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(Re-browsing the old calendar with a modern digital one using GIS-RS programs) and updating it to its digital form

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A B S T R A C T

Research and practical applications to update maps depend on successive steps and take into account the development of surveying devices and methods of producing old cadastral maps. which are the only maps available for ownership in Iraq, and that Iraqi government departments and Iraqi state departments use these maps. The research suggests a way to update old agricultural cadastral maps in Iraq by following a re-measurement-based modernization approach as an accuracy limit. Modern D.G.P.S scanning devices and GIS Software is used. to produce new and effective maps with a solid scientific update methodology. The study area is the Mosul district to which the methodology will be applied and the study area covers the Mosul district according to the approved index and old cadastral maps. The results of the study area showed that the methodology used in the research can produce a new correctly-measured map. The projection WGS 1984_ UTM Zone 38 in the Mosul.

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Introduction

In particular, the majority of countries in the world seek to update their maps within a unified reference system for the whole world, specific to the coordinate system, which is WGS84. ,As for Iraq most of the state departments lack regular maps linked to a national and global coordinate system. The coordinate systems Iraq went through are divided into:

The old or tripartite map used in preparing property maps by Cadestro was used from the 1930s to the 1980s. The reference point was located in Nahrwan, southeast of Baghdad. From 1974 to 1979, the Pole Service Company established a horizontal control network, and the Cadastro maps were used as a base map for updating the Mosul district. This led to errors and displacements in large parts of the maps. Cadastro maps are paper maps kept in official departments, exposed to problems like weather conditions and humidity. Technical developments in space photography and the global positioning system have made it easier to identify and address errors by linking these maps to satellite visuals. The Mosul District was chosen as the study area to design and update an effective geographical database based on remote sensing data and satellite visuals [1].

The problem of the study and its questions

Cadastral maps, which are paper maps with errors in grid system, coordinates, and displacement, can be damaged over time due to expansion, contraction, and deformation of their leaves. To create cadastral maps free of these issues, modern digital maps can be designed using GIS-RS software and an effective geographical database that can be deleted, added, and updated. This would help improve the accuracy and reliability of cadastral maps in study areas.[1].

Study hypotheses

Geomatics techniques can aid decision-makers in land use planning by addressing problems through spatial analysis models. Mosul District, like most Iraqi administrative units, lacks digital databases for map management, but remote sensing software offers accuracy, speed, and location [1].

The importance of studying

The study highlights the importance of cadastral maps in local studies and research due to their diverse data and ability to provide comprehensive land use surveys. They serve various purposes, including property identification, dispute resolution, and monitoring administrative borders. They are also useful in designing and evaluating agricultural projects, planning for increased efficiency, and choosing suitable sites for future construction. The study emphasizes the importance of technologies in updating cadastral maps, digital databases, GIS, and RS. software, and updating basic designs [2].

Purpose of the study

The study emphasizes the use of digital technologies for converting paper maps and updating regional changes using satellite images. It also highlights the importance of databases for future studies. Highlighting the role of remote sensing in providing accurate, fast, and comprehensive information about land use changes [2].

Methodology

The study used a geographical approach based on cartographic analysis, using descriptive and quantitative methods. Data was collected from government departments, libraries, and official bodies, including scientific research, official statistics, bulletins, maps, and satellite images. The research involved coding, coloring, classification, drawing diagrams, and final output operations for maps. Layers of point, line, and polygon were drawn, and a database was created, linking the phenomenon to a table explaining its properties [3].

Research limits (Mosul District)

The study area, located in Mosul District, is 180 km2 and spans from the east of the city to the south, including Telkaif, Fayda, Sinjar, and Ba'aj districts. It includes several provinces on both the left and right sides of the city, including Southern Nineveh, Northern Nineveh, Western Nineveh, Eastern Nineveh, and Northern Yaramjah, and Dandan Sharqiya Al-Zanjili [4].

Geographic information systems

Geographic information systems (GIS) are advanced technologies that organize, store, retrieve, analyze, and display spatial data. They link Earth's surface phenomena with a distinct coordinate system, store it in memory, and display the spatial information databases. GIS is at the forefront of modern methods for processing databases and offers programs for operations and analysis [5].

geographic information systems related to research in

Geographic information systems provide a digital database for spatial descriptions and data, enabling the easy creation of background information about a place. They can be used to identify deficits in service distribution, aid in redevelopment projects, and develop plans to match standards. These systems assist planning management and executive leadership in making sound decisions, reducing time, effort, and cost. They analyze quantitative information and provide quick, specific answers to population and urban growth phenomena, allowing decision-makers and planners to address these changes. They also provide dynamic locations and indicators, enabling daily review and appropriate action [6].

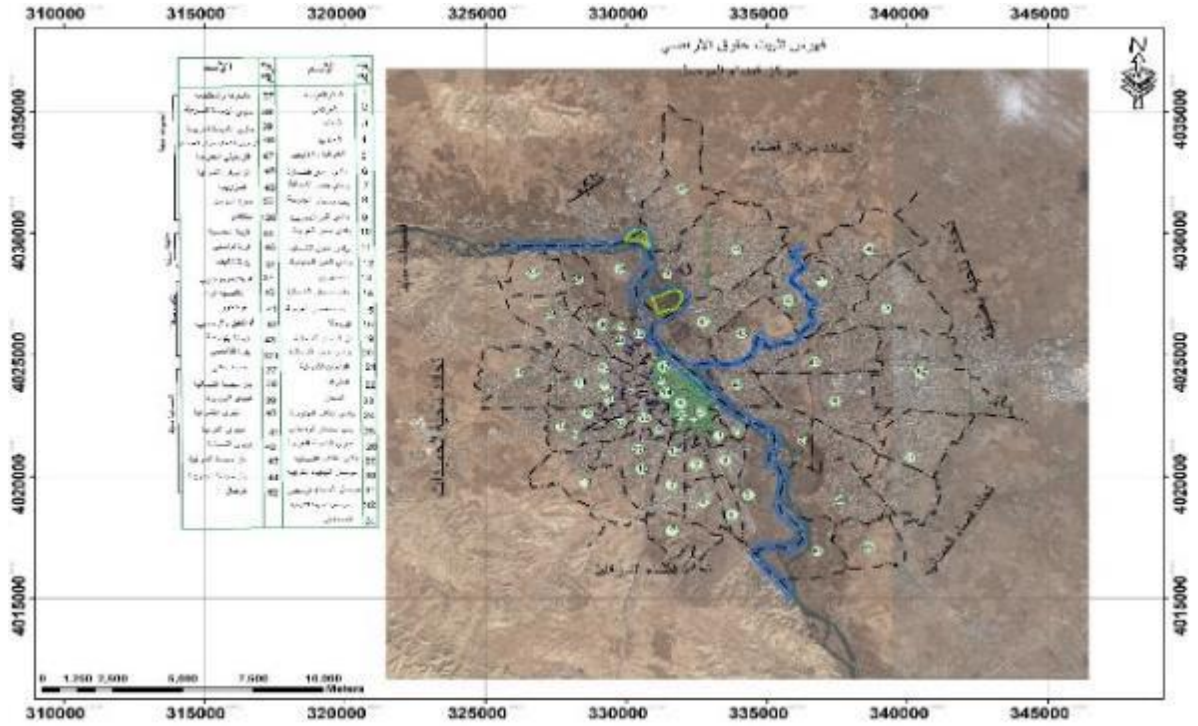

Figure 1. the location of the study area Mosul District

Source:- Nineveh Agriculture Directorate, Lands Department, Land Rights Confirmation Index, Mosul District Center, scale 1: 10 000. Source Based on the outputs of Arc gis 10.8.1

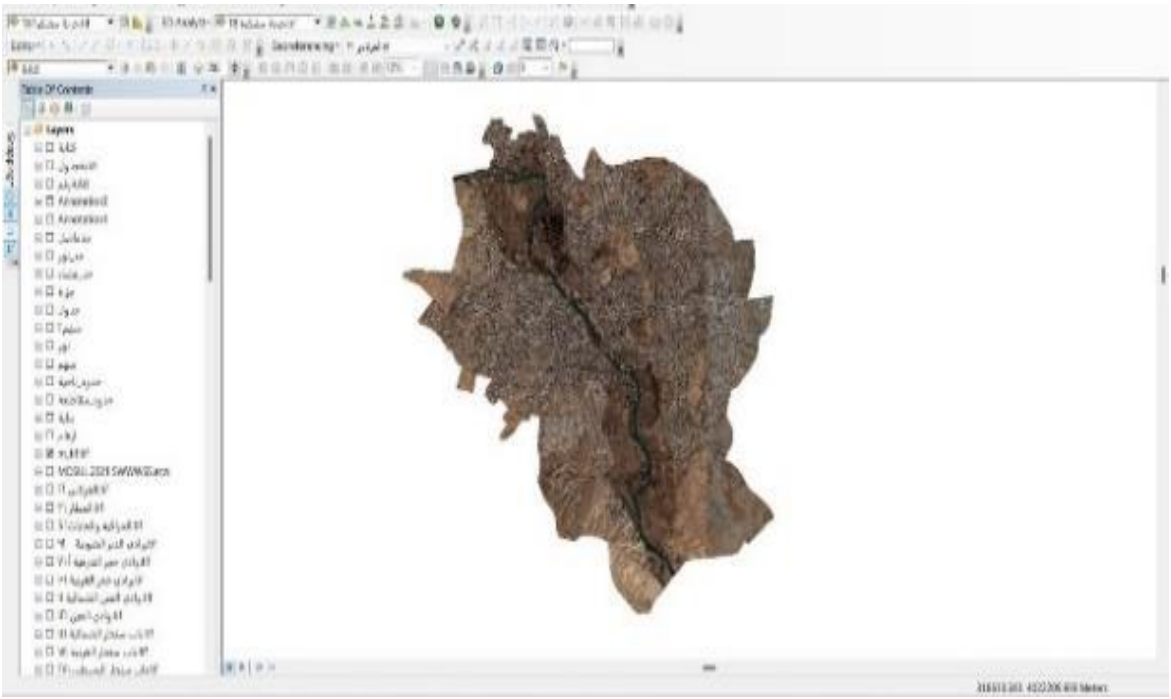

Figure 2. the location of the study area, Mosul District, after making a CLIP .for the study site

Source: Mosul District Satellite Visualization For the study area, for theQuick Bird ,satellite, 0.3 meter resolution extensionSID for the year ,2023. Source Based on the outputs of Arc gis 10.8.1

History of the emergence of cadaster maps

Cadastral maps have been developed throughout history, starting with the establishment of the General Authority for Survey in 1917. The first coordinate system for Iraq was developed in 1934, called Datum, and originated in the Nahrawan region southeast of Baghdad. This system was expanded to the Arabian Gulf and Yemen and later related to every country. As cartography developed, paper maps became outdated and insufficient for economic development. Cadastral maps were produced in 1938, but they were no longer capable of meeting decision-making and development planning needs. To address these issues, the Survey General created a UTM grid system for old paper maps, which was projected using a D.G.P.S. device based on coordinates from the public space grid system. This study aims to provide an abstract map containing all features, phenomena, and terrain in a region, providing an accurate coordinate system for any region [6].

First: The basic concepts of cadastral maps and their definitions

Map: It is defined as a miniature model of the Earth's surface or part of it at an appropriate scale with spatial and descriptive data for a specific period of time.[6].

Cadastral maps: These are special maps to ,determine the boundaries of land ownership whether those lands are owned by individuals or the ,state, showing the boundaries of governorates plots, their numbers, river index, area ,and copyright, irrigation, drinking water, various types of roads, and the right of passage"Cadastral maps" were drawn at the General Authority for Survey for the period between approximately at (1934 - 1958) different "scales; 1:1000 ,1:5000 ,1:2500 ,1:2000 and "1:50000 ,.[7]

The maps produced and their types

Digital maps: A map produced using digital technology using a computer

Satellite or aerial images: These are images taken from satellites or aerial survey aircraft of selected areas at a specific time and are taken with a specific resolution or at an appropriate photographic scale

The coordinate system: The x-axis and y-axis meet at the origin and are either in the form of geographical or quadratic systems, through which the locations of the data are determined according to the scale. The small scale is defined by the geographic system.

Which is measured in degrees, simulations, and seconds (longitude and latitude) and the large scale is defined in the square metric system east and north. As in Figure 3 [3].

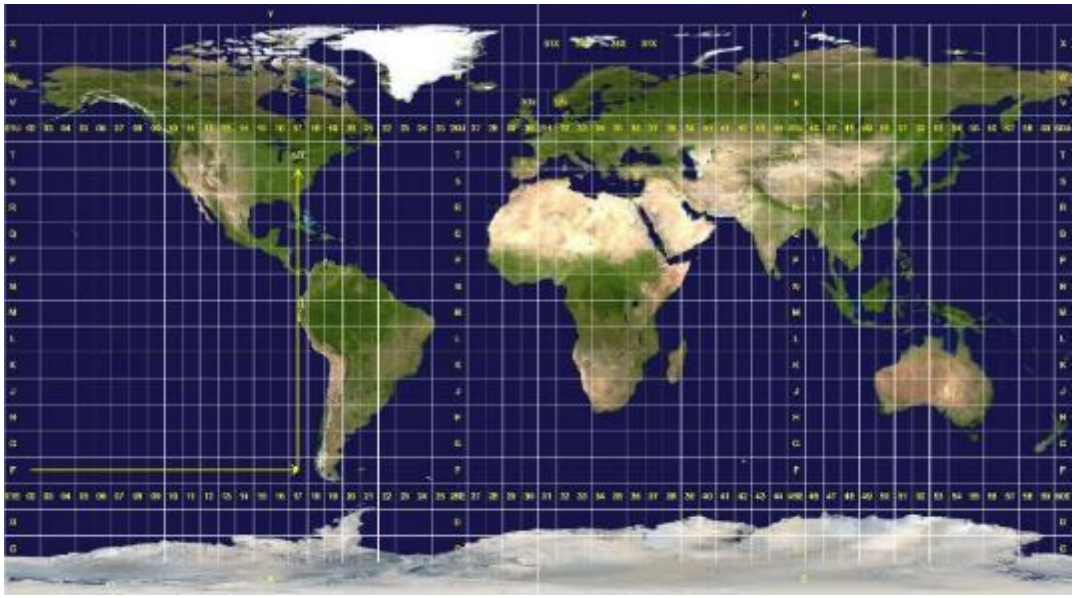

Figure 3. Mercator's global transverse system

DATUM

A regular mathematical or elliptical model on the Earth's surface is used to calculate the coordinates of points on the Earth's surface.

Projection

It is the transformation of the Earth's oval surface or any part of it into a two-dimensional surface using mathematical equations, including the universal transverse Mercator system.

There are **60** regions in the global Mercator browser system Iraq falls within regions 39, 38, 37

1. Range (°37), which is limited to the area lines between two longitude(°42-36 °) east.
2. The range (°38) is limited to the area between lines two longitude(°48-42 °) east.
3. Range (°39), which is limited to the area between longitudes(°54-48 °) east.[3]

Figure 4. The scanner input devices include a scanner.

Data: To find scientific solutions to certain problems in a particular spatial location, data is a digital representation of specific forms of data in that location on Earth. After the initial construction of the database for the "Geographic Information Systems" project, the update history is continuously updated to match reality. The database can be vast (up to a terabyte) or small (a few megabytes) and readily stored on a hard drive. It is kept on a very capable network server. [8]

Programs: There are many GIS programs that are designed to work on the user's personal computer and other more complex programs that are suitable for large institutions and are downloaded on the Insituation computer network server Most GIS software is commercial. Programs that are ,purchased from the companies that produce them such asArcGIS, ERDIS, ArcGIS Pro, and Global Mapper Each program has technical capabilities that differ from one program to another, and there are several versions within the same program, each with different capabilities.

Geographic Information System (GIS) It is a method or process of organizing geographical and non-geographic information about a computer and linking it to its geographical location using specific coordinates. Therefore, it is a method that links the geographical phenomena distributed on the earth's surface with the coordinate system and stores them in the computer memory, links the descriptive data of these phenomena through the database, and analyzes displays and prints them at a certain proportion. go out Global Positioning System D.G.P.S.: It is a global system that collects coordinates to determine the position of a specific point recorded by a DGPS device, a receiver that receives data from about 27 satellites orbiting the earth. [8th] **[8].**

Figure 5. D.G.P.S

Definition Real estate registry: This word is of Latin origin, and some believe it comes from the word "capitastrum," meaning regional registry, which the Romans used to collect taxes. The Cadastral maps have been developed throughout history, starting with the establishment of the General Authority for Survey in 1917. The first coordinate system for Iraq was developed in 1934, called Datum, and originated in the Nahrawan region southeast of Baghdad. This system was expanded to the Arabian Gulf and Yemen and later related to every country. As cartography developed, paper maps became outdated and insufficient for economic development. Cadastral maps were produced in 1938, but they were no longer capable of meeting decision-making and development planning needs. To address these issues, the Survey General created a UTM grid system for old paper maps, which was projected using a D.G.P.S. device based on coordinates from the public space grid system. This study aims to provide an abstract map containing all features, phenomena, and terrain in a region, providing an accurate coordinate system for any region [8].

Cadastral types

Real Estate Cadastral: This system was developed to register real estate and properties, whether residential lands or agricultural lands. Real estate registration is also a formal process whereby rights related to real estate are registered through physical registration papers or personal registration. This means having an official register (land registry) that explains the rights and changes in the legal status of specific parts of the property

Property tax cadastral: This system is mainly used to collect taxes.

Features of cadastral maps

The study involved monitoring ground coordinates and using GPS devices to monitor points in the study area. A cadastral map of the region was provided by the Mosul Real Estate Registration Department, but it lacks ground observation points. A modern map was created, which was then converted to an image format for projection and matching to satellite images. The image was then corrected, linked to a coordinate system, and converted to a digital map for drawing borders.[8].

Data type

The study involved monitoring ground coordinates and using GPS devices to monitor points in the study area. A cadastral map of the region was provided by the Mosul Real Estate Registration Department, but it lacks ground observation points. A modern map was created, which was then converted to an image format for projection and matching to satellite images. The image was then corrected, linked to a coordinate system, and converted to a digital map for drawing borders.[9].

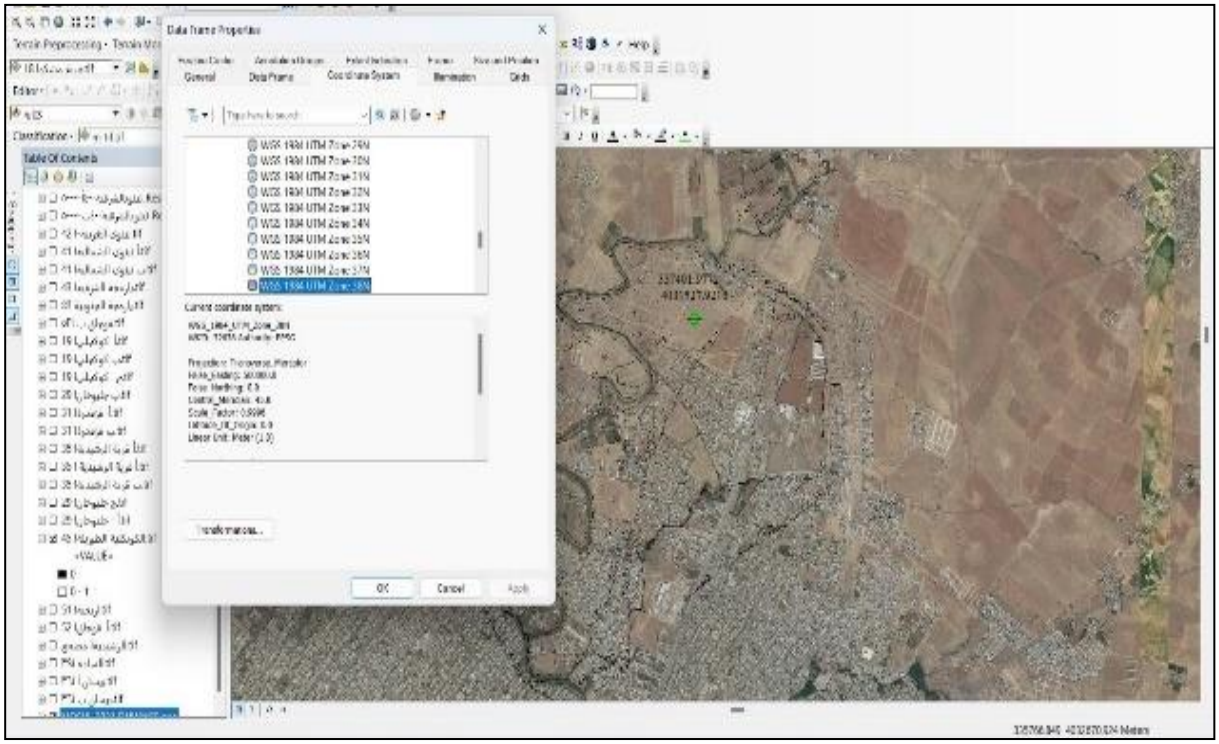

Figure . 6 UTM As in the picture shown below(8)

Source: Mosul District Satellite Visualization For the study area, Cadstro map theQuick Bird ,satellite 0.6 meter resolution, SID extension, for the year2023

Source: Image of the Cadstro map, spatially corrected according to theWGS_1984_UTM_Zone_38N system Coptic 45. Source Based on the outputs of Arc gis 10.8.1

It previously used the command File Add Data to add X-Y data and N coordinate files saved in Excel. The point coordinate plane appears as points at the correct locations in the image, and I conclude that the image is accurate and related to the UTM coordinate system and that the true dimensions and coordinates can be plotted on it. Then we proceed to another step of the correction process, that of correcting the satellite image, where the program creates the correcte image again . .And store it in th calculator file to be ready for drawing.[9].

Image modification process: This type of modification is called geometric correction, through which the image coordinates are corrected and linked to a specific coordinate system and a specific geographical projection, and this is done by obtaining coordinates.

Accurately capture some points in the image and then enter them into the program. The coordinates of some points in the study area were monitored on the ground.[10]

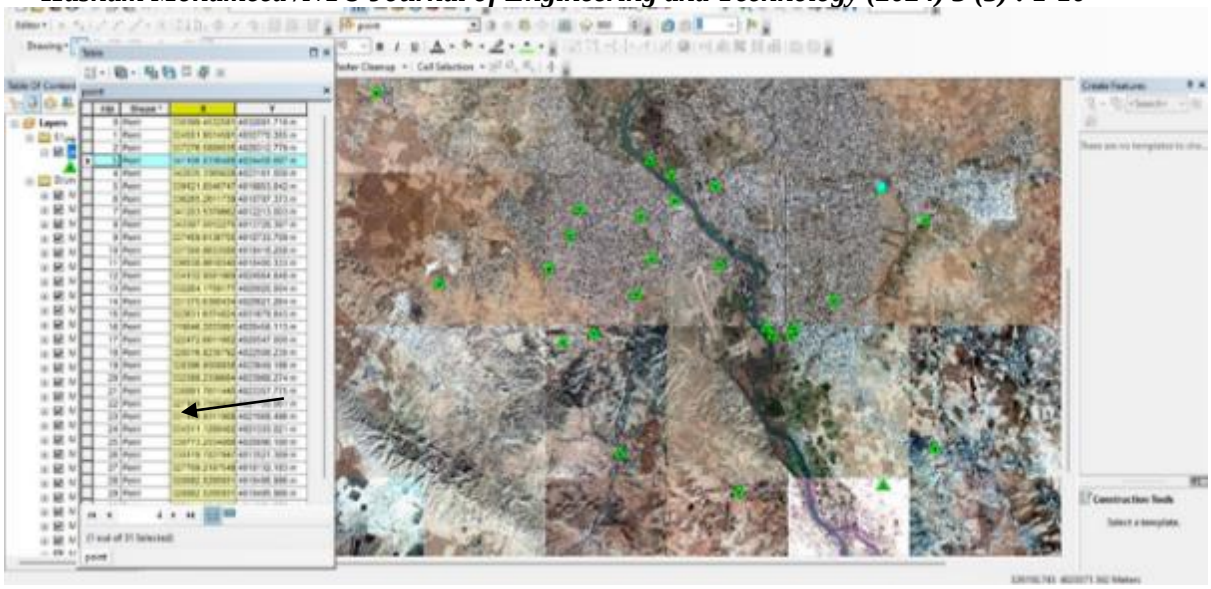

Figure.**7** Some points in the study area were monitored on the ground

GPS navigation " device in the monitoring process (8), then it was listed according to the "Arc Gis" program " " After that, we open the "Arc map" from theAre gis program and add the image of the study area to be set via " the add data command, then we add the point.

Third: Converting the image into a digital mapRescale Data Management Summary

Resize the raster by the specified x and y scale factors Operations are done through

The output size is multiplied by the scale factor for both the x and y directions. The number of columns and rows remains the same in this process, but the cell size is multiplied by the scale factor

The scale factor must be positive.

A scaling factor greater than one means that the ,image will be rescaled to a larger dimension resulting in a larger scale due to a larger cell size. [11]

A scaling factor of less than one means that the ,image will be rescaled to a smaller dimension resulting in a smaller range due to the smaller cell size.

its real dimensions and correct coordinate s according to the map's first picture No.(12) . Picture No. 13 shows the process of drawing the

You can save the output in BIL, BIP, BMP, BSQ DAT, or Esri Grid, GIF, IMG, JPEG, JPEG 2000 PNG, TIFF, or any geodatabase raster dataset .

When you store a raster dataset in a JPEG file , JPEG file, or geodatabase, you can specify the 2000 compression type and compression quality within environments. [16]

Or the image is converted into a digital map by redrawing the image using the AUTOCAD program after the factor is correct. It is exported as a redraw by AUTOCAD with the DFX extension and added to its geospatial location. And it is placed As a layer in the program, or drawing on a cadstro map, create a layer of polygon type, and its settings are adjusted in the UTM system. Then activate the Editor tool in the program and start drawing on this map to produce a digital map with

external boundaries of the governorate on a foundation Main map [13].

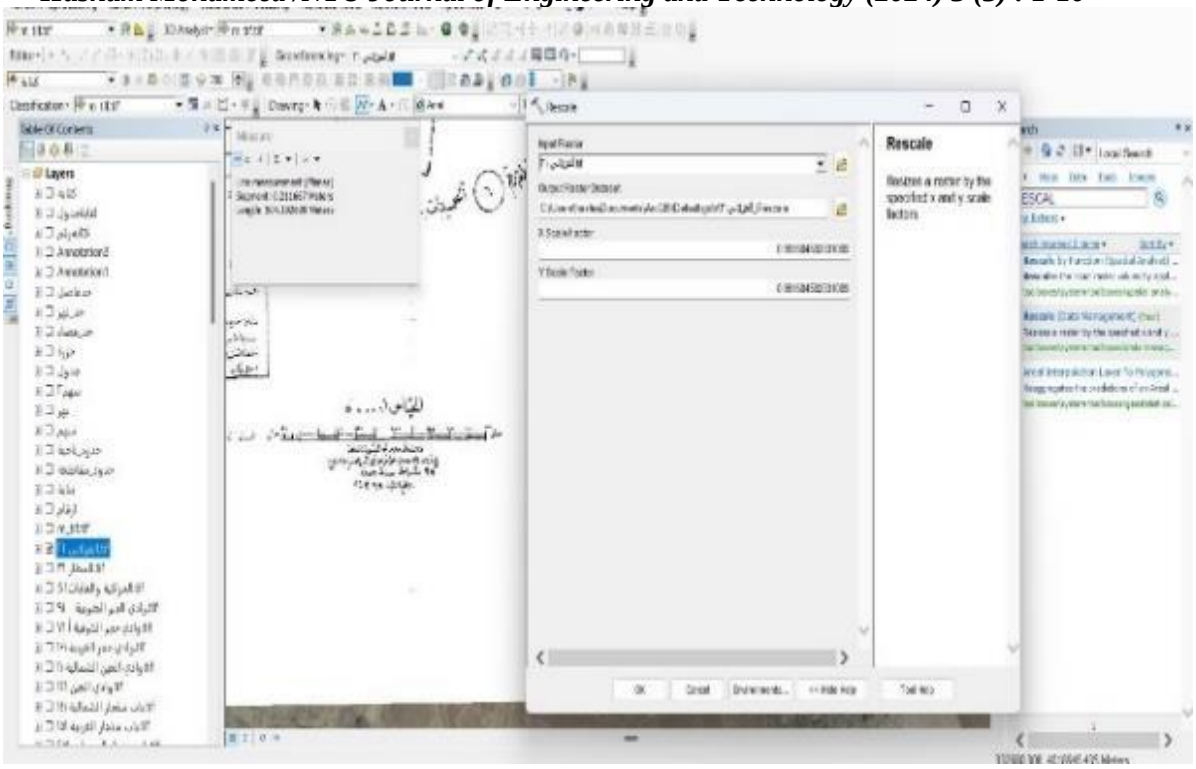

Figure .8 Re-measurement using the RESCALE tool**.**
source Based on the outputs of Arc Gis 10.8.1

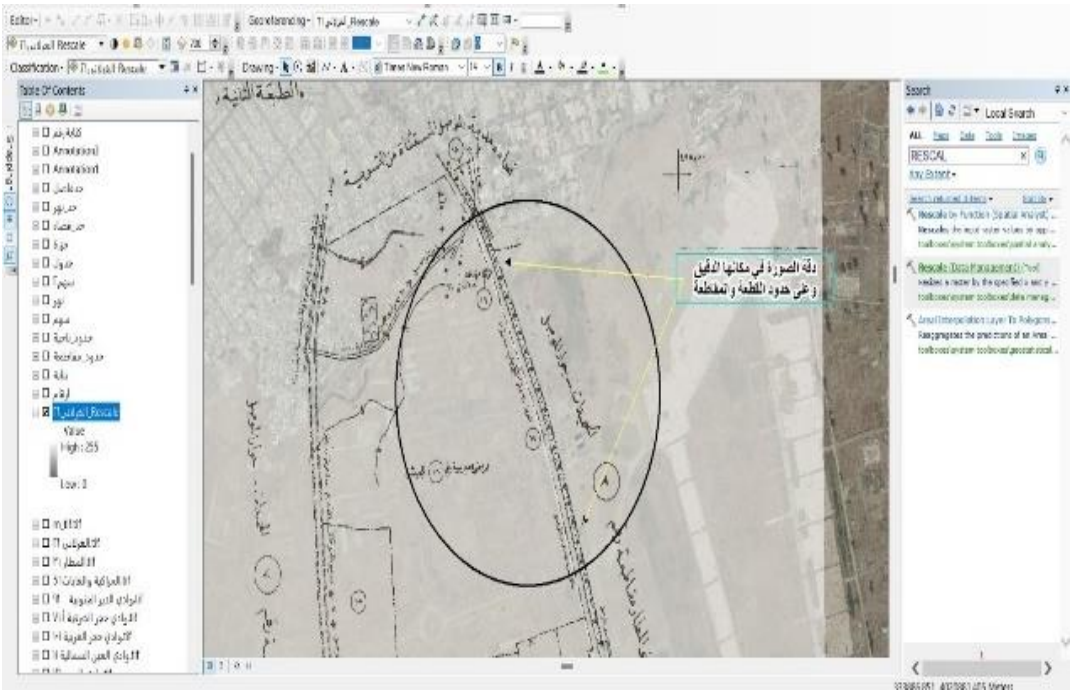

Figure.9 the accuracy Spatial district boundaries using the RESCALE tool
Source Based on the outputs of ArcGis 10.8.1

Fourth: Linking the digital map to the DEM Digital Elevation system for the purpose of producing contour lines for the study area.
A digital elevation mode (DEM) is a digital fil containing elevation data (relative) for a specific geographic area, which may be in linear (vector) form (a set of lines, each line consisting of theX, y,and z coordinates of a point) or may be ina raster grid image to represent the topography or topography of the Earth's surface in an area[13].
There are several universal digital elevation models (SRTM). Aster The ETOPO 2, GLOBE, ASTER, and SRTM models are among the most commonly used. [12].
Global models, especially in terms of spatial discrimination ability, A spatial-resolution DEM

digital elevation model(SRTM) shuttle radar topography mission for the study area was obtained. DEM (digital elevation model) of the the location study area,Mosul District , using the global Mapper program, due to the ability of this program to import this data from the Internet in real time. based on the geographic coordinates surrounding the study area After importing the digital elevation model for the study area, contour lines were produced based on this model, and then the contour lines were exported to the Geographic Information Systems program in a special layer to be placed with the other layers of the produced digital map, Image No. 13-14, upon completion. The previous steps turn off the satellite image, so only the digital map required to be produced from these previous steps remains, and we can add other information to it. In order for it to be an integrated map, such as adding the north [14].

direction and a square grid in the UTM system, we can also add the map content (legend) in theGIS program, but for ease, these layers are exported to AutoCAD and the Civil 3D program. The library is ,known for its high ability to deal with maps, colors and additions. The following images show the digital elevation model of the study area. [15],[16],[17].

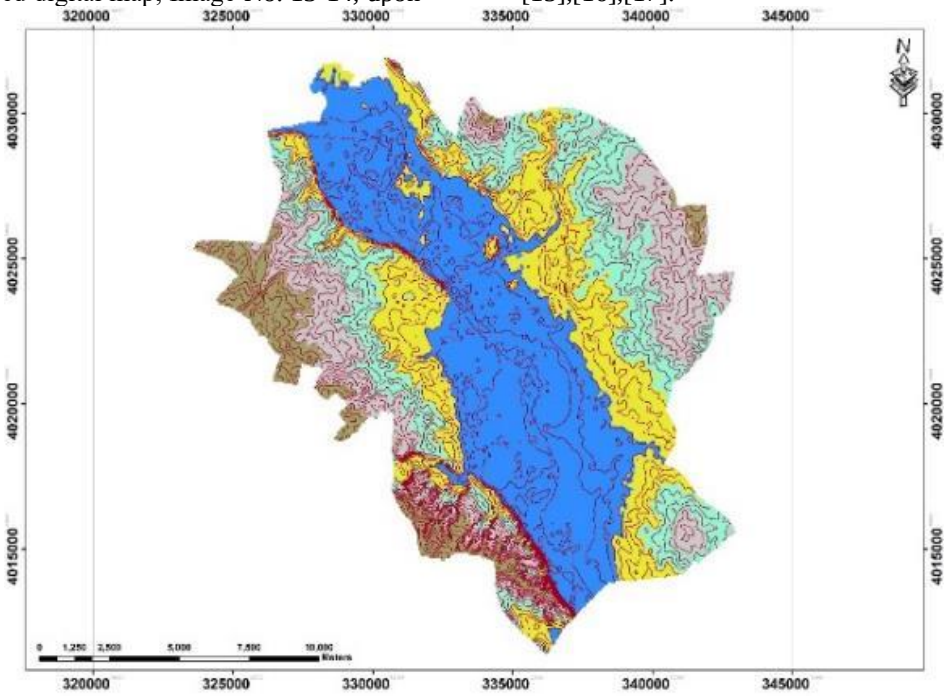

Figure.10 the contour lines of the study area

Source Based on the outputs of Arc gis 10.8.1

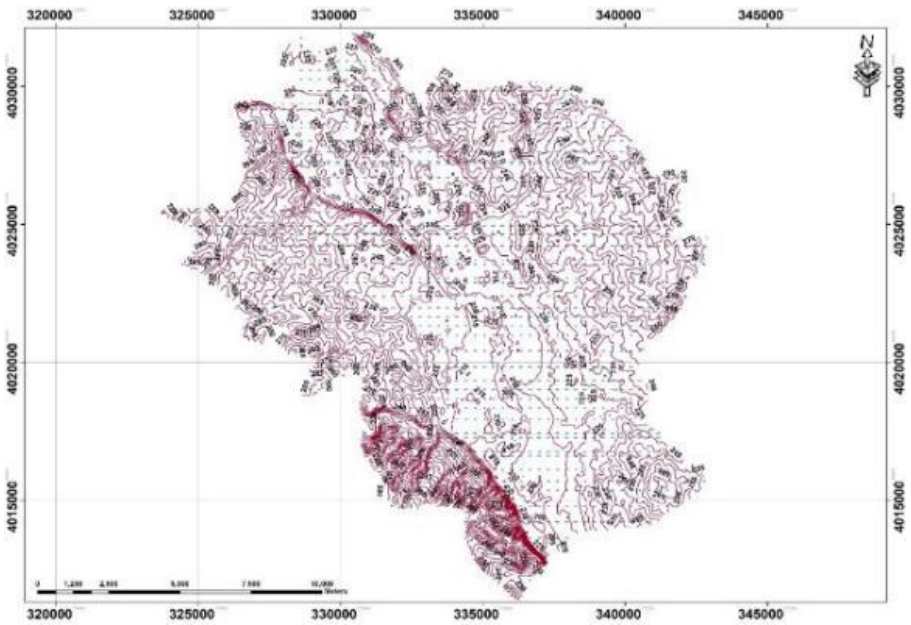

Figure.11 the slope level of the study area

Source Based on the outputs of Arc gis 10.8.1

Conclusions and recommendations Geographic information systems are crucial for researchers as they provide accurate coordinates and information about geographical locations, enabling them to provide a comprehensive and credible view of the region. They also enable the correction of paper maps and the use of digital technologies for spatial and descriptive databases. However, challenges exist in expanding the scope of updating large-scale maps, such as installing GPS devices and surveying and auditing sites. [17],[18],[19]

solutions

The national project aims to insert updated cadastral maps within a specific time frame, combining efforts from various parties, including the General Authority for Survey and Land Registry and real estate registry offices. Universities, institutes, and research centers are activated to make the process a regional research project, with government agencies providing the necessary scientific and technical assistance. Digital technologies are spread in all direct service departments, and technical personnel are qualified to convert old maps to digital formats.[19], [20].

References

1. Abdul Samad, L. (1988) Databases, Principles, Design, Management and Applications, Directorate of Dar Al-Kutub, University of Mosul.
2. Al-Azzawi, A. (2000) Geographic Information Systems and their Use in Planning and Development, Journal of Al-Mamoun University College, No. 4.
3. Al-Masraf, H. (1982) Principles of Cartography, Ministry of Higher Education and Scientific Research, Technical Institutes Foundation, Baghdad.
4. Al-Obaidi, D. (2005) Anecdotes and Anecdotes in Land Rights Settlement Decisions and Cadestro Maps, Deposit Number in the House of Books and Documents in Baghdad.
5. Al-Obaidi, D. (2005) Iraqi Cadastro Maps and Practical Geography, Filing No. 159, Public Authority for Agricultural Lands.
6. Al-Obaidi, D. (2007) Cadastro Maps in Geographic Information Systems, Public Authority for Agricultural Lands.
7. Al-Obaidi, D. (2015) Cadastro Maps in the Legislative, Judicial and Technical Perspective, Filing No. 1543, Public Authority for Agricultural Lands.
8. Al-Obaidi, D. (2015) Features of the geography of Iraq in the decisions of the settlement of land rights and its cadastral maps 1932-1970, House of Books and Documents in Baghdad 1050.
9. Al-Obaidi, D. (2015) Map in the Real Estate Registration Law No. 43 of 1971, Filing No. 1543, Public Authority for Agricultural Lands.
10. Al-Obaidi, D. (2015) The Map Art, Science and Law, Filing No. 1543, Public Authority for Agricultural Lands.
11. Al-Obaidi, D. Guidelines for Workers in the Geographic Positioning Device, Public Authority for Agricultural Lands.
12. Al-Obaidi, D.(2005) Rights and Provisions of Abandoned Land and Maps of the Iraqi Cadestro, Deposit No. 159 in the House of Books and Documents in Baghdad.
13. Dawod, M. (2012) An Introduction to computer Mapping (in Arabic), Holl makkan, Saudi Arabia.
14. Dawod, M. (2014) principles of GIS science (in Arabic), Holy Makkah, Saudi Arabia.
15. Dronova, P. Gong ,L. Wang and L. Zhong (2015) Mapping Dynamic Cover Types in a Large Seasonally F loodedwetland Using Extended principal Component Analysis and Object- Based Classification ,Remote sensing of Environment.
16. ESRI , Map Projection , what are map projections? , Arc GIS 10 , 2010/4/10
17. Mohammed ,S.(2009) UTM Mapping Problems for Nineveh Governorate, Unpublished Diploma Thesis , College of Education - University of Mosul.
18. Obaidi, Z.(2017) From the maps of the Iraqi cadestro and their characteristics and advantages and their drawbacks and lapses, a realistic study, House of Books and Documents in Baghdad 2209.
19. Odeh, S. (1990) Introduction to the methods of using maps and methods of artistic construction, Jordan, Amman.
20. Surveyor Bulletin, Second Issue, 1970.