IOT IN INDIAN AGRICULTURE

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Things
+ Sense
+ communication
INTERNET OF THINGS

Life simplified with IOT

Life Simplified with Connected Devices.mp4

Cyberdyne's robot suit HAL to keep people walking.mp4
Agriculture
Farming
Irrigation
?
Agriculture
- It is science of growing Plants, animals and birds for human consumption

Farming
- It is the practice of growing Plants, animals and birds for human consumption

Irrigation
- It is watering the plants artificially
Agriculture

agriculture

Traditional

Modern
raising a few chickens

traditional farming

a chicken farm

modern farming
ordinary fertilizer

traditional farming

chemical fertilizer

modern farming
traditional farming
ploughing the field with cattle

modern farming
ploughing the field with a tractor
traditional farming

a cracking land/
drought

modern farming

green house
MODERN FARMING CONCENTRATION

- Irrigation
- Biotechnology
- Chemical fertilizers and pesticides
- Mechanization
MODERN FARMING CONCENTRATION

- Irrigation
  - Depends on the reservoir water
  - Rainfall dependency
  - Water is pumped out and sent along smaller canals or pipes to the farms.
MODERN FARMING CONCENTRATION

- Biotechnology
- Produce crops that can resist pests and diseases
- Improve the nutritional contents of crops
- Improve the flavor and texture of crops
CHEMICAL FERTILIZERS AND PESTICIDES

- Chemical fertilizers are widely used
- ↑ soil fertility
- Pesticides, insecticides and fungicides are used to control pests and diseases
MECHANISATION

Intelligent Technology Smart Farming - Agriculture in the future.mp4
What more can be done in agriculture?
Future world farming systems face huge challenges

**RISING population**
- 4.4B in 1980
- 7.1B today
- 9.6B+ in 2050

Source: [http://esa.un.org/unpd/wpp](http://esa.un.org/unpd/wpp)

**GROWING middle class**
- 2B today
- 4.9B in 2030

Source: [http://www.acrane.com/middle-class-infographic](http://www.acrane.com/middle-class-infographic)

**RISING animal protein consumption**
- 9% in 1965
- 14% in 2030

**DECLINING arable land**
- 1 ACRE per person in 1961
- less than 1/3 ACRE per person in 2050
Key factors

- Sensors
- Information from hardware
- Environmental conditions
- Genetics
SOIL/MOISTURE/TEMPERATURE ANALYSIS
GREEN HOUSE MONITORING
ADVANTAGES

- User can monitor their large fields, forests, gardens from anywhere using mobile.
- Solar energy is plenty and renewable, people can depend upon this energy thus by saving the other non-renewable energy sources,
- It optimizes the power usage through water resource management and also saving government’s free subsidiary electricity.
- This proves an efficient and economy way of irrigation and this will automate the agricultural sector.
VERTICAL FARMING

LESS WATER
Aqua Monitoring
AQUA MONITORING SYSTEM IMPLEMENTED IN PONDS OF KRISHNA DISTRICT

Telecasted in Idi sangathi-ETV program
Published Eenadu
CAGE CULTURE

1. the cage is moored to the ocean floor
2. feeding with fish meal
3. bouyant tubes
4. fish faeces
Fish produce Ammonia rich waste. Too much Ammonia is toxic to fish but they can withstand high levels of Nitrates.

Bacteria which is cultured in the grow beds converts the Ammonia into Nitrites and then Nitrates.

Plants absorb the Nitrates as Nutrients and Fertilizer.

Clean water returns to the Fish.
Aquaponic
**MONITORING FISHES**

- Capturing the images of fishes with water proof cameras.
- Enhancing the images using digital image processing techniques.
- Observing the movements, populations of fishes, their productivity, etc.
- Glaucus is a case-based reasoning (CBR) system which aims to help fish farmers with their decision making during sorting operations at their aquaculture sites.
A**NALYZING SATELLITE IMAGES**

- **Passive:** uses natural energy, either reflected sunlight (solar energy) or emitted thermal or microwave radiation.
- **Active:** sensor creates its own energy
  - Transmitted toward Earth or other targets
  - Interacts with atmosphere and/or surface
  - Reflects back toward sensor (backscatter)
FarmShots(app) – Uses Satellites for monitoring crops.
It takes the images from satellites and from drones.
It detects the diseases, pests and poor plant nutrition on farms.
ADVANTAGES

- Land use land cover mapping
- Crop health monitoring
- Crop inventory
- Soil resource inventory
- Water supply management
- In seasonal agricultural operation
IN FIELD MONITORING

How it works?

- **Weight**: 1.5kg
- **Wingspan**: 1.2m
- **Operability**: Water resistant, operational under any weather conditions
- **Coverage capacity**: One flight can cover approx. 12km² in 50min

Capture of high resolution images ➔ View of data in real time ➔ Data is processed in the cloud & translated into useful information ➔ Maps providing different type of information from the field eg. Soil quality, plots size, plant health
Aerial technology to monitor crop health
Improves crop yield and reduce cost
Drones route is pre-programmed.
Uses computer vision to record the images.
After completing the route the data is send to the computer.
uses algorithms to analyze captures images
It sends a detailed report on the crop status like any diseases and fruit status.
ADVANTAGES

- Drones can do
  - Spaying.
  - Plant counting: plant size, plot statistics, stand number, compromised plots, planter skips),
  - Plant height: crop height and density
  - Vegetation indices: leaf area, anomaly detection, treatment efficacy, infestations
  - Water needs: damage/drown out

- They work in any weather condition
- Easy to maintain
- Less cost and immediate action
- Improved efficiency
PREDICTIVE ANALYSIS

- Weather and climatic conditions forecasting
- Disaster prediction
- Crop analysis
- Rain fall analysis
- Disease cycling
**PREDICTIVE ANALYSIS**

- Artificial Intelligence (AI), Cloud Machine Learning, Satellite Imagery and advanced analytics combined to do prediction
- International Crop Research Institute for the Semi-Arid Tropics (ICRISAT)-a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa.
- Microsoft in collaboration with ICRISAT, developed an **AI Sowing App**
- In June 2016, Chinna Venkateswarulu of Devanakonda Mandal in Kurnool district in AP he recieved data from AI sowing App.
- Analysed from 1986 to 2015 (30 years data).
- Yield increased by 30% by sowing late.
PREDICTIVE ANALYSIS

- Pest Risk Prediction API
- Indicates in advance the risk of pest attacks such as Jassids, Thrips, Whitefly, and Aphids
- To help farmers take preventive action.
- Providing guidance on the probability of pest attacks.
- In the first phase, about 3,000 marginal farmers with less than five acres of land holding in 50 villages across in Telangana, Maharashtra and Madhya Pradesh are receiving automated voice calls for their cotton crops.
- The calls indicate the risk of pest attacks based on weather conditions and crop stage in addition to the sowing advisories.
Predictive Analysis

- The government of Karnataka started using price forecasting for agricultural commodities.
- The model uses remote sensing data from geo-stationary satellite images to predict crop yields through every stage of farming.
- This data along with other inputs such as historical sowing area, production, yield, weather, among other datasets, are used in an elastic-net framework to predict the timing of arrival of grains in the market as well as their quantum, which would determine their pricing.
- The model currently being used to predict the prices of tur, is scalable, and time efficient.
PREDICTIVE ANALYSIS

- **Plantix** – it is a mobile crop advisory image recognition app for farmers around the world.
- Uses a smart phone picture and upload the picture to the Plantix.
- It identifies the defects and nutrient deficiencies in soil.
- **Trace Genomics App.**
  - It provides soil analysis services to farmers
  - Soil analysis like fungi and bacteria analysis
AGRICULTURAL ROBOTS

- Robot suit
  - To avoid straining of muscles and joints of farmers.
  - Supports in pulling and lifting heavy objects in agriculture
- Leaf pluckers
Agricultural Robots

See and Spray is a robot which uses computer vision to monitor and spray on weeds. Harvest CROO robots – to help strawberry farmers pick and pack their crops. The robot harvest 8 acres in a single day and replaces 30 human laborers. Crop picked on time and save money. TADD - robot that sorts and detects diseases of potato.
IOT for Cattle
FACE RECOGNITION

- Facial recognition of cows in dairy units can individually monitor all aspects of behavior in a group, as well as body condition score and feeding.

- When it comes to lameness, measuring the arch in the cows’ back could give an early sign of the problem.
Katana app
LoRa injected into stomach.
Gives health details of the cows.
Cows with holes
GENETICS

**THE PROBLEM**
European corn borer damages crops

**THE SOLUTION**
Bacillus thuringiensis (Bt) bacteria

**THE PROCESS**
Bt cells to Bt plantlets

**THE RESULT**
Corn borers die off

Genetic engineering allows the transfer of genes between different organisms.
CROP IMPROVEMENT

- Comparative genetics of the plant genomes has shown that the organization of their genes has remained more conserved over evolutionary time than was previously believed.
- These findings suggest that information obtained from the model crop systems can be used to suggest improvements to other food crops.
- At present the complete genomes of Arabidopsis thaliana (water cress) and Oryza sativa (rice) are available.
**Insect Resistance**

- Genes from Bacillus *thuringiensis* that can control a number of serious pests have been successfully transferred to cotton, maize and potatoes.

- This new ability of the plants to resist insect attack means that the amount of insecticides being used can be reduced and hence the nutritional quality of the crops is increased.
IMPROVE NUTRITIONAL QUALITY

- Scientists have recently succeeded in transferring genes into rice to increase levels of Vitamin A, iron and other micronutrients.
- This work could have a profound impact in reducing occurrences of blindness and anaemia caused by deficiencies in Vitamin A and iron respectively.
- Scientists have inserted a gene from yeast into the tomato, and the result is a plant whose fruit stays longer on the vine and has an extended shelf life.
DROUGHT RESISTANCE VARIETIES

- Progress has been made in developing cereal varieties that have a greater tolerance for soil alkalinity, free aluminum and iron toxicities.

- These varieties will allow agriculture to succeed in poorer soil areas, thus adding more land to the global production base.

- Research is also in progress to produce crop varieties capable of tolerating reduced water conditions.
It provides information on current weather and also the forecast for the next five days, market prices of commodities/crops in the nearest town, knowledge on fertilizers, seeds, machinery etc. The option to use the app in different languages makes it more widely accessible.
agricultural advisory, weather, market prices, agriculture information library in the form of text, imagery, audio and videos in the selected language at profiling stage
Users can choose from over 450 crop varieties, 1300 mandis, and 3500 weather locations across 50,000 villages and 17 states of India.
CONCLUSION

- IOT makes use of AI/ML techniques help farmers make analysis of land/soil/health of crop etc.
- Help farmers save time and allow farmers to grow right crop in each season that has best yield.
- Vertical cropping can reduce water usage, make efficient land usage, can be cultivated in urban areas in buildings.
- Reduces the problems with labor unavailability.
- Prediction of next year crop seasons/weather/climate/rainfall etc
- Suggesting appropriate pesticides/crops/place.
- Brings back the engineers to land

Including IOT to Agriculture is the current need of India