



**SCHOOL OF ADVANCED TECHNOLOGY, ENGINEERING AND
SCIENCE (SATES)**

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROJECT PROPOSAL**

BY

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ON THE TOPIC:

**ELECTRICAL POWER GENERATION USING SPEED BREAKER
SYSTEM OF MOVING VEHICLES**

JUNE 2016

TABLE OF CONTENT

1.0 Introduction

1.1 The field and subject area of study

1.2 Study objective

1.2.1 General objective

1.2.3 Specific objective

1.3 The problem statement

1.4 Methodology

1.5 Background of the study

1.6 The expected outcome of the project

1.7 Safety, environmental and economic aspects

1.8 Layout of thesis

1.9 Conclusion

1.0 INTRODUCTION

Electricity generation includes all technologies that convert some other form of energy into useful electric energy. The fundamental principles of electricity generation were discovered during the 1820s and early 1830s by the British scientist Michael Faraday. His basic method is still used today: electricity is generated by the movement of a loop of wire, or disc of copper between the poles of a magnet. This basic principle of electricity generation had been the main foundation upon which various technologies depends in electric power generation.

Electrical power plays a very important role in every sector of any economy around the world. Increasing population and economic activities had increased the demand for electrical power. The living standard and prosperity of a nation vary with increase in use of power. As technology is advancing the consumption of power is steadily rising. The availability of regular conventional fossil fuels which have been the main sources for power generation is getting depleted. A lot of efforts are being made to find other alternatives and new sources for power generation, which are not depleted easily. Another major problem is pollution which the burning of these fuels cause to the environment. Ghana's energy crisis which was as a result of shortfalls in power generation to meet the increasing population and economic activities has necessitated a need to look for other means of power generation. This is because Akosombo hydro generation dam which serves as Ghana's base load power station is no longer reliable due to the effect of climate change.

One of the emerging technologies in power generation has to do with the use of speed breaker otherwise known as Power Hump. It is an Electro-Mechanical unit. It utilizes both mechanical technologies and electrical techniques for the power generation and its storage. The numbers of vehicles on our roads are increasing on daily bases and a large amount of energy such as potential and kinetic energy are wasted every time a vehicle passes over a speed breaker (ramps) on our roads. There is a great possibility of tapping these energies and generating power by making the speed-breaker as a power generation unit. The Potential energy that a vehicle exerts on the speed breaker is converted into the rotational motion of generator through rack and pinion mechanism. By this method a considerable amount of electrical power can be generated, and this is the main concept of the project.

The project work entails a prototype from the speed breaker which is constructed for demonstration and experimentation purposes. This type of ramp is best suited for places

where the speed breaker is a necessity. Places like Toll booths, high density traffic pass ways or on vehicle parking stands are best for its. The electrical output can be improved by arranging these power humps in series. The generated power can be stored in a battery. We can supply this energy to street lights, traffic lights, and nearby areas, and thus helps in improving the power issues in the country and promote economic growth.

1.1 THE FIELD AND SUBJECT AREA OF STUDY

The field of study of this project is Electrical and Electronic Engineering and the subject area of study is Power Generation.

1.2 RESEARCH OBJECTIVE

1.2.1 GENERAL OBJECTIVE

The general objective of this project is to generate electricity through a non- conversional method of power generation which uses Speed breaker of moving vehicles.

1.2.2 SPECIFIC OBJECTIVE

The specific objectives toward the realization of electricity generation using speed breaker of moving vehicles would be:

- To design an electrical power generating system by using mechanism such rack and pinion.
- To convert linear motion of the vehicles passing on a speed breaker into a rotary motion to rotate a dynamo.
- To design an electronic converter to boost the 6 Volt D.C output of the dynamo into 12 Volt D.C necessary for the load.
- To use the generated power to Charge a battery in order to store the power for use when no car is passing through the speed breaker.
- To convert the DC output to AC necessary for powering the streetlight and traffic light etc.

- To empirically evaluate the output power based on various loads.

1.3. THE PROBLEM STATEMENT

As the world population increases, there is an increasing demand for energy which is the backbone for industrialization and economic growth. The conventional energy sources which had been depended upon for power generation is getting depleted in a very fast rate and there is a need of identifying non-conventional resources for energy generation. Ghana like many developing economies is confronted with power crises due to underinvestment in the energy sector over the years. The Akosombo hydro dam which serves as Ghana's base load power plant since 1965, is no longer serving its purpose because water level in the dam is below the required level, this is as a results of poor rainfall pattern caused by climate change. Increase in population and economic activities have also affected power supply since demand is more than supply.

There have been power crisis in the past but the uniqueness of the recent case is the longer period that the nation has to endure rotating load shedding programme. Unlike the previous power crisis which lasted less than two years, the current situation has persisted for over three years and still counting as there appears to be no end in sight. Also unlike the past where the situation was attributed to low levels of water in the country's hydro dams (Akosombo and Kpong), this excuse is no longer tenable since the nation is now not only dependent on hydro but also thermal (Aboadze, Tema, Sunon Asogli and CENIT Power Plants) and renewable energy (solar). [2]

About 1,500 MW or 51% of the 2,936 MW installed capacity has been available in recent times due to a myriad of factors, the primary one being the unavailability of gas to power the thermal plants and government's inability to purchase light cycle crude oil due to fiscal constraints[3].

These crises is affecting Ghana's economic growth and industrialization agenda. Many jobs are lost leading large unemployment rate.

With these problems enumerated, it has become necessary to explore other means of power generation to help solve some of our perennial power crisis. More attention is now on non – conventional energy resource as there abound enough potential for power generation. This

project seeks to explore the kinetic and potential energy available to moving vehicles passing over speed breaker in order to generate electricity.

The speed breaker method of power generation is gaining attention in some part of Europe and Asia. One major challenge with this method however, is a suitable location with dense traffic flow. This is because the amount of power generated depends on the number of vehicles passing on the speed breaker.

1.4 BACKGROUND AND JUSTIFICATION OF THE PROJECT

Electricity generation is the process of generating electric power from other sources of primary energy. The fundamental principles of electricity generation were discovered during the 1820s and early 1830s by the British scientist Michael Faraday. His basic method is still used today: electricity is generated by the movement of a loop of wire, or disc of copper between the poles of a magnet [8]. Electricity is most often generated at a power station by electromechanical generators, primarily driven by heat engines fueled by chemical combustion or nuclear fission but also by other means such as the kinetic energy of flowing water and wind. Other energy sources include solar photovoltaic and geothermal powers are being used in advance countries. These energy sources had been extensively used since the inception of power generation and various other technologies have been studied and developed for power generation. Developing countries are largely affected with energy crises because of lack of proper investment in the energy sector. Ghana for instance had depended upon the Akosombo hydro dam for many decades as the base load generation station. The perennial low level of water in the dam had created power crises for the country. Ghana's peak load on the transmission grid for 2014 ranges between 1900 – 2200 MW and the total system peak on the grid transmission system would lie within 2,200 – 2,300 MW. From this statistics, electricity demand within the constraints of limited available supply means that there is bound to be significant supply shortfalls any time a power plant is turned off even for scheduled maintenance [4].

In addressing the power crisis, Ghana is exploring various means of power generation to increase the installed capacity of power in order to meet demand. Some of the interventions being made are thermal plant (gas power plant and liquefied petroleum plant) and solar energy. These

conventional means of power generation alone cannot solve all the energy needs going forward as there are changes in our weather conditions and the increasing cost of buying fuel to power the thermal plants. It is imperative to harness some of the non-conventional energy sources to generate power. Electricity generation from speed breaker of vehicles is one of the emerging technologies in power generation. The idea is basic physics, to convert the kinetic energy into electrical energy that goes wasted when the vehicle runs over speed-breaker [5]. It is an electro-mechanical system that utilizes the energy which is wasted when the vehicles pass over a speed breaker to generate electricity. The speed breaker system is used as the generating unit and the vehicle as the prime mover. The kinetic energy of the moving vehicles can be converted into mechanical energy of the shaft through rack and pinion mechanism. These mechanisms are coupled to a generator through some gears which enables the generator to rotate and produce power. Like solar energy plants, the power produced by the speed breaker system is used to charge a battery in order to save the power produced so as to use the power later in the night to power street light etc.

The justification for Speed breaker power generation is because of the enormous energy conservation potential that it possesses. Any time a vehicle is in motion it possesses kinetic energy and on a speed breaker there is potential energy by virtue of its position. These energies are being wasted since they are not utilized. These energies are renewable and cannot be depleted because there are plying our roads on daily basis. Most of the conventional energy resources are almost getting depleted and affecting power generation. It is essential to produce the electrical energy with the existing natural resources that are self-replenishing to safeguard constant power generation. Therefore, by using this arrangement we can save lot of energy which can be used for the fulfillment of future demands. The cost of using speed breaker system for power generation is cheaper compared to others like solar, wind tide etc.

The studies to sort out energy crises in some countries led to the idea of generating power using speed breaker. Firstly, South African electrical crisis has made them implemented this method to light up small villages of the highway. Since then, a lot has been done in this field. An amateur innovator, Kanak Gogoi in Guwahati has developed a similar contraption to generate power, when a vehicle passes over speed-breaker. The idea has caught the eye of IIT-Guwahati, which funded the pilot project related to generate electricity from speed-breakers. They have evaluated

the machine and recommended to the Assam government. Their work has provided the need to think on this alternative to generate electricity on the large scale, as it proves to be a boon to the economy of the country. [7]

There are some advantages associated with this method which made it worth pursuing:

- Pollution free power generation.
- Simple construction, mature technology, and easy maintenance.
- No manual work necessary during generation.
- Energy available all year round.
- No fuel transportation problem

1.4 METHODOLOGY

The methodology to be used in undertaking this project will be in the following manner:

- Literature review
- Outline of Speed breaker power generation systems and operation
- Procurement of parts
- Fabrication and assembly
- Testing and experimentation

The method of generating power using speed breaker of moving vehicles will be to use special arrangement called power hump .It is an Electro-Mechanical unit. . All this mechanism can be housed under the dome, like speed breaker, which is called Hump. It utilizes both mechanical technologies and electrical techniques for the power generation and its storage. The power hump will mainly comprise of rack and pinion gears, ball bearings, spur gear, fly wheel, shaft, spring, electric dynamo, inverter and battery.

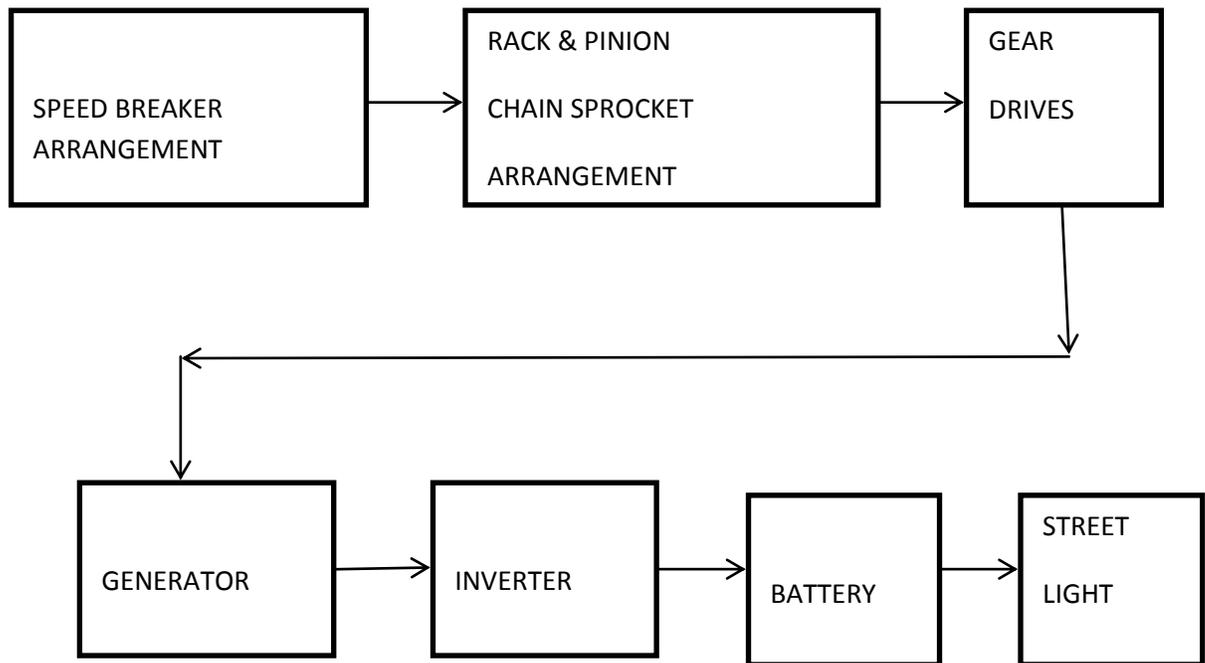


Fig 1. Simple Block Diagram of the Proposed System

1.6 THE EXPECTED OUTCOME OF THE PROJECT

The speed breaker power generation system will be design showing all the necessary circuit diagrams with the various components. There will be a designed prototype of the system that will be used for demonstration.

It is expected that this project will provide an alternative means for the effort being made to generate electricity to support the economy.

1.7. SAFETY, ENVIRONMENTAL AND ECONOMIC ASPECTS

The speed breaker power generation is more environmental friendly because it does not produce any toxic to the environment and all the mechanism are kept under the speed breaker.

It is more economical to generate power with this system since it uses the energy from the moving vehicles.

1.8 LAYOUT OF THESIS

- Chapter 1: This chapter would cover the introduction, background of study, statement of problem, objectives and limitations.
- Chapter 2: This chapter contains the literature review.
- Chapter 3: This chapter contains the methodology.
- Chapter 4: This chapter contains the design and evaluation
- Chapter 5: This chapter contains the conclusion, recommendation and references.