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Electric Power Generation Using Railway Track

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Abstract: ***In this project we are generating electrical power as non-conventional method by simply running train on the railway track. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy using locomotive path needs no fuel input power to generate the output of the electrical power. The main aim of the concept is to utilize the train crossing time on a railway track. The power is produced by the railway track power generation equipment. Here the train flat is rubbing the roller held on the axle with the gear set which rotates the generator to generate electricity during the roller rolling. The roller will be rolling for the entire length of the train moving on it, and the energy generated will be stored in the battery and also showing the output by glowing a set of 15 LEDs.***
Key words: Non-conventional, inexhaustible, dynamo, energy, railway track

I. INTRODUCTION

A. Generalview

In this project we are generating electrical power as non-conventional method by simply running train on the railway track. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy using locomotive path needs no fuel input power to generate the output of the electrical power. The main aim of the concept is to utilize the train crossing time on a railway track. Here the train flat is rubbing the roller held on the axle with the gear set which rotates the generator to generate electricity during the roller rolling. The roller will be rolling for the entire length of the train moving on it, which converts the mechanical energy into electrical energy and the energy generated will be stored in the battery and also showing the output by glowing a set of 15 LEDs. And here we are going to innovatively utilize the constructional features and operation methodology of the Indian railways.

World is growing at the faster rate with regards to consumption of fuel and so the scarcity of energy as the sources producing them are depletable in nature. Around the world, there were 8,06,000 cars and light trucks on the road consuming 260 billion US gallons 980000liters of gasoline yearly.

The extensive usage of energy has resulted in an energy crisis and there is a need to develop methods of optimal utilization, which will not only ease the crisis but also preserve the environment. Researches show that the world has already had its enough shares of its energy resources. Fossil fuels pollute the environment. Nuclear energy requires careful handling of both raw as well as waste material. The focus now is shifting more and more towards the renewable sources of energy, which are essentially, nonpolluting.

In the present day scenario power has become the major need for human life. Energy is an important input in all the sectors of any countries economy. The d increasing population and decreasing conventional sources for power generation, provides a need to think on non-conventional energy resources.

One of the systems in the world of transportation is Railways, which carries heavy loads next to shipping. The loads may be in the form of passengers or cargo. Railway becomes a biggest public transportation. Railways are always opting for passenger convenient systems and are developing various comforts and are devising easy operation for safety.

The importance of inter-module rail operations within the global supply chain has never been more apparent. Leveraging the tracking technology solutions implemented by Indian railways, shipping companies and other industries and general public have recently begun to utilize Indian railways and rely on it more than earlier.

Indian railways are the state owned railway network of India. The ministry of railways is responsible for the operation, maintenance and growth of the rail network in India, the fifth largest network in the world in terms of track length, behind the US, Russia, Canada and China. Indian railways is one of the largest and busiest rail network in the world, transporting eighteen million passengers daily and more than two million tones of freight daily.

The railways traverse the length and breadth of the country; the routes cover a total length of more than 63,327 kilometers. As of 2008, IR owned about 225,000 wagons, 45,000 coaches and 8300 locomotives and ran more than 18,000 trains daily, including about 8,984 passenger trains and 9,387 goods trains.

Railways were first introduced to India in 1853. By 1947, the year of India's independence, there were forty-two rail systems. In 1951 the systems were nationalized as one unit, becoming one of the largest networks in the world. IR operates both long distance and suburban rail systems.

Indian railways operates about 9000 passenger trains and transports 17 million passengers daily across twenty-eight states and three union territories.

The passenger division is the most preferred form of long distance transport in most of the country. A standard passenger train consists of eighteen coaches but some popular trains can have unto 24 coaches. Coaches are designed to accommodate anywhere from 18 to 72 passengers, but during the holiday seasons or when on busy routes, more passengers may travel in a coach. Most regular trains have coaches connected through vestibules.

Here we are looking forward to conserve the kinetic energy that gone wasted, while trains move. The number of trains passing over the system fixed on the railway track is increasing day by day.

This paper attempts to show how energy can be tapped and used at a commonly used system- the rail track power generation. The number of trains passing over the track is increasing day by day. A large amount of energy is wasted at the railway track during the rolling of trains on the track, every time a vehicle passes over it. There is great possibility of tapping this energy and generating power by making the power generation system using gears, rollers etc.

Beneath roller which is touched by the flat given on the track which will roll the roller which will in turn rotate the drive gear which rotates the driven gear and then the drive pulley drives the driven pulley of the generator to generate the electricity charging the battery. This generated power can be stored, by using different electrical devices. We can supply this energy to street lights, traffic lights, and nearby areas, and thus helps in country's economy.

B. Objectives Of The Project

1) To design and fabricate the railway track mechanism to be able to hold the roller which rotates the axle which is holding a set of gear to ultimately rotate the generator. The generated power shown by glowing a set of 15 LEDs and with changeover switch will be charging the battery, which can be used later on for lighting of surroundings on railway signal, LCD displays for passenger list and train timings etc.

2) To fabricate the train frame with engine and bogie shape held with two set of wheels from front to back and the flat strip which will be aligned to put pressure on the track roller to roll it during the train movement on the track by manual pushing of the train on Rail track.

3) To produce electricity by using Non-Conventional energy Source and utilize it for various purposes

C. Scope

The utilization of energy is an indication of the growth of a nation. A recent survey on the energy consumption in India had published a pathetic report that 85,000 villages in India do not still have electricity. Supply of power in most part of the country is poor. Hence more research and development and commercialization of technologies are needed in this field. India, unlike the top developed countries has very good rail track covering thousands of kilometer. By just placing a unit like the "Electric Power

Generation Unit from railway track", so much of energy can be tapped. This energy can be used for the lights on the either sides of the roads and thus much power that is consumed by these lights can be utilized to send power to these villages.
Energy conservation is the cheapest new source of energy. This idea attempts to show how the energy can be tapped and used at the commonly used system, the railways moving on track. The number of trains passing over the system on the track will produce the electricity which is charging the battery which can be used for street lights, signal lights and giving power to fields surrounding for the usage of agriculture machines.

D. Needstatemen

1) Total energy consumption of the world is 17 terawatts(2012):

Energy is the means of support of the global economy, and it plays a crucial role in the development of almost all sectors in the modern world. Stable, reasonably priced energy supplies are central to maintaining and improving the living standards of billions of people. As we all know that world is facing the energy crisis. An energy crisis is a great bottleneck in the supply of energy resource to an economy. Total energy consumption of the world is 17terawatts in 2012.The reason for the crisis is over-consumption, aging infrastructure but the main reason is dependence on non- renewable source of energy instead of utilizing renewable energy source.

2) Scarcity of the fuel:

Consumption of the fossil fuels is increasing day by day at higher pace. As these fuels are deplitable in nature they are going to exhaust in the coming 30 years. The principle of supply and demand suggests that as hydrocarbon supplies diminish, prices will rise. Therefore higher prices will lead to increased alternative, renewable energy supplies as previously uneconomic sources become sufficiently economical to exploit. Artificial gasoline and other renewable energy sources currently require more expensive production and processing technologies than conventional petroleum reserves, but may become economically viable in the near future.
It is our moral responsibility that we should save some amount of fossil fuels for next generation. We do not have any right to consume all the available fossil fuels and leaving nothing to the upcoming generation. So this is the time to switch ourselves to energy source which is inexhaustible in nature.

3) Environmental pollution:

More than 90% of greenhouse gas emissions come from the combustion of fossil fuels. Combustion of fossil fuels also produces other air pollutants, such as nitrogen oxides, sulphur dioxide, volatile organic compounds and heavy metals.
Fossil fuel-fired electric power plants also emit carbon dioxide, which may contribute to climate change. In addition, the sector has significant impacts on water and habitat and species. In particular, hydro dams and transmission lines have significant effects on water and biodiversity."
Combustion of fossil fuels generates sulphuric, carbonic, and nitric acids, which fall to Earth as acid rain, impacting both natural areas and the built environment. Monuments and sculptures made from marble and limestone are particularly vulnerable, as the acids dissolve calcium carbonate.
Harvesting, processing, and distributing fossil fuels can also create environmental concerns. Coal mining methods, particularly mountaintop removal and strip mining, have negative environmental impacts, and offshore oil drilling poses a hazard to aquatic organisms.
So there is a necessity for the eco-friendly alternate fuels which will address these issues.

E. Various types of energy sources mostly used for power generation

1) Solar Energy

Advantages

a) Inexhaustible energy source
b) The Earth receives 174 petawatts (PW) of incoming solar radiation

2) (insolation)at the upperatmosphere.

Disadvantages

a) Initial cost of the equipment used to harness.
b) Depends on weather conditions.

c) Wind Energy

Advantages

a) The wind is free and with modern technology it can be captured efficiently.

b) Once the wind turbine is built the energy it produces does not cause green house gases or other pollutants.

Disadvantages

a) The strength of the wind is not constant and it varies from zero to storm force.

b) Wind turbines are noisy

3) Nuclear Energy

Advantages

a) High power output

Disadvantages

a) Leads to environmental pollution.

b) Harmful radiations create dangerous working environment.

II. METHODOLOGY AND WORKING

A. *Principle of operation*

A flat strip is held on the axle of a train which will be touching the roller, and the roller starts rotating according to the rotational energy transformation features.

1) *Detailed Operation:* We are proposing to make the railway track of length 10 ft on which the train can be moved by manual pushing.The train frame is of approx length of 3 ft with 2 sets of wheels at front & back of strip which is aligned to put pressure on roller. At the center of the track length we are making this power generation mechanism which comprises of a rubber roller which is coated by a rubber ring held nearby the axle which is also holding a gear which will drive the driven gear held on another axle between bearings and housings and a drive pulley which drives the driven pulley of the generator. When train is moving, the flat strip of the train will be rubbing the roller which makes the roller to rotate continuously and which ultimately rolls the gears to finally rotate the generator to produce the electricity which can be shown by glowing a set of 15 LEDs Here the power generated will be approximately 8 to12 volts depending on the speed of the rotation of the rollers. The amount of voltage is depending upon the number of dynamos. Then the charged battery is used for various applications

2) *Methodology:* We are making the track into two parts, one main track of length 2140mm and another additional track of length 1840 mm, both are joined by bolts and nuts. the main track is fixed with the power generation unit comprising of gear assembly, roller, the drive and drive pulleys and generator. The train unit is made with the train engine and bogies being made in zinc steel sheet of 1.5mm thick with the requisite shape which are fixed on the tubular frame of width 130mm and length 1090mm. this train frame is fixed with the wheels being held on the axles and these axles are held within ball bearings and housings which are fixed. The wheels and the train roll on the track when pushed manually with very less effort. The roller being held on the axle which is holding the drive gear, the axle held within ball bearings and housings which are held on the gear holding plates, the drive gear being aligned to the driven gear which is holding the drive pulley on it's axle, again held within ball bearings and housings and finally the drive pulley drives the driven pulley held on the generator fixed on the frame. This entire gear assembly and pulley finally rotates the generator at fast speed to generate electricity during the train movement on the track. The flat fixed on the train frame is of length 850mm which will be rubbing the roller of diameter 35mm, so the roller rotates for at least circumference of the roller is 35x3.142= 109.97mm which is divided with 850mm = 7.72 rotations. The drive gear is of 59 number of teeth which rotates the driven gear of 12 number of teeth, so the ratio here will be 59/12=4.9166 The ratio by the pulley will be, drive pulley is of diameter 70mm and driven pulley is of 15mm, so the ratio here will be 70/15=4.66. The final ratios we get from gear and pulley will be 4.9166x4.66 = 22.944 rotations and by one time rolling of the entire train length = 7.72 rotations x 22.944 = 177 rotations the generator will rotate. When train is moving, the flat strip of the train will be rubbing the roller which makes the roller to rotate which ultimately rolls the gears to finally rotate the generator to produce the electricity which can be shown by glowing a set of LEDs. Here the power generated will be approximately 8 volts to 12 volts depending on the speed of the rotation

III. ADVANTAGES AND DISADVANTAGES

A. *Advantages*

1) Cost of power generation is nil, compared to the average prevailing cost of other power generation system.

2) Expenditure on transmission of power may be negligible since the
3) It is eco-friendly and pollution free.
4) Can be indigenously made.
5) Have tremendous potential to be used at various places.
6) Will make the people of the world less dependent on other sources of energy such as coal, oil, gas, wind energy and solar energy etc in near future.
7) Will solve the energy problem since it is generated in small way at various places where it can utilized for various purposes.

B. Dis-advantages

1) Flat plate is rubbing on the roller, so roller has to be replaced time to time once in a year for getting good efficiency.

IV. PARTS AND COMPONENTS

A. Main parts involved in this project

1)	Main Track	mild steel angle20x20x4mm	1set	Rs 500
2)	Additional track	mild steel angle 20x20x4mm	1set	Rs 300
3)	Battery holder	CRCA sheet 1.2mm thick	1set	Rs 90
4)	Gear holding plates	mild steel flat 40x6mm	2set	Rs 200
5)	Ball bearing housings	mild steel round dia 35x15mm	8set	Rs 400
6)	Ball bearings	standard---ID10/OD27/thk8mm	8set	Rs 400
7)	Drive gear plug	mild steel round dia 50x12mm	1set	Rs 300
8)	Drive gear	C30 steel bought	1set	Rs 400
9)	Driven gear	C30 steel bought	1set	Rs 200
10)	Driven axle	C30 steel round dia 20x100mm	1set	Rs 100
11)	Drive axle	C30 steel round dia 20x120mm	1set	Rs 100
12)	Roller	mild steel round dia 40x30mm	1set	Rs 100
13)	Drive pulley	mild steel round dia 75x15mm	1set	Rs 10
14)	Generator holder	mild steel flat 20x3x120mm	1set	Rs 50
15)	Generator	standard	1set	Rs 250
16)	Train frame	mild steel tube 20x20mm	1set	Rs 500
17)	Wheel axle supports	mild steel flat 20x5x95mm	2set	Rs 200
18)	Legs for street light base	mild steel flat 25x3x150mm	2nos	Rs 200
19)	Wheels	mild steel round dia 50x12mm	4nos	Rs 500
20)	Wheel axle	C30 steel round dia 12x130mm	2nos	Rs 400
21)	Base fr street light	mild steel flat 25x3x920mm	1set	Rs 300
22)	Street light poles	mild steel flat 12x3x380mm	5set	Rs 300
23)	Train engine cover	zinc steel sheet 1.5mm thick	1set	Rs 300
24)	Bogie cover	zinc steel sheet 1.5mm thick	2set	Rs 500
25)	Flat for pressing roller	mild steel flat 25x5x900mm	1set	Rs 200
26)	LEDs set	standard	1set	Rs 100
27)	Battery	standard	1set	Rs 200
28)	LEDs for street lights	standard	5set	Rs 200
29)	Wiring with switch			Rs 200
30)	Labor charges			Rs 250

a) *Main track:* This is made out of mild steel angle section being welded to make the track on which the train moves. The angle being cut from the size of 20x20x4mm for the lengths of 2140---2nos, flat of 20x3mm of lengths 180mm 8nos, all are hammered for flattening and then joined to make the track maintaining the distance of wheel alignment to be 114mm for the track on which the wheels roll smoothly. This 114mm is maintained for the entire length and flats are welded accordingly keeping the gauge to hold the angles as per the width and welded. Flats at equispaced are welded for the entire length of the track to make the track length as 2140mm on which the gear box and other items are welded. This is then ground to remove the welding burr and finish.

b) *Additional track:* This is made out of mild steel angle section being welded to make the track on which the train moves. The angle being cut from the size of 20x20x4mm for the lengths of 1840---2nos, flat of 20x3mm of lengths 180mm ----7nos, all are hammered for flattening and then joined to make the track maintaining the distance of wheel alignment to be 114mm for the track on which the wheels roll smoothly. This 114mm is maintained for the entire length and flats are welded accordingly keeping the gauge to hold the angles as per the width and welded. Flats at equi spaced are welded for the entire length of the track to make the track length as 1840mm and this is then fastened to the main track using nuts and bolts and is detachable from the main track.

c) *Legs:* This is made out of mild steel square tube of outer size 20x20mm of length 100mm cut and ground to remove the cutting burr and to make right angle, such 16nos are cut and ground and then joined to the main track and additional track to make as legs to raise the track above ground level to accommodate the gear box fixing below the track.

d) *Battery holder:* This s made out of CRCA steel sheet of 1.2mm thick being cut for the size of 75mm x 90mm and then marked and bend to make the box with the outer size of 50mm x 50mm of length 90mm and joined by arc welding to make the box structure which is closed at the bottom of 50x25mm to hold the battery in this. This is welded to the track base to be able to hold the battery.

e) *Gear holding plate:* This is made out of mild steel flat being cut from the size of 40mm x 6mm of length 130mm—2nos, hammered for flattening and then ground to remove the cutting burr and to make right angle. Marked for the holes at the center distance of 70mm and side reference as 35mm from one side and drilled to have the holes of 10mm as per the requirement in both the plates. Then gears with axles and bearing housings are aligned on these plates and welded to make the gear box.

f) *Ball bearing housings:* These are made out of mild steel round bar being cut from the diameter of 35mm for the lengths of 15mm and turned on lathe machine to make the diameter as 32mm and drilled at the center to have the hole diameter as 12mm and then counter bored to make the bore diameter as 27mm to suit the ball bearing outer diameter of the bearing for the depth of 8mm and then faced from the other side to make the total length as 12mm. such eight number of ball bearing housings are made for this project.

g) *Ball bearings:* These are roller type ball bearings bought from the market with inner diameter of 10mm, outer diameter of 27mm and thickness as 8mm. Such eight number of ball bearings are used in this project.

h) *Drive axle:* This is made out of C30 steel round bar being cut from the diameter of 20mm of length 120mm and then turned on lathe machine to make the diameter as 15mm to suit the gear inner diameter and step turned at the both the ends, one end to make the diameter as 10mm to suit the ball bearing inner diameter of 10mm for the length of 8mm and other side length of 60mm maintaining the 15mm diameter of 50mm length as per the sketch. such one number of axle is made for this project.

i) *Driven axle:* This is made out of C30 steel round bar being cut from the diameter of 20mm of length 100mm and then turned on lathe machine to make the diameter as 15mm to suit the gear inner diameter and step turned at the both the ends, one end to make the diameter as 10mm to suit the ball bearing inner diameter of 10mm for the length of 8mm and other side length of 35mm maintaining the 15mm diameter of 50mm length as per the sketch. such one number of axle is made for this project.

j) *Drive gear:* This is a standard gear from the automobile gear box being taken of diameter 120mm with 44mm hole diameter an 12mm thick and having 59 number of teeths on it. This is then plugged with the mild steel bush and welded and used in this project.

k) *Drive gear bush:* This is made out of mild steel round bar being cut from the diameter of 50mm of length 10mm and turned on lathe machine to make the diameter as 48mm and step turned to make the diameter as 44mm to suit the drive gear inner diameter for the length of 6mm and collar maintained as 2mm and faced from the other side. The center hole made is 15mm to suit the axle diameter. This bush is then welded on the drive gear.

l) *Driven gear:* This is made out of C30 steel which is bought from the market, the gear which is used in the automobile gear box, the diameter of 25.4mm of thickness 12mm with 12 number of teeths are taken and bored to suit the 15mm axle in this and used. This is then welded on the driven axle with proper alignment.

m) *Drive pulley:* This is made out of mild steel round bar being cut from the diameter of 75mm of 10mm thick and then turned on lathe machine to make the diameter as 70mm and center drilled to have hole of 10mm to suit the axle diameter and then grove is cut on the circumference to make the diameter as *N*67mm and width of 4mm to accommodate the rubber belt in this and keeping the side wall of 2mm thick at both the sides and faced to make the drive pulley which is fixed on the axle.

n) *Roller:* This is made out of mild steel round bar being cut from the diameter of 40mm x 30mm and turned on lathe machine to make the diameter as 35mm and step turned to make the diameter of 20mm for the length of 14mm and center drilled to suit the

axle diameter of 10mm for the entire length and then faced from the other side to make the total length as 28mm as per the requirement. A rubber bush is fixed on this roller.

o) *Wheels:* These are made out of mild steel round bar being cut from the diameter of 52mm of length 12mm and turned on lathe machine to make the diameter as 50mm and step turned to make the diameter as 42mm for the length of 6mm and center drilled to have the hole diameter as 10mm to suit the axle diameter and then faced from the other side to make the collar length as 2mm. such four number of wheels are turned for this project.

p) *Generator holder:* This is made out of mild steel flat being cut from the size of 20mm x 3mm of length 120mm and hammered for flattening and then marked for the holes drilling at the distance to match the generator and drilled to have 4mm diameter holes and then ground to remove the drilling burr and then this is welded to the gear holding plate to be able to hold the generator as required.

q) *Train frame:* This is made out of mild steel square pipe of outer size 20x20mm cut for the lengths of 1090mm---2nos, 90mm----2nos, are ground to remove the cutting burr and to make right angle and then joined to make the rectangular frame with outer size as 130mm x 1090mm. this is marked for the holes drilling to be able to fix the engine cover and bogie cover on this frame and wheel holding flats are also welded on this frame as per the requirement.

r) *Wheel axle supports:* These are made out of mild steel flat being cut from the size of 20mm x 5mm of length 95mm—2nos and hammered for flattening and then welded to the frame to be able hold the wheel axle holding ball bearing housings.

s) *Wheel axle:* These are made out of C30 steel round bar being cut from the diameter of 15mm of length 135mm and then turned on lathe machine to make the diameter as 10mm to suit the ball bearing inner diameter for the entire length and faced to make the total length as 130mm. such two number of wheel axles are made for this project.

t) *Legs for street light base:* These are made out of mild steel flat being cut from the size of 25mm x 3mm of length 150mm, such two numbers are cut and hammered for flattening and then used in this project.

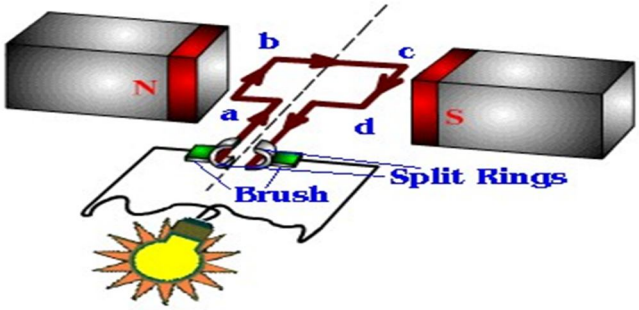
u) *Base for street lights:* This is made out of mild steel flat being cut from the size o 25mm x 3mm of length 920mm and hammered for flattening and then ground to remove the cutting burr and light poles are welded on this equi spaced as per the requirement and ground to remove the welding burr.

v) *Streets light poles:* These are made out of mild steel flat being cut from the size of 12mm x 3mm of length 380mm and hammered for flattening and then bent to the shape at the distance of 300mm from one side to make it as street light pole. These are then welded on the base flat. Such five number of street lights are made for this 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 1820s to 1830s by the British scientist Michael Faraday. His basic method is still used today. Electricity is generated by movement of a loop of wire or disc of copper between the poles of magnet. A generator produce electrical power based on principle of FARADAYS LAW OF ELECTROMAGNETIC INDUSTION, according to these law, when an conductor moves in a magnetic field it cuts magnetic lines force, due to which an electromagnetic force is induced in the conductor. The magnitude of this induced emf depends upon the rate of change of flux(magnetic line force) linkage with the conductor. This emf will cause an CURRENT to flow if the conductor circuit is closed.

B. Generator

An electrical Generator is a machine which converts mechanical energy (or power) into electrical energy (or power).

1) *Principle:* It is based on the principle of production of dynamically (or motionally) induced e.m.f (Electromotive Force). Whenever a conductor cuts magnetic flux, dynamically induced e.m.f. is produced in it according to Faraday's Laws of Electromagnetic Induction. This e.m.f. causes a current to flow if the conductor circuit is closed. Hence, the basic essential parts of an electric generator are : ▶ A magnetic field and ▶ A conductor or conductors which can so move as to cut the flux.



2) Design of dynamo

The emf induced in the armature of an alternator is similar to that of DC Generator. EMF Induce /Ph,

e = ZNØP/60 Volts

Where Z = no. of conductor in series / phase

N = Rotation of armature in revolution / min (rpm)

i.e. N/60 = rps

Ø = Flux produced per pole

P = no. of pole

According to Specification of Dynamo

No. of turns = 1000 Winding material = Copper Winding = 4

Z = 4 Conductors in series / phase

Assuming when

N = 12rpm of magnet = N / 60 rps

Assume Ø 3.6 web/Second per pole P = 3 no. of Poles

EMF induced = e = ZNØP/60

= 3 x 12x 3.6 x 4 60

e = 8.64volts

A gear train is formed by mounting gears on a frame so that the teeth of the gears engage. Gear teeth are designed to ensure the pitch circles of engaging gears roll on each other without slipping, providing a smooth transmission of rotation from one gear to the next.

The transmission of rotation between contacting toothed wheels can be traced back to the Antikythera mechanism of Greece and the South Pointing Chariot of China. Illustrations by the renaissance scientist Georgius Agricola show gear trains with cylindrical teeth. The implementation of the involute tooth yielded a standard gear design that provides a constant speed ratio.

C. Mechanical advantage

Gear teeth are designed so that the number of teeth on a gear is proportional to the radius of its pitch circle, and so that the pitch circles of meshing gears roll on each other without slipping. The speed ratio for a pair of meshing gears can be computed from ratio of the radii of the pitch circles and the ratio of the number of teeth on each gear.

Two meshing gears transmit rotational motion.

The velocity v of the point of contact on the pitch circles is the same on both gears, and is given by

$$v = r_A\omega_A = r_B\omega_B,$$

Where input gear A has radius r_A and meshes with output gear B of radius r_B, therefore,

$$\frac{\omega_A}{\omega_B} = \frac{r_B}{r_A} = \frac{N_B}{N_A}.$$

where N_A is the number of teeth on the input gear and N_B is the number of teeth on the output gear.

The mechanical advantage of a pair of meshing gears for which the input gear has N_A teeth and the output gear has N_B teeth is given by

$$MA = \frac{T_B}{T_A} = \frac{N_B}{N_A}.$$

This shows that if the output gear G_B has more teeth than the input gear G_A, then the gear train *amplifies* the input torque. And, if the output gear has fewer teeth than the input gear, then the gear train *reduces* the input torque.

If the output gear of a gear train rotates more slowly than the input gear, then the gear train is called a *speed reducer*. In this case, because the output gear must have more teeth than the input gear, the speed reducer amplifies the input torque.

D. Switch

In electronics a switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. The most familiar form of switch is a manually operated electromechanical device with one or more sets of electrical contacts. Each set of contacts can be in one of two states: either 'closed' meaning the contacts are touching and electricity can flow between them, or 'open', meaning the contacts are separated and non-conducting.

Since the advent of digital logic in the 1900s, the term has spread to a variety of digital active devices such as transistors and logic gates whose function is to change their output state between two logic levels or connect different signal lines, and even computers, network switches, whose function is to provide connections between different ports in a computer network. The term 'switched' is also applied to telecommunications networks, and signifies a network that is circuit switched, providing dedicated circuits for communication between end nodes, such as the public switched telephone network. The common feature of all these usages is they refer to devices that control a binarystate: they are either *on* or *off*, *closed* or *open*, *connected* or *not connected.*

Selecting a Switch

There are three important features to consider when selecting a switch:

Contacts (e.g. single pole, double throw)
Ratings (maximum voltage and current)
Method of Operation (toggle, slide, key etc.)

Switch Contacts

Several terms are used to describe switch contacts:

Pole - number of switch contact sets.
Throw - number of conducting positions, single or double.
Way - number of conducting positions, three or more.
Momentary - switch returns to its normal position when released.

Open - off position, contacts not conducting.
Closed - on position, contacts conducting, there may be several on positions.

For example: the simplest on-off switch has one set of contacts (single pole) and one switching position which conducts (single throw). The switch mechanism has two positions: open (off) and closed (on), but it is called 'single throw' because only one position conducts.

F. Switch Contact Ratings

Switch contacts are rated with a maximum voltage and current, and there may be different ratings for AC and DC. The AC values are higher because the current falls to zero many times each second and an arc is less likely to form across the switch contacts.

For low voltage electronics projects the voltage rating will not matter, but you may need to check the current rating. The maximum current is less for inductive loads (coils and motors) because they cause more sparking at the contacts when switched off.

G. Toggle switch

In the simplest case, a switch has two pieces of metal called *contacts* that touch to make a circuit, and separate to break the circuit. The contact material is chosen for its resistance to corrosion, because most metals form insulatingoxides that would prevent the switch from working. Contact materials are also chosen on the basis of electrical conductivity, hardness (resistance to abrasive wear), mechanical strength, low cost and low toxicity.

Sometimes the contacts are plated with noble metals. They may be designed to wipe against each other to clean off any contamination. Nonmetallic conductors, such as conductive plastic, are sometimes used.

A pair of contacts is said to be 'closed' when there is no space between them, allowing electricity to flow from one to the other. When the contacts are separated by an insulating air gap, an air space, they are said to be 'open', and no electricity can flow at typical voltages.

Switches can be and are classified according to the arrangement of their contacts in electronics fields— but electricians in the electrical wiring service business and their

electrical supplier industries use different nomenclature, such as "one-way", "two- way", "three-way" and "four-way" switches— which have different meanings in North American and British cultural regions as is delineated in the table below.

Some contacts are normally open (Abbreviated *"n.o." or "no"*) until closed by operation of the switch, while others are normally closed (*"n.c. or "nc"*) and opened by the switch action, where the abbreviations given are commonly used on electronics diagrams for clarity of operation in assembly, analysis or troubleshooting. They serve to synchronize meaning with possible mistakes in wiring assembly, where wiring part of switch one way and part another (usually opposite) way will pretty much guarantee things won't work as designed.

A switch with both types of contact, that can switch on a circuit in one position & can switch an other circuit on in other position, is called a changeover switch or "make-before-break" switch contact, whereas most switches have a spring loaded action which momentarily disconnect the load and so are "break-before-make" types by contrast— which type is used could be important, if for example, the switch selects two different power sources instead of switching circuit loads, or the circuit load will not and cannot tolerate any interruption in applied power.

The terms *pole* and *throw* are also used to describe switch contact variations. A *pole* is a set of contacts, the switch's electrical terminals that are connected to and belong to a single circuit, usually a load. A *throw* is one of two or more positions (the nomenclature is also applied to rotary switches, which can have many 'throw' positions) that the switch can adopt, which normally, but not always correspond to the number positions the switch handle or rotor can take when connecting between the common lead of the switch and a pole or poles. A throw position which connects no terminals (poles), has a mis-match between positions and positions which connect terminals, but are quite useful to turn things "Off" or for example, alternatively select between two scaled modes of operation. (e.g. Bright illumination, moderate illumination, no illumination.)

These terms give rise to abbreviations for the types of switch which are used in the electronics industry such as "single-pole, single-throw" (SPST) (the simplest type, "on or off") or "single-pole, double-throw" (SPDT), connecting either of two terminals to the common terminal. In electrical power wiring (i.e. House and building wiring by electricians) names generally involving the suffixed word *"-way"* are used; however, these terms differ between British and AmericanEnglish and the terms *two way* and *three way* are used in both with different meanings.

V. RESULT

As our project is Electric power generation using railway track and according to our fabricated model we are glowing around 15 LED’s which indicates the power is generated this is approximately equal to 8 volts. And even we are storing energy in battery by using toggle switch. Which can be utilized to any application.

In our project we are glowing 5 LED’s instantly when the train is passing over the roller and some of energy is stored in battery at the same time. And by using toggle switch we are glowing remaining other 10 LED’s at same time while train is passing over the roller. And over all energy generated in our model is 8volts.

VI. CONCLUSION

This generated electricity can be used for illuminating the street lights. From the experiment we can also conclude that the generated voltage decreases as the speed of the vehicle increases. In coming days, this will prove a great boon to the world, since it will save a lot of electricity of power plants that gets wasted in illuminating the street lights. As the conventional sources are depleting very fast, then it’s time to think of alternatives. We got to save the power gained from the conventional sources for efficient use. So this idea not only provides alternative but also adds to the economy of the country. Now, train traffic is increasing, we can utilize this for power generation by means of train track power generation. It has advantage that it does not utilize any external source. Now the time has come to put forte these types of innovative ideas, and researches should be done to upgrade their implication.

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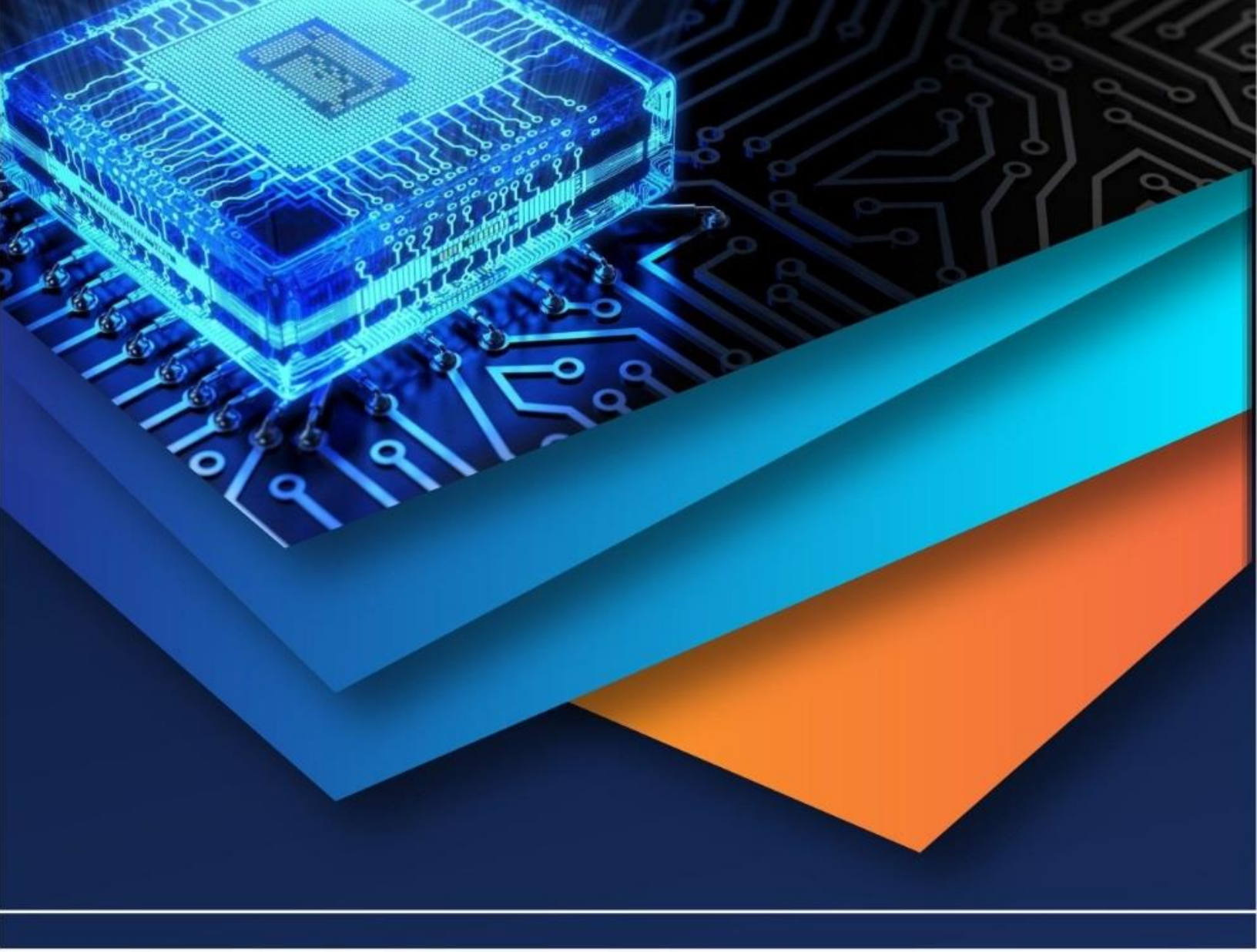

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