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Drone Technology in Agriculture

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ARTICLE ID: 15

Introduction-

815 million people suffer from food insecurity worldwide each year. According to FAO projections, by 2050, agricultural production levels will need to increase by 60%. The IPCC issues a warning, stating that by 2050, crop yield could drop by 10% to 25% due to climate change. Farming communities need to adjust to new technologies in order to produce more food grains and boost productivity.

One of the most recent examples of modern technology is the usage of drones, or small unmanned aerial vehicles (UAVs). These days, drones are employed in a vast array of non-military applications, such as firefighting, search and rescue, surveillance, traffic monitoring, weather monitoring, personal drone use, business drone photography, videography, agricultural, and even delivery services. The aircraft can be operated remotely or it can take off and land on its own using software-controlled flight plans in embedded systems that communicate with GPS and onboard sensors.

The Indian government also unveiled a certification program on January 26, 2022, allowing agricultural drones to carry payloads devoid of pesticides or other liquids that are typically used for drone spraying. These liquids can be sprayed as long as the relevant laws and guidelines are followed.

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The Indian government announced on January 23, 2022, that it would provide the Farm Machinery Training and Testing Institutes, ICAR Institutes, Krishi Vigyan Kendras, and State Agriculture Universities with a 100% subsidy, or 10 lakhs, whichever is less, until March 20, 2023, in order to encourage the use of drones for agricultural purposes and lessen the labor burden on farmers.

History of Drones

In 1849, Austrians started employing unmanned flying balloons. Japan began using remote control aerial spraying technology in 1983 to apply agrochemicals. The Japanese motor company Yamaha produced the R-50, the first autonomous crop-dusting helicopter in history, with a 20 kg payload capacity. The widely acknowledged potential for drones to transform agriculture reached its culmination in 2015. Drone technology has advanced significantly in the last 20 years, and its possibilities are expected to rise in the near future.

Classification of Drones

1. **Based on form, feature and functions**
   - Possess two identical wing designs to an aero plane.
   - Function at a maximum speed of 50 km/h.
   - Maps of large fields.
   - They are unable to take off vertically. they cannot transport heavy loads over long distances fixed wing drone

   a. **Single rotor drone**
      - Only possess one rotor.
      - Capable of vertical takeoff and landing.
      - More effective than drones with several rotors.
      - Approved for agrochemical spraying.

   b. **Multi rotor drone**
      - Utilize four out of every eight rotors.
      - Only a 10–20-minute lifespan.
      - Launch and descend vertically.
      - Take photos and move small amounts of cargo.
      - Mostly utilized for pesticide spraying.

   c. **Hybrid drone**

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- Equipped with both wings and rotors.
- Can take off and land vertically.
- Cover far longer distances.
- Carry heavier cargo than multi-rotor drones.

d. Ducted fan drone

- can take off and land vertically
- Used for crop monitoring.

2. Based on maximum takeoff weight (including payload)

The classification of civil remotely piloted aircraft is based on their maximum takeoff weight.

- **Nano:** weighing less than 250 grams
- **Micro:** more than 250 grams and up to or including 2 kg.
- **Small:** more than 2 kg and up to or including 25 kg.
- **Medium:** weighing more than 25 kg but not more than 150 kg.
- **Large:** weighing more than 150 kg.

Sensors Used in Agricultural Drones

1. Visual sensor

- Aerial mapping
- Imaging
- Plant counting
- Surveying

2. Thermal sensor

- Heat signature detection
- Livestock detection
- Surveillance
- Water source detection
- Emergency response

3. Multispectral sensor

- Measurements of plant health
- evaluation of water quality

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- Vegetation index
- Plant counting

4. Hyper spectral sensor

- Full spectral sensing
- Spectral research and development
- Vegetation index calculation
- Water quality assessment

5. LIDAR sensor

- Useful in 3D digital surface modelling
- Surface variation detection
- Flood mapping
- Short range

How are drones being used in agriculture?

1. Monitoring plant health

- Drones equipped with special imaging equipment called normalized vegetation index (NDVI).
- Software analysis can be used to change values in order to reflect the specific crop type and even in which stage of life a specific crop is in.

2. Monitoring field conditions

- Drones provide accurate field mapping.

Having information on field elevation is useful in determining drainage patterns and wet/dry spots which allow for more efficient watering technique.

3. Planting and seeding

- Automated drone seeders are mostly being used in forestry industries.
- Planting with drones means very hard to reach areas can be replanted without endangered workers.

4. Spray application

- Crop spraying drones can carry large liquid storage reservoirs, can be operated more safely.
- It can be operated and maintained at a fraction of the cost compared to crop dusters.

5. Security

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- Drones are used to monitor the far reaches of a farm and allows for more frequent monitoring of hard-to-reach areas.
- Monitoring remote areas, which used to take hours of walking, can now be completed in a few minutes.

6. Drone pollination

- Researchers in the Netherlands and Japan are developing small drones that are capable of pollinating plants without damaging them.
- The next step is to create autonomous pollinting drones that will work and monitor crop health without constant instruction from operators.

7. Drone irrigation

- Using microwave sensing, drones are able to capture very accurate soil health information.
- Water can be distributed in a field in the most efficient way in an effort to conserve resources.

8. Livestock

- Measurement of body temperature.
- Detect heat in livestock
- Locate inflammatory lesions.
- Counting the livestock.
- Screening of livestock for the possible presence of infections.

Conclusion

Advantages of using drones in agriculture	Limitations of using drones in agriculture
• Preserving pesticide spraying time. • Lower the labor demand. • Simple to use after learning. • Mapping with integrated GIS. • Crop imaging for health. • The work is done more efficiently. • Find the damage to the crops. • Cut back on pollution. • Boost output.	• Flight duration and range • Expensive for high-end drone features • Unsuitable for extremely tiny spaces • Operational safety • Federal law • Airspace interference • Weather-related • Expertise and abilities • Privacy

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Drones were originally only intended for use in warfare. Over the past ten years, drone technology has revolutionized the agriculture industry. Drones have the potential to usher in the next agricultural revolution in response to the growing demand for agricultural laborers and the need to boost food supply and security. Therefore, the State Agricultural Department, Agricultural Universities, and Research Institutes can deploy drones to implement future reforms.

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