Chapter 11
Smart Sensors for Smart Agriculture

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ABSTRACT

Agriculture is the primitive and crucial occupation for the people. Urbanization, which indirectly affected the lives of people in the agricultural sector by increasing level of environmental pollution, climate change, degradation of soil and water quality, increasing population, decreasing income from the farming industry, etc. come as a new challenge and makes mass migration of rural people to the cities. To overcome this problem, new technologies are emerging that play a pivotal role in developing smart agriculture based on IoT technology by using smart sensors. Smart agriculture helps improve crop yield, livestock tracking, soil moisture monitoring, remote water tank level monitoring, temperature, and humidity sensing, the security of farmland, monitoring the environmental conditions, and equipment tracking. This helps farmers protect and monitor their property remotely, etc. Internet of things (IoT)-based smart sensors is the new technique for the smart agriculture system. IoT-based smart agriculture system consists of various sensor nodes placed in different locations, internet service, smart remote devices, or computer systems with the internet that monitor the operation of sensor nodes, WiFi, a camera with a microcontroller, and different interfacing sensing nodes for service. Some of the examples of such sensors are temperature sensors for temperature sensing, soil moisture sensors to check the moisture content in the soil, PIR sensors used in the detection of animals, people and other objects present in the farm field, GPS-based remote control robots that perform spraying, weeding, security, moisture sensing, etc. This chapter will have the following sequence introduction of the agriculture sector with the problems it is facing now and a new technique to overcome the current issues, need of IoT in the agriculture sector, the link of IoT technique with wireless sensor network in full detail study of IoT-based system, IoT-based applications, benefits of IoT technique in the agriculture sector, and future scope.

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INTRODUCTION

The agriculture sector is an essential sector of an economy for food security. Agriculture is the primitive and crucial occupation for the people of India, about 70% of the Indian population depends upon agriculture for their livelihood, and it contributes around 16% of Indian GDP. However, due to urbanization which indirectly affected the lives of people in the agricultural sector by increasing level of environmental pollution, climate change, degradation of soil and water quality, increasing population food demand, decreasing income from the farming sector, etc. come as a new challenge and makes mass migration of rural people to the cities, emission of greenhouse gas (GHG), uses of fertilizers, water drainage system scarcity and production of agri-waste. Agriculture produces food by using different resources like nutrients, soil, and water. To overcome these problems, optimization of agricultural productivity is essential to meet the growing world population demand. Smart agriculture (SA) is the new method mainly focusing on farming practices that increase productivity, security, and management and changing in input resources while reducing GHG emissions. Sustainable agriculture provides the perfect solution for balancing agricultural production and environmental degradation. Smart farming provides smart technologies for smart agriculture to improve and optimize agrarian activities like increasing yields, promoting climate change, and supporting low emission from the agricultural sector, increasing the overall quality and quantity of farm products. SA has included proper farming management on water usage, fertilizer application, crop management, animal security through livestock tracking, soil moisture monitoring, temperature, and humidity monitoring, etc. using internet-of-things (IoT) and various smart sensors. IoT and sensors can improve management by optimizing the waste collection, transportation, and utilization for resource recovery.

IoT based smart sensors are the new trending technique for the intelligent agriculture system. It is mostly used in linking devices and assembles information. IoT enabled sensor networks and cloud computing help in the transmission of data in real-time among different destinations. It performs monitoring, prediction, decision planning, and making decisions. IoT based network consists of physical objects where sensors collected and transfer the real-time. IoT technique has been in use in different fields like health care, agro-industries, ecological monitoring, traffic monitoring, restaurants food management system, military applications, smart cities, waste management, transportation, smart agriculture, home automation, smart meeting, smart environment, smart water, security and emergency, and many more.

IoT can be used in different methodologies of agriculture. IoT is based on devices that can analyze the sensed data and then transmit it to the end-user. IoT based smart agriculture system consists of various sensor nodes that are placed in a different location as per the application need, internet service, intelligent remote device or computer system with the internet that monitor the operation of sensor nodes, WiFi, a camera with microcontroller and different interfacing sensing nodes for service. Some of the examples of such sensors are temperature sensors for temperature sensing, soil moisture sensors to check the moisture content in the soil, PIR sensors used in the detection of animals, people and other objects present in the farm field, GPS based remote control robots that perform spraying, weeding, security, moisture sensing, etc.