



Experimental Analysis of Field Working Hours of Cost Effective Quad Copter for Multipurpose Material Handling

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ABSTRACT: In the present scenario, fuel is the major issue for the market personals and many reputed companies, a large amount in the form of capital is investing as transportation cost for variable type of product which is not easily reduce, so it is very necessary now days that we will find the best alternative for the transportation system for less weighted products which reduces the fuel cost and eliminates the maximum transportation cost. It is possible only through best use or application of renewable resources or either we create special purpose system who consume very less amount of fuel as compared to today's commercial system like diesel vehicles after varying observations only one and very important issue which catches our eye again and again and needs attention with deep proactive participation is material handling, many companies suffering from very crucial problem of material handling, which occurs again and again and there is no possible solution of rectification for such cases because we are failing in it due to heavy cost. The main objective for our research paper is to manufacture of cost effective multipurpose material handling robot cum Quad Copter for companies perspectives, and for large amount of medicine spray in single time of frame for agriculture purpose in which we increase the time limit and load bearing by installing batteries and effective frame by new design technique which remove undesirable load which allow the Quad Copter for stay/fly more time in air so that the time limit increase with effective load bearing capacity. In this research paper we calculating the charging and discharging time of battery with varying load for calculating effective height and find the optimum discharging time which will support for the lifting require planned load for multipurpose material handling with good cost effectiveness for maximum time limit.

Keywords: brushless motor, flight controller board, lipo batteries, multipurpose material handling.

1. INTRODUCTION

In this project we aimed to build an Autonomous QUADCOPTOR which can balance itself while flying. This quad copter also consists of manual control system (transmitter-receiver). A four rotor helicopter was designed by Louis breguet. This was the first rotating wing aircraft to lift itself off the ground. After that in 1920s Etienne oehmichen have made 6 designed out of which design no 2 was good. It was having four rotor and eight propellers, all driven by the engine. It was made by steel tube frame with two-bladed rotors at the end of four arms. The quad copter which is spun by electric motors is controlled by adjusting the angular velocities of the rotors. The purpose of this paper is to present the basics of quad copter modeling and control as to form a basis for further research and development

in the area. In the last few, decades the need aircraft with greater maneuverability and hovering ability has led to a rise in quad copter research. The four-rotor design allows quad copter to be highly reliable and maneuverable. Research is continuing to increase the ability of quad copter by advancing in multi-craft if this developing quality can be combined quad copter would be capable of advanced autonomous mission that is currently not possible with other chiles. Quad copter has advantages over the conventional helicopter where the design of various mechanical elements is simpler. Besides that, Quad copter changes direction by manipulating the individual propeller's speed and does not require cyclic and collective pitch control [1]. A four rotor helicopter was designed by locus breguet. This was the first rotating wing aircraft to lift is self off the ground. After that in 1920 Etienne oehmichen have

made 6 designs out of which design no-2 was good. It was having four rotors and eight propellers, all driven by a single engine. It was made by steel tube frame with two bladed rotors at the end of four arms [2]. Mohd khan (2014) presented a quad copter with standard flight operation such as with standard flight operation such as taking-off, landing and hovering propose with indoor & outdoor flying capabilities. This paper presents a way to adjust thrust of the rotors via voltage supply to perform standard flight operations. Total thrust is determined by the user defined attitude and angles[3]. MONGKUN QETKEAW A/K VECHIAN presented a remotely operated quad copter system. The quad copter is controlled through graphical user interface (GUI). Communication b/w GUI and quad copter is done by using wireless communication system. For smooth landing quad copter is equipped with an ultrasonic sensor, maximum operated time of quad copter is six minutes using 2200 MAH lippo battery operated time can further be increased by increasing battery capacity[4]. Matt parker and Gerard Bottorff presented a UAN (unmanned aerial vehicles) quad copter for the military purpose. The aim of their project is to make a cost effective, long reliable, quad copter. They have made remarkable progress in demonstrating extensive tethered and untethered flight as well as limited autonomous flight [5].

II. OBJECTIVE

1. To calculate charging time.
2. To calculate discharging time.
3. To analysis proper balancing frame.
4. To analysis the proper stability of quad copter after assembly with varying height.
5. To calculate the total number of batteries required for final installation for planed working hours.
6. To analysis the optimum load carrying capacities with different height.

A. Problem Statement

In the present scenario, fuel is the major issue for the market personals and many reputed companies, a large amount in the form of capital is investing as transportation cost for variable type of product which is not easily reduce, so it is very necessary now days that we will find the best alternative for the transportation system for less weighted products which reduces the fuel cost and eliminates the maximum transportation cost. It is possible only through best use or application of renewable resources or either we create special purpose system who consume very less amount of fuel as compared to today's commercial system like diesel vehicles after varying observations only one and very important issue which catches our eye again and again and needs attention with deep proactive participation is material handling, many companies suffering from

very crucial problem of material handling, which occurs again and again and there is no possible solution of rectification for such cases because we are failing in it due to heavy cost. The main objective for our research paper is to manufacture of cost effective multipurpose material handling robot cum Quad Copter for companies perspectives, and for large amount of medicine spray in single time of frame for agriculture purpose in which we increase the time limit and load bearing by installing batteries and effective frame by new design technique which remove undesirable load which allow the Quad Copter for stay/fly more time in air so that the time limit increase with effective load bearing capacity.

III. NEED FOR THE PRESENT STUDY

The main needs of quad copter are-

1. To reduce the manpower in local areas who works as the delivery boys like pizza, courier boy, etc.
2. To reduce the overall cost of a quad copter so that it will use for commercial basis.
3. To make the cost effective frame with greater strength.
4. To make a quad copter with better stability.
5. To increase the material handling capacity.

IV. MATERIAL AND METHEDOLOGY

In the last few decades the need of aircraft with greater maneuverability and having ability has led to a rise in quad copter research. The four rotor design allows quad copter to be highly reliable and moveable. Research is continuing to increase the ability of quad copter by making advance in multi craft. If these developing qualities can be combined quad copter would be capable of advanced autonomous mission that are currently not possible with other vehicles.

A. Frame

The skeleton of a quad copter is the frame (caulis) in which all parts are attached quad copter frame comes in many design but we use here is a vague X-shape frame is made up of aluminum. For making our project the instrument used are motors, propeller, electronic battery & charger and frame



Fig. 1. (a). Prototype model of frame made by wood
(b). Aluminum Frame.

B. Motor

The motor have an obvious purpose to spin propellers. Brushless motors are used here in our project motors are rated. The motor spins at a constant voltage. We found a suitable motor of rating 1800 RPM.



Fig. 2. Brushless Motors 1800 R.P.M.

C. Propeller:

Basically a quad copter has four propeller directions & two propellers rotate in anticlockwise direction. Longer propeller can achieve stronger lift at lower RPM than a shorter propeller, but take longer to speed up & slow down. Shorter propeller allows the quad copter to change speed quickly.



Fig. 3. Propeller.

D. E.S.C:

The electronic speed control is that tells about how fast motor to spin at a given time we need Four E.S.C for our quad copter connected with each motor. An E.S.C supplies the proper modulated. Current to the motors which in turn produce correct rates at spin for both lift & maneuvering.

E. Flight controlled board

The flight controller board is the brain of quad copter which controls the craft, and interprets. The signals the transceiver sends to guide the quad copter.

F. Battery

It is the most important part of any gadget which runs on electrical energy. Quad copter is one of the gadget which uses battery as a power source. We are using 3200 Mah battery. We have added two batteries so that we can use more power and more time for flying. Always use recommended charger for safety.

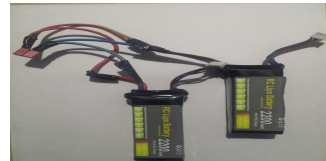


Fig. 5. Lipo Batteries 3200 mah.

G. Camera

Camera is used for security purpose as we are using camera in our quad copter for surveillance. It can be used for capturing and for video purpose respectively. It can be very useful in eve teasing as it will send that live video to the nearest police headquarter and they will take immediate action.



Fig. 7. Camera with battery attachment.

H. Remote

We need remote for controlling the quad copter because it cannot control itself. Remote should be properly synchronized with flight controller so that the command should be accurate.



Fig. 8. Remote Control.

I. Dongle:

It is device used to display the videos and images capture by the in laptops, LED TV etc.



Fig. 9. Image of Dongle with TV cable and Laptop attachment.

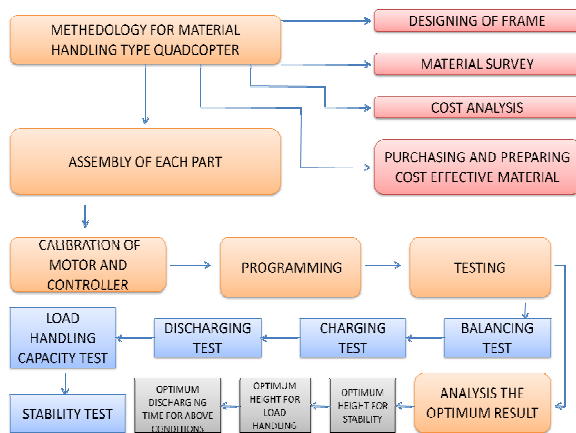
J. Reciever

It is device used to capture videos and images send by the transmitter to receiver under the supervision of varying signals in laptops, LED TV etc.



Fig. 10. Image of Receiver.

K. Methodology Used



Methodology Adopted for assembling of a Quad copter

1. First we are making a frame of light weight material.
2. Quad copter is a device with a intense mixture of mechanical and electronics.
3. It is basically on the principle of aviation.
4. The quad copter has 4 motors whose speed of rotation and the direction of rotation and the direction of rotation changes according to the users desire to move the device in a particular direction. (i.e. Take off motion ,landing motion , forward & backward motion , left & right motion)
5. The signal from microcontroller goes to ESC which control the speed of motor.
6. The rotation of motor changes as per transmitted signal send from the transmitter.

V. RESULT AND DISCUSSION

A. Balancing Test

Balancing test is the balancing of quad copter the arms of the copter should be lies parallel to the surface here balancing test is done with the thread put the thread on the four corner of the quad copter and stick it with the tape now stretch these threads to the center of the quad

copter as shown in fig. now hang the copter in air with the help of these bunches of threads now check the quad copter balancing it should be lies parallel to the ground and copter should not be tilt to one side .

B. Charging Test

Charging test of a battery means time taken to charge a battery put on it charging mode .now take a stopwatch and start it parallel to the starting of charging of battery. when the green light appears on the battery means that it is charged now stop the stop watch and hence time taken to charge a battery is received hence time is obtained that how much time our copter can fly.

C. Discharging Time

Discharging test of a battery means time taken to discharge a battery while operated take a stop watch now fly the copter in the air till the battery is emptied and copter comes back to the ground hence time is obtained in how much time our copter battery is empty.

D. Test with Different Load with Different Height

This test is going to test our copter to check the load carrying capacity there is various material which is to be dispatch to the homes like shoebox, pizza box, etc here we check these things whether our copter is able to lift this material or how much time or height it should be hovered .where we get the optimum load caring capacity with different height.

E. Stability with Varying Height Test

This test is conduct for prediction of optimum stable height for determining clear weight lifting capacity of the quad copter with varying height for multipurpose material handling regarding transportation of products and goods. The investigated results for stability coming best at height 180-200cm.

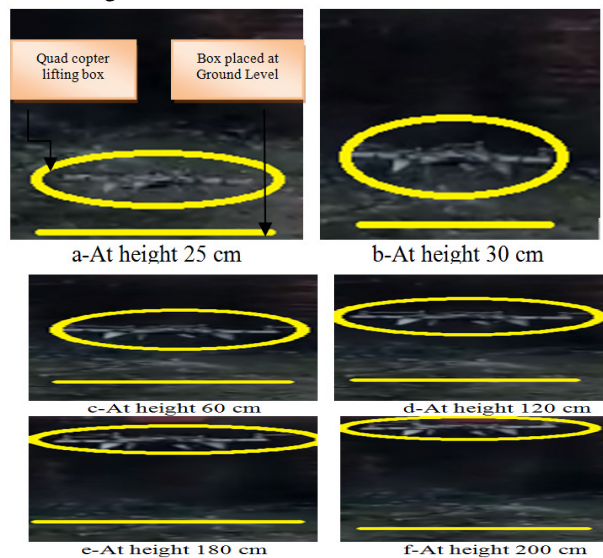


Fig.13. a,b,c,d,e,f: Stability with Varying Height During Good Weather.



Fig. 14. Effective Weight carrying capacity at height 80 cm.



Fig. 15. Effective Weight carrying capacity at height 180 cm.

F. Determining the Number of battery Used for Planned Working Hours:

After all above investigation including charging time of battery and discharging time of battery and the lifting capacity, it clears that our quad copter is able to lift extra weight 1600 gram including its own weight with two batteries up to a certain possible height for surveillance against eve teasing and different monitoring applications. So if we not carry such extra weight from our quad copter we convert that weight into battery installation weight which directly increases the time limit of our quad copter and we are able to determine the number of battery used for planned working hours. The total number of battery used instead of extra weight will be 6 batteries as the single battery weight was 160 grams. The planned working hour for our quad copter will be 7 hours which will lift 1kg extra weight for transportation of small goods from one place to another.

VI. CONCLUSION

In our research paper we made cost effective material handling robot cum quad copter against transportation and man power cost, in which we focus on several issues like minimize manufacturing cost, increase effective planned work hours, determine optimum height of stability for quad copter, analyze charging and discharging time of battery for further planning the actual work output of quad copter means that how much time it will stay on the air carrying 2kg extra material for supply with calculated number of batteries.

After assembling all parts of quad copter we started preparation for several testing. It was observed that the stability of our quad copter starts from 30cm and between ground to 30cm little bit vibration or instability was there. The planned working hour for our quad copter will be 7 hours with 2kg extra weight carrying capacity. Thus the total number of battery used instead of extra weight will be 8 batteries as the single battery weight was 160 grams. In future we increase battery capacity with less weight by using graphene and apply graphene material in quad copter frame. It is very lighter than aluminum which increases its strength with less weight as well as flexibility. Finally we fabricate new quad copter in future with increase weight lifting capacity about 150-200kg by improving the battery capacity with high motor RPM. Our fabricated quad copter show several advantages like it reduces man power, it is accessible to variable site, able to monitor large areas, reduce transportation cost and man power for low weighted products and it is use for several applications like surveillance against eve teasing, monitoring against large agricultural farm and terrorism, able to supply low weight goods to small location and effectively respond as air ambulance.

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