

Design and Performance Analysis of Gravity Assisted Power (GAP) Generating System for Harvesting Electrical Energy

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ABSTRACT

In this paper we proposed a new kind of system for harvesting electrical energy using Gravity Assisted Power (GAP) system. This proposed system design consists of a weighted pendulum made up of copper wire, which hangs between two bar magnets arranged in a parallel manner. As per the faraday's law an emf is produced when a coil is dropped in between the magnetic field. Copper coil is made to oscillate back and forth freely using the perpetual motion generator. Then we made wireless power transmission (WPT) for transmitting the data by the harvesting electrical energy. The entire design is simulated and modeled using MATLAB and MINITAB software. This is new kind of idea to harvesting electrical energy, which is no pileup and to provide energy for 24X7 hours with more ecological and high efficient set up.

KEYWORDS: pendulum, perpetual motion, gravity assisted power, WPT, simulation

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I. INTRODUCTION

All around the world people are trying to generate new forms of energy to satisfy their increasing needs. Generally energy harvesting using natural resources include airflow, sunlight etc is entirely different from energy generation involving the intake of non-renewable energy such as fossil fuels, lignite etc. The main difference is that for energy generation, the resource must be available in the direct environment for the application. First-generation technologies include fossil fuels, lignite etc. A fossil fuel power station have machinery to convert the heat energy into mechanical energy, which then operates an electrical generator. Variations between countries generating electrical power where only 10% of electricity is generated from non-transient source

like fossil fuels in France, US and China are at higher rate of production with 70% and 80% respectively. In US, other than any source, power generation causes around 40% of the hazardous emissions. Also, fossil fuel combustion for electricity generation is the major reason for 65% of the emissions of SiO₂, which is the main component causing acid rain. Another existing energy generation systems includes nuclear power generation which costs high. The cost spent for nuclear accidents are high and it will be a tedious process in rebuilding the nuclear power plant although it needs additional charges. Second-generation technologies include solar, wind, hydro and other power generation systems. In 2015 Hydropower generated 16.6% of the world total electricity and 70% of all renewable electricity. It also disturbs the water flow and lower the

dissolved oxygen levels in water which will affect the underwater species. As long as water is available, we can produce electricity and it may be affected by drought. Airflows can be used to run wind turbines. Wind power must compete with conventional generation sources on a construction cost basis. Turbine blades could damage local wildlife. Numerous technologies has been invented by people but no effective model and permanent solution has been found to find out a new form to convert available natural energy and that can be utilized without environmental hazards. No system is cost effective for energy generation.

This paper overcome those drawbacks that has been faced till date with a new Innovative method of power generation using the Gravitational force which is naturally present 24*7 hours. As because gravity is present everywhere, it can be easily utilized by anyone on the Earth. It will be an added advantage because Energy crisis is increasing at a faster pace and hence within a few years, there will be shortage of fuels for power generation and the other renewable energy like solar, wind, biomass, etc., are only available during the day/night. Third generation energy sources are different from

existing conventional energy sources which are based on forces of nature. This present invention relates to a device for conversion of gravitational energy to electrical energy which can be made available at a low cost to the common man. "GRAVITY ASSISTED POWER GENERATION SYSTEM" (GAP) system is the emerging technology in the power generation field which overcomes all drawbacks in the existing systems. Many "stand-alone" products will be made, which make use of their own generated energy, thus making them independent from a connection to an electrical socket/outlet. In our proposed system, we are using perpetual motion generation to oscillate the pendulum endlessly. Perpetual motion is motion of bodies that continues indefinitely. A perpetual motion machine is a mechanical setup that can do work without an input energy source.

The rest of the paper is organized as follows: section 2 presents the backgrounds and related works, section 3 describes the system design, section 4 system validation and section 5 briefs the results and data analysis and section 6 draws some conclusions.

II. BACKGROUND AND RELATED WORKS

Author	Work done	Techniques used
Prathamesh Natu, Sameer Nadkar and Abhishek Badgujar.	Developed a mechanical model to generate electricity with the help of gravity.	Used gears and chain with bicycle sprocket.
M.Musharraf, I.U.Khan, N.Khan	Model of energy efficient door is presented.	Wing oscillating coil pendulum generator by using magnet bar.
Yu-Jen Wang, Chung-de Chen and Cheng-Kuo-Sung.	They proposed for harvesting energy from a rotating wheel by using weighted pendulum type electromagnetic generator.	By using weighted pendulum type electromagnetic generator.
Rajat, Sonu and S.K.Mude	Developed a pendulum motion based power generator that sustains its motion with low maintenance	They used pendulum type energy generator with neodymium magnet.
Brandon hayes Louis Goguely	Designed a bicycle power generator for DC house	Used bicycle and alternator, generator for energy generators

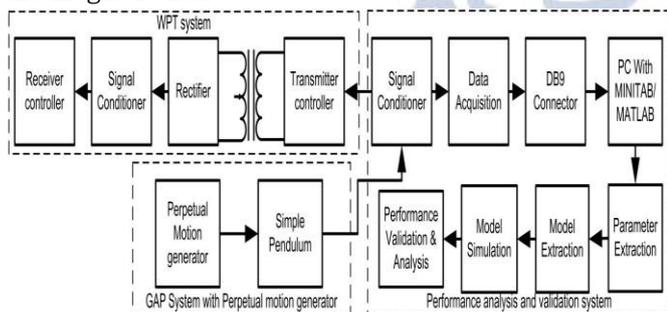
III. EXPERIMENTAL SETUP

The proposed work consists of three important modules as shown in Fig. 1. They are 1. GAP system with perpetual motion generator construction 2. Performance

analysis and validation system 3. System validation using Minitab.

A) GAP system with perpetual motion generator construction:

The setup is basically meant for lighting up a commercial LED lamp by converting the mechanical energy of the pendulum oscillation into electrical energy. With an aim to develop green technology model for generating electricity is Gravity assisted power generating system (GAP) based on the concept of Gravitational force. Our experimental setup based on the concept of simple pendulum consists of magnets and copper coil assembly where coil and its associated components are wound over the pendulum. At the two sides of the coil, magnet bar is fixed and magnetic flux produced around the magnets. Whenever coil is moved back and forth it cuts the magnetic flux



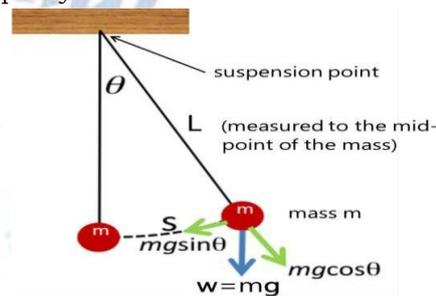
1 Experimental setup of GAP system

produced by the magnets and an emf induced. Gravity Assisted Power (GAP) generator system doesn't require any sources of energy. It's an autonomous/ standalone energy system. On contrary, this setup consists of perpetual motion assembly comprises a CPU fan with magnets been placed in the blades of the fan by which magnetic poles exert forces on each other in such a way that like poles repel and unlike poles attract each other which makes the assembly rotates continuously. Then a mechanical setup is employed, which resembles a pulley with its one side gets connected to the CPU fan assembly and on the other side to the simple pendulum. On using this entire assembly we can drive the simple pendulum coil that suspends between strong magnets endlessly. In Conventional methods an initial force is applied manually to the gravity assisted rotational mechanism to make it rotate continuously To validate and analysis the developed model for different dimensions/values of components to get a maximum energy, modelling techniques and simulation process were used.

B) Basic setup / components of pendulum:

A simple pendulum consists of a weighted object which is hung by a string with a fixed support. That object here denotes the pendulum bob. When the bob is disturbed from its equilibrium position, it begins to oscillate back and forth vibration between the magnets. The amplitude θ of a pendulum is given as the maximum angular deviation from the equilibrium position of the object. And frequency, f is given by number of oscillations from one side to the other made by a pendulum per second. The time taken T for one

oscillation of a pendulum is dependent only upon the length L of the pendulum and also the weight of the object. Perpetual Motion generator is used generate a energy that oscillates the simple pendulum with infinite period or till the external force applied to stop the oscillation. Perpetual motion is generated through the CPU fan like assembly in which the magnets are placed on each wings and common magnet with respect to the all wings is placed on outer chase of the CPU fan. Due to the attraction and reflection of the magnets, fan rotates continuously thus energy is generated. Generated energy is coupled on suspension point of the simple pendulum through pulley.



C) Performance analysis and validation of system

The output of the setup is send to the signal the digitizer. Then it is passes to Data acquisition control unit which logs the data and it is plotted in the Minitab. The curve is fitted for the plot and the parameters are extracted. As per the faraday's law an emf is produced when a coil is dropped in the magnetic field. When a magnet is placed in both sides it produces a magnetic field. When the pendulum is made to oscillate it cuts the magnetic field and thus emf is produced. The model should be tested for various dimensions of magnets/ various types of magnets, various number of coil turns to get the sufficient energy. The entire setup can be modeled using modeling tools such as MINITAB

D) Signal digitizer

Using digitizer, Analog signals that are continuously varying in the given period of time are converted into digital signals that are discrete .That digitized data is in the form of binary numbers, which facilitate computer processing and other operations, is given to two modules (Data acquisition unit and WPT block).

E) Data Acquisition unit

Data acquisition (DAQ) is the process of measuring an electrical or physical phenomenon such as voltage, current, temperature, pressure, or sound with a computer. It consists of sensors, DAQ measurement hardware, and a computer with programmable software.

IV. SYSTEM VALIDATION USING MINITAB

The simulation can be made in both Minitab and Matlab. The equations were obtained for both and it is taken for the overall analysis. The experiments are repeated for other two coils and its combination. In Minitab, Many factors/inputs/variables must be taken into consideration when making a product especially a brand new one Based on a Design of Experiments (DOE) methodology for determining parameter levels.

A) Model simulation and extraction:

The simulation and modelling is done in Minitab for better accuracy. And moreover Minitab provides a statistical analysis of a product performance. It shows the signal to noise ratio for the entire performance of the product. Minitab software shows the necessary result which is needed for the quality performance of the design. Logging of data is an important parameter from which we can get the values and that can be simulated and designed into a model.

B) Wireless Power Transmission system

The generic term of Wireless Power Transmission (WPT) implies various number of power transmission technology it been used on varying electric, magnetic, or electromagnetic fields. WPT consists of a "transmitter" and "receiver". The transmitter is connected to a source of power such as a mains power line, which converts the power to a time-varying electromagnetic field, and one or more "receiver" devices which receive the power and convert it back to DC or AC electric current which is used by an electrical load

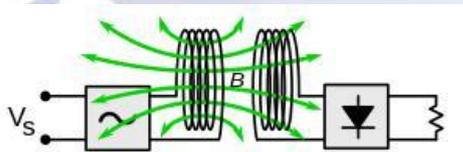


Fig.4 Schematic of Wireless Power Transmission system

V. RESULT ANALYSIS

Table 1 Validation of systems performance when N=50.

N=50			
S. No	L(m)	T(mm)	Output Voltage (V)
1.	10	1	3.4
02.	20	1.5	4.5

Table 2 Validation of systems performance when L=50m

L=50m			
S. No	N	T(mm)	Output Voltage (V)
1.	500	.5mm	3.7
2.	1000	1mm	5.2

Table 3 Validation of systems performance when T=0.5mm.

T=0.5mm			
S. No	N	L(m)	Output Voltage (v)
1.	500	.5	3.9
2.	1000	1	5.6

VI. RESULT ANALYSIS USING MATLAB

We analyzed our equation which comprises three parameters such as Rest time (T), Angle of oscillation (θ), No. of Oscillation (N) by using curve fitting tool in MATLAB. Curve fitting is the tool which is used for perfect fitting of curve according to the data we used.

$$f(x,y) = a + b \cdot \sin(m \cdot \pi \cdot x \cdot y) + c \cdot \exp(-(w \cdot y)^2) \quad (1)$$

Where X=Angle of oscillaton, Y=No.of oscillation Z=Rest time a,b and c are coefficients of X,Y and Z for the given data set.

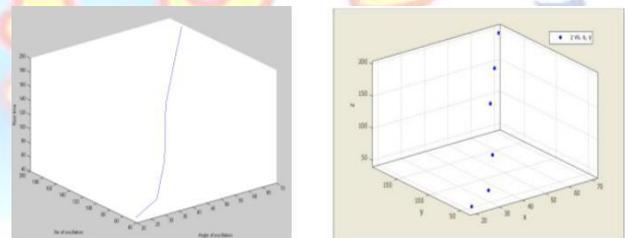


Fig. 5 Simulation results- Relation shows between T, θ , N

Table 4 Time Vs Oscillation.

S. No	Angle of oscillation (in deg)	No. of oscillation (n)	Rest time (s)
1.	20	42	47
2.	30	52	57
3.	40	82	87
4.	50	122	137
5.	60	152	167
6.	70	182	197

VII. CONCLUSION

In this paper we proposed three models to convert gravity energy into Electrical energy by oscillating simple pendulum using perpetual motion. The performance of the system is analyzed by varying the number of turns, length of the pendulum and thickness of the coil. Among the three methods adopted, the system produces maximum efficiency when increasing the length of the pendulum. Here

we gain our energy at certain period of time without any pileup and also it is easily implementable.

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