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Emergence of Drone Technology in Agriculture

(Cultivating Innovation)

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Introduction

Farmers today are involved in many aspects of agriculture. Global issues include soil quality, plants and pests, urbanization, population growth and environmental degradation. Agribusinesses around the world are using drone technology to revolutionize agriculture. Drone technology is an amazing invention that has the potential to change the way agriculture works every day. A drone is an unmanned aerial vehicle (RPA). The propulsion systems are equipped with programmable controllers, automatic flight planning capabilities, and the ability to carry payloads such as cameras and spray systems. To complete the mission. They can operate with or without satellite navigation systems. Agricultural drones are drones used for agricultural purposes. Drones are equipped with sensors that can send real-time information about the health of crops or animal movements, allowing accurate and efficient decisions in terms of operations and management. Complex navigation algorithms running on the onboard controller can be used to program the drone to follow a predefined path; Instead, it can be controlled remotely via wireless communication. Using data collected from drone-mounted cameras and data analytics, farmers can determine land areas, classify crops and varieties, create soil maps that control pests, and plan crops according to plan.

When it comes to applying pesticides, using drones can be beneficial as an alternative to labour-intensive and dangerous traditional techniques, especially in challenging terrain like hills. To improve understanding of soil conditions, plant health, and agricultural yield prediction, artificial intelligence and machine learning can be integrated with high resolution photos taken by drones using NDVI (Normalized Difference Vegetation Index) imaging technology. If a plant is stressed, each one can be found independently and examined using image processing methods. With the help of this finding, farmers can stop the spread of illnesses to other crops by taking preventative measures. Using analysed insights from data collected by drones and satellite-based remote sensing, timely actions can be taken to minimize losses from biotic stresses such as insects, pests, and diseases, optimize fertilization, rationalize irrigation, and lessen the impact of climate change and unpredictable weather. This essay attempts to evaluate how drone technology is emerging to support farming activities in the face of labour shortages and tight compliance.

Status of Drone Applications in Agriculture

The use of drones in agriculture has become common in Asia. But in other parts of the world, they are used only in private experiments and sometimes in commercial horticulture, agriculture and forestry. Drones are used for many tasks such as planting new trees, spreading microgranular pesticides and fertilizers, controlling diseases and weeds, and spraying against pests. The 10-litre capacity YMR-08 uses coaxial rotors and spray quality is comparable to Remex and Fazer helicopters on small farms where operating pressure is low. Workers rented more than 2,500 manual, radio-controlled or high-pressure sprayers to spray rice in about 42 percent of the country, according to Yamaha's report. The World Economic Forum (WEF) Four Business Centres and the Great Lakes Council's Bitou Bush Control program are other applications that use Yamaha Critical Weather Services Australia's helicopters to control bushfires in remote areas or regions. plants. The sites cannot be accessed. 40 drone startups in India are working to improve their technology to reduce the cost of agricultural drones and make them easier for farmers to use and enjoy. The Maharashtra government has invited drone companies to collaborate with them. The Maharashtra government recently signed a Memorandum of Understanding (MoU) to examine the possibility of using drones in various government projects. Farmers in the Sahani-Palghar tribal village of Maharashtra have learned how to use drones not only for their farms and orchards but also for organic farming, fish farming, crop rotation, biocontrol, hydroponics and biological waste management.

Application of Drones in Agriculture

Any crop in any location can be monitored with drones. Drone integration can increase crop yields, save time, improve long-term performance, and make land management more sustainable.

A) Soil and field analysis:

Drones equipped with cameras monitor the area, collect ground data, and examine the soil and area using electronic devices. Drones collect raw data and then use algorithms to turn it into usable data. Therefore, they can be used for many agricultural purposes such as the maintenance of:

- ✓ Crop health: pest-caused damage, nutrient deficits, and pest infection-related colour changes.
- ✓ Vegetation catalogues: leaf area, yield, phenology, and efficacy of treatment.
- ✓ Plant development: plant density, plant height, and plant LAI.
- ✓ Water requirements: the amount of water needed based on the climate, with water-
- ✓ Plant nutrition concentration and nutrient availability for plant nutrient management are investigated in soil stressed areas of the field or orchard requiring irrigation.

The best techniques for managing crops, planting, and soil can be determined by farmers using this information.

B) Planting the seed from air:

It is estimated that 15 billion trees are cut down each year for mining, urban expansion and horizontal farming. However, drone accelerators allow us to

plant trees quickly. Some drones use pneumatic launchers to launch seed pods deep into the soil in certain environments, such as mangrove trees or mountainous areas. Drones can cultivate the same land as humans in 10 minutes. India's first pilot plant was launched on June 5, 2017, near the banks of the Pinakini River in Aurelianos district of Karnataka. A group of scientists from the Indian Institute of Science (IISc Bangalore) wants to convert 4,000 hectares of Doddaballapur area in the north of the city into forests and green spaces.

C) Spraying operation in Agriculture:

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D) Crop health assessment:

Drones equipped with sensors that detect visible and near-infrared light on crops can be used to monitor crop health in real time and understand how plants respond to disturbances. These features can be enhanced to display elements such as NDVI, water stress or crop failure. Using information from smart devices that can be viewed in 2D or 3D, farmers can find and better understand new strategies to increase yields while reducing crop losses.

E) Crop count and plant emergence analysis:

Drones and high-resolution data combined with machine learning algorithms (MLA) can predict yields, guide crop decisions, and collect event data faster and cheaper than ever before with the help of unmanned aerial vehicles (UAVs). Thanks to drones equipped with lidar sensors, changes in tree/crop biomass can be estimated at different altitudes, and this information is used to estimate the number of trees produced in the forest.

F) Irrigation monitoring and planning:

Drones equipped with remote sensing and thermal cameras can help solve water-related problems by dividing an area into sections with different humidity levels. This makes it easier to establish an accurate watering schedule. The Food and Agriculture Organization (FAO) of the Philippines uses drones with high-quality imaging and navigation equipment that can resolve ground features as small as 3 centimetres.

G) Disaster risk reduction:

To support disaster risk reduction (DRR) initiatives, FAO has developed a drone data collection system in collaboration with national institutions. This information can help governments better develop disaster and disaster relief services while also providing reliable, effective advice to rural areas. Drones have a faster response time than humans on the ground when it comes to detecting, analysing and taking action. The use of drones can reduce disaster response time by up to 44.46%.

H) Wildlife conservation:

Drones equipped with thermal cameras can be used to track, examine and observe animals from different angles. Drones have the potential to revolutionize wildlife and forest conservation efforts. Otherwise, it is too expensive or difficult to obtain. The Government of Assam in India has partnered with Tata Consultancy Services (TCS) to use drones to monitor, detect illegal settlements and track encroachments in the 480 square kilometre Kazi Ranga National Park. Because thermal cameras can detect the thermal signature of poachers, they can detect poachers even if they are hidden in thick vegetation. The horned rhino benefited greatly from this effort.

A few benefits of drones for agriculture include:

In the past, satellite or aerial imagery was used to provide an overview of agriculture and identify potential problems. In addition to real-time video, it also provides time for the animation to show the trimming. Some of the key benefits are listed below:

- ✓ This is an outsourced solution that requires less labour. There is consequently less dependence on departmental staff.
- ✓ You can fly a drone in any kind of weather. Drones are waterproof, but taking pictures in the rain can distort the image quality.
- ✓ The results can be processed quickly because they can be obtained in about three to four weeks.
- ✓ Drones can help farmers increase the amount of time they spend scouting crops (validating treatments and actions taken), improve variable-rate prescriptions in real time, estimate yield from a field, and respond to threats (weeds, pests, and fungi) more quickly.
- ✓ Any crop in any location can be monitored with drones. Since it is a relatively new agricultural technology, the next few years should see a significant expansion of both its market and applications.
- ✓ Agricultural professionals can use the high resolution of drone data to evaluate crop fertility, which will help them plan irrigation systems, apply fertilizer more precisely, and cut down on waste.
- ✓ Replanting decisions can be aided by the technology's ability to provide a comprehensive picture of plant emergence and population.

The cost of drones in agriculture is as follows:

Most agricultural drones with fixed wings are priced at Rs. 4 rupees. 5 Lakh depending on the features and sensors required to implement the proposed project. It can be more expensive because the image sensor, software, hardware, and equipment are all included in the cost of some drones.

There are several constraints associated with the use of drones in agriculture:

Agriculture Drones have the following downsides or disadvantages.

- ✓ High starting price.
- ✓ A conventional farmer lacks the skills to conduct the essential examination of drone footage. Drones used in agriculture require a few basic knowledge and skills to

operate. The farmer will require knowledge and skills related to image software in these situations.

- ✓ Flying them becomes challenging in extreme weather. Severe wind, fog, or rain can all hinder the devices' ability to fly or record the necessary space. Rain can cause damage to a drone's electronic parts. It takes a lot of sunlight to take an effective picture.
- ✓ The increasing number of restrictions surrounding air space may result in financial or legal penalties due to the constantly evolving laws and regulations surrounding drone flight.
- ✓ One drawback of a drone survey is its battery life. It shortens the drone's flying duration.
- ✓ Drones operate in the same airspace as commercial aircraft, so they could interfere with manned aircraft if they fly in their flight path. They also fly above the ground, which could result in an accident if they lose control for any reason.

Conclusion

The rise of drone technology in agriculture is revolutionary; It offers accurate, efficient and data-driven insights. Despite the challenges, the ability to improve agriculture, increase yields and promote sustainability heralds promising times for agriculture, moving the industry into an advanced technological future.

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