

Using Virtual Reality Technology and Geographic Information Systems in the Field of Tourism Planning

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Abstract---This paper aims to detect and learn how to use virtual reality technology and geographic information systems and take advantage of its application in tourism planning at tourist sites for the development of tourist sites, and the provision of tourism data which include all the data relating to infrastructure, human and natural ingredients, which are easy to base handled through geographical information system, and therefore tourism planning's ability to achieve the best results, with reference to the importance of the database is to provide decision-makers with all the information concerning the development of tourist sites and manage optimally, and try to take advantage of available resources and try to connect them with some variables that can affect in their geographical distribution, and access to the results and outputs can help explain the geographic distribution pattern, and planned to help determine the pros and cons of this distribution, which is appointed in future planning to avoid the disadvantages of the current distribution pattern.

Keywords---virtual reality technology, geographic information systems, tourism planning.

Introduction

Tourism is becoming increasingly important as a major industry, with significant socio-economic benefits. The tourism industry has become a fast-track economic solution, to the point that it has led to uncontrolled growth at the expense of resources and services in many countries. Therefore, it has

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2820

become necessary to provide a comprehensive foundation for tourism planning, work on precise coordination in setting objectives, identifying available and applicable means, and taking into account the provision of a sufficient amount of data and information, as well as its inventory and analysis, in order to enhance and preserve available tourism capabilities and services related to tourism activity, ensuring its continuity in the present and future.

The tourism industry, in general, is a complex and interconnected process, intertwined with both human and natural factors, which interact, making it increasingly difficult to navigate such an activity. These factors collectively constitute diverse sources of data and information that assist in the tourism planning process, enabling information to be consolidated into data and maps. Developing the tourism sector requires a well-thought-out strategy that takes into account environmental considerations, available resources, and tourism potential. Therefore, it is imperative to plan, implement, monitor, and manage all levels, while following a sound scientific approach and specific programs to identify existing potential and optimally utilize it.

Planning requires a vast amount of accurate and detailed information closely related to the land. The process of collecting, organizing, analyzing, presenting, and coordinating this vast amount of information into a system that allows for easy, convenient, and rapid retrieval has become increasingly complex. Geographic Information Systems (GIS) represent a new and important scientific tool for preserving geographic information about the nature of places, monitoring and analyzing all their resources, and developing models for them, while also monitoring the impacts resulting from tourism development. GIS has become a fundamental application tool for analysis and as a means of presenting tourist and archaeological sites and other resources in the form of geographic maps, contributing to the provision of all the information and data that support tourism planning.

Research Problem:

The research problem is crystallized in the low level of awareness and interest in the information infrastructure for geographic information systems (GIS) data in the tourism sector. This is compounded by the absence of modern planning thought and the continued development of traditional plans that are not scientifically and accurately studied, and do not take into account the environmental dimensions of the nature of the areas to be identified and developed. This reveals the weakness and shortcomings of tourism plans and their incompatibility with actual reality. This is due to shortcomings in collecting and identifying data, documenting it in a coordinated and scientific manner, and documenting it in a new technological method using computers. This is accomplished through the use of specialized programs for data collection, images, charts, and all content, whether digital data or graphical graphics. This provides a realistic picture of the shortcomings, available and exploited capabilities, and services that must be available in tourist and archaeological areas. These are then displayed on the tourism map in a coordinated and planned manner. This is because data constitutes the basic foundation for tourism planning. On the other hand, there is a weakness in the skill level of those working in the planning structure within the tourism sector, in addition to a lack of expertise in dealing with modern information technology systems and their emerging technologies. This reduces the chances of developing good tourism planning in the tourism development processes of tourist and archaeological sites. Furthermore, studies focusing on (GIS) technology in tourism planning are limited, despite its importance in the tourism sector. This study provides a realistic picture of the nature of available capabilities and tourism and archaeological assets capable of meeting the needs and desires of tourists in the midst of global competition. This new technological approach includes an available digital database, providing all the information and data on the nature of archaeological and tourist sites.

The research aims to:

1. Shed light on virtual reality technology.
2. Identify the benefits of Geographic Information Systems (GIS) in tourism planning.

3. Identify and evaluate the uses of virtual reality technology and Geographic Information Systems (GIS) in the tourism sector.

Research Hypotheses:

1. The lack of accurate data and information about the nature of archaeological and tourist sites hinders tourism planning.
2. The use of GIS can contribute to the preparation of high-level and sophisticated tourism development plans, thereby increasing investment and tourism demand.

Research Contents:

Section One: Virtual Reality Technology

Section Two: Geographic Information Systems (GIS) in the Tourism Sector

Section Three: Tourism Planning

Section Four: Applications of Virtual Reality Technology and Geographic Information Systems in Tourism Planning

Section One: Virtual Reality Technology

Definition of Virtual Reality Applications: Different definitions have been proposed to describe the various important features of establishing a virtual reality experience. Virtual reality has been defined as the use of a three-dimensional computer environment—called virtual reality—that a person can navigate and interact with, resulting in a realistic simulation of one or more of the user's five senses.

The virtual reality experience can be described based on its effectiveness in providing actual immersion and psychological presence. The term "immersion" refers to the extent to which the user is isolated from reality. Since virtual reality systems require efficiency to deliver this high quality, we find that sensory data has evolved significantly since the advent of virtual reality technology in the 1960s.

Virtual Reality in the tourism field¹ is known as the realistic representation of tourist and archaeological sites, such that the user is transported to virtual reality in an interactive manner via computers, and lives with them in three dimensions and interacts with them in real time as if they were real objects existing on the ground, and allows us to move within them and watch and interact with the elements through tools prepared and designed for this purpose.

Modern Virtual Reality Technology: The continued development of virtual reality technology will lead to improved systems' ability to support each of the five human senses. Furthermore, the means and methods by which users interact with these systems will evolve beyond the input and output devices currently used. These technologies are used to provide the user with the most realistic experience possible, such as a virtual reality experience. This experience is interacted with via a computer screen, without physically being present within the tourist or archaeological site. Virtual reality technologies have some important properties that will clearly demonstrate their usefulness in the tourism sector in the future. For example, the process of intimate presence, which is the feeling generated by the user of virtual reality programs that they are truly present within this reality, connected to it, and responsible for it. This presence is divided into three different levels:²

First: Presence in space (spatial): The sense of being in a place, imagining it, and drawing relationships between its components by observing all its details.

Second: Temporal presence: meaning no aversion to this reality or a sense of alienation within it, but a clear desire to remain in it and follow its development and change.

Third: Emotional presence: meaning a sense of connection to this reality, even after leaving it and the ability to remember its components after the experience of experiencing it has ended.

Virtual reality must present a three-dimensional image and allow viewing from any angle, depending on the user's perspective. The quality of holographic images has improved significantly over the years, with improvements in the process of reproducing visual effects such as textures, shadows, and transparency. However, virtual reality's need to update 3D images in real time presents clear challenges that have limited the ability to reproduce complex phenomena such as light refraction. All output devices are designed for single-user use, but others allow multiple users to simultaneously experience the virtual

reality experience. For example, large panoramic displays can be configured to provide a shared visual experience for multiple users. Special glasses can also be used to view 3D images projected from a virtual table or computer-assisted virtual environment (CAVE), which projects these images to all sides within a closed room. When virtual images are superimposed or superimposed on the real world, through augmented reality (AR), users can share the experience. In AR, images are viewed through special glasses or other devices that may or may not be grounded.

Integration between Virtual Reality Technologies and Geographic Information Systems (GIS): The integration of virtual reality technology with leading GIS systems will enhance the role of GIS as a unified information resource, narrowing the gap between two-dimensional and three-dimensional geographic data. It will provide visual information in three-dimensional formats that enable the visualization of all areas surrounding the point of view, with the possibility of comprehensive integration with engineering drawing linking systems, satellite images, photographs, etc. It will also enable the processing of geographic maps, wide-angle (180)-degree images, and the geographic coordinates of elements through an application that combines other application interfaces as a single unit. This can be described as the new generation of geographic information systems. The advantages of integration can be summarized as follows:³

- Supports Raster and Vector systems for mapping information systems.
- 3D virtual elements are considered spatial properties (trees, lampposts, billboards, etc.).
- Supports the main functions that enable the processing of images and maps (zoom functions, wide-angle view, free-selection, etc.).
- The ideal solution for analyzing geographic information systems (GIS) using desktop computers with ease and precision.
- The system provides the user with the ability to search for and locate specific geographic locations and provides a comprehensive view that mimics their natural reality, saving significant effort, costs, and time if the site requires multiple visits.
- The system allows for all types of additions or modifications, such as adjusting position, orientation, size, inclination, or rotation, and measuring dimensions and distances, as well as obtaining coordinates based on the natural landscape.
- It analyzes the relationship between 3D data, information, and associated systems.
- It makes the user feel as if they are actually in the center of the area, viewing all directions, angles, and details. It is an interactive information source that mimics reality, enticing many to explore it more closely.

Virtual Reality Applications in Tourism: The potential for the use of virtual reality technologies within the tourism sector is increasing with the continued development of technology. There are numerous immediate applications of virtual reality within the tourism sector, and by analyzing some of them in key tourism areas, it becomes clear that they have significant impacts and offer numerous opportunities for researchers and tourism officials.⁴

1. Planning and Management: The properties of virtual reality make it uniquely suited for visualizing spatial environments, which is why it has been widely used for urban, environmental, and engineering planning purposes. Over the past decade, Chung (1995) has recognized that virtual reality has the potential to serve as an inexpensive tool in tourism policy formulation and planning processes. It is clear from the above that virtual reality allows the creation of virtual environments, enabling tourism planners to conduct analysis while considering potential developments. Compared to two-dimensional preliminary plans or fixed three-dimensional models, virtual reality models offer several advantages. For example, virtual reality models allow planners to view an environment from unlimited perspectives rather than a narrow perspective, and they allow for rapid visualization of potential changes that can be evaluated.

2. Marketing: In addition to using virtual reality in destination planning and management, it can also be used in destination marketing. Many authors have emphasized the potential contributions of virtual reality to tourism marketing. The potential for tourism marketing through virtual reality applications lies primarily in the application's ability to provide sensory information. Comprehensive for potential

tourists. This capability is particularly relevant to the tourism sector, as many tourism products are considered "trusted goods." Customers cannot experience the product in advance and must decide whether to purchase or not based on the detailed information available. Therefore, e-marketing is very important for the tourism sector. The experiential nature of virtual reality applications makes them an ideal tool for providing rich data to potential tourists seeking information about a tourist destination. Tourists can make better decisions and have more realistic expectations, and as a result, they will have a more satisfying vacation.

3. Entertainment: In addition to being a tourism marketing tool, virtual reality applications can be an attractive and entertaining tourist attraction. With the advent of virtual reality technologies, the entertainment sector, and video games in particular, have played a significant role. Although most virtual reality applications are designed for home use, others, such as the Rewind Rome 3D 'edutainment' show, have been specifically developed as tourist attractions.

4. Education: Virtual reality applications are considered educational tools as well as entertainment. Teachers have recognized their educational benefits for several years, as well. Research has proven the usefulness of virtual reality applications in teaching students at various educational levels and in several subjects. Virtual reality models can be used as a useful educational tool to deliver a large amount of information, as they stimulate the user's spatial abilities. Virtual reality applications can be used in museums, heritage sites, and other tourist sites. They can be virtual archaeologists who reassemble artifacts from scattered pottery, select clothing from various ancient eras to bring the user back to that era, and help a sculptor create an ancient statue. In addition to their use as tourist guides, virtual reality applications can serve as a unique and valuable tool to help researchers identify sites and objects visited by tourists.

Virtual reality applications can be used in museums, heritage sites, and other tourist attractions. Virtual archaeologists can reassemble artifacts from scattered ceramics, select clothing from various ancient eras to bring the user back to that era, and assist a sculptor in crafting an ancient statue. In addition to their use as tour guides, virtual reality applications can serve as a valuable tool to help researchers identify sites and objects visited by tourists.

5. Accessibility: Virtual reality applications provide accessibility for both researchers and tourists. This accessibility is limited to virtual reality, but it remains preferable to any alternative to physical visits, which are often not possible. For example, a tourist site may be too remote, too expensive, too difficult, too dangerous, too sensitive, or no longer exists. In addition to providing the best alternatives, virtual models can allow for effective interaction with historical or sensitive elements that cannot be encountered in real life.

The ability of these applications to virtually access sites can benefit everyone in general, and people with special needs in particular. People with disabilities who travel or wish to travel constitute a significant portion of the market. Unfortunately, they face numerous challenges, such as inadequate accommodation facilities, transportation difficulties, and negative community attitudes. Physical accessibility barriers can be overcome through collaboration with tourism service providers. However, in some locations, such as historical heritage sites, modifying the environment to accommodate people with disabilities may be impossible due to protection requirements and high costs. In these cases, virtual reality applications can provide alternatives for people with disabilities.

6. Heritage Protection: The number of heritage sites that can be visited virtually is growing dramatically, and countless heritage sites have been enabled with 3D virtual reality models, although most are not open to the public.

3D virtual models of these heritage sites can significantly contribute to heritage protection, as these models contain highly accurate data that can be stored indefinitely. As these sites are exposed to erosion and other risks, virtual reality models can provide accurate information about their previous state, which can be used to monitor deterioration and develop restoration plans. Virtual reality applications assist in the restoration process by monitoring restoration work or visualizing the potential impacts of such work. In fact, real-world UNESCO World Heritage sites are considered to be under significant threat, having gained significant popularity solely because of their inclusion on the list. "Most researchers

believe that listing a site as a real-world heritage site is an incentive for rapid tourism development, and that increased visitor numbers pose a significant threat to the site's sustainability," says Lee.

The Economic Feasibility of Virtual Reality Technologies in Tourism: The tourism industry is currently one of the most difficult and competitive industries, due to the intense efforts of several regional and international entities to attract tourists. This has posed several challenges for the General Authority for Tourism and Antiquities. In addition, there is a negative and stereotypical image of domestic tourism in society. To change this image, society must be endeared to domestic tourism in an attractive manner, without the need for high financial expenditures to learn about tourism services. Hence, the importance of virtual reality technologies in attracting tourists is highlighted, especially since the next generation is more open to reality and more knowledgeable about tourism, and is considered an avid user of modern technologies. Therefore, presenting these services in an attractive manner helps gain their acceptance and conviction. Among the tangible economic benefits directly from virtual reality technologies are:

1. Commercial advertising.
 2. Marketing tourism establishments' offerings.
 3. Tangible indirect economic benefits:
 - Encouraging visits by domestic and foreign tourists, thus increasing tourism activity.
 - Raising awareness of the importance of antiquities and museums and introducing them through various publishing media and exhibition events, with the aim of attracting the public and private sectors and targeted tourist groups to an interest in antiquities and museums.
 - Obtaining the support of officials, decision-makers, and various members of society.
- Section Two: Geographic Information Systems (GIS) in the Tourism Field: Geographic Information Systems (GIS) are a modern tool that has greatly facilitated the tasks and performance of planners when making spatial decisions related to the development or analysis of a specific problem with a spatial dimension. This technology has been used in many different scientific fields, such as studying the distribution of services, analyzing land use, or dividing transportation routes. This is due to the ability to store vast amounts of tabular data, prepare maps, and store data in an interconnected manner, making it easy for the user to display tabular data with maps using a variety of methods. It also allows for computational processing to extract results with minimal time and effort, and to utilize them in making a decision as quickly as possible, which is what modern planning requires.

Below, we will address the most important general terms for Geographic Information Systems (GIS): The terminology for Geographic Information Systems (GIS) has varied according to the scientific backgrounds of those involved and the diversity of its application fields. The continuous and consistent development of information and communications technology has contributed to the expansion and spread of its uses, leading to a clear diversity in the definition of the term according to different disciplines. Some of the most important definitions commonly used globally for Geographic Information Systems (GIS) are as follows:⁵

Definition (Dueker 1979): "A geographic information system is a special case of information systems that contains databases based on the study of the spatial distribution of phenomena, activities, and objectives that can be spatially defined, such as points, lines, or areas, to make the data available for retrieval, analysis, or querying."

Definition (Parker 1979): "A geographic information system is an information technology system that stores, analyzes, and displays all spatial and non-spatial information."

Definition (Smith et al. 1987): "A geographic information system is a database system containing organized spatial information, in addition to a set of operations that answer queries about spatial phenomena from the database."

Thus, we note that these definitions consider geographic information systems to be a special type of information system. Definition (1990 NCGIA): "A geographic information system (GIS) is a set of computer hardware, software, and automated functions that enable the capture, storage, management, analysis, modeling, and display of geographic data for the purpose of solving complex planning and management problems."

Burrough and NCGIA's definitions clearly show that GIS are multifunctional systems.

Some consider GIS an effective tool for assisting decision-making, as stated in Cowen's (1988) definition: "A geographic information system is a decision-making aid that integrates spatial data into the context of problem-solving."

One definition that suggests a significant divergence in the concept of GIS is the American ESRI (1990) definition: "A geographic information system is a coordinated complex of computer components, software, databases, and personnel that together accurately capture, store, update, process, and display spatial information."⁶

Based on these definitions, it can be said that a geographic information system is a spatially referenced system that includes a set of hardware devices. Software allows the user to perform a range of tasks, such as entering data from various sources (maps, aerial photographs, satellite images, etc.), and storing, organizing, managing, analyzing, displaying, and outputting data in various formats (maps, graphs, tables, and reports).

Specific objectives of a geographic information system:

1. Preserving information in a clear and final form; understanding phenomena and monitoring risks; making data and information related to geographic mapping systems available and facilitating their access to decision-makers in government agencies, the planning and economic sectors, especially investors and the general public; speeding up the completion of geographic maps; and determining space and time.
 2. Building a system with integrated modules based on geographic information systems and information technology applications to retrieve and extract spatial data and information.
 3. Assisting those familiar with planning projects; making it possible to easily upgrade information and maps.
 4. Sources of geographic information are numerous, and from ancient times to the present day, we have been equipped with new sources due to the advanced technology of our time. These sources include, but are not limited to: land surveying, using aerial photographs and digital images that determine the dimensions of each point.
1. Conducting representative investigations through statistics, population, and economics. Census. Remote sensing is a method of analyzing ground data, which is essential for understanding the natural environment.

Characteristics of Geographic Information Systems (GIS) Technologies⁷

This computer-based system primarily uses data to input, store, manage, analyze, and output geographic information related to various natural or industrial resources. The system allows for the translation of vast amounts of information from numerous sources and its conversion, using automated processing, transformation, and matching methods, into a simple, concise, and comprehensive format. This facilitates decision-making by officials when planning or monitoring any project or program.

Applications of Geographic Information Systems (GIS)⁸

We find that most technologically advanced countries have come to rely primarily on geographic information systems in their work, and the introduction of this technology into most government and private entities, particularly those providing public services. Most of these entities have direct access to computer networks. This technology has been used in several areas, including:

- **Transportation:** Planning, constructing, and maintaining roads, identifying the types of services required by villages and cities located along the roads, and obtaining various necessary information to determine traffic directions, monitor and regulate traffic signals, and establish security patrol centers and points.
- **Disasters:** Identifying disaster and fire sites, the nearest and fastest routes leading to them, identifying nearby facilities, identifying stored materials, and analyzing rescue and prevention methods.
- **Natural Resources:** Storing information and supplies, including analyses, geographic data, and maps related to various geological studies, such as research and exploration for natural resources.

- **City Planning:** Analyzing and converting various maps into useful information and applications that help identify land parcels, services, and public facilities, as well as analyzing water, sewage, and electricity networks and linking city plans together.
- **Agriculture:** Analyzing and classifying soil, identifying groundwater locations in agricultural projects, calculating products, and managing farms.
- **Communications:** Planning and analyzing telephone lines, towers, and communication networks.
- **Coastlines:** Analyzing marine information and data related to seawater, marine organisms and plants, and identifying coral reefs and fishing sites.

In general, GIS supports various planning activities, such as managing electricity, water, sewage, gas, telecommunications, and cable services, utilizing specific capabilities such as load management, problem analysis, voltage drop, line system analysis, positioning, network pressure and flow analysis, and leak detection.

Thus, the benefits of using GIS can be summarized as follows:

1. Facilitating the process of drawing maps, no matter how large, with high accuracy, enabling individuals to use them in their work.
2. Facilitating the process of storing data with large maps on a computer, allowing easy access and modification. This is perhaps one of the most important benefits of the system.
3. Easily displaying data on maps without the need to manually drop it. The required data is displayed in the format the user needs with great ease.
4. Easily creating backup copies of data and maps and using them when needed.
5. Performing searches within spreadsheets, where the computer searches for the required data and displays it in a very short time.
6. The ability to create 3D maps and utilize them, especially in mountainous areas.
7. In the field of street networks, the program's tools can be used to analyze routes and select the most appropriate ones.
8. In the field of water networks, faults can be identified in areas suffering from water shortages.
9. In the field of sewers and infrastructure, blockages can be easily identified.
10. Connection to a server allows for real-time tracking of object movement.
11. The ability to connect between local networks and the internet to display data at high speed.
12. The ability to use any coordinate system, and sometimes maps can be converted from one system to another without any noticeable errors.

Section Three: Tourism Planning: The concept of tourism planning did not crystallize clearly and specifically until after World War II. International travel developed rapidly and intensively, and the number of tourists increased, along with the diversification of tourism and recreation. Tourist areas multiplied, with their functions and characteristics varying. All of this led to increased interest in tourism and tourism activities. The need to control and direct these activities emerged to mitigate their negative impacts on society and the environment and achieve maximum economic benefit, especially after tourism came to be viewed as an industry and a primary source of income in many countries around the world. Tourism planning is a type of development planning. It consists of a set of deliberate, organized, and legitimate phased procedures aimed at achieving optimal exploitation and utilization of available and potential tourist attractions and achieving the maximum possible benefit. This process is monitored, directed, and controlled to keep this exploitation within the desired range and prevent any negative consequences or effects arising from it.

Definition of Tourism Planning: Tourism planning is defined as drawing an estimated future picture of tourism activity in a given country over a specific period of time.

This requires identifying the country's tourism resources in order to define the objectives of the tourism plan and achieve rapid and consistent tourism development through the preparation and implementation of a coordinated program that encompasses all branches of tourism activity and the country's tourist regions.⁹

Tourism planning should not be viewed as a field limited to official bodies, but rather as a joint program of action between government agencies, the private sector, and individuals. Therefore, tourism planning must be a joint process among all entities regulating the tourism sector—government agencies supervising this sector, tourism service providers (institutions and businessmen), consumers of these services (tourists), and the tourism host community—from the stage of formulating the objectives to be achieved to the stage of implementing and applying tourism plan programs. Some tourism planning writers believe that among the factors for the success of tourism planning is the presence of four relationships (E):¹⁰

A- The relationship between planning and economic activity: "Economics." The success of tourism activity in any region is closely linked to the levels of activities that can lead to a sustained increase in income and the ability of the local economy to absorb and utilize this income.

B- The relationship of planning to the Environment: "Environment": We find that tourism and the environment are the same, given that tourist flow is linked to tourist attractions such as climate, natural landscapes, beaches, etc., or to man-made attractions such as historical and archaeological sites, modern ones, etc. Here, an important point emerges regarding the need to preserve environmental assets.

C- The relationship of planning to Visitors to the Tourist Area: "Enrichment": It is appropriate to prepare residents to provide tourists with information that allows them to enjoy the mental experience. The combination of psychological enjoyment and intellectual enrichment makes tourists more willing to visit the area again.

D- The Relationship of Planning to Foreign Exchange: "Exchange": If planning aims to increase a country's foreign exchange resources, the success of tourism planning is measured, particularly for developing countries, by its ability to increase the flow of foreign exchange into the country, whether through international tourism revenues or through the inflow of foreign capital for tourism investment. Characteristics of Good Tourism Planning: Good tourism planning is characterized by its focus on the tourism product, as well as on promotion and marketing processes, in a manner that achieves a balance between economic, social, and environmental objectives within the framework of comprehensive and sustainable tourism development. Good tourism planning must also meet several other characteristics, the most important of which are: Flexible, continuous, and incremental planning, which accepts any necessary modifications based on ongoing monitoring and feedback.

1. Comprehensive planning for all aspects of tourism development: economic, social, cultural, environmental, demographic, etc.
2. Integrated planning, in which tourism is treated as an integrated system, where each part complements the others, and each element affects and is affected by the other elements.
3. Community-based planning, meaning it allows for the participation of all relevant parties in the planning process at its various stages.
4. Environmental planning that prevents the deterioration of natural and historical tourist attractions, works to provide the necessary measures for their ongoing maintenance, and ensures their preservation for the longest possible period.
5. Realistic and feasible planning, meaning that its objectives do not exceed the limits of capabilities and ambition, nor do they deviate from the scope of available and potential natural, financial, and human resources.
6. Organized, phased planning, consisting of a set of sequential and sequential steps and activities.
7. Planning that treats tourism as a system with specific inputs, processes, and outputs, and that these structures can be influenced and directed.

Spatial Levels of Tourism Planning: There are multiple spatial levels of tourism planning, but in general, four main levels can be discussed:¹¹

1. Tourism Planning at the Local Level. Tourism planning at this spatial level is more specialized and detailed than at other spatial levels, and typically includes details on many aspects, including:

- ☐ The geographical distribution of tourism services and accommodation facilities.
- ☐ Tourism services and facilities.
- ☐ Tourist attractions and features.

- ☐ Paved road networks, retail outlets, parks, and reserves.
- ☐ Road transportation systems, airports, and railway stations.

Many development plans at this spatial level are preceded by preliminary economic feasibility studies, as well as studies to evaluate environmental, social, and cultural impacts. These studies also evaluate development programs and appropriate administrative and financial structures for implementation, as well as spatial organization and engineering design rules. Such studies also include an analysis of visitor traffic and related recommendations. 2. Tourism planning at the Regional Level: Tourism planning at the regional level focuses on many aspects, including, but not limited to:

- ☐ Regional gateways and their associated regional and international transportation routes.
- ☐ All types of sleeping facilities and all other tourism services.
- ☐ Tourism, investment, and legislative policies and regional tourism regulatory structures.
- ☐ Tourism promotion and marketing programs.
- ☐ Training and education programs, cultural, social, economic, and environmental considerations, as well as impact and return analysis.
- ☐ Development phases and strategies, and project programming.

Tourism planning at the regional level is specialized and detailed to a lesser degree than at the local level and greater than at the national level. The level of specialization depends on the size of the country and the region. A national plan in a small country may contain as much detail as a regional plan in a large country, while a small country may not require both national and regional planning. 3. Tourism Planning at the National Level: Tourism planning at this level covers all aspects covered at the regional level, but in a less specialized and detailed manner, and at the country or state level with all its regions and areas.

4. Tourism planning at the International Level: Tourism planning at this level is limited to transportation services and routes between groups of countries, such as the European Union. This planning also includes the development of some tourist attractions that are geographically distributed across several neighboring countries, such as the Alps in Europe. In addition, there is tourism planning between several countries in the areas of tourism promotion and marketing. It is worth noting that international tourism organizations and bodies, such as the World Tourism Organization, often participate in this type of planning and sometimes provide full material and moral support in this field.

Section Four: Applications of Virtual Reality Technology and Geographic Information Systems (GIS) in Tourism Planning

The benefits of VR and GIS applications in tourism planning can be summarized as follows:

1. Providing information to decision-makers, enabling them to take action based on accurate and up-to-date information. This information is reflected in tourism planning and encourages tourism investment.
2. Integrating maps and data within a single system in an accurate and effective manner to accurately and effectively inventory and develop facilities, road networks, and other services at tourist sites.
3. It serves as an electronic archive of geographic information, including the locations of tourist sites and their related data, and has the ability to store large amounts of information so that it can be accessed easily and quickly.
4. The effective use of GIS in tourism planning contributes positively to identifying future needs and saving costs compared to other methods such as aerial photography and ground surveying.¹²
5. Reducing the time required to analyze sites and obtain rapid results, saving the effort expended in conducting similar studies using traditional methods.

The most important graphic elements involved in the geographic information system (GIS) in the planning process for tourism development areas are as follows:¹³

1. Topographic maps, geological maps, and hydrological maps.
2. Natural attractions, represented by (vegetation cover and the distinctive natural environment).

3. Tourist attractions, represented by (archaeological, heritage, and tourist landmarks).
4. Available infrastructure.
5. Tourist facilities and services.
6. Tourist statistics.

To achieve the best results using these technologies in the field of future planning for tourist sites to be planned and developed, some optimal steps are required:¹⁴

- Selecting appropriate satellite images based on the required scale or the size and type of the study area.
- Processing and analyzing images according to the study area, the type of results, and the desired objectives. Images are enhanced to show and monitor changes in development sites or to highlight certain phenomena.
- Gathering available information and maps for the study area and conducting field surveys as needed to correct the images geographically using GPS devices.
- Producing final images showing the desired landmarks. These can be used as a base map, relying on a specific projection to ensure consistency of information.
- Collecting detailed information for the site by the relevant authorities or through field surveys.
- Extracting Information from satellite images of the desired areas is stored in vector layers.
- Linking databases with the area's spatial data.
- Analyzing information according to the study's requirements.

The use of Geographic Information Systems (GIS) applications as an effective technology can perform many tasks in tourism planning. This involves analyzing, storing, processing, managing, and outputting spatial data and information, and linking them to descriptive information in the form of models, maps, and visual data. This helps planners and decision-makers in sound tourism planning in tourist areas to be developed and expanded. Furthermore, it represents a real opportunity to salvage any remaining data and maps before they are completely destroyed and preserve them through GIS software. This software has become an important and fundamental component of tourism planning, as it relies on a basic database of data and information needed for tourism development processes in tourist sites.

The basic stages of applying Geographic Information Systems (GIS) in tourism planning:

When creating and building a Geographic Information System (GIS) in tourism planning, it is necessary to select the tourist sites for development and to identify the basic scope of work aimed at completing the technical tasks undertaken by the tourism planner. This means that the proposed planning system requires technical work that deals with geographic data, including maps, satellite images, aerial photographs, and charts, in addition to the ability to link descriptive data to spatial data on maps. This is highlighted by GIS technologies in tourism planning for tourist and archaeological sites. Below, we will provide a more detailed explanation of the most important basic stages that tourism planning goes through through GIS applications. Traditional methods used in tourism planning are limited in their processing and analysis capabilities. They rely on manual "hard copy" map structures, which require considerable effort and time. They do not enable the planner to take all natural parameters into account, nor do they provide a sufficient number of planning options and alternatives that can be easily implemented using geographic information systems (GIS).

By studying practical cases of the use of GIS in tourism planning, which have addressed many of the negatives and shortcomings resulting from traditional tourism planning, they save effort and time, provide the ability to change characteristics and objectives more flexibly, and offer many alternatives and options quickly, while providing accurate results. However, they also require a combination of planning thinking, computer expertise, and the ability to use GIS software, in addition to the availability of financial resources to purchase software and equipment.¹⁵

First, identify the area to be planned and developed.¹⁶ In the first phase of developing the proposed GIS system, the geographic scope is determined, the boundaries of the target region are identified, and

the proposed system is applied to it. This facilitates the identification of land units and their characteristics, as well as the identification of geomorphological processes such as water and wind erosion, environmental hazards, flood channels, valleys, fault zones, joints, and folds, as well as agricultural and urban areas, which impact the established tourism facilities.

Second, establish planning foundations and standards: After identifying the natural limitations of the area to be planned, planning foundations and standards must be established to address these limitations and factors. The planning foundations and standards for identifying the study area's features can be summarized as follows:¹⁷

1. Study the soil, vegetation cover, and various land uses in the study area.
2. Select the most appropriate geological formations for establishing tourism facilities.
3. Study the slope of the land surface and determine the appropriate height above sea level.
4. Exclude areas with a high potential for agriculture from areas suitable for establishing tourism facilities.
- 5- Determine the appropriate distance for tourist facilities from joints, rock faults, and ground folds.
- 6- Determine the appropriate distance for tourist facilities from dangerous flood-prone streams.
- 7- Study the main and secondary road network in the study area.

These foundations or criteria are considered the parameters that feed into the model upon which the proposed system is based using geographic information systems (GIS).

Third: Collecting and Classifying Data Used in the Proposed System: After determining the study area, the data is collected and entered into a database. The GIS system is characterized by its ability to handle many types of descriptive and geographical data. Satellite and aerial images are among the most important sources of tourism data for the proposed area.

Topographic maps of various scales are an important means of determining the natural drainage network of water basins, matching and verifying them with satellite images, constructing maps to classify areas at risk (risk zone map), and defining and constructing the area of influence (buffer). They can also determine the height above sea level by entering contour lines for construction (digital elevation model).

Fourth: System Analysis and Design: The analysis and design phase of the Geographic Information Systems (GIS) includes three stages, as follows:

1. System Analysis Phase.
2. System Design Phase.
3. The practical and logical design phase of databases (data base physical conceptual design).

The system analysis phase includes several steps, including identifying the system user's needs, the quantities and types of available data, and determining the workflow. Based on the results obtained in the system analysis phase, new systems are proposed. Freeman (2004) believes that the proposed system uses the structured system analysis and design method (GIS) (SSADM).

After obtaining the results from the system analysis phase, the implementation steps followed to build the system are determined, the work methodology is described, and a clear and specific definition of the structure and components of the proposed system (System Compatibility) is provided.

The third step in system analysis and design involves processing the database in terms of identifying and evaluating its components, the contents of the data base, and the coordinate system.¹⁸

Fifth: Building applications, presenting, and evaluating the results: Geographic information systems contain several subsystems, each with individual functions that integrate with the other subsystems to ultimately form the main system structure to achieve the main objectives.

From the above, we can visualize the proposed system, capable of handling an infinite amount of data, and capable of linking descriptive data to its geographic location, performing complex analysis of ground elements, and identifying the ground locations for establishing tourist facilities within any tourist site based on specific pre-determined conditions. This facilitates the work of the tourism planner in identifying and selecting the most suitable sites for tourism development. Conclusion:

GIS can achieve numerous benefits in the fields of tourism planning, tourist area development, and archaeological discovery by creating maps of tourist sites and identifying areas where archaeological discoveries are likely. The system also contributes to improving analytical performance, which helps support decision-making processes. It should be noted that this system is still immature and is hampered by several difficulties, most notably the scarcity of databases for all tourist and archaeological sites. Furthermore, there are a number of difficulties, most notably the scarcity of human resources skilled in GIS programs, the scarcity of institutes and universities offering GIS within their specializations and curricula, and the scarcity of Arab companies operating in this field. Furthermore, decision-makers are unaware of the benefits of GIS, which impacts the financial support provided for the development of this technology, which requires continuous development to meet the changing demands of governments, businesspeople, natural resources, nature conservation, science, education, and services. GIS technology aims to create a better world, planned in a coordinated manner that takes into account all economic, social, and environmental dimensions. This may serve as a call to leverage its benefits as much as possible in the field of tourism and tourism planning to advance comprehensive development. Results: The study attempted to answer the first hypothesis, which is the lack of accurate data and information about the nature of archaeological and tourist sites, which hinders tourism planning. Therefore, tourism planning was linked to the geographic information system (GIS) in order to solve the data problem that contributes to supporting planners in benefiting from the geographic database of the regional plan and making sound decisions in identifying qualified sites for tourism sites and their development and growth in the future. This system may lead to benefiting from achieving tourism planning goals and increasing its effectiveness. The study also aimed to highlight the importance of using geographic information systems (GIS) as a multi-benefit technology in tourism planning. The study attempted to answer the second hypothesis, which is that the use of geographic information systems and their contribution to preparing high-level and sophisticated tourism development plans contributes to the growth of investments and tourism demand. The study proposed the provision of a proposed geographic database that includes all tourist sites.

The most important outcomes of Geographic Information Systems (GIS) applications in tourism planning are as follows:

1. Ease of collecting, documenting, updating, and analyzing social, economic, natural, environmental, and urban data related to project studies by creating a digital basemap capable of meeting the needs of planning projects in terms of representing spatial elements that represent various phenomena.
2. Ease of effective access to the geographic database facilitates the analysis of the spatial and descriptive data stored therein.
3. Providing project outputs, including dashboards, presentations, and reports, in a professional, high-quality format.
4. Supporting officials and decision-makers with the warnings and recommendations resulting from realistic analyses of problems, contributing to making the most appropriate decisions for the public good.

Recommendations:

1. The need to activate and enable reliance on geographic information systems in tourism development planning projects, which require large spatial and descriptive databases. This requires greater utilization of GIS technology applications.
2. The need to focus on equipping universities and institutes with specialists in GIS, remote sensing, databases, and their applications. This is to develop student skills and build a broad base of human resources to meet growing market needs and keep pace with these technologies globally.
3. Support tourism promotion centers, research institutions, and various government agencies with this technology, which has become widely used globally, saving time, effort, and money.
4. Study available and eligible areas for the possibility of establishing villages and tourist facilities in certain areas that are compatible with the surrounding environment at the lowest possible cost, using these GIS technologies in the process of comprehensive surveying of the region, clarifying and processing data to make decisions that contribute to the development of tourism planning.

5. Promote internally and externally using an advanced technological approach appropriate to the times, utilizing GIS technology and the capabilities of the Internet.
6. Determine the objectives and directions of the plans, as they constitute the source of the objectives of tourism plans and a source for renewing the role that these plans should play in achieving comprehensive development by adopting GIS technologies.
7. Emphasize the need to train human resources on the fundamentals and concepts of geographic information systems (GIS) to utilize the software used, their analytical capabilities, and the available means for retrieving and displaying information. Special units should be established within each institution to develop and adopt this modern "GIS" technology, tailored to each institution and its applications.

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