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The Role of Geogspatial Technology in Geographical Research

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ABSTRACT

Today Remote sensing and geographic information systems play an important role in space science as well as in earth science. And so these are of particular interest to geographers. Remote sensing involves imaging the Earth from aircraft or spacecraft at scales ranging from a few square kilometers to the entire globe. Images are formed from visible light as well as near-infrared light, thermal radiation, and microwave radiation, and thus extend well beyond the range of the human eye. Geographic information systems (GIS) assist in the display and manipulation of spatial data-points, lines, or areas with associated labels or data values. Remote sensing and geographic information systems are very useful for a wide array of research and applications in geography like ecological footprint analysis, forest resources, land desertification, farming in a rural area, tunnel construction, road mapping, land development, and solid waste management, wastewater management, etc.

Keywords : GIS , Remote sensing , Geography, Applications

Introduction

Geographic Information System (GIS)

A Geographic Information System or GIS is a computer system that allows you

to map, model, query, and analyze large quantities of data within a single database according to their location. A geographic information system (GIS) is a computer-based tool for mapping and analyzing feature events on earth.GIS gives you the power to:

* create maps
* integrate information
* visualize scenarios
* present powerful ideas, and
* develop effective solutions

GIS is a tool used by individuals and organizations, schools, governments, and businesses seeking innovative ways to solve their problems. GIS stores information about the world as a collection of layers that can be linked together by a common locational component such as latitude and longitude, a postal zip code, census tract name, or road name. These geographic references allow you to locate features on the earth's surface for analysis of patterns and trends. Dozens of map layers can be arrayed to display information about transportation networks, hydrography, population characteristics, economic activity, and political jurisdictions. GIS allows you to link databases and maps to create dynamic displays. Additionally, it provides tools to visualize, query, and overlay those databases in ways not possible with traditional spreadsheets. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies. We can use GIS in various geographical applications like road mapping, sea water management, waste water management, landscape desertification, farming in rural area, tunnel construction, land development, solid waste management etc.

Remote Sensing

* Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object and thus in contrast to on-site observation. Remote sensing is defined as the measurement of electromagnetic properties of a surface or object without being in contact with it. In modern usage, the term generally refers to the use of aerial sensor technologies to detect and classify objects on Earth (both on the surface, and in the atmosphere and

oceans) by means of propagated signals (e.g. electromagnetic radiation). It may be split into active remote sensing (when a signal is first emitted from aircraft or satellites) or passive (e.g. sunlight) when information is merely recorded. Remote sensing makes it possible to collect data on dangerous or inaccessible areas. Remote sensing applications include monitoring deforestation in areas such as the Amazon Basin, glacial features in Arctic and Antarctic regions, and depth sounding of coastal and ocean depths. Military collection during the Cold War made use of stand-off collection of data about dangerous border areas. Remote sensing also replaces costly and slow data collection on the ground, ensuring in the process that areas or objects are not disturbed. Remote sensing data are processed and analyzed with computer software, known as a remote sensing application.

* The basic properties of remote sensor :
* Spectral coverage (Spectral Band Locations)
* Spectral resolution (Spectral Band width)
* Spectral dimensionality (number of bands)
* Radiometric resolution (quantization)
* Instantaneous field of view (IFOV)
* Angular field of view
* Point spread function (PSF)

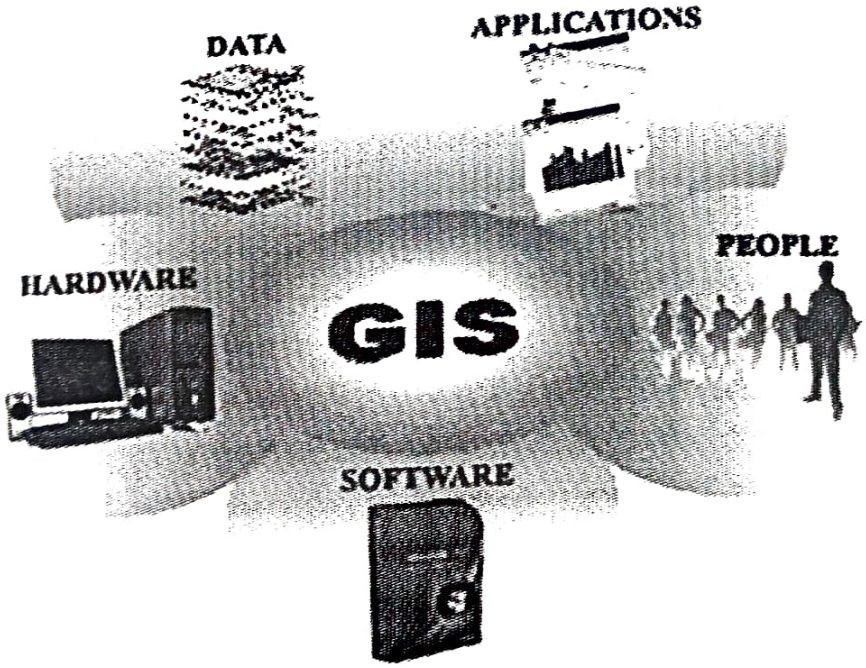
A large number of proprietary and open source applications exist to process remote sensing data. A source of geographical information, digital remote sensing represents more than a simple extension of conventional aerial photography, requiring fundamentally different approaches to the analysis of earth surfaces. There are various numerous applications of remote sensing as follows:

- Crop acreage measurement
- Crop yield estimation
- Agro-climatic planning
- Drought warning and assessment
- Flood control, risk zones, and damage assessment

- Watershed management
- Water resources management
- Prediction of snowmelt runoff
- Irrigation management
- Wetland mapping
- Land use/land cover mapping
- Wasteland management
- Fisheries management
- Mineral prospecting
- Forest resource surveys
- Urban planning
- Environmental impact

Remote sensing and GIS

The general features of remotely sensed data and alluded to some of the issues that must be addressed in integrating these data with other information sources for geographical analysis.



In satellite applications, satellite data differ from nearly all other geographical data in their consistency, high positional accuracy, high spatial and temporal resolution, and low level of human abstraction, or interpretation.

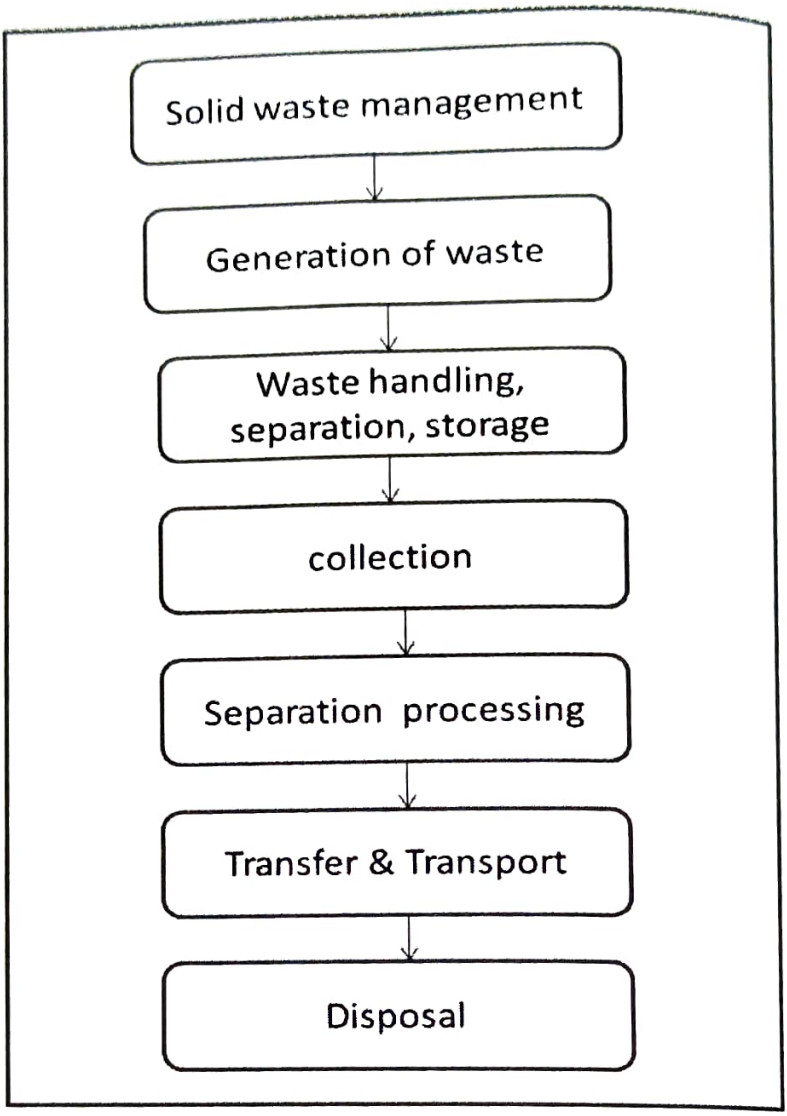
Maps use points and lines to portray selected features of reality in highly abstracted and generalized form. This information establishes a conceptual spatial context for the analysis of remotely sensed data. GIS require vector capabilities to store such information in a feature oriented data model that minimizes feature distortion and loss of topological information. Integrated geographical analysis work with multiple data structures and software that support a wide range of spatial queries and promote statistical and deterministic model.

Applications

i) Remote sensing and GIS in solid waste management

With rapid urbanization and ever-increasing population growth, there has been a substantial increase in the generation of solid waste and contamination of air, water, & land resources. The solid waste from different municipalities, not managed properly, has been creating problems for human health & environment. Some of the solid wastes have been proved to be extremely toxic & infectious. We know that water pollution is a major problem, at sacred places people throw coconut, flowers, etc in rivers like Ganga, and the Yamuna. Because of this, there is a need for such solid waste management. In the city, there is waste material from houses, industrial waste, shopping malls, markets, etc. These wastes are also in abundance. In the village also there is waste from farms that also can be managed with this system. The present system deals with how geographical information systems & remote sensing techniques can be used as a decision support tool for planning waste management. There are several phases in solid waste management, right from the stage where it is no more threat to the environment. Solid waste can be bifurcated in two phases. One is the waste management in the area where it is generated & second is the management of waste at dumping grounds. GIS could help in such factors, it is computer hardware & software, designed to allow users to collect manage, analyze & retrieve a large volume of spatially referenced data & associated attribute data collected from a variety of sources. Flow chart is given below shows the solid waste

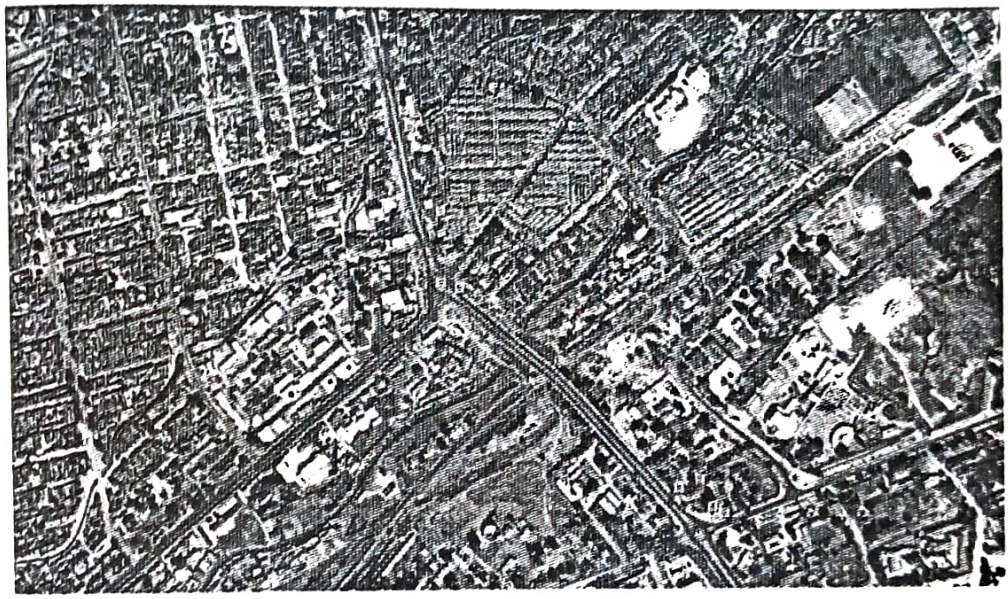
management.



ii) Remote sensing and GIS in road mapping

Roads are essential for easy movement of goods and materials, human beings and other movable things. A good road network promotes and accelerates the economic development of any country, through trade, tourism and other commercial developments. Road networks in most African countries are in bad shape; road conditions in the study area are poor at present. A database on road networks, existing spatial distribution of roads and their possible links to the roads of neighbouring places,

towns or even countries can be created, and updated, using Remote Sensing and Geographic Information Systems. The traditional method of road mapping is by physical inspection; this is tedious, time-consuming, and costly and requires much manpower and materials. It also constitutes danger to the mapping team , etc. As more and more roads are built, this traditional method can no longer adequately serve the desired purpose. It therefore becomes necessary to introduce modern methods and technologies to monitor our roads. Hence, the study or choice of GIS and Remote Sensing in road mapping as a better option. Geoinformation or geographic data & remote sensing images or satellite imagery useful in road mapping. The frequent revisit of each point on the earth's surface by satellites in space is an advantage of satellite imageries. The technology of remote sensing provides a descriptive and analytical way for identifying geographic features. Examples of geo-information materials that can be used for road monitoring include aerial photos, satellite imagery, radar imagery, etc.



Google map image.

iii) Remote sensing and GIS in land desertification

1 In day today life we see here forest becomes destroyed due to industrialization, urbanization, population explosion etc. So the important thing is find the area under desertification & planting trees grow forest. Dry lands cover about 5.2 billion hectares, a

third of the land area of the globe (UNEP, 1992). Roughly one fifth of the world population lives in these areas. Most of African countries affected by desertification are poor countries with low living standard. Desertification is global problem but it is one of the most urgent ecological problems in Sudan. Here overview is given how remote sensing and GIS technology can be used to monitor this phenomena. Sand encroachment is one of the main problems threatening the agricultural production in at some parts of the Sudan and in particular the northern State (Elhaget al., 2007). Sand creeping biggest threats that draws the general environment. The sand can be creep over long distances and lead to deterioration and desertification of areas that have crept forth. By growing more & more trees we can stop land desertification. We get idea about exact area under desertification & using proper solution we can stop land desertification.

iv) Remote sensing and GIS in tunnel construction

Tunnel's are generally constructed in hilly area so there is need of monitoring under ground area also. Using remote sensing & GIS we can implement the system for tunnel construction. Strong and numerous risks will be encountered in the construction of tunnel and underground works due to its complicated factors. Increasing attention to risk management research on this field and applications is being paid in recent ten years. In this paper several topics are discussed, such as the definition of the risk, mechanism of the risk, present research works and their level, main questions in risk management application and the possible research fields. Remote sensors can be sense the area & GIS can be used here for analyzing, mapping & storing the data.

Conclusion

We can conclude that remote sensing & GIS has wide area of application in geography. In all geography applications we use this system Due to this mapping become easy , analysis is possible, without taking any physical efforts we can made the system for any application & the output from this is very accurate. Easy to store data , capture images. Thus system is very useful in above mentioned applications.

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