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DESIGN, MODEL, ANALYSIS AND MANUFACTURING OF UNMANNED AERIAL VEHICLE

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Abstract: Quadcopter is a four-propeller motor driven radio controlled device. During this project work, we will design the Quadcopter through a thorough study of the research paper. We will model its parts inconvenient software. We will also try to analyse propeller blade design. We will do the structural analysis on the arms of the Quadcopter, which are the main load bearing members. We will manufacture it according to design. We will use several technologies for various performance related to it like GPS or Telemetry. We will use a convenient controller and program it accordingly.

INTRODUCTION

Unmanned aerial vehicles are also known as a drone, which is a component of UAS (Unmanned aircraft systems). UAV is defined as “powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and carry a lethal or nonlethal payload.” Drones are the aircraft which has no pilot on-board. UAS consist of UAV, ground-based controller, and communication system between two. UAVs were originated for military application, but nowadays they are also used in commercial, scientific, recreational, agriculture and other application. Essentially, a drone is a flying robot that can be remotely controlled or fly autonomously through software-controlled flight plans in their embedded systems, working in conjunction with on-board sensors and GPS. UAVs were most often associated with the military, where they were used initially for anti-aircraft target practice, intelligence gathering and then, more controversially, as weapons platforms. Drones are now also used in a wide range of civilian roles ranging from search and rescue, surveillance, traffic monitoring, weather monitoring and firefighting, to personal drones and business drone-based photography, as well as videography, agriculture and even delivery services.

[Fig 1. Quadcopter model]

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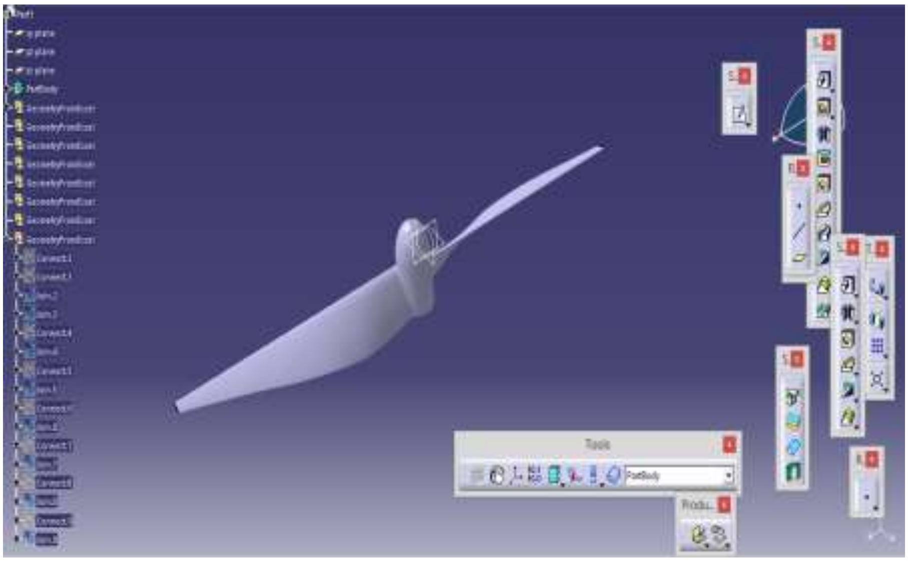
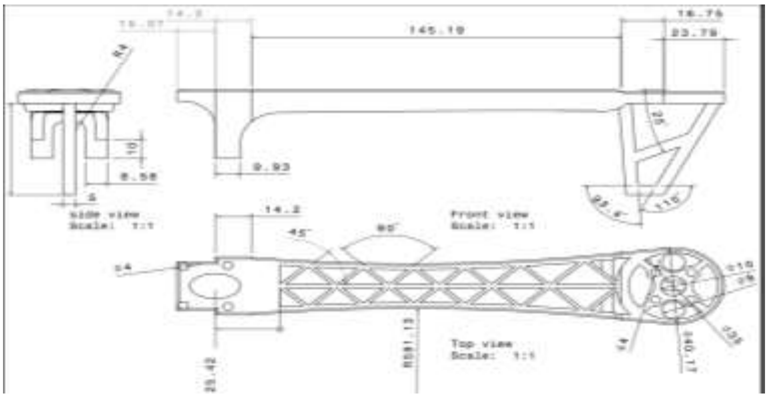


[Fig 13 geometry of propeller blade]

In this figure, the basic design of propeller is shown which is designed in CATIA and it has a length of 8, 10 and 12 inch. The dome was designed on the propeller hub using ellipse feature and revolve feature was used to model it. Fillets were given between the propeller blade and hub

DIMENSIONS OF MODEL

- In this topic dimensions of different component along with its dimensions is mentioned.



[Fig. 15 Quad-copter frame]

Above figures shows drafting of components of quad-copter. In figure no. 15 drawings along with proper dimensions for arm is shown in different views. Figure no. 16 is drafting of upper plate which is assemble in the centre of the frame, it is a PCB board where all circuits to be mounted. Figure no. 17 shows drafting of the lower plate, it has to carry payload. Proper dimensions are shown according to different view. In that different angle, radius and length is mentioned. These figures are done by using CATIA software. Figure no. 18 represents the drawing of landing gear which is designed along with dimensions. There are some design consideration is taken at the time of designing, and it is mentioned in section

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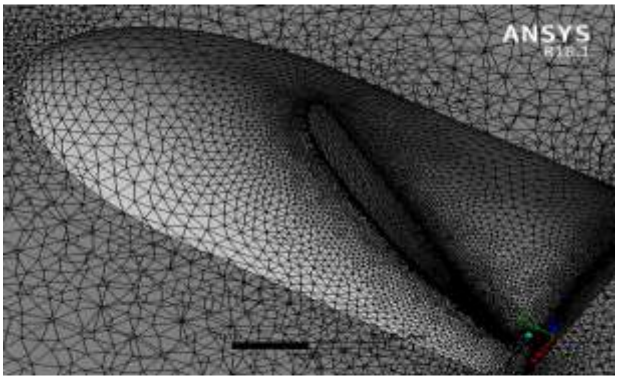
ANALYSIS

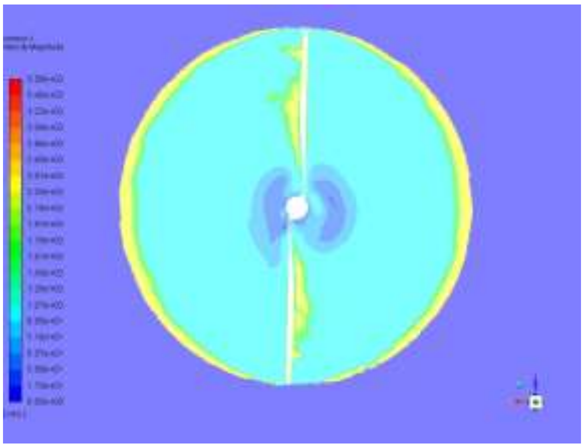
3.1 Mesh Generation



[Fig 19 Mesh generation on hub section, provided blades are perpendicular to plane]

In this Figure meshing on the propeller is shown. The relevance centre was **fine,** size function was curvature. Here two enclosures were made, one for rotating the propeller and other for visualization of flow. Rotating enclosure has 5mm radius and 60 mm length. And static domain has 1000mm radius and 3500mm length.

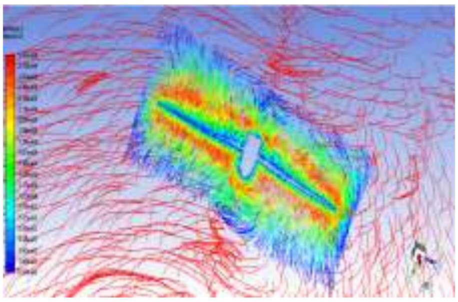
For static pressure along propeller surface



[Fig 22 velocity magnitude inside domain]

- Velocity profile over propeller geometry and the nearby portion is shown.
- Hub is stationary so there is no velocity over there which is shown by blue colour. As we go towards tip section velocity would increase and at the tip of propeller and region, outer boundary velocity is high as more velocity of the tip section.

Path lines



[Fig 23 path-lines showing the direction of flow along with magnitude]

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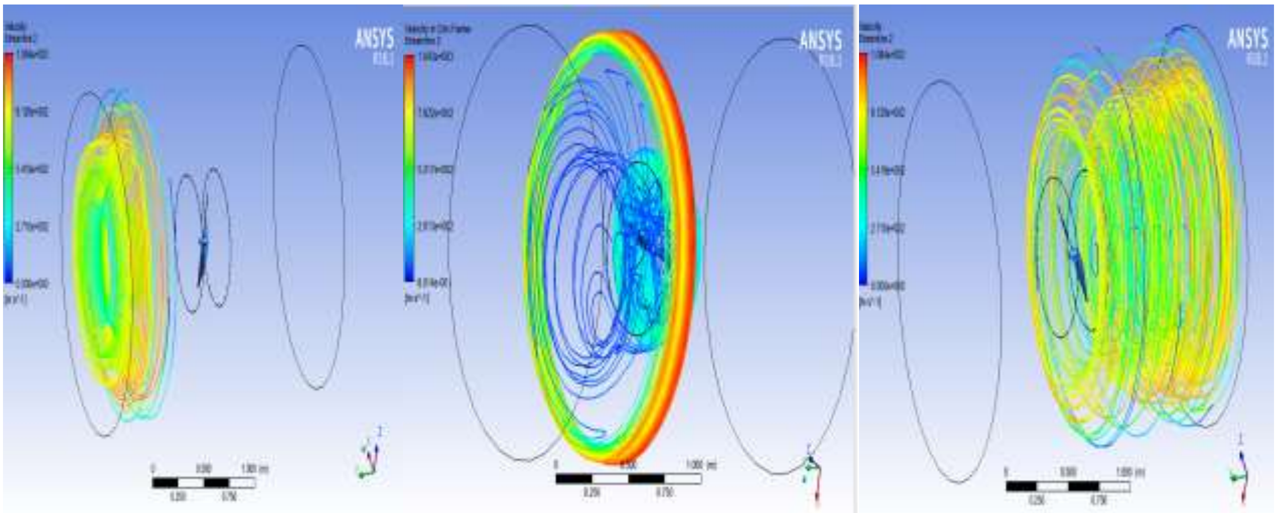
- Here path lines are shown which shows nothing but velocity around the propeller along with the direction of flow. Due to rotating enclosure velocity is low near the propellers and walls and around the region, it accelerates the flow so velocity is quite high. This shows the moment of air in the region.

For velocity streamline at the different section



[Fig 24 Velocity streamline behavior at the inlet of main domain]

Here streamlines from the inlet section are shown. At midsection, velocity is low compared to the tip section. As we go towards outside velocity increases as per $2\pi N/60$.

LIMITATIONS

- Range and maximum velocity are not able to find theoretically.
- Impact load on the structure is unknown as the shape of beam (landing gear) is not simple column.
- Manufacturing technique is based on the economy and ease.
- Theoretical value of drag coefficient for whole assembly can't be measured.
- Battery, motor, prop combination can't be tested and based on internet references.

CONCLUSION

Looking back at this project the overall outcome of the result is observed. This can be evaluated by looking forward at how our objectives were solely adjacent to the model of perfection that we achieved. Drones as observers in the sky will remain important for the indefinite future. They will grow at the fastest rate. The ease of flying and taking pictures can mask the fact that questions concerning how to use those pictures will not get any easier with higher sensor resolutions, better lenses, or cheaper memory.

REFERENCE

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