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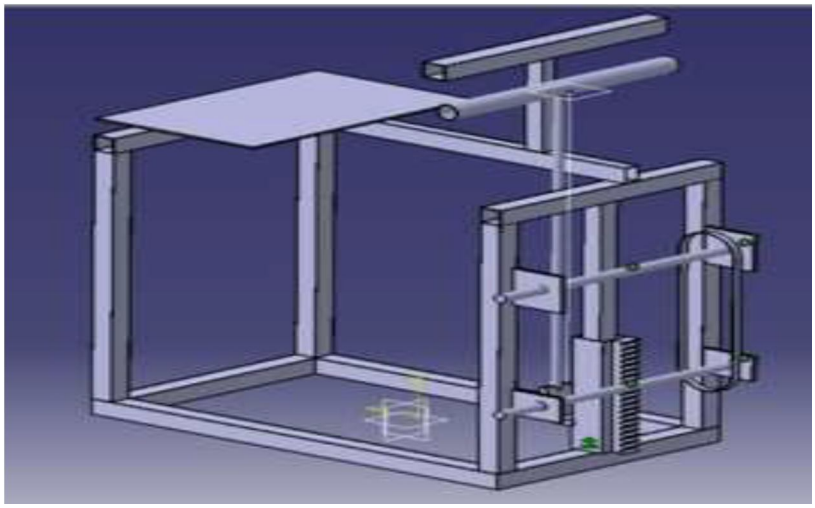
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Fabrication of Forearm Energy Generation

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I. INTRODUCTION

Energy neither be created nor be destroyed but can be converted from one form of energy to another. Energy is everywhere and drives everything. Today's modern life has become more dependent on energy and there is no limit to utilizing it. We have used energy at an increasing rate ever since we have come on this earth a few million years ago. We have come a far way without realizing how much energy we have wasted. In this modern life, we have many electronic gadgets and even vehicles that run on electric power. The following document outlines an investigation of the benefits of implementing a human-powered energy harvesting system that will be housed within a gym and used to offset the gym's requirements. The energy harvesting system in this project will be based on a rack and pinion mechanism by converting vertical motion into rotational motion. The pinion attached to the shaft rotates the alternator which generates electric power. Whenever the person is allowed to pass over the forearm gym equipment the spring attached to it gets compressed and as the rack attached at the bottom moves down the reciprocating motion is converted into the rotary motion with a certain RPM. The alternator connected to the pinion will generate electric power. The great outdoor gym (TGO) company in the United Kingdom has been producing energy-generating gymnasium equipment for cardio charge and lightning



World net electricity generation increased by 45%, rising from 23.4 trillion kilowatt-hours (kWh) in 2015 to 30.4 trillion kWh in 2040. The proposed forearm gym equipment will produce energy from the moving parts of the gymnasium machinery increasing the potential of renewable energy sources. Due to the development of modern technology, it would be possible to use human power more efficiently. Energy is everywhere and drives everything. Our modern lives, both individual and societal, are highly dependent on energy. It is the motive force within our bodies, propelling our vehicles, lighting our world. Consider a dead cell phone battery; living without energy, for even ten minutes, it says how important it is on daily activities. At the same time, the rate of consumption of energy is increasing day by day. If this continues, we will be left out with no energy sources in future. As a result, the scientists are now searching for the development of sustainable green energy sources like biomass, wind energy, solar energy, hydro power, tidal power, and human power. We need to think in such a way that how the energy demand of the world can be fulfilled. Pull up pull-down power is the transfer of energy from a human source through the use of rack and pinion system. This technology is most commonly used for gym center or house. less commonly gym power is used to power agricultural and hand tools and even to generate electricity. Some application includes battery charge home appliance. Whenever the person is allowed to pass over the gym pull up pull down. As the spring are attached to gym equipment, they get compressed and the rack, which is attached to, the bottom of the rod moves down reciprocating motion of rack in to rotary with certain RPM these shafts are connected through a chain drive to the dynamos, which converts the mechanical energy into electrical energy.

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II. OBJECTIVES

The 'Power generation through forearm machine' Project has developed an enhanced exercise system focused on improving the efficiency of current energy-harvesting equipment. This report has been created for the purpose of presenting all information regarding the research, design, processes, materials, work schedule, and completed model of the project. The central concept involves harnessing energy from an exercise machine through the use of a generator.

To know some details about the energy crisis in world at current situation

1) To understand what is Energy Harvesting and the need for it: also, the sources of energy harvesting
2) To understand in detail the Human Power Energy Harvesting.
3) To analyse the power consumption in a regular gym.
4) Analyse the concept of Green Gym and survey on the existing equipment which harness the Human Power into useful electrical energy , Implementation of the pneumatic technology.

III. LITERATURE REVIEW

A. *Power Generation through Gym Equipment*

Ansari Saddam Husain, Gujja Govardhan, Gund Kumar, Mohd Ahmed, Vivek Tiwari, Yakub Khan, (2012), ISOR Journal of Engineering.

In this paper, the main objective is to develop power using Gym Equipment. The amount of power is less than nearly 30-40w and the power generation is not continuous. They have used more mechanical parts which result in less power generation.

B. *Lat Pull-Down Machine Power Generation*

M. Muttu Subash, S. Prathiban, (2016), International Journal of Engineering Science and Computing.

In this paper, the main intention of the project is to generate power in the smart and maximum amount of power generation with minimum effort. Many calculative methods are used to design shaft, chain, and sprocket to get the required output power. The fabricated model is tested practically and corresponding graphs are obtained to generate more power fitness centers.

C. *Power Generation by Gym Pull-Up Machine*

Roshan Ojha, Shravan Kumar, Rahul Raj, T. Hari Prasad, Naveen Kumar, Dr. K.S. Bhadrinarayan (2016), International Research Journal of Engineering and Technology. In this paper, the project is developed by the integration of all the hardware components such as rack, gears, springs, and dynamo. The presence of every model is reasoned out and placed carefully to contribute to the best working unit.

D. *Turning Workout into Electricity Using Lat Pull-down Machine*

Saylee Bidwai, Amruta Jaykar, Shivani Sinde, (2017), International Journal of Engineering and Technology.

In this paper, the main objective of the project is to contribute a vital role in reducing the energy demand and rectifying the villages with the help of cycling equipment. Prime mover is the main part of the equipment which is used to run 250W, 24V, 2650rpm motor. A 12V, 7.5Ah battery is used to convert DC Voltage to AC Voltage. The energy from the equipment is used for light bulbs, laptops, mobile charging, etc, and helps in reducing electricity shortages in villages.

E. *Energy Harvesting from Gym Equipments*

Madhup Kumar, Dr. G S Mundada, (2017), International Journal of Innovative Research in Electrical, Electronics, Instrumental, and Control Engineering. The main objective of this paper is to harvest energy from Gym equipment. Power generated by a single exercise machine is saving 288 rupees per month for a ceiling fan.

IV. WORKING PRINCIPAL

In this project, we have used rack and pinion gears which comprise a circular gear (the pinion) meshes to the linear gear (the rack), which operates to translate linear motion into rotational motion. Our system makes use of a gripping rod that is connected to a spring-based mechanism having a rack and pinion which converts linear to rotary motion to generate power and the system provides resistance to the exercise movement during power generation hence it is a dual-purpose machine (exercise equipment as well as for power generation). Hereby we make use of an energy harvester system which is used to convert the kinetic energy of the human efforts on the machine to electrical energy. To generate power from the equipment, a DC motor has been used

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We hereby make use of an energy harvester system that moves in response to movement of the motion of an forearms exercise machine for converting kinetic energy of the forearms exercise equipment into electrical power. Our system makes use of the gripping rod connected to spring based motorized mechanism having rack pinion arrangement and multiple motors to power the system and generate power. The system aims to provide resistance to forearms movement while generating power from the same thus serving dual purpose. The machine makes use of 3 motor arrangement to provide 3 levels of generation capability. The machine aims to generate electricity through horizontal motion created while working our forearms. The spring based mechanism allows for efficient resistance settings in the machine as needed. Increased resistance leads to increased power generation in the machine.

V. CONCEPTUAL DESIGN

A. Our Innovation

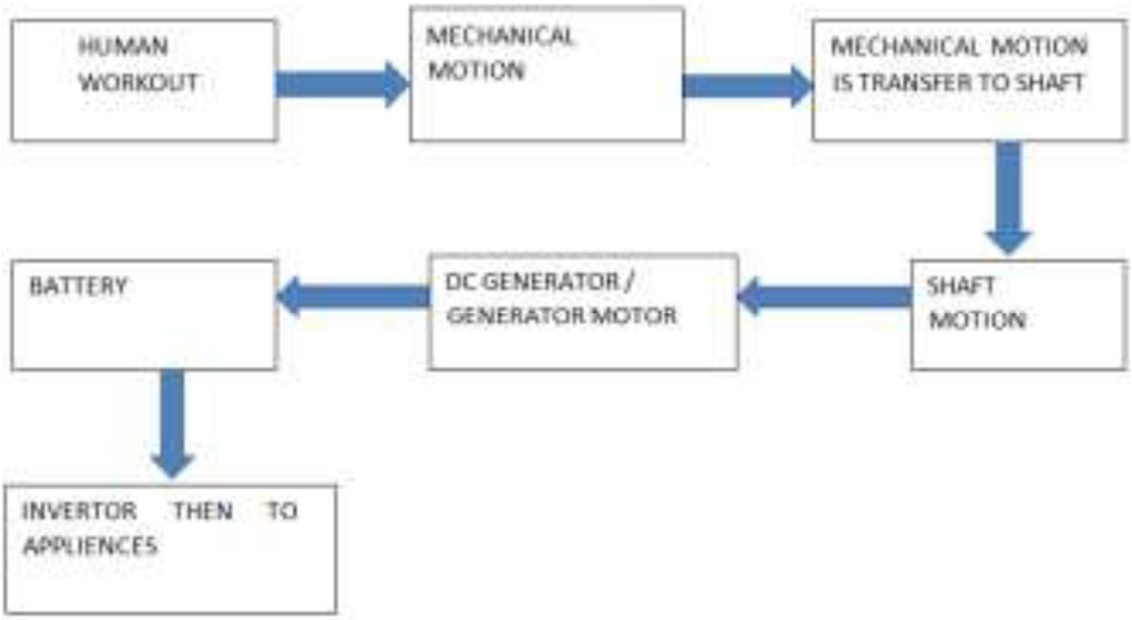
Human work is converted into mechanical motion with the help of various mechanical parts. Then this mechanical motion is transferred to shaft and it convert into shaft motion the shaft is coupled with DC motor and DC motor is
coupled with battery to store electricity and drive from the battery when it needed



B. Working Principle

A rack and pinion is a type of linear actuator that comprises a circular gear (the pinion) engaging a linear gear (the rack), which operate to translate rotational motion into linear motion. Driving the pinion into rotation causes the rack to be driven linearly. Driving the rack linearly will cause the pinion to be driven into a rotation. A rack and pinion drive can use both straight and helical gears. Helical gears are preferred due to their quieter operation and higher load bearing capacity. The maximum force that can be transmitted in a rack and pinion mechanism is determined by the tooth pitch and the size of the pinion.
A gym powered electric generator provides a method of generating electricity by means of a modified stationary gym equipment for use in electrical energy

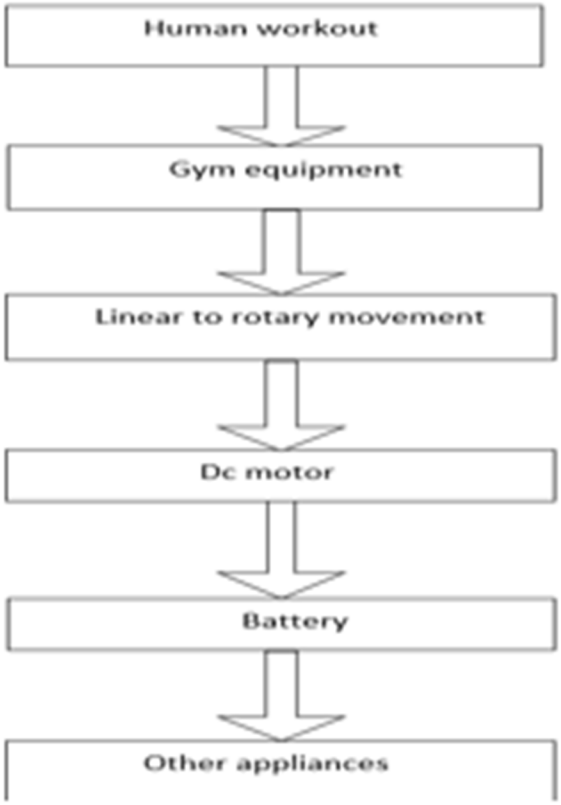
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C. Block Diagram

Forearms power generation project is one of the smart power generation projects that aims at harnessing the mechanical energy produced through the gym equipment and converting this energy into useful electrical energy.

The kinetic energy produced during the horizontal motion is transmitted to a generator or dynamo through rack and pinion arrangement to produce electricity



The system provides resistance to the reciprocating movement with the help of springs while generating power.

Due to this resistive motion, the system has a greater tendency to restore back to its original position with minimum loss in energy.

D. Fabrication Process

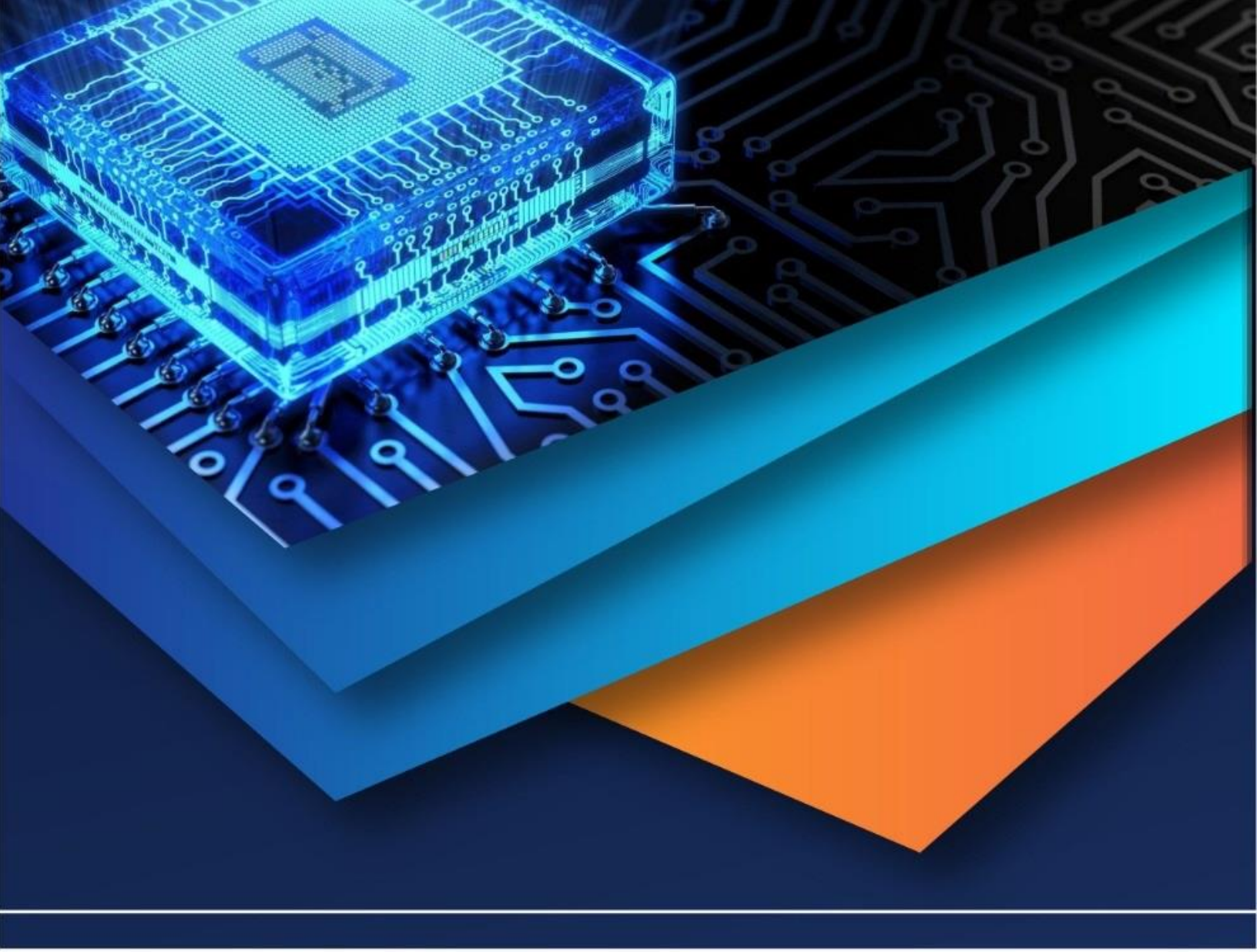
1) Fabrication of the frame structure,
2) Fabrication of the pillow block bearings to the frame,
3) Mounting the wheels on the axle by interference fit,
4) Mounting and aligning the crown wheel to the rear axle centre,
5) Inserting the axle through the pillow block bearing hubs,
6) Aligning and fabricating the pinion to the crown wheel,
7) Mounting the cutters and sprockets over the hub,
8) Placing and aligning the chain over rear and front sprockets,
9) Fabricating the handle to the frame

VI. RESULT

The project “Power Generator Forearms Machine” was designed such that to generate electrical power as non-conventional method by simply applying force by forearm. Non-conventional energy using forearm is converting mechanical energy into the electrical energy using reciprocating mechanism.

For this project the conversion of the force energy in to electrical energy. The control mechanism carries Rack and pinion, D.C generator, battery, simple reciprocating mechanism control. We have discussed the various applications and further extension also. The D.C generator used in this project is Permanent Magnet D.C generator. This DC geared motor such that its output is given to the reverse polarity preventer cum polarity corrector. We construct innovative exercise equipment for generating electricity. By using gym equipment, Dynamo, capacitor bank, rectifier circuit and LED lamp. We successfully take the 12 V output supply and it is used to light 3v led and 5v. When the exercise machine is not used, the main supply is used to charge the battery. So the battery also charges while the exercise machine is not in use. So provide a continuous supply. We construct innovative exercise equipment for generating electricity. By using gym equipment, Dynamo, capacitor bank, rectifier circuit and LED lamp. We successfully take the 12 V output supply and it is used to light 3v led and 5v. When the exercise machine is not used, the main supply is used to charge the battery. So the battery also charges while the exercise machine is not in use. So provide a continuous supply.

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