POWER GENERATION BY SPEED BREAKER & WIRELESS ELECTRIC CAR CHARGING SYSTEM

A report submitted to the Department of Electrical and Electronic Engineering, Sonargaon University of Bangladesh in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering.

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DECLARATION

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

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CERTIFICATION

This is to certify that this project entitled **"Power Generation by Speed Breaker & Wireless Electric Car Charging System"** is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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ABSTRACT

This project presents an innovative approach to sustainable energy through a dual-concept system: Power Generation by Speed Breaker and Wireless Electric Car Charging. The first module utilizes piezoelectric sensors embedded under speed breakers to convert the mechanical stress from vehicle movement into electrical energy. As vehicles pass over the speed breaker, pressure is exerted on the piezo elements, generating voltage which is stored in a battery. The second module focuses on wireless charging of electric vehicles (EVs) using inductive coupling. The stored energy is transferred to the vehicle's battery wirelessly using transmitter and receiver coils, enabling on-the-go charging with minimal human intervention. Key components include piezoelectric sensors, rechargeable battery, transmitter and receiver coils. This system promotes renewable energy utilization, reduces dependency on traditional charging infrastructure, and enhances the feasibility of EV adoption, especially in urban environments with high traffic flow and braking activity.

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CHAPTER 1
INTRODUCTION

1.1 Overview

Now a day's power has become the major need for human life. Energy is an important input in all the sectors of any countries economy. 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 investigate 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. 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. W 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. In this paper, our aim is to conserve the kinetic energy which convert into electricity that gone wasted, while vehicles move.

On road vehicles waste a tremendous amount of energy on speed breakers, where there is a necessity to provide speed breaker to control the speed of the vehicles. The annual rate of growth of motor vehicle population in India has been almost 20 percent during the last decade. There is tremendous vehicular growth in year by year. The increasing traffic and number of speed breakers on roads motivate to manufacture an innovative device which can channelize the energy of vehicles that is wasted on speed breakers to some useful work. In this paper it is mainly focused on the principle of Potential Energy to Electrical Energy Conventional. Potential energy can be thought of as energy stored within a physical system. This energy can be released or converted into other forms of energy, including kinetic energy. It is called potential energy because it has the potential to change the states of objects in the system when the energy is released. If h is the height above an arbitrarily assigned reference point, then Kinetic energy of an object is the extra energy which it possesses due to its motion. It is defined as the work needed to accelerate a body of a given mass from rest to its current velocity. Having gained this energy during its acceleration, the body maintains this kinetic energy unless its speed changes. Negative

work of the same magnitude would be required to return the body to a state of rest from that velocity. In this paper it is explained the working of a mechanism to generate power by converting the potential energy generated by a vehicle going up on a speed breaker into kinetic energy. When the vehicle moves over the inclined plates, it gains height resulting in increase in potential energy, which is wasted in a conventional rumble strip. When the breaker comes down, it moves the breaker up and down. This in turn rotates a geared shaft loaded with recoil springs. The output of this shaft is coupled to a dynamo to convert kinetic energy into electricity. A vehicle weighing 1,000 kg going up a height of 10 cm on such a rumble strip produces approximately 0.98 kilowatt power .

1.2 Problem Statement

The demand of electricity is increasing rapidly day by day but the production rate is not according to meet the need. Establishing new power plants to produce more electrical energy is not a solution to this problem as per economical point of view. The government and the electricity generating companies is suffering huge losses in electrical power production due to inefficient methodology and various other constraints especially in thermal power plants. The existing huge gap between demand and production can be filled by producing electricity at individual level in order to meet various household needs. To generate electricity to satisfy daily or basic needs various sources can be used that are normally overlooked in daily life, one of these sources include mechanical pressure of vehicles on speed breaker.

1.3 Motivation

An energy crisis is any significant bottleneck in the supply of energy resources to an economy. Industrial development and population growth have led to a surge in the global demand for energy in recent years. There is a current global need for clean and renewable energy sources. Fossil fuels are non-renewable and require finite resources, which are dwindling because of high cost and environmentally damaging retrieval techniques. So, the need for cheap and obtainable resources is greatly needed.

1.4 Objective

The objectives of this project are

- To study,design and construct the **Power Generation by Speed Breaker & Wireless Electric Car Charging System**
- To Generate electricity using piezoelectric sensors embedded in speed breakers.
- To design a cost-effective and eco-friendly energy generation system.
- To utilize non-conventional energy sources for powering local infrastructure like streetlights and traffic signals.
- To reduce dependence on fossil fuels and promote sustainable energy solutions.
- To put the whole system into action so that we can observe its practical effects and verify our work.
- To study the system performance for future reference and improvement purpose.

1.5 Methodology

Our methodology for the project:

- Creating an idea for design and construction of An Power Generation by Speed Breaker & Wireless Electric Car Charging System. And designing a block diagram & circuit diagram to know which components we need to construct it.
- Collecting all the components.
- Setting up all the components in a PCB board & then soldering. Lastly, assembling all the blocks in a board and to run the system & for checking purposes.

1.6 Work Flow Diagram

The image illustrates the development process of the "Power Generation by Speed Breaker & Wireless Electric Car Charging System" project in a structured flow. It begins with the study phase, where research and analysis of the concept are conducted. This is followed by the design stage, where the system layout is planned. Next is the components collection phase, involving the gathering of necessary materials and devices. After that, the assembling phase involves building and integrating the system. Finally, the complete project stage includes testing, evaluation, and final implementation. The project aims to convert the mechanical energy of vehicles passing over speed breakers into electrical energy, promoting sustainable and renewable power generation.

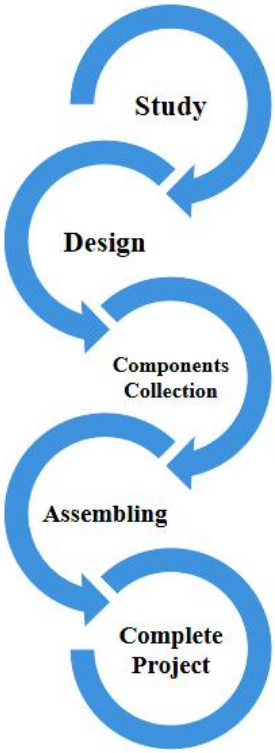


Figure 1.1 : Work Flow Diagram

1.7 Research Outline

This project book consists of Six chapter. The first chapter contains the statement of the Introduction,Overview, Problem Statement, Motivation,Work Flow Diagram, objectives of the study and Methodology. Chapter two contains system Literatur e Review details. Chapter three System Architecture, Discussed in Block Diagram,Circuit Diagram,Working principle and Cost analysis.Chapter Four describes the hardware implementation with component details and the software which we have used for our work. Chapter Five deals with the result Analysis,shows the complete prototype,Advantage, Application and Limitation of the project that we have built. In the final chapter, we have discussed the , Future Scope, conclusion of the project.

CHAPTER 2
LITURATURE REVIEW

2.1 Introduction

In this chapter we discuss our system overview. In this paper we are also work about **Power Generation by Speed Breaker & Wireless Electric Car Charging System**. In below section we will describe some previous literature review. From previous literature we gather more knowledge to build this project and we successfully made it .

2.2 Literature Survey

SPEED BREAKERS" [1] in Journal of Engineering Research and Studies attempts to show how energy can be tapped and used at a commonly used system- the road speed breakers.

The number of vehicles passing over the speed breaker in roads is increasing day by day. A large amount of energy is wasted at the speed breakers through the dissipation of heat and also through friction, every time a vehicle passes over it. There is great possibility of tapping this 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 breakers. The utilization of energy is an indication of the growth of a nation. For example, the per capita energy consumption in USA is 9000 KWh (Kilo Watt hour).

In another paper by Shakun Srivastava et al [2], explains that**,** the rotor is directly connected to the prime mover and rotates as the prime mover turns. The rotor contains a magnet that, when turned, produces a moving or rotating magnetic field. The rotor is surrounded by a stationary casing called the stator, which contains the wound copper coils or windings. When the moving magnetic field passes by these windings, electricity is produced in them. By controlling the speed at which the rotor is turned, a steady flow of electricity is produced in the windings. These windings are connected to the electricity network via transmission lines. IIT Guwahati has evaluated the machine and recommended it to the Assam ministry of power for large scale funding. IIT design department says it is a „very viable proposition" to harness thousands of megawatts of

electricity untapped across the country every day. A vehicle weighing 1,000 kg going up a height of 10 cm on such a rumble strip produces approximately 0.98 kilowatt power. So one such speed-breaker on a busy highway, where about 100vehicles pass every minute, about one kilo watt of electricity can be produced every single minute. The figure will be huge at the end of the day. A storage module like an inverter will have to be fitted to each such rumble strip to store this electricity.

A publication in Elsevier by Mohamad Ramadan et al [3], revealed that powers of roughly 26.2 to 44.7 W can be generated from the speed-breaker system when masses of 65 kg and 80 kg are applied. Hence, a consequence average of 0.37 W/kg forms a promising sign for the performance of such systems in real applications. Extrapolations to a real physical system indicate that a minimum average power of 0.56 kW can be generated for every passing vehicle. In other words installing a speed bump power generator on road will provide a power that may be utilized to lighten city streets, boulevards, and supply low-voltage powers to cameras or speed-sensors.

The speed breaker is connected to the U-shaped shaft with help of the connecting rod, and springs are used in order to provide the return motion of the speed breaker after the vehicle passes over it. the U-shaped shaft is connected to the sprocket and using a chain drive mechanism the power from U shaped shaft is transferred to the small sprocket which is transferred to the DC motor using gear drives, which in result generates power. The specifications of the equipment used in this particular arrangement are as follows, permanent magnet D.C. generator, the voltage generated is 12 Volt D.C. This D.C. voltage is stored in the lead 12-volt battery. The battery and inverter are connected. The inverter is used to convert 12 volts D.C. to 230 volts A.C. [4].

The speed breaker used is a roller type that rotates as the vehicle moves on it then the kinetic energy is converted into mechanical energy which is then converted into electrical energy. which means when a vehicle moves over a roller, the rollers are arranged in a way of free rotation and mounted on bearings on each side so the moving vehicle makes the roller rotate. The roller speed breaker is connected to a sprocket which is mounted on bearings. The chain drive is used to transfer the motion from a sprocket to gear which is used to drive the motor to generate electricity. As a result, we can see that if the speed of

the car increases, then the speed of the roller also increases which helps in increasing the efficiency [5].

The number of rollers used is 3 which are connected by a chain sprocket mechanism, to achieve uniform motion when a vehicle is passed over the speed breaker. the total mechanism is the same as explained before in roller type speed breaker as the kinetic energy is converted into mechanical energy which after is converted into electrical energy. but here it is mentioned the efficiency given by this speed breaker power generator is very low as the test is done by a two-wheeler and also mentioned that for a day the average number of vehicles passed on a speed breaker is more which automatically gives more efficiency. the fine advantage of this process is that the moving parts are less compared to other processes and also the maintenance cost is also less .in this process we are able to reduce the maintenance cost by replacing the chain mechanism with a V-belt mechanism which will reduce the lubricating cost. And The amount of friction can be increased by providing the texture on the roller in order to make the fine rotational motions of the roller when a vehicle passes over it.[6].

The power generated by the speed breaker process uses the rack and pinion mechanism to generate the power. The kinetic energy of the car is converted to linear motion when the car is passed on the speed breaker and the linear motion of the speed breaker is converted to the rotational motion using the rack and pinion mechanism. since the moving parts are less its maintenance cost is less. The circular motion created by the rack and pinion mechanism is transferred to the chain sprocket mechanism and transferred to the DC motor which in result generates the electricity. here a flywheel is used in order to maintain a uniform speed of rotation.[7]Ammar Ahmed explained about the designing of movable-speed bump-based mechanism is used to store kinetic energy which is dissipated when automobiles run on bumps. The system is designed as follows consists of Integrated double-sided rack which has two racks on either ends parallel to each other attached to each pinion and these pinions are connected to two separated gears. The pinion is placed between two gears to increase velocity further this pinion is attached to Flywheel for conservation of angular momentum so as to increase efficiently store rotational energy which occurs during motion of rack and pinion. This flywheel is attached to generator for conversion of Mechanical into Electrical energy. The motion analysis of system is performed on cad model which is designed in Solid works. Different levels of frequencies are applied and analysed using Autodesk Inventor. The force sensors are placed for noting

the amount of force applied by different automobiles. To find an accuracy of measured results the uncertainty calculations are performed for finding Errors further developed an Equation. Selection of Generator is based on less Electrical damping and resistive load for higher Efficiency. On basis of obtained results the overall Efficiency of mechanical energy harvester (MEH) is calculated as 57.5%. It is concluded by the both practical and simulation results are compared which results by 5.7% in difference of efficiency.[8] Aniket Mishra conducted an experiment with the load of 300kg, and Power developed for 60 minutes (1 hr) is 441.45 watts. The power generated by this can be more sufficient to run four street lights in the night time [9].

Mohammad Ramadan conducted the experimental studies and the results were roughly 26.2 to 44.7 W by the masses of 65 kg and 80 kg. if the masses increases then the output power also increases linearly. it is believed that the power generated can be supplied to the street lights, cameras, and the radars on the roads [10]. Sanket S. Khodke eliminated use of chain, sprocket and flywheel to make the model simple and installation easy. The rectifier is used to convert the AC power to pure DC power at the end of the circuit. The rectifier used is bridge rectifier which
consists of 4 rectifier diodes [11].

The process of power generation by rack and pinion method is conducted and the power generation by using roller mechanism is also used. As we all know whenever a rolling motion transfers on the roller arrangement the rollers in the arrangement also get rolled. So, by using this simple process power can be generated. When a vehicle passes through this roller arrangement speed braker the rollers get rotated. The rotations of the roller are transferred to the gear arrangement and then the maximum amount of the rotations is transferred to the generator or motor and thus electricity is generated and that generator is connected to the battery. By using this power road street lights can glow. The differences between roller, rack, and pinion method are mentioned here such as the roller method is less efficient and rack and pinion method are more efficient, the maintenance required for roller method is high compared to rack and pinion method, designing of roller method is easy as compared to rack and pinion method. [12]

In this paper, Chung-Cheng Hsiao discussed about Developing a mechanical roadway system for waste energy capture of vehicles and electric generation. In automobiles the

complete fuel is not consumed to run vehicles whereas only 15% is used and all other exhausts as wastage. It is whole about developing a compressive system for capturing energy during braking by using hydraulic system. In downhill roadways the piston arrangement is placed and vehicles will decelerate during this energy is captured. These piston plates are pressed by vehicles and the fluid results in transporting in to potential energy for storage. These storage system drives a generator through hydraulic device by uplifted weight. This hydraulic drive consists of 136 pistons which is composed of piston plates. The energy is stored and connected to Generator for conversion of energy in to Electrical. The reservoir consists of oil is arranged to save hydraulic fluid. The overall efficiency depends on factors are plates of piston, potential storage and transmission of hydraulic results as 90.38 %,95.09 % and 57.52 %.It is concluded that by using this mechanical roadway system results in overall efficiency is 41.03%.[13]

Singh et al. [14] discussed rack pinion mechanism to generate electricity. They proposed mechanism using chain aporocket and springs with rack pinion to generate electricity. Vehicle was passed over that mechanism and then due to rack pinion there was rotation in gears and shafts moved with chain sprocket movement. Dc power was generated and was stored in a battery and then using an inverter they changed that dc in ac power.

Das et al. [15] proposed mechanism in which electricity was produced by kinetic energy of speed breaker. The basic principle was when a car passes over the jump or dome which is the device use in place of jump the dome will go down due to weight of car while moving car possess kinetic energy that kinetic energy will be converted into rotational energy with the help of rack and pinion. A fly wheel was mounted on the shaft whose function was to make energy uniform. That shaft is connected through a belt with dynamos. These dynamos were used to convert mechanical energy in electrical energy. The power was generated in both directions. They used Zener diode to generate power in opposite direction too.

Kaur et al. [16], discussed mechanism of power generation with speed breakers by using rack and pinion technique. They made a dome like assembly to place under the speed breaker. When a car passed over this dome the rack will convert linear motion into rotatory motion with the help of pinion and pinion is connected to a shaft which will also rotate with the pinion. A large gear was also connected to the shaft which will also move

and it will move with the same speed of pinion this gear is connected to another small gear using chain sprocket arrangement this will rotate the small gear and small gear will complete more rotations as compared to bigger one. A flywheel was mounted on the lower shaft whose function was to regulate the fluctuation in the energy and to make the energy uniform, now this shaft was connected to the generator using spur gear due to which the generator was rotated and the electricity was produced.

2.3 Summary

From the literature discussed above, we gained a lot of knowledge and we inspired to do this project. We were able to do it with everyone tireless work.

CHAPTER 3
SYSTEM ARCHITECTURE

3.1 Introduction

The project objectives, methods, literature evaluation, and other details were all clarified in the preceding chapter. The block diagram, circuit diagram, Working principle,Project final Image and cost analysis will all be covered in this chapter.

3.2 Block Diagram

Here is the block diagram of the **Power Generation by Speed Breaker & Wireless Electric Car Charging System** with all the essential components. All of the components are shown in below as a block in this diagram.Here we use Battery, Piezo, Wireless Coil, Street Light of our project and work together for perform as our desire outcome.

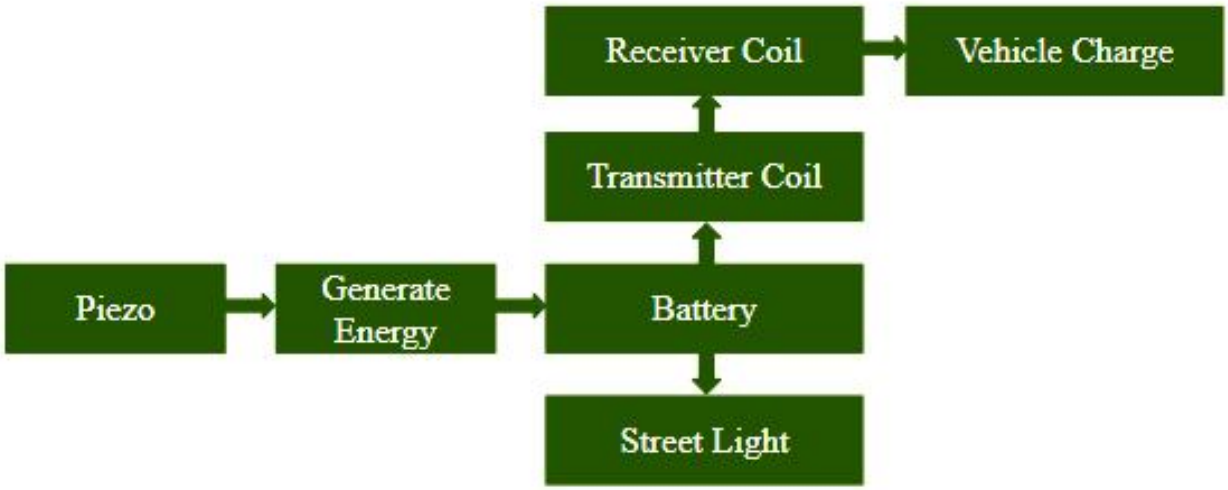


Figure 3.1: Block Diagram of Our Project

3.3 Circuit Design

In this part we show our project circuit design and connect out instrument through standard wire.

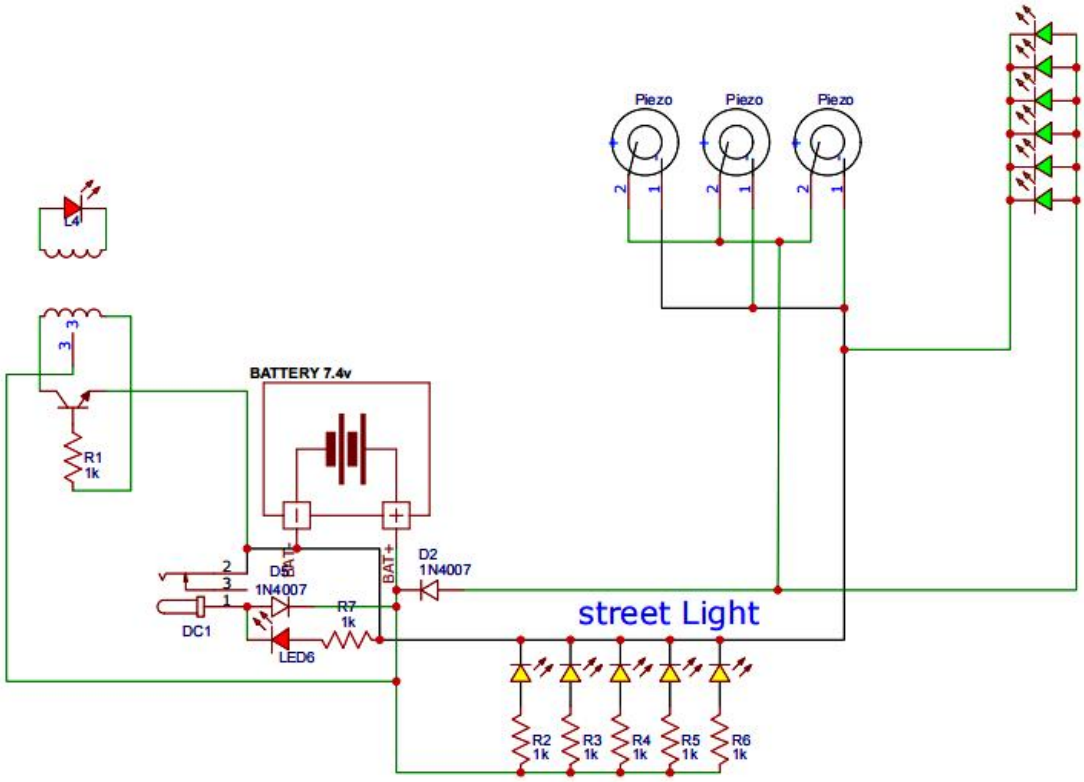


Figure 3.2 : Schematic Design of our Project

3.4 Working Principle

The system operates by placing piezoelectric sensors beneath speed breakers to harvest energy from vehicle movement. When a vehicle passes over the piezo sensors, pressure is applied, causing them to generate an electric charge. As soon as charging begins, an indicator light will turn on to signal energy generation. The generated electricity is then stored in a rechargeable battery. This stored energy is used to power street lights and is also transferred wirelessly to electric vehicles using transmitter and receiver coils through inductive coupling, enabling convenient and contactless EV charging while promoting sustainable energy use.

3.5 Cost Analysis

Table 1:List of Component with Price

Sl.no	Particulars	Specification	Qty.	Unit Price (Taka)	Total Price (Taka)
1	Battery	3.7V	2	150	300
2	Piezo		3	100	300
3	Wireless coil	Transmitter & Receiver	2	350	700
4	SMDLight		5	5	25
5	LED Light		8	3	25
6	Others				1000
				Total	2350/=

CHAPTER 4
HARDWARE AND SOFTWARE ANALYSIS

4.1 Introduction

In this section, we will discuss elaborately about " **Power Generation by Speed Breaker & Wireless Electric Car Charging System**" and the component description, features, working procedure of our all equipment. The system hardware fabricates composed of micro-controller unit, power unit, source unit, power store unite, sensor unit and many more related components.

4.2 Hardware & Software

Hardware

- Battery
- Piezo Elements
- Wireless Coil
- LED Light
- Transistor

Software

- Easy EDA

4.3 Piezo Elements

Piezoelectric sensors measure the electrical potential caused by applying mechanical force to a piezoelectric material. Piezoelectric sensors are used in a variety of pressure-sensing applications. A few examples

- Alumina ceramics
- Single crystals
- Ultrasonic transducers

A piezoelectric sensor works on the principle of conversion of energy in mechanical and electrical energy forms. When a polarized crystal is put under pressure, some mechanical deformation takes place in the polarized crystal, which leads in the generation of the electric charge. The generated electric charge or the mechanical deformation can then be measured using a piezo sensor.

Types

There are many types of piezoelectric sensors. Examples include

- piezoelectric accelerometer
- piezoelectric force sensors
- piezoelectric pressure sensors

A piezoelectric accelerometer is widely used for OEM applications and is suitable for working at a lower power consumption and wider frequency range. Piezoelectric force sensors are low impedance voltage force sensors designed for generating analog voltage signals when a force is applied on the piezoelectric crystal and are widely used in machines for measuring force. A piezoelectric pressure sensor is also known as a piezoelectric sensor pressure. Piezoelectric pressure sensors are used for measuring change in liquid and gas pressure. Other piezoelectric sensors are commonly available.

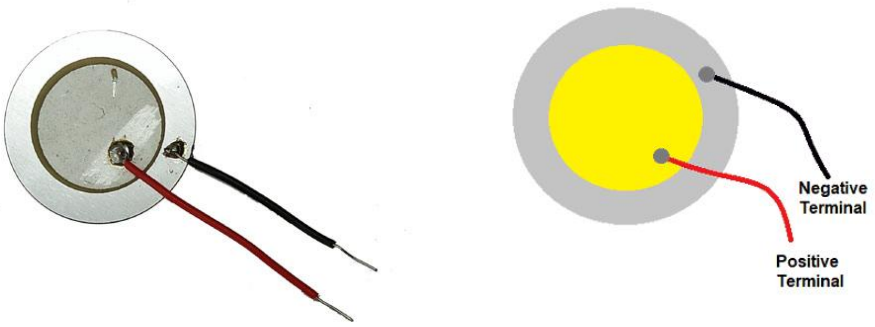


Figure 4.1: Piezo Sensor and Pin output

Pin Configuration

Table 2: Pin Configuration of Piezo Element

Pin Name	Description
Outer Circle	This gives Negative output voltage
Inner Circle	This gives positive output voltage

Features and Specifications

- Impedance:≤500Ω;
- Voltage:≤30Vp-p;
- Operating temperature:-20°C~+60°C
- Storage temperature:-30°C~+70°C
- Low Soldering temperature
- Strain sensitivity: 5V/με
- Material: Quartz (mostly used)

Brief Description

Pierre Curie founded the piezoelectric effect in 1880, but it started to be used for industrial sensing application in 1950. **Piezoelectric sensor** is used to convert the mechanical stress into electric charge, it gives AC at output.

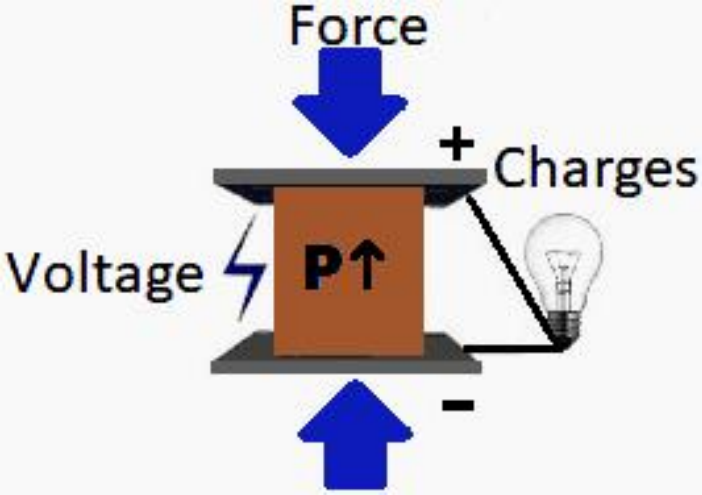


Figure 4.2: Piezoelectric Effect

Piezoelectric Effect

The ability of a piezoelectric material to convert a mechanical stress into electrical charge is called a **Piezoelectric Effect**. The word Piezoelectric derived from the Greek word 'piezein' which means to push, press and squeeze. Piezoelectric effect is reversible effect means when we applied mechanical stress to the piezoelectric material we get some electrical charge at output. Same as when we feed electrical charge to the sensor it gets stretch or compresses.

Piezoelectric Material

Table 3: Piezo Material description

Natural Piezoelectric Material	**Synthetic Piezoelectric Material**
Quartz (most used)	Lead zirconate titanate (PZT)
Rochelle Salt	Zinc Oxide (ZnO)
Topaz	Barium Titanate (BaTiO3)
TB-1	Piezoelectric ceramics Barium titanate
TBK-3	Calcium barium titanate
Sucrose	Gallium orthophosohate (GaPO4)
Tendon	Potassium niobate (KNbO3)
Silk	Lead titanate (PbTiO3)
Enamel	Lithium tantalite (LiTaO3)
Dentin	Langasite (La3Ga5SiO14)
DNA	Sodium tungstate (Na2WO3)

4.4 Battery

Lithium batteries are primary batteries that have metallic lithium as an anode. These types of batteries are also referred to as lithium-metal batteries. They stand apart from other batteries in their high charge density and high cost per unit. Depending on the design and chemical compounds used, lithium cells can produce voltages from 1.5 V (comparable to a zinc–carbon or alkaline battery) to about 3.7 V.

Disposable primary lithium batteries must be distinguished from secondary lithium-ion or a lithium-polymer, which are rechargeable batteries. Lithium is especially useful, because its ions can be arranged to move between the anode and the cathode, using an intercalated lithium compound as the cathode material but without using lithium metal as the anode material. Pure lithium will instantly react with water, or even moisture in the air; the lithium in lithium ion batteries is in a less reactive compound.

Lithium batteries are widely used in portable consumer electronic devices. The term "lithium battery" refers to a family of different lithium-metal chemistry, comprising many types of cathodes and electrolytes but all with metallic lithium as the anode. The battery requires from 0.15 to 0.3 kg of lithium per kWh. As designed these primary systems use a charged cathode, that being an electro-active material with crystallographic vacancies that are filled gradually during discharge.



Figure 4.3: 3.7V Battery

Product Specification

Table 4: Battery Specification

Voltage	3.7 V
Product Type	Lithium-Ion
Battery Capacity	2200mAh
Weight	45 g
Model Number	ICR 18650

4.5 LED Light

A light-emitting diode (LED) is a semiconductor device that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.



Figure 4.4: LED Light

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared (IR) light. Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, and in seven-segment displays.

4.6 Wireless Coil

There are different shapes of coil used in WPT systems.Among them, the circular coil is the most effective structure in high-frequency wireless transfers as there are no sharp edges. So, the eddy current is kept to minimum .The high magnetic field produced by the coil causes better

Transmitter Coil. The coil of the RF transmitter, inside the MR imager is used in excitation of the spins. Also called transmit-only coil it is used to create the B1 field. As a radio frequency generator send this coil bursts of RF pulses. These pulses serve to disturb the spins in the patient.

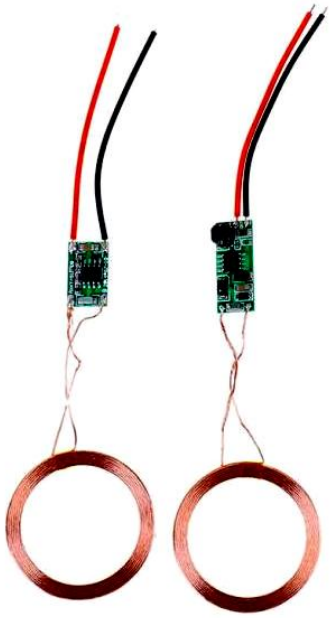


Figure 4.5: Transmitter and Receiver Coils

Receiver Coil. A coil, or antenna, positioned within the imaging volume and connected to the receiver circuitry that is used to detect or receive the MR signal from the patient as the disturbed spins relax back into their equilibrium distribution. Also called receive-only coil.

4.7 Transistor

Specifications

- Bipolar Transistor, npn, 45v, to-92
- Transistor Polarity: NPN
- Collector Emitter Voltage V(br)ceo: 45V
- Transition Frequency Typ ft: 300MHz
- Power Dissipation Pd: 625mW
- DC Collector Current: 100mA
- DC Current Gain hFE: 150
- Straight-lead housing

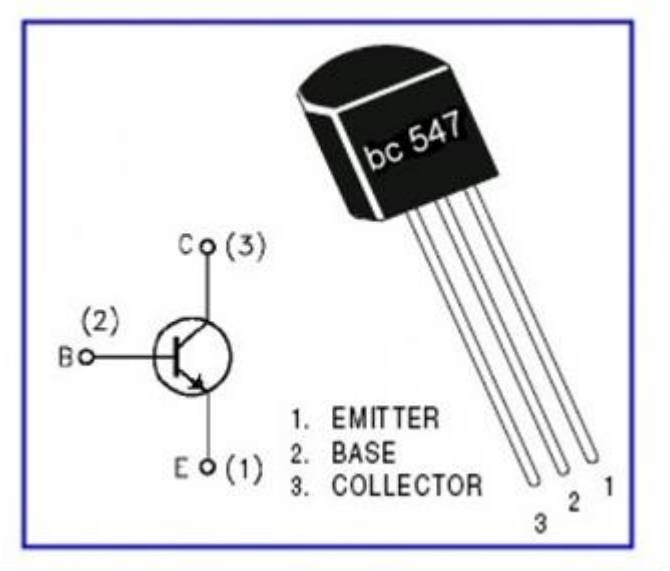


Figure 4.6: BC 547

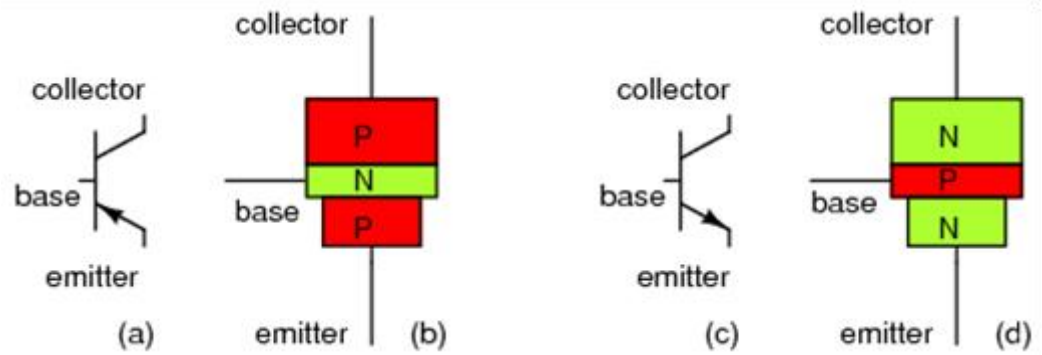


Figure 4.7: Transistor Symbols

My intent here is to focus as exclusively as possible on the practical function and application of bipolar transistors, rather than to explore the quantum world of semiconductor theory. Discussions of holes and electrons are better left to another chapter in my opinion. Here I want to explore how to use these components, not analyze their intimate internal details. I don't mean to downplay the importance of understanding semiconductor physics, but sometimes an intense focus on solid-state physics detracts from understanding these devices' functions on a component level. In taking this approach, however, I assume that the reader possesses a certain minimum knowledge of semiconductors: the difference between "P" and "N" doped semiconductors, the functional characteristics of a PN (diode) junction, and the meanings of the terms "reverse biased" and "forward biased." If these concepts are unclear to you, it is best to refer to earlier chapters in this book before proceeding with this one.A bipolar transistor consists of a three-layer "sandwich" of doped (extrinsic) semiconductor materials, either

P-N-P in Fig below a(b) or N-P-N at (d). Each layer forming the transistor has a specific name, and each layer is provided with a wire contact for connection to a circuit. The schematic symbols are shown in Fig below (a) and (d).

BJT transistor: (a) PNP schematic symbol, (b) physical layout (c) NPN symbol, (d) layout.

The functional difference between a PNP transistor and an NPN transistor is the proper biasing (polarity) of the junctions when operating. For any given state of operation, the current directions and voltage polarities for each kind of transistor are exactly opposite each other.Bipolar transistors work as current-controlled current regulators. In other words, transistors restrict the amount of current passed according to a smaller, controlling current. The main current that is controlled goes from collector to emitter, or from emitter to collector, depending on the type of transistor it is (PNP or NPN, respectively). The small current that controls the main current goes from base to emitter, or from emitter to base, once again depending on the kind of transistor it is (PNP or NPN, respectively). According to the standards of semiconductor symbology, the arrow always points against the direction of electron flow. (Fig below)

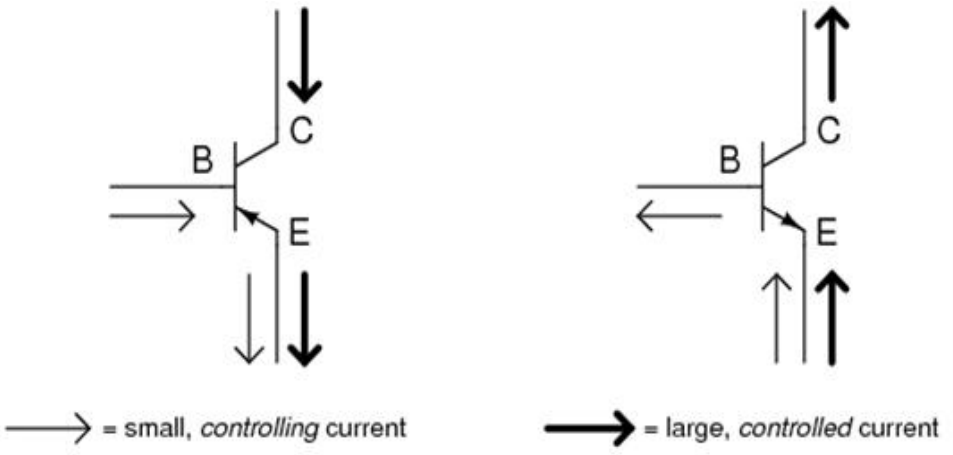


Figure 4.8: NPN & PNP Transistor Symbol

Small Base-Emitter current controls large Collector-Emitter current flowing against emitter arrow. Bipolar transistors are called bipolar because the main flow of electrons through them takes place in two types of semiconductor material: P and N, as the main current go from emitter to collector (or vice versa). In other words, two types of charge carriers—electrons and holes—comprise this main current through the transistor.

As you can see, the controlling current and the controlled current always mesh together through the emitter wire, and their electrons always flow against the direction of the transistor's arrow. This is the first and foremost rule in the use of transistors: all currents must be going in the proper directions for the device to work as a current regulator. The small, controlling current is usually referred to simply as the base current because it is the only current that goes through the base wire of the transistor. Conversely, the large, controlled current is referred to as the collector current because it is the only current that goes through the collector wire. The emitter current is the sum of the base and collector currents, in compliance with Kirchhoff's Current Law. No current through the base of the transistor, shuts it off like an open switch and prevents current through the collector. A base current, turns the transistor on like a closed switch and allows a proportional amount of current through the collector. Collector current is primarily limited by the base current, regardless of the amount of voltage available to push it.

4.8 Easy EDA

Easy EDA is a web-based EDA tool suite that enables hardware engineers to design, simulate, share-publicly and privately-and discuss schematics, simulations and printed circuit boards. Other features include the creation of a bill of materials, Gerber files and pick and place files and documentary outputs in PDF, PNG and SVG formats. Easy EDA allows the creation and editing of schematic diagrams, SPICE simulation of mixed analogue and digital circuits and the creation and editing of printed circuit board layouts and, optionally, the manufacture of printed circuit boards.

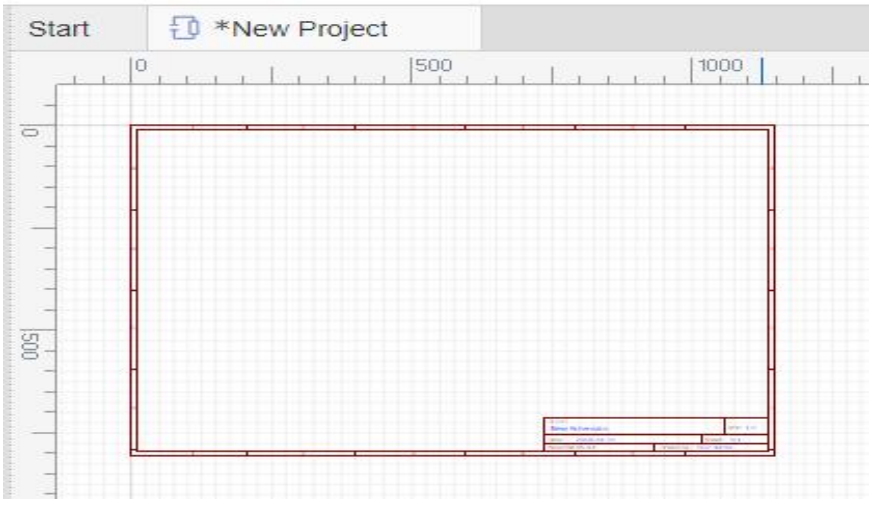


Figure 4.9: Easy EDA Software Interface

Subscription-free membership is offered for public plus a limited number of private projects. The number of private projects can be increased by contributing high quality public projects, schematic symbols, and PCB footprints and/or by paying a monthly subscription.Registered users can download Gerber files from the tool free of charge; but for a fee, Easy EDA offers a PCB fabrication service. This service is also able to accept Gerber file inputs from third party tools.

CHAPTER 5
RESULT & DISCUSSION

5.1 Result Analysis

After finally completing this project, we ran it & we observed the output of this project. We can see that it is working well as expected. After making our project we observe it very careful. It works as we desire. Our project give output perfectly and all equipment are work perfectly. We check how much it works and we get perfect output from this project.

- Finally, we have completed our project successfully & check our project its run accurately according to our objective.
- At first, we start our system.
- Following are The outputs of our project.
- Piezoelectric sensors effectively generated electricity from vehicle pressure on speed breakers.
- Battery stored generated power efficiently for later use.
- Wireless energy transfer between transmitter and receiver coils was functional.
- Streetlights and small vehicle charging units operated using the stored energy.
- System proved eco-friendly and suitable for high-traffic areas.

5.2 Final Project



Figure 5.1: Complete Project Prototype

5.3 Advantages

There are certainly many advantages of our project and some of the major ones have been given below

- No consumption of any fossil fuel.
- No manual work necessary during generation.
- Eco-friendly.
- 24 hours applicable.
- Low installation cost.
- Low maintenance cost.
- Simple in construction.
- Less space is required.
- Pollution free power generation.
- Energy available all year round.
- Maximum utilization of energy.

5.4 Application

The application areas for this project in this modern and practical world are huge and some of these are given below:

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

5.5 Limitation

It is a demo project so we found some limitation. In future we will work for reduce this kind of limitation. These limitations are –

- Energy output depends on traffic volume; low traffic generates less power.
- This project can now be only used for small scale purposes
- No energy backup.
- Used cheap Chinese products for the prototype so there's some processing delay present in the circuit.

5.6 Discussion

While working on our project, we did face some difficulties as it is a very complex system but the end results, we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involves improvement in system design and wiring, adding features for more efficient.

This project effectively combines two green technologies—piezoelectric power generation and wireless EV charging—to create a smart, energy-efficient system. By utilizing vehicle pressure on speed breakers, the system captures otherwise wasted mechanical energy and converts it into usable electrical power. The inclusion of an indicator light enhances real-time feedback on system performance. Stored energy not only powers street lights but also enables wireless charging of electric vehicles through inductive coupling, offering a contactless and convenient solution. This approach supports sustainable transportation infrastructure, reduces grid load, and encourages renewable energy integration in urban areas with high traffic density and frequent braking activity.

CHAPTER 6
CONCLUSION

6.1 Conclusion

The “Power Generation by Speed Breaker and Wireless Electric Car Charging System” project offers a practical and innovative solution to modern energy and transportation challenges. It effectively demonstrates how mechanical energy, which is usually wasted during vehicle braking, can be captured using piezoelectric sensors embedded beneath speed breakers. This harvested energy is successfully stored in a rechargeable battery and used for multiple purposes, such as powering street lights and enabling wireless charging of electric vehicles via inductive coupling. The addition of an indicator light enhances system interactivity by providing real-time feedback during energy generation.

The wireless charging system eliminates the need for physical connectors, making it safer and more convenient for users. This dual-purpose system promotes clean energy usage, reduces pressure on the electrical grid, and encourages the adoption of electric vehicles, especially in traffic-heavy urban areas. Its design is scalable, low maintenance, and eco-friendly, making it highly suitable for smart city infrastructure. By integrating sustainable power generation with EV technology, this project aligns with global efforts toward renewable energy adoption and carbon footprint reduction. Overall, it proves to be an effective step forward in the direction of green technology and intelligent transport systems for the future.

5.2 Future Scope

We are thinking about adding many features to our project in the future to get more desirable out comes. Some of the steps that we are thinking about taking are given below:

- In future development this project can be develop by Microcontroller Unit .
- In future, I will try it to apply in real field.
- In Future we will add extra power system.
- In future develop Control on IoT System

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