Journal of Basic and Applied Engineering Research
Print ISSN: 2350-0077; Online ISSN: 2350-0255; Volume 1, Number 5; October, 2014 pp. 60-63

http://www.krishisanskriti.org/jbaer.html

The Rescue Mission with QUADCOPTER by Real time GPS 3D Surveillance

S. Santhosh Kumar[1], A. Sam Sundar[2], M. Manoj Prabhakar[3]

[1,2,3]*Park College of Technology, Coimbatore*

Abstract: **The rescue missions during disasters and war periods have been really under a great risk because of the lack of earlier knowledge about the upcoming hazard. During disasters the main problem is that we can't reach the specific area at exact time, Due to the vulnerability we have lost a lot of people. But this is possible with real time GPS 3D surveillance. This can be done on the basis of generic term we use GNSS (Global Navigation Satellite System) for these satellite systems. Here we use these principles to screen the emergency scenario in the surveillance aircraft which have been in the process of surveillance at disaster prone areas. In such emergency scenario, a surveillance aircraft reports back to mission control. Under the commands given by the mission control, the surveillance aircraft, which has the quadcopters, will start the rescue mission henceforth. The quadcopter which is on board to perform rescue mission is capable of producing enough thrust to lift the victims. Hence this criterion is analyzed by using thrust equation for specific propeller motors and respective propellers with required strength. Different UAVs can then perform rescue operations or monitor the situation. The rescue operations in UAVs are done by isolating the human.**

1. INTRODUCTION

Human life is the most precious as resurrection is still impossible. Of course we don't have enough guts to take risk over our life. This is the main reason for which man has gone through the quest of some alternative go. Finally the result is unmanned aerial vehicle (UAV) which can do the complex works of man in a simple way without any major risk. The UAV is a type of aircraft which has no on-board crew or passengers. A UAV differs from a cruise missile, that a UAV is recovered after its mission while a cruise missile impacts its target. While speaking about UAVs we always think about quadcopters. They can fly anywhere and transmits the information from the respective areas to his master and thus makes us to take a deep breath through its unique technical advantages. But these UAVs are not a complete one until it's combined with technology of information transmission like wireless technologies.

2. DESCRIPTION

2.1 Principle Objectives of Invention

To perform the rescue missions in a smarter and in a brilliant way, thus saving lives easier by using the availability of the GPS-Guided real-time aerial surveillance system. Of course this is the ever smartest quadcopter updated with extreme new technology of communication field. On controversy it's a rugged quadcopter of very hard components as it have to deal with hard external impacts.

The effective usages of this invention are:

- Disasters like landslides, earthquakes, volcanic eruptions (only to certain radius from volcano).
- Distress in coastal lines during sink or any other emergencies.
- To rescue abandoned people in deep forests where human can't enter easily.

2.2 Quadcopter

A quadcopter is a multi-rotor helicopter that is lifted and propelled by four rotors. They are classified as rotorcraft, as opposed to fixed-wing aircraft, because their lift is generated by a set of rotors (vertically oriented propellers).They have been in existence from earlier since 1920, Ohemichen by the US air force. More recently quadcopter designs have become popular in unmanned aerial vehicle (UAV) research. These vehicles use an electronic control system and electronic sensors to stabilize the aircraft. With their small size and agile maneuverability, these quadcopters can be flown indoors as well as outdoors. The four rotors are driven by a motor to produce a thrust and thus making flight possible.

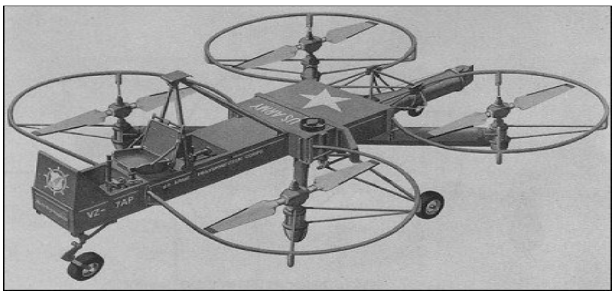

Fig. 1. First quadcopter Ohemichen [1920]

The motors use batteries with certain volts and these batteries supplies current to the motor by which the rpm of the motor varies. The upward lift depends on the propeller blade design, but we don't want to care for the pitch angle for a great extent, because the propeller we use here is not too big as the one in helicopter propellers.

2.3 GPS 3D surveillance

Aerial surveillance has become a vital part of security, law enforcement and even warfare, whereby unmanned aerial vehicles fitted with cameras provide real-time surveillance. The goal of this project was to design a quadcopter with GPS-Guided real-time aerial surveillance system. Three subsystems were combined in terms of technology and design. A unique system to design a GPS-guided aerial surveillance aircraft, and secondly, to design a quadcopter suitable for excellent rescue mission with zero fear of failure in migration and thirdly to make our UAVs to detect human presence thermally.

3. WHAT IS UNIQUE IN THIS QUADCOPTER AND HOW IT IS SMART?

- First thing is the power of this UAV. Unlike the other small quadcopters this quadcopter is specially made for rescue missions.
- As we made this for rescue, we have concentrated a lot in its power than its efficiency.
- This is never weightless like the other quadcopters, since it has to face heavy wear and tears while in process of rescue.
- The smartness lies on the GPS guidance, as it tracks the victims and also uses thermal detection and in turns approaches the humans in order to save them.

4. UNIQUE DESIGN CONSIDERATIONS OF THIS RESCUE QUADCOPTER

4.1 Quadcopter frame

- This quadcopter is exclusively made for providing high thrust and power when comparing the others. Here four arms are connected together at the central hub.
- This hub contains the transmission and a receptor control component which also contains GPS guided thermal detection to spot a man.
- The frame is made up of space frame aluminium which has interlocking system among them. These arms have enough strength and ductility to carry over the dead weight and fly away.
- This UAV has to lift a bit heavy weight. So the entire console should have enough properties to face zero chance of structural failure.
- The structural design has been designed in CATIA and deformation is analyzed in ANSYS.
- The results for analysis in stainless steel are given below as the space metal parameters are not yet clearly declared.
- But space frame aluminium is used for better structural properties and very less deformation.
- The analyzed result if for factor of safety 3.5 and hence it won't fail at even thrice of design load.

NOTE: Here space frame aluminium has been used as a basic structural consideration. But we may also use some other metals like boron steel, carbon fiber and even composites, with the attention considered to the structural properties as our quadcopter is exclusively made to face extreme external effects. We can also use titanium if we don't consider cost factor.

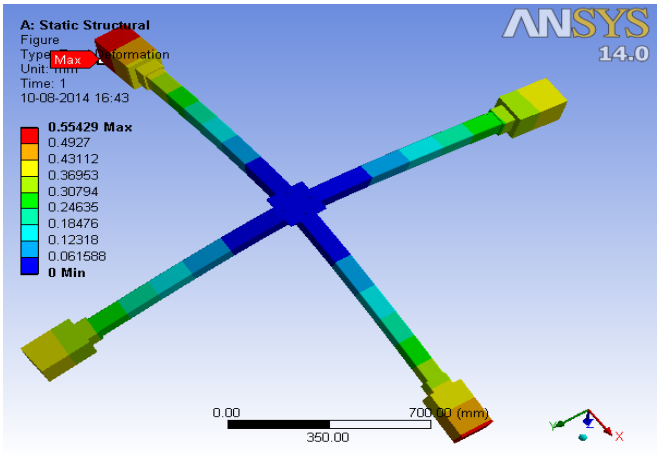

Fig. 2.Model (A4) > Static Structural (A5) > Solution (A6) > Equivalent Stress > Fig.

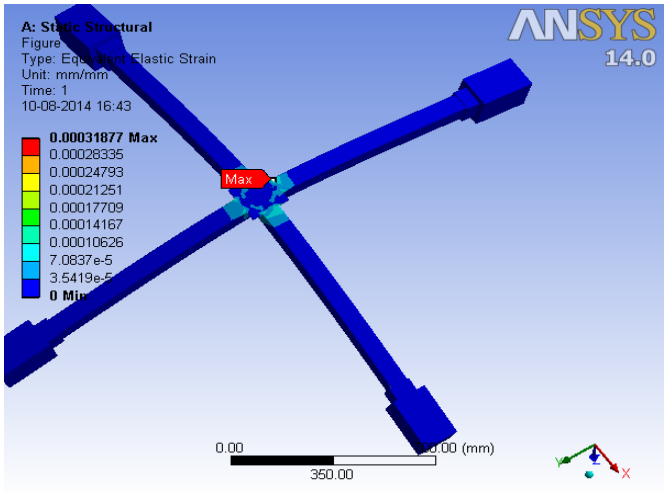

Fig. 3.1 strain analyse in ANSYS

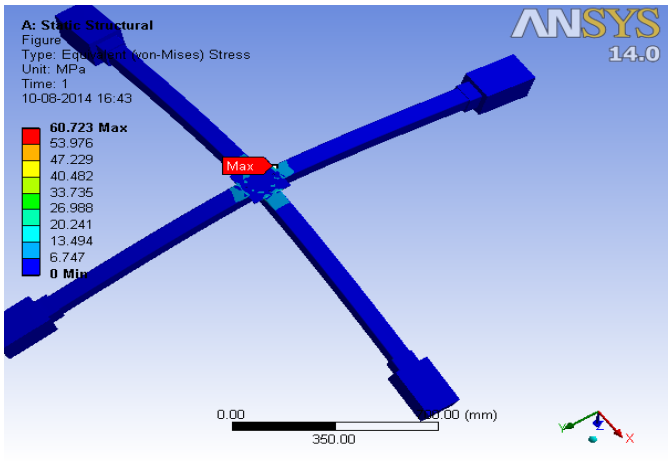

Fig. 3.2 stress analyse in ANSYS

4.2 Rotor

- In quadcopter each rotor produces both a thrust and torque about its center of rotation, as well as a drag force opposite to the vehicle's direction of flight.
- If all rotors are spinning at the same angular velocity, with rotors one and three rotating clockwise and rotors two and four counterclockwise, the net aerodynamic torque, and hence the angular acceleration about the yaw axis, is exactly zero, which implies that the yaw stabilizing rotor of conventional helicopters is not needed. Yaw is induced by mismatching the balance in aerodynamic torques.
- Each rotor consists of an engine or a motor and the propeller attached to its shaft.
- The propeller is made up of carbon fiber and hence bending is mostly compensated by this material unlike the normal ones.
- Every propeller blade is of length 20 to 25cm.The propeller pitch angle is not more important as we are not using a large propellers like helicopters and the optimum pitch angle to produce considerable lift is enough. (the schematic representation of the propeller blade is given below)
- The next important consideration is motor. Here we are in the need to produce a high torque and a high thrust.
- Hence we have to use a motor of very high horse power than we are using in a normal quadcopter.
- An electrical engine will do this better than a motor. Here we use the less weight and efficient engines to produce high thrust.

Some of the engines suggested are, the ultra light weight HIRTH engines, the electrical compact engine used in CRI-CRI electrical aircraft or the Viking engine of HONDA may be used. The only deal is the engine should have high specific impulse and less weight.

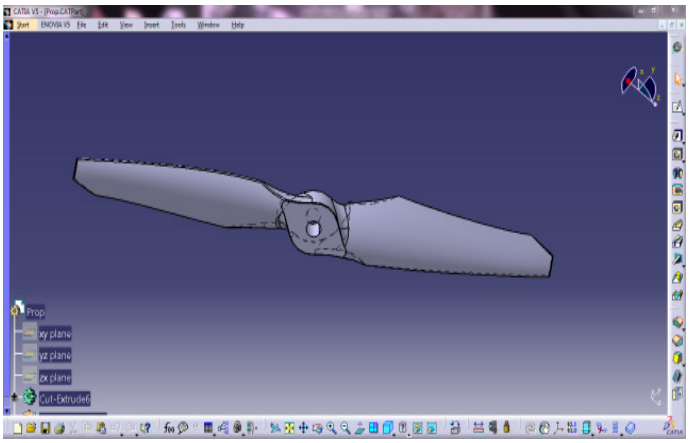

Fig. 4.propeller design in CATIA

4.3 Battery considerations

- The engines in this quadcopter are electrically driven. Hence the electrical supply terminologies have a good impact to drive the engine.
- The engine chosen for this purpose should produce high horsepower and hence it requires 500watts of power.
- Thus we selected VRLA (valve regulated lead acid) battery (12V) which supplies 42AH of current.
- We have to connect four batteries in series to produce increase voltage to (45V).
- The total power generated is 2016watts from the four batteries and this setup will provide enough power supply which is capable of running the quadcopter for an hour.

5. INSPIRING SMARTNESS OF INVENTION

5.1 Real Time GPS 3D Surveillance

- The real smartness lies on the implementation of the new technology of GPS 3D surveillance technology.
- A surveillance aircraft either an airship or a normal aircraft with space for cargo is used for the surveillance process. This aircraft will be equipped with all the necessary control components to precede the real time GPS tracking of the happenings.
- Additionally it can also be instructed about the meteorological changes and alerts and about much more warnings of hazards and the process can be made much easier.
- The surveillance aircraft should contain a number of quadcopters with all above explained criteria.

- When the mission control commands the mission to the GPS equipped aircraft to trigger out rescue, the quadcopters in the cargo section will be ejected from the aircraft to pursue the mission.
- While triggering the quadcopters in such a way, it also starts the engine electrically.
- This process is not only useful in disasters, but also during the other rescue missions like during the quest for abandoned people in the dense forest like areas where survival is really complicated.
- The quadcopters thus triggered is equipped with GPS tracker and the thermal detector.
- Thus while the quadcopter reaches the spot, it can sense the presence of human in the specific area by detecting him thermally with the help of thermal detector and can approach the victim to save him.
- In alternative cases like the need of some other missions other than saving a human, the inbuilt GPS system can be used to track the objective and make it possible.
- In case of any malfunctions in the self maneuvering system the mission control will manually operate the console.

5.2 Rescue components

- The bottom plate of quadcopter contains an electromagnet to hold the safety harness belt (made by the same material of string) with a ferrous buckle.
- After reaching the victim the small electromagnetic force turns of and the safety harness belt is released from the frame.
- A polymer substance containing polyethylene and a copolymer of ethylene and of alkyl acrylate favors the fire proof string to lift the victim.
- The victim should equip himself with buckling the safety harness belt.
- The string is connected to the four ends of the quadcopter arms and also to the bottom plate thus in such a way that load will be shared in an equilibrium to the frame.

Fig. 4. Schematic representation of a harness safety belt

6. RECOMMENDED CRITERIA TO BE FOLLOWED

6.1 Frame

The individual arms and components may be fabricated as a single whole material. The material chosen should be of best structural properties. The rubber or rubber like material is placed between plate of hub and arms and also in engine sections.

6.2 Harness safety belt

The safety belt and string is made of fire proof material. The buckle is connected to hub electromagnetically.

6.3 Recommended specifications

Table 1. Specifications

Factor of safety	3.5
VRLA battery Power	500(watts)
Current supply	42 amp
Voltage	12V
Total voltage	2016V
Taper ratio	3
Propeller diameter	20-25cm
Engine	High horsepower and less rpm engines.

7. CONCLUSION

Some of the materials and components recommended to fabricate this invention are still on process of completion like space frame aluminum and electrical engine of cri-cri. We can't demand high efficiency as we should concentrate only in high power and thrust but not in lift. If fabricated, this will be a great turn over in defense administration.

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