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AUTOMATIC FERTILIZER SPRAYER

Sri Suvetha C S[1], Sneha R[2], Obli Karthi[3], Pradeep S[4]

[1]Student, Department of Electronics and Communication Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India
[2]Student, Department of Electrical and Electronics Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India
[3]Student, Department of Mechanical Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India
[4]Student, Department of Mechatronics Engineering, Kumaraguru College of Technology, Coimbatore, Tamilnadu, India

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Abstract - *Indian agriculture needed production and protection materials to achieve high productivity. As serious food insecurity persists in many parts of the world today improving the production of healthy crops in agriculture in a sustainable manner is today's realistic target. This paper aims at developing an automatic fertilized control and management system for the improvement of healthy crop production by timely application of fertilizer in the required amount depending on the type of the crop. The implementation of the system has been achieved by interfacing several components and intelligence units such as level sensor, Arduino, ultrasonic sensors, and other components to automatically apply soluble agrochemical fertilizer and water-based on plant needs. An Unmanned aerial vehicle has become cheaper due to many of the control functions that can be implemented using software rather than depending on a large number of the hardware.*

Key Words: *Unmanned aerial Vehicle, Level sensor, Ultrasonic sensor*

1. INTRODUCTION

Agriculture is the backbone of the Indian economy as almost 70 percent of the population depends directly or indirectly on agriculture. Agricultural production depends on various factors like soil moisture, fertility, climatic conditions, and it is also affected by some biological factors like pests, disease, etc. It is very essential to improve the efficiency of agriculture by providing safe cultivation to the farmers. The majority of the farmers spray fertilizer and pesticides without taking precautions measures. So, they suffer from diseases like nausea, skin disorder, and digestive problem.

According to the survey conducted by the World health organization was analyzed that each year employee's area per unit is plagued by poisoning from pesticides from that 18000 dies. To overcome this product is developed with basically octocopter frame structure to reduce the human efforts and timing when compared to the traditional method. This project aims to overcome the problems faced by the farmers by using an automatic fertilizer sprayer drone. This drone can lift 10 liters of liquid that can be sprayed on crops at the right time and in the desired area. It has 5 minutes of flight time and can also cover 1 acre within 10 minutes. In addition to this, the drone includes Ultrasonic and Level sensors which will be used to avoid obstacles, check and intimate the level of tank in the fertilizer in the tank with the buzzer sound. This UAV can fly over at the range of 400 m in radial.90% of water can be saved in comparison to the traditional spraying method. This is possible by using solenoid valves to control spraying. It will spray 30-50times faster than manual spraying and it can also be used in all the variety of crops including terrain regions.

2. LITERATURE SURVEY

In order to finalize the work, the reviews of following literature have been taken. Design & Analysis of Multi-Frame for Octo & Quad Copter Drones in this paper the design and analysis of Octocopter and Quadcopter drones has been discussed [1]. Development of UAV Octocopter Based on Pesticides Spraying System is developed to spray the fertilizers and pesticides to the agricultural area using Unmanned aerial vehicle, this system will be unable to avoid the obstacles [2]. Development and evaluation of drone mounted sprayer for pesticide applications to crops is a hexa-copter drone used for spraying the fertilizers in the fields where human interventions are not possible, this system cannot indicate the amount of fertilizers in the tank [3]. To overcome the above limitations, our work uses the ultrasonic sensors and level sensors which can indicate the obstacle and level of liquid in the tank.

3. TECHNICAL BACKGROUND

3.1 HARDWARE

The octocopter frame is provided with a frame length of 78cm. The frame is provided with 4 pipes like arrangement inclined at 45degree is fixed with solenoid valve perpendicular to each other on the lower side to spray fertilizer. 3-hole mist sprayer with 1.5meter spray

diameter is connected to every pipe. The bottom of the octocopter is fixed with a solid base to land. The drone frame is made of carbon fiber. The drone frame is 3d printed. Fertilizer tank is fixed below the drone. Capacity of the tank is 10 liter and made of polyethylene. Eight 10-inch props are used. The drone frame is provided with 8 BLDC motors of 5500g(maximum) thrust,320 kv. Two 11.V, 10000mAh, 3s rechargeable lipo batteries are taken in parallel for the power supply. Eight 80A individual ESC's are used. F4 flight controllers with onboard Power distribution board is used. 2.4GHz transmitter and receiver module with 1kilo meter range is used. Ultra-sonic sensors are used to detect the upcoming obstacles. Using ultrasonic sensors nearby the ESC disturbs the ultra-sonic sensor. So, we are using an external compass GPS is used to avoid disturbance. Solenoid valves are used to achieve different desired spray rates. Solenoid valves and ultra-sonic sensors are controlled by Arduino. Level sensors are fixed in fertilizer tank to detect the fertilizer level. Bluetooth module is added to Arduino to transmit the output of ultra sonic sensors readings and level sensor readings and input for solenoid valves. To power Arduino 9V batteries are used. The model cost is estimated to be 80,000 Indian Rupee [4].

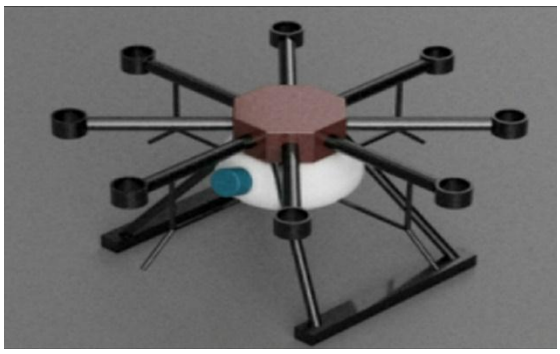

Fig -1- OCTOCOPTER

3.1.2 CALCULATION

The estimated weight of the model is 19 Kg. Thrust weight ratio of the octocopter is 2:1. The motor can produce 7,000 rpm. The flight time of the octocopter is 5 minutes. The spray diameter of the model is 3 meters. The velocity of the octocopter lies between 0-10 meter/second. The model can cover more than an acre by 10 minutes. The rate of fertilizer sprayed per second can be adjusted by using Arduino controlled solenoid valve. The model is remote controlled the lipo battery can recharged in 1hour. It is 30 times faster than manual spraying.

TOTAL WEIGHT OF THE DRONE

Total weight = Drone weight (main body parts) + battery weight + Equipment weight

= 13.9844 + 1.38 + 3.46

= 18.82 kg (approx.)

FLIGHT TIME CALCULATIONS

Flight Time = (Battery capacity / Average amp draw) × 60

Battery capacity = 10,000 mAh /1000 = 10 Ah

10 × 60 (minutes in an hour) = 600-amp minutes

600/ 5(minutes you flew) = 120 Amps (Average amp draw)

= (10/ 120) × 60 = 5 minutes.

ADVANTAGES OF DRONE:

- Running out of fertilizer in tank can be detected in prior.
- Can achieve different spray rates.
- By achieving different spray rate, we can use this model to all types of crops.
- It can be used for mountain terrain farming.
- It can also be used for large area farming.

3.2 SOFTWARE

ARDUINO

To sense and control more physical quantity than your desktop computer the Arduino is a thing for marketing. This is also the open source physical computing platform based on simple board of microcontroller and a good developing environment for software writing on a board. Interactive objects, inputs from switches or sensors, controlling variety of lights, motors etc. for developing this Arduino is used. Programming language is an implementation of writing the Arduino is. This is based on the processing multimedia programming environment.

4. PROPSED METHODOLOGY

The drone is user-friendly for every farmer and is easily controlled via transmitter and receiver module. The drone uses a Bluetooth module to connect to the mobile with sensors in the drones. The drone circuit is simple and it consists of transmitter and receiver for controlling purpose and flight controller controls the BLDC motors and ESC's and Arduino control the ultrasonic sensors for obstacle avoidance and it also controls the solenoidal valves to spray effectively. All these circuits are connected to the lipo battery for power supply.

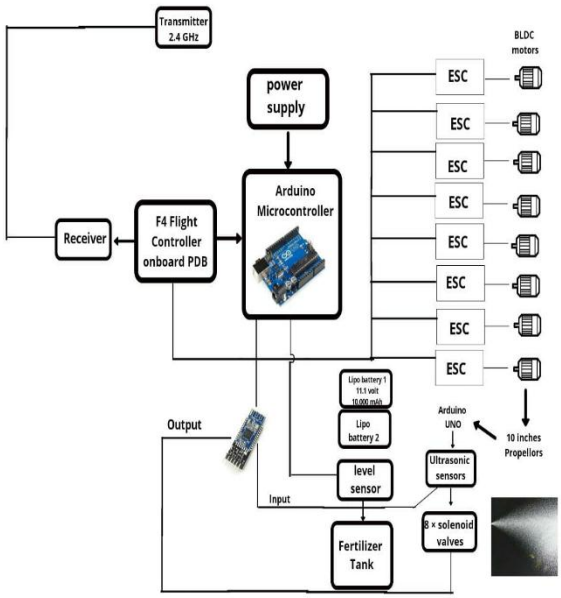

Fig -2- Block diagram

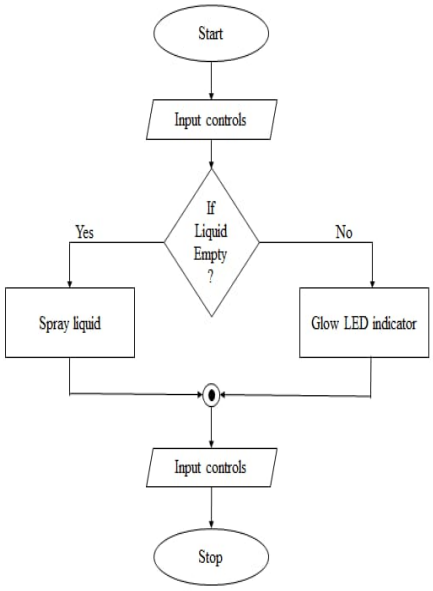

Fig -3- Flowchart of Spraying of Fertilizers

ADVANTAGES OF SPRAYING MECHANISM:

TRADITIONAL METHOD OF SPRAYING:

- Approximately 200 liters of water is used.
- Needs 2 people to carry out the work.
- Penetrations of Pesticides and fertilizer is low.
- Time Consuming (full day).
- The personnel involved in spraying are put on harm's way when spraying.

ADVANCED METHOD OF SPRAYING USING DRONE:

- Unmanned aerial Vehicle.
- High penetrations of pesticides and fertilizer.
- Time saving (30 minutes).
- Can spray large area in a single day.
- No harm for the humans.

5. CONCLUSIONS

The main advantage of our drone will be helpful for farmers in spraying fertilizers, pesticides and crop protection products while being controlled by a single person operating from a safe and secure location.

6. FUTURESCOPE

• Condition of the crops can be achieved by using crop surveillance methodology for monitoring the farm from a safe position.

• Multi Wii based Flight controller can be implemented and it adopt for a big variety of flying machines. This will be used to read the accelerations and gyro data from the MPU unit.

• It can also be IOT enabled which means that the user can get custom notification on smartphone when the OCTOCOPTER has completed the spraying action. The user can also use smartphone to turn on the OCTOCOPTER anywhere in the field and enable to spray.

• Increased weight lifting capacity will allow us to carry more fertilizer in the tank.

• In future there are many chances to increase the flight time using high capacity batteries with lesser weight.

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