Basic component, standard GIS packages

Introduction

GIS enables the user to input, manage, manipulate, analyze, and display geographically referenced data using a computerized system. To perform various operations with GIS, the components of GIS such as software, hardware, data, people and methods are essential.

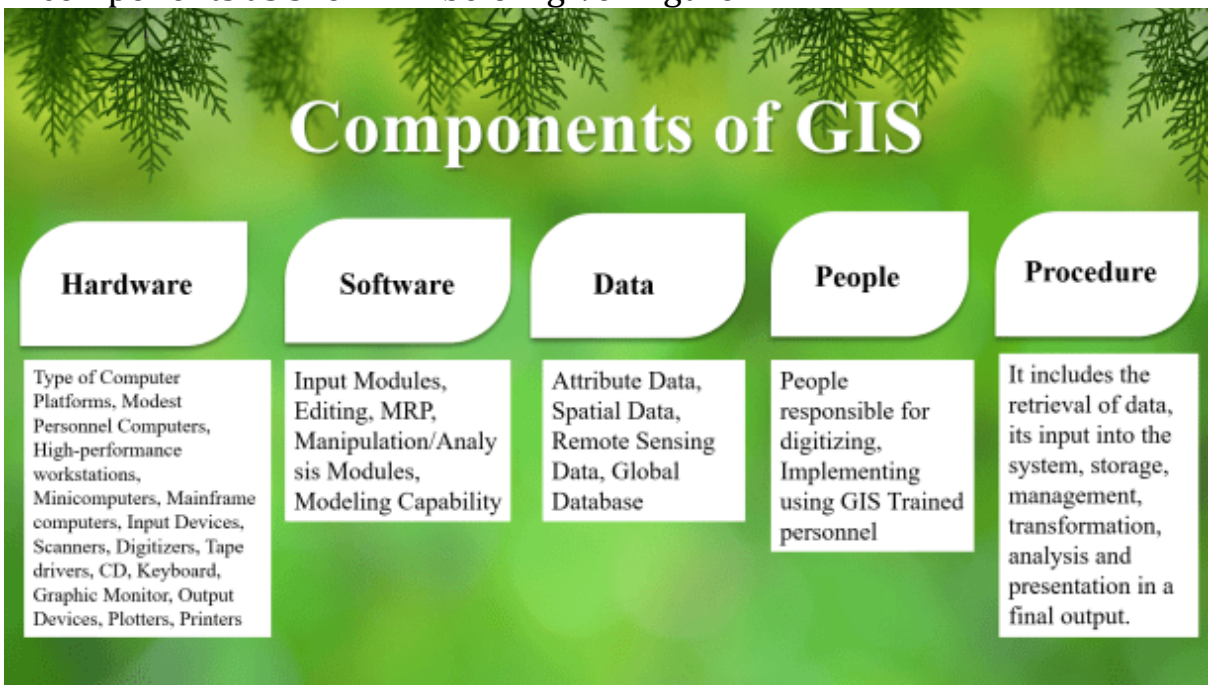
There is almost as much debate over the components of a GIS as there is about its definition. At the simplest level, a GIS can be viewed as a software package with various tools to enter, manipulate, analyze and output of geographical data (Heywood et al., 2006). At the other extreme, GIS components include the computer hardware, software, spatial data, data management and analysis procedures and the peoples to operate it. If the computer is located on a network, it can also be considered as the component of GIS since it enables data sharing among users. Hence, GIS is the combination of all these six components organized to automate, manage, and deliver information through geographic presentation (ESRI, 1999).

Like any other System, Geographic Information Systems is also an integration of various components. Software, Hardware, People, Method and Data, are the 5 components. These 5 crucial components are brought together to build a robust and powerful system. Every System integration requires a powerful and synchronous

amalgamation between all the primary and crucial components. Software and Hardware are important to handle many geospatial data, databases, visualizations and even complex process inputs or outputs. The rest of the things are completed by People, Method and Data. In a nutshell, GIS Components are the crucial factors for forming or building a system that can handle all kinds of GIS-related tasks.

Components of GIS

A working of GIS (Geographic Information System) integrates five key components as shown in below given figure



Hardware

Almost any type of computer platform including relatively modest personal computers, high performance workstations, minicomputers, and mainframe computers belong to the hardware element. The workstations were quite popular in the early 1990s. The unix operating system is an example of such workstations. Apart from the standard input, storage and output devices, additional specialist peripherals are required for data input and data output. The examples, of additional input devices are – scanners, digitizers and pen-drives. Similarly the examples of additional data output devices are plotters and printers. Sometimes additional devices are also required for data storage and processing.

Hardware is Computer on which GIS software runs. Nowadays there are a different range of computer, it might be Desktop or server based. ArcGIS Server is server based computer where GIS software runs on network computer or cloud based. For computer to perform well all hardware component must have high capacity. Some of the hardware

components are: Motherboard, Hard driver, processor, graphics card, printer and so on. These all component function together to run a GIS software smoothly.

Software and Hardware complement each other when they are deployed correctly, looking at the compatibility. If there is any mismatch in any of the two components, then the functionality effects and results are not approximate.

Hardware should be robust and should have the future potential to deal with heavy software patches and updates. Latest high chip and AI-based processors, Motherboards and even GPUs are needed in today's world to handle GIS software and data.

Software

Most of the software packages comprise several hundred commands and have a wide variety of functions. There are variations in the organisation and capabilities of GIS software but three basic designs have evolved in them. These are – file processing, hybrid and extended designs. In the file processing design, each data set and function is stored as a separate file and these are linked together during analytical operations. In the hybrid design, attribute data are stored in conventional DBMS and separate software is used for geographical data. The examples of hybrid designs are Are info, deltamap/Genamap, Erdas Imagine, Esri, MapInfo, ArcGIS, etc. In the third design type i.e. extended DBMS, both geographical and attribute data are stored in DBMS. The DBMS is extended to provide appropriate geographical analytical functions.

GIS software which provide tools to run and edit spatial information. It helps to query, edit, run and display GIS data. It uses RDBMS (Relational Database Management System) to store the data. Few GIS software list: ArcGis, ArcView 3.2, QGIS, SAGA GIS.

Good software that handles a large amount of geospatial data, GUI for manipulating data and querying the environment for analyzing and visualizing large data sets is a perfect fit for GIS.

Data

Data is Collection, storage and manipulation of geographical data are very expensive since large volumes are normally required to solve substantive geographical problems. There may be varying estimates of

data collection but commonly it takes about 70 percent of the total cost of implementing a GIS. Till recently, there was a scarcity of data for use in GIS. But now it has been overcome by the widespread use of remote sensing satellites, ambitious national mapping programmes undertaken by many countries and the collaborative international ventures which aim to create global database.

The most important and expensive component of the Geographic Information System is Data which is generally known as fuel for GIS. GIS data is combination of graphic and tabular data. Graphic can be vector or raster. Both type of data can be created in house using GIS software or can be purchased. The process of creating the GIS data from the analog data or paper format is called digitization. Digitization process involves registering of raster image using few GCP (ground control point) or known coordinates. This process is widely known as rubber sheeting or georefrencing. Polygon, lines and points are created by digitizing raster image. Raster image itself can be registered with coordinates which is widely known as rectifying the image. Registered image are mostly exported in TIFF format. As mentioned above, GIS data can be Raster or Vector.

GIS Data Types:

Raster: Raster image store information in a cell based manner. It can be aerial photo, satellite image, Digital Elevation Model (DEM). Raster images normally store continuous data.

Vector: Vector data are discrete. It store information in x, y coordinate format. There are three types of Vector data: Lines, Points and Area.

People

The GIS community means the people responsible for designing implementing and using GIS. Nothing can be achieved without properly trained personnel with a vision and commitment to a project. On many occasions the lack of adequately trained people has been highlighted. Despite the best efforts and initiatives undertaken to train people, much remains still to be done to compensate the shortage of skilled people.

People are user of Geographic Information System. They run the GIS software. Hardware and software have seen tremendous development which made people easy to run the GIS software. Also computer are affordable so people are using for GIS task. These task may be creating simple map or performing advance GIS analysis. The people are main component for the successful GIS.

People are an important catalyst in doing a GIS Components setup. With the help of proper management and technical expertise, all the known-unknown problem areas can be addressed. Project-Program Management is then used to understand any scope of a GIS project.

People with the right level of geology, information systems, and statistics knowledge participate in the project setup's technical aspects. In contrast, the ones with strong management and business knowledge concentrate on handling the projects and the business. GIS projects require a strong workforce and inventory management, and hence people also concentrate more on the overall project development lifecycle techniques.

Procedure

There should be a defined business process for any system to function to approximate the desired results efficiently. Organizations nowadays use various standardized process models to build a system that is still in a transition phase.

For successful GIS operation a well-designed plan and business operation rules are important. Methods can vary with different organizations. Any organization has documented their process plan for GIS operation. These document address number question about the GIS methods: number of GIS expert required, GIS software and hardware, Process to store the data, what type of DBMS (database management system) and more. Well designed plan will address all these question.