Chapter 5
Farming Automation

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ABSTRACT

Farming automation requires a whole lot of new skills and use of technology for achieving a substantial increase in the crop yield. Smart farming enables the use of technology in tracking, monitoring, and analyzing various farming operations. Internet of things (IoT) platform is formed with sensors and actuators, cameras and drones, telecommunication technologies, edge devices, cloud servers, and specialized hardware and software. This chapter will discuss the available hardware and software technology elements that can be used in farm automation. The chapter is comprised of four sections. The first section provides an overview of precision agriculture and smart farming. The second section provides the literature review of existing research. The third section describes IoT techniques, sensors, and cloud and edge computing solutions for the implementation of smart farming. The fourth section provides a few case studies of the application of IoT in smart farming. Specifically, the chapter will describe the IoT platform solution for complete farm automation.

INTRODUCTION

Farming Automation makes use of the technology, Internet of Things (IoT) and robotics to automate the crop production and livestock management in order to make farms more efficient and productive.

Over the years the amount of food consumption is increasing because of the growth in population as well as people are increasingly got concerned about the quality of food. Moreover the impact of environmental changes also have forced scientist to think about finding the innovative ways to meet the new challenges faced in agriculture sector. All these developments have lead to emergence of a new paradigm called precision agriculture.

Precision Agriculture has gained lots of attention recently. Basically precision agriculture employs information technology in farming. Use of information technology in farming has tremendous potential for better and informed decision making. It leads to the creation of smart farms that will be sustainable and environment friendly and also leads to the increased production. The scope of precision agriculture also includes the crop management, livestock management as well as the management of other agricul-

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ture products. The precision Agriculture can improve overall efficiency, productivity and profitability of the agriculture.

The quality of soil is a major contributor in sustainable farming. The soil must have the required organic matter and other nutrients. As compared to chemical based fertilizers, the compost method is proved to be better in preserving the desired minerals and nutrients in the soil. Internet of Things (IoT) has potential to improve composting and thereby to improve the overall quality of soil. This chapter focuses on a number of solutions for smart farming and smart composting system. In the next section the research work conducted in smart farming in recent years is highlighted.

LITERATURE REVIEW

The literature review presents research work conducted on Smart Farming in recent years. Araby et al. (2019) has proposed a smart IoT monitoring system. The system offers a predictive analysis. As mentioned in the paper, a wireless sensor network can be deployed that collects the data about certain crops. In this study the crops of potato and tomato have been utilized. The data obtained is provided to the machine learning algorithms which generate a warning message.

The use of machine learning algorithms in cultivation of potato crops can detect the signs of infection early so that appropriate measures can be applied to prevent further spread of the disease. This paper suggested a system to detect the occurrence of Late Blight disease in crops such as potato using regression analysis and gives appropriate advice to the farmer using a Graphical User Interface. The proposed system also has the advantage of reducing the unnecessary use of pesticides.

Jo et al. (2019) proposed an IoT enabled Compost Monitoring System. The system performs the monitoring of essential parameters of soil in real time. In this study an IoT based technique has been used to properly performing all processes of composting. The processor used in the system is Raspberry Pi and communication module is LoRa based. DHT11 sensor has been used to monitor temperature and relative humidity. The proposed approach will help the farmers to identify the most suitable time to turn the compost.

Abbasi et al. (2019) has presented a survey on the application of Internet of Things (IoT) on agriculture. This survey explored the IoT hardware platforms for agriculture like Arduino, Raspberry and Intel based models. The survey also explored various software platforms related to the agriculture. These software platforms are mostly cloud based platforms including Amazon Web Services (AWS) IoT Platform, Salesforce IoT platform, SAP IoT platform, Google Cloud Platform, Oracle IoT Platform IBM Watson IoT Platform and Microsoft Azure IoT hub. The IoT applications listed in the survey are environmental and ecological monitoring and irrigation. Several mobile apps on agriculture related tasks are also discussed. The challenges on the use of IoT in agriculture are identified as standardization of IoT devices, sensors and communication protocols, security and privacy and data storage and analysis on which more work is required.

Dewi et al. (2019) proposed an approach on decision making with IoT data collecting on Precision Agriculture. The data can be collected using various sources. For instance, it can be climate related data, crop and soil related data as well as agriculture machinery related data. Data collection requires the selection of appropriate sensors. Common sensors are temperature and humidity sensors like DHT11, LM35 and SHT 3x-DIS. Then a decision model is required for decision making. In this paper, a decision tree based implementation is provided.