

Power Generation Using Speed Bumps

Associate. Prof. Dr. B Srinivasulu, Mohd Faisal Farooq Malik, Mohammed Safdar Ullah,
Mohammed Suleimaan

Bachelor of Engineering in Mechanical Engineering,
ISL Engineering College,
Bandlaguda, Hyderabad, Telangana, India.

Abstract- In the following article, we will learn how speed breakers can be used as power generators. Adding a rack-and-pinion gear with a generator attached to a combination of the gears mentioned above can accomplish this. The electricity can also be stored in various cells or other storage sections. The following paper includes a sample calculation for which energy calculations have been conducted.

Keywords- Speed Breaker, Rack & Pinion Gear, Generator, Storage Cells/Battery, Passenger Car.

I. INTRODUCTION

The most widely used energy source is electricity. Electricity innovation has transformed the entire planet, and it has also become the most significant component of the industrial world. It has become a revolutionary aspect of our lives, not only in the case of the home, but also in the case of industrial development.

As a result of technological advancements and industrialization, the need for energy has skyrocketed. India currently has the world's fifth greatest electricity generating capacity, but it is also the world's sixth largest energy user, accounting for roughly 3.4 percent of worldwide energy consumption. Electricity demand grew as a result of improved human living standards and industrialization. As a result, we must create our own electricity.

We use energy generation techniques that are either renewable or non-renewable. However, in today's lifestyle, renewable energy generation must be upgraded to meet the rising demand for electricity. Solar wind mills, for example, are only a few of them. We're generating electricity in a renewable manner right here, from one of our everyday activities. i.e., the energy exerted in the ground by humans, cars, or other sources when walking or jogging on the floor is transformed to electrical energy.

Is the kinetic energy that is exerted in the ground by vehicles or humans being moved has been transformed to electrical energy. This is a non-traditional energy source. It is also less expensive to implement, and the generated energy can be used for a variety of purposes while having no negative effects on the environment.

II. LITERATURE SURVEY

Li Tianze, Zhang Xia, Jiang Chuan, and Hou Luan [2009] offered a paper based on an examination of piezoelectric sensor features and application research [1].

The operating principle, piezoelectric effect, and operation of piezoelectric sensors are originally described in this publication.

This paper also looks at the impedance matching circuit and the piezoelectric transducer's impedance characteristics. When building the measurement circuit for the piezoelectric sensor, pay special attention to the impedance characteristics and impedance matching circuit of the piezoelectric transducer, and draw numerous key conclusions. Finally, discuss the findings and future applications of piezoelectric sensors.

Ahmed, G. R. Jamal Sharmeen A Lisa, Hamidul Hasan, Amitav Das, JannatulFird, Hamidul Hasan [2013] Proposed a paper based on the generation of useful electric power from random sound energy accessible. [2] In this study, the proposed source of green energy is rather low. We can use random sound energy as a source of electric power by using the suitable transducer. Usable this study presents the available random sound electric power energy. The project's piezoelectric transducers convert sound into electrical energy. Many super capacitors store the electrical energy generated by many piezoelectric transducers.

The stored energy is then expressed and amplified with the help of a voltage multiplier circuit and a connection. This electric power is then used to charge a rechargeable DC battery. Using a medium sound source, the suggested conversion circuit allows a small 9-volt DC battery to be entirely recharged in half an hour after the stage has been totally depleted. Random sound energy from a variety of sources can be stored as electric power, which can then be used to drive appropriate tinyloads.

SenkSelik, AnilCan Turkmen, [2016] A paper based on energy was proposed. Piezoelectric Materials for Cutting [3] Integrated shoe Electricity's importance has grown. Everyone is aware of the importance of energy efficiency. It is feasible to retrieve the energy usage of produced

technologies. The project's major goal is to recuperate the energy that has been transferred. People have ground piezoelectric materials in their daily lives.

Mechanical energy is converted into electrical energy using piezoelectric materials. Service The only purpose is to design multiple piezoelectric materials for a single space. Humans Computer software is used to inspect the weights. PZT-5H and PZT-8H were used to perform parametric analysis on 50, 60, 70, 80, and 90 kg.

Ceramic Piezoelectric and Frame Steel and aluminum are used in its construction. PZT-5HPiezoelectric Ceramic System with Steel Frame Embedded in a Human Shoe The applied force of a human shoe weighing 90 kg was reduced by 0.4 percent to 1.43 mw. Electricity is a renewable resource.

M Pravin and Sundararajan suggested [2015] a study based on the creation of piezoelectric material for an open traffic control model and alternate ambulance routing [4] Energy production based on piezoelectric material for an open traffic control model and alternate ambulance routing Embedded boards with interface modules are required to implement traffic control. To replicate manual operation, an embedded board is used.

The advantages of an embedded board are portability, real-time operation, low cost, and programmability. Users can run the measurement system with the help of the operating system and a GPS module that connects to the Internet. It also includes step-by-step instructions to assist the user in their work, such as how to use the embedded measuring system for traffic flow information.

Flow of traffic Expansionism is a liquid crystal display as well. This is depicted in this design. This system uses GPS to identify vehicle condition information. Control part of the vehicle will send state information. Piezoelectric works by using mechanical vibration. For traffic lights, the crystal creates electrical energy. Piezoelectric technology is used to create electricity. Material with a piezoelectric effect when a vehicle passes by it on the side of the road, it generates extra electricity. This design makes use of wireless transmission.

M. Varzakez Rodrigues [2011] proposed a strategy in road traffic applications based on modelling piezoelectric harvesting materials. [5] Modeling piezoelectric on Madrid harvesting material in road traffic applications demonstrates that generating green and green power is a challenge not only for transportation, urban, and commercial areas, but also for microelectronic devices and digital systems.

Recently, the study has contributed to the self-governed system by powering sensor networks, tracking gadgets, and systems.

A test application in road traffic was designed to get an electric used as a model of piezoelectric materials Generator. In many circumstances, the response of Materials for an electronic circuit must be linked. Use off-conduction converters or adaptive circuits for remote applications to examine generated electricity.

III. METHODOLOGIES

This power generation program's working principle is to convert kinetic energy to electric energy via mechanical energy. When the brakes are applied to the vehicle's kinetic energy, this can be done.

The kinetic energy is then transferred to mechanical energy using a rack and pinion gear, and the energy is then converted to electrical energy by connecting the pinion gear to a generator shaft.

1. Speed Breaker:

This is a common occurrence in everyday life. This component can be built of a carbon fiber and rubber composite so that the speed breaker can withstand the weight of a vehicle, such as a container full with material. The starting and finishing slopes of the speed breakers might be formed of concrete and cement mixture, while the central area would be made of the composite indicated before.

2. Rack and Pinion Gear:

This is one of the simplest types of gears and can be manufactured according to one's own need. As the name suggests this type of gear has two components namely Rack which is a straight gear with tooth in only one direction, the second component is the Pinion which is a round shaped gear and will roll upon the rack to perform its task. The alignment of this gear will be in vertical direction.

3. Generator:

A generator is an electrical energy converter that converts mechanical energy into electrical energy. In this instance, the generator's work stays unchanged, and the shaft of the generator will be equipped with a pinion gear on its edge. The pinion gear of the Rack and Pinion system will mesh with the pinion gear of the pinion gear. The second pinion gear will spin with the shaft of the generator while the first pinion gear rotates. The generator will produce electricity as a result of the EMF (Electro Motive Force).

4. Electricity Storage:

It is extremely difficult to store electricity for an extended period of time in any type of storage. To address this problem, a battery pack will be developed that will allow us to store electric energy in the battery pack. Battery packs can also be used to move electric energy from one location to another.

IV. ADVANTAGES

- Free Energy Source
- No Dependency on Sun or Wind
- Environment Friendly
- Easy To Deploy.
- 24 hours applicable.
- Low installation cost.
- Pollution free power generation.
- Energy available all year round.
- Maximum utilization of energy.

V. APPLICATIONS

The Power generated can be used in many places like

- Street lights.
- Road signals.
- Sign boards on roads.
- Digital advertising boards on roads.
- Lighting of the check post on the highways.

VI. CALCULATION

Consider 120 men of mass 80 kg passes over a speed bump power generation system in an hour. The height of rack is 14cm, the diameter of the final pulley is 18mm and having revolution speed (N) is equal to 37 RPM. Down word motion of foot step is due to the weight of moving the person and upward motion of foot step is take place due to the utilization of energy from springs.

Let's us consider,

Weight (mass) of a man= $m=80\text{ kg}$

Force= $F=mg=80\times 9.8=784\text{N}$

$r=9\text{mm}$

$T=r \times F(\text{Nm})$

$T=9\times 10^{-3}\times 784$

$T=7.056\text{Nm}$

$P=T \times w$

$P=7.056\times 2\pi N/60$

$P=7.056\times 2\pi 37/60$

$P=7.056\times 3.87$

$P=27.34$

Total generated power in forward and reversed stroke.

$P=2\times 27.34\text{W}$

$P=54.68\text{W}$

Revolution in one minute= $200/60=3.33\text{rev}/\text{min}$

Power generated in one minute

$=54.68\times 3.33=182.1(\text{minute})$

Power generated in one hour= $182.1\times 60=10925.01\text{W}(\text{hr.})$

Power generated in one hour= $10.925\text{ KW}(\text{hr.})$

VII. BLOCKDIAGRAM

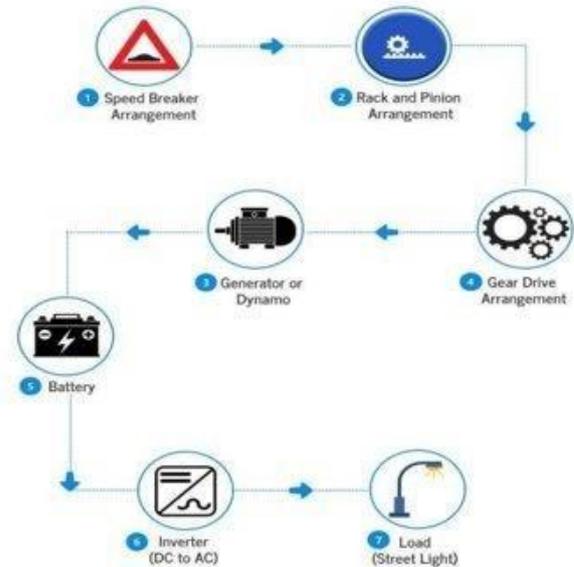


Fig 1. Block Diagram.



(a)



(b)

(a) Operational (b) Completed.
Fig 2. Rendered Design.

VIII. CONCLUSIONS

The demand for electricity is increasing as much as the usage of power. As a result, this project can be applied into everyday life in order to control power usage and limit the use of other fossil fuels.

IX. FUTURE SCOPE

The project's long-term goal is to increase the speed breakers' long-term viability by employing a variety of materials in their production. It is also possible to improve the power producing system by employing different types of generators.

REFERENCES

- [1] <http://www.aui.ma/ssecapstonerepository/pdf/spring2019/speed%20bump%20generating%20electrical%20power.pdf>
- [2] <https://www.slideshare.net/bratisundarnanda/power-generation-from30954152>
- [3] <https://timesofindia.indiatimes.com/city/pune/patent-for-powergenerating-device-from-speed-breakers/articleshow/81518552.cms>
- [4] https://ijarce.com/wpcontent/uploads/2018/11/IJAR_CCE.2018.71010.pdf