DESIGN AND FABRICATION OF a AGRICULTURAL DRONE

A Critical Review

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ABSTRACT

There are too many technology worried in today's Agriculture, out of which spraying insecticides the usage of drones is one of the rising technology. Manual pesticide spraying reasons many dangerous aspect results to the employees worried withinside the spraying procedure. The Exposure results can variety from slight pores and skin inflammation to delivery defects, tumors, genetic changes, blood and nerve disorders, endocrine disruption, coma or death. The WHO (World Health Organization) expected as a million instances of sick affected, while spraying the insecticides withinside the crop discipline manually. This paved the manner to layout a drone installed with spraying mechanism having 12 V pump, 6 Liter garage capability tank, four nozzles to atomize in first-rate spray, an octocopter configuration frame, appropriate touchdown frame, eight Brushless Direct Current (BLDC) vehicles with appropriate propellers to provide required thrust approximately 500 Gm (at 100% RPM) and appropriate Lithium- Polymer (LI-PO) battery of contemporary capability 22000 mAh and 22.2 V to satisfy vital contemporary and voltage requirements. A First-Person View (FPV) digital digicam and transmitter also can be constant withinside the drone for tracking the spraying procedure and additionally for checking pest assaults on vegetation. This Agricultural Pesticide Sprayer & COVID Sanitization Drone reduces the time, quantity of exertions and value of spraying software. This kind of drone also can be used to spray disinfectant drinks over buildings, water our bodies and in pretty populated regions via way of means of converting the glide discharge of the pump.

Keywords: *Drone, Agriculture, Payload, Sensors, Pump, Spray etc.*

I. INTRODUCTION:

In India the principal supply of career is agriculture. About 60% of the career is finished from agriculture. We want to enhance the productiveness of various kinds of plants via way of means of presenting secure cultivation. And especially the plants should now no longer have an effect on via way of means of any type of pests or insects. So, we want to spray insecticides and unique kinds of chemical substances to preserve plants secure. In manual, it takes a large quantity of time and electricity of farmers for big regions of the sphere. Basically, it's far dangerous to farmers to spray insecticides and different chemical substances with their hands. So we are able to use the generation and decrease the time and electricity of the farmer via way of means of the usage of UAV (Unmanned Aerial Vehicles) referred to as Drones for the big regions of fields. The use of drones enables the farmers via way of means of doing a large quantity of works finished via way of means of humans. They are secure to apply and are extra beneficial in agricultural fields. Using those gadgets withinside the discipline affords higher cultivation, accurate crop health. There are many sorts of drones which

are utilized in agriculture , we want to select out the drone that's beneficial to us. The Drones can spray insecticides and pesticides for big fields. This venture objectives to lessen the sick results of insecticides or different chemical substances on human beings. And additionally spraying the insecticides over big fields in a quick span of time. The tool we make is a aggregate of spraying mechanisms in a drone. This tool makes use of to spray the fields that farmers can't spray. We use drones to spray the insecticides. The manage of drones isn't plenty hard to learn. The drone may be used everywhere withinside the fields even indoor or outside. This tool includes a regularly occurring sprayer that sprays insecticides the worldwide nozzle can spray each insecticides and fertilizers. When the drone flies within side the air it takes the pix of the sphere from its elevation with the assist of the controller who controls the drone via the remote. The pix are taken from the sky-view display the issues on the sphere, infections of the crop like fungi, bacteria. Unmanned Aerial Vehical are notably applied to matter quantity the huge sort of vegetation on the world. UAVs beautify crop productivity and tell the manner to keep the crop healthy. Drones entire the artwork in plenty much less time, it moreover covers the large amount of area inner a short span of time. Drones moreover help in irrigation manage with the help of clean cameras equipped in it. The drone sprays at 40-60 faster than manual spraying. We need to use the drones precisely simply so there may be no hassle whilst we use drones

Fig 1. Agricultural Drone View

Now a days the health of the crop is greater crucial to the agricultural area. Suppose a crop is infected with in the area, from that single infected crop many numbers of vegetation get infected, so the health of the vegetation is a lot crucial with in the area. Various illnesses with in the crop get identified through manner of method of the virtual dig cam on the UAV. After monitoring the vegetation UAV sprays fertilizers or pesticides based totally definitely on the damage that passed off to the crop. The drones help the farmers in plenty of techniques through manner of method of lowering the workload and time consumption. These UAVs having multispectral cameras and takes photographs of the world from unique views. We can use clean virtual dig cam which can come upon crop health issues. This project goals to growth productivity and beautify crop health and saving the time of the farmer.

II. LITERATURE REVIEW

- **Shilpa Kedari et al [6].** Proposed the Quadcopter (QC)♣ tool this is low value, and lightweight. The Quadcopter is also known as Unmanned Aerial Vehicle (UAV). These quadcopter is small size, and this tool can be used for indoor flora similarly to outdoor flora. Quadcopter is an self maintaining flight for spraying pesticides and fertilizer the use of the android device. Between the quadcopter and android device communique is completed through manner of method of Bluetooth device in real time operation. This tool is used to reduce agriculture place related issues, and moreover will growth the yield of agriculture

- **S.Sabikan et al [14]** Implemented USP platform that had been used to expand the self reliant Remotely Piloted vehical (RPV) quadcopter to in shape for any software. The improvement of quadcopter take a look at mattress configuration able to appearing self reliant flight assignment is offered on this paper. It is an clean. Fast and effectual.

- **Parth N. Patel et al [9]** modified the above system by placing the infrared digicam to the quad copter for surveying the plants. The image captured was processed to distinguish between inflamed or diseased crop and matured crop based on the color property. To ease the transportation of drones the design concept of quadcopter was modified such that two arms of the quad copter arms can be folded for removing the propeller and the camera attachment. This method focused on reducing the size of UAV.

III. OBJECTIVE OF THE PROJECT

- The goal of our project is to design, implement,and take a look at a strong flying AGRICULTURE DRONE that may be used for Seed Sowing.
- The drone which we manipulate thru the far flung enables in sprinkling the water and spraying pesticides, spraying fertilizers, and different chemical compounds like UREA.
- It additionally takes photos of the sphere from a sure peak above the ground, with the ones pictures we will discover which crop receives inflamed and which one is healthy.
- Through this we will made a much less low-cost tool so as to be labored for agricultural reason particularly for seeding Through this we will lessen the operating time of a exertions in agricultural discipline for seeding reason
- The UAV is used to boom crop production withinside the place and allows to reduce the workload and time of the farmer.
- Agriculture drone is likewise captured the picture of the crop..

IV.DESIGN AND FABRICATION

The faraway controls all of the movements of the drone and facilitates to spray water and pesticides, and also facilitates to take snap shots of the sector in distinctive perspectives and facilitates to pick out the inflamed plants. We want to layout all of the components of the drone and gather them.

Components Required:

Frame: The body is a shape that holds all of the additives together. It is the principle essential a part of the drone. It have to be sturdy and it have to be light-weight. If the load is heavy it cannot fly so we want to apply light-weight cloth to layout the body

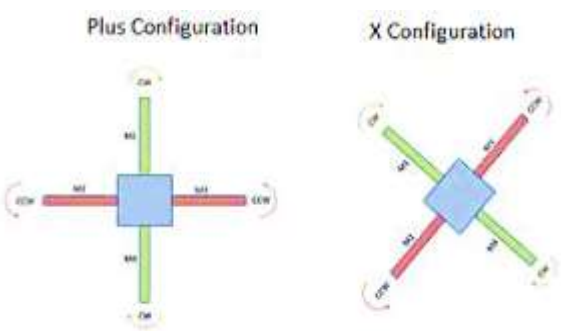

Fig. 1 Quadcopter Configurations

- **Electronic speed controller:** These are truly referred to as as ESCs. These are the gadgets that permit drone flight controllers to manipulate and regulate the rate of the aircraft's cars. A sign from the flight adjustments ESC to growth or lower the voltage to the cars as required. They extrude the rate of the propellers.

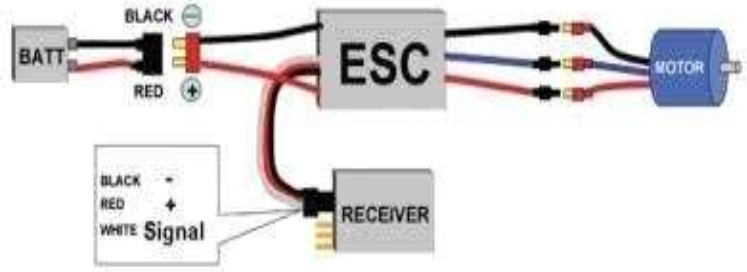

Fig 3: Electronic Speed Controller.

- **Brushless DC Electric Motors:** - These are normally referred to as BLDC cars. These are synchronous cars the usage of the direct modern-day to run. If the motor doesn't work, it'll forestall spinning and the propeller connected to it stops rotating and the drone will now no longer fly. This is likewise one of the essential components of the drone

Fig 4: Brushless DC Motors.

Propellers: These are the wings of the drone. These are the gadgets that rework rotary movement into linear thrust. The drone propellers whilst begins offer evolved spinning they offer airlift with the aid of using spinning and flight the drone. They create an air flow which paperwork a strain distinction among the pinnacle and backside surfaces of a propeller.

Figure5: Propellers.

- **Fly Sky Transmitter and Receiver CT6B:** Fly sky CT6B is a 2.four GHz channel Transmitter and the Receiver is a faraway which controls drone with the aid of using the faraway

Figure6: Fly Sky Transmitter and Receiver CT6B.

Battery and the Charger: We all recognize approximately the battery and the charger. Without a battery, any digital tool might not work. So those also are an essential a part of drones.

Fig 7: Battery and the Charger

V. DESIGN AND CALCULATION

5.1 Design of Quadcopter.

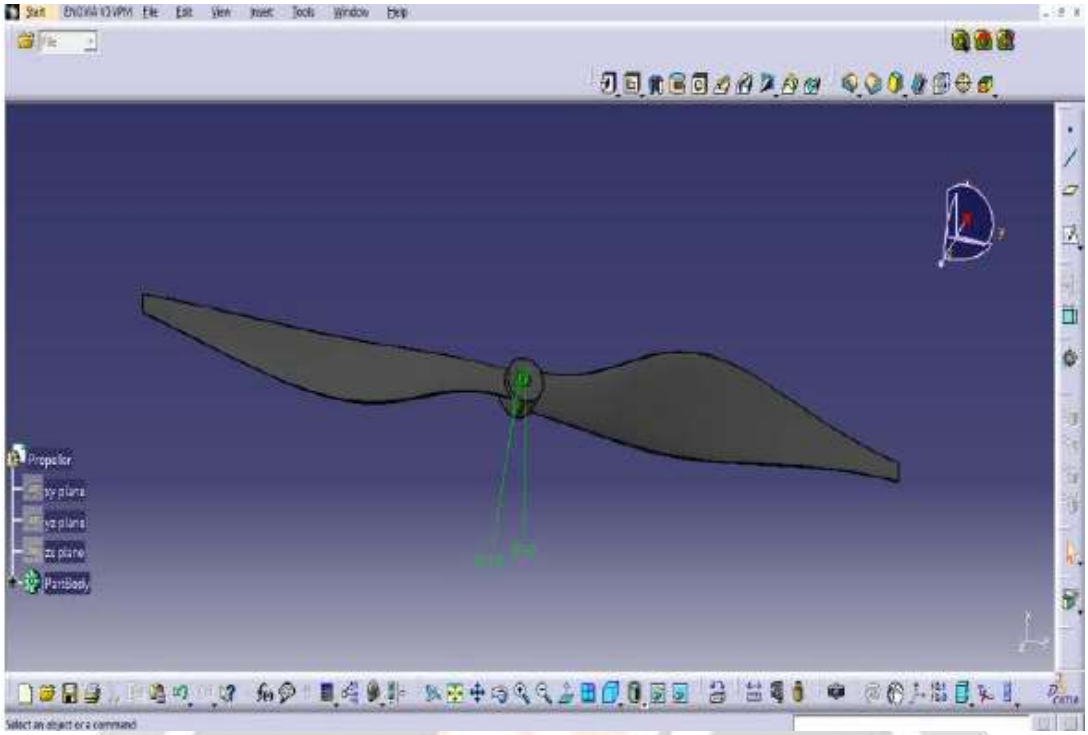

Fig. 8.1 Design of Propellers

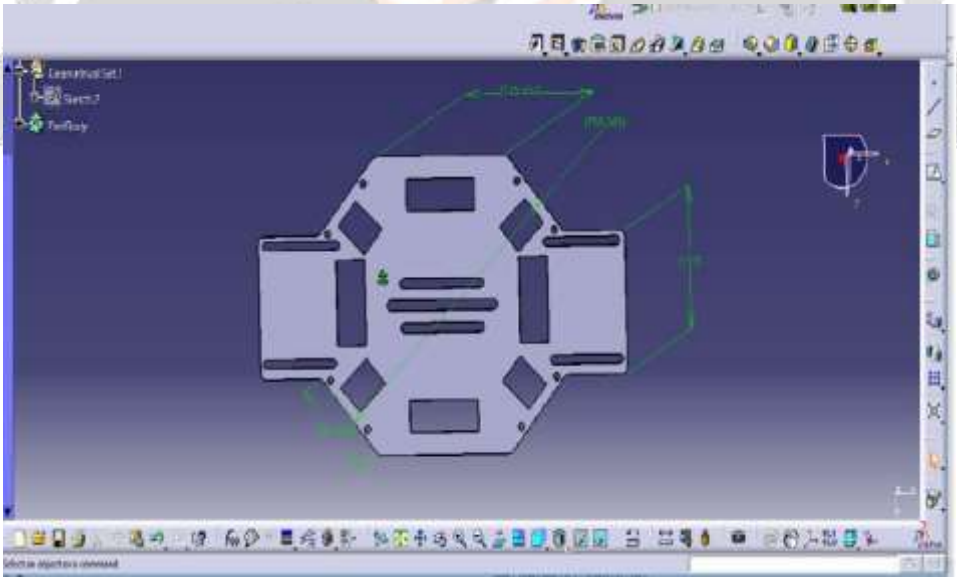

Fig. 8.2 Frame of Quadcopter.

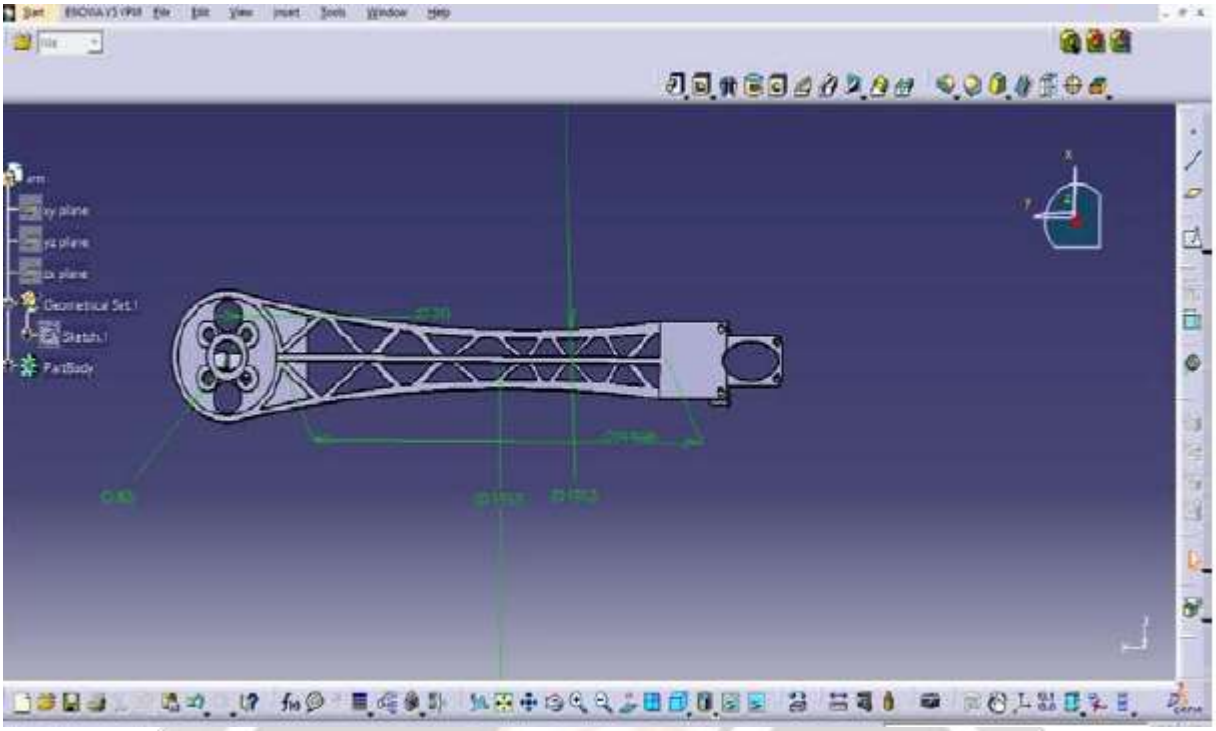

Fig. 8.3 Frame part of Quadcopter.

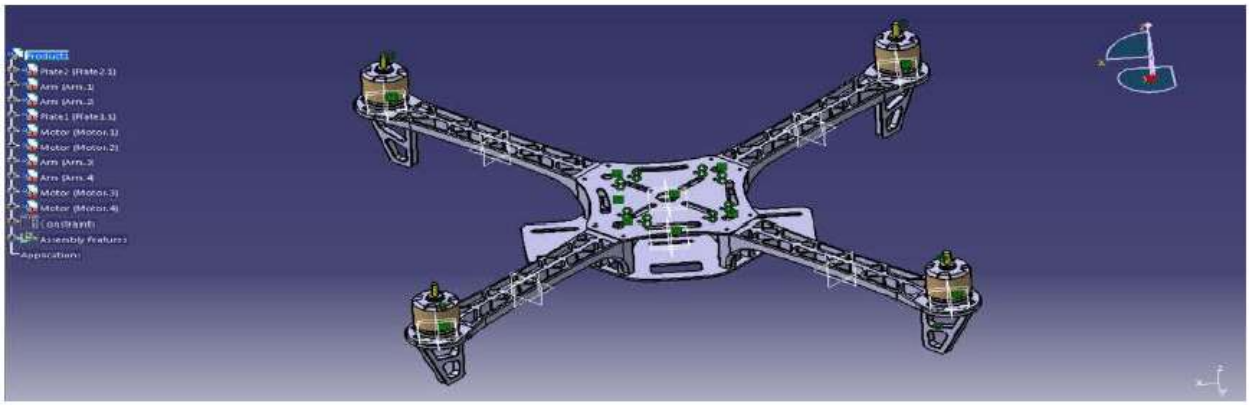

Fig. 8.4 Assembly Design of Drone

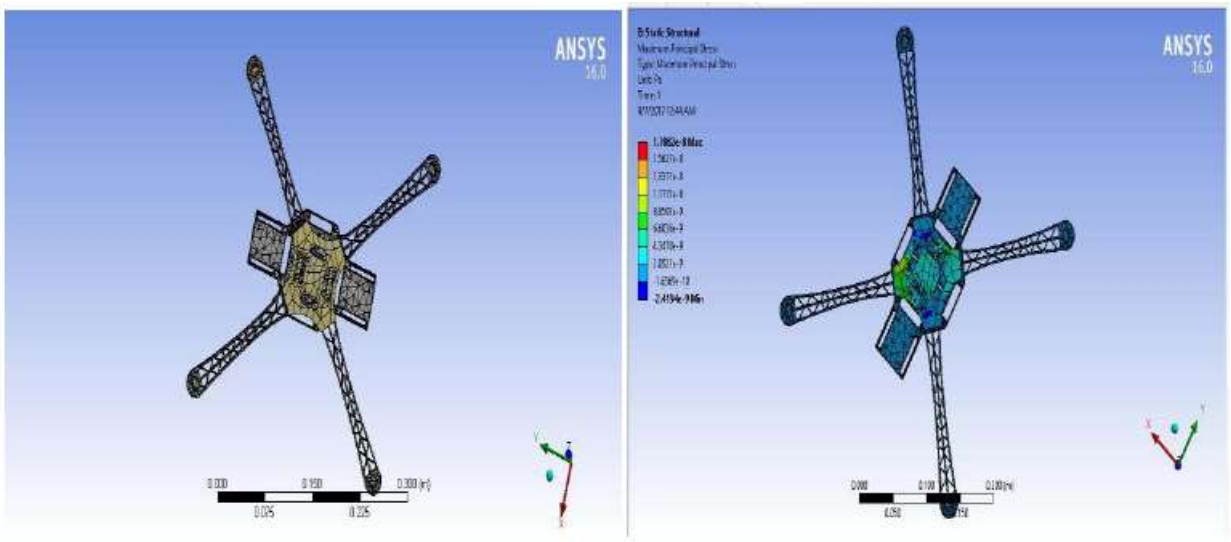

Fig. 8.5 Modal and structural analysis of Quadcopter

5.2. Calculation For Esc

5.2.1 Max Amp Rating

Brushless ESCs are used to govern brushless automobiles which are used on maximum quadcopters. The most amperage an ESC can take care of wishes to be more than the motor/prop aggregate will draw. In phrases of ESC, suggesting 20%-50% more Amps is ideal rule to make certain your ESC do now no longer burn out. For example, Current score for motor is 22A so ESC you're thinking about 30A must do fine. Here is straight forward formula,
ESC = 1.2- (1.5 x max amp rating of motor).
So, we can select ESC between ranges of 26A to 33A.

5.2.2 Voltage from battery

Make certain your ESCs the capacity to face up to the voltage from the selected battery. If you don't forget our motor attracts max 15 amp, So watt fee for 3S and 4S may be At 3S battery 11.1 x 15 = 166.five Watt Since our motor and esc aren't lots green in able to 4S battery we used 3S battery handiest Since our motor is of max modern-day sixteen Amp and we are able to take the esc of 30A. Due to motive or formulae,

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

Hence, the thrust

5.2.3 Thrust Calculations (Without Seeding System) of Drone

General required thrust is given through an formula referred to under it is,

Thrust required = (overall weight of setup) × 2/4.
Therefore in keeping with the body, esc, battery and different setup we have become a weight of 1300 grams. i.e. body weight is 950 grams and different will kind of weights of 350 grams

Required Thrust = 1300×2/4 = 2600/4= 650 grams
Here we get the specified thrust for every motor ought to be 650 grams for every motor. Now we ought to calculate the real quantity of thrust this is going to produced through an individual motor. According to a few reassets i've discovered that the thrust generated through motor is given through following formulation

T= [(eta×P) ² ×2 ×22/7 ×r² ×air density] ^ (⅓)

$Where,$

$eta = prop\ hover\ efficiency\ let\ us\ take\ it\ as\ 0.7 - 0.8$

$P = shaft\ power = voltage \times current \times motor\ efficiency$

$R = radius\ of\ propellers\ in\ meters$

$Air\ density = 1.22 kg/m^3$

$Voltage = 10v$

$Current = 16A$

$Motor\ efficiency = 75\% = 0.75\ Eta = 0.7$

$Then, thrust\ is,$

$T = [(0.7 \times 10 \times 16 \times 0.75)^2 \times 2 \times 3.14 \times 0.127^2 \times 1.22]\text{^}0.33$

$T = [(84)^2 \times 0.123]\ \text{^}0.33$

$T = (7056 \times 0.123)\ \text{^}0.33$

$T = 871.92\text{^}0.33$

$T = 9.348N$

$Therefore\ Thrust\ calculated$

$T = 9.348N$

$T = 9.348 \times 0.101\ Kg$

$T = 0.943kg$

$T = 943\ grams$

generated by each motor = 943grams Since we have 4 motors in the quadcopter, the total thrust generated by all motors is given by multiplying, thrust with 4 Total thrust (T = 943×4 = 3772 grams)

$$\boldsymbol{T = 3.772kg}.$$

If we again choose any less efficiency in motor then we will take some factor of safety, if they work only 70% efficient in the above 70% efficient work we can produce thrust of Thrust

$$T = 3.772 \times 70/100$$
$$T = 2.64kg$$

Therefore, the min-to-min amount of thrust produced by all the motors is 2.64kg

5.3 Battery Calculations

We have to calculate the amount of energy it is consuming; hence we have now calculating the source required by the battery.

$$Max\ source = discharge\ rate * capacity$$
$$Max\ source = 20 \times 2200$$
$$Max\ source = 44000$$
$$Max\ source = 44\ Amp$$

5.4 Propeller Calculations for Thrust

We have,

$\boldsymbol{Payload\ Capacity + The\ weight\ of\ the\ craft\ itself = Thrust * Hover\ Throttle}$ %,

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

$$1000 + 1700 = T \times 75\% T = 2700/0.75\ T = 3600\ grams$$

This amount of thrust should be provided by 4 motors, so we can calculate individual thrust required by **T = 3600/4T = 900** grams Since the thrust required is 900 grams, as we calculated above thrust produced or generated by each motor is 943 grams. The system will be safe or run without any default. Finally, we have concluded to select the 4 propellers of size8"-10" inch2 are supposed to CW and others for CCW.

VI. RESULTS AND DISCUSSION

- **Result Analysis**

The drone developed is additional economical and sturdy in nature compared to its contemporaries. It will fly across totally different terrains and varied climate. the largest advantage of the drone is that it's customizable in line with the necessity. The drone also will be helpful to spray not solely fertilizers and pesticides however can also be wont to spray paints, monitor fields with the assistance of transmitter .To ensure a high-quality product, diagrams and inscription should be either computer-drafted or drawn victimisation India ink.

Future Scope

Way forward for a quad-copter is kind of huge supported numerous application fields it may be applied to. Quadcopter may be used for conducting rescue operations wherever it's humanly not possible to achieve. In terms of its military applications it may be additional wide used for police work functions, while not risking a person's life. As additional automatic quad-copters square measure being developed, there vary of applications will increase and thence we are able to guarantee there commercialisation. so quad-copter may be employed in day to day operating of a person's life, guaranteeing their well-being.

VII. REFRENCES

[1] A.A Sarangdhar, & Pawar, V. R. Machine learning regression technique for cotton plant disease detection and dominant exploitation IoT. International conference of physics, Communication and part Technology,Vol. 2, pp.449-454,2017.
[2] Chebrolu, N.,Labe, T.,&Stachniss,C. sturdy semipermanent Registration of UAV pictures of Crop Fields for exactitude Agriculture. IEEE DRONEICS AND AUTOMATION LETTERS, Vol.3, No.4, pp.3097-3104, 2018.
[3] Duan, T., Chapman, S. C., Guo, Y., & Zheng, B. Dynamic observance of NDVI in wheat scientific agriculture Associate in Nursingd breeding trials exploitation an pilotless aerial vehicle. Field Crops analysis, Vol.210,pp.71-80,2017.
[4] Ferentions,K. Deep learning models for disease detection and diagnosing. Computers and physics in Agriculture,Vol.145,pp.311-318,2018.
[5] Ghosal, M., Bobade, A., & Verma, P. A Quadcopter based mostly setting Health observance System for good Cities. Second International Conference on Trends in physics and information science (ICOEI) ,pp. 1423-1426,2018.
[6] Kedari, S., Lohagaonkar, P., Nimbokar, M., Palve, G., & Yevale, P. Quadcopter-A Smarter method of chemical Spraying. Imperial Journal of knowledge domain analysis, Vol.2, No.6, 2016.
[7] Kabra, T. S., Kardile, A. V., Deeksha, M. G., Mane, D. B., Bhosale, P. R., & Belekar, A. M. Design, Development & optimisation of a Quad-Copter for Agricultural Applications. International analysis Journal of Engineering and Technology,Vol.04No.07,2017.
[8] Kerkech, M., Hafiane, A., & Canals, R. (2018). Deep leaning approach with colorimetrical areas and vegetation indices for tracheophyte diseases detection in UAV pictures. Computers and physics in agriculture, 155,237-243.
[9] Patel, P. N., Patel, M. A., Faldu, R. M., & Dave, Y. R. (2013). Quadcopter for agricultural police investigation. Advance in Electronic and electrical Engineering, 3(4), 427-432
[10] Qin, W., Xue, X., Zhang, S., Gu, W., & Wang, B. (2018). drop deposition and potency of fungicides sprayed with little UAV against wheat mildew. International Journal of Agricultural and Biological Engineering, 11(2), 27-32.
[11] A.A Sarangdhar, & Pawar, V. R. Machine learning regression technique for cotton plant disease detection and dominant exploitation IoT. International conference of physics, Communication and part Technology,Vol. 2, pp.449-454,2017.
[12] Chebrolu, N.,Labe, T.,&Stachniss,C. sturdy semipermanent Registration of UAV pictures of Crop Fields for exactitude Agriculture. IEEE DRONEICS AND AUTOMATION LETTERS, Vol.3,

No.4, pp.3097-3104, 2018.
[13] Duan, T., Chapman, S. C., Guo, Y., & Zheng, B. Dynamic observance of NDVI in wheat scientific agriculture Associate in Nursingd breeding trials exploitation an pilotless aerial vehicle. Field Crops analysis, Vol.210,pp.71-80,2017.
[14] Ferentions,K. Deep learning models for disease detection and diagnosing. Computers and physics in Agriculture,Vol.145,pp.311-318,2018.
[15] Ghosal, M., Bobade, A., & Verma, P. A Quadcopter based mostly setting Health observance System for good Cities. Second International Conference on Trends in physics and information science (ICOEI) ,pp. 1423-1426,2018.
[16] Kedari, S., Lohagaonkar, P., Nimbokar, M., Palve, G., & Yevale, P. Quadcopter-A Smarter method of chemical Spraying. Imperial Journal of knowledge domain analysis, Vol.2, No.6, 2016.
[17] Kabra, T. S., Kardile, A. V., Deeksha, M. G., Mane, D. B., Bhosale, P. R., & Belekar, A. M. Design, Development & optimisation of a Quad-Copter for Agricultural Applications. International analysis Journal of Engineering and Technology, Vol. 04 No.07, 2017.
[18] Kerkech, M., Hafiane, A., & Canals, R. (2018). Deep leaning approach with colorimetrical areas and vegetation indices for tracheophyte diseases detection in UAV pictures. Computers and physics in agriculture, 155,237-243.
[19] Patel, P. N., Patel, M. A., Faldu, R. M., & Dave, Y. R. (2013). Quadcopter for agricultural police investigation. Advance in Electronic and electrical Engineering, 3(4), 427-432.
[20] Qin, W., Xue, X., Zhang, S., Gu, W., & Wang, B. (2018). drop deposition and potency of fungicides sprayed with little UAV against wheat mildew. International Journal of Agricultural and Biological Engineering, 11(2), 27-32.