

## Design Report

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### Introduction:

This Project involves the designing the Frame and the Exterior of a Foldable Drone. The structures made in the frame are well tested to sustain the given load conditions and the images of stress analysis are put in a folder. They are also made such that the structures are compact and have ease to fit in. The arms of the drone can be folded in place while packaging.

### Design Speciality:

The arms of the drones are made according to the Shape Optimization methodologies to reduce mass and to withstand the given load efficiently. Also, the arms have pathway throughout to put in the wires from the motor to the ECU. The exterior is designed aesthetically and covers the frame as required. When folded, the drone's dimensions are about 308 x 58 mm in length and breadth. The bottom part of the exterior contains cavities to maintain the airflow inside overall keeping the inside cool for maximum efficiency. A camera slot is provided where Go-Pros or 360cameras can be mounted in the frame.

### Electric designed:

ECU slot is provided in the frame where the Electric board could be pasted in and the wires from the board are very tidily passed through the path inside the arms. The Battery mounted below can be can directly supply power to the board without much wiring complications. The aim is to produce 2kg thrust according to the problem statement.

## Propeller Size:

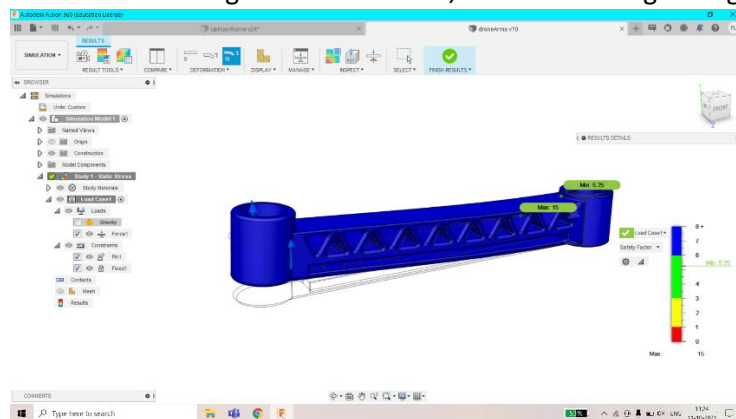
Each propeller is 210mm in diameter. Mock propellers have been made to represent a visual aspect in the CAD which you can see in the screenshot image.

## Innovation:

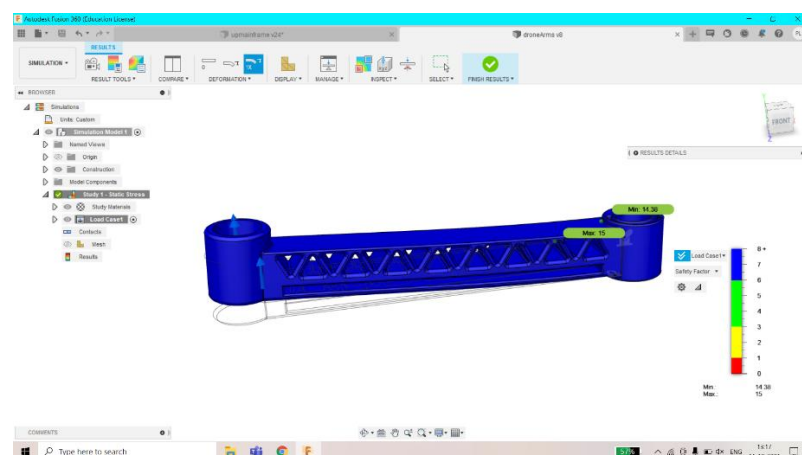
- The major innovation includes the Foldable design of the Drone to make the arms easy to fit in after use minimizing the space required for packaging.
- The arms constructed uses shape optimization methods to reduce the mass overall and fly efficiently.
- The frame and the exterior can be easily 3d Printed.
- This type of drone can be easily maneuvered to fly at various altitudes and different angles.
- The exterior structure is designed aerodynamically to smoothly move through the air reducing the drag.

## Stress Analysis & Efficiency:

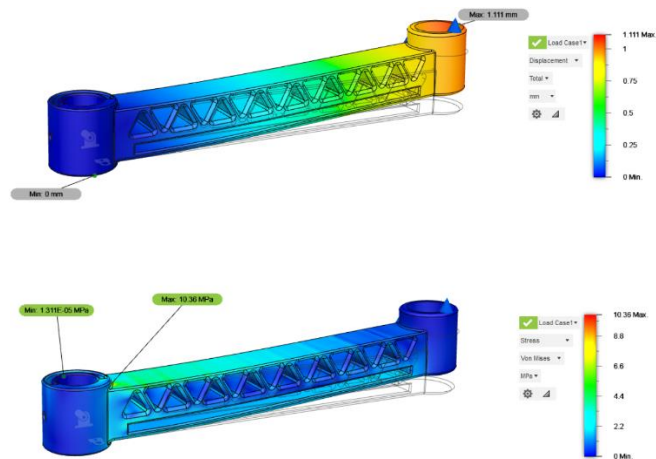
- Arms:  
Assuming 2kg of thrust overall, each motor has to provide 0.5kg of thrust minimum to lift the drone. Assuming maximum loading conditions each arm has been applied 1kg at the motor's end and fixed cylindrically on another end.  
The materials used were CFRP and ABS plastic for analysis. Although CFRP always preferred due to its mass to strength ratio. However, both materials gave a good FOS.



Material: ABS Plastic



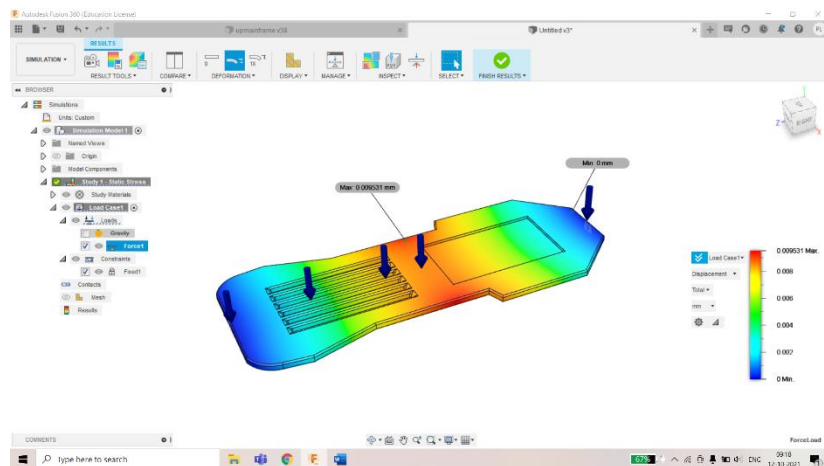
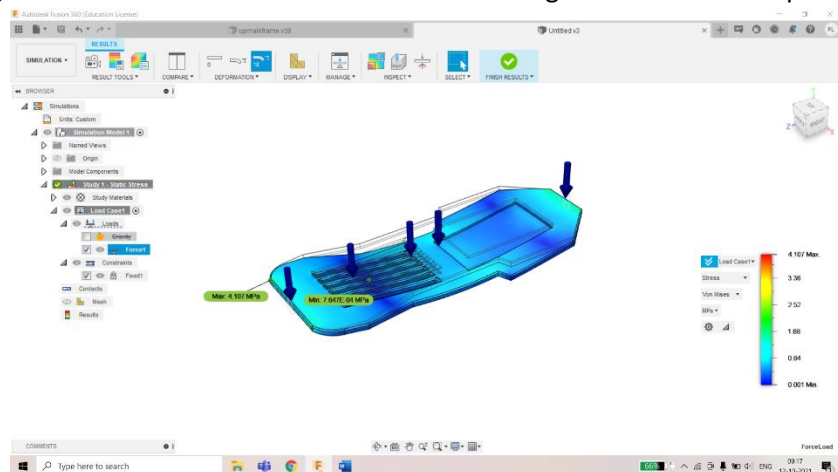
Material: CFRP



- **Bottom Frame:**

Material chosen for bottom frame was CFRP to carry the heavy load including the battery and electronic components.

The stress included includes fixing the opposite edges of the frame and applying load on the face of 2kg. Results stated that the material and the design well suits for the process.



**Conclusion:**

Thus, the overall drone structure is designed according to the given problem statement and the structure well suits the loading condition as provided.

The foldable arms design and the aesthetic aerodynamic exterior and the other innovations implemented in the project prove the design to be successful.

The design procedures can be seen in the screenshots in the folder. A lot of efforts and time was put in to research and analysing the concepts to design a drone before arriving at this final design.

Thank you!