



DRONE BASED PESTICIDE SPRAYING FOR AGRICULTURAL CROPS

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Abstract

Quad copters aid in achieving vertical flight in a stable manner and can be employed for acquisition of data from remote or inaccessible locations. The goal of this project is to primarily reduce direct contact of farmers with harmful chemicals present in pesticides and fertilizers, secondly, the quad copter developed can be used for effective spraying of pesticides and water for irrigation purposes. Indian farms are conspicuously smaller in area as compared to farms abroad and consequentially do not require extremely high power batteries, or more number of motors. This project can serve as a basis for future developments wherein more advanced boards can be employed to cater to numerous other features like point-based applications which will further reduce wastage of pesticides.

Index Terms: BEC- Battery elimination circuit, BLDC- Brushless DC motor, ESC- Electronic speed controller, LIPO- Lithium-ion polymer battery.

I. INTRODUCTION

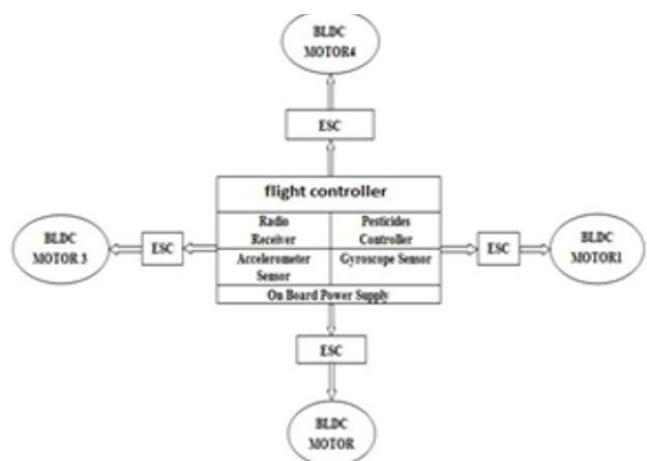
Quad copter, also known as quad rotor helicopter or quad rotor, is a multi-rotor helicopter that is lifted and propelled by four rotors. Quad copters are classified as rotorcraft, as opposed to fixed-wing aircraft, because their lift is generated by a set of rotors. In a quad copter, two of the propellers spin in one direction (clockwise) and the other two spin the opposite

direction (counterclockwise) and this enables the machine to hover in a stable formation.

Our Quad copter uses four propellers, each controlled by its own motor and electronic speed controller. Using accelerometers we are able to measure the angle of the Quad copter in terms of X<Y and Z and accordingly adjust the RPM of each motor in order to self-stabilize itself.

The spraying section includes a servo motor which presses a switch when controlled through RC transmitter. The switch pressed causes a motor pump to get the power supply. The motor then pumps the pesticide in the container and it can be sprayed directly over required area with means of nozzle.

Block diagram:



II. HARDWARE DESCRIPTION

A. ATmega644 PA: The ATmega644 PA IC unit processes this signal according to the user selected firmware and passes control signal to the installed electronic speed

controllers. These signals instruct the ESCs to make fine adjustments to the motor's rotational speed which in turn stabilizes multi-rotor craft (<https://www.microchip.com/wwwproducts/en/ATMEGA644PA>, n.d.).

B. BLDC (1000kv):

Brushless DC electric motor also called as electronically commutated motors (synchronous motors) are powered by a DC electric source via integrated inverter/switching power supply, which produces an AC electric signal to drive the motor. A BLDC motor for quad copter is constructed with a permanent magnet rotor and wire wound stator poles.



C. ESC (30A):

ESC is used to control BLDC motor. Signal from microcontroller breaks into 3 parts in ESC and sent to the BLDC motor. We require 4 ESCs as we are using 4 BLDC motors. The ESC is a motor controller board that has a battery input and a three phase output for the motor. Each ESC is controlled independently with a PPM signal (similar to PWM). The frequency of the signals vary, but for a Quad copter it is recommended the controller should support high enough frequency signal, so the motor speeds can be adjusted quick enough for optimal stability (C. Zhang, 2012).



D. LIPO Battery: (Voltage: 11.1V & Capacity: 2200 mAh)

Lithium batteries are the preferred power sources for most electric modellers today with high discharge rates and a high energy storage/weight ratio.



E. Flight controller:

Its purpose is to stabilize the aircraft during flight. KK2.1.5 Multi-Rotor control board also uses signals from your radio systems receiver (Rx) and passes these signals to the ATmega644PA IC via the aileron, elevator, throttle and rudder inputs. Once this information has been processed the IC will send varying signals to the ESCs which in turn adjust the rotational speed of each motor to induce controlled flight.



F. Fly sky Transmitter and Receiver:

Fly sky Transmitter and Receiver which we are using is CT6B which has 6 channels. It Requires a PC to change the channel variables, mixing and servo reversing. The radio transmitter and receiver allow you to control the quad copter. Specifications:

Channels: 6channels

Model type: Heli, Airplane, Glider

RF power: less than 20db

Modulation: GFSK

Code type: PCM

Sensitivity: 1024

Low voltage warning: LED warning.



III. SOFTWARE DESCRIPTION

It is the leading cloud software platform for commercial drones, and is making the power of aerial data accessible and productive for everyone. DroneDeploy's built-in Plant Health Toolbox allows you to quickly adjust the contrast on your drone maps to highlight crop variability and visualize problem areas, turning a drone map into actionable data. It enables professional grade imagery and analysis, 3D modeling and more from any drone on any device (<https://www.dronedeploy.com/>, n.d.).

IV. CONCLUSION

As per the design specifications, the quad copter self stabilizes using the array of sensors integrated on it. It provides for effective spraying through the pipe terminated via nozzles, and does so when commanded by the operator through the programmable switches on the transmitter. It acts appropriately to the user specified commands given via a remote controller.

The primary motive of the drone was to reduce farmer contact with the pesticides, has been met, and secondary goal of reduction in wastage of water for irrigation or pesticide for cultivation is also taken care of.

Thus, its functionality is monitored under human supervision, henceforth being beneficial towards military applications. It can be used to provide surveillance at night through the usage of infrared cameras.

This project demanded not only interfacing and calibrating of the various components, but also effective planning for the spraying mechanism. It has been an extremely nurturing experience and required the culmination of both, technical as well as interpersonal problem solving skills. It has all been, thus, an effective collective effort.

V. REFERENCES

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