

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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## Design, Fabrication and Characteristic Analysis of Gracity

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**ABSTRACT:** Chemically modifying vegetable oils to produce an alternative to petroleum-based materials is one of the most important emerging industrial research areas today because of the adverse effects of petroleum products on the environment and the shortage of petroleum resources. Bio lubricants, bio plasticizers, non-isocyanate polyurethanes, bio fuel, coating materials, bio composites, and other value-added chemicals can easily be produced by chemically modifying vegetable oils. This short review discusses using vegetable oils or their derivatives to prepare lubricants that are environmentally safe. Chemically modified vegetable oils are generally used as base fluids to formulate environmentally friendly lubricants reports of their application as sustainable additives have attracted special attention recently because of their enhanced multifunctional performances (single additives perform several functions, i.e., viscosity index improver, pourpoint depressant, antiwear products) and biodegradability compared with commercial additives. Here, we have reviewed the use of chemically modified vegetable oils as base fluids and additives to prepare a cost-effective and environmentally friendly lubricant composition.

**KEYWORDS:** vegetable oil; triglyceride; chemical modification; bio lubricant; base stock; additive.

### I. INTRODUCTION

In today's scenario electricity is the one which operates the world, and everything is running on the basis of electricity. But, by today's survey, the world's fuel resources will empty within 2050. So, the world is moving towards renewable energy. The various sources of the renewable energy resources are the, wind, tidal, hydro, solar, geothermal, etc. The various problems faced in the above renewable energy resources are that, the initial investments are too high for a lower end people to install and the maintenance requirements are also too high. Another major problem face is that, most of the renewable energy resources found and being consumed by the society are seasonal dependent. The world is in need of a renewable energy resource, which is constant world-wide and can be consumed in any situation irrespective to nature and place. The new system must also be a cost-effective product and can be easily usable. The solution for all these problems may come to an end by introducing gravity as a renewable energy resource. The gravitational based power generation is an emerging field in the powerplant engineering, and various researches are being done to implement a system which can produce electricity only through gravity and our project is a concept that the potential energy being produced by gravitational pull can be utilized into electricity generation by converting the potential energy into kinetic energy and further into electrical energy.

### II. LITERATURE REVIEW

**TITLE:** GRAVITY LIGHT IN NIGERIA:

**AUTHOR:** Martin Riddiford, Jim Reeves.

The above illustrated literature is about the solution for the problems faced by the Nigerian lower-class people due to the abundance of electricity because of which they are using kerosene lamps to light up their homes which's cost

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varies with the necessity and is a pollution forming content and also cause asthma and other breathing issues to the people and children having the usage of kerosene lamps. Their interest in the field of mechanical as well as the electrical engineering and their interest towards providing electricity even to the lowest grade of people on the environment made them to conclude to the solution of the gravity light. The new innovative concept in the field of powerplant engineering as well as the renewable energy resources which deals with power generation purely through gravitational pull where there is no source of pollution forming content and no cost for power generation.



### INFERENCE:

Even though the design was so compact as their aim of achieving the gravity light, the construction of the gravity light was more complex and a tedious process.

### TITLE: CHANGING PERSPECTIVE: GRAVITY LIGHT

**AUTHOR:** Pankaj Gode, Ankit Jadhav, KalpeshGardi, S.R Bhandari.

We think we live in modern world but there are still areas which have limited or no supply of electricity. Most of this area is located in mountains where we cannot provide electricity generated from tidal, hydroelectric, thermal energy by grid connectivity as they are situated in very remote places. They still depend on kerosene lamp which we consider as obsolete. So how to provide electricity in such places? You might think of solar or wind energy. But the problem with solar energy is it varies from places to places which are same with wind energy. So we've to think a better alternative to get rid of this question and which is also viable.

Here Gravity comes into picture. Our idea is to use the concept of bicycle dynamo electricity generation. The only difference is we're going to use gravitational pull instead of pedal work. The overall setup of gravity light can be operated indoor just by hanging some weight to gear train which in turn rotates generator which generates light. The gravity light requires only initial investment and no running cost. The cost of gravity light is approximately equal to the cost of kerosene required to light lamp for 3-4 months after this span it saves money.

### TITLE: GENERATION OF ELECTRICITY USING GRAVITY

**AUTHOR:** PrathameshNatu, Sameer Nadkar and Abhishek Badgujar

Even today, after advancement of science and technology, more than 1 billion people do not have access even to basic electricity. That is almost 1 among every 5 people. These people use other costly and harmful resources like kerosene to light their homes. Gravity being one of the fundamental forces of nature, is available everywhere across the Earth. Currently it is a dream to meet all energy requirements of the world. But when we have a light that gives free, clean energy at least the basic requirement of millions of people will be fulfilled.

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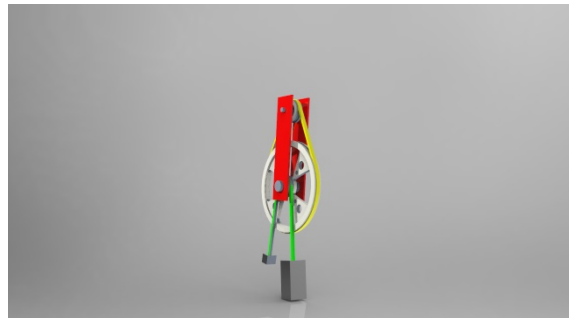
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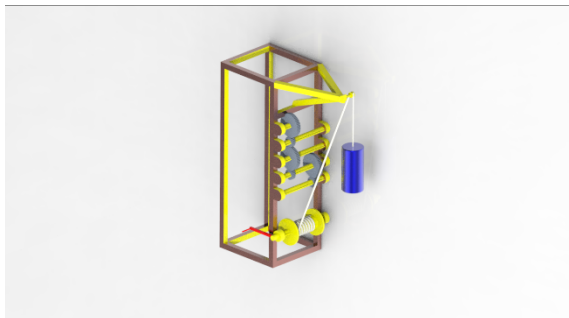
## III. DESIGN AND FABRICATION

### MODEL 1:



The preliminary and first design of our project is shown in the figure above, which is an update and improvement from the design that was reviewed in the literature review. The structure is being developed by implementing a secondary mass to the falling mass which opposes the falling of primary mass. The system is a successive one from the above one that is illustrated in the literature review, but the balancing a. k. a. counter mass only opposes the fall of primary mass to an extent of approximately 30 seconds only. It may be an improvement from the above system but it is quite negligible only because of the necessity and the scarcity of electricity.

### MODEL 2:



To overcome the drawbacks of the above design, the above design is being utilized by studying about the characteristics of a speed reducer also known as gear reducer. The inversion of the speed reducer can be known as the speed increaser assembly we have used here. The system above illustrated is highly performing compared to the system in the literature review. The performance of the system is increased 5 times compared to the gravity light mechanism. The achievement of the system was tremendous than the expected rating.

### PROBLEM IDENTIFICATION:

The problem is faced in the system is that, when the mass is applied to the system, the center of mass varies from the center to the front which causes the forward falling of the system and make it an unstable one. Another problem faced in the system is that, due to the heavy mass on the one side and smaller mass on the other side, the falling of mass provides oscillation of the chain which transmits the potential energy to rotation of the shaft. Due to this oscillation, slipping occurs in the system and there is a chance of mass falling out of the system due to heavy and uncontrollable oscillations.

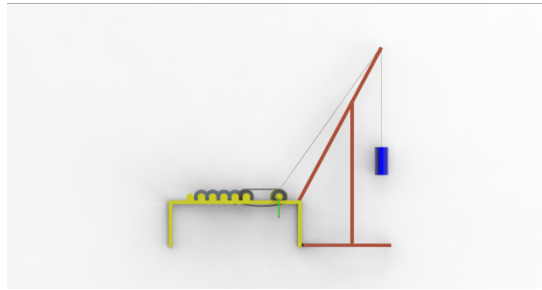
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### MODEL 3:



On the motive of making the system purely balanced even while applying the load, the above system was updated from the last one. When increasing the surface area, the mass of the system is spread evenly throughout the four legs of the system.

Even though there were several problems in the system like the lifting of the load to a height of 1m was very hard in the initial stage and the disengagement of the gear train while reloading the system was not applied. There were several modifications carried out to come to the final solution which is the model displayed in the above figure.

The lifting was simplified by increasing the length of the handle, by increasing the length proportionally the torque requirement is reduced. And for the disengagement of gear arrangements, the sprocket and chain arrangement from the basic bicycle which is incorporated in the system to reduce the effort of lifting the mass. And so, this system was selected.

### ARC WELDING:

Arc welding is a welding process that is used to join metal to metal by using electricity to create enough heat to melt metal, and the melted metals when cool result in a binding of the metals. It is a type of welding that uses a welding power supply to create an electric arc between a metal stick ("electrode") and the base material to melt the metals at the point of contact.

## IV. COMPONENTS

The components used in our project are as follows:

- Spur Gear.
- Speed increaser.
- Frame.
- Bearing.
- Bearing Block.
- Shaft.
- Pulley.
- Winding Drum.
- Wire Rope.
- Handle.
- Mass/Weight.
- LED & Electronic Circuit.
- Freewheel (Sprocket).
- Chain.
- Capacitor and resistor.

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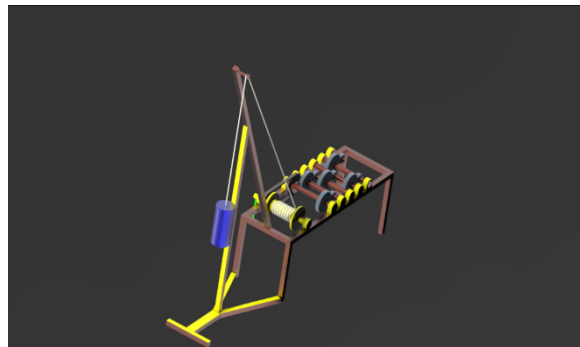
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### V. WORKING PRINCIPLE

The experimental setup is shown in the figure below.



The hand crank must be initially rotated to setup the mass at a required potential level. To simplify the manual work done to the system, the radius of the hand crank is increased to reduce the effort to be made to rotate and thus the heavy mass in a stress-free manner. Drum and pulley along with the free wheel (sprocket and chain) arrangement is provided to increase the mechanical advantage by reducing the mechanical effort given to the system to reduce the mechanical work manually given to the system.

After setting up the load at the required datum head level, the mass is set to freefall due to its own acceleration due to gravity. The datum head provides the potential energy to the system, and when the mass is set to freefall the mass gives a kinetic energy to the system with a large amount of torque. The torque is then converted into speed (rpm) by incorporating a speed increaser system.

The end gear's shaft is coupled with a gear motor which acts as a generator. The generator obeys the Faraday's first law which states that, "when change in magnetic field cuts the coil, emf is induced" and thus electricity is produced in this system.

### VI. CALCULATION

#### MODEL CALCULATION:

At  $m=22\text{kg}$ ,  $g=9.81$  and  $h=1$  m for a time period of 224s, the power input is calculated as below.

$$\begin{aligned} P_{in} &= m \cdot g \cdot h \\ &= 22 \cdot 9.81 \cdot 1 \\ &= 215.82 \text{ J.} \\ P_{in} &= 215.82 \text{ J} / 224 \text{ s} \\ P_{in} &= 0.963 \text{ W.} \end{aligned}$$

For an input of 0.963 W, the output power is obtained as  $V = 19$  V and  $I = 0.041$  A, for that the power output is,

$$\begin{aligned} P_{out} &= V \cdot I \\ &= 13.5 \cdot 0.03. \\ P_{out} &= 0.783. \end{aligned}$$

Therefore, the efficiency for the load of 17Kg can be determined as follows,

$$\begin{aligned} \eta &= P_{out} / P_{in} \\ \eta &= 0.963 / 0.783 \\ \eta &= 81.32\%. \end{aligned}$$

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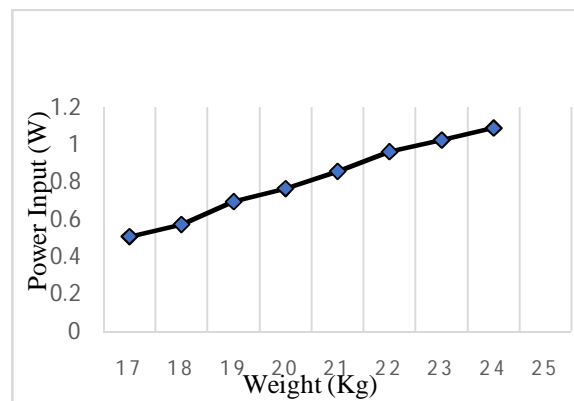
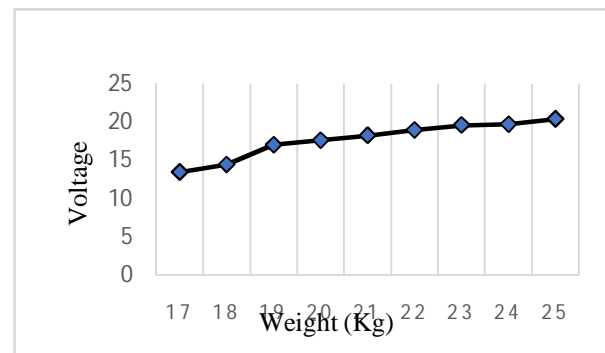
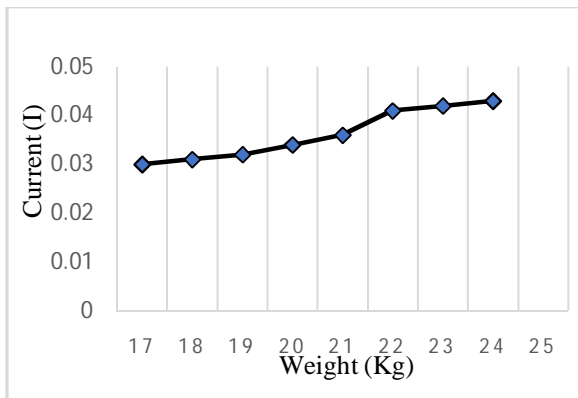
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PERFORMANCE TABLE:

WEIGHT (Kg)	HEIGHT (m)	TIME (s)	VOLTAGE (V)	CURRENT (A)	P <sub>IN</sub> (W)	P <sub>OUT</sub> (W)	EFFICIENCY (%)
17	1	328	13.5	0.03	0.508	0.405	79.72%
18	1	308	14.5	0.031	0.573	0.459	80.02%
19	1	268	17.06	0.032	0.695	0.553	79.53%
20	1	256	17.66	0.034	0.766	0.617	80.57%
21	1	240	18.3	0.036	0.858	0.675	78.69%
22	1	224	19.0	0.041	0.963	0.783	81.32%
23	1	220	19.65	0.042	1.026	0.831	81.03%
24	1	216	19.75	0.043	1.09	0.855	78.45%
25	1	208	20.45	0.045	1.179	0.933	79.16%

## VII. PERFORMANCE GRAPHS

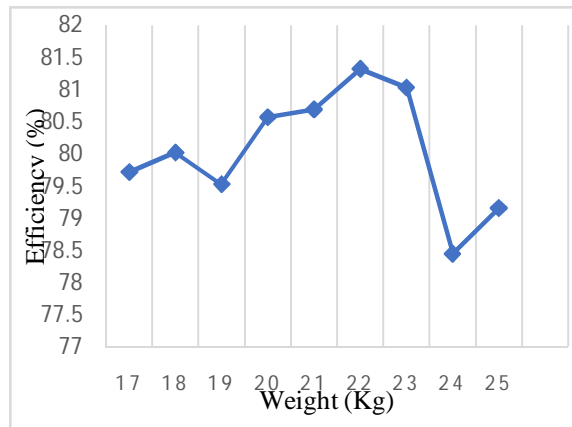
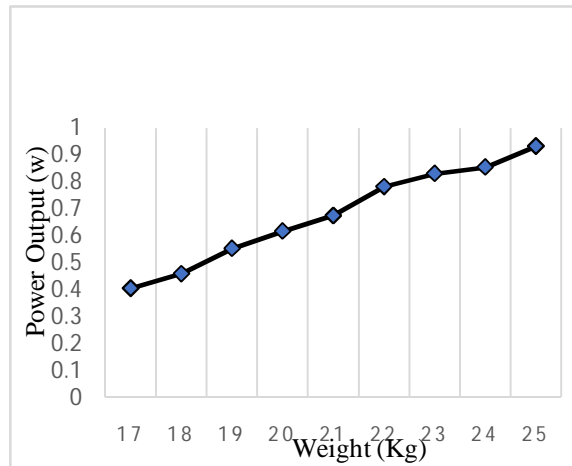


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The optimal power output is obtained at a weight of 22kg which is 81.35% efficient having the power output of 0.4W for an input of 0.5W. So the mass of 22kg is selected for the system.

## VIII. PHOTOGRAPHY



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## IX. CONCLUSION

Generation of gravity power can be increased by applying much heavier load at the end of pulley. Though heavy load increases the voltage and current of synchronous motor but it decreases the lighting time of LED. Applying heavy load, it may cause bending to the pipe stand. So a suitable mass must be used to fall it as much long time as possible.

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.

Gravity will be able to replace Kerosene Lamp and other obsolete lighting mediums. Also it will provide renewable, sustainable and cheap alternative to conventional lights. It can also be used to charge up capacitable electronical equipments. The impact will be beneficial for the social, health and economic situations of end users.

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