



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 5, May 2025

Power Generation from Speed Breaker and Wind Turbine

Aishwarya P Jain, Radhika L, Shanthala K S, Kalpana S

U G Student, Department of EEE, PESITM, Shivamogga, Karnataka, India

U G student, Department of EEE, PESITM, Shivamogga, Karnataka, India

U G student, Department of EEE, PESITM, Shivamogga, Karnataka, India

Assistant Professor, Department of EEE, PESITM, Shivamogga, Karnataka, India

ABSTRACT: This work explores a new way to generate power from speed breakers using a combination of piezoelectric discs and vertical wind turbines installed on dividers. As vehicles pass over speed breakers, the piezoelectric discs convert the mechanical stress into electrical energy, while the vertical wind turbines harness the airflow to produce additional power. This innovative hybrid system offers a promising solution for sustainable energy generation in urban areas, which can be utilized to power roadside infrastructure, such as streetlights, traffic management systems, and electric vehicle charging stations. The system significance lies in its potential to reduce greenhouse gas emissions, decrease reliance on fossil fuels, and promote energy self-sufficiency in urban areas.

I. INTRODUCTION

The world is witnessing a paradigm shift towards renewable energy sources to mitigate climate change, ensure energy security, and promote sustainable development. In this context, innovative technologies that harness kinetic energy from urban infrastructure have gained significant attention. This system focuses on developing a novel, hybrid system that integrates piezoelectric discs embedded under speed breakers with vertical wind turbines installed on dividers. The proposed system aims to capture the kinetic energy generated by vehicles passing over speed breakers and convert it into electrical energy using piezoelectric strips. Additionally, the wind turbines on the dividers will harness the airflow created by moving vehicles to produce supplementary electricity. This synergistic approach enables the system to generate power from two complementary sources, enhancing overall efficiency and energy output. The integration of piezoelectric discs and vertical wind turbines offers a unique opportunity to tap into the kinetic energy generated by traffic flow, reducing reliance on non-renewable energy sources and contributing to a cleaner environment. The piezoelectric discs will be designed to withstand the mechanical stress generated by vehicles, while the wind turbines will be optimized to capture the airflow created by moving vehicles. The system will be designed to be scalable, allowing for easy installation and maintenance. Furthermore, the system will be equipped with a power conditioning unit to ensure efficient energy conversion and storage.[1][3]

The proposed system has numerous benefits, including reduced greenhouse gas emissions, lower energy costs, and increased energy independence. Additionally, the system can be used to power streetlights, traffic management systems, and other urban infrastructure, reducing the strain on the grid and promoting sustainable development. The system can also be integrated with existing renewable energy systems, such as solar panels, to create a hybrid energy harvesting system.

II. PROBLEM STATEMENT

Develop a sustainable and efficient system to generate electricity using speed breakers using a combination of piezoelectric discs and vertical wind turbines, aimed at reducing dependence on fossil fuels and minimizing environmental harm.

III. METHODOLOGY

The power generation from speed breakers using piezoelectric discs and vertical axis wind turbines involves installing piezoelectric discs under speed breakers to harness mechanical stress from passing vehicles. Vertical axis windmills are mounted near road dividers to capture wind energy. The vertical axis wind turbines involves designing and fabricating a vertical axis wind turbine with a small diameter and height, suitable for low-speed wind conditions, and attaching piezoelectric discs to the vertical axis wind turbine blades or hub, ensuring optimal placement for maximum energy harvesting. The piezoelectric discs are then connected to an electrical interface, such as a rectifier, filter, and voltage regulator, to convert the generated AC voltage to a stable DC output. The mechanical stress and wind energy are then converted into electrical energy, conditioned and stored using rectifiers and batteries. Finally, the generated electricity is distributed to nearby infrastructure, such as streetlights and traffic signals. The process includes site selection and planning, installation of the energy harvesting systems, conversion of mechanical stress and wind energy into electrical energy, power conditioning, energy storage, and power distribution to nearby infrastructure. [6]

Block Diagram

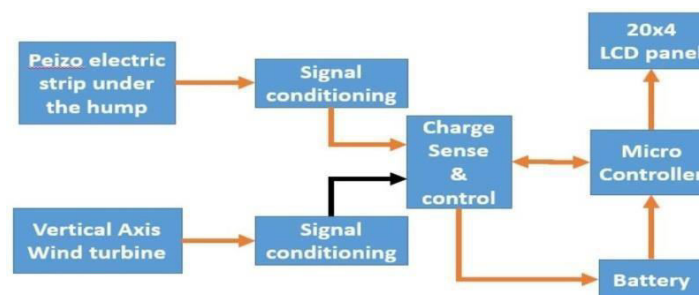


Fig 1 Block Diagram

Hardware Description

Piezoelectric Disc

A solar panel generates electricity by allowing particles of light, or photons, to knock electrons loose from atoms, causing them to move. This movement of electrons creates electricity, and solar panels are designed to capture this flow and convert it into usable electric current. In simple terms, heating panels work by using photons to dislodge electrons from atoms, producing electricity. These panels are made up of smaller units called photovoltaic cells, which convert heat or light into electrical energy. Solar panels offer several benefits, such as providing clean, renewable energy, reducing greenhouse gas emissions, and lowering electricity costs. The efficiency of solar panels depends on factors like the amount of light they receive and the electrical load they handle. The efficiency of a solar module determines the size needed for a specific power output.[2]

Voltage Regulator

The 7809 voltage regulator is a widely used linear voltage regulator IC that provides a stable 9V output voltage. With an input voltage range of up to 35V, the 7809 regulator can handle a variety of input sources, making it a versatile component for many electronic circuits. The regulator's high accuracy and reliability make it suitable for a range of applications, including power supplies, voltage stabilization, battery chargers, and electronic devices such as radios, TVs, and audio equipment.

Capacitor

A capacitor is a device that can store energy in the form of an electrical charge. It consists of two conductive plates separated by a dielectric material, which can be air, ceramic, or other materials. When a voltage is applied across the plates, electric charges build up on the plates, creating an electric field. The capacitor's ability to store energy makes it a crucial component in many electronic circuits, including power supplies, filters, and oscillators. capacitors are often used to filter out noise and ripple from the input voltage, ensuring a stable output voltage.[4]

Battery

A battery transforms chemical energy into electrical energy through a chemical reaction. The chemicals responsible for this reaction are stored within the battery. In circuits, batteries provide power to other components by generating direct current (DC). They are also used to store the energy produced. Rechargeable batteries, also called secondary cells, can be used multiple times by recharging them with electricity.

Diode (IN4007)

A diode permits electrical current to flow in a single direction while blocking any reverse flow. The IN4007 diode has a maximum peak repetitive reverse voltage of 1,000 volts and can handle an average rectified forward current of 1 ampere. It is commonly utilized in electronic circuits for rectification, converting alternating current (AC) into direct current (DC).

Neodymium magnet

Neodymium magnets, also known as NdFeB magnets, are a type of permanent magnet made from a combination of neodymium, iron, and boron. They are known for their exceptional strength, durability, and resistance to demagnetization. Neodymium magnets have a high magnetic field strength, making them ideal for applications where strong magnetic fields are required, such as in electric motors, generators, and magnetic resonance imaging (MRI) machines.

Acrylic blade

Acrylic blades are a type of wind turbine blade made from acrylic materials, which are lightweight, corrosion-resistant, and offer high transparency. These blades are designed to optimize energy harvesting from wind flows, while also providing a unique aesthetic appeal. Acrylic blades are often used in small wind turbines, such as those used for residential or commercial power generation, as well as in decorative wind sculptures. The transparency of acrylic blades allows them to blend in with their surroundings, making them a popular choice for installations in urban or natural environments.

Copper Coil

Copper Coil consists of a series of turns of copper wire wound around a central core, which can be made of materials like plastic, wood, or even air. The copper coil's primary function is to convert electrical energy into magnetic energy, and vice versa, through the process of electromagnetic induction. When an electric current flows through the coil, it generates a magnetic field, which can induce an electromotive force (EMF) in nearby coils or conductors.

Thrust bearing

A thrust bearing is a type of bearing that is designed to withstand axial loads, which are forces that act parallel to the shaft. Thrust bearings are typically used in applications where a shaft is subjected to thrust loads, such as in gearboxes, pumps, and turbines. The thrust bearing consists of a series of rolling elements, such as balls or rollers, that are arranged in a circular pattern and are designed to transmit the axial load from the shaft to the bearing housing. Thrust bearings are designed to provide smooth, low-friction motion, and are often used in high-speed applications where low vibration and noise are critical. In the context of wind turbines, thrust bearings are used to support the main shaft and withstand the axial loads generated by the wind.

IV. WORKING MODEL

A piezoelectric generator is a device that converts mechanical energy into electrical energy. This phenomenon occurs when the mechanical stress aligns the internal electric dipoles of the material, creating an electric field. As a result, an electric charge is generated and collected, with the amount of charge depending on the magnitude of the mechanical stress. And also a vertical axis wind turbine (VAWT) generates power by converting the kinetic energy of the wind into electrical energy. As wind flows through the turbine, it causes the blades to rotate around a vertical axis, which is connected to a generator or an electrical interface. The rotation of the blades creates a mechanical stress on the generator, which induces an electromagnetic field and generates an electrical current. The collected electric charge is then converted into a usable electrical output through an electrical interface, such as a rectifier, filter, and voltage regulator, and the resulting electrical output is used to generate power, which can be stored in a battery or used to power small electronic devices.

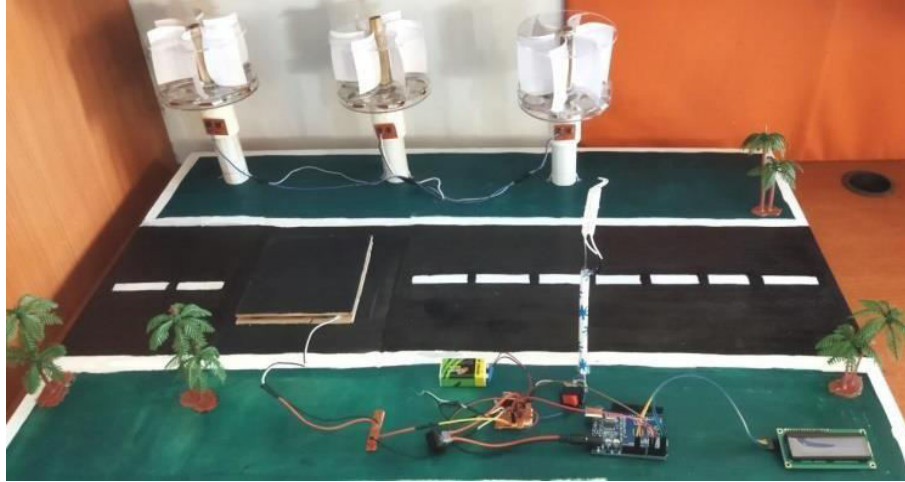


Figure 2. Working Model.

V. RESULTS

A hybrid energy harvesting system, combining piezoelectric discs and wind turbines, generates approximately 24 watts of electrical power. This harvested energy is then processed and conditioned through a power management system, which optimizes the energy for efficient storage in batteries. Meanwhile, the generated voltage is continuously monitored and displayed in real-time, providing a visual representation of the system's performance and energy output.

VI. CONCLUSION

The integration of piezoelectric discs and vertical axis wind turbines represents a groundbreaking innovation in renewable energy, poised to transform the global power generation landscape. By harnessing vibrational energy and optimizing wind capture, these hybrid systems will significantly enhance efficiency, reduce costs, and increase sustainability. With vast applications in urban and rural settings, this technology is system to play a vital role in mitigating climate change, ensuring energy security, and powering a cleaner, greener future. The potential for widespread adoption is immense, with far-reaching implications for energy policy, economic development, and environmental stewardship. As research and development continue to advance, new business models, innovative financing mechanisms, and collaborative partnerships will emerge, driving the commercialization and deployment of this technology. Ultimately, the integration of piezoelectric discs and vertical axis wind turbines has the potential to revolutionize the global energy paradigm, creating a more sustainable, resilient, and equitable energy system for generations to come.

VII. FUTURE SCOPE

The integration of piezoelectric discs and vertical axis wind turbines presents a promising future for sustainable power generation. As research and development continue to advance, it can be expected to see increased efficiency and scalability of these hybrid systems. One potential application is in urban areas, where vertical axis wind turbines can be installed on rooftops or in narrow alleys, generating electricity while minimizing visual impact. The piezoelectric discs can harness the vibrations and stress generated by the wind turbine, converting them into additional electrical energy. Furthermore, the use of piezoelectric materials can also enable the harvesting of energy from other environmental sources, such as vibrations from traffic or ocean waves. As the technology matures, it can be anticipate the widespread adoption of these innovative power generation systems, contributing significantly to the global transition towards renewable energy.

REFERENCES

- [1] International Journal of Latest Engineering Science (IJLES) E-ISSN: 2581-6659 Volume: 02 Issue: 02 March to April 2019 Praful Nandankar#1, Prashant kumar Dhawas*2 Assistant Professor, Department of Electrical Engineering Government College of Engineering, Chandrapur, Maharashtra, India.
- [2] IEEE Transactions on Industrial Electronics (TIE) * E-ISSN: 1557- 9948 Volume: 66 Issue: 04 April 2019, IEEE A.K. Singh#1, R.K. Singh*2 Research Scholar, Department of Electrical Engineering Indian Institute of Technology, Kanpur Uttar Pradesh, India.
- [3] Journal of Renewable and Sustainable Energy (JRSE) E-ISSN: 1941- 7012 Volume: 11 Issue: 02 March to April 2019, JRSE P.K. Sahu#1, S.K. Panda*2 Research Scholar, Department of Electrical Engineering National Institute of Technology, Rourkela Odisha, India.
- [4] International Journal of Wind Energy (IJWE) E- ISSN: 2454-9157 Volume: 02 Issue:01 January to March 2020 P.K. Sahu#1, S.K. Panda*2 Research Scholar, Department of Electrical Engineering National Institute of Technology, Rourkela Odisha, India.
- [5] Immanuel, S., Banu, A., Shanti, K., & Mahalaxmi P. (2021). Harvesting Energy from Traffic Breakers using Piezoelectric Discs. International Journal of Science and Research (IJSR), 10(1), 1-5.
- [6] The publication is titled "Power Generation from Small Wind Mill" and was published in the International Research Journal of Engineering and Technology (IRJET), Volume 06, Issue 05, in May 2019.



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details