Electric Power Generation from Gym Equipment with Polarity Checker and Changer Circuit

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Abstract— Intention of this project is to design a renewable energy source based around a piece of exercise equipment. The energy expended in a typical workout at the gym is usually wasted in the mechanics of the equipment. This project harnessed the mechanical energy of the machine and converted it to electrical energy using a generator-based system. The exercise equipment, attached to the shaft of the generator. Thus produced electrical energy is used in The powering a piece of equipment such as lamp. This project will help one develop engineering skills while learning about a clean way of generating electricity.

Key words: Gym Pull Up Machine, Circuit, Load, Etc

I. INTRODUCTION

The field of energy conservation is becoming an increasingly notable subject of research among the scientific community today. The intention of this project is to build a straight forward human powered generator from a used gym and to use it to power light bulbs, cell phones, and other small appliances. This project will help one develop engineering skills while learning about a clean way of generating electricity. These systems need to be improved and designed for maximum power output, cost-efficiency, and marketability. Engineered to be used for retrofitting an existing exercise machine, this project includes an efficient yet controllable power storage. The exercise equipment will be attached to the dynamo motor. Thus produced electrical energy is used in powering a piece of equipment such as lamp while exercising. Over the past decade, scientists and engineers around the world have been designing unprecedented energy-harvesting systems, drawing power from a variety of sources. One of the most creative and unlimited sources available is the kinetic energy produced from human exercise. Although recent designs of energy-harvesting exercise equipment have been introduced into the market, these systems are costly and do not produce a noticeable output of power. These systems need to be improved and designed for maximum power output, cost-efficiency, and marketability. Engineered to be used for retrofitting an existing exercise machine, this project includes an efficient yet controllable power storage and distribution system.

A. The Energy Challenge

The world's energy consumption is at an all-time high with the demand continuously increasing. This situation brings up several challenges that need to be addressed.

- Increasing population, especially in developing countries which lack resources for clean energy.
- Global warming with the related climate changes and adverse implications.
- These challenges have been reason for much controversy in the developed world; however, recent investigations have also shown a much more basic challenge of availability in the less developed parts of the world.

II. LITERATURE REVIEW

A. A Brief History Of Human Power Generation

In 1817 Baron von Drais invented a walking machine that would help him get around the royal gardens faster: two same-size in-line wheels, the front one steerable, mounted in a frame which you straddled. The device was propelled by pushing your feet against the ground, thus rolling yourself and the device forward in a sort of gliding walk. The machine became known as the Draisienne or hobby horse

The next appearance of a two-wheeled riding machine was in 1865, when pedals were applied directly to the front wheel. This machine was known as the velocipede ("fast foot"), but was popularly known as the bone shaker, since it was also made entirely of wood, then later with metal tires, and the combination of these with the cobblestone roads of the day made for an extremely uncomfortable ride.

III. PROPOSED DESIGN

A. Block Diagram

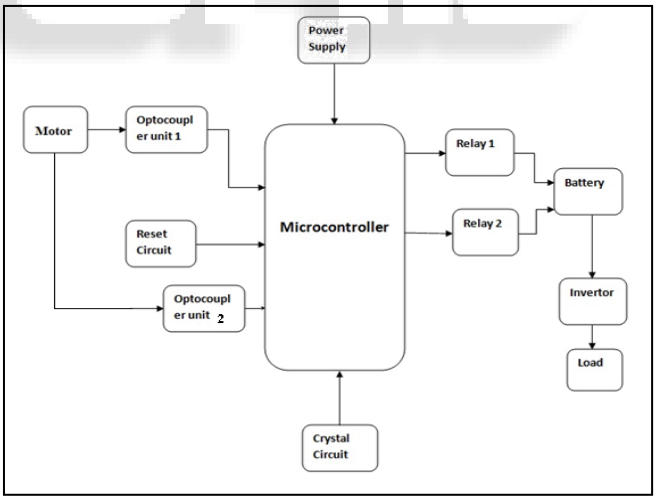

Fig. 1: Proposed Design of Overall Project Design

In this project electricity is generated through wind mill. For generating the electricity motor always move in forward direction. But sometimes motor will rotate in reverse direction so that negative voltage is generated so that we can overcome this system by using polarity changer and checker circuit. In this project when motor will move in forward direction the opt couplers give signal to the microcontroller. According to that microcontroller given signal to the relay1 which is attached to the battery terminal and charge the battery. Inverter is connected to the battery which gives dc to ac conversion. And that ac supply is given to the load.

But when motor will move in reverse direction then optocoupler2 gives signal to the microcontroller. According to that relay2 which is attached to the battery terminal and charge the battery. In these system then motor will move in reverse direction it gives positive voltage to the battery through relay2.

IV. METHODOLOGY OF PROJECT

We will construct and manufacturing an entirely unique electric generation system that fuses both form and function into a cost-effective and convenient solution. Using a stationary puller machine to generate electricity and charge a 12 volt battery, we will obtain an output power of approximately 60 watts – plenty of power for lights, an amplifier, an iPod charger, and any unforeseen additional loads the student group may attach later. The system provides about 5 hours of fully-loaded use, and requires the equivalent for charging.

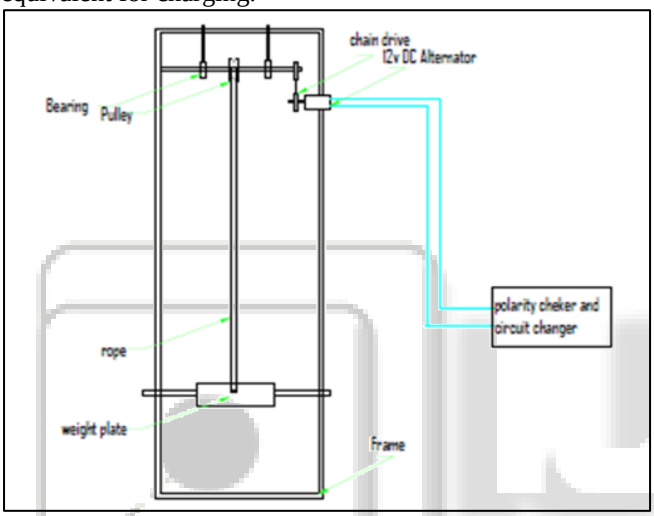

Fig. 2: 2D diagram of overall project in autocad

1) The system is comprised of several subsystems that will work collectively to efficiently produce the desired 50 to 150 watts of power.
2) The first subsystem is the mechanical connection which is will transfer the kinetic energy from pulling to the generator.
3) The second subsystem is the electrical generator. This subsystem transfers the rotational movement created when puller machine is in use to the rotor of a generator which will in turn output an AC voltage.
4) The third subsystem is the rectifier, which convert AC power to DC.
5) The fourth subsystem the battery and the battery charger. The Charge Controller adjusts the output to a single lead acid battery to optimize the use of the generated energy. This component will play a major factor in the efficiency of the system. The fifth subsystem is the inverter which convert the 12V DC to 12 V AC.
6) A sixth subsystem is the step up transformer which step up the 12V AC to 230V AC supply.
7) The seventh and final subsystem is the additional power supply for the battery when bicycle is not in use, which consists of single phase AC supply, rectifier and a step down transformer.

A. Elements of Proposed Design

1) Prime Mover
2) Generator(Alternator)
3) Battery
4) Rectifier
5) Inverter
6) Relay
7) Load
8) Battery Charger

1) Prime Mover

All generators, large and small, ac and dc require a source of mechanical power to turn their rotors. This source of mechanical energy is called a prime mover. Prime movers are divided into two classes for generators-high-speed and low-speed. The type of prime mover plays an important part in the design of alternators since the speed at which the rotor is turned determines certain characteristics of alternator construction and operation.

2) Generator (Alternator)

An alternator is an electrical generator that converts mechanical energy to electrical energy in the form of alternating current. Occasionally, a linear alternator or a rotating armature with a stationary magnetic field is used. In principle, any AC electrical generator can be called an alternator. The alternator consists of two main parts, rotor and the stator. Here the alternator is used to charge the battery and to power the electrical system when the pulling. The last practical option to implement for the puller machine system was to use a standard car alternator.

Battery

Battery is essential to supply DC power for the alternator rotor and for the storage of generated power. An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode, which allows current to flow out of the battery to perform work. Battery we used is 12V, 10 Ah rating.

3) Rectifier

Rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification.

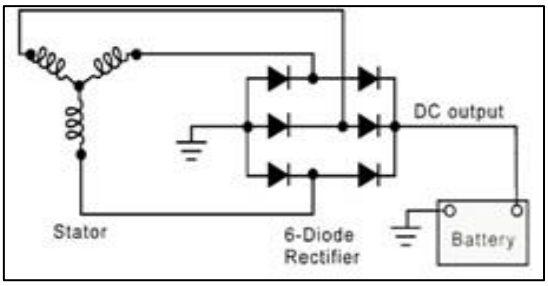

Fig. 3: Rectifier

Rectifier circuits may be single-phase or multi-phase. Most low power rectifiers for household equipment are single-phase, but three-phase rectification is very important for industrial applications and for the transmission of energy as DC.

4) Inverter

The inverter should be chosen so that its input voltage matches that of the storage battery. Suddenly, most inverters

are designed to operate at about 12V in order to function with standard lead-acid batteries.

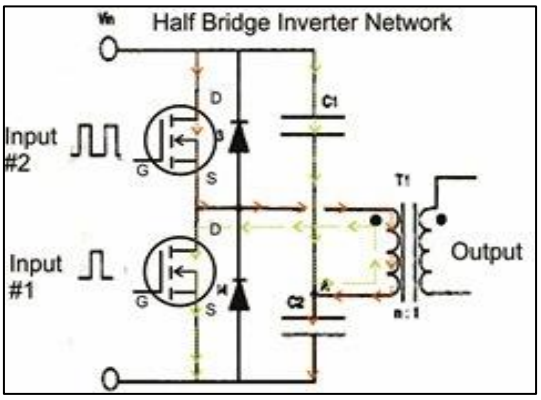

Fig. 6: Inverter

Inverter is a small circuit which will convert the direct current (DC) to alternating current (AC). The power of a battery is converted in to 'main voltages' or AC power. This power can be used for electronic appliances like television, mobile phones, computer etc. the main function of the inverter is to convert DC to AC and step-up transformer is used to create main voltages from resulting AC.

5) Relay:

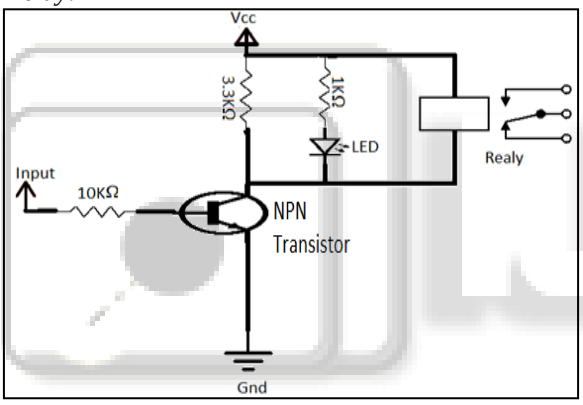

Fig. 7: Relay

Relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. A relay is used for electronic to electrical interfacing i.e. it is used to switch on or off electrical circuits operating at high AC voltage using a low DC control voltage.

6) Load

Load is the generic term for something in the circuit that will draw power. Anything that uses electricity to do work will draw current. The amount depends on how much resistance to current flow the device has and the amount of voltage applied to it. Here we are using a 40W incandescent lamp as load.

7) Battery Charger

A battery charger is a device used to put energy into a cell or (rechargeable) battery by forcing an electric current through it. Lead acid battery chargers typically have two tasks to accomplish. The first is to restore capacity, often as quickly as practical. The second is to maintain capacity by compensating for self-discharge.

V. Element Specifications: Our design will provide all of the following

A. Bicycle

A stationary bicycle with belt and pulley arrangement

B. Alternator

120VA, 12V, 10A, 300 rpm alternator

C. Rectifier

Three phase bridge rectifier. Diode used IN4007

D. Battery

10Ah 12VDC deep cycle lead acid battery for compatibility, convenience, and cost.

Single phase 230V AC supply, step down transformer and rectifier provide additional source for the battery.

E. Rectifier

Single phase full wave rectifier. Diode use In4007

F. Inverter

100W MOSFET inverter with 12V AC output.

1) Load

40W 230V incandescent bulb is connected as load.

VI. Cost Estimation

A. Material Details

Sr.	Gym Equipment	Materials
1.	Frame	Mildsteel
2.	Bearing	Std.
3.	Chain Drive	Std.
4.	Connecting wire	Plastic
5.	Dynamometer	Std.
6.	Control circuit	Std.
7.	Battery	Lead-acid
8.	Pulley	Std.

Table 1: Material Detail

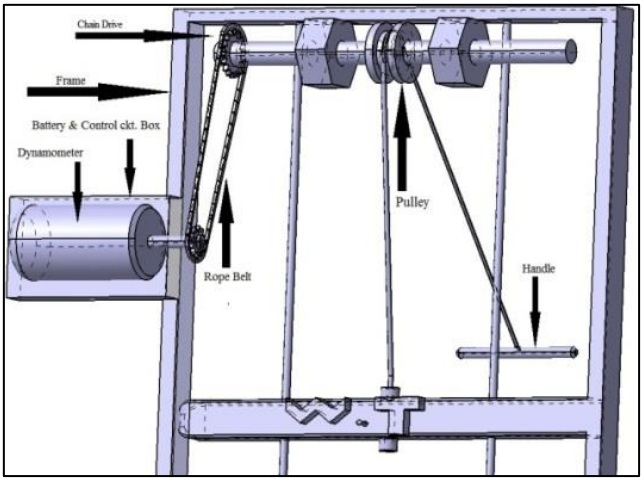

Fig. 8:

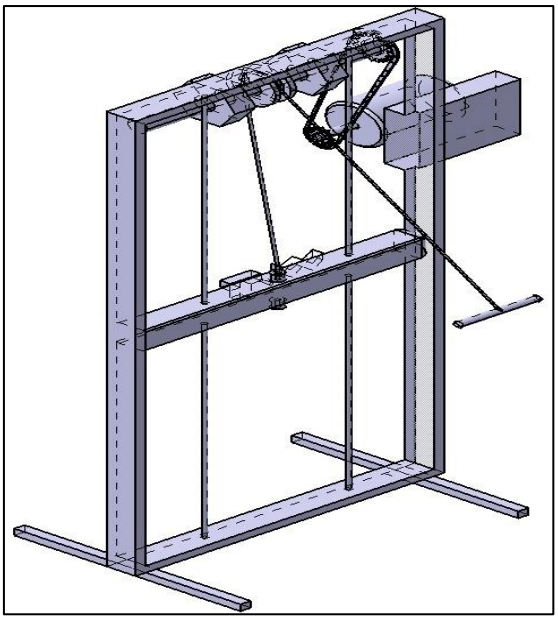

Fig. 8:

B. Cost Estimation

Cost of project = Materials cost (A) + Labour cost (B) + Overhead Charges (C) + Miscellaneous cost (D)
Cost of project = A+B+C+D

C. Labour Cost

Lathe, Drilling, Welding, Grinding, Power Hacksaw, Gas Cutting:
∴Cost = Rs. --/-

D. Overhead Charges

The overhead charges are arrived by "Manufacturing cost"
Manufacturing Cost = Rs. (Material Cost + Labour cost)
= Rs. (---/-)
Overhead Charges = --% of the manufacturing cost= Rs. ---/-

E. Miscellaneous Cost

Total cost = Rs (Material Cost + Labour cost + Overhead Charges+ Miscellaneous cost)

VII. Applications

- Power generation using gym pulling can be used most of places such As Colleges, School ,Gym centre
- It is use for plenty of power for lights, an amplifier, and an iPod charger.

VIII. Advantages

- It is clean and eco-friendly energy.
- Low maintenance cost.
- It does not require any fossil fuel.
- It does not produce harmful effect on environment.
- Human health benefit.

IX. Disadvantages

- Less amount of power generation nearly 30-40 W.
- Intermittent power generation.
- Mechanical moving parts are is more.

X. Expected Outcome

In the existing system the gym is used as the equipment for electrical energy generation. Which cannot be used to generate electricity during night time.In the proposed system we are using the Exercising puller machine Equipment for electric power generation. In this electric power is generated even though the absence of sunlight. We will construct in bring in new ideas equipment for generating electricity by using puller machine, alternator, inverter, battery, step up and step down transformer, rectifier circuit and incandescent lamp. The 230 V single phase 50Hz output supply and it is used to light 40W incandescent lamp.

XI. Conclusion

We purpose and a put into effect innovative exercise equipment to generate electrical power for the house appliances. These models vary in complexity and accuracy and therefore the model chosen must match the application for which it is needed. It will be very helpful for the rural areas.In this day where the world is challenged to be more responsible sourcing of electrical power. If additional design and study of this concept proves it effective in energy use reduction, localized energy delivery and sustainability education, it could productive with effort.

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