Spatial Information Technology

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The word spatial refers to the features and the phenomena that are distributed over a geographical space. The Data which have spatial components (location) such as an address of a municipal facility, or the boundaries of an agricultural holdings, etc. attached with it is called spatial information. Hence, the Spatial Information Technology relates to the use of the technological inputs in collecting, storing, retrieving, displaying, manipulating, managing and analysing the spatial information. It is an amalgamation of Remote Sensing, GPS, GIS, Digital Cartography and Database Management Systems.

What is GIS (Geographical Information System)?

A system capable of processing of georeferenced information is called Geographic Information System (GIS). It is defined as a system for capturing, storing, checking, integrating, manipulating, analysing and displaying data, which are spatially referenced to the Earth. It is an amalgamation of Computer Assisted Cartography and Database Management System.

Forms of Geographical Information

Two types of the data represent the geographical information. These are spatial and non – spatial data. The spatial data are characterised by their positional, linear and areal forms of appearances. They have a definite locations in a map. The non-spatial data is not tied to any location they can be found anywhere.

Box 6.1 : Spatial and non-spatial data

Stock Register of a Cycle shop			Literate Population in States 1981		
Part No.	*Quantity*	*Description*	*State*	*% Male*	*% Female*
101435	54	Wheel Spoke	Kerala	75.3	65.7
108943	68	Ball Bearing	Maharashtra	58.8	34.8
105956	25	Wheel Rim	Gujarat	54.4	32.3
123545	108	Tyre	Punjab	47.2	33.7

Advantages of GIS over Manual Methods

Geographical information through Manual methods such as the maps can only be processed and presented in a particular way, shows a single predetermined theme and the alteration of the information is difficult. But GIS possesses inherent advantages. It provides options for viewing and presenting the data in several ways.

1. Users can interrogate displayed spatial features and retrieve associated attribute information for analysis.
2. Maps can be drawn by querying or analysing attribute data.
3. Spatial operations (polygon overlay or buffering) can be applied on integrated database to generate new sets of information.
4. Different items of attribute data can be associated with one another through shared location code.

Components of GIS

The important components of a Geographical Information System include the following:

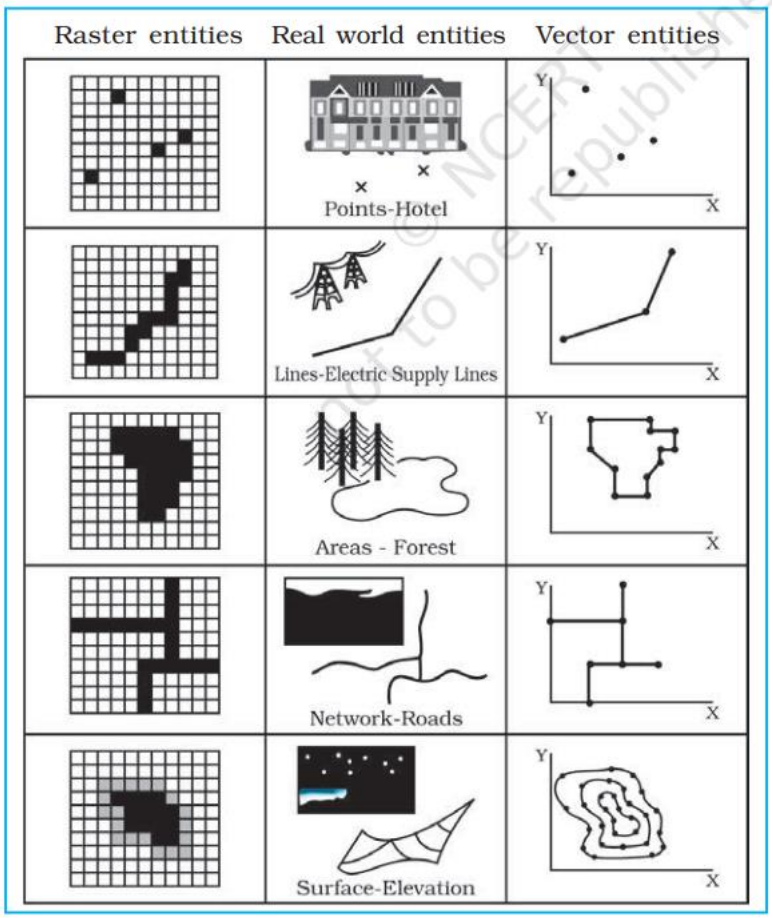
(a) Hardware: Hardware comprising the processing, storage, display, and input and output sub-systems.
(b) Software: An application software related to data entry, editing and maintenance. Software related to analysis/transformation/manipulation. Software related to data display and output.
(c) Data: Spatial data and related tabular data are the backbone of GIS. The digital map forms the basic data input for GIS.
(d) People: GIS users are engineers, resources and environmental scientists, policy-makers, and the monitoring and implementing agencies.
(e) Procedures: include how the data will be retrieved, stored, managed, transformed, analysed and finally presented in a final output.

Spatial Data Formats

The spatial data are represented in raster and vector data formats: Raster data represent a graphic feature as a pattern of grids of squares, whereas vector data represent the object as a set of lines drawn between specific points.

Raster Data Format: Consider a line drawn diagonally on a piece of paper. A raster file would represent this image by sub-dividing the paper into a matrix of small rectangles called cells. Each cell is assigned a position in the data file and given a value based on the attribute at that position.

Vector Data Format: A vector representation of the same diagonal line would record the position of the line by simply recording the coordinates of its starting and ending points. Each point would be expressed as two or three numbers as X,Y or X,Y,Z coordinates)



Spatial Analysis

The strength of the GIS lies in its spatial analysis functions. The analysis functions use the spatial and non-spatial attributes in the database to answer questions about the real world. For example, GIS may effectively be used to predict future trends over space and time related to variety of phenomena. The following spatial analysis operation may be undertaken using GIS: (i) Overlay analysis (ii) Buffer analysis (iii) Network analysis (iv) Digital Terrain Model

Overlay Analysis Operations

The hallmark of GIS is overlay operations. An integration of multiple layers of maps using overlay operations is an important analysis function. In other words, GIS makes it possible to overlay two or more thematic layers of maps of the same area to obtain a new map layer. Map overlay has many applications. It can be used to study the changes in land use/land cover over two different periods in time and analyse the land transformations.

Buffer Operation

A buffer of a certain specified distance can be created along any point, line or area feature. It is useful in locating the areas/population benefitted or denied of the facilities and services. This kind of analysis is called proximity analysis. For example, numbers of household living within one-kilometre buffer from a chemical industrial unit are affected by industrial waste discharged from the unit.