



Uses of IOT in Agriculture

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In modern days agricultural technologies are evolving day by day and more sustained methods and techniques are being found. Use of electronics and IOT based techniques is having major emphasis on the agriculture system. UAV farming, Smart irrigation, Residue management, monitoring forestry and supply chain management are major fields in which IoT is being utilized for better output in terms of productivity, sustainability and reliability. In this article we have discussed about applications of IoT in agriculture.

Introduction

Application of IoT in agriculture could be a life changer for humanity and the whole planet. Currently, we witness how extreme weather, deteriorating soil, drying lands and collapsing ecosystems make food production more and more complicated and expensive. Famous prediction says there will be more than 9 billion people in 2050. That's a lot of peoples to feed. Smart agriculture is a broad term that collects agriculture and food production practices powered by Internet of Things, big data and advanced analytics technology. When we talk about IoT, we generally refer to adding sensing, automation and analytics technology to modern agricultural processes. enabled smart farming sensors, modules and software help inform decisions for productivity improvements. IoT-enabled smart farming leverages sensors and gateways to collect and analyse data.

Applications of IoT in smart agriculture are:

- Sensor-based systems for monitoring crops, soil, fields, livestock, storage facilities, or basically any important factor that influences the production.
- Smart agriculture vehicles, drones, autonomous robots and actuators.
- Connected agriculture spaces such as smart greenhouses or hydroponics.
- Data analytics, visualization and management systems.
- Predictive modelling and planning.

1. Precision farming and Smart agriculture:

Farmers have already begun employing some high-tech farming techniques and technologies in order to improve the efficiency of their day-to-day work. For example, sensors placed in fields allow farmers to obtain detailed maps of both the

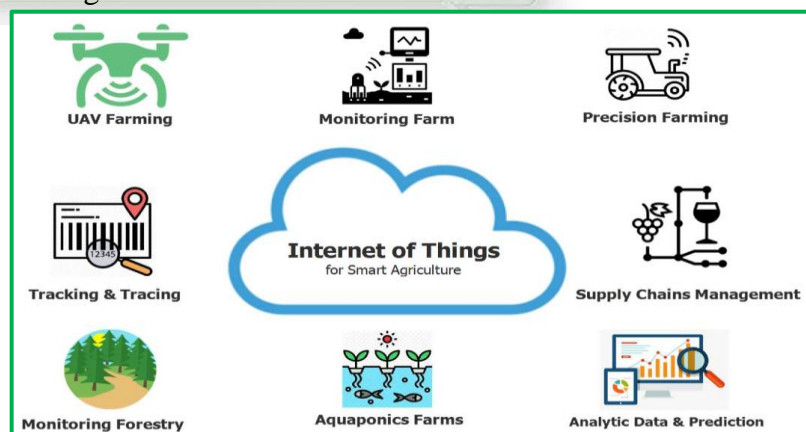


Fig 1: Applications of IoT in Agriculture

topography and resources in the area, as well as variables such as acidity and temperature of the soil. They can also access climate forecasts to predict weather patterns in the coming days and weeks. Farmers can use their smartphones to remotely monitor their equipment, crops, and livestock, as well as obtain statistical information on their livestock feeding and produce. They can even use this technology to run statistical predictions for their crops and livestock. From soil conditions to water control, IoT agriculture solutions help farmers for sustainable growth.

Optimization of farming processes by precision farming.

- Monitor and control irrigation management to maximize efficiency and reduce waste
- Measure and respond to inter- and intra-field crop variability
- Track trends and conditions to determine what seeds to plant and when to harvest
- Control pests and utilize organic farming techniques to disrupt mating patterns
- Monitor and analyse soil conditions and other changing parameters in real time to optimize crop yields
- Develop tracking solutions that allow farmers to monitor livestock and vehicles in remote areas
- Use connected devices to detect water and nutrient deficits for timely interventions

2. Crops and livestock:

Oversee operations using unmanned aerial vehicles (UAVs). Optimize yields based on real-time monitoring and predictive data analytics. IoT devices support crop and livestock health by empowering farmers to act at the first sign of an issue and adjust care. IoT-enabled livestock management solutions take the guesswork out of herd health. Using a wearable collar or tag, battery-powered sensors monitor the location, temperature, blood pressure and heart rate of animals and wirelessly send the data in near-real-time to farmers' devices. This allows farmers to check in on the health and location of each individual animal in their herd from anywhere as well as receive alerts if something falls outside of the normal range. Rather than physically check the vitals of each individual animal to see if an illness has spread, they know immediately which livestock is affected and which are not. Besides tracking health, livestock monitoring solutions can use GPS tracking to gather and store historical data on preferred grazing spots or use temperature tracking to determine the peak of mating season.

Benefits of IoT enabled Livestock management

- Monitor the health and vitality of livestock in real-time, enabling farmers to quickly treat animals and prevent the spread of illness or disease.
- Track grazing animals to prevent loss and to identify grazing patterns.
- Gather and analyse historical data to identify trends in cattle health or to track the spread of illness.
- Monitor readiness to mate or give birth, preventing the loss of new calves and optimizing breeding practices.

3. Smart irrigation:

Reduce water waste and improve yields through connected, sensor-based water monitoring and management. Sensor data and analytics help farmers manage irrigation to keep up with demand and conserve natural resources. Sustainable practices increase profitability and conserve water over time. Farming uses more water resources than any other industry or activity. Smart irrigation systems help farmers conserve more water over time and empowers them to:

- Collect real-time water usage data with remote sensing technologies for smarter irrigation decisions
- Trigger actions based on sensor data to switch water on and off

- Use data-driven insights to prevent water misuse and underutilization
- Detect pipeline leaks and faults to address issues and reduce water waste

Smart irrigation helps growers improve the efficiency and consistency of their yield. By enabling smarter water management, farmers can:

- Leverage smart sensors to monitor changing environmental conditions (e.g., temperature and rainfall)
- Measure and monitor soil moisture levels in soil remotely
- Trigger sprinkler systems to address low soil moisture levels to prevent crop damage or loss.
- Capture data to indicate trends and make forecasts based on various conditions.

4. Remote sensing:

IoT finds a wide usage in data acquisition, processing and interpretation in many fields of interest, and Remote Sensing is one of them, being an important area of signal processing research and studies. The smart sensors are in fact used in a wide number of applications related to environmental monitoring such as for instance air quality control; water contamination assessment; water contamination monitoring; radiation assessment, that also contribute to monitoring the territory, the environment and may impact on several fields as listed below. IoT for Remote Sensing applications is another exciting area of interest where IoT empowers smart systems to detect, sense and analyse various parameters that assist in a robust monitoring of the environment.

- Forest monitoring and assessment of factors related to plants and animals.
- Agriculture monitoring and assessment of soil quality, water quantity.
- Industrial monitoring.
- Data monitoring.
- Security and surveillance applications.

Future of IoT in agriculture

Smart agriculture and precision farming are taking off, but they could just be the precursors to even greater use of technology in the farming world. The rise of blockchain technology is making its way to the IoT, and could be important in the farming sector due to its ability to provide companies with important data on crops. Farmers can use sensors to gather data about crops, which is written onto blockchain, and includes identifying factors as well as salt and sugar content and pH levels. Given all of the potential benefits of these IoT applications in agriculture, it's understandable that farmers are increasingly turning to agricultural drones and satellites for the future of farming. Drones allow farmers to monitor how far along crops are in their respective growth periods. Additionally, farmers can spray ailing crops via drones with substances to bring them back to life. Dronefly estimates that drones can spray fertilizer 40 to 60 times faster than hand.

Conclusion

The adoption of IoT is very necessary as we have seen in above information, with every atomization need and unreliable service or input, the need of more productive technology appears. Agriculture is being evolving with these modern techniques contributing into betterment of farming and livelihood. It can be summarized as the more farmer gets to know the modern techniques of farming the more, he will be benefited with it. Given the many potential advantages of these IoT applications in agriculture, it seems sense that more farmers are inclined towards the technology.

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