Analysis of Mechanical Foot Step Power Generation using ANSYS

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Abstract-

These days electricity has become the most important source in human life. As a part of it lot of renewable energy sources are getting wasted. This project is mainly Designed and analyzed to utilize renewable energy. In this project mechanical energy is converted into electric energy using Footsteps, where lot of humans tend to lose their energy towards ground or floor while walking. The mechanism used in this project is Rack and Pinion where the linear motion is converted into rotary and vice versa. This project is Designed using solid works software and Analysis is done using ANSYS software which gives the clear idea of deformation when the load applied.

Keywords*: *Renewable energy, footsteps, Rack and pinion, Design, Analysis, Assembly, Solidworks 2019, Ansys 2020,

1. INTRODUCTION

In general, people walk very frequently in this busy world, while walking they tend to lose some energy towards the floor, to utilize that energy and convert it into electricity is the main objective of this type of power generator. In this project mainly rack and pinion mechanism is used which converts rotary motion to linear motion and vice versa. When a person's weight is applied on the top plate of the footstep power generator the springs gets compressed and rack tend to move vertically downwards thereby shaft starts rotating, simultaneously the gear which is mated to shaft starts rotating in the anticlockwise direction and it leads to the rotation of smaller gear which is mated to the second shaft in the clockwise direction. When a smaller gear rotates in clockwise direction it rotates DC motor in anticlockwise direction and the dynamo generates electricity which is further stored in a battery. When the load applied on the plate is released, the springs get expanded and opposite rotation of gears takes place, to produce electricity in expanded case, a rectifier need to be installed.

In this paper, a footstep power generator is designed using solid works software and further analysis has performed using ANSYS software to know the deformation of spring when compressed with respect to the load applied.

2. Design of Parts and Assembly of system

The parts of the system are designed and assembled using solid works software 2019 using required dimensions

Table-1: Specifications of the mechanical parts

Parts	Diameter (mm)	Length (mm)	Thickness (mm)	Number of teeth
Gear	65	-	5	50
Pinion	33.75	-	5	25
Motor gear	15	-	5	10
Rack	-	110	5	30
Flywheel	60	-	6	-
Shaft	-	150	8	-

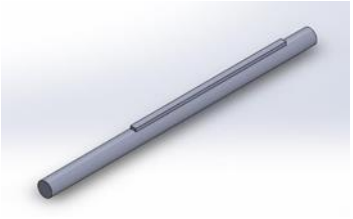

Fig-1: Shaft

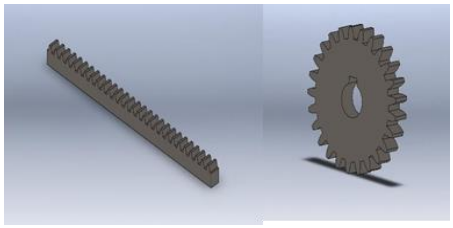

Fig -2: Rack and pinion

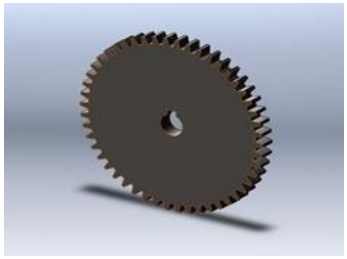

Fig -3: Gear

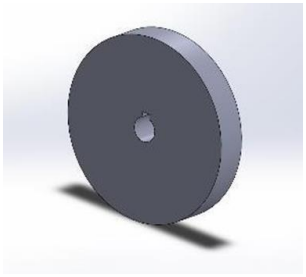

Fig-4: Flywheel

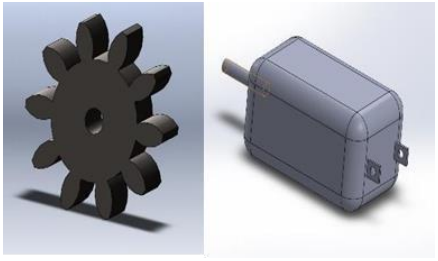

Fig-5: Dc motor

2.1 Assembly of the system

The complete view of system is done by assembling all the parts as shown in the Fig-6

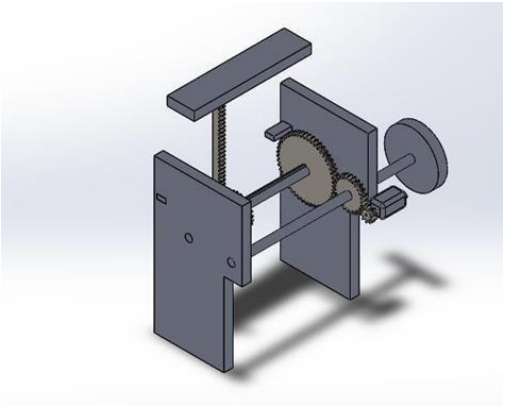

Fig-6: Assembly of system

3. RESULTS AND DISCUSSION

Static Structural analysis is performed on the system to know the amount of deformation of plate when respective loads are applied

The structural analysis is performed by considering three loads 65kgs,75kgs and 100kgs

3.1 Amount of deformation for a load of 65kgs

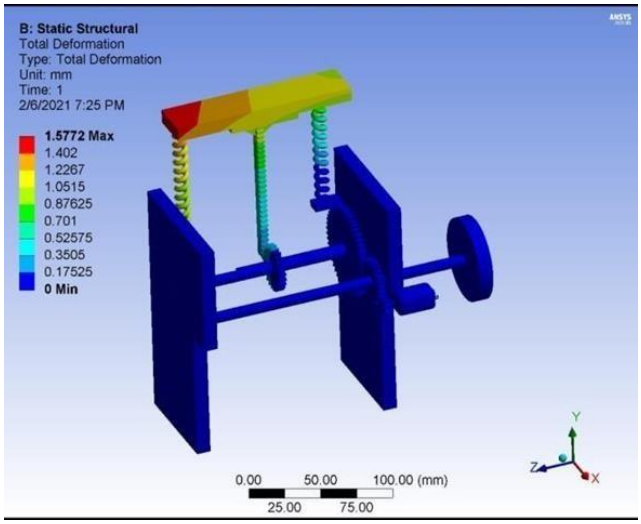

Fig-7: Total deformation for load of 65kgs

Maximum total deformation observed is 1.5772 mm

Minimum total deformation observed is 0 mm

3.2 Amount of deformation for a load of 75kgs

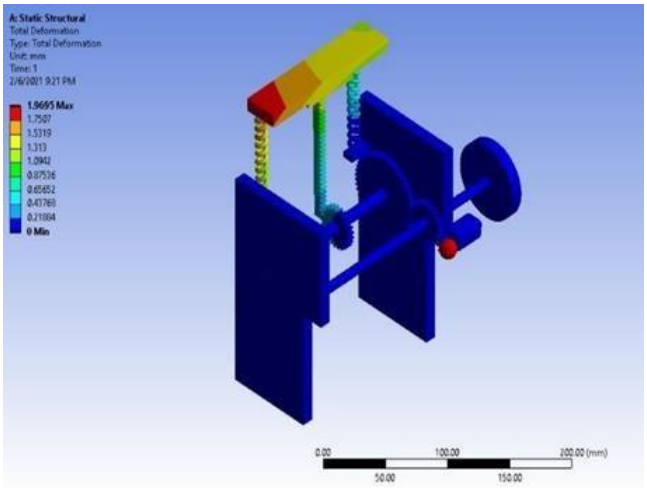

Fig-8: Total deformation for a load of 75kgs

Maximum deformation observed is 1.9695 mm
Minimum deformation observed is 0 mm

3.3 Amount of deformation for a load of 100kgs

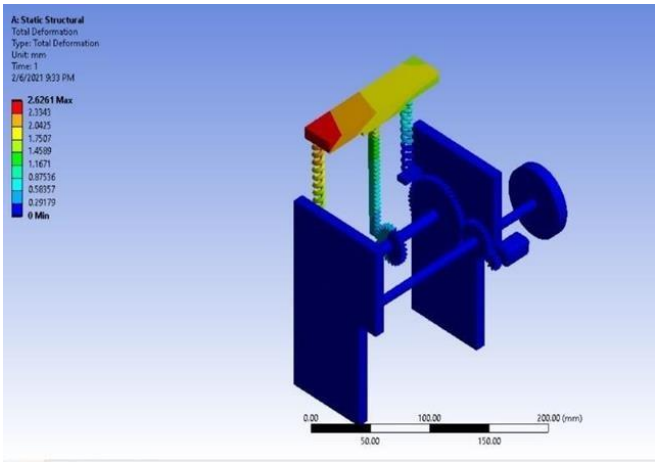

Fig-9: Total deformation for a load of 100kgs

Maximum deformation observed is 2.6261 mm

Minimum deformation observed is 0mm

3.4 Output Power Calculations

Let us take mass of 65kgs

F=ma

F=65*9.81

F=637.65 N

Distance travelled by body=height of spring

=0.032 m

Output power=work done/sec

= (490.5*0.032)/60

=0.261Watts

4. CONCLUSION

The analysis is performed on the system that is designed using solid works, As the analysis done for all the three loads, the maximum total deformation observed for 100kgs load is more when compared to remaining loads that is 65kgs and 75kgs. From this we can conclude that higher the load high amount of deformation takes place and produce high power output

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