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Generation of Electricity by Using Speed Breaker

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Abstract: *The generation of electricity by using a speed breaker is an innovative approach to harness waste mechanical energy produced by moving vehicles on roads. Every time a vehicle passes over a speed breaker, a significant amount of kinetic energy is dissipated as heat and vibration. This project aims to capture and convert that otherwise wasted energy into useful electrical power.*

In this system, mechanical components such as rollers, springs, rack-and-pinion mechanisms, or piezoelectric sensors are installed beneath the speed breaker. When a vehicle moves over the hump, the applied pressure causes mechanical motion or stress, which is converted into electrical energy using generators or piezoelectric materials. The generated electricity is then stored in batteries and can be used for low-power applications such as street lighting, traffic signals, road signage, or charging small electronic devices.

This method of power generation is environmentally friendly, renewable, and does not require additional fuel or large infrastructure. It is especially suitable for high-traffic areas such as highways, toll plazas, parking areas, and urban roads. Although the amount of power generated from a single speed breaker is limited, large-scale implementation across multiple locations can contribute significantly to decentralized energy generation. Thus, electricity generation using speed breakers offers a sustainable and cost-effective solution to meet growing energy demands while promoting green technology..

Keywords*:* Speed Breaker

I. INTRODUCTION

The rapid increase in energy consumption and the depletion of conventional energy resources have created an urgent need for alternative and sustainable sources of power. At the same time, a large amount of mechanical energy is continuously wasted in daily activities, especially on roadways where thousands of vehicles move every day. One such overlooked source of energy is the kinetic energy produced when vehicles pass over speed breakers.

Speed breakers are installed on roads to control vehicle speed and improve safety. When a vehicle crosses a speed breaker, its kinetic energy is partially lost in the form of vibrations, pressure, and heat. Instead of allowing this energy to go unused, it can be effectively harnessed and converted into electrical energy using suitable mechanical and electromechanical arrangements. This concept forms the basis of electricity generation using speed breakers.

The system typically consists of mechanical mechanisms such as springs, rollers, rack-and-pinion assemblies, or piezoelectric materials connected to an electrical generator. The downward force exerted by the vehicle causes movement in these components, which is then converted into electrical energy. The generated power can be stored in batteries and used for nearby applications like streetlights, traffic signals, surveillance systems, and public utility services.

Electricity generation using speed breakers is a non-conventional, eco-friendly, and cost-effective method of energy harvesting. It is particularly suitable for areas with heavy traffic density such as highways, toll booths, urban intersections, and parking zones. Although it cannot replace large-scale power plants, this technology can support decentralized power generation and contribute to energy conservation and sustainable development.

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II. LITERATURE REVIEW

Several researchers have explored the concept of road-based energy harvesting. Earlier studies focused on piezoelectric materials embedded in roads to generate electricity from vibrations. Some researchers proposed rack-and-pinion mechanisms connected to DC generators, while others experimented with hydraulic systems to convert vertical displacement into rotational motion.

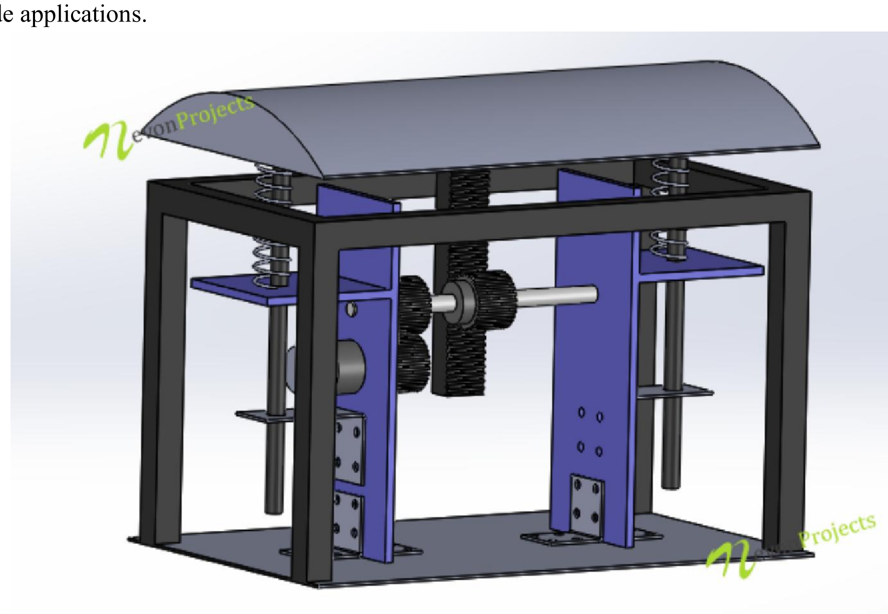
Research findings indicate that although the power generated per vehicle is small, the cumulative energy produced in high-traffic areas can be significant. Studies also highlight challenges such as system durability, maintenance, and cost optimization. This research builds upon previous work by proposing an efficient mechanical arrangement suitable for real-world road conditions.

III. WORKING PRINCIPLE

When a vehicle passes over the speed breaker, a downward force is applied due to its weight. This force causes vertical displacement of the speed breaker mechanism. The motion is transferred to a mechanical system such as a spring-loaded rack-and-pinion or roller arrangement.

The linear motion is converted into rotational motion, which drives a DC generator or alternator. According to Faraday's law of electromagnetic induction, the rotating generator produces electrical energy. In piezoelectric-based systems, mechanical stress applied to piezoelectric crystals generates electrical charges directly.

The generated electrical energy is then rectified, regulated, and stored in batteries. This stored energy can be utilized for various roadside applications.



IV. SYSTEM COMPONENTS

4.1 Speed Breaker Mechanism

Acts as the primary energy collector by converting vehicle pressure into mechanical motion.

4.2 Mechanical Transmission System

Includes rack and pinion, gears, springs, or rollers that convert vertical motion into rotational motion.

4.3 Electrical Generator

Converts mechanical energy into electrical energy.

4.4 Rectifier and Voltage Regulator

Ensures stable DC output suitable for battery charging.

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4.5 Energy Storage Unit

Rechargeable batteries store the generated power for later use.

4.6 Load

Street lights, traffic signals, signboards, or charging points.

V. METHODOLOGY

The system is installed beneath a speed breaker at a selected road location. When vehicles pass over it, mechanical energy is harvested and converted into electrical energy. Experimental testing is carried out by varying vehicle load and traffic frequency. The output voltage, current, and power are measured and analyzed to evaluate system efficiency.

VI. RESULTS AND DISCUSSION

Experimental results show that the electrical output increases with vehicle weight and traffic density. Light vehicles generate small amounts of power, while heavy vehicles such as buses and trucks produce higher output. The system performs efficiently in high-traffic areas. However, energy losses due to friction and mechanical wear are observed and discussed.

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