Chapter 4
A Comprehensive Study on Smart Farming for Transforming Agriculture Through Cloud and IoT

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ABSTRACT

The amount of food produced in fields is directly proportional to the Earth's growing population. Taking into account the deteriorating climatic conditions and ineffective agricultural productivity, we must modernize our agricultural methods immediately. India is second in terms of agricultural performance. The main concerns that farmers have are crop rotation, fertilizer use, and irrigation. Due to technological advancements, farmers nowadays are unable to produce their crops to their maximum potential. The main focus is on utilizing contemporary technology in agriculture and using it to boost yield. We can now better estimate crop output thanks to the deployment of IoT in agriculture and cloud computing. Implementing IoT and cloud computing strategies is a way to overcome challenges in agriculture. This chapter gives a brief summary of the integration of cloud and IoT (internet of things) technologies into agricultural practices, which will make agricultural practices smarter.

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1. INTRODUCTION

The agricultural production system has undergone seismic change as a result of the development of precision agriculture technology during the last few decades. The quality of the yield increases the opportunity for the export business and contributes a major part to the GDP growth rate. The majority of Asian countries are still in the early stages of developing and adapting agritech. Smart agriculture systems built on the IoT are crucial for the successful utilization of land, water, and energy resources. One approach to achieving this is by adopting IoT and Cloud Computing (CC) strategies. Things in the term “IoT” refer to actual physical things embedded with sensors, computing power, software, and other technologies, that are connected to other systems and devices via the Internet or other networks, for receiving or transferring agronomic information to data centers. CC is a concept that involves integrating cutting-edge technology assistance mechanisms for the backend in order to provide computing facilities for a range of users. Applications for SA can employ a variety of communication protocols with different capabilities. To make an appropriate and ideal choice, it is necessary to analyze the aspects of potential protocols while creating a smart agriculture system. An IoT network is made up of tangible assets, network elements, and data analysis software. CC offers an analytical capability using big data and Deep Learning (DL) models to get maximum profit from the robust computing environment. According to Sadu et al. (2022), agricultural operations produce a large amount of agronomic data, which is swiftly processed and examined. The creation of an automated system makes it possible to water irrigation, sow seeds, and quantify the moisture in the soil. Taylor et al. (2019) state that the primary elements of pest surveillance for agricultural diseases include sensing, evaluating, and treating. Recent developments in image processing have made it possible to analyze agricultural images to classify various plant diseases for pest management purposes.

Figure 1 shows the Taxonomy of Agriculture, in which it classifies smart practices into major categories, such as Agricultural Data Gathering, Edge computing mechanisms, Agricultural data transmission, and Cloud computing system analysis, providing a systematic overview of agricultural activities. It also specifies the flow of information from perception to application through processing, communication, and middleware.

2. CHALLENGES WITH TRADITIONAL AGRICULTURE TECHNIQUES

The eighteenth century saw a significant advance in chemical understanding. To increase crop productivity, several synthetic compounds are produced for agricultural use. With time, there was an increase in the use of these chemicals in agriculture, but along with their advantages came certain drawbacks. Traditional farming focuses on treating the soil and plants with poisonous chemicals, which were formulated artificially in a lab. These elements protect the plants against disease and pests. Chemical use results in building up fatty tissues in our body, and if the concentration is high enough, a disease like cancer may occur. The use of these synthetic compounds has a number of serious drawbacks, one of which is that they kill out all life in the topsoil and subsoil. It requires both microfauna (protozoa, nematodes, and arthropods) and microflora (bacteria, fungi, and actinobacteria) to be valuable. The loss of microbial life in soil has eventually been attributed to the use of powerful chemical agents that kill or inhibit undesirable fungus or fungal spores, kill or inhibit harmful insects and other pests, and manage undesirable plants (herbicides), to the point that it is necessary to use extremely large amounts of fertilizer to nurture

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