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POWER PRODUCTION FROM SUBWAY

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Abstract—
In this project, we are generating electrical power as a non-conventional method by simply running the train on the railway track. Non-conventional energy using railway tracks needs no fuel input power to generate the output of the electrical power. This project uses simple drive mechanisms such as rack and pinion mechanisms. The control mechanism carries the rack and pinion, D.C generator, battery, and inverter control. In this, we are attaching the dynamo with gear (pinion) set up on the train and we are placing the rack on the track. Rack & pinion used the rotational motor to affect the linear motion via a rack & pinion combination. The generator used here is a permanent magnet D.C. generator. The generated voltage is 12Volt D.C. The battery is connected to the inverter. This inverter is used to convert the 12 Volt D.C to the 230 Volt A.C. This 230 Volt A.C voltage is used to activate the light, fan, etc. By increasing the capacity of the battery and inverter circuit, the power rating is increased.

Keywords: Railway Track, DC motor, rack and pinion mechanism, DC Generator, Inverter, Rechargeable Battery.

INTRODUCTION

In this project we are generating current as non-conventional method by running the train on the railway track. Non-conventional energy using railway track without fuel input power to generate the output as the electrical power. This project using simple drive mechanism such as rock and pinion mechanism.

In this project force energy converted into electrical energy. The control mechanism carries the D.C generator, rack & pinion mechanism, battery and inverter control. In this we are attaching the dynamo with gear (pinion) setup on train and we are placing the rack on track. Rack & pinion used rotational motor to affect the linear motion via a rack & pinion combination. When the trains move on the track, the flywheel is attached to the shaft of the generator so if the flywheel will rotate then there is a rotation shaft generator, power get generated and that power is stored in the battery. This battery power is used to run the train and converts this battery power into AC using inverter.

This system can be installed under the railway tracks where ever there is shortage of electricity. In India many villages still facing lack of electricity supply. To supply power to those villages with the electricity our system can be the one solution which can be installed under the nearby railway tracks, and the system will generate the electricity.

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Implementation:

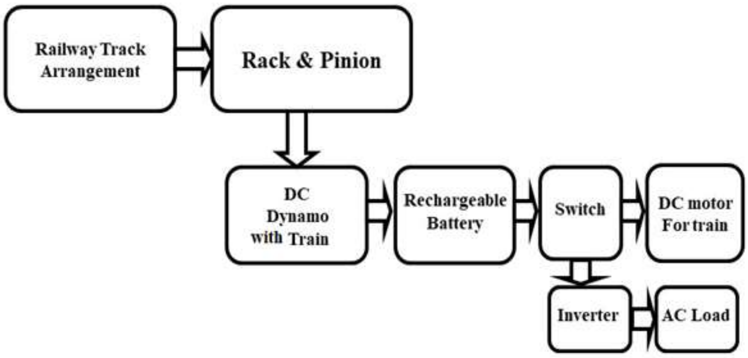

Fig: Block diagram of the project

When the trains move on the track, the flywheel is attached to the shaft of the generator so if the flywheel will rotate then there is a rotation shaft generator and power get generated and that power is stored into the battery. This battery power is used to run the train and converts this battery power into AC using inverter.

Permanent magnet D.C generator is used here. The generated voltage is 12Volt D.C. This D.C voltage is stored in the 12 Volts Lead-acid battery. The battery is connected to the inverter. This inverter is used to convert the 12 Volt D.C to the 230 Volt A.C. This 230 Volt A.C voltage is used to activate the light, fan etc. By increasing the capacity of the battery and inverter, the power rating is increased. This arrangement is fitted in the railway track and train.

Related Work:

The brief introduction of different components used in this project is discussed below:

Railway track:

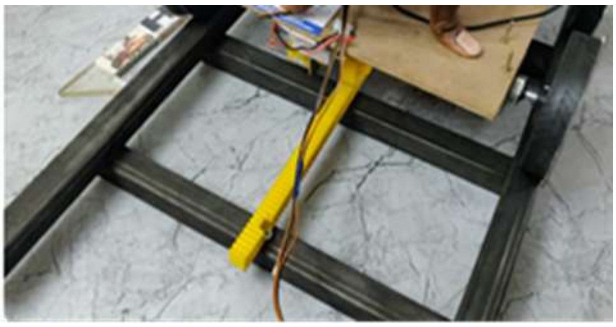

Fig: Railway track

A railway is a track where the vehicle drives over the two parallel steel bars called rails. The rails Support and guides the wheel of the vehicles which are commonly in trains.

Rack and pinion:

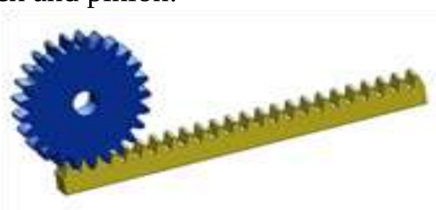

Fig: Rack and pinion mechanism

Through the use of a rack and pinion assembly, rack and pinion utilize a rotary motor to influence linear motion. They are mostly used in long journey applications that demand high rigidity & precision.

DC Generator:
A DC Generator is an electrical device which converts mechanical energy into electrical energy. /.A DC generator is a device that changes motion into electricity. It works by using magnets and wires. When a wire moves near a magnet, it makes electricity flow in the wire. This is called induced emf (Electromotive Force). The wire has to be part of a loop, so the electricity can go around. In a DC generator, there are coils of wire that spin near magnets. These coils are called the armature. The magnets are called the field coils. The electricity that is made in the armature is called DC (Direct Current). It means that the electricity always flows in the same direction. To find out which way the electricity flows, you can use Fleming's right-hand rule.

Fig: DC Generator

Rechargeable battery:
A rechargeable battery is a kind of electrical battery that can be used more than once. It has one or more cells that store energy by chemical reactions that can be reversed by electricity. It is also called a secondary cell. Rechargeable batteries have different shapes and sizes, from small ones in watches to big ones in power grids. They also have different chemical materials, such as: lead–acid, nickel cadmium (NiCd), nickel metal hydride (NiMH), and others.

Fig: Rechargeable battery

Inverter:
Inverter is an electronic device or circuitry which changes direct current (DC) to alternating current (AC). The input voltage, output voltage and frequency and overall power handling depends on the design of the particular device or circuitry. The circuit requires a relatively stable DC power source capable of supplying enough current for the intended power demands of the system.

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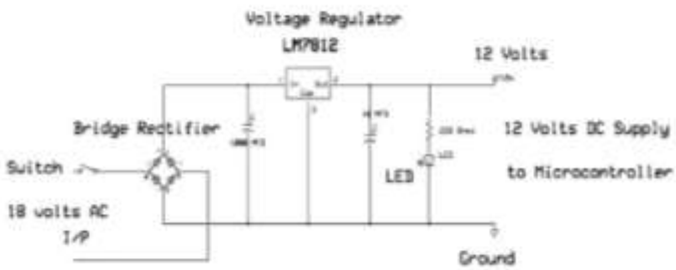
Fig: Inverter

DC Motor:

A DC motor produces mechanical energy by using electrical energy, very typically through the interaction of magnetic fields and current-carrying conductors. The reverse process, producing electrical energy from mechanical energy, is achieved by an alternator, generator or dynamo. Many types of electric motors can be run as generators, and vice versa. The input supply of a DC motor is current/voltage and its output is torque (speed).

Fig: DC Motor

CHARGING CIRCUIT:



The circuit diagram shows how to get 12V steady DC from 18V AC. First, the 18V AC is changed to 18V pulsating DC by the diode bridge. Then, the capacitor smooths out the pulsating DC to make it more stable. Next, the voltage regulator 7812 reduces the voltage from 18V to 12V. Finally, another capacitor filters out any spikes that might remain after the regulation. The LED will light up if the output terminal has 12V steady DC.

TRANSFORMATION:

Transformation is the name of the process that changes energy from one device to another. We use devices called transformers to do this.

RECTIFICATION:

The process of converting an alternating current to a pulsating direct current is called as rectification. For rectification purposes we use rectifiers.

RECTIFIERS:

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They are devices that change AC to DC, which is called rectification. They can be used for many things, like power supplies and radio detection. They can be made of different things, like diodes, tubes, valves, and more. A device that does the opposite (changing DC to AC) is called an inverter.
A diode is a device that can block one direction of current in a circuit. A rectifier is a device that uses diodes to change AC (which has both positive and negative cycles) to DC (which has only one direction of current). The term rectifier is used when a diode is used for this purpose. Most rectifiers have more than one diode in a certain arrangement to change AC to DC more efficiently than with only one diode. Before silicon semiconductor rectifiers were invented, vacuum tube diodes and copper (I) oxide or selenium rectifier stacks were used.

BRIDGE FULL WAVE RECTIFIER:
A bridge rectifier circuit, as shown in the figure, is a device that converts an alternating current (ac) voltage into a direct current (dc) voltage by using both positive and negative cycles of the ac input. The circuit consists of four diodes arranged in a bridge configuration. The ac input is applied across two opposite corners of the bridge, while the load resistor is connected across the other two corners. When the ac input is positive, diodes D1 and D3 are ON and diodes D2 and D4 are OFF. The current flows through D1, RL, and D3 in this case. When the ac input is negative, diodes D2 and D4 are ON and diodes D1 and D3 are OFF. The current flows through D2, RL, and D4 in this case. In both cases, the current flows through RL in the same direction, producing a dc output. Therefore, the bridge rectifier circuit converts a bi-directional wave into a uni-directional wave.

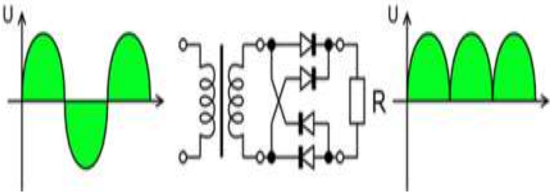

Fig: Bridge rectifier: a full-wave rectifier using 4 diodes
DB107:
Now -a -days Bridge rectifier is available in IC with a number of DB107. In our project we are using an IC in place of bridge rectifier.
LED:
A semiconductor device that emits light when an electric current passes through it is called a light-emitting diode (LED). Many devices use LEDs as indicators, and they are also becoming more common for lighting purposes. LEDs were first invented in 1962 as practical electronic components that produced low-intensity red light. However, nowadays LEDs can produce light of different colors and wavelengths, ranging from visible to ultraviolet and infrared, with very high brightness.
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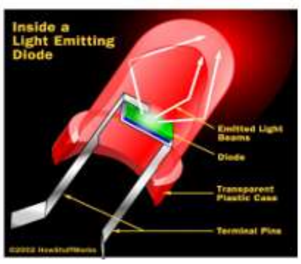

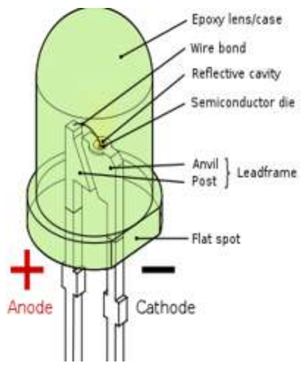

Fig: Parts of a LED
Resistors:
A resistor is an electronic component with two terminals that creates a voltage difference between them according to the current that flows through it, following Ohm's law: V = IR Resistors are found

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in almost all electrical and electronic circuits and devices. They can be made of different materials and shapes, such as various compounds, films, or resistance wire (wire with high resistance made of an alloy, such as nickel/chrome). The main features of a resistor are the resistance, the tolerance, maximum voltage and power rating. Other features include temperature coefficient, noise, and inductance. There is also a critical resistance, which is the value that determines the maximum current or voltage that the resistor can handle, depending on which one is lower. Critical resistance depends on the design, materials and size of the resistor. Resistors have many applications, such as controlling current, dividing voltage, dissipating power and shaping electrical waves when combined with other components. The basic unit is ohms.

Fig: Resistor

Filtration:

The process of converting a pulsating direct current to a pure direct current using filters is called as filtration.

Filters:

Electronic filters are electronic circuits, which perform signal-processing functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones.

Introduction to Capacitors:

A capacitor is a passive device that can store energy in an electrostatic field between two parallel conductive plates. The plates are separated by a non-conductive material called a dielectric, such as air or plastic. When a voltage is applied to the plates, electrons flow from one plate to the other, giving one plate a positive charge and the other a negative charge. This charge difference creates a static voltage across the capacitor, which is equal to the applied voltage Vcc when the capacitor is fully charged. The flow of electrons to the plates is called the charging current and stops when the capacitor is fully charged. This is shown in the diagram below.

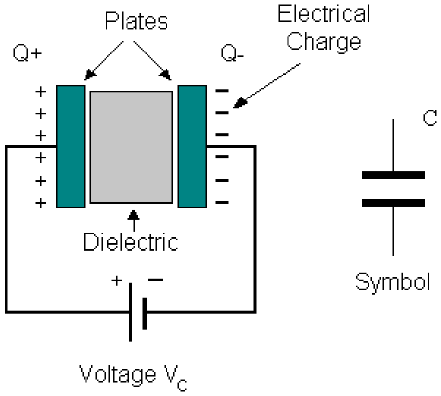

Fig:Electrolytic Capaticor

Units of Capacitance:
Microfarad (μF) 1μF = 1/1,000,000 = 0.000001 = 10-6 F
Nanofarad (nF) 1nF = 1/1,000,000,000 = 0.000000001 = 10-9 F
Pico farad (pF) 1pF = 1/1,000,000,000,000 = 0.000000000001 = 10-12 F

CONCLUSION:

We have created and tested a system that produces electricity from the movement of trains on the tracks. This system uses a non-conventional energy source that is simple and eco-friendly. We have carefully chosen and integrated all the hardware components to make the system work efficiently. Our project, called "Generation of Power from Railway Track", is a perfect example of innovative design.

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