DOCUMENTING THE ARCHITECTURAL HERITAGE RESOURCES IN MAFRAQ GOVERNORATE USING GEOGRAPHIC INFORMATION SYSTEM (GIS)

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Abstract

Mafraq Governorate contains many types of architectural heritage resources that belong to different historical eras and civilizations, which requires great efforts to conserve it. The documentation considered as one of the most important processes that maintain the resources, which allows the study, classification and analyzing the resources and find out the best ways to employ it and investing to serve the communities. This research aims to define and document these sites to facilitate accessing the available data for any of these sites, using Geographic Information Systems (GIS).

Keywords: Architectural heritage, (GIS), documentation, conservation, digital technology, Fdayn Castle, Mafraq, Jordan

ДОКУМЕНТИРОВАНИЕ ИСТОЧНИКОВ АРХИТЕКТУРНОГО НАСЛЕДИЯ В ПРОВИНЦИИ МАФРАК С ИСПОЛЬЗОВАНИЕМ ГЕОИНФОРМАЦИОННОЙ СИСТЕМЫ (ГИС)

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Аннотация

Иорданская провинция Мафрак содержит много источников архитектурного наследия, которые принадлежат к разным историческим эпохам и цивилизациям, что требует больших усилий для их сохранения. Документирование рассматривается как один из важнейших процессов сохранения этих источников, что обеспечивает их изучение, классификацию и анализирование, а также нахождение пути их использования и инвестирования для обслуживания населения. Исследование направлено на определение и документирование этих источников для облегчения доступа к имеющимся данным для любого из них, с использованием Географических Информационных Систем (ГИС).

Ключевые слова: архитектурное наследие, географические информационные системы, документирование, сохранение, цифровые технологии, Мафрак, Иордания

1. Introduction

Heritage resources with both material and non material types are considered as the living memory of individuals and nations. For the importance of these resources, national and local efforts have been made and continue to be made in order to conserve them. Documenting the resources of cultural heritage in all its forms and types, is considered as one of the most important and first operations to conserve these resources, which is (documentation) characterized by great difficulties in its procedures, for the necessary collection of information related to cultural resources, lifting, registration, classification, write the date and set its significance and realize their values. It becomes more difficult when those procedures are conducted under the use of traditional means of documentation processes, which necessitates researching for new and sophisticated methods to facilitate the documentation procedures for those resources.

With the emergence of what is known as the digital revolution in the late last century and what it provided of techniques and capabilities of modern technology, and using and employing them in all scientific fields, the opportunity became greater to employ those techniques in the documentation processes and the systematic scientific registration for the cultural heritage resources easily in an accurate and firm method through using what is known as GIS (Geographic Information System).

Due to the uniqueness of the Arab world in general and Jordan in particular, containing many heritage resources, particularly the architectural heritage resources scattered all around the Arab world, which are distinguished by its historical, cultural, and scientific importance, the opportunity appears to be now appropriate to document these resources in a modern and new methods to be presented in an outstanding manner adequate to the developments and their available potentials in documenting and conserving these resources.

Mafraq governorate, located at the north-eastern part of Jordan – unique of its wide geographic location, constituting one fifth of the country– is a vivid example of the Jordanian areas rich with architectural heritage resources in the various cities and villages, which contains cultural and civilization stocks due to the succession of civilizations and different historical eras in the region for the significance of its geographic location on the crossroads of ancient and modern trade routes.(Fig. 1)

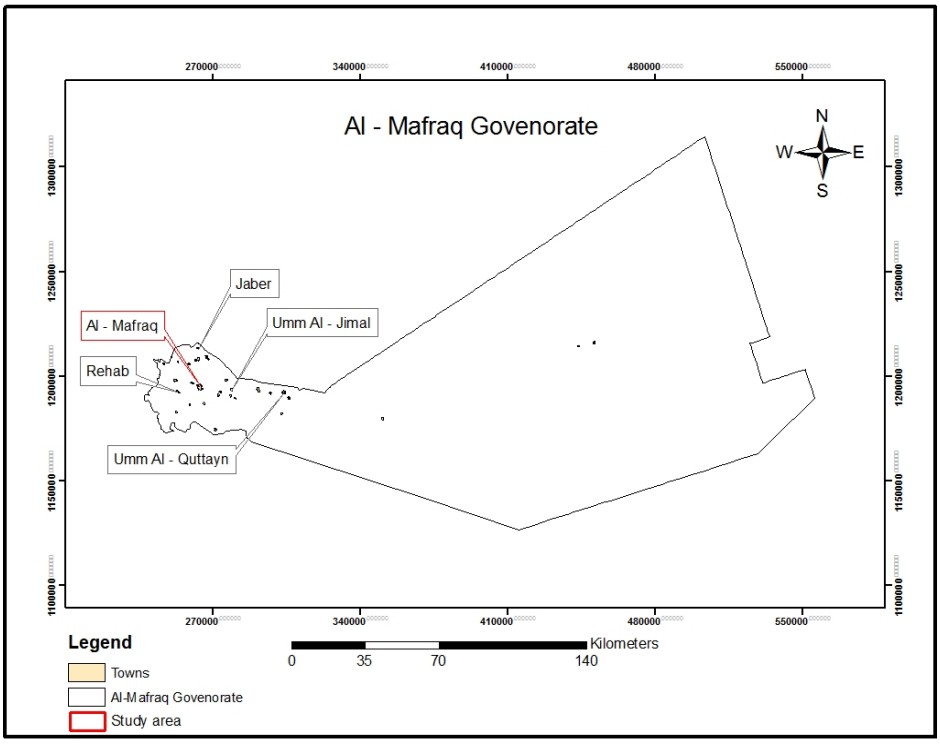

Fig. 1. The base-map showing the boundaries of the study area (Mafraq governorate) and the most important areas containing architectural heritage resources

2. Research Problem

The documentation process of heritage resources passed through different traditional stages and is now in dead end phase, under the massive developments in data technology and the digital revolution. Therefore, this research will explain how to take advantage from the capacities offered by the digital revolution, technology of data, availability of digital media, software variety, and the huge potential of the documentation processes of those resources in a better modern method than the traditional methods commonly used until recent time.

3. Research Significance

Through this rule, we can convert paper data into electronic one, in order to know the details of its antiquities, and its layers. The artifacts can be added for each building, if any, and enter all their data.

4. Research Objective

This research aims to reach an easy developed mechanism to document the architectural heritage resources scattered in Mafraq governorate, with all categories and types, by using the GIS software, and its applications, multimedia and different means of communication that can be linked to it, in order to gather all relevant data in one resource (database) to facilitate the process of retrieving them, identify their characteristics and exchange them between interested parties and concerned.

5. Structure Axes

This research will discuss the following aspects:

- Define the significance of the heritage, study, document, and conserve it.
- Define the concept of documentation, the methods and processes associated with it.
- Define GIS, its importance, and how to use it in documenting the architectural heritage resources.
- Specify a methodology for documenting the architectural heritage resources in Mafraq governorate.
- Review an application model of the documenting process for some of these resources in Mafraq governorate using the GIS.

6. The Significance Heritage Conservation

Heritage has a great significance, and conserving it is obligatory for all nations, and individuals. This has been confirmed in conventions and international agreements, mainly what is known as Convention Concerning the Protection of the World Cultural and Natural Heritage of UNESCO 1972 in Paris. The convention includes a set of articles that refer to the need to conserve the architectural heritage resources (including antiquities, urban communities, and heritage sites of historical, artistic or scientific value) [1], and that all countries must make all possible efforts in order to conserve and protect it from destruction, damage, any natural effects, and human influences that may defect it, for many reasons and objectives, including:

- Maintaining all types of heritage (material and immaterial) and its cultural and civilization dimensions lead to conserving the memory and the identity of nations and individuals.
- The diversity of the heritage resources helps in enriching and variation of human knowledge of nations.

- The values and significance inherent in the different heritage resources may be educational, scientific, cultural, economic and social values.

- Referring to the heritage resources can create solutions for the contemporary human problems.

- Different heritage resources have significant role in promoting the national income of countries and can be used to create jobs through tourism and recreational projects.

In Jordan, the concern of the architectural heritage resources came since the thirties of the last century when the first law of antiquities was enacted in Jordan, called "*Qanoon Aladiat*"[2], (Antiquities Law). Then, different laws were enacted to protect archaeological and heritage resources, most recently was the "Jordanian Law for the Protection of Architectural and Urban Heritage of (2005)"[3], which included in the second article a definition for the heritage site as a landmark or a site with a heritage value as of construction style or its relationship to historical characters, national, ethnic, or religious significant events, including the following:

- **Heritage landmark**: Architectural structures, architectural vocabularies of architectural, historical, or cultural properties, which tells a story of certain events.

- **Urban site**: Architectural structure, plazas, residential neighborhoods, and harmonization of landmarks that represent the constant values of people's knowledge-base.

The concept of conserving the heritage resources takes different forms and ways depending on its type, significance, methods and procedures taken to maintain and other things not the focus of research here. However, what is of interest to the researcher in this regard is to emphasize is that despite the existence of differences in concepts and methods to conserve the heritage resources, the main result are preservation. Documentation [(1)] is considered as one of the most significant and necessary means and procedures to conserve the heritage resources in general [4].

7. Documentation using GIS

The human society lives in the era of "digital revolution" and "data revolution" both linked with sophisticated data technology, using computerized systems and modern communication systems, that allow data formation through multimedia, either in the form of list, graphs, animations, or speaking sounds, in addition to easy copying and dissemination in a very easy means. ESRI, 1995 argues that GIS is an organized collection of computer hardware, software, and geographic data designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information [5].

The GIS is considered as one of the most important outputs of the modern era, which contributed immensely to facilitate the tasks on the planners during taking spatial decisions related to the development or analysis of a specific problem which has Geo-reference. Bolstad, 2008, argued that the concepts and explanations vary about the identification dimensions of GIS pursuant to different domains that could have functional or practical relationship with this technique, since this system depends mainly on computer in input, storage, management, analysis and output of geographic data related to various natural or industrial resources [6].

GIS operations concerned with large scale maps based on major financial resources, which are produced by governments and management departments and municipalities, since the primary objective is to support the political managers to make balanced decisions regarding natural and human resources [7]. While Star, et al, argued that GIS is designed to work with data referenced by

1) In this field, documentation can be defined as a set of processes and techniques necessary to provide the maximum possible use of information, data, events and facts for each resource of architectural heritage, using the well-known methods and significant processes, including: Recording and Classification, photography, and drawing and other new methods, which eventually lead to the compilation of all data in one resource and then presented to the interested people to benefit from them.

spatial or geographic coordinates [8]. In other words, a GIS is both a database system with specific capabilities for spatially-referenced data, as well as a set of operations for working with the data.

The system allows the translation of data no matter of its size, origin and convert it, using automatic processing, converting, and conformity processing methods, into simple form, characterized with clarity of vision and inclusiveness, which facilitates correct decision making for managers, when dealing with any planning or follow up for any project or program [9]. This technology can be benefited in various fields of science and various aspects of life, since geographic database serves as a group of varied complex data information than different phenomena, study and make clear relationships and conclude innovative data [10].

The geographical information system became is now a significant means in documenting the architectural heritage resources since it's distinguished with the following attributes [11]:

- Simplicity of creating electronic (digital) databases for all architecture heritage resources, no matter of its size and type.

- Simplicity in using digital multimedia at work in limiting and classifying these resources as required.

- Fast entry, extract, and printing of data continuously and periodically, and be linked to one reference.

- Easy to analyze data and get quick results in accordance with study requirements.

- Save effort, cost, and time compared with the traditional methods, especially in the imaging, field survey, and so.

- All of the applications used in this system can be updated, developed, connected and integrated with various databases and systems inside and outside programs.

- Easy to exchange experiences between parties interested in documentation and restoration operations for the heritage resources and develop the concept of common research and studies between researchers and those interested world wide.

- Easy to use the system by non-specialists through the presence of different applications.

- Ability to browse, present, analyze data, extract reports and print their contents.

- Assist decision makers to take the right decision by providing diverse data on such resources.

8. Steps of Applying the Methodology in Documenting Architectural Heritage Resources in Mafraq Governorate

8.1. Determine the study area (Base Map)

The administrative boundaries of Mafraq governorate are defined as a ground reference to examine and approve as the Base Map of all the applications and programs used in the system in order to facilitate the operations of site analysis and establish a unified database of all heritage resources. Then, the layer of villages and cities are fixed within the governorate on the map, set the heritage sites, and set a special documentary number for each heritage resource. In addition to reviewing the Base Map, Jordan Coordinating System (JTM) was adopted to facilitate the tasks of documentation for the specialists in this domain, and facilitate locating sites through means of modern technology, to ensure conformity and comprehensiveness of data, facilitate the documentation process, and to reach to best results.

8.2. Identify the Necessary Data for Documentation (Fields of Documentation)

Data that lead documenting the resource in an accurate and comprehensive method and submit it to the concerned parties in an integrated view, and define its relative values, understand its meaning, define its significance, which helps in choosing the most suitable ways and appropriate means to maintain and manage or take any other related action. The researcher prepared a unified form to collect and record the available data for each heritage source, and adopted classification within the main axes (sets), as shown in the Tables (1-4).

Table 1. General Data of heritage resource

General data					
Heritage source primary name:					
Ottoman fudayn castle					
Site identity code					
05050512	Heritage resource code	Heritage site code	City code	Governorate code	
	05	01	01	12	
Resource significance					
Excellent	Good	Average	Regular		
X					
Location coordinates (JTM)	Latitude	Longitude			
Period of construction					
Pre- history	Greek	Roman	Byzantine	Islamic	Others
				X	
Classification by the original function					
Religious	Commercial	Military	Residential	Cultural	Mixed
X	X	X	X		
The general situation of the heritage source					
Ruined	Ramshackle	Moderate	Good		
X					

Table 2. Historical data of heritage resource

HISTORICAL DATA				
DATE OF CONSTRUCTION				
YEAR	COVENANT			
1570	OTTOMAN RULE			
BUILDING CONDITIONS AND GOALS				
ORIGINAL FUNCTION	A MILITARY FORTRESS ON THE PATH OF HAJJ AL-SHAMI			
SUCCESSIVE FUNCTION ON THE SOURCE				
HISTORICAL EVENTS SUCCESSIVE ON THE SOURCE				
IMPORTANCE AND VALUES RELATED TO THE HERITAGE SOURCE				
RELIGIOUS	HISTORICAL	ARCHITECTURE	AESTHETIC	OTHER
X	X	X	X	

Table 3. Urban and architectural data of heritage source

Urban Data	
Urban Fabric (site plan)	
Surrounding environment	
Infrastructure and services	
Architectural Data	

Architectural Style	
Entire elements Plans	
Architectural Sections	
Exterior Elevations	
Interior Elevations	
Architectural Details	

Table 4. Structural data of heritage source

Structural Data	
Structural System	
Building Materials	
Roofs	
Walls	
Structural Details	

8.3. Data Collection

Based on that collecting data about the architectural heritage resource is the first phase of documentation and the most significant at all [12], data were collected in various methods:

- Refer to the concerned parties (Ministry of Tourism, Mafraq Antiquities Dept., Mafraq Governorate, Mafraq Municipality, Al al-Bayt University, Hijazi Railway, and others of specialized governmental organizations.

- Refer to books, references specialized in archaeological and heritage sites in Mafraq governorate such as "Mafraq Governorate and its Surroundings across Ages"[13].

- Conduct interviews with aged people of concern with the area and researchers.

- Conduct field visits to sites, conduct field surveys using survey devices, GPS, drawings, photography, etc.

- Results of the study was that (175) archaeological heritage resources were defined as the discovered ones in the governorate, which varied according to their significance, functions and types of related civilizations, archaeological styles, their locations and their general status, etc. All of them were placed on the basic map of the system in order to be used by the concerned parties at one view and get the available data.

8.4. Documentation Levels

Three location levels were adopted to document the archaeological heritage as follows:

- Documentation as per Governorate Level: In order for the researcher to know the significant and major areas available for these resources and geographically distribute them in the governorate. Sites were entered according to geographical locations and city name of the heritage resource (i.e., Um al-Jimal, Rehab, Sama Asserhan, etc.).

- Documentation as per City/Village Level: In order for the researcher to know the significant and major areas available for these resources and geographically distribute them in the governorate. Heritage resources were entered according to geographical locations and the known name of the resource (i.e., al-Fdayn archaeological site, Um al-Qottain archaeological site, etc.).

- Documentation as per the One Resource (entire site, element) Level: In order to document data in details of the resource to include all data in the previous tables.

8.5. Classification Criteria

There are many criteria to classify heritage resources, but the researcher adopted classification according to three criteria: historical time period of the heritage resource, the prevailing archaeological style, and its major function.

8.6. Software & Multimedia used in the Study

Diversity in using various resources of software and applications were considered with expansion using what is called Open Source. Application was conducted by using the following softwares & applications:

- Major applications: Arc Map, Arc (Arc GIS 9.3), Catalog, Arc View.
- Sub-Applications: AutoCAD, 3D Max, Microsoft Office and its applications.
- Digital high-speed communication networks.
- Tools of digital imaging (digital cameras).

That will include using other digital multimedia adequate for the subject later on.

9. Practical Example for the Applied Documentation Methodology

Applied the documentation methodology use in documenting an important urban heritage resource at the level of Jordan and Mafraq Governorate, located in the city of Mafraq and known as (Fdayn Archaeological site), considered to be the historical and cultural center of the city and the basis of its emergence and evolution.

This methodology was applied in sequence according to approved levels to reach architectural documentation for one of the heritage resources which the site consists "Fdayn Ottoman Castle". Which has a historical and religious importance as it is considered to be a dilapidated castle belonging to the Ottoman period and a significant milestone on the path of Hajj Al-Shami and has distinctive architectural nature and has relevance with the emergence and evolution of the modern city of Mafraq.

The accompanying photographs (Fig. 2 - Fig. 8) explain how the methodology was applied in entering and showing the data in sequence starting from the general location of the heritage resource until it reaches the resource itself (Fdayn Ottoman Castle) and its related details.

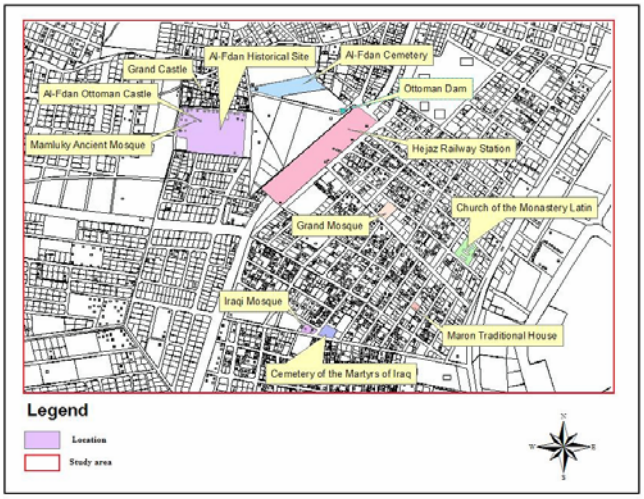

Fig. 2. Shows part of the study area at the city level and the important architectural heritage resources

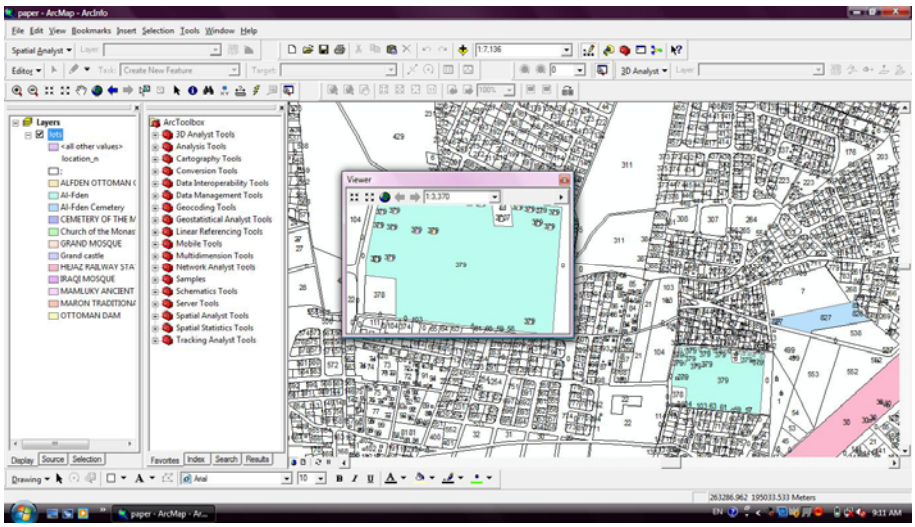

Fig. 3. Shows how to enlarge part of the study area (the site level to the heritage source) in a new window

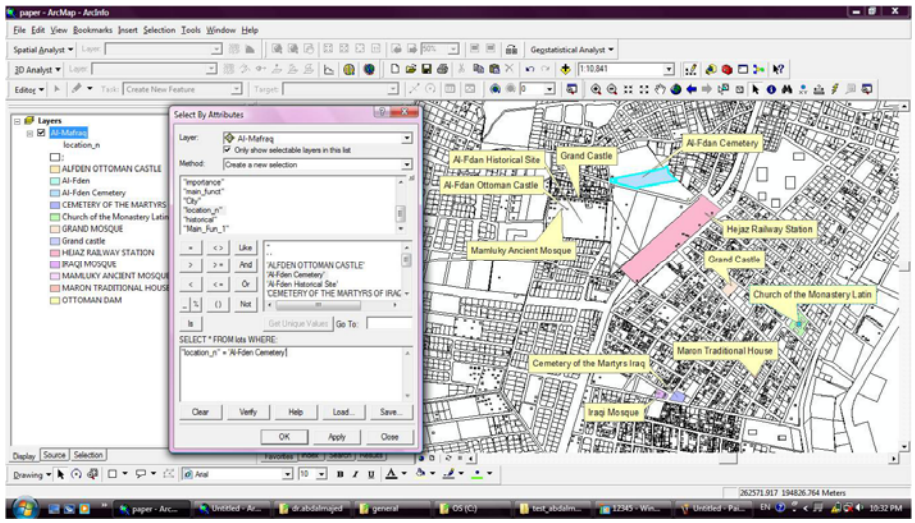

Fig. 4. Shows searching for heritage resources in the study area and the data appears when you click on it

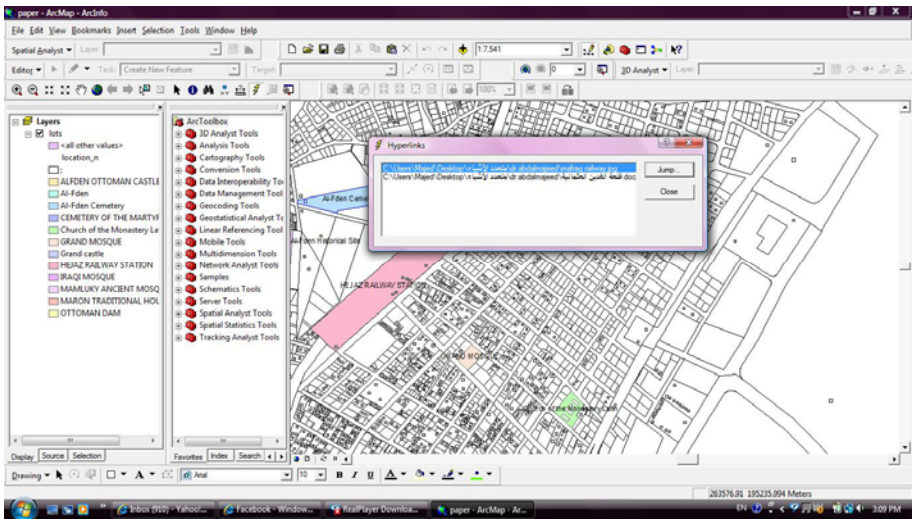

Fig. 5. Shows how to make a hyperlink for the information through using multimedia

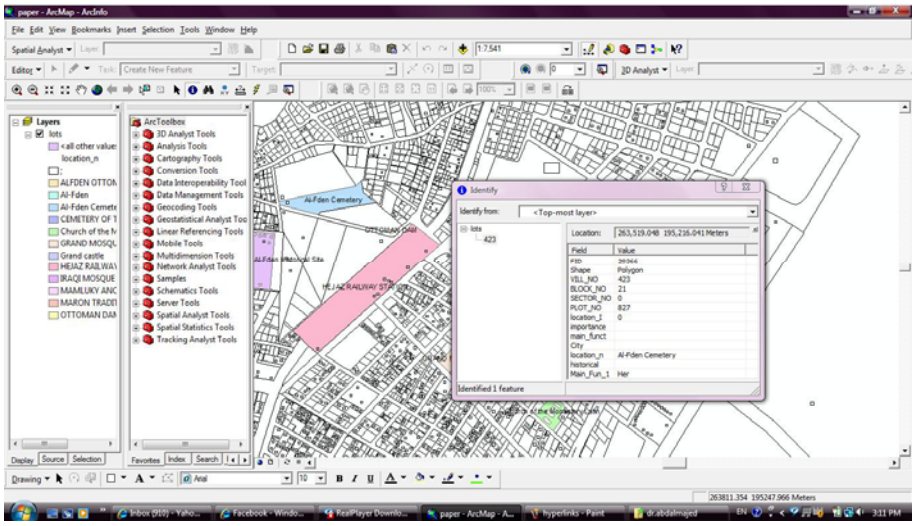

Fig. 6. Shows a view for the general data of the heritage resource (photo)

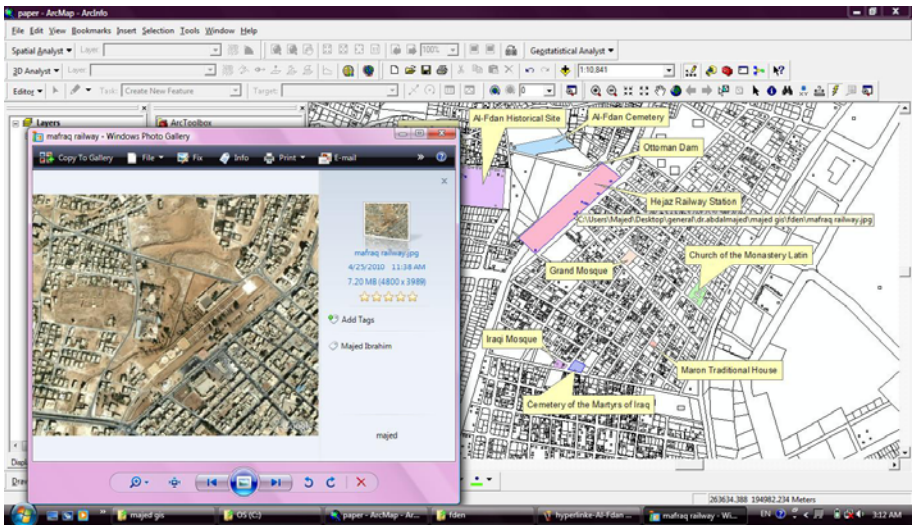

Fig. 7. Shows the Fdayn Archaeological site and the data, historical information, the aerial photos of the region that can be obtained

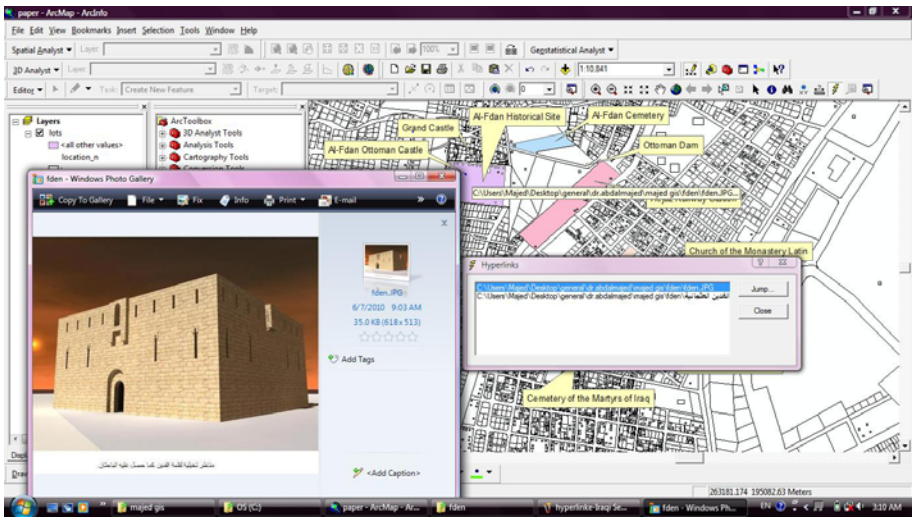

Fig. 8. Shows the general view of Fdayn Castle after conducting the researches and a simulation view for the site using 3D Max software and the related data by the researcher

10. Results

- The documentation and reservation process of all data on historical buildings, documenting inscriptions, designs, and historical archaeological details are one of the most important stages of preservation, either in their present situations or after the repair and maintenance.

- The research reveals the need to use advanced methods imposed by the recent digital revolution to take advantage of it and employ it in documentation and registration processes for architectural heritage resources along with the known traditional methods to form an integrated system.

- The research is considered as a beginning step to establish a micro-database, which can be modified on the process of documenting the architectural heritage at the level of the study area to pave the way to develop a main database, interactive encyclopedia, and reference bank for heritage. This can be done, through the unified efforts of all parties related to documentation and preservation, evaluation, and development of architectural heritage and any related field in all its cultural and scientific dimensions.

11. Recommendations

- There must be a comprehensive plan for the bodies and interested parties to conserve the heritage resources to enter into a global and local data networks, and to set an integrated work plan to simulate the existing systems and available in developed countries, which have the expertise and the lead in this field.

- To take into consideration the full interrelationship between the various types of data for each historical or archaeological building, and link between the means of registration, either written documents or photos.

- The necessity to provide human, scientific, technical, and financial potentials to support the work of the architectural documentation of the historical buildings and the preparation of staff capable of building databases of the historical buildings and provide them with the necessary data and the skills.

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