

UNIT 1: CONCEPT, DEFINITION, HISTORY AND EVOLUTION OF REMOTE SENSING

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OBJECTIVES

The objectives of this unit are to acquaint with and to introduce the fundamentals of remote sensing technology to you with respect to the following:

- Need, Scope and Importance of Remote Sensing.
- Concept and Definition
- Satellite Remote Sensing Versus Aerial Photography.
- Historical Overview.
- Evolution of Satellite Remote Sensing in India.

INTRODUCTION

❖ This unit presents the basic principle of remote sensing data acquisition limiting the scope to the intersection of earth observation and remote sensing.

❖ While introducing and including this unit in your academic course curriculum, you might be very keen to know the objectives, queries like why remote sensing is needed, in which way it is useful to the society, what are its nature, principles, background, importance, merits and limitations.

CONCEPT

- ❖ Remote sensing means sensing from the remote areas or observation or taking information from far off distance. In the simplest words, remote sensing is acquiring information about an object without touching it.
- ❖ With this concept, you will be able to understand that remote sensing deals with the observation and measurement of objects on the Earth's surface from a distance.

- ❖ The concept of remote sensing also encompasses both the fields of aerial photography and satellite imagery.
- ❖ Both these fields highlight the characteristics of objects of interest for their identification, measurement and analysis without any physical touch or direct contact.
- ❖ Remote sensing (RS), also called earth observation, refers to acquiring information about varieties of spatially distributed areas on the Earth's surface without being in direct contact with the object or area.

- ❖ Humans accomplish this task with aid of eyes or by the sense of smell or hearing; so, remote sensing is day-today business for people.
- ❖ Reading the newspaper, watching cars driving in front of you are all remote sensing activities.
- ❖ Most sensing devices record information about an object by measuring an object's transmission of electromagnetic energy from reflecting and radiating surfaces.
- ❖ Electro-magnetic radiation which is reflected or emitted from an object is the usual source of remote sensing data.
- ❖ However, the common remote sensing systems rely on variations in electromagnetic fields, force fields and acoustic wave fields.

❖ Remote sensing systems based on electromagnetic field variations include Aerial Remote Sensing, satellite Remote Sensing, Multiband Aerial Photography, Microwave Remote sensing and Radar.

❖ Remote sensing systems based on force field variations include Gravity Meter, Magnetometer and Galvanometer.

❖ Remote sensing systems based on acoustic wave field variations include Ultrasound, Bat and Ultrasonic phenomena.

Definition

- ❖ Remote sensing has been defined in many ways.
- ❖ It is the science, art and technique of obtaining information about an object or phenomena, through electromagnetic radiations, from a distance without any physical touch or contact.
- ❖ It can also be defined as the science and technology by which the characteristics of objects of interest can be identified, measured or analyzed without direct contact.
- ❖ According to Dr. Nicholas Short, Remote sensing is a technology for sampling electromagnetic radiation to acquire and interpret non-immediate geospatial data from which to extract information about features and objects on the Earth's land surface, oceans and atmosphere. As the land surface features are changing with the change of environmental conditions, remote sensing encompasses all such degree of dynamism under each satellite pass over the earth surface.

❖ According to National Aeronautics and Space Administration (NASA) remote sensing is the acquisition and measurement of data/information on some property (ies) of a phenomenon, object or material by a recording device not in physical, intimate contact with the feature(s) under surveillance; techniques involve amassing knowledge pertinent to environments by measuring force fields, electromagnetic radiation, or acoustic energy employing cameras, radiometer and scanners, lasers, radio frequency receivers, radar systems, sonar, thermal devices, seismographs, magnetometers, gravimeters, scintillometers and other instruments. This is rather a comprehensive definition highlighting the extensive fields, tools, techniques and scope of remote sensing.

❖ John R Jensen has defined remote sensing as the acquiring data about an object without touching it.

❖ Canada Centre for Remote Sensing (CCRS) has defined remote sensing as the science and to some extent art of acquiring information about the earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing and applying that information. It is simple definition but there is no mention about electromagnetic radiation as medium of sensing and the term "distance" from where the object is sensed otherwise the idea of 'Remote' will disappear.

Historical overview

- ❖ The concept of photography was developed by Greek mathematician Aristotle by using a pinhole camera in the 5th and 4th centuries.
- ❖ Photography was originally invented in the early 1800s.
- ❖ The world's first chemical photograph was taken in 1826 by Joseph Niépce of France using a process known as heliography.
- ❖ The word "photograph" was coined in 1839 by Sir John Herschel and is based on the Greek meaning "drawing, writing", together meaning "drawing with light".
- ❖ The first black and white aerial photograph was taken in the year 1860 by James Wallace Black from the height of 2,000 feet in Boston by using hot air balloon and during the year 1861 colour photographs were taken by James Clerk Maxwell.

❖ In 1897, Alfred Nobel became the first human being in the world to succeed in capturing an aerial photo with the help of a rocket mounted camera.

❖ In 1859 Gaspard Tournachon took an oblique photograph of a small village near Paris from a balloon. With this picture the era of earth observation and remote sensing had started.

❖ His example was soon followed by other people all over the world.

❖ During the period 1900-1914, continuous development with respect to film, mounting base of cameras, height from earth surface etc took place in the field of aerial photography for improving the quality of photographs and the ground coverage.

Evolution of satellite Remote Sensing in India

- ❖ Following the successful demonstration flights of Bhaskara-1 and Bhaskara-2 - experimental Earth observation satellites developed and built by ISRO (Indian Space Research Organization) - and launched in 1979 and 1981, respectively, India began the development of an indigenous IRS (Indian Remote Sensing Satellite) program.
- ❖ India realized quite early that sustaining its space program in the long run would depend on indigenous technological capabilities (in particular, US export restrictions made this clear).

❖ India under its different earth observation missions and programmes has launched varieties of satellites which have been proved to be an indispensable tool for natural resource mapping, monitoring, management and planning including environmental assessment at global, regional and local levels.

❖ The success of missions and developmental programmes have been based on its judicious scientific approach of selecting multi-space platform, multi-resolution, and synoptic viewing capabilities.

❖ Keeping this in mind, besides building satellites, India embarked as well on satellite launch vehicle development in the early 1970s.

❖ As a consequence, India has two very capable launch systems at the start of the 21st century, namely PSLV (Polar Satellite Launch Vehicle) and GSLV (Geosynchronous Satellite Launch Vehicle).

❖ IRS is the integrated LEO (Low Earth Orbit) element of India's NNRMS (National Natural Resources Management System) with the objective to provide a long-term space borne operational capability to India for the observation and management of the country's natural resources (applications in agriculture, hydrology, geology, drought and flood monitoring, marine studies, snow studies, and land use).

❖ The intent of the program is to create an environment of new perspectives for the Indian research community as a whole, to stimulate the development of new technologies and applications, and to utilize the Earth resources in More meaningful ways.

❖ Note: The INSAT system is India's GEO (Geosynchronous Earth Orbit) element, providing for simultaneous domestic communications and earth observation functions.

THANK YOU