



Power Generation using Piezoelectric Crystal, Hydraulic Press & Electromagnetic Induction

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ABSTRACT: The use of extents non-renewable resource has driven humanity to new form energy. In this project we have tried to solve the problem. We have created a project using piezoelectric and hydraulic press in it. When we put pressure on one side of piston, we get an amplified output on other side of piston. As a result the piezo get press and we get sustainable amount of energy. The installment of our project can be done over a toll plaza and under speed breakers. Only sky is limit to the amount of energy can be produce as number of piezoelectric on other side piston can be change, the energy we get in a ac form so it can be use directly to the homes or it can be converted in dc form and it can store in batteries and use later.

KEYWORDS: piezoelectric crystal, hydraulic press

I. INTRODUCTION

The population rise and economic growth are two main reasons for energy insufficiency. The number of people without access of electricity remained unacceptably high at 1.3 billion, around 20% of the world population. In the current scenario, when every day the newspapers are flooded with news on accident due to high speed, speed bumper help to reduce the speed of vehicles. This energy loss on speed bumper can be utilized for useful purposes.

In this project we approach a new mechanism to generate power from speed bumper. In our project we use combination of hydraulic mechanism, piezoelectric crystal mechanism & electromagnetic induction. Traffic signal & Toll Plaza are provided with speed bumper to control the speed of vehicles. When the vehicle pass over the speed bumper which is made of cylinder and piston arrangement, then the first piston rod is subjected on a compressive force 2 things happens the permanent magnet moves and the oil get pressurized and comes out through the pipe it get pressurized to second piston in upward direction which strikes the piezoelectric plate and also the second set of electromagnet moves in turn the potential to which the electric energy generated. Here the mechanical energy available at the speed bumper is converted in to electric energy through a moving load, piezoelectric and induction. We use this mechanism on the toll plaza speed bumpers. It is very beneficial because on toll plaza passing 15 vehicle in one minute which generate more amount of electric energy. This energy we will use for toll plaza electric working like lights on toll plaza, computer, machine etc.

II. RELATED WORK

We are working on a project which generates electricity using piezoelectric and through induction Permanent magnet and coil, we choose this project because the energy generation through our project is far more compared to earlier projects these are crank shaft mechanism, roller mechanism, and older version of hydraulic systems.

1. Crank shaft: These mechanism work as when a passing vehicle slows on a speed the bumper would dip vertically downwards due to the weight placed on it, this vertically translation movement is then converted into rotational movement by means of crank shaft system which then can be used to drive a dynamo to generate electricity. Limitation of this method is Crank-shaft are required to be mounted on bearings which creates balancing problem leading to mechanical vibrations which in turn damage the bearings.

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

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Vol. 5, Issue 2, February 2017

2. Roller mechanism roller a fitted in between a speed breaker and some kind of a grip is provided on the speed bumper so than when a vehicle passes over speed breaker it rotates the roller. This movement of roller is used to rotate the shaft of D.C.generator by the help of chain drive. Limitation of this method is in the case of roller mechanism. Maintenance will be very difficult and it might cause collision.

3. Older version of hydraulic system: When the vehicle passes over the speed bumper which is made of cylinder and piston arrangement, then the piston rod is subjected on a compressive force which in turn the oil gets pressurized and comes out through the outlet nozzle which strikes the turbine blades then the potential energy of oil is used to run the turbines to which the electric generator is coupled. Limitation of this method is In this system only single piston is used it cannot generate that much power we required.

The project does not depend on whether an like solar energy, wind energy, the project also does not depend on tidal energy which generates only on time of high tides and low tides, the problem with geothermal is the site requirement but our project only requires load which is easily available another advantage of our project is that only installation cost is there and requires less The products used in the system are cost efficient and easily available compared to other renewable energy sources.

III. PROPOSED ALGORITHM

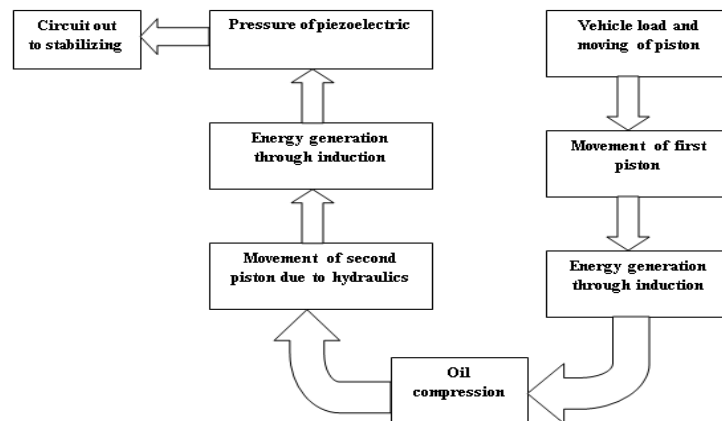


Fig.1.Block diagram of proposed system

The overall functioning of the System is explained through the block diagram shown in figure. It represents the general order and hierarchy of various working blocks of the project. The 1st pipe is attached to a piston and the shaft of the piston is attached to base plate, at the shaft the permanent magnets are attached and a coil is attached to cylinder when the shaft is moved due pressure of vehicle, the oil in the pipe get pressurized results in compression of 2nd shaft is also attached to the permanent magnet which also in turn results in electricity generation, when that plate moves it results in compression on the piezoelectric which generates electricity. The transformer is added to step down the incoming AC voltage we get sufficient amount of current to charge the battery ,since the voltage is in AC it is pass through bridge rectifier so we can make it to pulsating DC. The electricity is then passed through series of capacitor arranged in such order that the output of it 9V. When capacitor gets fully charged they produce output which again passes through LM317 which stabilizes the voltage level to battery.

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Vol. 5, Issue 2, February 2017

IV. THEROTICAL CALCULATION FOR MAXIMUM VOLTAGE

We connect 4 piezo in series. 3 such series parallel connection

We Know, $Q = C \times V$

So, $C=Q/V$

Hence, $V_{eq}/Q = V1/Q+V2/Q+V3/Q+V4/Q$

Thus , $V_{eq}. = V1+V2+V3+V4.$

Output voltage from 1 piezo is 3.4v

Thus, $V_{eq}= V1+V2+V3+V4$
 $= 3.4+3.4+3.4+3.4$
 $= 13.6V$

Maximum output from this system is **13.6V**

V. SIMULATION AND RESULTS

A. PIEZOELECTRIC CRYSTAL



Fig.2.The circuit above shows the digram of single piezo o\p

The circuit above shows the diagram of single piezo output. Where a piezo is connected to the digital multimeter as per the polarities. As we press the piezo (20 times)the changes in pressure, acceleration ,and temperature it converted into electric energy, the output of one piezo it comes around 3.4v which is stored in a capacitor the capacitor discharges according to the load voltage.



Fig.2.series and parallel combinations of piezoelectric.

International Journal of Innovative Research in Computer and Communication Engineering

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Vol. 5, Issue 2, February 2017

The above figure shows we uses the nine piezoelectric crystal on plates which is having two polarities positive and negative .The piezoelectric crystal is connected in series and parallel, as per parallel connections occur the voltage are comes low as per the series connection, the series connection piezo is done ,as we pressed the piezo in same amount of time or simultaneously to get a max voltage . This plate is then placed on a second piston.

B. HYDRAULICS PRESS



Fig.3.Hydraulics press

The above fig shows the structure image. Figure shows there are two piston that are connected to each other by hollow iron pipe at end to end of pipe. The pipe and a piston is filled with a oil to brim of to maintain the appropriate pressure on both side. One of the side have less diameter compare to other, so the movement of piston is fast as compare to other The first piston is contains a spring and limiter. The spring is use to come a piston in original position or recall its height, the limiter is use or work as a limiter or stopper, limiter is holds a particular pressure which applied on a first piston by a vehicle, load or human being. In figure the second piston is opposite side of a first piston where it contains a two spring correspondingly to recall its original position, second piston also contains a 6x6 plates stage, the top having a wood plate. The piezoelectric plate is placed in between of piston and wood plate of gap of 3mm height space ,the buttons are place on the each of piezo. As vehicles move on first piston the hydraulic acts and the second d piston get pressed with piezo to wooden plate to provide a output in voltage, this is a kinetic energy is converted to electric energy.



Fig.4.Less diameter piston

This side of piston use for taking load of the vehicle, it contains a spring and a limiter the spring repositions the piston back to its position after being press by the vehicle the limiter limit the action of the piston. So it doesn't move after certain point since the diameter of piston is small the movement of the piston is more compare to the other side.

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Vol. 5, Issue 2, February 2017



Fig.5.Large diameter piston

This side of piston contains a piezoelectric which are gets pressed to the wooden plank this contains springs which regains its position and cause the equilibrium. The side of piston has larger diameter which results in large amount of force but for per piezo he force get divided according to its area as a result less force is acted upon per piezo.

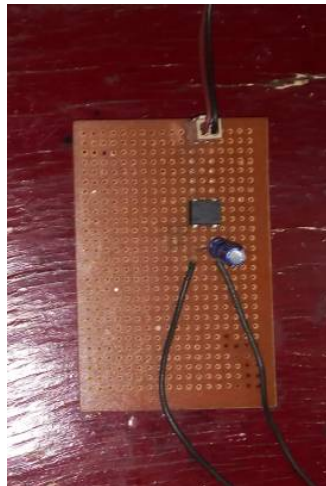


Fig.6.Circuit diagram

The above fig shows the circuit diagram which smooths the output of piezoelectric, since the output of piezoelectric is AC signal it has to be converted to DC signal lets it store in battery. the circuit contains bridge rectifier , a capacitor , wires to connect the piezo to output. When piezo electric is pressed the AC signal is passed bridge IC as a result it the signal is connected to pulsating DC and the output is then sent the capacitor as a result the capacitor gets charged and we get smooth output.



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Vol. 5, Issue 2, February 2017

VI. CONCLUSION AND FUTURE WORK

The system we use can be great deal in giving a world a new form of energy to world in case of renewable energy which is free of cost there are only installment cost and basic maintenance cost as result its quite reliable for lighting up the street lamps . The project could give a very cost efficient deal for energy for almost free. The system is independent on whether so continuous energy from the system.

The power generation from magnetic coil. Magnetic coil is placed on moving piston, magnet on limiter .When piston is moving up and down the flux cut in magnetic coil and electric energy is introduce. This give maximum current so time require for battery charging is less.

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BIOGRAPHY

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