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Frictionless Energy Generation Using Wheels

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Abstract

The increasing demand for energy and the depletion of conventional fossil fuels have encouraged researchers to explore alternative and sustainable methods of power generation. The present work focuses on the development of a frictionless energy generation system using a wheel, neodymium magnets, and electromagnetic coils. Unlike conventional bicycle dynamos and generators that rely on physical contact and consequently produce frictional losses, the proposed system utilizes electromagnetic induction without direct contact between moving and stationary components. A rotating wheel fitted with neodymium magnets passes through a stationary coil arrangement, generating electromotive force (EMF) through magnetic flux variation. The generated electrical energy is stored in a battery and can be used for charging portable electronic devices. The proposed system aims to reduce friction, eliminate fuel consumption, minimize environmental pollution, and provide a low-cost solution for auxiliary power generation.

Keywords: Frictionless Energy Generation; Electromagnetic Induction; Flywheel; Neodymium Magnet; Kinetic Energy Recovery; Battery Charging.

How to Cite This Article

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Introduction

Energy plays a vital role in modern society and is required for transportation, communication, industrial activities, and domestic applications. Conventional energy sources such as petroleum, coal, and nuclear fuels are finite and contribute significantly to environmental pollution. Therefore, the development of renewable and clean energy technologies has become increasingly important. The proposed frictionless energy generation system utilizes the rotational motion of a wheel to generate electricity through electromagnetic induction without physical contact between the generating elements. The concept is based on the operating principle of an electric motor and generator. Neodymium magnets are mounted on a rotating wheel while stationary electromagnetic coils are positioned nearby. As the wheel rotates, magnetic flux linkage through the coils changes continuously, inducing an electromotive force according to Faraday's law of electromagnetic induction. Unlike conventional dynamos, the proposed arrangement avoids direct contact and thereby minimizes frictional losses. The generated electrical energy can be stored in a battery and later utilized for charging mobile devices or auxiliary electrical loads. The system is particularly suitable for bicycles and light vehicles where otherwise wasted kinetic energy can be partially recovered.

Literature Review

Several researchers have investigated flywheel-based energy storage and kinetic energy recovery systems. Ghedamsi et al. reported that Flywheel Energy Storage Systems (FESS) are suitable for storing energy in the form of rotational inertia and improving power quality in electrical systems [1]. Patterson et al. demonstrated the feasibility of flywheel power systems and highlighted their potential for future energy storage applications [2].

Mathew et al. emphasized that flywheels are effective kinetic energy storage devices capable of delivering high power outputs at elevated rotational speeds. Their study identified geometry, rotational speed, and material strength as critical design parameters affecting flywheel performance [3].

Sneha and Reddy investigated power generation from bicycle pedaling using a dynamo mechanism and demonstrated that electrical power generation is directly related to pedaling speed [4]. Sevatkar et al. proposed a flywheel-based kinetic energy recovery system for bicycles that captures energy during braking and reuses it during acceleration [5].

Sawant et al. highlighted the necessity of frictionless power generation methods for reducing dependence on fossil fuels and improving energy efficiency [6]. Arun et al. demonstrated that kinetic energy recovery systems (KERS) using flywheels can achieve energy savings of approximately 10% during bicycle operation [7].

Gijare et al. studied flywheel-based energy generation systems using magnets and copper windings and concluded that energy generation efficiency can be improved significantly by reducing frictional losses [8]. Walunj et al. investigated flywheel-driven energy generation systems employing pulley arrangements to increase shaft speed and improve electrical output [9]. The literature indicates that flywheel-based energy storage and contactless energy generation systems provide a promising approach for sustainable and efficient energy recovery.

Problem Definition and Objectives

The increasing demand for electrical energy, coupled with the rapid depletion of conventional fossil fuel resources, has created a significant need for alternative and sustainable energy generation technologies. Conventional energy generation systems primarily depend on non-renewable resources such as petroleum, coal, and natural gas, which contribute to environmental pollution and greenhouse gas emissions. Furthermore, the rising cost of fuel and the growing energy requirements of modern society necessitate the development of efficient and economical power generation methods. In small-scale applications such as bicycles and motorcycles, electricity is commonly generated using dynamos or alternators. These systems operate through direct mechanical contact between moving and stationary components, resulting in frictional losses, wear and tear, increased maintenance requirements, and reduced overall efficiency. The friction generated during operation also increases the mechanical effort required to rotate the wheel, thereby reducing the effective utilization of available kinetic energy. A considerable amount of kinetic energy produced during the motio of a vehicle remains unutilized and is dissipated into the environment. Recovering and converting this otherwise wasted energy into useful electrical power can significantly improve energy utilization efficiency. Therefore, there is a need for a contactless energy generation system that can harness the rotational energy of a wheel without introducing additional friction, mechanical losses, or environmental pollution. The proposed frictionless energy generation system addresses these challenges by employing a combination of neodymium magnets and electromagnetic coils based on the principle of electromagnetic induction. The system generates electricity without direct mechanical contact, thereby minimizing frictional losses and providing a clean, sustainable, and low-maintenance method of power generation.

The primary objectives of the project are:

- To reduce friction using a contactless flywheel-based energy generation mechanism.
- To reduce air and environmental pollution by eliminating fuel consumption.

- To develop a low-cost power generation system suitable for common users.
- To compare battery charging performance with conventional charging methods

System Design and Methodology

The system consists of a wheel, shaft, pulley arrangement, neodymium magnets, electromagnetic coils, battery storage unit, and supporting frame. The wheel is connected to a pulley mounted on the same shaft. Since the pulley diameter is smaller than the wheel diameter, rotational speed amplification is achieved. Neodymium magnets are mounted on the rotating wheel while the electromagnetic coils remain stationary. As the magnets rotate past the coils, magnetic flux variation induces an electromotive force that is subsequently stored in a battery.

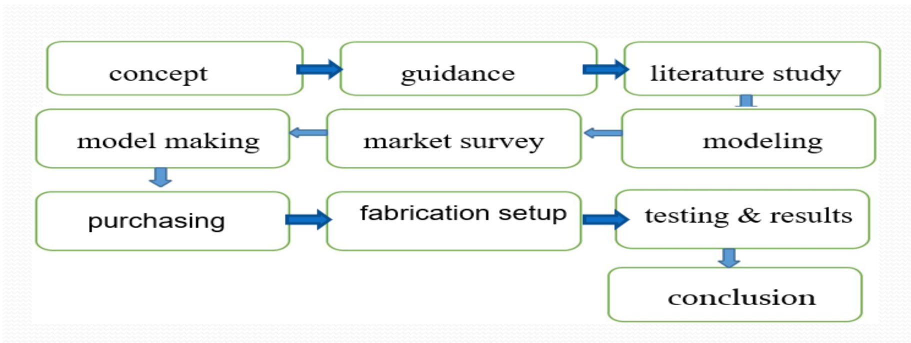

Fig. 1. *Methodology adopted for the development of the frictionless energy generation system*

Motor Selection

A variable-speed DC motor was selected for the experimental setup. The motor operates at approximately 8500 rpm with a rated power of 50 W. The transmitted power is given by:

$$P = \frac{2\pi NT}{60}$$

where:

P = Power transmitted (W)

N = Shaft speed (rpm)

T= Torque transmitted (N·m)

Using the design specifications, the calculated torque was approximately 56.24 N·m.

Belt Drive System

A V-belt transmission system was employed for power transfer. The selected groove angle ranged between 32° and 38° to provide an optimum balance between power transmission efficiency and belt wear. The belt length was calculated using:

$$L = 2C + \pi\left(\frac{D_1 + D_2}{2}\right) + \left(\frac{(D_2 - D_1)^2}{4C}\right)$$

where D_1 and D_2 are pulley diameters and CCC is center distance. The calculated belt length was 23.22 inches

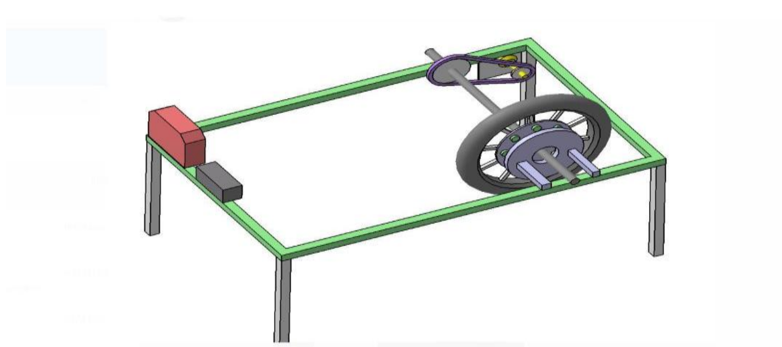

Fig. 2. *CAD Model*

Material Selection

Mild steel was selected as the material for the frame, shaft, base plate, and support brackets due to its excellent combination of strength, durability, availability, and cost-effectiveness. The material possesses sufficient tensile strength and rigidity to withstand the loads generated by the rotating components while maintaining structural stability during operation. In addition, mild steel is readily available in standard sizes and is significantly more economical than many alternative engineering materials. Another important reason for selecting mild steel is its good machinability and weldability, which simplify manufacturing and assembly processes. Components such as the frame and shaft can be easily fabricated using conventional machining and welding operations. Furthermore, mild steel offers adequate resistance to wear and deformation under normal operating conditions, making it a reliable choice for the frictionless energy generation system while keeping the overall project cost low.

Results And Discussion

The developed prototype successfully demonstrated contactless electricity generation using rotating neodymium magnets and stationary electromagnetic coils. The absence of physical contact between the rotating and stationary components significantly reduced frictional losses compared to conventional dynamo systems.The generated electrical power was sufficient for charging mobile devices through a battery storage system. The voltage output was observed to vary with wheel rotational speed; therefore, a battery was incorporated to provide a stable power supply. Experimental observations indicated that continuous charging could be achieved when the shaft rotated at approximately 80–90 rpm, corresponding to normal bicycle operating speeds.

The system exhibited the following advantages:

- Frictionless operation
- No fuel consumption
- Low maintenance requirements
- Reduced environmental impact
- Lightweight and compact design
- Silent operation due to the absence of contact between moving parts

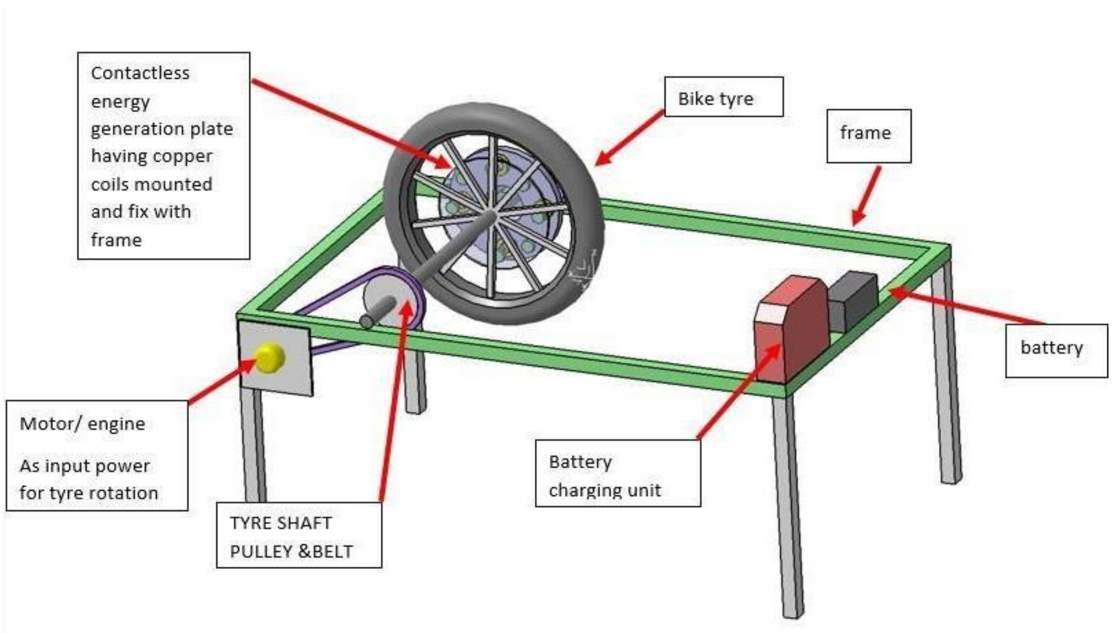

Fig. 3. *3D model of frictionless energy generation using wheel*

Conclusion

A frictionless energy generation system based on electromagnetic induction was successfully designed and implemented. The proposed arrangement utilizes neodymium magnets and stationary coils to generate electricity without direct mechanical contact. The generated power can be stored in a battery and used for charging portable electronic devices. The system eliminates fuel consumption, reduces frictional losses, minimizes maintenance requirements, and contributes to environmental sustainability. Experimental observations demonstrated that battery charging can be achieved continuously during normal wheel operation. The proposed system therefore offers a simple and economical solution for supplementary energy generation in bicycles and lightweight vehicles.

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