

# **Role of Internet of Things (IoT)**

**In Promoting Sustainable  
Economic Growth in India 2047**



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## 5. INTERNET OF THINGS IN SOLVING KEY CHALLENGES IN AGRICULTURE

*Dr. G.Yamuna & Mrs. M.Preethi*

### Introduction

The increasing demand for food along with shrinking agricultural lands, and depletion of finite natural resources such as freshwater, has made the need to enhance farm yield critical. Further, the slowing yield trends in several staple crops and the negative impact of climate change have further aggravated the problem. Another impending concern over the agriculture sector is the shifting structure of the workforce. The productive agricultural labor in most countries has declined due to labor moving out of agriculture and aging agriculture labor. If there is one sector that we all as the human race really need to become more efficient and prosperous using all the possible technologies such as IoT, it's the Agriculture sector.

### Need for IoT in Agriculture

There is an exponential growth in world population, according to the UN Food and Agriculture Organization, the world will need to produce 70% more food in 2050. Feeding the world is directly connected with how prosperous and peaceful we are as societies as well as nations. Internet of Things is the use of new technology to

increase the land productivity. One of the features of the internet of things is that it can determine temperature, soil quality (pH), rainfall, pests and humidity. The current problem is the difficulty of farmers in determining planting and pest control. IoT in agriculture is designed to help farmers monitor vital information like humidity, air temperature and soil quality using remote sensors, and to improve yields, plan more efficient irrigation, and make harvest forecasts. Today's agriculture routinely uses sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems allow businesses to be more profitable, efficient, safer, and more environmentally friendly.

IOT enables precision farming leading to reduced use scarce resources in lower cost and have better productivity, minimize the food loss both in pre and post harvest, it saves water consumption due to better irrigation management and automation, it helps to have more transparent and value chains which lead better realization for farmers and finally automation and robotics make farming less physically demanding and less intense. Better data based decision making makes expertise benchmark lower.

Digital Platform 'Kisan Sarathi' has been launched to facilitate farmers to get 'right information at right time' in their desired language. Major technology innovations in the space have focused around areas such as indoor vertical farming, automation and robotics, livestock technology, modern greenhouse practices, precision agriculture and artificial intelligence, and blockchain. Today the term "agricultural digitalization" refers to the process of integrating advanced digital technologies like Artificial Intelligence, big data,

robotics, unmanned aviation systems, sensors, and communication networks, all connected through the Internet of Things into the farm production system.

IoT finds immense application in agricultural sector, wherein, the sustainable future of food is considered as the target by almost all the developing economies. By 2050, it is expected that the world population will grow by 30% to 10 billion and this requires increase in agricultural productivity by 1.5 times. The global climate stability target involves inter alia at least 67% curtailing of greenhouse gas emission which necessitates rectifying problems with the current system. In developing Countries, there are multiplicity of problems in the agricultural sector such as lack of system for crop selection, faulty irrigation system, no integration with weather forecasting, no process for soil testing, inefficient animal husbandry etc.

## **IoT Smart Solutions in Solving Key Challenges in Agriculture**

### **1. Precision Agriculture**

Precision agriculture is a farming management approach that uses digital technologies to enable farmers to make better decisions about where, when, and how much to fertilize, irrigate, and spray pesticides. By using sensors to collect data on weather, soil moisture, crop health, and real-time locational asset tracking (RTLAT), farmers can make more informed decisions about how to care for their crops. By using IoT sensors, farmers can collect a vast array of metrics on every facet of the field microclimate and ecosystem: lighting, temperature, soil condition, humidity, CO<sub>2</sub> levels, and pest infections. This data enables farmers to estimate optimal amounts of water, fertilizers, and pesticides that their crops need, reduce expenses, and raise better and healthier crops.

### **2. Crop Monitoring**

Crop monitoring involves the use of sensors, drones, and satellites to monitor crop health and identify locations requiring attention. Crop monitoring systems also include all data such as crop health, humidity, rainfall, temperature, and more. Sensors help farmers determine the best time to sow crops and harvest them, and can also detect problems early. With sensors in place throughout the farm, farmers can track everything from soil moisture levels to crop health. With so much data at their fingertips, farmers can monitor their crops 24/7. This allows them to detect any problems early on and take corrective action before they become serious. As a result, crops are healthier and produce higher quality yields. Perhaps one of the most promising agritech advancements is the use of agricultural drones in smart farming. Also known as UAVs (unmanned aerial vehicles), drones are better equipped than airplanes and satellites to collect agricultural data. Apart from surveillance capabilities, drones can also perform a vast number of tasks that previously required human labor: planting crops, fighting pests and infections, agriculture spraying, crop monitoring, etc. Crop management is another key area, where IoT finds application, especially in collecting data specific to crop farming; temperature and precipitation to leaf water potential and overall crop health. This may help inter alia monitor crop growth and any anomalies to effectively prevent any diseases or infestations that can harm the proposed yield. Soil testing is another area of application wherein efficient planning may help strategically coordinate crop cycle and irrigation which may lead to efficiency improvement in the areas of power usage and fertilizer cycle.

### 3. Drought Monitoring:

A big challenge for many farmers is dealing with drought conditions. IoT solutions can help farmers detect water shortages before they become a problem. Some systems can even provide information on when and where to irrigate in order to maximize crop watering.

### 4. Livestock Monitoring

Livestock monitoring uses sensors and RFID tags to track the location and health of livestock. This information aids ranchers in determining the condition of their livestock. For example, finding sick animals so that they can be isolated from the herd to avoid spreading disease to the rest of the cattle. The ability for ranchers to use IoT-based sensors to locate their livestock minimizes labor costs by a significant extent.

### 5. Irrigation Management

Irrigation management uses sensors to detect when and how much water is needed by individual plants. This saves water and also reduces weeds and runoff. With IoT, many agricultural tasks can be automated. This saves the farmer time and money. For example, automatic irrigation systems can adjust water flow rates based on soil moisture levels. This makes sure that crops get the right amount of water without over or under watering them. : Automation has a direct impact on operational costs. IoT can also increase productivity making farms more efficient. With the help of sensors and data analytics, farmers can reduce water usage, energy consumption, and inputs like fertilizers.

### 6. Smart Pest Control

Sensors detect the presence of pests and then dispense pesticides as required to protect crops. This helps reduce pesticide usage and can be used with smart irrigation management for targeted spraying only where it is needed. The net benefit of IoT application is the increased agricultural output, improved quality of agricultural products, reduced labour costs coupled with increased agricultural income for farmers.

### 7. Fertilizer Management

When fertilizer gets too low, sensors notify farmers so they can use a crop-yield map to determine which areas need more fertilizer. They can also track how much fertilizer has been used by each plot or farm throughout the season. This reduces costs and keeps runoff to a minimum, reducing environmental damage.

### 8. Weather Forecasting

Farmers employ satellite weather forecasts to decide when it is appropriate to plant or harvest in the course of the season. Weather stations with smart sensors can collect data and send valuable information to a farmer.

### 9. Harvesting Automation:

Robotics are increasingly being used in agricultural harvesting tasks. This saves labor costs and results in a more consistent product quality. By tracking weather conditions, for example, farmers can make better decisions about when to plant and harvest their crops. This helps reduce the risk of losing a crop to bad weather.

## Conclusion

We are increasingly reliant on technology in today's world for almost everything we do. And when it comes to farming, the reliance is only going to grow in the years ahead. Thanks to the Internet of Things (IoT), more and more farmers are using smart technology to increase productivity and efficiency. IoT platform that helps farmers to connect all their devices (weather station, irrigation system, soil moisture sensor, etc.) to the internet and manage them through a single dashboard. With the IoT platform, farmers can monitor in real-time the status of all their devices and equipment, get alerts for any abnormal situation, analyze data to detect patterns and trends and spot inefficiencies in their production process and take corrective actions. By using IoT sensors, farmers can collect a vast array of metrics on every facet of the field microclimate and ecosystem: lighting, temperature, soil condition, humidity, CO2 levels, and pest infections. This data enables farmers to estimate optimal amounts of water, fertilizers, and pesticides that their crops need, reduce expenses, and raise better and healthier crops. Thus IoT Proves how advanced technologies used in agriculture practices can become site-specific, locally adaptive, operationally feasible and economically affordable.

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