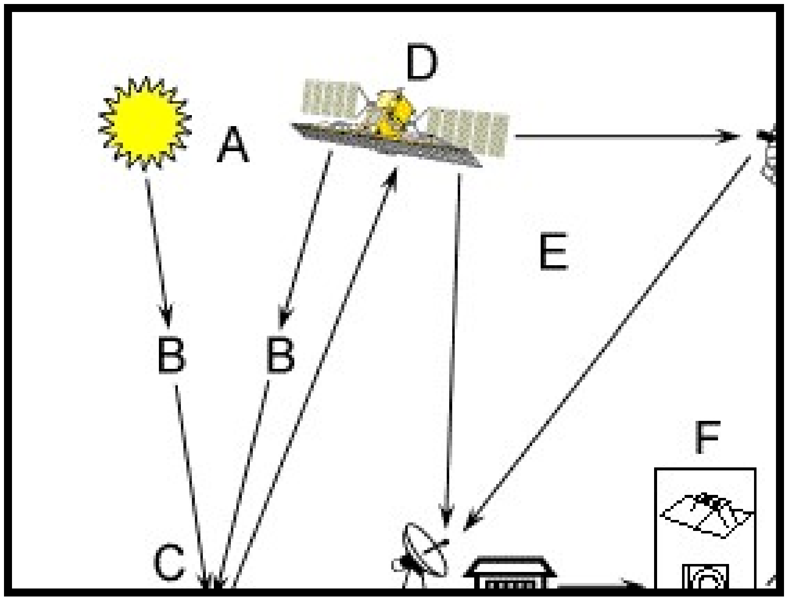
Fundamental of Remote Sensing

Dr. Pravat Kumar Shit
Assistant Professor
Dept. of Geography
Raja N. L. Khan Women's College
Medinipur-721102

What is Remote Sensing?

- "Remote sensing is 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."

STAGES IN REMOTE SENSING



- Energy Source or Illumination (A)
- Radiation and the Atmosphere (B)
- Interaction with the Target (C)
- Recording of Energy by the Sensor (D)
- Transmission, Reception, and Processing (E)
- Interpretation and Analysis (F)
- Application (G)

STAGES IN REMOTE SENSING

- 1. Energy Source or Illumination (A) - 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 (B) - as the energy travels from its 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 (C) - once the energy makes its way to the target through the atmosphere, it interacts with the target depending on the properties of both the target and the radiation.
- Recording of Energy by the Sensor (D) - after the energy has been scattered by, or emitted from the target, we require a sensor (remote - not in contact with the target) to collect and record the electromagnetic radiation.

STAGES IN REMOTE SENSING

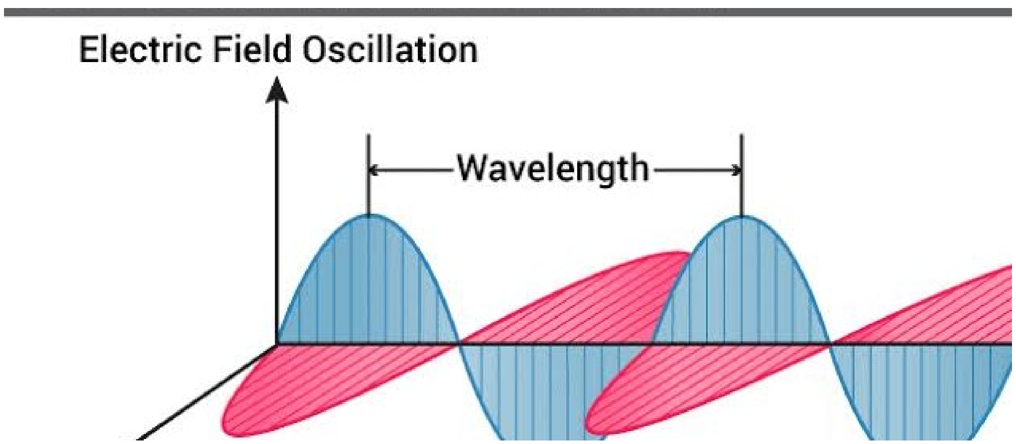
- 5. Transmission, Reception, and Processing (E) - the energy recorded by the sensor has to be transmitted, often in electronic form, to a receiving and processing station where the data are processed into an image (hardcopy and/or digital).
- 6. Interpretation and Analysis (F) - the processed image is interpreted, visually and/or digitally or electronically, to extract information about the target which was illuminated.
- 7. Application (G) - 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.

These seven elements comprise the remote sensing process from beginning to end.

ELECTROMAGNETIC RADIATION (EM RADIATION

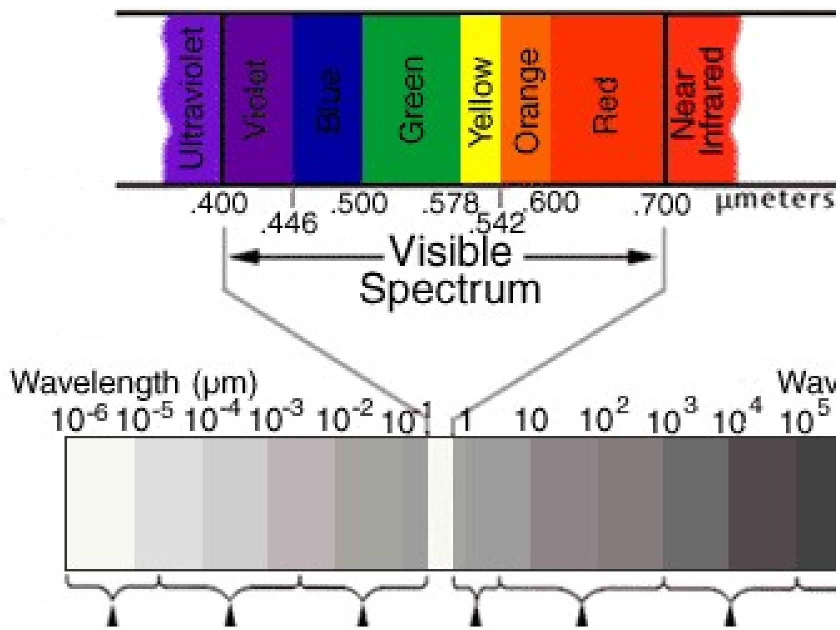
- Electromagnetic radiation (EM radiation or EMR) refers to the waves (or their quanta, photons) of the electromagnetic field, propagating (radiating) through space, carrying electromagnetic radiant energy.

It includes radio waves, microwaves, infrared, (visible) light, ultraviolet, X-rays, and gamma rays



Electromagnetic spectrum

The electromagnetic spectrum is the range of frequencies (the spectrum) of electromagnetic radiation and their respective wavelengths and photon energies



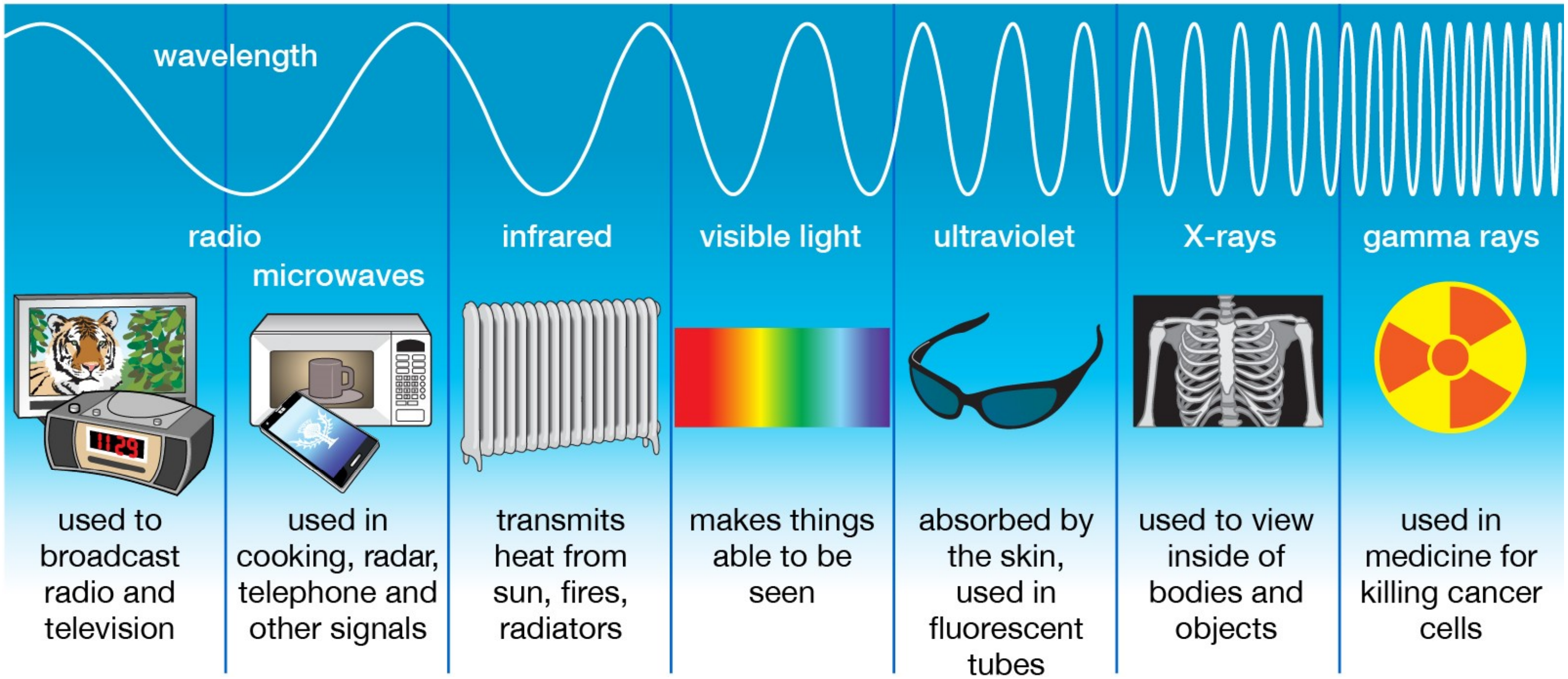
Electromagnetic spectrum

- Electromagnetic spectrum, the entire distribution of electromagnetic radiation according to frequency or wavelength.
- Although all electromagnetic waves travel at the speed of light in a vacuum, they do so at a wide range of frequencies, wavelengths, and photon energies.
- The electromagnetic spectrum comprises the span of all electromagnetic radiation and consists of many sub ranges, commonly referred to as portions, such as visible light or ultraviolet radiation.
- The various portions bear different names based on differences in behavior in the emission, transmission, and absorption of the corresponding waves and also based on their different practical applications.
- There are no precise accepted boundaries between any of these contiguous portions, so the ranges tend to overlap.

Electromagnetic spectrum

- The entire electromagnetic spectrum, from the lowest to the highest frequency (longest to shortest wavelength), includes all radio waves (e.g., commercial radio and television, microwaves, radar), infrared radiation, visible light, ultraviolet radiation, X-rays, and gamma rays. Nearly all frequencies and wavelengths of electromagnetic radiation can be used for spectroscopy.

Types of Electromagnetic Radiation



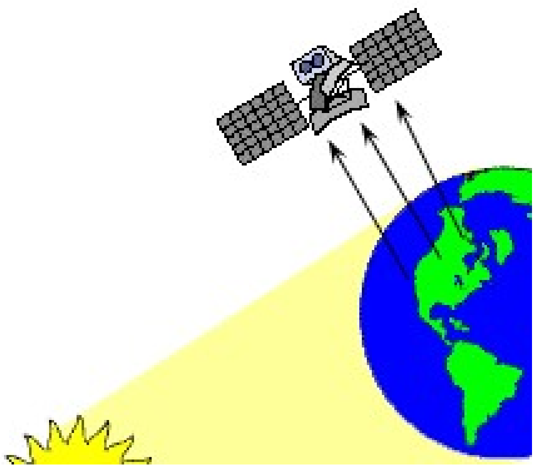
TYPES OF REMOTE SENSING

There are two types of remote sensing technology-

- active remote sensing.
- Passive remote sensing.

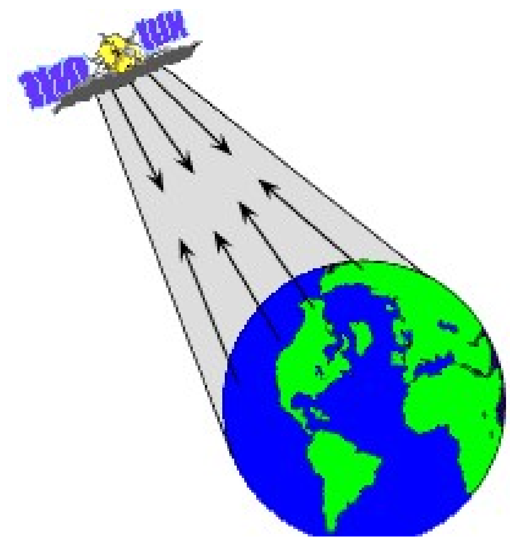
PASSIVE REMOTE SENSING.

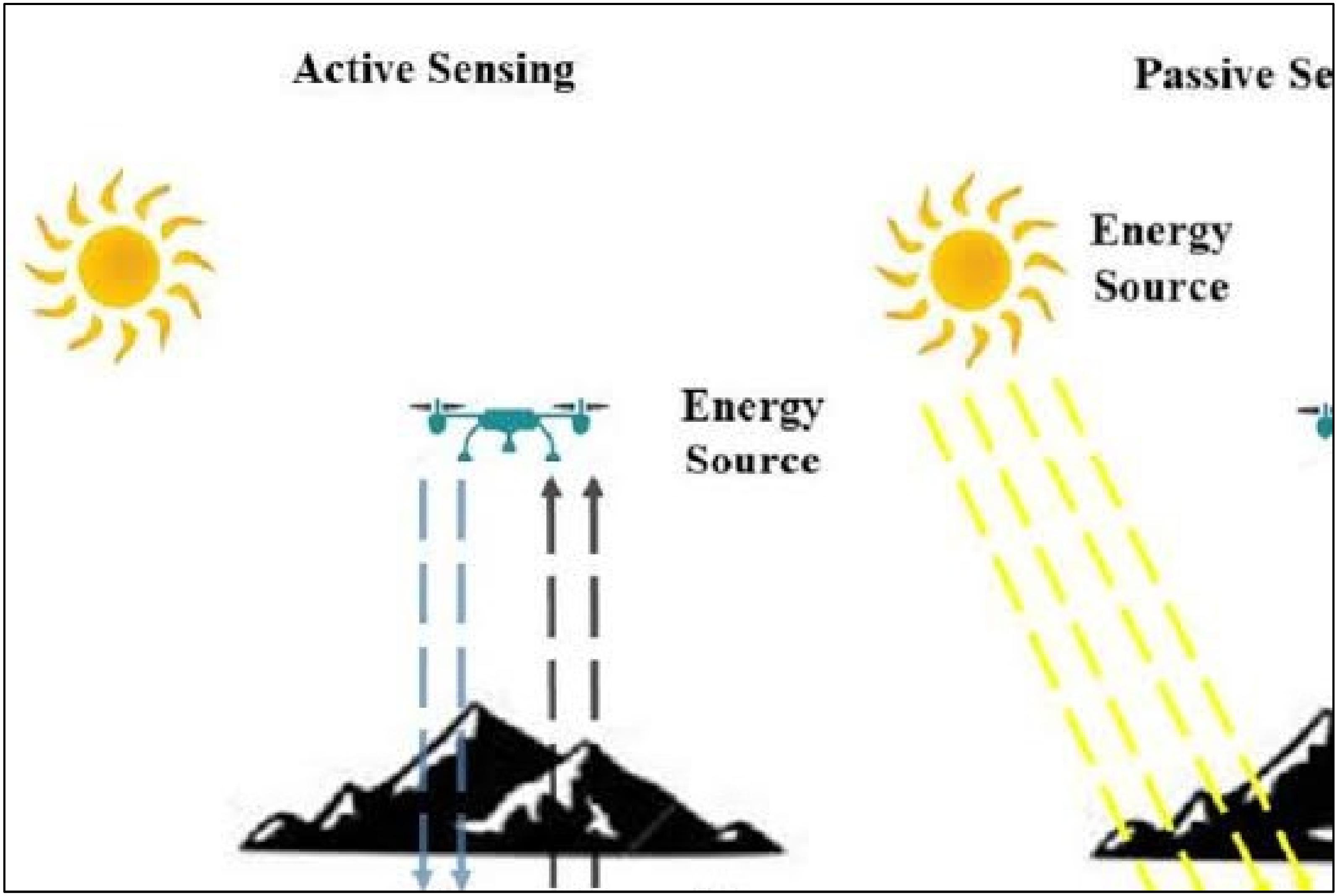
- The sun provides a very convenient source of energy for remote sensing. The sun's energy is either reflected, as it is for visible wavelengths, or absorbed and then reemitted, as it is for thermal infrared wavelengths.
- Remote sensing systems which measure energy that is naturally available are called **passive sensors.**
- Passive sensors can only be used to detect energy when the naturally occurring energy is available. For all reflected energy, this can only take place during the time when the sun is illuminating the Earth. There is no reflected energy available from the sun at night.
- Energy that is naturally emitted (such as thermal infrared) can be detected day or night, as long as the amount of energy is large enough to be recorded.



Active remote sensing

- Active sensors, on the other hand, provide their own energy source for illumination. The sensor emits radiation which is directed toward the target to be investigated. The radiation reflected from that target is detected and measured by the sensor. Advantages for active sensors include the ability to obtain measurements anytime, regardless of the time of day or season.




Active Sensing
Passive Se
Energy
Source
Energy
Source