Smart city: a futuristic solution for Oman

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Abstract-   In this research paper, we will highlight the future plan of the Sultanate of Oman with the smart city environment. We will evaluate e-tourism and e-transfer sectors. Moreover, after analyzing the results of this paper, it will be clear to know the possible scenario for each sector studied in this research.

Keywords – sustainable development, Smart city, Smart city projects, Smart City, Artificial Intelligence, Technology Development, Technology-Based Cities.

I. INTRODUCTION

The development of the concept of the city during the different ages reflecting the development in the different human activities and in parallel with the development in the different scientific and technical fields. The growing evolution of information and communication technologies has led to a parallel development in all human activities, leading to the emergence of terms and concepts that have become part of the daily life of societies, such as e-commerce, e-mail, e-learning, e-university and For the e-government, all this has led to the emergence of the information society, and as the city is a place where individuals practice different life activities that have become increasingly dependent on technology, changes are taking place in the city's structure in response to the requirements of those activities.

In fact, a city in the world (both developed and developing) is barely free from a certain amount of technological development, all cities have telecommunications networks that serve individuals in different ways However, the growing technological development has led some cities to rely mainly on technologies leading to the emergence of new models for urban development and planning.

The emergence of several cities that rely on electronics and networks, and has acquired several designations, including the digital city, electronic, virtual, informational, and smart, from the catalysts of emergence of the dependence of both society and the contemporary economy on knowledge and innovation, as the main engine for the development of cities, in addition to the emergence of new spaces It is based on technologies and digital representation, and consists in its entirety of multiple networks comprising user data, applications and electronic services, as well as creative complexes and collaborative online environments.

II. BACKGROUND

Writers addresses the economy, which highlights the course of economic growth of the city smart. Also show the most important pros and cons that may affect the smart city economically. The research also reveals the potential use of technology and communications to reduce the use of resources and energy in our countries. The research concluded by identifying the range of functions performed by smart cities: collective intelligence, technology exchange, creativity, and community development.[1]

Smart city and its development from the beginning of 2000s, it gained great international popularity in various fields. It touched upon the problem of climate and high temperature. It has also paid great attention to the rapidization of urbanization and progress in the societies of the world.[2]

New ideas have also been put forward to monitor the development of smart cities in the United States and Asia.[2]

Authors have developed a framework for the indicators of the assessment of the city smart, characterized by a low rate of polluting gases and ease of economic life as well as the index of urbanization and urbanization in the city.

It also examined the means of transport and movement and the differences between them, which contributes to raising the level of urbanization in the city. It also studied the most important effects of the approach of smart city development in different cities.[3]

III. METHODOLOGY

This paper will be with the final result of statistical analysis using SPSS. To evaluate the result I have been using Statistical Package for the Social Sciences (SPSS) on different parameters. It is used by researchers to perform statistical analysis. As the name suggests, SPSS statistics software is used to perform only statistical operations. Using the result of this paper, it will clearly be visible that what will be the potential scenario of different sectors after establishing the smart city environment.

IV . EXPERIMENT AND RESULT

As we mentioned previously that this study is based on a study of 2 different sections of the smart city. At the end of each section we will know the perspective that the Sultanate of Oman will have after applying the smart city system in each section.

The sections that we studied are e-tourism and e-transfer. We will discuss each section of them in detail below.

E-tourism

The tourist importance of Duqm

Duqm region has many tourist potentials that make it the focus of attention of tourists in this wonderful location on the shores of the Arabian Sea, where birds play the most melodious tunes.

The Rock Garden is one of the most prominent tourist vocabulary for Duqm, and it is a rare geological site that the Special Economic Zone Authority in Duqm works to preserve, develop and employ as a tourist, based on its historical value as a landmark that embraces a diverse, rich and rare group of rocks with formations that mimic man and nature and draw a unique and aesthetic painting from Its type.

Application strategy for e-tourism

The strategy mainly aims to promote cultural heritage, and work on tourist attraction through meeting the diverse needs of tourists and to achieve the goals of the strategy it is necessary to define a set of partial goals, which are:

- Promote and introduce tourist sites and thus encourage them to visit them on the ground.

- Provide data on tourist sites for individuals before visiting them on the ground, which helps in determining tourist destination, by choosing some tourist sites and overcoming others.

- Provide an alternative to a realistic visit to risky or inaccessible sites, or sites that no longer exist, or threatened sites, in order to protect historical areas and artwork and the fossil and architectural dimension of heritage and preservation.

- Providing tourists, while they are touring, with a digital tourist guide in 3D, providing information in a photo direct or indirect.

Strategic goals	Activation levels	Suggested projects
The promotion of tourist sites, and the development of tourism awareness of historical areas.	Level of information provided.	- Two-dimensional maps (event locations). - Historical and cultural paths.
Provide data on tourist sites to individuals before visiting them on the ground.	Level of information provided	- Provide knowledge content about historical and archaeological importance.- - Create a flexible knowledge base.
Provide an alternative to a realistic visit to risky or inaccessible sites, or sites that no longer exist.	- Display level - Level of interaction	- Virtual tours in historical areas - Rediscovering the past through virtual reality (sites that no longer exist or where change has been sought)
Providing tourists, while they are touring, with a digital tourist guide in 3D, providing information directly or indirectly.	- Display level	- Virtual tours in historical areas, supported by 3D computer technologies.

Table 1: The strategy of implementing e-tourism

E-Tourism Application Methodology [7]

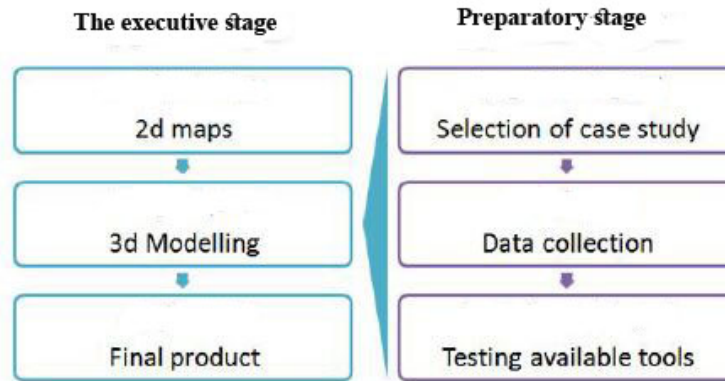This methodology includes a group of phases, shown in Figure 1

Figure1: E-tourism application methodology.

- The preparatory stage: This stage includes several series of steps, as follows:[7]
- The study case selection stage: Duqm was chosen due to its distinctiveness and economic value, architectural and urban, where its port is considered one of the most important ports since a long time through which trade commodities are exchanged.
- The data collection stage: This stage includes the collection of information related to the region, and includes several Studies, which are:
  - Integrated plan for conservation and development in the Duqm region.
  - Current Status Plans.
  - Oman Tourism Ministry website(https://www.omantourism.gov.om/).
- Auxiliary Equipment Selection Stage: All assistive devices are selected at this stage (Software and simulations) to meet the requirements.
  - ❖ Geographic Information Systems (GIS) Software
  - ❖ 3D modelling tools.
  - ❖ Website Management System
- The executive stage: This stage includes several steps in handling the data obtained in the preparatory stage, in order to present the data in an interactive way.

- The implementation phase using (GIS) program: through which drawings and plans are transferred manual to two-dimensional and three-dimensional.
- The implementation phase using three-dimensional modelling tools: in this stage the buildings are modelled historic to prepare historical simulation, virtual tours.
- The implementation phase using the WordPress management system: the previous data is displayed in a website that represents the final product.

Technical requirements for e-tourism

E-tourism application requires a set of technologies that can be classified according to levels. The following table shows these technologies.[9]

E-tourism activation levels	Technical requirements		
	Data collection techniques	Data processing software	View and transfer data
Level of information provided		-Geographical Information Systems (GIS). - Multimedia tools.	- website
Display level		- GPS positioning techniques. - Multimedia tools.	- Wireless networks. - website

		- 3D modeling tools. - Programming the creation of virtual tours.	
Interaction level	- Security cameras - Sensors		- Wireless networks. - Information Kiosks - website

Table 2: Technical requirements for e-tourism according to levels

Intelligent Transfer

Transportation in Duqm

The transportation system in the Duqm region and its surroundings depends mainly on the means of transportation with small capacities, and the shares of the means of transportation

in them are estimated as follows: Taxis: 23%, private cars: 33%, minibuses: 38%, buses 12%. [10]

The polarization of the Duqm area for many trips resulted in traffic jams, and the current highway network in the Duqm region is radial, and its internal roads are limited or ineffective. This means that most long-distance trips, whether heading to the city centre or not, are likely to pass through congested internal roads, which will thus increase the volume of vehicle traffic inside it, it is urgent to make the most of existing roads, and enhance their efficiency through to take the necessary measures at the level of traffic management.[12]

Thus, the analysis of the transportation system and giving a clear picture of traffic problems enables the development of solutions, which are considered one of the most important priorities of the work, provided that the solutions are commensurate with the future situation and the proposed planning visions.

The strategy of implementing a smart transportation system for Duqm

Traffic problems	Intelligent transport system applications	Suggested projects
traffic jam High level of pollution	Traffic management	- Traffic management systems. -Installing cameras and sensors. - Installing a traffic alert signal.
	Transportation demand management	- Development of the public transport system. - Increased dependence on bicycles and electric cars.
	Electronic collection of fees.	- Install necessary equipment on the side of the roads.
Insufficient car parking	Car parking management	- Create smart car parking. - Preparation of a parking management system. - Installing cameras and sensors.
Traffic accidents and long response times for emergencies	Enhanced traffic safety (emergency vehicle management)	- Establish a system for reporting traffic accidents.
	Automated Safety Check (Vehicle Weight Measurement)	- Install necessary equipment on the side of the roads.
	Provide information about the weather.	- Installing monitoring devices and information delivery devices to drivers.
	Automatic closure of roads.	- Install necessary equipment on the roads.

Table 3: Smart Transportation Application Strategy

Objectives of the strategy

The strategy of implementing the smart transport system aims to:

- Enhancing the efficiency of the transportation system.
- Establish a secure transportation system.
- Energy conservation and environmental protection.

After applying the smart transportation structure to the Duqm region Table 4, it turns out that most smart transportation applications must be applied, due to traffic problems in the city, and certainly this is not possible at the same time, due to many reasons including the high cost of technologies, time Necessary to implement these applications.

Traffic problems	- Traffic jam - Insufficient car parking - Traffic accidents - Long response time to emergencies - High level of pollution	
Suggested smart transport system applications	- Traffic management - Car parking management - Transportation demand management - Automatic closure of roads - Electronic collection of fees - Automated Safety Check (Vehicle Weight Measurement) - Provide information about the weather - Enhanced traffic safety (emergency vehicle management) - Reducing the level of pollution	
Suggested techniques	Data collection	security cameras
		Sensors
		Electronic counters
		Vehicle weighing equipment on the move
		Radar to measure speed
	Data processing	Geographical Information Systems
	Control, control and transmission of information	Telecommunications networks
		Electronic guiding boards
		Automated message signals
		website
		Information booths

Table 4: The proposed smart transportation structure for Duqm

Consequently, a priority has been set for the approval of some applications, based on the importance of these applications, where the highest priority (short-term) 1-3 years has been given to applications that contribute to solving basic problems related to congestion, car parking, and the level of pollution, while the middle priority is 3-7 It included applications that relate to solving immediate problems, such as automated road closures and provision of weather information, and applications that partly contribute to solving problems such as automated vehicle inspection and automatic fee collection. The least priority (long term) has been given more than seven years.

The table 5 shows the priority of smart transmission applications for Duqm.

Intelligent transport system applications	priority
Traffic management	*
Transportation demand management	*
Electronic collection of fees	* * *
Car parking management	*
Enhanced traffic safety (emergency vehicle management)	*
Automated Safety Check (Vehicle Weight Measurement)	* *
Provide information about the weather	* *
Highway monitoring	* *
Automatic closure of roads	* * *
Traffic management	*
Transportation demand management	*

Table 5: The priority of smart transportation applications for Duqm

(*) High Priority Applications, (**) Medium Priority Applications, (* **) Low Priority Applications

Technical requirements for the intelligent transportation system in Duqm

The smart transportation application in Duqm area requires the availability of a set of technologies, and to determine the required technologies, it is necessary to determine the technical elements available in the region, as a large part of the transportation network in the region is equipped with radars to measure speeds, but the smart transportation application requires providing the rest of the parts with these technologies Also, the wired and wireless networks that cover the city can contribute to data transmission, table 6 shows the technologies currently available in the region, which are available in part, in addition to the required technologies.

Technical requirements			Available	Partially available	Required to be provided
Technologies used	Data collection	security cameras		×	×
		Sensors			×
		Electronic counters			×
		Vehicle weighing equipment on the move			×
		Radar to measure speed		×	×
	Data processing	Geographical Information Systems			×
	Control and transmission of information	Telecommunications networks	×		
		Electronic sign boards			×
		Automated message signals			×
		website			×
		Information booths			×

Table 6: Technical requirements for the intelligent transportation system in Duqm

V.CONCLUSION

At the end of this research paper, we can say that countries are still moving forward as they move forward with the technological progress that the world is witnessing in our time. The Sultanate of Oman is one of the most important countries that seek to embody the mechanisms of smart cities and take advantage of them. The Sultanate's 2040 plan takes in its eyes are the establishment of an integrated smart city in all its scientific, practical and social branches. Together in this research paper we examined the ability of the Sultanate of Oman to develop an infrastructure for smart tourism and smart transportation and is able to establish all departments in a way that is not inconsistent with the smart city system. And the work is still ongoing to cover all scientific departments and the process and make it a beacon and a beam to be followed in this field.

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