APPLICATION OF DRONE TECHNOLOGY IN AGRICULTURE MANAGEMENT SYSTEM TO SUSTAIN PRODUCTIVITY

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Abstract

The use of drones in the agriculture industry is steadily growing as part of an effective approach to sustainable agricultural management that allows agronomists, agricultural engineers, and farmers to help streamline their operations, using robust data analytics to gain effective insights into their crops. Crop monitoring, for example, is made easier by using drone data to accurately plan and make ongoing improvements, such as the use of ditches and evolving fertilizer applications. Products can be accurately traced from farm to fork using GPS locations for every point in the journey, rather than more traditional time and labor-intensive data collection.

UAVs are particularly useful for the careful monitoring of large areas of farmland, considering factors such as slope and elevation, for example, to identify the most suitable seeding prescriptions. The technology has also proven useful in gaining an extensive overview of plant emergence and population, as more accurate data can help with replanting decisions, as well as thinning and pruning activity and the improvement of crop models.

INTRODUCTION

While aiming to produce enough food and remain sustainable, agriculture is facing significant changes. In the new agricultural era, farmers are able to use various high-tech sensing devices based on GPS, variable rate application, steering systems and remote sensing, as well as farm management software. The introduction and the use of modern and precise farm technologies brings revolutionary changes into farming. In other words, modern farm technology revolutionizes the way in which farmers work.

By using precise technology, farmers are able to optimize both farm productivity and profitability based on real-time field information thus protecting the environment, which can be a turning point to success.

Technological progress made in monitoring, supervision, management and control systems have opened a new era in which many traditional agricultural practices are outdated. Their replacement with new technologies falls into the "precision farming" category, which translates into applying the agronomic variables in the right place, at the right time and with precise control over the amount of material inputs or crop production

“Drones can monitor any type of crop during its growing season, in any area.”

What Are Drones?

Unmanned aerial vehicles (UAV), commonly named drones, are small aerial platforms weighing up to 20 kg (50 lbs). Due

to their size, they cannot be boarded by a human body (yet). Drones can be operated in two ways; directly, in which a human has complete control of the vehicle by wireless remote; and autonomously, in which the vehicle is able to control itself and follow a route based on the data from GPS or other sensors.

COMPONENTS OF DRONE:

Chassis, Propellers, Motors, Electronic Speed Controller (ESC), Flight Controller, Radio Receiver, Battery.

TYPES OF DRONES

1.Fixed wing
2.Rotary wing
3. Tethered vehicle
4. Lighter-than-air (LTA) vehicles

APPLICATIONS OF DRONE IN AGRICULTURE:

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 could operate during the night. This enables them to monitor and research on wildlife without causing any disturbance and provides insight on their patterns, behavior 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 MANAGEMENT

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:

Startups have 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.

DISEASES MONITORING:

Crop diseases can be devastating and classified as fungal, bacterial or viral. Drones equipped with Infrared cameras can see inside plants, giving a clear image of the condition thereof. If a farmer can detect an infection before it spreads, preventative measures can be taken - like removing the plant -before the infection spreads to neighbour plants. Image-based tools can, thus, play an important role in detecting and recognizing plant diseases when human assessment is unsuitable, unreliable, or unavailable, especially with the extended coverage provided by UAVs. RGB and multispectral images have been preferred methods for acquiring information about the studied areas, but hyper spectral and thermal images have also been tested. The latter is employed mostly to detect water stress signs potentially caused by the targeted disease.

WEED CONTROL:

Agro-drone application for weedicide spray useful for pre-emergence & post emergence weed control. Weedicide application through drone is efficient and optimizes uses of weedicide. It is simple to use and easy to carry and maintain. Operate remotely that is very safe for health.

BENEFITS OF DRONES:

➢ Ability to capture high accurate 3D maps!

➢ Provide way over When, How and Where the images are collected!

➢ Economic, Fast & Flexible

➢ Extremely useful in hazardous & hard-to reach areas

➢ Accessible & Easy to use Inherently safe

FUTURE OF DRONES IN AGRICULTURE:

Initially the drone was introduced in the agriculture with a bit hesitation. But now the farmers have started to realize its importance. Different research work is going on at different research institute in India. Like, the Indian Council of Agricultural Research (ICAR) through the Indian Agricultural Research Institute (IARI) under a collaborative research project is developing indigenous prototype for drone-based crop and soil health monitoring system using Hyperspectral Remote Sensing (HRS) sensors. This type of research work is required in India to utilize this technology more effectively in the agriculture sector.

CONCLUSION:

Drones have great potential to transform Indian agriculture. With the advancement of technology in the future, the production of drones is expected to become economical. The modern youth are not attracted towards farming due to hard work and drudgery involved in it. The implication of drones may fascinate and encourage the youth towards agriculture. Drones provide real time and high-quality aerial imagery compared to satellite imagery over agricultural areas. Also, applications for localizing weeds and diseases, determining soil properties, detecting vegetation differences and the production of an accurate elevation models are currently possible with the help of drones. Drones will enable farmers to know more about their fields. Therefore, farmers will be assisted with producing more food while using fewer chemicals. Nearly all farmers who have made use of drones have

achieved some form of benefit. They can make more efficient use of their land, exterminate pests before they destroy entire crops, adjust the soil quality to improve growth in problem areas, improve irrigation to plants suffering from heat stress and track fires before they get out of control. Therefore, drones may become part and parcel of agriculture in the future by helping farmers in managing their fields and resources in a better and sustainable way.

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