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وزارة الشؤون البلدية والقروية
إدارة منطقة المدينة المنورة



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The national system

Consulting engineering services project for a development study

Geographical information

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Project information

Project information			
project name:		Project "Consulting engineering services to study the development of geographical information in the Municipality of Madinah Region"	
Project code:		34008	
The executing agency :		Saudi Engineering Union Company is preacher and scholar	
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the beneficiary		The project is sponsored by the Secretariat	M. Walid Barakat
The representative of the beneficiary		Project manager from the Secretariat	M. Akram Alsarani
Project manager from the implementing agency		Project Manager from the Implementing Entity:	M. Hassan Jabaei

A general definition of the project

The project aims to develop a strategic plan to develop geographic information systems in the Municipality and to establish an electronic infrastructure for geographic information. The plan is based on defining the future vision of the secretariat in relation to geographic information systems and identifying future initiatives and projects required to achieve the vision and strategic tasks. The plan also defines the roadmap and provides the operational tools for developing geographic information systems in the secretariat for the next three to five years. The project also aims to prepare a plan to transform the currently used work environment. *MapInfo* In Medina Municipality to the new work environment *Esri* Based on the standards and criteria approved by the Ministry of Municipal and Rural Affairs.

The project includes the following main elements:

- Study and evaluation of the current situation and geographical data available to the Secretariat
- Preparing a strategic plan to develop the geographical information system in the Secretariat
- Issue recommendations for establishing an electronic infrastructure for spatial information (*SDI* In the Secretariat
- Preparing a brochure of conditions and technical specifications for the project of transferring data and applications of the system *GIS* From the current situation " *MapInfo* To the new work environment *Esri*

an introduction

Medina Municipality seeks to develop a comprehensive geographical information system based on the foundations and specifications of the

Ministry of Municipal and Rural Affairs for geographic information systems, thus ensuring integration and compatibility between geographical information systems and the

Therefore, through the consulting engineering services project to study the development of geographic information, the status of information

systems in the Ministry of Municipal and Rural Affairs will be investigated and understood to determine the current conditions, specifications and

standards followed in the ministry that will lead to the unification of a digital environment for geographic information systems, and a comprehensive

view of the future integration between the Ministry's systems and secretariats through Standardization of infrastructure for geographic information systems.

In this regard, this document has been prepared, which contains the standard reference specifications for the development of geographic

information systems in municipalities and municipalities, in order to ensure the achievement of future integration with geographical information systems in the ministry.

The goal of the report

The report aims to list the various reference specifications related to the development of geographic information systems, which are approved by

the Ministry of Municipal and Rural Affairs, so that they form a document to be adopted when developing GIS in the Municipality of Medina.

Report content

This report contains a detailed presentation of the various reference specifications related to the development of geographical information

systems in the Ministry of Municipal and Rural Affairs. This report includes:

- Specifications of the design and development of the geographical database model
- Coordinate systems specifications
- Specifications of the architectural structure of a geographic information system
- Specifications and mechanism for developing geographical data
- Geographical application development specifications
- Software and hardware specifications

Geographic information systems specifications

Design and development of a geodata model

The design of geographical databases is considered one of the most important issues in the development of the system. Therefore, the comprehensive database model existing in the Ministry of Municipal and Rural Affairs was reviewed, in order to maintain the integration between the GIS model in the ministry and the GIS model that will be developed in the future of the municipality, so that the geographical database that will be developed in the future of the municipality will constitute a main database that will be linked to the local databases in the municipalities of the Municipality of Medina.

The data model must be built at the Municipality of Madinah based on the existing data model in the ministry, where modifications are made according to the needs of the secretariat's departments, and those required by the integration process with the electronic services systems existing in the municipality or to be developed in the future, by specifying the requirements for applications and integration With the regulations in place in the secretariat.

When designing geographical databases, the design must meet the following specifications:

- A database that accommodates various types of data (satellite imagery, aerial photography, linear data) *Vector Data* , Typical data (*Raster Data* Metadata (*Tabular Data* Statistical data, etc.).
- Flexible database available to all applications so that they can interact with it and access the necessary data. Achieve flexibility
- by archiving updated data for future review and analysis) . (*Versioning Control*
- Data consistency) . (*Consistency*
- Achieve data security in the geographical database (*Security*
- Defining the categories of users and authorities, so that specific data related to them can be accessed without others. Achieving
- procedures for saving backup copies of data and the possibility of retrieving them if an emergency shutdown or system breakdown occurred as a result of technical failures or natural disasters, God forbid.

When designing geographical databases, the design must go through the following stages:

1. Conceptual / Logical Design

Data is generally divided into three types:

- Linear data) : (*Vector Data* They are data that relate to geographic or spatial location, and it includes two types: the geometric shape (points, lines, surfaces)
- Tables) (*Tables* They are called fields and records: they are data tables in the database that can be linked to spatial elements by means of a unique field .*Unique ID*
- Typical data) (*Digital Imagery or Raster*

When designing a geographical database, the following geographical database elements must be adopted:

- Data sets *Datasets*

It is a group of geographical layers that includes spatial or non-spatial relationships between them (for example: transportation data set, land data set, administrative boundaries data set, water data set, electricity data set, cultural heritage data set, etc.)

- Geographical classes *Feature Classes*

It is a repository that includes a group of geographical elements with a single geometric shape (point, line or polygon), such as the land layer, the building layer, the municipal layer, etc.)

- Relationships between database objects *Relationship Classes*

Relationships are a logical link that links the elements of a geographic information base with each other through a spatial relation, or a link field existing in the layers connected to each other.

- Domains *Domains*

Domains are tables of coded values so that these fields can be used in more than one geographical layer within the database.

- Subtypes *Subtypes*

Subtypes are encoded value tables and these subtypes cannot be linked in more than one geographic layer.

- Topology and its rules *Topology & Topology Rules*

It represents the concept of spatial relationships of geographical elements.

- Engineering networks *Geometric Networks*

It is an engineering network that logically connects the linear and point geographic layers that form a unified network (such as road networks, water, sewage, and others).

- Area data sets *Survey Datasets*
- Typical Data Handbook *Raster Catalogs*
- Modular data sets *Raster Datasets*

It represents the typical data stored in geographical databases.

2. Detailed design of the database

The detailed logic model is represented using a program *Visio* Compatible with technology *UML* For modeling, so this model is used to create the final database.

6. Building Geodatabase

The detailed form is converted to the actual database using special tools provided by the geographic information system (*Case Tools* The geographical database becomes ready to receive spatial data and metadata information and to link with the geographic applications that are being developed.

1. Create a SDE geographical database, which includes the following specifications:

- Environment: ORACLE
- Version: 11g or later Format:
- digital
- Link to geographic information systems: via the SDE portal
- Place of installation: on the GIS data servers in the Secretariat
- How to access the data: through GIS programs and applications on the desktop and the Internet, or through the Oracle system via SQL.

Coordinate systems specifications

The following is a review of some of the coordinate systems used in the Ministry of Municipal and Rural Affairs that must be followed in the

Municipality of Medina:

- Deputy Ministry for City Planning: The system is used *Ain El Abd UTM zone 38N Extended* As an approved coordinate system for maps produced and used in the Urban Planning Department.
- Deputy Ministry of Lands and Survey: The system is used *UTM* And the reference rotational ellipse is used (*WGS84* As a reference for a projection system

Municipalities located within Madinah range of 67 according to projection *UTM*

Area name	The name of the municipality	the range
Medina region	Badr Municipality	37
	Khyber Municipality	
	Al-Ula Municipality	
	Medina Municipality	
	Yanbu Municipality	
	Manger Municipality	
	Municipality of Wadi Branch	
	Al Ais Village Complex	
	Al-Hanakia Municipality	

Table 1: The municipalities located within the Al-Madinah Al-Munawwarah region, the range of 37, according to projection UTM

Review the appendix of the proposal to unify axes systems and geographical reference references

Specifications of the architectural structure of a geographic information system

The design of the architectural structure for centralized geographic information systems aims to lay down the details related to the devices of servers and computers, programs, databases, and an electronic network, and therefore it differs and depends on the existing situation and the requirements of the secretariat. It exists from electronic networks, servers, computers, data storage devices, programs, databases, human cadres and others, in order to study and analyze them and determine the extent of their utilization of geographic information systems and then submit proposals to develop this infrastructure to suit the requirements of the project.

When preparing the architectural design of a geographic information system, it must take into account the requirements of geographical data and the database and the number and types of users inside and outside the secretariat, bearing in mind that the database will be loaded on servers in the secretariat where GIS users can access these servers Through the existing network in the secretariat, in addition, an evaluation of this current network must be conducted and proposals and the most appropriate solution to develop it must be presented to be able to serve all users of the system with high efficiency.

When designing the architectural structure of a system, there are rules and standards that must be followed, the most important of which are:

- The design, specifications, and standards of the database to be established shall be compatible with the specifications and standards of the Open GIS Consortium (OGC) and the ISO specifications The design of the architectural architecture of the database shall, as a minimum, meet the following requirements:
- Absorb all geographic information and descriptive information related to it, currently in the secretariat or in the future.
- Ensure that the system continues to operate 24 hours a day, seven days a week, and to find alternatives and operational solutions in the event of a problem or natural disaster or other such as power outages or others. To accommodate all the needs of the
- current applications and systems that may be developed in the future. To accommodate all users of all kinds from inside and
- outside the municipality.
- Open Data Interchange, Open Platform
-
- Open Development Environments Open Databases
-

- Load / stress tolerance and high processing efficiency
- Security level
- Performance
- A structure that enables connection with other systems

To clarify this, a survey was conducted on the design of the architectural structure of the geographic information systems followed by the Ministry of Municipal and Rural Affairs, so that the theoretical use of the model during the design of the architectural structure of the system in the Municipality of Medina.

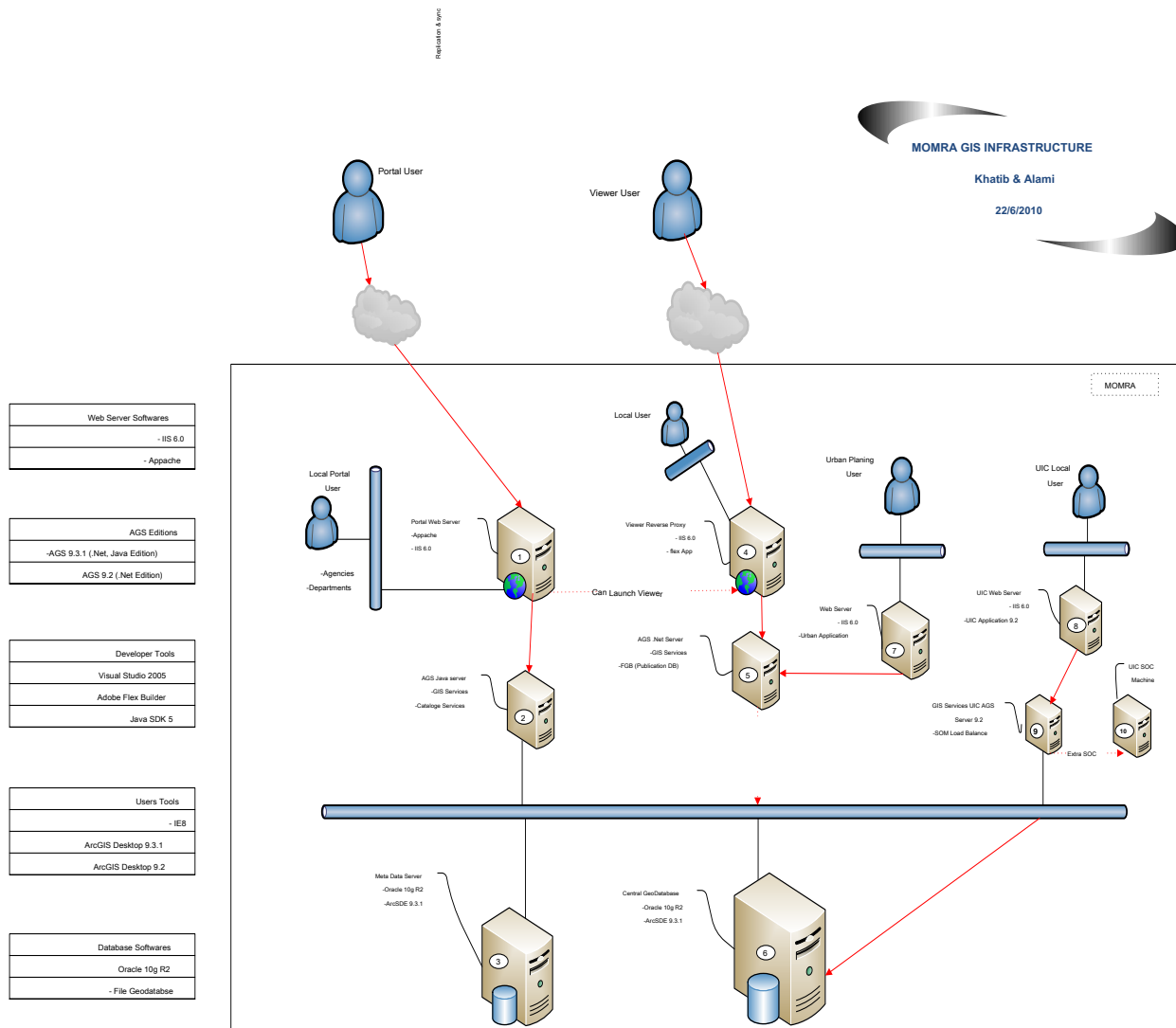


Figure 1: Architectural design for GIS in the Ministry of Municipal and Rural Affairs

Geographical Data Development Specifications

The geographical database that will be developed must include a basic map for the entire Madinah region and its cities on various scales and includes:

- The different layers of the regional base map for the region on a scale of 223,333 (roads, valleys, main and tourist attractions, administrative boundaries, etc.)
- The different layers of the basemap for area cities (urban areas) on a scale of up to 1: 2,055
- Layers of detailed plans for these cities and plans for land divisions (plots of land, roads, neighborhood boundaries, plans boundaries, buildings, various service networks, major landmarks, etc.), in addition to the descriptive information of the land use associated with the plots of land.
- Layers of regional city organization plans. Layers
- of urban ranges

1. Technical specifications for the base map for the area at a scale of 1: 223,333

The specifications of the base maps must comply with the standards of the Agency for Lands and Survey at the Ministry of Municipal and Rural Affairs, and therefore it is necessary to fully coordinate this with the Ministry in this regard.

2. The technical specifications of the base map for the region's cities at a scale of 1: 2,233

- Basic maps available at the Ministry of Lands and Survey Agency, detailed plans
- and plans for the division of lands (plots of land), roads
-
- The boundaries of neighborhoods
- Layout boundaries
- Buildings and their roles
- Various service networks
- The main and tourist attractions
- Governmental lands and their administrations

- Industrial cities plans
- Agricultural land schemes
- Org charts
- Land use information

6. Photographers satellite

The specifications of the satellite and aerial photographs must be identical to the following specifications:

The Photographers	Coverage
Corrected according to the Ministry's coordinate systems, Spot Corrected according to the Ministry's coordinate systems, Quickbird (0.6 Resolution)	As needed
	As needed

1. Metadata

Indicative data enables the data to be used properly. Data identity includes the following information, but is not limited to:

- The reference related to the institution, the department and the employee who provided the data and the
- means of communication with him. Data source
- Hand preparation
- Date of setting.
- Coordinate system.
- Name and type of each file containing graphic attributes) (*Attribute File*)
- The fields included in each spreadsheet, and the specifications of these technical fields.

Review the pilot data appendix

Geographical application development specifications

According to current and future trends, the Ministry of Municipal and Rural Affairs adopts AZRI technologies *ESRI* To be the main environment for geographic applications in the ministry and secretariats, so Azri technologies must be adopted *ESRI* Any future applications developed by the Secretariat.

Application design and development is divided into two methodologies:

- Development
- integration

Where the development of applications is either on the desktop or within the web environment, as for integration between the systems available in the secretariat or with the ministry, as follows:

1. Geographical information systems and electronic services

Geographic information systems support the electronic services provided by the secretariats, and these services are divided into three sections:

- Services that do not depend on a spatial component
- Services that depend on a partly spatial component
- Services that are completely spatial

Here we can distinguish between two basic environments for geographic information systems, where the applications are divided within them according to the scope of work, the nature of users, their place of work and the nature of their work, namely:

- ArcGIS Server technology is used on the Internet environment *ArcGIS Server* To develop geographical applications on the web,

as it allows users of the various departments within the Municipality and its municipalities and outside it to browse, inquire, and analyze

geographical data (*Vector* And space photographers () *Raster* Through the intranet or the Internet, without neglecting to allow the determination of access rights and data security, in addition to that, remote data editing applications can be developed for the region's municipalities with the power to view, edit, and download data.

- Desktop environment with ArcGIS technology

Applications include GIS on a desktop environment *ArcGIS* Inquiry processes, inquiries,

And the production of various reports, and the printing of maps and plans, and spatial analysis of services and other facilities, and make a set of spatial comparisons and different scenarios.

2. Application development methodology

After reviewing the methodology for developing geographical applications followed by the Ministry of Municipal and Rural Affairs and the best international practices in this field, it is recommended to follow the following stages:

- Facade design

Designing application interfaces to be simple and easy-to-use interfaces in both Arabic and English languages.

- Application development
 - Building screens and programming applications using ESRI ArcGIS technology and using the programming languages VB.Net, Flex, Silver Light, and other emerging programming languages.
 - Preparing a User Manual to guide and guide the use of developed application mechanisms and tools.
 - A guide to installing and installing the system and the central geographic database (& Configuration System Installation).
 - Set up help files so that the user can access them from application interfaces and test applications
 -
 - check up And application testing, where many technical aspects must be taken into account during testing of the system, the most important of which are
 - Functionality, system requirements
 -
 - Volume
 - Load / Stress System Security
 -
 - Recovery data
 - Performance
 - Usage Resource

- Definitions Configuration
- Compatibility
- Installation
- Serviceability benefit
- Delivery and installation of applications, where applications are installed and placed within the examination and testing phase of the concerned departments and users of the Secretariat.
- Application features, as the geographical applications should be distinguished by the following features:
 - Ease of use
 - Open code system
 - Open development
- Application security: setting access rights according to applications and data required by those applications.

Some users will be able to view and browse, while others will be able to view or browse and edit.

6. A list of applications proposed by the ministry

After reviewing the applications proposed to be developed by the Ministry of Municipal and Rural Affairs and after analyzing the needs of the

Municipality, the following is a list of GIS applications that can be developed on the Internet and the desktop environment:

The application	Application functions
Org chart management application	<p>This application aims to enable the user to browse and search in the organization chart and produce reports of search results. Among the most important functions of the application are:</p> <ul style="list-style-type: none"> • Show / hide the organization chart • Issuing a report on the organization chart • Navigation on a map by using navigation tools, adding • attachments to a location, point, or plot of land. Moving • from one scale to another

The application	Application functions
Data and application security application	<ul style="list-style-type: none"> Log in to data and applications using a username and password
Geolocation application and issuance of reports	<ul style="list-style-type: none"> Search for cities according to different variables (name, region, population, density, etc. Search for locations of geographical areas Search for locations of municipalities and sub-municipalities Search for services
Regional schemes management application	<ul style="list-style-type: none"> Show / hide layers of regional charts, issue a report on population numbers and percentages in cities, show graphs on the map by population, show graphs on a map by population, show graphs on a map by area, create / update geographical data
Remote editing application	<ul style="list-style-type: none"> Create / update metadata Metadata creation / update Create / update linked files
Urban Zones Management Application	<ul style="list-style-type: none"> This application aims to enable the user to deal with the urban areas of a specific city, and among the most important functions of the application: Show / hide the urban boundaries on the map for a specific city

The application	Application functions
	<ul style="list-style-type: none"> Issuing a report on urban areas that includes the areas of each zone and the coordinates of the urban boundaries and their
Map printing application	<ul style="list-style-type: none"> direction. Printing maps according to the templates
System management application	<ul style="list-style-type: none"> Determine the username and password for each user. Define the access rights for system users Define viewing and editing powers for system users. Create, edit and delete copies for each entity / user Dumping the contents of the backup copies to the urban database
Land use management application	<ul style="list-style-type: none"> Searching for plots of lands in a specific city, a specific neighborhood, a specific sub-district, or a specific scheme according to the main and sub-land uses Search for buildings in a specific city, a specific neighborhood, a specific sub-district, or a specific scheme according to the type of building materials, aging, street name, etc. Show / hide plots of land on the map for a specific city, coded according to land use Show / hide the vacant lands for a specific city on a map Issuing a graphical report on the plots of land in a specific city or a specific neighborhood or a specific detailed plan that includes graphs

The application	Application functions
Space photographers management application	<p>This application allows the user to add the satellite images available in the urban information base and save the trouble of searching for them, including:</p> <ul style="list-style-type: none"> • Adding satellite cameras to the map according to their type (... , Quickbird, Ikonos, Spot) • Adding satellite images to the map according to geographical areas, municipalities, neighborhoods, etc.
Local schemes approval application	<ul style="list-style-type: none"> • The goal of this application is to automate the procedures followed for approving local plans, according to a complex workflow between planning departments and between secretariats, municipalities and the ministry.
Local layout management application	<ul style="list-style-type: none"> • Searching for a local plan according to various variables (name, number, municipality, area, etc. ...) and issuing a report with the results of the search. Displaying the plots of land on the map according to the numbers of local plans • Issuing graphical reports on local plans. Analyzing urban
The application of various urban analyzes	<ul style="list-style-type: none"> • development • Current state analysis of land use analysis of • building conditions • Building Height Analysis • Analysis of building construction • materials Analysis of the road and traffic network

The application	Application functions
	<ul style="list-style-type: none"> • Utility networks analysis • Analyzing public services sites in the city and finding the most suitable site for: • Religious services • Educational services • Health Services • Cultural services • Postal services • Security services • commercial services • Recreational services

Table 2: The list of applications proposed by the Ministry

Software and hardware specifications

1. Programs

the program	the number
ArcGIS Server 10.1	They are determined in accordance with the booklet of conditions and technical
ArcGIS- All Extensions ArcGIS ArcView	specifications and the architectural structure of the system. They are determined
10.1 or latest ArcGIS- ArcEditor 10.1 or	according to the need according to the booklet of conditions and technical specifications.
latest ArcGIS- ArcInfo 10.1 or latest	They are determined according to the need according to the booklet of conditions and
	technical specifications. They are determined as needed according to the booklet of
ERDAS latest version	conditions and technical specifications. According to the specifications and technical
Oracle 11 g or latest	specifications, they are determined according to the requirements and technical specifications

2. Servers, workstation devices, printers, and networks:

Devices	the number
Server	They are determined in accordance with the booklet of conditions and technical
Computers (PC)	specifications and the architectural structure of the system. They are determined
workstations	according to the need according to the booklet of conditions and technical specifications.
Portable Calculators	They are determined according to the need according to the booklet of conditions and
Printer (A4 / A3) color printers 33 "	technical specifications. They are determined as needed according to the booklet of
color printers (Plotter)	conditions and technical specifications. According to the conditions and technical specifications brochure
Networks	It is determined as needed according to the conditions and technical specifications booklet, and in full coordination with the Information Technology Department.

Data source

- Plans available at the Ministry for Urban Planning in the Ministry
- The schemes are available in the various agencies of the ministry
- Available plans in municipalities and municipalities
- Aerial and space photographers and systems of the ministry

Accessories

Appendix 1: The proposal to unify systems of axes and geographic reference references

Systems of axes and geographic reference references

High accuracy positioning plays an important role in surveying and planning operations and saving them in geographical databases. Pivot systems are prepared *Coordinate Systems* The only method of locating sites on digital maps that facilitates research, analysis and production of maps using geographic information systems, which supports administrative and strategic decisions. Understanding pivotal systems is one of the most important means of exchanging information between systems and one of the most important means of documenting spatial information to enable the user to search in the unified information base of the ministry. These axes also serve advanced computational capabilities in spatial information systems, such as calculating the north and east coordinates, and calculating distances and areas.

Many and multiple axes systems, including, for example, the Cartesian axes *Cartesian Coordinate Systems* It is usually represented by a horizontal line (the x-axis X) It intersects vertically with a vertical line (the y-axis Y) This type of axis is known as planar axis systems or horizontal axes (*2D* Two-dimensional, in which the sites are determined by the intersection of the vertical and horizontal axes.

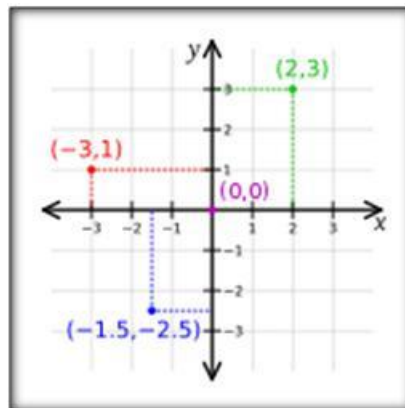


Figure 2 Concept of axes systems

There is another type of axis system known as geographic axis systems *Geographic Coordinate System*

This type of axis is a spherical system that determines the locations on the surface of the globe in degrees of latitude and degrees of longitude.

This system is usually converted into a two-dimensional system for cartographic and computational purposes and this convexity is produced which is called a projection. *Grid* That appear on the finalized maps. This transfer or transfer is done

From the surface of the earth to flat surfaces in several ways, the most important of which is direct to plane projection, cylindrical projection, or conical projection.

The understanding and knowledge of geographic axes systems is also very important in geographic information systems. The geographic axes system is considered

Geographic Coordinate System One of the most important axial systems in the field of spatial information, which uses the three dimensions of cylindrical surfaces to determine locations on the surface of the globe. The geographic axis system is often referred to as a reference *Datum*, And this is a common mistake as the cross reference *Datum* It is only part of the geographic axes. The geographical axis consists of three basic elements:

- Angle units.
- Prime Meridian longitude
- The spherical reference reference.

The globe in geographic axes systems is divided into parallel lines (latitude (heading east / west), and longitude lines perpendicular to latitude heading north / south, forming a grid covering the globe known as

.Graticule It is a network of latitude and longitude that appears on the maps, and the middle line between the southern and northern poles is known as the "equator", and the line connecting the north and south poles through Greenwich in

"England "is called the main longitude. Thus, the reference point with a zero value is the point of intersection of the equator with the main longitude (Greenwich mean line).

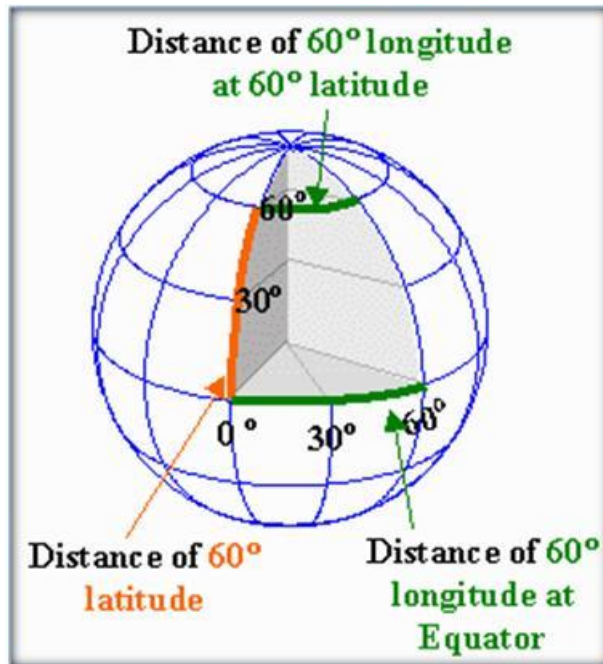


Figure 3: Divisions of longitude and latitude

In the case of cylindrical and conical projection, the globe is surrounded by the conical or cylindrical surface, then the lines of longitude and latitude are projected onto those surfaces, and then these surfaces are separated into flat surfaces on which are drawn by longitude and latitude or so-called) (*Graticule* And due to the multiplicity of different projections, this resulted in a large number of map networks ((*Grid-Maps* These projections and these networks are accompanied by various references *Datums* Horizontal and vertical. In the case of the vertical reference, the sea level that has been observed and observed for decades is considered a basic reference. As for the horizontal reference, it expresses the surface of the Earth - semi-spherical and irregular - with a number of missing sectors that represent the surface of the Earth mathematically, as shown in the previous figure, and these elliptical sectors consist of a semi-basic axis or greater) (*Semi-Major Axis* It is symbolized by the Latin symbol. "*a*" And another smaller (*Semi-Minor Axis* It is symbolized by the Latin symbol. *b* These elliptical ellipses are used to identify the geodetic references to which the spherical geographic axes can be linked.

The problem of variation of the geodetic reference surface (Datum And coordinate systems

A geodetic reference surface is an imaginary surface that does not exist in nature and is used in geodetic calculations. Therefore an infinite number of geodetic reference surfaces can be assumed. But it is useful to define one geodetic reference surface for each country in order for the point coordinates to be determined and calculated with respect to one reference surface. However, in surveying works we may have to deal with more than one geodetic reference surface for the same country. For example, in the Ministry of Municipal and Rural Affairs, the local geodetic reference surface (Ain al-Abd) is used in the Ministry's Agency for Town Planning, and the global geodetic reference surface is used. *WGS84* At the Ministry of Lands and Survey Agency. But with the widespread use of GPS devices *GPS* Which adopts the universal geodetic reference surface *WGS84* As a basis for the system's operation, the coordinates of the points depend on the geodesic reference surface used. The reason for this is due to one of the following factors:

- The shape of the spheroid varies from one reference surface to another.
- The position of the center of the spheroid varies from one reference surface to another (this difference can reach hundreds of meters).
- The cartesian coordinate system used with the first reference surface does not correspond to the used coordinate system with the second reference surface. Therefore, dealing with area measurements and calculations requires full knowledge of the reference surface used and the coordinate system defined with it. This is because not knowing the reference surface and the coordinate system leads to erroneous results due to the use of coordinates relative to the reference surface and a different coordinate system.

Proposing a mechanism for unifying axes and geographic reference systems

Currently, due to the use of the Global Positioning System, spatial measurements are known with respect to the global reference surface *WGS84* Drop system is recommended *UTM_WGS84* Where the available data can be converted from the first coordinate system () *UTM_Ain El Abed* To the second coordinate system (*UTM_WGS84* If the relationship between the two coordinate systems is known. The relationship between any two coordinate systems can be defined by knowing the following:

- A set of equations that define the arithmetic relationship of the conversion process from the first system to the second system.

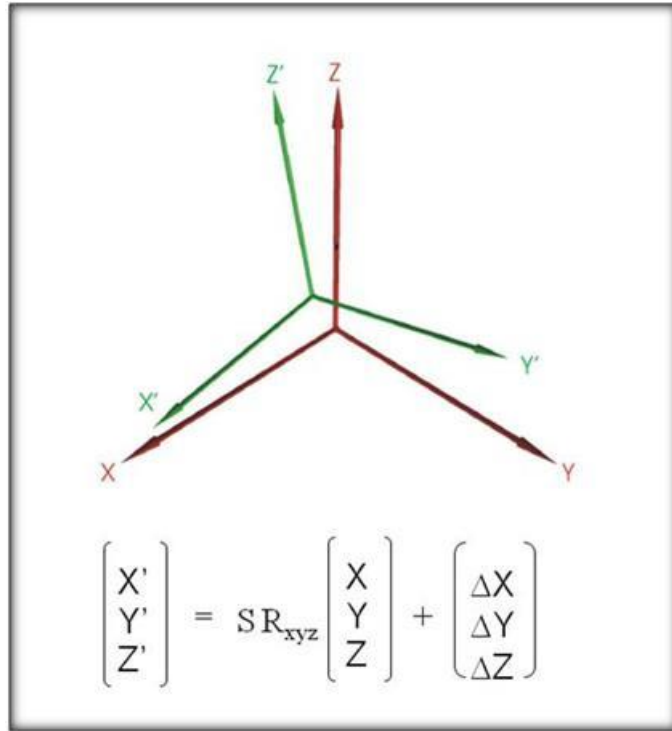


Figure 4: Shows the coordinate axes of two different systems and the conversion equations between them

- A set of parameters called conversion factors. It defines the mathematical relationship between the two coordinate systems used and is substituted for it in the equations that define the arithmetic relationship between the two systems. Transfer coefficients are calculated by analyzing the cadastral data of a set of points in the two coordinate systems whose coordinates are known. Such points, whose coordinates are known with high accuracy, are called ground constants points. The minimum required number of ground constants points varies according to the coordinate system used. In general, it is recommended to use more constants' points than the required number in order to judge the accuracy of the coordinate conversion process.

The following diagram presents the proposed transfer mechanism to transfer the axes from the system *UTM_Ain Elabed* To system *UTM*

.WGS 84

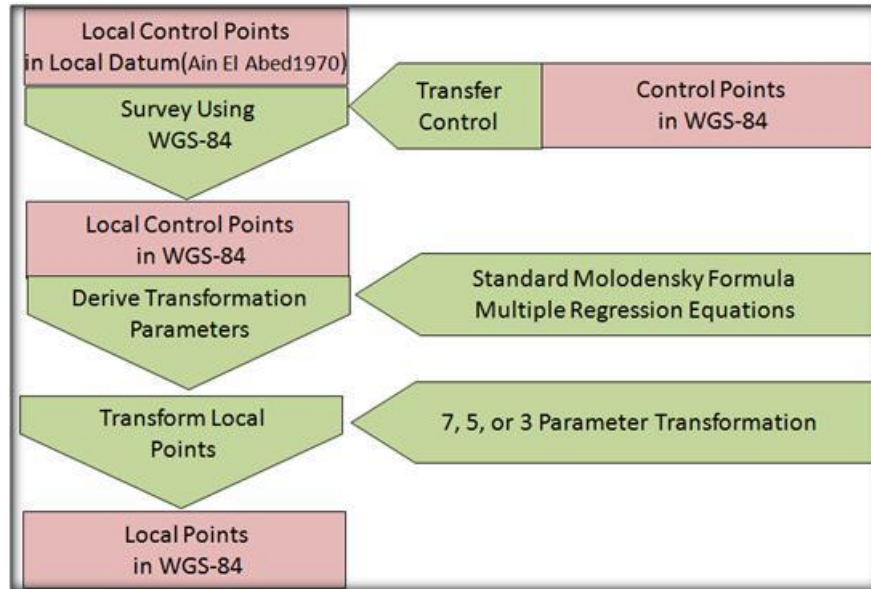


Figure 5: Suggested conversion steps

Define the scope by projection system **UTM** To the municipalities

The Kingdom of Saudi Arabia is located on a vast geographical extension, as its territories cover four geographical regions according to the global

Mercator projection () **UTM** The municipalities are divided into these areas as follows:

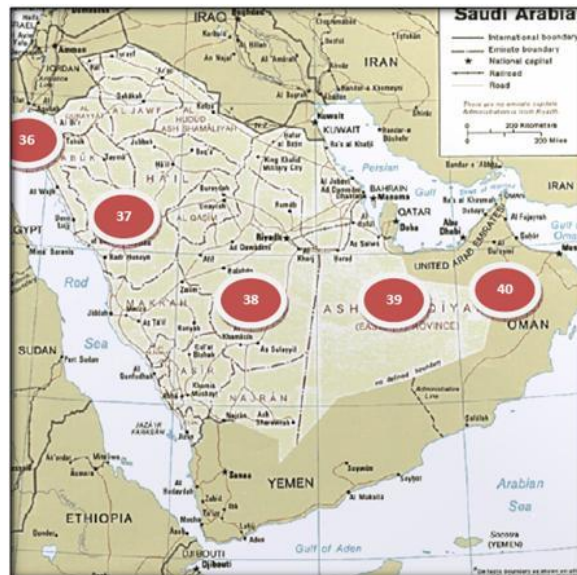


Figure 6: Geographical regions of the Kingdom

Appendix 2: Pilot Data

Pilot data

Data identity or metadata is structured information (built according to a specific system) whose mission is to describe, clarify and facilitate the retrieval of information sources. *information resources* And use it and regulate it. They are called "metadata" or "data on data" or "information about information", while some use it to refer only to records describing electronic sources. *.electronic resources* In the field of geographic information systems, data identity is often used to refer to the description of data sources, the purpose for which they were created, and the data owner. The following are the points that concern the data identity:

- Data source
- The date of collection or production
- of the geolocation data
- The method of collecting or
- producing data is the reference system
- Scale drawing
- Spatial resolution
- Data matches standards and criteria
- Modification dates
- issue number

Types of index data

- Descriptive metadata identity, which is concerned with describing sources with the aim of finding and identifying them.
- Structural metadata refers to how layers of geographic information are structured and structured in a single building, such as data sets for roads, the environment, or data on parcels.
- The identity of the administrative metadata, which provides information that helps in managing the resources, such as the date of creation, how it was created, the type of files and other technical information in addition to the right to access the resources. The identity of the administrative data is divided into:
 - The data identity for managing right of access to information deals with copyright.
 - Identity of maintenance data required to archive and maintain sources.

Reasons for creating a data identity

The most important reason for creating the data identity is to facilitate the exploration of sources, just as good indexing that leads to quick access to maps, data and information, which facilitates the process of data exchange. Based on its subject matter or the audience that uses it, and it is done dynamically through databases that maintain the identity of the data, the identity of the data helps to:

- Quick exploration
- Coordination between agencies to inventory spatial data
- Improve data quality and geographic coverage
- Providing solutions to spatial information issues, such as:
 - The need for spatial data
 - The possibility of obtaining spatial data
 - Reach out to entities that own the spatial data
 - The need for Map Services
 - Recurring data
 - Data obsolescence

Processing of data identity

Due to the volume and diversity of data that the ministry possesses, the project team prepared and developed a special program (*Meta Data*

Harvester SDI) In order to prepare and equip the data identity for the data available in the ministry

In an automated way, this program facilitates feeding the Ministry's geographical portal with sufficient and accurate information on the identity of the data. Among the benefits of this program:

- Accuracy in determining the spatial extent of the geographical data that the data talk about.
- Speed in preparing and processing data ID.
- It reduces the number of manpower required to process this type of data. Experience in
- this field is not required
- The working mechanism is easy and does not require training to work.

Reviews the data identity models supported by the portal



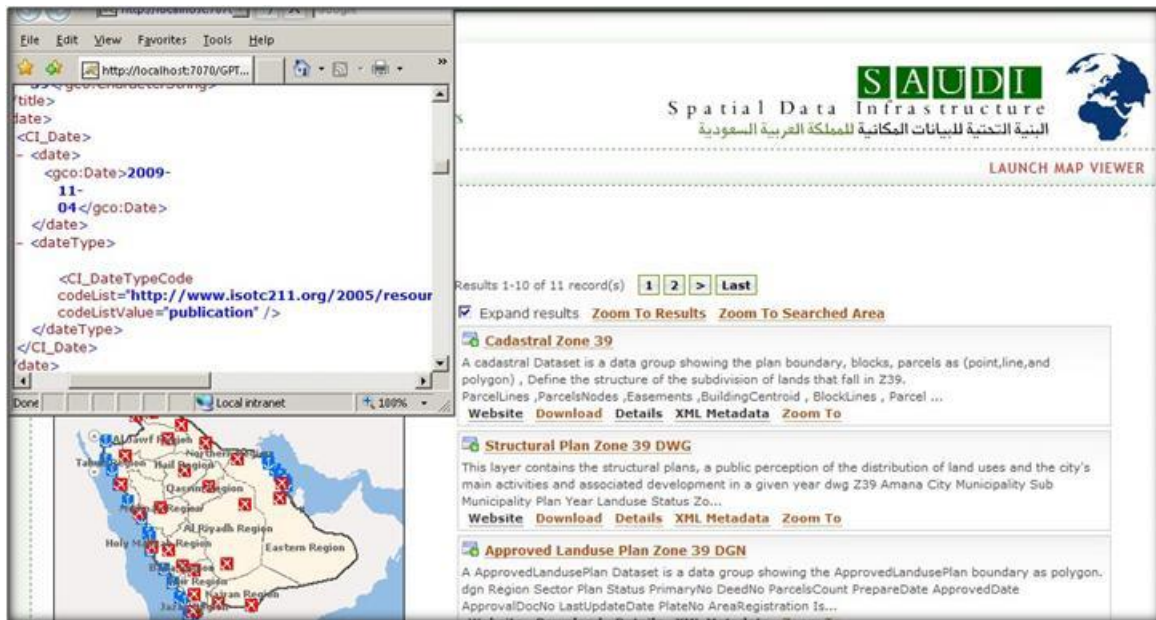
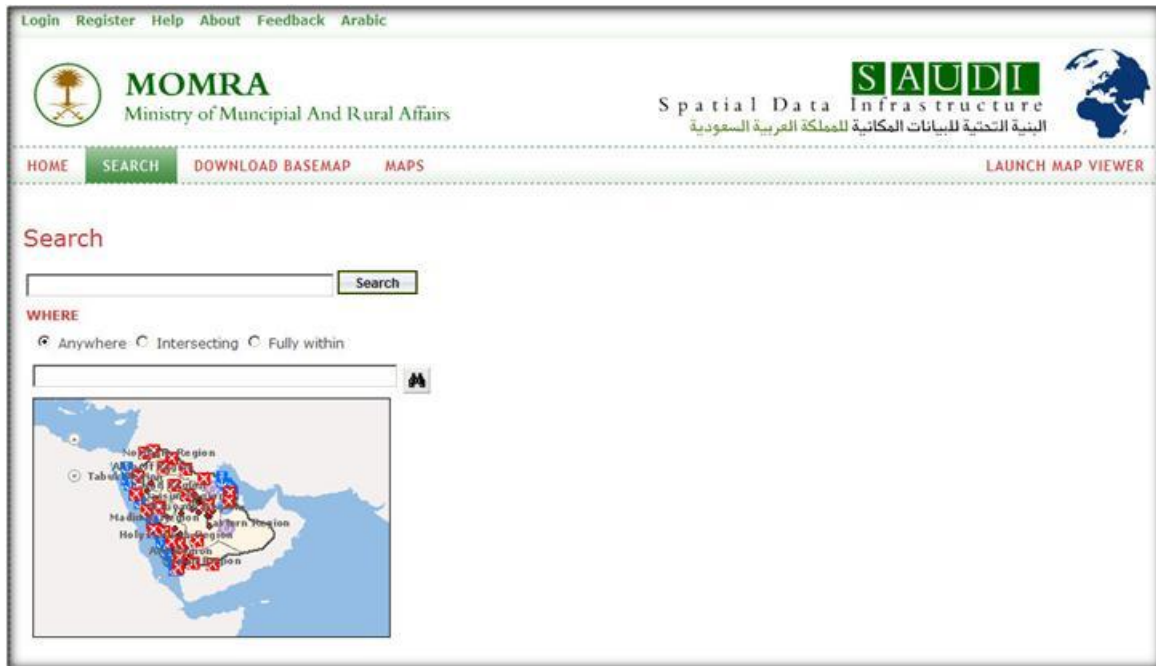


Figure 7: Data Identity Management Interface