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MODERN TECHNIQUES IN GEOGRAPHY

What we have learnt

- The data generation with the artificial satellites are helpful in meterological studies.
- Topographic maps depict physical and cultural details of the surface of the earth.
- Computer performs different tasks with the softwares.

Ever since the origin of the earth, it has been subjected to changes. In his endeavor to study the earth, Man has crossed mountains, oceans and valleys. Such explorations helped him in getting information about new regions. However, there are a number of places on earth that are still inaccessible and hence devoid of any information. With the development of the Remote Sensing technology, collection of information about regions difficult to reach, has become possible. Geographers, now-a-days rely upon Geographical Information System (GIS) to store and analyse data about the earth's surface collected using remote sensing and other means. Let us now try to understand the latest techniques in the study of the earth, namely Remote Sensing and the Geographical Information System.

Remote Sensing

The method of analyzing the details about the objects or processes without touching them by using a distantly placed sensor is called remote sensing.

The term remote sensing was first used by the American Navy in 1960.

Terrestrial Photography

Taking pictures of the earth's surface from the ground or from higher elevations is called terrestrial photography. During picnics we take photographs of natural scenes using cameras. This is an example of terrestrial photography.

The surface used to place the camera or sensor for collecting remote sensing data is called platform. Depending upon the type of platform we can classify remote sensing technology into two, namely Aerial Remote Sensing and Satellite Remote Sensing.

Eyes in the sky...

Aerial photography is the process of taking photographs of the earth's surface with the help of cameras fitted in aircrafts. It started in 1858 when the French photographer Gaspard Felix Tornashan during his balloon flight took pictures of the earth's surface. The French army had used balloons to take pictures of the Paris city in 1859. Such pictures are called aerial photographs.

What is overlap in aerial photographs?

Take a look at figure 4.1 given.

The figure represents three aerial photographs A, B, and C taken from an aircraft from an altitude above ground level. figure A shows majority of regions shown in figure B. Similarly, majority of the regions of B are visible in C. Thus, every aerial photographs contain about 60 percent of the area shown in the previous photograph. This is termed as the overlap in aerial photos. Two such adjacent photographs having overlap is termed as a stereo pair (fig. 4.2).

When a stereo pair is kept under an instrument called stereoscope and viewed by adjusting the distance between the lenses, we get a three dimensional view of the region. This is called 'stereoscopic vision'. For example, view the figure 4.2 using a stereoscope. It is to be noted that only photos with overlap can give three dimensional views.

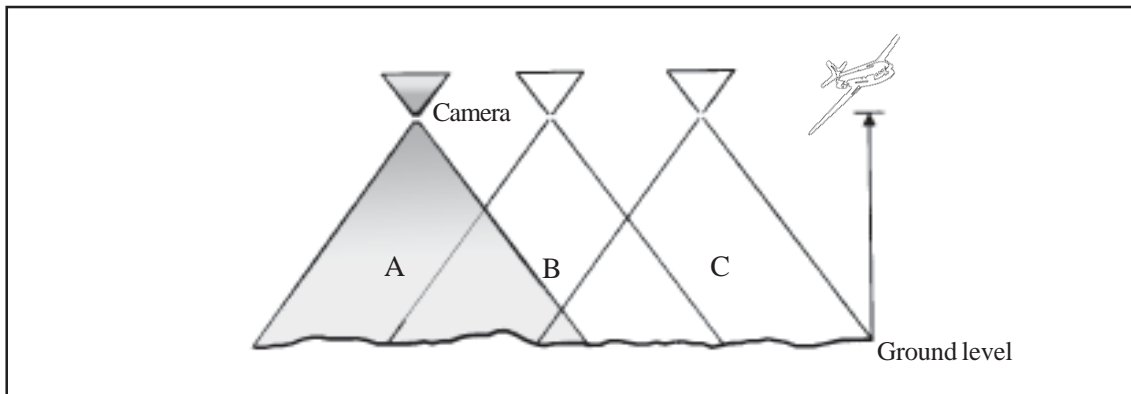


figure 4.1

Aerial photos were widely used during the second world war for a bird's eye view of large regions as well as for identifying heights and depths of the ground.

Aerial photography is ideal for making pictures of the earth's surface with clarity. Aerial

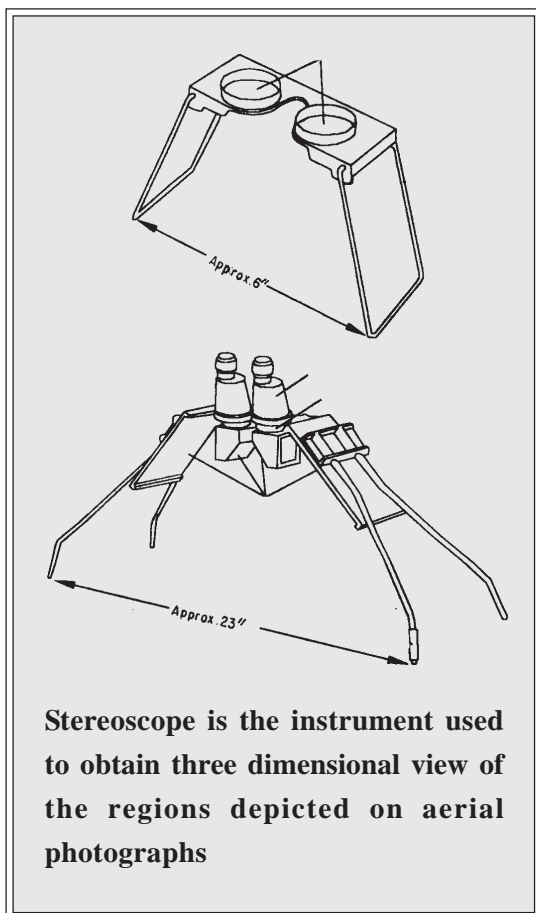
photos find wide application in the preparation of topographic maps.

The responsibility of aerial survey in India has been given to the Indian Air Force, the Indian Aerospace company with its headquarters at Kolkata and the Hyderabad based National Remote Sensing Agency (NRSA).

However, the following drawbacks are there for the aerial survey technique.

- Shaking of the aircraft is a serious hindrance to the taking of quality photographs.
- Considerable open space is required for the take-off and landing of aircraft.
- Frequent landings for refuelling is costly.
- It is quite impossible to view extensive regions from a height of 5-10 km.

The present development in remote sensing is due to the invention of artificial satellites. Pictures obtained from the Landsat satellite launched by America in 1972 has revolutionized remote sensing. For repeated earth observations nothing else can match satellite remote sensing.





Aerial Photographs

figure 4.2

Satellite remote sensing and satellite imageries

Collection of information about the earth's surface with the help of sensors fitted in artificial satellites is called satellite remote sensing. Sensors detect various surface features of the earth and transmit data about them in a digital form to ground based stations. With the help of computers these data are interpreted and converted into pictures. These are termed as satellite imageries.

Geostationary satellites and Sun synchronous satellites

Artificial satellites which orbit the earth at an altitude of about 36,000 km are called geostationary satellites. As they orbit along with the earth, they remain fixed facing a particular region on earth. Hence, they can be utilized for gathering permanent information about a region. Generally, these satellites are used for climatic observations and telecommunications. The INSAT series of satellites

launched by India are geostationary in nature.

Satellites that orbit the poles at a height of about 800 to 950 km are called Sun synchronous satellites. As they travel along orbits much lower than that of the geostationary satellites, they can be used for collecting information about the earth's surface with greater clarity. Sun synchronous satellites pass over the same place at the same time at regular intervals and hence it is possible to collect information about that place on different days.

With the help of remote sensing technique we can even detect and record features that cannot be discerned by human eyes. Electromagnetic radiation falling on objects is reflected back and is recorded by the sensors fitted in satellites. The quantity of electromagnetic radiation that is reflected/scattered by an object is called its spectral signature. Spectral signatures vary for different objects depending upon their physical characters. These spectral signatures are recorded by sensors fitted to satellites. These can be converted into satellite pictures with the help of computers. Analysis of satellite pictures/imageries help us in understanding about the various objects and features on the earth's surface.

The size of the smallest object on the earth's surface that a satellite sensor can distinguish is called the sensor's spatial resolution. Satellite imageries of early days,

could only distinguish objects having a minimum size of 72.5×72.5 m. However, satellites launched later gave imageries in which even objects of 5 m size could be distinguished. Recently launched satellites are giving imageries that can distinguish objects on the ground having a size of 1 m.

Won't you try to understand more about the various artificial satellites and their repetivity? For this, you can seek your teacher's help.

The vast potential of remote sensing is utilized in all fields today. Important among them are:

- For estimating crop area and pest attack in a region as well as for assessing periodic growth of crops and the spread of pests.
- Detection of forest fires and taking control measures by monitoring their spreading.
- Identification of drought and flood affected areas.
- In the fields of mineral, petroleum and ground water explorations.
- For oceanographic studies.
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Global positioning System (GPS) helps us to find the geographic coordinates of a place, and its height and time on the basis of signals from about 24 satellites orbiting the earth.

With the help of study materials and enquiries, prepare a note about the achievements of India in the field of remote sensing technology. Let us see what can be included in it.

- The sun synchronous satellites launched by India.
- Research institutions in India working in the field of remote sensing.
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With the advent of remote sensing technology we started getting manifold information about the earth's features. Computers have become an indispensable tool for the analysis and interpretation of these information. Today, computers are very much helpful for geographical studies. Look at Ramu's experience.

Ramu, a native of Palakkad went to Canada for his higher studies. He secured an admission in the St. Mary's University and preferred to stay in a rented house outside the campus than in the hostel. He contacted a real estate office upon the advice of the college authorities. Ramu told about his requirements to the lady staff of the office.

- *It should be a place near the college at a walkable distance.*
- *The monthly rent should be below 100 dollars.*
- *There should be library, playground and hospital nearby.*
- *The place should be neat and clean.*
- *There should be hotel facility nearby.*

The lady, after hearing Ramu carefully, clicked the computer mouse several times. After that she turned the

computer monitor towards Ramu. The monitor showed a map with different places indicated by red spots. She brought the cursor to each of these spots and clicked while telling Ramu that the places in red are the ones fitting his description. Then even the smallest details about these places appeared on the computer screen. Ramu got surprised. He became curious and had a series of questions.....

- *What is the technique?*
- *How is it made possible?*
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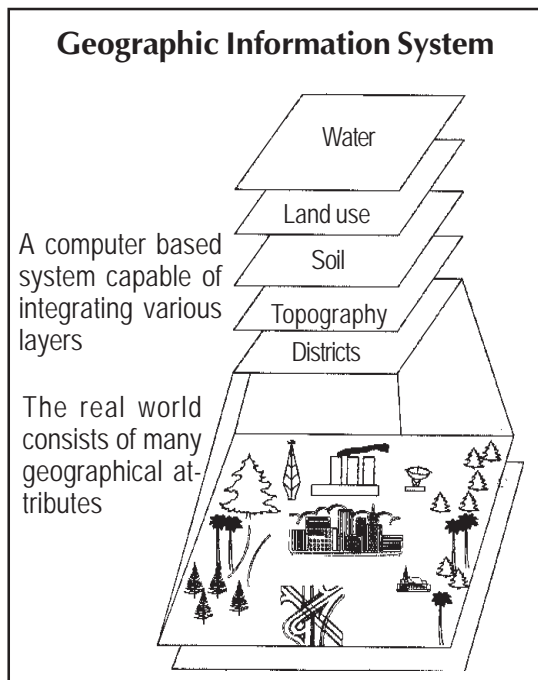
Don't you want to know how the lady replied to Ramu's questions?

It is with the help of the Geographical Information System (GIS) that this became possible.

What is Geographical Information System?

Geographical Information System is the method of storing, retrieving and transforming geographical data in computers and their analysis, finding answers to queries and displaying them in the form of pictures, graphs, and charts. It is very much helpful to understand the spatial relation between objects and phenomena. As it involves analyses based on geography, this technology is called the Geographical Information System (GIS).

In short, the Geographical Information System is the technique of collection of earth related information, their storage for use and analysis.



As you know, topographic maps contain different ground related information. We can prepare different thematic maps based on rivers, roads, houses, cultivatable areas and forests from topographic maps. Each map thus prepared is called a layer. Each layer is incorporated into a computer using the vectorisation method. Attributes of different locations are stored in computer using a Database Management System (DBMS). The different layers are analysed together using the overlaying technique for finding solutions to specific problems.

Why Geographic Information System?

- For delineating the required information from a large geo-referenced data base.
- To select theme wise (e.g. relating to soil, water etc.) or region wise details.
- To find and analyse spatial relations of geographical phenomena.
- To show the peculiarities or events in a region on a locational basis.

- In order to update information in a fast and cheap manner.
- To create visual models of future processes and phenomena using present day information.
- For creating maps, graphs and tables for specific uses.

What are the analytical capabilities of the Geographical Information System?

Imagine that the Government wants to construct a road connecting the boundaries of a reserved forest by widening a footpath by five metres on either side. Using the buffering technique of the Geographical Information System the extent of forest land lost due to the road construction can be estimated quickly and at a cheaper rate. Won't you try to find out similar situations where the Geographical Information System can be made use of?

Let us now find out how the Geographical Information System helps the revenue authorities to estimate land tax of a region on the basis of its geographic characteristics.

For this, theme based maps of the regional showing soil type, slope, vegetation, and regional characteristics (rural, urban, industrial etc) are utilized. These maps stored within a computer are analyzed with the help of a Geographical Information System software by the overlay analysis method to estimate land holdings of similar nature to fix the land tax. Thus goes the vast potential of the Geographical Information System.

Look at Ramu's another experience.

One day there was a fire in the house of Abu, Ramu's friend. Abu ran outside the house with his mobile phone. He

had only dialed the number of the fire force when a voice asked from the other end of the telephone.

- Oh, you're Abu ?
- When did the fire occur in your house?
-

Such questions were asked by them through the telephone. Within minutes the fire force reached Abu's house and doused the fire within no time.

Abu was thinking as to how the fire force reached his house exactly without informing them the location.

As the computer network of the fire department has a citizen data base prepared with the help of the Geographic Information System, just when the number was dialed, the location and the easiest route to reach were displayed on the Fire Force's computer. It is by that route that they reached Abu's house.

Geographic Information System has got diverse applications in various fields

- In the formulation of forest management policies
- For planning troop deployment for defence purposes
- In designing roads and highways
- In collection of information by the local self government institutions for planning and execution of various projects.
- For distribution of milk, medicine and other essential items.
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You can also find out the other applications of the Geographic Information System.

GIS for catching thieves also

Crime Information System created using the Geographical Information System by the Police Department is of immense help in catching thieves. This helps to collect information about crimes, finding out criminals on the basis of nature of crimes, encircling areas where escaped criminals could be traced and to display photographs of criminals at local level through the visual media.

The geo-referenced information system created for a region on the basis of GIS is helpful in the following respects.

- To find out the name, latitude and longitude of a particular place in the region.
- In order to find out places that suit our various requirements.
- For finding out the spatial relations between various geographic factors.
- To find out past changes in that region and prepare future models.

The applications of Geographic Information System in map preparation

- Reproduction of existing maps in a faster and cheaper manner.
- To prepare thematic maps from the existing maps to meet the needs of users.
- In the preparation of maps without the help of a skilled cartographer.
- For displaying the same information in different picture formats.

- To reproduce maps by incorporating additional information.
- For the construction of three dimensional models.

Did you understand the characteristics and advantages of GIS. Can't you see the influence of its use in the various fields of life. GIS is extremely useful in geographic studies, transport planning, resource distribution and natural disaster studies.



SUMMARY

- Remote sensing is the method of analyzing the information about distant objects or phenomena without touching them by the use of a sensing device.
- Remote sensing technology can be classified into aerial remote sensing and satellite remote sensing.
- Taking pictures of ground with the help of cameras fitted on aircrafts is called aerial photography.
- The method of collecting information about the earth's surface with the help of sensors fitted in artificial satellites is called satellite remote sensing.
- The size of the smallest object that a sensor can distinguish is called its spatial resolution.
- The technique of collection, storage and analysis of earth related information is called the Geographic Information System.
- Geographic Information System holds great potential in different fields including geographic studies.

QUESTIONS

1. Evaluate the salient features of remote sensing and based on it analyse the significance of remote sensing in practical applications.
2. Mention the merits and demerits of terrestrial photography and aerial photography by comparing between them.
3. Explore the possibilities of aerial photography and prepare a note on it.
4. What is the significance of overlap in aerial photographs?

5. How does the analytical capabilities of Geographic Information System influences its application in various fields?
6. Explain buffer analysis and overlay analysis.
7. Evaluate the salient features of Geographic Information System.
8. Mention the analytical capabilities of Geographic Information System.
9. Analyse the cartographic potentialities of Geographic Information System.
10. Find out the different ways by which remote sensing and Geographic Information System help Geographic studies and prepare a note on it.

