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The Cultural And Economical Impacts Of Using Virtual Heritage In Archaeological Sites In Egypt

Mohamed M. Abdelaziz Farid[1], Abdelhamed Ezzat Abdelhamed[2]

[1]*Assistant Professor, Architecture Department, Faculty of Fine Arts, Helwan University, Cairo, Egypt,*

[2]*LEED GA, Estidama PQP,andArchitect at Escan ConsultancyCo.,Abu Dhabi,U.A.E*

Abstract

Egypt is among one of the world's richest countries in the diverse architectural heritage resulting from the various civilizations that have arisen on the land of Egypt. However, the architectural heritage in Egypt suffers from multiple problems represented in the poor handling of the heritage site and the lack of protection for those sites. Which lead to the deterioration of the situation of some sites, and with the technological advances that the world is witnessing today in all spheres of life. Virtual Heritage Technology is emerging as one of the solutions that can be used in heritage sites in Egypt. This is one of the latest and most innovative technologies for the virtual environment, which is emerging as an integral part of it, and it is the reconstruction of historical sites as they were at the beginning of their construction. This depends on re-documentation of architectural buildings and heritage sites in detail through 3D models and holographic drawings. It also depends on many techniques and one of those that are often used in the applications of the virtual heritage are augmented reality technology, which is used to reconstruct archaeological sites in the site, by using tools or devices that support that technology, whether from portable smartphones or through devices that are worn like glasses and contact lenses. The virtual heritage technology offers many advantages to heritage sites, where it is considered historically as a digital documentation process for heritage which ensures that the artistic and historical value of buildings and heritage sites are preserved. It can also be used in the process of restoration of buildings; in addition to economic assistance in further enhancing heritage sites that attracts many tourists and visitors, which gives them the possibility to view the history of archaeological sites interactively; allowing them the sensory and intellectual integration with the site and this contributes to obtain historical information.

This research will examine the possibility of utilizing the technology of virtual heritage through its application in the heritage sites in Egypt and the cultural and economic impact of the use of such technology on heritage sites. In addition, some virtual design cases will be discussed for heritage sites around the world and a SWOT analysis would be made to exemplify the challenges and discuss how they may be addressed. These examples are then presented to demonstrate how to deal with some of the difficulties, taking into account the arrival of proposals and recommendations that can be used and applied in Egypt.

Keywords

Virtual heritage; Archaeological sites; Virtual environmental; Augmented Reality; Visualization; 3D Modelling; Case study

1. Introduction

Cultural heritage is a highly valuable collection of (tangible and intangible materials) such as traditions, and knowledge that can be used to have better understand for the past and civilizations The cultural heritage of Egypt is one of the most important historical heritage rich places in the world; as it is one of the most cultural heritages in terms of diversity of civilizations (King, 1984), This heritage has always been truly appreciated since its inception, and over the centuries there have been important activities to ensure the preservation and evaluation of the ancient heritage. Among the most famous restoration and preservation of the heritage sites that took place was in the temple of Philae, and the Temple of Abu Simbel, and the Temple of Luxor, which are only the most distinguished cases. However, there are many buildings that have been severely damaged and altered, as a result of poor handling of heritage sites and the lack of mechanisms to protect and preserve them from being damaged.

At the present time, with the increasing awareness of the society and its interest in all forms of cultural expression, especially the architectural and historical heritage, which is the most distinctive mark of every historical era;some of the new concepts and methods developed by the world in the way of preserving and restoring heritage sites have emerged. These modern methods depend on the tremendous progress in computer science in general, and virtual reality sciences in particular; and their ability to create a virtual reality that simulates reality through augmented reality techniques.

This technology is known as virtual heritage, which is the reconstruction of heritage sites on the site and relies mainly on the technology on the process of re-architectural documentation of the sites through the development of plans and drawings and 3D. Applying this technology not only to improve our knowledge of heritage sites but also to increase the interaction of tourists and visitors to heritage sites. On the other hand, this new technology offers the ability to overcome restrictions on restoration works in heritage sites and facilitate the conduct of the works in the sites, which contributes to the preservation.

The virtual reconstruction of monuments to heritage sites has received considerable attention around the world in the past decade, and there are many forms of virtual reconstruction, including the state of complete physical loss of heritage sites, the re-creation of a lost human environment or the combination of the virtual world created and reality through enhanced reality technology, or in the case of historical changes to historical sites and their monitoring over time. The possibilities that can be achieved through that technology seem unlimited, even if there are some difficulties in rebuilding the past which is usually enormous, because of the lack of complete graphics or written documents.

This paper presents a great deal of investigation and cooperation between archaeologists, art historians, architects, and planners. This paper presents the study conducted to create a 3D model in the village of Tal Al-Amarna. The main objective is to know the cultural and economic impact of using heritage technology in heritage sites.

Nomenclature

VR Virtual Reality

HV Heritage Reality

AR Augmented Reality

1.1. The Research Problem

Despite Egypt having a rich cultural heritage and the efforts of the country in trying to preserve archaeological sites and increase tourist rates, cultural heritage in Egypt seems to be in a difficult situation, and the preservation and upgrading of archaeological sites in Egypt is facing some problems, represented in:-

- Some of the sites are mismanaged in dealing and management, in addition to the lack of new research in the field of restoration and rely on old methods that may affect the negative sites archaeological.
- The absence of the full architectural documentation of archaeological sites, which can be used in the field of

archaeological research.

– Lack of renewal in visual displays in archeological sites and the lack of technology integration.

1.2. Research Hypothesis

In the light of the exposure of some archaeological sites to the poor handling, management, and restoration, the deterioration of the status of some of these archaeological sites and others to the destruction, affecting the cultural heritage of the country and lose the luster of archaeological sites.In an attempt to preserve archaeological sites and the desire to strengthen ways of dealing, management, and restoration of those sites and the attempt to provide Archeological sites in a better form, this study is carried out.

1.3. Research Objective

Current research attempts to integrate modern technology in the system of conservation of archaeological sites by reconciling the technology of virtual heritage and preservation of archeological sites in line with the Egyptian context. This research focuses mainly on two issues:

First, the knowledge of the cultural and economic impact of the use of virtual heritage technology in archeological sites. Second, the selection of an archeological site in Egypt, a case study from one of the Pharaonic archaeological site (Tel Al-Amarna).

1.4. Research Methodology

In order to do, therefore, the research is carried out a mixed-method

– Using a descriptive, analytical methodology based on a collection of data and information on virtual heritage technology and enhanced reality technology in order to know all aspects of this technology and how it works.

– Studying previous cases in the use of virtual heritage technology and enhanced reality technology in archeological sites

– The use of the deductive approach to arrive at the knowledge of the cultural and economic impact of the use of virtual heritage technology in archeological sites

2. Virtual Reality (VR)

The virtual reality sciences started at the hands of the actual founder of this science, Licklider. RCJ. He studied senses and hearing in humans. He began this science, which later became known as Modeling. In 1960, he wrote and explained his conception of the method of human contact with computers and the computer with teeth efficiently .He explained how to connect the human brain computers and has presented his ideas on how to use the keyboard and television screens to share information to the military; the results are the form of personal computers we know now. The most obvious idea, of virtual reality, was born in 1965 by Licklider, who claims to be Sutherland Ivan, later known as The Father of the Computer Graphics. He presented a paper entitled ”The Ultimate Display” (Levy, 1995,Kakawsky 1993) This paper led to the basic ideas of virtual reality. The first HMD and the first virtual reality system were developed and its first work became the basis for all subsequent research. After its application and success in training pilots of the US Air Force. (Levy & Bjelland, 1995).

3. Heritage Virtual (HV)

Virtual Heritage Technology is a collection of works that are organized through information and communication technologies) ICT (and then applied to cultural heritage, such as virtual archeology. (Sullivan, 2016) Virtual heritage and cultural heritage have independent meanings: cultural heritage refers to sites, monuments, buildings, and objects ”with historical, aesthetic, archaeological, scientific, ethnological or anthropological value”, whereas virtual heritage refers to instances of these within a technological domain, usually involving computer visualization of artifacts or Virtual Reality environments (Bawaya, 2010). One technology that is frequently employed in virtual heritage applications is augmented reality, which is used to provide on-site reconstructions of archaeological sites or artifacts.

4. Augmented Reality (AR)

Augmented Reality is the direct or indirect display technology on the physical environment in the real world, where elements are added through the computer and extracted in the real world sensory inputs such as audio, video, and graphics. It is connected to a more general concept called computer reality. Modify the actual view by a computer. Enhanced Reality, enhances the current perception of reality, while virtual reality replaces the real world with a single simulation. Enhanced reality is used to enhance experienced environments or situations and to provide enriched experiences. Originally, immersive reality experiences were used in entertainment and games, but are now used in other business industries where they can be used, for example, in knowledge sharing, education, and remote meetings. Enhanced reality gives the person a lot of potential in collecting and sharing implicit knowledge. Typically, real-time enhancement techniques are implemented in a semantic context with environmental elements. The user can deal with information and virtual objects in reality enhanced by several devices, whether portable smartphones or through devices that are worn as glasses, and contact lenses. All these devices use a tracking system that provides precision projection and display information in the right place as the Global Positioning System (GPS), camera, and compass as inputs have interacted with them through applications (Steuer, 1993).

5. Difference Between Augmented Reality And Virtual Reality

In general, the difference between augmented reality and virtual reality is that Augmented Reality (AR) is a technology that allows computer-generated virtual imagery information to be overlaid onto a live direct or indirect real-world environment. Augmented Reality (AR) is different from Virtual Reality (VR). In Virtual Reality (VR), people are expected to experience a computer-generated virtual environment. In Augmented Reality (AR), the environment is real, but it is extended with information and imagery from the system. In other words, Augmented Reality (AR) bridges the gap between the real and the virtual in a seamless way (Chang, Morreale & Medicherla, 2010). The differences between Virtual Reality (VR) and Augmented Reality (AR) can be summed up in the following (Table 1).

The middle ground between real and virtual environments is called Mixed Reality, which also includes Augmented Virtuality; where most of the input, including the environment, or background, is computer-generated, see Fig 1. Reality - Virtuality continuum and corresponding interaction styles.

Table 1. Differences between Virtual Reality (VR) and Augmented Reality (AR), (author).

Virtual Reality	Augmented Reality
Virtual reality replaces the real world with the artificial.	Augmented reality enhances real life with Artificial images and adds graphics, sounds & smell to the natural world, as it exists.
The user enters an entirely immersive world and is cut off from the real world.	The user can interact with the real world, and at the same time, can see both the real and virtual world.

Continued on next page

Table 1 continued

Everything around the user is fabricated by the system. This may display inside a blank room, headset, or other device that allows the user to feel present in the virtual environment.	The users are not cut off from the reality.
It is preferred to use VR for video games and social networks in the virtual environment or with PlayStation	The AR is based on the use of smart devices such as smartphones or devices that can be worn and containing software, as well as small digital display devices that show images of objects in the real world
Here the head-mounted display (HMD) & input devices block out all the external world of the viewer and present a view that is under the complete control of the computer.	The phones receive information about the geographical location through GPS technology and are added with several other tags such as Images, videos etc. which can be imposed on this site.

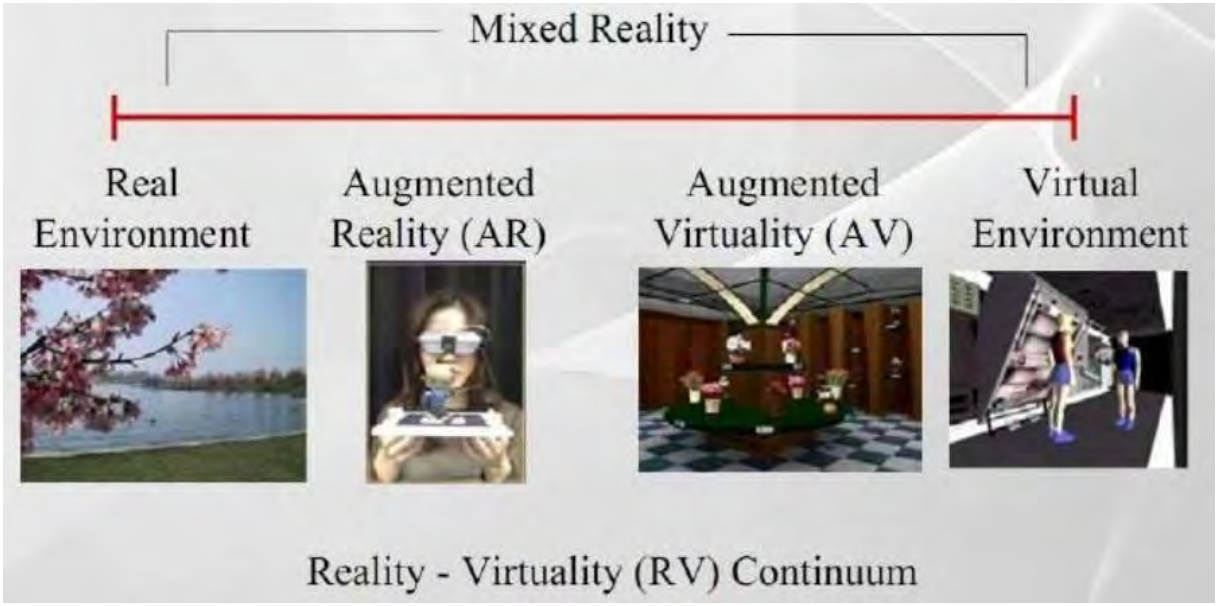

Figure 1. Reality - Virtuality continuum and corresponding interaction styles, (Chang et al, 2010).

6. Method Of Augmented Reality Display

An Augmented Reality system must be able to provide an output that is a mix of the real and the virtual. The display must hence, allow the user to see the real world overlaid with 3D graphics (Henrysson, 2007). Displays can be categorized in numerous ways, one of them is what sense they provide simulation for. The most common display methods provide visual and audio signals, while there are also sensory signals like smell, taste, and touch. Displays can also be categorized by whether they are attached to the participant in some way or not at all (Craig, 2013). According to this strategy, Augmented Reality displays will be categorized as follows:

6.1. Head-Worn (Head-Mounted Display HMD)

HMD is a display device paired with a headset such as a harness or a helmet. This enables bimanual interaction since both users' hands are free. In many industrial and military applications, this property makes HMDs the only option (Henrysson, 2007). HMDs place images of both the physical world and the virtual objects over the user's field of view, see Fig 2.A binocular head-mounted display as an HMD Example. It has many problems: (De Schepper, Van Passel, Lizin, Vincent, Martin & Gandibleux, 2013)

– Wearing a salient HMD in public is not socially accepted.

– Most systems are expensive.

– It hardens the building of wide field-of-view displays.

Figure 2. Abinocular head-mounted display as an HMD Example, (Digitaltrends, 2016).

6.2. Smart Glasses

Smart glasses are glasses with augmented reality techniques that can be worn to add information to reality. It is also known as enhanced reality glasses which have the ability to change their optical properties at run time. Smart sunglasses that are programmed to change the color by means of electronic means are an example of this latter type of smart glasses. Superimposing information onto a field of view is achieved through an augmented reality (AR) overlay that has the capability of reflecting projected digital images as well as allow the user to see through it (Newman, 2012). There are some advantages of this system:

– A small display that fits in a user's hand.

– Portable.

– Ubiquitous.

– Physical constraints of the user having to hold the device.

– Distorting effect.

Figure 3. Reality - Virtuality continuum and correspondinginteraction styles, (Vuzix, 2016).

6.3. Handheld Devices

Handheld display systems, such as mobile phones and tablets, allow both direct observations of the physical world augmented and an observation of the augmented scene on the screen. It thus allows more design possibilities for modifying the representation of the physical world. There are some advantages of this system:

– Portable.

– Ubiquitous.

– Physical constraints of the user having to hold the device.

– Distorting effect.

Figure 4. SmartphoneExample of a Handheld Device, (Freshmindstalent, 2017).

6.4. Stationary AR Systems

This system works through windows facing the augmented world. There is no possibility of tracking the same display system, but it has the ability to cover a large area of enhanced reality. This system is usually made up of projection devices or computers, which provide 3D spatial displays. Providing a large field of view, there's no difference between the projected graphics and the place of the real object. There's no need to wear any gadgets.

Figure 5. StationaryAR Wardrobe at a Topshop in Russia, (Mashable, 2016).

7. Augmented Reality Framework

The Augmented reality framework consists of several stages. This stage includes several sequential steps:

– The stage of selection of the case study: The study case is chosen because of its distinction and historical value and architectural in terms of aesthetic elements characteristic and associated with the period of its establishment.

– Data collection stage: This stage is considered one of the most important preparatory stages. It is a compilation of all the information related to the status of origin, regardless of the changes that have taken place throughout history.

- Study of historical data: - The study of descriptions of travelers and men of history and oral information and the historical stages through which the impact and impact on the establishment.
- Study the structure of the building internally and externally: - This is the preparation of all plans and horizontal projections and facades and sections and the details old or modern, in addition to doing geometric work and photography and analysis of these images.
- Study the perimeter of the building: - The study of the original and local fabric of the perimeter of the building.
- The stage of determining the odds: At this stage, all the tools are chosen according to their availability and flexibility. We refer to the auxiliary tools here: software, methods of communication and simulation so that there is a compatibility between the different software and technologies and that the user interface meets all its needs to explore different parts of the project. See fig 6 for the sequence of action steps and the augmented reality framework.

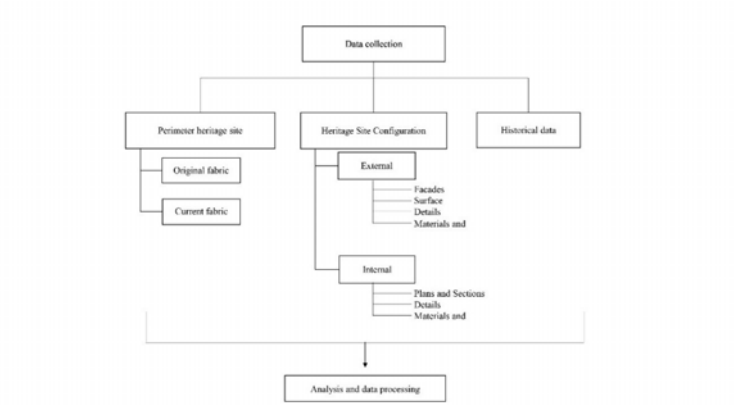

Figure 6. AugmentedReality Framework, (author).

8. Cultural Heritage In Egypt

Cultural heritage is a collection of all the traditions, traditions, sciences, literature, arts and so on, that can be used to better understand the past. The cultural heritage is the essence of civilization, and this makes the world to preserve and protect it and represents the material evidence of the different ages and civilizations. Egypt is one of the countries with a great cultural heritage. However, some sites and buildings have deteriorated due to various reasons and factors such as the poor management of heritage sites or the lack of protection and the bad use of restoration methods to those sites.

In the attempt to find the latest mechanisms and methods of protection and preservation of cultural heritage, virtual heritage technology, which has gained great interest around the world in the last decade, is seen as one of the most important methods and mechanisms for preserving archeological sites. The site has a lot of positive effects, including the possibility of benefiting from this technology in the process of restoration of archaeological sites and also in the field of research and studies, which is contributing to access to new discoveries in the future.

9. Tourism And Economic In Egypt

Until 2011, at its peak in 2010, the sector employed about 12% of Egypt's workforce, serving approximately 14.7 million visitors in Egypt and providing revenues of nearly $12.5 billion. As well as contributing more than 11% of GDP and 14.4% of foreign currency revenues (Smith, 2014). It was of particular importance as it affected various

economic activities and fields. However, after 25 January 2011, the number of tourists who came to Egypt, which negatively affected all activities related to tourism, started with the cessation of external funding for restoration projects of heritage sites, stopping some hotels, bazaars and gift shops from work, and decreasing interest in heritage sites.

To find solutions to Egypt's return to the list of countries competing in the field of tourism, which lost the benefit of other countries who do not have a cultural heritage similar to Egypt. In light of the restoration of security and gradual stability in Egypt, the search for new mechanisms and methods to revive tourism and the global interest in modern technologies integrated into various areas of life, especially virtual heritage and enhanced reality. The use of virtual heritage technology in heritage sites in Egypt is a new starting point for discovering the Egyptian monuments in a new and innovative way. It may attract tourists in large numbers to go through that experience and visit Egypt.

10. Case Studies For AR Applications In Cultural Heritage

Many projects have used augmented reality technologies for presenting cultural heritage to users. The augmented reality display methods used in several main projects in cultural heritage will be analyzed as follows:

10.1. The Hera Temple, (Olympia, Greece)

In the temple of Hera, the archaeological site of Olympia in Greece is one of the most important applications of enhanced reality in cultural heritage. HMD has been used to give each visitor the possibility to get to know the entire site through the site reconstruction. The system offers a set of predefined tours that each visitor can choose from at the beginning of the tour within the site while wearing special equipment. The system has gained considerable interaction among users, but the installation of HMD with calibration cameras and tracking sub-systems is a daunting task. The display system is based on a trend-oriented tracking method for displaying reconstruction images of temples and other monuments at the site (Vlahakis, 2001), the reconstruction model or animation, see fig8 (a). It is matched to the live video stream from the web camera, transformed accordingly, and rendered. At the same time, the audio narration is synchronized to the visual presentation and are both presented to the user via the binocular and a pair of earphones. The image seen by the user is illustrated in fig 7 (b). He/she can interrupt or alter the flow of information by moving away from the viewpoint or turning in another direction.

Figure 7. (a) Current view of the HeraTemple; (b) Augmented temple with the rendered model on top of the live video,(Vlahakis, V., 2001).

10.2. Reggia Di Venaria Reale, (Italy)

Within Tacitus, one of the field test areas of the Augmented Reality applications is a project called Reggia Venaria Reale's Palazzo di Diana,in which the architecture was modified several times over the years. Each status of the buildings was documented through drawings. These drawings were overlaid on the current facade of the main building through a handheld device. While listening to the story about the Palazzo through an audio guide, the

Figure 8. :(a)Visualizationof virtual athletes in the stadium of Olympia; (b) Tourist is carrying anoperating laptop and an AR HMD at the viewpoint of Hera temple ruins,(Vlahakis, V., 2001

appearance of the building switched through the centuries, while seamlessly integrating into the environment, see Fig. 9 (a). Finally, the whole scene looked like a real-time ancient drawing, where visitors standing in the large courtyard were watching the fountain and the previous up to the current restoration statuses of the Palazzo rendered like drawings on the device, see Fig. 9 (b), (Stricker, D. Et al. 2009). This application worked as a virtual tour guide, involving the user into the story in a better way.

Figure 9. :)a) Historicaldrawing of Palazzo di Diana; (b) Historian watching Palazzo di Diana on ahandheld device, (Stricker, D. et al. 2009).

10.3. Cathedral of Jakob, (Sibenik, Croatia)

One of the most popular applications of augmented reality in Croatia is the use of augmented reality in the Cathedral of Jakob (Sibenik, Croatia) by creating a 3D character in the augmented reality of the medieval cathedral. This character was for the builder Giorgio DA Sibenico, visitors could view him through their smartphones or their tablets. At the beginning, Giorgio welcomes visitors and then begins to tell them facts and historical information about the construction of the cathedral and the stages of its construction and importance. Visitors can choose the language of explanation between multiple languages, among the most distinctive things in the application is it gave a sense to visitors as if it were real and there was a wonderful fusion between real and enhanced reality (Croatia Sibenik Tourism Board DSP Studio, 2013), see Fig 10. The application was easy to use and entertaining. There were no costs to use except the presence of your smartphone or tablet.

11. Case Study

There is a need to introduce and use the application of virtual heritage in the provision of Egyptian cultural heritage for visitors, which contributes to enhance their knowledge of Egyptian heritage and helps in the arrival of visitors to a high level of indulgence and integration by giving them the possibility of enhanced simulation and see the reconstruction of heritage sites as they existed previously. The aim of this paper is to learn about the cultural and

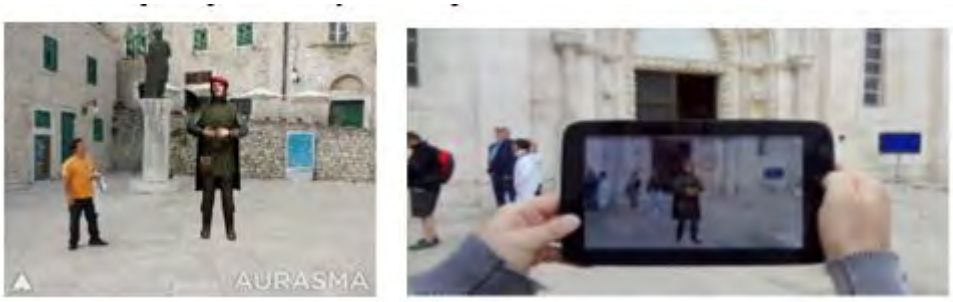

Figure 10.)a): a3D virtualmodel ofGiorgio DA Sebenico appears (”emerges from the floor”) and starts toperform; (b)Tourist sees augmented reality through his tablet, (Sibenik Tourism Board DSPStudio, 2013)

economic impacts of the use of virtual heritage technology in the heritage sites in Egypt and we will try to find out through one of the models of the village of Tel Amarna, the ancient capital of Egypt in the Pharaonic era.

11.1. Tal Al-Amarna, (Minya Governorate, Egypt)

Tel Amarna, is the ancient capital of Egypt built by Akhenaten and encircles the ancient capital of Akhenaten and lies about 365 miles south of Cairo in the natural amphitheater between rugged slopes. This narrow aperture exists for some twelve kilometers along the Nile Road and has a depth of about a half radius of about five kilometers. The remains of the old capital still exist. But, its most of the buildings are almost completely destroyed.

By relying on virtual heritage technology and augmented reality technology, we try to reestablish one of the most important heritage sites as one of the most important historical monuments in Pharaonic civilization. The site will be fully reconstructed in augmented reality, enabling tourists to see the full history and knowledge of the site.

The first step in establishing the augmented reality of this site is to start collecting data, documents, drawings, and hypotheses. All the data will be processed and analyzed, then architectural documentation of the site will be prepared, the view will be adapted to the historical era of the site, and the augmented reality will support by historical stories and information about the archaeological site. The visitors have the freedom to choose the methods of presenting the augmented reality. In this paper, it has already presented different methods of the augmented reality display where smartphones, tablets or smart glasses can be used. See fig 11. (a) Current view of the village of Tal Al-Amarna, (b) Augmented temple with the rendered model on handheld devices

Figure 11.)a) first picture to the left:Currentview of thevillage ofTal Al-Amarna; (b) second picture tothe right: Augmented temple with the rendered model on handheld devices,(author).

It can be said that Handheld is considered the most appropriate presentation methods, in fact, enhanced in archeological sites where the cost is not expensive as well as easy to use and deal with and can be allocated to all categories regardless of age, gender, educational level, and cultural or religious identity, which contributes to the ease of understanding historical information. In general, many visitors have weak knowledge of the site, although they are very interested in acquiring knowledge while visiting the required sites. On the other hand, the traditional means of providing knowledge hinders visitors from being free in motion within the site.

All this contributes to the increase in the rate of interaction of tourists at the archaeological site, which gives a positive impression to tourists, which affects the increasing rates of tourists visiting the archaeological site.

Figure 12. Touristsees augmented reality through his tablet, (author).

12. SWOT Analysis of the Previous Case Studies

A SWOT analysis was conducted on the case studies with Cultural and Economical criterias and on studying the SWOT analysis for the case studies we found that from the cultural aspects, there have been several strengths for the use of enhanced reality techniques in heritage sites, including the preservation of buildings and heritage sites through architectural documentation, In addition to the fact, that the buildings and heritage sites are not harmed by direct visitors' interaction with them and the possibility of benefiting from this technology in reconstructing the destroyed sites completely and inserting them into the list of buildings and heritage sites.

On the other hand, the weakness was more than a point such as visual discomfort, sound implementation and the relationship between the surrounding heritage site and the public and the lack of complete documentation previously for some heritage sites. While the opportunities where the possibility of using the enhanced reality in the development of assumptions for the restoration of some heritage sites in the future; in addition to, the use in the study of heritage sites in a way that could contribute to access to historical discoveries in the future. It also had threats such as the possibility of losing heritage sites, cultural and historical value as a result of integrating the site with technology in favor of virtual reality.

As for the economic aspects, the strengths were clear. Where enhanced reality techniques were used to advertise heritage sites, and could be used to encourage tourism and use that technology to perform parties and events in heritage sites, it would change content and presentation over time as opportunities. Unfortunately, there were weaknesses and threats such as equipment cost a lot and the need to have engineers trained and experienced in this area, which is an additional cost, in addition, it may affect the desire of tourists to be in the heritage sites and to observe virtual reality. While the chances were that they could be increasing the country's national income from tourism, it could promote tourism and further promote heritage sites and buildings through content to change and display through time.

In addition to examining previous international and national case studies, there are different types of ways to provide augmented reality, most of which can be applied in Egypt. They have great potential such as it will help preserve heritage sites and protect them from damage, Egyptian tourism will be enhanced through advanced audio and optical displays can be used, and most importantly, they may not adversely affect the surrounding environment and the environment may be a source of income to manage.

However, we can't ignore the constraints it faces, it needs trained designers, full architectural documentation that needs high-precision experts and may cause cultural identities to be lost to some heritage sites as a result of technology integration and visual discomfort to tourists due to using smartphones close to the eye.

But these limitations can be solved and managed by time, training designers and relying on equipment with advanced technology.

Table 2. SWOT Analysis of the case studies, (author).

Criteria	Strengths	Weaknesses	Opportunities	Threats
Cultural	Preservation of buildings and heritage sites Architectural documentation of heritage sites Reduce the vulnerability of buildings and heritage sites Resurrect completely destroyed sites	Visual discomfort Sound implementation and the relationship between the surrounding heritage site and the public Lack of full documentation of some heritage buildings	Possibility to use in the development of assumptions for the restoration of some heritage sites in the future Their use in the study of heritage sites in a way can contribute to access to historical discoveries in the future	The possibility of loss of heritage sites, cultural and historical value as a result of the integration of the site with technology in favor of virtual reality.
Economical	Used in advertising Can be used to promote events in heritage sites	High initial cost Needs special expertise in design and installation, causing extra cost.	Increasing the country's national income from tourism Promote tourism Promote heritage sites and buildings through content to change and display through time.	Affect the desire of tourists to be in the heritage sites and to observe virtual reality

13. Results & Conclusion

According to the analyses and discussions above, this paper's conclusions may be summarized as follows:

Implementing virtual heritage technology in archaeological sites has a positive impact on attracting visitors, increasing the number of tourists and promoting archaeological sites, which contributes to the prosperity of the economy in Egypt, especially as tourists are one of the pillars of the Egyptian economy as mentioned above.

Implementing virtual heritage technology at archeological sites ensures the preservation of the cultural heritage. It is considered as a process of re-documenting architectural monuments of archeological sites, but it needs to be under the full management of the Egyptian government agencies. This technology can also be used in the restoration of archeological sites through Assumptions and testing in augmented reality to see how successful they are before they start.

Using handheld augmented reality (AR) on archaeological sites for providing better information rather than other augmented reality display modes,where the cost is not expensive as well as easy to use.

In addition, we can see how virtual heritage technology can affect archaeological sites economically and culturally as shown in the SWOT analysis, and how it can be an additional source of income increase for archaeological sites and countries that use this technology by encouraging tourism and increasing the promotion of archaeological sites, From the cultural point of view, it can contribute to the preservation of cultural heritage from the possibility of destruction and the possibility of using it in the study of archaeological sites in a manner that contributes to access to new archaeological discoveries.

In order to be clear, so far, much research has been done on the use of virtual heritage technology in archaeological sites, for example, the choice of a virtual reality display mechanism suitable for archaeological sites, the development of a virtual reality framework in archaeological sites, all of which have yielded positive results.It allows us to begin collecting current discoveries, to move to a better approach to consider, sum up and disciplines, and to build

an understanding of the use of virtual heritage technology in archaeological sites.

14. Recommendations & Further Researches That Can Be Done Based On This Research

Further research can be done in this area to find mechanisms for the application of virtual heritage technology archaeologist sites in Egypt.

- There is a need to use modern applications and technologies to introduce Egyptian cultural heritage to visitors in a non-traditional way, not only to the tangible elements, but also to the intangible elements of Egyptian cultural heritage, making them a vital part of today's culture.
- An augmented reality can be created for buildings that are destroyed (such as the old opera building, the Alexandria lighthouse, the old library of Alexandria) for scientific or historical research purposes.
- It is necessary to expand the production of augmented reality copies for all Egyptian monuments in general and Pharaonic in particular, especially the most important and famous ones.

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