#### **REPUBLIQUE ALGERIENNE DEMOCRATIQUE ET POPULAIRE**



MINISTERE DE L'ENSEIGNEMENT SUPERIEURET DE LA

#### **RECHERCHE SCIENTIFIQUE**

UNIVERSITE KASDI MERBAH OUARGLA

Faculté des Sciences appliquées

Département de Génie Civil et Hydraulique

Mémoire fin d'études

#### **MASTER ACADEMIQUE**

Domain : Science et Technologie Filière : Travaux publics. Spécialité : Voies et Ouvrages d'Art.

**Présenté Par :** BADA Mohammed Taher. BENNAI Mohammed Deiya.

Thème :

Use of GIS in Controlling and Mentoring the Road Network for the Regions of Ouargla and Touggourt

> Soutenu publiquement le : .../.../... Devant le jury composé de :

Dr. ABIMOULOUD Youcef	MCA (UKM Ouargla)	Président
Dr. GHOUGHALI Mammar	MAA (UKM Ouargla)	Examinatrice
Dr. SAGGAI Sofiane	MCA (UKM Ouargla)	Encadreur

Année Universitaire :2022/2023





### ب مِالْمَالْتَرْمَالِيَّنَا لَيْنَا مِ

#### وطلى الله على سيدنا محمد وسلم

اللهم لك الحمد حتى ترضى، ولك الحمد إذا رضيت، ولك الحمد بعد الرضا، الحمد لله دائما وأبدا لا يمكن للكلمات أن تعبر عن عمق الامتنان والحب الذي أحمله لكل واحد منكم. لقد كنتم أعمدة قوتي، ودعمي الذي لا يتزعزع، ومصدر فرح عظيم في حياتي.

إلى الصدر الحنون والقلب الرفيق إلى أعز ما أملك في الدنيا، إلى الغالية الطاهرة، إلى التي يهواها القلب ويعشقها الر<mark>وح،</mark> إلى أ**مي الحبيبة** أسأل الله أن يرعاها ويحفظها.

إلى الذي ناضل من أجلي وهيأ لي أسباب النجاح، إلى الذي سعى جاهدا لتربيتي وتعليمي، إلى **أبي العزيز** أسال الله أن يحفظه ويرعاه.

إلى الذين تسرني رؤيتهم ويسعدني لقاءهم ولا يطيب العيش إلا بمم ومعهم إلى -عائلتي- أشكركم على حبكم غير المشروط، خلال مطبات الحياة، وقفتم بجانبي، مقدمين حبكم، وتشجيعكم، وتفهمكم. لقد جلب وجودكم الدفء والسعادة إلى أيامي، وأنا محظوظ للغاية لوجودكم في حياتي، أسأل الله تعالى أن يحفظكم ويرعاكم.

إلى أصدقائي، لقد كنتم عائلتي الثانية، لقد أزهر وأنار وجودكم حياتي بطرق لا حصر لها. معًا شاركنا المغامرات واحتفلنا بالمعالم وخلقنا ذكريات دائمة ستبقى محفورة في روحي إلى الأبد.

أنا محظوظ حقًا لوجود مثل هذه الدائرة الاستثنائية من العائلة والأصدقاء الذين جعلوا رحلتي أكثر جمالًا ومتعة، وأنا ممتن إلى الأبد للحب والسعادة الذي تعطونه لي دون مقابل.

مع کل حبي وتقديري

محمد ضياء بناي



Acknowledgments

### به والماليكن الترب م

#### صرَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَىٰ وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحًا تَرْضَاهُ/

قتال رسول الله حلى الله على وسلو:

" من لو يشكر الناس لو يشكر الله حديث شريف.

الحمد والشكر لله سبحانه الذي أعاننا على إتمام هذا العمل، نرجو منه القبول عز وجل.

وبعد:

يسعدنا أن نتقدم بالشكر والعرفان إلى البروفيسور الفاضل " **سفيان سقاي**" مشرف ومؤطر هذه المذكرة على صبره ومرافقته الدائمة، فجزاه الله خير الجزاء.

عرفانا بالجميل نتقدم بالشكر الجزيل لأساتذتنا الكرام وهيئة التدريس قسم الهندسة المدنية والري على مساعدتهم لنا والذين كانوا لنا خير معين وخير موجه، وكذلك **الدكتور ملوح وليد** وجميع الزملاء والطلبة الذين دعمونا طوال هذا المسعى الأكاديمي. نشكركم على تشجيعكم خلال هذه رحلة الجامعية. لقد كان إيمانكم بقدراتنا وكلمات التشجيع المستمرة مصدر إلهام لنا. فجزاكم الله خير الجزاء.

نود أيضًا أن نعرب عن تقديرنا لأعضاء مديرية الأشغال العمومية لولايتي ورقلة وتقرت، وبالأخص **السيد محمد السعيد لحسيني والأنسة قسوم**، والمصلحة التقنية لبلديتي ورقلة وتقرت، وبالأخص **السيد لحسن صندالي**، كانت مساعدتكم حيوية في جمع المعلومات ذات الصلة وضمان التقدم السلس لهذا العمل.

ولكل من ساعدنا من قريب أو بعيد بمعلومة أو نصيحة أو دعاء، نرجو من الله أن يوفقهم لما يحبه ويرضاه ويسهل لهم سبل الخير وأن يجزيهم عنا خير الجزاء.

محمد الطاهر بادة

محمد ضياء بناي

## Abstract.

In this work, we aim to prove that geographic information systems can be a solution for managing, analyzing and controlling the roads in the regions of Ouargla and Touggourt, and we take an overview of the geographic information systems and the software used, then a brief study of the road network in the two study areas, and how GIS can be used in modeling and controlling the road network and showing all information related to it.

Keywords: GIS, road network, GIS software.

## Résumé.

Dans ce travail, nous visons à prouver que les systèmes d'information géographique peuvent être une solution pour gérer, analyser et contrôler les routes dans les régions de Ouargla et de Touggourt, et nous faisons un tour d'horizon des systèmes d'information géographique et des programmes utilisés, puis un bref étude du réseau routier dans les deux zones d'étude, et comment le SIG peut être utilisé pour modéliser et contrôler le réseau routier et montrer toutes les informations qui s'y rapportent.

Mots-clés : SIG, réseau routier, logiciel SIG

الملخص.

نهدف في هذا العمل إلى إثبات أن نظم المعلومات الجغر افية يمكن أن تكون حلاً لإدارة وتحليل والتحكم على الطرق في منطقتي ورقلة وتقرت، ونلقي نظرة عامة على أنظمة المعلومات الجغر افية والبرامج المستخدمة، ودراسة موجزة عن شبكة الطرق في منطقتي الدراسة، وكيف يمكن استخدام نظم المعلومات الجغر افية في نمذجة شبكة الطرق وتحكم فيها واظهار كافة معلومات المتعلقة بها.

الكلمات المفتاحية: نظم المعلومات الجغرافية، شبكة الطرق، برامج نظم المعلومات الجغرافية.

### List of Contents.

Dedication	
Acknowledgements	
Abstract.	
List of Contents.	
List of Tables.	
List of Figures.	
Introduction.	2
Chapter I: Geographic Information Systems & ArcGIS.	
I- Geographic Information Systems.	4
I-1. The history of Geographic Information Systems.	4
I-2. The definition of GIS.	4
I-3. GIS components.	5
3.1. Data	5
3.1.1. Descriptive data.	6
3.1.2. Spatial data.	6
3.2. Computer equipment (hardware).	6
3.3. Application(software).	6
3.4. Human resources (people).	7
3.5. Methods.	7
I-4. Features of GIS.	8
I-5. Benefits of GIS.	8
I-6. Domain of Use GIS.	9
6-1. GIS in agriculture.	9
6-2. GIS in climate and meteorology.	10
6-3. GIS in Environment and Ecology.	10
6-4. GIS in water management.	11
II- ArcGIS.	12
II-1 Definition of ArcGIS.	12
II-2. Users of ArcGIS.	12
II-3. ArcGIS Software's.	12
II-4. ArcGIS Features.	15
Chapter II: Study Area	
I- Ouargla Area.	17
II- Touggourt Area.	17
III- The Hardware and Software.	19
Chapter III: The Practical Side of the Study	1
I- Google Earth pro.	21
II- Global Mapper.	23
III- ArcGIS 10.8 Desktop.	27
IV- The Results.	36
General Conclusion	38
References	40

### List of Tables.

Table (II - 1)	The Size of Road Network in Ouargla.	17
Table (II - 2)	The Size of Road Network in Touggourt.	18
Table (II - 3)	The Information used in this study.	19

### List of figures

Figure (I - 1)	Layers in GIS	5
Figure (I - 2)	Components of GIS.	5
Figure (I - 3)	ArcGIS Logo.	12
Figure (I - 4)	ArcMap Icon.	13
Figure (I - 5)	ArcCatalog Icon.	13
Figure (I - 6)	ArcGIS Pro Icon.	13
Figure (I - 7)	ArcScene Icon.	14
Figure (I - 8)	ArcGlobe Icon.	14
Figure (I - 9)	ArcReader Icon.	14
Figure (I - 10)	ArcToolbox Icon.	14
Figure (II - 1)	Road Network of Ouargla and Touggourt states.	18
Figure (III - 1)	Select "Add Path".	21
Figure (III - 2)	drawing the Path.	22
Figure (III - 3)	Save drawing road.	22
Figure (III - 4)	Save file.	23
Figure (III - 5)	Open data files.	24
Figure (III - 6)	select file and open data.	24
Figure (III - 7)	Export Vector Format 1.	25
Figure (III - 8)	Export Vector Forma 2t.	25
Figure (III - 9)	Shapefile Expert Option.	26
Figure (III - 10)	Configure.	26
Figure (III - 11)	Configuration General.	27
Figure (III - 12)	ArcMap interface.	28
Figure (III - 13)	Add Data 1.	28
Figure (III - 13)	Add Data 2.	29
Figure (III - 15)	data appeared in workspace.	29
Figure (III - 16)	Open Attribute Table.	30
Figure (III - 17)	Attribute Table and Add Field.	30
Figure (III - 18)	Add Field Numeric format.	31
Figure (III - 19)	Add Field Alphabet format.	31
Figure (III - 20)	Start Editing 1.	32
Figure (III - 21)	Start Editing 2.	32
Figure (III - 22)	input info to Attribute Table.	33
Figure (III - 23)	Create Features.	33
Figure (III - 24)	Create Road (Shape: line).	34
Figure (III - 25)	Add to Attribute Table 1.	34
Figure (III - 26)	Add to Attribute Table 2.	35
Figure (III - 27)	Save Edits and stop Editing.	35
Figure (III - 28)	Show data.	36

# Introduction

#### **General Introduction.**

In recent years, the control and management of road networks has become increasingly complex in the modern society. With increasing urbanization, population density and vehicular traffic, effective and safe road network control has emerged as a critical challenge for transport authorities around the world. In this context, geographic information systems (GIS) have proven to be indispensable tools for improving road network control strategies. This introduction will explore the use of GIS, specifically the ArcGIS program, in controlling the road network of the regions of Ouargla and Touggourt.

The regions of Ouargla and Touggourt, located in the southeastern part of Algeria, are known for their extensive road networks connecting urban centers, industrial zones, and rural areas. Effective control and management of these road networks are essential for ensuring smooth traffic flow, improving road safety, and facilitating economic development in the region. This is where GIS and the ArcGIS program come into play a high part.

This work was organized as follows:

- **Chapter one:** A definition of GIS, its components and functions, examples of some areas of use. Additionally, concepts, functions, components, and uses of ArcGIS.
- **Chapter tow:** A brief definition of the two study areas, the states of Ouargla and Touggourt, and the size of the road network in them. Mention the devices and software used in the completion of the study.
- **Chapter three:** The discussion revolves around designing roads and adding related data, using GIS-related software's.

The purpose of choosing this topic is:

Most of the states of Algeria suffer from poor management and organization of information related to the road network, in this case Ouargla and Touggourt. Here, GIS offers a solution to this problem, through the optimal use of its advantages, it is possible to organize and control the huge amount of information and store it in a secure manner that facilitates access to him in the future.

# <u>Chapter I</u>

# Geographic Information Systems (GIS) & ArcGIS

#### Introduction

In this chapter we'll talk about the geographic information systems and the program ArcGIS, as well as what related to them (their components, features, basic elements, and benefits....).

#### I- Geographic Information Systems.

#### I-1. The history of Geographic Information Systems.

With a brief historical look, we find that geographic information systems began in Canada in 1964 by "**Roger Tomlinson**", sometimes called the **father of geographic information systems**. During the seventies, the number of companies specialized in **GIS** software increased. The eighties witnessed an increase in the budget allocated to government agencies and private companies for **GIS**. As well as an increase in the number of specialists and a decrease in the prices of computers **GIS** and software. The nineties era witnessed an improvement in software and the ability of one program to carry out work that in the past required more than one program. With the development of computers during the third millennium, the use of multimedia and the Internet began, and the coming period will witness a revolution in the use of moving maps, thanks to the remarkable improvement in handheld computers. Internet and network connection. (By: <u>GISGeography</u>.19.01 2023).

#### I-2. The definition of GIS.

It is a computer-based system that collects, maintains, stores, analyses, outputs, and distributes spatial data and information. These systems help in planning and decision-making in relation to agriculture, urban planning, and housing expansion, in addition to reading the infrastructure of any city through what is called "layers."





#### I-3. GIS components.

GIS consists of five basic elements:

- Spatial and descriptive information (data).
- Computer equipment (hardware).
- Application (software).
- Human resources (people).
- Methods used for spatial analysis.



Figure (I - 2) Components of GIS.

#### 3.1. <u>Data.</u>

Data is one of the most important components of a GIS, which in turn provides the system with data to complete the analysis process. Data within GIS is divided into:

#### 3.1.1. <u>Descriptive data.</u>

It includes table data and various statistics on the elements and natural features that can be represented by nature.

#### 3.1.2. Spatial data.

It is information that shows a place or location, and this information is linked to a location within a spatial or geographical reference (linked to geographical coordinates) and includes all the natural and artificial elements present in an area such as: civil borders, buildings, roads.

#### 3.2. <u>Computer equipment (hardware).</u>

The concept of a machine in any system is a computer, where GIS operate on many types of computers, starting from the mainframe services that serve giant projects to personal computers that serve individuals.

This is in addition to the spread of GPS devices on the surface of the earth, which are used to determine the coordinates of certain points on the surface of the earth.

#### 3.3. <u>Application(software).</u>

GIS programs provide the tools and methods for storing, analysing and displaying geographic information with application destinations as a tool for easy communication between the device and the user.

There are many different software programs used in GIS, each with their own strengths and weaknesses. Some commonly used GIS software programs include:

- **ArcGIS:** developed by ESRI, this is one of the most widely used GIS software programs in the world. It is a comprehensive suite of GIS tools that can handle all aspects of GIS data management, analysis, and visualization.
- **MapInfo:** a GIS software program that is often used in business settings for market analysis and demographic research.
- **Google Earth:** a popular GIS software program that allows users to view satellite imagery and maps of the world, as well as create custom maps and add their own data.
- **QGIS:** an opensource GIS software program that is free to use. It has many of the same features as ArcGIS, but may not be as polished or user-friendly.

- **GRASS GIS:** another opensource GIS software program that is widely used in academic and research settings. It is known for its powerful spatial analysis capabilities.

These are just a few examples of the many GIS software programs available. The choice of which program to use will depend on your specific needs and the types of GIS tasks you will be performing. (By: <u>GISGeography</u>.19.01 2023).

#### 3.4. <u>Human resources (people).</u>

Human power is an important part and a key factor in GIS. Here are some ways in which people are involved in GIS:

- GIS professionals.
- Data collectors.
- Data analysts.
- Decision-makers.
- End-users.

In short, people are essential to the design, implementation, and use of GIS systems. They are responsible for collecting and analysing data, making decisions based on that data, and using GIS technology to achieve a wide range of goals.

#### 3.5. <u>Methods.</u>

The strength and importance of GIS lies in its ability to perform spatial and statistical analysis, and analysis methods is the beating heart without which there is no life or benefit from the collected and revised information. There are many different methods and techniques that can be used within GIS to accomplish various tasks, including:

- Data acquisition.
- Data storage and management.
- Data analysis.
- Visualization.
- Modelling.
- Network analysis.
- Geocoding and geolocation.

These are just a few examples of the many methods and techniques that can be used within GIS, depending on the specific application and data being used.

#### I-4. Features of GIS.

- Assist in planning new and expansion projects.
- Speed in accessing a large amount of information with high efficiency.
- Help to make the best decision in the fastest time.
- Helps spread information to the largest possible number of beneficiaries.
- Integration of spatial information and descriptive information into one database.
- Documenting and confirming data and information with unified specifications.
- Coordination between the information and the relevant authorities before making a decision.
- High spatial analytical ability.
- The ability to answer inquiries about location or descriptive information.
- The ability to visualize spatial information.
- Reducing production time and improving accuracy.
- Reducing labour and cost.

#### I-5. Benefits of GIS.

GIS can provide many benefits at the economic, social, and cultural levels. Here are some examples:

*Economic benefits:* GIS can be used to analyze and visualize spatial data related to economic activities such as retail sales, real estate, and tourism. This can help businesses and governments make better-informed decisions about where to invest and allocate resources. GIS can also help businesses identify new market opportunities and optimize their operations by analyzing transportation routes, logistics, and supply chains.

*Social benefits:* GIS can be used to analyze and visualize data related to social issues such as poverty, education, and health. This can help governments and non-profit organizations identify areas of need and allocate resources more effectively. GIS can also be used to map social networks and community assets, which can help build stronger, more resilient communities.

*Cultural benefits:* GIS can be used to map and preserve cultural heritage sites and artifacts, such as historical landmarks, traditional land-use patterns, and indigenous cultural practices. This can help promote cultural tourism and education, and preserve cultural heritage for future generations. GIS can also be used to analyze and visualize cultural data, such as language use and migration patterns, which can help promote cross-cultural understanding and cooperation.

Overall, GIS can help promote economic development, social equity, and cultural preservation and understanding at the local, regional, and global levels.

#### I-6. Domain of Use GIS.

GIS can be used in many domains such: agriculture, ecology, water management, meteorology, etc.....

#### 6-1. GIS in agriculture:

There are several specific GIS application areas in agriculture:

- including crop yield estimation, soil fertility assessment, cropping patterns monitoring, drought assessment, pest and crop disease detection and management, precision agriculture, and fertilizer and weed management.
- Evidence-informed decision-making using GIS can empower small-scale farmers to make informed decisions and implement practicable activities that increase agricultural productivity.
- Limitations and challenges to implementing GIS in agriculture include the cost of technology, lack of appropriate skills, and the challenge of simulating crop yield production due to the variety of cropping systems and levels of technology used.
- To address these challenges, there is a need for capacity building programs to train farmers and other stakeholders on how to use GIS technologies effectively. Additionally, there is a need for investment in infrastructure and resources to support GIS implementation in agriculture. (Mwehe Mathenge, Ben Sonneveld, Jacqueline E W Broerse. 08-2022).

#### 6-2. GIS in climate and meteorology:

here are some examples of how GIS is used in climate and meteorology:

- **Mapping weather patterns:** GIS can be used to map and analyze weather patterns, such as temperature, precipitation, and wind speed. This information can be used to identify areas that are at risk for severe weather events like hurricanes or tornadoes.
- **Climate modeling:** GIS can be used to create models of climate change by analyzing data from various sources, such as satellite imagery and weather stations. These models can help scientists predict future climate patterns and their potential impact on the environment.
- **Disaster response:** GIS can be used to help emergency responders plan for and respond to natural disasters like floods or wildfires. By mapping the affected areas and identifying vulnerable populations, responders can allocate resources more effectively.
- Urban planning: GIS can be used in urban planning to analyze the impact of climate change on cities, such as rising sea levels or increased temperatures. This information can help city planners develop strategies for adapting to these changes. (Scott Shipley, Ira A. Graffman. 01-2000)

#### **<u>6-3. GIS in Environment and Ecology:</u>**

Here some ways to use GIS in the environment:

- Environmental Impact Analysis (EIA): GIS aids in assessing the magnitude and characteristics of environmental impact from human activities. Integration of GIS layers enables efficient EIA by analyzing natural features.
- **Zoning of Landslide Hazard:** GIS facilitates the evaluation and zonation of landslide hazard by integrating various spatial data.
- **Determination of Land Cover and Land Use:** GIS technology helps determine changes in land cover and land use over time. It enables the detection of sudden changes caused by natural forces or human activities like deforestation.

- **Estimation of Flood Damage:** GIS assists in mapping flooding risk areas and estimating flood damage. It helps document the need for federal disaster relief funds and assess property loss for insurance purposes.
- Management of Natural Resources: GIS aids in the management of agricultural, water, and forest resources. It enables monitoring of forest conditions, managing crop yield, and analyzing the distribution of water resources.
- Soil Mapping: GIS helps identify and classify soil types, delineate soil boundaries, and create soil maps. It provides valuable information for land use activities, preventing environmental deterioration.
- Wetland Mapping: GIS allows for quick mapping and design projects for wetland conservation. Integration with remote sensing data facilitates wetland mapping on various scales.
- **Irrigation Management:** GIS assists in the proper and efficient management of water availability for irrigation purposes.
- **Identification of Volcanic Hazard:** GIS, combined with historical records of volcanic activities, helps identify potential volcanic hazard zones. also; It enables impact assessment studies on volcanic hazards, considering economic loss and the safety of populated areas.

#### 6-4. GIS in water management:

Here are some examples of how GIS can be used in water management:

- Spatially Distributed Crop Water Use Estimation.
- Soil Moisture Mapping for Floods and Droughts.
- Spatial Land Use and Land Cover Mapping. (W.G.M. Bastiaanssen, Muhammad Jehanzeb Masud Cheema, 12-2017)

There is also:

- Watershed Analysis and Modelling and Simulation
- Water Supply and Distribution and Water Quality Monitoring.
- Drought Monitoring and Planning. (Peter H. Gleick, 2000) (Johan Rockström, 2004)

#### II- <u>ArcGIS.</u>

#### II-1 Definition of ArcGIS.

**Aeronautical Reconnaissance Coverage Geographic Information System** or (**ArcGIS**) is geospatial software to view, edit, manage and analyse geographic data. developed and maintained by **Esri** for mapping on desktop, mobile, and web. Their motto is **"Science of Where"**. As such, the focus for ArcGIS is on location intelligence and analytics. (By: <u>GISGeography</u>.19.01 2023).



Figure (I - 3) ArcGIS Logo.

#### Esri (Environmental Systems Research Institute) develops ArcGIS software.

In 1969, the company was first founded primarily for land use development, and ArcGIS is the leading GIS software in the market today.

GIS integrates many different subjects using geography as its common framework. Esri is the global leader in the development of GIS, location intelligence, and mapping. (By: <u>GISGeography</u>.19.01 2023).

#### II-2. Users of ArcGIS.

ArcGIS users are in a wide range of fields and industries. For example, government, education, and commercial industries use ArcGIS. But the largest user base is in the environment, military, and land planning. Because most colleges use ArcGIS, graduates are usually somewhat familiar with it.

#### II-3. ArcGIS Software's.

ArcGIS is a set of software consisting of:

- ArcMap: is the centrepiece of the Esri suite of GIS software. It's how users create maps from scratch. By analysing data, they can find location patterns and trends in ArcMap. Finally, users edit data and can call it their own. The main format for ArcMap is an MXD (Map Exchange Document).



#### Figure (I - 4) ArcMap Icon.

- ArcCatalog: ArcCatalog is more like Windows Explorer which shows only geospatial data. In a way, it's also like a library where you can organize and manage your GIS data. ArcCatalog is where you document and write metadata as well.



Figure (I - 5) ArcCatalog Icon.

ArcGIS Pro: ArcGIS Pro will one day replace ArcGIS. It has several advantages over ArcGIS. For example, its main advantages are 64-bit processing, integrated 3D, and ribbon-based interface. Unlike ArcGIS, it stores your maps, data, and toolboxes as a project file (.APRX). Finally, ArcGIS Pro has tools and extensions that go a bit beyond ArcGIS.



#### Figure (I - 6) ArcGIS Pro Icon.

- ArcScene: Using the 3D Analyst extension, you can access ArcScene. ArcScene focuses on local areas like the size of a neighbourhood. If you want to save a scene, its format is SXD.



ArcScene

#### Figure (I - 7) ArcScene Icon.

- ArcGlobe: ArcGlobe is a 3D application for larger study areas. Instead of the size of a neighbourhood, it's well-suited for global extents. If you're going to use ArcGlobe, its file format is 3DD (ArcGlobe Document).



Figure (I - 8) ArcGlobe Icon.

 ArcReader: ArcReader provides GIS users with a method to share maps locally, over networks, and on the Internet. ArcReader preserves a live connection to data so your data view is dynamic. This also makes ArcReader useful for publishing maps based on ArcGIS Server content.



#### Figure (I - 9) ArcReader Icon.

- ArcGIS Extensions and ArcToolbox: By using ArcGIS extensions and addons, you can boost the capabilities of the stand-alone product. For example, there are extensions for GPS tracking, geostatistics, and more. Each add-on has a toolset that you can use as part of an ArcToolbox.



ArcTool box

Figure (I - 10) ArcToolbox Icon.

#### II-4. ArcGIS Features.

the features of ArcGIS software include:

- **Mapping and Visualization:** ArcGIS provides a powerful set of tools for creating, managing, and sharing maps and other visualizations. Users can create dynamic and interactive maps that can be customized to display a wide variety of data and information.
- **Geoprocessing and Analysis:** ArcGIS provides a wide range of geoprocessing tools for analyzing and manipulating spatial data. These tools can be used for tasks such as data conversion, spatial analysis, and data management.
- **Data Management:** ArcGIS provides tools for managing a wide variety of spatial data including raster and vector data, geodatabases, and feature classes.
- **Spatial Analysis:** ArcGIS provides a suite of advanced spatial analysis tools for tasks such as site selection, spatial statistics, and terrain analysis.
- **3D Visualization:** ArcGIS supports the creation of 3D visualizations, including the ability to create and edit 3D models, terrain, and buildings.
- **Mobile GIS:** ArcGIS provides tools for creating and deploying mobile GIS applications, allowing users to collect and analyze spatial data in the field.
- Web GIS: ArcGIS provides tools for creating and deploying web GIS applications, allowing users to share and collaborate on maps and other spatial data over the web.
- **Integration with other systems:** ArcGIS can be integrated with other systems and technologies, including enterprise systems, databases, and other GIS systems.
- ArcGIS Online: ArcGIS Online is a cloud-based platform that provides access to a variety of GIS services, including mapping, data storage, and analysis tools. (By "ArcGIS Enterprise". 30 August 2022).

#### Conclusion.

In this chapter, we have seen the definition of GIS and ArcGIS, as well as their components, features, basic elements, and benefits of using them.

# Chapter II

# Study Area

#### Introduction

In this chapter we will talk about the two-study area we're working in theme; **Ouargla** and **Touggourt**, we'll talk about the location and their geographical coordinates, as well as the size of their road network.

We'll also talk about the hardware and software used to conduct this study.

#### I. <u>Ouargla Area.</u>

**Ouargla** a state **n**°**30** located in the Sahara Desert in Algeria. Its geographic coordinates are approximately

- **31.9625** degrees north latitude.
- **5.3233** degrees east longitude.

Ouargla is an important state in south-eastern Algeria, and it has a relatively developed road network for the region. The road network connects the city with other major cities in the country, as well as with neighbouring countries in the Sahel and North Africa region.

Table (II - 1) The Size of Road Network in Ouargla.

Secteur Route	
Longueur Routes Nationales	1211.0 Km
Longueur Chemins de Wilaya	129.5 Km
Longueur des Chemins communaux	178.8 Km
Nombre de Chemins communaux	30 nbr

#### II. <u>Touggourt Area.</u>

**Touggourt** a state  $n^{\circ}55$  located in the Sahara Desert in Algeria, Its geographic coordinates are approximately:

- **33.0996078** degrees north latitude.
- **6.0785104** degrees east longitude.

Touggourt was until **2019** administratively affiliated to Ouargla, until it was considered an independent state from it.

Secteur Route	
Longueur Routes Nationales	273 Km
Longueur Chemins de Wilaya	230.6 Km
Longueur des Chemins communaux	143 Km
Nombre de Chemins communaux	38 nbr

Table (II - 2) The Size of Road Network in Touggourt.

- > The road network in Ouargla and Touggourt is divided into:
  - NATIONAL ROADS.
  - ROADS OF WILAYA.
  - COMMUNAL ROADS.
  - URBAN ROADS.



Figure (II - 1) Road Network of Ouargla and Touggourt states.

We used in this work the following information, we summaries it in a table:

Type de Route	Wilaya	Longueur	Largeur	Départ & PK départ	La fin & PK la_fin	Etat Général	Trafic
Routes Nationals		-	-	-	-	Bon	-
Chemins de Wilaya	Touggourt Ouargla	-	-	-	-	Moyen Mauvais	-
Grand Routes Urban		-	-	-	-		-

#### Table (II - 3) The Information used in this study.

PK: point Kilometrique.

#### III. <u>The Hardware and Software.</u>

In this work we used:

- Projection system: WGS\_1984.
- Coordinate system: UTM.

Hardware: one pc **ASUS**:

- Intel(R) Core (TM) i7-4510U CPU @ 2.00 GHz 2.60 GHz.
- Memory (Ram) 8GB.
- 64-bit operating system x64 processor.
- Windows 11 pro.

#### Software: Google Earth pro, Global Mapper 20, ArcGIS 10.8 Desktop.

#### Conclusion.

In this chapter, we have seen two-study area **Ouargla** and **Touggourt**, and their location and their geographical coordinates.

Likewise, we've seen the hardware and software used to conduct this study.

# **Chapter III**

# The Practical Side of the Study

#### **Introduction**

In this chapter we're talking about how to design a road and add data about this road, by using these software's: **Google Earth pro, Global Mapper 20, ArcGIS 10.8 Desktop.** 

This study was divided into three phases, and all information used dates back to 31/12/2022.

- > First, the road is drawn and saved in KML format using Google Earth.
- Secondly, the saved data is converted from KML format to Shapefile format using Global Mapper, and the geographical projection system is modified as well.
- Thirdly, the converted data is entered into ArcGIS, and the information for each drawn road is added, which is information that can be modified.

These are the steps followed during this study.

#### I. Google Earth pro.

By using **Google Earth Pro**, the road network will be drawn, and the data will be saved and sorted by name (RN, CW, GRU). Follow the steps detailed in the following pictures:



#### Figure (III - 1) Select "Add Path".

We select add path from the toolbar to draw the road we want.



Figure (III - 2) drawing the Path.

We can add a description and choose style, color and other settings.



#### Figure (III - 3) Save drawing road.

We save all the data we have in "save place as.".

Google Earth Pro					- a ×
Elle Edit Yiew Jools Add Help				•	
▼ Search	💼 🗑 🖉 S 🥥 S 🗶 🚛 🔣	2. B. 15. 👟			
Search			172	A	8
ex: 15713	Save file.		×		
Get Directions History					
▼ Places	$\leftarrow \rightarrow \lor \uparrow$ ${\frown}$ Desktop > Notes > GEarth files	> Main Project		and the second states	
Starting Location	Ormore a New Solder			A State State State State	(0)
+ I Sightsreing Tour	Aleren	and the second second	len l	and the second second	
layer is checked	> Mohamed - Per Name	use modified ype		A STATE OF THE STATE OF THE STATE	
Ouargia     Diatote	S Grand Routes Urban	13/05/2023 00:38 KML	14 KB		
+ 🖌 🖾 Routes Nationnal	💭 🧰 Desktop 💉 🍣 Ouargla	10/05/2023 03:06 KML			The second s
V En Routes Wileys     V En Grand Routes Lifean	🚽 Devenloads 🍺 😂 Ouargla_Touggourt map				
Carls Ouargla	Documents # S Ouargia Touggourt map			4	
Reads Touggout     Demonstry Places	S Route Nationnal	10/05/2023 00:04 KML	190.68	The second se	
	BM.Dha #	10.05/2022 00:04 /04	9117		
	New folder (; *	10/03/2023 00/04 NML		the second second	
	AdultGM 💉 🖉 Koutes Wilaya	20/05/2025 2044 KML	89 49	a second second	
	🖈 المذكرة 🦳			Same of the second second	
				R. W. Contraction of the State of the	
	File names Routes Wilaya		~	the set of the set	
	Save as type Kml (* kml)				
🔍 🔳 🔹 🔸 🕈 🖻				and the second the second	
▼ Lavers	∧ Hide Folders		Save Cancel	The shears a	
🔻 🗏 🥪 Primary Database		UNAR IN A CAN BE		have the state of the	
Contract Announcements     Contract Announcements     Contract Announcements     Contract Announcements     Contract Announcements	The second	NGOUGER 4-1-M	A Part of		
Places		allocha Balan		and the second second	
Photos		a the second sec	1 A A A A A A A A A A A A A A A A A A A	A STATE STATE	
D Buildings		No. 1 Contraction	1		
Set Weather     Gallery		162.0		And the second second	
More		Hand Hanning	Contra Contra		
- 🕐 forrain		rectify one idea		A BARAN	
	10				
	Provide Caller Contract (Contract			Te . A	IN LA
				ABER MORE BUSIERS	All and a second
			Accessed and and A Passandones		
	Tanka and the first state of the		a sufficient and surface more	A STREET AND	
	and the second sec			ALL DE CALLER	Google Earth
	ay and a started	NE	A DESTROY & PROPERTY	WICHEST D	FAREARE do IVA AREARING

Figure (III - 4) Save file.

Choose the folder where to save the data, and save it in KML format.

After doing these steps, we've completed the First Phase; and go to Global Mapper.

#### II. <u>Global Mapper.</u>

By using Global Mapper, the data will be transferred from **KML** format to **Shapefile** format, which can be read by **ArcGIS**.

Before doing that, the existing data needs to be exported to a **Vector Format**, and the projection system will be modified to comply with the study's projection system.

The following pictures explaining that:



Figure (III - 5) Open data files.

Here we see the Global Mapper Interface, we choose Open data files.



Figure (III - 6) select file and open data.

We go to the folder where save our data, and choose data whit KML format.



Figure (III - 7) Export Vector Format 1.

From toolbar we go to "File" then "Export" then "Export Vector Format".



Figure (III - 8) Export Vector Format 2.

from the box we choose shapefile, this format can be readable by ArcGIS. (The Esri vector data storage format is to store the location, shape and features of geographical features).



Figure (III - 9) Shapefile Expert Option.

In this step we choose where to save our shapefile data from "Export Lines" and select file, and press OK.



Figure (III - 10) Configure.

After we done whit exporting, from **toolbar** we go to "Tools" then "Configure".



#### Figure (III - 11) Configuration General.

From the apparent box we go to "Projection", then we set these parameters:

- Projection (UTM).
- Zone (31(0°E 6°E Northern Hemisphere)).
- Datum (WGS84).

We press Apply and OK.

We close Global Mapper and move on to The Third Phase.

#### III. ArcGIS 10.8 Desktop.

In **The Third Phase** of this Study, we enter the converted data into the **ArcGIS**, and then add the information for each road that was drawn, which is information that can be modified and updated.

We'll be working with **ArcMap**; The following pictures explaining that:



#### Figure (III - 12) ArcMap interface.

When we open ArcMap first time we see command bar, a large workspace, toolbar, table of contents...etc.

First step: input data to ArcMap.



#### Figure (III - 13) Add Data 1.

From table of contents: Layers, by clicking right button of the mouse we choose: Add Data.

Tarta/WI - Arthur		- 1 X
g orangeness - wronge Ele Life View Residentiate Incent Selection Generocorrism Customics Westmar Hale		
Table Of Contents 4 X		
- A & A &		10 A
S 😅 Layers		100
Route Network		Ibde
		A
		7 but
		5
		11 2
		0.00
	Add Data X	710
	Laak In 🔁 Main Project 🗸 🖉 🥥 🕼 🗯 🕶 🖾 🕲 🖓 🍪	1
	Chernins deWileya.shp	
	😁 cw.shp 🔤 GeneRoutecilitian shn	Sea
	🗱 Ouergla Al	100
	Ourgle, lougourt mep.tf	
	Routes Nationales.shp	
	Zone ship	
	News	
	She of here:	
	Linker under Datasets, Layers and Results	
0.0 0 0 0		
		3.985 33.246 Decimal Degrees

Figure (III – 14) Add Data 2.

Then we choose data we want to work with, in this case we need data with these formats: tif (for images or map), shp (for other features).



Figure (III - 15) data appeared in workspace.

we see in workspace:

- the map layer: (Tgrt&Orgl.tif).
- the road layer: (RN.shp), (CW.shp), (GRU.shp).

Second Step: Enter Road data; At this point, we're going to set up a road database.



Figure (III - 16) Open Attribute Table.

After adding data, we go for adding information about the road we draw before.

exp: Routes Nationals then Open Attribute Table.

Find and Replace						
Select By Attributes	Départ	La_fin	Longueur km	Largeur m PK_Départ	PK_laFin	Etat_Gnral
secces by randocent	nmune d'El Alia	Commune de Touggourt	110	7 311+000	421+000	bon = 58 km/ moyen =52 km / mauvais = 0 km
clear selection	refour RN3 tg/RN 16, Nezla	Commune de Bennaceur, Limite de wilaya avec El Oued	46	7.5 587+000	633+000	bon =18.08 km / moyen =0 km / mauvais =0 km
Switch Selection	Rached, Limite de wilaya avec El Oued	Square Bresson El Hadjira, limite de wilaya avec Ouargia	111	8 311+000	621+000	bon = 17 km / moyen =52 km / mauvais = 16 km
Select All	are Bresson El Hadjira, limite de wilaya avec To	uggourt Carrefour RN49/RN56, (3 Pitons) com. Ain Beida	62	14 6+000	68+000	bon =99 km / moyen = 23 km/ mauvais =2 km
JUCCIPA	refour RN53 / RN53A, (Zemlet Larbi)	Limite de wilaya avec Illizi	328	7 0+000	328+000	bon =228 km / moyen = 13 km/ mauvais =92 km
Add Field	refour RN51/RN 49 Ouargla	Limite de wilaya avec El Goléa	142	7 0+000	142+000	bon =59 km/ moyen =0 km/ mauvais =89 km
Turn All Fields On	ite de wilaya avec Ghardaia	Carrefour RN49/RN3, Hassi Messaoud	164	14 70+000	234+000	bon =299 km / moyen = 8 km/ mauvais =21 km
Add Eald	in El Hadjira, limite de wilaya avec To	uggourt Rhourd El Nouss, Limite de wilaya avec Illizi	293	7.5 621+000	914+000	bon = 104 km/ moyen = 144 km / mauvais = 76 km
Related Tables Create Graph Add Table to Layout Reload Cache Print Reports Export	· ·					

#### Figure (III - 17) Attribute Table and Add Field.

When open attribute table, we can see all information that has a relation with our data, such name, shape, départ.... etc.

From table option we can add field to our table if we need one.

Note:   Add field   18	B- 5	N © ⊕ ×							ą	×
Into         Wate         Wate         Wate         Wate         Originat         Commune dB Tails         Commune dB Taigsont           1         Nith 5         Fraggent         Commune dB Tails	s Nationale	5			Add Field	×				×
NH1     Torgert     Contrue dB Alla     Contrue dB Cont	FID N	AME Wilsya	Départ	La_fin			PK_Depart	PK_laFin	Etat_Gnral	
1 N1/6     Comput US (Special Conductor Vision (Special Conductor Visi	O RN B	Touggourt	Commune d'El Alia	Commune de Touggourt	Name: Loopuus		311+000	421+000	bon = 58 km/ moyen =52 km / mauvais = 0 km	
1 kitig Tougort (sei skytek, Limite de vilge see Clagort (andre vilge avec Clagort) (andre vilge avec	1 RN16	Touggourt	Carrefour RN3 tg/RN 16, Nezla	Commune de Bennaceur, Limite de s	Lungueur		587+000	633+000	bon =18.08 km / moyen =0 km / mauvais =0 km	_
a) (MSK) Dougly Boards fractor (Msg/m, Bind de uitga avec (Tougout) United avely a avec (Tougout) United avely avec (Tougout) United avec (Tougout) United avely avec (Tougout) United avely avec (Tougout) United avely avec (Tougout) United a	2 RN3 t	Touggourt	Sidi Rached, Limite de wilaya avec El Oued	Square Bresson El Hadjira, limite de	Times		311+000	621+000	bon = 17 km / moyen =52 km / mauvais = 16 km	
a moza jedanja Cardevina jedanja za oklada sili ja za oklada jeda jeda jeda jeda jeda jeda jeda j	3 RN56	Ouargla	Square Bresson El Hadjira, limite de wilaya avec Touggourt	Carrefour RN49/RN56, [3 Pitons] cor	Float	. *	5+000	68+000	bon +99 km / moyen + 23 km/ mauvais +2 km	_
a) the base for the state of output of the state of output of the state output of t	4 R/\53	A Ouargia	Carretour KN53 / RN53A, (Zemlet Larbi)	Limite de wilaya avec IIIIzi			0+000	\$28+000	pon +228 km / moyen + 13 km/ mauvais +92 km	_
Person Person Person Person Person Decarga Decar	5 RN51	Ouargla	Carretour KN51/KN 49 Ouargia	Limite de wileya avec El Goléa	Held Properties		20+000	242+000	bon =53 km/ moyen =0 km/ mauvais =89 km	-
	7 843	Ouargta	Limite de wilaya avec Ghardaia	Carretour KN49/KN3, Hassi Messaoi	Precision 0		704000	234+000	bon #299 km / moyen #8 km/ mauvais #21 km	_
( lout of 8 Selected)	•	1 × × 🗐 🗖	(0 out of 8 Selected)							

#### Figure (III - 18) Add Field Numeric format.

To add field with numeric format we go for: Type **Float**.

Our field with **Float type** is: Longueur, Largeur.

0         Met/l         Witese         Depart         Add T(cl)         X         Request M         RE_UBJect         PR_UBJect         <	0         NAU         Wites         Depart         Add Teid         X         Depart         RX_UPIC	Nationales											x
0         NM81         Torggout:         Commune d'B Alla         Into a for page of the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and the set of heady, interve char maxima of the milling and themilling and the milling and the milling and themilling a	0         NA81         Torggavt.         Carnetua d'D Alas           1046         Torggavt.         Carnetua d'D Alas           10405         Torggavt.         Carnetua d'D Alas           10405         Torggavt.         Safe Advest. Lumits de aniting avec Doued           10405         Torggavt.         Safe Advest. Lumits de aniting avec Doued           10405         Torggavt.         Safe Advest. Lumits de aniting avec Doued           10405         Torgavt.         Safe Advest. Lumits de aniting avec Doued         Torgavt.           10405         Torgavt.         Safe Advest. Lumits de aniting avec Doued         Torgavt.           10405         Dourga         Carneture Misi. Na vectore Safe Manuel Safe M	D NAME	Wilaya	Départ	Add Field			×	Longueur km	Largeur m	PK_Départ	PK_laFin	Etat_Gnrai
1 [M31]     Torggourt     Gardburk Mit gift Nd, Neara     Name:     L_jin       2 [M32]     Torggourt     Gardburk Mit gift Nd, Neara     Name:     L_jin       3 [M34]     Torggourt     Gardburk Mit gift Nd, Neara     Name:     L_jin       4 (6 )     7.8 [S17:000     633-000 [bon -10 km /megen -21 km /mexusin -3 km       6 (7 )     Saraga     Cardburk Mit Gift Nd Gardpa       6 (7 )     Gardburk Mit Gift Nd Gardpa     Field Popertee       7 [M3 or     Ouergin     Sayama Gardburk Mit Gift Nd Gardpa     Field Popertee       7 [M3 or     Ouergin     Sayama Gardburk Mit Gift Nd Gardpa     Field Popertee       7 [M3 or     Ouergin     Sayama Gardburk Mit Gift Nd Gardpa     Field Popertee       7 [M3 or     Ouergin     Sayama Gardburk Mit Gift Nd Gardpa     Field Popertee       0 (1 )     Gardburk Mit Gift Nd Gardpa     Field Popertee     Sayama Gardburk Mit Gardpa       7 [M3 or     Ouergin     Sayama Gardburk Mit Gardpa     Field Popertee       0 (1 )     Ouergin     Sayama Gardburk Mit Gardpa     Field Popertee       0 (1 )     Ouergin     Sayama Gardburk Mit Gardpa     Field Popertee       1 )     Ouergin     Sayama Gardburk Mit Gardpa     Sayama Gardburk Mit Gardpa       1 )     Ouergin     Sayama Gardburk Mit Gardpa     Sayama Gardburk Mit Gardpa<	1   MAT   Torger II (Arrebuc MD g1W) (A   Sueza   Arrebuc MD g1W) (A   Sueza	O RN B1	Touggourt	Commune d'El Alia					110	7	311+000	421+000	bon = 58 km/ moyen +52 km / mauvais +0 km
2   N01 g       Torggourt       gink factor, umit and winker avec 10 used       111 d       8   11 - 000       box + 1000       box + 10000       box + 1000       box + 1000 </td <td>2  M3 tg Torgent j Bit Robe, Limits de nilsys arec 10 usid 1866 Outrgits Square Samo Hiskin, Initia de nilsys arec Torgent 1863 Outrgits CarrebuckS5 / RSS (2003), Limits de nilsys arec Torgent 5  M3 d Outrgits CarrebuckS5 / RSS (2003), Limits de nilsys arec Torgent 2  M0 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 2  M0 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits  M3 d Outrgits</td> <td>1 RN16</td> <td>Touggourt</td> <td>Carrefour RN3 tg/RN 16, Nezla</td> <td>Name:</td> <td>La fin</td> <td></td> <td></td> <td>46</td> <td>7.5</td> <td>587+000</td> <td>633+000</td> <td>bon =18.08 km / moyen =0 km / mauvais =0 km</td>	2  M3 tg Torgent j Bit Robe, Limits de nilsys arec 10 usid 1866 Outrgits Square Samo Hiskin, Initia de nilsys arec Torgent 1863 Outrgits CarrebuckS5 / RSS (2003), Limits de nilsys arec Torgent 5  M3 d Outrgits CarrebuckS5 / RSS (2003), Limits de nilsys arec Torgent 2  M0 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 2  M0 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits Square Breason El Hadjin, Initia de nilsys arec Torgent 0  M3 d Outrgits  M3 d Outrgits	1 RN16	Touggourt	Carrefour RN3 tg/RN 16, Nezla	Name:	La fin			46	7.5	587+000	633+000	bon =18.08 km / moyen =0 km / mauvais =0 km
3   M64   Ourgia   Square Breason El Hadjin, limite de willays avec Touggourt   M62, M   Ourgia   Ourgia (Arrefue M63, M   Ourgia   Ourgia (Arrefue M63, M   Ourgia	3   M64   Ourgin Carrebu M63, (Min Gewillips wee Touggout 1   M64   Ourgin Carrebu M63, (Min Moyer a 12 km/maximi 2 km   Min Min Min Moyer a 12 km/maximi 2 km   Min Min Min Min Moyer a 12 km/maximi 2 km   Min Min Min Min Min Moyer a 12 km/maximi 2 km   Min	2 RN3 tg	Touggourt	Sidi Rached, Limite de wilaya avec El Oued	-				111	8	311+000	621+000	bon = 17 km / moyen =52 km / mauvais = 16 km
4 (NSA) Ourgin (Garadou KRS) (RSA), Garadou Lano) (Pro- lied) (V) (Range Garadou KRS), Garadou Lano) (Range Garadou KRS), Kalandou Kalan, Mayaka 20 km (S) (RSA), Garadou KRS), Kalandou KRS, Kalandou	4  N03.4  Durgia Carrebuck05/1003, ganeta (arrebuck05, 1003), ganeta (arreb	3 RN56	Ouergla	Square Bresson El Hadjira, limite de wilaya avec Touggourt	Tune			1	62	14	6+000	68+000	bon =99 km / moyen = 23 km/ mauvais =2 km
s jmsi. jourga Lunde do varga var	10       Currege	4 RN53A	Ouargia	Carrefour RN53 / RN53A, (Zemlet Larbi)	1100.	let		× .	328	7	0+000	328+000	bon =228 km / moyen = 13 km/ mauvais =92 km
a) more     jower (overgre     jumet de uninge avec ontranse     14     14     100000     2244000     Bon 429 km /mayels 42 km       7 (M3 or     (bergre     (bergre     14     10     10     10	a jmore joarga junte da aninga avec darana de allaya avec Touggourt 160 FT0p0666 104 junt de aninga avec darana de allaya avec Touggourt 100 FT0p0666 201 201 202 200 200	S RNS1	Ouargia	Carrefour KN51/KN 49 Ouargta	Dulu D			-	142	7	0+000	142+000	bon +59 km/ moyen +0 km/ mauvais +89 km
/ IMA GP         (powrg m         popure presson & red (int, innex de minge area; lougport)         [Length         60]         233         7.5 (621000         [9144000         [901 + 104 km/ mayers = 144 km / mayers = 75 km           OK         Cancel         OK         Cancel         Cancel         Interview         Interview <td>/ Into or         jourga         jour</td> <td>6 RN49</td> <td>Ouargia</td> <td>Limite de wilaya avec Ghardaia</td> <td>Held Prop</td> <td>erties</td> <td></td> <td></td> <td>164</td> <td>14</td> <td>704000</td> <td>234+000</td> <td>bon =299 km / moyen = 8 km/ mauvais =21 km</td>	/ Into or         jourga         jour	6 RN49	Ouargia	Limite de wilaya avec Ghardaia	Held Prop	erties			164	14	704000	234+000	bon =299 km / moyen = 8 km/ mauvais =21 km
OK Cancel	OK Canol	* Investor	Loosid)a	adoare areason a neofice, innite de witays svec rouggourt	Length		60	1 -	293	/.3	044-999J	1244-000	pour - automy mayer - att km / meuvers = /0 km

#### Figure (III - 19) Add Field Alphabet format.

To add field with Alphabet format we go for: Type **Text**.

Our field with **Text type** is: Name, Wilaya, Départ, La fin, Etat General, Trafic.



Figure (III - 20) Start Editing 1.

To input information to road network, we go to **Toolbar** then **Editor** then **Start Editing**.



Figure (III - 21) Start Editing 2.

After start editing, we select the layer that we want to edit or modify.

Bitter         Barling         Deprint         Lyfn         Logenore         Logenore         Ref (beer         Ref (beer	9-1-9	© ∉ ×								
D         Unity         Unity <thunity< th="">         Unity         Unit</thunity<>	fationales.						-	-		
0         10         Teggint         Connot all Bas         Exclusion         Exclusion           10         Viritig to general connot all Bas         Connot all Bas         Connot all Bas         Exclusion         Exclusion           10         Viritig to general connot all Bas         Connot all Bas         Connot all Bas         Exclusion         Exclusion           10         Viritig to general connot all Bas         Connot all Bas         Connot all Bas         Exclusion         Exclusion           10         Viritig to general connot all Bas         Connot all Bas         Exclusion         Exclusion         Exclusion           10         Viritig to general connot all Bas         Connot all Bas         Exclusion         Exclusion         Exclusion           10         Connot all Bas         Connot all Bas         Exclusion         Exclusion         Exclusion         Exclusion         Exclusion           10         Connot all Bas         Connot all Bas         Exclusion	D NAME	Wilaya	Départ	La_fin	Longseur km	Largeur m	PK_Depart	PK_lafin	Etat_Grow	Th
1 004 105 004 004 005 004 005 004 005 004 005 004 005 004 005 005	0 RN 81	Touggourt	Commune d'El Alla	Commune de Touggourt	210		7 311+000	421+000	bon = S8 km/ moyen =52 km / mauvais =0 km	Inconnu
2   102  2   102  3   102  5   10	1 4N16	Touggourt	Carrelour RN3 tg/RN 16, Nezla	Commune de Bennaceur, Limite de wileye avec El Oued	46	. 7.	5 587+000	635+000	bon x18.08 km / moyen x0 km / mauvais x0 km	Incontu
1         00.000	2 6143 18	19uggsurt	Sidi Reched, Limite de wileye ever til Ouell	Square Bresson El Madjara, limite de wilaya avec Quargia	315		5 311+000	6214000	60n = 17 sm / moyen +52 sm / mauvers = 16 sm	1/MA moyer = 54830
1         60         Ourp         Comp	4 84524	Ouergie	Square bresson to reagine, innite de winaye evec rouggourt	Carverour mines/misso, (3 Prices) com. Ain bailde	92		* 8*000	58+000	bon -00 km / moyen = 20 km / meuvers =2 km	Treamu Area
1         Hog         Corp?         Lines & miss and Corp.         Corp?         Lines & miss and Corp.         Miss and Corp.	R ANSON	Ousigis	Compose RMS1 (RM 48 Charges)	Limite de wildys svec tvizi	320		7 04000	143+000	bon +220 km / moyen + 15 km / meuvals +52 km	1/MA moyen + 2003
No.         Oscilla (Second)         Space Research Second)         Space Research Second (Second)	5 5145-5	Ouargia	Carrender Westphere and Chardelin	Contra de Wrieye svec si Gores	164		204000	232+000	bon -30 km moyer -0 km magest -31 km	1/100 mpyer = 1914
	7 SNL or	Ourrela	Savara Bersten B Medice Units de alface par Taurentet	Record D Marian Limits de collecte avec 1014	284		E #214000	81.64000	have a 10d km/ moure a 14d km / moure a 76 km	T1545 mouto = 5375
	7 8745 DF	Usargia	square eresson el Hadpra, límite de enlaya avec rouggiunt	Reducid El Nouce, Limite de Wileya avec mito	201		5 6/14000	3144000	con e the rul molan e tee rul ushasit e le ru	1/644/m0201+8378
	a cista	-	-		~		-	-		

#### Figure (III - 22) input info to Attribute Table.

By starting edit we can add info to Attribute table, we can notice, you can't add field when you start editing.

There is an important note, which is that other roads and paths can be added by Start Editing without the need to go back to the first and second phase. (Going back to steps of google earth & global mapper). The following pictures explain that.



Figure (III - 23) Create Features.

From **Editor** then **Editing Windows** Then **Create Features**, we can create features such: line, Rectangle, circle, ellipse, freehand.



Figure (III - 24) Create Road (Shape: line).

If we want, we can add another road to our network, and start drawing it in the map directly.



Figure (III - 25) Add to Attribute Table 1.

To add the new road to attribute table, we select the road, right click, Attribute.



Figure (III - 26) Add to Attribute Table 2.

Now we can put all info about the road in Attribute table, and will be directly added to it with the other roads.

s kutionalis I I I I I I I I I I I I I I I I I I I	National         Original         Special         National	1	8 - 1 <b>4</b> 6 63	⊇ @ ×			2.1	Start Editing Stop Editing						₹×
NID:         Workst         Wage         Depart         Operation         Depart         Depart </th <th>0         Num         Wings         Commune of U Airs         Descendence of U Airs         <thdescendence airs<="" of="" th="" u=""> <thdescendence of="" th="" u<=""><th>es N</th><th>ationales</th><th></th><th></th><th></th><th></th><th>Save Edits</th><th></th><th></th><th></th><th></th><th></th><th>×</th></thdescendence></thdescendence></th>	0         Num         Wings         Commune of U Airs         Descendence of U Airs <thdescendence airs<="" of="" th="" u=""> <thdescendence of="" th="" u<=""><th>es N</th><th>ationales</th><th></th><th></th><th></th><th></th><th>Save Edits</th><th></th><th></th><th></th><th></th><th></th><th>×</th></thdescendence></thdescendence>	es N	ationales					Save Edits						×
Image: Instance in condition     Conservation in condition     Conservation in condition     See and instance	grant       0:00000       0:00000       0:00000       0:00000       0:00000       0:00000       0:00000       0:00000       0:00000       0:00000       0:000000       0:000000       0:000000       0:000000       0:0000000       0:0000000       0:0000000       0:0000000       0:0000000000       0:0000000000	FID	NAME	Wilaya	Départ			More Faller	Longueur km	Largeurm	PK_Départ	PK_laFin	Etat_Gnral	T
a nital magenti unregioni unregioni ni vezi in	a losa loggen carreno na gen a, mar a mar a loggen carreno na gen a, mar a loggen carreno na gen a, mar a loggen carreno na gen a, mar a loggen carreno na gen a loggen carreno na loggen carreno na gen a loggen carreno na g	_	0 N81	louggourt	Commune d al Alia	Coms		Sold	110	7	3114000	+21+000	pon = 56 km/ moyen =52 km / mauvais =0 km	Inconnu
a http://www.unitedimentational.com/procession/c	a) Otok (1) Control (1) Co	_	1 0010	Touggout	Carretour Kno tg/Kn 15, Nette	Com	1.1	Save all edits made since the last	46	7.5	30/1000	633+000	bon size os km / moyen s0 km / mauvais s0 km	Titta marte - Forme
4       1333       Coregits       Secreting, INST 1053, Derived and Internet experiment reagenet.       32       17       1000       Discreting, INST 1053, Derived and YTM, Rescale 497 Im       1000 previous editing operations.       32       17       1000       Discreting, INST 1053, Derived and YTM, Rescale 497 Im       1000 previous editing operations.       32       17       1000       Discreting, INST 1053, Derived and YTM, Rescale 497 Im       1000 previous editing operations.       32       17       1000       Discreting, INST 1053, Derived YTM, Rescale 497 Im       1000 previous editing operations.       32       17       1000       Discreting, INST 1053, Derived YTM, Rescale 497 Im       1000 previous editing operations.       32       17       1000       Discreting, INST 1053, Derived YTM, Rescale 497 Im       1000 previous editing operations.       32       17       1000       Discreting, INST 1053, Derived YTM, Rescale 497 Im       1000 previous editing operations.       32       12       1000       Discreting, INST 1053, Derived YTM, Rescale 497 Im       1000 previous editing operations.       114       14       14       14       14       14       14       14       14       14       14       14       14       14       15       15       15       15       15       15       15       16       16       16       16       16       16       16	2         0.01 ge         Control of the control of the set (service the set	_	4 10763 LB	Concella	proninaumes, cimite de willays avec si qued	Squa	12	save. After saving, you cannot	111	8	511+000	621+000	bon = 17 km / moyen = 52 km / mauvais = 16 km	rumAmoyen = 54830
s 1342 Ougles Ourge Ourge Ourge State State State State State State Ourge State Stat	Service (1982) Control (1982)		4 841534	Cuargia .	Control of the second standard and the second standard and the second standard sta	Limite	61	Cop undo previous editing operations.	02	14	0.000	338-000	box -228 km / moyen - 23 km / mauvais -2 km	TIMAN INCOMES - 3663
6         1849         Ourge         Imme de wilsys avec Obrenis         The period         164         14         100000         124000         100000         124000         1000000         100000         100000         100000         100000         1000000         1000000         1000000         1000000         1000000         1000000         1000000         1000000         10000000         10000000         100000000         100000000         100000000000000000         1000000000000000000000000000000000000	1     1 </td <td>_</td> <td>E ONE1</td> <td>Quargia</td> <td>Carrefour PNE1/2N 40 Quarters</td> <td>Limit</td> <td></td> <td>Marca</td> <td>142</td> <td>7</td> <td>0+000</td> <td>1424000</td> <td>hon -59 km/ moves -0 km/ mevedia 192 km</td> <td>TIMA moven = 2003</td>	_	E ONE1	Quargia	Carrefour PNE1/2N 40 Quarters	Limit		Marca	142	7	0+000	1424000	hon -59 km/ moves -0 km/ mevedia 192 km	TIMA moven = 2003
2     Note     Courge is     Separate forescand through is a long word in a constraint of the course are through in a constraint of the course are through it is a constraint of the course are the course	Normality     Description     Description     Description     Description       1	-	6 RN49	Quarria	Limite de wilava avec Ghardaia	Carro		the gen	164	14	70+000	234+000	bon =299 km / moven = 8 km / mauvais =21 km	TIMA moven + 18300
Uberno	Image: Incomposition of the incompositio of the incomposition of the incomposition of the i		7 BN3 or	Ovarela	Souare Brasson El Hadiira, limite de villava aver Touerourt	Rhou	1	Buffer	293	7.5	621+000	914+000	hon = 104 km/moven = 144 km/maxwais = 76 km	TIMA moven = \$373
Clp Widde Features Snapping • More Editing Vindows • Options	Clip Validate featurent Snapping More Editing Vindows Options	_			adverse er en andre a			Union	2.73					
								Snepping  More Editing Orders Editing Windows  Options						
1 > N   B   Out of 8 Selected) Tabacada:		4	1 •	H	🥕 (0 out of 8 Selected)									

#### Figure (III - 27) Save Edits and stop Editing.

After we done editing, we can simply **Save Edits** and **stop Editing** from **Editor**.

#### IV. <u>The Results.</u>

If we want to show information about each road drawn, we take the following steps:



Figure (III - 28) Show data.

From **Toolbar** then **select tool** then right click in the road figure then **Identify**, we can see all the info we put earlier in Attribute Table, this information changes whenever we choose another road.

By doing that we've been able to achieve our purpose from this study.

#### Conclusion.

In this chapter, we have seen how to design a road network and add data about this network, by using software's related to GIS, and we explained how to do so with pictures & steps.

# General Conclusion

#### General Conclusion.

In conclusion, the use of GIS and the ArcGIS program in controlling the road network of the regions of Ouargla and Touggourt offers tremendous potential for effective management. By harnessing the power of spatial data and analysis, GIS enables authorities to make informed decisions, optimize resources, and enhance the overall transportation infrastructure.

Through ArcGIS we can eliminate tons of paper and free up large areas of archive bins, all by putting valuable information in one place that is safe from damage and easy to access, through it, it is possible to facilitate the extraction and display of information with a click of a button, and it can also be changed and modified quickly.

For the greatest benefit, engineers and decision makers must provide the program with constantly updated information, to get the most benefit from its advantages.

Embracing GIS technology and investing in its continued development and implementation will undoubtedly contribute to the sustainable growth and development of the road network in the future.



- Ikram DRICHE. GIS-based multi-criteria model as decision support tool for managing road maintenance [Master memory]. Ouargla: Ouargla University, Faculty of Applied Sciences; 2022.
- 2- Ahmed Mustafa. The role of geographic information systems in planning development projects in local communities. Egypt. Faculty of Social Work, Fayoum University; 2022.
- 3- Ahmed Abdel-Rahim and his colleagues. Application of Geographic Information Systems in Transportation [Bachelor's Degree] Sudan: Sudan University of Science and Technology, College of Engineering; 2020.
- 4- Muhammad Jehanzeb Masud, Remote Sensing and GIS Applications in Water Resources Management; Department of Irrigation and Drainage, University of Agriculture, Faisalabad, Pakistan.2017.
- 5- Wim G. M. Bastiaanssen, Remote Sensing and GIS Applications in Water Resources Management; Department of Water Resources, Delft University of Technology, Delft, the Netherlands.2017.
- 6- Mathenge, M.; Sonneveld, B.G.J.S.; Broerse, J.E.W. Application of GIS in Agriculture in Promoting Evidence-Informed Decision Making for Improving Agriculture Sustainability: A Systematic Review. Sustainability 2022, 14, 9974.
- 7- Scott Shipley, Ira A. Graffman. GIS applications in climate and meteorology;
   01-2000

#### Webography:

- 1- https://www.esri.com/en-us/arcgis/about-arcgis/overview.
- 2- <u>https://gisgeography.com/history-of-gis/</u> [May 28, 2022]
- <u>https://gisgeography.com/what-gis-geographic-information-systems/</u>
   [April 23, 2023]
- 4- Yashraj Singh Shaktawat: what is ArcGIS;
   <u>https://www.geospatialworld.net/blogs/what-is-arcgis/</u> [January14,2020]
- 5- https://www.researchgate.net/publication/362656227 [August 2022]