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Application of Drone in Agriculture

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A B S T R A C T

The world population has increases day by day and projected to reach 9 billion people by 2050, so that the agricultural consumption will also increase. There is extreme need to fulfil the food demand of each and every person. Agriculture sector is the most promising sector, dealing with the lot of problems now a day's one of the main problems is labour unavailability for farming. Other problems or difficulties are extreme weather events, inadequate amount and inefficient application of fertilizer, infection, diseases, allergies and other health problems due to chemical application (fungicide, pesticide, insecticide etc.) or insect/ animal bite. The Use of advanced technologies such as drone in agriculture offer potential for facing several major or minor challenges. The major applications of drone in agriculture are irrigation, crop monitoring, soil and field analysis and bird control.

Introduction

The world population has increases day by day and projected to reach 9 billion people by 2050, so the expert expect that the agricultural consumption will also increase in the same time period. In order to feed this larger, more urban and richer population, food production (net of food used for biofuels) must increase by 70 percent. Annual cereal production will need to rise to about 3 billion tonnes from 2.1 billion today and annual meat production will need to rise by over 200 million tonnes to reach 470 million tonnes. Agriculture sector is the most promising sector and challenging sector because it is depends on climate or weather, condition of the soil, irrigation water quality and quantity and their application rate. This report argues that the required increase in food production can be achieved by adopting the advance technologies in agricultural production. The Use of advanced technologies such as drone in agriculture offer potential for facing several major or minor challenges. The major applications of drone in agriculture are irrigation, crop monitoring, soil and field analysis and bird control.

Drone or UAV

A UAV (Unmanned Aerial Vehicle) is a flying device that can fly a pre-set course with the help of an autopilot and GPS coordinates. The device also has normal radio controls; it

can be piloted manually in case of a fault or dangerous situation. Sometimes the term UAV is used to refer to the complete system, including ground stations and video systems, however the term is most commonly used for model planes and helicopters with both fixed and rotary wings.

Advantages

Unmanned Aerial Vehicle offers less stressful environment, it is used for better decision making, it presents safer environment, and they can fly longer hours as long as the vehicle allows for it (no human fatigue in the plane).

There is no need for the qualified pilot to fly it, in the long run,

Unmanned Air Vehicle can stay in the air for up to 30 hours, doing the repetitive tasks, performing the precise, repetitive raster scan of the region, day-after-day, night-after-night in the complete darkness or in the fog and under computer control.

Unmanned Air Vehicle performs the geological survey, it performs the visual or thermal imaging of the region, it can measure the cell phone, radio or TV coverage over any terrain, the drone pilots or operators can easily hand off controls of the drone without any operational downtime.

The drones can have more pinpoint accuracy from greater distances

Basic Principle - How do drone work?

The 4 propellers of a drone or quadcopter are fixed and vertically orientated. Each propeller has a variable and independent speed which allows a full range of movements. The core components of a drone are as follows:

Chassis: the skeleton of the drone which all componentry is fixed to. The chassis design is a trade-off between strength (especially when additional weights such as cameras are attached) and additional weight, which will require longer propellers and stronger motors to lift.

Propellers: principally effect load the drone can carry the speed it can fly and the speed it can manoeuvre. The length can be modified; longer propellers can achieve greater lift at a lower rpm but take longer to speed up/slow down. Shorter propellers can change speed quicker and thus are more manoeuvrable; however they require a higher rotational speed to achieve the same power as longer blades. This causes excess motor strain and thus reduces motor life span. A more aggressive pitch will allow quicker movement but reduced hovering efficiency.

Motors: 1 per propeller, drone motors are rated in "kV" units which equates to the number of revolutions per minute it can achieve when a voltage of 1 volt is supplied to the motor with no load. A faster motor spin will give more flight power, but requires more power from the battery resulting in a decreased flight time.

Electronic Speed Controller (ESC): provides a controlled current to each motor to produce the correct spin speed and direction.

Flight Controller: the onboard computer which interprets incoming signals sent from the pilot and sends corresponding inputs to the ESC to control the quadcopter.

Radio Receiver: receives the control signals from the pilot.

Battery: generally lithium polymer batteries are used due to high power density and ability to recharge.

Further to this, sensors can be used such as accelerometers, gyroscopes, GPS and barometers for positional measurements. Cameras are also frequently mounted for navigation and aerial photography.

Drone mechanism - How do you fly a quadcopter drone?

A drone is controlled manually with a hand-held radio control transmitter which manually controls the propellers. Sticks on the controller allow movements in different directions and trim buttons allow the trim to be adjusted to balance the drone. Screens can also be used to receive live video footage from the on-board camera and to display sensor data.

Further to this, on-board sensors can provide helpful settings such as;

- Auto altitude where the drone will move at a fixed altitude, and;
- GPS hold, where the drone will remain at a fixed GPS position.

Drone can also be flown autonomously, modern flight controllers can use software to mark GPS waypoints that the vehicle will fly to and land or move to a set altitude.

Applications of drone

Main areas of applications are

Military

Military usage of drones or RPAS (Remotely Piloted Aerial Systems) has become the primary use in today's world. Used as target decoys, for combat missions, research and development, and for supervision, drones have been part and parcel of military forces worldwide.

Drones are used in situations where manned flight is considered too risky or difficult. They provide troops with a 24-hour "eye in the sky", seven days a week. Each aircraft can stay aloft for up to 17 hours at a time, loitering over an area and sending back real-time imagery of activities on the ground.

Delivery services

Drones could save a lot of manpower and shift unnecessary road traffic to the sky. Besides, they can be used over smaller distances to deliver small packages, food, letters, medicines, beverages and the like.

Security and law enforcement

Drones are also used for maintaining the law. They help with the surveillance of large crowds and ensure public safety. They assist in monitoring criminal and illegal activities. In fact, fire investigations, smugglers of migrants, and illegal transportation of drugs via coastlines, are monitored by the border patrol with the help of drones.

Search and rescue

Presence of thermal sensors gives drones night vision and makes them a powerful tool for surveillance. Drones are able to discover the location of lost persons and unfortunate victims, especially in harsh conditions or challenging terrains. Besides locating victims, a drone can drop supplies to unreachable locations in war torn or disaster stricken countries. For example, a drone can be utilized to lower a walkie-talkie, GPS locator, medicines, food supplies, clothes, and water to stranded victims before rescue crews can move them to someplace else.

Films & television industries

Drones are now being used to capture footage that would otherwise require expensive helicopters and cranes. Fast paced action and sci-fi scenes are filmed by aerial drones, thus making cinematography easier. These autonomous flying devices are also used in real estate and sports photography.

Furthermore, journalists are considering the use of drones for collecting footage and information in live broadcasts.

Agriculture

Farmers and agriculturists are always looking for cheap and effective methods to regularly monitor their crops. The infrared sensors in drones can be tuned to detect crop health, enabling farmers to react and improve crop conditions locally, with inputs of fertilizer or insecticides. It also improves management and effectuates better yield of the crops. In the next few years, nearly 80% of the agricultural market will comprise of drones.

Power and pipeline inspection: Many systems such as power lines, wind turbines, and pipelines can be checked by drones.

Wildlife monitoring

Drones have served as a deterrent to poachers. They provide unprecedented protection to animals, like elephants, rhinos, and big cats, a favorite target for poachers. With its thermal cameras and sensors, drones have the ability to operate during the night. This enables them to monitor and research on wildlife without causing any disturbance and provides insight on their patterns, behaviour, and habitat.

Disaster management

Drones provide quick means, after a natural or man-made disaster, to gather information and navigate debris and rubble to look for injured victims. Its high definition cameras, sensors, and radars give rescue teams access to a higher field of view, saving the need to spend resources on manned helicopters. Where larger aerial vehicles would prove perilous or inefficient, drones, thanks to their small size, are able to provide a close-up view of areas.

Agricultural applications of drone

Soil and field analysis: Drones can be instrumental at the start of the crop cycle. They produce precise 3-D maps for early soil analysis, useful in planning seed planting patterns. After planting, drone-driven soil analysis provides data for irrigation and nitrogen-level management.

Planting: Startupshave created drone-planting systems that achieve an uptake rate of 75 percent and decrease planting costs by 85 percent. These systems shoot pods with seeds and plant nutrients into the soil, providing the plant all the nutrients necessary to sustain life.

Crop spraying: Drones can scan the ground and spray the correct amount of liquid, modulating distance from the ground and spraying in real time for even coverage. The result: increased efficiency with a reduction of in the amount of chemicals penetrating into groundwater. In fact, experts estimate that aerial spraying can be completed up to five times faster with drones than with traditional machinery.

Crop monitoring: Vast fields and low efficiency in crop monitoring together create farming's largest obstacle. Monitoring challenges are exacerbated by increasingly unpredictable weather conditions, which drive risk and field maintenance costs.

Irrigation: Drones with hyper-spectral, multispectral, or thermal sensors can identify which parts of a field are dry or need improvements. Additionally, once the crop is growing, drones allow the calculation of the vegetation index, which describes the relative density and health of the crop, and show the heat signature, the amount of energy or heat the crop emits.

Health assessment: It's essential to assess crop health and spot bacterial or fungal infections on trees. By scanning a crop using both visible and near-infrared light, drone-carried devices can identify which plants reflect different amounts of green light and NIR light. This information can produce multispectral images that track changes in plants and indicate their health.

Picture.1 Image of the drone

At beginning of 21st century, people looked forward to new millennium. No one could imagine what kind of new technology take place. In that way, Agricultural drone is an amazing advance technology, which is becoming a tool like any agricultural equipment. Various reasons have behind this, like comparatively cheap agricultural drone with advanced imaging capabilities and sensor are giving specific data to the farmer. By using this data, farmer can increase yields and reduce crop damage. Moreover, less use of pesticides reduces environmental damages.

However, Farming is an input-output problem. With using of drone, farmer can reduce inputs – water and pesticides and maintaining same output, it will be overcoming the food shortage. Agricultural drone changes farmer's ability to monitor and manage the key aspect of farm business that is impossible to sustain in remote place. Conclusively, we can say Drone, which started as a military technology may end up better known as a green-tech technology.

General India drone laws

Drone use is allowed in India, but there are several drone laws that need to be followed when flying in the country. Operators must ensure that they follow the following drone laws when flying a drone that weighs over 250 grams in India,

Do not fly your drone over densely populated areas or large crowds.
Respect others privacy when flying your drone.
Do not fly your drone within 5km of airports or in areas where aircraft are operating.
You must fly during daylight hours and only fly in good weather conditions.
Do not fly your drone in sensitive areas including government or military facilities. Uses of drones or camera drones in these

areas are prohibited.
You must be at least 18 years old and have completed a training course.
All drones must be equipped with a license plate identifying the operator, and how to contact them.
You must only fly your drone within visual line of sight.
You cannot fly more than one UAV at a time.
Do not fly your drone within 50km of a border.
Do not fly your drone more than 500 meters into the sea, from the coastline.
Do not fly within 5km of Vijay Chowk in Delhi.
Do not fly over national parks or wildlife sanctuaries.
All drones must have liability insurance.

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