

Applications of Drones in Agriculture

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Drone:

The rise of drone technology has been one of the most significant technological advancements in recent years. A drone, also known as an Unmanned Aerial Vehicle (UAV) or Unmanned Aircraft System (UAS), is a type of aircraft that operates without a human pilot on board. Drone is a robotic device that can be controlled remotely or fly autonomously using software-controlled flight plans and embedded systems, in conjunction with onboard sensors and GPS. It is controlled by specific point and serves as a valuable tool for navigating small distance flying areas. Drone technology is primarily used by companies working in industrial sectors such as mining, construction, army, hobbyists etc., and in transforming industries such as agriculture, businesses, construction, energy, logistics, media, entertainment and several more applications.

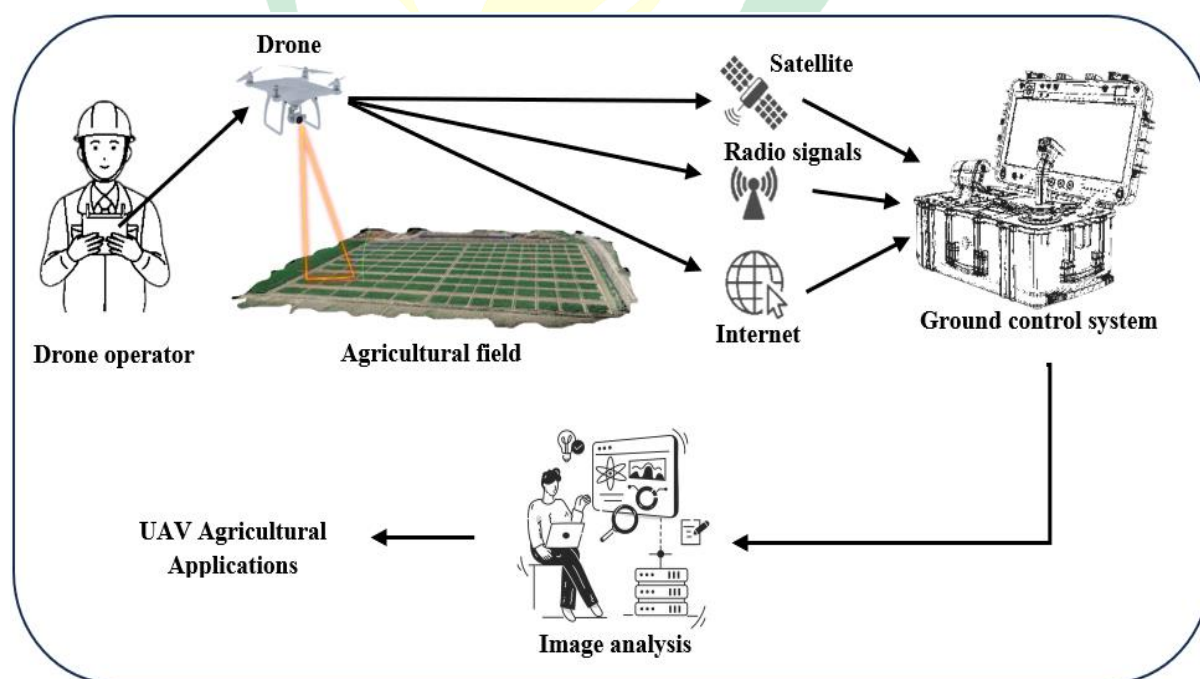


Figure 1: UAV data acquisition methodology

In agriculture, drones are highly recommended for capturing aerial imagery at significant altitudes, which can assist observe crops while scanning and evaluating areas to accumulate essential agricultural information, this imaging technique can help in the determination of crop growth and development. This imaging technology plays a key role in assessing various aspects like crop monitoring, precision agriculture, monitoring the soil health, agricultural field mapping and surveying, livestock monitoring, irrigation management, harvesting, seeding etc. The integration of drones into agricultural practices exemplifies the transformative potential of this technology, promising greater efficiency, sustainability and data-driven decision-making in the world of farming.

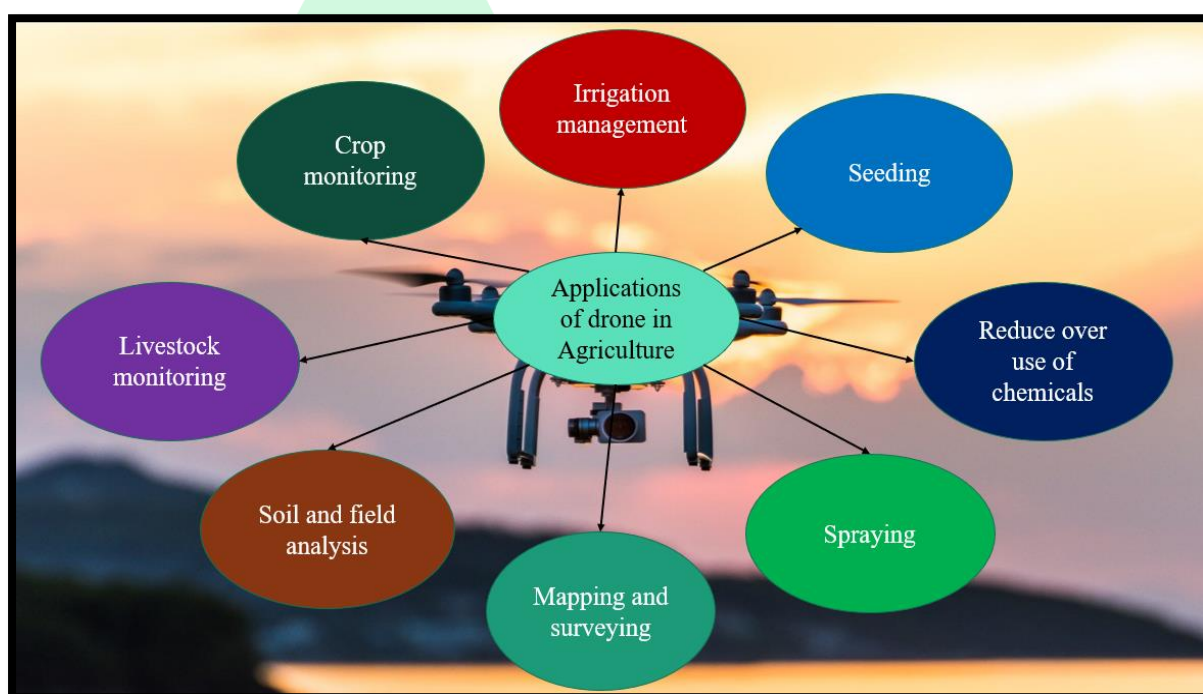


Figure 2: Applications of drone in agriculture

Applications:

Drones are increasingly finding applications in agriculture to enhance crop productivity and reduce operational costs. Some of the main applications of drones in agriculture include:

- a) **Crop Monitoring:** Drones equipped with high-resolution cameras can capture detailed images of crops from above. These images can be used to identify various issues, including pest infestations, diseases, and nutrient deficiencies. By monitoring crop health and growth throughout the growing season, farmers can take timely action to address problems and optimize their crop yield.



- b) **Precision Agriculture:** Precision agriculture involves using drones to apply fertilizers, pesticides, and other inputs with great accuracy. Drones equipped with specialized equipment can target specific areas of a field, ensuring that resources are used efficiently and reducing the environmental impact of agriculture.
- c) **Soil Health Monitoring:** Drones can carry sensors that measure soil properties such as moisture content, pH levels, and nutrient levels. This data helps farmers make informed decisions about irrigation, soil amendment, and crop selection, ultimately improving soil health and productivity.
- d) **Agricultural Field Mapping and Surveying:** Drones can create detailed 3D maps of agricultural fields using a combination of cameras and LiDAR (Light Detection and Ranging) technology. These maps provide valuable information about the terrain, elevation, and soil types, allowing farmers to plan planting and harvesting activities more effectively.
- e) **Livestock Monitoring:** Drones equipped with thermal imaging cameras are used to monitor the health and movement of livestock. This technology can detect changes in body temperature, which may indicate illness, and help farmers manage their herds more efficiently.
- f) **Disease Detection:** Drones equipped with specialized sensors can detect crop diseases at an early stage. By identifying affected areas quickly, farmers can take targeted action, such as applying fungicides, to prevent the spread of diseases and reduce crop losses.
- g) **Weed Management:** Drones can be used for weed detection and management. They can identify weed-infested areas within fields, allowing farmers to selectively apply herbicides only where needed, minimizing chemical usage and costs.
- h) **Microclimate Monitoring:** Drones equipped with weather sensors can monitor microclimates within fields. This information helps farmers make decisions related to frost protection, temperature regulation, and micro-irrigation to create optimal growing conditions.
- i) **Crop Forecasting:** By analysing historical data and current conditions, drones can provide accurate crop yield forecasts. This information is valuable for supply chain management and marketing decisions.
- j) **Irrigation Management:** Drones can fly over irrigation canals and fields to assess water levels and identify areas that may be over- or under-irrigated. This information allows



farmers to optimize their irrigation systems, conserve water, and prevent waterlogged or drought-affected areas.

k) Harvesting: Drones can be used to monitor the progress of crop growth and predict the optimal time for harvesting. This data ensures that crops are harvested at their peak ripeness, maximizing yield and quality. In some cases, drones equipped with mechanical arms can even assist in the actual harvesting process.

l) Seeding: Precision planting using drones involves dropping seeds with high accuracy in specific areas of a field. This method allows farmers to control seed placement, spacing, and depth more precisely, resulting in improved crop uniformity and higher yields.

These applications demonstrate how drones are revolutionizing modern agriculture by providing farmers with real-time data, enhancing resource management, and ultimately increasing crop yields while reducing environmental impacts.

Conclusion:

The applications of drones in agriculture have introduced in a new era of precision and efficiency in farming practices. Drones equipped with advanced sensors, cameras, and mapping technologies are empowering farmers to make data-driven decisions, optimize resource utilization and enhance crop health. From crop monitoring and precision agriculture to soil analysis and livestock management, drones are revolutionizing the way farmers operate and manage their fields. Currently, research indicates that approximately 85% of drone technology is predominantly employed for military purposes, while the remaining 15% serves civilian applications across various sectors. However, with the rapid advancements in technology, it is reported that growth of drone technology is increasing 25-32% every year in Agriculture sector. As the agricultural sector continues to embrace drone technology, we can anticipate further advancements and innovations. These innovations promise to increase not only crop yields but also the overall sustainability and resilience of agricultural systems in the face of evolving challenges such as climate change and food security.