

SPEED BUMP PROTOTYPE WITH PIEZOELECTRICS FOR CONVERTING MECHANICAL ENERGY TO ELECTRICAL ENERGY IN STREET LIGHTING SYSTEMS

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ABSTRACT

The growing demand for electrical energy, coupled with the limited availability of fossil fuels, drives the development of renewable, environmentally friendly alternative energy sources. One underutilized energy potential is the mechanical energy generated by vehicles passing over highways. This research aims to design and develop a piezoelectric-based speed bump prototype that converts vehicular mechanical energy into electrical energy to support public road lighting systems. The research methodology includes prototype design, testing of piezoelectric output, and evaluation of street lighting control and energy storage systems. Test results demonstrate that piezoelectric materials can generate electrical voltage from mechanical pressure, which can be stabilized using the LTC3588 module. However, the energy produced is insufficient to charge a 12V battery via the MPPT 5A module effectively. The street lighting system, incorporating LED lights, LDR sensors, and relays, operates effectively and automatically. This study highlights the potential of piezoelectric speed bumps as an alternative energy source, although further development is necessary to increase output power.

Keywords: Piezoelectricity, Speed Bump, Renewable Energy, Street Lighting, Energy Conversion.