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# Conceptual Design, analysis, and 3D Printing of modified assembly of SMART DRONE

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Abstract: **An increase in demand for drones and also the uses of the drone for various applications, has brought engagement of people from various fields, which leads to competition in the market, to discover new technologies in the field of drones, considering their high efficiency and the safety. For the development of analysis, Ansys software is used for better prediction of the final structure. In this work, a new model is designed and analyzed in such a way that new technology has been induced to add a new application to the drone to drive, in such a manner that it can fly as well as can drive on the road. For doing this CAD model is developed in Solidworks based on the required size the CAD structure is modified and the motion study was studied. The materials are selected, tested and trials are made. The elastic properties and the strength were tested and validated in the Ansys workbench software. The development process of the model is well explained, and the consideration with regards to the effect of each material and parts in its final weight are developed. The trial is performed on the model constructed and a comparison between the results is discussed the conclusion was made on the accuracy and performance of the model. The use of the 3-D printing machine introduces the development of finely designed parts. The efforts are taken to achieve the new technique of driving the drones on the surfaces.**

***Keywords —3D printing, analysis, design, drone, material properties, stress***

## I. INTRODUCTION

In the past decade, we have seen lots of demand and use of drones for various applications. Before the past decade, it was just used for military operations, but nowadays its use has increased in various fields like agriculture and medicine supply. After observing this demand and need it is clear that there is a need of designing the new application-based drone as it is necessary to maintain safety. All the necessary factors are to be considered which are affecting the performance of this smart drone.

The growth and the development in computers and software in this past decade have given the easy design of the structure. Even before making the actual model software like Ansys gave the designer a chance to simulate and study the behavior of the model and predict the design and working of the model. Firstly, a CAD model was developed and then it was analyzed in the Ansys and a model was made based on the results calculations were performed to select a servomotor.

After the conception of design, the model for performing all the operations such as flying in the air after that folding and driving on the surface. The selected parts are sent for 3D printing. after trails fitting changes are made and again sent for 3D printing and final parts were obtained.

## II. PROBLEM STATEMENT

As existing drones were taking only top view images doesn't give exact or clear information for solving this issue something new concept should be implemented.

## III. OBJECTIVES

1. To make a conceptual design for various operations in SolidWorks.
2. To analyze it in Ansys by giving it a simple boundary condition and testing the material strength.
3. To obtain the 3D printing parts and assemble them with electronics parts.

## IV. CAD MODEL

For achieving the final goal of the project, the conceptual design has been done for the modified part of the total assembly the rest assembly is the same as the drone assembly.

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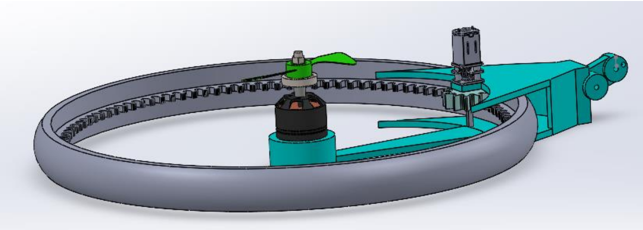

**Fig.1 modified parts of smart drone**

Figure 1 shows the assembly of the modified parts of smart drone. The additional parts have included a bracket to hold the tyres, and folding arms to hold and fixed the bracket. The tyres are nothing but the internal gears assembly. To run this assembly the gear motor is used.

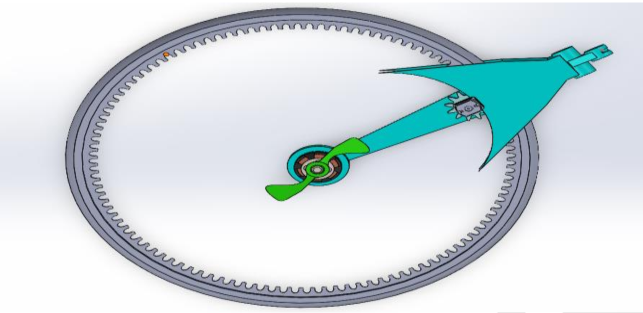

**Fig.2 top view of the modified assembly.**

Figure 2 shows the top view of the assembly this position gives the idea of electronic parts of the drone system.

## V. SELECTION OF MATERIAL

Comparison between different types of materials [1]

| Material | Density (g/cm$^3$) | Tensile strength @73°F (psi) | Stiffness Mpa | Methods of manufacturing | Price |
|---|---|---|---|---|---|
| Aluminum | 2.7 | 30,000 | 70,000 | Forging | Expensive |
| Wood | 0.8 | 550 | 10,000 | Adhesive bonding | Cheap |
| Styrofoam | 0.18 | 100 | 5000 | Hotwire cut by CNC | Cheap |
| Plastics (PVC) | 1.15 | 7000 | 3000 | Vacuum forming | Very cheap |
| Carbon fiber | 1.78 | 10,0000 | 50,000 | Epoxy resin | Very expensive |

**Fig.3 comparison of materials**

By studying this table plastic has been finalized as a material due to its easy manufacturing and also very cheap also other good properties.

## VI. ANSYS REPORTS

The simple boundary condition is applied, fixed support is given to the bracket at the circular cross-section and a force is applied to its end to push the bracket down. These tests are just done to calculate the strength of the material. As there is air application lightweight and cheap material is selected as plastic.

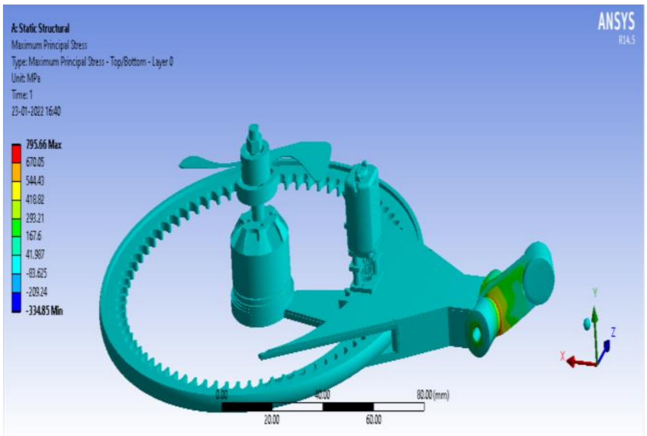


**Fig.4 Maximum principal stress**

Fig. 4 shows that the maximum principal stress is 795.66 MPa and the minimum is -334.85MPa.

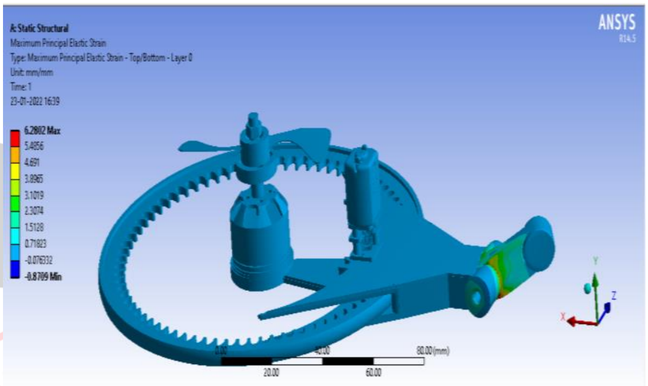


**Fig.5 Maximum principal elastic strain**

Fig. 5 shows that the maximum principal Elastic Strain is 6.2802 and the minimum is -0.8709.

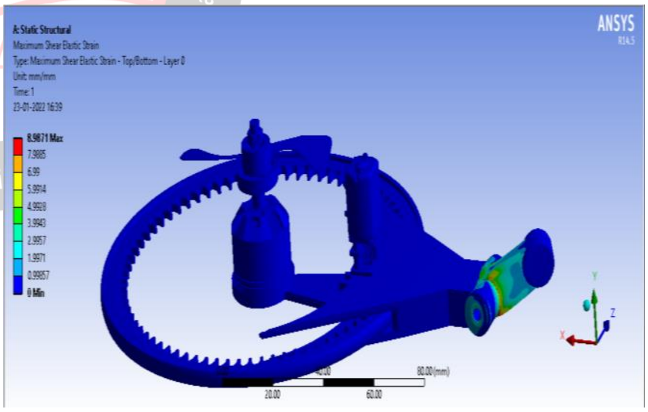


**Fig. 6 Maximum shear elastic strain**

Fig. 6 shows that the maximum shear Elastic Strain is 8.9871 and the minimum is 0

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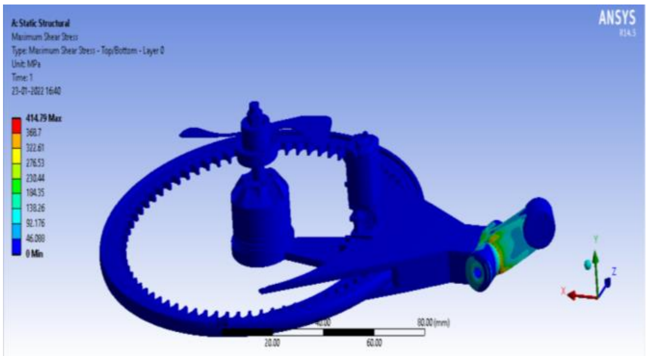


**Fig.7 Maximum shear stress**

Fig. 7 shows that the maximum shear stress is 414.79MPa and the minimum is 0.

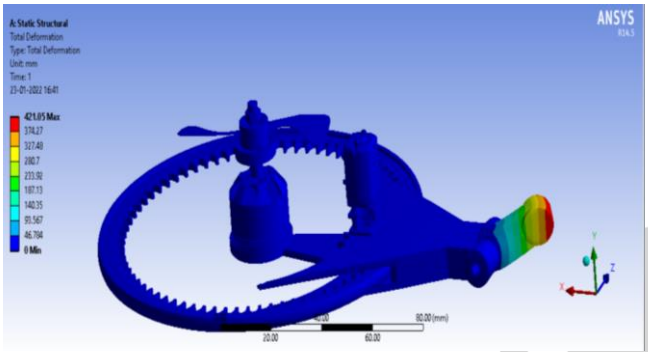


**Fig.8 Total deformation**

Fig. 8 shows that the total deformation is 421.05mm and the minimum is 0

So, from the above study of this strength of the material the use of plastic is good for aerial and land use purpose and also the strength of material is good and can sustain arial and land thrust finally we can use it for our end goal.

## VII. 3D PRINTING PARTS ASSEMBLY

After the model making final parts are send for 3D printing. the solidworks file is converted and save as IGES file for 3D printing software. After nearly about 20 to 22 hrs. of print the solid parts were formed.

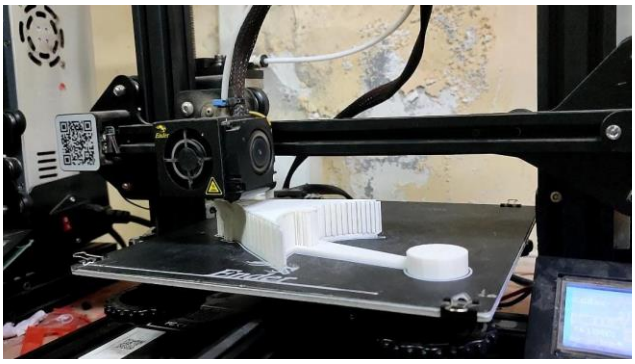

**Fig.9 3D printing machine printing solid part**

Fig. 9 shows the 3D printer making of solid part by additive manufacturing by adding the white plastic wire to solid from part.

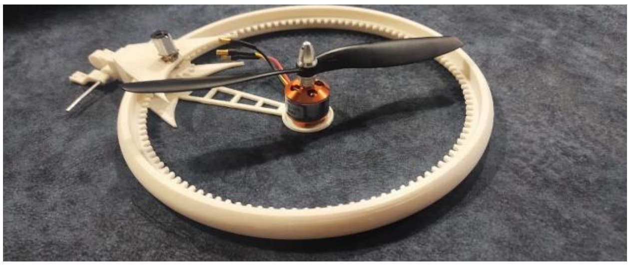

**Fig.10 Side view of assembly**

Fig. 10 shows the side view of assembly where electronic parts and 3D printing parts are assemble together.

**Fig.11 top view of assembly**

Fig. 11 shows the top view of the assembly which was printed by 3D printing machine.

Please include a brief summary of the possible clinical implications of your work in the conclusion section. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. Consider elaborating on the translational importance of the work or suggest applications and extensions.

## VIII. CONCLUSION

In this current work the conceptual design, analysis, and 3D printing of smart drone is done where the conceptual design is to perform various application and to check the strength of material and also manufacture new design parts by 3D printing and after several trial and error the final design and 3D printing parts are manufactured. this assembly is done for drone to fly in the air and land and drive on the road.

## IX. FUTURE SCOPE

In this current work by adding small size speed boat motor in the frame and also by doing some modification the drone will be able to run in the water, fly in air, and drive on ground.

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