Augmented Reality's Role in Highlighting Historical Heritage / Kirkuk Citadel

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ABSTRACT

Augmented Reality (AR) is one of the technological developments in recent years that uses the real world as a basic pillar and enhances it by overlaying virtual objects created by computers. The study provides an overview of the use of augmented reality technology in meeting one of the most important requirements of cultural tourism: highlighting cultural and historical heritage. Accordingly, the research problem concentrated on the lack of local literature associated with the use of augmented reality in cultural tourism. It aimed to fill this gap by building a knowledge base and demonstrating the potential of augmented reality in this field. Hence, the importance of research in drawing the attention of tourism practitioners to the importance of augmented reality and discovering its potential. The research discusses the topics of cultural heritage, cultural tourism, augmented reality, and the study of its potential and applications in tourism. Augmented reality capabilities from the theoretical framework have been applied to Kirkuk Citadel -as a case of study- through the application of a proposal by the researcher for Kirkuk Citadel. The research concludes that augmented reality is an interactive scientific guide that supports the tourist, meets his cultural needs, and positively impacts the quality of tourism and tourist attractions.

The study is part of an ongoing research project aimed at developing the tourism of historic city centers through augmented reality technology.

Keywords: Augmented reality, Simulation, Historical heritage, Cultural tourism, Kirkuk Citadel.

دور الواقع المعزز في إبراز الإرث التاريخي / قلعة كركوك

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الخلاصة

الواقع المعزز (AR) أحد اهم التطورات التكنولوجية والثورات الرقمية في السنوات الأخيرة, يستخدم الواقع المعزز العالم الحقيقي كركيزة أساسية ويعززها بتراكب الكائنات الافتراضية التي انشأت بواسطة الكومبيوتر. تقدم الدراسة لمحة عامة عن استخدام تقنية الواقع المعزز في تلبية احد اهم متطلبات السياحة الثقافية, وهو ابراز الإرث الحضاري والتاريخي, وعليه تركزت مشكلة البحث في قلة الادبيات المحلية المرتبطة باستخدام الواقع المعزز AR في مجال السياحة الثقافية. لذا هدفت الدراسة على سد هذه الثغرة وذلك ببناء قاعدة معرفية وبيان امكانيات الواقع المعزز في هذا المجال. ومن هنا تتضح أهمية البحث في لفت انتباه القائمين في مجال السياحة الى أهمية الواقع المعزز واكتشاف امكانياته الكامنة التي تساعد في التعرف على المواقع التاريخية وإبراز ارثها الحضاري. يناقش البحث مواضيع التراث الثقافي والسياحة الثقافية والواقع المعزز ودراسة إمكاناته وتطبيقاته, في السياحة. وتم تطبيق إمكانيات الواقع المعزز المستخلصة من الاطار النظري على قلعة كركوك -كحالة دراسية- من خلال تطبيق مقترح من قبل الباحث خاص بقلعة كركوك. ويتوصل البحث الى ان الواقع المعزز يعد دليل علمي تفاعلي يدعم السائح ويلبي احتياجاته الثقافية وله تأثير إيجابي في تحسين جودة السياحة والجذب السياحي. تعد الدراسة جزء من مشروع بحثي مستمر يهدف لتطوير سياحة مراكز المدن التاريخية عبر تكنولوجيا الواقع المعزز.

الكلمات المفتاحية: الواقع المعزز, المحاكاة, الإرث التاريخي, السياحة الثقافية, قلعة كركوك.

1. INTRODUCTION

Augmented Reality technology (AR) has become one of the most important information and communication technologies in obtaining information in the twenty-first century more smoothly, interactively, and quickly. It is a complex technology based on integrating the real user environment with virtual digital elements in a scientific manner **(Milgram, 1994)** that helps to provide information and highlight the cultural heritage of historical sites and thus contributes to the development of the tourism field **(Boboc et al., 2022).**

Cultural heritage is of global interest, being one of the basic ingredients to reveal the civilizational depth of societies and highlight their cultural and intellectual development. It also represents the memory of people, as it is a source of knowledge and culture that reflects the values, ideas, beliefs, and traditions of society, so many international cultural organizations pay attention to cultural heritage and its preservation in the World Heritage Convention, UNESCO considered that cultural heritage includes all architectural works, elements, and inscriptions that separate buildings, collections, or Archaeological sites of exceptional historical., aesthetic or scientific value **(UNESCO, 1972).** Hassan Fathi expresses the heritage that each society has its ideas, folk arts, forms of clothing, languages, and architectural styles, which are loved by their people and stemming from their conscience, as it is the product of the marriage of society's ideas and the requirements of the environment **(Ibrahim, 1987),** which is an irreplaceable historical record that expresses identity and

experience and reflects the cultural significance of society **(ICOMOS, 2013).** The Convention for the Protection of World Heritage classified heritage into two categories (natural heritage) and (cultural heritage) **(Tareq, 2017),** where the latter represents all monuments of high exceptional value, whether historical., scientific, or artistic, and cultural heritage includes (physical heritage) its physical elements built from architectural sites, World Heritage sites, and national historical monuments **(UNESCO, 1972).** (Intangible heritage) folklore reflects a sense of belonging and identity and is represented by skills, handicrafts, cultures, customs, and traditions **(UNESCO, 2003).** Generally, heritage refers to moral values associated with memories, meanings, skills, techniques, and heritage customs **(Alsaliq, 2015).** Thus, cultural heritage mirrors society's civilization and embodies the events that have passed through history and the product of everything built by man. It is not limited to temples and historical buildings but includes a wide range of unspecified tangible and intangible elements of value, such as historical centers, customs, and traditions. Heritage has an important role in highlighting the authenticity and identity of people and is closely related to society's economic and social dimensions.

While cultural tourism is one of the types of tourism that a certain segment of tourists with a level of culture and education are interested in, this tourism is linked to cultural., historical., and educational motivations. It is to visit archaeological areas, see antiquities, and learn about ancient civilizations' history, customs, and traditions **(Ghadban, 2014)**. Cultural tourism is usually seen broadly as linked to discovering cultural and historical heritage and social identity **(Albazzaz, 2017).** ICOMOS classified it as a wide range of tourist activities that attract international and local tourists, consisting of discovering and experiencing cultural environments and learning about different cultures, civilizations, values, and customs **(ICOMOS, 2002),** as well as trips to places of cultural interest such as museums, art galleries, and festivals **(Medlik, 2003),** and heritage markets are one of the pillars of cultural tourism in all countries of the world **(Alwan, 2009).** Non-financial objectives (such as protecting and respecting the authenticity and diversity of cultural values, building awareness and education) often have the strongest role than financial objectives and achieving gains **(ICOMOS, 1976).**

Cultural tourism overlaps with other patterns, where it shares with religious tourism the same motivations and purposes, as being places of spiritual and historical value, as well as its association with recreational tourism in terms of comfort and recreation, in addition to representing educational tourism for the historical and cultural information received by the tourist.

The World Tourism Organization has defined the tourism elements or so-called (Tourism products) as a combination of tangible and intangible elements, services, and activities. They are tourist attractions that create a comprehensive tourist experience, including emotional aspects **(Medlik, 2003)**. Cultural tourism products can be classified into basic attractions represented by the place, such as archaeological sites, museums, monuments, and symbolic monuments. Supporting tourism elements associated with and support the main attractions, which are tourism services in terms of infrastructure services, road services, transportation, and good management, and complementary tourism elements that support, enhance the basic and secondary elements and make them more attractive to tourists, represented by accommodation, recreational and commercial services. The effects of cultural tourism on historical sites and all sectors directly appear as planners try to maximize their positive impacts and minimize their negative effects. **Table 1** summarizes these impacts.

Table 1. Positive and negative impacts of tourism historical centers

Ref.	Positive impacts	Negative impacts
(ICOMOS, 1976)	Preserving and highlighting the urban heritage and ensuring sustainability and continuity, at the same time, the urban heritage provides tourism with distinctive attractions and economic resources.	Mismanagement and intensive and uncontrolled use lead to damage and vandalism to the physical and historical environment, which negatively affects the sense of place and cultural identity
(Ripp, 2009)	Improving the aesthetic image of historical sites and monitoring pollution and noise improves the quality of the environment.	Indiscriminate investment leads to optical image change and environmental degradation, such as energy use, polluting emissions, waste, etc.
(Abdel Hakim, 2012)	Economic impacts of attracting investments, creating jobs for locals, and improving the quality of life and standard of living	Inflation and the consequent rise in the prices of services, the use of foreign employment, and the dispensation of local employment.
(Ghadban, 2014)	Increasing interest in developing transport services and infrastructure and improving their efficiency, as the importance of these services isn't limited to tourists only, but also to local communities.	Overcrowding in traffic congestion and pressure on infrastructure networks and basic services result from the increase in the rate of consumption by tourists and residents.
(Csapó, 2012)	Replacing activities incompatible with heritage and repurposing historical buildings as tourism products that develop culture, traditions, and collective memory and protect them from extinction and loss.	The exploitation of cultural heritage as a trade, where museum numbers have multiplied for economic and commercial reasons away from cultural objectives.

In **Table 1,** cultural tourism is a double-edged sword. Its positive effects appear when used as an economic policy tool based on the sustainable use and management of available resources and capabilities, and vice versa. Its negative effects appear when it lacks these data, so it needs to be studied and well planned to address the challenges and negative impacts that hinder tourism movement growth and enable special regulations and laws in developing tourism to historical sites as they are tourist treasures that must be preserved.

2. AUGMENTED REALITY AR

Augmented Reality definitions are multiple. Most of them refer to real scenes that have been improved or enhanced by digital virtual information and graphics created by computers (**Milgram, 1994). I**t is the technology based on projecting virtual objects and data into the real user's environment to improve and increase the user's sensory perception of reality and the surrounding environment; thus, the information becomes more interactive and can be controlled digitally **(Kounavis et al., 2012).** some synonymous terms and meanings refer to augmented reality in various literature, such as alternative, enhanced, hybrid, false, digital., integrated, immersive, and others, all signify Augmented Reality and symbolize AR (**Peddie, 2017).** which means the addition, improvement, and combining of the virtual and real worlds, where the user realizes that real and virtual objects synchronize in the same place and time and can be dealt with and interacted with **(Fritz et al., 2005),** Augmented reality integrates virtual information with the user's physical environment, through a display in which computer graphics overlay spatially on geographical locations and the real environment **(Julier, 2000).** In a simple sense, Baltsavias indicates that augmented reality

is a whole new way of imagining spatial environments by inserting digital data into the user's real environment in the form of digital signs or information that can respond to external influences such as changing data sources or user interactions **(Baltsavias, 2005).**

Augmented reality aims to complete the real world rather than create a completely artificial environment, where physical objects in the user's surroundings become the background, and computer-generated digital content is the target element **(Höllerer, 2004).** Augmented reality applications are written in a special software language that promotes visual enhancement, consisting of digital synthetic information in images, text, video, or GPS data **(Yovcheva et al., 2012).** also includes sounds and tactile reactions that intensify one's understanding of the real world, improving the user experience and contributing to the dissemination of culture and knowledge **(Aggarwal., 2019). T**his enhanced information is also closely related to the real environment, often (a spatial relationship), and is known as Registration **(Bimber, 2005).**

Augmented Reality AR applications require specific software and devices that allow the integration of virtual objects with the real world, as most of these devices are connected to the Internet, these devices can be divided into input devices (it's intermediary between the user and the AR system, represented by touching on the user's screen in mobile devices, gloves with sensors, gestures, speaking), Sensors (used for tracking purposes and locating the user or object, consisting of tracking devices and technologies such as GPS, ultrasound, etc.) **(Arena et al., 2022)**, and display devices that allow the user to interact with the AR system, there are many types of display devices that are often small, easy to carry, and relatively inexpensive, designed to meet user's information needs (**Tussyadiah et al., 2018),** can be classified into spatial devices **Fig. 1a** represents visual-spatial displays such as transparent LCD screens, which are not connected to the user and does not allow interaction with it, characterized by a fixed, high resolution, higher field of view, easily controllable, and comfortable for the eye **(Bimber, 2005).** Head-warn wearables **Fig. 1b** are represented by HUD (head-up display), HMDs (head-mounted displays), smart glasses, Helmets, and contact lenses **(Peddie, 2017).** Hand-held devices **Fig. 1c** are an ideal platform for AR because of their screen, colors, compact camera, fast processors, lightweight devices, ease to handle and control, and inexpensive compared to other devices **(Wang, 2008**).

Different projectors have advantages and disadvantages, and the criteria for selecting the display depend basically on the user's desire in terms of weight, size, or cost, in addition to the accuracy and quality of the image, transparency of the display, and field of view, as well as the sense of interaction. Smartphones are the most widely used, as they can combine the necessary features and technologies in one pocket device.

| (a) | (b) | (c) |

Figure 1. Display devices of Augmented reality**.** a) Spatial display **(Ogi et al., 2001)**
b) Augmented reality glasses **(Microsoft.com),** c) handheld device **(Banerjee, 2011)**

3. THE POTENTIAL OF AUGMENTED REALITY IN TOURISM

UNWTO urges the use of technological services and new technologies in the tourism industry and the focus on augmented reality technology by stakeholders, as it contributes to improving the competitiveness of cultural tourism and promoting its sustainable development **(UNWTO, 2021),** experiences have proven that augmented reality technology plays an important role in the tourism industry by engaging visitors with immersive educational experiences, more specialized services to meet their specific needs, improve their knowledge of their tourism destination or attractions, and provide higher levels of entertainment during tourism **(Kounavis et al., 2012).**

Tuscany+, the first AR application developed specifically for the tourism and culture promotion campaign in Tuscany as a digital tourist guide, showing a set of information and data taken from websites in a multimedia format and virtual elements when pointing the phone's camera anywhere in the city, it also allows the user to know the distance between important landmarks and area services, an interactive application not only for tourists but also for the local population. Augmented reality is usually used in cultural tourism for several reasons, the most important of which is a guide providing flexible and up-to-date content, especially in tourist destinations that lack sufficient financing opportunities for maintenance or development **(Han, 2013).** Augmented reality is used in inaccessible locations **(Boboc et al., 2022),** as in national parks in the United States, augmented reality stations have added telescope-like devices that allow the experience of augmented reality at archaeological sites on distant slopes that overlay graphics and images on the real world, and display information over archaeological excavation remains **(Fritz et al., 2005).** Augmented reality also provides the opportunity to replace the absent senses of persons with disabilities. For example, it can provide information and auditory signals related to the coordinates and characteristics of the place, guiding people with visual impairment and blind people while roaming easily **(Höllerer, 2004).** Augmented reality is used to preserve the environment by using virtual space in mobile applications dealing with the issue of space and limiting the placement of billboards, which are likely to alter or negatively affect urban heritage sites **(Jung, 2014).** As well as using augmented reality to achieve scientific goals and improve the tourist experience in external and domestic tourism environments such as museums **(Ossmann, 2021)** and in Supporting the local economy by attracting investments to tourist sites and marketing products, expertise, and social benefits. Academics and practitioners in the tourism industry believe that augmented reality is a technological tool of an industrial nature that stimulate the tourism experience by enhancing the immediate surrounding and that its potential in this field is still not widely exploited **(Jung, 2014), Table 2** shows the importance of augmented reality in the development of that industry.

The potential of augmented reality in tourism consists in giving more interactivity, realism, and additional information in better visualizing and understanding the history of the site, and also as an assistant in the site and navigation services; thus, AR technology becoming an attraction per se **(Dela Cruz, 2018).**

The rapid pace of technological developments far exceeds the ability to exploit the potential of augmented reality (AR) in cultural tourism and enhance the tourist experience, although developers are constantly working to improve the technological standards of augmented reality. Since the research aims to develop cultural tourism and highlight historical heritage, it will focus on leveraging the potential of augmented reality in this aspect:

Table 2. The importance of simulation systems that can be employed specifically in tourism and cultural tourism**.**

The importance of AR in tourism	Details
Guideline	A virtual mobile tour guide without the need for guides or guidebooks **(Jung, 2014)**.
Education and cultural enrichment	It provides a database, an educational environment, and an instant search and browsing mechanism to access relevant information and data accurately and constantly updated**(Boboc et al., 2022)**.
Augmented Transportation	Directions, navigation, location, and information about specific points of interest (POIs) using the Global Navigation System (GPS) also provide regional maps service and metro maps **(Yovcheva et al., 2012)**.
Discovery	Tourists manage their own tourism experience by planning the itinerary, discovering the urban surroundings of the tourist site, searching for information or services, and Important places of interest (POIs) can be added to the itinerary **(Tussyadiah et al., 2018)**.
Interactive AR view	This is done by integration with online social networks, allowing for interaction with annotations, sharing information, expressing opinions, and providing more information about specific POI points**(Kounavis et al., 2012)**.
Decision-Making	Supports individual and participatory decision-making processes and enhances experiences regarding improving user experiences **(Pereira et al., 2018)**.
Simulation	Simulating the future and rebuilding the past through the possibility of digitally rebuilding historical places in their sites as they were in that era, which contributes to spreading cultural heritage, preserving local identity, and reviving community memory **(Fritz et al., 2005)**.
Managing tourism flows	Track and monitor tourists, know the capacity of cultural sites, and gauge their satisfaction with the site to improve the tourist experience in general**(Tussyadiah et al., 2018)**.
AR Translation	Augmented reality instantly translates a written text into the user's language by overlaying translated phrases over real text **(Pereira et al., 2018)**.
Documented and preserved cultural heritage	Digitization technology is a complementary way to preserve cultural heritage, documenting architectural monuments, arts, engineers' work, architectural changes over the ages, and countless other possibilities **(Höllerer, 2004)**.

According to the UNESCO Charter for the Preservation of Digital Heritage, Preserve and protect the cultural heritage and permanent value and importance, whether cultural., educational., or technical, in a digital manner, including texts, databases, static and moving images, audio, etc. for future generations. **(UNESCO, 2009).** Digitization techniques (augmented reality) are used within the preservation sector in the preservation and digital documentation of cultural heritage, especially in sites threatened by natural disasters or terrorist acts, where the recording of valuable information related to the historical site,

represented in urban, historical and technical details **(Boboc et al., 2022).** It works on Dissemination and displays cultural assets worldwide **(Baltsavias, 2005).**

Digitization techniques (AR) are also used for educational use for tourists and users where information relevant to cultural heritage is updated **(Han, 2013).** A visible incorporating digital objects (documented images, videos, or text information) that appear in the physical environment and are integrated with it, taking tourists on a journey through time to explore historical and archaeological sites and places and overcome the temporal and spatial dimension **(Jung, 2014) Fig. 2.** Augmented Reality is also an attractive way for tourism, which the London Museum found in 2010 The use of augmented reality has increased the attraction by allowing exploring and visualizing the city of London's history in 200 different locations, displaying historical two-dimensional images (taken from the Museum of London) in their actual place once the mobile camera is directed to current street scenes, via the augmented reality app (Street Museum) **(Kounavis et al., 2012).**
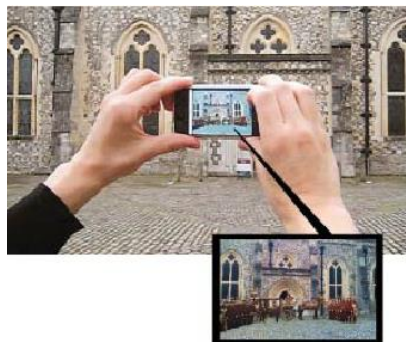
Figure 2. Use augmented reality in preserving and highlighting cultural heritage in the courtyard of Winchester Castle **(Jung, 2011)**

The potential of augmented reality in the restoration and reconstruction of the remains of old buildings that are lost or not in good physical condition (often within historical sites) appears in three dimensions manner and their original location while providing relevant information to help tourists understand these historical buildings and monuments **(Höllerer, 2004),** where a tourist can see the non-existent elements and missing parts of historical monuments that are digitally defunct and incomplete landmarks within the real environment, the landmark appears complete when the phone screen is pointed at the ruins of the building **Fig. 3 (Fritz et al., 2005).** It allows a better understanding and experience of history through more accessible and interactive ways. Moreover, the possibility of augmented reality in the digital restoration of degraded historical monuments reduces costs and helps planners and specialists in the field of tourism and archaeology to determine the most appropriate approach and method for the revival of degraded physical cultural heritage **(Boboc et al., 2022). Table 3** summarizes the effective potential of augmented reality for achieving the research objective (highlighting the cultural heritage) and applying it to the study area.
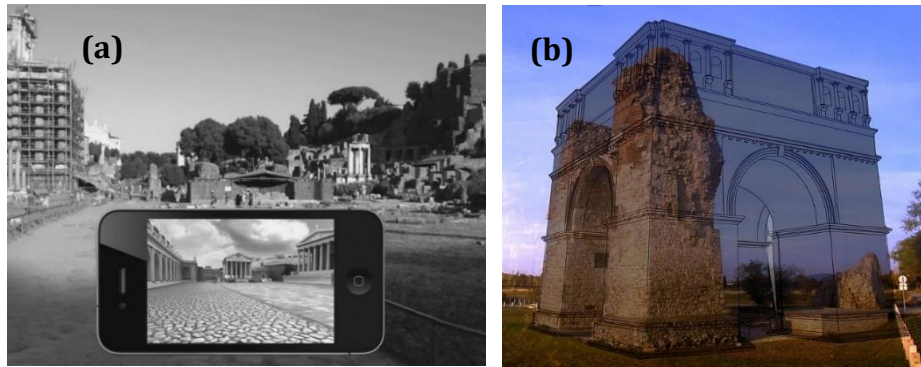
Figure 3. Some examples that show the potential of augmented reality in simulating the future and reconstructing the past. a) The Roman form **(LiestØl, 2015),** The Heidentor Gate/Austria **(Shushan, 2018)**

Table 3. Extracting the potential of augmented reality in cultural tourism and highlighting cultural heritage

The potential of AR to highlight cultural heritage	Details
Digital Documentation	It is the process of digitally saving and storing valuable information related to the historical site, represented by urban, historical., and artistic details, without making any change or modification to ensure it is saved and accessed accurately and reliably over a long period **(Boboc et al., 2022)**.
preservation	Preserve the external structure of the historic building and extend to include all necessary measures to preserve the urban entity and its special character, urban identity, and historical., architectural., and artistic values **(Jung, 2011).**
Simulation of the past	Enriching the historical site with textual information, images, or three-dimensional representations takes the tourist on a journey through time to explore historical and archaeological sites and places no longer available **(Baltsavias, 2005).**
Reconstruction	Reconstruct the remains of lost old historical buildings in three dimensions with the same shape, location, and details to help tourists understand these buildings and historical landmarks **(Fritz et al., 2005).**
Tour guide	It serves as a mobile guided and virtual tourist guide without needing guides or guidebooks at the historical site **(Höllerer, 2004).**
Urban revitalization	It is represented by reviving tourism by integrating tourism activities and events of the historical site with the events within its urban fabric and creating complementary functions to attract people and activities **(Pereira et al., 2018)**.

4. THE HISTORICAL KIRKUK CITADEL AND ITS ROLE IN CULTURAL TOURISM

Kirkuk Citadel is the center city historical of Kirkuk and the oldest part of the urban city; built for defensive reasons and the need for protection and immunization, it was a civilized, religious, and cultural center and then became more like a residential area with many residential houses within its urban fabric **(Mokhtar, 2017)**. Kirkuk Citadel has a semi-rectangular shape with rounded corners and dimensions (400*500)m **(Saban, 2021). B**uilt on a hill -overlooking the Khassa River- it rises above the level of the adjacent land about 18m. Its sides slope from all sides gradually downward **(Ahmed, 2002), Fig. 4** The area of the Citadel is 25 hectares and has four main entrances; inhabited from mid-3rd BC to the

present time **(Maarouf, 2004)** Where Muslims (Kurds, Arabs, and Turkmen) have been juxtaposed with their Christian brethren for many centuries **(Alwan, 2013).**


Figure 4. Panorama of Kirkuk Citadel (silhouette) **(Mokhtar, 2017)**

Kirkuk Citadel represented an integrated city, including various land uses linked to a series of mutual relations between the parts of its urban system **Fig 6**. However, as a result of the demolition of the Citadel in 1997, the bulk of residential use disappeared, including narrow winding alleyways the facades of its houses and arches, so it became part of history. Only some individual monuments and houses stripped of their organic urban fabric remained **(Saban, 2021) Fig. 5.** Urban Citadel components can be divided according to the five main elements of Kevin Lynch in the division of the urban structure of the city, **Fig. 6**:

- **Paths** are networks of movement where the Kirkuk Citadel is characterized by its layout linked to its four gates that lead to the main streets in the city, represented by the organic narrow alleys that connect the city's areas and residential lanes **(Mokhtar, 2017), Fig. 6**
- **Edges** are the linear frontiers (fences) used to fortify the Citadel in lower-lying places and reduce collapses that may occur at the edges of the hill **(Al-Darraji, 2018).**
- **Nodes** are gathering places and stops, represented by the intersections of alleys known as (Maidan), which are open spaces for gathering people and may be an open market **(Mokhtar, 2017). Fig. 6** shows a general shortage of open spaces and green areas**.**
- **District:** The largest part of the city, represented by the residential use **Fig. 6**, is distributed over three Sectors: Maidan, Aghlaq, and Hammam **(Dinç, 2018).** These residential Sectors include many Heritage houses, which are similar in planning and differ in spaces and decorations according to their owner's capabilities **(Al-Hermzi, 2008).** It combines various methods showing the ingenuity of architecture, interest in local heritage, and openness to renewal. It forms a distinctive style that reflects social life, customs, traditions, and climate requirements**.** Permeated residential use religious and service buildings such as (Kayseriya Kirkuk Citadel) and several schools **(Al-Darraji, 2018)**.

(a)   (b)
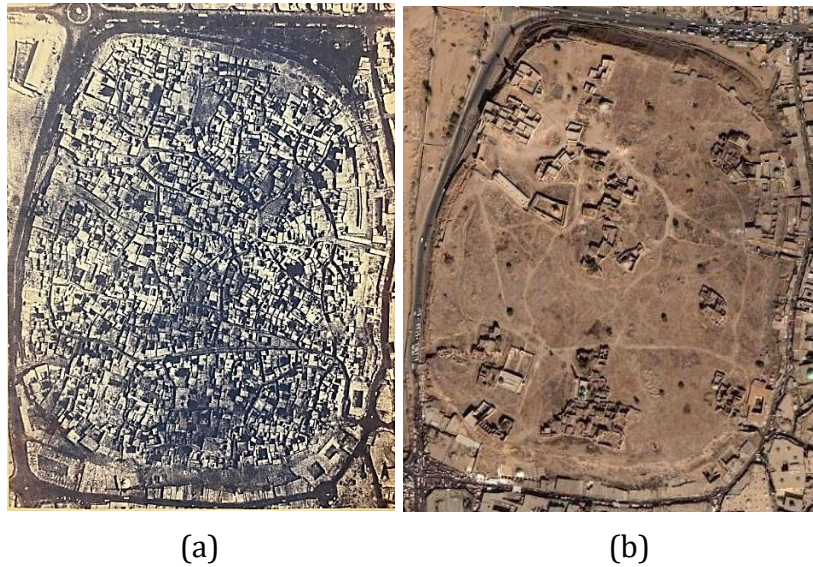
Figure 5. Kirkuk Citadel before and after demolition, (a) Kirkuk Citadel with its organic texture before demolition in 1975 **(Doxiadis, 1976),** b) Current situation after demolition **(Mokhtar, 2017).**
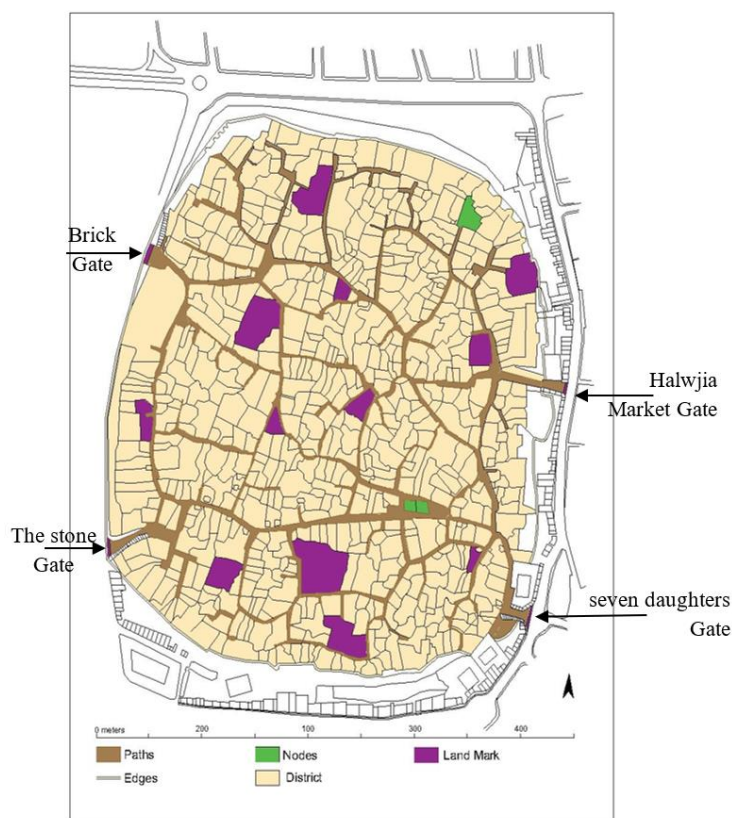
Figure 6. A diagram showing the division of the urban structure
of the Kirkuk Citadel, according to Kevin Lynch's main elements.

· **Landmark**: They are the reference points that are inferred, and they are mosques and religious buildings such as the Mosque of the Prophet Daniel, the Great Mosque known as (Mary Anna), the Cathedral of Um Al-Ahzan, the Green Dome, and others, as well as the

gates of Kirkuk Citadel **Fig. 7** of the important features in the Citadel. They are the main entrances to the Citadel and are represented by four gates: Brick Qabo, the stone gate (Dash Qabo), the gate of the seven daughters (Yedi Qizler), and the gate of the Halwjia market (Helwa Geler Pazari) **(Mahmoud**, **2016) Fig. 6.** Thus, the Kirkuk Citadel included all the features and characteristics of distinct universal value despite losing some of its urban fabric. However, this does not affect the authenticity of the historical site and its importance in representing the civilized roles that passed through Mesopotamia. This qualifies Kirkuk Citadel to be included in the World Heritage List and to develop its cultural tourism in a way that enhances its importance and does not affect it negatively.

Figure 7. Kirkuk Citadel gate the only gate that exists to Date **(Department of Antiquities Kirkuk)** a) The Brick Gate, b) The stone gate with stone stairs **(Oglu, 2019)**

5. THE ROLE OF AUGMENTED REALITY IN THE DEVELOPMENT OF KIRKUK CITADEL TOURISM

After reviewing the cultural tourism related to cultural heritage and its relationship to augmented reality, as well as identifying the history of Kirkuk Citadel and analyzing its urban structure, now consider the most important aspect of the research of applying the capabilities extracted from the theoretical framework Table (3) on Kirkuk Citadel at interconnected levels to achieve the desired goal (highlighting the cultural heritage of Kirkuk Citadel) taking into account the moral., cultural and civilizational aspects of the architectural heritage, Based on the application proposed by the researcher for Kirkuk Citadel AR **(Kirkuk Citadel AR) Fig. 8**, it aims to deliver information to users and tourists in a simple way and to highlight the castle's tourism potential for stakeholders to reuse and revive it again and thus revive tourism in Kirkuk Castle, in an innovative and simplified way in terms of use and data addition, taking into account the context and urban and historical aspects.

Figure 8. The homepage of the proposed application **(Kirkuk Citadel AR)**

5.1 Digital Documentation

By augmented reality techniques, special digital content can be created to document Kirkuk Citadel Based on reliable information, data, and documentation. For example, relevant data is recorded to document the green dome digitization, such as the building's history, name, and reason for construction, etc. Urban and historical details, as well as original building plans and the changes that have passed in the building in different periods, are entered and stored in the database for augmented reality application. The location is also installed with GPS. When the user directs the phone screen toward the building, this data appears as digital elements such as images, videos, text, location, and three-dimensional charts on the user's real environment in an interactive and easy-to-use way **Fig. 9**

Figure 9. The image of the green dome - before returning it to its original form - appears when using an augmented reality app

5.2 Preservation

Augmented reality technology is not limited to the architectural preservation processes of the external structure of historical buildings. However, it extends to include all necessary measures to preserve the Citadel's entity, its special character, and its historical and cultural value, including (silhouette), which must be protected as a scene by providing additional

information about the condition of those monuments and problems that need to be repaired and restored.

5.3 Simulating the Past

Augmented reality provides the ability to view historical layers of the brick gate and enrich the site via graphic representation (based on the database taken from the department of Antiquities) **Fig. 10**, which leads to the revival of the community's memory and local identity and digitally simulates the past as it was in that period. The possibility of augmented reality is not limited to image representation but can enhance reality with three-dimensional representation, text information, and videos of historic buildings that are no longer available.

Figure 10. Simulate the past and revive the user's memory by showing images of the original brick gate when using augmented reality

5.4 Reconstruction

Advanced augmented reality technology is used to present suggestions for the reuse of demolished buildings in the form of three-dimensional plans and models that allow the user and stakeholders to see and experience the building realistically before starting the implementation work and in a manner commensurate with the nature of the building, which facilitates the decision-making process in the appropriate function of the building.

One of the potentials of augmented reality in presenting the proposal for the reconstruction of one of the demolished heritage houses in the Citadel with its original facades -based on documents and data taken from the Department of Antiquities and taking into account local cultural and architectural trends and other factors - and reusing it as a popular heritage market, which increases its heritage, moral and economic value and preserves the Citadel's local identity **Fig. 11**

Figure 11. The possibility of augmented reality in a proposal to reuse one of the demolished heritage houses in Kirkuk Citadel as a heritage market after its reconstruction**.**

5.5 Tour Guide

Augmented reality provides a unique tourism experience through an easy-to-use and interactive interface that enriches the user experience and enhances their understanding of reality by mixing virtual and real models within one environment and in three or two-dimensional form, allowing the experience of the past and the future in general and providing additional information about urban landmarks and existing historical monuments, and seeing the demolished ones and knowing their details and elements clearly and accurately, this makes it easier to explore and understand.

5.6 Urban Revitalization

Augmented reality connects the Citadel with its urban surroundings. It gives the urban landscape an integrated vision that reflects historical continuity, spatial continuity, visual continuity, and integration of an all-and-part perspective by knowing the spatial signature of the tourist attractions and activating the surrounding linking movement lines that emphasize the role of the Citadel as a basic urban node based on GPS, with attention to pedestrian movement inside the Citadel to support the tourist orientation. And present proposals for the reuse of heritage buildings that integrate tourism activities and vital events in the Citadel with the events in the fabric of the area surrounding the Citadel, propose new complementary functions, sign them, and test their suitability for the site more efficiently than traditional methods that attract people and activities and thus enhance connectivity to the city. As well as following the policy of urban conservation at the level of (whole – part), not limited to the rehabilitation and development of the historical and heritage features of the Citadel, but also to develop of the external image of the Citadel and its urban fabric surrounding the rehabilitation of its facades, making it a historical landmark viewed from outside.

6. CONCLUSIONS

Augmented reality does not replace reality but improves its content and develops discovery and knowledge, especially about cultural heritage. The research provided an overview of cultural tourism for cultural heritage and the field of augmented reality and studied its

potential in developing cultural tourism and highlighting historical heritage. Regarding the relationship between modern techniques and tourism, we can conclude that technologies are increasingly integrated in tourism. This integration is effective and clear in its multiple aspects (digital documentation, preservation, simulation of the past, reconstruction, Tour Guide, and urban revitalization). It digitally does not affect the actual cultural values of historical sites but rather increases their civilizational., economic, and social value and works to enrich and enhance the user's tourism experience. Thus, the validity of the research hypothesis shows that augmented reality technology in tourism has a clear role in highlighting cultural heritage and thus contributes to the development of cultural tourism in an integrated and effective manner, taking into account the need for high accuracy, advanced performance in design and implementation, and high financial resources to ensure the success of the augmented reality experience in tourism.

Most of the previous studies related to the use of augmented reality in tourism are theoretical studies that emphasize the importance of using AR in historical sites to highlight their cultural heritage and increase tourist attractions without actual application. This is what different from the current research in which the researcher tried to propose an application special for the study area that is easy to use, available for all phone systems, in which all data is taken from the Department of Antiquities, Books and Special Research, It combines all the potential of augmented reality in one application in a way that sings the tourist (user) from tourist guides, and highlights the importance of the historical Kirkuk Citadel and revives it touristically and economically, as well as highlighting its tourism potential for stakeholders to revive and reuse it.

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