

Foot Step Power Generation using Piezoelectric Sensor

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Abstract - From the sunrise of time, guy has required and utilised developing quantities of electricity for survival and well-being. As a result, many electricity reassets were depleted and wasted. The notion of the use of waste electricity from human mobility with foot energy is mainly applicable and crucial for quite populated international locations like India, in which train stations, temples, and one of type public areas are continuously congested. When piezo electric powered flooring is utilised, ground sensors record the electric electricity launched via way of manner of the strain and convert it to an electrical charge, that is then saved and used as a energy deliver via way of manner of piezo transducers. Agriculture, personal own family applications, public lights, and vehicle sensor charging are just a few of the makes use of for this energy deliver.

This have a take a observe is ready how humans stroll and generate energy at the ground. Consider how an awful lot energy you deplete this is wasted whilst a person walks. The concept is to convert mechanical energy into electric powered energy. The reason of the energy era ground is to convert kinetic energy into electric powered energy. The energy disaster is currently the world's maximum urgent concern. The reason of this studies mission is to discover a way to the problem. We have to make a thousand Watt in 100 twenty steps if we increase a energy producing ground which can produce 100W in best 12 steps, and if we set up a hundred flooring the use of this way, we are able to produce 1 Mega Watt. It is a fulfilment to make it remarkable.

Key Words: piezo; kinetic energy; energy

I. INTRODUCTION

There are loads of strategies to generate electricity as an alternative, and one in every of them, footstep electricity technology, may be a green manner to generate electricity. Walking is the maximum not unusual place kind of human activity. Because of the truth that his weight is transferred to the street floor thru foot falls at the floor for the duration of every stride, a person loses electricity to the street floor withinside the shape of effect, vibration, and sound. This electricity may be harnessed and converted into something beneficial, which includes electricity. If it is placed withinside the walkway, this tool can turn foot effect

electricity into electric powered electricity. Walking, running, and swimming have all been covered through human-powered mobility because the sunrise of humanity. On the different hand, contemporary era has enabled machines to make higher use of human strength. Pedal electricity is an super supply of electricity that has been used for the reason because the 19th century and utilises the body's maximum powerful muscles. 90% of the pedalling attempt is converted into electricity. Pedal electricity is a cost-powerful and approachable supply of electricity that can be used for quite a few tasks. Human kinetic electricity, on the alternative hand, may be utilized in quite a few ways, such as electricity technology thru diverse technology and quite a few different applications. establishments are already doing so

Block Diagram

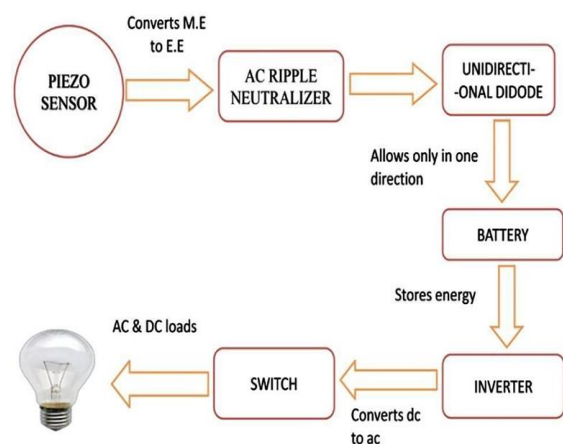


Fig 1: Block Diagram of Foot Step of Power Generation

- a) Our paper's essential running premise is primarily based totally on a piezoelectric sensor.
- b) We adjust the timber plates above and beneath the sensors and adjustable springs to do this.

c) Footstep-primarily based totally non-traditional electricity converts mechanical electricity to electric electricity.

d) Stepping board, it is made of sixteen piezoelectric sensors which might be stressed in series.

e) When strain is implemented to the sensors, mechanical electricity is transformed to electric electricity.

f) This electric electricity may be saved in a 12-volt rechargeable battery.

g) Inverter.

h) We're additionally the use of a conventional battery charging unit to energy the circuits.

i) This inverter converts 12 volts DC to 230 volts AC. The voltage is 230 Volts A.C.

The concept for using waste strength from human motion is mainly relevant and crucial in particularly crowded global locations like India and China, wherein highways, educate stations, bus stops, temples, and first-rate public areas are all crammed and hundreds of masses of humans stroll at some stage in the clock. If all of this wasted human/bioenergy may be harnessed, it is going to be a superb concept, and crowd strength farms might be particularly beneficial strength reassets in crowded countries. Walking on the ground of a "Crowd Farm" might be fun for lazy folks that can enhance their fitness at the equal time as incomes money. These farms' energy might be used withinside the encircling area.

II. FOOT STRENGTH WASTE STRENGTH IS HIRED AT THE ELEMENT OF HUMAN MOBILITY.

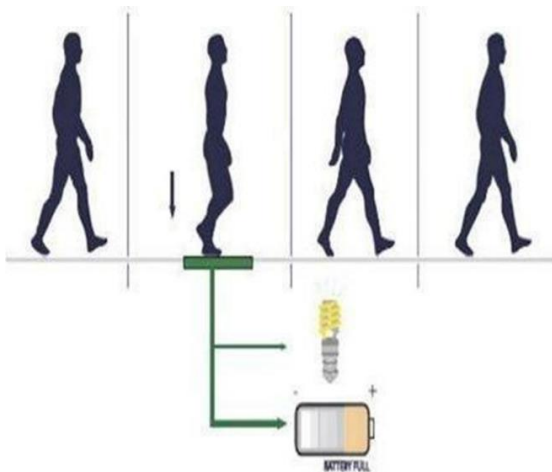


Fig 2: Schematic Representation

The power generated through the foot step generator may be stored in a power garage device. Through an ac-dc converter bridge, the generator's output is attached to a 12 V lead acid battery. The battery turned into quick exhausted. As quickly because the FSEC is engaged with the resource of putting a foot pressure on it, the power is saved in the battery. An inverter connects a 100 W, 230V bulb to the batteries. Figure four confirms the configuration.

Table 1: Confirms the lights time, bulb for big form of footfall and associated power saved.

NO. of footsteps	Duration of lighting 100watt 230 Volt bulb (s)	Total energy (J)	Energy / step(J)
250	6	600	2.4
500	12	1200	2.4
750	18	1800	2.4
1000	25	2500	2.5

The piezoelectric material's anxiety is becoming electric powered energy. The weight of autos riding thru it or the burden of humans strolling throughout it is able to all reason anxiety. A piezoelectric material's output varies. To remodel this oscillating voltage to a linear value, a bridge circuit is employed. An AC ripple smooth out is utilised as unexpectedly as feasible to dispose of any greater output changes. After then, the output voltage is recorded and stored in a chargeable battery. Because the energy output of a unmarried piezo movie is insufficient, a group of piezo movies is examined. Every parallel and collection hyperlink was located to the test. The parallel connection's voltage output did not appreciably increase. The collection produced greater piezo movies.

III. MAXIMUM THEORETICAL VOLTAGE GENERATED

When a piezo cloth is stressed, a charge is produced. As a result, it is extensively less high-priced to trust it is a incredible capacitor. As a result, it is like minded with any capacitor formula. In this project, 3 piezos are related in collection on one tile. Ten comparable collection connections are related collectively in parallel. As a result, the capacitance of 3 piezoelectric discs related in collection is the same

$$1/ C_{eq} = 1/ C_1 + 1/ C_2 + 1/ C_3$$

We Know, $Q = C * V$

So, $C = Q/v$

Finally, $V_{eq} = V_1 + V_2 + V_3$

As a result, the sum of the individual voltages generated across each piezoelectric disc equals the net voltage generated in a series connection. The piezo disc's output voltage is 13 volts.

Thus,

$$V_{eq} = V_1 + V_2 + V_3 = 13 + 13 + 13 = 39 \text{ V}$$

Thus, the maximum voltage that can be generated across the piezo tile is around 39V.

IV. ANALYSIS DONE ON THE PIEZOTILE

To take a look at the Piezo tile's voltage producing capacity, humans weighing forty to seventy-five kg have been forced to stroll on it. Figure eight depicts the connection among a person's weight and the quantity of energy developed.

Maximum voltage is created even if most weight/pressure is applied, as proven withinside the graph. Even with a weight of seventy-five kg on it, the tile generates a most voltage of 40V throughout. Figure eight: Piezo tile weight vs. energy graph

V. POWER GENERATION PIE CHART

A sensor is a tool that detects a bodily quantity and converts it right into a sign which could be tested the usage of an observer or instrument. The useful aid of mercury is used to remodel temperature into liquid increase and contraction, which can be decided the usage of a calibrated glass tube. A thermocouple is a tool that transforms temperature right into a voltmeter-readable output voltage. Most sensors are calibrated in opposition to mentioned requirements for accuracy. SENSOR

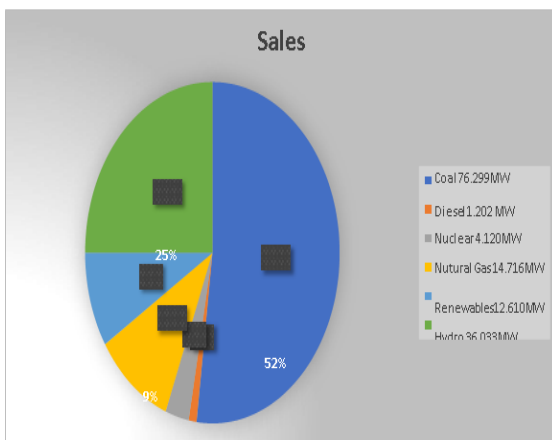


Fig 3: Pie Chart of Piezoelectric Sensor

A piezoelectric sensor is a tool that makes use of the piezoelectric impact to convert pressure, acceleration, or anxiety into an electrical sign. In a extensive variety of applications, piezoelectric sensors have proven to be beneficial size tools. For notable assurance, method control, and studies and development, they are utilized in quite a number industry. In the 1950s, the piezoelectric impact has become famous for commercial enterprise sensing. Since then, this size method has grown in popularity. It now seems to be a mature technology with true inherent reliability. As a pressure sensor, it is been hired in medical, aviation, nuclear, and cellular phone touchpads.

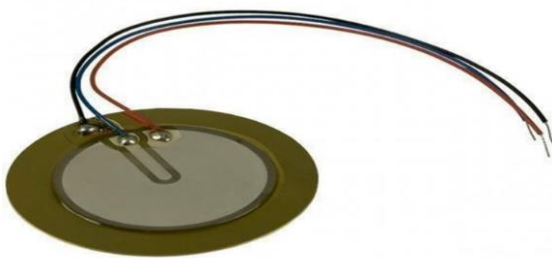


Fig 4: Piezoelectric Sensor

The emergence of piezoelectric generation is because of a number of inherent benefits.

Many piezoelectric substances have an excessive modulus of elasticity that opposition that of many metals, carrying out 10e6 N/m2.

Despite the fact that piezoelectric sensors are electromechanical systems that respond to compression, the sensing elements display almost no deflection.

This is why piezoelectric sensors are so long lasting and feature this kind of excessive herbal frequency.

With incredible linearity over the whole amplitude variety Furthermore, piezoelectric generation is evidence in opposition to electromagnetic fields and radiation, permitting measurements to be taken in tough settings. Some of the substances employed (in particular gallium phosphate and tourmaline) are thermally robust, permitting sensors to characteristic at temperatures as excessive as one thousand stages Celsius. In addition to the piezoelectric effect, tourmaline has piezoelectricity, or the capacity to generate an electrical sign as the temperature of the crystal changes. That may be a not unusual place incidence in piezoceramic substances.

VI. BATTERY

A battery (energy) is a hard and fast of electrochemical cells that may preserve energy in my opinion or in an unmarried device. One or greater electrochemical cells paintings collectively to convert chemical power into electric powered power in an electrical battery. Batteries may be used as speedy as after which thrown away, or they will be replenished and used for years in standby energy programs. Small batteries energy paying attention to aids and wristwatches, on the equal time as big batteries offer backup energy for cellular telephone exchanges and laptop statistics centres.

Lead-acid batteries are the maximum famous in PV structures due to the fact that they have got a less expensive initial value and are without problems to be had nearly everywhere at the planet. The maximum crucial feature of lead-acid batteries is that they're deep cycle batteries. There are varieties of lead-acid batteries: wet-cell (which calls for maintenance) and sealed (which does not). Lead-acid batteries are dependable, value-effective, and long-lasting. Because in their capacity to store energy, lead acid batteries are pretty trustworthy.

stand as tons as overcharge, over discharge, vibration, and shock. Because we use state-of-the-artwork sealing procedures, our batteries are leak-proof and non-perishable. The batteries' immoderate rate acceptance, big electrolyte volume, and espresso self-discharge purpose them to best for programs that require little maintenance. Lithium-ion batteries are they CAD(Computer Aided Design) -designed and tested?. These batteries had been showed to perform in hostile situations and are applied in inverter and UPS structures. The batteries have electrolyte capability, PE

Separators, and are housed in robust packing containers that prevent leaks and corrosion.

VII. RECTIFIER

Because we use cutting-edge sealing procedures, our batteries are leak-proof and non-perishable. The batteries' immoderate rate acceptance, huge electrolyte volume, and occasional self-discharge purpose them to best for applications that require little maintenance. Lithium-ion batteries Are they CAD-designed and examined? (CAD) stands for Computer Aided Design. These batteries had been examined to perform in adverse situations and are applied in inverter and UPS systems. The batteries have electrolyte capacity, PE Separators, and are housed in robust boxes that prevent leaks and corrosion. D1 and D3 behaviour at some stage in the fantastic 1/2 of the enter ac voltage cycle, whilst D2 and D4 continue to be OFF. Because the engaging in diodes are linked to the weight resistance, the weight cutting-edge will glide throughout RL. During the terrible 1/2 cycle of the enter ac voltage, diodes D2 and D4 behaviour whilst D1 and D3 are switched off. The show Because RL is coupled to diodes D2 and D4, cutting-edge will tour the identical course as withinside the first a part of the cycle. A bidirectional wave will become a unidirectional wave due to this transformation.

VIII. UNIDIRECTIONAL CURRENT CONTROLLER INVERTER

This circuit best permits present day to go along with the waft in a single direction, because of the reality the choice suggests. Some gadgets that paintings with unidirectional present day are indexed below.

1. Diodes
2. Thyristors

In this venture, we're going to rent a diode as a unidirectional current control device. As all of us know, the maximum now not unusual place feature of a diode is to permit an electric powered contemporary to journey in best one way (the diode's ahead direction). While preventing the go along with the waft of power withinside the alternative direction (the opposite direction). The diode can therefore be concept of as an electrical take a look at valve. The diode used on this venture is D-IN4007. A non-save you amount is transformed right proper right into a discrete temporal virtual example through way of method of an analog-to-virtual converter (abbreviated ADC, A/D, or A to D). An ADC also can offer a remoted measurement. A virtual-to-analog converter reverses the process (DAC). A virtual integer proportional to the significance of an analogue voltage or contemporary is transformed right proper right into a virtual integer the usage of an ADC. ADCs can, however, embody non-digital or partly digital additives like rotary encoders.

IX. INVERTER

An inverter converts direct cutting-edge (DC) to alternating cutting-edge (AC) the utilization of appropriate transformers, switching, and manage circuits (AC). The

converted AC might also additionally have any voltage and frequency you choose.

From small switching energy assets in pc structures to large electric powered utility high-voltage transmission lines, solid-state inverters are applied in a considerable type of applications. Applications that use direct cutting-edge to transport large portions of energy. To convert DC energy from solar panels or batteries into AC energy, inverters are commonly utilised. During Inverters are categorized into groups. The output of a changed sine wave inverter is equal to that of a rectangular wave inverter, besides that it in short is going to zero volts in enhance than switching first-class or negative. It's easy to apply and cheap, and it virtually works with nearly all electric powered devices, apart from touchy or specialized device like laser printers. A natural sine wave inverter produces an almost perfect sine wave output this is almost equal to grid power (with plenty an awful lot much less than 3% fashionable harmonic distortion). As a result, it's far nicely relevant with any AC-powered digital device. This form of inverter is carried out in grid-tie inverters. Its form is extra sophisticated, and it costs five to ten instances extra regular with unit of power. The electric powered system,

ADVANTAGES

- It simplest takes some steps to generate electricity. There isn't any want for fuel. This isn't always your common setup.
- Because there aren't any shifting parts, the product has an extended carrier life. Because it's miles self-generating, no outside electricity is necessary. Although little, it's miles noticeably sensitive.
- Dependable, affordable, and inexperienced non-renewable strength intake is decreased. Running or running out on the step generates strength. The generated strength is saved in a battery. With almost little noise, the dynamic variety is extraordinarily wide.

DISADVANTAGES

- Only legitimate in that precise place.
- This approach has an excessive preliminary investment. The manufacturing is affected. through the temperature. This approach has a excessive preliminary investment.

APPLICATIONS

- Footstep-generated strength may be used for agricultural, domestic, and streetlighting purposes.
- In the occasion of a strength outage, footstep strength manufacturing may be utilised. Metros, rural applications, and so forth
- It may be utilised in each alternating present day and direct present day applications. It's extensively utilized at faculties and universities.

It may be utilized in times in which there's a strength outage, inclusive of hospitals

X. CONCLUSION

The challenge "power generation using foot step" has been very well investigated and carried out, and it's far through a way the maximum cost- effective, powerful, and approachable energy choice to be had to the overall population.

This may be used for numerous responsibilities in rural regions wherein strength is scarce or non-existent. Strength manipulates is a main assignment in India due to the fact it's far a rapidly developing USA. with a huge population.

This challenge may be used to pressure each A.C and D.C. loads primarily based totally at the stress we understand at the piezoelectric sensor A 40V piezo tile has been produced. When evaluating the residences of several piezoelectric materials, PZT is the clean winner.

Furthermore, a series-parallel combination connection become determined to be extra suited. The weight carried out to the tile and the following voltage are examined, and it's far determined that they have got a linear connection. It's nice utilized in busy regions. This may be used to illuminate roadways without the want for lengthy strength cords. Alongside the sidewalk, it is able to additionally be used as charging stations and lighting fixtures.

Renewable electricity debts for best 11% of our overall energy. If this mission is carried out, we can be capable of now no longer best remedy the electricity crisis, however additionally make contributions to global warming.

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