

Experimental Investigation of Field Working Hours of Cost Effective Surveillance Robot cum Quad Copter against Eve Teasing and Multipurpose Applications

Shivasheesh Kaushik, Deepak Joshi

Abstract— In the present scenario, after varying observations only one and very important issue which catches our eye again and again and needs attention with deep proactive participation is eve teasing, many cities suffering from very crucial problem of eve teasing, which occurs again and again and there is no possible solution of rectification for such cases because we are failing in twenty-four hours monitoring for such issues, as government have very low man power which engaged in various other works, whatever the amount of the man power left for such issues are not able to solve this problem due to unidentified areas and lack of evidence. The main objective of our research paper is to manufacture of cost effective surveillance robot cum Quad Copter against eve teasing, in which we increase the time limit of monitoring 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 which is directly proportional to monitoring and surveillance. In this research paper, we calculating the charging and discharging time of battery and find the charging time and optimum discharging time with varying height, optimum height at proper image visibility from low-cost pre-assumed camera which will support for the planned working hours for surveillance with a cost effective manner against eve teasing.

Index Terms— Brushless motor, Flight controller board, Lipo batteries, Camera, Surveillance, Charging and Discharging time of the battery, Weight lifting capacity, Stability, and Balancing.

1 INTRODUCTION

In this project we aimed to build an Autonomous quadcopter 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 bregeet. 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 percent 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 lipo battery operated time can further be increased by increasing battery capacity [4]. Matt parker and Gerad 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]. Parth N.patel, Malav A.patel, Rahul M.faldu &yash R.dave presented aerial quad copter used for agricultural surveillance and unmanned vehicle used for

proper and accurate surveying of the crops and leaves reducing the human effort. The innovative high strength and less weighted frame design will allow the quad copter to be transmitted safely and with ease in a cylindrical shaped cushioned box packing. The core intention of this project is to make a robust design of a quad copter which can be used in the market for agricultural surveillance use. The main aim of the project is to reduce human effort in agricultural surveillance by appropriate use of image processing.[6] Meta dev Prasad murthy presented a quad copter for search and rescue operation for search and rescue operation in natural calamities. There have been a lot of climate changes because of human interference into the natural way of working or sometimes its natural. Due to the changes in climate there is a change of natural calamity. These copters send wireless messages to the sites of control which handle such conditions & save the lives of people as well as their property.[7] Sajal Sharma, Ankit Muley, Rajesh Singh, Anita Gehlot presented a quad copter for surveillance and environmental monitoring. This copter includes a system for real time. A video transfer temperature sensing and also a smoke detecting unit. The multi rotor described in this paper is a quad rotor which is capable of flying autonomously and transmitting the collected data in real time along with a video feed. The control of this quad copter is done with GUI.[8]

2 OBJECTIVE

In this research paper we calculate the charging and discharging time of battery and find the optimum charging time and optimum discharging time with varying height, for determining optimum height for proper image capturing and visibility from low cost pre-assumed camera which will support for the planned working hours for surveillance with a cost-effective manner against eve-teasing. The main aims of our present research paper are as follows:

1. To calculate the charging time of battery.
2. To calculate discharging time of battery.
3. To analyze the design and balancing of frame.
4. To analyze flying stability after complete assembling with varying height for determining the optimum height for the working field.
5. To determine the installation of total no. of battery for final planned working hour of quad copter in field.
6. To calculate optimum image visibility with varying height.

• Shivashresh Kaushik, Assistant Professor in Department of MECHANICAL Engineering, AGI (Amarpali Group of Institute) Haldwani, Uttarakhand, India, PH-9756298215. E-mail: shivashresh.rachit.kaushik@gmail.com

• Deepak Joshi, Diploma in Department of MECHANICAL Engineering, AGI (Amarpali Group of Institute) Haldwani, Uttarakhand, India, PH-9690092796. E-mail: deepakjoshi28041992@gmail.com

2.1 Problem Statement

After various observations only one and very important issue which catches our eye again and again and needs attention with deep proactive participation is eve-teasing, many cities suffering from very crucial problem of eve-teasing, which occurs again and again and there is no possible solution of rectification for such cases because we are failing in twenty-four hours monitoring. Also for such issues, we are not able to solve this problem due to unidentified areas and lack of evidences. The main objective for our research paper is to manufacture a cost-effective surveillance robot cum Quad Copter against eve-teasing, in which we increase the time limit of monitoring by installing pre-calculated number of batteries which effectively participate and will respond throughout the planned working hours of Quad copter with effective frame of high strength and low weight by new design technique and methodology which remove undesirable load and allow the Quad Copter to stay/fly more time in air so that the time limit increase which is directly proportional to monitoring and surveillance.

3 NEED FOR THE PRESENT STUDY

1. An effective frame is very important for a good balanced quad copter and effective stability at lower heights. Because the angle between the arms should be accurately designed so that it balances with varying loads. We have failed up to 3 times in making a good frame. Each and every step for making a frame should be accurate. A good balanced frame will give you max stability.
2. Cost Reduction or cost-effective- As we know that India is a very large country. It will be very costly and impossible to monitor large and broad areas through man power. So it is necessary to build a special type of product which monitors the larger areas, farms, defense areas and monitoring against terrorism and eve-teasing without any barrier and restriction which reduces man power, man effort, and save money and life also, to achieve above all it is necessary to construct or manufacture the quad copter technology in a very cheap way because the parts used in quad copter are very costly specially batteries and controllers, so that it will be used commercially in future.
3. Stability is very important for a quad copter because an unstable quad copter can be dangerous for itself, for surrounding as well as for their attached parts which are very costly. Stability can be gained by proper frame structure with proper measurement.
4. Increase Surveillance Timing- A quad copter has a limitation of time to fly in air due to ineffective batteries. After focusing on such issues it is necessary we should start work on effective battery installations, determining installing capacity of battery with weight/power ratio which makes quad copter more reliable. Today we require high power output batteries which sustain larger load for long time and have advantage of less weight with easily or fast chargeable features.

4 MATERIAL AND METHODOLOGY

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.

4.1 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



Figure1: (a). Prototype model of frame made by wood (b). Aluminum Frame.

4.2 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.



Figure2: Brushless Motors 1800 R.P.M.

4.3 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.



Figure3: Propeller.

4.4 E.S.C:

It is an electronic device which is used to give speed to rotors and to give direction. It plays main role in balancing the quad copter because the speed is varied from it. They are connected to brushless motors.

4.5 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.

4.6 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.



Figure6: Lipo Batteries 3200 mah.

4.7 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.



Figure7: Camera with battery attachment.

4.8 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.



Figure8: Remote Control.

4.9 Dongle:

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



Figure9: Image of Dongle with TV cable and Laptop attachment.

4.10 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.



Figure10: Image of Receiver.

4.11 Methodology Used:

This is a first step toward making a Quad copter. Frame is basically a base of quad copter which is very important for balancing. Normally there are many type of design given by experts H-Shape, X-Shape are best for making a quad copter. We have chosen X-Shape design for frame.

We have Aluminum alloy for making the frame of quad copter, because aluminum is light and have good strong with varying allows. Aluminum is also rusting proof, so it can be used in rainy and foggy day. Material survey is very important for making a quad copter because we choose a light weighted, good strength, rusting proof and non-brittle material for making a good quad copter. We have gone through the local mar-

ket we found so many material like steel, iron, aluminum etc. We choose aluminum for our quad copter because it was having all the properties of a good material, as we are trying to make a cost effective quad copter. So we have gone through various shapes various cities like Delhi, Haridwar and Roorkee etc.

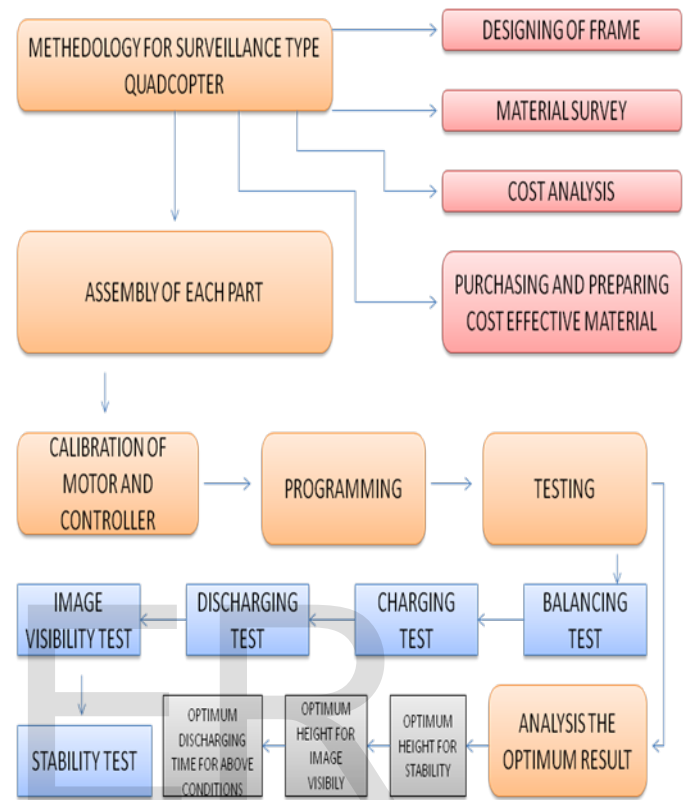


Figure11: Methodology flow chart.

Every shop was having different price of material, so we analyze the prices of material after that we got material at good priced. After we got material we assemble then. Assembling each part should be done carefully because the material get defect if they handle carefully. After assembling we have to prepare the quad copter for calibration. While calibrating we should do it properly because if quad copter is calibrated wrong it will be dangerous, the fan rotates at very high rpm they can hurt any person standing around it. And if the motor gets fall down it may have chance of getting defect. Every part is sensitive so handling is very important. Programming is a step of making the remote, E.S.C, F.C. and receiver ready for use, because they should be programmed correctly so that they can follow the command properly. This will result in proper balancing of quad copter.

5 RESULT AND DISCUSSION

5.1 Balancing Test:

In balancing test, firstly we stick the nylon thread at the edge of all four arms at the center, sticking of thread moves continuously from end side toward center from all four end arms.

After reaching the threads to the center, rap the threads tightly with the tape, then lift that thread up and hang it to the stationary area. With the help of scale measure the gap of all four arms between flour and frame, if it will come equal then the result will be balanced otherwise, if it will not come equal then the result will be not balanced. The result for our frame rated as balance and the all arms are 90° with each other which measured with the help of try square manually.

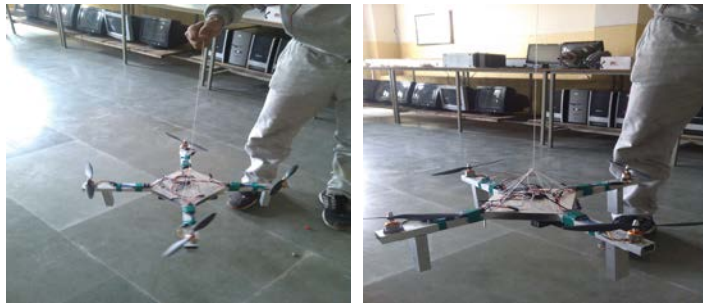


Figure12: Thread Balancing Test.

5.2 Charging and Discharging of Battery Test:

Charging test of a battery means time taken to charge a battery. Put it on 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 stops the stop watch and hence time taken to charge a battery is received. Now if we talk about that how time will obtain by our copter to fly for that we require discharging time. Discharging test of a battery means time taken to discharge battery while aerated. Take a stopwatch; now fly the copter in the air till the battery not emptied and parallel start the stopwatch. Now stop the stopwatch when battery is emptied and copter comes back to the ground. Hence time is obtained in how much time our copter's battery is empty. It observed that the charging time of two batteries was 2 hours and the discharging time was 1 hour 50 minutes when quad copter lift upward in air with its own weight including battery weight i.e. 1950 gram. It is also observes that as the quad copter lift upward with its weight, it only lift 1600 gram weight to a certain height as designed.

5.3 Stability with Varying Height Test:

This test is conduct for prediction of optimum stable height for obtaining clear still images and videos from camera against eve teasing.

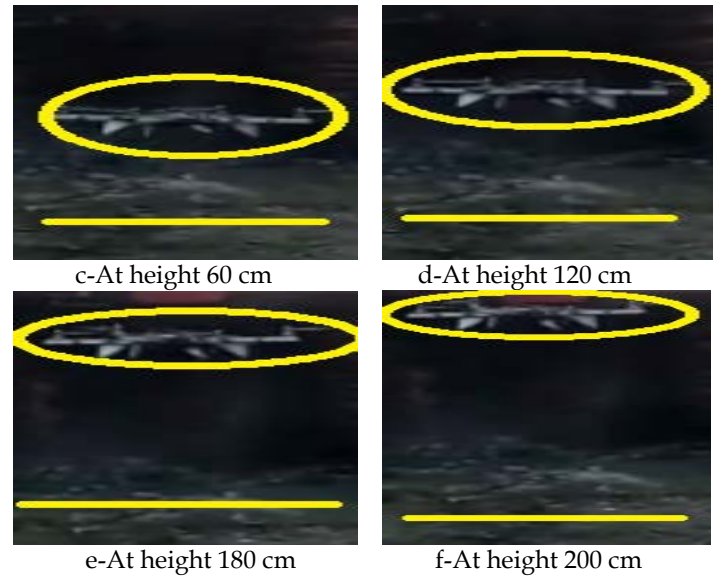
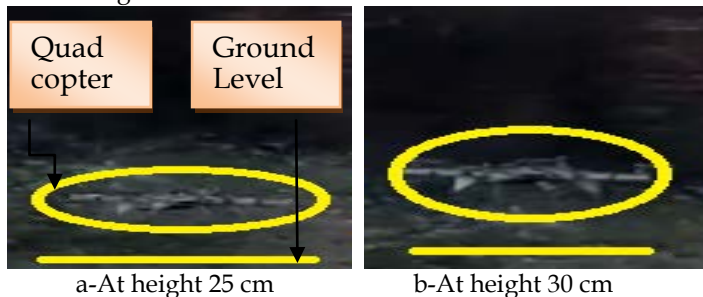


Figure 13: a,b,c,d,e,f: Stability with Varying Height During Good Weather



Figure 14: Effective Stability Starts at 30 cm During Good Weather

5.4 Image Visibility with Varying Height Test:

This test is going to determine the optimum visibility of captured images height and clarity of videos height, so that the quad copter generates the clear evidences against eve teasing.





Figure 15: a,b,c,d,e,f,g: Image Capture at Day Time During Bad Weather
Figure 15: h,i: Image Capture at Night Time During Bad Weather
Figure15: Image Visibility with Varying Height Test



Figure 16: a,b,c,d,e,f,g,h,i: Image Capture at Day Time During Good Weather
Figure 16: h,i: Image Capture at Night Time During Good Weather
Figure16: Image Visibility with Varying Height Test

It is calculated with the help of thread which is pasted at the beneath of the copter, as the copter move up and reaches to stable image or video capturing height condition, it is noticed with the help of dongle and receiver which display the images and videos captured by camera in laptop and the travel path or height calculated by measuring the displaced amount of thread by scale.

5.5 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 10 batteries as the single battery weight was 160 grams. The planned working hour for our quad copter will be 11 hours.

6 CONCLUSIONS

In our research paper we made cost effective surveillance robot cum quad copter against eve teasing, 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 for surveillance 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 11 hours. Thus the total number of battery used instead of extra weight will be 10 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 with increase weight lifting capacity about 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

References

- [1] Nanyaporn intaratep, W. Nathan Alexander, William J. Devenport Virginia Tech, Blacksburg, "Experimental Study of Quad copter Acoustics and Performance at Static Thrust Conditions," "volume 22, No 01-11|June," "PP 2016-2873, 2016
- [2] Mohd khan "Quad copter flight dynamic," "International journal of scientific & Technology research," "Volume 3," "Issue 8 Aug," "paper 130-136," "2014".
- [3] Mongkhun qetkeaw A/L VECHIAN "wireless control quad copter with stereo camera and self balancing system." July 2012.
- [4] Matt parker and gerad bottorff "quad copter," "paper 1-37," 2012
- [5] Mohd khan "Quad copter flight dynamic," "International journal of scientific & Technology research," "Volume 3," "Issue 8 Aug," "paper 130-136," "2014".
- [6]" Parth N.patel, Malew A.patel Rahul M.faldu and yash R.dave," quad copter for agricultural surveillance", "volume 3" number 4", "paper 427 - 432", 2013.
- [7]"meta dev Prasad murthy", "quad copter for search and rescue operation in natural calamities", April 2015"
- [8]" Sajal Sharma , Ankit muley, Rajesh singh, Anita gehlot", " quad copter for surveillance and environmental monitoring", "Indian journal of science and technology", " volume 9", November 2016".