Journal of Thermal and Fluid Science
Vol.5, Issue 1, June 2024, pp 25 - 30
https://doi.org/10.26706/jtfs.5.1.20240304

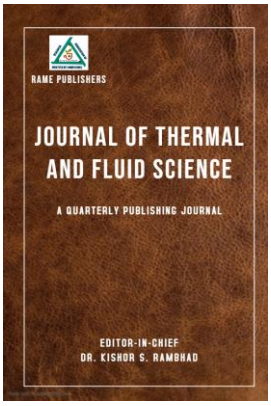
Design and Fabrication of Frictionless Power Generation Through Wheel

Sagar Patil*, Ashutosh Bamane, Parth Desak, Vaibhav Dumada, Chirag Gharat

Department of Mechanical Engineering, St. John college of Engineering and Management, Palghar, Maharashtra, India
*Correspondence: sagarrp@sjcem.edu.in

Abstract: This project aims to design and fabricate a novel system for frictionless power generation by harnessing the principles of Faraday' law of electromagnetic induction. Traditional methods of power generation often involve friction and mechanical wear, leading to energy loss and maintenance issue. In this project, we propose a solution that minimizes friction and maximizes efficiency by leveraging the rotational motion of the wheel. The core principle behind this system involves placing conductive coil strategically around the circumference of a rotating wheel. As the wheel rotates, the magnetic field created by permanent magnets embedded within the wheel induces an electric current in the coil, according to Faraday's law. This induced current can then be harvested and utilized to generate electrical power. By minimizing friction, the system can efficiently convert kinetic energy into electrical power.

Keywords: Power Generation, Magnets, Coil, Frictionless, Faraday's Law



ISSN: 2583-3022

Article – Peer Reviewed
Received: 12 March 2024
Accepted: 15 May 2024
Published: 18 June 2024

Cite this article: Sagar Patil, Ashutosh Bamane, Parth Desak, Vaibhav Dumada, Chirag Gharat, "Design and Fabrication of Frictionless Power Generation Through Wheel", Journal of Thermal and Fluid Science, RAME Publishers, vol. 5, issue 1, pp. 25-30, 2024.
https://doi.org/10.26706/jtfs.5.1.20240304

1. Introduction

In the quest for sustainable energy solutions, there is an increasing demand for innovative approaches to power generation that minimize energy loss, reduce environmental impact and enhance overall efficiency. Traditional methods of power generation often rely on mechanisms that involve friction and mechanical wear, leading to energy wastage and maintenance challenges. In response to these limitations, there is a growing interest in developing frictionless power generation systems that capitalize on advanced principles of physics and engineering [1].

The concept of harnessing rotational motion for power generation is not new, but conventional methods have typically been plagued by friction-related issues. However, recent advancements in materials science, engineering, and design have opened new possibilities for frictionless power generation through innovative wheel-based systems. The project titled "Design and Fabrication of Frictionless Power Generation through Wheel by Applying Faraday's Law" addresses this challenge by proposing a novel system that harnesses the principles of electromagnetic induction, specifically Faraday's law, to generate electrical power without the drawbacks of friction-based mechanisms. By leveraging rotational motion and magnetic fields, the project aims to design and fabricate a system capable of efficiently converting mechanical energy into electrical energy, thus offering a sustainable and efficient solution to power generation. Faraday's law of electromagnetic induction, formulated by the renowned physicist Michael Faraday in the 19th century, states that a changing magnetic field induces an electromotive force (EMF) in a conductor, leading to the generation of an electric current[2]. This fundamental principle forms the basis for numerous technologies, including generators, transformers, and electric motors. By applying Faraday's law within the context of a rotating wheel system, this project seeks to create a frictionless power generation mechanism that operates with minimal energy loss and mechanical wear. The significance of this project lies in its potential to revolutionize the way electrical power is generated, particularly in environments where traditional methods may be impractical or inefficient. By eliminating friction, the proposed system offers advantages such as reduced maintenance requirements, increased longevity, and enhanced energy efficiency [3].

Moreover,by utilizing renewable energy sources to drive the rotational motion of the wheel, such as wind or water currents, the system can contribute to sustainable energy production and environmental conservation efforts. Through a multidisciplinary approach that integrates principles of physics, engineering, and materials science, this project aims to pave the way for a more sustainable and efficient future in power.

2. Literature Review

Dighe Sagar Kisan el al [4] in 2014, the flywheel energy storage systems (FESSs) are suitable for improving the quality of the electric power delivered by electric motor. The flywheel is a time-tested device for reducing power fluctuations and storing energy. Some historical applications of flywheels include the potter's wheel and the spinning wheel. In this examination, we will look specifically at the automotive industry's usage of flywheels as an important intermediate energy storage device. A mechanical device that stores energy as inertia, this one makes use of a flywheel.

Magnus Hedlund el al [5] in 2004, the broad goal of this project was the development and demonstration of a complete prototype Flywheel Power System (FPS) and successful proof of the feasibility of this energy storage technology. Engineering the interfaces needed for a field experiment and making any last-minute adjustments to the system will be the following steps in the development process.

Michael Mathew el al [6] in 2009, flywheels serve as kinetic energy storage and retrieval devices with the ability to deliver high output power at high rotational speeds as being one of the emerging energy storage technologies available today in various stages of development, especially in advanced technological areas, i.e., spacecrafts. Presently, the majority of research is focused on enhancing the energy storage capacity of flywheels so that they can provide high power during transfer periods and persist longer than traditional battery powered devices. There are essentially three things that determine how well a flywheel works.

Yang Hongxing el al [7] in 2018, energy generation system plays a very important role in recent years. A flywheel's ability to retain rotational energy and facilitate the machine's smooth operation dates back many centuries. Modern flywheels incorporate numerous components that store and transmit energy from the flywheel to a motor or battery. A magnet and a copper winding arrangement are used to accomplish this. Reduced total frictional losses are a result of the system's high overall efficiency, which is an important component. Growing the diameter of the flywheel raises its moment of inertia. It was demonstrated that energy can be generated using flywheels without the presence of friction..

2.1 Problem Definition

A. Loss of Power: Conventional power generation systems often suffer from significant energy losses due to frictional forces and inefficiencies in the conversion process. This loss of power results in reduced overall efficiency and increased energy costs, ultimately impacting the reliability and affordability of electricity supply.
B. Excessive Friction: Frictional forces within mechanical components of power generation systems contribute to energy loss and wear and tear, necessitating frequent maintenance and replacement of parts. High levels of friction also reduce the lifespan of equipment and increase operating costs, posing challenges to the sustainability and reliability of power generation infrastructure.
C. Depletion of Finite Fuel Resources: The reliance on finite fuel sources such as fossil fuels for power generation contributes to environmental degradation, air pollution, and climate change. Furthermore, the finite nature of these resources raises concerns about long-term energy security and economic stability. Finding alternative, renewable sources of energy is imperative to mitigate the adverse effects of fuel depletion.
D. Wastage of Energy: Inefficient energy conversion processes and outdated power generation technologies resultin the wastage of valuable energy resources. This wastage not only contributes to higher energy costs but also exacerbates environmental impacts by increasing greenhouse gas emissions and pollution levels.

2.2 Objectives

A. Low Cost: Develop a frictionless power generation system that is cost-effective and accessible, ensuring affordability andscalability for widespread adoption.
B. Reduce Friction: Minimize friction within the power generation mechanism by implementing innovative design strategies andutilizing materials with low friction coefficients, thereby enhancing overall efficiency and reducing energy loss.

C. No Air & Environmental Pollution: Eliminate air and environmental pollution associated with traditional power generation methods by harnessingrenewable energy sources and adopting clean energy technologies, aligning with sustainability goals and mitigating ecological impact.
D. Save Energy: Optimize energy utilization and conservation through efficient conversion of mechanical energy into electricalenergy, maximizing output while minimizing waste and promoting energy-saving practices in power generation processes.

3. Methodology

Because the pulley's diameter is smaller than the wheel's diameter, we were able to increase the wheel's rotational speed by connecting it to the shaft. The wheel features an assembly of Neodymium magnets and coils. The neodymium magnet will begin to spin once the wheel and coil are steady. In this case, the arrangement of magnets and coils generates electromotive force. Power can be generated and stored in a battery in this way.

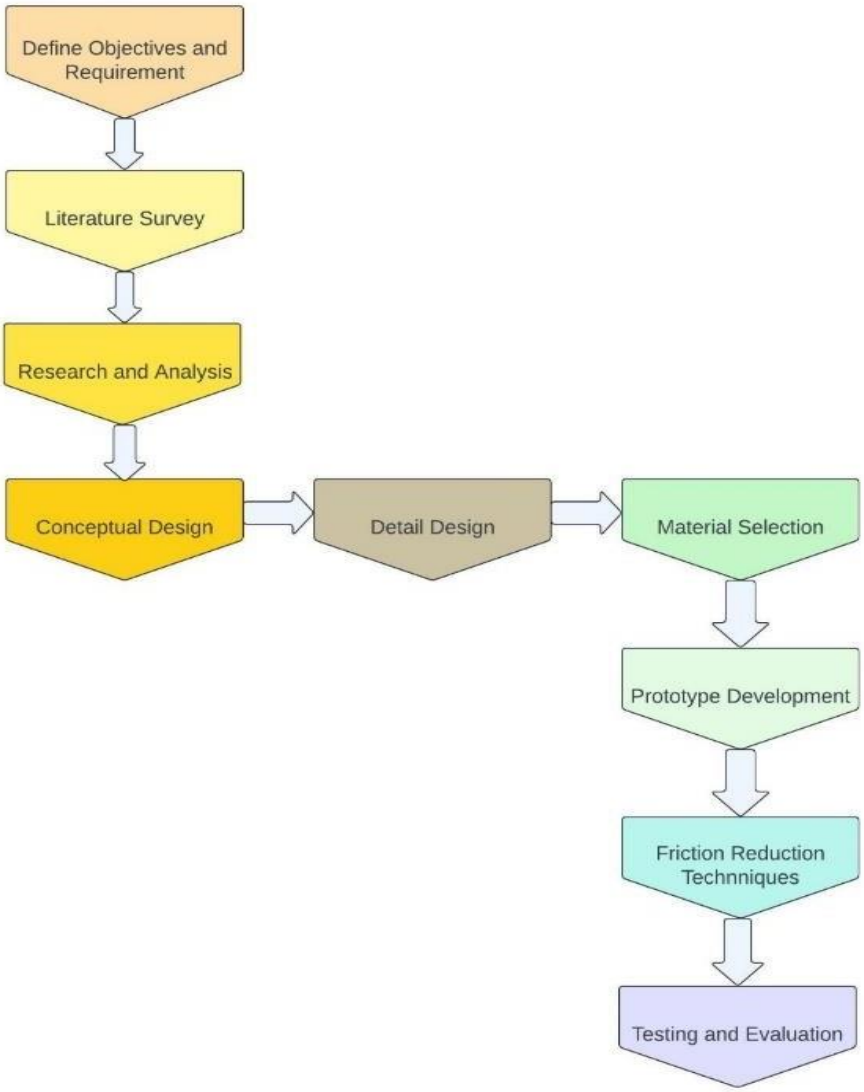


Figure 1: Proposed Methodology with Flow Chart

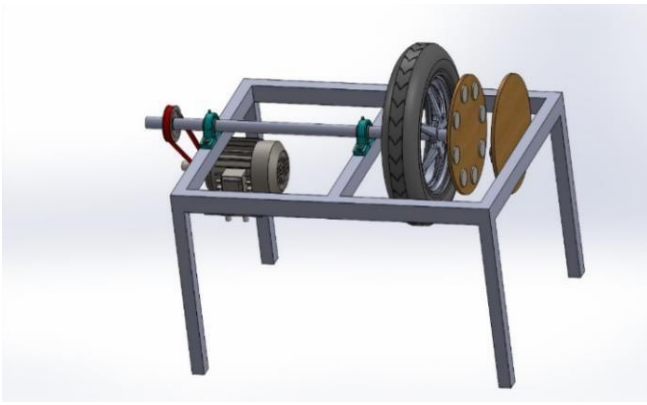


Fig. 2 3D Model of Frictionless Power Generation Through Wheel

Fig. 3 Experimental setup

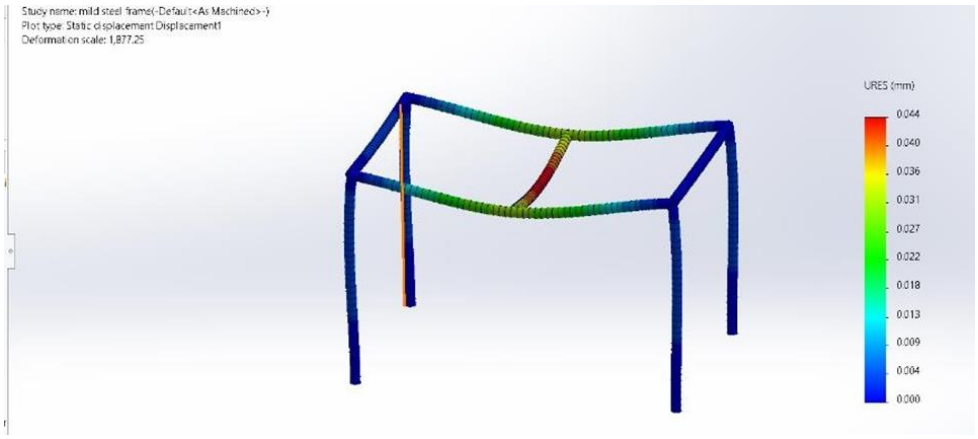


Fig. 4 A simulation for Static Displacement

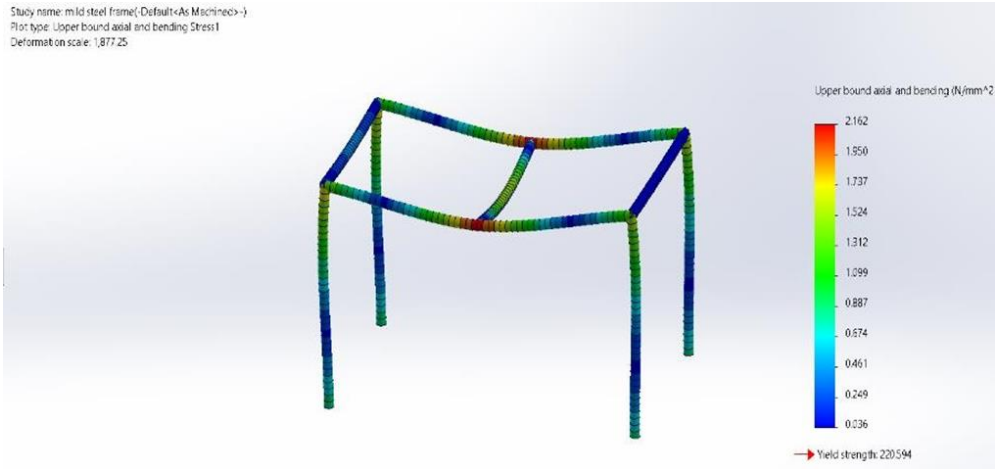


Fig. 5 A simulation for axial and bending Stresses

Table 1. Experimental Readings

Reading no.	Time (Min.)	Shaft Speed (RPM)	Voltage in DC
1.	2	230.21	14
2.	4	245.36	15
3.	6	262.52	16
4.	8	278.02	17
5.	10	295.36	18
6.	12	310.25	19
7.	14	330.36	20.5
8.	16	345.45	21
9.	18	360.36	22
10.	20	376.8	23.1

4. Conclusions

It follows that the system configuration is capable of producing electricity with no wheel friction and can be used to its full potential. In addition to comprehending electromagnetism and how to produce electricity by merely positioning an equal number of magnets and coils on separate disks without touching them, we have accomplished the design and implementation of the project on a frame, and the produced power is used to recharge mobile phones and other electronic devices. Because the voltage output from the assembly is highly sensitive to the rotational speed of the wheels, we utilize a battery to ensure that our cell phone has a continuous power source. When the shaft rotates at the typical bike speed of 80 to 90 revolutions per minute (rpm), a battery linked to the generator assembly is constantly charged. The battery is charged continually by this assembly.

4.1 Future Scope

Our main focus is on developing a project that can charge electric vehicle batteries while traveling to remote areas. We can make it even better by increasing the quantity of magnets and coils and decreasing the space between the disks that hold the magnets and coils. This will allow the coil to cut the force line the most effectively, generating the most induced voltage. The traditional power generator uses a dynamo, which causes friction and slows down the bike, however with this invention we can eliminate that drawback. Through this effort, we were able to overcome this obstacle and generate clean energy.

References

[1] M. A. Kumbhalkar, M. M. Sardeshmukh, D. V Bhise, S. A. Choudhari, P. H. Sahare, and S. Thakur, “Thermal Analysis of Lithium-Ion Battery for Radial and Axial Heat Dissipation,” SSRG International Journal of Mechanical Engineering, vol. 10, pp. 21–30, 2023, doi: 10.14445/23488360/IJME-V10I8P103.

[2] M. A. Kumbhalkar et al., “An insight into conversion of internal combustion engine (ICE) vehicle to electric vehicle for green transportation technology,” Multidisciplinary Science Journal, vol. 5, no. 4, pp. 2023040–2023040, May 2023, doi: 10.31893/MULTISCIENCE.2023040.

[3] M. Mane, S. Kamble, D. Dighe, N. Pawar, C. Author, and K. Mane, “Frictionless Power Generation Using Flywheel and Magneto System in Electric Vehicle,” International Journal of Advances in Engineering and Management (IJAEM), vol. 4, pp. 2395–5252, 2022, doi: 10.35629/5252-0402251256.

[4] K. Pattar, K. Rathod, P. Goudra, S. Malagi, R. M. Galagali, and A. Professor, “Frictionless Energy Generation Using Flywheel For Electrical Vehicles,” 2022, Accessed: Aug. 25, 2024. [Online]. Available: www.ijcrt.org

[5] M. Hedlund, J. Lundin, J. de Santiago, J. Abrahamsson, and H. Bernhoff, “Flywheel Energy Storage for Automotive Applications,” Energies 2015, Vol. 8, Pages 10636-10663, vol. 8, no. 10, pp. 10636–10663, Sep.

2015, doi: 10.3390/EN81010636.
[6] [object Object], “Design of Flywheel for Improved Energy Storage using Computer Aided Analysis,” 2008.
[7] H. Yang, Z. Wei, and L. Chengzhi, “Optimal design and techno-economic analysis of a hybrid solar–wind power generation system,” Appl Energy, vol. 86, no. 2, pp. 163–169, Feb. 2009, doi: 10.1016/J.APENERGY.2008.03.008.