

Power Generation by Gravity using Flywheel

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Abstract

In recent times because of the the results of pollution and global warming there's a necessity for generating power from renewable sources. The essential concept of a gravity power generating mechanism is easy. When a body moves down from the high altitude to lower altitude its potential energy is converted into mechanical energy. This motion is converted into circular motion of the shaft which is then converted into electrical energy employing a generator. Gravity Light was developed to supply a clean, safe, reliable, and cheap source of renewable energy.

Flywheels are into consideration to be used for energy storage purposes. In developing countries like India with rising condition, the demand for electricity is increasing day by day. With the rising demand for reliable, inexpensive and environmental friendly energy storage, the Flywheel Energy Storage System is quickly coming to known to us. This study presents an analysis which shows that using an FESS may be a decent alternative in depleting energy storage problems in decentralized electricity generation projects where an uninterrupted power supply (UPS) is required.

Key Words: Gravity Light, Flywheel energy storage system(FESS),

1. INTRODUCTION

When a body is at certain height from ground, it possesses P.E. . Due to gravitational pull the body falls down. In this process, P.E. is converted to K.E. in the mechanical torque. And this converted into electrical energy using generator. The electrical energy is supplied to the LEDs where electrical energy is converted into light energy. Gravity lamp and Gravity Generator follows an equivalent mechanism. In this system a main Rotating Shaft is used to drive a series of pulley and belt arrangement which forms a gear train arrangement which produce a twice/ thrice speed at the shaft of generator. The inertia of flywheel is increases by increasing the radius of flywheel and weight of flywheel.

It also increases if the flywheel weight is concentrated as far out toward the rim of the flywheel as is feasible.

Firstly the need for an efficient system must be an appropriate flywheel with as large a diameter as is practical, and much of the load must be close to rim. The construction needs be robust and secure as ideally, the speed of rotation need to be high as possible, and in fact, the wheel must be exactly at right angles to the axle on which it rotates and exactly centered on the axle. Flywheel energy storage works by accelerating a flywheel to very high speed and which keeps the rotational energy within the system. When energy is extracted from the system, the flywheel's rotational speed is

reduced due to the principle of conservation of energy; adding energy to the system correspondingly results in a rise within the speed of the flywheel. Most FES systems use electricity to accelerate and decelerate the flywheel, but devices that directly use energy are being developed.

2. LITERATURE SURVEY

Electricity Generation Using Flywheel (IJRASET) -2016 by Akhilesh Barwahe, Amrendra Kumar and Deepak Dhakad. In this paper they concluded that if we increase the weight of flywheel then it stores more energy within the sort of inertia and once we cutoff main supply it'll continue give electricity but it increase time period in the comparison of first one. Flywheels appear poised to exchange or supplement batteries as a backup power supply in UPS systems. when flywheel isn't attached in setup then series of L.E.D. light is switch off after switch off of A.C. supply while when the flywheel is attached to the setup then all of the L.E.D. lights are not off after the 5 seconds of A.C. supply off . We supply 12 V AC current to the setup and that we got 10 V DC current.

A Review of Flywheel Energy Storage System Technologies and Their Applications (MDPI) - 2017 Mustafa E. Amiryar and Keith R. Pullen . This paper has

presented a critical review of FESS with reference to its main components and applications. The structure and components of the flywheel are introduced and the main types for electric machines, power electronics, and bearing systems for flywheel storage systems are described in detail. FESS offer the unique characteristics of a very high cycle and calendar life, and are the best technology for applications which demand these requirements. A high power capability, instant response, and ease of recycling are additional key advantage.

DESIGN AND FABRICATION OF A GRAVITY POWERED

LIGHT ICMERE2015-PI-254 Md. Shahed Hossen, Md. Tazul Islam and Sabir Hossain has experimented The gravity light consists of a synchronous motor as the generator, a bicycle wheel as the larger pulley, a wooden pulley as the smaller one and a belt which is attached with larger to smaller pulley. When a heavy load applied to the one end of the larger pulley, due to gravity the load starts to move downward. Hence the larger pulley starts to rotate. With the rotation of the larger pulley the belt transmits power to smaller pulley where a synchronous motor is fitted. As the synchronous motor rotates with a low rpm (4-5 rpm), it produces enough electricity to light the LEDs. For 1kg of load from a height of 1.45m the input energy is 14.23 J and the output by the generator is 1.62J. Hence the efficiency of gravity powered light is 11.23%.

Changing Perspective: Gravity Light (IOSR-JCE)

Pankaj Gode, Ankit Jadhav , Kalpesh Gardi , S.R Bhandari has concluded that renewable energies are currently looked at as the sources which will meet the future energy requirements. Solar, Wind, Tidal, Geothermal are some popular examples of renewable energy sources. Yet these sources have their own unique geographical as well as other limitations and are not available throughout. But gravity is available across our entire planet. Thus we can use something like electricity from gravity on a large scale to generate electricity any time at any place.

3. PROPOSED SYSTEM

System consists of rotating shaft due to the descending load and pulley system. System consists of dynamo, flywheel system which rotates at higher rpm than shaft. It also consists weight lifting mechanism which lifts the load against gravity. The load is connected to the pulley which rotates the shaft. Another pulley and belt arrangement is used to drive the flywheel. Flywheel System generates the electrical output through generator which produces output energy to light the bulb. A belt and

pulley system consists of two or more pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted from one to another axles. To gain the mechanical advantage the pulley size needs to be different. A flywheel is a device specifically designed to efficiently store rotational energy. Flywheel resist change in rotational speed by its moment of inertia.

The amount of energy stored within flywheel is proportional to the square of its rotational speed. The flywheel's stored energy can be changed by increasing or decreasing its rotational speed by applying a torque along the line of symmetry. The basic dynamometer type wattmeter working rule is that when a current carrying moving coil is placed in the magnetic field produced by the current carrying fixed coil, the deflection of coil takes place due to the force applied on coil sides of the moving coil.

3.1 Advantages of Proposed System:

The key benefits of gravity light include the following:

- It is inexpensive.
- It has no operating costs.
- It does not requires any batteries.
- It can power radios, reading lights and other small electrical devices.

4. SYSTEM ARCHITECTURE

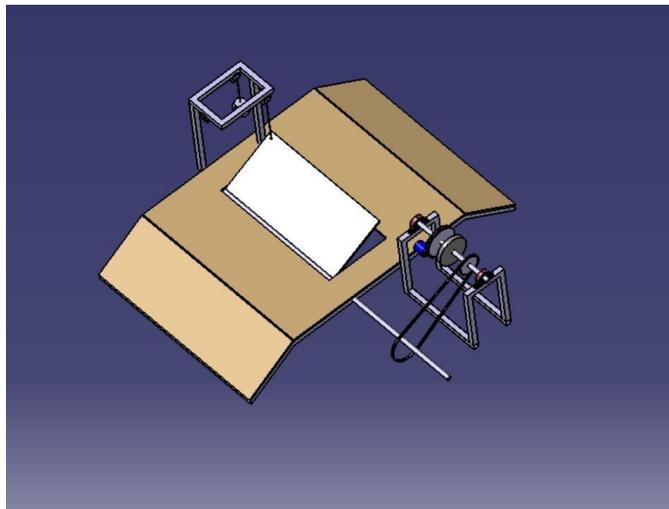


Fig-1: Working of the system

4.1. Components

- 1] Flywheel
- 2] Pulley Arrangement
- 3] Shaft
- 4] Generator
- 5] Chain and Sprocket
- 6] Dead Weight
- 7] System Frame
- 8] Flip Plate

5. Calculations

5.1) Mechanical power Generated

Assuming $N=100$ rpm

Here we are attaching 10kg mass, so the vertical force $F=m*a$
 $=20*9.81$
 $F=196.2$ N

So the torque generated due to flip motion with 5 mm as the radius of shaft is calculated as,

$$\begin{aligned} T &= F * R \\ &= 195.2 * 5 \\ T &= 0.981 \text{ N-m} \end{aligned}$$

Hence the power generated is calculated as, $P= 2*3.14*N*T/60$

$$P=10.27 \text{ Watts}$$

5.2) Flywheel Calculations

Diameter has chosen according to space requirement as 0.15 m .

Material =mild steel

Density of Mild Steel = 7860 Kg/m³ We know that,

$$\text{Density} = \text{Mass} / \text{Volume}$$

$$V= \text{volume} (A*L) = \pi/4 * d^2 * L = 2.90 * 10^4 \text{ mm}^3 \quad \rho = m/V$$

$$7860 = m/2.90 * 10^4$$

$$m = 2.28 \text{ Kg}$$

Mass of Flywheel = 2.28 Kg

(Inertia) $I = 0.5 mr^2$

$$= 0.5 * 2.28 * 0.0752$$

$$= 6.41 * 10^{-3} \text{ m}^4$$

5.3)Energy Generated by Flywheel $E = 0.5 I \omega^2$

Where, $\omega = 2*\pi N/60 = 2\pi*410/60 = 42.94$ rad/sec

$$E = 0.5 * 6.41 * 10^{-3} * (42.94)^2$$

$$E = 5.91 \text{ Joules}$$

For 410 rpm the alternator will generate 12 V and 50 mA current.

6. Conclusion:

Renewable energies are currently looked at as the sources which will meet the future energy requirements. Solar, Wind, Tidal, Geothermal are some popular examples of renewable energy sources. Yet these sources have their own unique geographical as well as other limitations and are not available throughout. But gravity is available across our entire planet. Thus we can use something like electricity from gravity on a mega scale to get electricity any time at anywhere Hence by suitable arrangement components like mass of the flywheel, pulley diameters ,shaft and generator for 410 rpm the alternator will generate 12 V and 50 mA current.

6.1. FUTURE SCOPE:

The objective of this work is to develop a New Automatic operated Machine of flywheel power generation. Low cost energy generation using load and flywheel system. In future, the world will entirely depends on the renewable energy. Renewable energy replaces conventional fuels in four distinct areas: Power generation, hot water heating, transport fuels and rural (off grid) energy services.

7. REFERENCES

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