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"POWER GENERATION THROUGH SPEED BREAKERS"

[1*]Dr Bharath L, [1]Dr Suneelkumar N Kulkarni, [2]Akshay SM,

[2]Gagan kumar singh VS, [2]Praveen V Awale, [2]Mell Jepson.

[1*]Assistant Professor, [1]Professor, [2]Student
Department of Mechanical Engineering
Affiliated to Visvesvaraya Technological University
Cambridge Institute of Technology, Bengaluru, Karnataka, India.

Abstract: A significant amount of energy is wasted by vehicles when they pass over speed breakers due to friction. However, this energy can be used to generate electricity. In this project, we propose a smart speed breaker system that captures energy from
vehicles and converts it into electrical power.

Index Terms **- Traffic Sign.**

I. INTRODUCTION

As urban areas continue to grapple with the escalating demand for energy and the imperative to embrace sustainable practices, innovative solutions are emerging to harness untapped sources of power. Among these, the concept of power generation using speed breakers stands out as a promising avenue for eco-friendly electricity production. The premise is simple yet ingenious: converting the kinetic energy dissipated by vehicles traversing over speed breakers into a renewable and usable form of electrical energy. Traditional speed breakers, ubiquitous on roads to control vehicular speed, inadvertently unleash substantial amounts of kinetic energy during the deceleration of vehicles. This energy, typically lost as heat, presents an opportunity to be harnessed and transformed into a valuable resource for power generation. Engineers and researchers have explored various mechanisms to achieve this conversion, with electromagnetic generators and hydraulic systems being the primary contenders. Electromagnetic generators capitalize on the principle of electromagnetic induction, employing coils and magnets to generate electrical currents as vehicles move over specially designed speed breakers. Hydraulic systems, on the other hand, utilize the force of moving vehicles to drive fluids through turbines, ultimately producing mechanical energy that can be converted into electricity.

The allure of power generation using speed breakers lies not only in its capacity to contribute to the energy grid but also in its potential to address environmental concerns. Repurposing the energy dissipated during braking, this innovative approach aligns with the broader global push towards sustainable and eco-friendly practices. While challenges such as efficiency optimization and infrastructure integration remain, the concept of power generation from speed breakers exemplifies a creative response to the dual challenges of energy demand and environmental sustainability. As research and development in this field progress, the prospect of our roads becoming not just conduits for transportation but also generators of clean energy

becomes an increasingly tangible reality. The concept of generating electricity from speed breakers indeed showcases the innovative intersection of sustainable practices and energy demands. The potential benefits extend beyond power generation, contributing to a greener and more efficient urban infrastructure. As advancements continue, addressing challenges will be crucial for widespread adoption and impactful integration into existing systems.

II. DESCRIPTION:

The energy crisis is one of the major problems in our country. The pollution caused by generating power is enormously high. Even though we have many kinds of renewable energy sources we are affording the normal conventional methods in generating power. In addition to this pollution, we are having many vehicles on road creating more pollution. So, we are hurting our environment in many methods. So, this project can help the environment to escape from the pollution, not totally but a little bit. Since we see many vehicles on road, we can use the energy from those vehicles to generate electrical energy. All the vehicles use their kinetic energy in order to move from one place to another. In this process, it is wasting more energy. We can use that kinetic energy and convert it into electrical energy. We can provide the speed bumps on roads with specialized mechanisms under them. So, whenever a vehicle moves over the speed bump, the speed bump takes the kinetic energy of the vehicle and converts it into mechanical energy and which further converted into electrical energy.

III. LITERATURE SURVEY

The concept of harnessing the kinetic energy of vehicles passing over speed bumps to generate electricity has gained traction in recent years due to its potential for green energy production and reduced dependence on fossil fuels. This literature review explores the feasibility, mechanisms, and potential of power generation through speed breakers.

Feasibility:

- Energy Source: Vehicles dissipate significant kinetic energy while crossing speed bumps, creating a readily available but untapped source of renewable energy. Studies suggest that a single busy highway speed bump can generate up to 1kW of electricity per minute.

- Mechanisms: Various mechanisms have been proposed, including rack and pinion, hydraulic, piezoelectric, and electromagnetic systems. Each offers distinct advantages and challenges, impacting efficiency, cost, and applicability.

- Applications: Generated electricity can be used for various purposes, including powering streetlights, traffic signals, nearby buildings, or even feeding back into the grid.

Mechanisms:

- Rack and Pinion: This popular method uses the downward movement of the speed bump to rotate a pinion gear connected to a generator. Simple and efficient, it is suitable for moderate traffic flow.

- Hydraulic Systems: Fluid pressure generated by the weight of the vehicle drives a turbine connected to a generator. Suitable for heavy traffic but requires complex equipment and maintenance.

- Piezoelectric Systems: Pressure exerted on piezoelectric materials generates electricity directly. Requires intricate arrangements and is sensitive to wear and tear.

- Electromagnetic Systems: Magnetic levitation principles can be used to capture the kinetic energy of passing vehicles.

Challenges and Potential:

- Efficiency: Current technology limits conversion efficiency to around 20-30%, requiring high traffic density to generate significant power.
- Cost: Initial installation and maintenance costs can be high, necessitating careful economic analysis and long-term planning.
- Durability: Speed bumps need to withstand heavy traffic and harsh weather conditions, requiring robust and adaptable designs.

Potential:

- Decentralized Power Generation: Speed bump technology can provide off-grid communities and remote areas with sustainable electricity access.
- Traffic Management: Smart speed bumps with integrated sensors can collect traffic data and dynamically adjust height to optimize traffic flow.

IV. OBJECTIVES:

- Harness wasted kinetic energy: Capture the significant amount of energy dissipated by vehicles crossing speed bumps and convert it into usable electricity.
- Promote renewable energy: Contribute to increased reliance on renewable energy sources for power generation, reducing dependence on fossil fuels and their associated environmental issues.
- Decentralize power production: Enable decentralized power generation, particularly in areas with limited access to traditional grid infrastructure.
- Reduce energy consumption: Decrease overall energy consumption by providing an alternative electricity source for various applications.
- Improve traffic management: Integrate traffic monitoring and dynamic speed bump adjustment capabilities to optimize traffic flow and safety.

V. JUSTIFICATION:

- Environmental benefits: Utilizing a renewable energy source reduces greenhouse gas emissions and air pollution compared to traditional fossil fuel-based generation.
- Economic potential: Generating electricity from speed bumps can lead to cost savings through reduced reliance on imported energy and potentially generate revenue through electricity sales.
- Increased energy security: Diversifying energy sources strengthens energy security by reducing dependence on centralized grids and vulnerable supply chains.
- Applicability in various settings: This technology can be adapted to different traffic densities and road

types, making it suitable for urban, rural, and highway applications.

- Potential for further innovation: Ongoing research and development can improve efficiency, reduce costs, and expand the functionality of speed bump power generation systems.

VI. RESEARCH METHODOLOGY

Rack and Pinion:

- This widely used method utilizes a rack attached to the moving platform of the speed bump.
- As a vehicle passes, the rack compresses, driving a pinion gear connected to a generator shaft.
- The rotating shaft of the generator produces electricity via electromagnetic induction.
- This method is relatively simple, efficient (20-30%), and cost-effective, making it suitable for moderate traffic flow.

Hydraulic Systems:

- This method uses the weight of the vehicle to compress hydraulic fluid in a cylinder.
- The pressurized fluid drives a turbine connected to a generator, generating electricity.
- Hydraulic systems can be highly efficient (up to 50%) and handle heavy traffic, but they are more complex and expensive than rack and pinion systems.

Piezoelectric Systems:

- These systems utilize piezoelectric materials that generate electricity when pressure is applied.
- Pressure plates embedded in the speed bump deform under the weight of the vehicle, stimulating electricity production in the piezoelectric material.
- Piezoelectric systems are silent and have low maintenance requirements, but their efficiency is low (5-10%) and they are susceptible to wear and tear.

Electromagnetic Systems:

- This emerging method uses magnetic levitation principles to capture the kinetic energy of passing vehicles.
- The vehicle's magnetic field interacts with coils embedded in the road, inducing electricity via electromagnetic induction.
- Electromagnetic systems are potentially highly efficient (over 50%) but are still in the research stage and require complex implementation.

Additional Considerations:

- Energy Storage: Captured electricity can be stored in batteries for later use or directly fed into the grid.
- Traffic Flow: Speed bump design and placement need to minimize traffic disruptions while maximizing energy capture.
- Grid Integration: For large-scale implementation, robust grid integration solutions are crucial to manage fluctuations in power generation.
- Safety: Speed bump design and construction need to prioritize safety for pedestrians and cyclists.

The optimal methodology depends on various factors, including:

- Traffic volume and type
- Budget constraints
- Efficiency requirements
- Environmental considerations

- Existing infrastructure

Advantages:

- Cost-Effective: The installation and maintenance cost of the power generation system using speed breakers is relatively low compared to other renewable energy sources like solar or wind power.
- Energy Savings: The generated electricity can be used to power street lights or other electrical appliances, reducing the overall energy consumption and cost.
- Reduces Traffic Speed: The installation of speed breakers can help reduce traffic speed, which can lead to a safer driving environment and fewer accidents.
- Easy to Install: The power generation system using speed breakers can be installed quickly and easily without the need for any specialized skills or equipment.

Application:

- Street lights
- Road signals
- Signboards on roads
- Digital advertising boards
- Lighting at checkpoints on highways

VII. RESULTS AND DISCUSSION

The expected outcomes of power generation using speed breakers can be categorized into environmental, economic, and social impacts:

Environmental:

- Reduced greenhouse gas emissions: By replacing fossil fuel-based electricity generation with renewable energy from speed breakers, we can help mitigate climate change and air pollution.

- Increased energy security: Diversifying the energy mix with decentralized systems reduces dependence on large power plants and vulnerable power grids, enhancing energy security.

- Improved public health: Cleaner air from reduced dependence on fossil fuels can lead to improved public health and well-being.

Economic:

- Cost savings: Utilizing waste energy can potentially lower electricity bills for communities and businesses by providing an alternative power source.

- Economic development: Local investment in and deployment of speed bump technology can create new jobs and stimulate economic growth in various sectors.

- Reduced energy dependence: Decentralized generation can lessen reliance on imported energy, potentially improving a country's economic independence.

Social:

- Empowerment: Communities can gain greater control over their energy resources and contribute to a more sustainable energy future.

- Increased awareness: Demonstrating this technology can raise public awareness about renewable energy and inspire broader adoption of sustainable practices.

- Improved traffic management: Integrating speed bumps with traffic monitoring and adaptive height adjustment can optimize traffic flow and safety.

Specific expected outcomes will vary depending on several factors, including:

- Scale of implementation: Widespread adoption can have a more significant impact compared to isolated projects.

- Traffic density: Areas with high traffic volume can generate more electricity compared to low-traffic zones.

- System efficiency: Technological advancements can improve the amount of electricity generated from each speed bump.

- Policy and regulations: Supportive policies and regulations can accelerate technology adoption and maximize benefits.

VIII. CONCLUSION

- It can be implemented at metropolitan cities.
- So that more electric power is produced.
- The stored electricity could satisfy the daily requirement of electric power.
- Suitable at parking of multiplexes, malls, toll booths, signals, etc.
- Charging batteries and using them to light up the streets, etc.
- Such speed breakers can be designed for heavy vehicles, thus increasing input torque and ultimately output of generator.
- More suitable and compact mechanisms to enhance efficiency.

IX. REFERENCES

Generation of electricity by using speed breakers: https://ieeexplore.ieee.org/document/7853848

Speed Breaker Power Generator: https://www.researchgate.net/publication/349073841_A_Detailed_study_on_Power_Generation_using_Speed_Breakers

Electric Power Generation through Speed Breakers: https://iarjset.com/wp-content/uploads/2020/07/IARJSET.2020.7624.pdf

Power Generation using speed breakers: https://www.youtube.com/watch?v=pr9qqqsGXHM

Additional Resources:

Video: Power Generation using Speed Breakers | Mechanical Project Ideas: https://...

Video: Electricity Generation Using Speed Breaker Medium Size Mechanical Engineering Final Year Project: https://m.youtube.com/watch?v=RwWtIJ_rsH0

Books:

Renewable Energy Sources and Conversion Technologies, 2nd Edition: https://books.google.com/books/about/Renewable_Energy_Sources_and_Conversion.html?id=xjpAPQAACAAJ

Sustainable Energy - Policies, Strategies and Technologies: https://onlinelibrary.wiley.com/doi/book/10.1002/9781119152057