DESIGN OF DC GRID USING HYBRID RESOURCES FOR DOMESTIC APPLICATIONS

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Abstract: Energy is the most important of all resources, while sustainability concept is focuses on the long-term survival of communities. Energy need of the world is growing day by day because of consumption of energy at a larger extent with the population growth. Energy resource mainly decides the development of any nation. Hence, we need to look at various different means of power generation. This paper is about generating power by using grid with the combination of wind and a new method for human power conversion based on children's play on playground equipment (SWING), which is used by children for playing that will produce electricity when being used. In such a way that when it swings the mechanical energy is generated and it is converted into electrical energy by a commutator and is stored in a battery. The construction is such a way that, the swinging action makes the horizontal beam rotating through an angle. This shaft is connected to a sprocket to transfer the motion to the free wheel which rotates proportionally with respect to the angle of motion of the swing. The angular movement is converted into a complete rotation with the help of a chain drive connecting both sprocket and free wheel. The free wheel is connected to a shaft which in turn rotates the spur gear and dynamo arrangement to generate electricity.

Keywords: Swing energy, wind energy, bearings, dynamo, free wheel.

I. INTRODUCTION

Energy is the driving force of modern societies, and generation and utilization of energy are essential for socio- economic development. Per-capita energy consumption levels are often considered a good measure of economic development. In recent years, energy scarcity has become a serious problem due to depletion of non-renewable energy sources, increasing population, globalization of energy intensive economic development, environmental pollution, and global warming.

In recent years, there have been many interesting developments in the field of human power conversion. In the Present project, a method of harnessing the power of Children's play in play grounds and public places, on device such as swing is proposed.

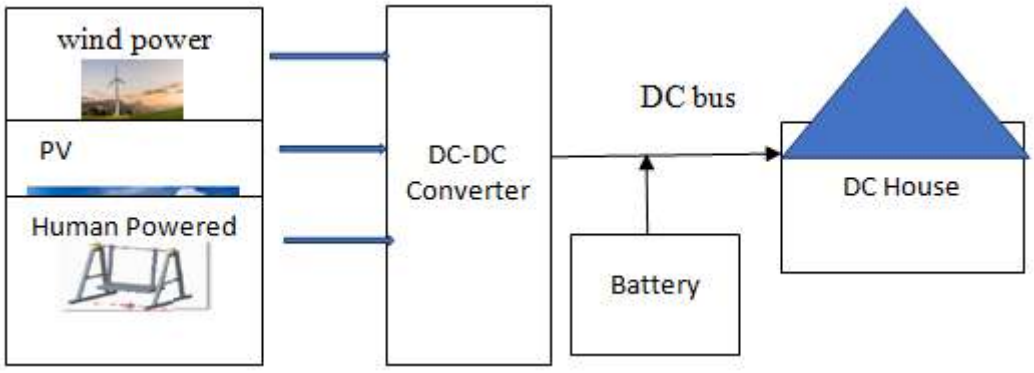

Figure 1: DC House System Overview

When large number of children plays in a school playground, part of the power of their play can usefully be harnessed resulting in significant energy storage. This stored energy can then be converted to electricity for powering basic, low power appliances in the school such as lights, fans, communications equipment, and so on. The method provides a lowcost, low resource means of generation of auxiliary electric power, especially for use in developing countries. This swing electricity project not only generates electricity but also can be a very useful tool to educate children to learn to conserve energy. This project utilizes energy that is given away while playing.

II. LITERATURE SURVEY

The study Gokul and Cyril John Tellis [1], as every single details about the design of the swing is listed in this journal with all its 2-D, 3-D model and calculations. Calculations are important but for only fabrication it's not much important to go deep in the design of the swing.

The paper which is proposed by Pandian [2], is all about generation of power in small scale using man power in a playful manner and utilizes that power in our daily life. It describes about the requirement and consumption of power in our daily routine and power is generated using play ground equipment's like swing, see-saw, and merry go-round etc.

Mithun Gajbhiye et al.[3] explained that with the demand for energy requirements increasing tremendously, it can be met by alternative energy resources such as Gravity. Particularly, it can generate more power compared to the other type of nonconventional energy. In addition, this alternative energy source offers benefits such as easy deploying, low installation cost and maintenance systems, and less operating cost. In terms of operational lifetime, installation cost and reliability, so a Pendulum Power Generator is considered as a promising alternate for traditional power sources. Man has always been in detection of energy to meet his ever increasing demand. 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, rich and reliable too and it cannot be efficiently converted into electrical energy. In this paper we designed a methodology wherein gravitational energy is further amplified in terms of its magnitude by using Perpetual Motion Mechanism and hence can be successfully transformed into usable electrical energy. The basic concept of a gravity power generating mechanism is simple. When a body moves down from a higher altitude to a lower one its potential energy is converted into kinetic energy. This motion is converted into circular motion and is then converted into electricity using a generator.

III. COMPONENTS OF PROPOSED MODEL

The main components used to fabricate the model are:

- Main frame
- Shaft
- Sprocket
- Free wheel
- Chain drive
- Bearing
- Dynamo
- Spur gear
- Light emitting diode / Battery

- Plastic fan blade set

The selection of the components can be done as per requirement. A mild steel square tube is used as a material for supporting frame. It is well fixed with nut and bolts to the base which is made up of wooden or metallic board. At the centre of the supporting frame, seating arrangement is attached. The bearings are provided on both the side for the smooth motion.

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power .The various members such as pulleys and gears are mounted on it. A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs, that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth. Chain drive is a way of transmitting mechanical power from one place to another. In mechanical or automotive engineering, a freewheel or overrunning clutch is a device in a transmission that disengages the driveshaft from the driven shaft when the driven shaft rotates faster than the driveshaft. An overdrive is sometimes mistakenly called a freewheel, but is otherwise unrelated.A bearing is a device to permit constrained relative motion between two parts, typically rotation or linear movement. Bearings may be classified broadly according to the motions they allow and according to their principle of operation.Dynamo is an electricity generator. This dynamo produces direct current with the help of a commutator. It was the first generator, capable of power in industries. The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. The commutator was needed to produce direct current. Spur gears are the simplest and most common type of gear. Their general form is a cylinder or disk. The teeth project radially, and with these straight-cut gears, the leading edges of the teeth are aligned parallel to the axis of rotation. These gears can only mesh correctly if they are fitted to parallel axles. The torque ratio can be determined by considering the force that a tooth of one gear exerts on a tooth of the other gear. Consider two teeth in contact at a point on the line joining the shaft axes of the two gears. A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it. The light is not particularly bright, but in most LEDs it is monochromatic, occurring at a single wavelength. The output from an LED can range from red (at a wavelength of approximately 700 nanometers) to blue-violet (about 400 nanometers). We have used LED to check for output battery can be connected at output and even dc stepping circuit can be used.

Table 1: Summarizes the Advantages and Disadvantages of the Design

	Advantages	**Disadvantages**
Human-Powered Generator-Swing	Simple design involving fewer components.	Less higher power output.
	Can be implemented using locally available materials (bicycle and car parts).	Little research for this design.
	Made with locally available tools and limited mechanical and electrical knowledge.	

	Cheaper design.	

IV. REQUIREMENTS AND SPECIFICATIONS

Table 2: Swing Human Powered Generator Requirements and Specifications

Marketing requirements	Engineering specifications	Justifications
1	The system costs less than $1,000.	A low alternative to getting electricity from a power company.
2,3	Constructed using metal parts for the frame.	Structurally sound swings can be made from good quality materials. The type of materials chosen determines its durability.
1,2,5	The size of the system should not exceed the regular size of a swing, 10 feet high and 6 feet wide, and assembles in less than 2 hour with tools.	The size of the swings would determine how easily it can be assembled. The system should not consume a lot of time during assembly.
4	The system converts mechanical energy to electrical energy at 33% efficiency.	Convert the abundant energy of playful kids into power homes.
4	The system generates an average of 0.5-1W each full swing.	25kwh is the average power consumed by a household in a day.
2	The system should abide by the Public Playground Safely Handbook, more specifically the swing section, set by U.S. Consumers Product Safety Commission.	Abiding by the regulation set for a playground safety when building the swing would increase safety for users.
1	Plastic wind blades	When the blades are rotating wind will be produced.
Marketing Requirements 1. Low cost 2. Structurally sound 3. Weather-proof and durable. 4. Efficiency converts mechanical to electrical energy.		

Table 2 shows the marketing requirements on the first column corresponding to an engineering specification in the second column and the third column of the table justifies why certain specific values corresponds to certain engineering specification. The marketing requirements such as low cost and easy to assemble seen in the bottom of the table generally improve the sales of the product. The engineering specifications, however, are characteristics specific to the project such as the average power produced by the device. In most cases, an engineering specification supports a marketing requirement. However, there are cases when an engineering support contradicts or opposes a marketing requirement. This can also occur in marketing requirements. Usually this involves the marketing requirement of low cost. Low cost usually contradicts improvements in other areas such as higher power or greater durability. Thus, cost and improvements in other areas must balance. Having a specific budget can also limit the improvements, buteases the trouble of choosing expensive components. The same occurred in the swing project. The initial problem is that the budget has no limit, which complicated the design since the budget dictates the type of motor other

components. These components, then, dictates the performance of the swing. Setting a limit to the budget solves the circular problem.

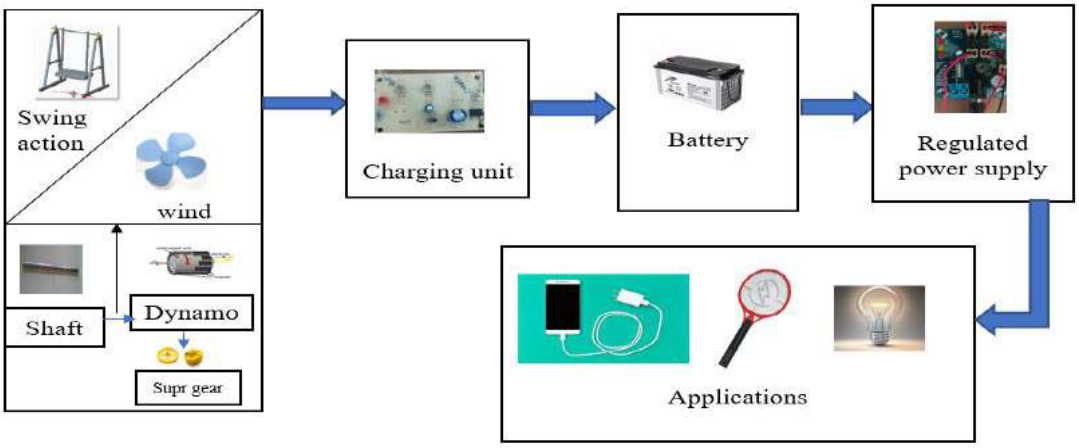

Figure 2: Block Diagram of Proposed System

Working of Proposed Prototype Model:

Figure 4 shows the prototype model of swing which is used to generate power. During the forward stroke & backward stroke of swing some torque is induced in shaft. The shaft is mounted between two bearings. At both end of the shaft a large sprocket is attached rigidly, this sprocket pivots over shaft axis when the shaft is displaced. The larger sprocket is attached to a smaller sprocket (freewheel) using chain. The shaft in which smaller sprocket is mounted in other shaft which is placed in another ball bearing which in turn connected with the spur gear arrangement. With this arrangement power is generated in the dynamo and can be stored in the battery. The construction of the swing model When the seating of the swing set moves forward & backward some torque is induced in the shaft by the holding bars of swing set. This torque displaces the larger sprocket which is pivoted over axis of shaft causing the angular displacement. This angular movement is converted to rotational motion of smaller sprocket by chain attachment. The sprocket rotates the spur gear arrangement which runs the dynamo, thus producing the electricity. The electricity thus produced is stored in a battery. Here in this project we are showing production of electricity using LED. In this project the production is in both directions for that we have used freewheel which arrests the motion in only one direction. That freewheel is placed under both sprockets in opposite direction. Hence when swing action happens when moving in forward one side freewheel rotate spur gear arrangement when backward the arrangement is ideal. Same happens vice versa on other side of frame and hence motor gets rotated in both direction of movement and power will be produced.

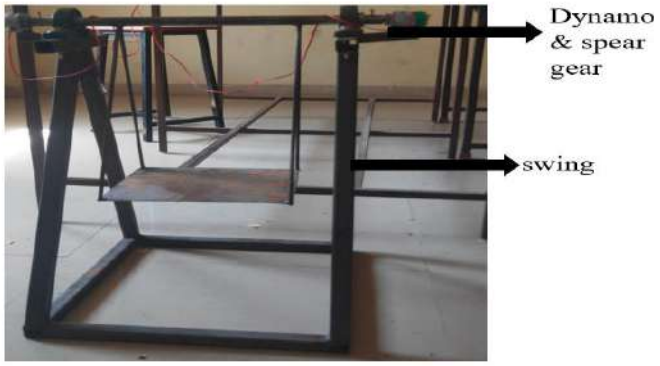

Figure 3: Proposed Prototype System

The figure: 5 shown below is proposed prototype circuit showing different application such as LED light, DC motor, Charging socket and battery for storing energy.

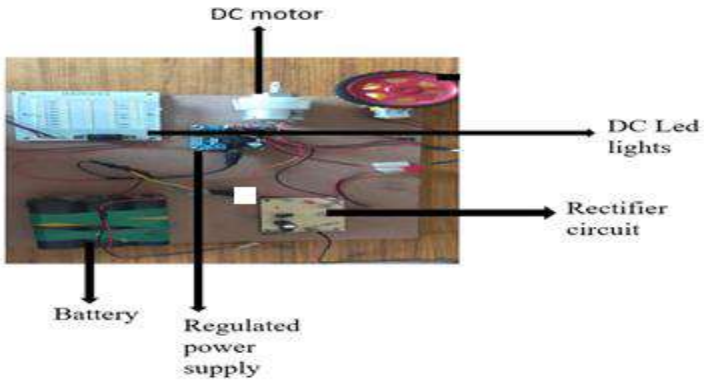

Figure 4: Proposed Prototype Circuit Showing Different Application

Figure: 5 shown below is the working prototype system with plastic fan as source of power generation. As blades of plastic fan are rotated due to atmospheric air, the energy which is generated is stored at battery bank for further usage in different applications as shown. The blades of plastic fan are connected to horizontal shaft with some supporting rod. As wind blows through the day, blades starts rotating according to blow of wind and here mechanical power is which is converted electrical power and is stored in battery bank for further usage in different applications.

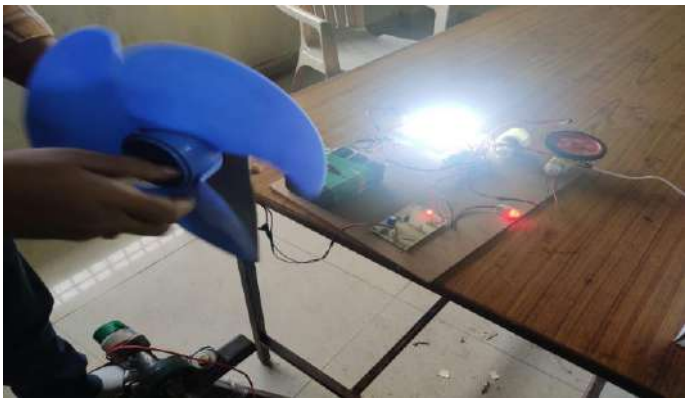

Figure 5: Working Prototype System with Plastic fan as a Source of Power Generation

VI. FUTURE SCOPE

There are a few categories that the next team could work on in the design of the project. The first is redesigning or improving the physical swing design. Due to the inexperience of the

team when handling mechanical and structural work, the swing is unstable when set on inconsistent ground level. However, there is an easy fix to this. Adding two A beams on the current legs at an angle would support the current frame of the swing and would reduce its tendency to overturn or tip over when going at high rotational speeds or angular velocities. These A beams would be welded onto the main supporting beam at the very top of the swing. Another approach would be to attach the concrete blocks on the horizontal aluminium beam that connect the legs of the frame. Both redesigns are suitable when dealing with stability. Doing both designs together would improve the stability of the entire swing. Having a mechanical engineer or architectural engineering student in the future team is necessary.There are various ways of creating constant voltage from the swing motion. The first is by mechanical means via the addition of a flywheel, which will keep rotating even during the dead time of the shaft rotation. However, backward and forward motion by the upper beam must be translated to a single backward or forward rotation of the shaft. Solving this problem by electrical means is achieved with the use of filtering system. Furthermore it is easier to achieve the constant voltage problem by electrical means. The rotating flywheel, also, needs start up time to get the flywheel at a certain continuous rotational speed. Therefore, the solution to this problem leans toward the electrical approach. Finally, the weather-proofing of the design must be improved. A compartment to store the future electrical system must be created. The gear mechanism must be hidden via a plywood wall to avoid tampering by people and to insure the safety of the rider.

VII CONCLUSION

With the demand for energy increasing tremendously, different methods of extracting energy from the available environment is focused and world is in search of alternative sources. The way of producing power from the mechanical energy that can be wasted is persevered for the future purpose which is having a great scope. So, swing power generator is considered as a promising alternate for exhausting energy sources. In this project, grid model is used in the combination of wind and a new method for human power conversion based on children's play on playground equipment (SWING). If it is employed in every garden, playground, parks with proper designing it could acquire sufficient power from it and also it will create awareness of electrical energy conservation in children. It will be a useful device which can be used in countryside area or in the agriculture field where electricity is not easily available. In the coming days the demand for energy resources will be increasing day to day, the aim of this research is to develop the world by enriching. Now time has come for using this type of innovative ideas and it should be brought into practice. It is full independent system and it outlines the need for cost effective technology in rural region.

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