

Fabrication of Low Cost Gravity Powered Led Light

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Abstract - Gravity Light is a gravity-powered lamp designed for harnessing gravitational energy into useful electrical energy. It uses a bag filled with rocks or any heavy objects, attached to a cord, which slowly descends similar to the weight drive in cuckoo clock. This action powers a generator which lights up an LED bulb. Its basic principle is conversion of potential Energy into kinetic energy in a smart way.

The Following project shows how to harness Gravitational energy into useful electrical energy with simple mechanical systems. There are no operating costs after the initial purchase of the appliance. The light can be turned on by filling the Bag with approximately 10kg of weight and lifting it up to the base of the device; the weight falls over an extended period of time, pulling a strap that spins gear and drives a generator, which illuminates low power LEDs.

Key Words: Gravity Light, Gravitational energy, Clean Energy, Design and Fabrication, Alternative energy.

1. INTRODUCTION

20% of the world's population do not have access to electricity. That's 1 in 5 people. With a growing world population, this number is projected to remain the same For the next 20 years. Without electricity, most of these people have no other option but to use kerosene lamps to light their homes. A typical lamp is made by taking an empty bottle or tin can, putting a wick in the middle, filling it with fuel and lighting. According to a survey, the use of kerosene results in vastly higher cancer rates due to smoke Inhalation, and 2.5 million burn victims due to dropped or jostled lamps every year in India Alone. The problem of bringing light to remote parts of the developing world has been tackled in The past with everything from solar-powered lamps to wind-up devices and rechargeable Batteries – all of which require relatively expensive kit or physical effort by the user.

1.1 DEFINITION OF THE PROBLEM

The World Bank estimates that, as a result, 780 million women and children inhale smoke which is equivalent to smoking 2 packets of cigarettes every day. 60% of adult, female lung-cancer victims in developing nations are non-smokers. The fumes also cause eye infections and cataracts, but burning kerosene is also more immediately dangerous: 2.5 million people a year, in India alone, suffer severe burns

from overturned kerosene lamps. Burning Kerosene also comes with a financial burden: kerosene for lighting ALONE can consume 10 to 20% of a household's income. This burden traps people in a permanent state of subsistence living, buying fuel for their daily needs, as and when they can. The burning of Kerosene for lighting also produces 244 million tonnes of Carbon Dioxide annually.

1.2 OBJECTIVE

The goal of this project is to bring awareness in the people regarding the use of clean energy sources. Give alternatives to the existing clean energy techniques which are considered to be expensive. Help young enthusiasts develop their own clean energy devices. And also to develop a realistic alternative to Kerosene lamps by harnessing the power of gravity.

2. METHODOLOGY

Free fall of any weight would take seconds to reach ground for a height of fall, say 2 meters. With our device we are creating a high resisting torque using Ac synchronous motor which makes the suspended weight, difficult to descend down rapidly. We apply the weight at the sprocket end which is attached to a shaft on which a larger diameter wheel is fixed. And the wheel is connected to a smaller pulley using a V-Belt which in turn is connected to the motor. Because of the gear ratio small rotation in sprocket end makes the pulley turn faster which in turn runs a synchronous motor to produce uninterrupted electricity.

Input energy is muscle power. An average person can lift weights up to 10 kg with ease. Hence, our product is designed keeping weight factor in mind. In scoping out likely performance, some further numbers were needed next to important parameters. For these, a lift height of 8 feet was set (2.5m), as this is achievable by an adult with arms raised above their head, and a drop time target of 15 minutes between lifts (charges) was set. These parameters were important in allowing us to estimate the potential power output of the system and to calculate the efficiencies that would need to be achieved.

3. DESIGN AND FABRICATION

With three main aspects defined: LED(s) as the light source, an AC synchronous motor as the generator, and the storage of input energy in potential form, the requirement for a highly efficient and low-cost belt drive is indeed confirmed, as the AC motor would require a high torque and low speed input drive, and the raised weight must descend slowly in order for a charge to last for the target duration.

3.1. COMPONENTS

AC Synchronous Geared Motor, Sprocket, Wheel, Chain, Pulley, Belt, Ac to Dc circuit, Led Bulb.



Fig -1: Final 3D model after assembling mechanical components.

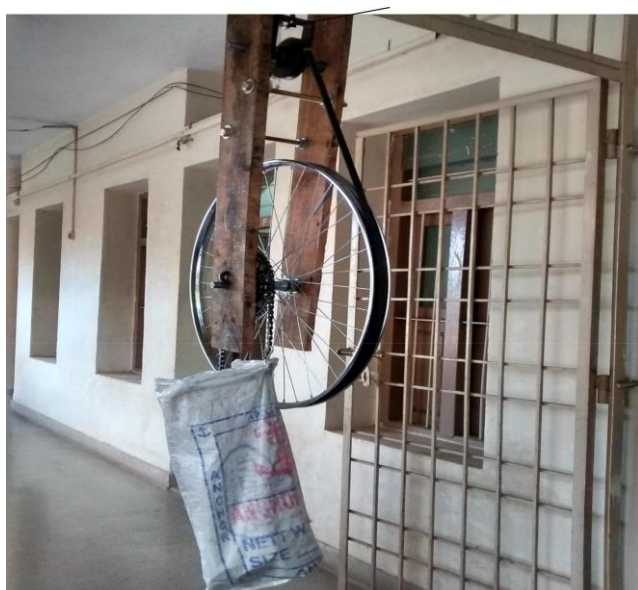


Fig -2: Fabricated Gravity Light

Table -1: Cost Report

SL NO	COMPONENT	QUANTITY	PRICE IN INR
1	Synchronous Motor	1	100
2	Bicycle Wheel	1	300
3	Sprocket	2	200
4	Chain	1	50
5	Pulley	1	100
6	V Belt A95	1	300
7	Mild Steel shaft	1	50
8	U Clamp	1	20
9	M12 Bolt	2	8
10	M6 Screw	2	4
11	Washer	8	16
12	Wood piece	2	30
13	0.5W LED Bulb	1	80
14	Ac To Dc Circuit	1	50
15	Labor Cost		50
TOTAL COST			1358.00

4. RESULTS AND DISCUSSION

The Following assumptions were made for calculations:

- No Slip in Belt drive
- Frictional Losses Are Negligible

Trial 1: Time of fall is Calculated Initially by keeping the Mass Constant and the values are tabulated.

For a Fixed mass = 5 Kg

Table -2: Time of Fall Vs Height for fixed mass

Height Of Fall(in Meters)	Time Of Fall (in Minutes)
1	5.65
2	11.31
2.5	14.14

For a fixed mass the time of fall is increased as the Height of fall is increased.

Trial 2: For a Fixed mass = 6.4 Kg

Table -3: Time of Fall Vs Height for fixed mass

Height Of Fall(in Meters)	Time Of Fall (in Minutes)
1	5.1
2	10.18
2.5	12.73

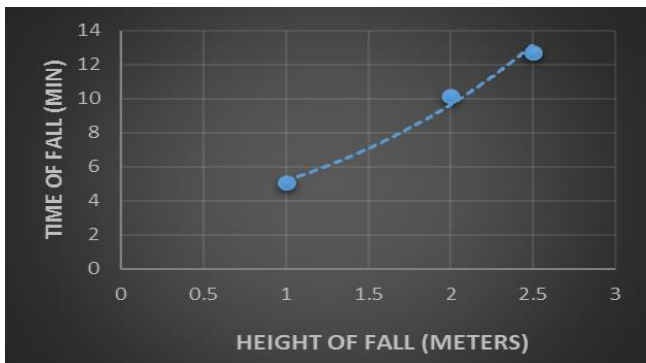


Chart -1: Plot of Time of Fall Vs Height of fall

Trial 3: For a Fixed Height of fall = 2.5m

Table -4: Time of Fall Vs Mass Hanged for Fixed Height of fall

Mass Hanged (in Kg)	Time Of Fall (in Minutes)
5	14.14
6.4	12.73
10	9.8

For Fixed Height as the table shows the Time of Fall is decreased as the Mass Hanged Increase.

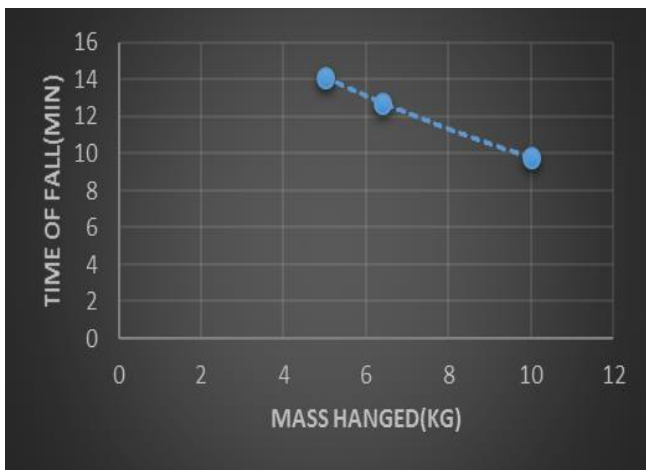


Chart -2: Plot of Time of Fall Vs Height of fall

Table -5: Power Output Vs Mass Hanged for fixed Height of Fall = 2.5m

Mass Hanged (in kg)	Power Output(In Watt)
5	0.235
6.4	0.3353
10	0.681

Power Output is increased with increase in Mass Hanged.

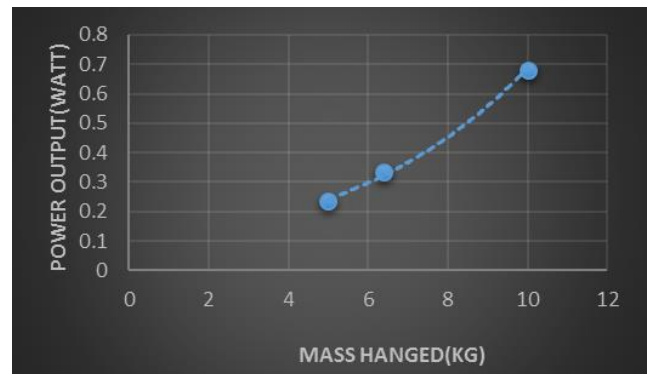


Chart -3: Plot of Time of Fall Vs Height of fall

4.1 EFFICIENCY

Efficiency of the System is calculated for a Height of fall of 2.5 m and Mass of 6.4Kg.

Output Voltage Measured = 25V
 Output Current Measured = 3mA
 Output Power = 0.08W

Efficiency = (Measured power/Theoretical Power) *100

Efficiency = 22.36%

Considering the Frictional losses, slip in belt drive and losses in circuit 22.36% efficiency is a fair value achieved.

5. CONCLUSION

Hence, we conclude that, gravity light meets all these drawbacks and its advantages over others are,

- Lower expenditure on lighting and increased income
- Safe, cheap and clean light
- Access to better energy solutions
- Increase time for productivity and lower fuel overheads
- Ability to study after dark
- Ability to work after dark
- Eliminates health hazards of kerosene lamps: Burns, fumes and eye infections

6. SCOPE FOR FUTURE WORK

Fall time achieved is around 12 min. It can be made up to 25min to 30 min thus reducing the manual effort. Use a taped wire instead of Industrial V Belt. Slip will occur but one can find other easy measures to avoid it. Overall size can be reduced i.e. making it compact using very high torque motor or by increasing resisting torque

Improvement in LED technology will boost Gravity light's performance further.

With Deci watts of power it generates, Gravity Light provides a light superior to kerosene lamps and can also power other devices, such as a radio.

One can make provision for DC jack at the back of it for connecting rechargeable LED bulbs and/or other devices.

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