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Energy Conservation at Toll Plaza

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Abstract: *Now a days the Consumption of power has been increased tremendously. In order to meet the demand of Power by various units various setups has been introduced for effective power generation. In this Project electrical power is being generated as non-conventional method by simply passing vehicles on to the specially designed Roller Setup. This method of Electrical power generation needs no input power. This Project is implemented by using simple drive mechanism such as Roller, some interfaced Electrical components and chain drive Mechanism. The basic principle is simple energy conversion form mechanical to electrical energy by using the vehicles weight (potential energy) & motion (kinetic energy). Here the process of Electric Power Generation comes under the Mechanism of Electro-Kinetic power Generator. The electro-kinetic power generator is a method of generating electricity by harnessing the kinetic energy of automobiles that drives over the track. The track operates by virtue of a number of specially designed rollers placed on it. When the vehicles pass on the rollers, pressure is exerted on them, which develops the mechanical energy and by means of a specially designed mechanism, a generator is driven, which is capable of producing AC/DC current.*

In this Project we are generating electrical power as non-conventional method by simply passing vehicles on to the specially designed Roller Setup. This method of Electrical power generation needs no input power. This Project is implemented by using simple drive mechanism such as Roller, some interfaced Electrical components and chain drive Mechanism. The basic principle is simple energy conversion form mechanical to electrical energy by using the vehicles weight (potential energy) & motion (kinetic energy)..

Keywords: Kinetic energy, Speed rollers, Electro-mechanical unit, Non-Conventional Energy

I. INTRODUCTION

A Toll Plaza Booth is a counter/booth on a toll road where the driver must stop to pay the toll taxes to drive any further. Toll roads are usually on the national and state highways where these toll booths are stationed. Several toll booths in a row constitute a toll plaza. The toll tax amount at a toll plaza booth is levied only on all four-wheelers or larger vehicles.

This road track generates free electricity as vehicles pass over and they are not like conventional speed rollers. They don't damage your car or waste petrol when you drive over them - and they have the added advantage that they produce energy free of charge. The Electro-Kinetic power generator is capable of generating around 10kW of electricity which can then be used to power road signs, traffic lights and street lights or stored in batteries for future use. The track is made up of metal rollers that rotate by using the pressure exerted by vehicles passing over it. The movement of the rollers drives a specially developed design, which in turn drives a generator to produce electricity. The repeated rotations from the rollers, which is further attached to another free wheel allowing it to spin freely in- between while vehicles passes over the track.

II. IMPORTANCE OF ENERGY CONSERVATION AT TOLL PLAZA

Energy generation through speed breakers at toll plazas presents a promising avenue for sustainable infrastructure development. By harnessing kinetic energy from passing vehicles, toll plazas can generate electricity locally, reducing operational costs, dependence on the grid, and environmental impact. This initiative not only demonstrates a commitment to renewable energy but also showcases innovative technology while enhancing public perception and engagement. Moreover, it offers resilience to the energy infrastructure, ensuring uninterrupted operation in the face of

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grid disruptions. Overall, integrating energy generation systems into toll plaza infrastructure signifies a tangible step towards a cleaner, more sustainable future.

III. COMPONENTS OF ENERGY CONSERVATION AT TOLL PLAZA

- **Speed Breaker**: This is the physical structure installed on the road to slow down vehicles as they approach the toll plaza.
- **Kinetic Energy Converter**: This is the mechanism installed beneath the speed breaker to convert the kinetic energy of vehicles passing over it into electrical energy.
- **Generator or Alternator**: The kinetic energy converter is usually connected to a generator or alternator, which converts the mechanical energy into electrical energy.
- **Power Electronics**: There may be power electronics involved to regulate and manage the electricity generated, ensuring it is suitable for use or storage.
- **Energy Storage System**: In some installations, there might be a battery or other energy storage system to store the generated electricity for later use.
- **Control System**: A control system may be in place to monitor the speed breaker's operation, regulate the generation process, and ensure safety.
- **Wiring and Distribution Infrastructure**: The generated electricity needs to be properly wired and distributed to either the local grid or to power nearby equipment or lighting.
- **Monitoring and Maintenance Equipment**: Systems for monitoring the performance of the energy generation system and conducting routine maintenance are also essential components.

IV. BENEFITS OF SELF-CURING CONCRETE

- Renewable Energy Generation: Speed breaker energy generation utilizes the kinetic energy of vehicles to produce electricity, providing a renewable energy source that reduces reliance on fossil fuels.
- Localized Power Generation: Energy generated at toll plazas can be used locally to power nearby facilities, such as toll booths, lighting, or other infrastructure, reducing the need for electricity from centralized grids.
- Cost Savings: By generating electricity on-site, toll plaza operators can potentially save on electricity costs, especially in remote locations where connecting to the grid may be expensive.
- Environmental Benefits: Utilizing kinetic energy from vehicles reduces carbon emissions and air pollution associated with traditional energy generation methods, contributing to cleaner air and a healthier environment.
- Traffic Management: Speed breakers naturally slow down vehicles approaching the toll plaza, which can enhance traffic management and safety by reducing speeding and encouraging smoother traffic flow.
- Revenue Generation: Energy generated from speed breakers can be sold back to the grid or used to offset electricity costs, potentially generating additional revenue for toll plaza operators.
- Community Engagement: Implementing renewable energy technologies at toll plazas can engage the community and raise awareness about sustainable energy practices, contributing to a culture of environmental responsibility.
- Innovation and Technology Showcase: Speed breaker energy generation serves as a tangible example of innovative renewable energy technology, showcasing the potential for creative solutions to energy challenges.

V. CHALLENGES AND FUTURE PROSPECTS

Challenges:

1. Initial Investment: Implementing speed breaker energy generation systems requires an initial investment in infrastructure and technology, which can be a barrier for some toll plaza operators, especially in developing regions.
2. Maintenance: The mechanical components of speed breaker energy generation systems require regular maintenance to ensure optimal performance and longevity. This maintenance can incur additional costs and logistical challenges.

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3. Compatibility with Vehicles: Some vehicles, such as low-clearance or heavily loaded vehicles, may not interact well with speed breakers, potentially causing discomfort for passengers or damage to vehicles. Designing speed breakers that accommodate a wide range of vehicles is essential.

Future Scope and Opportunities:

1. Technological Advancements: Continued research and development can lead to advancements in speed breaker energy generation technology, improving efficiency, durability, and compatibility with different types of vehicles.
2. Integration with Smart Grids: Integration of speed breaker energy generation systems with smart grid technologies can optimize energy distribution, storage, and consumption, enhancing overall system efficiency and reliability.
3. Innovative Financing Models: Exploring innovative financing models, such as public-private partnerships or government incentives, can help overcome initial investment barriers and accelerate the adoption of speed breaker energy generation systems.
4. Urban and Rural Applications: Beyond toll plazas, speed breaker energy generation systems can be deployed in urban areas, residential neighborhoods, and rural roads to capture kinetic energy and contribute to local energy needs.

VI. CONCLUSION

No one is happy with present situation of electricity in India. We need electricity for every small thing. More suitable and compact mechanisms to enhance efficiency. So, this is a small step to try to improve this situation by this project and contribute something for the society. Although less electrical output is being generated. The idea of generating electricity from kinetic energy of the moving vehicles has successfully implemented.

This knowledge of project will definitely be helpful in our future. So we must maintain that this final year project was an essential part of our engineering education enhancing our technical knowledge and practical skill.

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