



# DESIGN AND DEVELOPMENT OF AN ECO SUSTAINABLE TREADMILL BICYCLE

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**Abstract-**The abstract delves into the technical intricacies of the design, outlining the synchronization of treadmill and bicycle components. Special attention is given to the efficiency of the DC power generator, exploring its capacity to harness and convert the energy produced during exercise. The project's innovative approach is underscored by its potential to contribute to clean energy initiatives and promote eco-friendly fitness solutions. Consideration is also given to the health benefits of this hybrid exercise device. By combining the cardiovascular advantages of cycling and walking, users can experience a comprehensive workout that targets various muscle groups. The abstract emphasizes the potential impact on personal fitness routines and the broader fitness industry. Moreover, the abstract discusses the applications of the Treadmill Bicycle beyond individual use. The generated DC power could find applications in powering small electronic devices or feeding into local energy grids. The project's interdisciplinary nature, bridging fitness and renewable energy, is highlighted as a key strength. This Treadmill Bicycle with a DC power generator represents an innovative convergence of exercise and sustainable technology. The abstract encapsulates the project's technical aspects, health benefits, and potential societal contributions, positioning it as a pioneering solution at the intersection of fitness and renewable energy.

## CHAPTER 1

### INTRODUCTION

The treadmill bicycle is completely a new way of moving which is designed mostly for runners. Basically, using a treadmill is similar to running, hiking or walking. Think about the last time you were riding a bike over a few obstacles such as train tracks, potholes, speed bumps etc. The possibilities are you stood up on the pedals to improve your balance when crossing the obstacle. Basically, the treadmill bicycle will provide the rider a well-balanced position the entire time. Since it uses no fuel it a very conventional option for people in their busy schedule to take care of their health completely. People with a busy schedule will also be able to take care of their health and physical fitness. Above all, it is not a conventional treadmill to make use of only in closed rooms, people using treadmill bicycles can roam around freely on roads as well. This project overcomes the drawback of the conventional treadmill which is stationary and moreover the jogger gets exposed to the natural atmosphere too. So this proposed methodology provides an ultimate solution by making use of the wheels and making the treadmill bicycle a walking cycle. The walking cycle has a simple mechanism, operated with free wheels, gear chain, bearing shaft and links arrangement. The conversion of the linear motion into rotary motion is done by the gear chain and free wheel mechanisms of the linkages, which involves very simple movements. The rotary motion is again converted into linear motion of the cycle through mechanical linkages (gear chain and free wheels) arrangement. The conveyor system is either a continuous movement or intermittent which depends on the person's usage. So a basic free wheel mechanism with bearings is designed with time delay which can be used to halt the movement when necessary. This invention relates to improvements in transport devices, and it relates particularly to devices for transferring people, small in number like that of a bike or a cycle. The Walking Bicycle is the one, which combines walking and cycling into one activity. The Walking Bicycle combines the two activities into a linear motion, allowing you to propel yourself forward at desired speed, simply by walking on the belt provided. Usually, the operation of the walking cycle machine is controlled by the user itself by simply walking on the treadmill belt and also balancing the cycle. The operating speed of the walking cycle differs on the amount of force applied by the user.

**CHAPTER 2****LITERATURE SURVEY****Manish Debnath et al, Generation of electricity by running on a leg powered treadmill [2015].**

Manish Debnath et al (2015) proposed an eco-friendly method of generating electricity. They proposed the feasibility of this method for the remote areas where the electricity is beyond the reach of common people. Their suggested treadmill can be easily operated by anyone as the small connected DC generators require very small torque. Their method can reduce a significant portion of our consumption of fossil fuel, spent for generating electricity.

**Shamshad Ali et al, Design of manual treadmill with electricity generator for energy saving [2015].**

Shamshad Ali et al (2015) designed simple and sustainable manual treadmill with Electricity. They suggested that this manual treadmill can manage a wide range of health problems and improve strength of muscles. They emphasised that this manual treadmill with Electricity Generator can reduce Green House Gases up to some extent.

**Gopinath.R et al, Power generating using human foot step with piezoelectric sensor and treadmill [2018].**

Gopinath et al (2018) proposed a technique that can produce electricity with the assistance of electricity components that create use of the energy of human footsteps and storing of the charge by converter employed in the circuit for future applications. They suggested the need of constant increase of power to be met by putting in the systems in heavily packed places to overcome the energy crises however conjointly build up a healthy encompassing.

**Ravindra Burkul et al, Treadmill Bike [2018].**

Ravindra Burkul et al (2018) developed a branch and bound approach to optimize the 'Treadmill Electric Bicycle' serving the purpose of exercise and to reduce the use of non renewable energy resources. They created a platform in which mechanical energy is converted into linear motion. Their proposed prototype can be a good promoted area to use the energy being wasted on treadmills in fitness centres, not only to save energy but also to create a new idea of energy distribution in electrical field which is a common need for everyone in future.

**V.R. Gandhewar et al, Utility and Application of Treadmill Bicycle [2017].**

Gandhewar et al (2017) proposed a project creating a platform in which mechanical energy is converted into linear motion. Their highly fuel-saving technology based prototype was promised to utilise the energy being wasted on treadmills in fitness centres. They investigated its application as an indoor locomotive device infrastructure with large roof span i.e. malls, warehouse, open markets, large office spaces, etc.

**Masuma Akter et al, Electricity Generation from Treadmill Using Piezoelectric Transducer [2017].**

Masuma Akter et al (2017) proposed the idea of utilizing the wastage energy from human locomotion. They investigated observed as millions of people move every day in cities, significant amount of electricity can be generated by installing feasible devices at places where public walk everyday like railway stations, shopping malls, roadways, densely populated public spots etc. Their piezoelectric system can be a practical product for capturing footstep power.

**Vikas Pansare et al, Power generation from rotating shaft of manual Treadmill [2019].**

Vikas Pansare et al (2019) proposed a project that can achieve all the power requirements for basic daily household needs such as inverter battery charging for auxiliary power supply, mobile and other electronic device charging.

**Abhiram et al, Electricity Generation Using Treadmill Tricycle [2017].**

Abhiram et al (2017) proposed a new model of tricycle which is combination of treadmill and tricycle. They investigated that the treadmill tricycle can be used in place of regular bike at reduced initial and running cost. They suggested it as a future vehicle and it does not emit any pollutants, it is an eco-friendly vehicle.

**Kunal Titare et al, Design and Fabrication of Power Generating Manual Treadmill [2018].**

Kunal Titare et al (2018) observed during the test run of the project that the current was obtained at some specific speed. They further calculated the current output, taken out from the motor to battery and investigated that the assembly of treadmill so obtained is free from any failure and deformation.

**R.Harsha et al, Design and fabrication of treadmill bicycle [2018].**

Harsha et al (2018) developed a treadmill based human power generator using an electromagnetic dynamo generator coupled to a manual treadmill's flywheel. They investigated that a human power treadmill generator could help reduce energy consumption significantly in the gym environment. They emphasised application of the treadmill generator for a low-cost, quick to implement, simple to operate, and low maintenance solution in isolated areas such as rural countryside or developing countries. They discussed application of the treadmill as an educational tool to give people a physical perspective on quantities in energy, helping realize the importance of energy conservation. They observed that in current era, the method of human power generation could be a solution that also helps mitigate the issue of obesity and overweight.

**CHAPTER 3****IDENTIFICATION OF PROBLEM & OBJECTIVE****3.1. PROBLEM DEFINITION:**

While working out in the gym people use treadmill for the purpose of jogging and running. The main drawback of treadmill is that it is stationary. That becomes boring for user to run in a still surrounding with natural exposure to environment. Similarly cycling in the conventional way is common and not possible for all age groups as old people prefer walking. Even for travelling short distance people prefer vehicles that cause pollution and wastage of energy in terms of fuel. So, we came up with the concept of walking bicycle.

- In our day to day life we see that many people's use bikes cars as a source of transportation, This results in environmental pollution and fuel consumption.
- In manual treadmill the motion of the treadmill is rough to overcome this we use a motor to rotate the rotors.
- Batteries which are widely used in automobile sector is not rechargeable thus when they disposed create pollution.
- To improve all above phenomenon we take initiative by designing something which would help to reduce these harmful results.

**3.2. OBJECTIVE:**

Treadmill cycle is the new way of locomotion. It makes workout more interesting and competitive. There is no need to get stuck in the gym at a corner when you can roam while you hectic schedule. workout. Secondly, looking from the ever-growing problem of pollution, this cycle turns out to be eco-friendly without emission of harmful pollutants. Moreover it saves fuel thus helping in saving the natural resources. Lastly, in this metropolitan world, people are ignoring their health and fitness. This cycle would be a boon for such fitness deprived people having

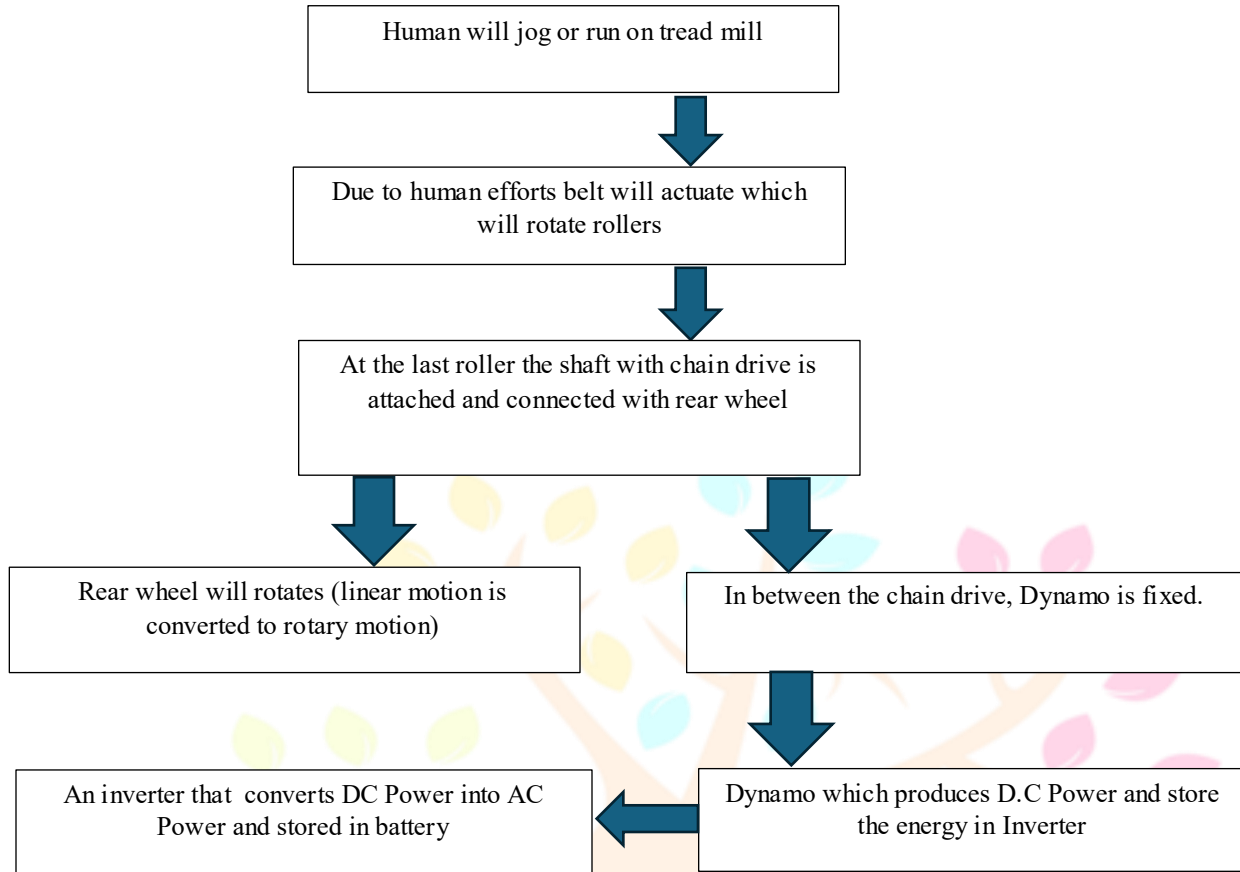
- Useful for exercise purpose.
- To reduce the use of non-renewable energy sources.

**3.3. NOVELTY OF THIS PROJECT:**

- In existing projects, E - Treadmill which uses electric brushless DC motor or Hub motor to run the E - treadmill bicycle, by using this method offers certain advantages, there are also potential disadvantages to consider.
  - Reduced pedal efficiency
  - Battery dependence
  - Cost
  - Maintenance complexity
  - Weight
- So, we used DC power generator to produce power and stored in battery with help of inverter in treadmill bicycle.
- The novelty of the treadmill bicycle with a power generator project lies in its dual-purpose functionality, seamlessly merging fitness and renewable energy generation. Unlike traditional exercise equipment, this project transforms the kinetic energy produced during physical activity into electrical power through a dynamo power generator. This innovative approach not only promotes a healthier lifestyle but also harnesses and stores the generated energy in an inverter.

Key aspects of novelty include:

- Green Energy Integration
- Compact Design
- Efficient Energy Storage
- Eco-Friendly Exercise
- Practical Implementation
- Overall, the novelty of this project lies in its ability to transform routine exercise into a meaningful and tangible contribution to renewable energy, offering a unique and sustainable solution for fitness enthusiasts and environmentally conscious individuals alike.

**CHAPTER 4****WORKING METHODOLOGY OF TREADMILL BICYCLE**

The fabrication of the treadmill traveller is very advantageous because of its simple construction and easy working principle. To say in a one line, this machine follows the action of the user. That is, when the driver walks forward, the machine moves forward and when he walks backward, the machine moves backward. A treadmill setup is made so that the operator can walk on the belt. A handle is placed in the front for the controlling of the vehicle. The rollers above which the conveyor belt (treadmill belt), held in tension are coupled to the wheels of the machine, usually rear wheels. The rollers are connected by a suitable arrangement for efficient transmission of motion thus having minimal losses during the transmission of motion. The frame of the machine is designed in such a way that it is balanced and the operator doesn't put any effort in balancing the machine. Now when the operator walks forward, the conveyor belt moves in one direction which makes the wheels of the machine to rotate so that the machine moves front. When he walks backwards, the motion direction of the belt is reversed and thus the vehicle moves backwards.

**CHAPTER 5****LIST OF COMPONENTS & ITS DESCRIPTION****LIST OF COMPONENTS:**

- Rectangular pipe for frame
- Hollow circular pipe for roller
- Bearings
- Shafts
- Treadmill belt
- Bicycle fork
- Bicycle handlebar
- Bicycle wheels
- Bicycle sprockets
- Bicycle chain
- Dynamo
- Inverter



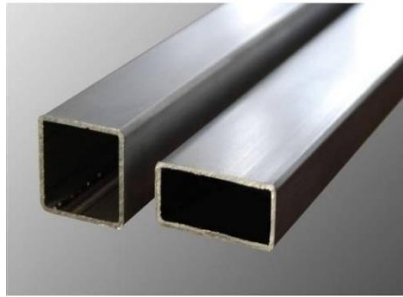
**DESCRIPTION:****5.1. RECTANGULAR PIPE FOR FRAME:**

Fig 5.1

- A Rectangular pipe is used to make a frame structure.
- A frame is often a structural system that supports other components of a physical construction and/or steel frame that limits the construction's extent.

**5.2. HOLLOW CIRCULAR PIPE FOR ROLLER:**

Fig 5.2

Hollow circular pipes are also known as round steel tubes. They are a common type of steel section used in many industries. Circular hollow sections are rolled from slit coil or steel sheet.

A treadmill roller is a hollow tube product. When buying a hollow circular pipe for a treadmill roller, you can consider these factors:

- Size: The size of the roller.
- Construction: Whether the roller is solid or hollow.
- Thickness: The size of the rolls goes up with the square of the increase in thickness.

**5.3. BEARING:**

The main purpose of bearings is to prevent direct metal-to-metal contact between two elements that are in relative motion. This prevents friction, heat generation and ultimately, the wear and tear of parts. It also reduces energy consumption as sliding motion is replaced with low-friction rolling.



Fig 5.3

A ball bearing is a type of rolling-element bearing that serves three main functions while it facilitates motion: it carries loads, reduces friction and positions moving machine parts. Ball bearings use balls to separate two "races," or bearing rings, to reduce surface contact and friction across moving planes.

**5.4. SHAFTS:**



Fig 5.4

Shafts are used in treadmills to transmit power between the source and the machine absorbing power.

For example, in a treadmill bicycle, a sun gear attached to the treadmill roller drives a gear on a shaft. This shaft is then transmitted to another shaft by increasing the gear ratio by 2.5 times. This shaft is then coupled with the gear fitted on the wheel.

Other uses of shafts in treadmills include:

Roller shaft: Extends through the treadmill rollers.

### 5.5. TREADMILL BELT:

A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium—the conveyor belt—that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. Today there are different types of conveyor belts that have been created for conveying different kinds of material available in PVC and rubber materials. The belt consists of one or more layers of material. Many belts in general material handling have two layers. An under layer of material to provide linear strength and shape called a carcass and an over layer called the cover.



Fig 5.5

### 5.6. BICYCLE FORK:

A bicycle fork connects the frame to the front wheel and helps the rider steer the bike. It's made from two fork ends that attach to the front wheel.

A bicycle fork consists of:

- A steerer tube
- A crown
- Fork legs
- A dropout for receiving wheel axle
- Brake mounts



Fig 5.6

### 5.7. BICYCLE HANDLEBAR:

A bicycle handlebar is a curved bar with handles that is used for steering a bicycle. It's the foundation for all of the bicycle's controls. The handlebar is mechanically linked to a pivoting front wheel via a stem, which attaches it to the fork.



Fig 5.7

### 5.8. BICYCLE WHEELS:



Fig 5.8

Bicycle wheels are a crucial part of a bicycle. They allow the rider to roll over the ground with great speed and efficiency. High quality wheels can make a ride feel smooth and fast.

### 5.9. BICYCLE SPROCKET:



Fig 5.9

Sprockets are sturdy wheels with teeth that lock onto a chain. As the sprocket spins, the teeth grab onto the chain and move other parts that interlock with the chain. This sequential series of operations allows for simple and controlled rotational movement of larger equipment and machinery.

### 5.10. BICYCLE CHAIN:

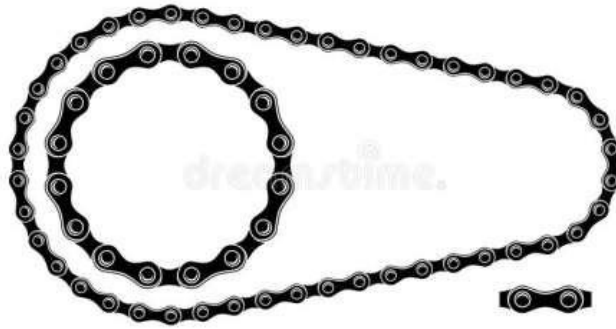


Fig 5.10

A bicycle chain is a roller chain that transfers power from the pedals to the drive-wheel of a bicycle, propelling it. A bicycle chain is made up of a series of links, comprised primarily of side plates, pins, and rollers. A chain is designed to mesh with the chainrings and cassette on the bike's drivetrain, to transfer your power through the pedals into forward propulsion.

Most bicycle chains are made from plain carbon or alloy steel, but some are nickel-plated to prevent rust, or simply for aesthetics.

### 5.11. DYNAMO:

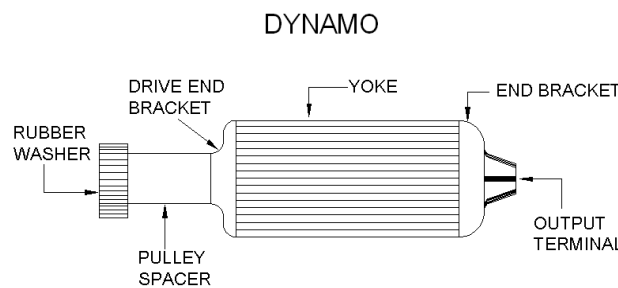


Fig 5.11

In a bicycle generator, a small dc generator is attached to one of the wheel of the bicycle. When the bicycle runs, the rotor which is attached to the cycle wheel also rotates and emf will be generated across the output terminals of the generator. This emf is then generally used for lighting the head-light of the bicycle and stored in battery.

### 5.12. INVERTER:

- An electrical inverter is a device that converts Direct current (DC) to Alternating current (AC).
- In this project we use a inverter that will step up the DC power from 12V to 27V. this inverter has an inbuilt battery with 12V 1.2Ah capacity this inverter will stores an energy with help of inbuilt lead acid battery . this inverter has a capability to run three 9V CFL bulbs for 3 hours.
- It is commonly used to power AC devices like appliances, from dc source such as battery.

## CHAPTER 6

### ADVANTAGES:

- The components used for the fabrication are simple and easily available.
- The cost of the system is less.
- No need of separate time for exercising.
- No need of skilled operators to operate this machine.



- Less maintenance is needed.
- Compact in size.
- Less weight.
- Easily portable.
- Inverter charges the battery automatically.
- Simple in construction.

#### APPLICATION:

- Exercise: Treadmill bicycles can help maintain a proper physique. They can also help burn fat, and can be used outdoors or on the way to work.
- Reduce non-renewable energy sources: Treadmill bicycles can be used to reduce the use of non-renewable energy sources.
- Connect with nature: Treadmill bicycles can allow people to connect with nature while running on a treadmill.
- Save time: Treadmill bicycles can save time for exercising.
- Travel: Treadmill bicycles can be used to travel from one place to another.

## CHAPTER 7

### MATERIAL AND COST ESTIMATION

Material	Cost estimation
Rectangular pipe for frame	600
Hollow circular pipe for roller	1200
Bearings (16)	800
Shafts	900
Tread mill belt	2400
Bicycle	1500
Dynamo	600
Inverter	1700
Fasteners	300
Lathe work and welding work	500
<b>Total cost</b>	<b>10,500</b>

## CHAPTER 8

### CONCLUSION

In conclusion, the treadmill bicycle DC power generator project successfully harnesses human energy to generate electricity. Through the integration of a treadmill mechanism with a bicycle, it promotes sustainable and eco-friendly power generation. The project offers a practical solution for fitness enthusiasts to contribute to clean energy production while engaging in physical activity. The generated DC power can be utilized for various applications, such as charging electronic devices or powering low-energy appliances. This innovative combination of exercise and renewable energy aligns with the growing emphasis on sustainable practices in our daily lives. As we pedal and walk, we simultaneously produce electricity, emphasizing the dual benefits of health and environmental consciousness. The project serves as a small-scale, decentralized energy solution with potential applications in off-grid or remote areas. Overall, it exemplifies the synergy between human motion and electricity generation, encouraging a greener approach to power production in a fitness-oriented context.

By this project we are creating a platform in which mechanical energy is converted into linear motion. By using our simple walking nature we are changing it to a good running speed by which we are not only saving energy but also recreating a formula of using small investment to a big amount of achievement. This prototype can be a good promoted area to use the energy being wasted on treadmills

in fitness canters. By using this prototype we can not only save energy but also create a new idea of energy distribution in electrical field which is a common need to everyone in the future.

## CHAPTER 9

### REFERENCE

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