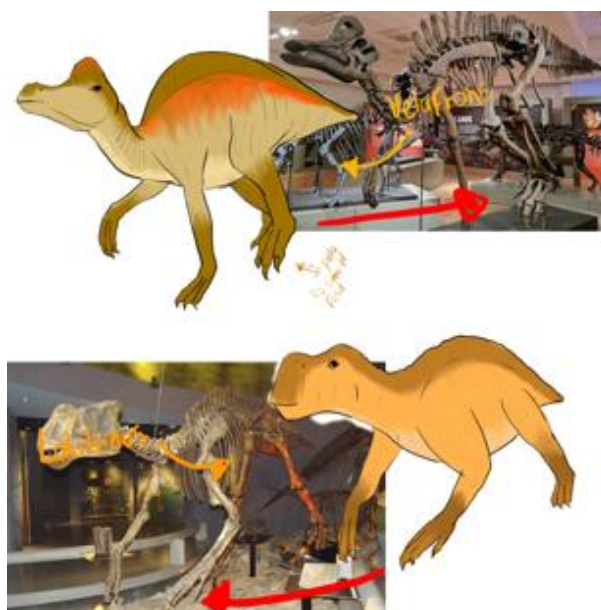
Figure 5 Dinosaurs based on real skeleton.
Source: IAEV students

Once they were drawn in order to validate the characteristics and types of skin or feathers that each species had (Figure 6), a meeting was held with the work team and the museum manager to validate the objects and identify findings of different characteristics to those drawn, in order to find relevant modifications and proceed to use the Maya software tool (Figure 7).
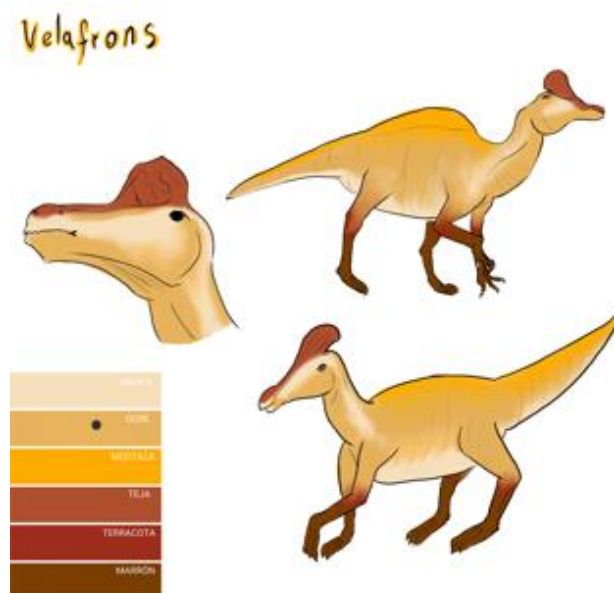
Figure 6 Image of dinosaur using colors approximating the real one
Source: IAEV students
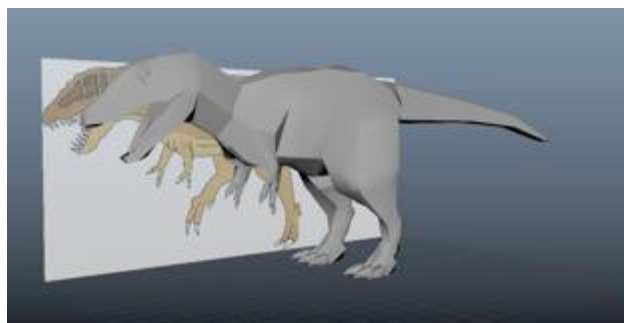
Figure 7 Element created in Maya Software based on sketch
Source: IAEV students

Results

As a result, four dinosaur sketches were obtained in the process of applying textures, movement and environment with the creation of vegetation and type of place, with this it is expected to maximize the interaction of people with the types of dinosaurs that existed in the region, in addition to promoting the visit to the site, since being in a not very busy area the museum has little attendance.

Another of the expected actions is to complete the mobile application and to be able to upload as a developer to the Play Store platform the application in downloadable format, in order to bring information about dinosaurs, types, food, among others to the largest possible population, since there are several visits from foreigners to the area of Coahuila, as well as foreigners who visit the museum in search of observing and learning about the characteristics of that time.

Currently the museum has visits throughout the year, but mainly on school dates due to the excursions made by educational institutions, besides having scheduled excursions by the tourism area of the area, that is why it is expected that at the end of the application it can be disseminated and installed on the users' devices and take a part of the museum, which can be appreciated anywhere in the world.

As future work is expected to fully realize the application and from this analyze the possibility of making a virtual tour throughout the museum, to provide a better view of the site, apart from seeking federal support to promote the project and to be made for multiple platforms and in order to reach any corner of the world, all with the support of cellular technology and internet, two powerful tools in today's age.

Thanks to

Conclusions

From the development of the application is expected an increase in the number of people who currently attend the museum, in addition to seeking the increase of visits is proposed to upload the application to the Play Store platform, in order to share knowledge, in addition to proposing to make some promotional events by Morelear A.C. in the Paseo Colón, which will be inviting the community in general to meet the dinosaurs that at some point in the life of the planet were traveling around and can be seen from the augmented reality application, in addition to requesting various supports for the museum in order to expand the search for more specimens and thus can diversify the activities that currently have.

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