

**Paper name: Remote Sensing, GIS and GPS**

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**Topic: GIS: Definition and Development**

A Geographical information System (GIS) is a system of computer software, hardware and data, personnel that make it possible to enter, manipulate, analyze, and present data, and the information that is tied to a location on the earth's surface. This system comprises of Software, Hardware, Data, and Personnel that make it possible to enter, manipulate, analyze and present information that is tied to a location on the earth's surface.

**Definitions of GIS**

Different people have defined GIS according to capability and purpose for which it is applied. Few of the definitions are:

- “A computer - assisted system for the capture, storage, retrieval, analysis and display of spatial data, within a particular Organization” (Stillwell & Clarke, 1987).
- “A powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world” (Burrough, 1987).
- A GIS is also defined as follows (Aronoff, 1989):
  - A GIS is a computer-based system that provides the following four
  - sets of capabilities to handle geo-referenced data:
    - Input,
    - data management (data storage and retrieval),
    - manipulation and analysis, and
    - Output.
- Thurgood (1995) defined GIS as “a computerized system for capture, storage, retrieval, analysis and display of spatial data describing the land attributes and environmental

features for a given geographic region, by using modern information technology”. According to this definition, a GIS includes not only computing capability and data, but also managers and users, the organization in which they function and institutional relationships that govern their management and use of information.

- “A system for capturing, storing, checking, manipulating, analyzing and displaying data which are spatially referenced to the Earth”.
- “An information technology which stores, analyses and display both spatial and non-spatial data”.
- “A database system in which most of the data are spatially indexed, and upon which a set of procedures operated in order to answer queries about spatial entities in the database”.

Although the above definitions cover a wide range of subjects, the activities best refer to geographical information. Sometimes, it is also termed as Spatial Information Systems as it deals with located data, for objects positioned in any space, not just geographical, a term for world space. Similarly, the term ‘a spatial data’ is often used as a synonym for attribute data (i.e. rainfall/temperature/ soil chemical parameters/ population data etc.).

## **History and Development of GIS**

The GIS history dates back to 1960 when computer based GIS have been used and their manual procedures were in life 100 years earlier or so. The initial developments originated in North America with the organizations such as US Bureau of the Census, The US Geological Survey and The Harvard Laboratory for computer graphics and Environmental Systems Research Institute (commercial). Canadian Geographic Information Systems (CGIS) in Canada, Natural Experimental Research Center (NREC), Department of Environment (DOE) and other notable organizations in U.K. were involved in early developments. The laboratory for Computer Graphics and Spatial Analysis of the Harvard Graduate School of Design and the State University of New York at Buffalo achieved worldwide recognition. Commercial agencies started to develop and

offer GIS software. Among them were today's market leaders ESRI, Intergraph, Laserscan, Autodesk etc.

**Roger Tomlinson – the father of GIS:** It was during Roger Tomlinson's tenure with the Canadian government in the 1960s when he initiated, planned and directed the development of the Canadian Geographic System (CGIS). This was a key time in the history of GIS because many consider CGIS as the roots of Geographic Information Systems. CGIS was unique because it adopted a layer approach system to map handling. Because of the vast amount of territory Canada occupies, the idea for a Canadian Land Inventory was developed in 1964. But it wasn't until 1971 that it became fully operational. The Canadian Land Inventory used soil, drainage and climate characteristics to determine land capability for crop types and forested areas. It quickly recognized that accurate and relevant data was vital to land planning and decision-making. Over the years CGIS had been modified and improved to keep pace with technology.

A sound and stable data structure to store and analyze map data became dominant in the early 1970's. This has led to the introduction of topology into GIS. Topology and the related graph theory proved to be effective and efficient tools to provide logically consistent two-dimensional data representations. Another significant breakthrough occurred with the introduction and spread of personal computers in 1980's. It was possible to have a computer on the desk that was able to execute programs that previously could only be run on mainframe computers. At the same time minicomputers, and later, workstations became widely available. Relational database technology became the standard. Research on spatial data structures, indexing methods, and spatial databases made tremendous progress. The 1990's can be characterized as a period of the breakthrough of object-orientation in system and database design, recognition of geoinformatics as a professional activity, and spatial information theory as the theoretical basis for GIS. Potentiality of GIS is realized in the recent past and now it has become popular among many users for a variety of applications.

In India the major developments have happened during the last one decade with significant contribution coming from Department of Space emphasizing the GIS applications for Natural Resources Management. Notable among them are Natural Resource Information System (NRIS), Integrated Mission for Sustainable Development (IMSD) and Bio-diversity Characterization at National Level. IIRS is also playing a major role in GIS through education and training programs at the National and International level. Recently the commercial organizations in India have

realized the importance of GIS for many applications like natural resource management, infrastructure development, facility management, business/market applications etc. and many GIS based projects according to the user organization requirements were developed.

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