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A Brief Technical Review Of Remote Sensing: Application And Challenges

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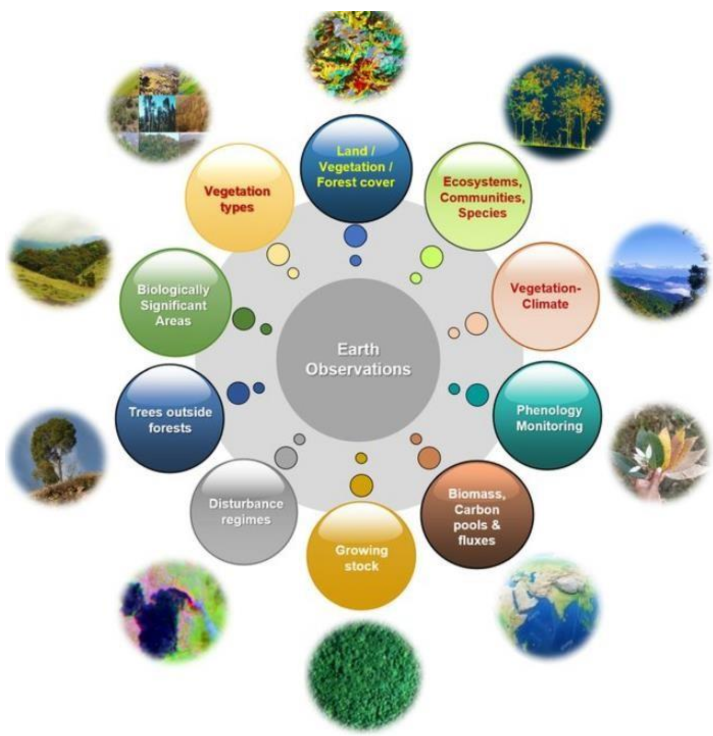
Abstract
Remote sensing is the science of identifying the earth's surface characteristics and estimatingtheir characteristics. Remote means something that is not physical contact but far away. Remote sensing is an overly complex system. This system uses a satellite equipped with a sensor for sensing data from remote locations. It is used for geological, ocean studies, forestry, and data for remote locations. In this paper, we have studied remote sensing technology and types of remote sensing. We also talked about the challenges of remote sensing in detail. The applications are very important for any scientific technology. This paper explains in detail of remote sensing technology as well as its challenges and applications.

Keywords: Remote, Sensing, Passive, Active, Satellite, Sensors.

1. Introduction

Remote sensing is made of two words, i.e., remote and sensing. Remote means something which is not precisely in contact or physical contact, something that is far away. The far awaycould be something that is slightly away or even very far away, and sensing the second word,sensing, means getting information or data and getting any input. The input could be something like temperature pressure photographs [1,2]. When you look at these two terms, remote sensing, people usually think of one technology: satellite remote sensing. Remote sensing is well defined as remote sensing used primarily for the technology where we have sensors on satellites orbiting around Earth which have scanners and cameras on them whichare scanning the earth surface and link the images and since its collecting information aboutthe Earth's surface from far away [3]. The example is remote sensors like your sonography medical imaging and simple X-rays because you get information and data without physical contact [4]. After knowing about remote sensing, we have to look at the working process of remote sensing. We have to get information about any objects that object will need to be illuminated. You can see me now so the primary need for any remote sensing has a source of illumination and conventional illumination is only in the visible Spectra which means light the way our eyes perceive light remote sensing is also done in other wavelets like in the infrared in the radar region in the thermal infrared [3,6]. In general way, the sunlight falls on the surface of earth through the different layer of the atmosphere. The interaction of sunlightto surface of earth and different types of object on the earth. The reflection of energy is depend on the intrinsic properties of object. So, the energy received by the sensor are different for different object [7,8]. It would be detected by a sensor or eyes of human beingsto see these objects. In other words, remote sensing is the process of sensing and supervisingof the properties of reflected and absorbance spectra in the path.

Fig. 1. These are a broad area application of remote sensing [ref_9].



The application of remote sensing is extensive because it take image of any part of the Earthfrom the cameras on the satellite. It is used for the take image of ocean and analysed the physical properties of the ocean, such as temperature, level etc [10]. It is used in agriculture, remote location information, large forest fires can be through remote sensing from satellite cameras, tracking the movement of clouds to predict the weather or about natural disasters [11,12]. The mapping of mountain ranges, agriculture fields, river paths, and magnetic striping of ocean can be done with the help of remote sensing.

2. Review of literature:

Remote sensing aerial photography started with the camera's invention in 1800. The lightweight camera was mentioned earlier for pigeons to take aerial photographs in 1903, and then in 1909, Wilbur Wright took the first aerial photograph from an airplane in world wars I and II [13,14]. The cameras were often mounted on airplanes to get land views of an invaluable military survey in World War II. The use of remote sensing methods in farming has been practiced. The term "remote sensing" was coined in the 1930s and 1940 [15]. Remote sensing systems use high-resolution images for analysis. So, it needs massiveamount of storage of data [16]. The processing of recorded data is not an easy task because the data recorded is a very huge amount. They need specific algorithms or software for the process of big data [17]. Cloud computing systems have been applied to store, development,and utilize huge quantities of data for products. These innovative data acquisition and deal with methods have been used worldwide to facilitate the decision-making process for crop area, agriculture, grazing land, and livestock [18,19].

In last decades, several studies have published. Some of them are discussed here the microwave radiation penetrates in soil and emission from that they measured moisture contents in soils [20]. They have used passive microwave radiometry to investigate atmospheric and hydrological models for the surface of the soils. The microwave approachescannot be used to estimate soil moisture in forest regions. The microwave emission from anyobject is different and its depends on the physical properties of the object such as the dielectric constant and its temperature [21]. In another way, the response array of different objects. We can distinguish on the basis of these physical parameters of that. The wavelengthof the electromagnetic wave plays an important role in distinguishing the different objects. The wavelength of a microwave depends on the physical properties as well as the intrinsic properties of objects [22,23,24]. The interaction of microwaves with the sensors through theenvironment such glass, soil, forestry, ocean, metal ,water. The remote sensors have been sense their wavelength and output as images. The commonly applied remote sensingsatellites from NASA and ESA [25,26].

3. **Technology and its operations:**

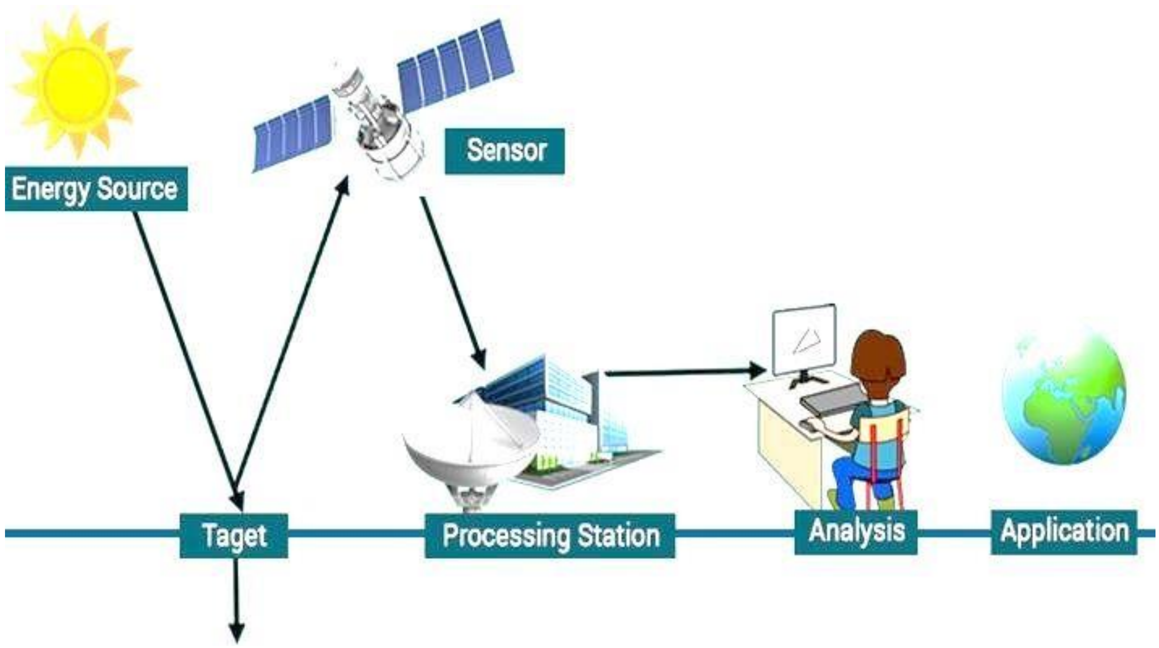


Fig. 2. Components of remote sensing [ref_27].

Remote sensing is not a device. It is a complete system or technology i.e., and it has various components such as energy source, sensors, processing station, analysis system, and applications: The main components of remote sensing are discussed as follows [28]:

(i) Source: The first necessity for remote sensing is an electromagnetic wave that radiates to the surface of the earth. Passive remote sensing systems depend on the energy of sunlight,but active remote sensor utilized their own energy source.

(ii) Interaction of energy: The interaction of electromagnetic energy with the earth's surface features results in signals. These signatures are valid for detecting, identifying, and analyzing earth's surface features.

(iii) Received Energy: The sensor records the electromagnetic energy reflected by the target. Sensors are electronic devices that are installed on satellites. These sensors are susceptible to wavelengths. No single sensor is sensitive to all wavelengths and has fixed spectral and spatial limits.

(iv) Data processing and transmission: The sensor's EM energy is electronically transmittedto a ground-based earth station. These recorded data have been converted into an image aftervarious levels of correction.

(v) Data analysis: The trained people visually/digitally interpret the processed image to extract info about the elements of the surface of earth.

(vi) Application: There are several applications of remote sensing. It is used for monitoringof forestry, ocean temperature, natural resources, agriculture land, hill areas and urban planning can all benefit from the information extracted from imagery.

Remote Sensing devices are broadly categorized into two types based on the sensor used intechnology:

3.1 Active remote sensing:

It makes use of its electromagnetic energy source. The sensor sends radiation in the directionof the target or object and receives it back at the input of energy-measuring sensors, such asRADAR and LIDAR. Remote sensing understands active remote sensing as in when you have a satellite which is equipped with a radar transponder its sending out radar waves radiowaves which bounce off from the earth surface the time required for the waves to include surface and their recorded by sensors on the satellite is what is utilised for making an imageit's an excellent example of active remote sensing.

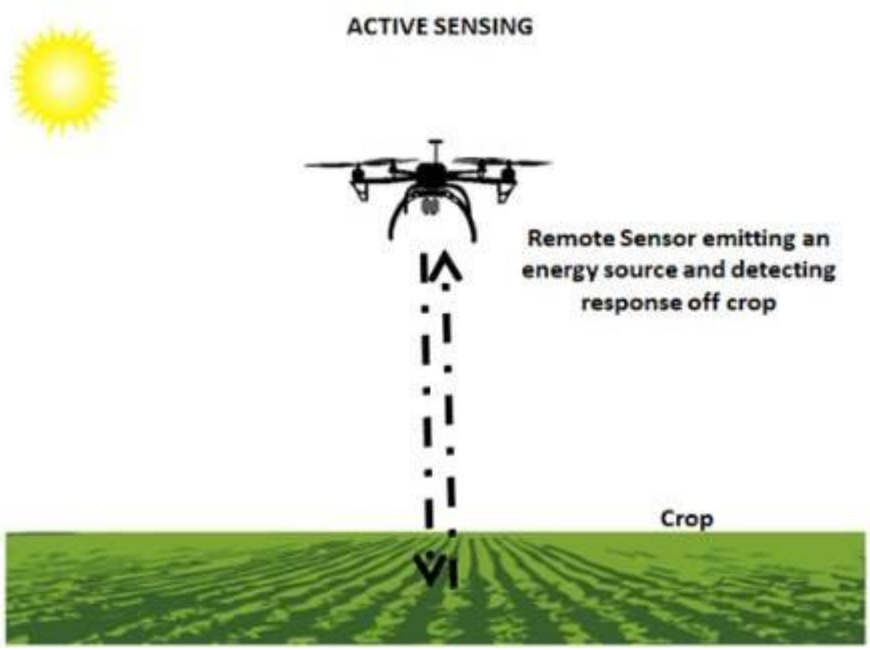


Fig. 3. The working process of active remote sensing [ref_29]

3.2 Passive Remote Sensing:

It gets its electromagnetic energy from the sun. Passive sensors pick up energy that is emittedor reflected naturally by objects or the environment. The remote sensing there is a digital camera in front of me its imaging me a collecting data of photographing me only because I am being illuminated by camera light. This is very similar for passive remote sensing, the sun illuminates the earth and reflected from the earth surface is collected by the satellite so the sensor. Sensor itself is not having a source of illuminating the ground surface or the objectwhich it is imaging the sun earth and satellite sensor. Passive remote sensing which passivebecause the sensor is not carrying its own source of energy. Examples include infrared sensors and charge-coupled device (CCD) cameras.

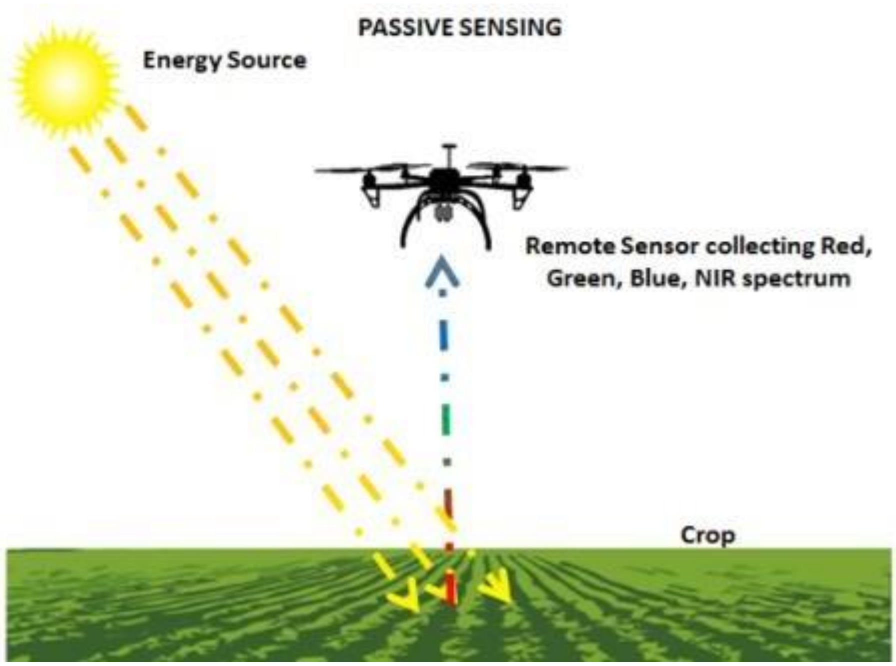


Fig. 4. The working process of passive remote sensing [ref_29]

4. Applications of remote sensing:

There are various applications of remote sensing, important applications are as follows [30]:

- **(i) Agriculture**
- **(ii) Forestry**
- **(iii) Geology**

- **(iv) Hydrology**
- **(v) Sea ice**
- **(vi) Land cover and land used**
- **(vii) Ocean and costal monitoring**
- **(viii) Atmosphere monitoring**
- **(ix) Metrological parameters measured by remote sensors**
- **(x) Develop online mapping service**

5. Challenges:

There are various challenges in application of remote sensing. The big data handling is the key challenges of remote sensing. Many different countries are data used for different applications success natural hazards monitoring global climate change, urban planning. Because remote sensor records the images with very resolutions. The atmospheric environment affecting the process of remote sensing. Because the electromagnetic energy travels very long range to reach on target and reflected back to the sensors. So, atmosphericenvironment correction in recorded data is very hard to tackled. The classified the multispectral images are very hard [31].

6. Conclusions:

The remote sensing is nothing else and observing an object from a distance without physicalcontact. So mostly when we talk about remote sensing, we talk about satellite remote sensingthat means a satellite is actively and passively working. Remote sensing can also go down tovery close range applications and it always depends what you want to do and which application you want to solve that observed the activity of field, forestry, climate, mountain,agriculture field on the earth. Satellite remote sensing that means satellites observe the earthfrom space and help people to study large areas that means you are surface and but also theirchanges overtime. Especially changes are very important you can think of coastal areas. Example when we deal with climate change science, remote sensing take very important role.

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