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International Journal of Recent Advances in Engineering and Technology

ISSN: 2347 - 2812

Volume 14 Issue 01s, 2025

Automatic Smart Speed Breaker Based On Day -Night Sensor and Power Generation

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Peer Review Information

Submission: 11 Sept 2025

Revision: 10 Oct 2025

Acceptance: 22 Oct 2025

Keywords

Piezoelectric plate , rack-and-pinion , EHSB

Abstract

Energy can neither be created or be destroyed and can only be transform from one form to another. The increasing demand for energy in urban environments necessitates innovative solutions to harness untapped energy sources and The increasing demand for energy in urban environments necessitates innovative enhance energy efficiency. The proposed energy-harvesting speed breaker (EHSB) system using piezoelectric plate & rack-and-pinion mechanism employs a mechanical-to-electrical energy conversion mechanism, transforming the kinetic energy generated by vehicles passing over speed breakers into electrical energy. The study includes the design, construction, and testing of a prototype of the power generation system using speed breakers.

The results of the study show that the EHSB system is a viable and sustainable method for generating electricity. The system is capable of generating significant amounts of energy. The speed breaker is used as it can function into two different uses such as for slowing of road vehicles and hence generating energy by harnessing applied force into electrical energy. The electrical energy produced can either be use to power up street lights or stored in a battery for emergency purposes.

INTRODUCTION

Energy can be converted into several forms that can be measured in various ways. Energy is important considering all sectors of a country's economy. Energy crisis is mainly due to two reasons first the population of the world has increased rapidly and second the standard of living of human beings has increased. The share of global electricity demand of developing countries jumps from 27% in 2000 to 43% in 2030. According to the International Energy Agency, the world will need almost 60% more energy in 2030 than in 2002. [1]. [2] Another major problem, which is becoming the exiting topic for today is the pollution. Power stations and automobiles are the major pollution producing places. So non-conventional power source is needed to reduce this problem. We proposed a non-conventional power generating system based on speed breaker mechanism which generate electricity without using any commercial fossil fuels, which is not producing any polluting products [2]. In this paper, our aim is to conserve the kinetic energy which convert into electricity that gone wasted, while vehicles move. This concept involves converting the vertical kinetic energy produced by vehicles as they pass over speed breakers into electrical energy. By employing mechanisms such as electromagnetic induction or piezoelectric materials, this energy can be captured and stored for various applications. [3] This research paper explores the feasibility, efficiency, and practical

implications of power generation using speed breakers. By investigating the technological advancements, economic viability, and environmental benefits of this approach, we aim to provide insights into its potential as a sustainable energy solution.

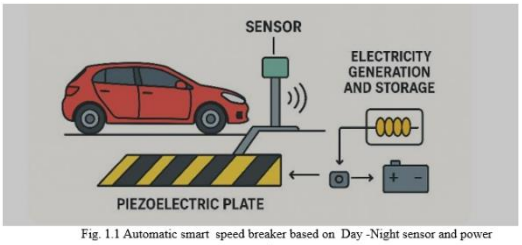


Fig. 1.1 Automatic smart speed breaker based on Day -Night sensor and power generation

Problem Statement

In our country due to increased paying capacity, advanced lifestyle and rapidly growing industrialization, the need & demand of transportation is increasing day- by- day. The number of vehicles passing on the track is increasing daily. Hence, we the group of our class found the need of designing and manufacturing such a system, which will make the track somewhat flexible, soft which will not damage the vehicle more also the impact energy being absorbed by the generation system will be utilized to convert it in to electricity rather than this hard impact transferring to damage the suspension.

LITERATURE REVIEW

1. Piezoelectric sensors for electricity generation from speed breaker A. A. Girde etal :

The population of India is increasing drastically. In 2024, it has reached 140 crores, which leads to more energy consumption. The energy generated from conventional sources is limited and non-renewable. Also, due to urbanization, the energy demand is increased tremendously. So, there is a need to generate energy through renewable sources. One of the effective ways to generate renewable energy is by using piezoelectric cells. Piezoelectric cells are the cells that can generate electric charge through mechanical stress. The mechanical stress is generated on the roads, especially on the road breakers. This mechanical stress is created by vibrations of the vehicles on the speed breaker which will induce electrical energy. By installing piezoelectric cells beneath the speed breaker, the generated mechanical energy can be converted into electrical energy. The generated electricity can be utilized for street lighting, traffic signals, etc

2. Automatic Speed Breaker Control System By Using Pic Controller Sureshkumar etal :

India has a large network of road throughout the country. India faces the highest number of accidents and accidental fatalities in the world. To prevent the accidents caused due to over speeding of vehicles, speed breakers are used. But, the accidents are caused due to both presence and absence of speed breakers. During night, speed breakers are not necessary. During day time, the speed breaker comes up and during night time, the speed breaker flattens. Here LDR is used to sense the available light and RFID is used to sense the vehicles.

3. Aswathaman .v (2011) etal :

discussed about generation of electricity from speed breaker. Energy conservation is the cheapest new source of energy. The number of vehicles passing over the speed breaker in roads is increasing day by day. There is a possibility of tapping the energy and generating power by making the speed breaker as a power generation unit. The generated power can be used for the lamps near the speed breaker. The load acted upon the speed breaker setup is there by transmitted to rack and pinion arrangements.

4.Fabrication of Automatic Speed Bump with Day- Night Control S Mathivanan etal :

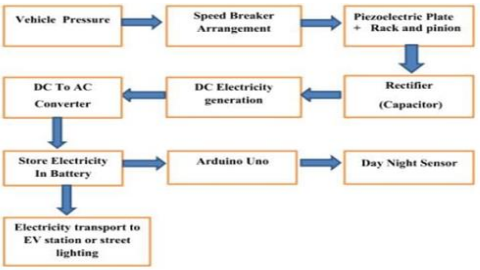
Here we are fabricating the model pneumatic speed breaker with day night control. Nowadays traffic has increased as the use of vehicle has increasing day to day. We require speed breaker to slow down the vehicles which are traveling at high speed. In certain areas at daytime traffic may be heavier than nighttime. So, we require speed brake only during the daytime and not at night. For this purpose, this project gives a solution. This equipment consists of pneumatic cylinder, Speed breaker setup, solenoid valve, LDR, proximity Sensor and Control unit.

5. Electrical Power Generation Through Speed Breaker:

This project is to enlighten the streets utilizing the jerking pressure which is wasted during the vehicles passes over speed breaker on the roadside. The system can tap the energy generated by moving vehicles and produce power by using the speed breaker as a power generating unit. The kinetic energy of the moving vehicles can be converted into mechanical energy through a rack and pinion mechanism and piezo electric plate this mechanical energy will be converted to electrical energy using a generator which will be used for lighting the streetlights. Therefore, by using this mechanism we can save a lot of energy which can fulfill our future

demands.

METHODOLOGY



Flow chart of electricity generation process

Methodology adopted

1. Selection of a site for installing a speed breaker For installing the sensors, appropriate places like junctions or residential neighborhoods, where there is a lot of traffic and where there are noticeable zones for reduced vehicle speeds are selected.
2. Selection of piezoelectric sensors the piezoelectric sensors should be selected based on information on vehicular traffic in the selected area.
3. Formation of an array of piezo-electric sensors the piezoelectric sensors should be connected in the array for placing it inside the breakers. All the 36-volt piezoelectric sensors were connected in the array.
4. Fixation of the array inside the speed breaker the arrays of piezoelectric sensors are fixed inside the breakers.
5. Installation of speed breaker on the selected site. The speed breakers are then installed on the selected road.
6. Installation of a monitoring system A monitoring system is to be installed to monitor the vehicular traffic, pressure applied by the vehicles, energy production and identify damage or problems with the sensors.

Methodology applied

1. Selection of a site for installing a speed breaker. In the present study, the college campus was selected, as it has high vehicular traffic of an average of 2000 vehicles per day.
2. Selection of piezoelectric sensors. After a detailed literature survey, for heavy vehicular traffic of 2000 vehicles per day, a 35mm piezoelectric cell producing a voltage of 4-6 volts is selected. Hence 35mm piezoelectric sensor cells producing a voltage of 4-6 volts are used in the present study .
3. Formation of an array of piezo-electric sensors. All 35mm piezoelectric sensor cells producing a voltage of 4-6 volts were connected in an array .
4. Fixation of the array inside the speed breaker. The prepared arrays of piezoelectric sensors were fixed inside the breakers.
5. Installation of speed breaker on the selected site. The speed breakers were then installed on roads inside the college campus
6. Installation of a monitoring system A monitoring system is installed to monitor the vehicular traffic; pressure applied by the vehicles, energy production and identify damage or problems with the sensors.

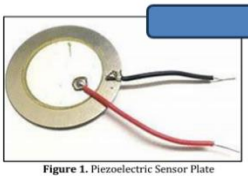


Figure 1. Piezoelectric Sensor Plate

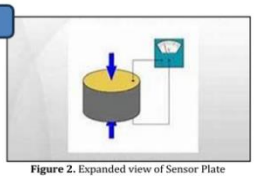


Figure 2. Expanded view of Sensor Plate

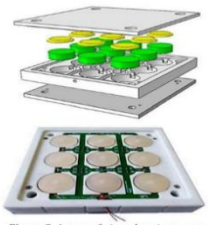


Figure 3. Arrays of piezoelectric sensors

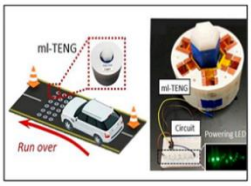


Figure 4. Harnessing process

Calculate Traffic Volume Data IN front Of Jaihind College Of Engineering Road

Definition Of Traffic Volume:S- Traffic Volume (also called Traffic Flow) is the number of vehicles passing a point on a roadway during a specified time period.

Basic Formula: Traffic Volume (Q) = Number of vehicles (N) / Time (T)

Where:

Q = flow rate or volume (vehicles/hour)
N = total number of vehicles counted
T = time period of observation (in hours)

Methods of Traffic Volume Data Collection:

Manual Counting :- Observers count vehicles by type (car, 2-wheeler, bus, truck, heavy vehicle and other vehicle). Usually done using a tally sheet. Suitable for short-duration surveys or low-traffic areas.

Traffic volume data for 12 hours

Hour	2-Wheelers	4-Wheelers	Heavy Vehicles	Other Vehicles	Total Volume
6-7 AM	80	120	40	15	255
7-8 AM	90	135	45	18	288
8-9 AM (Peak)	125	188	63	25	401
9-10 AM	100	150	50	20	320
10-11 AM	100	150	50	20	320
11-12 PM	100	150	50	20	320
12-1 PM	90	130	45	18	283
1-2 PM	85	125	40	15	265
2-3 PM	90	130	45	18	283
3-4 PM	100	150	50	20	320
4-5 PM	100	150	50	20	320
5-6 PM (Peak)	125	188	63	25	401

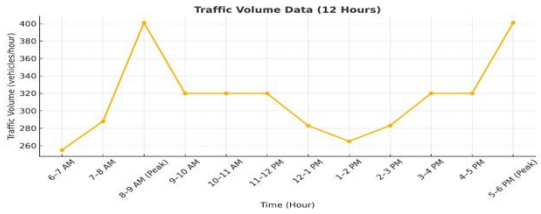


Fig: Graphical Representation Traffic volume data

Sample calculation for peak hour (8 – 9 AM)

2wheeler = 125
4wheeler = 188
Heavy vehicle = 63
Other vehicle = 25

Traffic volume of peak hour = 125+188+63+25 = 401 vehicle per hour

Total:-

2-wheeler = 2108 vehicle in 12 hours
4-wheeler = 1411 vehicle in 12 hours
Heavy vehicle = 770 vehicle in 12 hours
Other vehicle = 205 vehicle in 12 hours

Gross Traffic Volume Calculation: -

Consider night traffic factor = 30 % gross total vehicle

Total vehicle =1616+ 591+ 1085+ 205 = 3500 vehicles

Peak hour traffic = 401 vehicles/hour (8–9 AM and 5–6 PM)

Average hourly traffic = around 315 vehicles/hour.

Total 12-hour traffic volume = 3,500 + 1050 = **4550 vehicles**

CONCLUDING REMARK

Looking at the recent conditions of the electricity crisis in India, government focuses on utilizing the non-conventional energy sources for electricity generation and reducing the share of global warming. So, the techniques which are described above will also contribute to the power generation. It will provide electricity to villages without any extra efforts throughout year.

This arrangement, with some modification can also be used in different application like in footsteps in schools, colleges and residential apartments, so that the power production rate is increased and demand at a particular area can be fulfilled.

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