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IOT BASED PESTICIDE SPRAY DRONE IN AGRICULTURE

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carried onboard and dispensed

Abstract:

Over the last few years, we have seen massive growth in the manufacture and sales of remote control airborne vehicles known as a quadcopter. Which we used in the agriculture sector for spraying pesticides can be a new era in the agriculture sector. The project aims to reduce the health issues caused by pesticides by spraying in a manual method. This pesticide spraying drone reduces time, number of labour and cost of the pesticide application. This type of drone can also be used to spray disinfectant liquid over buildings, water bodies and highly populated areas by changing the flow discharge of the pump.

Keywords: Drone, Sensors, Pump,Spray, Payload, ElectronicSpeed Controller.

1. INTRODUCTION

We use Unmanned Aerial Vehicles (UAVs) for agriculture use to spray pesticides which can be time-saving and health is saving.

The application of crop inputs such as fertilizer by UAV presents an engineering design challenge where the payload and power demands from spraying or granular applicator are significantly greater than those of law-mass, or sensors for inspection. Increasing the payload mass that can be leads to increases in the payload mass that can be carried and improved economic returns. The initial uses in agriculture have been for remote sensing, with an emphasis onvisual inspection of crop or field conditions and for tracking assets such as machinery, workers or products can be tracked.UAV technology has utility in agriculture, forestry, and vector control for not only observation and sensing but also for delivery of payloads.

This paper contains the UAV[1] that offers the potential for addressing several major challenges to global agriculture. With the world's population projected to reach 9.8 billion people by 2050, experts expect agricultural consumption to increase by nearly 70 % over the same period.

2. LITERATURE SURVEY

Rao Mogili, U.M., and Deepak, B.B.V.L (2018) Review on Application of Drone Systems in Precision Agriculture. The helicopter has a main rotor diameter of 3m and a maximum payload of 22.7 kg. It used to require at least one gallon of gas every 45 minutes. This study paved the way for developing UAV aerial application systems for crop production with a higher target rate and larger VMD droplet size.

Prof. B. Balaji et al. (2018) [6] developed a hex copter UAV to spray pesticides as well as crop and environment monitoring using Raspberry Pi that runs on python language. Their UAV was designed not only for spraying but also for monitoring agricultural fields with the use of cameras and GPS. Their design was optimized for cost and weight.

i.EXISTING METHODOLOGY

The Existing system was farmers spray the pesticides by themselves so they get affected by the pesticides according to the WHO per year there was 1.8 million are affected by the pesticides over 18000 are died. We have titled our project Pesticides Spraying Drone which is a combination of a Quadcopter and we have synchronized a seeding system to an X-configured quadcopter. Pesticides are common chemicals used to eliminate a great variety of unwelcome living organisms, particularly in agriculture.

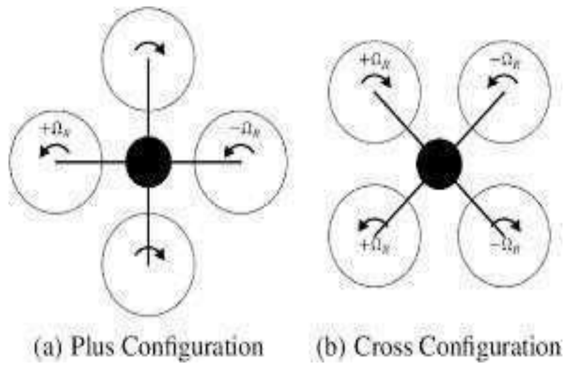
Fig.1 Farmer spraying pesticides.

ii.PROPOSED METHODOLOGY

To avoid the above-mentioned issues, we propose a new system which we call a Quadcopter-based pesticide spraying system. Our project is a combination of a quadcopter and a pesticide spraying system, we had synchronized a pesticide system to an X-configured quadcopter. Thus the combination of these two pieces of equipment results in the formation of our project. There are two types of configuration in quadcopter construction. The first one is a plus (+) configuration and another one is a cross (X) configuration. In these projects, we used X (cross) configuration.

We require four ESCs for a quadcopter, one associated with each engine. The ESCs are then associated specifically with the battery through either a wiring outfit or a power circulation board

Fig.2 Quadcopter configuration.



3. DESIGN AND WORKING

We have titled our project Dronewith pesticides sprayer which is acombination of a Quadcopter and spraying system. To Design a Quadcopter first we have to Estimate our payload, then with respect, to the weight of the payload motor, Propeller, Electronic Speed Controller, Pump, and transmitter[2] have to be selected. The battery has to be selected by knowing the current and voltage requirements of the components

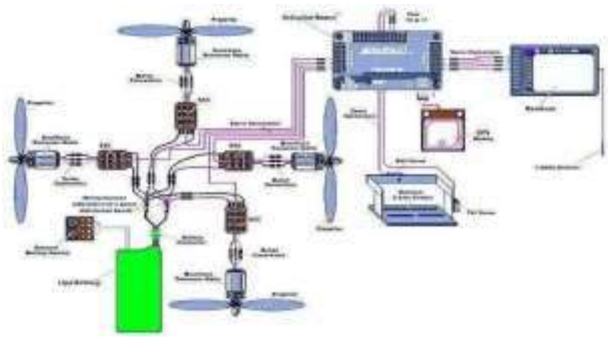


Fig.3 circuit diagram of drone

Construction

The prefix quad-copter implies ("quad" = four), is a drone configuration where there are four arms. The main frame is made of carbon fiber composite material with an arm length of 450 mm. At each free end of the arm, a motor will be fixed and the propeller will be mechanically coupled to the motor. For all four motors the output side of an ESC will be connected and the input side of the Electronic Speed Controller (ESC)[3] will be connected to the flight controller.

The other input of the ESC will be connected to the power distribution board where the power supply is provided by the Li-Po battery. Similarly, all the other ESCs, motors, and propellers are connected. A receiver will be connected to the Flight controller to receive signals from the transmitter. A suitable transmitter is connected to the Flight controller to receive signals from the transmitter. A suitable transmitter is connected to the flight controller. The storage tank of dimensions 200 x 300 x 110 mm is mechanically coupled to the frame, the bottom of the tank will have a slope so that the entire tank gets drained completely. A plastic tube of 1.3 meters in length and four nozzles are fixed at 45cm between each other.

The ESC controls the speed of an AC motor with frequency, not voltage. If you plug an 11.1volt battery into your power system, you have 11.1 volts going to the motor with the full amperage potential of the battery backing that voltage. The AC brushless motors we use are true 3-phase AC motors. The motors do run on AC. The ESC is a trapezoidal wave generator. It produces 3 separate waves (one for each wire to the motor). The speed of the motor has nothing to do with voltage or amps, but instead the timing of the current fed into it. By increasing and decreasing the wavelength (frequency) of the trapezoidal wave in the 3 phases, the ESC causes the motor to spin faster and slower. The ESC switches the polarity of the phases to create the waves. This means that the voltage through any given winding flows 'Alternately' in one direction then the other. This creates a push-pull effect in the magnetic field of each winding, making the motor more powerful for its size and weight. The motor and the load that is placed on it are what determine the amp drawn from the ESC and the battery.

Brushless DC Motor

Brushless motors may be described as stepper motors; however, the term stepper motor tends to be used for motors that are designed specifically to be operated in a mode where they are frequently stopped with the rotor in a defined angular position. This page describes more general brushless motor principles, though there is overlap. Two key performance parameters of brushless DC motors are the motor constants Kv and Km. Outer runner BLDC motors in which there are no brushes have a permanent magnet. The RPM of the motor can be controlled by varying the input current. This motor MOTOR MN 7005 KV115 and
P24x7.2F propeller produce a maximum thrust of 4783grams.

Fig .4 Brushless DC Motor

Propeller

The propeller is 24 inches in length and has 7.2 inches pitch. It is made up of carbon fiber which possesses a high strength-to-weight ratio when compared tothe propellers made up of plastics.

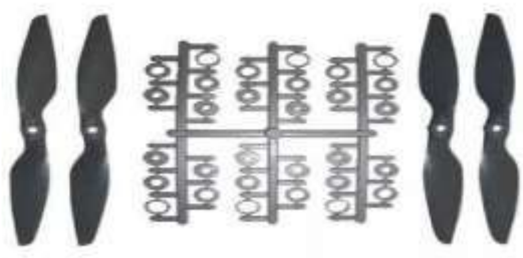


Fig 5 Propeller

Electronic Speed Controller

The electronic speed control, or ESC, is what tells the motors how fast to spin at anygiven time. You need four ESCs for a quadcopter, one connected to each motor. The ESCs are then connected directly to the battery through either a wiring harness or power distribution board. Many ESCs come with a built-in battery eliminator circuit (BEC), which allows you to power things like your flight-control board and radio receiver without connecting them directly to the battery.

Fig.6 ESC 30A

Battery

A lithium polymer battery, or more correctly lithium-ion polymer battery (abbreviated variously as Li Po, LIP, Li-poly, and others), is a rechargeable battery of lithium-ion technology in a pouch format. Unlikecylindrical and prismatic cells, Li- Pos come in a soft package or pouch, which makes them lighter but alsoless rigid.

Fig.7. Li-Po Battery

Flight Controller

The KK2.1.5 is the next big evolution of the first generation KK flight control boards. The KK2.1.5 was engineered from the ground up to bring multi-rotor flight to everyone, not just the experts. The LCD screen and built-in software make installation and setup easier than ever. The original KK gyro system has been updated to an incredibly sensitive 6050 MPUsystem making this the most stable KK board ever and allowing for the addition ofan auto-level function. At the heart of the KK2.1.5 is an Atmel Mega 644PA 8-bit AVR RISC-basedmicrocontroller with 64kof memory.

Fig.8 Flight controller

Radio 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. It has a standard 2.4GHz antenna .it can be folded 90 degrees and can also be rotated for easy storage.

Fig.9 Fly sky Transmitter and Receiver Pump

To pressurize the liquid a 12 V DC water pump can be used which has a 2.5 L/min capacity can be used. This type of drone can also be used to spray disinfectant liquids over buildings, water bodies, and highly populated areas by changing the flow of the liquid.

Fig.10 Pump

Nozzle

Nozzle types commonly used in low-pressure agricultural sprayers include fan, hollow-cone, full-cone, and others. Special features such as air induction (AI) and drift reducing (DG) are available for some nozzles.

Fig.11 Nozzle

i.CALCULATIONS

Thrust Calculation

General required thrust is given by a formula mentioned below it is, Thrust required = (total weight of setup) × 2/4. Therefore according to the frame, ESC, battery, and another setup we are getting a weight of 1300 grams. i.e, frame weight is 950 grams and other will roughly weight of350 grams.

Required thrust =1300*2/4=2600/4 = 650 grams.

Voltage from Battery Calculation

Make sure your ESCs the ability to withstand the voltage from the chosen battery. If you remember our motor draws max 15amp. So, the watt value for 3S and 4S will be

At 3S battery 11.1 x 15 = 166.5 Watt.

ESC (A) =1.2- (1.5×max amp of motor) = 1.5×16 = 25. (SO, we have chosen the ESC of 30A.)

Propeller Calculation for ThrustWe have, Pay

load Capacity + The weight of the craft itself =

Thrust* hover throttle%

If you choose a 3s Li-po battery to supply power. Your propeller is 10*4.7 and the throttle is 75%. The weight of the craft itself is 1700g and we, want to build our quadcopter which can load 1000 grams.

1000+1700 = T×75%T = 2700/0.75

T =3600 grams.

Nozzle Calculation

To select a specific orifice size, the spray volume, nozzle spacing, and travel speed are needed for the following calculation,

Nozzle discharge (GPM) = (travel speed x nozzle spacing x spray volume) /5940.

ii.RESULT

The drone developed is more efficient and robust in nature compared to its contemporaries. The drone will also be useful to spray not only pesticides but also can be used to spray paints

and also used for sanitation purpose.

Fig.12 Output of pesticide spraying drone

4.CONCLUSION

In this project, we have designed a Drone with a pesticide sprayer which is an architecture based on the unmanned aerial vehicle (UAVs) that can be employed to implement a control loop for agricultural applications where Drones with

pesticides sprayer is responsible for seed sowing. Here we can reduce the human efforts not much but some amount. This will help perform the seeding task done in agricultural fields in less time. This will reduce the labor cost also and perform the work very accurately. This is completely operated by the radio transmitter and receiver within the range of the signal. If we are getting far away within the signal range then the Drones with pesticides sprayer will not work properly.

5.FUTURE SCOPE

The weight-lifting capacity of the quadcopter can be increased by increasing the number of motors or increasing the propeller size or by increasing the rpm of the motor.

Flight time can be increased by increasing the battery capacity. Flight time can be increased by increasing the battery capacity Pesticide carrying capacity can be increased by increasing the size of the tank. A larger area can be covered by using more nozzles which can be arranged in the form of an array . The angle of spraying can be controlled for accurate spraying.

6.REFERENCES

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