

Chapter 5

Precision Agriculture and Unmanned Aerial Vehicles (UAVs)

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ABSTRACT

This chapter examines the correlation between precision agriculture (PA) and unmanned aerial vehicles (UAVs), emphasizing their pivotal significance in contemporary agricultural practices. This chapter delves into the historical origins of public administration (PA), tracing its progress over time and examining the introduction of unmanned aerial vehicles (UAVs) within this field. The text provides a study of different types of unmanned aerial vehicles (UAVs), examining their distinct qualities, advantages, and diverse range of applications. These applications encompass crop monitoring, soil analysis, irrigation management, and livestock tracking. The chapter also discusses many challenges, including regulatory compliance, data security, and technical limits. Additionally, the chapter emphasizes the practical implementation of unmanned aerial vehicles (UAVs) in both extensive and small-scale agricultural practices, as well as potential advancements and emerging patterns in this field.

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1. INTRODUCTION

The integration of Precision Agriculture with Unmanned Aerial Vehicles (UAVs) has significantly transformed the methodologies employed in farming and land management. Precision Agriculture, also known as precision farming or smart farming, is a contemporary agricultural methodology that utilizes advanced technology to enhance the efficiency and effectiveness of all facets of agricultural production. The proposed methodology encompasses the utilization of a blend of data-centric methodologies, sophisticated sensors, and automated systems to oversee, evaluate, and regulate diverse facets of agricultural practices, encompassing soil conditions, crop vitality, and resource allocation. The principal objective of precision agriculture is to enhance operational efficiency, mitigate resource wastage, and optimize crop yields, all while minimizing the adverse effects on the environment. Through the utilization of accurate data and up-to-date information, agricultural practitioners can make well-informed choices that effectively improve both productivity and sustainability.

Unmanned Aerial Vehicles (UAVs), more generally referred to as drones, serve as vital components in the execution of precision agriculture strategies. Remotely piloted airplanes have emerged as indispensable instruments for farmers and land managers. Drones possess a diverse range of sensors, such as multispectral cameras and LiDAR technologies, enabling them to acquire high-resolution imagery and data from an aerial perspective. The data is subsequently utilized to generate comprehensive cartographic representations, discern regions of interest, and monitor fluctuations in agricultural vitality.

Unmanned Aerial Vehicles (UAVs) provide farmers the capability to observe their agricultural plots with unparalleled precision, thus facilitating the implementation of focused interventions, such as the exact administration of fertilizers or pesticides. The integration of precision agriculture and unmanned aerial vehicles (UAVs) holds considerable promise in enhancing the sustainability, productivity, and profitability of agricultural techniques, hence positioning it as a highly prospective domain for the future of farming.

1.1 What is Precision Agriculture

Precision agriculture is an agricultural management strategy that leverages information and communication technologies to enhance the effectiveness and long-term viability of agricultural production. The process entails the gathering and examination of data pertaining to the well-being of crops, soil conditions, and various other elements to make informed judgments regarding the use of inputs and the management of crops. Figure 1 illustrates the concept of Precision Agriculture. Precision agriculture technology has the potential to assist farmers in achieving various benefits and improvements in their agricultural practices (Khang & Agriculture et al., 2023).

1.1.1 Benefits of Precision Agriculture

- **Increase Crop Yields:** Precision agriculture is a technological approach that aids farmers in enhancing crop yields by effectively managing the application of inputs, such as fertilizers and pesticides, at optimal timings and quantities.
- **Reduce Input Costs:** Precision agriculture has the potential to assist farmers in mitigating input costs through the reduction of wastage. This can yield economic benefits for farmers by reducing costs, while simultaneously contributing to the reduction of environmental harm.

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