CHAPTER 4

Trends in Geospatial Technology (GT)

Learning Objectives

By the end of this chapter students would be able to understand:

4.1 Introduction

4.2 Remote Sensing Trends & Technology.

4.3 GIS Trends & Technology

4.4 GPS Trends & Technology

4.1 Introduction

The fundamental goal of Geospatial Technology is to provide up-to date information, at lowest cost and highest quality. In this decade, Information System is being spatially enabled to cope up with the needs of users always wants to know location and events happened on the earth, which enables them to make spatial decisions. In this Chapter, we have discussed trends of geospatial technology which includes RS, GIS and GPS, that helped to show how development trends are meeting the needs of the public and users.

4.2 Remote Sensing Trends and Technology

Remote sensing technology plays a crucial role to monitor and study the natural resources and environmental conditions. A remarkable progress has been made in utilizing remote sensing data to study, monitor and model the earth's surface as well as sub surface. Improvements in sensor technology, especially in the spatial, spectral, radiometric and temporal resolution, have enabled. The trend of development of remote sensing is listed below.

1. Aerial Photographs through balloons, kites, and aircrafts
2. Panchromatic satellite images (PAN)
3. Multispectral Satellite images (MSS)
4. High Resolution data
5. Manual interpretation
6. Digital Image Processing (DIP)
7. Integration of satellite data with GIS

8. Integration with GPS data
9. Hyperspectral Images
10. Digital Photogrammetry (DP)

Below figure shows the Trends in Remote Sensing Technology from 1960-2010

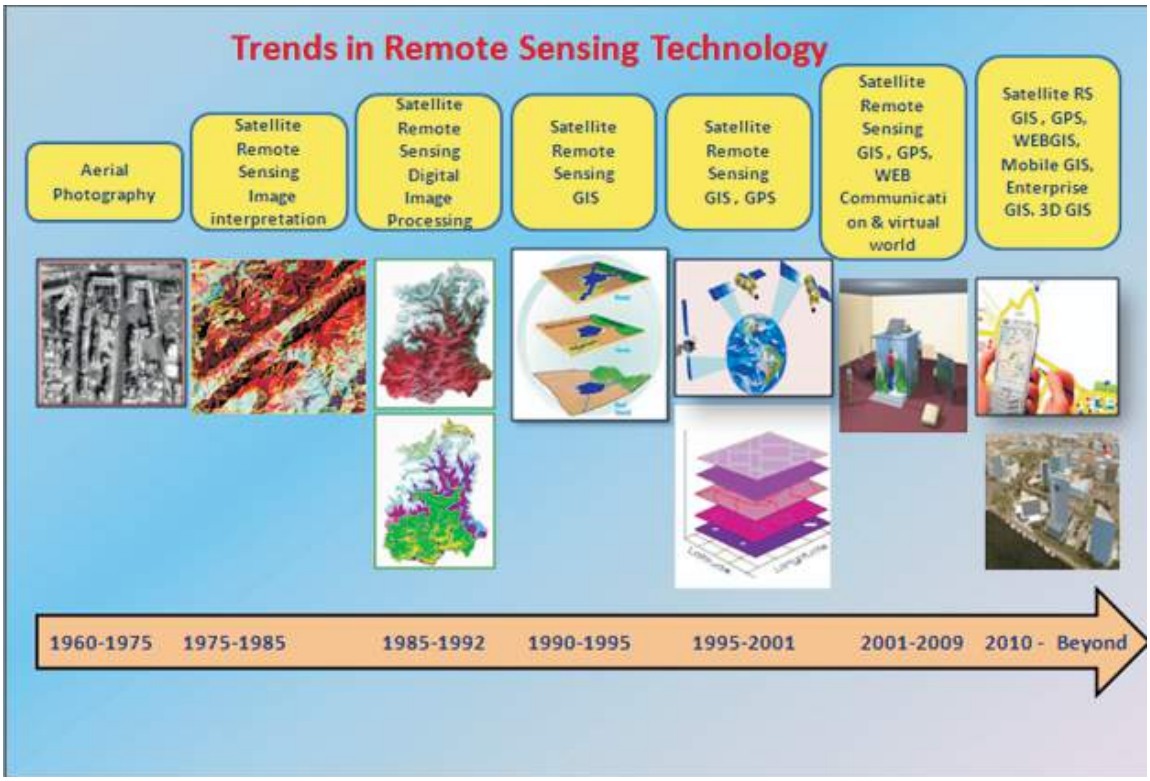

Fig. 126

Trends in Remote Sensing

1. Aerial Photographs

Photography was born in 1839. In early 1840 Argo, Director of the Paris Observatory advocated the use of photography for topographic surveying. The first aerial photograph was taken in 1858 by Parisian photographer. He used balloon to obtain the photograph in near Paris. Remote sensing technology started with photographs in the early nineteenth century. The photographic camera has served as a prime remote sensor for more than 150 years. It captures an image of earth from a balloon through a lens onto a recording medium.

Fig. 127

Photographs are captured by Balloons Courtesy: http://rst.gsfc.nasa.gov

Meanwhile, an alternate approach, mounting cameras on kites, became popular in the last two decades of the 19th Century.

Fig. 128

Photographs are captured by Kites Courtesy: http://rst.gsfc.nasa.gov

After the First World War, cameras mounted on airplanes, commonly handled by aviators, provided aerial views of fairly large surface areas that were valuable for military reconnaissance.

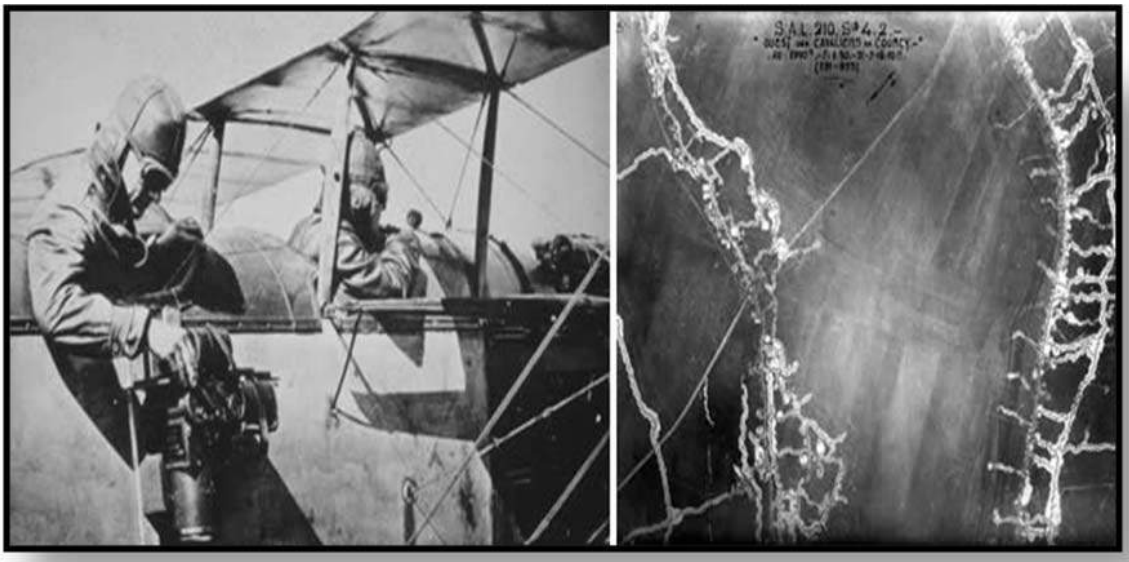

Fig. 129

Photographs are captured through Aircrafts by Handheld Camera
Courtesy: http://rst.gsfc.nasa.gov

The aerial photographs are used for pictorial representation of earth surface, mosaicing, photo interpretation and for photogrammetric survey.

2. Panchromatic Satellite Images

Remote sensing above the atmosphere originated at the starting of the Space Age. The first U.S. meteorological satellite, TIROS-1, was launched by an Atlas rocket into orbit on April 1, 1960. In 1960s the first sophisticated imaging sensors were incorporated in orbiting satellites. At first, these sensors were providing low resolution black and white pictures of clouds and Earth's surface as shown in figure. The advancement in technology has a capability to get the high resolution Pan Images such as Cartosat 2 (80 cm Resolution)

Fig. 130

Pan Image

3. Multispectral Remote Sensing

Multispectral remote sensing is defined as the collection of reflected, emitted, or backscattered energy from an object or area of interest (AOI) in multiple bands of the EMR. Multi-spectral imaging allows extraction of additional information that the human eye cannot to capture. Usually satellites have 3 (LISS-III) to 7 (LandSat) or more bands. Each band acquires one digital image in a small range of visible spectra called red-green-blue (RGB) region, Near Infrared (NIR), Middle Infrared (MIR) and Microwave

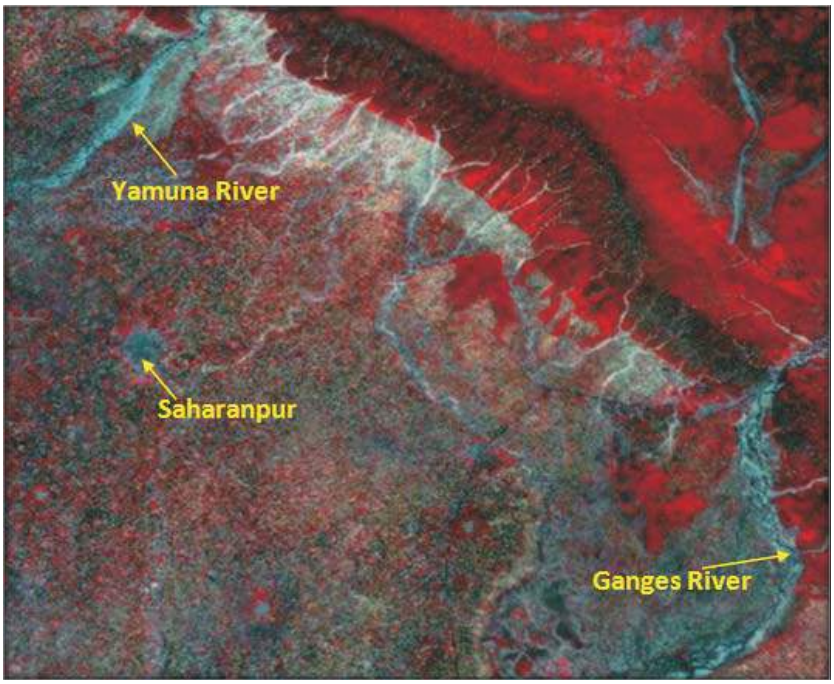

Fig. 131

MSS Image with three bands (RGB) - LISS III (Source: RRSC North)

Characteristics of MSS

- It has 4 or 7 bands
- It consists of broad Bandwidth from Visible to Microwave
- Ground sampling is easy
- Easy Display
- It is easy to do classification
- Availability of data is easy

4. High Resolution data

In the past remote sensing was providing low resolution data. As technology advancement took place space remote sensing has brought a new dimension to develop sensors which provides high resolution data to better understand the earth features .The examples for high resolution for different satellites are presented in below table.

Fig. 132

An example of High Resolution Data (Quckbird)

Sensor	Resolution
LISS III PAN	5.8 m
LISS IV	2.5 m
IKONOS	1 m
Cartosat-2	0.8 m
Quckbird	0.6 m
Geoeye	0.5 m

Table : 8

5. Manual interpretation

In initial stages of remote sensing the interpretation was made visually and manually. This interpretation was made based on knowledge, familiarity with area and personal interpretation skills. The interpreter examines the images based on the supporting materials such as maps, reports of field observation. The success in image interpretation varies with the experience of the interpreter or depends on the nature of the object, phenomenon, or quality of the image being utilized. The interpreter was using interpretation keys such as tone, texture, shape, size, shadow pattern, and association.

6. Digital Image processing

Digital Image processing involves the manipulation and interpretation of images with the help of computer. During 1985 it started with limited organization due to high cost of the computers. The computers were very costly and their performance was low. Today low cost efficient computer, hardware, software are available. Many organizations are implementing digital image processing techniques. By using computer algorithms image quality has been enhanced to increase the distinctions between the features to increase the amount of information that

can be visually interpreted from the data. Various image processing technologies such as histogram stretching, contrast enhancement, spatial filtering and classifications are used

7. Integration of satellite data with GIS

The procedures are used to combine the image data of a same area with other geographical referenced data set. For example image data are combined with soil, ownership, zoning and, topographic information. The evolution of GIS integrated these satellite images for better understanding of spatial phenomenon and for need based analysis. GIS categories the satellite data with various thematic layers and makes the utilization of information effectively in vector format.

8. Integration with GPS data

The evolution of GPS system during 1995 added additional values in Geospatially technology which can accurately determine the location of any spatial feature. Due to GPS system the GIS analysis capabilities are enhanced.

9. Hyper Spectral Imagery

Hyperspectral sensor collects 200 or more bands of data which enables the construction of an effectively continuous reflectance spectrum of every pixel in the scene. This system can discriminate among each surface features that have absorption and reflection characteristic over a narrow wavelength intervals that are lost within the coarse bandwidth of various bands of the multispectral scanners. Hyper spectral imaging collects and processes information from visible as well as from the ultraviolet to infrared band. Hyper spectral images can be used for application in agriculture, mineralogy, physics, and surveillance. More details about hyperspectral imagery is discussed in Chapter-1

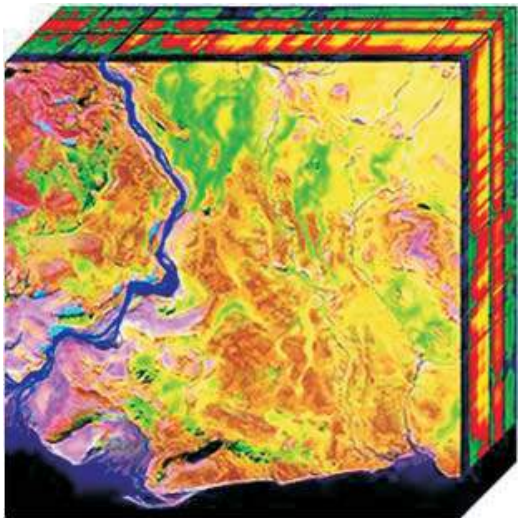

Fig. 133

Hyper Spectral Images with Multiple bands Source:rst.gsfc.nasa.gov

More than 200 bands are available so it is difficult to select the useful bands. Narrow Bandwidth reveals hidden ground character, which is not understood. Laboratory spectra of ground sampling is needed,

Difficulty in display (Which 3 bands to choose for R G B),Hyperspectral data are difficult to classify because of High Processing time, more memory needed.

10. Digital Photogrammetry

Historically the most common use of Photogrammetry is hardcopy topographic map. Today Photogrammetry procedures are used to create GIS data products such as precise raster vector images and digital elevation models. Earlier the photographs are collected through analog camera and processed through hardcopy format. Now advanced technology is developed. In digital Photogrammetry the digital photographs are used. Modern technology provides direct digital images by digital camera or by satellite sensors. So the process of conversion from analog to digital is minimized. Digital Photographs are radiometrically more accurate than analog data, therefore the interpretation is simpler and accurate

Trends in Remote sensing Application

Earlier remote sensing data has been used only to create the topographic maps, but nowadays the data acquired by the remote sensing system are used in various applications. Some of the trends in application are listed and shown in below figure.

1. Topographic Mapping
2. Thematic map creation
3. Widening thematic resolution
4. Integration with GIS
5. Spatial Modeling
6. Decision Support system

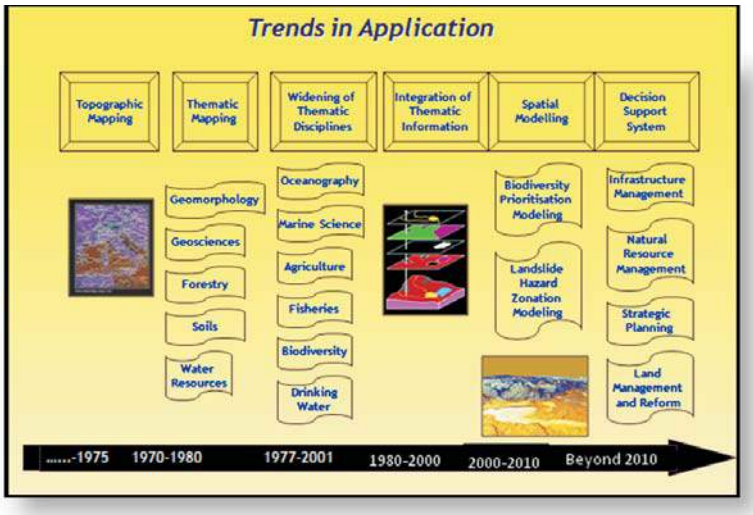

Fig. 134

Trends in Remote Sensing Application

Earlier the remote sensing data was used to create topographic maps. But due to the advancement in technology like digital image processing the remote sensing data is used to create the thematic maps for a limited area such as geomorphology, soil, forestry, geosciences water etc. The advancement in spatial, spectral and radiometric resolution in remote sensing data trend has developed to interpret more features and to create more number of thematic layers in wide area such as fishery, oceanography, agriculture, marine science, biodiversity etc. During 1980 when GIS emerged, integration of GIS and remote sensing data became possible. GIS is used more in spatial modeling to manage the natural disasters. Nowadays the GIS acts as spatial decision support system in many areas.

4.3 GIS Tends and Technology

GIS has developed from traditional map making technique. Modern GIS dramatically increase the amount of information that can be contained and manipulated in a map interactively. In the past it was very difficult to draw and interpret multiple information themes from a hardcopy map. Before computers became widely available, thematic maps on plastic Mylar (tracing) sheets was laid on top of each other to reveal more information about an area. The process was cumbersome and the amount of data received was limited. But this method looks like the output of contemporary GIS. A grid-based mapping program called SYMAP, developed at the Laboratory for Computer Graphics and Spatial Analysis at the Harvard Graduate School of Design in 1966, was widely distributed and served as a model for later systems. These early GIS packages were limited for specific applications and required the mainframe computing systems. Mainly these systems were used in government and universities. In the 1970s, private vendors began offering GIS packages. Currently Intergraph and Environmental Systems Research Institute (ESRI) are the leading vendors of GIS software. In the late 1990s, GIS is being adopted by many private and government organizations. The recent development of Web GIS provides distributed mapping and spatial analysis over the Internet. Some of the recent trends in GIS are listed below;

1. Web Based GIS
2. Enterprise GIS
3. Mobile GIS
4. 3D GIS visualization and flythrough
5. Open GIS

The development of Internet GIS is also called web GIS. It has played a major role in expanding the GIS usage and helping the users to access the geo information at low cost in client-server environment

1. Web based GIS

Web based GIS is the process of designing, implementing, generating and delivering maps on the *World Wide Web* (www) and its product. Below Figure shows an example of Web based GIS.

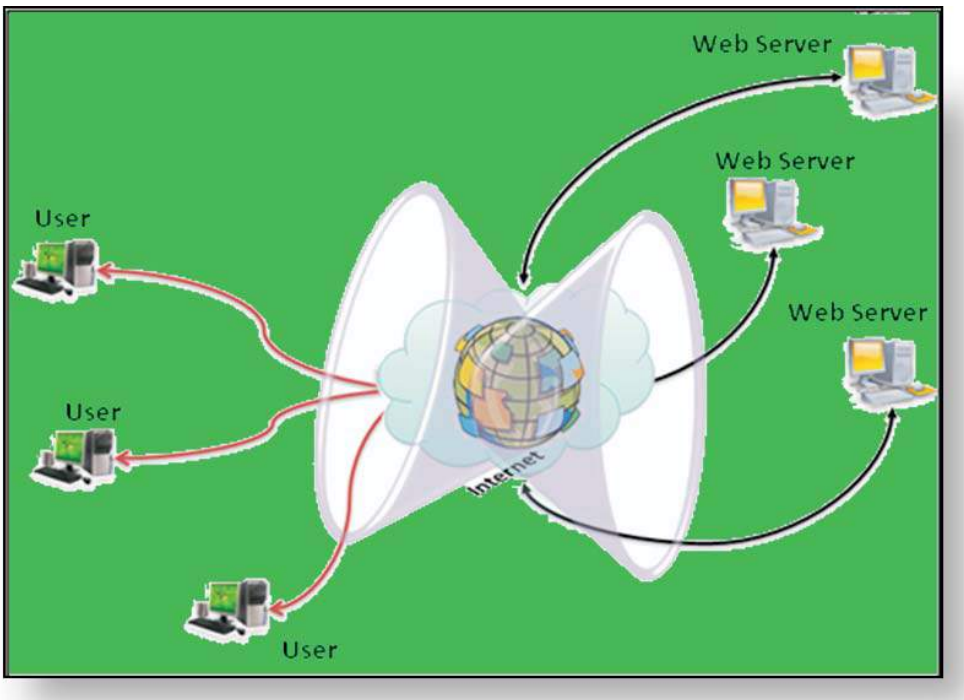

Fig. 135

Web Based GIS

In past an individual would have to buy an expensive software package to use and manipulate the data needed for GIS, the same is not correct today. With the use of Java based programming, and availability of software applications for web-based GIS, requires the user to buy some software, where as others require plug-ins to be added to web browsers. Web based GIS emphasis more on analysis, processing of project specific geo database and exploratory aspects. It is often used as a presentation media. Web GIS has the potential to Distribute Geographic Information (DGI) to a very large worldwide audience. Internet users will be able to access GIS applications from their browsers without purchasing proprietary of

GIS software. Web GIS makes it possible to use GIS as a wide range of network-based applications in different departments such as, town planning, government, transport and airport authority. Many of these applications will run on intranets within departments as a means of distributing and using geospatial data. Because of these advancements, many people who were not able to easily get information now they can easily access this information. Web-based GIS allows and controls the amount of information that can be transferred over the Internet and made available to the public. With web-based information distribution, it will not be misused by users. Analysis of data by a widely scattered group can also be accomplished in a faster, more efficient manner when the information is available almost everywhere in the world. Below figure shows general architecture of Web Based GIS.

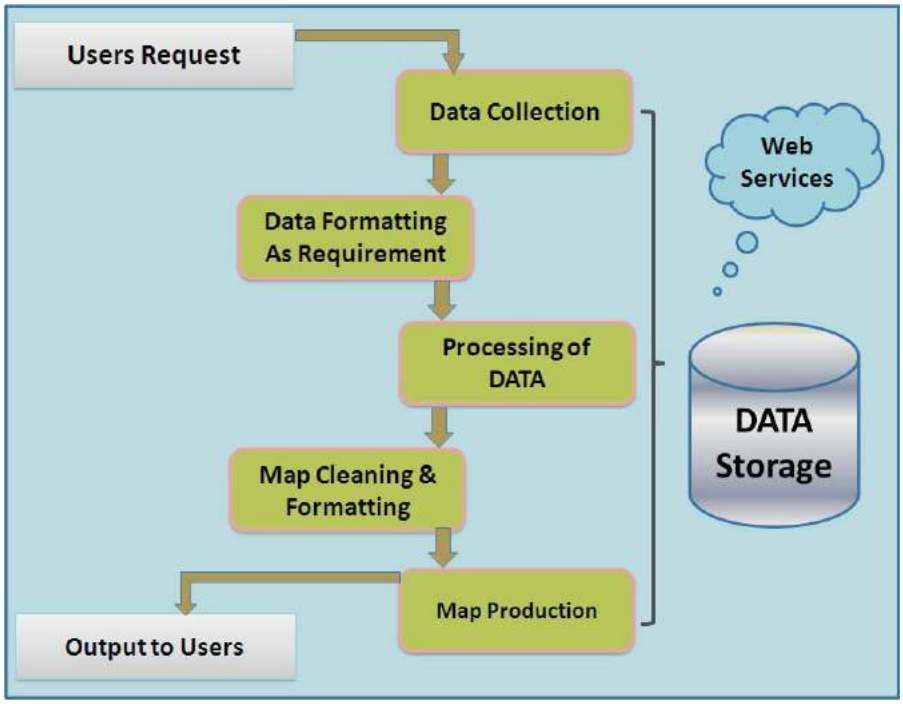

Fig. 136

Typical Web Based GIS Architecture

a) Advantages of Web Based GIS

- Web based GIS deliver latest and up–to-date information. For example a map displaying election results, as soon as the election results become available and a map displaying the real-time traffic situation using traffic data collected by sensor networks.
- Software and hardware infrastructure for web based GIS is cheap.
- Data and product updates are easier, cheaper, and faster.

- It allow for personalization by using user profiles, personal filters and personal styling and symbolization. Users can configure and design their own maps.
- It supports hyper-linking to other information on the web.
- It acts like an index to other information on the web. Any sensitive area in a map, a label text, etc. can provide hyperlinks to additional information. For example map showing public transport options can directly link to the corresponding section in the online train time table.
- It is easy to integrate multimedia in and with web maps. Today's web browsers also supports the playback of video, audio and animation

b) Disadvantages of Web maps

- Reliability issues - the reliability of the internet and web server infrastructure is not yet good enough. Especially if a web map relies on external, distributed data sources, the original author often cannot guarantee the availability of the information.
- Bandwidth issues – Web maps usually need a relatively high bandwidth.
- Limited screen space –web based GIS maps have the problem of limited screen space. This is in particular a problem for mobile web maps and location based services where maps have to be displayed in very small screens with resolutions as low as 100×100 pixels.
- Quality and accuracy issues – Many web maps are of poor quality, both in symbolization, content and data accuracy.
- Privacy issues – With detailed information available and the combination of distributed data sources, it is possible to find out and combine a lot of private and personal information of individual persons. Properties and estates of individuals are now accessible through high resolution aerial and satellite images throughout the world to anyone.

2. Enterprise GIS

An Enterprise GIS is a system that integrated through an entire organization so that a large number of users can manage, share, and use spatial data and related information to address a variety of problems, such as data creation, modification, visualization, analysis, and distribution. In recent years more and more organizations have started adopting GIS to manage spatial information in support of spatial decision making, which can improve the working efficiency and also reduces the enterprises operating costs. With GIS software capability,

users are allowed for the integration of enterprises into other enterprises through a type of internet service. Enterprise can integrate the applications to the utmost flexibility with reusable cost in both internal and external aspects.

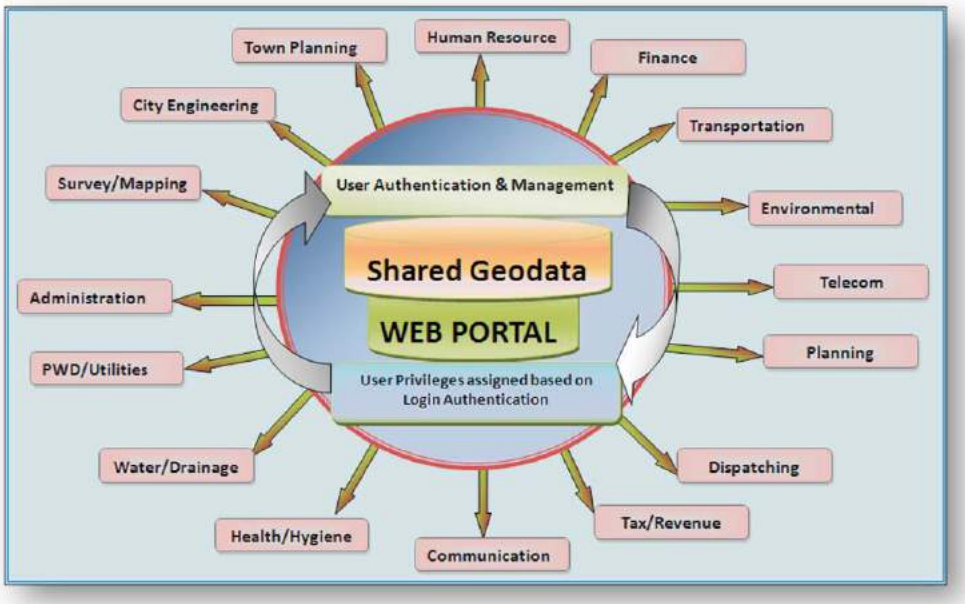

Fig. 137

Enterprise GIS System

a) An Enterprise GIS should be capable of:

(i) It supports large number of simultaneous transactions; many people can access information at the same time.

(ii) It Integrates with other Enterprise Systems (such as ERP, Billing Systems etc.)

(iii) It enables easier integration with other systems / software formats.

(iv) Maintains the uniform display pattern of the data like style, symbol, color etc. for Desktop, Web and Mobile users.

(v) It offers reusable functionality across Desktop, Web and Mobile platforms.

Above figure 137 shows Enterprise GIS system where geospatial data is shared by various departments such as Town planning, environmental, human resources, finance, transportation etc

3. Mobile GIS

Fig. 138

Mobile GIS System

Mobile GIS is the expansion of GIS technology from the office into the field. A mobile GIS enables field-based officer to capture, store, and update, manipulate, analyze, and display geographic information. Mobile GIS integrates one or more of the following technologies: Mobile devices, Global positioning system (GPS), Wireless communications for Internet GIS access. In past, the process of field data collection and editing were time consuming and tends to have more errors. The paper maps were used in field to mark the locations of ground. The sketches and the notes are drawn on paper to edit the field data. Once back in the office, these updates made in the field were checked and manually entered into the GIS database. Mobile GIS enables organizations to add real-time information to database and applications to create more accurate data and analyze spatial data.

a) Advantages of Mobile GIS

- Creates, edit, and uses GIS maps in the field.
- Creates and maintains an inventory of asset locations and attribute information.
- Updates asset location and condition and is used for schedule maintenance.
- It maintains digital records and locations of field assets for legal code compliance and ticketing.
- Documents the location and circumstances of incidents and events for further action or reporting.
- Performs measuring, buffering, geo processing and other GIS analysis during field survey.

4. 3D Visualization

A large number of human activities utilize 2D geo - data using paper or digital maps to complete various kinds of activities like creating mapping and analysis. In many cases the two dimensions maps are not sufficient because 2D maps may lose some of their properties and relations to other objects. 2D maps create difficulties to understand, analyze and evaluate the surrounding world for example urban city planning, landscape planning, road, railway, building construction, utility management. For such type of activities it requires three-dimensional and the 3D objects presentation. 2D objects only have length and width but 3D objects have an extra dimension called depth. In a 2D GIS, a feature is represented as an area of grid cells. But in case of 3D GIS, it deals with volumes and information about what includes inside the cube. 3D GIS and Flythrough applications need more advanced tools for representing and analyzing the 3D world. 3D GIS application is tool to model, store, analyze and visualize 3D data in an efficient and effective way in different areas. 3D GIS viewer allows users to experience the power and flexibility of desktop 3D GIS. There are already few

Fig. 139

3D Map created for Delhi Chandini Chowk Area
Source: Bhoop Singh

systems available in the market that can be categorized as systems providing 3D solutions i.e. Rolta Geomatica, ArcView 3D Analyst, (ESRI), Imagine VirtualGIS (ERDAS), and GeoMedia Terrain (Integraph Inc.). All the systems provide excellent tools for 3D visualization, animation and navigation through 3D textured models. Below figure shows the representation of spatial feature in 3D GIS in city / town Planning of Chandini Chowk Area. Delhi.

Fig. 140

3D Representation of Buildings

Source: Bhoop Singh

5. Open GIS

Open GIS is the full integration of geospatial data into mainstream information technology. It means that GIS users would be able to exchange data to a GIS software systems and networks without format conversion. Open GIS facilitate the exchange of information between individual GIS systems as well as other systems, such as statistical analysis, image processing, document management, or visualization. The Open GIS should have following fundamental requirements.

- Interoperable application environment – a user environment that is configurable to utilize the specific tools and data necessary to solve a problem.
- Shared data space – a generic data model supporting a variety of analytical and cartographic applications.
- Heterogeneous resource browser – a method for exploring and accessing the information and analytical resources available on a network.

The Open Geospatial Consortium (OGC), an international voluntary consensus standards organization, originated in 1994. In the OGC, more than 400 commercial, governmental, nonprofit and research organizations worldwide collaborate in a consensus process encouraging development and implementation of open standards for geospatial content and services, GIS data processing and data sharing.

4.4 GPS Trends and Technology

Since the beginning of time people used to navigate by means of different landmarks such as mountains, trees and traveling across the ocean they used to follow the coastal line. Later they used position of stars and moon for navigation and compass was used to find the direction. Later they discovered radio based navigation systems which were used in world war–II. As the technology advancement took place the satellite based navigation system was introduced which is commonly known as GPS. Now GPS can be used for personal positioning, national defense, commercial and scientific purpose. Nowadays GPS enabled cell phones are used for navigation. India is also planned to launch a GPS satellite system named as Gagan in near future

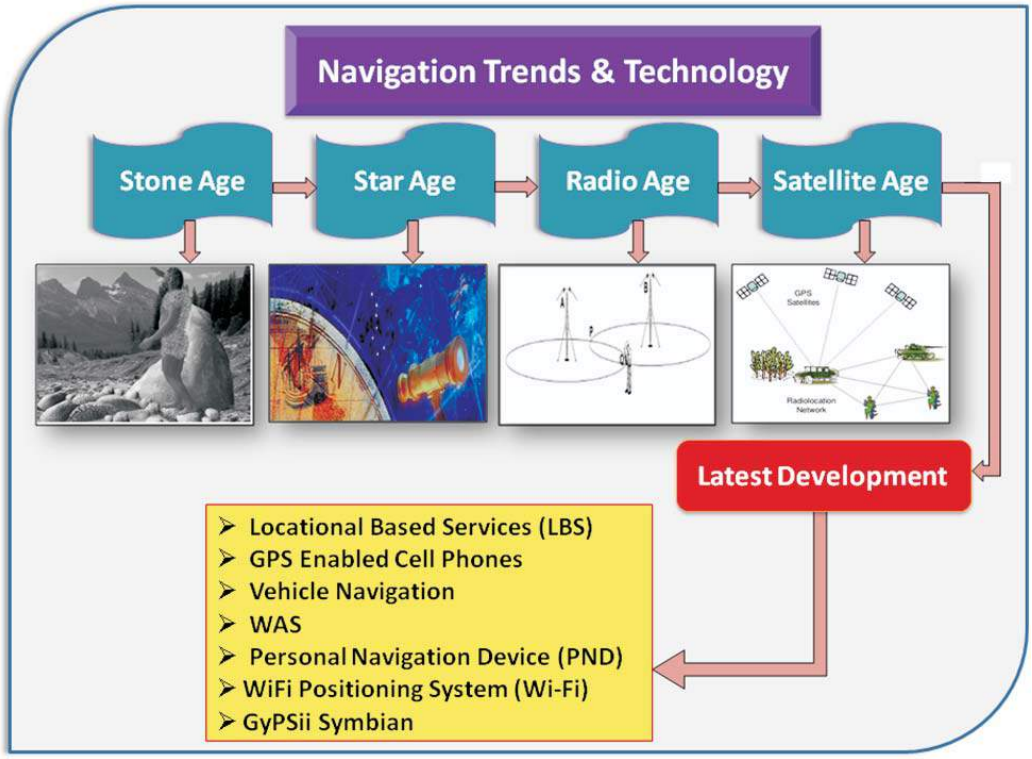

Fig. 141

Trends in GPS Technology

The benefit of having GPS in the cell phone is that anything can be tagged with geographical location with the accuracy of 10 meters. Presently the Locational Based Services (LBS) are used for locating specific information such as restaurant, ATM's, hospitals, traffic conditions and weather information. This mobile content is obtained using GPS which utilizes a constellation of satellite in Earth's orbit that transmit precise microwave signals enabling a GPS receiver in a mobile device to determine its location, speed, direction and time. LBS consist of five basic components such as mobile device, positioning, communication network, service provider and content provider. These all components interact in the processing chain of service request sent by the user. If user had a GPS enable cell phone it is capable of establishing location. When user seeks emergency services (communication network) from the location (positioning), the agent provide voice telephony service (service provider) which directs the request to a database (content provider) containing the emergency services information for the location. It is then returned to the cell phone along with the corresponding navigation instructions. There are several digital map information providers such as Navteq, Teleatlas, Tom-Tom for providing the data for automated navigation system, mobile navigation devices and internet based mapping application, government and business solutions. The Google has launched MyLocation which uses information which is broadcasted by cell towers to find the location of Mobile device using the triangulation method. SiRF a manufacturer of GPS chip cells has licensed skyhook's WPS (Wi-Fi positioning system) which is a single position system by Wi-Fi network for wireless carrier that includes GPS and Wi-Fi technology. For social networking and mobile gaming GyPSii symbian which is geo location and social networking platform that provides location based news and services. The universal address system developed & introduced by NAC Geographic product inc. which represents the entire earth, using latitude, longitude and altitude information of any given place. An eight character universal address can uniquely specify every building in the world and a 10 character universal address can uniquely specify any square meter. Recent technology such as Personal Navigation devices (PND) has been developed and used in the cars, pedestrian navigation and outdoors. It offers advanced features such as MapMyIndia Navigator and SatGuide. Currently brands like Airtel, Google, MapMyIndia, Nokia and Yahoo provides navigational maps for Indian cities. With the MapMyIndia navigator people will have more knowledge and safety on the roads. It also allows for seamless turn by turn navigation from any point to any point in the country. According to the new technical market research report from BCC the vehicle navigation, surveying and mapping machine are using GPS technology. Wide Area Augmentation (WAS) systems or hybrid systems like wireless assisted GPS (WA-GPS) which will be used in the future.

Let us wrap up what we covered in this chapter

- The fundamental goal of Geospatial Technology is to provide up - to date information, at lowest cost and highest quality.
- Remote sensing technology plays a crucial role in monitoring and studies the natural environmental conditions.
- A remarkable progress has been made in utilizing remote sensing data to study monitor and model the earth surface
- The trend of development of remote sensing is from Aerial, Panchromatic, multispectral, High resolution data, Manual interpretation, Digital image processing, Integration of RS data in GIS & GPS, Hyperspectral images and Digital Photogrammetry.
- Multispectral remote sensing uses multiple bands of EMR which allow the extraction of additional information that the human eye fails to capture.
- In MSS each band acquires one digital image. It has broad bandwidth; it includes three or more bands depending on the satellites. such as visible, NIR, MIR & microwave
- MSS images have capabilities of easy ground sampling, display, classification and availability of data.
- In initial stage image interpretation was made using visual interpretation keys. Later various image processing algorithms are developed to carried out digital image processing
- Integration of satellite data with GIS and GPS leads better understanding of spatial phenomenon and need based analysis to use as decision support system
- Hyperspectral sensor collects information as set of images. Each image represents a range of EMS and known as spectral band. These images are combined to form of 3 dimensional hyperspectral cubes for further processing and analysis.
- Hyperspectral images are acquired at entire spectrum so it does not require prior knowledge of sample data. Post processing allows all available information from the database to be used
- Hyperspectral sensors allow preparing more accurate models and classification of the images.
- Earlier the photographs were taken through analog camera, but nowadays the technology with improved digital camera and fine resolution are used
- Digital photographs are more accurate than analog photograph which enables simple and accurate interpretation

- The trends in application of remote sensing started with topographic mapping, later the trend has come to prepare thematic mapping for limited areas. Further it widened preparation of thematic maps for more areas. As the advancement in GIS technology has developed as a tool to integrate RS data to prepare various spatial modeling to understand and mapping landslide, hazard, zonation, modeling. Recently GIS is used as a decision support system.
- The World-Wide-Web (WWW) is a useful tool for the gathering, displaying visualization, and manipulation of data over the internet.
- Web GIS has the potential to Distribute Geographic Information (DGI) to a very large worldwide audience. Web-based GIS allows and controls the amount of information that can be transferred over the Internet and made available to the public.
- Software and hardware infrastructure for web based GIS is cheap.
- An Enterprise GIS is a geographic information system that is integrated through an entire organization so that a large number of users can manage, share, and use spatial data and related information to address a variety of problems, such as data creation, modification, visualization, analysis, and dissemination.
- Mobile GIS is the expansion of GIS technology from the office into the field. A mobile GIS enables field-based officer to capture, store, and update, manipulate, analyze, and display geographic information.
- A large number of human activities utilize 2D geo-data using paper or digital maps to complete various kinds of activities like create mapping and analysis.
- 2D objects only have length and width but 3D objects have an extra dimension called depth.
- Open GIS refers to exchange data to GIS software systems, network without format conversion
- Open GIS facilitates to exchange information between individual GIS and other systems such as statistical analysis, image process, document management and visualization.
- In past people used to navigate using different landmarks such as mountain, tree, stars, compass. As the technology advancement took place the radio based and satellite based navigation system was introduced.
- Currently GPS enabled cell phones are used for navigation. The benefit of having GPS in the cell phone is anything can be tagged with geospatial location with accuracy of 10 meters.

- The LBS are used to get location specific information such as Restaurant, ATMs, Hospital, Traffic Condition and Weather information
- Navteq one of the leading providers of comprehensive digital map information for automated navigation, Mobile navigation devices, and internet based mapping application
- Airtel, Google, MapMyIndia, Nokia, and yahoo provide navigational maps of India.
- With MapMyIndia navigator people will have more knowledge and safety on the road. It also allows by seamless turn by turn navigation at point to any point in the country.

Review

Very Short Questions

1. List down the recent trends in RS
2. Multispectral image can allow extraction of additional information that the human eye fails to capture. True or false?
3. Hyperspectral remote sensing uses broad bandwidth from visible to microwave true or false?
4. What is EMR rage for Multispectral Image, and hyperspectral Image?
5. Why hyperspectral images do not require prior knowledge of sample data?
6. Why hyperspectral imaging helps in preparing more accurate models and classification of the image?
7. Define digital Photogrammetry
8. List down the recent trends in GIS
9. Define the term Web Based GIS.
10. Web-based GIS allows and controls the amount of information that can be transferred over the Internet and made available to the public. True or False?
11. Software & hardware infrastructure for web based GIS is cheap. True or False?
12. A mobile GIS enables field-based officer to capture, store, and update, manipulate, analyze, and display geographic information. True or False?
13. Open GIS is the full integration of geospatial data into mainstream information technology. True or False?
14. List the systems available in the market that can provide 3D solution.
15. What are LBS? Where it is used?
16. What do you mean my location? What is its role?
17. By using GIS anything can tagged with geographical locations with accuracy of 10 matters. True or False?

Short Questions

1. What is the fundamental goal of Geospatial Technology? Give example .
2. What are the characteristics of MSS?
3. Explain hyperspectral Image.
4. Difference between multispectral and hyperspectral imageries.
5. What are the disadvantages of hyperspectral Imageries?
6. What is difference between low and high resolution explains with example?
7. Why RS data is integrated with GIS and GPS?
8. Define digital Photogrammetry.
9. What is the deference between analog and digital photographs?
10. Define the functionality of Web Based GIS.
11. What are the advantages and disadvantages of Web Based GIS?
12. What are the capabilities of Enterprise GIS?
13. What is the difference between Web GIS and Enterprise GIS?
14. Why 3D GIS is used?
15. What are the advantages of 3D GIS?
16. What are the roles of OGC?
17. Explain the components of LBS, How it works?
18. Define MapMyIndia Navigation System.

Long Questions

1. Explain the trends of Remote sensing in data acquisition and application
2. Define the following
    a. Web GIS
    b. Enterprise GIS,
    c. Mobile GIS
    d. Open GIS
3. Explain the trends in GPS.
4. Health officer would like to collect data on diseases. What type of GIS technology would be used to capture store and manipulate the data. How he would provide real time information to create more accurate data.