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Drone Technology: A Modern Breakthrough in Precision Agriculture

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INTRODUCTION

The production of agriculture relies largely on natural resources around the world, yet the rapid rise in population and unsustainable management practises have had a devastating impact on natural resources leading to their depletion. The population has been steadily growing and the United Nations projects that there will be 9.6 billion people on Earth by 2050 and according to the Food and Agriculture Organization of the United Nations, we will require 60% more food by then. The application of technology to agricultural development is fast increasing and widely practiced in many parts of the world, where agriculture serves as a major source of revenue and livelihood. Technological applications to the agricultural sector eliminate the stress and tedious manual labour involved. It also increases yield and aids proper management of farm input resulting into better output. The advantages of applying modern technology to agricultural productivity are: more people would eat better, while eradicating hunger and reducing malnutrition from increased production; improved nutrients in food; reduction in the physical pressure on the environment; improved quality of life and living standards as food costs decline etc.

Dynamic Remotely Operated Navigation Equipment, or DRONE (sometimes also known as UAV i.e. Unmanned Aerial Vehicle), is a gadget that can fly using GPS coordinates and an autopilot to follow a programmed course or manually using a remote control or smartphone. They have the ability to detect objects that are not visible to the human eye with the help of mounted cameras with different sensors and are also used for spraying of chemicals. Additionally, a precision farming approach recognises site-specific differences within fields and adjusts management actions accordingly to obtain maximum profit, sustainability, and environmental protection rather than managing an entire field based upon some hypothetical average condition, which may not exist anywhere in the field.

Utilizing real-time data from sensors, precision agriculture aids in making better decisions for increasing yield while saving resources (Mulla, 2013).

Types of drones

1. Fixed wing drones: Fixed-wing drones have a rigid wing (a non-movable wing) and are able to fly faster for longer periods of time, covering a wide range of potential habitats (ex: jungle, desert, mountain, maritime etc.). The drawback of these drones is that they can't hover and need a runway or launcher to take off and land.

2. Rotary wing drones: These drones are known as rotatory wing drones because they use propeller- or rotary blade-based propulsion systems. These drones, as opposed to fixed-wing types, can fly in all directions, both horizontally and vertically, as well as hover and have excellent mobility. However, these also have the drawbacks of poor speed and limited range.

3. LTA & tethered systems drones: Rarely used in agriculture as these have challenging management.

Why one should select drone for farming?

The unique characteristics of drones, such as their low operational costs, low operating altitudes with hovering capabilities, light weight, full ground station control, effective communication, and operational simplicity may be used to enhance agricultural planning, management, and production. Satellite-based images cover a larger area of the globe and are more expensive, have a lower resolution power and are impacted by cloud cover. In contrast, drones provide very high pixel resolution, fast information conveyance to the user and independence from cloud cover factors during crucial growth phases. By using current, affordable sensors and operating at a lower altitude, UAVs can gather more precise data with less effort. In this approach, this platform might be useful for producing accurate, location- and time-specific agricultural statistics. The data creates a solid foundation for precision agriculture technologies, such as variable rate irrigation, fertiliser, and pesticide applications. It may then turn out to be a successful instrument for increasing input usage effectiveness, profitability and environment protection. In addition to providing crop and land information, the drone also can apply pesticides and fertilisers in a more prudent and secure manner.

Applications of drones in agriculture

1. **Planting:** Although they are not yet widely used, some manufacturers have developed devices that can fire pods containing seeds and plant nutrients into the ready-made soil. The cost of planting will be reduced by 85% by the use of drone-planting devices.
2. **Crop spraying:** Drones can accurately and evenly spray the necessary volume of liquid in real time thanks to their capacity to monitor and control their distance from the ground. As a result, there is an increase in efficiency and a decrease in the amount of chemicals that seep into the groundwater. In fact, researchers predict that drone spraying will be demonstrated five times more quickly than conventional approaches.
3. **Crop monitoring:** Ineffective crop monitoring of larger areas is one of the biggest challenges in agriculture. The increasing unpredictability of spatial and temporal variability exacerbates monitoring issues. The most sophisticated type of surveillance was previously provided through satellite images, however there were negatives. Drone can act as an early warning system which help in timely and need based action. It will eliminate the need to visually inspect the field by farmers.
4. **Irrigation scheduling:** The dry areas of a field can be identified using hyperspectral, multispectral, or thermal sensors, allowing water supplies to be distributed much more economically—more water for the dry areas and less for the wetter ones.

Drones also make it possible to calculate the vegetation index, which describes the crop's relative density and health, and to visualise its heat signature, or the amount of energy or heat it releases, once it has begun to grow.

5. **Crop health assessment**: It's crucial to evaluate the condition of the crop and look for bacterial or fungal infestations on trees. Drone-borne equipment may determine which plants reflect various quantities of green light and near infrared light by scanning a crop using both visible and near-infrared sensors. Multispectral photographs that track changes in plants and show their health can be created using this information. An entire orchard/field can be assessed quickly with the help of it. Farmers can also more accurately apply treatments once a disease is identified.
6. **Weed identification:** It can also be used to identify the weeds present in the field which will aid in timely uprooting of these weeds so that they do not compete for nutrient, water and other resources with the main crop.
7. **Livestock monitoring:** Drones equipped with thermal sensors are a reliable choice for keeping an eye on herds from above; they can detect missing, hurt, or giving birth animals. Therefore, drones allow livestock farmers a new way to constantly monitor their cattle, which lead to higher income.

CONCLUSION

Agricultural drones are an incredibly innovative technology. By limiting the usage of fertiliser, pesticides, fungicides and other chemicals, they provide growers and farmers with new options to save costs and enhance yields while enhancing overall plant health, soil health and crop productivity. In the upcoming years, UAVs will be a commonplace in the farming sector thanks to the enormous advantages it provides. Precision agriculture takes into account temporal and spatial variability and enable synchronisation of soil supply and demand for plants. Instead of managing production inputs on a few big zones, precision farming tries to manage them over many smaller management zones. This technology can help them make decisions more precisely and develop the best management strategy for the field.

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