Internet of things (IOTs) and drones: applications in agriculture

Purushotham Rudraraju
B.Sc(Agri) MBA(Technology Mgmt)
Food and Agribusiness Consultant
Internet of Things (IOTs):

Network of connected objects that enables to captures and exchange data.
Communication between Physical world and Information world
4 Layers Model for IoT

- Integrated Application Layer
- Management Layer
- Network Construction Layer
- Sense and Identification Layer
Smart Appliances

Wearable Tech

Healthcare
The Global Food and Agriculture System

The Challenges:

• Feed a growing, more prosperous world – and hopefully better than we have in the past
  – Increase food output 50% by 2025
  – More than double by 2050

• Contribute to food and nutrition security in many countries

• Preserve/enhance the environment

With these constraints:

  – While using the same or fewer resources
  – And, do this against the backdrop of global climate change!
Feeding more 9 billion by 2050

• Over the past half-century, human population has doubled but **food production hasn’t kept pace**

• Fraction of people with insufficient food has declined dramatically, from 60% in 1960 to about 15% in 2010

• Nonetheless, 1 billion people remain chronically underfed and another 2 billion suffer from micronutrient deficiencies.

• **Need a doubling of crop production between 2015 and 2050**

• Is it imperative, to accelerate agricultural production?
Enabling factors:
- Agricultural schools
- Agricultural research organizations
- NGO’s
- Private research organizations
- Government body dealing with agricultural research and development
- Weather forecasting labs
- Soil testing labs
- Food quality labs

Enabling factors:
- Irrigation system
- Automations system
- Fertilizers spraying
- Farm Tilling
- Crop planting
- Harvesting
- Weather forecasting
- Crop protection

Enabling factors:
- Access to financial services
- Pre-production planning
- Financial planning
- Factors of safety
- Environmental considerations
- Scope of using technology

Connected Agriculture
Applications: Hyperlocal Weather Station

- Temperature
- Rain Sensor
- Camera
- UV
- Humidity
- Pressure
Applications: Soil Moisture Network
Applications: Drought Detection and Monitoring
Applications: Field Operations

- Rear wall as reference
- Directional Distance Measurement
- Front mid-range distance sensor
- Long-range distance sensor
- Rear mid-range distance sensor
- 2.6 m
- 0.5 m
Applications: Connected/Driverless Tractors
Applications: Water Level Sensor
Applications: Irrigation system Control
Applications: Pest Surveillance and Control
Applications: Aggregation to Market Place

Current Price?

Best Buyer?

Farmer calls Toll free number 1800 102 8767

Farmer negotiates to get best price

Ensures better earnings

Sells to buyer with highest price

Personalized market price and buyer data is sent to farmer through SMS

Fasad Farmer Profile captured to send personalized information

Takes produce to a market where price is higher

950

850

825
“Big Data is a term that describes large volumes of high velocity, complex, and variable data that requires advanced techniques and technologies to enable the capture, storage, distribution, management, and analysis of the information.”
Farm-level data and personal data uploaded or collected from ground & equipment sensors, robotic drones, etc.

Service provider aggregates farmers’ data, combines other relevant data sets, and applies algorithms

Service provider provides farmer customized solution

- Weather forecasters can now predict near chance of rain.
- Better yields from precise instructions on planting depth.
- Density, and schedule;
- Pinpointing areas for soil amendments;
- Precise management of soil moisture and composition
- Animal health management by continuously assessing the health of cattle and predict the onset and spread of disease and heat periods.
- Forecast crop demand and Yield estimates.
- Forecast Input requirements based on geographic location and crop growth stages.
- Access to inputs and credit
- Customised and personalised advisory services.
- Connected E-Commerce Market Place
Predictive Analytics

• Describes a range of analytical and statistical techniques used for developing models that may be used to predict future events or behaviors.
Predictive Analytics – Precision Agriculture

• Optimizing crop yields
  – 90% of crop loss is due to weather
• Water management
  – 70% of world’s fresh water is used for irrigation
• Minimizing large variable costs
  – Animal feed
  – Labour
• Intelligent pesticide, herbicide, & fungicide spraying
ACTIONABLE INSIGHTS

- What Crops to grow?
- When to Till?
- Crop Growth Stages?
- What to Spray?
- How is the Weather?
- How much is the Water?
- When to water?
- How to manage labour.
- How to Trouble shoot my machines
- Is my production profitable?
- Where to Store?
- When to Sell?
- How much to Sell?
Conclusion

• Better decision making system for farmer
• Better production planning
• Increased productivity
• Increased profits
• Increased food production
• Water conservation
• Data collection can be used by government policy makers
Application of Drones in Agriculture

• Drones are formally known as unmanned aerial vehicle which is essentially a flying robot.
• It can be controlled by either pilot from the ground or it can be autonomous.
• The drones which are used for agriculture purpose are called as agriculture drone.
• In current scenario it is also being used for surveillance, weather monitoring, spraying....
VISUAL SENSOR

• It is used for aerial mapping and imaging
• Photogrammetry and 3D reconstruction
• Plant counting
• Surveillance
• Emergency response
• Surveying and Land use application
MULTISPECTRAL SENSOR

They range in numbers of bands and resolution topping out under 1 cm per pixel.

Multispectral Sensors are widely used in:

• Plant health measurement
• Water quality assessment
• Vegetation index
• Plant counting
THERMAL SENSOR

Thermal sensors are best utilized in:

• Heat signature detection
• Livestock detection
• Surveillance and security
• Water temperature detection and water source detection
• Emergency response
LIDAR SENSOR

• Short range, 270° scanning LASER rangefinder
• Useful in 3D digital surface modelling stockpile calculation
• Surface variation detection and flood mapping
• Penetrates through vegetation: It can perform plant height measurement by collecting range information from the plant canopy and the ground below (as opposed to the passive optical imagers that provide height data from the canopy)
HYPERSPECTRAL SENSOR

Hyper spectral sensors are widely used in:

• Plant health measurement
• Water quality assessment
• Vegetation index calculation
• Full spectral sensing
• Spectral research and development
• Mineral and surface composition surveys
APPLICATION OF DRONES IN AGRICULTURE

Applications

Start & Growth
- Research
- Smart data

Monitoring
- Crop monitoring
- Animal monitoring
- Building & equipment monitoring

Actions
- Mapping
- Spreading

Analytics
- Variable-Rate Fertility
- Diagnosis of diseases
- Water stress
- Crop yield
- Soil erosion
- Wild game damage
APPLICATION OF DRONES IN AGRICULTURE

Crop monitoring (Hot Spots, Nutrient, Moisture, Pest and Disease damage)
APPLICATION OF DRONES IN AGRICULTURE
APPLICATION OF DRONES IN AGRICULTURE

Bug Mapping of Mite Population in Groundnut
APPLICATION OF DRONES IN AGRICULTURE

Crop monitoring (Hot Spots, Nutrient, Moisture, Pest)

Livestock inventory management
APPLICATION OF DRONES IN AGRICULTURE

INVENTORY MANAGEMENT IN OPEN FIELD NURSERIES
APPLICATION OF DRONES IN AGRICULTURE

Canopy Estimation
APPLICATION OF DRONES IN AGRICULTURE

PLANT POPULATION COUNTING
APPLICATION OF DRONES IN AGRICULTURE

DISEASE/STRESS DETECTION

Thermal Camera
APPLICATION OF DRONES IN AGRICULTURE

Highest Economic Benefit

• Spot disease/problems faster
• Use less chemicals and water (save money, better for food and environment)
• Improve productivity
Thanks!