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Power Generation Using Piezoelectric Material

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***Abstract*: At present, electricity is the necessary part of human life in daily activities and demand for electricity is increasing exponentially. Piezoelectric material to generate footsteps as a source of Renewable energy which can be obtained by walking on a certain arrangement i.e, The vibrations are created on the surface of piezoelectric. This is designed to collect maximum power generated from the Sun and converted into electrical energy and to increase efficiency, solar panels add on to provide more electricity along with power generated through vibrations(footsteps). The unwanted energy exhausted to the ground is collected by piezoelectric sensors which is tracked by a central monitoring system, where the footstep count per day, amount of pressure and the total power produced. By this, electricity is produced by power generated through piezoelectric sensor and solar panel, which is supplied to nearby main power supply or to the street lights etc. The proposed system can be installed in any public places like market, bus stop and other shopping places or the places where people gather to charge their mobile phones.**

***Keywords*: Charging, mobile charging, piezoelectric, solar**

1. Introduction

In this paper we have presented the design of footstep power generation using footstep based on available piezoelectric sensor along with solar panel in order to increase the efficiency of power generated. The growth of India's energy consumption will be the fastest among all significant economies by 2040, with coal meeting most of this demand followed by renewable energy. Renewables became the second most significant source of domestic power production, overtaking gas and then oil, by 2020.The demand for renewables in India will have a tremendous growth of 256Mtoe in 2040 from 17 Mtoe in 2016, with an annual increase of 12%. This project implements aim at one such energy source, to generate electricity through footsteps. The piezoelectric materials to generate footsteps as a source of renewable energy that can be obtained by walking on a certain arrangement like stepping foot on a piezo tile. In this, a human walking, machinery vibration, car and other vehicle moving on road way is used to generate and accumulate energy, when there is some vibrations, car and other vehicle moving on roadway is used to generate and accumulate energy, when there is some vibrations, stress or straining force exerted on flat weight of the person. The piezoelectric sensor will send the signal into the Arduino uno and transform it into electrical energy. The LCD will display the amount of voltage generated by the circuit.

2. Literature Review

In 2005 the piezoelectric materials were used as sensors and actuators but when it comes to the electrical generation is less established. It has a great potential for remote applications like MEMS devices and distributed networking in communication fields. [1]In 2006 the new power conversion circuits to interface a piezoelectric power generation. The idea of such arose as the need for portable and lightweight electronic devices arose in today's world with high efficiency is necessary [2]. In 2011, came the use of piezoelectric material as a fibre-based flexible piezoelectric composites. It is very advantageous in the place of energy harvesting and some locomotion purposes. This also has other advantages such as efficient, silent over large range of frequency transmission, but not light weight. Then it comes in 2017 ,the design of footstep power generation from piezoelectric sensors. We humans require a large energy at a very rapid rate for the living and the wellbeing from the time of arrival on this planet to until the day we fade off from this planet. It can be used in public places where humans are highly populated and the places where they visit in large numbers with less efficiency [3].

3. Hardware Implementation

In this paper, underwater thrust and generation of electricity through piezoelectric components are investigated by focusing on macro-fibre composite piezoelectric.

1) Flow chart

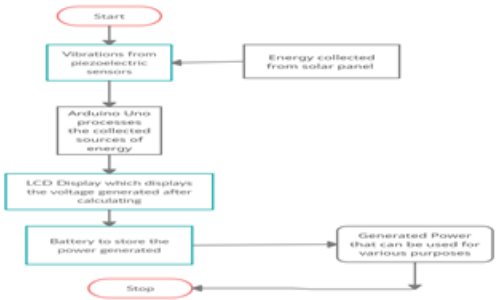

Fig. 1. Flow chart of proposed system

The above flowchart describes the working flow of the

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piezoelectric power generation. Initially the vibrations collected from the ------piezoelectric sensors is collected from the external sources such as the vibrations caused due to humans, vehicles and other vibrations. Also to increase the intensity of the energy we have placed a piezoelectric solar panel in which the solar energy is absorbed and stored. The vibrations are fed to the Arduino Uno which further processes to voltage and current. LCD is fixed where the voltage and power generated due to vibrations are visible. Also, a boost up battery is connected to boost up the energy source and the energy generated through piezoelectric sensors and solar panel is stored in it. The generated voltage can be used as an electrical source for many purposes such as lighting up streetlights, charging mobile phone and other applications in some public places etc.

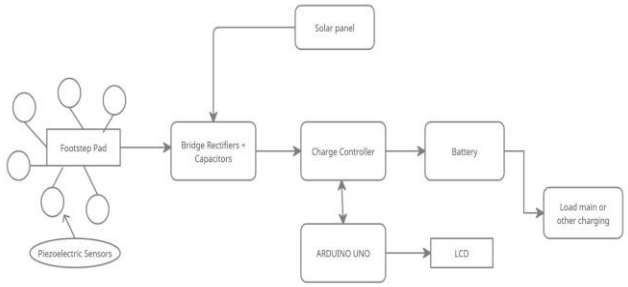


Fig. 2. Block Diagram of proposed system

This block diagram clearly shows the process of the piezoelectric power generator. Initially the Piezoelectric sensors along with solar panel are placed as a base where the vibrations are collected from the footsteps and other forms of vibrations etc. It is fixed to the surface of the road so that the vibrations can be collected. Then the output from this goes to the charge controller where the charge is collected massly and used for further purposes. Also, the energy from the solar panel is also fed to the charge controller through the rectifier circuit. The UNO here processes the input vibrations and the according voltage generated by it is given as the output. The Voltage generated and current is displayed on the LCD board. The current and voltage is calculated using the fixed formula in UNO board but before that it is initially recognized by current and voltage sensors. And then finally the batter which is used to boost up the energy and also to store. From the battery the generated voltage (i.e.; Electricity) is distributed for useful purposes such as the street lights for highways, USB feature on public places etc.

2) ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button and it contains everything needed to support the microcontroller.

Arduino UNO

Fig. 3. Ardunio UNO

3) Rechargeable battery

A rechargeable battery is generally a more sensible and sustainable replacement to one-time use batteries, which generate current through a chemical reaction in which a reactive anode is consumed. The anode in a rechargeable battery gets consumed as well but at a slower rate, allowing for many charges and discharges.

Fig. 4. Rechargeable Battery

In use, rechargeable batteries are the same as conventional ones. However, after discharge the batteries are placed in a charger or, in the case of built-in batteries, an AC/DC adapter is connected. Rechargeable batteries are used in many applications such as cars, all manner of consumer electronics and even off-grid and supplemental facility power storage.

4) Piezoelectric Sensors

A piezoelectric sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, strain, or force by converting them to an electrical charge.

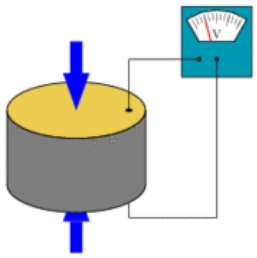
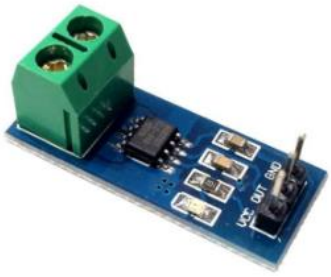


Fig. 5. Piezoelectric Sensors

5) Current sensor

Current sensors are used to measure AC or DC current levels. This sensor needs to be in-line with the circuit or if it works by being clamped around the wire to be measured. The current sensing is important to monitor and control the entire application and very importantly for a battery containing application. The internal resistance of this conductive path is

1.2 mΩ typical, providing low power. This allows the ACS712 current sensor to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques.



current sensor

Fig. 6. Current Sensor

6) DC voltage sensor

A DC voltage sensor determines and monitors the measure of voltage supply. It is then able to take those measurements and turn them into a signal that one will then be able to read.The signal will often go into a specialized electronic device for recording, but sometimes, an observer will be present to manually read the sensor output.DC Voltage Sensors are used to measure the potential difference between the ends of an electrical component. This can be used to measure the DC voltage in the circuits. The sensor is mechanically fixed by soldering the secondary circuit pins to the PCB.

DC voltage sensor

Fig. 7. DC Voltage Sensor

4. Results

In this paper, we have implemented footstep power generation using piezoelectric sensors and solar panel, in which voltage is produced. Here we have used around 10 piezoelectric sensors so the voltage generated will be minimum. But in real time applications we may have to use a large number of piezoelectric sensors so that it would be capable of lighting up a street light, charging mobile phone and other applications. The voltage required for that is around 230 to 260Volts. Also, we have included a solar panel to boost up the voltage in which the energy from the sun is stored in the battery. Thus the voltage produced from both , will be able to provide electricity for lighting up street lights.

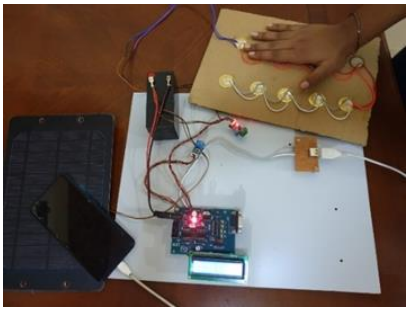


Fig. 8. Piezo electric power generation for mobile charging

Fig. 9. Piezo electric power generation LCD display

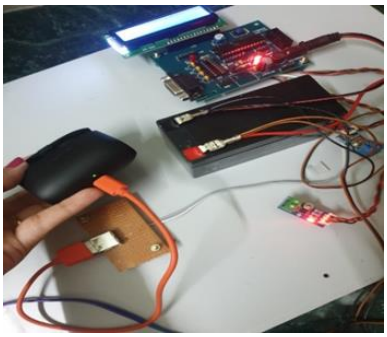


Fig. 10. Piezo electric power generation for Head phone charging

Fig. 11. Piezo electric power generation for mobile charging

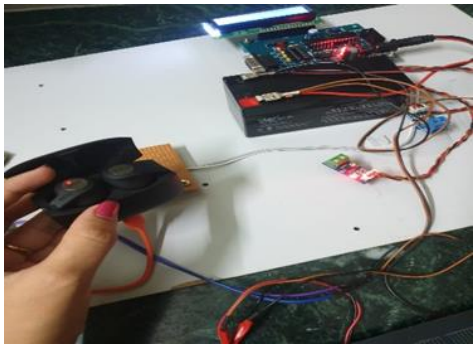


Fig. 12. Piezo electric power generation for Head phone charging.

5. Conclusion and Future Works

The proposed system allows us to use the footsteps exerted by humans which serves for a useful purpose rather than getting wasted. As electricity plays a vital role in our day to day lives, this method shows even a small vibration that are caused and pressure exerted is converted into electrical energy in an efficient way. In future we have planned to improve our project in such a way that the piezoelectric sensors are set on main roads and highways so that pressure exerted by these vehicles like car, lorry, bus will be helpful for generating more electricity.

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