Design and Fabrication of A Gravity Powered LED Light

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Abstract- *In recent times due to effects of pollution and global warming there is a need for generating power from renewable sources. The reason for generating power using gravity is that it is available all over the Earth, abundant and consistent too. In this project, the gravitational energy of a heavy particle is converted to the electrical energy. When the heavy particle falls down from a higher altitude to a lower one, its potential energy is converted into the kinetic energy. Then this energy is converted to electricity by using a synchronous motor. With the increasing of the altitude of the load, the lighting time increases. If load increases, power production also increases, but the lighting time decreases. using of load from the elevation the generation of lighting came be obtained on the LED bulb.*

Keywords- Renewable source, Gravitational energy, Environment friendly.

I. INTRODUCTION

Renewable energy is the energy which comes from natural resources such as sunlight, wind, rain, tides and geothermal heat, which are renewable. In some parts of the world, lighting is provided through expensive and polluting kerosene. Kerosene lamps are hazardous to health and environment and constantly require replenishment. Fumes which are raised from the burning of biomass fuels can cause cataracts and eye infections as well as emitting smoke that is the equivalent to smoking two packets of cigarettes every day. Also, it was estimated that nearly 2.5 million people in India alone suffer severe burns from over turned kerosene lamps every year as well as the vast amounts of carbon dioxide produced. 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. 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 windup devices and rechargeable Batteries – all of which require relatively expensive kit or physical effort by the user.

II. REASON FOR SELECTING THE PROBLEM

- Over 1.2 billion people globally have no access to supply. Instead they use dangerous, polluting and expensive kerosene lamps for light.
- Collectively, kerosene lamps cause 3% of the worlds CO2 emissions and are a significant source of black carbon, with even more intense local warming impact.
- 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 nonsmokers. The fumes also cause eye infections and cataracts, but burning kerosene is also more immediately dangerous

III. OBJECTIVES

- To convert the gravity potential energy into kinetic energy and then to convert the kinetic energy into electrical energy.
- Gravity power generation mechanism which can provide a continuous and stable light.

IV. 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 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 6.5 feet was set (2m), as this is achievable by an adult with arms raised above their head, and a drop time target of 10 minutes between lifts 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.

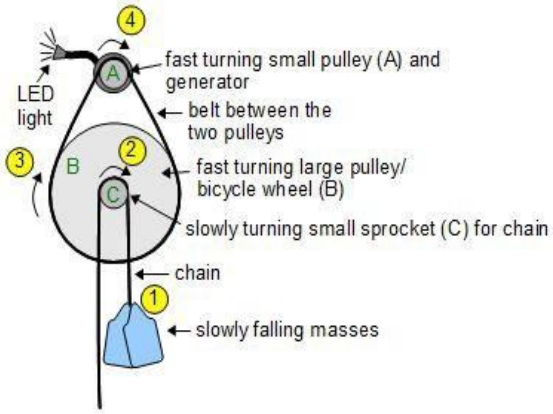

Fig.1: Schematic diagram of a gravity powered light

V. OPERATION

5.1 Synchronous motor:

A synchronous electric motor is an AC motor in which, at steady state, the rotation of the shaft is synchronized with the frequency of the supply current; the rotation period is exactly equal to an integral number of AC cycles. Synchronous motors contain multiphase AC electromagnets on the stator of the motor that create a magnetic field which rotates in time with the oscillations of the line current. The rotor with permanent magnets or electromagnets turns in step with the stator field at the same rate and as a result, provides the second synchronized rotating magnet field of any AC motor. A synchronous motor is only considered doubly-fed if is supplied with independently excited multiphase AC electromagnets on both the rotor and stator.

Fig.2: Synchronous motor

5.2 WHEEL:

A bicycle wheel is a wheel, most commonly a wire wheel, designed for a bicycle. A pair is often called a wheel set, especially in the context of ready built "off the shelf" performance-oriented wheels. Bicycle wheels are typically designed to fit into the frame and fork via drop outs and hold bicycle tires. A typical modern wheel has a metal hub, wire tension spokes and a metal or carbon fiber rim which holds a pneumatic rubber tire.

Fig.3: Bicycle wheel

5.3 LED:

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for other lighting. Appearing as practical electronic components in 1962, early LEDs emitted low intensity red light, but modern versions are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness. When a light-emitting diode is switched on, electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.

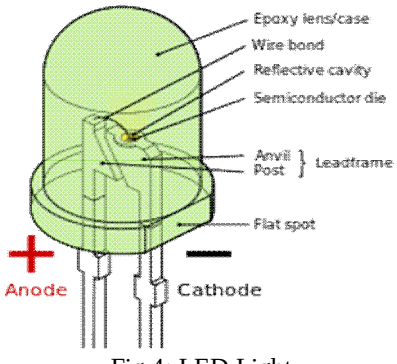

Fig.4: LED Light

5.4 Electrical polarity of LED:

As with all diodes, current flows easily from p-type to n-type material. However, no current flows and no light is emitted if a small voltage is applied in the reverse direction. If the reverse voltage grows large enough to exceed the breakdown voltage, large current flows and the LED may be damaged. If the reverse current is sufficiently limited to avoid damage, the reverse-conducting LED is a useful diode.

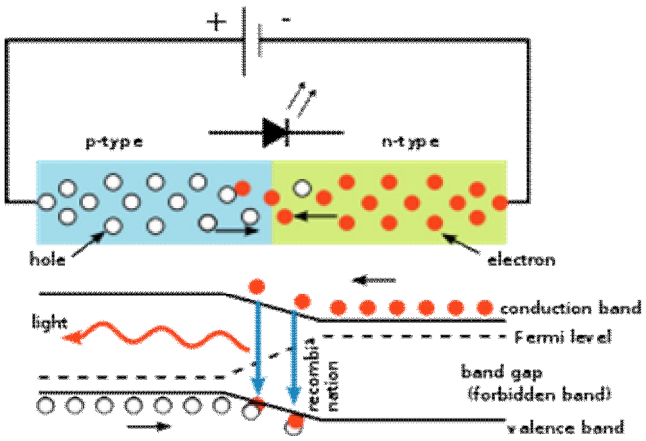

Fig.5: Electrical polarity of LED light

VI. DESIGN AND FABRICATION

With three main aspects defined: LED 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.

6.1 Working procedure of the Gravity powered LED Light:

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.

Fig.6: Fabricated gravity powered light

VII. RESULTS

Table 1: Observation of lighting time, voltage and current for different masses from a fixed height

Observations Observations	Weight (kg)	Voltage (V)	Current (mA)	Lighting Time (seconds)
1	6kg	3.2	12	42
2	7kg	3.6	15	38
3	8kg	3.9	17	34
4	9kg	4.3	19	29
5	10kg	4.7	22	26

VIII. CONCLUSION

Generation of gravity power can be increased by applying much heavier load at the end of bicycle wheel. 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. A suitable mass must be used to fall it as much long time as possible. If we use 2.5-3 rpm synchronous motor, the lighting time will increase. Due to friction of the pulley and belt, there is a power loss in a great extent. Gravity light needs no operating cost, so it can be operated as the demand of the light. In the remote areas, it may play a great important rule for the education as well as fulfilling the demand of the power. Moreover, the power can be stored in the battery so that it may give a great advantage to emergency situation. Gravity light will be able to replace Kerosene Lamp and other obsolete lighting mediums. It will provide renewable, sustainable and

cheap alternative to conventional lights. The impact will be beneficial for the social, health and economic situations of end users. With gravity light installed in each one of these homes eliminates the hazards of kerosene lamp, biomass which in turn improves environment, health and also reduce greenhouse emissions.

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