Application and Development of New Drones in Agriculture

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Abstract. With the advancement of technology and advances in technology, the research on drones has become more and more in-depth, and the practical application fields have become more extensive. Its unparalleled advantages also play an important role. At present, drone technology has also gradually matured. Drones are creating a new agricultural revolution. It is estimated that the size of drones in the agricultural market will reach billions of dollars in the next few years. As editor of the UN Food and Agriculture Organization and the International Telecommunication Union’s research report on “UAVs and agriculture”, information expert Gerard Sylvester said that as farmers work to adapt to climate change and meet other challenges, drones are expected to help the entire Agricultural enterprises improve efficiency.

1. UAV application
Farmers using drones can benefit in the following ways. UAV industry insiders believe that agriculture is a huge area for UAV applications. Drones can spray pesticides, fertilize and sow, as well as observe crop production and harvests. For livestock farms, drones can also be used to monitor animals and quickly collect useful animal health and population data.

Figure 1. NDVI (Normalized Difference Vegetation Index) Map.
It takes a lot of time and manpower to monitor the area where the entire crop is grown, and drones can quickly sweep and check to find plants that are slow to grow and may require remediation. The sensor monitors plants for absorbing and reflecting light of a specific wavelength, forming a color contrast image that visually reflects the problematic area. The images generated from these data include the NDVI (Normalized Difference Vegetation Index) map, which is derived by calculating the ratio of the difference between near-infrared and visible radiation, and is obtained by long-term monitoring of satellite images and drones. In this way, soils, crops and forests can be distinguished, and sick plants can be found, because plants that are harmed or dehydrated have different ways of reflecting light. The latest research shows that this spectral data can be found in crops that are damaged by floating pesticides, as well as weeds that grow in crops and are immune to herbicides. As shown above, the researchers conducted a test on a wheat field in Ontario, Canada, using a sensor-equipped drone to investigate the field. The resulting map highlights areas for further investigation: the NDVI map has a section infected by worms (Zone B) and the side is a healthy crop without infection (Zone A). You can also see the rock (Zone D), where the damaged area of the wheat stem is highlighted in bright pink in the map.

2. Herd monitoring

The ranchers who farmed cattle used drones to track their livestock on vast farms and to check where the fences needed to be fixed. When equipped with a high-definition thermal imager and night camera, the drone can also help investigate animals that may be harassing and attacking herds. In the Kaziranga National Park in India, this drone has also become a tool for tracking human poachers. NASA's early efforts to monitor the growth of the Great Plains by satellite have spurred the development of NDVI. Plant leaves can absorb and reflect light of different wavelengths: chlorophyll in healthy leaves absorbs visible light while reflecting near-infrared light. Yellow, stressed leaves and dead leaves (and rocks as soil) reflect and absorb these wavelengths in different ways. Sensor-equipped drones can collect these spectral data and create maps showing crop health changes.

3. Disease surveillance

In the absence of careful review, pathogens that cause plants to wither and otherwise destroy crops can evade detection. Although spectral imaging technology can reveal yellowing plants in green plants, Schmale of Virginia Tech is using drones to discover pathogens that have not landed in vacancies. He captured the air spores of Fusarium graminearum, which destroys wheat and corn and has drifted away by a few kilometers or more. If farmers know about the outbreak of pathogens in nearby counties, air
sampling can remind them that they are coming. Federal and state agencies can also monitor pathogens on a larger scale, enabling farmers to prepare before the outbreak.

4. Moisture monitoring
Land absorption of water is often uneven. Some parts may work faster than others or be missed by watering equipment. Spectroscopy and thermography can reveal the dry point of crop wilting. Imaging can also detect leaks in equipment and irrigation channels. More importantly, farmers can use airborne laser scanning technology or software that stitches thousands of high-quality aerial photographs into 3D maps to assess the topography of their land. These maps identify catchments, reveal the direction of water flow at the bottom of each tree in the orchard, and identify other land features that may affect crop health and soil erosion.

5. Mechanical pollinator
In fact, bee robots may not help much in pollination, but drones may one day help real bees. A New York-based startup has developed a pollen dump drone that helps pollinate fruits such as almonds, cherries and apples. The company reported that its drone rate could be increased from 25% to 65%, but external analysis verified that these figures have not been completed. Despite this, some fruit growers are optimistic that drones may be useful in orchards.

Second, farmland information monitoring

6. Agricultural Insurance Investigation
Sixth, crops are inevitably affected by natural disasters during the growth process, causing damage to farmers. For farmers with small-area crops, it is not difficult to investigate the affected areas. However, when large areas of crops are naturally infested, the workload of crop surveys is extremely large. The most difficult to accurately define the loss area. In order to more effectively measure the actual disaster area, agricultural insurance companies conduct agricultural insurance disaster loss surveys and apply drones to agricultural insurance claims. The drone has the characteristics of maneuvering fast response, high-resolution image and high-precision positioning data acquisition capability, application expansion capability of various task devices, and convenient system maintenance, which can efficiently perform disaster-damaged tasks. Through aerial surveys to obtain data, post-processing and technical analysis of aerial photographs, and comparison with field measurement results, insurance companies can more accurately determine the actual disaster area. The drone was damaged by the disaster, which solved the problem of difficulty in surveying damage and lack of timeliness in agricultural insurance claims, greatly improved the speed of exploration work, saved a lot of manpower and material resources, and ensured the farmland compensation survey while improving efficiency accuracy.

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