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DRONE APPLICATIONS FOR PROMOTING SUSTAINABILITY IN HORTICULTURE

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Introduction

The increasing demands for food production and consumption in recent decades have made the contemporary farming sector more significant than before. Drones are a rapidly developing and efficient way for academics, agronomists, agricultural engineers, and farmers to precisely plan and oversee current and future developments while streamlining agricultural operations in a sustainable agricultural management platform. A busy scientific sector with a high probability of future directions is smart agriculture, which uses powerful data analytics to gain insightful knowledge about the crops and fields. While enabling agricultural experts to focus on the resources and methods now available to enhance farming operations, precision agriculture plays a vital role in attaining improved sustainability standards. Unmanned aerial vehicles also called as drone which integrate advanced data models, artificial intelligence, communication and information technologies, and highly technical innovations like positioning systems, remote sensor systems alongside soil and crop detecting software, and variable rate technologies, are among the most recent uses of precision agriculture. Thus, drones can be employed for a range of horticultural agricultural operations, including as crop and nursery surveillance, early pest and disease identification and remediation, and mapping the field for crop development assessments.

Drone applications for environmentally friendly horticultural techniques

Precision farming methods can help farmers make better decisions that will increase yields, guarantee a consistent supply, and increase profitability. In addition to being less expensive than most traditional agricultural equipment, UAVs are also easy to operate for anyone with a little understanding of technology. UAVs can reduce working hours, which enhances productivity, measurement accuracy, and production stability even if they are not yet widely utilised in agriculture. under a range of environmental conditions.

Numerous agricultural operations employ drones in a variety of ways like,

Crop Monitoring: The technique of assessing crop data to predict a crop's status or productivity is known as crop monitoring. Crop monitoring is essential for optimal crop production. But monitoring a large farm requires a lot of effort and time. Satellites are often used to observe large farms. This isn't suitable for tracking specific crops, though. Crop monitoring using UAVs has been proposed as a remedy. This reduced the effect of weather and allowed for the collection of high-resolution data. Utilising the vegetation index data, UAVs are providing important productivity and improvement metrics. More sophisticated UAVs that can compute vegetative indices like NDVI and GNDVI independently are now available on the market.

Yield assessment: Crop yield measurements and quality assessments are crucial for farmers, scientists, financial advisors, agricultural officials, local and international organisations, and commercial farmers. In addition to increasing assessment accuracy, UAV-based imaging—especially when paired with AI—offers prospects to reduce or eliminate the need for field surveys.

Budgeting, estimating storage needs, planning for harvesting to maximise output quality, anticipating prior crop requirements to ensure a sustainable yield, and insurance needs are all made easier with the support of the entire data set.

Mapping: High-resolution UAV images can be utilised to assess the soil properties of a rural area, namely the crop growth condition. Because UAVs can provide 2D and 3D maps, agricultural experts can apply model developments to determine crop efficiency. The maps created by UAVs aid in boosting profit margins by offering details on uniform areas of the massive planted fields.

Phenotyping: In order to meet the demands of the growing global human population, management and breeding decisions can be made that optimise agricultural productivity through the efficient and timely non-destructive acquisition of phenotypic data by UAVs. For example, UAV-based colour sensors that can gather a range of information, such as plant size, canopy coverage, and average flower count, and fruit quantities in plants, can be used to evaluate leaf colour. The nutrient contents of plant leaves, the leaf area index, the amount of chlorophyll, the biomass of plants, and the yield from a field may all be determined using the spectrum sensors of unmanned aerial vehicles. The ability of UAV thermal sensors to measure canopy temperature and determine stomatal conductance is essential for figuring out water potentials and consumption efficiency.

Spraying: Compared to a conventional chemical sprayer or a wide-area sprayer, UAVs can improve the efficacy of chemical sprays, such as insecticides, herbicides, and fertiliser solutions, by only spraying the regions that have been identified as having a pressing need for such chemicals. Selective application using drones can reduce the need for chemical field applications, lessen their negative effects on the environment, and increase business margins by eliminating the need for more expensive chemicals. Furthermore, in large farms, this technology can distribute chemicals to up to 50 hectares every day with just about 10 minutes of work required for every 0.5 ha of land. Thus, UAVs can help commercial farms by lowering labour requirements as well. Recent trials have shown that UAVs use altitude sensors to spray insecticides at varying heights onto plant canopies. Recently, research has focused on developing precision algorithms to improve crop control precision.

Identification of Insect Pests: In comparison to other difficulties, pests and illnesses significantly damaged the field, which resulted in a large loss in earnings. Early detection is essential because insect damage can spread swiftly. To do this, multispectral sensors and high-resolution RGB cameras mounted on UAVs were used to scan fields for infections. They provide very accurate maps and rapid pathogen diagnosis by utilising high-quality spectral data.

Planting: In large fields, UAVs can improve planting efficiency. They also make it possible to plant on uneven terrain. A novel method for optimal plant growth uses unmanned aerial vehicles (UAVs) to properly scatter seeds under the suitable climate conditions. Even though UAV use is still relatively new, planting tasks can be efficiently optimised using UAVs which have good image recognition skills.

Challenges and initiatives of drone agriculture in India

Drones can help farmers, academics, extension specialists, businesspeople, bureaucrats, and decision-makers manage livestock and agriculture. In Indian agriculture, drones have only been used sometimes as the outcome of several challenges. Due to legislative restrictions on their use in the air, farmers are hesitant to deploy drones for agricultural purposes. In India, a large number of small and marginal farmers are struggling financially. They will therefore just purchase the essentials with their money. Young people today are not interested in farming because of the intense effort and monotony involved.

Drones have the potential to significantly transform Indian agriculture in spite of all of these challenges. It is projected that future technological developments will enable the production of commercial drones. Drones' prospective applications could be fascinating. Indian youth and encourage them to work in agriculture. These concerns recently forced the Indian government to prioritise the use of drones in agriculture. Consequently, the Prime Minister of India has approved the use of 100 "Kisan Drones" to apply pesticides to fields around the nation. The Indian government is also providing financial aid for drone purchases. The Government of India's Ministry of Agriculture and Farmers Welfare (PIB) recently published the standard operating procedure for employing agri-drones to spray pesticides and fertiliser.

Conclusion

Drones have the potential to drastically change Indian agriculture. Drone surveillance devices allow farmers to examine their property from above. This provides details on the water system, pests, disease outbreaks, and soil types. Drone crop photographs contain information in both the visible and infrared spectrums. From these photos, a number of elements that provide details on the plant's condition can be identified. Another noteworthy aspect of this technology is its capacity to measure crop vitality on a regular basis, such as weekly or even hourly. Crop information is regularly available, allowing farmers to make the appropriate choices and/or adjustments for improved crop management.

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