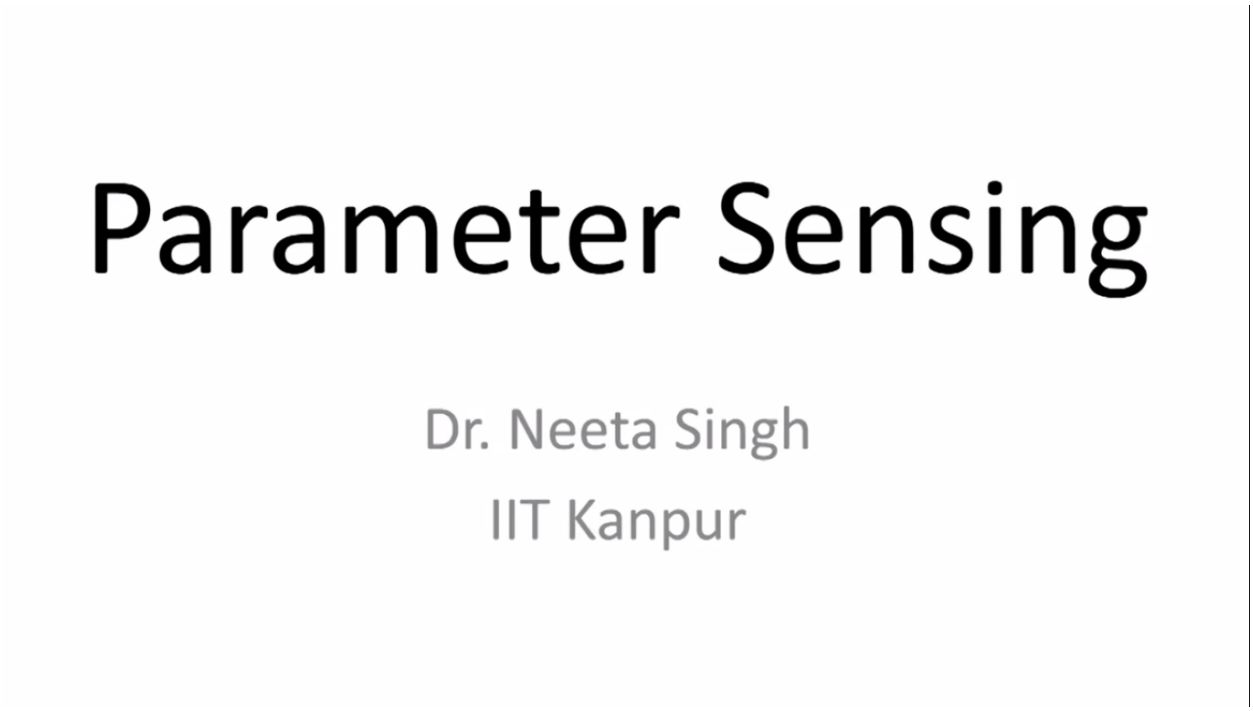

Parameter Sensing

Dr. Neeta Singh

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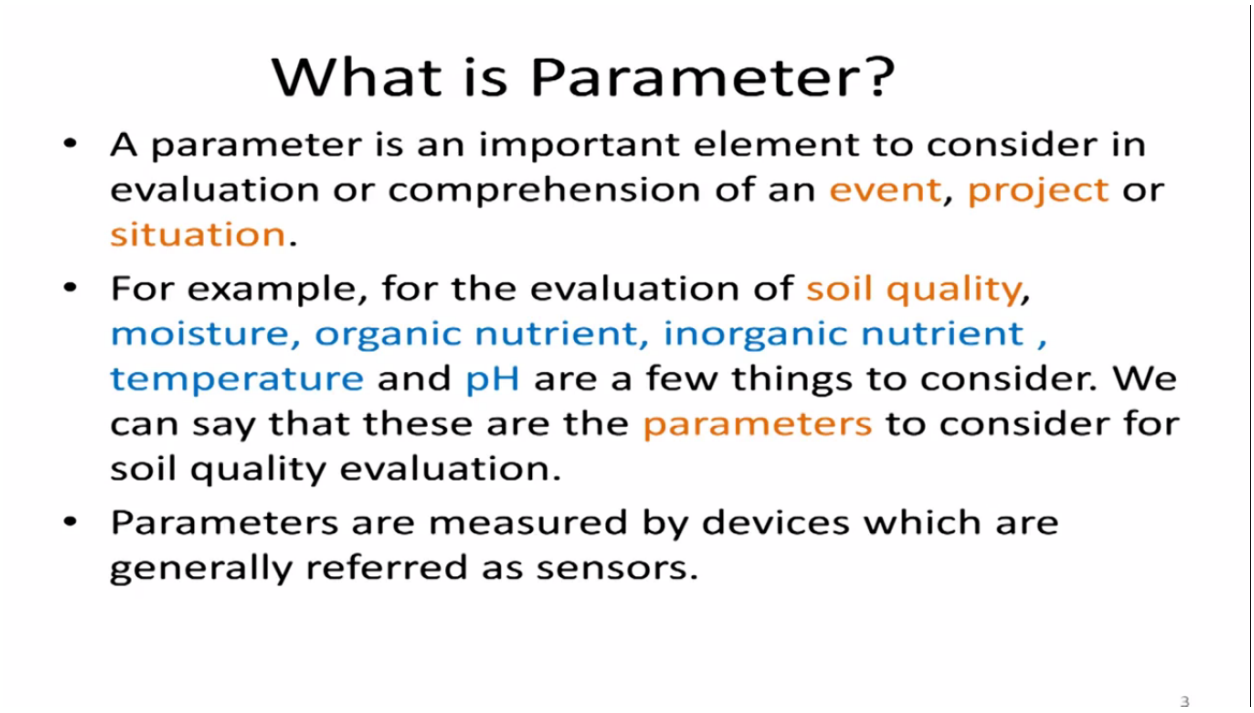
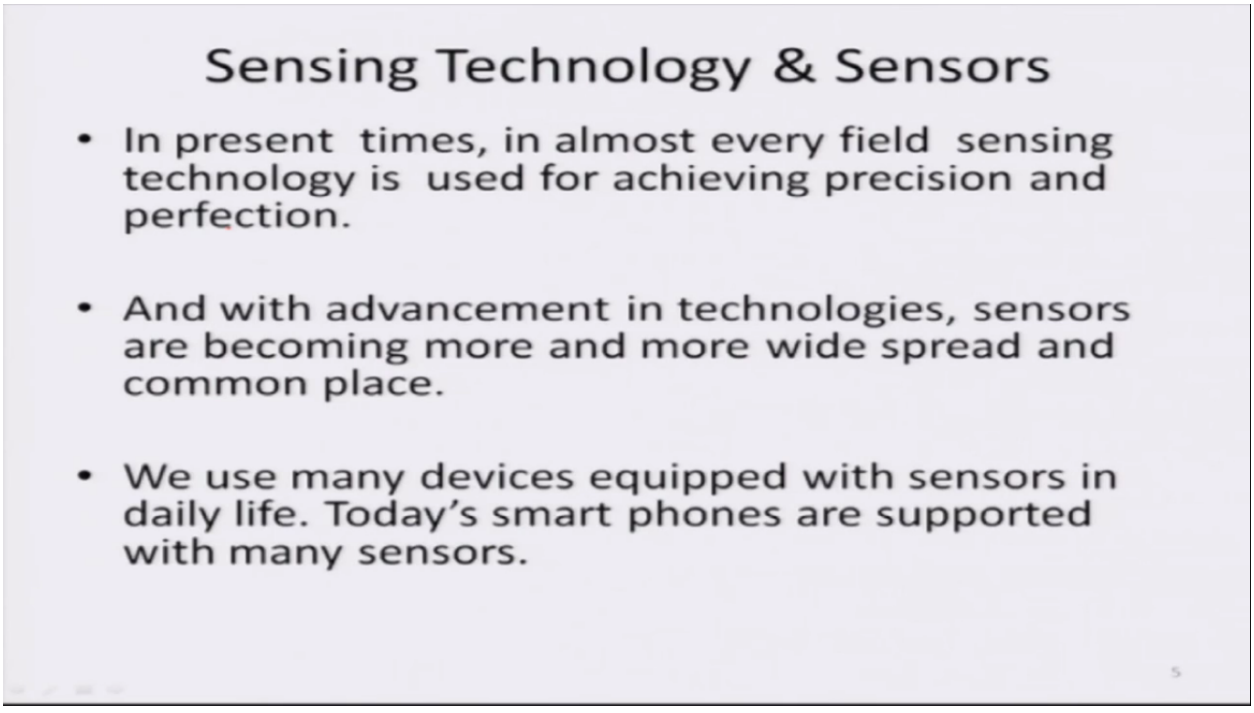
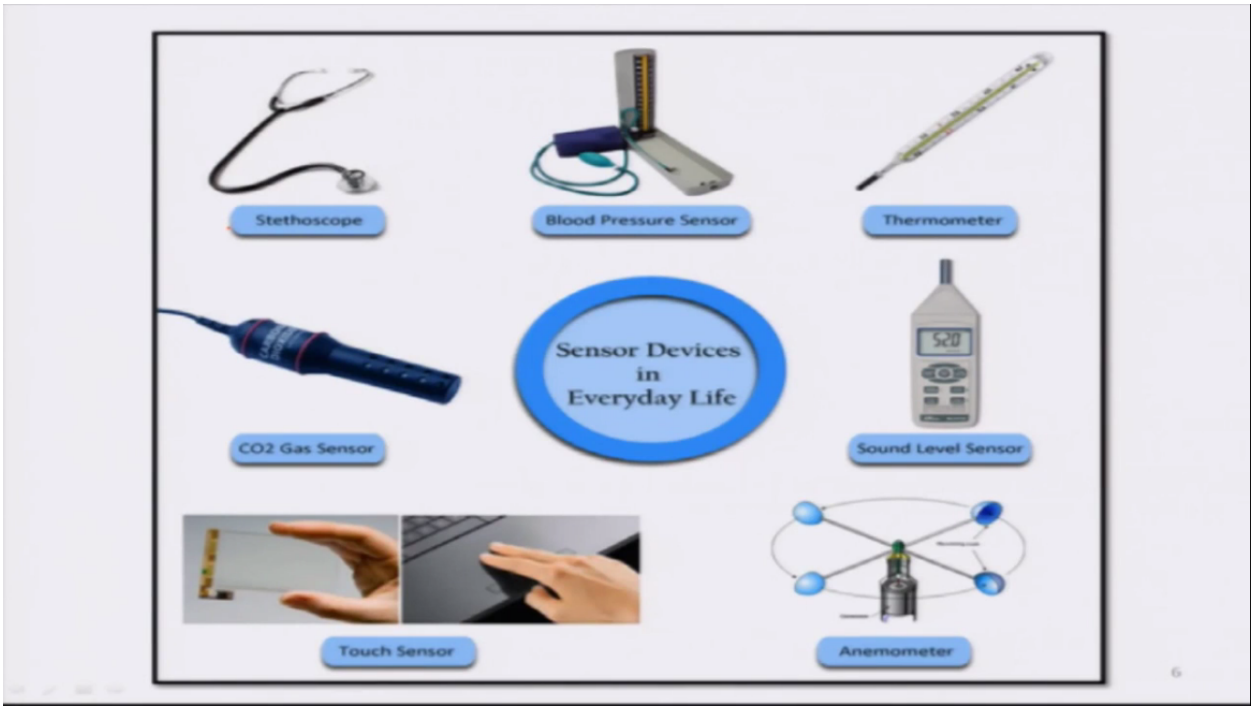
Hello and welcome to this lecture on parameter sensing. I am Neeta Singh with AG MOOCs team at ITK.



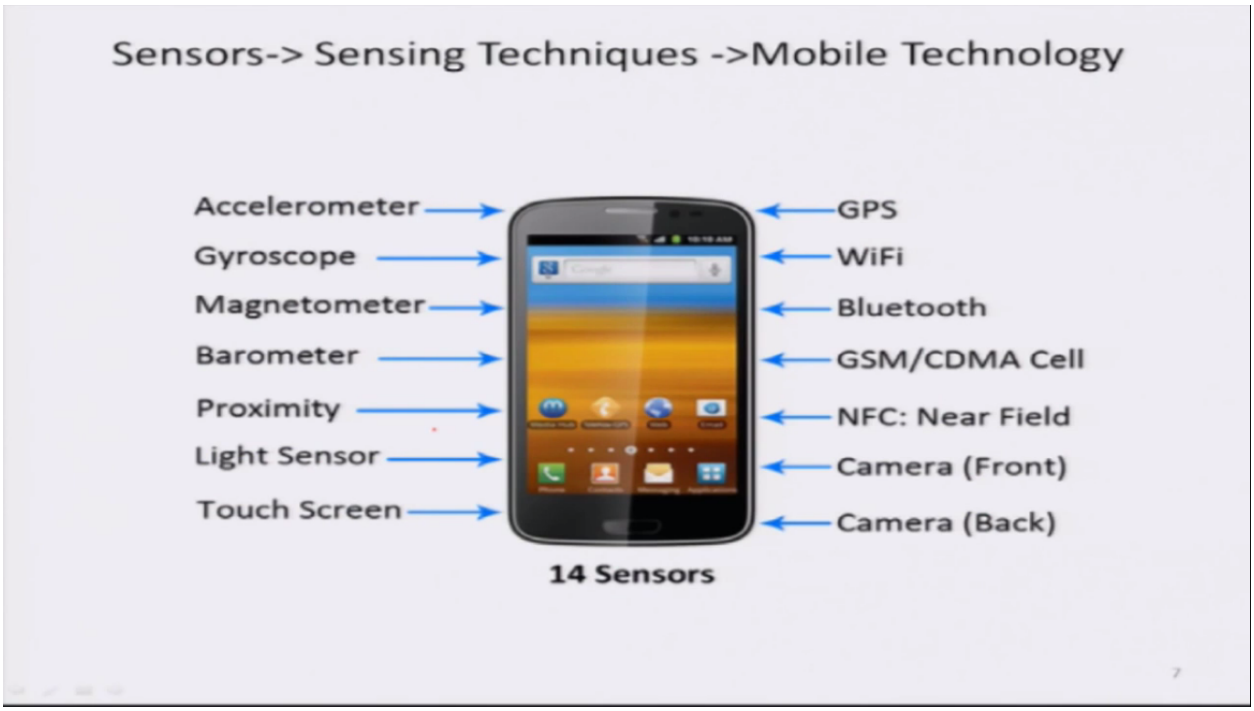
Let's see what is parameter. A parameter is an important element to consider in evaluation or comprehension of an event, project, or situation. For example for the evaluation of soil quality, moisture, organic nutrient, inorganic nutrient, temperature, and pH are a few things to consider. We can say that these are the parameters to consider for soil quality evaluation. Parameters are measured by devices which are generally referred as sensors.



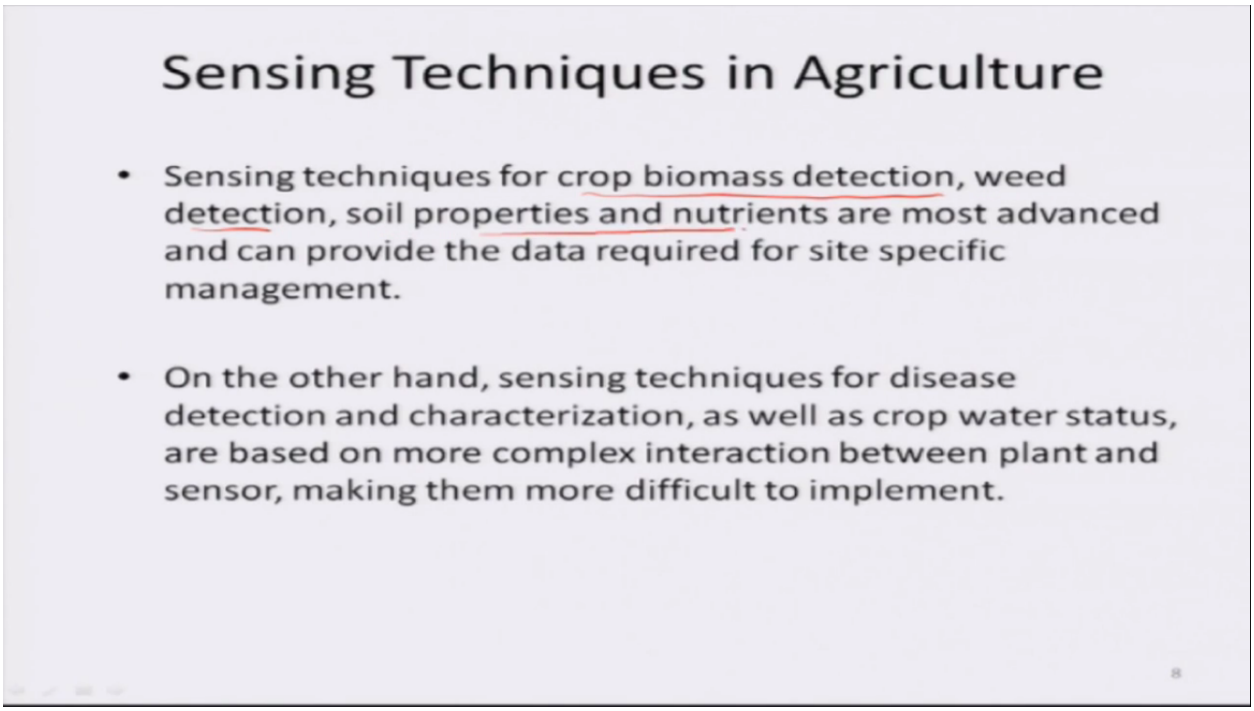
Sensors are tools for sensing technology. In present times in almost every field sensing technology is used for achieving precision and perfection and with the advancement in technologies sensors are becoming more and more widespread and common place. We use many devices equipped with sensors in daily life. Today's smartphones are supported with many sensors.



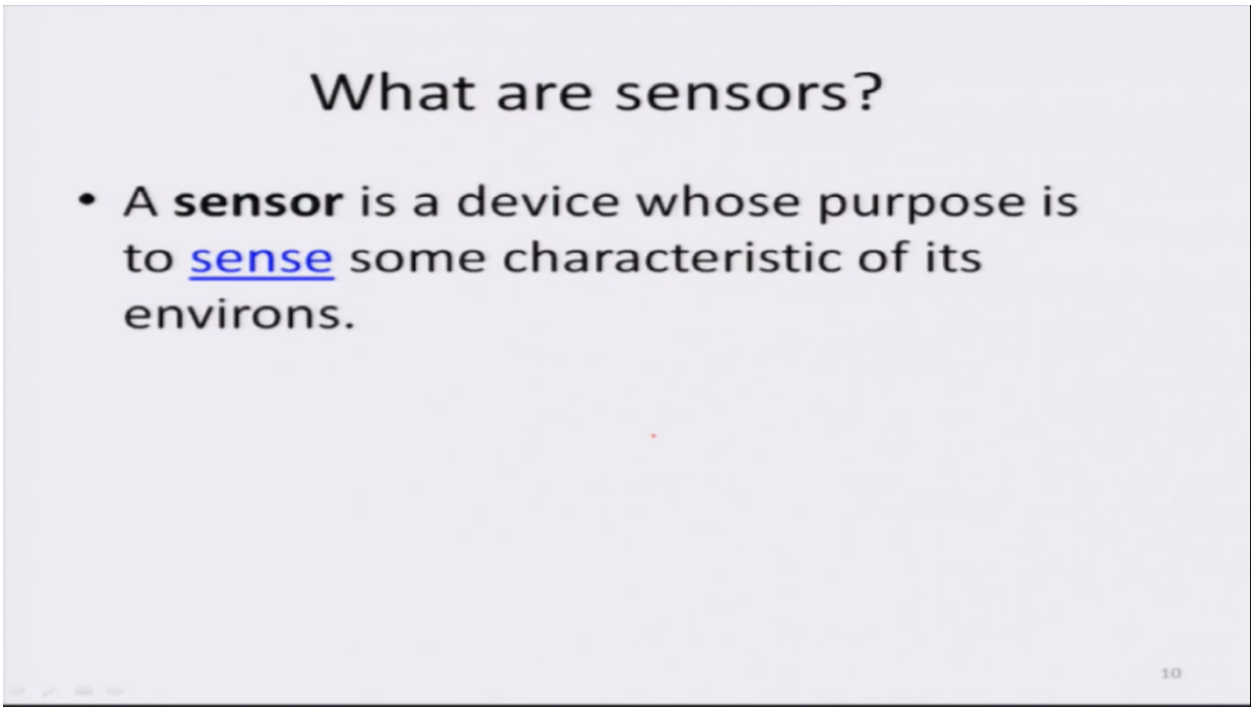
Here are a few very commonly used sensor devices. You must be familiar with most of these devices like stethoscope, blood pressure sensor, thermometer, sound level sensor, anemometer, touch sensor, CO2 gas sensor.



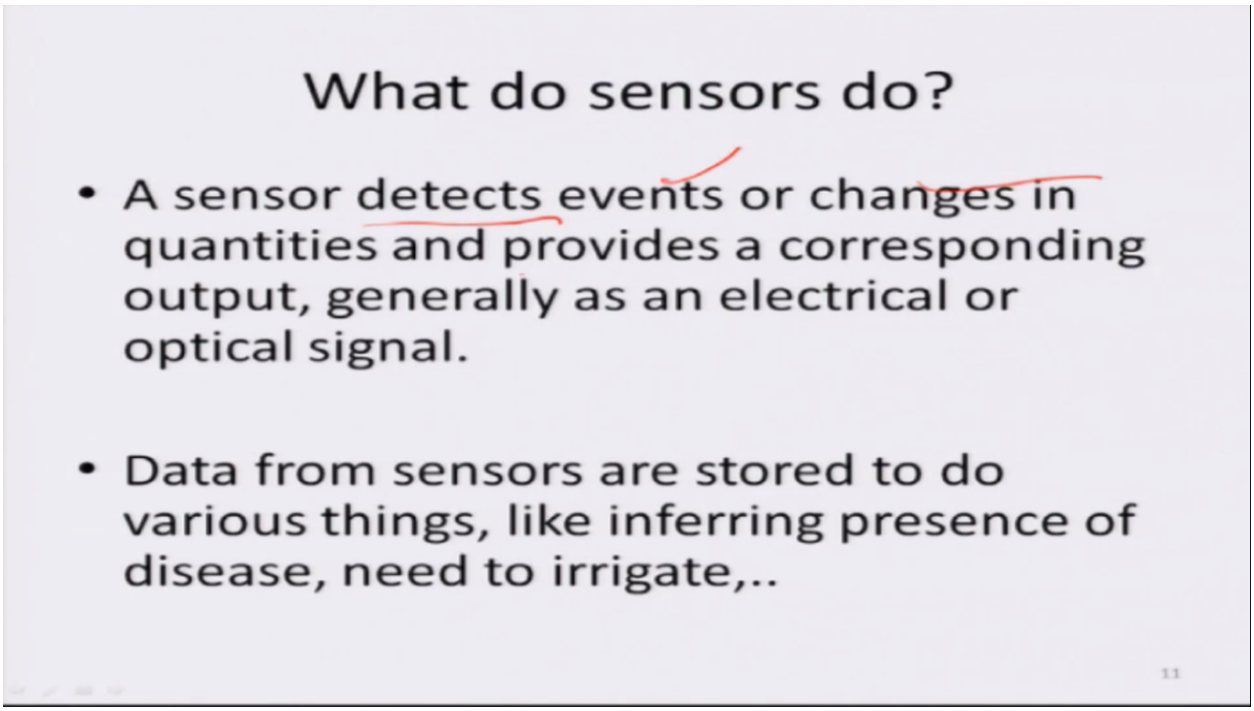
Mobile technology uses many sensing techniques and a smartphone is generally equipped with proximity range sensor, touch sensor, tilt sensor, and as you can notice that there are 14 sensors in this picture.



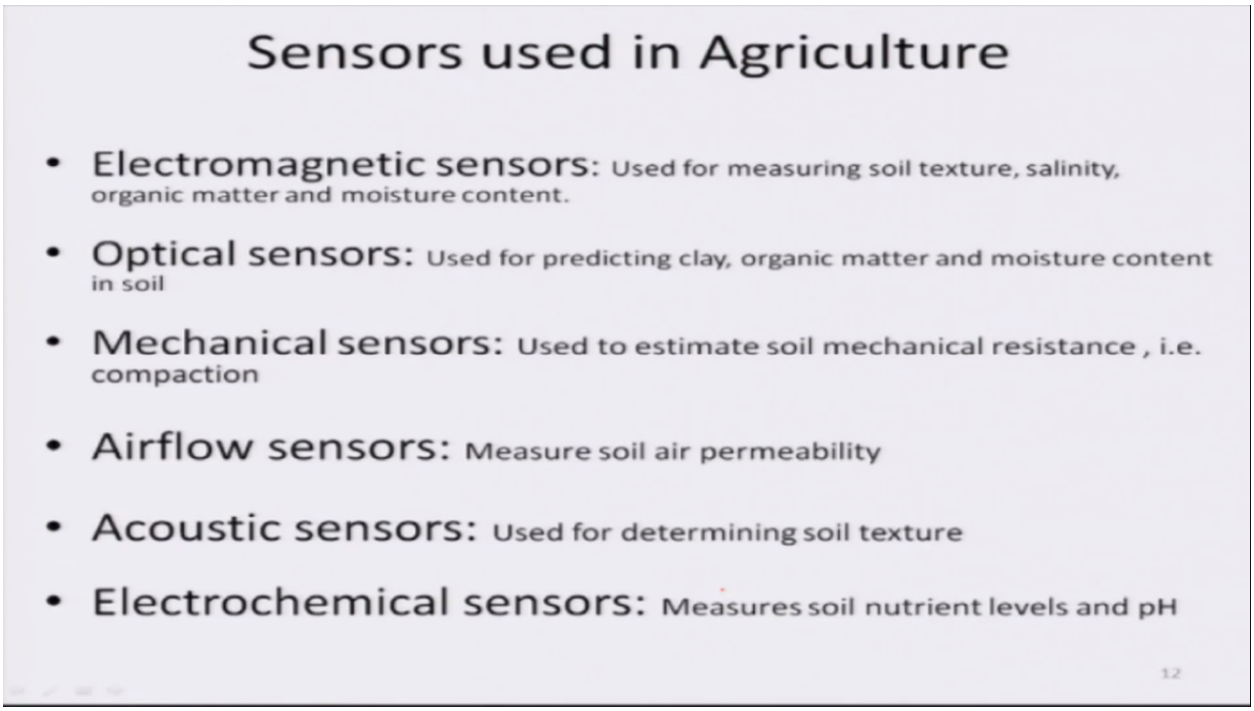
In agriculture sensing techniques for crop biomass detection, weed detection, soil properties and nutrients are most advanced and can provide the data required for site-specific management. On the other hand, sensing techniques for disease detection and characterization as well as crop water status are based on more complex interaction between plant and sensor, making them more difficult to implement.



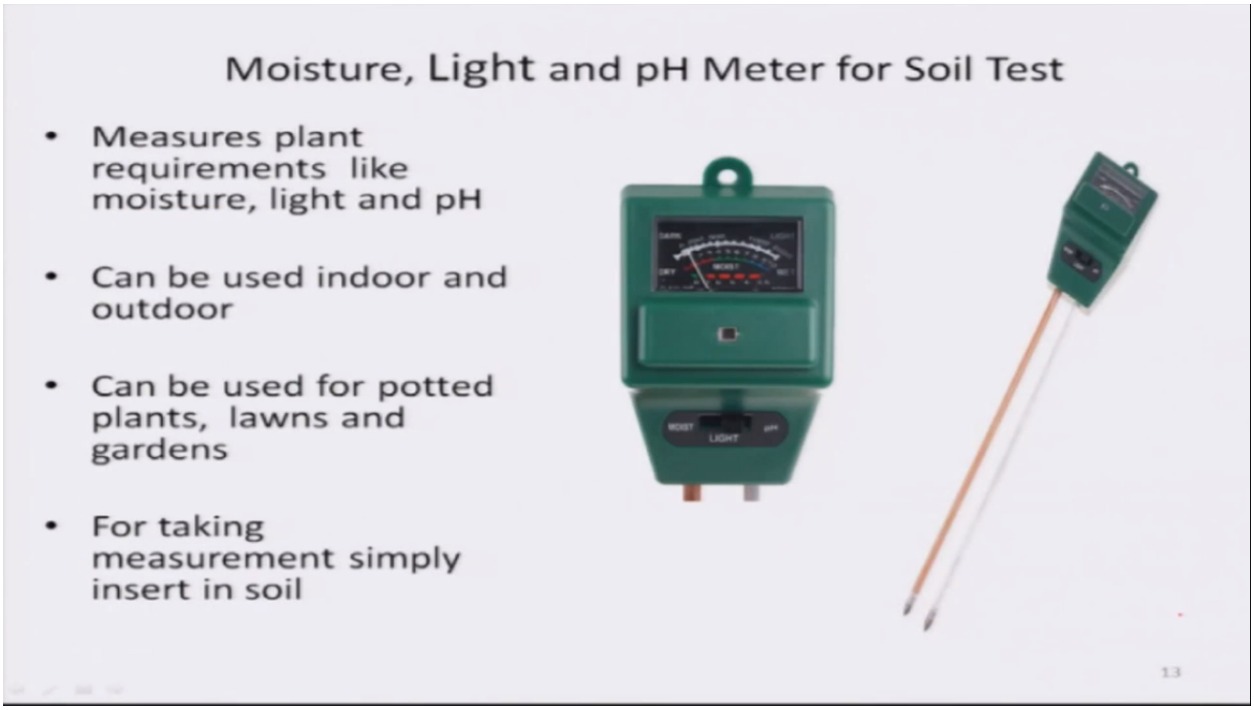
Let's understand sensors. What our sensors? A sensor is a device whose purpose is to sense some characteristics of its environs.



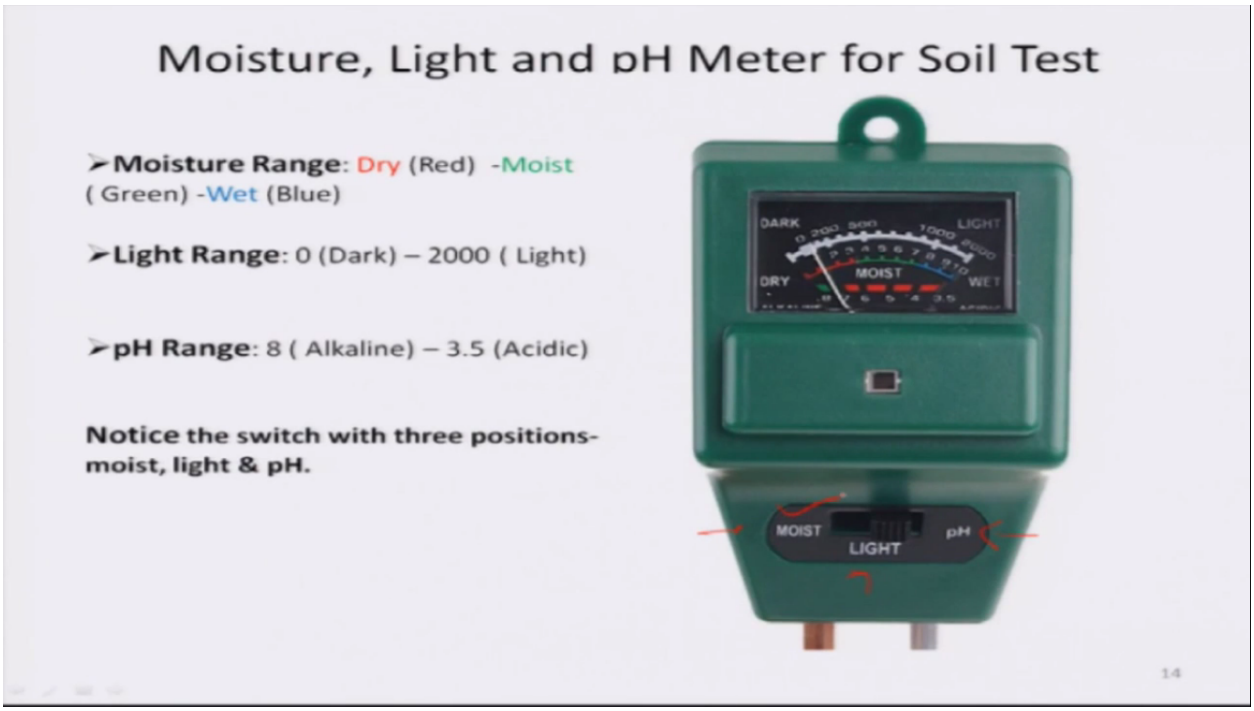
What do sensors do? A sensor detects events changes in quantities and provides a corresponding output generally as an electrical or optical signal. Data from sensors are stored to do various things like inferring presence of a disease, need to irrigate, etcetera.



A variety of sensors are used in agriculture these days. They can be broadly put under the following categories. Electromagnetic sensors; these are used for measuring soil texture, salinity organic matter, moisture content. Optical sensors; used for predicting clay, organic matter, moisture content in soil. Mechanical sensors; used to estimate soil mechanical resistance that is compaction. Airflow sensors measure soil, air permeability. Acoustic sensors used for determining soil texture. Electrochemical sensors measure soil nutrient level and pH.



To see how sensors are helping in collecting information about various plants and soil related parameters we are going to see the functioning of a very simple moisture light and pH meter for soil test. The speeder measures plant requirements like moisture, light, and pH. It can be used indoor and outdoor. It can be used for potted plants, lawns and gardens and for taking measurement it is simply inserted in soil.



The meter has a switch with three settings; for moisture, light, and pH. When the switch is on moist the needle gives reading for moisture level. When it is on light it gives reading for the light intensity. When it is on pH it tells pH level. As you can notice moisture range is from dry to moist to wet. Light ranges from 0 to 2000 and pH range is from 8 to 3.5.

Here is a short video and some other activities to show how a simple meter like this can be useful for maintaining healthy plants and gardens whether it's reading for pH, moisture, and light.

[Video Playing]

Hello. Now we are going to see the functioning of this 3 in 1 meter. In the first set up I have three soil samples and we are going to see the moisture level in these three soil samples. I will first put the switch on my side. Then I will insert the probe in the first sample and now the meter should tell the moisture level. As you can see the soil is very dry and our meter reading is zero. Now we will check the moisture level in the second sample. I will take the meter out and put it in the second sample. Let's see what's the reading for the sample. As you can see the moisture reading in this sample is A, on a scale of 1 to 10 which means it is on the moist side.

Now we will check this moisture level in the third sample. As you can see in the third sample the moisture reading is maximum which meets soil is very wet. This shows how sensitive this meter is.

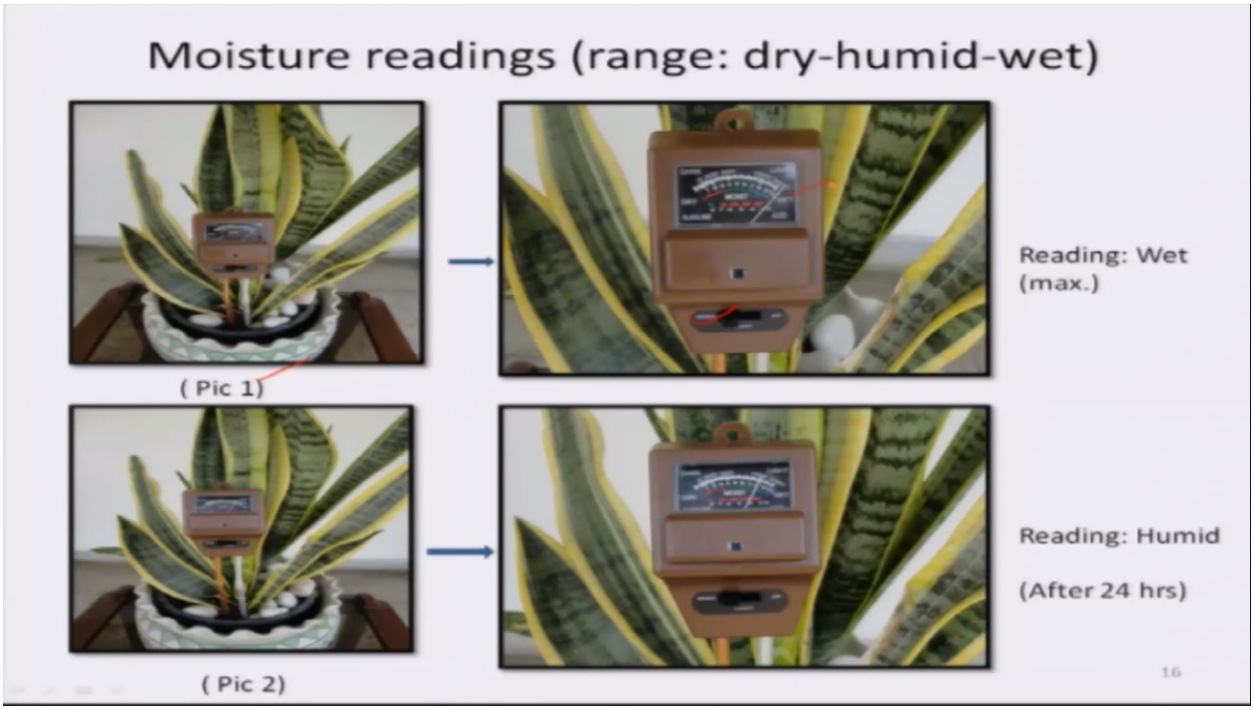
In another setup I have three samples and I am going to check the pH level of these samples. For that I am going to put the switch on the pH side. Now I am going to put this meter in the first sample. Let's check the reading. It is on 8 which means that the sample is on the alkaline side.

Now I am going to put this meter in the second sample and let's see the reading in this sample. It is still on the alkaline side but it has shifted slightly on the left hand side which means the pH level has moved toward towards the acidic side.

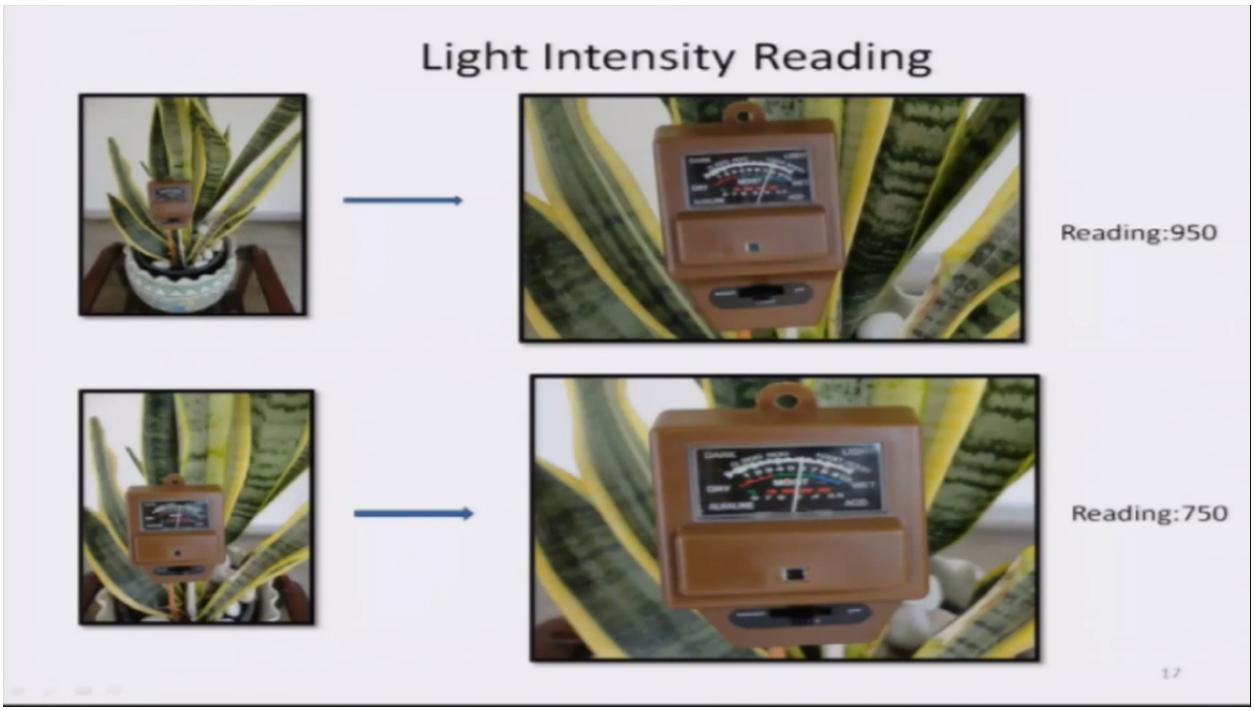
In the third sample let's see what is the pH value. As you can see it is taking some time for the probe to read the pH level in this sample and it is 5.

Let's take the light intensity with the help of this meter in and around this building and for this I am going to put the switch on light side. As you can see the needle has not moved from zero position on the scale of 0 to 2000 needle is showing 0 lightened intensity for inside the building. Now we will move from here and check light intensity for different places outside this building.

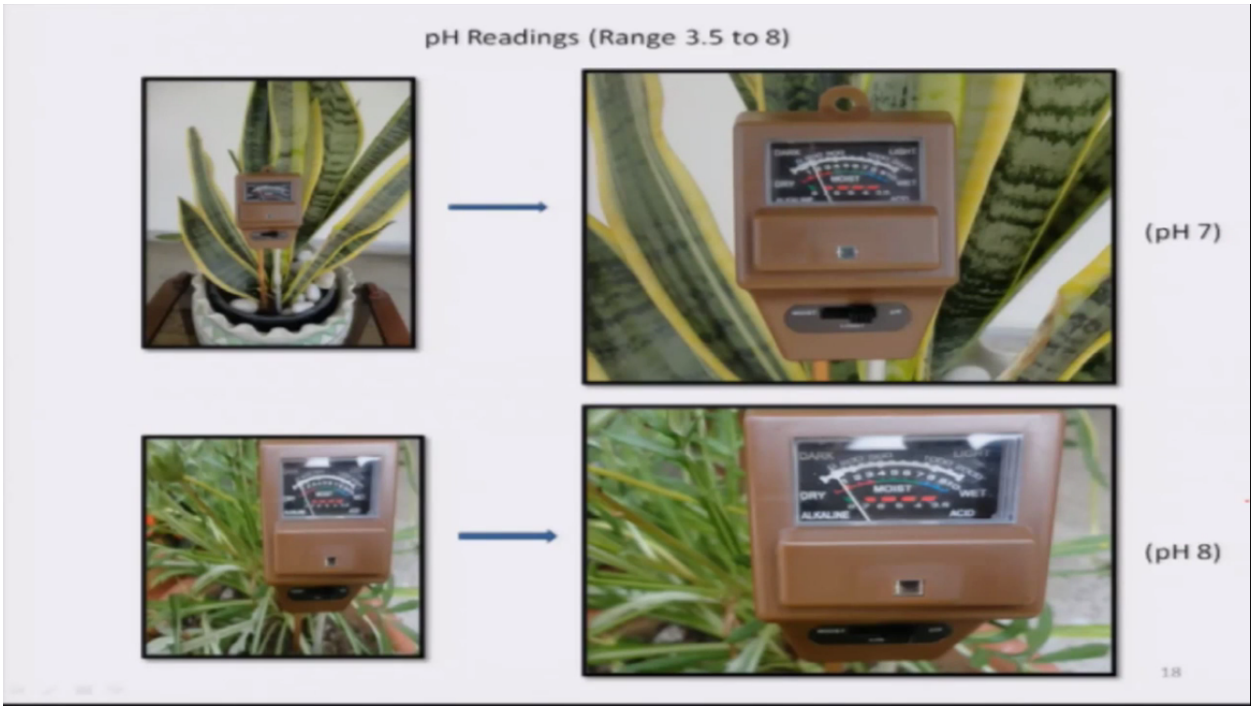
Now we are standing right outside the building and let's see what is the light intensity in this portion. Now we will check intensity reading for full sunlight. As you can see it is at maximum which is 2000. Now we will see moisture, light, and pH data for potted plants.



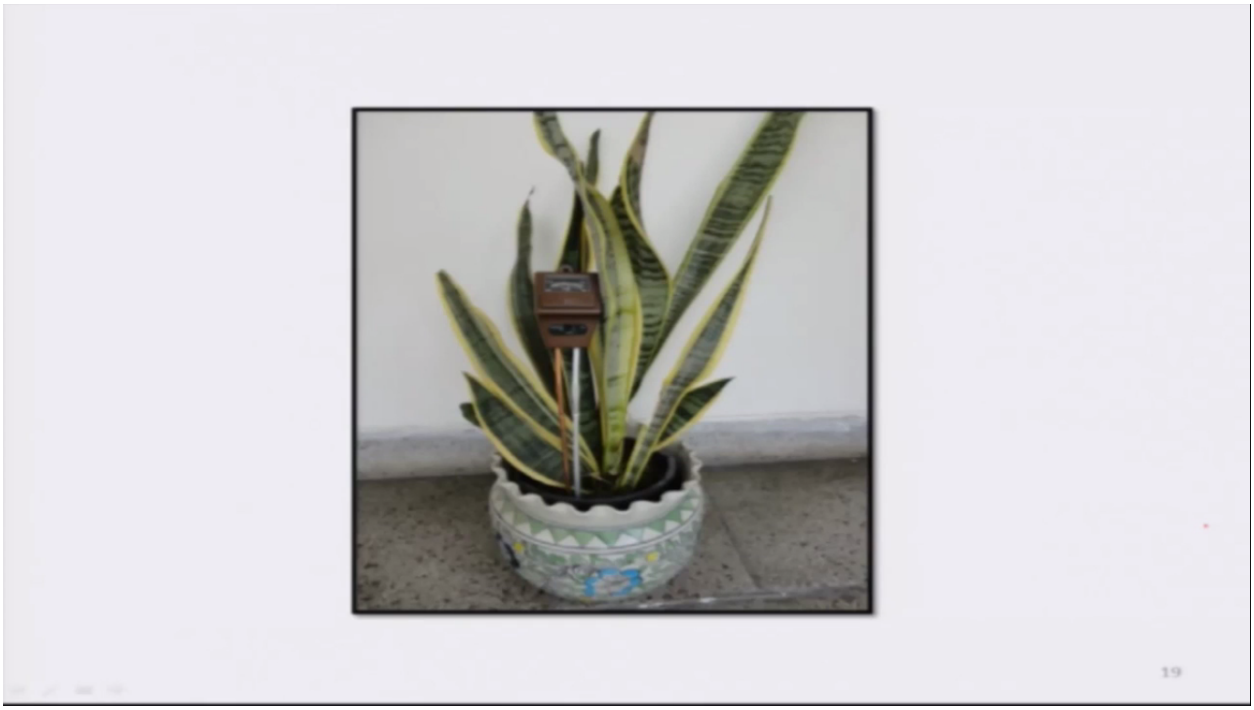
For moisture reading switch is set to moist position. In picture one needle is showing maximum reading when the reading was taken after one day. The moisture content had decreased and the needle had moved back as you can notice in picture 2.



For light measurement the switch was set to light position and reading taken two different locations were 950 and 750. As you can see for two different pots pH readings are different.



Simple sensors like this can be used for the maintenance of healthy potted plants, flower beds in the garden, and lawns.



Agriculture sensing technology has made great advancement. Sensors and sensor boards are integral part of sensing technology. Sensors are available for measurement of air temperature, humidity, soil temperature, moisture, leaf wetness, atmospheric pressure, solar radiation, ultraviolet radiation, trunk diameter, stem diameter, fruit diameter, anemometer, wind vane, pluviometer, luminosity. Sensor boards are equipped with some pins to connect to sensors. Microcontrollers which can be programmed to interpret the data from the sensors. A USB port to send the data. Wi-Fi to connect to wireless network for monitoring systems.

Agriculture sensing technology

Sensors

- Air Temperature
- Humidity
- Soil Temperature
- Moisture
- Leaf Wetness
- Atmospheric Pressure
- Solar Radiation - PAR
- Ultraviolet Radiation - UV
- Trunk Diameter
- Stem Diameter
- Fruit Diameter
- Anemometer
- Wind Vane
- Pluviometer
- Luminosity

Sensor Boards

These are equipped with:

- Some pins to connect to sensors.
- Microcontrollers which can be programmed to interpret the data from the sensors.
- A USB port to send the data .
- Wi-Fi to connect to wireless network for monitoring system.

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A sensor board allows many sensors to be connected at one place. Many sensor boards are connected through Wi-Fi to form sensor network for monitoring systems. A sensor network can measure irrigation effectiveness, crop growth, and micro climatic conditions as well as detect adverse weather events. The sophisticated monitoring brings extreme precision to crop growing by enabling irrigation and climate control to be matched to local conditions.

Agriculture Sensing Technology

- A Sensor Board allows many sensors to be connected at one place.
- Many Sensor Boards connected through Wi-Fi to form Sensor Network for monitoring systems.
- A Sensor Network can measure irrigation effectiveness, crop growth and micro-climatic conditions as well as detect adverse weather events.
- This sophisticated monitoring brings **extreme precision** to crop growing by enabling irrigation and climate control to be matched to local conditions.

Contd.

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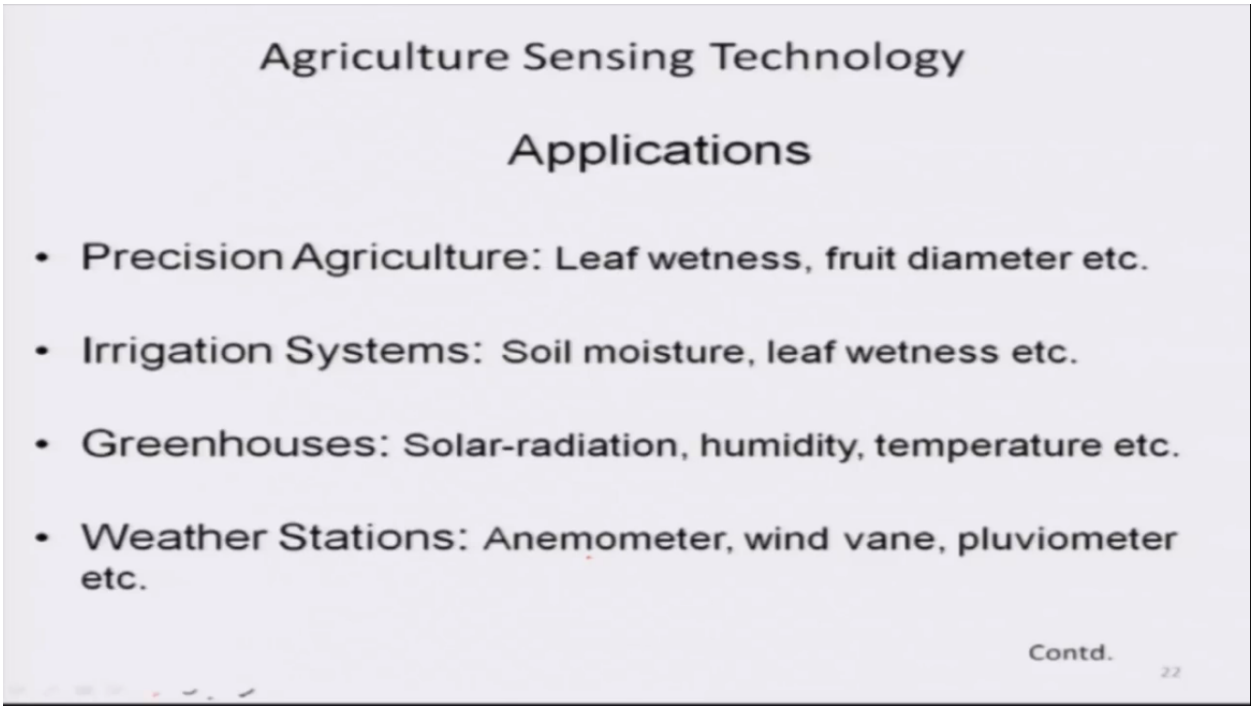
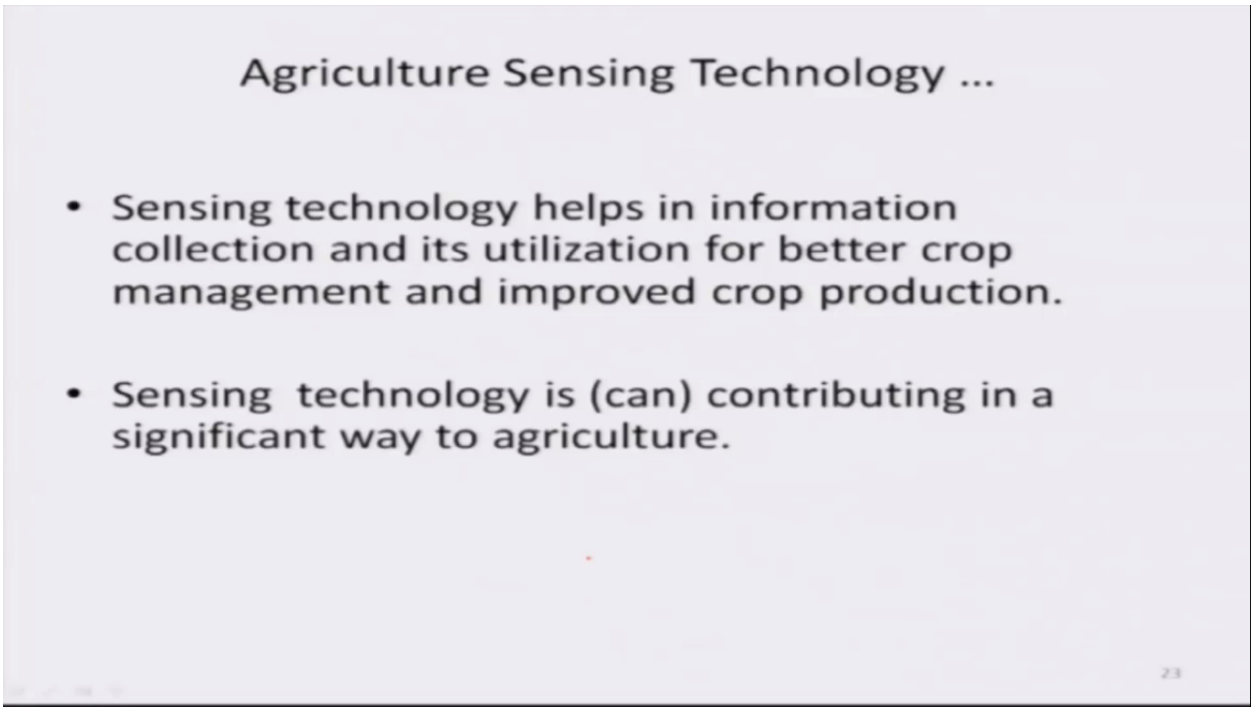
Application of sensing technology is in precision agriculture where leaf fitness, fruit diameter are important parameters. In irrigation system soil moisture, leaf fitness are measured. In greenhouses solar radiation, humidity, temperature are important parameters. In weather stations anemometer, wind vane, pluviometer, etcetera. are used.



Now we have seen how sensing technology helps in information collection and its utilization for better crop management and improved crop production. Sensing technology is contributing and can contribute in a significant way to agriculture.



Hope you will learn more by discussing sensors and parameters on the forum.

Thank you.