REMOTE SENSING

Remote sensing is a technology used to obtain information about the environment from a distance. In agriculture, remote sensing is used to gather data about crops, soils, weather patterns, and other environmental factors that can affect crop growth and yield.

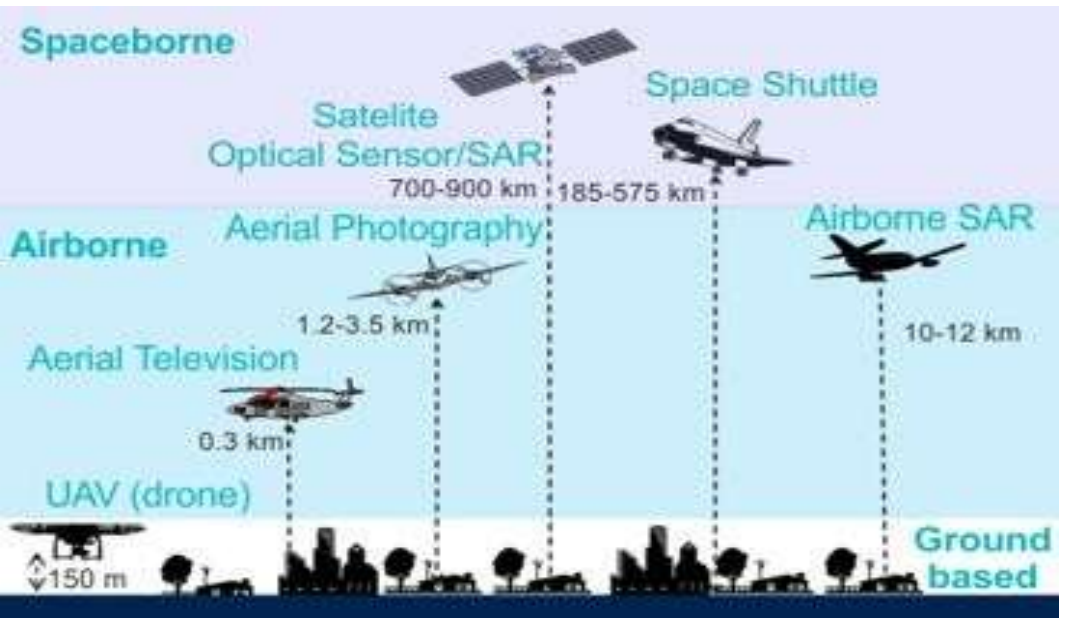
Remote sensing involves the use of various types of sensors, such as cameras and scanners, mounted on satellites, aeroplanes, or drones to collect data about the Earth's surface. The data obtained through remote sensing can be used to create detailed maps of agricultural fields, analyze crop health, and monitor changes in the environment over time.

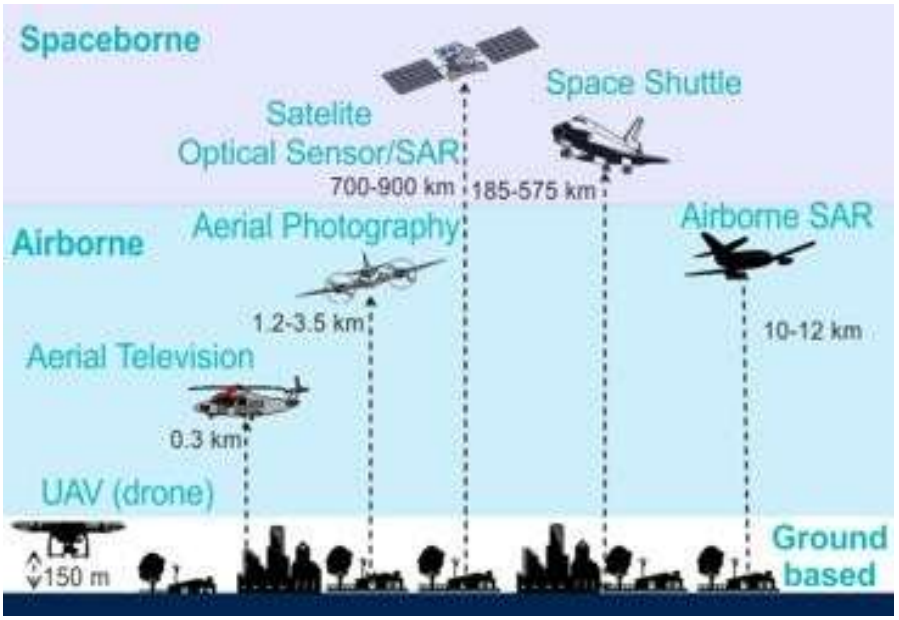
Components of Remote Sensing Platform

It can be defined as the carrier for remote sensing sensors. There are three main remote sensing platforms, which are mentioned below:

1. Ground-level platforms – Like cranes and towers
2. Aerial platforms – Like helicopters, high altitude aircraft, and low altitude aircraft.
3. Spaceborne platforms – Like space shuttles, geostationary satellites, and polar-orbiting satellites.

Below is an image showing different types of platforms used in remote sensing.





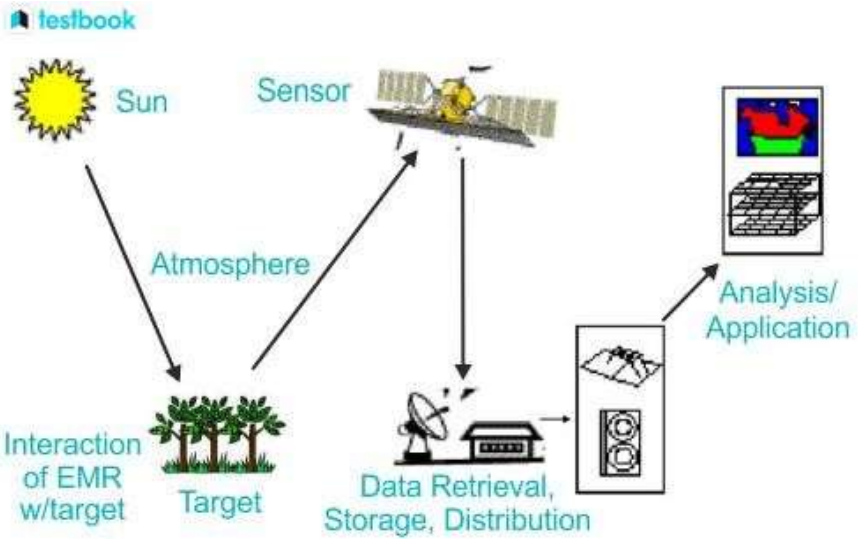
Sensors in Remote Sensing

It is a device that is used to receive electromagnetic radiation from different objects and surfaces and convert them into a signal that can be recorded and exhibited, either in the form of numerical data or in the form of an image.

There are also many elements involved in the functioning of remote sensing, which are mentioned below:

1. Source of energy (A)
2. Radiation of a source of energy in the atmosphere (B)
3. Interaction of radiation with the object (C)
4. Recording of the energy by a sensor (D)
5. Transmission, Reception, and Processing of the radiation (E)
6. Interpretation and analysis of the radiation by the sensor (F)
7. Application of that radiation (G)

   Below is an image showing all the elements involved in remote sensing.



Types of Remote Sensing

There are mainly two types of sensors used, which are as mentioned below:

Active Remote Sensing

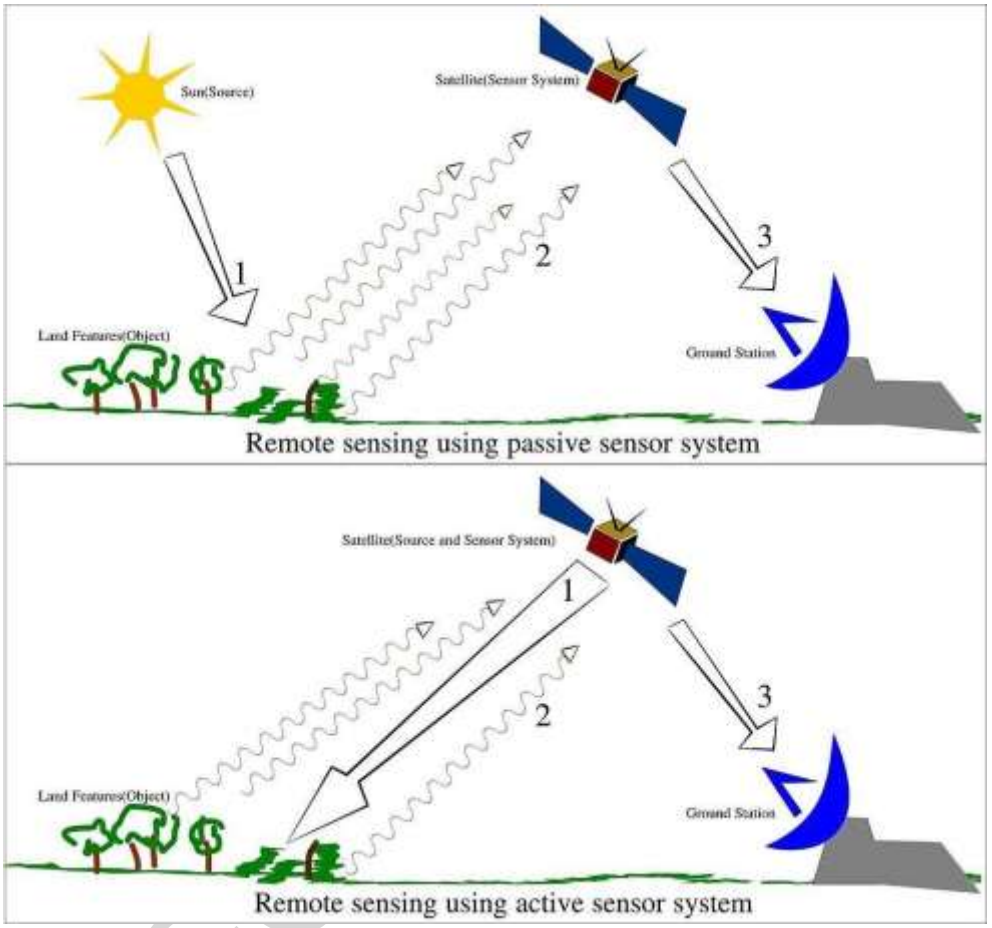
Active remote sensing utilizes an artificial source of radiation as an investigation, and the resulting signal, which scatters back to the sensor, depicts the Earth or the atmosphere.

The Synthetic-Aperture Radar system is a type of active sensor, which can emit radiation in the form of a beam coming from a moving sensor and can also measure the backscattered components returning to the sensor from the ground in the region of the microwave.

Passive Remote Sensing

Passive remote sensing depends only on solar radiation as its source of energy, which can be seen in multispectral, and hyperspectral sensors. It is mainly concentrated in the visible, near-infrared, and shortwave infrared spectral regions.

These sensors at the satellite measure the emerging radiation from the surface of the Earth's atmosphere system in the direction of sensor observation. In a remote sensing image, a grid of pixels is located to achieve image sensing by a combination of scanning in the cross-track direction and the sensor platform movement along the in-track direction.



Concepts

Some of the concepts related to remote sensing include:

1. **Electromagnetic Spectrum:** Remote sensing sensors detect different wavelengths of electromagnetic radiation, such as visible light, infrared radiation, and microwaves. Each wavelength corresponds to a specific color or energy level, and different sensors are designed to detect specific wavelengths.
2. **Spectral Signature:** Each type of material, such as **crops or soil, has a unique spectral signature**, which is a characteristic pattern of reflected or emitted radiation. By analyzing the spectral signature of different materials, remote sensing can identify and differentiate between them.
3. **Spatial Resolution:** The spatial resolution of a remote sensing image refers to the size of the smallest object or feature that can be detected. High-resolution images can provide more detailed information about crop health and soil conditions.
4. **Spectral bands:** Remote sensors typically capture data across a range of spectral bands, which are different sections of the electromagnetic spectrum. *For example,* visible light is captured in the red, green, and blue spectral bands.

5. **Temporal Resolution:** The temporal resolution of remote sensing refers to how frequently data is collected. Frequent data collection can help to monitor changes in crop growth, soil moisture, and other environmental factors over time.
6. **Data Processing**: The data obtained through remote sensing needs to be processed and analyzed to extract useful information. This can involve techniques such as image classification, which involves grouping pixels with similar characteristics into classes, and vegetation indices, which provide information about crop health.
7. **Radiometric resolution**: This refers to the ability of remote sensors to detect differences in the intensity of radiation. Higher radiometric resolution means more subtle differences in radiation can be detected.
8. **Image processing**: The data captured by remote sensors must be processed to generate useful information. This involves tasks such as filtering, enhancement, and classification to extract relevant information from the raw data.

   Remote sensing has several applications in agriculture, including crop monitoring, yield prediction, and soil mapping. It can also be used to monitor changes in the environment, such as deforestation and desertification.

Application of Remote Sensing in agriculture

Remote sensing applications in agriculture involve the use of remote sensing techniques and technologies to collect and analyze data on crops, soil, weather, and other aspects of agriculture. *Some of the key applications of remote sensing in agriculture are:*

1. **Crop identification and monitoring:** Remote sensing can be used to identify and monitor different types of crops, their growth stages, and their health status. This information can help farmers make informed decisions about irrigation, fertilizer application, and pest control.
2. **Soil mapping and analysis:** Remote sensing can be used to map and analyze soil properties, such as texture, moisture, and nutrient content. This information can be used to create soil fertility maps and develop precision farming strategies.
3. **Weather monitoring and forecasting:** Remote sensing can be used to monitor weather patterns, such as temperature, precipitation, and wind speed, and to forecast weather conditions. This information can be used to plan planting and harvesting schedules, as well as to make decisions about irrigation and pest control.
4. **Water management:** Remote sensing can be used to monitor water resources, such as lakes, rivers, and aquifers, as well as to monitor irrigation and drainage systems. This information can help farmers optimize water use and conserve water resources.
5. **Yield estimation**: Remote sensing can be used to estimate crop yields by analyzing data on crop growth, vegetation indices, and environmental conditions. This information can help farmers plan for future crops and make informed decisions about marketing and distribution.
6. **Crop health assessment:** Remote sensing can be used to monitor the health of crops and detect early signs of stress or disease. This information can help farmers to take corrective measures to prevent further damage to the crops.
7. **Land use mapping**: Remote sensing can help in mapping land use patterns and changes over time, which can aid in the planning and management of agricultural landscapes
8. **Pest and disease management**: Remote sensing can be used to monitor the spread of pests and diseases, which can help in early detection and control measures.
9. **Precision agriculture:** Remote sensing can be used in combination with other geospatial technologies to support precision agriculture practices such as variable rate application of fertilizers and pesticides, and targeted irrigation.

Overall, remote sensing applications in agriculture can help improve crop productivity, reduce resource waste, and enhance environmental sustainability.
one of the benefits that can be gained from the use of remote sensing -

- Early identification of crop health and stress
- Ability to use this information to do remediation work on the problem
- Improve crop yield
- Crop yield predictions
- Reduce costs
- Reduce environmental impact
- Crop management to maximise returns through the season
- Crop management to maximise returns during harvest time.