Drone Assisted Farming

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ABSTRACT

The agricultural industry is crucial; thus, labor shortages are one of several issues. Alternative issues include terrible weather, inadequate fertilizer application, diseases, allergies, and many other health issues caused by chemical (fungicide, pesticide, insecticide) or insect application. Agriculture workers and governments are investigating sustainable ICT problems in farming. Unidentified aircraft were used for fast, non-destructive air quality, soil, and chop tests. Water consumption, climate, wind, soil quality, weeds and insects, growing seasons, and more affect farmers' results today. Finally, farmers are relying on top-tier drone technology to help solve these difficulties quickly and effectively. Drones can monitor statistics, weather, rainfall, and more. These data can be used to map problems and find solutions based on reliable data. UAVs, or drones, are flying machines. It may be piloted from the ground or autonomous using pre-programmed hardware and pathways. Drones can see things beyond human sight because to their many sensors. Agriculture drones serve agricultural purposes. Drones provide real-time, efficient, reliable, and detailed information with fewer mistakes. Consequently, the primary objective of my project is to apply precise quantities of pesticides only on diseased crops. In addition, this drone will be equipped with a number of sensors and spraying systems, as well as an advanced programming language; this drone will be fully autonomous, that is, it will fly autonomously to the crop farms, take data of the field by taking pictures, and then either process the data and begin the spraying mission or send the data to the main station. This drone will be designed with numerous sensors and components, including a Gyro probe Sensor, Temperature sensor, Motion sensor, Digital light sensor, high-quality cameras, etc. In terms of components, a drone is essentially a collection of interconnected devices, such as a flight controller, esc, motors, GPS module, high-quality cameras, programmable machines such as raspberry pi or Arduino, telemetries, and many others depending on the drone's features.

Project Aim

The aim of this project is to involve technology in agriculture by helping the farmers to spray the trees or crops, the insects or chemicals on it using smart drones.

Project Objectives

The objectives are the specific steps for achieving the aim of the project.

1. Drones fly autonomously following a predetermined path or manually following RF signal from remote control to complete mission.
2. Drone sprays a pesticide over target area based on RF signal command.
3. Drone capsule video/image of the field and send to the ground control.

Literature Review

Implementation of Drones in Agriculture

Conventional agricultural systems (CAS) use more fertilizers, insecticides, and other agrochemicals because the world's population is expected to reach 9,000,000,000 by 2050, increasing agricultural ingestion by over 70%. Thus, climate change and pollution are two of our most pressing global issues, and they are affecting agricultural production. Asia has 64% of the 815,000,000 chronically malnourished people. (FAO, 2018).Extreme weather, inadequate fertilizer application, pollution, infections, allergies, and various health difficulties caused by biochemical applications like fungicide, pesticide, insecticide, insect, etc. Weather impacts food security. Asia has 64% of the world's chronically hungry. By 2050, the world must increase supplement production by almost 50% to feed over 9 billion people, yet resources like land and water are scarce. Kasar (2018).

Farming communities and workers must adjust to climate change and other concerns. In this context, ICT-driven tools and systems that provide accurate, trustworthy, and fast data to help individuals make better choices are crucial. Agriculture needs new technologies to solve some of its problems. Technology in monitoring, supervision, administration, and control has rendered some classic agricultural approaches obsolete. "Precision farming" involves applying agronomic parameters at the proper time, location, and amount to manage crop production and material inputs.

FAO, ITU, and partners have been leveraging ICTs to solve agricultural problems. UAVs can quickly and non-destructively monitor air quality, soil element physical characteristics, and crop growth. Sustainable data and communication technologies in agriculture are unfeasible in the present environment. It's vital." Sylvester 2020.

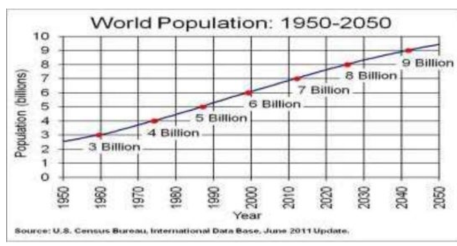

Figure 1. World population growing rate.

Tree-Planting and Seeding

UAS grow trees by dropping biodegradable seed pods or seed bombs with nutrients into the soil.

Crop spraying: Drones can scan the field and apply the right quantity of pesticides in real time. Drone agricultural spraying limits human interaction with dangerous pollutants. Farming drones work quicker than aircraft or vehicles. Drones have RGB and multispectral sensors to find trouble areas. UAV aerial spraying is five times quicker, according to experts.

Crop health surveillance: By photographing a crop with both visible and near-infrared light, drones can determine which floras reflect varying amounts of green and near-IR light. These data might provide multispectral pictures that track plant changes and health.

Application and Development of New Drones in Agriculture

Technology has advanced drone research and broadens its practical applications. Its unmatched advantages also matter. Drone technology is evolving. Drones are changing farming. UAVs in agriculture might reach billions of dollars in the next several years. The editor of the UN Food and Agriculture Organization and the International Telecommunication Union's research report on "UAVs and agriculture," information expert Sylvester (2021), said drones are expected to help the entire agricultural enterprise improve efficiency as farmers adapt to climate change and other challenges.

Drone farmers will gain. UAV specialists say agriculture is a major UAV use. Drones can fertilize, sow, and spray pesticides. Drones can easily gather livestock farmhouse animal health and population data.

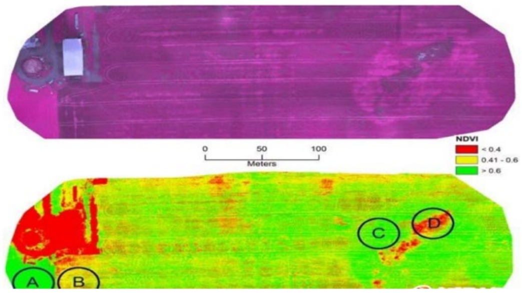

Figure 2. NDVI (Normalized Difference Vegetation Index) Map. (Dahn, 2022)

Drones can quickly search for slow-growing plants and trees that may require human intervention. The sensor detects plants that absorb and reflect a certain wavelength of light, providing a color contrast image of the problem area. Normalized Difference Vegetation Index (NDVI) maps are created by calculating the rate of near-infrared and visible radiation changes using long-term satellite and drone (UAV) monitoring. This method classifies soils, crops, woodlands, and sick plants.

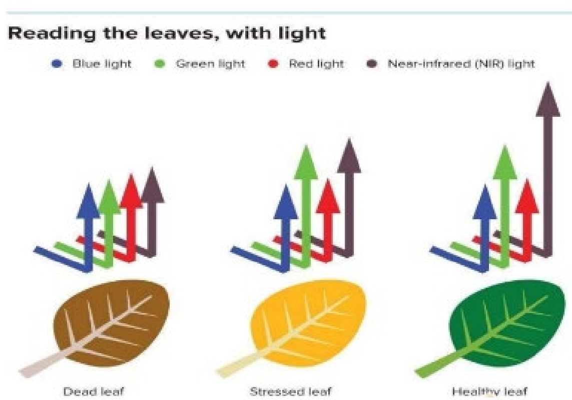

Figure 3: A map of crop health changes (Dahn, 2022).

Cattle farmers utilized drones to track animals and check fences on huge properties. The drone's high-definition thermal imager and night camera may help investigate animals that annoy and threaten livestock. This drone tracked Kazi Ranga National Park human poachers.

The Rise of the Drones in Agriculture

Drones are Changing Agricultural Cultivation

Drone advocates have long promoted precision agriculture, which uses GPS and big data to manage crops, to increase agricultural output and alleviate water and food shortages. Unfortunately, drones have had little impact on agriculture until lately. Drones in agriculture and precision farming have garnered interest lately.

Figure 4. Land monitoring using drone (Veroustraete, 2021).

Farmers and agricultural consultants are using drones to image, recreate, and analyze corn plant leaves from 120 meters up, measure soil water-holding capacity, and apply variable-rate water. Despite extensive research, drone service providers failed to deliver on many of their promises to farmers. Commercial drone agriculture research has been denied by airspace authorities. A regulation reform allows certified drone service provider firms, many of which are still in development, to help large and small agricultural operations with water and disease management and fee for their services. Service providers may use drones to improve planting, agricultural rotation, and crop monitoring with open airspace up to a particular height.

Drone service providers and farmers will explore all drone usage in the next years. Crop intelligence will help small farms compete with Big Ag.

In conclusion, as the calendar turns to 2016, it may be argued that the examples provided in this Editorial are contemporary and popular usage for drones in precision agriculture. This application list is likely to increase significantly soon as more research is conducted and will be conducted, and when airspace in the European Union is opened to licensed drone equipped agricultural service providers.

Methods

Right, balanced process will finish the job on schedule and well. Project approach is critical. The methodology section outlines the project's goal, how it will be launched, and why. This section also describes how the project will be built and executed ("Importance of the Methodology of Project Proposal Writing", n.d.).

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The kind of project determines the technique, which has pros and cons (Cohen, 2019). The most popular and oldest strategy, progressive refinement, works well for projects with clear outcomes and data (Cohen, 2019). Agile software development has no phases, deliverables, or requiems, unlike progressive refinement (Cohen, 2019).

This project uses a successive refinement approach, which helps developers unfamiliar with application domain. Additionally, this method is based on constant steps I will follow to implement the project, which are:

First, I'll explain the project's goals, outcomes, and environmental benefits.

Architect: this is the second phase in project implementation. An architect creates hardware, software, or networking applications and services for a company or other entity. To execute the project, I need all hardware and software details. Mirta (2017).

Designing is the third phase in successive refinement model process. In this step, I'll design my project's prototype to understand how the circuit and software will work, then plan how to build the spraying drone using the hardware and software I chose.

Build: I will install the hardware and connect the programmed microcontrollers in this stage. In this step, I must build a spraying drone with smooth software for the motors. (Kumar, 2020).

Testing completes the project. After installing the hardware and programming the microcontrollers and software, it's time to fly the project. If it doesn't work, I'll go back and try again (Mirta, 2017).

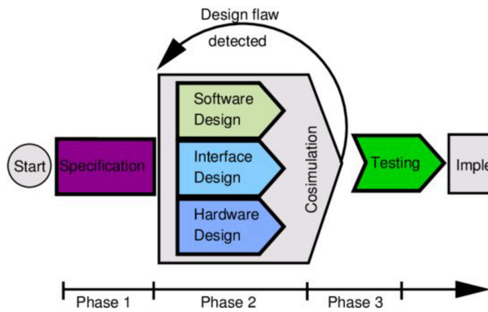

Figure 5. Parallel design in Co-design (Oppenheimer, 2021)

Results

The first task would be to determine the hovering accuracy of the UAV. The gadget was designed to arrive at a specified coordinate point and then retain that location. This point is 5 meters above ground level. As a result of these measurement settings, it can be concluded that the gadget has only been exposed to laminar wind flow and has not been disrupted by turbulence from topographical impediments. This is one of the fundamental jobs, with the primary goal of regulating the UAV's position during hovering to study the device's position drift throughout flight.

Task 2 is based on five waypoints that represent the endpoints of the UAV-covered sectors. The waypoints were set on the base and organized in a cross, with each arm measuring 25.00 m in length and parallel to the world's directions (counting from the center of the base). The purpose for defining this mission was to establish the fundamental criteria of UAV work in terms of ISO standards for industrial robotics.

3rd task aimed at ensuring the correctness of the barometer system installed in the UAV, which is responsible for ensuring that the planned flying altitudes are implemented correctly. This mission presupposed the steady ascension of several heights, previously set in 5-meter intervals between 20 and 90 meters.

The next step about the gadget configuration is to execute a photogrammetric mission across a certain region in a simulation of a photogrammetric mission as well as spraying on the crops or plants. By pausing at the set waypoint and then turning and going on to the next point, the trajectory of the changing direction of the aircraft has been utilized.

In the last a photogrammetric mission simulating, with the exception that it used the trajectory of the altered direction of flight, in which the UAV does not halt at the turn point, but instead makes a smooth turn towards the next point, as in task 4. The UAV's on-board computer automatically adjusts the device's forward speed to the turn.

Conclusion

In conclusion, using drones to enhance plant health care is a terrific method to develop agriculture. Drones and agriculture have been studied extensively. My bachelor project paper on farm drones incorporates four publications from numerous research. The first article covered agricultural drone uses, thus examples included crop mapping and surveying, real-time animal monitoring, and more. Drones' agricultural advantages have been addressed, among other topics. The second investigation gave a fundamental understanding of drone use in farming, therefore RGB and multispectral sensors were considered. Drones in agriculture are also discussed. The third research covered uses and development of newest drones in agriculture, providing a concise explanation and an excellent example to help readers comprehend the issue. The latest study report discusses how drones improved agricultural results over time. The progress is shown in numerous figures. Chapter 2 briefly describes the progressive refinement model process used for system design. Drones seriously impact agricultural results for farmers. Drones can accomplish the labor without farms or workers. The drone sprays water, insecticides, medicinal substances, and more.

Limitations

Unfortunately, there are several limitations may this drone faces such a like:

1. Short battery life, hence, this drone uses a lithium battery therefore, the drone will be only able to fly for short period of time therefore, the drone can fly maximumly for 45 mins after that the battery should get charged before flying it again.
2. Nighttime flying issues, because of lack of light the sensers can't work efficiently and this can cause lots of problems such a like motion senser in other words this sensers avoids any moving things considering humans for example therefore, at nighttime this sensers cannot work perfectly so it may harm people and causes real damage to them.
3. Overheating: in a few countries like gulf countries the weather is mostly warm therefore, this can cause overheating of the drone motors which can make them stop working and let the drone work less efficiently.

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