

# Power generation using Piezoelectric Sensor

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## ABSTRACT

As we know in today's life power is very necessary for every work. It has become one of the basic needs for everyone. So in this project the main thing is to generate power. There are some rural areas where short of electricity is very much and also because of short of electricity sometimes there is no street lights and because of that many accidents takes place so to overcome all these problems we can use methods to generate electricity so there are lots of ways to generate electricity but we are using piezoelectric sensors to produce electricity. These piezoelectric sensors which are kept along the footpath so that piezoelectric sensors will charge the battery and will supply force at whatever time we need and will convert mechanical energy into electrical energy. So by doing this we are able to produce electricity and can be used to overcome problems faced due to lack of electricity.

**Keywords:** SENSORS, ARDUINO UNO, BATTERY, PIEZOSENSOR, LCD DISPLAY, LED STRIP

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## I. INTRODUCTION

Walking is very common activity in human's life. Aged people are suggested by doctors to do walk both in morning and evening to keep body fit, healthy & lower many heart risks. For youngsters running is beneficial exercise for keeping body fit and healthy. But when the person is walking or running his/her foot touches the footpath and loses some energy in the form vibration due to transfer his/her whole body weight on the surface of footpath and this waste energy can be utilized to generate electricity. So while walking on the footpath human loses some energy due to the transfer of his/her whole body weight on the surface of footpath. So this waste energy can be used to convert in usable form i.e. electrical form. The main aim of this is to convert mechanical energy i.e. energy lost by human's while walking or running can be converted into electricity and can be used in street lights, Traffic lights and so on. There are lots of methods to generate electricity out of all we are using footstep energy generation and So for this we are using piezoelectric sensors.

## II. PREVIOUS RESEARCH

[1] Electrical Power Generation Using Foot Step for Urban Area Energy Application by Joydev Ghosh, Supratim

Sen, Amit Saha, Samir Basak 2013. This paper presents the design methodology of electrical power generation using foot step for urban area energy applications.

[2] Cost Analysis of Smart Lighting Solutions for Smart Cities by Giuseppe Cacciatore, Claudio Fiandrino, Dmitry Kliazovich, Fabrizio Granelli, Pascal Bouvry 2018. In this paper we propose heuristics and devise a comparison methodology for new smart lighting solutions in next generation smart cities.

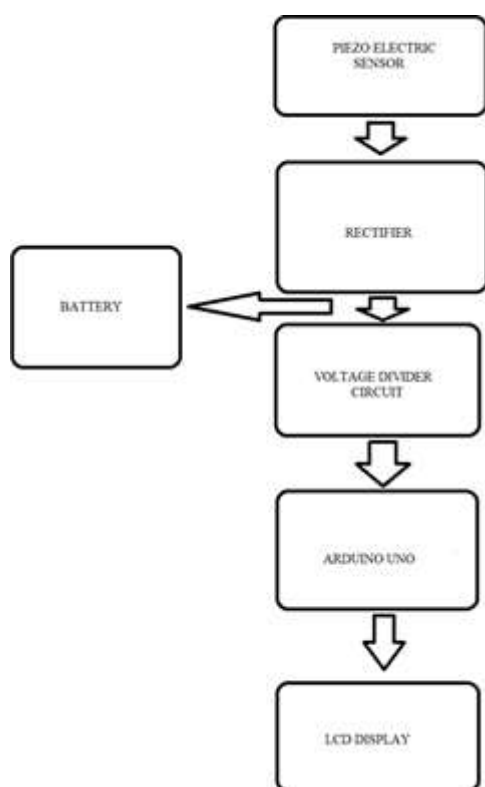
[3] Utilization of Pedestrian Movement on The Sidewalk as A Source of Electric Power for Lighting Using Piezoelectric Sensors by AgusDwi Triono, Arthur Daniel, Limantara, Edy Gardjito, Yosef Cahyo Setianto Purnomo, Ahmad Ridwan, Hery Lilik Sudarmanto, Gentur Cahyo Setiono, Fitri Windradi, Sri Wiwoho Mudjanarko 2018. The main purpose of this research is to design the sidewalk design with the latest innovation, to attract the public to use the sidewalk to walk, by making the street as an independent power source by applying Piezoelectric Sensor Technology as energy conversion media, calculating the average power in every single step pedestrian, and the average number of walkers.

[4] Footstep Power Generation Using Piezo Electric Transducer by Kiran Bobby, Aleena Paul K, Anumol.C.V,

Josnie Ann Thomas , Nimisha K.k 2014. In this paper we came to know that piezo tile is capable of generating 40V has been devised and also Comparison between various piezo electric material shows that PZT is superior in characteristics.

[5] Measurement of static electricity generated by human walking by Yuki Bunda ,Kajiro Watanabe ,Kazuyuki Kobayashi , Yosuke Kurihara 2010. In this paper, a newly developed static electricity sensor and its performance in our experiments. The static electricity charged when walking is synchronized with the walking steps. The static electricity was openly detected by a bioelectric amplifier.

### III. METHODOLOGY



#### Block no.1 Arduino:-

Arduino is used in this project to display the power generated by piezo electric sensor on an LCD display. The piezo electric output voltage after passing through a rectifier is analog in nature and the pins of the LCD require a digital input. Here we use the Arduino Uno to convert the analog value to a digital value. The output of piezo electric sensor is given to the analog pin of the Arduino. With the appropriate code, analog to digital conversion takes place and the value is displayed on the LCD. Arduino is preferred in this project because it is easy to program compared to other micro controllers.

#### Block no.2 Piezoelectric Sensors:-

A sensor that utilizes the piezoelectric effect, to measure changes in acceleration, strain, pressure, and force by converting them into electrical charge is called as a piezoelectric sensor. Piezo is a Greek word which means 'press' or 'squeeze'.

Piezoelectric effect causes the occurrence of electric dipole moments in solids due to the pressure applied to

certain solid materials such as piezoelectric crystals, ceramics, bone, DNA, and some proteins that generates electric charge. This generated piezoelectricity is proportional to the pressure applied to the solid piezoelectric crystal materials. In this article, we will discuss about one of the most frequently used piezoelectric sensor applications, that is, piezo sensor switch.

#### Block No. 3: LCD

LCD has the ability to display numbers, characters and graphics. The display is interfaced to I/O port of micro controller (P0.0-P0.7). The display is in multiplexed mode i.e. only one display remains on at a time.

Within 1/10th of a second the next display switches on.

#### Block No. 4: Battery

Lead battery is most commonly used in PV systems due to low cost and easily available everywhere in the world. These batteries are available in both sealed and wet cell batteries. Lead acid batteries have high reliability due to their capability to withstand overcharge, over discharge & shock. The batteries have excellent charge acceptance, low self-discharge and large electrolyte volume. Lead acid batteries Are tested using Computer Aided Design.

These applications of these batteries are used in UPS Systems and Inverter and have the skill to perform under dangerous conditions.

#### Block No. 5: Rectifier

It is used in AC-to-DC conversion. The rectifier is rated with a maximum 1KV reverse voltage and 1A current rating. It comes with 4-pin case DF tube.

#### Block No. 5: Voltage Divider

Here we are going to apply battery to the analog pin of the microcontroller. The maximum voltage allowed to the analog pin is 5V.

The battery we are using is 12 volts. Therefore reduce the voltage, a voltage divider is used.

$V_s$  (Source Voltage) =12V  $R_1$ =Resistance Of Resistor 1  $R_2$ =Resistance of resistor 2

$V_{out}$ =Output Voltage=5V (Maximum Permissible output voltage that won't damage the microcontroller)

$$V_s \cdot \frac{R_2}{R_1 + R_2} = V_{out}$$

Assume  $R_1 = 14\Omega$

$$12 \cdot \frac{R_2}{R_1 + R_2}$$

$$5 = \frac{12 \cdot R_2}{14 + R_2}$$

$$5(14 + R_2) = 12R_2$$

$$70 + 5R_2 = 12R_2$$

### IV. TESTING AND RESULTS

Mass of pedestrian = 65 kg, Distance covered on plate = 20 cm So, work done on plate by impact= weight of body \* distance

$$= 65 \cdot 9.81 \cdot 0.2 \text{ Nm}$$

$$= 127.53 \text{ J}$$

So,

power output =work done/sec

= 127.53/60 Watts

=2.1255 Watts

After doing this project we were able to generate sufficient power for lighting a led strip with the help of rechargeable battery. There was no consumption of any renewable energy resources and hence this system of power generation would also be used. The power generation can be increased by using more number of sensors. It also depends on the pressure applied and therefore by the number of footsteps. Hence this type of power generation system should be used in crowded areas.

## V. CONCLUSION

The project "FOOT STEP POWER GENERATION WITH PIEZO SENSOR" is successfully tested and implemented which is the best economical, affordable energy solution to common people. This can be used for many applications in rural areas where power availability is less or totally absence. As India is a developing country where energy management is a big challenge for huge population. By using this project we can drive both A.C. as well as D.C loads according to the force we applied on the piezo electric sensor.

## VI. FUTURE SCOPE

The utilization of energy is an indication of the growth of a nation. For example, World average per capita electricity consumption is 2730 kWh compared to India's per capita electricity consumption of 1000 kWh. India has an installed electricity generation capacity of 30,000MW. One might conclude that to be materially rich and prosperous, a human being needs to consume more and more energy. India is facing serious energy crisis at this time. India as one of the most fastest growing or developing country is not affected by this energy crisis in the world. The major issue is electric crisis which is known as load shedding. India's small manufacturing markets are lot affected by the rise of energy prices. By just placing a unit like the "Power Generation through the footstep", so much of energy can be tapped. This energy can be used for the lights on the either sides of the Roads at schools, colleges, temples and at many other busy places like railway stations and bus stations.

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