

Integrating Intelligent Remote Sensing Technologies for Urban Master Planning: A Case Study of Rashid Camp

Ahmed A. Abdullah¹, Kifah Tout², Zaid F. Make³

ahmad.anwer988@gmail.com

Abstract The economic blockade and wars in Al-Iraq have had significant negative impacts on the quality of life for the population, including harm to the historical and cultural foundations of cities and difficulties in finding adequate housing. Challenges in urban development are exacerbated by political polarization and a lack of legal frameworks, and much of the country's land is devoted to resource extraction. In the aftermath of conflict, there is a need to rebuild metropolitan areas and create comfortable living spaces utilizing technology like GIS, GPS, and remote sensing to create smart cities. Iraq's urbanization is expected to increase rapidly over the next several decades, presenting significant challenges related to pollution, inadequate water and energy resources, and waste management infrastructure. The Al-Rashid camp in Baghdad offers potential for smart city development while preserving its historical character and civilization, but has been neglected by the Iraqi state. To promote development in this area, it is essential to prioritize smart technologies and consider their integration with the region's natural features.



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1. INTRODUCTION

The wars against Iraq have caused significant challenges for its populace, including a crisis in finding adequate housing and no legal framework in place to handle issues of urban development and political polarization. The majority of the land is used for oil and gas extraction and mineral exploration and trade, leaving little room for urban development [1]. As urbanization increases, so do issues such as slums, pollution, water and energy restrictions, delays, and insufficient capacity to treat wastewater and dispose of trash.

To address these challenges, the development of smart cities using emerging technology such as remote sensing, GPS, and

GIS (3S) is a potential direction state policy. The Al-Rashid Camp in Baghdad is one of the most untapped areas in Iraq, with plans to convert it into a smart city due to its proximity to the Tigris River [2]. This research study focuses on the use of smart remote sensing technologies to develop master plans for the Al-Rashid Camp, which has remained neglected and abandoned since its destruction in 2003. The aim is to create a relaxed space for post-war living while protecting the city's cultural identity and civilization.[3]

Rashid Camp (research study area)[4], coordinates 33 ° 16 40 N, 44 ° 29 41 East is one of the Middle East's oldest cities, and Rashid Base is the first army camp set up in Baghdad in the Ottoman time. as shown in figure (1).



Figure 1. Iraqi Map with Rashid Camp, (selected part).

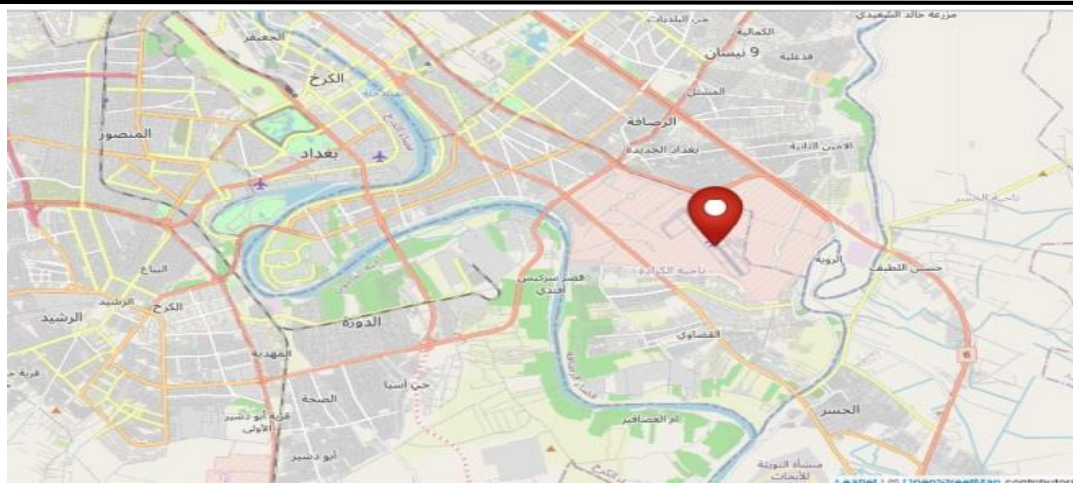


Figure 2. Rashid Camp (source: active research).

Table 1. People living in Rashid Camp.

Year	Inhabitants
2012	131,120
2014	150,000
2017	180,000

Table 2. Population and city-type relationships.

City Type	Population (p)
small town.	50,000.
Central city.	50,000 – 100,000.
large city.	100,000- 250,000.
Very big city.	250,000 - ≥.
Metropolitan.	1,000,000.



Figure 3. Rashid Camp (source: active research).

Background

In order fully comprehend the potential benefits of implementing smart city technology in Rashid Camp city, it is necessary to explore the fundamental principles and basic

components of this technology. Smart city technology primarily involves leveraging digital and technological solutions to enhance the sustainability, efficiency, and quality of life of urban areas. This often necessitates the incorporation of advanced analytics and data-driven insights, the integration

of technology into urban infrastructure and systems, and the creation of an interconnected and unified urban environment. If smart city technology is successfully implemented in Rashid Camp city, it has the potential to positively impact the local economy, improve user experiences, and enhance overall livability.

1.1. Smart City And Analysis

In the 1990s, the idea of a "smart city" emerged as a way to demonstrate how urban development was fusing tech, creativity, and globalization. Governments have turned to the development of smart cities in response to challenges such as rapid population growth and traffic congestion, which can lead to pollution and diminished quality of life. Smart cities aim to create a more livable environment and enhance transportation safety by utilizing intelligent and connected systems and technologies to reduce travel time and improve quality of life for residents and visitors, while also reducing pollution.

To design a smart city like Rashid Camp, various information and communication technologies (ICT) are used to optimize territorial management and urban development. It is important to establish linkages based on geographic information science and technology (GPS, GIS, and RS). High criteria are set for the planning and design of urban environments and a smart city must be connected to smart economic and commercial systems, smart transportation and people, and a smart government using technology. Additionally, a smart city should provide an environment conducive to a smart lifestyle. Figure (4) demonstrates how various technologies can be utilized to develop land and create a comfortable living environment for people, such as by inputting and networking data using remote sensing, analyzing data using spatial or non-spatial methods, and managing data to obtain useful information using computers and smartphones from a large database.

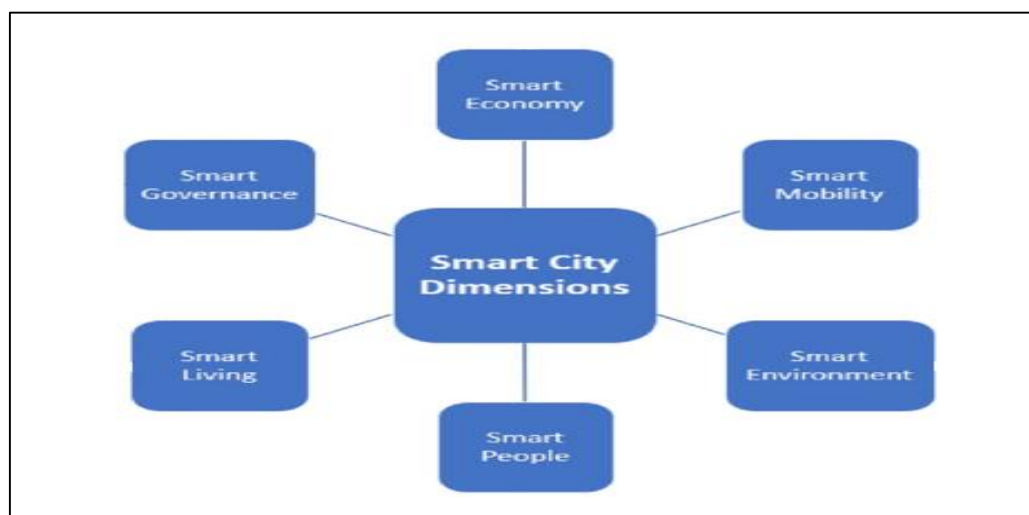


Figure 4. Diagram of the smart city development process.

1.2.

1.3. Using Satellite Photos For Urban Planning And Development.

Urban design includes data collecting and analysis, prediction, design, strategic planning, economic modeling, and social analysis. It also includes the regeneration of built metropolitan areas as well as open land sites. Geospatial data is being utilized more and more to map the urban system and foresee how changes will affect it.

Today, as more cities grow, there is a rising demand for current maps of land use and topography as well as other specialized data products. These maps are crucial for applications in engineering, resource management, and land use planning. Several urban planning initiatives use remote sensing methods from a variety of sources to guarantee the greatest quality data over large areas. Urban mapping programs seek to provide

high-quality outputs by utilizing the newest and most economical techniques [5].

1.3.1. Middle Resolution Expertise

In metropolitan settings, it is common practice to run global abstraction queries on medium-resolution satellite data. It is a useful assessment tool because of the wide area coverage, which makes it possible to record whole areas in a single picture. Decision-makers can visualize the distribution patterns of informal settlements in relation to active growth initiatives by comparing the incidence rate of informal settlements with the expansion rate of new developments using Landsat data. It also makes it easier to analyze land use trends and pinpoint locations where invasion and environmental sensitivity arise.

1.3.2. Information In High Resolution

Spatial updates, settlement classification, infrastructure and service delivery mapping, green site development, access management strategies, and regional planning are all made possible by high-resolution images. Precision location planning and accurate data collection regarding spatial contexts are made possible by the enhanced spatial accuracy.

1.3.3. Information In Panchromatic

Valuable tools in many industries, such as environmental planning, land management, transportation analysis, criminal mapping and analysis, disaster management, public safety, and web-based property data access via GIS, are built on the foundation of panchromatic imaging.

2. APPROACH AND RESOURCES

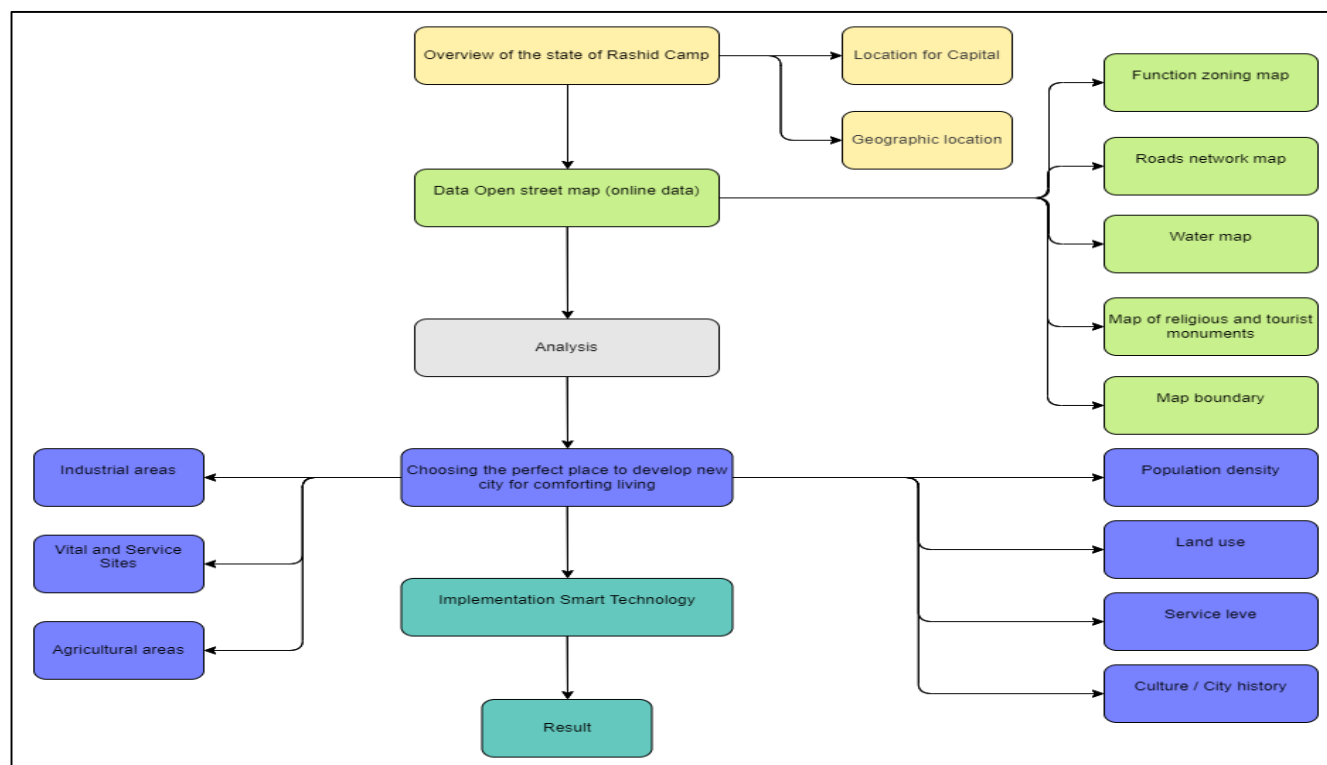


Figure 5. process flow diagram.
(Source: The work of the researcher).

The methodology for implementing smart technology in Basra city is presented in Figure (5) and consists of two main stages: data collection and data editing, managing, and processing.

2.1 Data Collection

1. An overview of the area is studied, including weather and population.
2. Open Street Map is utilized to map functional zoning, road networks, public transportation, aquatic regions, and recreational areas using remote sensing data.
3. *Data Management, Processing, and Editing*

Analyzing many elements, including population density, land use, pollution levels, society, and municipal history, is what this step entails. Farmlands, oil field areas, and industrial areas are subtracted using query equations.

The tools employed include EOS data analytics and ArcGIS software, as indicated in Figure (6). To investigate, analyze, and map the research area, ArcCatalog is used to construct a database, Arc Toolbox is used for analysis, and the Table of Contents is used to display and manage study area layers. In this stage, judgments must be made as well as environmental damage caused by oil production and other issues that determine how territories are used.

A powerful framework for displaying and analyzing two-dimensional features with X and Y coordinates is offered by ESRI Production, ArcGIS, and EOS Data Analytics. Geographic Information Systems (GIS) also provide the capacity to work in a three-dimensional space where a point's coordinates along the X and Y axes are linked to the Z value. This feature enables a more thorough and accurate analysis and representation of spatial data [3].



*Figure 6. Arc Map's representation of 2D data
(source: the work of the researcher).*

To facilitate a better understanding and based on analysis, the study region has been divided into a number of zones using the Arc GIS 10.2 and EOS data analytics software. An online base map was utilized to aid in this process. The zones include water areas, farmlands, residential areas, industrial zones, public utilities, archaeological areas, nearby service areas, and population groupings. These zones are further explained in figure 7.

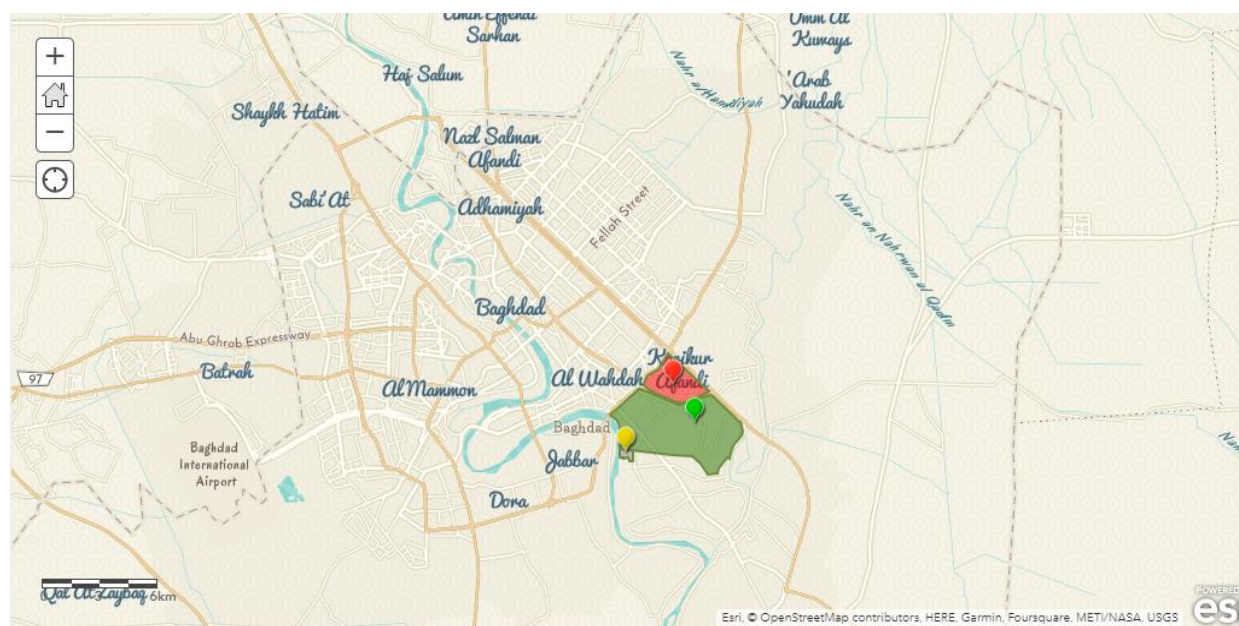


Figure 7. Rashid suburb's strategic location in Baghdad Arc Map (source: researcher's working).

The Rashid camp, situated in close proximity to important areas of Baghdad, including Baghdad International Airport, Baghdad University, the University District, and Baghdad New City, is strategically located to take advantage of the benefits of constructing a smart city in the capital.

The study area, depicted in green as Sarkis Palace and in yellow as a significant archaeological site, is bordered by the new city of Baghdad, marked in red.

The EOS data analytics program was employed to analyze the study area, revealing its extensive usability due to its size, as illustrated in Figure 8, which indicates that the area spans approximately 21 kilometers.

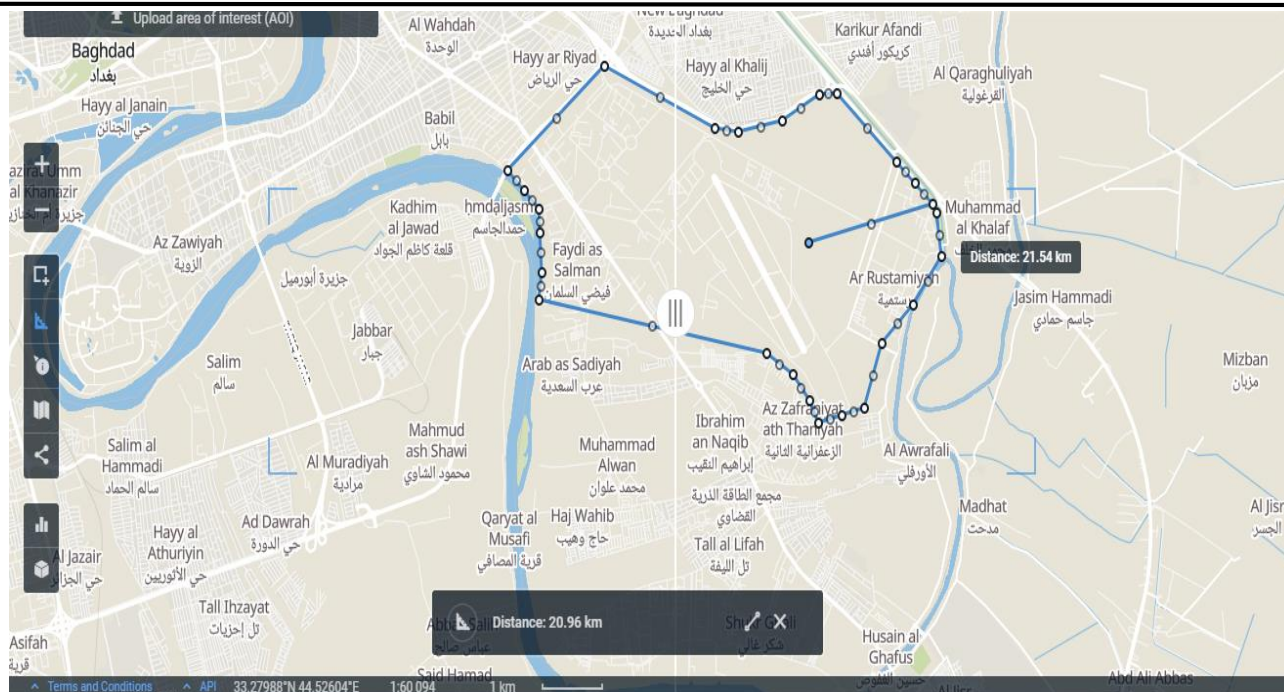


Figure 8 Rashid analyze in EOS data analytics
(source: researcher's working).

Functional zoning, a technique for classifying land uses based on their performance, can be classified into two categories according to both their performance and their physical characteristics. A functional zoning strategy might, for instance, designate particular zones according to their use, such as an industrial zone, a leisure zone, and a housing zone. In addition to defining zones based on traits like population density, size, height, elevations, and coverage, physical traits can also be used. Based on its functional zones, Rashid Camp has been categorized in this study, as indicated in Figure 9.

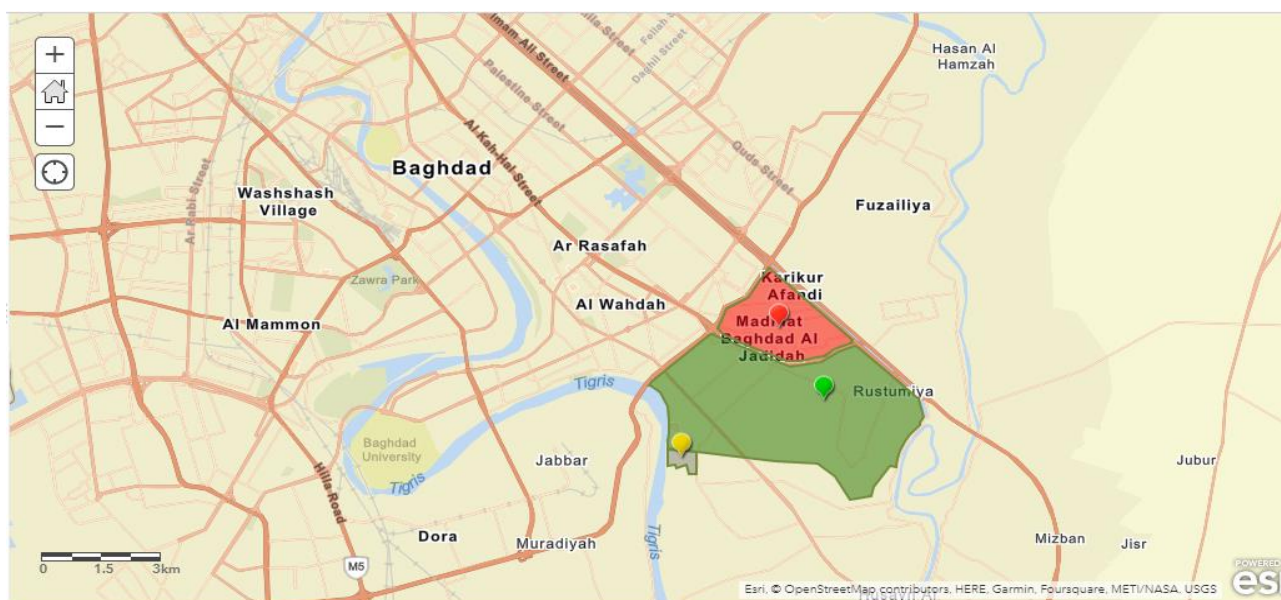


Figure 9. Study Area Analysis for Important Surrounding Locations on an Arc Map (from the work of the researcher).

It is possible to locate the research area by three different zones: green, representing Sarkis Palace; yellow, representing a distinctive archaeological site; and red, representing the new city of Baghdad.

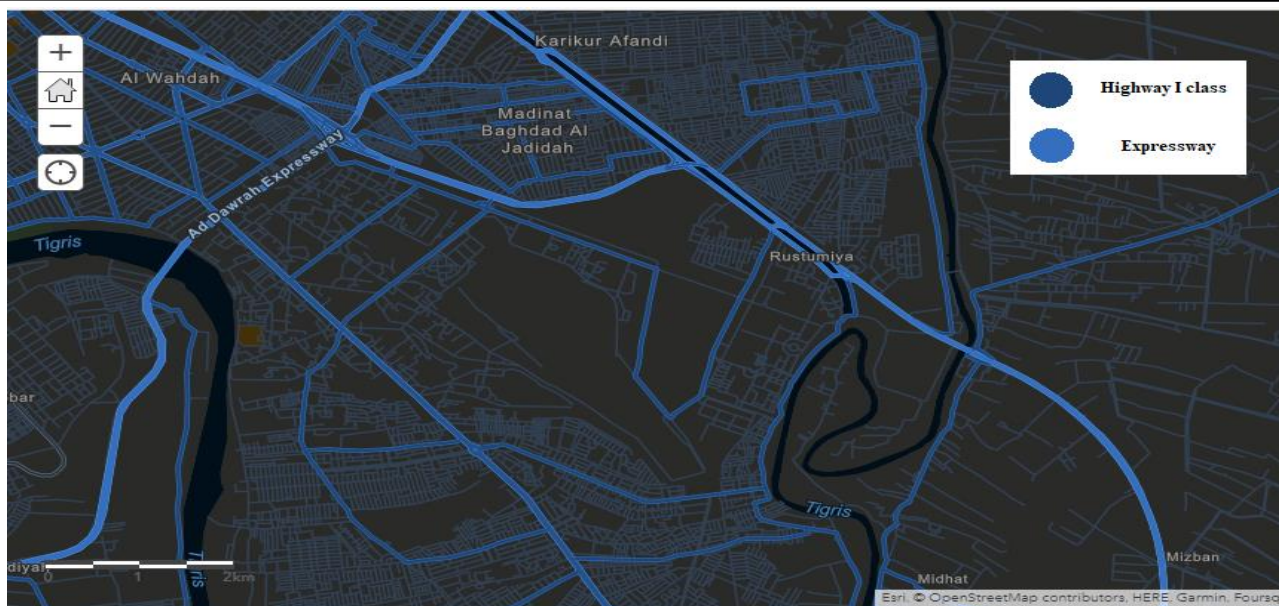


Figure 10. Analysis of the study area in relation to international main routes passing through the region in Arc Map(source: researcher's working).

The division demonstrates the layout of important roads in the study area and its potential to capitalize on the interconnectivity of neighboring provinces through the study area and its location, which intersects several significant international routes to enhance the area's development and utilize these features for industrial, commercial, and population growth.

The According to their importance and permitted speed, the city of Basra's transportation system can be divided into many types, including motorways and class I highways, as illustrated in figure (10). The classification of the road network in Rashid Camp is based on speed, as shown in table 3.

Table 3. Rashid Camp's road classification system.

Road Design	Allowable Speed (Km / h)
Expressway	80 – 120
Highway I class	60 – 80

(Source: researcher's working).

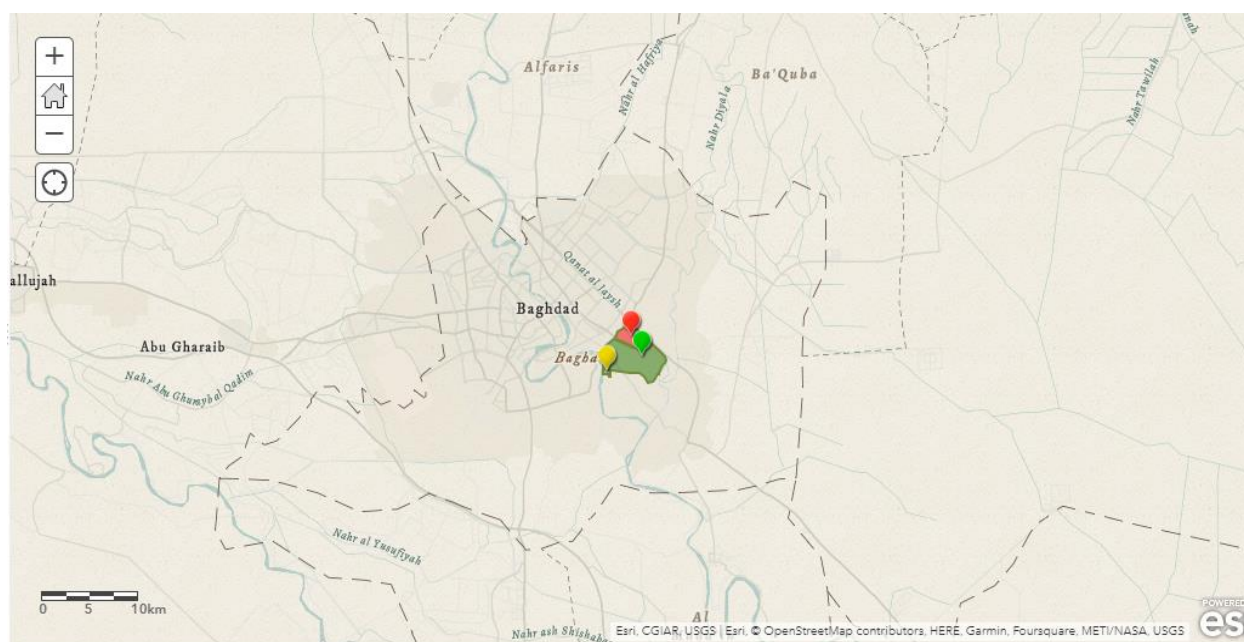


Figure 10. Analysis of the geographical location of the capital Baghdad EOS data analytics
(Source: researcher's working).

Time series analysis of the study area was conducted using EOS data analytics with a focus on two factors:

- **NDVI analysis.**

- **NDWI analysis.**

An integrated approach was used to analyze satellite data, with the shape of the time series graph being influenced by the types of surfaces recorded by the peak readings and the satellite sensor are affected by meteorological factors as temperature, humidity, and cloudiness. The graph, which presents data based on the spectral index values of satellite photos with a minimum amount of cloud cover, was created using interpolation using cubic splines. in the area of interest. Additionally, the graph can be split by year to allow for comparison and evaluation of the time series dynamics using available data for the selected period.

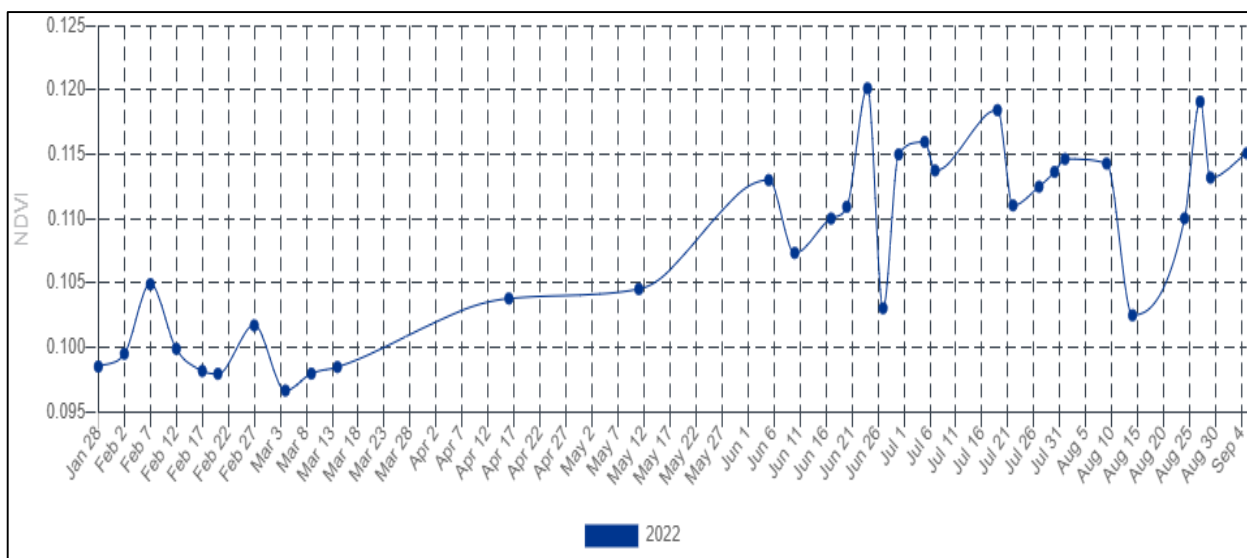


Figure 11. NDVI analysis study area 2022 / EOS data analytics
(Source: researcher's working).

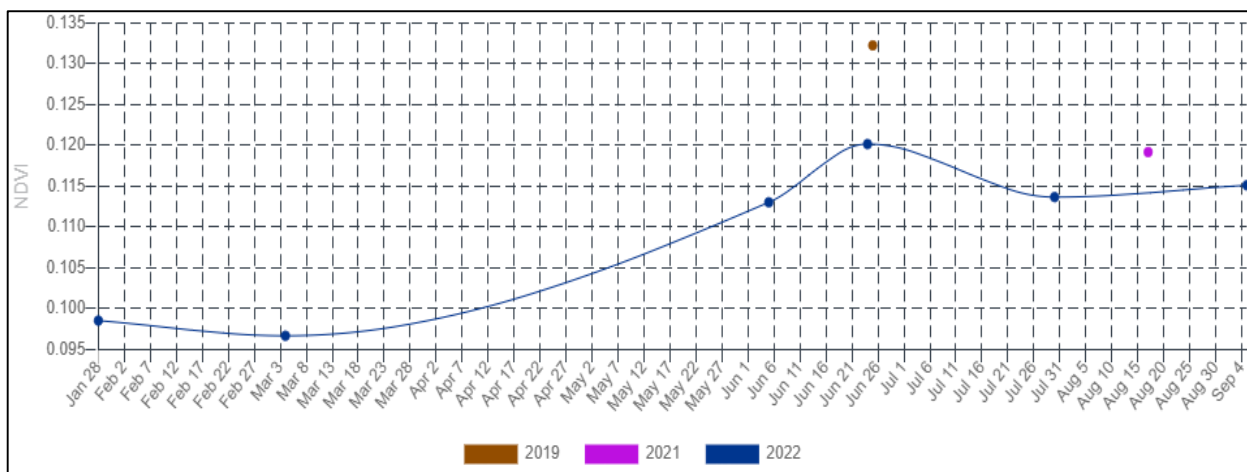


Figure 12. NDVI analysis study area 2019-2022 / EOS data analytics
(researcher's working).

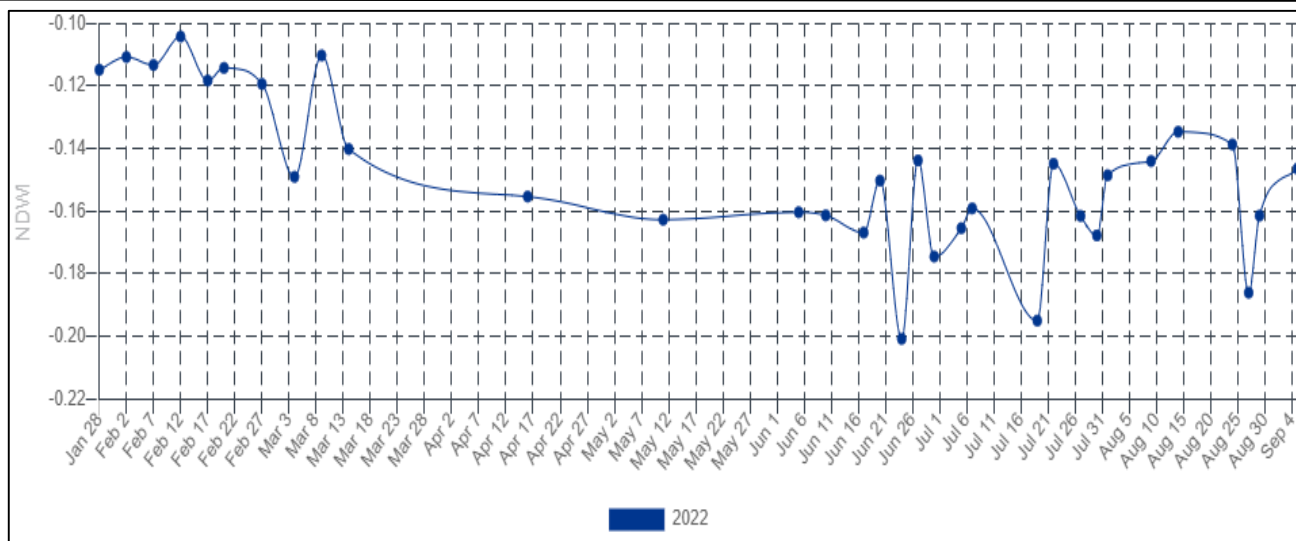


Figure 13. NDWI analysis study area 2022 / EOS data analytics
(Source: researcher's working).

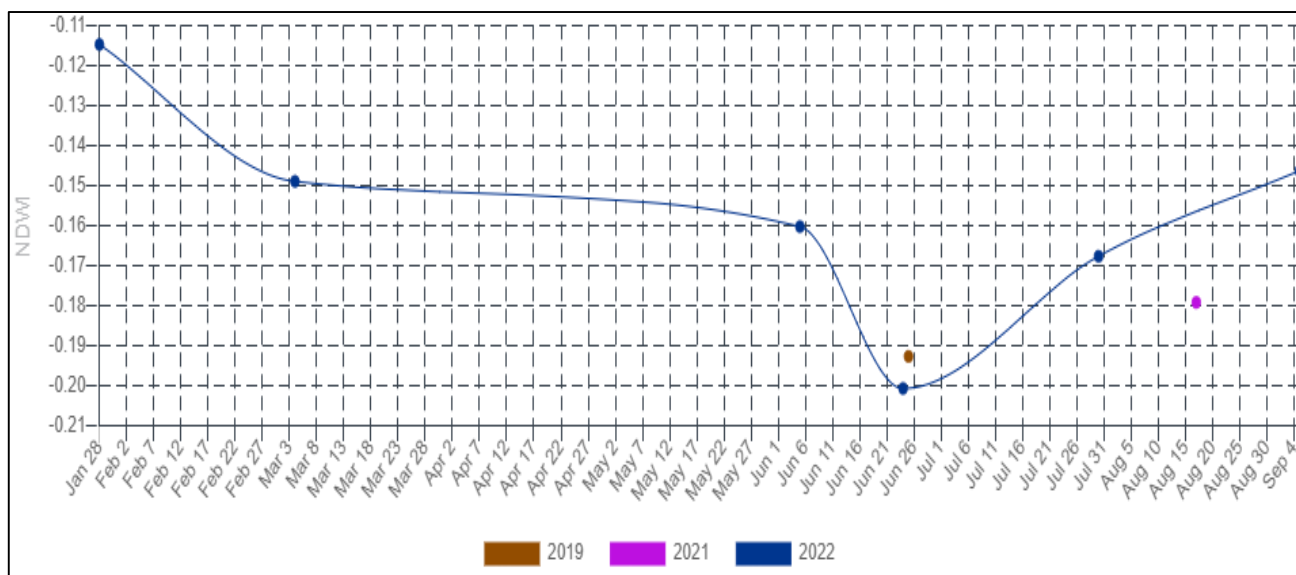


Figure 14. NDWI analysis study area 2019-2022 / EOS data analytics
(Source: researcher's working).

3. DATA ANALYSIS AND RESULT DISCUSSION

It is important to note that the establishment of a buffer zone around certain land use areas is a common practice for environmental protection purposes. In this study, a buffer zone of 1000 meters was established around agricultural land, industrial zones, and transport areas based on standard requirements. This buffer zone provides a special area that can be used as a starting point for transportation. To determine the area that can be developed for a new city, the equation (area can be developed) = $\sum$ (agricultural land - industry zone - transport areas) was used. The analysis was conducted in steps according to standard requirements and guidelines, including

land use, public utilities and industrial zones, transport network, and the development of a smart city. EOS data analytics and Arc Map were utilized in the field analysis process to ensure accuracy and consistency of results. The application of the aforementioned equation allows for the identification of appropriate areas for the development of a new city within the Rashid Camp, referred to as the Smart City. Figure 9 depicts the subdivision of the study area and proposed land use development, which includes the addition of green areas, industrial and development zones for industries, and the proposed Smart City.

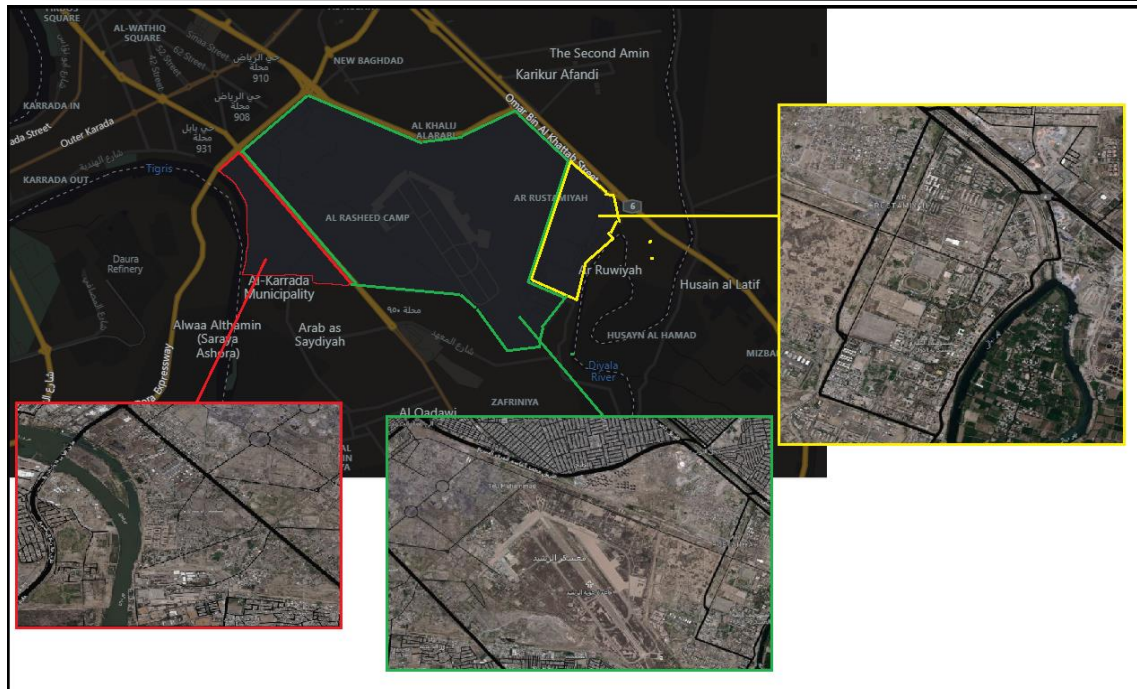


Figure 15. Spatial division of the study area
(Source: researcher's working).

The proposed development plan for the Rashid camp area includes the creation of green spaces, recreational areas, hospitals, modern educational facilities, as well as preserving the archaeological and religious sites within the region's borders which are indicated in red. Additionally, industrial zones and smart transport zones associated with several international routes will be established within the limits of the area in yellow. The development plan also includes the construction of a Smart City, specifically a proposed Smart Media City, which will be located within the limits of the region in green.

Figure (15) presents a detailed overview of the study area, including proposed development plans, various factors and information, and the types of methods and permissible speed as outlined in previous tables. Additionally, EOS data analytics was utilized to support the analysis. Based on the speed function, the time for commuting between the large city center and other indoor urban centers is expected to be no more than 15 minutes, as per the researcher's working.

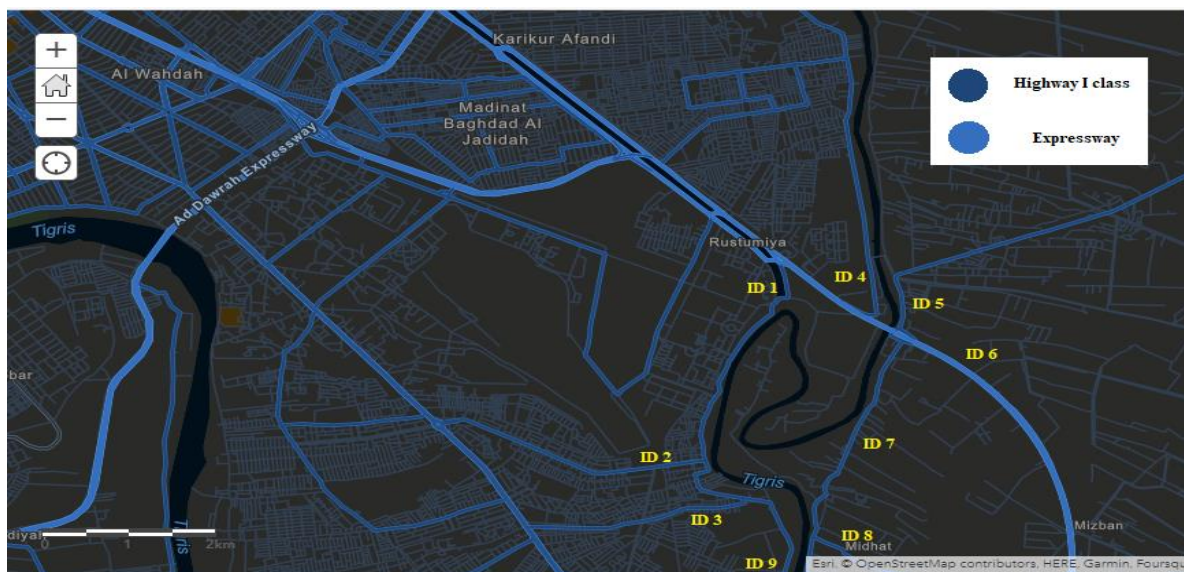


Figure 16. Rashid Camp transport data base Proposed Main Roads (Expressway for example and smart transport).
(Source: Researcher's work).

Table 4. Rashid (Source: researcher's work) Travel data base (Expressway, for instance, and smart transportation).

ID	L.(m)	Velocity(km/h)	Length Kilometer	Time(h).	Time (min).
1	4490	120	4.49	0.037	2.22
2	5240	80	5.24	0.066	3.96
3	3550	80	3.55	0.044	2.64
4	3820	80	3.82	0.048	2.88
5	6920	80	6.92	0.087	5.22
6	10690	120	10.69	0.089	5.34
7	4500	80	4.5	0.056	3.36
8	4230	80	4.23	0.053	3.18
9	4320	80	4.32	0.054	3.24

4. RESULT & CONCLUSION

- 1) Land use is often categorized into Industrial Land, Green Land, and Public facilities and services, with a buffer zone of 1000m applied.
- 2) The transportation network and roads are classified based on allowable speed.
- 3) The selection of potential urban growth zones is influenced by a number of elements including existing cities.

In the case of the Rashid Camp, using sophisticated remote sensing techniques, such as EOS data analytics and Arc Map, has provided valuable insights and information for the development of a master plan. These technologies were used to analyze land use, public utilities and industrial zones, transportation networks, and the potential for a smart city. By applying buffer zones and classifying roads based on allowable speed, suitable areas for development were identified.

Overall, the use of smart remote sensing technologies has potential to greatly improve the efficiency and accuracy of urban planning processes. However, it is important to note that these technologies should not be seen as a replacement for traditional planning methods and community engagement. Instead, they should be seen as a complementary tool that can

enhance the planning process and provide valuable information for decision-making. Ultimately, the success of using these technologies will depend on the ability to integrate them effectively into the planning process and to use the information gained to make informed and sustainable decisions for the future development of cities.

Based on the available information, it is unclear what specific benefits or outcomes have been identified as a result of using smart remote sensing technologies to develop master plans for the Rashid Camp city, or how they have impacted the planning process. However, it is clear that these technologies were used to sectionalize the city into different categories, such as industrial land, green land, and public facilities and services, and to apply a buffer zone of 1000 meters around certain land use areas for environmental protection purposes. The transportation network and road classifications were also based on allowable speeds. Additionally, criteria and factors were used to choose areas for potential city development. It would be helpful to have more information on the specific ways in which smart remote sensing technologies were used to inform the development of master plans and how they contributed to the identification of potential development areas.

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