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AN OVERVIEW ON REMOTE SENSING: PRINCIPLE AND APPLICATIONS

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Abstract
Remote sensing is a technique that uses different sensors and resolutions to measure the amount of electromagnetic radiation (EMR) exiting a body or geographic area at a far distance and then collecting information from the data using mathematical and statistical tools or algorithms or models. Geographic information systems (GIS) tools are used to analysed the data and the utilized for applications in different fields. The different kinds of interaction between the incident energy and the targeted material are the principle behind remote sensing and this reflected energy is being collected and interpret for different applications. Large amount of data can be collected rapidly for large area non- destructively using remote sensing. Various applications of remote sensing used over a wide range of disciplines (Jensen, 2007).

Keywords : Remote Sensing, Agriculture, Geology, Satellite

Introduction
Remote sensing is a method for acquiring information about different objects on the surface without any physical contact with it. The exercise of gathering of data in the ultraviolet (UV) to radio wave regions of electromagnetic radiation (EMR) spectrum. The collection of information can be related to any discipline, environment or field and its measurements of EMR or its energy characteristics without any physical contact with the target. Remote sensing offers the capability to observe and collect data for large areas relatively rapidly, and is a non-destructive and important source of information can be used for further analysis and interpretation in various disciplines (Campbell et al. 2011).

The principle behind the remote sensing is the interactions between the incident energy or EMR and the targeted material that take place at the surface of that substance or medium and it is a surface phenomenon and penetration of EMR below the surface of a substance or medium results in the interaction which is called volume phenomena. The surface and volume interactions with medium can produce a sum of characteristic changes in the incident EMR or the energy. There may be some primary changes in magnitude, direction, wavelength, polarization and phase when the incident energy interacts with any targeted surface. Remote sensing detects and records these representative changes and produce subsequent images and these data are then interpreted to recognize remotely the characteristics of the targeted material that produced the changes in the recorded EMR (Curran, 1985).

The following interactions may occur in which radiation may be **reflected**. If radiated energy is come back unchanged from the surface of a medium with the angle equal and opposite to the angle of incidence, then it is called specular reflectance (e.g., like in a mirror). If radiated energy is reflected equally in all directions, it is called diffuse reflectance. Radiation or the energy may be **transmitted** or passed through the substance or phase. The velocity of EMR changes when it is transmitted from one medium like air into other substances or phase or medium. Radiation may be **absorbed** by a medium and give away as heat energy to heat the medium or phase. Radiation energy may be **emitted** or released by a substance in form of different EMR. Radiation may be **scattered** or dispersed, and the energy is deflected in any direction and lost into the atmosphere.

Types of Remote Sensing

1. Based on Source of Energy**: Passive remote sensing** uses natural energy source radiated or reflected from an object. An **active remote sensing** has its own source of energy, which is focused on the target to collect data of the reflected energy. When compared, flashlight photography at night is active remote sensing but daylight photography uses sun's light is passive remote sensing. Radio wave Detection and Ranging (RADAR) is a good example of active Remote Sensing which uses its own source of EMR.

2. **Based on platform used:**
   i. **Satellite based remote sensing :** It is a stable platform but need to wait a time for certain event and have fixed spatial resolution. Three types of Satellites are found, they are:
      - Low Earth Orbits/Satellites: Usually used in Military purposes
      - Sun-synchronous Orbits/Satellites: Most of the earth resources satellites are sun-synchronous orbit. (E.g., LANDSAT TM Satellites)
      - Geostationary Orbits/Satellites: At a height of around 36,000 km, which view the same portion of the Earth's surface all the time. For metrological observations

   ii. **Aerial surveying :** Collect data at any time with variable spatial resolution due to changing flight altitude and camera focal length. But it has high geometric errors and requires sophisticated geometric correction model and costly for small areas or specific purpose.

   iii. **Ground based remote sensing :** Scientific experiment purposes like crop canopy studies, soil physico-chemical studies, soil pollution, etc. Hand held Spectroradiometer is a good example of ground-based platform.

Advantages of Remote Sensing

1. Remote sensing can cover and identify very large areas in less time.
2. Remote sensing is an inexpensive and constructive method for creating maps
3. Remote sensing makes easy date collection over a variety of scales and resolutions.
4. There is no limitation on the amount of data that can be collected from a single remotely sensed image.
5. Remotely sensed data can be processed and analysed using GIS tools and that data can be utilized for various application.
6. Passive remote sensing does not disturb or affect the targeted object.
7. Large data can be collected through remote sensing which minimizes the field work.
8. Remote sensing can repeat coverage over course of time.
9. It is easier to monitor floods or forest fire using remote sensing.

Limitations of remote sensing

1. Remote sensing is expensive for smaller or specific areas.
2. Remote sensing needs special trained personnel to use this technology.
3. Powerful EMR used in active remote sensing systems may affect the target.
4. The image may be sometimes be affected by other phenomena and introduce error to the result.
5. It is easier to introduce human error during data collection and calibration.
6. Different models need to be prepared regularly to gain precision and preparation of models is sometimes time consuming.
7. The information provided by remote sensing data may not be complete and may be temporary and need to be corrected regularly.

Applications of Remote Sensing

1. Agriculture: Agriculture plays an important source of income and livelihood in almost every country. Use of satellites and airborne images are used to map, classify the crops and soil, examining and monitoring their healthiness. Agricultural applications include crop classification, crop yield estimation, mapping of soil characteristics and soil management practices, monitoring of the crops and soils, and irrigation scheduling in standing crops (Jones and Vaughan, 2010).
2. Forestry: Forests are a valuable resource provider and it balance the various important earth systems. Various applications in Forestry include collection of forest data and monitoring the forest cover, vegetation types, density, and their measurement, and mapping of forests.
3. Geological applications of remote sensing include structural mapping, sand and gravel aggregate exploration, mineral exploration, geo-botanical mapping, sedimentation and geo-hazard mapping and their monitoring.
4. Hydrological and Sea Ice applications include river and delta change, flood, and lake ice mapping and their monitoring, drainage basin mapping and watershed modelling, wetland mapping and monitoring, snow pack, ice and its thickness measurement and their monitoring, iceberg and glacier dynamics detection and monitoring, meteorological / global climate change research and pollution monitoring in hydrosphere (Navalgund et al. 2007).
5. Land Cover & Land Use applications of remote sensing include natural resource and land use classification and management, wildlife habitat monitoring and protection, urban data collection, expansion, planning and mapping, natural resource extraction activities and its identification.
6. Oceans & Coastal Monitoring includes ocean current pattern, regional circulation identification and monitoring, Storm forecasting, ocean water temperature, gases, and pressure monitoring, phytoplankton and corals diversity and concentration, fisheries surveillance, marine diversity assessment, oil spills and its prediction in extent and effects, Shipping navigation, routing, and traffic monitoring, coastal vegetation mapping (Sabins Jr. 1987).

Conclusion

Remote sensing can cover large areas rapidly and is an inexpensive method to create maps. Remotely sensed data can be processed and analysed using GIS tools and that data can be utilized for mapping, monitoring, measurement, and management in across disciplines. Large amount of data can be collected along with repetitive coverage can be done through remote sensing which minimizes the field work. It is easier to monitor the change in weather, floods or forest fire using remote sensing. The main limitation is that it is expensive to cover and study smaller areas and it requires special training to utilize this technology.

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