CUSTOM AND DESIGN OF AGRI DRONE

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ABSTRACT--The primary reason for using the proposed Agricultural drone is to spray fertilizer. Utilizing 3D printing technology, the Agri drone is manufactured. The Flight controller (KK2.1.5), electronic speed controllers (ESCs), transmitter and receiver (six channels), Brushless DC motors (1000 KV), propellers (1045), relay, and a 12 volt dc power pump are part of the electronic parts used in quadcopters. Electronics parts and 3D printed pieces are used to assemble the agricultural drone. It is urgently necessary to update old agricultural practices due to the world's population growth and shrinking arable land. The problem of effective and productive farming is serious on many levels, particularly in a country like India, which was once regarded as the "land of farmers." The only answer to this issue is modernization of agricultural methods. Innovations in biotechnology, appropriate instruction, and the use of cutting-edge farming equipment can all help to achieve this. Drones for agriculture might be one such instrument.Assembly mistakes, sizing problems, and weight balancing problems were challenges faced throughout the drone's development. The agricultural drone is made using contemporary technologies like 3D printing, fast prototyping, and drone technology. An open environment is used to test the Agri drone's ability to spray fertilizer.

Keywords—*unmanned aerial vehicle;KK2.1.5;drone; drone spraying; Poly Lactic Acid base drone; quadcopter, agricultural drone*

1.INTRODUCTION:

Drones or multi-copter are frequently seen in airborne activities in the modern world and are not just the domain of manned aircraft. Scientific and industry are very interested in using UAVs in a variety of agricultural, research, and recreational activities. Over the past ten years, technology has become increasingly used in the field of farming and other agri fields. Agriculture is the foundation of any country's prosperity. Any valuable technological development in the farming industry will help not only that country as well as the entire planet. The research recommends using a drone or unmanned aerial vehicle (UAV) with clustering communication capabilities to sprinkle agrochemicals on crops to help farmers produce food more effectively and economically. Lightweight materials were used in the design of the drone's overall body. The primary purpose of the drone is to lessen the load on farmers who occasionally need to spray pesticides in their fields. Farmers can more easily operate the drone and apply fertiliser to their fields because to the way it is built and how it functions. The majority of recent developments in UAV endurance research have been made in the areas of energy consumption modelling, endurance optimization methods, and investigation of factors that affect endurance.

2. LITERATURE SURVEY:

The authors[1] of this research go into detail regarding the use of agricultural drones for automatic spraying systems. The issue statement in this publication states that, according to the World Health Organization, there are up to 220,000 fatalities from pesticide poisoning each year, mostly in developing countries, and 3 million cases of pesticide poisoning as well.. They also discuss cost-effective technology that uses PIC microcontrollers to control agricultural robots and the precautions that farmers should take to prevent the damaging effects of pesticides and fertilisers. You can access the published paper at IJRTI, Volume 2, Issue 6, 2017.

The authors [2] of this book provide a detailed description of how agriculture wonder drones are used.. They discussed the composition of pesticides in locations that are difficult for humans to get while providing details about quadcopter UAVs and sprayer modules. They talked about how to detect the margins of the crop area and the green field using multispectral cameras, which are used to take remote sensing photos. Their quadcopter can hoist an 8 kilogramme total payload. In order to analyse the photos from remote sensing, they employed QGIS software. The written article may be found at International Academic Research, Journal of Engineering Sciences, Volume 1, Issue 1, February 2016.[8]

The authors[3]of this publication go into great depth about the Agriculture Drone System's deployment. In this study, the electronic speed control (ESC),transreceiver, body, battery, and flight controlled board (FCB)-based wireless drone system is discussed. A flight controller board was employed to manage the drone's movements, lifts, positioning, and other operations.. In this project, FCB is written to manage many sensors, including GPS, barometer, accelerometer, gyroscope, etc., as well as parts, like motors.This drone has two modes—manual mode and autonomous mode—programmed into it. Project reference number: 39S BE 0564, K. L. E. Institute of Technology, Hubballi, published this article.[3]

3.PROPOSED SYSTEM OF AGRICULTURAL DRONE:

SolidWorks was used to create the 3D model of the agricultural drone frame, which was then 3D printed. CubePro and Ultimaker are employed for this. Materials containing polylactic acid (PLA) are employed to create the frame. Four BLDC motors are supplied with PWM signals through individual electronic speed controllers (ESC) by the KK2.1.5 flight controller. Gyroscope and accelerometer embedded into the device guarantee the steadiness of the agricultural drone. The useful diagram can be seen in Figure 1.

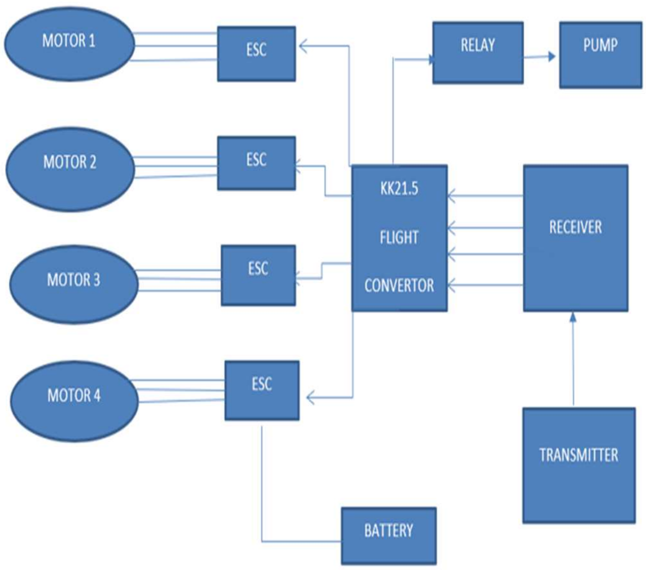

Figure1: Block diagram of Agriculture Drone

Our proposed model will be operational and cost effective. Cost estimation of our project is in table 2. Operational efficient in the sense flight time of our drone will be more efficient as weight our drone is reduced than a normal agricultural drone. This is made possible because of the material and the use of additive manufacturing that is 3d printing technology.

4.COMPONENTS USED AND SPECIFICATION:

The drone frame, which was 3D printed, a BLDC motor, a propeller, a LiPo battery, an ESC, a KK2.1.5 flight controller, a transmitter and receiver that use the 2.4 GHz frequency, LiPo connectors, a pump, a relay, and a sprayer nozzle are all included in the model's mechanical and electrical parts. Table 1 contains information on the major system components.

- Used components weight:

a) Utilized materials = Poly Lactic Acid.

b) Thickness = Poly Lactic Acid – 1.25 g/cm3

c) Drone Body =200 g

d) Brushless dc motor = 75 g

e) Electronic Speed Controller = 92 g

f) Blade = 80 g

g) KK2.1.5 controller = 80 g

h) Pump = 50 g

i) Pesticide tank = 150 g

j) Relay = 20 g

k) Lithium Polymer battery = 200 g

Total weight (W) = 947g

Table1: List of components

Components	***Description***
1. Brushless DC motor	1000 KV
2Electronic speed controller	30Ah
3.LiPo battery	2,200 mAh 25 C
4.Propeller (1045)	10inch,4.5inch pitch
5. Transreceiver	2.4Ghz 6 channel
6.KK2 flight controller	Up to 8 motors, inbuilt IMU
7.3-Dimensional frame	As per design
8.Battery connecter	T type connector
9. Screws	Stainless steel
10.Pump	12v
11.Relay	As required
12.Jumper wires	As required

5.MODELCALCULATION:

i) Total propulsive force = No. of motor* single motor thrust (g)

= 4*900

= 3600g

ii)Esc Rating Current =1.5* Maximum ampere of motor

= 1.5*(4 ~10)

= 6~15Ah

iii) Flight duration = (Battery capacity / Current used)*60

= (2.2/6)*60

= 22 minutes

6.DESIGN OF AGRI DRONE BY 3D PRINTING:

6.1 COMPUTER AIDED DESIGN:

The design phase is the most crucial in the development of any product. The parts are first assembled once the part drawings are created to the desired dimensions. SolidWorks is preferred over AutoCAD because it makes it easier to work with complicated models. Figure 2 depicts the 2D drone modelling.[20]

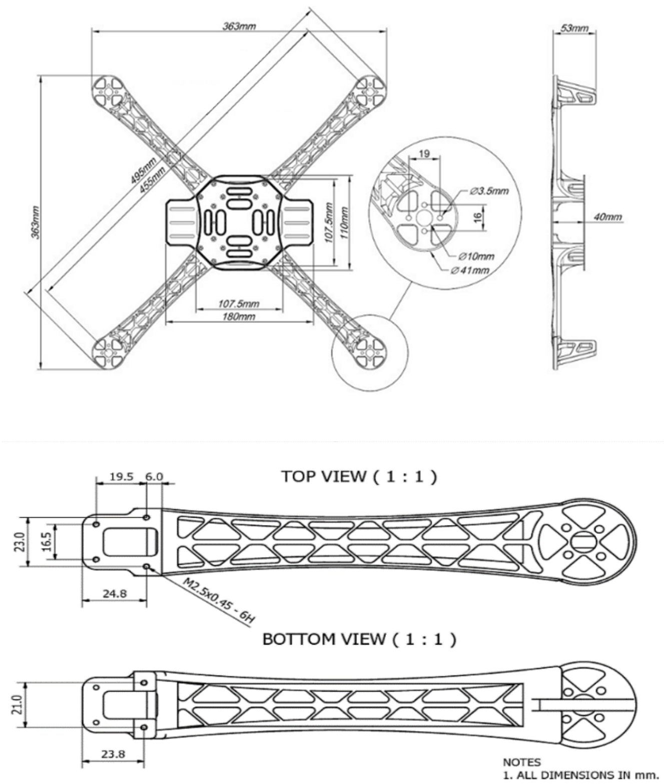

Figure 2: 2D design of quadcopter

The Figure 3 depicts the 3d model of agricultural drone which was done using Computer Aided Design.

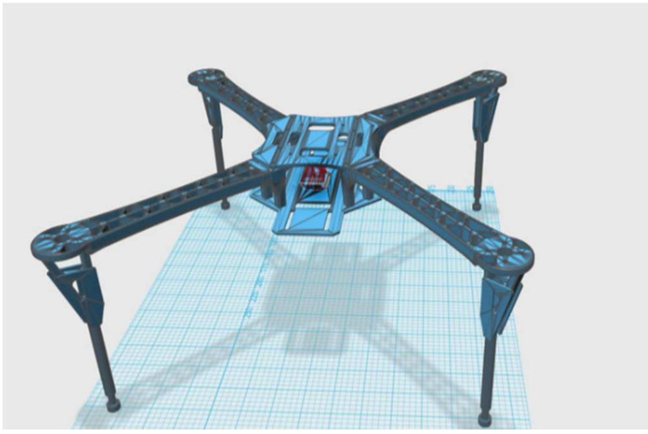

Figure3: 3d model design

6.2 ELECTRICAL INTERFACING:

The drone's electrical components include a flight controller, receiver, BLDC motor, and ESC, pump and relay A pin used to generate PWM signals connects the receiver to the KK2 flight controller. When a user sends an input signal through a transmitter and that controller produces an output that is sent to a pin on the motor connection, the BLDC motor is controlled. LiPo battery power supplies the entire system.

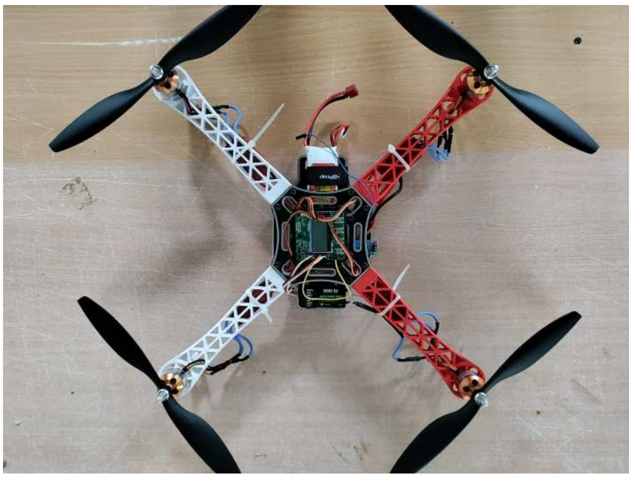

Figure 4: Electrical interfacing

The engine and propeller diameters are taken into account while designing the 3D printed drone frame. The motor is fixed to the frame using a motor mount. The frame size, which is determined by the diagonal distance between two motors, is approximately 760 mm. The landing box is positioned beneath the frame and serves as a vehicle for battery sources as well. To reduce motor torque, the propeller is positioned to the motor in the opposite direction.

7.RESULT AND DISCUSSION*:*

The KK2.1.5 flight controller works with an ESC to drive four brushless DC motors that are mounted in the UAV. The drone's orientation and stability are maintained by an inertia measuring unit sensor that is incorporated inside the device.When there is a drone battery present, the flying controller can calibrate the Electronic speed controller .The drone is prepared to fly in the skies after calibration. The drone is controlled with the aid of a transmitter by turning up the accelerator stick to 60% of the motor's execution speed.Pump in tank activates and the fertiliser in the tank begins to spray when the Switch (SwA)on the transmitter is turned on.

8.CONCLUSION*:*

This project's primary goal is to use 3D printing to construct a quadcopter that can spray fertiliser. The drone was controlled by a transreceiver,kk2.1.5 controller, ESC, and DC motor. SolidWorks was utilized for design and analysis of drone frame structures. The evolved drone's extended fly time and improved roll, pitch, and yaw performance are represented in the proportional, integrated controller action.

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