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Farming Quad Copter for Splashing Pesticides and Fertilizers

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Abstract
Indian horticulture required creation and insurance materials to accomplish high Productivity. Horticulture compost and substance every now and again expected to murder bugs and development of harvests. The WHO (World Health Organization) gauges there are more than 1 million pesticide cases in consistently. In that more than one lakh passing's in every year, particularly in creating nations because of the pesticides splashed by person. The pesticide influences the sensory system of people and furthermore prompts issue in body. A remote-controlled quadcopter is utilized to splash the Pesticide just as manure to maintain a strategic distance from the people from pesticide poison. The quadcopter UAV is worked by manual flight plans and the Sprayer is physically activated. The vertical take-off and landing quadcopter is utilized to splash the low volume pesticide in a little region. Our undertaking portrays the advancement of quadcopter UAV and the sprayer module

Keywords**:** *Flight controller, RC transmitter, RC reciever, Brushless DC motor, Brushless Electronic Speed Controller(ESC),Camera, Propellers, Tank with sprayer, Battery, DC submersible water pump.*

1. Introduction

Quadcopters are more formally known as unmanned aerial vehicle (UAVs). A drone is a flying robot that can be remotely controlled or fly autonomously through software controlled flight plans in their embedded systems, working in conjunction with onboard sensors.
Importance of drone can be understood from the fact that it can provide farmers with three views firstly,keeping eye on crop from air can help show a problem related to irrigation,soil variation and fungal infections. secondly, drone uses remote sensing method which is used to identify the cropgrowth by comparing multiple images taken by the camera.thirdly, cameras can make multispectral images, capturing data using visual spectrum as well as infrared,which shows the different between the distressed and heathy plants cant be viewed with naked eyes.

Motivation

Small holder farms support more than the two billion people all over the world, but many of then relay on the inefficient and environment unsustainable agricultural practices. Small changes in agricultural practices can drastically improve productivity and profitability. As the population is increasing the demand for food is also getting increased, so using the present technology we can make it easier for the farmers. As the farmers are struggling with less benefit and less profits, this motives us to make our project with the hopes that, it could help our farmers. Our team wants to develop a quadcopter which would help the farmers for spraying pesticides and detecting the type of disease the plant is affected in the agricultural lands and we are highly motivated by the sentence "FARMERS ARE THE BACKBONE OF OUR COUNTRY".

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Objectives-

- Reduce the ill-effects to humans.
- To get efficient solution for payload carrying capacity using UAV.
- To build a suitable Quadcopter with stable flight controller.
- To design mechanism for spraying and controlling various parameters like drone speed, spraying speed control etc.…
- To design an efficient code for leaf disease detection.

2. Literature survey

Prof.D. Yalappa, Veerangouda, Devanand Maski in 2017 has published a paper entitled "Development of evaluation of drone mounted sprayer for pesticide". Conference:2017 IEEE Global Humanitarian Technology Conference (GHTC). In this paper authors have given details about implementation of agriculture drone for automatic spraying system. A drone mounted sprayer was developed for application of pesticide sprays on to crops which improves coverage, boosts chemical effectiveness and makes spraying job easier and faster. Their main goals were to develop a drone mounted sprayer and evaluate its performance for application of chemicals/pesticides and to work out the economics of operating with drone mounted sprayer. The complete design was calculated by considering the total weight of the drone mounted sprayer as reference and these consideration parameters are payload capacity, design of supporting frame, landing gear, design of fluid tank, selection motors, battery, propeller, flight controller, transmitter and receiver .This technology is very useful where human interventions are not possible for spraying of chemicals on crops including rice fields and orchard crops as well as crops under terrain lands.

Prof.S. Meivel M. E, Dr. R. Maguteeswaran Ph.D., N. Gandhi raj B.E., G. Srinivasan Ph.D.

has published a paper entitled "Quad copter UAV fertilizer and pesticide spraying system".

Conference: International Academic Research Journal of Engineering Sciences, At Coimbatore, Volume: Vol. no.1 issue no 1, February 2016. This project describes the development of quadcopter UAV and the sprayer module. And also discusses the integration of sprayer module to quadcopter system. The Universal Sprayer system is used to spray the liquid as well as solid contents which are done by the universal nozzle.

Multispectral camera was used to capture the remote sensing images which are used to identify the green fields as well as the edges of crop area. Total payload lift-off weight of quadcopter remote sensing images are analysed by QGIS software. Multispectral camera used to capture the remote sensing images.

Prof. Madhukar S. Chavan, has published a paper entitled "Automatic Arial Vehicle Based Pesticides Spraying System for Crops". International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-11, September 2019. The solutions proposed for these drones can help improve things even further if they are integrated into various machine learning concepts and internet concepts. The main objective of proposed work was to provide automatic spraying capability to an Arial vehicle and to implement the system based on Microcontroller 8051 platform. The farmers can control the drone by the Android app here and can connect to the phone via the Wi-Fi module on the drone. The pesticide sprinkling drone precisely passes through the land of the particular famer via GPS irrespective of the field form. and the type of culture the job is done. The board 8051, the open-source prototype platform for electronics, has been used here, and interfaces the WIFI module with the GPS.They used ACCELEROMETER GYRO (MPU06050), MAGNETOMETER (HMC005883L) to balance directions and directions. We have a wireless camera that allows us to communicate high resolution pictures and obtain.

Harsh Vardhan.P.D.P. R, Dheepak.S, Aditya.P. T, Sanjivi Arul (2014) has published a paper entitled "Development of Automated Aerial Pesticide Sprayer". This paper is published by IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308. This system includes hastening the spraying process of pesticide thereby reducing the causalities due to pesticide exposures, the nozzle of sprayer module will be activated by remote control. There are two methods of implementing this mainly a GPS system is integrated into it. In areas where multiple cropping patterns are implemented, certain cropping patterns, or certain pest infested area alone can be targeted and commanded to be quarantined and secondly a proximity sensor can be attached in the front face of the blimp which takes a turn on encountering a sign board and thus follows a trajectory which covers the whole field area.

Vikrant Krishna Suryawansi, Dr.J.Ashok, Sumit Ashok Rajmane,Snehal Shivaji Mali has published a paper entitled "Design and development of agricultural fertilizer spraying drone with remote control.", May 2019 in Journal of Remote Sensing GIS & Technology Volume 5 Issue 2.The agricultural fertilizer spray drone is used to carry pesticides to spray all over the farm which reduces the work of farmer as well finish his work soon. The Main objectives were to get an efficient solution for payload carrying capacity using UAV (up to the weight of 3kg including vehicle) and to Design light weight frame and chassis, assemble the UAV using necessary components and to build a suitable quad copter with stable flight control. Different climate and temperature variations on landscape the wind speed varies. So, the drones are not able to spray the required amount of fertilizer to particular Area. The aim was to provide a controlled automotive spraying mechanism

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with atmospheric conditions. So, their aim was to provide a controlled automotive spraying mechanism with atmospheric Conditions.

3. Problem Statement

The agriculture practice involves, the human's interaction in spraying, fertilizers and pesticides which will cause irritation in skin, itching rashes, blisters, etc. And if cases if it exceeds it causes death also. Inhalation of spraying causes coughing, throat infection, etc. This practice involves more labors this increases the expenditure. The uneven spray of pesticides may affect the fertility of soil which in-turn affects the crop growth.

4. Proposed system

Quadcopter inbuilt pesticide sprayer is basically sprayer integrated into a drone to spray pesticides and fertilizers in open crop fields. The main objective of this project is to reduce the ill effects to humans. The drone is used to spray the contents under any climatic conditions. The drone inbuilt sprayer contains the universal sprayer which is used to spray the both fertilizer and the pesticide on a same sprayer. The universal nozzle is used to regulate the liquid content as well as solid content. The DC pressurized pump is used on a pesticide spraying. Camera is used to capture the images of the plants and transferred to the desktop on which the code is executed identifies the disease which has affected the plant as a result based on the type of the disease pesticides can be sprayed to the agricultural land.

5. Detailed description: Components used Flight Controller.

Pixhawk is an independent open-hardware project that aims to provide the standard for readily-available, high-quality and low-cost autopilot hardware designs for the academic, hobby and developer communities.

Figure 5a): Flight Controller

RC Transmitter and Receiver.

The remote control contains a radio transmitter which operates on a particular frequency that the receiver is designed to receive. Receiver: The receiver is fixed within the car and constantly receives signals from the transmitter.

Figure 5b): RC Transmitter and Receiver

Brushed DC Motor.

In a brushed DC motor, the rotor spins 180-degrees when an electric current is run to the armature. In brushless DC motors, the permanent magnets are on the rotor, and the electromagnets are on the stator.

Figure 5c): Brushed DC Motor

Brushless ESC(Electronic Speed Controller) System.

Brushless ESC systems basically create three-phase AC power, like a VFD variable frequency drive, to run brushless motors. Brushless motors are popular with radio controlled airplane hobbyists because of their efficiency, power, longevity and light weight in comparison to traditional brushed motors.

Figure 5d): Brushless ESC

Propellers. The purpose of propellers is to generate thrust and torque to keep the drone flying, and to operate. The upward thrust force generated by the propellers is usually measured in pounds or grams. To keep your drone flying at a hover, the upward thrust needs to be equal the weight of the drone.

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Figure 5e): Propellers

Power module

Power module is a simple way of providing SmartAP with power from a LiPo battery as well as current consumption and battery voltage monitoring, all through a 6-pos cable. The on-board DC-DC converter outputs 5.3V / 3A from up to a 6S LiPo battery.

Figure 5f): Power Module

Lipo Battery

A lithium polymer battery, is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte.

Figure 5g): Lipo Battery

Anti-vibration kit

It is used as the shock observance to the drone when it falls and also absorbs the vibration of the drone.

Figure 5h): Anti Vibration Kit

DC Powered Pump.

DC powered pumps use direct current from motor, battery, or solar power to move fluid in a variety of ways. Motorized pumps typically operate on 6, 12, 24, or 32 volts of DC power.

Figure 5i): DC powered pump

Camera.

Camera is used to take picture and record video.

Figure 5j): Camera

Tank with Sprayer

Tank is used to store the pesticides and through the sprayer the pesticides is sprayed and tank is used to hold used to hold the pesticides.

Figure 5k): Tank with Sprayer

6. System design

Drones are unmanned aerial vehicles that can be equipped with high definition, live-feed video cameras, thermal infrared video cameras, heat sensors, and radar all of which is for surveillance. Drones can capture images and record video in daylight or infrared. Working principle, the drone mainly needs to complete attitude control, shooting /measuring, information storage/transmission, and environmental awareness (preventing from collision). For automatic control principle, After the input adjustment is applied, the change of the control amount is measured and is adjusted to input until the control amount reaches the target value. The drone moves vertically and uses the rotor to move and stop. The relative nature of the force means that when the rotor pushes the air, the air also pushes the rotor back. This is the basic principle that the drone can go up and down. And the faster the rotor rotates, the greater the lift, and vice versa. To turn the drone to the right, the angular velocity of the rotor 1 needs to be reduced. Although the

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lack of thrust from the rotor 1 can cause the drone to change the direction of motion, the upward force is not equal to the downward gravity at the same time, so the drone drops.The drone is symmetrical; it also applies to lateral movement. Each side of the four-wheeled drone can be the front side, so how to move forward explains how to move backwards or to the sides. The sprayer module is connected to frame the sprayer module consists of servomotor, DC powered water pump, sprayer nozzle with a tank, the water pump is connected to tank, tank is connected with the sprayer nozzle, servo motor is binded with receiver and transmitter, switch is kept to on the frame to make the nozzle on when the drone reaches the required height the servomotor will rotate 180 degrees and turn on the switch with in turn activates the nozzle and starts spraying.

Figure 6.1: Drone Connection Diagram.

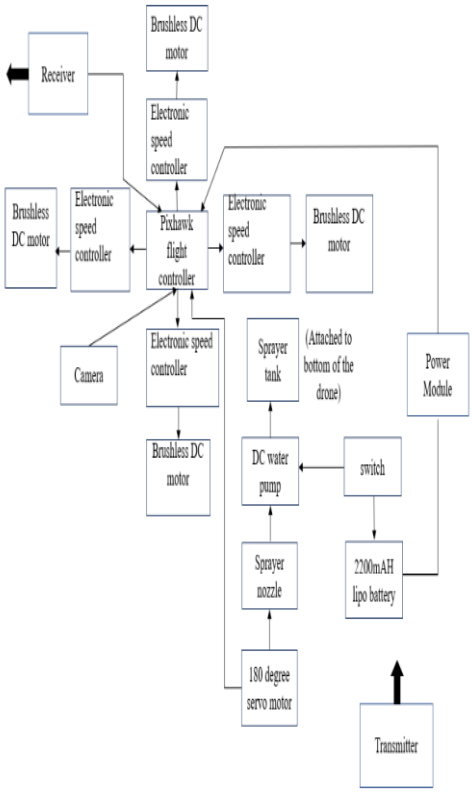

Figure 6.2:Block diagram of drone connection.

The block diagram of the drone explains how the connections are made the pixhawk is the flight controller mainly all other parts of the drone are connected to it, very firstly the 450 frames are attached based on the requirement later the pixhawk is attached to it, the motors are attached to the frame at its end corner and ESC is fixed to each motor, two motors are made to rotate clockwise(opposite) and the other two motors are made to rotate anticlockwise to make the drone fly, the ESC's are connected to the pixhawk, receiver is binded with the transmitter later connected to the pixhawk, camera is connected to pixhawk, battery is connected to power module in turn pixhawk is connected to power module, the sprayer module is connected to frame the sprayer module consists of servomotor, DC powered water pump, sprayer nozzle with a tank, the water pump is connected to tank, tank is connected with the sprayer nozzle, servo motor binded to the receiver and transmitter, switch is kept to on the frame to make the nozzle on when the drone reaches the required height the servomotor will rotate 180 degrees and turn on the switch with in turn activates the nozzle and starts spraying.

7. Implementation

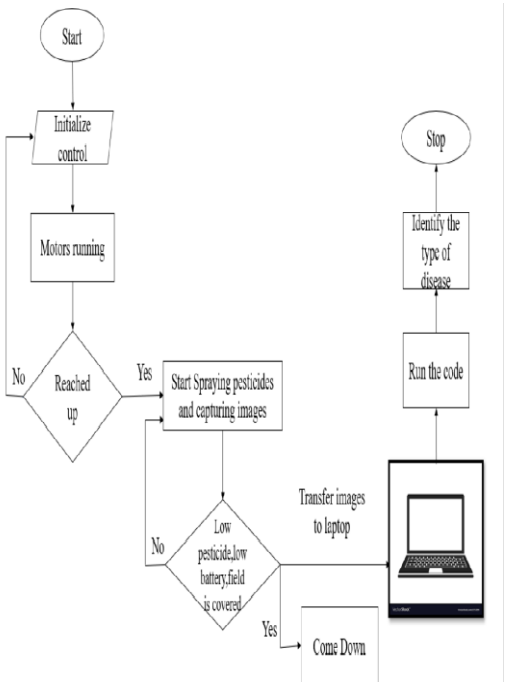

Figure 7.1: Flow chart of Spraying Module.

Very firstly, the drone is initialized and the motors start to run and when it reaches the appropriate height the sprinklers nozzle is turned on and starts spraying the pesticides, it can be adjusted to wide or narrow type based on the requirements and later (low pesticide, low battery, field is covered)if any of these conditions is true then it is taken down to fulfil the requirements. First the empty drone is sent to capture the images and identify the type of disease based on that later, the pesticides are filled and then sent for spraying the images captured are sent to the laptop using the transmitter and receiver of the

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camera later the code is applied on the images and it identifies the type of disease affected.

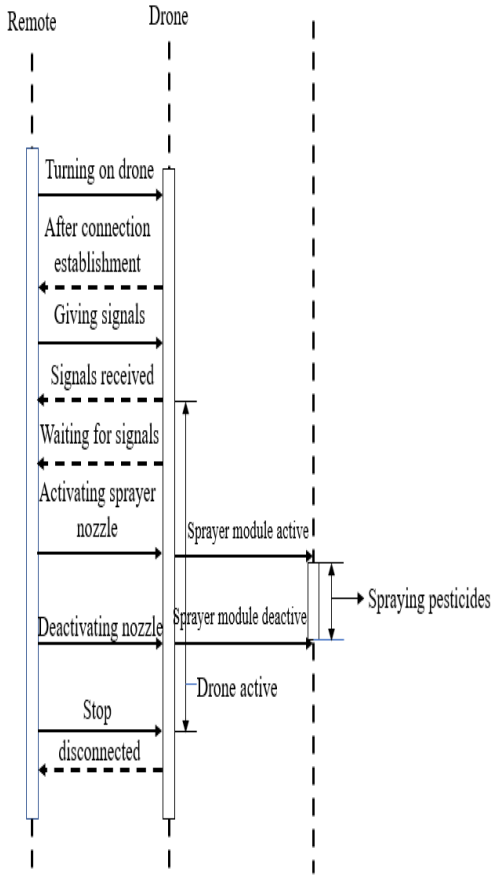

Figure 7.2 : Uml diagram of drone with spraying module.

8. Results

Developing a quadcopter with Sprayer system which uniformly sprays pesticides/fertilizers throughout the field, Camera which is attached to the drone which captures the images of plants which intend used for image processing to detect the type of disease affected the plants based on the type of disease the pesticides can be sprayed.

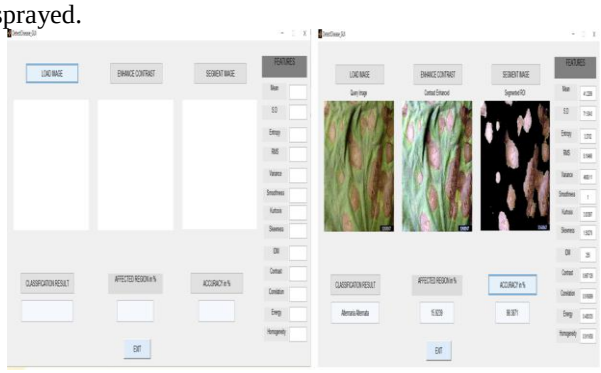

Figure 8.1: Software implementation which identifies the type of disease.

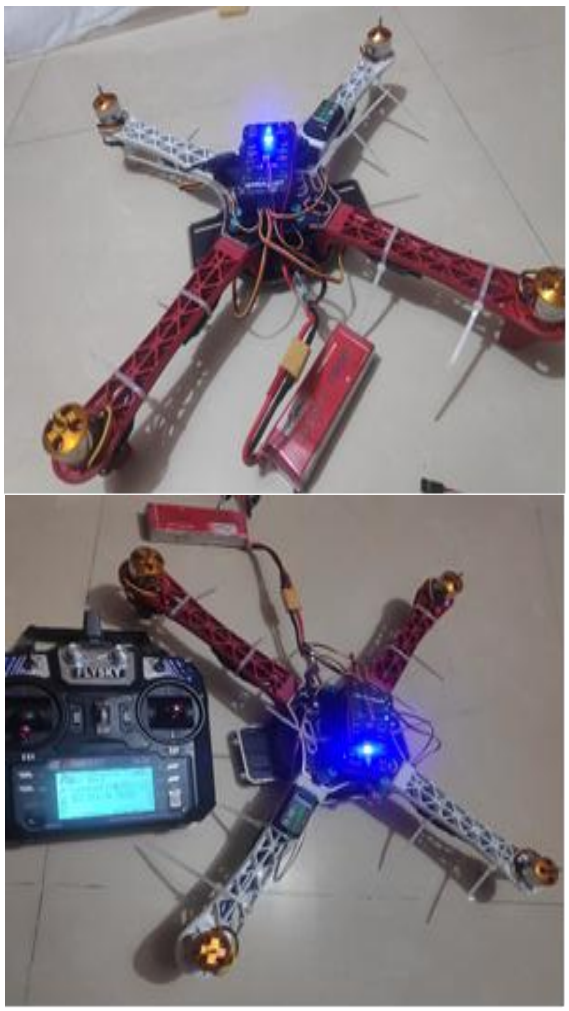

Figure 8.2: System design of drone.

Figure 8.3: Drone with sprayer module.

9. Conclusion

This method can be used in all types of situation, especially in the places where labors are hard to find. It has many advantages that include speed up the spraying process of pesticide thereby reducing the fatality due to pesticide exposures and it also prevents the rendezvous

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with the poisonous snakes like viper and cobra which are regularly found in our agricultural fields. Environmental pollution can be reduced when it sprayed from lower altitude. The pest management can be achieved by the combination of the spray system with the drone results in an autonomous spray system, it has a great potential to enhance pest management for small as well as the large crop filed to get high accurate site-specification application. The image processing of the affected plants helps in finding the type of disease affected and spraying the proper pesticides. And also, our quad copter will be helpful for the farmers in spraying the fertilizers, pesticides and crop protection products while being controlled by a single person operating from a safe. Applying the image processing for videos captured by the quad copter so that while capturing it shows the part of the leaf is affected also adding GPS, so that the quad copter can be tracked where appropriately it is spraying and can get back easily, making it automated.

Applications

1. Can be used in the field of crops to spray pesticides.
2. To detect leaf disease.

Benefits

1. One time invest to reduce the cost.
2. Using quadcopter, spraying can be done for any crops.
3. Using quadcopter, spraying of pesticides can be done for the larger agricultural fields.
4. This reduces the mankind.

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