

Paper Piezoelectric Generation And Transmission: Using Cars and Piezoelectric sensors .

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Abstract—This Piezoelectricity refers to generation of electric charge in response to mechanical stress using piezo sensors, has fascinated researchers for over a century, with its practical applications emerging in fields such as energy harvesting, and green energy innovation. The concept dates back to the 20th century, when Pierre and Jacques Curie first discovered the phenomenon in quartz crystals. Piezoelectric sensors have quartz material that has a unique property to generate electric charge when its subjected to about this technology and found a innovative way of harvesting energy just by walking on these sensors, which triggers the property and generates electricity which is termed as piezoelectricity. But the limitations of this was that this technology using footsteps was very less efficient because the current produced will be in milli amperes. Instead of this a suitable approach involves using cars or piezo railways which can be a better alternative for producing the piezoelectricity. We can also use dc motors to carry out the same process by means of mechanical pressure, but this idea is a bit costly as the dc motors used will be of high power and heavy which makes this a project with high initial cost and maintenance.

Index Terms— Piezoelectricity, Energy, Harvesting, Green energy, clean energy.

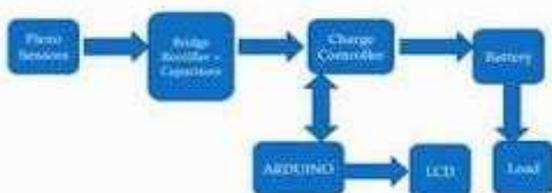
I. INTRODUCTION

Topic for the research paper is “Piezoelectricity Generation and Transmission: Using Cars and Piezo sensors.”. Piezoelectricity is an innovative concept to generate electricity by using piezoelectric sensors. Piezo sensors have a unique characteristic, and they can generate an electric pulse with the help or assistance with mechanical pressure, the material used in the piezo sensors is quartz material which has a property due to its solid structure that it can generate electric pulse when its subjected to mechanical stress . Piezoelectricity can be a innovative way to generate electricity in future times as this will not contribute to any type of pollution or environment hazardous activities. This can be the future of the clean and green energy. Fossil fuels or coal-based energy sources can be replaced by this energy-producing alternative.

We can implant the piezoelectric sensors in the road and footpaths so that due to the mechanical pressure of cars and trucks or simple walking the electricity can be generated. The ways to use the piezo sensors are many but they are not as efficient to generate electricity. Old researchers used footsteps to generate piezoelectricity but that’s very less efficient so new way has been introduced in this research paper to use cars and other automobile vehicles such as trucks which can help in applying more mechanical pressure on the piezoelectric sensors which will produce more electricity as compared to using footsteps. When we harvest energy through this then this can be used to power up small villages or to provide electricity to iot based devices or semiconductor-based devices. Today the need of energy is increasing day by day in our day-to-day life and also, we need the energy to build technology and to foster development. Project focuses building a circuit using components like Arduino Uno board, I2C LCD display, resistors, transistors and piezoelectric sensors, jumper and hookup wires.

The plan is to showcase the output voltage from the piezoelectric sensors on the LCD display and to power the leds by using the electric pulse generated through this. Further on, by using more and more quantities of sensors we have power up large scale devices like computers or IOT based devise etc. As this project uses piezoelectric sensors, due to the mechanical pressure on these sensors the wear and tear of the sensors takes place. So, this can be one of the flaw of this project but to avoid this we can use dc motors that can convert the rotor’s rotation to generate electricity. In the literature review section the information about the history and references is given along with short and crisp summary about the old research paper.

Block diagram



II. LITERATURE REVIEW

Piezo means pressure and electricity refers to the generation of the electricity.

Kyrillos K.Salim [1] Explains the concept of making a floor tile which, when subjected to foot pressure, could generate a peak power of 249.6 milliwatts. The idea was good it has some flaws as well such as the efficiency of the outcome is very low which makes it a average idea for the generation of electricity.

Experiment by Md.Raseduzzaman Ruman[2] on “Human Footsteps for Energy Generation by Using Piezoelectric Tiles” explains the idea on the Designs and configurations of piezoelectric tiles aimed at optimizing energy harvesting the problem for this research was the use of humanized or human footsteps which will result in less effective outcome.

Experiments by Akshat Kamboj and Ayush Kumar[3] on “Design of Footsteps Power Generator Using Piezoelectric Sensors” , this research paper is also having the flaws such as low effectiveness of outcome and problem of damaging of the piezoelectric sensors which can be solved by using cars and trucks or even railways instead of the footsteps or other and the wear and tear of the sensors can be minimized by using the dc motor using a special mechanism that will mechanically convert the translational motion of the pressure to the rotation motion of the motor.

Experiments by Elham Maghsoudi Nia[4] on “A Review Of Walking Energy Harvesting Using Piezoelectric materials, this research papers have a common limitation as that of the mentioned above regarding the output due to the use of the footsteps.

We have tried to use the information about the voltage booster from the base paper by Iswanto, Slamet Sripto[5] on “Energy Harvesting on Footsteps Using Piezoelectric Piezoelectric Sensors Based on Circuits LCT3588 and Boost Up Converter” to boost the voltage generated by the piezoelectric sensors. Also to remove all the flaws from the above-mentioned research papers the project is designed to work on the mechanical pressure by cars and other automobile devices. The project also uses microcontroller to showcase the output voltage on the I2C display and LEDs.

III. METHODOLOGY/EXPERIMENTAL

Materials/Components/Flowchart/Block Diagram/Theory

The project outline consists of generating the electricity by using Piezoelectric quartz material i.e. piezoelectric sensors , The quartz material undergoes mechanical compression and expansion i.e. subjected under mechanical pressure and then the electric pulse is generated due to its solid state property and further this electric pulse can be directly used to power up IOT devices or they can be stored in batteries for future use to power up small towns and villages . Before storing the outcome, it is amplified by using H-bridge and to get a better application transistors are also used. Resistors are also used to control the outcome to save the circuit from shorting out

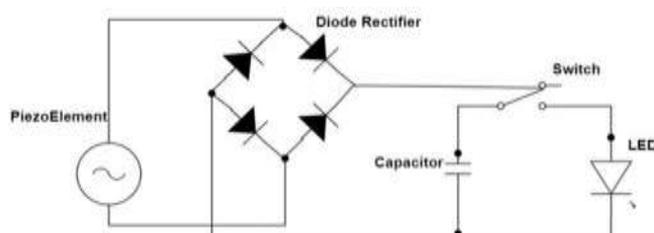
▪ Materials Used:

10 Piezoelectric sensors
 Arduino uno board
 LCD I2C display
 Breadboard
 Hookup wires
 Jumper wires
 10 micro-farad capacitors
 100 micro-ohm resistors
 1N4007 diodes
 BC547 transistors
 9-volt battery
 Cardboard

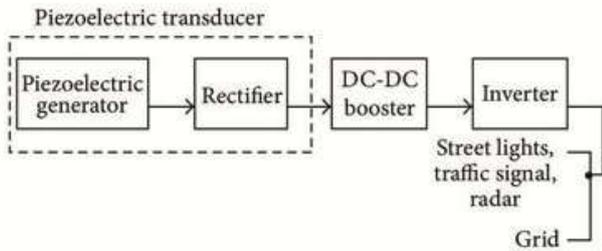
▪ Procedure Of The Project:

1. Implanting piezoelectric sensors on the cardboard such that all the sensors are connected with each other.
2. Setting up the breadboard with the connections from the LCD and Arduino uno and also integrating these with transistors, resistors and capacitors in the specified fashion.
3. Building the H-bridge using the diodes on the breadboard.
4. Connecting the outline wires from all the connected piezoelectric sensors to the breadboard and from it to the Arduino uno.
5. Further connecting the LCD display to the Arduino uno board
6. Compiling the code to display the amount of voltage generated by piezoelectric sensors on to LCD screen.
7. Connections are made by jumper and hookup wires and based the connections on the breadboard.
8. Power up the Arduino uno based circuit by using 9-volt battery.

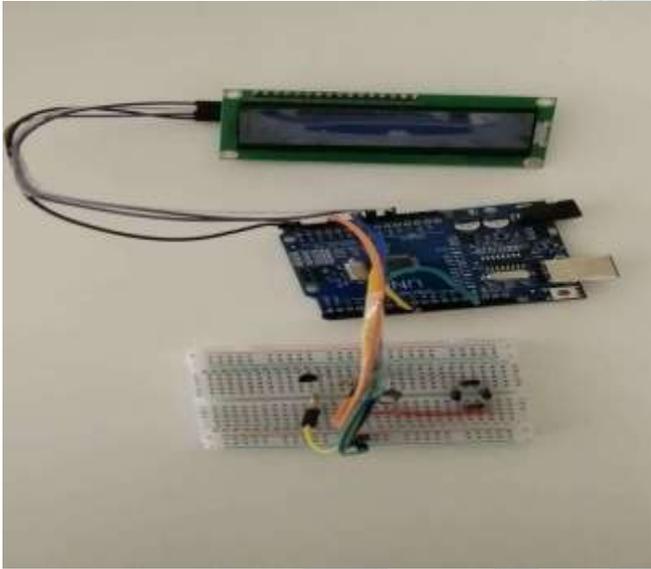
BLOCK DIAGRAM:



FLOWCHART:

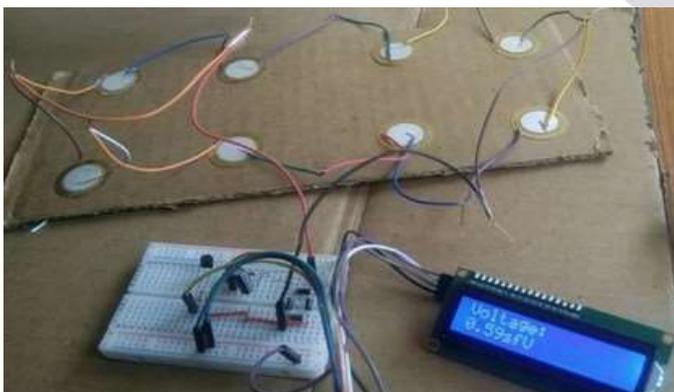


PREPARATION CHART:

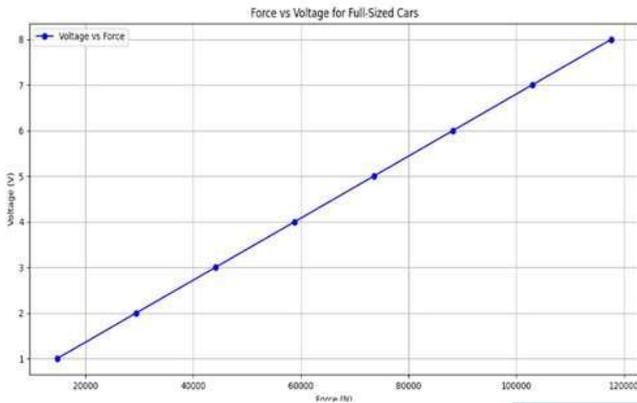
**III. RESULTS AND DISCUSSIONS**

Outcome of the research goes as that the electrical energy obtained is in milliwatts if we use small no. of piezoelectric sensors , thus using a good quantity of the piezoelectric sensors will be preferable as the quantity of electrical energy will be more and the voltage obtained can be amplified by using transistor , further the Alternating Current supply obtained can be converted to Direct Current supply by using diode bridge (H-bridge).The Outcome voltage of the system after amplifying is in between 5-10 volts with at least 10 piezoelectric sensors. While, when using footsteps as the sources of mechanical pressure the outcome voltage is about 2-3 volts and that too with 13- 15 piezoelectric sensors, this clearly shows that the limitations of the earlier research papers are removed by the idea of this project. Future of this technology can be extensive in the field of energy harvesting, clean and ecofriendly sources of energy, piezo railways etc.

RESULT OF THE PROJECT:



ANALYSIS OF THE PROJECT OUTCOME- Force V/S Voltage Graph:



IV. FUTURE SCOPE

In the Future, this technology can be helpful for generating clean and green energy which will replace the energy sources like fossil fuels and coal-based sources of energy. The advancement of this topic in the future can be in the form of “Piezo railways” i.e. railways powered by piezoelectricity generation sources which is an excellent alternative for both electric and fuel-based railways systems. Further advancement can be done in generating electricity through places with lots and lots of vibrations as due to the vibration the piezoelectric sensors will generate small electrical impulses that can be stored in batteries to use in the future.

V. CONCLUSION

Generating electricity through mechanical pressure using piezoelectric sensors is an innovative idea but there are many challenges in achieving expertise in this method, challenges like replacing the piezoelectric sensors when they get wear and tear due to mechanical pressure, amplifying the outcome through transistor, ensuring equal distribution of the pressure on the piezoelectric sensors, storing the energy in a battery to use this for future use, etc. In future this technology will surely help mankind to reach the energy needs of the human and also to power up the advanced futuristic world.

REFERENCES

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