# Internet of Things in Agriculture : A Review

Mr. Navoday Atul Kopawar*, Miss. Komal Gajanan Wankhede

Department of CSE, Jawaharlal Darda Institute of Engineering & Technology, Yavatmal, Maharashtra, India

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ABSTRACT

In agriculture, Internet of Things means using smart devices like sensors and cameras to gather information about crops, soil and weather. This data helps farmers make better decisions about watering, fertilizing, and protecting their plants. By connecting everything to the internet, farmers can monitor their fields remotely and take action quickly when needed, leading to healthier crops and higher yields. This paper analysis the IoT have developed new device for smart agriculture. The first how IoT works and which device are used for smart farming and then application of IoT in agriculture like precision farming, Livestock Monitoring, Alerts and notification, Crop health monitoring, Sprinkler. Then which IoT device used in agriculture. So, the use of IoT in agriculture will be covered in this paper.

**Keywords:** Internet of Things (IoT), Agriculture, Sensors, Drones, Application.

## I. INTRODUCTION

The Internet of Things (IoT) refers to the networks of physical objects or "things" embedded with sensors, software, and other technologies that enable them to connect and exchange data with other devices and systems over the internet. These objects can range from everyday items such as household appliances and wearable devices to industrial machines and infrastructure components. The goal of IoT is to facilitate the automation of processes, improve efficiency, enhance decision-making, and create new services or experience by enabling communication and data exchange between physical object and the digital world.

Internet of Things is a modern technology which deals with the interaction of things embedded with communication devices [1]. The IoT has capacity to strengthen and enhance the agriculture sectors through examining soil moisture and in the case of vineyards, monitoring the trunk diameter [27].

In agriculture, the internet of things (IoT) is revolutionizing traditional farming practices by incorporating technology to enhances productivity, efficiency and sustainability. IoT devices such as soil moisture sensors, weather monitor, crop monitor and drones are developed across farms to collect real-time data on various factors like soil conditions, weather patterns, crop growth and equipment performance.

IoT is a global network of things i.e. physical and virtual devices having independent identity each one, which can be connected via a vast network to share information and process it into meaningful data [2]. IoT allows farmers to get connected to his farm from anywhere at any time [28].

Adoption of IoT technologies in agriculture can enhance the competitiveness of farms by improving efficiency, quality, and sustainability, meeting regulatory requirements, and satisfying consumer demand for transparent and environmentally-friendly food production practices.

IoT technology helps the formers for collecting information about agricultural conditions like weather, moisture, temperature and other at any time. And the wireless cameras have been used to view remotely the condition of the form.

## II. APPLICATIONS OF IOT IN AGRICULTURE

The Internet of Things has made smart farming possible. Application of internet of things (IoT) are as follow:

### Precision farming

Precision farming uses a number of technologies to maximise crop yields, including GPS systems, sensors and Big Data [12].
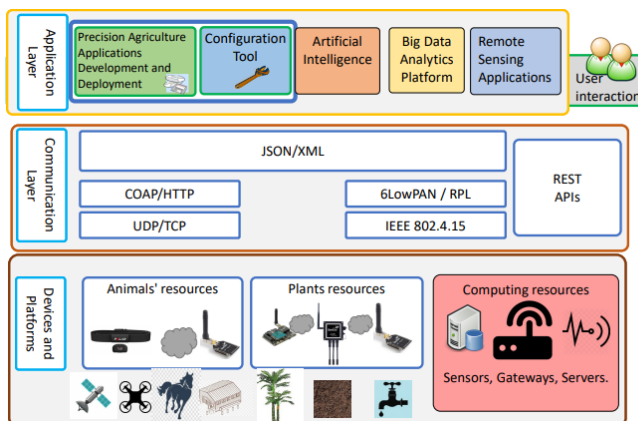


Figure 1. Proposed IoT system model for precision agriculture, showing the relationship between various entities such as sensors, network-enabling technologies, and agriculture resources for real-time monitoring and cons [13]

### Smart Irrigation

The smart irrigation system is an emerging technique that automates irrigation systems and conserves water usage [20]. This technique adjusts irrigation based on actual soil and weather conditions [22]. Usually, the need for irrigation appears in places where the rainfall is irregular, in dry times, or in places where dehydration is regular. [21]. Traditional irrigation is such as surface irrigation, drip irrigation and sprinkler irrigation.

### Crop Health Monitoring

The agriculture crop Monitoring System is one such technological innovation. It uses wireless sensor networks and the Internet of Things (IoT) [14].

Monitoring crop health is essential for identifying early signs of stress, diseases, nutrient deficiencies, and other factors that can affect plant growth and productivity [15].



Figure 2. Crop Health Monitoring Hyperspectral Remote Sensing [6]

### A. Livestock Monitoring

Two important resources to manage livestock production line are (i) the quality of life (QoL) of

livestock and (ii) the condition of the land where animals are farmed [16].

Approaches to achieving success in animal husbandry monitoring include the design and construction with a cloud control unit. The aim of the system is to gather data from various IoT devices at defined intervals or in real time [17].
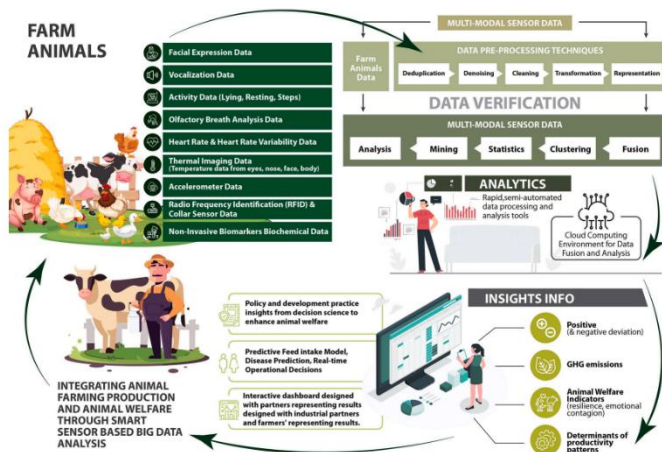


Figure 3. Big Data for Animal Farming: The chain of sensors-based big data application in precision livestock farming [18].

## B. Alerts and Notifications

Implement alert mechanisms to notify farmers about weather changes or irrigation needs. Continuously collect real-time weather and soil data [19].

## III.IOT DEVICES USED IN AGRICULTUR

IoT devices used in agriculture encompass a wide range of sensors, actuators, and connected devices tailored to monitor, manage, and optimize various aspects of farming operations.

## A. Soil Moisture Sensor

Soil moistness sensor processes the water contented in soil. It is uses the stuff of the electrical hostile of the soil [7]. A soil moisture sensors is used to detect the data for requirement of water to the soil [23]. It is used for automatic watering to the land [24]. This helps farmers to generally use less water to grow a crop.

## B. Temperature Sensor

It is very low cost sensor. It as low output impedance and linear output [8]. A temperature sensors is an electronic devices that monitors the temperature of its surrounding [26]. Soil temperature affects: photosynthesis, respiration, transpiration, water potential of the soil and microbial activity [25].

## C. Drones

Drone technology has the potential to revolutionize routine manual activities in agriculture [3]. By employing various sensor configurations, farmers can accurately measure land sizes, classify crop types and varieties, develop soil maps, and implement effective pest management strategies [4].

Drones are used for crop health monitoring, water stress monitoring, nutrient status and deficiency monitoring, spraying, planting of seed from air, etc [9].

## D. Electromagnetic sensors:

Electromagnetic sensors are useful in detecting agriculture soil and contamination. Electromagnetic sensors detect wide spectrum of wave that are received from various objects [10]. Which is increased by the translation factor to give the value of actual temperature [11]. Ground penetrating radar and electric magnetic induction have been implicated in estimation of soil-water content [5]. Moreover, the sensors are useful to measure residual nitrate level, organic matter concentrations in soil, and real-time measurement of transpiration rate [6].

## IV.CONCLUSION

The internet of things (IoT) in agriculture is revolutionizing the way farming is done by leveraging technology to enhance productivity, efficiency, reduce input costs, minimize environmental impact, and improve the overall sustainability of agriculture operations. Embedding IoT in the agriculture will also be helpful for formers. Due to IoT in agriculture field it is easy to monitor crop from anywhere at any time.

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