TITLE: - FERTILIZER SPRAYER WITH DRONE

A project report submitted for fulfilment of the Bachelor of Technology Degree in Electrical Engineering under Maulana Abdul Kalam Azad University of Technology.

Institute of Engineering & Management
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Report

COURSE PROJECT-II

Department of Electrical Engineering for the Academic year

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Affiliated To

Maulana Abul Kalam Azad University of Technology
BF-142, Salt Lake, Sector-I, Kolkata-700064

CERTIFICATE
TO WHOM IT MAY CONCERN

This is to certify that the project report entitled **FERTILIZER SPRAYER WITH DRONE**
Submitted by

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Students of **INSTITUTE OF ENGINEERING & MANAGEMENT,** in fulfilment of requirements for the award of the degree of **Bachelor of Technology in Electrical Engineering,** is a bona fide work carried out under the supervision and guidance of **Prof. Dr. Madhumita Pal** during the third year of the academic session of 2021-2024.

It is further certified that work is entirely original and its performance has been found to be quite Satisfactory.

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ABSTRACT

There are too many technologies involved in today's Agriculture, out of which spraying pesticides using drones is one of the emerging technologies. Manual pesticide spraying causes many harmful side effects to the personnel involved in the spraying process. The Exposure effects can range from mild skin irritation to birth defects, tumors, genetic changes, blood and nerve disorders, endocrine disruption, coma or death. The WHO (World Health Organization) estimated as one million cases of ill affected, when spraying the pesticides in the crop field manually. This paved the way to design a drone mounted with spraying mechanism having 12 V pump, 6 Litre storage capacity tank,4 nozzles to atomize in fine spray , an octocopter configuration frame ,suitable landing frame, 8 Brushless Direct Current (BLDC) motors with suitable propellers to produce required thrust about 38.2 KG(at 100% RPM) and suitable LithiumPolymer (LI-PO) battery of current capacity 22000 mAh and 22.2 V to meet necessary current and voltage requirements. A First-Person View (FPV) camera and transmitter can also be fixed in the drone for monitoring the spraying process and also for checking pest attacks on plants. This pesticide spraying drone reduces the time, number of labor and cost of pesticide application. This type of drone can also be used to spray disinfectant liquids over buildings, water bodies and in highly populated areas by changing the flow discharge of the pump.

CONTENTS

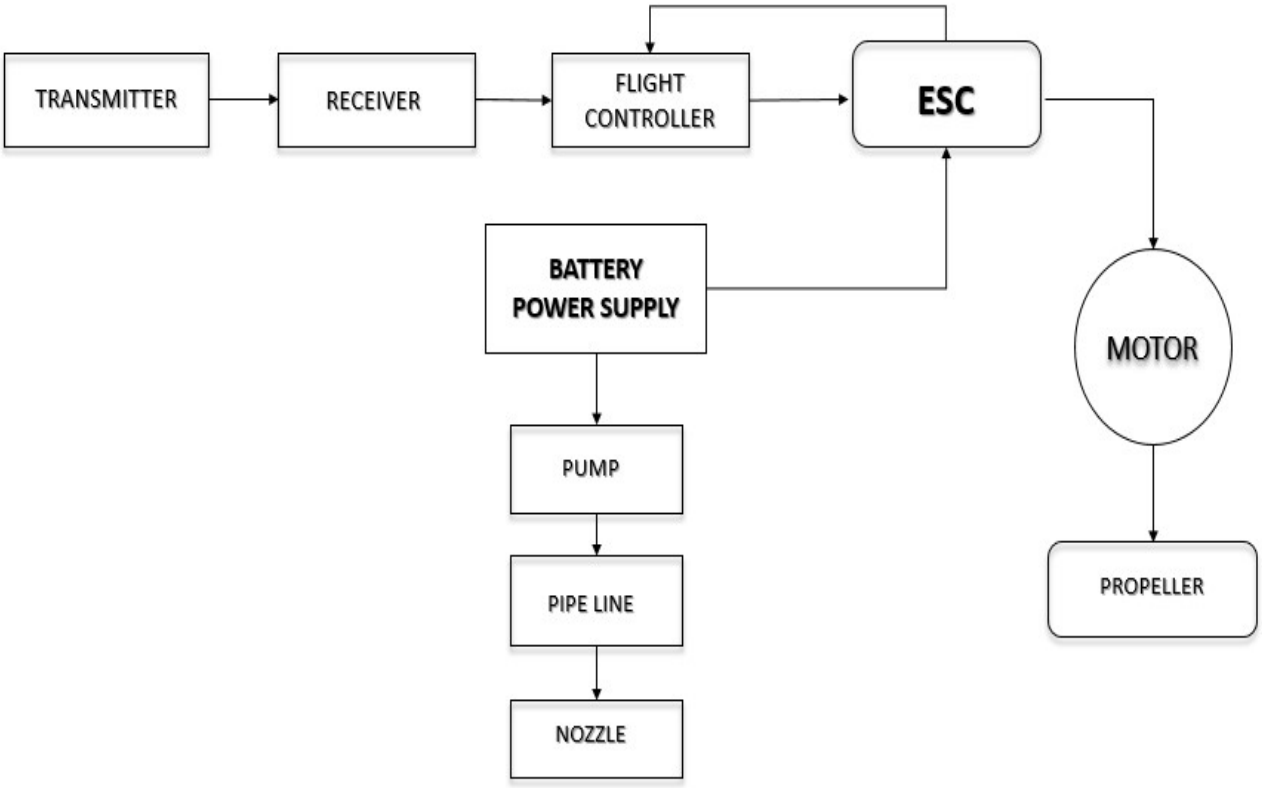
INTRODUCTION

The Indian Agricultural sector is the most important sector as it amounts to a staggering 18% of India's Gross Domestic Product (GDP) and also provides employment to 50% of the national human workforce. Our country is dependent on agriculture so much, has yet to tap into the real potential of agriculture, because of improper methods of monitoring crops and the irrigation patterns and the pesticides required to be applied.

In India, there are over 35 drone start-ups that are working to raise the technological standards and reduce the prices of agricultural drones. This project aims to develop Unmanned Aerial Vehicle (UAV) for overcoming this problem and also spay large amounts of pesticides within smaller interval of time using Quadcopter.

As a part of the agricultural industry, drones are being employed for various operations in aerial surveillance, mapping, land inspection, monitoring, spraying fertilizers, checking for diseased or rotting crops, and much more. The diverse kinds of drones are being tested to determine the most creative space in agriculture, horticulture, and farming. For crop fertilization, drones such as quadcopters prove to be the most favourable owing to their multi-rotors. Fixed-wing drones suit the purpose of crop fertilization, albeit their large structure requiring a large space for take-off and landing comes in the way.

SIMULATION FLOWCHART



DESIGNING OF QUADCOPTER

To Design an octocopter first we have to Estimate our payload, then with respect the weight of the payload motor, Propeller, Electronic Speed Controller, Pump, First Person View camera and video transmitter has to be selected. Battery has to be selected by knowing the current and voltage requirements of the components. Then the thrust requirement has to be calculated and finally the frame of the copter has to be designed by determining required arm number, arm length and application of payload.

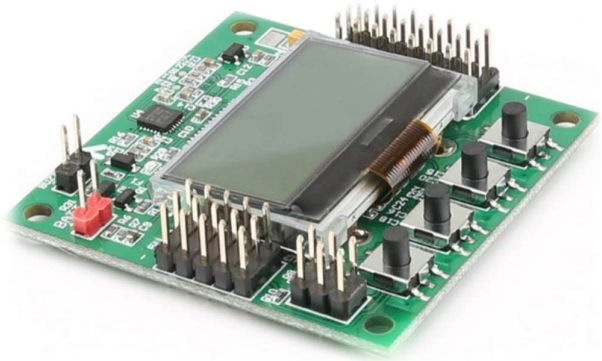
The signals will be transmitted from Transmitter and it will be received by the Receiver in the drone. From the receiver the signal goes to the Flight controller where the signal will be processed with accelerometer and gyroscope sensors. The processed signal will be sent to the ESC, which allows the specific amount of current to the motor based on the signal it receives. The propellers are mechanically coupled to the motors so that they rotate and produce thrust. The pump takes current supply from the Li-Po battery and pressurizes the liquid from the storage tank then the pressurized liquid flows through the pipeline and enters the nozzle then gets sprayed. The flow rate of the pump can be controlled by varying the input current which can be controlled from the transmitter.

COMPONENTS USED

- FLIGHT CONTROLLER
- ELECTRONIC SPEED CONTROLLER 30 AMP
- 1200 KV BRUSHLESS MOTOR
- 2200 MAH LIPO BATTERY
- TRANSMITTER & RECEIVER
- PROPELLERS
- PUMP 12V & NOZZLE
- STEP-UP BOOST VOLTAGE CONVERTER
- SWITCH

COMPONENT'S DESCRIPTION

KK 2.1.5 Flight Controller : The KK2.1.5 Multi-Rotor controller is a flight control board for multi-rotor aircraft (Tricopters, Quadcopters, Hexcopters etc). Its purpose is to stabilize the aircraft during flight. To do this it takes the signal from the 6050MPU gyro/acc (roll, pitch and yaw) then passes the signal to the Atmega644PA IC. The Atmega644PA IC unit then processes these signals according the users selected firmware and passes control signals to the installed Electronic Speed Controllers (ESCs). These signals instruct the ESCs to make fine adjustments to the motors rotational speed which in turn stabilizes your multi-rotor craft. The 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.



Speed Controller : An electronic speed controller (ESC) is a device that controls the speed and direction of a motor by regulating the voltage and current supplied to the motor. It is commonly used in electric vehicles, drones, and remote-controlled models.

An ESC typically consists of a microcontroller, power transistors, and a control circuit. The microcontroller reads the input signal from the receiver and adjusts the output voltage to the motor accordingly. The power transistors switch the voltage on and off at high frequencies to control the motor's speed. The control circuit also provides features such as battery voltage monitoring, over-current protection, and thermal protection.

Brushless Motor : A Brushless DC (BLDC) motor, also known as a Permanent Magnet Synchronous Motor (PMSM), is an electric motor that operates on the principle of a magnetic field generated by a set of permanent magnets on the rotor interacting with the stator's magnetic field.

Unlike traditional DC motors, BLDC motors use electronic commutation to control the stator windings' current. This results in better performance, efficiency, and longer lifespan.

BLDC motors have a higher power-to-weight ratio, lower maintenance requirements, and higher efficiency compared to traditional DC motors and AC induction motors. They are used in a wide range of applications, including electric vehicles, robotics, drones, and industrial automation.

Transmitter & Receiver : A drone radio transmitter is a handheld device that allows the operator to control the flight of a drone remotely. It transmits control signals wirelessly to the drone's receiver, which then translates those signals into actions such as changing the drone's altitude, direction, or speed.

A typical drone radio transmitter consists of a control unit and a receiver unit. The control unit typically has two joysticks, or control sticks, which control the drone's movements. One control stick controls the throttle, which adjusts the drone's altitude, and the other controls the drone's direction and orientation. The transmitter may also have additional switches, knobs, or buttons for controlling other features, such as camera settings or lighting.

The receiver unit is mounted on the drone and receives the control signals from the transmitter. It then sends those signals to the drone's flight controller, which interprets the signals and adjusts the drone's motors accordingly. Some receivers may also have built-in sensors, such as GPS or compass modules, which provide additional data to the flight controller.

Lipo Battery : Here we have used a 2200 maH Lipo Battery as power supply to the motors. A 2200mAh LiPo battery is a rechargeable lithium polymer battery with a capacity of 2200 milliampere-hours (mAh). It is commonly used in radio-controlled (RC) models, including drones, airplanes, and cars, as well as in portable electronics, such as smartphones, tablets, and cameras.

LiPo batteries are known for their high energy density, which means they can store more energy in a smaller package than other types of batteries. They also have a high discharge rate, which allows them to deliver high currents quickly. However, LiPo batteries are also sensitive to overcharging, over-discharging, and overheating, which can lead to swelling, fire, or explosion if not handled properly.

Propellers : The propeller is of 10 inches length. It is made up of carbon fiber which possesses high strength to weight ratio when compared to the propellers made up of plastics.

Dc Pump : A 12V DC water pump is a type of pump that is designed to be powered by a 12-volt direct current (DC) power source, such as a battery or a solar panel. It is commonly used in applications where a small, portable, and low-power pump is required to move water from one location to another.

The pump typically consists of a motor, an impeller, and an inlet and outlet port. When the motor is powered by a 12V DC source, it rotates the impeller, which draws water from the inlet and pushes it out through the outlet. The flow rate and pressure of the pump depend on the impeller design, motor power, and the water's viscosity and temperature.

Step-Up Boost Converter : The XL6009 DC-DC Step Up Boost Converter Module is an electronic device that converts a lower voltage DC power source into a higher voltage output. The module is designed to be small and efficient, making it a popular choice for hobbyists, DIY enthusiasts, and electronics projects.

The XL6009 module is capable of boosting input voltages from as low as 3V up to as high as 32V, with an adjustable output voltage range of 5V to 35V. The output voltage can be adjusted by rotating a multi-turn potentiometer on the module. The module also has a maximum output current of 4A, making it suitable for powering small motors, LEDs, or other low-power electronic devices.

WORKING PRINCIPLE OF QUADCOPTER

- A quadcopter has four propellers at four corners of the frame.
- For each propeller, speed and direction of rotation is independently controlled for balance and movement of the drone.
- In a traditional quadrotor, all the four rotors are placed at an equal distance each other.
- To maintain the balance of the system, one pair of rotors rotates in a clockwise direction and the other pair rotate in an anti-clockwise direction.
- To move up (hover), all rotors should run at high speed. By changing the speed of rotors, the drone can be moved forward, backward, and side-to-side.

FUTURE USES

Precision agriculture: By using drones to apply fertilizer, farmers can target specific areas of their crops that need it the most. This results in more efficient use of fertilizer and can lead to higher crop yields and reduced costs.

Forestry management: Drones can be used to spray fertilizer on trees in remote or hard-to-reach areas, such as hillsides or forests. This can help improve the health of the trees and increase timber yields.

Environmental monitoring: Drones equipped with sensors can be used to collect data on soil moisture, nutrient levels, and plant health. This data can then be used to optimize fertilizer application and reduce environmental impact.

Emergency response: In the event of a natural disaster, drones can be used to quickly and efficiently apply fertilizer to damaged crops or forests. This can help minimize the impact of the disaster on the local economy and environment.

CONCLUSION

In conclusion, the fertilizer sprayer with drone project has the potential to revolutionize the way fertilizer is applied in agriculture and forestry. By using drones to precisely and efficiently apply fertilizer, farmers and land managers can achieve higher crop yields, healthier forests, and reduced environmental impact.

The project involves developing a drone platform that is capable of carrying and spraying fertilizer accurately and efficiently. The drone needs to be equipped with sensors, such as GPS and cameras, to ensure precise application of the fertilizer and to collect data on crop health and nutrient levels.

The use of a fertilizer sprayer with a drone can significantly reduce the time and cost associated with traditional fertilizer application methods, such as manual spraying or using ground-based equipment. The drone can cover larger areas in a shorter amount of time and can access difficult-to-reach areas, such as steep hillsides or remote forests.

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