Chapter 13
Investigation Into the Use of IoT Technology and Machine Learning for the Identification of Crop Diseases

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ABSTRACT

The control and management of crop diseases has always been a focal point of study in the agricultural domain. The growth of agricultural planting areas has posed several obstacles in monitoring, identifying, and managing large-scale illnesses. Insufficient disease identification capacity in relation to the expanding planting area results in heightened disease intensity, leading to decreased crop production and reduced yield per unit area. Evidence indicates that the reduction in crop productivity resulting from illnesses often surpasses 40%, leading to both financial setbacks for farmers and a certain degree of impact on local economic growth. A total of 1406 photos were gathered from 50 image sensor nodes. These images consist of 433 healthy images, 354 images showing big spot disease, 187 images showing tiny spot disease, and 432 images showing rust disease. This chapter examines the cultivation of maize fields in open-air environments and integrates internet of things (IoT) technologies.

DOI: 10.4018/979-8-3693-2964-1.ch013

OVERVIEW

Since the beginning of the 21st century, the fast development of Internet of Things (IoT) technology (Lombardi, 2021) and image recognition technology has garnered significant interest among researchers in the "IoT technology + agriculture" (Yan, 2020) concept. To effectively mitigate the occurrence of widespread localized maize illnesses in their cultivation regions, the use of agricultural Internet of Things (IoT) is unquestionably the optimal solution for disease prevention and management. This technology enables early detection of diseases and seamless integration with diverse agricultural systems. The use of agricultural IoT has led to the advancement of modern agriculture.

Advancing towards precision prevention provides a robust assurance for data gathering, real-time analysis, and efficient management. Furthermore, the progress of IoT technology has enabled the enhancement of image recognition technology for the identification of maize illnesses in particular regions, establishing a strong basis for the future application of agricultural IoT and the continuous monitoring of crop growth conditions.

Managing maize diseases gets more challenging as the cultivation area grows. This article suggests a way for quickly identifying the location and severity of maize diseases in outdoor corn planting regions using IoT technology. The approach involves using image recognition to analyze corn disease images. This approach utilizes sensor nodes specifically built for maize planting regions, which possess the qualities of completeness, fault tolerance, precision, and real-time monitoring technology. The collection of real-time dynamic information on the maize planting area is achieved by the placement of sensor nodes. Once the corn picture data is gathered, image processing methods are used to extract characteristics based on color, shape, and texture. Ultimately, a suitable image recognition model is developed using the specific features of node deployment and data collecting. This model guarantees precise disease management during the most effective prevention and control period, hence minimizing economic losses resulting from unnecessary preventative and control procedures.

LITERATURE REVIEW

Investigation of the Use of Internet of Things (IoT) Technology in Disease Monitoring Systems

The emergence of the Internet of Things has greatly impacted agricultural intelligence, leading to the creation of several sensor devices that have revolutionized the interaction between things and users. In order to enhance the efficacy of disease pre-warning and in-process warning, it is necessary to use sensor nodes for data collecting in the cultivation of crops on a wider scale. Liu Hui et al. developed two node deployment schemes in 2011 to evaluate the comprehensiveness and logic of sensor node deployment. The schemes were evaluated using parameters such as deployment cost and connectivity.

In 2012, López et al. developed an independent monitoring system that used low-power image sensors to cover a wide region. The system time stamped the image sensors at the control station for analysis and identification of disease damage. Li Hao and his colleagues used IoT technology to address the real-time gathering and identification of fruit photos. To address the issue of data transmission in wireless sensor networks for agricultural disease monitoring. Pierce (2007) developed sensor networks at both regional and farm levels to enable remote and real-time monitoring of crucial agricultural activities. This initia-