UNIT-I

Remote Sensing

Remote sensing is the science and art of obtaining information about an object, area or phenomena, through the analysis of data, acquired by a device, that is not in contact with the object, area or phenomena under investigation.

Historical Development of Remote Sensing

Sl.No	Year	History or Development of Remote Sensing
1	1830	Invention of Stereoscopes
2	1840	Balloonists took pictures of the ground using the newly invented photo-camera
3	1858	The first aerial photograph was claimed to have been taken by Felix Tournachon, known as Nadar, from a tethered balloon over the Bievre Valley in France.
4	1903	The most novel platform at the end of the last century is the famed pigeon fleet that operated as a novelty in Europe
5	1919	Hoffman first to sense from an aircraft in thermal IR.
6	1920	First books on aerial photo interpretation.
7	1931	Stevens development of an IR sensitive film (Black &White)
8	1940	Identification of V-1 rockets, radar, water depth for amphibious landings etc.
9	1942	Kodak patents first false colour IR sensitive film.
10	1950	Advances in sensor technology move into multi-spectral range, color-infrared photography recognised for non-military applications.
11	1954	Westinghouse, under sponsorship from USAF, develops first side-looking airborne radar (SLAR) system.
12	1957	Advent of Sputnik, the possibility of putting film cameras on orbiting spacecraft was realized. The first cosmonauts and astronauts carried cameras to document selected regions and targets of opportunity as they circumnavigated the globe. (Russia launched)
13	1960	TIROS-1 launched as first meteorological satellite.
14	1964	Nimbus Weather Satellite Program begins with the launch of Nimbus-1.
15	1970	Operational system for collecting information about the earth on a repetitive schedule remote sensing matured in the 1970's when instruments were flown on skylab (and later, the Space Shuttle) and on Landsat, the first satellite dedicated specifically to monitoring land and ocean surfaces to map natural and cultural resources.
16	1958	Early prototypes for the TIROS (Television and Infrared Observation Satellite) and Vanguard were created.
17	1959	
18	1970	China launched its first communications satellite.
19	1972	Launch of ERTS-1, the first Earth Resources Technology Satellite (later renamed Landsat-1). Carried return beam vidicon RBV) and multispectral scanner (MSS).

20	1975	India built its first satellite, Aryabhata, which was launched by USSR.
21	1977	Lauch of Meteosat-1, the first in a long series of Europeann weather satellites
22	1978	Seasat, Nimbus-7 with TOMS and CZCS. TOVS (TIROS Operational Vertical Sounder was operational in 1978.
23	1980	A radar imaging system was the main sensor on Seasat and, going into the 1980's, a variety of specialized sensors-CZCS, HCMM, and AVHRR among others-were placed in orbit primarily as research or feasibility programs.
24	1982	The first non-military radar system was JPL's Shuttle Imaging Radar (SIR-A) on the Space Shuttle in 1982 and Indian National Satellite (INSAT-1A) launched.
25	1986	Launch of SPOT-1. Spot transmitted multispectral data at 20m resolution and panchromatic data at 10m resolution.
26	1995	Launch of OrbView-1 the world's first commercialimaging satellite, launch of ERS-2, Radarsat-1 and IRS-1C.
27	1999	Lauch of Landsat 7, IKONOS 1m resolution, QuickSCAT, CBERS-1, Terra etc.
28	2000	Shuttle SRTM Mission, laucnched Tsinghau-1, Eros A1(1m resolution).
29	2000	LiDAR is an active remote sensing technology that makes possible the characterization of t e forest vertical structure on scales ranging from an individual tree to the world's forests.
30	2001	Launch of Quickbird, 61cm resolution. GSAT-1
31	2004	Republic of China Satellite (RocSat2) launched, high resolution 2m PAN,8m RGB.
32	2007	Launch of RapidEye, a constellation of five interlinked high resolution satelllites.
33	2008	Cartosat-2A, it carries PAN capable of capturing black and white pictures, IMS-1 and Chandrayan-1
34	2009	RISAT-2 (Radar Imaging Satellite) to monitor the India's borders.
35	2010	StudSat (Student Satellite) and GSAT-5P
36	2011	Resource Sat-2, Youthsat, GSAT-8 and 12Meghat Tropiques, SRMSat
37	2012	RISAT-1
38	2013	SARALIRNSS-1, INSAT-3D, Mars Orbiter Mission (MOM)
39	2015	IRNSS-1D, GSAT-6, AstrisatGSAT-15
40	2016	IRNSS-1G, Cartosat-2C, Swayam-1, Pratham (to count electrons in the earth's atmosphere), ScatSat,
41	2017	INS-1A ISRO Nano Satellite carried SBR and SEUM, IRNSS-1H
42	2018	MicroSat-TD (Microsatellite) , HySISExceedSat-1
43	2019	Microsat-R (military use), KalamSat-V, EMISAT, CHAndrayan-2, CartoSat-3 etc

Types of Remote Sensing

Based on source of energy remote sensing classified into passive and active remote sensing;

a. Passive Remote Sensing: Remote sensing of energy naturally reflected or radiated from the earth's surface.

b. Active Remote Sensing: Remote sensing methods that provide their own source of electromagnetic radiation to illuminate the terrain. Example Radar.

Based on platforms remote sensing is classified in to aerial remote sensing and satellite remote sensing;

a. Aerial remote sensing: In remote sensing process aircraft are used means it is called aerial remote sensing.

b. Satellite remote sensing: In space satellites are used as a platform in remote sensing means it is called satellite remote sensing.

EMR (Electro Magnetic Radiation)

EMR stands for electromagnetic radiation, it is the energy emitted/reflected from ground features and transmitted to the sensing instrument in the form of waves. This emitted energy/radiant energy is called electromagnetic radiation. The remote sensing of land surface features is based on detection of electromagnetic radiation.

Electromagnetic spectrum

The entire array of electromagnetic waves comprises the EMR spectru. It is defined as the ordering of the radiation according to wavelength, frequency or energy. The electromagnetic spectrum can be explained as the continuum of energy that ranges from meters to nanometers in wavelength, travels at the speed of light and propagates through a vacuum like the outer space.

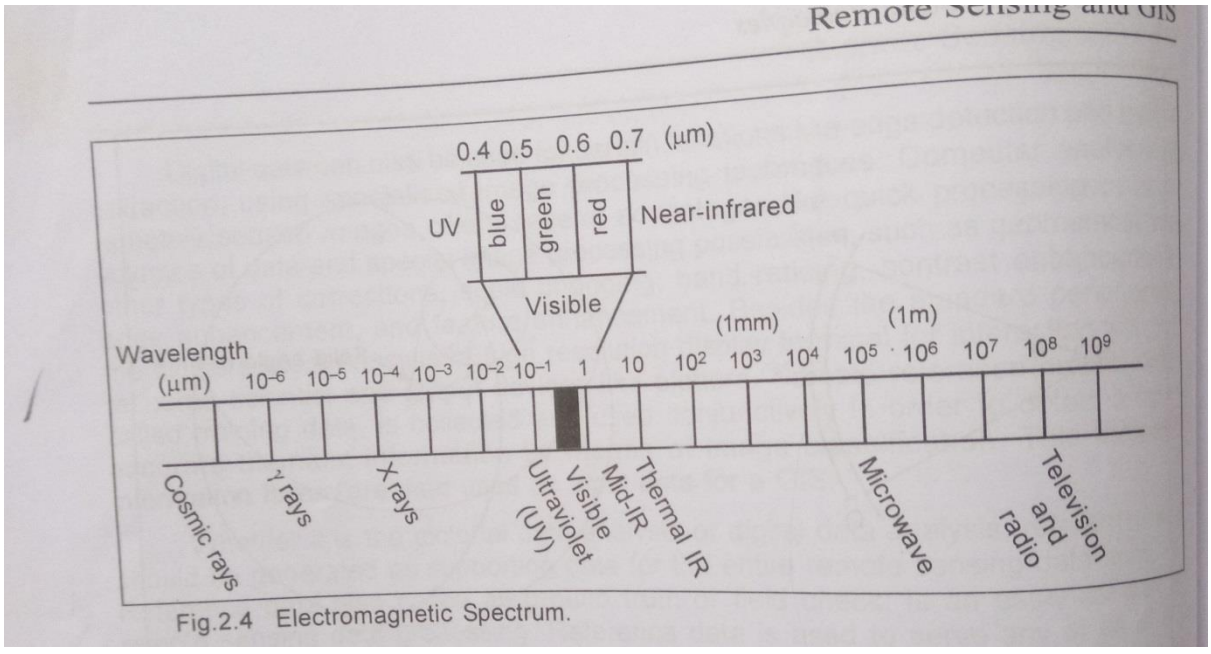


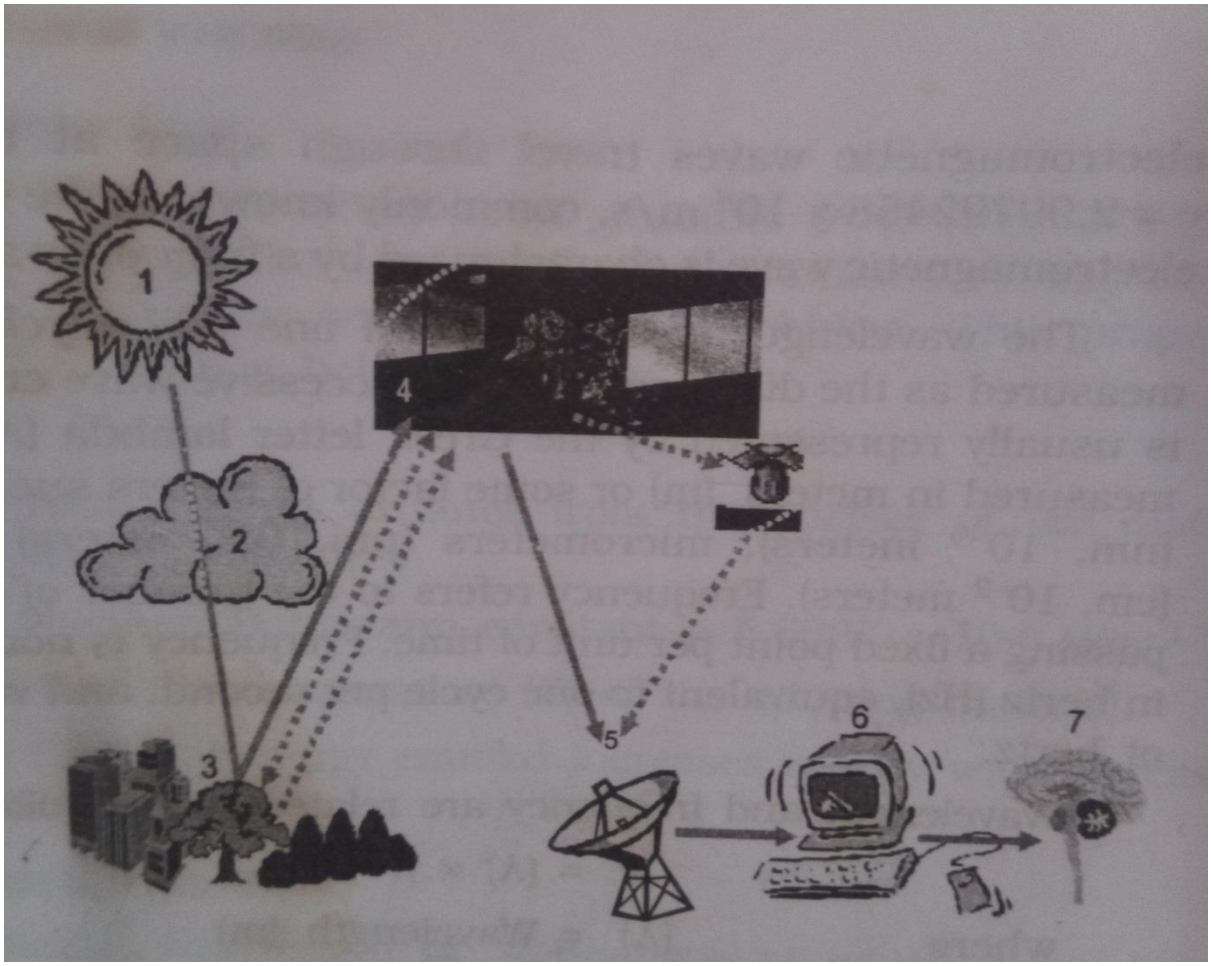
Fig.2.4 Electromagnetic Spectrum.

Ideal Remote Sensing

1.Energy source or Illumination – the first requirement for remote sensing is to have an energy source which illuminates or provides electromagnetic energy to the target of interest.

2. Radiation and the atmosphere – as the energy travels fromits source to the target, it will come in contact with and interact with the atmosphere it passes through. This interaction may take place a second time as the energy travels from the target to the sensor.

3. Interaction with the target – once the energy makes it ways to the target through the atmosphere, it interacts with the target depending on the properties of both the target and the radiation.



4. Recording of energy by the sensor- after the energy has been scattered by, or emitted from the target, we require a sensor to collect and record the electromagnetic radiation.

5. Transmission, reception and processing – the energy recorded by the sensor has to be transmitted, often in electronic form, to a receiving and processing station where the data are processed into an image (hardcopy and / or digital).

6. Interpretation and analysis – the processed image is interpreted, visually and / or digitally or electronically, to extract information about the target which was illuminated.

7. Application – the final element of the remote sensing process is achieved when we apply the information we have been able to extract from the imagery about the target in order to better understand it, reveal some new information, or assist in solving a particular problem.