Interactive Modelling of lost Landmarks – Qishla of Mosul a Case Study

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ARTICLE INFO	Abstract
	The recent technological development in many fields has made a significant contribution to the reconstruction of a historical buildings. The matter becomes complicated when the buildings are destroyed, and it is required to collect as many different sources of information as possible. The research problem lies in the absence of studies on reconstructing the lost historical landmarks in the old Mosul city in an interactive 4D modelling. This study aims to develop a strategy to reconstruct historical cultural landmarks in an interactive digital way, based on the collection and integration of multiple sources of information, in addition to an attempt to extrapolate the lost elements based on similar data and various available information, and all this using available software techniques to create interactive environments. To produce documents that can be used in the process of restoring the real origin as an advanced engineering document, used for future periodic maintenance and preservation purposes. The study seeks to reconstruct the military Qishla building in the completely destroyed in Mosul, as a case study, using multiple tools and techniques, in parallel with the techniques Modern digital, and various CAD programs for engineering and parametric drawing and Ar-media augmented reality app.

1. Introduction

The process of preserving historical buildings stems from the human interest in something because it has a value that makes it distinct from others [1], Preserving historical buildings is intended to preserve its distinctive characteristics, as each building has something that distinguishes it from others, and thus the method of dealing with the building varies from case to case [2]. At present, the reconstruction of historical buildings offers significant advantages in the field of urban heritage at different levels (culturally, economically and socially). The problem increases when the country is exposed to successive wars that led to the loss of many heritage monuments, and despite the attempt of some countries to rebuild

the vanished monuments, these attempts must be at a high level of accuracy and credibility, and avoid personal judgments and individual self-efforts [3]. The technological development that the world is witnessing recently and, in all fields, has led to the emergence of new concepts and modern and diverse methods in the field of urban heritage preservation, such as the use of interactive modeling techniques in the field of urban heritage preservation [4]. The ancient Mosul city contains many monuments and buildings of historical and architectural value and importance, which express the identity of the city [5]. After a large number of these monuments were subjected to destruction and disappearance over the years, it became necessary to take the necessary measures to preserve them through the available methods

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[6]. The research aims to provide a working approach through which a holistic perception of the vanished features is formed based on logical reasoning, to achieve this, it is necessary to collect information from multiple sources, try to analyze its content and synthesize the information, fill the knowledge gap by analyzing similar data, and by integrating it with software techniques, interactive models of the vanished landmarks are created.

2. Theoretical framework

2.1. Heritage and urban preservation

Heritage represents everything left by the ancestors and must be preserved by restoring it or preserving it as much as possible in order to pass it from generation to generation [7], As for its value, it is the possession of a historical, archaeological, architectural, technical, beauty, scientific, spiritual, social, and other aspects of excellence that are related to human activity [8]. The urban heritage is exposed to risks that lead to its extinction, loss in whole or in part, and some of these dangers are great and difficult to avoid and others are controlled. There are many factors that affect the value of heritage monuments and facilities and that contribute to their deterioration and destruction, including physicochemical and natural factors of damage, in addition to the impact of wars and disasters such as earthquakes and fires [2]. Feledien (2003) [9] defined preservation as all measures taken to prevent the deterioration of the building, and that the lower degrees of intervention are the better for the building for the purpose of its preservation, The process of virtual reconstruction is one of the methods used to enhance the preservation of urban heritage, which can be classified into two main categories: Preventive Conservation, which means all mechanisms that reduce levels of deterioration and reduce risks to buildings in the future to a minimum, and it is included in sustainable use. For buildings, curative conservation and it means all the procedures that are applied directly to the structure to stop the deterioration processes or to strengthen and support the buildings [9].

2.2 Digital representation of urban heritage

The introduction of technology into the urban heritage has provided great potentials that have contributed greatly to its digital re-representation by making use of 3D scanning tools, modeling tools, virtual reality technology, building information modeling, and so on, a kind of trend that requires a large amount of data and information sources and a comprehensive approach to reach a good level in addition to integrate the efforts of specialists in different sectors [10], The digital reconstruction of buildings is classified according to its dimensions into: 2D; 2.5D; 3D; 4D; 5D. And any of them can be used according to the goal and purpose, the available systems and programs, the type of users and the information to be conveyed through the representation process [11]. Virtual Reality represents the technology that proposes and presents a believable reality despite its non-existence, and it is defined as a figurative scene to re-enact the elements linked to a tree-hierarchical of a visual database [12]. Recent research and studies have shown that virtual reality enhances the understanding and awareness of space and details. As for its types, they are represented by the immersive systems; non immersive system; Augmented reality systems. The latter, sometimes called Mixed Reality, is a technology based on the signature of virtual elements or components in the user's real-world environment within displays to provide additional information through sensory inputs generated by a computer, such as sound, video, and graphics. This technology enables users to deal with information about items through devices such as glasses, smartphones and tablets [13].

2.3 Previous studies

Several studies have dealt with the concept of digital representation of urban heritage with three-dimensional models and interactive environments. These studies have been applied to the re-representation of historical buildings, whether they exist or are completely or partially destroyed. (Jacob and Nobreg) [14] discuss how augmented reality technology can be used in

virtual museums and in outdoor locations to create interactive environments for cultural heritage, and in outdoor locations as well, augmented reality has achieved mixed results but has proven to be successful and contributes significantly and provides interesting content for users to explore real things. (Condorelli et al.) [15] used photogrammetry technology for black and white images to try to retrieve information about destroyed buildings, and the drawings were inserted into the CAD program, but the accuracy of the results was low. The study (Tomilina et al.) [16] aims to evaluate the possibility of using augmented reality technology to recreate the original form of lost cultural heritage buildings. Making virtual visits to it, which is a first step for a complex work that needs more effort and details. While (Rashid and Antlej) [17] sought to address two problems, the first is to demonstrate the application of 4D modeling and reality-based modeling with historical metadata of lost architectural heritage sites in Australia; The second is to suggest a way to spread new knowledge through digital platforms and virtual and augmented reality experiences. (Kargas et al.) [18] touched on how to develop museums, virtual galleries and archaeological sites that no longer exist. Historical research sources and pictorial survey methods for the remaining monuments were used, with the aim of using them for various purposes, whether tourism, educational, recreational, or for preservation and maintenance purposes, and the result was average Precision. (Couceiro et al.) [19] dealt with how to combine virtual reality and augmented reality to generate an interactive experience to provide knowledge about the lost heritage in order to create a methodology and software capable of providing an appropriate application for tourists and visitors. As (Scianna and others) [20] discussed how to use augmented reality technology in the architectural heritage, a site survey was conducted and additional information was obtained from various sources such as records, photos, documents and drawings, and the technology contributed greatly to enhancing access to cultural sites that are difficult to access. (Krumina) [21] focused on how to

recover the vanished and partially and completely destroyed heritage items by using the largest number of materials and information sources to create three-dimensional models, the work was the beginning of a complex work that requires great effort and experience. (Bevilacqua et al.) [22] dealt with how to restore damaged and lost buildings through the integration of information sources. Photos and documents were considered main sources of information; However, the problem of low-resolution images remains, which is often difficult to analyze. (Beykan and Edin) [23] tried to define the importance of applying technologies and augmented reality devices in the field of preserving the cultural heritage. Their study presented models that were tested and evaluated for their contribution to digitizing and storing data using virtual and augmented reality in the field of preserving cultural heritage.

By analyzing previous studies, it can be seen that they used many different available sources to re-model and represent their constructions digitally, whether the building was completely or partially destroyed and with a three- or four-dimensional representation. In the case that the building was partially destroyed, most of the studies utilized photogrammetry or laser scanning techniques, considering them as the main source for the formation of the 3D models, and benefiting from other supporting sources such as pictures, documents, historical texts and graphic drawings. However, in the case of completely destroyed building, the model creation is mainly based on historical sources as a main source for collecting information. The current knowledge gap lies in how to deal with these sources accurately in order to reach appropriate and credible information to estimate and extrapolate the missing elements in a scientific way and to avoid self-assessment.

3. Research methodology

The research presents a working methodology that relies on four basic stages to completely re-represent a lost source, which includes the stage of collecting information

sources, the stage of analyzing and criticizing the sources, and the stage of comparing and compiling information on each other, and then completing the knowledge deficiency by following the method of extrapolating the elements based on evidence, proofs and comparisons. With examples and similar buildings to fill the shortfall, estimate the missing parts, and finally the stage of showing the final product and inserting it into the augmented reality environment. Each of these stages consists of a set of steps, as follows:

3.1 The stage of collecting information sources

Which depends on the multiple and available sources, including ruins and assets at the site and building level, text documents and images of all kinds (location: site survey, site characteristics), (building: remains of the basic structure, remains of elements, decorations and furniture, elements transferred to a place Other), text documents (official documents, traveler's novels, historical archaeological studies, popular stories and novels, articles and lectures), and pictures of all kinds (personal photos, pictures for documentation purposes, pictures in books, pictures in museums and archives) plans and plastic drawings (drawings of travelers and historians, Architectural plans, coins, stamps and logos, previous perceptions of the building), as well as multimedia (documentaries, cinematic films), stereoscopic (digital, physical), and finally buildings and facilities similar in shape and construction period (architectural building characteristics, constructional building characteristics, time period characteristics).). Thus, the sources are varied, and their availability varies from one building to another.

3.2 The stage of analyzing and criticizing the sources

This stage includes analyzing and criticizing the collected information sources to ensure their credibility and the validity of the information contained in these sources, which differ according to the type of source and the party that issued it. Ruins and assets describe their architectural and constructional

characteristics. Determining its function and its relationship to other elements, the chronological age and architectural current, the level of change and combination. Analyze documents, texts, and narrations from: their content and compatibility with other elements. Pictures of all kinds: they are analyzed by knowing their characteristics and the extent to which the picture matches the reality of the situation or other sources. The multimedia source is the extent of its conformity with the reality of the situation and other sources. Similar buildings describe their architectural and structural characteristics determining their function and relationship with other elements determining the chronological age and architectural current.

3.3 Information comparing and assembling stage

This stage is based on the correct combination, installation and collection of information, as all references may agree about some elements within the available information, while there may be elements mentioned in one source, with the lack of agreement between the references on the existence of other elements, and the possibility of missing elements that not addressed in any reference. Such elements are processed by logical inference by their extrapolating. Then, to weight and compare the most credible scenarios with the elements that date back to the same period, place, or to the similar elements and buildings in function.

3.4 Final product analysis stage

In the last stage, the results of the information synthesis are analyzed to arrive at elements with varying levels of reliability, as well as elements that are determined through logical inference.

4. Application part
4.1. Determinants of choosing a study case

For the purpose of applying the current research methodology and in a practical way, the selected facility should be completely or partially extinct, and sufficient information sources are available for digital retrieval, with the aim of criticizing and analyzing them to

extract the largest possible amount of reliable information. The building chosen to implement the study must be of great importance on the functional, architectural, historical and archaeological levels.

4.2. Military Qishla in Mosul

Al-Qishla is a Turkish word of origin that means the place where the soldiers stay, the fortress, the castle, the serail, and the seat of the governor of the Ottoman government [24]. It was built in the Wilayat of Mosul and the neighboring states and sanjaks in 1251 AH - 1835 AD [25]. Al-Qishla Military Building in Mosul is one of the historical buildings in the city, as it was built by Muhammad Pasha Inge Bayraktar in 1832 AD, and over the years, neglect began to hang over the building and it was completely destroyed during the British occupation period [24]. It had a capacity of about 3000 soldiers and had a great deal of order and a coherent and regular planning of the city, and many books and historical novels mention the Qishla building and describe how this building was of great importance in that period.

4.3. The general characteristics of the Qishla that were built in the Arab cities in the Ottoman period:

- Function: The Qishla is one of the military buildings built for defensive and administrative purposes in the cities in the Ottoman period [26].
- Planning: it was rectangular or square. It was a wide courtyard surrounded by rooms and halls. The halls are regular and overlapping, overlooking the inner courtyard and preceded by a corridor. The building often consists of two floors and sometimes a basement was used to house horses and store [27].
- Architectural style and building materials: The local construction materials available in each city and the local architectural style for which the region is famous were used [28].
- The external façade: it often suggested that it was an impenetrable fortress with small openings that open at the top of the

rooms, and some openings were used for throwing and defense in wars. They sometimes contained towers in their corners used for observation and protection [29].
- Decorations: Al-Qishla building is characterized by being free of decorations, adornments, inscriptions and muqarnas, which were widely used in buildings in the Ottoman period [28].

4.4. Stages of re-representing the exterior of the Al Qishla Military Building

The stage of gathering information sources

The researcher collected a number of sources of information, represented by a group of text documents from historical books, research, articles, a number of pictures and plans, and information about similar buildings and from various sources obtained through repeated visits to the library of the Mosul Studies Center at the University of Mosul, the central library at the University of Mosul, and the library of the Department of Architecture in the College of Engineering at the University of Mosul, and from the documents of the Ottoman Archives[30] in addition to the number of web pages on the Internet

The stage of analyzing and criticizing the sources

After collecting the sources of information, the stage of critique and analysis of the sources was started. As for the obtained images, their sources were analyzed and their content compatible with each other, and a number of images were excluded in which the title of the image did not match its content and its incompatibility with other sources due to the lack of credibility of its source. As for the characteristics of these images, most of the collected images are photographs that have been scanned to convert them to digital to ensure ease of use and circulation on websites. The sources of these texts were reliable and for well-known writers at the level of the city of Mosul, or official documents belonging to the Ottoman archive. As for the plans and plastic drawings, a

plan for the military Qishla and a blueprint for the city of Mosul were obtained from the documents of the Ottoman archive, which is considered a rare and precious document obtained. The information was compared among themselves, and other plans of the city of Mosul were also obtained for travelers who visited the city and wrote what they saw in it. Similar examples: The Kirkuk Qishla is the closest architecturally and functionally to the military Qishla of Mosul. Some pictures were obtained that document the military Qishla building in Kirkuk. Its architectural and structural characteristics and the building materials used in it were identified, and it dates back to the same time period in which the Mosul Qishla was built.The stage of comparing and synthesizing information.

After synthesizing the information collected on the Qishla building from various sources, it was found that:

The building is distinguished by its location, as it is located outside the wall of the city of Mosul in the south of it and on the banks of the Tigris River within a government complex that was established in that period. For the manufacture of cannons and gunpowder, it also included a large yard in front of the military Qishla called (Al-Arsah) used to train soldiers and hold celebrations in front of it, the Shazrawan, i.e., a water fountain. On the eastern and southern sides, it was overlooking the Al-Jawsaq area at the present time. As for the location at the present time, the Al-Qishla for the military was demolished and replaced by the House of Justice, i.e., the courts now. The Royal Qishla turned into the Mosul municipality building, the guest house and the square turned into the Martyrs' Park now, in addition to the building of the Civilization Museum, as in Figure (1).

Figure 1. The location of the Qishla in Mosul 1914 [30]

The external dimensions of the building were extracted from the Qishla diagram, which included the dimensions of 110 cubits in width and 120 cubits in length, equivalent to approximately 56 meters in width and 60 meters in length. From the analysis of the images, it is possible to determine the height of the building with two floors as shown in Figure (2), (3) and (4).
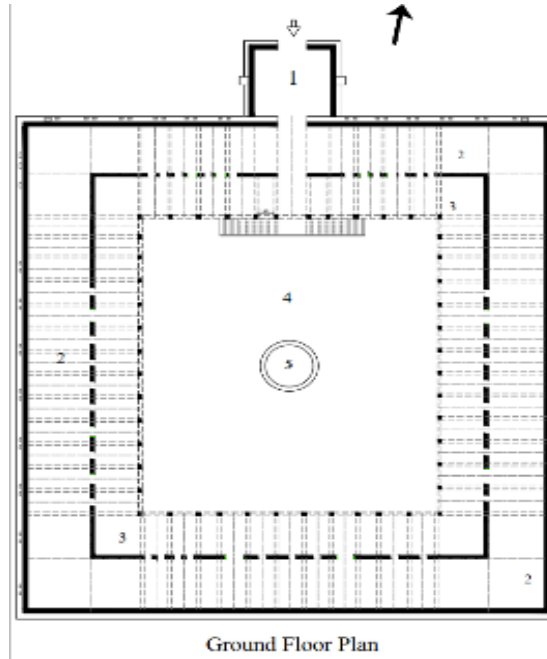
Ground Floor Plan

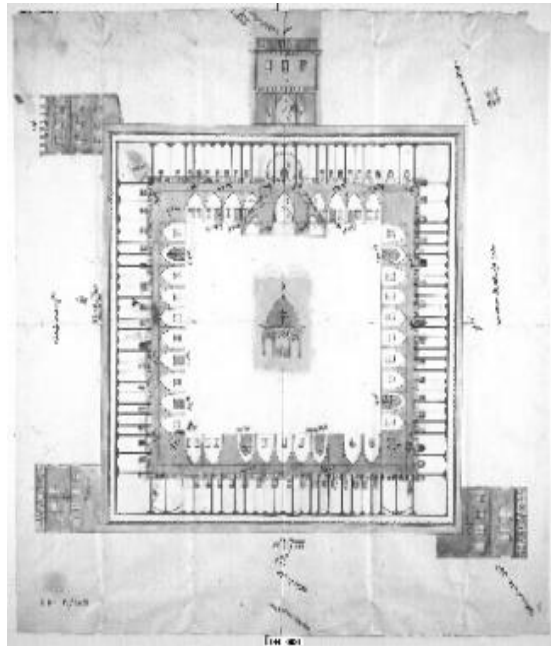**Figure 2.** Al-Qishla diagram [Drawing of researchers]

Figure 3. Al-Qishla diagram 1914 [30]

Figure .4 Military Qishla 1914 [30]

Regarding to the entrance, it can be noted that there is a discrepancy in the references. The entrance in the plan is located towards the west, and it corresponds to some extent with the Mosul plan - 1862 AD, which was drawn by the British traveler Felix Jones, which is preserved in the British Museum [31] due to the presence of a prominent block on the west side, which is likely to be the entrance. But it contradicts the Mosul plan - 1907 AD, a document obtained from the Ottoman archives in Turkey, which shows that the entrance is located towards the north [30], as well as with the Mosul map - 1911 AD, which was obtained from the book "An Archaeological Journey to the Tigris and Euphrates" by Friedrich Saar and Ernst Herzfeld [32]. It can be noted the agreement of the pictures that suggest that the entrance is located on the north side of the building, and in comparison with the site plans, the site plan in 1907 AD and the site plan in 1911 AD. And the site plan in 1852 AD, the three plans suggest that the shorter side is the side parallel to the entrance wall, and the longer side is the side perpendicular to the direction of the entrance, and based on this information, the direction that is agreed upon by a larger number of people has been weighted. Expropriation and keeping the main entrance on the northern facade and not on the western facade, and the secondary entrance on the southern side. The discrepancy of a number of sources in providing spatial information and structural details of the Al Qishla building may be attributed to the different time periods of these plans, during which modifications, changes and additions are likely to be made to the original building, and the accompanying possibilities of change on the main building blocks and the internal functions of its affiliated spaces.

Figure 5. The location of the Qishla in the city in relation to the four schemes [30], [31]

The external facades of the walls tend to be at a slight angle from their straightness, which can be seen in the documentary photos of the Qishla building, which shows the presence of a deviation of the external walls, and also the amount of deviation can be measured from the Qishla diagram and an approximate amount of about (1 meter). as in Figure (6).
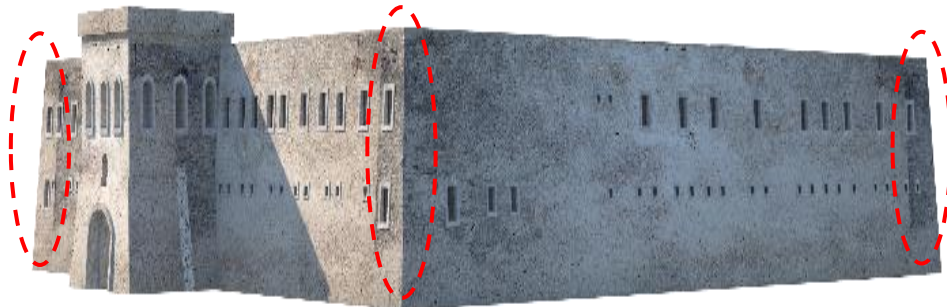

Figure 6. The inclination of the outer walls of the Qishla [Drawing of researchers]

The entrance block on the northern facade stands out from the building at a distance of about eight meters, from which clear and complete pictures are available. The dimensions of the openings can be calculated, given that the total height of the building is more than 10 meters, as [24] is mentioned in the description of the Qishla as "overlapping halls room, it leads to rooms through the corridors.... from window shutters that open at the end of roofed walls that rise more than 10 meters." As well as from measuring the height of the inner courtyard facade and the facades attached to the sides of the plan (Ottoman archive documents) it is clear that the block height The totality is within 11.5 meters. As for the window openings on the external facades, they were known from the available images through correction operations on the images, in order to measure the dimensions accurately, using the Photoshop program. Tools with matching their length and height with what was obtained from the diagrams and other sources.

It was concluded that the large openings on the northern facade were about 1 meter-1.2 meters wide and 1.5-1.6 meters high. The small openings were square with dimensions of 0.4 meters - 0.5 meters per side, and these dimensions apply to all openings of the other facades, and the total number of openings in the northern facade is (24) window openings on the ground floor and (20) window openings on the first floor, as shown in Figure (7).

Figure 7. The northern facade of Qishla [Drawing of researchers]

As for the western facade, it included (21) window openings on the ground floor and (12) window openings on the first floor, and (9) openings within the basement floor as shown in Figure (8).

Figure 8. The western interface of Al-Qishla [Drawing of researchers]

As for the eastern facade, which was facing the Tigris River, it was connected to part of its side with the Al-Qishla Al-Madani building, and part of it appears in a copy of the Ottoman documents, meaning that this facade has a partial lack of information, as in Figure (9). The missing part of it can be extrapolated in a scientific way by comparing the number of openings between inside and outside with the number of spaces to find out the number of openings for each space towards the outside. Window on the first floor, and the facade of the ground floor on the courtyard was symmetrical and consisted of two spaces, and thus the shape of the missing part is predicted that it also

consists of (8) window openings on the ground floor for the missing part, while the first floor also consists of 4 spaces with a door for officers and soldiers And a prison door in each half of the facade, i.e. the missing part of the external facade on the first floor can be deduced from (12) external window openings, but part of this facade will disappear at the connection point of the royal facade with the military facade, meaning the total number of openings in the eastern facade becomes in The ground floor has (13) window openings and (22) window openings on the first floor as shown in Figure (10).

Figure 9. The eastern facade of the Qishla [31]

Figure 10. The eastern facade of the Qishla [Drawing of researchers]

There is currently no information about the southern facade or any document that shows the shape and number of openings in it, and it is considered completely missing, and logical extrapolation was used to try to find its shape. It turns out that the latter contains a secondary entrance smaller than the main entrance in size and less details, which is likely that this block is a secondary entrance on the southern facade. And since the shape of the Qishla building is a regular geometric shape, it has an almost regular rhythm with respect to the window openings on the outside or the inner courtyard, and they were regular in each of the sides. Most of the openings in the other three facades were large, with dimensions 1-1.2 meters wide and 1.5-1.6 meters long, which indicates that the pattern of openings on the first floor of the three facades was large. It is high and the openings on the first floor are large, so it can be guessed that the openings of the south facade on the ground floor were small with dimensions of 0.4-0.5 meters and on the first floor they were 1-1.2 meters wide and 1.5-1.6 meters long.

As for the number of openings in the southern facade, it can be extrapolated from comparing it with similar buildings, which is the Qishla of Kirkuk, in which the distribution of the openings was in a regular rhythm and in continuous harmony and harmony, and also from comparing the southern facade of Qishla with other facades in the same building.

On the ground floor

The northern façade contained 24 window openings on the ground floor, offset by 4 doors, or 4 spaces, meaning that each space had approximately 5 openings to the outside. As for the external western façade, it contained 21 windows and 3 doors toward the interior, meaning 3 spaces, or approximately 7 openings for each space approximately Exterior, the eastern facade contained 13 window openings to the outside, as opposed to 2 doors (two spaces) on the inside, ie about 6-7 openings for each space.

Thus, we conclude that the number of openings for the southern facade on the ground floor was about 6-7 window openings for each district, and since the number of spaces is 2 then the total number of openings is 12-14 windows

In the first floor

On the northern facade, it contained 20 windows to the outside, compared to 4 doors (4 spaces) to the inside, which is approximately 5 windows for each space, and in the western facade it contained 12 windows to the outside, compared to 4 doors (4 spaces), which is approximately 3 windows for each space, and the facade Eastern, it contained 22 windows to the outside, compared to 4 doors to the inside (4 spaces), which is approximately 5 windows for each space.

So, it can be concluded that the number of openings in the southern facade is 3-5 windows for each space on the first floor, and since the number of spaces is 2, then the total number of openings is about 6-10 windows as in Figure (11)

Figure 11. The southern facade of the Qishla [Drawing of researchers]

- The stage of analyzing the final product:

After synthesizing the available information that was collected and obtained from various sources, the stage of analyzing the final results of the re-presented object or structure was started. The information was categorized into a group of elements that all sources agree on, elements mentioned in one source, elements on which the sources differ, and missing elements that are identified through logical induction to try to reach a perception of the missing element or part. In the Al-Qishla building, there were many elements and information that all or most of the sources agree on, such as the location of the Qishla in relation to the city of Mosul, the function of the building, the number of floors, the general plan of the building. And elements

mentioned in one source, such as the facade of the building on the inner courtyard, and elements on which the sources differ, such as the location of the entrance in relation to the building. And missing elements for which no source is available, such as the southern facade and half of the eastern facade, which were reached through logical induction.

4.5. *The stages of creating the missing Qishla building using programs and applications*

The AutoCAD program was used to create the three-dimensional digital model of the building by linking images and diagrams and supporting them with the collected sources as in Figure (12). The hologram was rendered using 3DS Max program to make the anthropomorphic more realistic as in Figure 13.
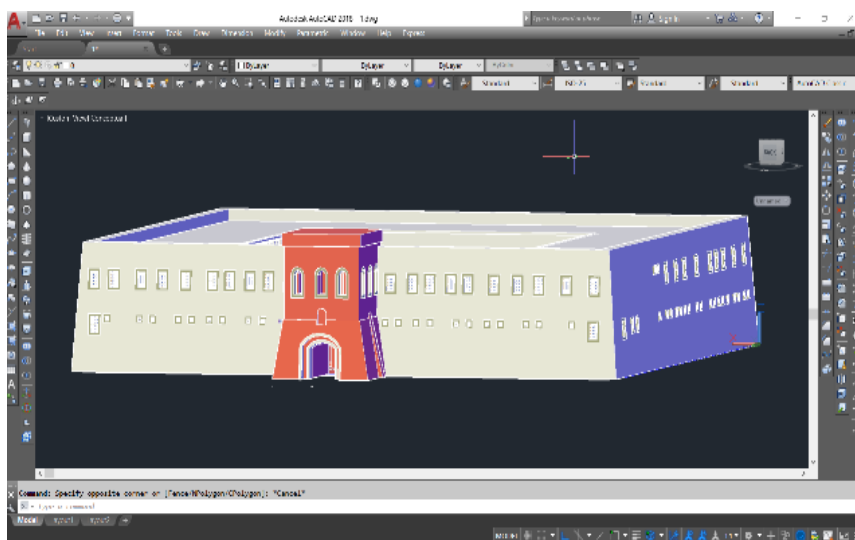

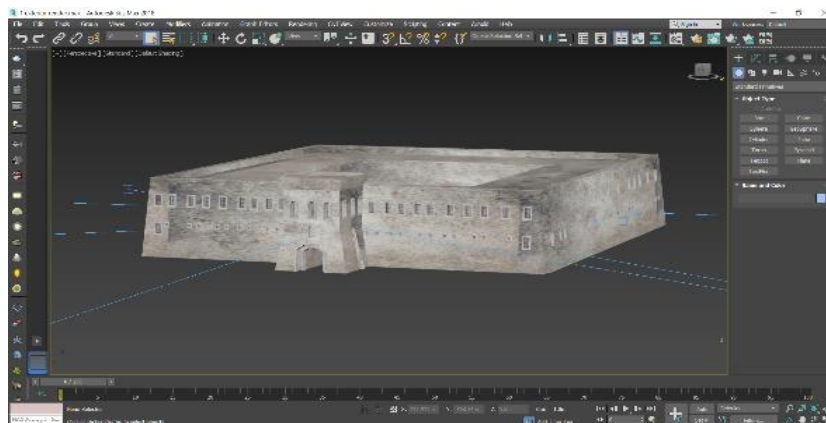**Figure 12.** The creation of the stereogram in AutoCAD [Drawing of researchers]

Figure 13. The stereogram in 3DS Max [Drawing of researchers]

The file has been exported in FBX format from 3DS Max to be uploaded to the Inglobe Technologies platform to create an augmented reality environment for the Al Qishla building as shown in Figure (14).
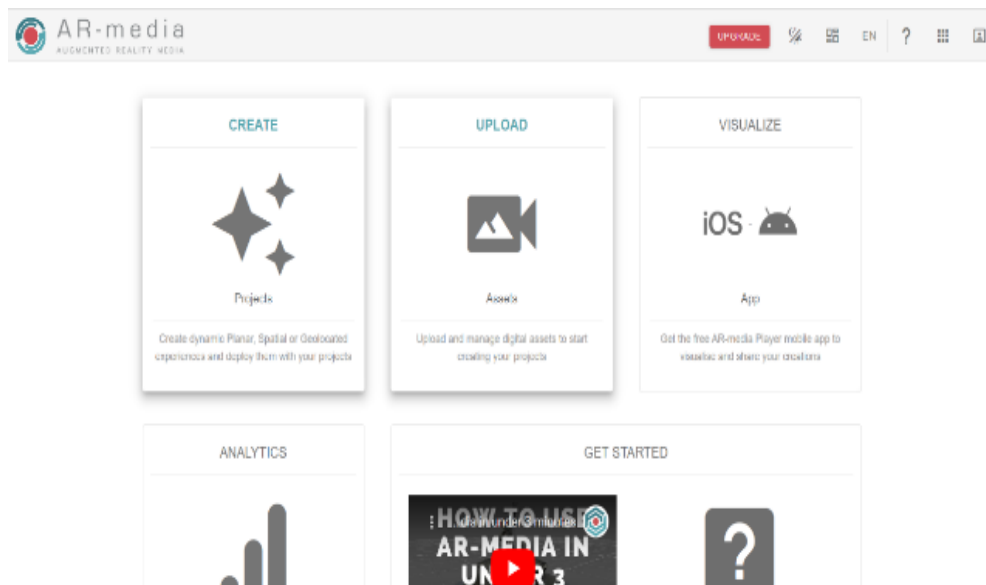

Figure 14. Upload files to Inglobe Technologies platform

After uploading the model on the platform, it is activated and some features are added to it, such as linking the model with the coordinates of the location and adding some pictures, explanations and illustrative signals to the model as shown in Figure (15).
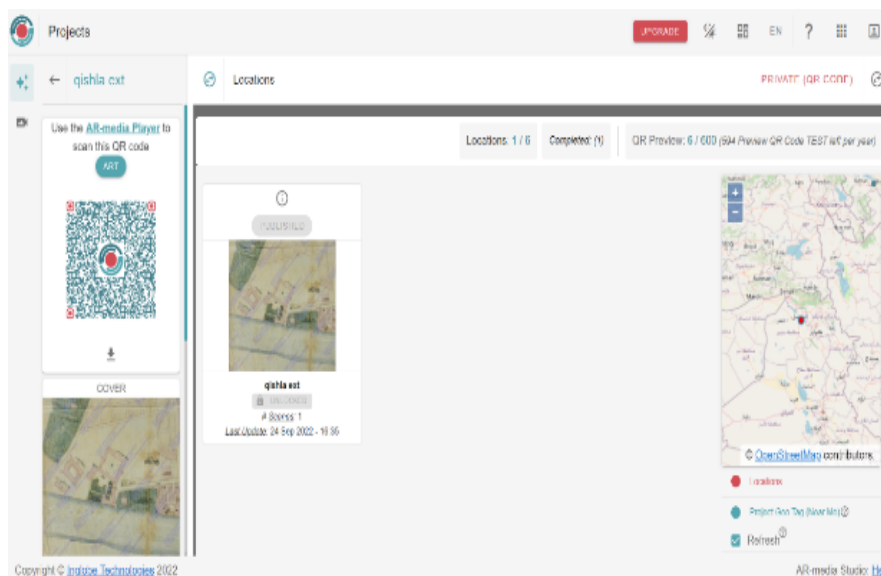

Figure 15. Lifting the model on the Inglobe Technologies platform

Using the Ar-media application for augmented reality on mobile phones and tablets, Apple and Android, the interactive hologram was displayed on the mobile screen to identify the building and interact with it within the real environment as in Figure (16).
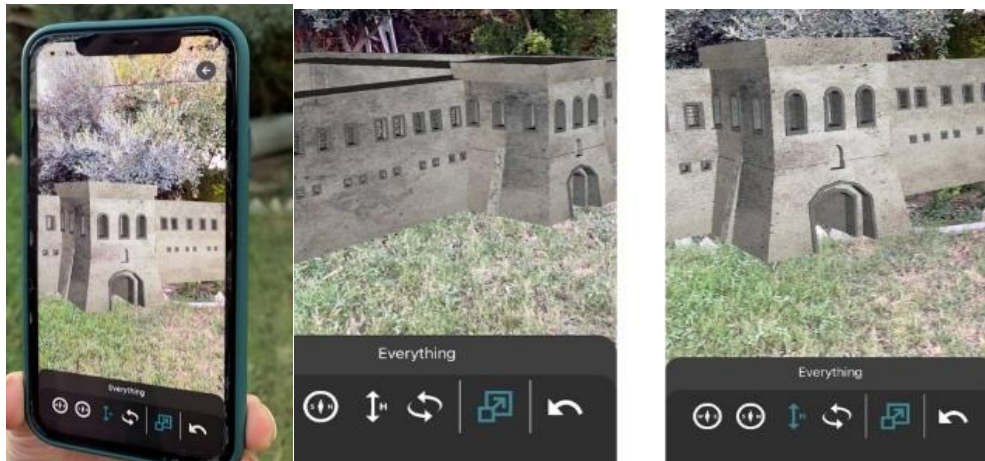
Figure 16. Al-Qishla in Augmented Reality [Researchers]

5. Conclusions

5.1. *Conclusions of the theoretical framework*

- Technology has recently been used in the field of preserving digital heritage and restoring the lost to contribute to the documentation, preservation and restoration work.
- The use of interactive systems, including augmented reality, has recently increased in the areas of urban heritage preservation due to its multiple capabilities and ease of use by professionals and users alike.
- Ruins and finds, text documents, images of all kinds, multimedia, physical models, buildings and structures similar in shape and construction period are among the most important sources from which the model and shape of the missing building can be extrapolated.
- The process of information synthesis is the crucial stage for deducing the final form of the structure and re-representing it after the process of investigation and analysis of the available information.

5.2. *Conclusions of the application part*

- When the final model of the military building of Al-Qishla in Mosul was formed, a group of elements appeared on which most or all sources agreed. These elements are classified among the most accurate and reliable elements, namely the location of the Qishla relative to the city of Mosul, the function of the building, the number of floors, the general plan of the building, and the northern and western facade. There are elements on which the sources differ, such as the location of the entrance in relation to the mass of the building. In addition, there are missing elements about which not enough information is available, such as the southern facade and part of the eastern facade.
- Missing elements for which there is not enough information can be accessed through logical induction from similar elements.
- The use of interactive forms contributes to enhancing conservation processes, and allows them to be shared with the community and people through the Ar-media application.

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