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Design, Analysis and Manufacturing of Planetary Gear Used in Clock Mechanism Using Rapid Prototype Technique

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Abstract:
The use of RAPID PROTOTYPING is becoming more popular in recent years. The trend seems to continue as long as the technology meets diverse and challenging needs in educational, business, economical, fashion, the creation of new models and for many other purposes. The project deals with design, analysis and manufacturing of planetary gear which explains the total process how easily the prototype can be made using the technology of 3D printing machine.

Keywords: *Design, analysis, and manufacturing.*

1. Introduction

Planetary gear train is a gear system consisting of one or more planet gears, revolving about a sun gear. And it is wildly used in industry, such as paper industries, wind mills, and sugar industries. This gearing system is particularly well suited for achieving a high-reduction ratio in a relatively small, power dense package. Planetary gears have been in motion for many years. The advantages are the higher torque capacity, smaller size, lower weight and improved efficiency characteristics of a planetary design. The small size and modular construction of planetary gearboxes also means that they can be assembled in several stages, providing high reduction capability from a highly compact package. And it can be wildly used in industry, such as printing lathe, automation assembly and sugar industry.

Because a planetary gear box is smaller and lighter, up to half the size and 60% lighter than conventional heavy engineered gearboxes, it is tempting to suppose that it is not as strong. Companies are using planetary gears not just for the weight saving, the reduction capability and the compact size, but also, in some cases because the units are weight balanced, i.e. in instances where a conventional gearbox is used the shaft is not in line with the bulk of the gearbox and it's casing, hence there is an overhang and unbalanced weight to deal with. Because planetary gearboxes operate around a central shaft, they can be used in-line with turbines, pumps and wheel drives.

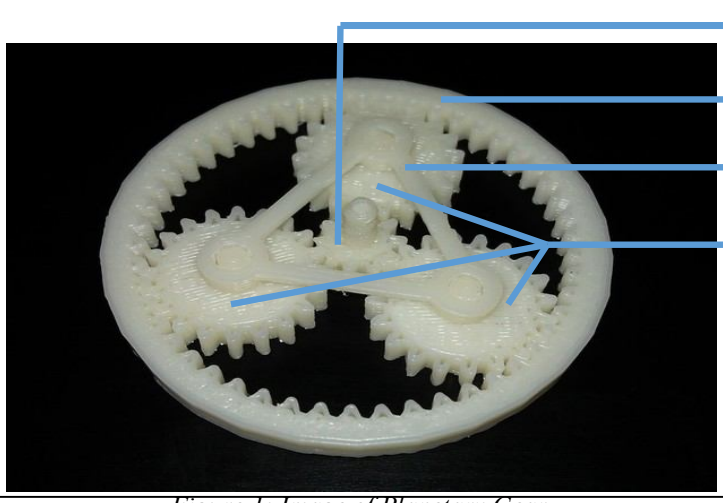

Figure 1: Image of Planetary Gear

2. Related Work

The main concept of this project is to design the model of planetary gear using cad software and analysis the model using ANSYS V15 and to be manufactured by using rapid prototype techniques with the help of 3D printer to show the mechanism of the planetary gear in clock mechanism.

3. Scope of Project

This project helps in getting knowledge and awareness of use and ease of rapid prototype techniques to us and others.
With this knowledge we can design new models in many fields like medical, educational institutes, fashion technology, manufacturing industries, food industries and many more.

4. Proposed Methodology and Discussion

In this project we deal with three different stages to get the proto type that we require,

1. Design,
2. Analysis and
3. Manufacturing.

4.1. Design

Designing of the model of planetary gear is done by using advanced CAD software CATIA V5R20.
To design this model we need some input parameters which are shown in table.1

	SUN GEAR	PLANET GEAR	RING GEAR
QUANTITY	1	3	2
NUMBER OF TEETH	24	36	96
PRESSURE ANGLE	20°	20°	20°
PITCH DIAMETER	24mm	36mm	96mm
ADENDUM	1.0m	1.0m	1.0m
FULL DEPTH STUB	0.8m	0.8m	0.8m
DEDENDUM	1.25m	1.25m	1.25m
FULL DEPTH STUB	1.0m	1.0m	1.0m

Table 1: Input Parameters For Cad Design

4.2. Analysis

Analysis of the model is done by ANSYS R15 software with the input parameters such as angular velocity and momentum.

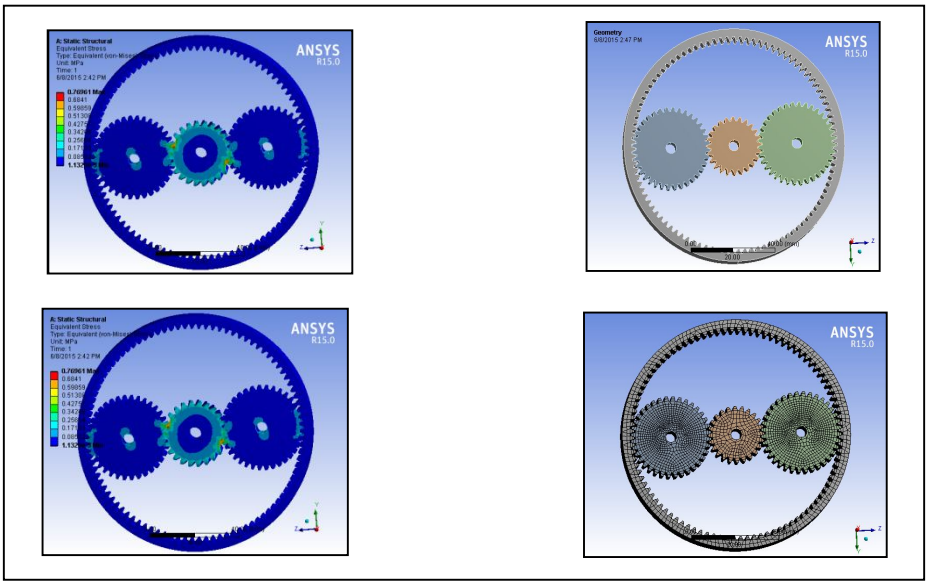

Figure 2: Analysis of Gear Using Ansys

4.3. Manufacturing.

Manufacturing of planetary gear is done by using 3D printer with rapid prototype techniques. To print (manufacture) the models by using the 3d printer we need to convert CAD file to STL file format so the input parameters for printing the models are CAD drawings in STL format.

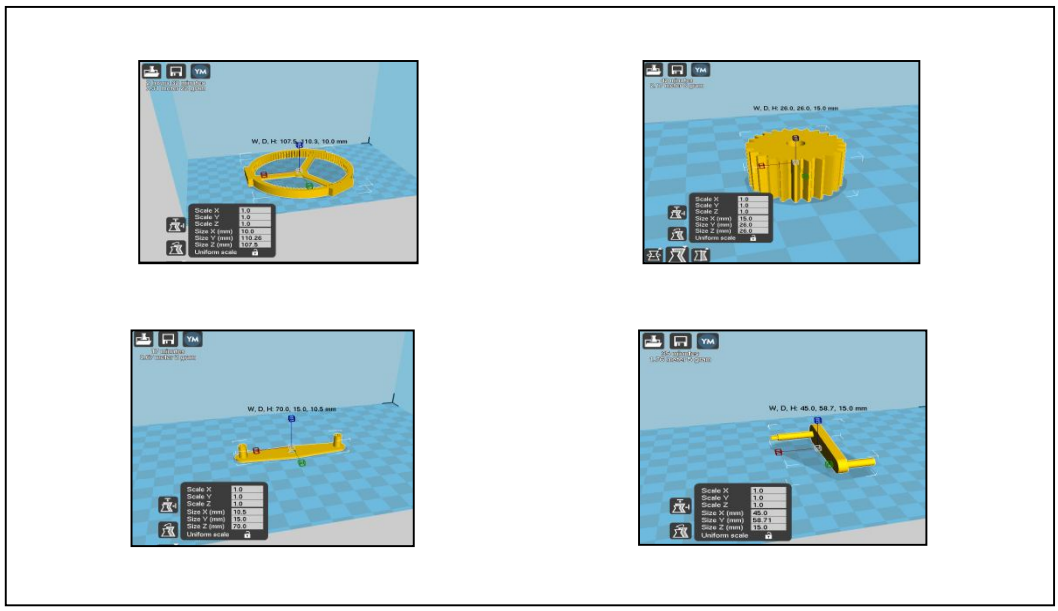

Figure 3: Inputs for 3d Printer to Manufacture the Model in STL Format

4. Future Scope

There are several future recommendations that should be considered. When we are designing the gear we need to consider the numbers of teeth, pitch, gear ratio, addendum, dedendum etc. to avoidance problems such as wear, not rotating, no movement etc.

5. Conclusion

In conclusion, the model that is design and manufactured is in working state, that is, the planetary gear, which is design, analyzed and manufactured using CAD V5R20, ANSYS R15 softwares and rapid prototyping techniques, to show the mechanism of clock is able to work with the desired functions. This prototype of planetary gear can be applied to the clock mechanism in real time with the same values or they can also change the dimensions with their requirements by using this procedures as guidelines.

6. **References**

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