EXPLORING EFFICIENCY OF USING AUGMENTED REALITY TECHNOLOGY IN REENACTMENT OF THE HISTORICAL EVENTS IN LUXOR

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ABSTRACT

Cultural tourism is a promising augmented reality application domain with substantial potential for boosting advantages for the location and its tourists, locals, and companies while also preserving cultural identity. It is a method of gaining a competitive edge by enhancing the visitor's experience and by improving promotion and management. This study aims to explore efficiency of using augmented reality technology in reenactment of the historical events in Luxor. For that purpose, the research employed the open interview as the qualitative technique for data collection. The study sample was academics, representatives from the Tourism Promotion Authority and all stakeholders, archaeologists, and tour guides. The results of the study indicated importance of AR in archeological sites in the re-enactment of festivals, thus preserving cultural heritage. Overall, it is clear that investment in and adoption of innovative technologies is a necessity for tourist organizations that wish to remain sustainable and competitive in the future. The study recommended that the Ministry of Tourism and Antiquities should pay more attention to the studies and research that are concerned with using new technologies in cultural heritage sites.

KEYWORDS: Cultural tourism, Augmented Reality, Historical events, Reenactment, Opet festivals, Luxor.

INTRODUCTION

Since the turn of the century, technology has advanced incredibly quickly across all aspects of the tourism and hospitality industries. Recent studies from 2015 to 2019 demonstrate that smart technology is being used in the tourism and hospitality industries for improve visitor accommodations and

vacation experiences, as well as offering creative visitor services that raise overall trip satisfaction (Jasrotia & Gangotia, 2018).   Furthermore, Gajdok (2018) ensured that the use of modern technology is becoming a necessity for various destinations to remain competitive, attractive, and financially viable. One of the most recent technological advancements is augmented reality (AR), a digital system that combines an image of the environment with computer-generated data like text, image, and video using a computer, a smartphone, or other devices (Kounavis et al., 2012). According to Ding (2017) immersive technologies like augmented reality (AR) and virtual reality (VR) are now more economically viable than ever because of the technological advancements and the spread of affordable hardware and software, with the use of specialized and personalized information. Significance of this research lies in shedding light on using augmented reality technology in reenactment of archeological sites in Luxor. The Opet Festival was chosen as a model of augmented reality technology. The study problem focuses on lack of current technical methods at ancient archaeological sites in Luxor, which makes them less participatory, less alluring, and rather less thrilling to form aspects of attraction for visitors and tourists. In general, Luxor relies on cultural tourism which is one of the more conventional forms of travel. Luxor hasn not yet seized its rightful place as a global destination for cultural tourism, though. It' is possible that the primary cause of this relative stagnation in this form of tourism, which is regarded as one of the most significant sources of national income, is a change in the passion of many tourists for that type of travel.

RESEARCH QUESTIONS

This study is based on providing answers for the following three research questions:

(1) What is the importance of using augmented reality technology in archaeological sites in Luxor?
(2) To what extent is it possible to implement and to design augmented reality technology in Luxor?
(3) What is the impact of using augmented reality technology in reenactment of the historical events in Luxor?
(4) How is using augmented reality technology useful in reenactment of historical events in Luxor?
(5) What are the challenges and threats that face designing and using augmented reality technology in heritage sites in Luxor?

RESEARCH AIM AND ITS OBJECTIVES:

The main aim of this research is exploring efficiency of using Augmented Reality Technology at the archeological sites in Luxor. In order to achieve the

research main aim; some objectives were targeted as indicated below:

- Identifying significance of using augmented reality technology in the archaeological sites in Luxor.
- Assessing impact of using augmented reality technology in reenactment of historical events in Luxor. In this regard, the Opet Festival was used as a case study.
- Determining challenges that passively face using augmented reality technology in Luxor.

LITERATURE REVIEW

AUGMENTED REALITY CONCEPT

Due to the novelty of the concept, augmented reality (AR) has been given numerous names, including additional reality, merged reality, extended reality, improved reality, enhanced reality, and augmented reality, which is the most popular. As a result, various scientists have defined augmented reality technologies, including the Reference:

The first and most often used definition of augmented reality (AR) was provided by Azuma (1997, p. 355), who defined it as "a virtual environment or virtual reality technology that immerses users in a created environment". Additionally, Carmigniani et al. (2011) defined AR as creating a direct or indirect image of the real-world environment by adding information on the world created virtually via computers. According to Siltanen (2012), these are applications that enable interaction with graphically represented items in order to merge digital data with the physical world. Additionally, augmented reality is a type of technology created and developed via superimposing images on objects through computers (Jacob et al., 2012, p. 319). According to Sirakaya & Seferoğlu (2016), while the real situation in virtual reality environment is carried to the virtual world, the augmented reality environment is enriched with the data in the digital environment transmitted to the real world.

AUGMENTED REALITY AND ITS IMPLICATIONS FOR TOURISM

New technologies like smart and digital technologies are thought to be the primary factors that induce travelers to choose their vacation spots, according to recent trends in the tourism and hospitality industries in the 21st century. According to Vidal (2019), 75% of travelers use the internet

to arrange their vacations, while 13% still work with travel companies to do so. Additionally, 97% of Millennials post pictures from their travels on social media, 85% of travelers use their cellphones for transfers and trips, and 1.50 million people login to Trip Advisor for basing their decisions on the reviews of other users (mocaplatform, 2020). Therefore, Smart technology can have an impact on how journeys are managed, advertised, and offered. According to Van Kleef et al. (2010), the definition of augmented reality could be stated as a method that blends live views in real-time with virtual computer-generated pictures to produce a real-time enhanced experience of reality. The popularity of AR has increased significantly in business and academia, where it is regarded as one of the most significant achievements of contemporary times (He et al., 2018). According to Kipper and Rampolla (2012), AR can help improve the real view, create an augmented view, or produce a completely artificial view based on the three distinct principles of integration (of real and virtual), interaction, and 3-D registration (of both real and virtual objects) (Ye et al., 2003). AR has been praised for being an innovative tool for the promotion (Rahimi et al., 2020; Shabani and Hassan, 2018) and marketing of tourism products and services (Dadwal and Hassan, 2016). It is brimming with positive aspects like user-friendliness and innovativeness (Hassan et al., 2018). AR creates opportunities for improved visitor engagement (Tom Dieck et al., 2018), novel ways of discovering unfamiliar attractions (Han et al., 2018), favorable changes in visitor behavior (Chung et al., 2018), an enhanced tourist experience, more successful flexibility (Kounavis et al., 2012), an increase in the number of tourists and visitors (Cranmer et al., 2018), improved marketing of tourism-related goods (Cranmer et al., 2020; Rahimi et al., 2020), company profitability, and innovation-driven improvements to tourism-related goods and services (Hassan and Rahimi, 2016).

Recent research has looked into the organizational, cross-cultural, business model and stakeholder perspectives of AR in the travel and tourism sector (Cranmer et al., 2020). In addition, thanks to its integration with mobile platforms, ARvalue and accessibility are expanding to unprecedented heights (Michele et al., 2013). Additionally, by offering interpretation to visitors who are not fluent in the local tongues, AR can take the place of tour guides (Chang et al., 2015). Despite this, AR has not been utilized to its full potential in the tourism industry (Çeltek, 2016) because of its novelty, perceived complexity, and technical knowledge requirements (Voitik and Maslov, 2019).

TOURISM IN LUXOR

Luxor, the city current name, is the Arabic name of Thebes, the capital of the great deity Amun during ancient Egypt middle and new kingdoms. The site was added to the UNESCO world heritage list in 1979 (Raevskikh et al., 2021). Most of the monuments that are left date back to the Egyptian age of empire during the new kingdom (c. 1550–1069 BCE). These include the cult temples on the east bank of the Nile and the mortuary temples, and the Necropolis on the west bank (World Heritage, 2019). Antiquities and monuments date back to early Pharaonic dynasties (3000 B.C.) as well as later Roman, Coptic, and Islamic ones. Moreover, Abraham (2002) mentioned that 'World heritage sites' including the royal tombs of the Kings' Valley, Queens' Valley, and the Tombs of the Nobles, are just a few of Luxor's most well-known sights; they also contain masterpieces such as the Colossi of Memnon, the Luxor Temple, and Karnak Temple, which is the largest Pharaonic temple in all of Egypt. They are among the greatest cultural achievements of all time and some of the best representations of early human civilization, therefore; they have always fascinated travelers from all over the world (Rashed & Hanafi, 2003). In addition, Abulnour (2018) stated that tourists, who seek to explore the city by themselves and to have a comprehensive experience of storytelling, activities, and getting in touch with the local community, fail to receive what they aim for.

On the other side, tourism in Luxor has been a major economic activity for most of its population, as it is the source of various jobs and business opportunities. The local economy is, therefore, largely dependent on tourism and has been seriously affected by any regional or political disruptions. Before Covid-19 pandemic and its drastic and dramatic effect on tourism, the visitor numbers in 2019 (see Table1.3) indicate that the most visited site in Luxor city is the Karnak temple, followed by Kings' Valley and Deir el Bahari (Abouelmagd, 2023). The other heritage sites have fewer numbers of visitors. Tourists' activities include shopping in the city newly developed tourist bazaars (inside the monuments and the city center) and the sound and light shows in the Karnak temple. Comparing these statistics with the world heritage sites of other cities that formed the ancient world's heart, it can be concluded that Luxor still needs to catch up. For example, the Greek civilization icon of the Acropolis of Athens received 2.5 million visitors between (Jan-Aug) 2019, which is already double the number that visited the Karnak (Drinia et al., 2022). The Callosum of Rome had 7.55 million visitors in Rome for the same year in 2019, almost seven times the number of Karnak visitors (Banfi et al., 2022).

Table (1) Visitors' numbers to heritage sites in Luxor in 2019

No.	Site/Museum	Location	Foreigner	Foreigner Students	Egyptian	Egyptian Students	Total Number of Visitors in 2019
1	Karnak Temple	East Bank	996,640	50,239	95,571	46,583	1,189,033
2	Kings Valley	West Bank	930,174	43,349	92,011	40,280	1,105,814
3	Luxor Temple	East Bank	570,884	22,644	81,377	63,364	738,269
4	Deir el Bahari Temple	West Bank	807,260	40,953	94,319	34,227	976,759
5	Habu Temple	West Bank	280,281	9,344	5,281	23,347	318,253
6	Queens Valley	West Bank	120,976	5,530	4,376	1,567	132,449
7	Ramesses Temple	West Bank	12,920	1,257	1,914	231	16,322

Source: Abouelmagd (2023, p.243)

EXAMPLES OF AUGMENTED REALITY APPLICATIONS IN ARCHAEOLOGICAL SITES

Recently, AR technology has become a well-accepted technology among the scientific community and the public. It is used for combining real and virtual objects and for mixing them into the real environment, which improves the visitor's experience of a cultural heritage site (Noh, 2009). In addition, augmented reality is frequently employed in a variety of fields, including education, entertainment, virtual heritage, simulation, games, and enhancing the overall experience of visitors to cultural heritage sites. Additionally, the interactive, realistic, and complicated AR system can improve, inspire, and stimulate students' knowledge of certain events, particularly for the traditional notion of instructional learning that has proven ineffective or challenging (Fällman, 1999). Several AR-related projects are underway as a result of the rapid advancement of modern

technologies. The next section discusses the concepts of augmented reality in the Virtual Heritage project.

1- ANCIENT POMPEII PROJECT

According to Papagiannakis et al. (2002), the ancient city of Pompeii serves as a symbol of European cultural identity and archaeological history. This project, according to Papagiannakis et al. (2005), depends on the 3D reconstruction of old fresco paintings for the real-time revival of their flora and fauna, featuring groups of virtual animated characters with artificial life dramaturgical behaviors in an immersive, fully mobile AR environment.

According to Magnenat-Thalmann & Papagiannakis (2005), the project uses a video-see-through HMD to capture genuine scenes. In a scenario based on real-time storytelling, this scene was combined with accurate real-time registration and 3D modeling of realistic comprehensive simulations of virtual people and plants. Additionally, these virtual people have fully realistic simulations of their bodies, speech, faces, and clothing. The project was implemented in real-time while being carried out on a portable and wearable system with a marker-less tracking camera.

Figure (1) Revival of ancient life in Pompeii

Source: Papagiannakis et al. (2005, p. 12).

Figure (2) Virtual human character in ancient Pompeii

Source: Papagiannakis et al. (2005, p.12).

2- AUGMENTED REALITY BASED SYSTEM FOR PERSONALIZED TOURS IN CULTURAL HERITAGE SITES (ARCHEOGUIDE PROJECT)

ARCHEOGUIDE is an interesting project that helps visitors to explore and experience ancient artefacts based on their interests and/or needs. The application was embedded in a personalized electronic device and worked as a tour assistant (Vlahakis, 2001). Enthusiasts choose the desired place, and the system then leads them around it.

The system was created to change how people view and learn about a site that is a cultural property. Furthermore, Stricker et al. (2001) stated that the user profiles visitors provide at the system outset reflect their interests and backgrounds; therefore, the visitor must then select from a list of predetermined tours offered by the system. The technology will rely on the position-orientation tracking component to provide an AR reconstruction of the site's temples and other landmarks (Vlahakis, 2001). The following figure shows the visitor's perspective of the natural view, followed by the same view enhanced by the 3D model. To view the 3D picture display, site visitors are using AR glasses. A handy unit carried by visitors during their site tours and communication networks (Liestøl, 2019). Moreover, Vlahakis (2001) mentioned that monuments of interest were identified, and the temple of Hera, the temple of Zeus, the Philippeion, and the Stadium were selected for the initial prototype scenario.

Figure: 3(a) Current view of the Hera Temple; (b) Augmented temple with the rendered model on top of the live video,

Source: Vlahakis (2001, p.6).

Figure: 4 (a) Visualization of virtual athletes in the stadium of Olympia; (b) Tourist is carrying an operating laptop and an AR HMD at the viewpoint of Hera temple ruins

Source: Vlahakis (2001, p.7).

According to Vlahakis (2001), 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 display system is based on a trend-oriented tracking method for displaying reconstruction images of temples and other monuments at the site (Vlahakis, 2001). For the reconstruction model or animation, see Fig. 3(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 is both

presented to the user via the binoculars and a pair of earphones. The image seen by the user is illustrated in Fig (4.b). The system was evaluated at the archaeological site of Olympia, in Greece, by representative user groups (see Fig. 4). Moreover, a site survey was performed for collecting topographical data, which was combined with photographic images to create a 3-D representation of the site.

THE IMPACT OF REENACTMENT EVENTS OF HISTORICAL EVENTS

Historical re-enactment events generally offer visitors the opportunity to observe and experience facts about a historical period, creating an atmosphere in which visitors may increase their knowledge about the handicraft, food, and cultural traditions of that period. Activities such as craft demonstrations, traditional arts, historical battles, and medieval markets are offered (Chhabra et al., 2003; Fu et al., 2018; Light, 1996). Thus, as Ray et al. (2006) highlight, a re- enactment event allows visitors to relive history in a playful way, having a simultaneously educational and recreational function.

Furthermore, it has been recognized that historical re-enactment events provide several benefits for both local communities and their attendees. They have great potential for promoting the development of a tourism destination (Chhabra et al., 2003; Ray et al., 2006) by: increasing local tourism demand (Tkaczynski and Rundle-Thiele, 2011); decreasing tourism seasonality (Tkaczynski and Rundle-Thiele, 2011); stimulating local economic growth, generating more commerce, more employment, and more income (Carnegie and McCabe, 2008; Light, 1996; Ray et al., 2006); enhancing the quality of life and pride of local people (Akhoondnejad, 2016); and by reinforcing the cohesion of local communities through the involvement and participation of residents (Akhoondnejad, 2016; Carnegie and McCabe, 2008; Light, 1996). These events also provide experiences that benefit their attendees: through expansion of their knowledge/cultural enrichment through the opportunity for exploration, through discovering local culture and traditions and learning about historical facts and events; through improvement of their interaction and socialization skills, through collective experiences of social contact with residents, family, friends and other event attendees; and through improvement of their physiological capabilities, given the opportunities for physical challenge and exercise, entertainment, and enjoyment (Light, 1996).

CASE STUDY

Egypt's 2030 vision, released in 2016, includes culture and urban development as pillars for sustainable development. The plan is adopting

programs to raise historical and cultural awareness in society, support and empower cultural industries, and protect and maintain the heritage (CAPMAS, 2016). Within the vision of Egypt, this research addresses a case of the reenactment of Opet festivals.

REENACTMENT OF THE OPET FESTIVALS

Since Queen Hatshepsut's (the 18th dynasty) time, the Opet Festival has been observed annually. It took place in Thebes in the season of inundation's 2nd month and lasted roughly for 22 days. This event was associated with the Nile's flood and its representation of fertility (Darnell, 1994). Additionally, Kamal (2021) stated that the reliefs of King Amenhotep III that are inscribed on the walls of the expansive colonnade of the Luxor Temple provide us with a great deal of information on the Opet Festival, and the eastern wall depicts the return trip, while the western wall depicts the procession and festivities from Karnak to Luxor. Although this event occurred more than three thousand years ago, it is still represented in modern rites (see Fig .5), such as the Moulid (religious feast) of the Muslim sheikh Abu El Haggag. He was a revered Muslim sheikh who moved to Luxor about 1245 and whose mosque and tomb are located on the grounds of the temple (Saleh et al., 2014). Every year, during the Islamic calendar month of Sha'ban, the modern holiday of Moulid is observed, as witnessed in many of the ancient festival traditions. Luxor is then transformed into a carnival for three days (Saleh et al., 2014).

Figure (5) Image of 2011 moulid festival – one of the many makeshift boats used in the procession
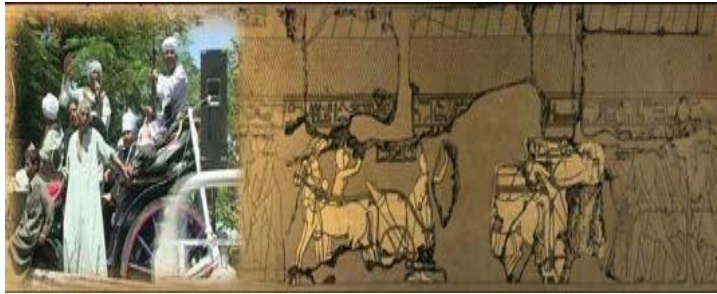**Source: Flanagan (2017, p. 30)**

Figure (6) A visual comparison between the modern rituals represented by Moulid Abu Al-Hajjaj and the ancient rituals engraved on the walls representing the Opet Festival
Source: Saleh et al. (2014. P.4)

According to Accetta (2012), reenactment (historical reenactment) is an activity in which people replicate specific details of a historical event or era. The reenactment fulfills both the implicit educational function of cultural tourism as well as the recreational function because it was created and delivered concurrently as an educational activity and as a leisure activity, taking into account the tourist's interest in this heritage interpretation (Mălăescu, 2014). Reenactment can also be conceptualized as active role playing (Mălăescu, 2014), which involves recreating historical events as wars, feasts, rites, or actual historical situations. Historical reenactments, which are often staged in public parks by organizations known as leisure organizations (Galán, 2014), require a certain environment. According to Canney 1938; Wachsmann 2012; Wickett 2012; Wicket 2009, the fact that both the moulid celebration and the Opet festival were mentioned indicates that they at least showed signs of being a continuation of one another. Additionally, Hornell (1938) noted that this beautiful festival has dwindled away lamentably [from its Opet origins]. Its personality has totally altered, therefore; in an attempt to preserve cultural history. Jung et al. (2020) stated that to improve visitors' experiences and bring people closer to their historical identity, a variety of contemporary technologies have been implemented, including audio, video, 2D/3D movies, and documentaries (Fig. 7).

Figure: (7) Preservation of cultural heritage

Source: Mendoza et al. (2023, p: 3)

The magnificent ceremony of Opet has been subsumed and reduced into a ragged procession through the streets of Luxor in honor of a little-known Muhammadan saint, with one or two small boats taking center stage. The moulid today is a grand event with dancing, fake stick fighting, a procession, multiple car-sized or larger symbolic barques, ceremonial dress, and other entertainment festivities (Hornell, 1938). In addition, Hornell (1938) noted that a number of Islamic celebrations and traditions "echo" those of ancient Egypt in a pretty evident way. According to Flanagan (2017), tradition-based practices or rituals are carried out outside their original religious contexts. Even when the ritual, tradition, or practice's ideological underpinnings may have altered, it continues to be done in a variety of situational circumstances and is still a significant part of a culture.

REENACTMENT OF HISTORICAL EVENTS IN LUXOR BY USING AUGMENTED REALITY TECHNOLOGY

Blanco-Fernández et al. (2014) determined the stages of reenactment of the events, where participants can live the event, learning about it from inside as reenactors and also from outside as historians. In addition, they added that REENACT is not a multiplayer online game but a collective in-person activity supported by handheld devices.

Stage 1 (reenactment) is about getting groups of people to participate in battle reenactments. They can physically roam around a room while acting out certain acts from a script of the relevant historical event for a specified role and engaging with other players inside the game. Participants see an augmented reality view that resembles a multiplayer role-playing game

thanks to tactile mobile devices. The participants have the opportunity to spend some time in various designated zones (inside the reenactment room) that represent actual locations important to the battle in question. A participant can interact with other users while remaining in the reenactment script set zone, such as by conversing, bargaining, voting on decisions, fighting, and so on.

In stage 2 (replay), the attendees are led to a projection room where they can consider what transpired. They have already experienced the war firsthand, with only a very limited view. Therefore, it is now their role to learn more by observing events from the outside and by evaluating how well their reproduction corresponds to the actual historical events. One expert provides the explanations, which may be visible on screen from a distant place or physically present in the projection room.

Finally, in stage 3 (debate) the expert leads a group brainstorming session about the short-term, medium-term, and long-term effects of the conflict. The projection screen transforms into a dynamic large board to display comments left by learners, which the expert can rearrange as the discussion progresses. The expert can at any time provide examples of the various issues raised by multimedia contents, which are chosen based on their applicability in the given situation.

METHODOLOGY

Interviews are part of the qualitative research approach. According to Bloomberg and Volpe (2008), there is several data-collection methods used in the qualitative research to choose from interviews, summative focus groups, document review, observation, or critical incident reports. In this study, interviews have been chosen as one of the primary data-collection methods because they have the potential to elicit rich, thick descriptions and could also give the researcher an opportunity to clarify statements and probe for additional information (Bloomberg and Volpe 2008).

In order for the data from the semi-structured interviews to be useful, it needs to be analyzed and the meanings understood (Saunders et al., 2009). Since the researchers did not have access to computer-aided-qualitative-data-analysis software, they undertook the analysis manually. The designed questions were open-ended ones so as the interviewees could answer freely and they could also add their ideas and opinions about the topic.

SEMI-STRUCTURED INTERVIEW

The semi-structured interview is known as a 'topical' or 'guided' interview. "With the more typical type – the topical or guided interview – the researchers explore a few general topics to help uncover the participants' views, but otherwise they respect the way the participants frame and structure the responses" (Smith, 2017, p.29). Semi-structured interviews, therefore; allow the researcher to guide the interview while still allowing the participant a sense of control, which in turn, could provoke much more depth in responses of the participant. The researcher has, therefore; concluded that this would be a beneficial method of research as the participants have wide experience in the proposed topic. Accordingly, this would not impose any restrictions on the participants' answers.

SAMPLE OF THE STUDY

Regarding the sample techniques, reenactment of Opet festival, were chosen to conduct the research as a model of augmented reality technology.

As for the interviews, during the process of gathering data, (11) informants were selected for interviewing on the subject. These interviews helped to gather in-depth knowledge about the topic that went beyond the questions from the survey. The interviewees were all related in a particular way to the aim of the study, as shown in Table (2). The interviews were recorded and transcribed in order to be analyzed properly. This method has been followed for being a common tool of collecting facts, which if they are gathered from reliable informants, they can be a complement to the qualitative data in the process of inferring patterns (Moses and Knutsen, 2012). Before the actual interviews, the researcher prepared an interview guide. The aim of the questions used during this stage of data collection, was to ensure validity and reliability. In other words, the questions were framed in such a way that they would not be misunderstood or loaded and that they could produce the same answers in different times and situations (Moses and Knutsen, 2012). The purpose of using interviews is to make sense out of what was said, and then to categorize ideas and to attain conclusions

INTERVIEW RESULTS

Semi-structured interviews were employed as a data gathering tool in this study. This interview approach is used for discovering what is going on, to get new ideas, to establish broad patterns, and to comprehend the relationship between variables (Altinay & Paraskevas, 2008, p. 113). Interviews were conducted between March and May 2023.

Based on a purposive or judgmental sample, the field study was conducted with (44) semi-structured interviews with the General Director of Antiquities for Luxor, directors of the Ministry of Tourism office in Luxor, and experts in the field of tourism and tour guides. Purposive sampling is important when the researcher wants to describe a phenomenon or to develop something about which only a little is known (Kumar, 2014:244). Moreover, Purposive sampling is based on the researcher's judgment as to who can provide the best data that achieves the study aim (Kumar2014). Fifty (50) potential interviewees were contacted, out of which (44) were actually conducted. The selected interviewees were considered experts and the most knowledgeable persons in their field to provide the researchers with suitable information that is necessary to develop an understanding of the problem and to provide recommendations to encourage the adoption of this new technology in archaeological sites.

The interview guide consisted of (44) open and closed questions. The first two questions collected data about the current position of respondents and their years of experience. The third question asked respondents about their familiarity with AR technology. The fourth question asked respondents about their opinions on the use of technology at archaeological sites in Luxor. The fifth question clarified the current technologies used at archaeological sites in Luxor. The sixth and seventh questions dealt with the respondents' opinions about the obstacles that face using augmented reality at the archaeological sites in Luxor. The eighth and ninth questions are employed to discover the respondents' opinions about the importance of using augmented reality to conserve and preserve cultural heritage, as well as to reenact historical events. The last question dealt with the respondents' opinion about using augmented reality technology in the case study that was selected for the study.

DATA ANALYSIS

The current positions and specializations of interviewees were as follows: academics, representatives from the Tourism Promotion Authority and all stakeholders, archaeologists, and tour guides. Concerning the years of experience, nearly all interviewees have long experience in their field (more than 10 years).

1. LEVEL OF FAMILIARITY WITH AR

Four of interviewees indicated that they were familiar with AR, while the rest of the interviewees were unfamiliar with AR.

Table (3): Respondents' familiarity with AR technology

level of familiarity with AR	Number of interviewees
Familiar	12 (27%)
Unfamiliar	32 (73%)

2. CURRENT TECHNOLOGIES WHICH ARE USED IN LUXOR

According to interviewees, Luxor has a website and uses VR for several archaeological sites. GPS navigation is also accessible in Luxor. According to all interviewees, "there is no free Wi-Fi service in the archaeological sites in Luxor." One of them went on to say, "Free Wi-Fi internet service will operate for free inside the archaeological sites in Luxor by the winter season in 2023." "There is a massive project to develop the technological infrastructure of the antiquities sector and to increase efficiency of the Internet," he continued.

Two other respondents confirmed that there is an agreement between the former governor of Luxor Governorate, the CEO of the Egyptian Telecom Company, and a number of the company's leaders to provide free high-speed Internet ("Wi-Fi") service in the tourist and archaeological areas of Luxor. It will start in the areas of Luxor Temple and Karnak Square, and then extend to a number of different areas in the governorate.

Another respondent mentioned the importance of using technology in archaeological areas, pointing out that there is a project to link information centers to them. Another respondent confirmed that Luxor implemented a project to install surveillance cameras in important and main streets and vital areas in the governorate.

3. IMPORTANCE OF USING TECHNOLOGY IN CULTURAL HERITAGE SITES

The vast majority of interviewees emphasized how crucial it is for cultural heritage sites to use new technologies in order to stay appealing and competitive, as well as the important roles that these new technologies play in preserving and sharing the history of these historic places. One interviewee stated that "This technology contributes to preserving the intangible heritage by re-presenting the ancient ceremonies and festivals, which include many rituals that are part of our cultural heritage." Other interviewee mentioned that "such new technologies are extremely important in conditions of lack of funds", the respondent continued, "There

are things that are difficult to complete and implement while we accomplish them using digital technology".

Another respondent added, "In addition to the great benefits it provides from preserving heritage and funds, augmented reality technology adds another benefit, which is enriching the tourist experience and satisfying the tourist, and they are most important - in managing tourism first by satisfying the tourist - and this technology will contribute to a satisfactory tourist experience - Current tourists, particularly young people, have grown more interested in technology. As a result, more travelers use smart phones and tablets to plan more memorable trips, search for information, and engage with other people online" According to another respondent, "the majority of heritage sites all over the world are now using technology to attract more tourists and to encourage revisits." According to one respondent, "using technology in heritage sites keeps these sites up to date."

However, few interviewees were completely objected to using this technology, because that will erase the work of guides. One of them mentioned that "I know the benefits offered by this technology, but it would reduce the importance of tour guides and, accordingly, the Tourist Guidance Department in universities."

Another respondent stated that "augmented reality technology can attract young people who use technology. Young people are the group that will be most interested in this technology."

A few respondents stated that "animated graphics and videos attract attention more than explanations and are more ingrained in memory." Another stated, "With the use of augmented reality technology, the tourism offer is diversified, making Luxor more competitive and unique."

Table (4): Importance of using technology in archeological sites in Luxor

Importance of using technology in archeological sites in Luxor	Number of interviewees
Prefer to use technology	36 (82%)
Objected to using technology	8 (18%)

4. CHALLENGES OF AR IN ARCHEOLOGICAL SITES IN LUXOR.

Despite the benefits of AR, all interviewees acknowledged that there are numerous hurdles to implementing the technology in archeological sites in Luxor.

In terms of human factors, one participant mentioned "one of the main reasons for failing to adopt AR technology is a lack of knowledge and awareness about the significance of such new technologies for heritage sites." According to another respondent, "the major barrier to implementing this unfamiliar technology is that the concerned institutions must consider the importance of AR for heritage sites." Another person mentioned "a lack of communication between those in charge of heritage sites and those in charge of technology." According to the same respondent, "generally, there is a lack of coordination between all responsible authorities." Another respondent believes that "change takes time for the new technologies to be trusted, and it is possible that technology faces disapproval at the beginning, and this is normal."

In terms of funding, one interviewee stated "another challenge is a lack of funds. Another respondent noted "almost all heritage sites lack the financial means to integrate new technology". However, another respondent mentioned "There are no financial challenges regarding the augmented reality technology, as this technology, as I explained earlier, saves a lot of money compared to the role it plays in the virtual construction of heritage sites." Regarding technological hurdles, one interviewee stated that "the implementation of AR technology in heritage sites is a challenge in itself" because implementing AR in the outdoors is more challenging than indoors - such as museums - due to many operational variables.

Another interviewee mentioned "AR outdoor systems should withstand all potential weather conditions such as rain, heat, and wind." Another interviewee stated, "the display is considered the major challenge during the usage of AR in heritage sites, because most AR applications use screen-based displays and direct sunlight may affect the image resolution, as well as the need for sufficient light sources to overcome the darkness during the night hours." Finally, almost all interviewees acknowledged that GPS effectiveness is a significant obstacle. Despite the usefulness of GPS for tracking in AR systems, it occasionally provides mistakes in the information provided in Luxor.

Another interviewee stated that "There are many bodies supervising archaeological areas, and their jurisdictions overlap."

5. POSSIBILITY OF IMPLEMENTING AND DESIGNING AUGMENTED REALITY TECHNOLOGY IN LUXOR

A number of respondents stated that "to adopt AR technology, all stakeholders must cooperate with each other to create a successful application." One of them stated, "The application of augmented reality needs software designers to create the application and to work on it, in addition to engineers in information and communication technology, as well as academics to create content, in cooperation with the Ministry of Tourism and Antiquities. Another of those interviewed added, "Working through a business model helps to achieve the success of the mission." as a result of the continuous change in the work environment.

6. IMPORTANCE OF AUGMENTED REALITY TECHNOLOGY IN PROTECTION OF ARCHEOLOGICAL SITES IN LUXOR

Table (5): Importance of AR in protection of archeological sites in Luxor

Importance of AR in protection of archeological sites in Luxor	Number of interviewees
Useful	40 (91%)
Not useful	4 (9%)

7. IMPORTANCE OF AUGMENTED REALITY TECHNOLOGY IN REENACTMENT OF HISTORICAL EVENTS.

Table (6): Importance of AR in reenactment of historical events in Luxor

Importance of AR in reenactment of historical events sites in Luxor	Number of interviewees
Useful	44 (100%)
Not useful	0 (0%)

9. USING AUGMENTED REALITY TECHNOLOGY IN RE-ENACTMENT OF OPET FESTIVAL

All the interviewees agreed about importance of the Opet Festival and that it is one of the largest ancient festivals, and one of them said, "It is necessary to preserve the intangible heritage by re-enactment of the ancient

festivals, because these festivals represent part of the ancient Egyptian identity, and it is also interesting to revive an important ancient festival." Such as the Opet Festival." Another added, "I am excited to witness such festivals, which will be unique and which will attract more tourists, in addition to the possibility of tourist to repeat the trip."

Another responded stated that "using augmented reality in reenactment making things memorable and eye-catching, sensory-oriented. This is a significant advantage of using augmented reality in marketing, for presentations or trying to reveal more details". Furthermore, another interviewee added that "AR is able to create new value in opet festivals. Another interviewee ensured that "What represents as one of the most significant benefits of using AR in reenactment is from a supply perspective because an increasing number of tourists are looking out for unique and memorable on trip experiences."

3-4 ANSWER OF THE RESEARCH QUESTIONS

There are five questions of the study. The answers were mentioned in the results and discussion. They can be summarized as follows:

- What is the importance of using augmented reality technology in archaeological sites in Luxor? This question was answered in table (4) which shows the results of interviews that indicated the importance of using Augmented Reality in archeological sites in Luxor. In addition, table (5) shows the important of AR in protection archeological sites in Luxor. Moreover, table (6) shows the important of AR in reenactment of historical events in Luxor.

- What is the possibility of implementing and designing augmented reality technology in Luxor? This question was answered in result of interviews page (15) which shows the possibility of implementing and designing augmented reality technology, and this also indicates the need for the application to be applied.

- What is the impact of using augmented reality technology in reenactment of historical events in Luxor? This question was answered in result of interviews on page (16) which show the impact of using augmented reality technology in reenactment of historical events.

- How is using augmented reality technology useful in reenactment of historical events in Luxor? This question was answered in literature review in page (10) which show reenactment of historical events in Luxor by using augmented reality technology. Furthermore, page (5)

indicated examples of Augmented Reality Applications in Archaeological Sites.

- What are the challenges and threats that face designing and using augmented reality technology in heritage sites in Luxor? This question was answered in result of interviews on page (15) which shows challenges that face designing and using augmented reality technology in archeological sites in Luxor

4- CONCLUSION AND RECOMMENDATIONS

The main aim of this research is exploring efficiency of using the augmented reality technology in reenactment of historical events in Luxor. The research aimed to understand the perspective of key organizations towards AR adoption. The literature review focused on the definition of AR, and on the implications of augmented reality for Tourism, tourism in Luxor, reenactment of the Opet festivals which was chosen as a case study. The practical study has been conducted to achieve the research aim and to clarify the importance of this technology for the protection and for conservation of the intangible cultural heritage (ICH) and to investigate possibility of implementing and designing augmented reality technology in Luxor. This is in addition to tackling the challenges that face the implementation of AR. Finally, this research provides suggestions that encourage AR implementation in historical sites in Luxor.• More than half of the respondents (73%) of interviewees are not familiar with augmented reality technology. This is agreed with Chung et al., 2015; Cranmer et al., 2016 which stated that despite the many advantages that augmented reality has brought to visitors and cultural heritage sites, its use is still not widespread and effective, and adoption has been slower than anticipated. In addition, the level of perception of interviewees about the benefits of using AR in archeological sites is high as (82%) of interviewees prefer using AR in archeological sites.

BASED ON BOTH THE LITERATURE REVIEWED AND THE PRACTICAL STUDY, THE FOLLOWING RECOMMENDATIONS COULD BE SUGGESTED

1. Using AR could capitalize on the uniqueness of historical sites in Luxor, allowing visitors to appreciate using augmented reality technology.
2. AR should be funded (grants, external funding, etc.), and revenue streams will be generated through secondary revenue, such as increased ticket sales, increased traffic and spending in the café or shop, and increased spending in the local area.

3. It is necessary to equip a number of headgear devices and augmented reality glasses for those visitors who do not have a smartphone or who want to experience augmented reality with these devices.

4. AR should be offered for free; there should be no additional fees for visitors to use and experience it. The cost of development, implementation, and maintenance should be covered as part of improving their experience.

5. It is advisable to integrate AR to improve education by providing additional information, and by tailoring information to different interests and knowledge levels, and through introducing an element of fun and excitement.

6. Academics should pay more attention for the studies and research that are   concerned with the usage of new technologies in cultural heritage sites. These studies provide both practitioners and academics with valuable information.

7. AR can be used to broaden the appeal, attracting people who are less specialized and more generalist. Tourist organizations should investigate the use of augmented reality (AR) to engage audiences, increase tourist numbers, and to encourage more sustainable year-round visitor flow. Similarly, corporations can think about incorporating AR to increase efficiency and efficacy of educating their visitors in order to improve learning. For example, this could be performed through introducing AR animations or overlays on current screens to demonstrate complex processes.

FUTURE STUDIES

A number of potential areas for future research can be identified from this research as indicated below;

- It is recommended for future research to examine AR pricing methods and revenue models because this remains an under-researched field to fully understand the success of proposed pricing methods and revenue models.
- As a newly identified AR benefit, it is suggested to further examine the potential of using AR to increase tourist attraction sustainability.
- The use of augmented reality technology has proven successful for reviving cultural heritage. However, the impact of using these technologies on the learning process of cultural heritage has not been studied in depth. Therefore, it is suggested for future studies to focus on using AR in the learning process.

- More research can be conducted to re-enact more ancient historical events in Egypt.

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