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DESIGN AND FABRICATION OF FLYWHEEL DRIVEN BATTERY CHARGER

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ABSTRACT-

Pedal operated energy generator is a device that utilises human energy to produce electricity to charge battery. The design was originally conceived to meet the energy needs of those living in rural areas. Our study focused on the design and fabrication of pedal operated power generator with an intention of exercising while generating electricity. Here a generator is used to generate electricity. The generator is coupled to a pulley which is rotated by a belt and chain- sprocket system of a bicycle structure. The input power is given to the paddle and final rotational speed is achieved in the generator rotor. Most components of the pedal power generator are based upon existing inventions, both recent and historic. This research brings together the fecundity of pedal power generation with exercising feasibility thus helping towards wellbeing. The integrated unit will generate needed electricity in-situ, and transport it to the site with pedal power. We think our project will inspire students and the public to think about the realities of exercising, energy utilization and production which may spark new solution. In many countries it can be used in rural and urban areas as a useful source of energy for conjugal family where the family members can itself charge the device for a short period of time or in public places such as parks and playgrounds where one can pedal and charge their electronic device in unison. This will not only produce electricity when needed but also an alternate way of physical exercise for them. Due to the low cost and maintenance, extensive use of this application of 'Paddle Powered Generator' can be a suitable source of free energy. Electronic devices such as mobiles, laptops have a 12 V battery. These devices have become very effective tool in modern world mode of communication in developing countries or least-developed countries (LDCs), it is easily available. But the problem arises on how to charge a mobile phone when the local power system is not available. The project was designed to be cheap, simple, durable, portable and easily be maintained. It was fabricated using nearby materials. The purpose of this project is to efficiently transfer human power to develop a pedal power battery charger system.

INTRODUCTION- The Pedal operated power generation utilizes human energy to produce electricity quickly and efficiently. This energy can be harness by using human efforts through the movement of human feet and hands in some cases for the generation of electricity. The use of pedal power also used for leg exercise and reduces the stiffness of the muscles. The use of pedal power developed over a time period. These days it has become a useful and viable option and an alternative source of generating energy. The energy generated in this process is also used to produce electricity. Usually in developing countries or least-developed countries (LDCs) use of pedal operated machines are still the key to run industry. These types of practices are most commonly used in order to frugal electricity and cut labour cost. The energy obtained from Pedal power has been employ in a really coherent manner and really special tools have been introduced essentially, flywheel helps to smooths out delivery of power for electrical energy and storages energy with a rotating mass whose function is to regulate the voltage of the lines attached to the flywheel. Historically these devices haven't used by humans to produce energy, but over the years it has proved to be a reliable source of energy production/generation. Another astonishing creation to utilize pedal power is through a pedal power generator. Pedal power generators produce electricity in a moment and allow one to charge the batteries of all kinds. Various forms of batteries which can be charged include laptop, mobile, cameras and ipod batteries. The aim of this project is to design and fabricate a pedal powered generation using flywheel apparatus and the battery charging widget. Pedal power is the source of getting energy from human beings. It can be explain as the transfer of energy generated through pedal operation using the movement of human feet and hands. The use of pedal power also strengths the muscles.

AIM & OBJECTIVE

Any project at its starting stage starts with setting of objectives followed by the ideas compared to get the best method to achieve the objective. Similarly for this project a lot of good ideas resulted in the model of Pedal Operated Flywheel Based Battery Charger.

From the literature we found out that its better and efficient to use a DC GENERATOR compared to alternator as it requires less torque. With discussion and research, we concluded that a battery charger along with a physical exercise will benefit the user as well as the physical health of the user, to enhance this idea towards reality we framed the following objectives for our project:

- To develop Flywheel driven battery charger pedal operated for a source of electricity in the rural area.
- To provide provision for mobile battery charging along with the charging of 12v battery.
- Serve the dual purpose of power generation and helping the person to maintain physical fitness through exercise.

Advantages:

1. Low maintenance
2. Low life
3. Low environmental impact
4. Excellent load following characteristics
5. No fuel or any other resources consumed

LITERATURE REVIEW-

Author	Anyanwu, S.Ikechukwu, Ashinze E Anthony
Paper Title	Design and Fabrication of a Pedal Operated Power Generator[1]
Mechanism	Pedal mechanism, Belt-pulley
Motion	Rotary motion
Construction	A stationary bike-pedal operated attached via a belt or pulley drive system driving a generator which is further connected to a blocking diode, fuse, battery and an inverter system.
Motion	Rotary motion
Mode of operation	Exercise bike, Pedal operated, Inverter system
Limitation	Higher amp-hour battery could have been used Charging mobile phones while in motion capability could have been added.
Take aways	Overall efficiency of this idea can be above 50(66.6%in this case) Easily a 15V 2.5A at a speed of 483rpm generator speed can be achieved.

Author	Pravin Dharmaraj Patil, Mahesh Ashok Marathe, Santosh D Barse
Paper Title	Design of human operated flywheel to generate 9v electricity.[2]
Mechanism	Pedal mechanism, chain drive system.
Motion	Rotary motion.
Construction	S.S Frame arrangement having an adjustable chair, pedal mechanism driving a freewheel through a chain, which in turn drives a flywheel. The shaft from the flywheel rotates the alternator. The electricity produced is then fed through the control circuit and to the inverter system and stored in a battery.
Mode of operation	Pedal operated.
Limitation	Common cycle frame could have been used Charging an electronic device feature is missing. Limited to only charging a battery.

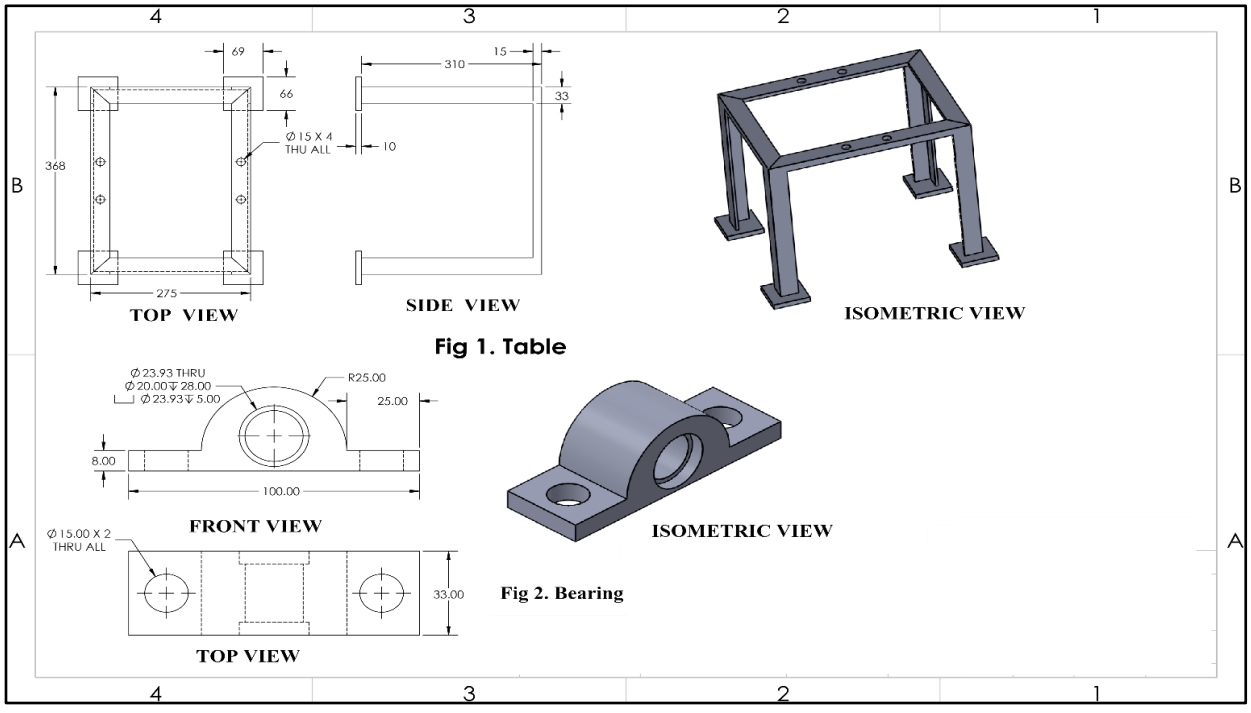
Author	Rajesh Kannan Megalingam, Pranav Sreedharan Veliyara[3]
Paper Title	Study of Pedal power generation.
Mechanism	Pedal mechanism, chain drive; Bottle dynamometer.
Motion	Rotary motion
Mode of operation	Pedal operated.
Takeaway	Dynamo/Generator can be used instead of alternator which produces electricity at low rpm(170-200rpm).

Author	Yadav R, Punith P, Sharatbabu, Dr. Jyothi P Koujalagi
Paper Title	Flywheel based bicycle generator[5]
Mechanism	Pedal mechanism, belt-pulleys drive system.
Motion	Rotary Motion
Construction	The Permanent Magnet Direct Current (PMDC) generator is clamped on the rear wheel of the bi-cycle. As the rear wheel rotates the pulley system rotates the flywheel which in turn rotates the PMDC generator. The battery is mounted on the rear bi-cycle carrier.
Mode of operation	Pedal operated
Limitation	Not stationary have to ride the bi-cycle to generate the electricity. 8-10kmph to produced 12volts.

Author	M. T Islam, S Bhattacharjee and M A Islam
Paper Title	Design & fabrication of a pedal powered mobile phone charger[6]
Mechanism	Pedal mechanism, chain drive; Bottle dynamometer.
Motion	Rotary motion
Construction	Clamped the dynamo in the rear wheel of the bi-cycle. The dynamo roller is engaged in such a way that when the wheel rotates the roller also rotate at a certain rpm and generate AC voltage.
Mode of operation	Pedal operated.
Limitation	No systematic arrangement of circuit board.

Author	Swapnil Pramod Waykole, Pankaj Prakash Ande
Paper Title	Flywheel Based Battery Charger[4]
Mechanism	Pedal mechanism, Chain drive system
Motion	Rotary motion
Construction	Stainless Steel frame with a base on which a pedal mechanism is provided driving a flywheel via a chain drive. This flywheel is driving the generator directly through a belt drive and stores the energy in a secondary battery.
Mode of operation	Pedal operated.
Take aways	The potential of this project is high and has the ability to give massive positive returns.

DESIGN



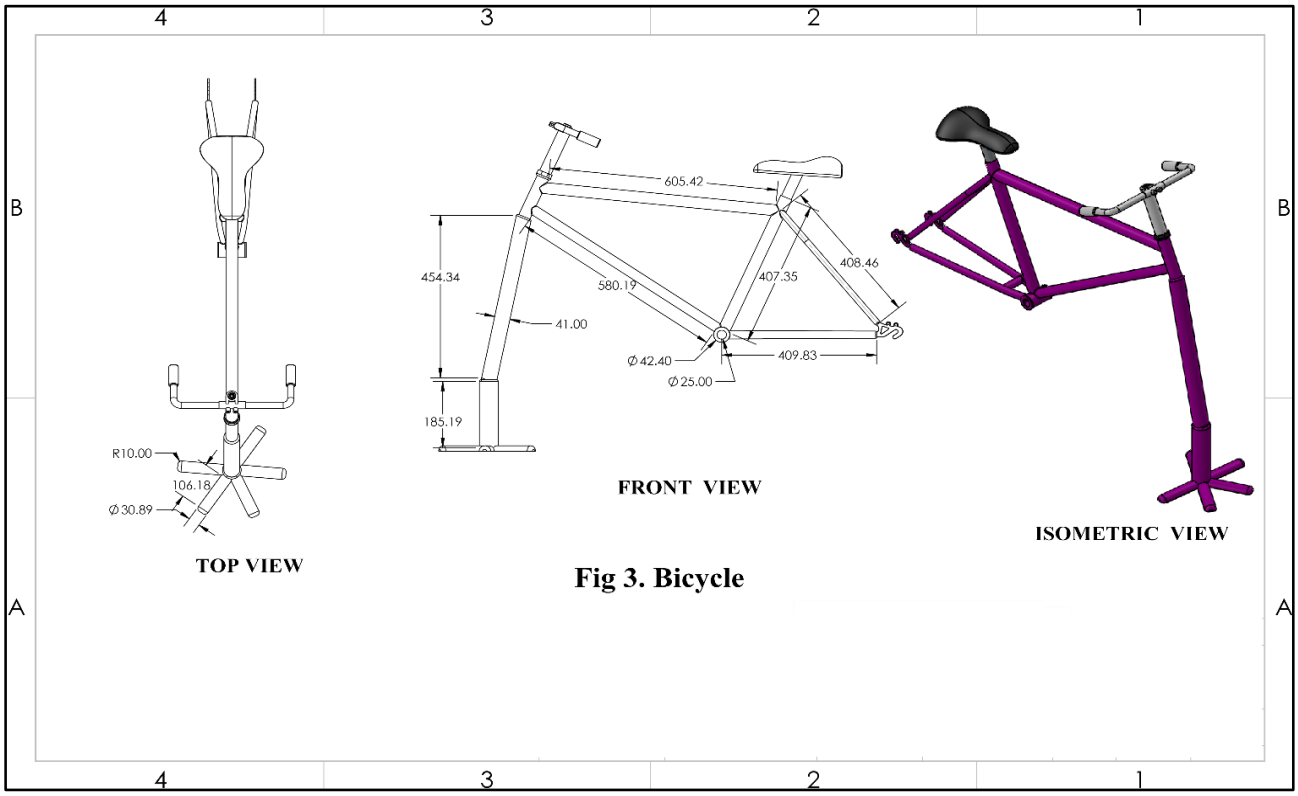


Fig 3. Bicycle

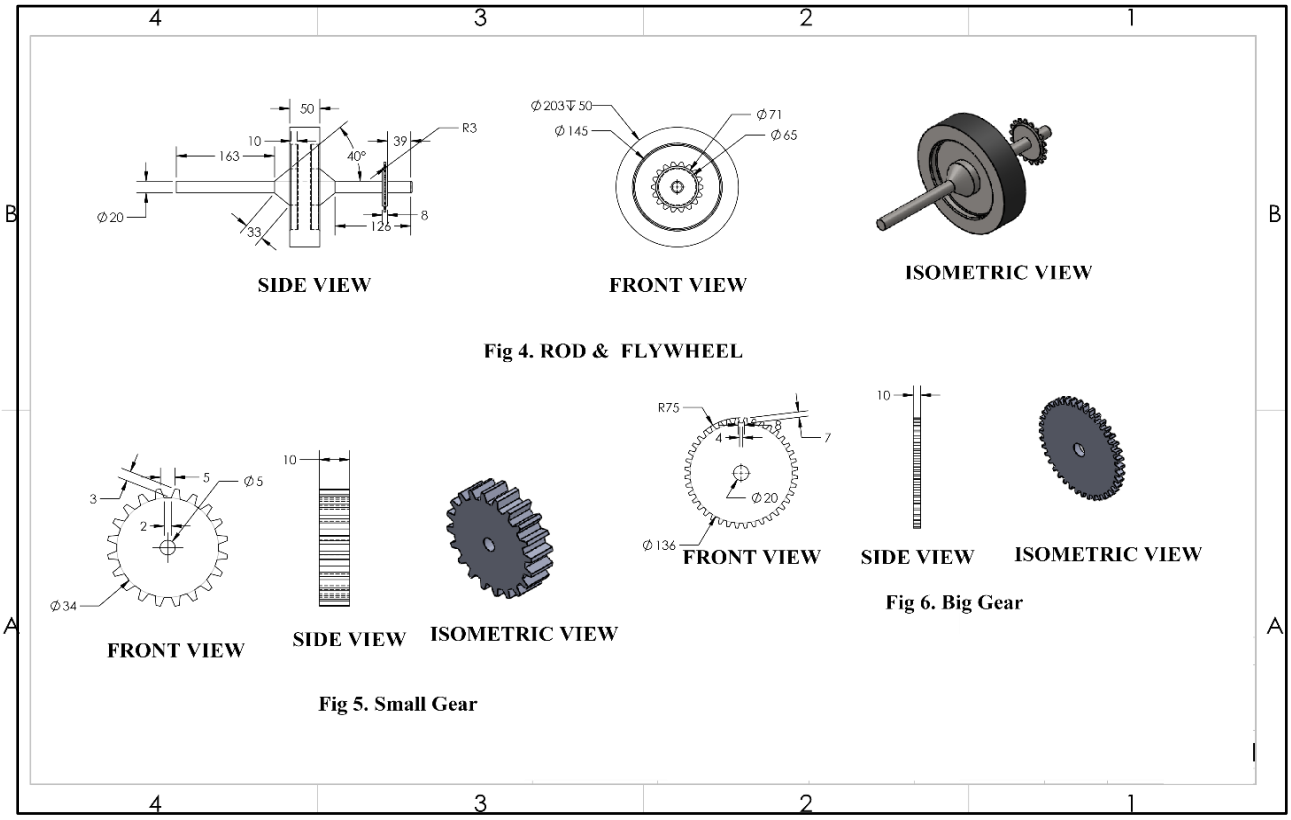
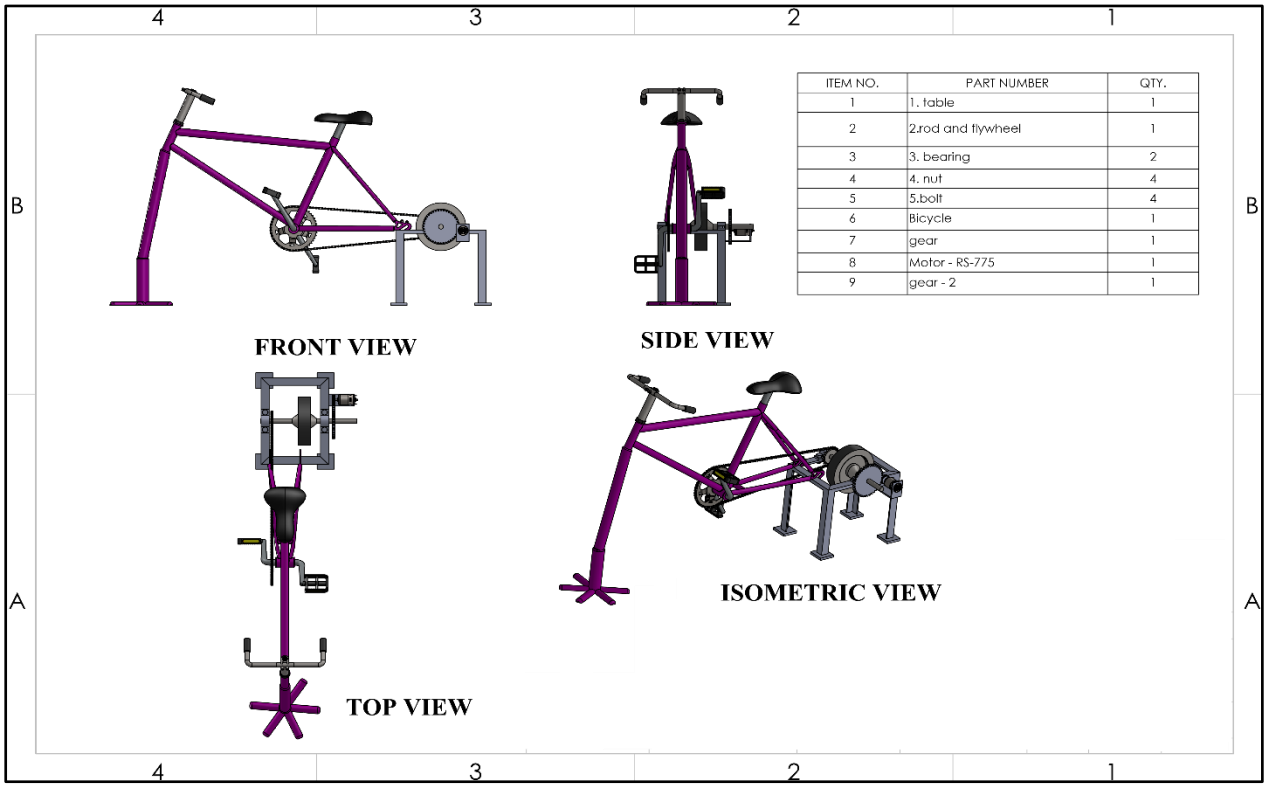


Fig 4. ROD & FLYWHEEL

Fig 5. Small Gear

Fig 6. Big Gear



ITEM NO.	PART NUMBER	QTY.
1	1. table	1
2	2.rod and flywheel	1
3	3. bearing	2
4	4. nut	4
5	5.bolt	4
6	Bicycle	1
7	gear	1
8	Motor - RS-775	1
9	gear - 2	1

CALCULATION-

First when the user pedals the machine the large sprocket is rotated at a speed equal to the rotation of the pedal. This large Sprocket has 44 teeth. The large sprocket is connected by a chain with the small sprocket of 16 teeth.

Let the large sprocket rotates at a speed N1 and the small sprocket rotates at a speed N_2. So, the relation of the rotation of the two sprockets is $\frac{N2}{N1} = \frac{44}{16}$

Now the small sprocket has the same shaft with the large gear

So, the larger gear rotates at the same speed as the small sprocket. So, if the speed of the large gear is N_3 then N_2=N3 = 165rpm

Here no of teeth on large gear is 59 and small gear is 14 and let the speed of the small gear be N_4. So

$\frac{N4}{N3} = \frac{59}{14}$= 4.21

Now, $\frac{N4}{165} = 4.21$

N4=4.21x 165=694.65rpm

Motor rpm =694.65rpm.

CONCLUSION & FUTURE SCOPE-

After going through various research and review papers, we are designing and developing a flywheel-based battery charger. This machine is mobile. At a time, it works as a battery charging device and also a n exercising device. Due to having a simple mechanism and working this machine can be used by people of any ages easily.

Charging and wellbeing of a person can be done simultaneously.

The performance of the machine can be further improved by taking the following steps:

1. A permanent magnet generator is a better option than AC alternator. It requires only the rotation of the rotor, no extra power for the magnetic field. It can also provide instant power supply. But it is rare now a days and one time use.
2. Flywheel is the simple solution of maintaining uniform speed. But, balancing of a flywheel is a difficult task. So, a heavy wheel can be used as a rear wheel of the cycle.
3. A larger wheel can provide greater speed to the rotor. At the same time, if smaller pulley is used in the alternator speed can be increased.
4. . Permanent joint (welding, riveting) should be avoided for easy maintenance and transportation. It also gives opportunity to use the bicycle
5. An adjustable cycle frame can be used so that people at different ages and sizes can pedal comfortably
6. Power can be tremendously increased by connecting same arrangement in series. Rickshaw can be used instead of bicycle so that two rear wheels can take part in electricity production

REFERENCE-

[1]. Design and Fabrication of a Pedal Operated Power Generator | Innovative Systems Design and Engineering. ISSN 2222-1727 (Paper) ISSN 2222-2871 (Online) Vol.7, No.3, 2016.

[2]. Design of human operated flywheel to generate 9v electricity | International Journal of engineering technology science and research. IJETSR www.ijetsr.com ISSN 2394-3386 Volume 5, Issue 4. April 2018.

[3] Conference: 3rd International Conference $n Emerging Trends In Engineering And Technology, (IETET - 2012)

[4]. Flywheel Based Battery Charger | International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064

[5]. Flywheel based bicycle generator | vol-2 issue-5 2017 ijariie-issn(o)-2395-4396

[6]. Design & Fabrication Of A Pedal Powered Mobile Phone Charger | International Conference On Mechanical Engineering And Renewable Energy 2013 (Icmere2013) 1 – 3 May 2014, Chittagong, Bangladesh Icmere2013-Pi-285.

[7]. Bicycle Power Generator | International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 p-ISSN: 2395-0072 Volume: 08 Issue: 05 | May 2021