



Mustansiriyah University
College of Sciences
Department of Atmospheric Sciences



Remote Sensing of the Atmosphere

Laboratory

(Geographic information system)

GIS

3rd Stage

Lab. No. (1)

Introductory Overview of the Program

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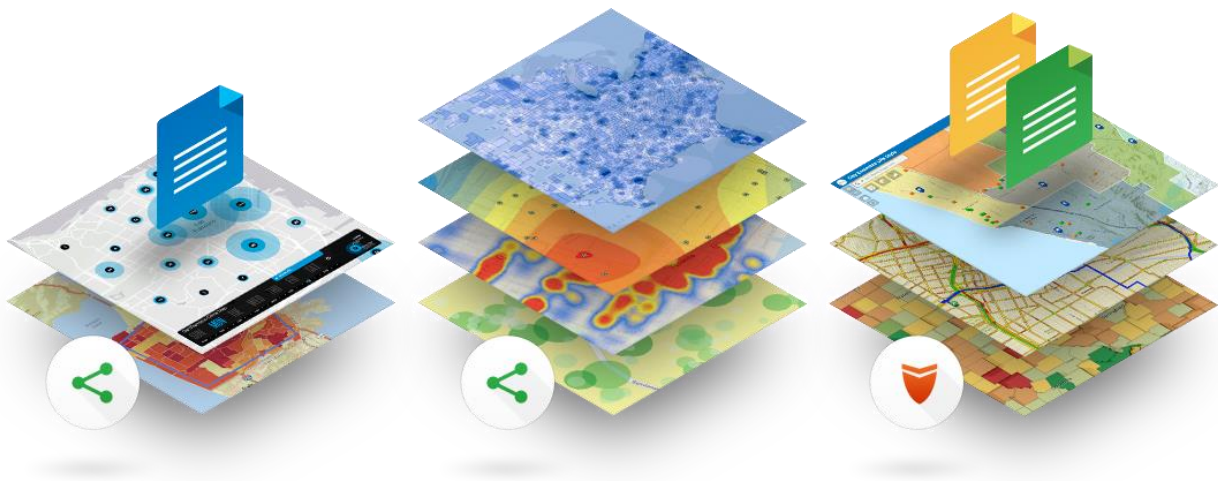
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Introduction to the Program

Geographic Information Systems (GIS)

GIS are systems designed to **collect, input, process, analyze, display, and output spatial and descriptive information** for specific purposes. They assist in **planning and decision-making** related to agriculture, urban planning, and residential expansion, in addition to analyzing a city's infrastructure through the creation of **layers**.

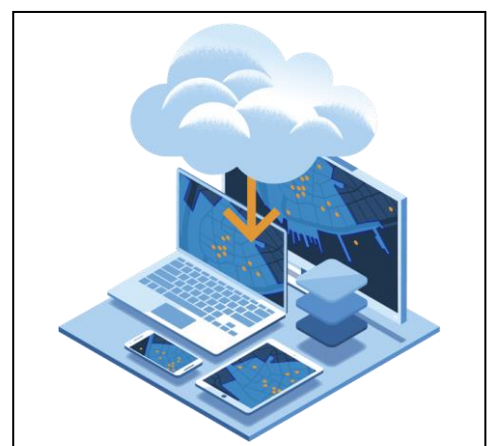
This system allows the **input of geographic data** (maps, aerial photographs, satellite imagery) and **descriptive data** (names, tables), followed by **processing** (error correction), **storage, retrieval, querying, spatial and statistical analysis**, and **displaying the results** either on a computer screen or on paper in the form of **maps, reports, and graphs**, or via a **web platform**.

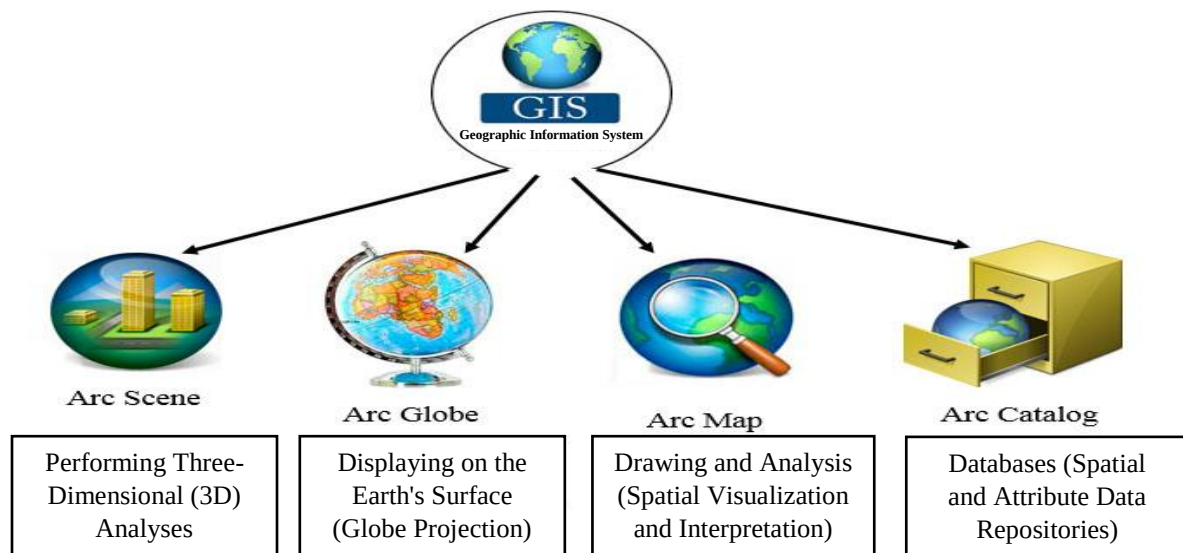


The ArcGIS Program

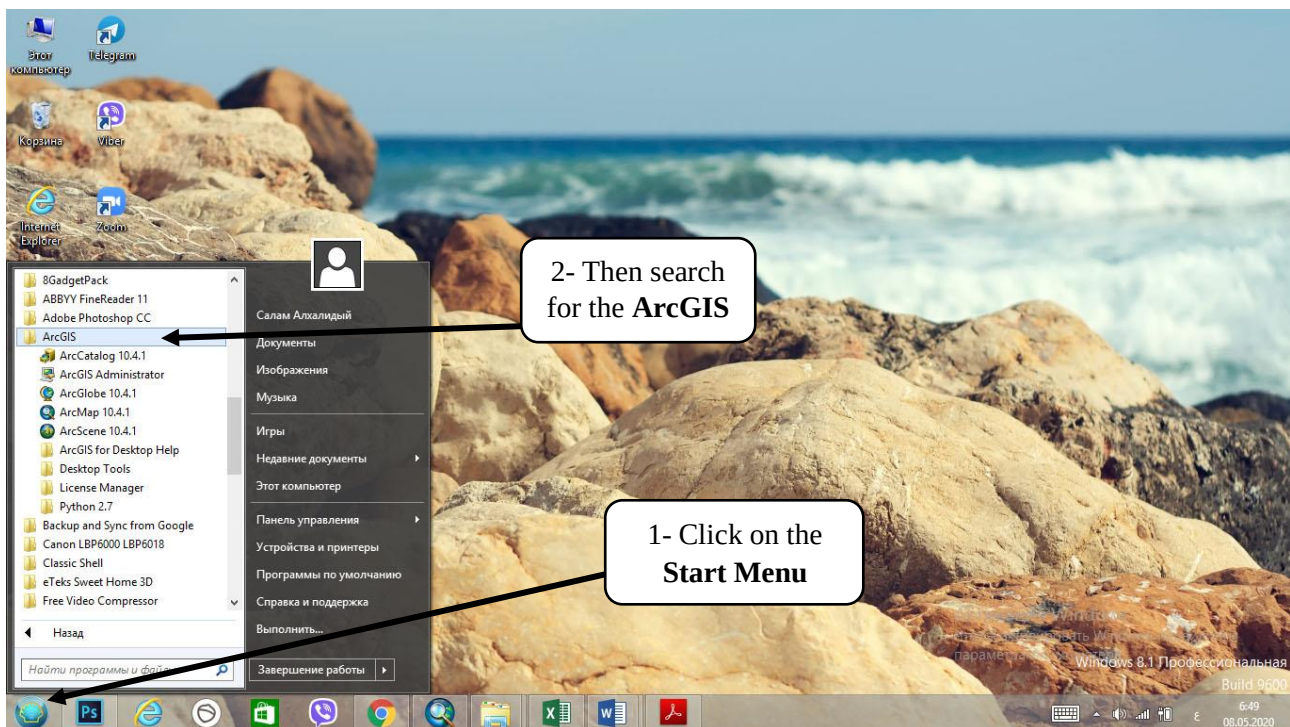
ArcGIS is one of the most important programs used in **Geographic Information Systems (GIS)**. Here, we will learn how to **work with this program** and use it to **produce maps** based on **descriptive (attribute) and spatial (geographic) data**, as well as its **utility in remote sensing (RS)** applications.

It is important to know that this program contains several **applications (modules)** such as **ArcMap, ArcCatalog, ArcGlobe, ArcScene**, and many other integrated applications, each serving different **functions (functionalities)**. We will focus on the **most commonly used applications**, how to interact with them, and understand their **specific purposes**.





After installing ArcGIS, go to the **Start menu** and search for the file named **ArcGIS**



After clicking on it, a set of extensions and applications installed with the program will open. *The most important of these applications, which we will be using in our study, include:*

1- ArcCatalog

ArcCatalog is an application dedicated to **managing Geographic Information System (GIS) databases**.

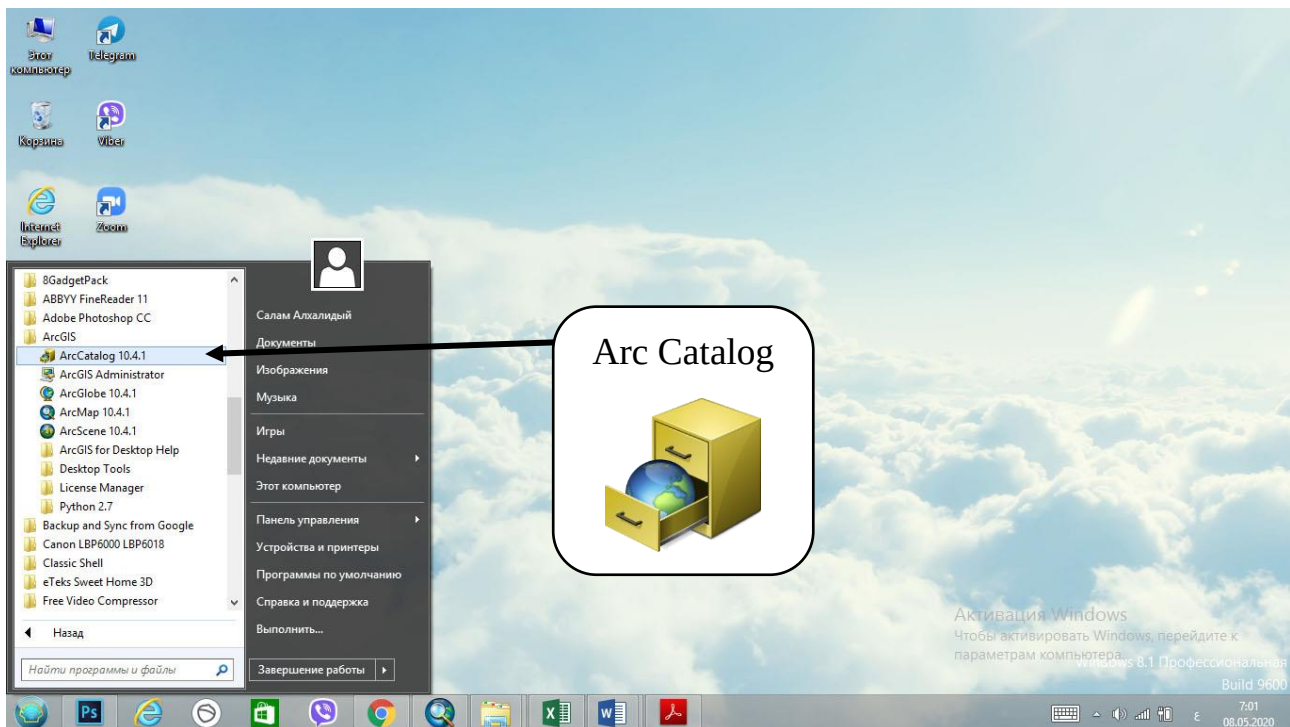
Through this application, users can **create, organize, and manage geographic databases**, as well as **add spatial (geographic) and attribute (descriptive) data**.

Proper use of this tool ensures **accurate data management, efficient retrieval, and reliable analyses** for GIS and Remote Sensing (RS) applications.

(Glossary:)

- **Geographic Information System (GIS):** A system for capturing, storing, analyzing, and managing spatial and geographic data.
- **Spatial Data:** Information that represents the location, shape, and dimensions of geographic features.
- **Attribute Data:** Descriptive information about spatial features, such as names, tables, or measurements.
- **Database Management:** The process of organizing, storing, and maintaining data for efficient access and analysis.

(Enhanced Note: ArcCatalog is essential in GIS workflows as it provides a structured environment to handle large volumes of geographic and descriptive data, ensuring the foundation for accurate mapping and analysis in ArcMap and other GIS modules.)

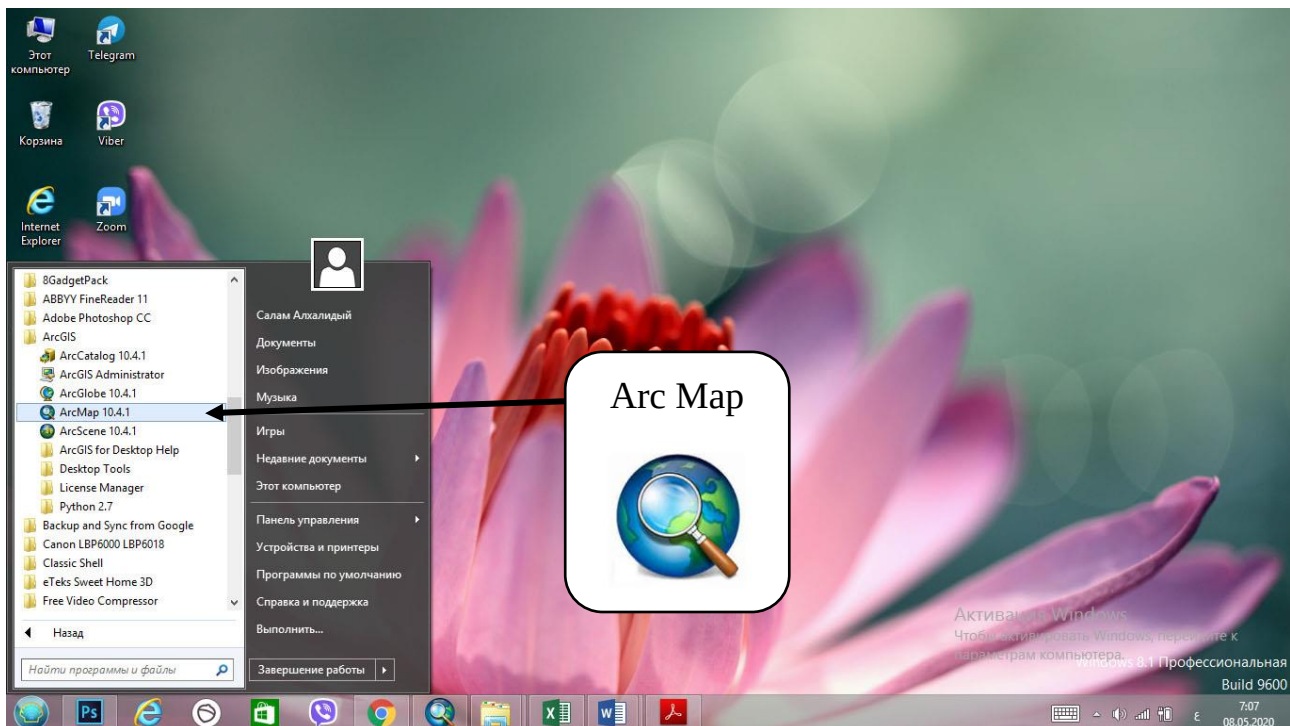


2- ArcMap

ArcMap is considered the **core of the ArcGIS program**, as it is the main application used to **display data after processing and analysis**, producing **visual maps**. The **database created in ArcCatalog** is displayed in ArcMap, allowing for **map creation, cartographic design, and output production**.

Additional Features of ArcMap:

ArcMap can also be defined as an application for **displaying, managing, and analyzing data, creating maps, and generating tabular data (tables)**. Moreover, **ArcCatalog can be accessed directly from within ArcMap via the toolbar**, allowing users to work on it without opening it in a separate window.



(Glossary:)

- **Core:** The most essential or central part of a system.
- **Visual Maps:** Maps that represent spatial data graphically for easy interpretation.
- **Cartographic Design:** The art and science of creating maps that are accurate, clear, and visually effective.
- **Output Production:** Exporting maps or data in a usable form, such as printed maps, digital files, or reports.
- **Tabular Data:** Data organized in rows and columns, such as attribute tables linked to spatial features.
- **Toolbar:** A graphical interface in ArcMap that provides quick access to commands and tools.
- **Embedded Window:** A window that opens within the main application interface, eliminating the need for a separate program window.

(Enhanced Note: ArcMap is central to GIS workflows because it not only allows visualization and cartographic output but also enables direct access to ArcCatalog tools, data analysis, and creation of tables, making it an all-in-one platform for spatial and attribute data management.)

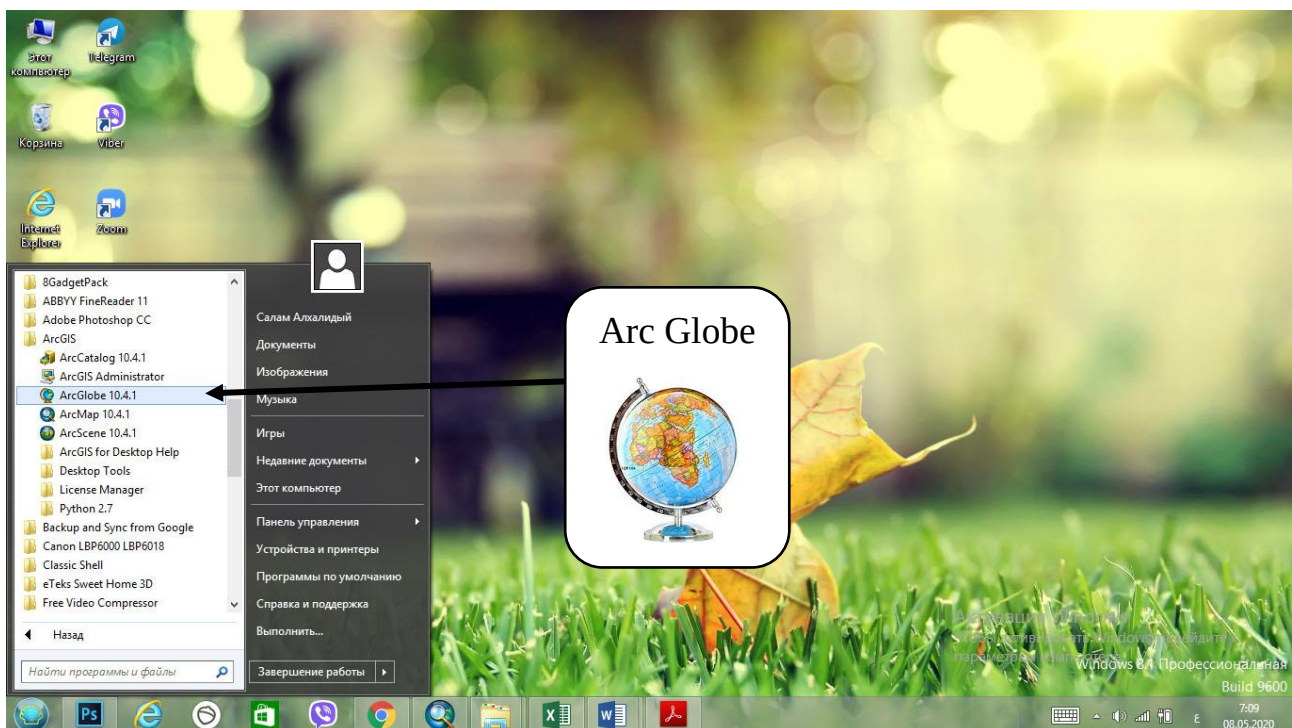
3- ArcGlobe

ArcGlobe is an application similar to **Google Earth**, where opening it displays a **three-dimensional (3D) model of the Earth**. This allows **maps to be visualized in 3D**, providing a realistic representation of geographic features. ArcGlobe also includes additional functions that will be explored later, but its main purpose is to **display maps in three-dimensional form on the Earth's surface**.

(Glossary:)

- **Three-Dimensional (3D) Model:** A digital representation of geographic features with depth, height, and terrain variation.
- **Visualization:** The process of representing data graphically to facilitate understanding and analysis.
- **Earth's Surface:** The outer layer of the Earth where geographic features and phenomena are mapped and studied.

(Enhanced Note: ArcGlobe is particularly useful for **global-scale analyses** in GIS and Remote Sensing (RS), allowing students and researchers to interact with spatial data in a fully 3D environment, which is essential for environmental studies, urban planning, and large-scale geographic visualizations.)



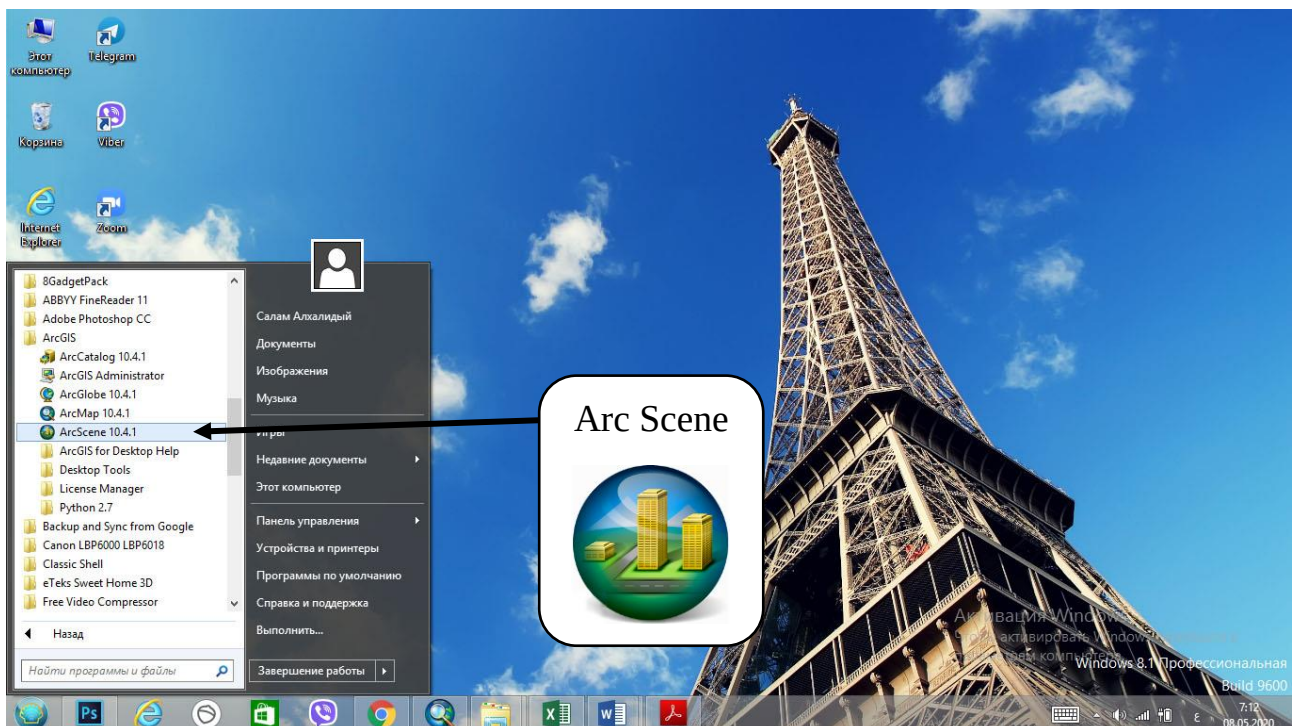
4- ArcScene

ArcScene is an application dedicated to **creating and analyzing data for three-dimensional (3D) outputs**. It is primarily used to **generate 3D graphics and models** that need to be visualized in a **three-dimensional form**.

(Glossary:)

- **Three-Dimensional (3D) Outputs:** Data or models represented with depth, height, and volume, allowing realistic spatial analysis.
- **Graphics and Models:** Visual representations of geographic features or spatial phenomena in a 3D environment.
- **Visualization:** Representing data in a graphical format for better understanding, interpretation, and analysis.

(Enhanced Note: ArcScene is essential for **local-scale 3D analyses**, urban modeling, terrain visualization, and any GIS or Remote Sensing (RS) tasks that require detailed three-dimensional representation of geographic features.)



MXD Doctor

MXD Doctor is a small and simple application, but it serves a **very important function**. It helps to **open ArcGIS map documents (MXD files) created in a higher version of the software** than the version you are currently using.

For example, if your ArcGIS version is **10.6** and you want to open an MXD file created in **version 10.7**, it cannot be opened directly because the file was created in a higher version. MXD Doctor allows you to **access and open these higher-version files**, making it possible to work with them without upgrading your main ArcGIS software.

(Glossary:)

- **MXD File:** A map document file used by ArcGIS to store map layouts, layers, and settings.

- **Software Version:** A specific release of a software program that may include new features or updates.
- **Backward Compatibility:** The ability to open or use files created in newer versions of software with an older version.

(Enhanced Note: MXD Doctor is essential for GIS professionals who need to collaborate with files created in different ArcGIS versions, ensuring continuity of work without losing map data or layouts.)



Accessing the Program

The work will be carried out on the **ArcMap application** from the **ArcGIS program**, which, as previously mentioned, is considered the **core of the software**. Its interface includes the following components:

- **Title Bar:** Displays the name of the current map document and the software.
- **Menu Bar:** Provides access to all commands and functions of ArcMap.
- **Toolbar:** Contains shortcuts to frequently used tools and functions.
- **Table of Contents:** Lists all layers in the current map and their Symbology.
- **Layers:** Individual datasets that can be displayed and analyzed on the map.
- **Data Frame:** The main map window where layers are displayed.
- **Catalog Window:** Provides access to datasets, folders, and databases.
- **Add Data Icon:** A shortcut for importing spatial and attribute data into ArcMap.

- **Open Catalog Window Icon:** Opens the Catalog window directly from the Toolbar.

(Enhanced Note: Understanding these interface components is essential for effective navigation and management of GIS data in ArcMap, ensuring smooth workflows for map creation, analysis, and visualization.)

