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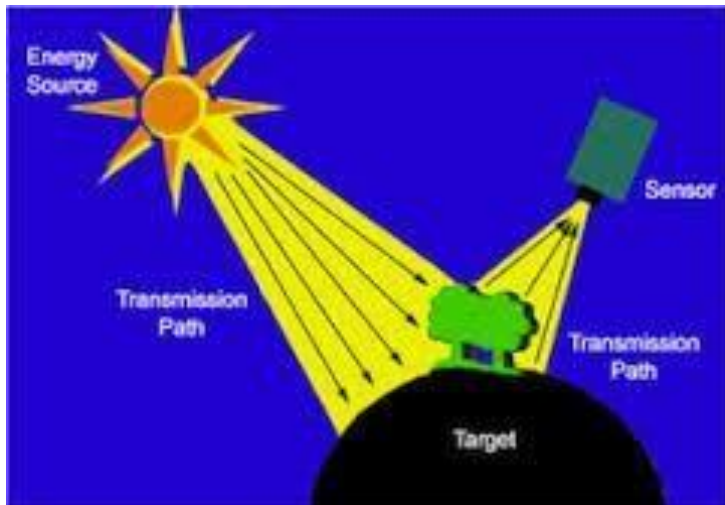
Biography

- January 2009 – todate, Professor, School of Earth and Environmental Sciences, Chapman University, Orange, USA
- August 2007 – January 2009 • Professor, Department of Earth System Sciences, GMU, USA
- July 2003 – July 2005 • Distinguished Visiting Professor, GMU, Fairfax, USA
- May 1997 - 2007 • Professor, Department of Civil Engineering, IIT Kanpur
- March 1991 – May 1997 Organization: Associate Professor, Department of Civil Engineering, IIT Kanpur
- Nov. 1986 - March 1991 • Assistant Professor, Department of Civil Engineering, IIT Kanpur
- Feb. 1986 - Nov. 1986 • Lecturer, Department of Civil Engineering, IIT Kanpur
- December 1981 - January 1986 • Postdoctoral and AOSTRA Fellow, University of Alberta, Canada
- November 1981 - December 1981 • Senior Research Officer, Indian School of Mines, Dhanbad
- January 1978 - October 1981 • Research Fellow, Department of Geophysics, BHU
- September 1977 - December 1977 • Guest Scientist, Int. Center for Theoretical Physics, Trieste, Italy
- November 1976 - September 1977 • Institutes Research Fellow, NGRI, Hyderabad

Research Interest

✚ *Remote sensing and applications*

✚ *Atmospheric pollution*



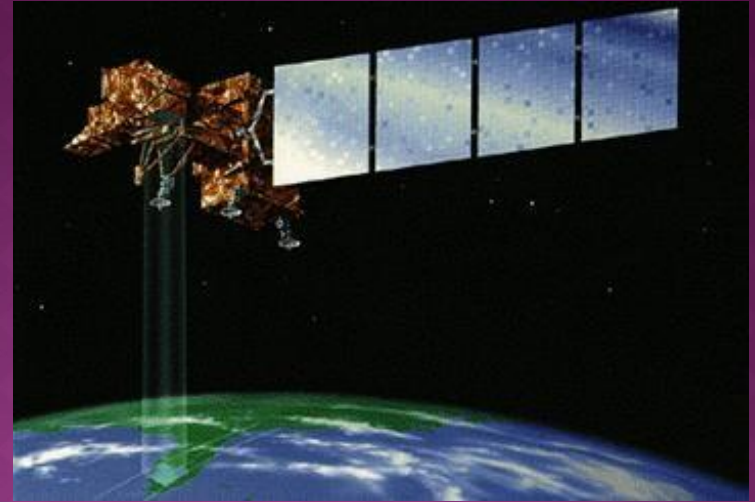
Remote Sensing

A satellite image of the Earth showing the Atlantic Ocean, Europe, and Africa. The ocean is a deep blue, and the landmasses are green and brown. The title 'Remote Sensing' is overlaid in large yellow letters at the top.

REMOTE SENSING *is the process of sensing and measuring objects from a distance without physical contact with them*

Sensing

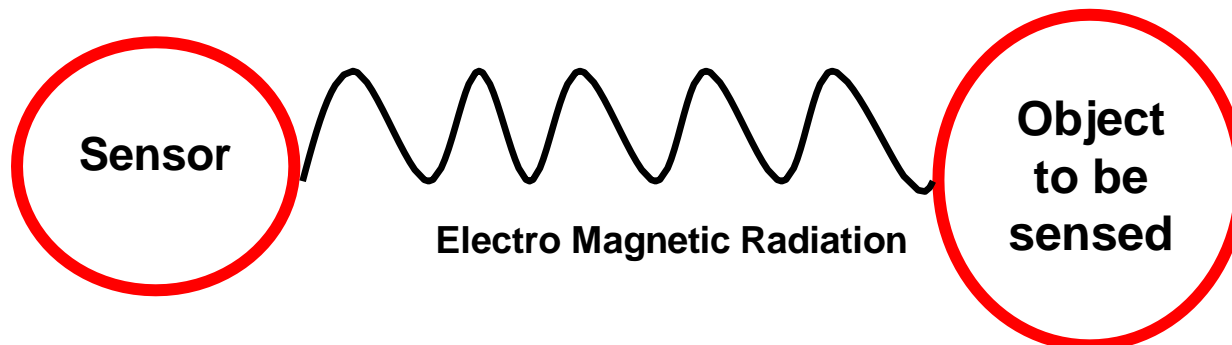
- 1.Scanning
- 2.Characterizing
- 3.Classification
- 4.Identification/ Quantification
- 5.Analysis



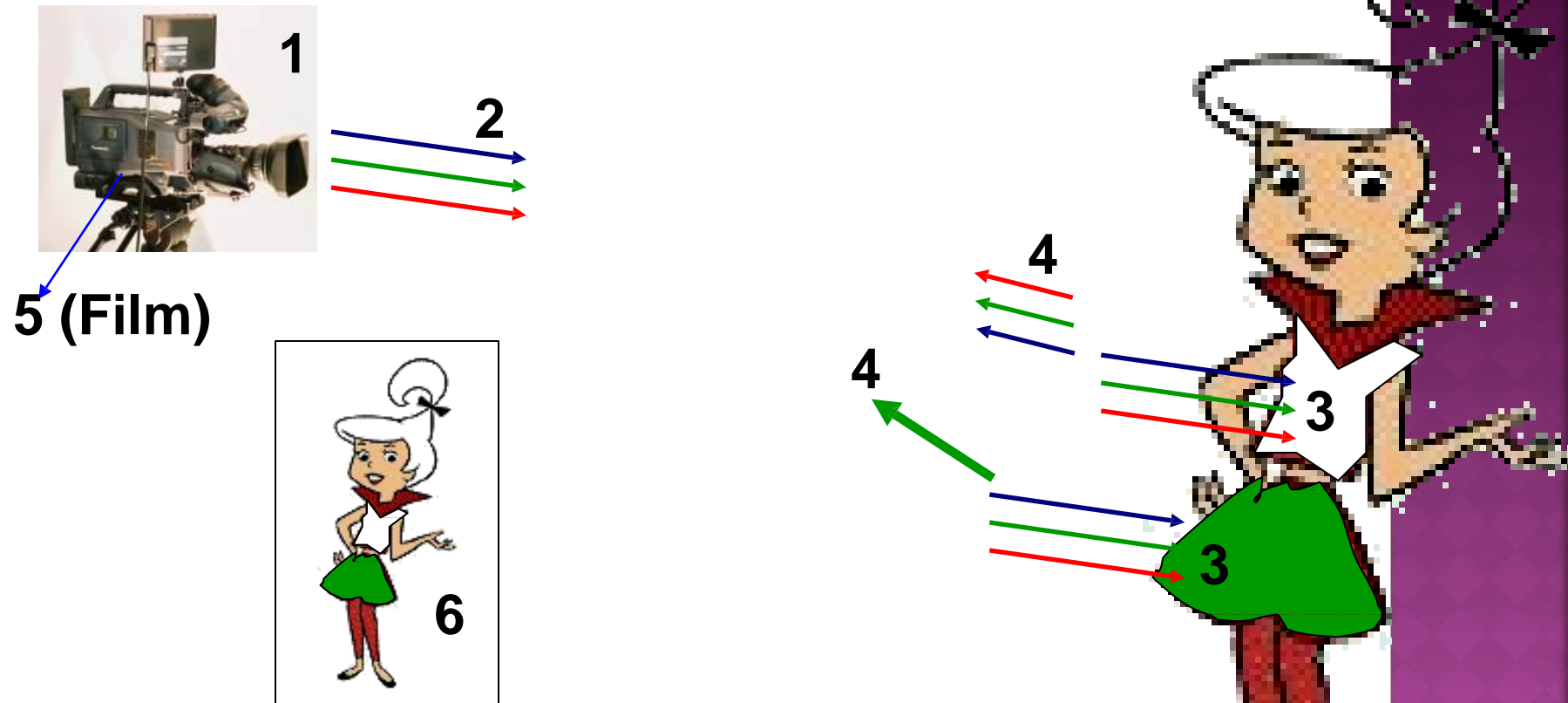
REMOTE SENSING

· "Remote sensing is the science 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."

Three Essential Things for Remote Sensing



SIX STAGES IN REMOTE SENSING



Stage-1. **Source of energy**

Stage-2. **Transmission of EMR towards the Object**

Stage-3. **Interaction of EMR with the Object**

Stage-4. **Transmission of Interacted EMR towards the Sensor**

Stage-5. **Recording of the Image by the Detector**

Stage-6. **Analysis of the Imagery**

Fundamental Principle

Most remote sensing instruments (sensors) are designed to measure photons. The fundamental principle underlying sensor operation centers on what happens in a critical component - the detector. This is the concept of the photoelectric effect. This, simply stated, says that there will be an emission of negative particles (electrons) when a negatively charged plate of some appropriate light-sensitive material is subjected to a beam of photons. The electrons can then be made to flow from the plate, collected, and counted as a signal. A key point: The magnitude of the electric current produced (number of photoelectrons per unit time) is directly proportional to the light intensity. Thus, changes in the electric current can be used to measure changes in the photons (numbers; intensity) that strike the plate (detector) during a given time interval.

Types of RS system

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graph TD; A[Types of RS system] --> B[Active RS system]; A --> C[Passive RS system]; B --> D[Artificial Energy source]; C --> E[Natural Energy source]; D --> F["e.g. radar systems<br/>SLAR,SAR"]; E --> G["e.g.sensors on<br/>satellites<br/>Landsat,SPOT"]
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Active RS
system

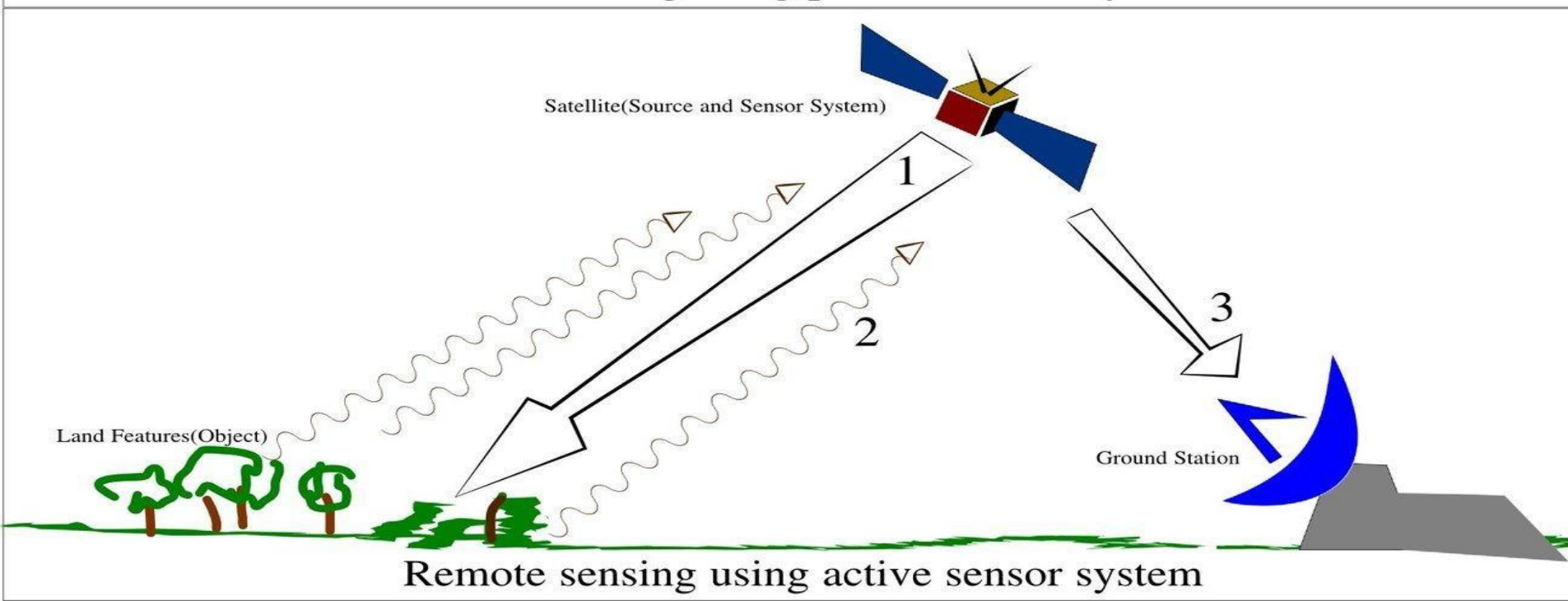
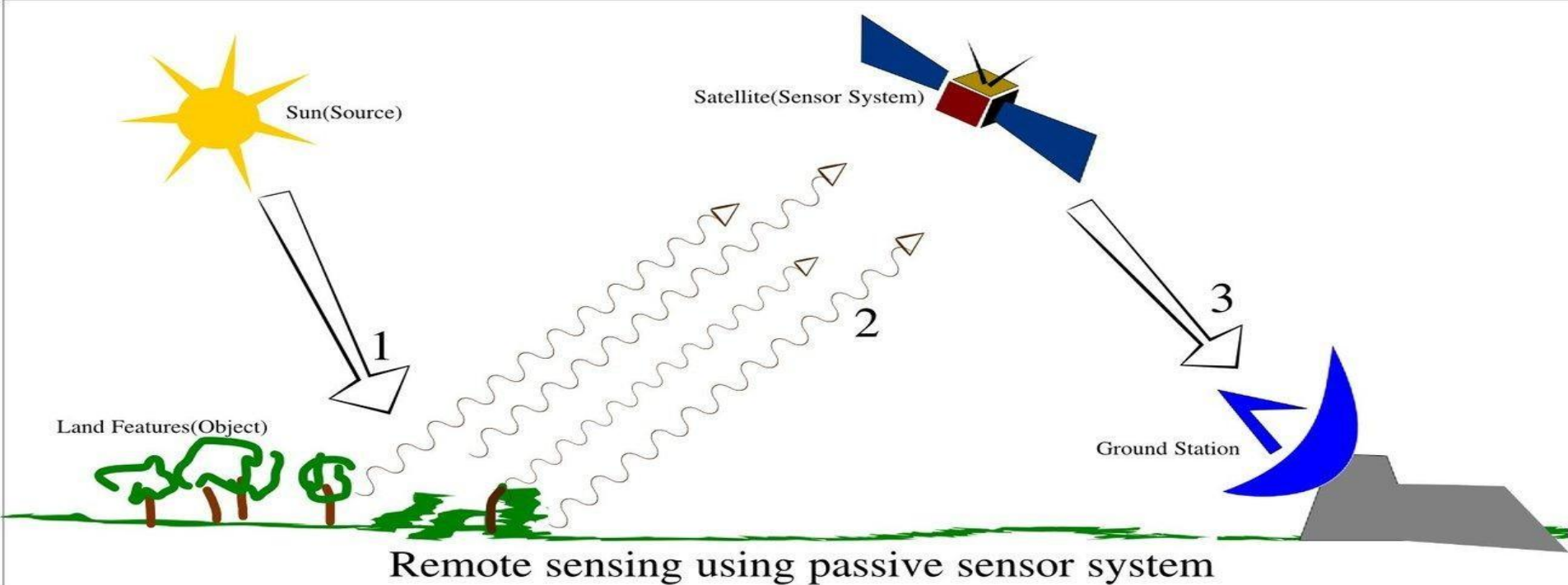
Passive RS
system

Artificial Energy
source

Natural Energy
source

e.g. radar systems
SLAR,SAR

e.g.sensors on
satellites
Landsat,SPOT



Sensor Detection

1. Passive Detection

- Sensors measure levels of energy that are naturally emitted, reflected, or transmitted by the target object.
- **Passive sensors** are those which detects naturally occurring energy. Most often, the source of radioactive energy is the sun.
- Detection of reflected solar energy, for example, can only proceed when the target is illuminated by the sun, thus limiting visible light sensors on satellites from being used during a nighttime pass.
- The Thematic Mapper, the primary sensor on the Landsat satellites, is a good example of a passive sensor.

2. Active detection

- ✚ Active Sensors provide their own energy source for illumination of the target by directing a burst of radiation at the target and use sensors to measure how the target interacts with the energy.
- ✚ Most often the sensor detects the reflection of the energy, measuring the angle of reflection or the amount of time it took for the energy to return.
- ✚ Active sensors provide the capability to obtain measurements anytime, regardless of the time of day or season.
- ✚ They can be used for examining energy types that are not sufficiently provided by the sun, such as microwaves, or to better control the way a target is illuminated. However, active systems require the generation of a fairly large amount of energy to adequately illuminate targets.
- ✚ *Doppler radar is an example of an active remote sensing technology.*

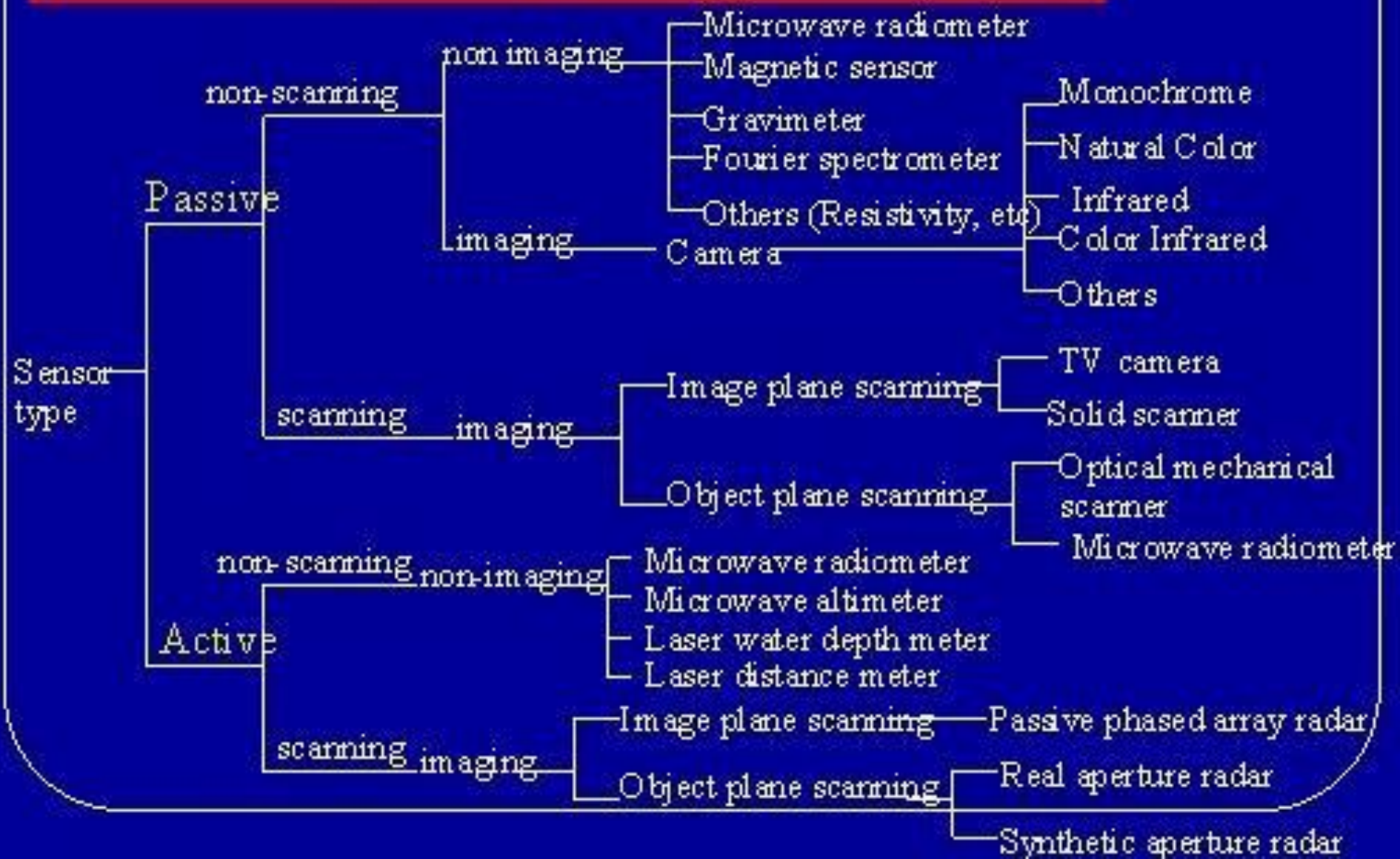
- **IMAGING SENSORS**

- Sensors which provide output to create an image
- Eg : LISS I, LISS II, LISS III etc.

- **NON IMAGING SENSORS**

- Sensors which provide numerical output with respect to the quantum of radiation
- Eg: Radiometer, Scatterometer etc.

There are many remote sensors



INDIA in the field of Remote Sensing

India has launched four satellites, the IRS series, each with multispectral sensors.

India successfully operates several Earth-resources satellites that gather data in the Visible and Near IR bands, beginning with IRS-1A in March of 1988. The latest in the series, IRS-1D, launched on September 29, 1997. Its LISS sensor captures radiation in the blue-green, green, red, and near IR bands at 23 m spatial resolution.

**IRS-1D 5.8 meter panchromatic view
of part of the harbor along the
coastline at Tamil Nadu in India.**



In 2003 the IRS program orbited the first in a new series, ResourceSat-1, whose chief sensor images at 56 meters. Here is its first returned image of a part of the Himalayas, seen on October 23, 2003.



Applications of Remote Sensing

- Coastal water mapping, soil/vegetation discrimination, forest classification, man-made feature identification
- Vegetation discrimination and health monitoring, man-made feature identification
- Plant species identification, man-made feature identification
- Soil moisture monitoring, vegetation monitoring, water body discrimination
- Vegetation moisture content monitoring
- Surface temperature, vegetation stress monitoring, soil moisture monitoring, cloud differentiation, volcanic monitoring
- Mineral and rock discrimination, vegetation moisture content

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