

POWER GENERATION THROUGH ROLLING MECHANISM AND AUTOMATION

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ABSTRACT

Now a day's, power has become basic need for human life. Energy is responsible for major developments of a country's economy. Conventional energy sources generate most of the energy of today's world. But the population is increasing day by day and the conventional energy sources are diminishing. Moreover, these conventional energy sources are polluting and responsible for global warming. So, there is a need for saving energy and requires an alternate energy source which is available and feasible. This paper explores the concept of utilizing the rotational motion of rolling objects, such as vehicles, to capture and convert mechanical energy into electrical power. We studied, a renewable non-conventional energy source based on speed breaker mechanism. Our project aim is to enlighten the streets by making use of the energy which is wasted during the vehicles passes over speed breaker. In metro cities, the number of vehicles increases gradually. We can tap the energy generated by moving vehicles and produce power by using the speed breaker as power generating unit. Replacing normal speed breaker with this simple mechanism, the kinetic energy of the moving vehicles can be converted into mechanical energy and this mechanical energy will be converted to electrical energy using generator which will be used for lighting the street lights, power station, automation of drip irrigation, digital display on road side. Therefore, by using this mechanism we can save lot of energy which can fulfill our future demands.

Keyword: Kinetic energy, power generation, speed breaker rolling mechanism, non-conventional energy, automation.

1. INTRODUCTION

Power generation has become a major need for human life. Energy is an important input in all the sectors of any countries economy. Energy drives economic growth, primarily generated from traditional sources. The availability of regular conventional fossil fuels will be the main sources for power generation, but there is a fear that they will get exhausted eventually by the next few decades. Therefore, we have to look into other types of renewable sources. The day-to-day increasing population and decreasing conventional sources for power generation, provides a need to think on non-conventional energy resources. Declining conventional energy sources highlight the urgency to shift towards renewable, eco-friendly alternatives. This transition is essential to reduce environmental harm, combat climate change, and safeguard our long-term energy supply. Another major problem, which is becoming the exiting topic for today is the pollution. So, non-conventional power source is needed to reduce this problem. A non-

conventional power generating system based on speed breaker mechanism which generates electricity without using any commercial fossil fuels, which is not producing any polluting products. In this paper, our aim is to conserve the kinetic energy which converts into electricity that goes wasted, while the vehicles move over the speed breakers. This project explores the feasibility of generating electrical energy from speed breakers on busy roads. In metropolitan areas, the increasing number of vehicles creates an opportunity to harness this energy. By replacing traditional speed breakers with a unique mechanism, we can generate electricity. The generated energy can then be stored and utilized to power streetlights or supply electricity to remote or rural areas. With the shift away from traditional energy sources, finding new and sustainable ways to generate power has become a major issue. As the availability of the conventional energy sources such as fossil fuels are the main sources for power generation for current time period, new innovations would still be heavily required towards direction of green energy generation. The green energy utilization can change the recurrent impact on environment by the pollution levels while creating an unbiased distribution of electricity. Due to constant usage of the conventional based energy system, environment has suffered and so has mankind. It is also clear that the technological advancement has also not yet reached to a stage where the non-conventional methods can replace the conventional. 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 [1]. 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 pass over the track. There is a little literature about extraction of kinetic energy from flow of vehicles on the streets. Most of the proposed systems have been ineffective due to their frequent use of small radial flux generators with inefficient designs. Power generation through rolling mechanism utilizes the kinetic energy generated by rotating speed breakers to produce electricity. This process harnesses the energy generated by the rolling speed breakers to create sustainable power. By capturing the kinetic energy generated by vehicles, this method contributes to sustainability and boosts renewable energy production, opening up new possibilities for energy gathering [1].

2. LITERATURE REVIEW

Environment degradation due to consistent energy spending needs a rational and pragmatic approach, using non-conventional renewable methods for drawing energy can help sustain the environment while creating green energy.

The ramp was invented by Peter Hughes, in the year 2002 an electrical and mechanical engineer who is employed by Highway Energy Systems Ltd. The company says that under normal traffic conditions, the apparatus will produce 30 kW of electricity. Other proposed applications for the road ramps heating roads in the winter to prevent ice forming and ventilating tunnels to reduce pollution. "The full potential of this is absolutely enormous." Hughes claims that 10 ramps could generate the same power as one wind turbine.

Aswathaman and Priyadarshini (2010) Mishra et al. (2013) Rao et al. (2014) designed rack and pinion mechanical speed breakers electricity generators and recorded outputs of 245watts for 250kg load, 441watts for 300kg load, and 147watts for 150kg load respectively in an hour [2]. Their designs did not harness the energy stored in the springs during compression. The design and construction of a double actuated mechanical speed-breaker are pertinent as it harnesses the energy stored in the spring and increases the machine output significantly.

In India, the power consumption has spurred so much that under the 12th Plan, the total capacity addition for power generation was 88537 MW, against this, the actual capacity added till December 2014 was 49058. 22 MW. (Commission, 2012) This shows that a need to use other methods for power generation and distribution is required. Use of speed breakers so as to generate electricity is one of the techniques which can help curb the energy crises as well as pollution generated through fossil fuel-based energy consumption.

Aniket Mishra (2013) invented a technique to create electricity in rural areas that lack sufficient distribution. A similar approach was started in South Africa as their current electrical crisis in opposition to their heavy demand made them to implement this method to light up small villages of the highway. Techniques that are used both in India and South Africa are Air Piston mechanism, Rack and Pinion mechanism, and Roller mechanism.

N. N. Ghuge, Arati Sathe, Varsha Patil, Anagha Warankar (2014) Published research article which is based on 'Every speed breaker is a source of power'. The bearing is provided in order to permit the relative motion between the shafts. In this way vertical motion is to be converted into rotational motion. The one end of the shaft will be

fixed with the help bearing. The working of this speed breaker arrangement for producing electricity is very simple. The ball bearings are connected in one side of roller in this project. At one side ball bearing is used to make the linear and smooth rotation of roller. At the second side synchronous AC motor has been connected through mechanical coupling. As the roller rotates because of vehicle motor also starts to rotate due to which electricity is being produced. . The speed breaker on a busy road will be lifted to some height from one side and fixed to the road from other side. Then there will be a shock absorber kind of mechanism beneath the speed breaker

Piyush Bhagdikar (2012) proposed a model which is based on roller mechanism was developed by VIT University Chennai Campus, uses rollers which generates electricity. The setup uses simple rollers that use the vehicular motion as a mechanism to spin off the rollers which in turn is transformed into energy. With a single run of 2-wheeler, 0.06W/tire is produced through the model. However, the roller mechanism is not self-capable to generate electricity and the usage of rollers in the model are not optimum in size, which makes a concern for proper movement of the rollers in order to generate sufficient energy. Therefore, the conveyor mechanism creates optimum grip within the roller mechanism in order to generate electricity, the purpose of the conveyor is not only to generate the sufficient electricity but also to create minimal friction which is also one of the functions of speed breakers. In the conveyor roller mechanism, the rollers are also large in size which can hold the sufficient weight of the different type of vehicles.

B. Santosh Sarma, V. Jyothi, D. Sudhir (2014) claims that the generation of electricity is possible using road track, as vehicles pass over roller mechanism set up electricity can be produced. For reduction of carbon dioxide emission, renewable energies are considered as proper alternative energy. Unlike conventional speed bumps, the roller mechanism set up won't damage the car or waste petrol while driving the car over the rollers. In this Mechanism, a roller is fitted in between a speed breaker and some kind of a grip is provided on the speed breaker so that when a vehicle passes over speed breaker it rotates the roller. This movement of roller is used to rotate the shaft of D.C. generator by the help of chain drive which is there to provide different speed ratios. As the shaft of D.C. generator rotates, it produces electricity. This electricity is stored in a battery. Then the output of the battery is used to lighten the street lamps on the road. Now during daytime we don't need electricity for lightening the street lamps so we are using a control switch which is manually operated. The control switch is connected by wire to the output of the battery. The control switch has ON/OFF mechanism which allows the current to flow when needed.

3. METHODOLOGY

Power can be produced from conventional and nonconventional energy sources. Energy conversion from kinetic energy to rotational energy and rotational energy to electrical energy takes place. This project explains the mechanism of electricity generation from speed breakers. It is a simple but optimum process to generate energy from speed breaker arrangements. There are a large number of vehicles running on the road; these vehicles are going over a number of speed breakers present on the road. We want to replace this traditional speed breaker with rolling speed breaker. It is an Electro-Mechanical unit. This system utilizes both mechanical technologies and electrical techniques for the power generation and its storage. The generation will be proportional to the traffic density. When the vehicles pass through the speed breaker placed on the busy routes, the rotation of speed breaker generates electricity which is converted by dynamo motor and gets stored in battery. The generated electricity is used in street lights, power station, automatic drip irrigation, digital display on roadside. We have used Light Dependent Resistor (LDR) which automatically switches ON/OFF street lights as there is no need of it during daytime [3].

3.1 System Construction

Speed breaker, generator, charging circuit, battery, dark sensing & switching circuit.

3.1.1. Speed breaker

The main function of this speed breaker is to sustain the pressure of vehicle and rotate it when vehicle passes through it. It generates electricity from the kinetic energy of vehicles. As vehicles slow down over the speed breaker, their kinetic energy will be converted into electrical energy.

3.1.2. Generator

The device which converts mechanical energy into electrical energy is called generator. As vehicles pass over the speed breakers, they impart kinetic energy to the system. This kinetic energy is then transferred to a generator, which converts it into electrical energy through electromagnetic induction. An AC generator is used for producing alternating current which contains an assembly of stationary (stator) and moving parts (rotor). The rotor is connected with the rod. The torque which generated by generator rotates the rotor of the generator. The rotor creates a moving magnetic field around the stator, which induces a voltage difference between windings of stator and produces the alternating current (AC) output of the generator.

3.1.3. Dark sensing and switching circuit

Dark sensing circuit senses the dark and switches the light on. The LDR used in these circuit stop the flow of current in the circuit as light rays fall on it during the day time. And During night time as the circuit sense the dark circuit gets completed and street lights on the road side gets automatically switch ON. A dark sensing and switching circuit also known as a light dependent resistor (LDR) circuit, is designed to detect changes in ambient light levels and a switch or relay accordingly. Its resistance changes based on the intensity of light falling on it. In darkness, its resistance is high, and in light, its resistance decreases [4]. In darkness, the resistance of the LDR is high, causing the voltage at the junction between the LDR and the resistor to be relatively high. This process is fully automatic due to the sensor used in the circuit. We have also used the dark sensing circuit in the digital display, automatic drip irrigation system. The displays on roadsides or highway can be used to show distance between two mega cities or upcoming villages or city names. Fig. 1 shows the dark sensing & switching circuit.

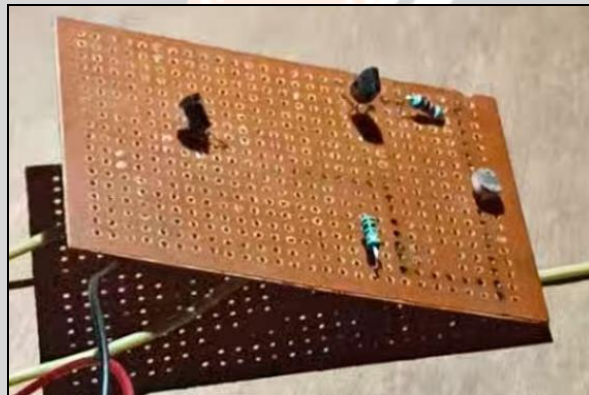


Fig 1. Dark Sensing Circuit

3.2 Working Principal

When the vehicle passes through the rod which is connected to the dynamo motor, the rod will rotate and energy gets generated. The system generates electrical energy, which may enough to power streetlights and traffic signals. The rising number of vehicles, this system can effectively address the ongoing energy crisis. The dynamo motor converts mechanical rotation into a pulsing direct electric current [5]. And this generated energy gets store in the battery. Similar to other power plants that generate electricity, this mechanism for generating electricity from speed breakers utilizes the principle of converting mechanical energy into electrical energy. In this setup, the vertical movement of the speed breaker's top is transformed into rotational motion, which then powers a generator to produce electricity, effectively utilize the mechanical energy. Generated energy we will use in street light during night time. There will be automatic drip irrigation to the plants planted on road side during night. The energy generated will also use in the digital displays that will shows advertisements, distance and direction. And also be used in charging station for electric vehicles [6].

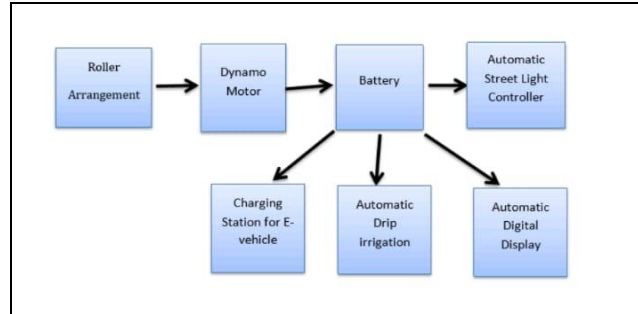


Fig. 2: Block diagram

3.3 Components required

3.3.1 Roller Arrangement:

It can be done at speed breaker side; so that there should be a proper rolling takes place.

3.3.2 Dynamo motor:

The primary function of the dynamo motor is to convert the mechanical energy generated by the rolling mechanism into electrical energy. This motor is also known as a generator, which is a device that can convert mechanical energy into an electric current.

3.3.3 LED Light and Resistors:

LED (light emitting diode) is a semiconductor device that emits infrared light. In this project, we have used LED for street lights and Digital display. And a resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit.

3.3.4 BC 547 Transistor:

It is semiconductor device and has three terminals. It is used to amplify electric signals. The BC547 transistor can operate over a wide temperature range. It has a relatively high DC current gain, making it suitable for use in amplification circuits.

3.3.5 LDR:

LDR Stands for Light Dependent Resistance. It is also known as a photoresistor which is a passive electronic component whose resistance varies with the intensity of incident light. During the day time as light increases resistance decreases and during night time as light decreases the resistance increases vice versa. The primary function of an LDR is to detect changes in light intensity. As the amount of light falling on the LDR changes, its resistance changes accordingly [7].



Fig. 3: Working model

4. ADVANTEGE AND APPLICATIONS

4.1. ADVANTEGES

Using this technology, we can get the following advantages:

- Non-polluting power generating sources.
- Power generating at low cost.
- Simple construction, mature technology.
- Less floor area required and no obstruction to traffic.
- No need of manual work during power generation.
- Auto generation.
- Economical and easy to install.
- 24 hours applicable.

4.2. APPLICATIONS

- Street light.
- Tollbooths.
- Traffic signals.
- Irrigation to plants on roadside.
- Charging station for electrical vehicles.
- Check post on highway.
- Digital display board on road.

5. CONCLUSION

The electrical output is currently limited and the concept of harnessing kinetic energy from moving vehicles has proven successful. If this idea is further refined and scaled up to its full capacity, it has the potential to make a significant contribution to society. The listed system is non-conventional and the way of power generation technique is also eco friendly. It has advantage that it does not utilize any external source. By using this system we will be able to reduce power crisis and load shedding. The stored electricity could satisfy the daily requirement for street lighting. We can also use it for signal system on road, tollbooth or any other useful work. So, from every angle we can see that this system is very much effective to reducing the power crisis and wasted kinetic energy of vehicles at speed breakers. The existing source of energy such as coal, oil, etc. may not be adequate to meet the ever increasing energy demand. This project is a one small step to harnessing energy from several non-conventional energy sources. So, this system will contribute to some extent. Once installed, these systems have low operational costs and can provide long-term benefits in terms of energy savings and sustainability.

6. FUTURE SCOPE

- To operate traffic signals.
- Energy required for fans, light, computers and barrier of tollbooth.
- Speed Controller.
- CCTV cameras on highway.

7. REFERENCES

1. Annamalai Arunachalam, Eco-friendly Electricity generation: Electricity from speed-breakers, India, 2011.
2. Awasthman.V & Priyadarshini. M, Every Speed Breaker is Now a Source of Power, IPCBEE vol.1, Singapore.
3. https://www.researchgate.net/publication/313804513_Electrical_power_generation_through_speed_breaker
4. https://www.academia.edu/40741561/PROJECT_REPORT_Power_Generation_through_Speed_breaker
5. <https://www.slideshare.net/biswajitcet13/power-generation-from-speed-breakers>
6. <https://www.youtube.com/watch?v=aDOUZwaw6dA>
7. <https://www.youtube.com/watch?v=IUxLfvRWiU>