Electrical Power Generation Using Footstep

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***Abstract*- Power generation and its use is one of the issues. Now a day's numbers of power sources are present, non-renewable & renewable, but still we can't overcome our power needs. Among these human population is one of the resources. In this project we are doing generation of power by walking or running. Power can be generated by walking on the stairs. The generated power will be stored and then we can use it for domestic purpose. The utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India where the railway station, temples etc. The idea is to convert the weight energy to electrical energy The Power generating floor intends to trans- late the kinetic energy to the electrical power. Energy Crisis is the main issue of world these days.**

The motto of this research work is to face this crisis somehow. Though it won't meet the requirement of electricity but as a matter of fact if we are able to design a power generating floor that can produce 100W on just 12 steps, then for 120 steps we can produce 1000 Watt and if we install such type of 100 floors with this system then it can produce 1MegaWatt. Which itself is an achievement to make it significant.

I.INTRODUCTION

For an alternate method to generate electricity there are number of methods by which electricity can be produced, out if such methods footstep energy generation can be an effective method to generate electricity. Walking is the most common activity in human life. When a person walks, he loses energy to the road surface in the form of impact, vibration, sound etc, due to the transfer of his weight on to the road surface, through foot falls on the ground during every step. This energy can be tapped and converted in the usable form such as in electrical form. This device, if embedded in the footpath, can convert foot impact energy into electrical form.

Human-powered transport has been in existence since time immemorial in the form of walking, running and swimming. However modern technology has led to machines to enhance the use of human-power in more efficient manner. In this context, pedal power is an excellent source of energy and has been in use since the 19th century making use of the most powerful muscles in the body. Ninety-five percent of the exertion put into pedal power is converted into energy. Pedal power can be applied to a wide range of jobs and is a simple, cheap, and convenient source of energy. However, human kinetic energy can be useful in a number of ways but it can also be used to generate electricity based on different approaches and many organizations are already implementing human powered technologies to generate electricity to power small electronic appliances.

II. LITERATURE SURVEY

[1]According to T.R.Deshmukh described along with design International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072 and modeling of parts of the model of the foot step power generation system using 3d modeling software. This process consist number of simple setups that is installed under the walking or standing platform. Project system works on the principle of converting the linear motion because to pressure of footsteps into rotating motion by rack and pinion arrangement. This mechanism fails if there is any occurrence of variable load leads to balancing type problems Power is not generated during return movement of rack.

[2] Vipin Kumar Yadav1, Vivek Kumar Yadav1, Rajat Kumar1, Ajay Yadav, [2]In this research paper authors used the equipment with following

specification: Motor Voltage:10 volt Type: D.C. Generator, RPM:1000 rpm, Gear 1-Mild Steel, No. of teeth: 59(big gear),No. Of teeth: 36(small gear), Type: Spur Gear, No. Of gear used:2 Spring 1-Load bearing capacity: 60-90 kg, Mild Steel, Total displacement:5 inch, Bearing 1- Type: Ball bearing, Bearing no.N35,Shaft 1- Diameter: 15 mm- Material: Mild steel author concluded that with these method energy conversion is simple efficient and pollution free.

[3] From the perspective of Sasankshekhar Panda has described the based on crank shaft; fly wheel, and gear arrangement. This type of footsteps power generation system is eligible to be installed in crowded places and rural areas. Thus, this is a very good technology to provide effective solution to power related problems to affordable extent. This will be the most acceptable means of providing power to the places that involves difficulties of transmission. Maintenance and lubrication is required time to time.

[4] Jose ananthvino described the simple drive mechanism which include rack and pinion assembly and chain drive mechanism. The conversion of the pressure or force energy in to electrical energy. The power generation is very high but the initial cost of this system is high. There is no need of power from the mains and this system is ecofriendly. It is very useful at the crowded places and on all roads and as well as all kind of foot step which is used to generate the electricity. Maintenance and lubrication is required time to time. Power is not generated during return movement of rack.

III. OBJECTIVES

In this foot step, power generation project is to convert foot step, walking and running energy into electrical energy. It is used to generate electricity from by walking on foot step. The need of electrical energy is increasing day by day. But power generation conventional resources are not enough for a total demand of electrical energy. Therefore many researchers are working on nonconventional ways of electrical power generation. Footstep power generation system is also a non-conventional electrical energy production system. It converts mechanical energy of footsteps into electrical energy by using transducers. This power generation system can become very popular among countries like Pakistan, china, India. It can be implemented on roads, bus stations, and many public places.

IV. PROPOSED METHODOLOGY

PIEZO ELECTRIC EFFECTS:

Piezoelectric effect is the ability of some piezoelectric materials (such as quartz, topaz, zinc oxide and etc.). To generate an electrical charge in feedback to the mechanical stress.' Piezoelectric' word is derived from the Greek word 'piezein' which means to push, squeeze and press.

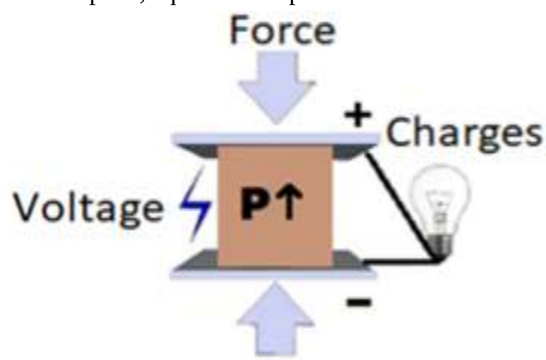


Fig 1: Piezo electric effects

Also, the piezoelectric effect is reversible, which means when we apply mechanical stress to the piezoelectric material we receive some electrical charge on output. And, when we apply electricity to the piezoelectric material, then it compresses or stretches the piezoelectric material.

Mechanism of Piezo electricity:

The nature of the piezoelectric effect is closely related To the occurrence of electric dipole moments in solids. The latter may either be Induced for ions on crystal lattice sites with asymmetric charge surroundings (as In batio3 and pzts) or may directly be carried by molecular groups (as in cane Sugar).

The dipole density or polarization (dimensionality [Cm/m3]) may easily be calculated for crystals by Summing up the dipole moments per volume of the crystallographic unit cell.

As every dipole is a vector, the dipole density P is also a vector or a directed Quantity. Dipoles near each other tend to be aligned in regions called Weiss Domains. The domains are usually randomly oriented, but can Be aligned during poling (not the same as magnetic poling), a process by which A

strong electric field is applied across the material, usually at elevated Temperatures of decisive importance for the piezoelectric effect is the change of Polarization P when applying a mechanical stress.
This might either be caused by a re-configuration of the dipole-inducing surrounding or by re-orientation of molecular dipole Moments under the influence of the external stress. Piezoelectricity may then manifest in a variation of the polarization strength, its direction or both, With the details depending on, V The orientation of P within the crystal, V crystal symmetry.
The change in P appears as a variation of surface charge Density upon the crystal faces, i.e. As a variation of the electrical field extending Between the faces, since the units of surface charge density and polarization are The same, C/m2] = [Cm/m3]. However, piezoelectricity is not caused by a change. In charge density on the surface, but by dipole density in the bulk. For example,
A 1 cm3 cube of quartz with 2 kn (500 lbf) of correctly applied force can Produce a voltage of 12500 V.
Piezoelectric materials also show the opposite effect, called Converse piezoelectric effect, where the application of an electrical field creates mechanical deformation in the crystal.

Crystal classes:
Any spatially separated charge will result in an electric field, and therefore an electric potential. Shown here is a standard dielectric in a capacitor. In a piezoelectric device, mechanical stress, instead of an externally applied voltage, causes the charge separation in the individual atoms of the material.
Of the thirty-two crystal classes, twenty-one are non-centre symmetric and of these, twenty exhibit direct piezoelectricity. Ten of these represent the polar crystal classes, which show a spontaneous polarization without mechanical stress due to a non-vanishing electric dipole moment associated with their unit cell, and which exhibit piezoelectricity. If the dipole moment can be reversed by the application of an electric field, the material is said to be ferroelectric. V Polar crystal classes: 1, 2, m, mm2, 4, 4 mm, 3, 3m, 6, 6 mm. V Piezoelectric crystal classes: 1, 2, m, 222, mm2, 4, 4, 422, 4 mm, 42m, 3, 32, 3m, 6, 6, 622, 6 mm, 62m, 23, 43m.

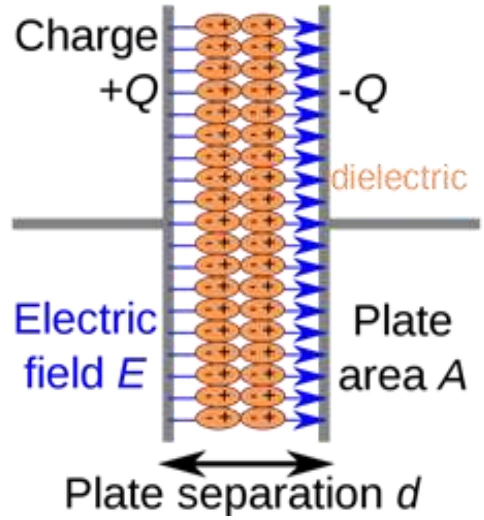
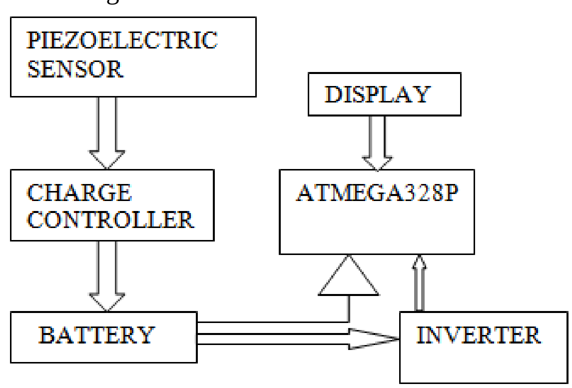


Fig 2: Crystal Classes

For polar crystals, for which P ≠ 0 holds without applying a mechanical load, the piezoelectric effect manifests itself by changing the magnitude or the direction of P or both.
For the non-polar, but piezoelectric crystals, on the other hand, a Polarization P different from zero is only elicited by applying a mechanical Load. For them the stress can be imagined to transform the material from a nonpolar crystal class (P =0) to a polar one, having P ≠ 0.

HARDWARE DESCRIPTION OF THE PROJECT:
Block diagram:



ATmega328p:
The 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 ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or

battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Fig 3: Ardunio Board

Arduino Uno Specifications

- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14
- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory 32 KB
- SRAM 2 KB
- EEPROM 1 KB
- Clock Speed 16 MHz

Piezoelectric Sensors:

It is a sensor which converts force applied on sensor into voltage with the help of mechanical vibrations. It basically converts kinetic energy into electrical energy. Array of sensors should be connected in series to generate reasonable amount of electrical power. Two types of such sensors majorly used are lead zirconate titanate (PZT) and PVDF. The output voltages of these sensors are controlled by filters.

Liquid Crystal Display (LCD):

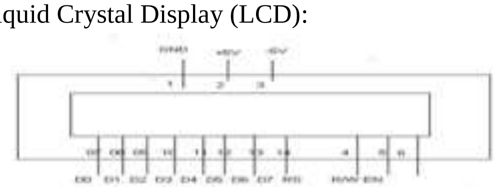


Fig 4: Pin Diagram of LCD

PIN DESCRIPTIONS:

Vcc, Vss and Vee

While Vcc and Vss provide +5V and ground respectively, Vee is used for controlling LCD contrast.

RS Register Select: - There are two very important registers inside the LCD. The RS pin is used for their selection as follows.

If RS=0, the instruction command code register is selected, allowing the user to send a command such as clear display, cursor at home, etc.

If RS=1, the data register is selected, allowing the user to send data to be displayed on the LCD.

R/W, read/write: R/W input allows the user to write information to the LCD or read information from it.

R/W = 1 for reading.

R/W= 0 for writing.

EN, enable: - The LCD to latch information presented to its data pins uses the enable pin. When data is supplied to data pins, a high–to-low pulse must be applied to this pin in order for the LCD to latch in the data present at the data pins. This pulse must be a minimum of 450 ns wide.

D0 – D7: - The 8–bit data pins, DO – D7, are used to send information to the LCD or read the contents of the LCD‘s internal registers.

To display letters and numbers, we send ASCII codes for the letters A–Z, a-z numbers 0-9 to these pins while making RS=1.

Power Supply:

Power supply block consists of following units:

- Step down transformer.
- Bridge rectifier circuit.
- Input filter.
- Voltage regulators.
- Output filter.
- Indicator unit.

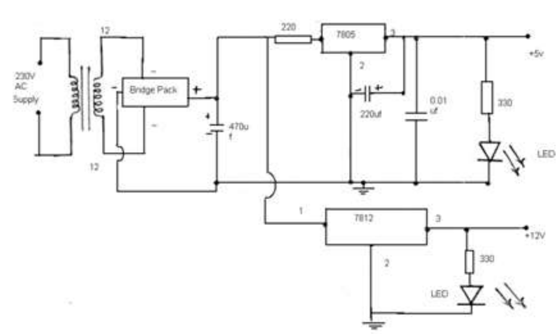


Fig 5: Power Supply Circuit Diagram

BATTERY:

Battery (electricity), an array of electrochemical cells for electricity storage, either individually linked or individually linked and housed in a single unit. An electrical battery is a combination of one or more electrochemical cells, used to convert stored chemical energy into electrical energy.

Batteries may be used once and discarded, or recharged for years as in standby power applications. Miniature cells are used to power devices such as hearing aids and wristwatches; larger batteries provide standby power for telephone exchanges or computer data centers.

Fig 6: Rechargeable Battery

Inverter:

A power inverter, or inverter, is a power electronic device or circuitry that changes direct current (DC) to alternating current (AC).

The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. The inverter does not produce any power; the power is provided by the DC source.

A typical power inverter device or circuit requires a relatively stable DC power source capable of supplying enough current for the intended power demands of the system. The input voltage depends on the design and purpose of the inverter. Examples include:

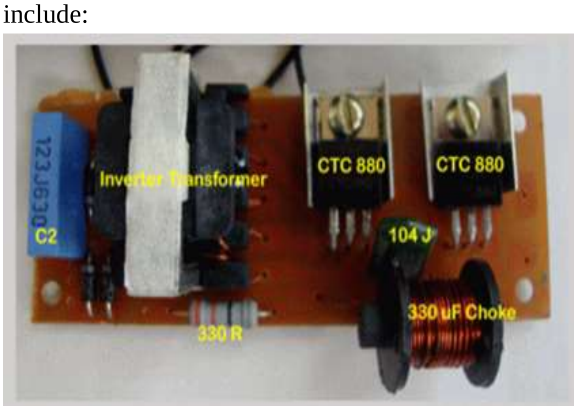


Fig 7: Simple Inductive Choke

12 V DC, for smaller consumer and commercial inverters that typically run from a rechargeable 12 V lead acid battery or automotive electrical outlet.

24, 36 and 48 V DC, which are common standards for home energy systems.

200 to 400 V DC, when power is from photovoltaic solar panels.

300 to 450 V DC, when power is from electric vehicle battery packs in vehicle-to-grid systems.

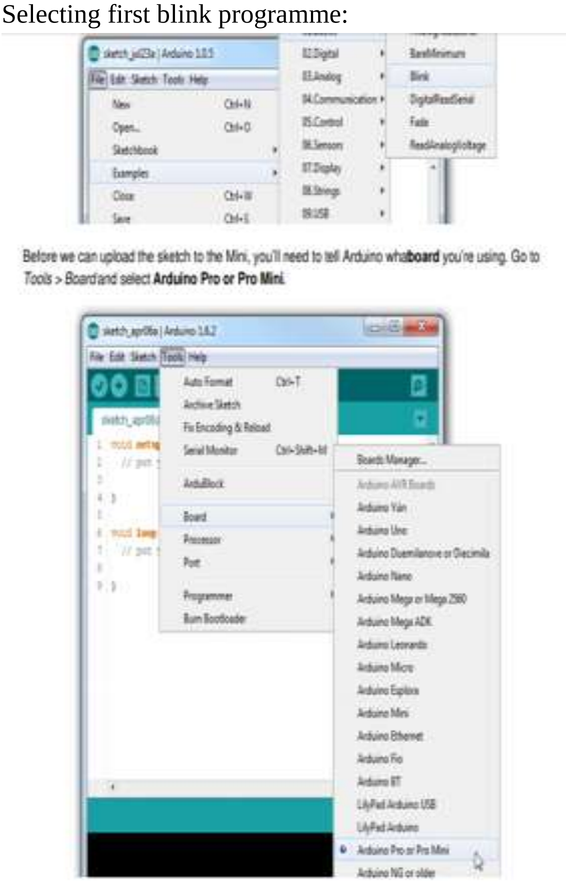
Hundreds of thousands of volts, where the inverter is part of a high-voltage direct current power transmission system.

SOFTWARE DESCRIPTION OF THE PROJECT:

Arduino IDE:

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Selecting first blink programme:



Selecting board and com port:

HARDWARE IMPLEMENTATIONS:

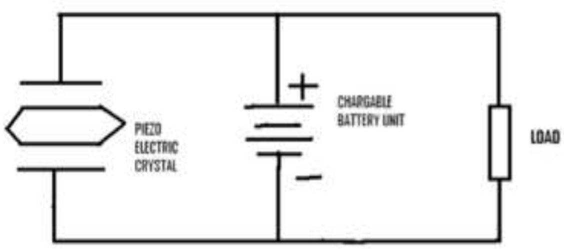


Fig 8: Circuit Diagram

V. DETAILED WORKING

Piezoelectricity is the charge which accumulates in certain solid materials (notably crystals, certain ceramics, and biological matter such as bone, DNA and various proteins) in response to applied mechanical strain. The word piezoelectricity means electricity resulting from pressure. It is derived from the Greek Piezo or piezein , which means to squeeze or press, and electric or electron , which stands for amber – an ancient source of electric charge. Piezoelectricity is the direct result of the piezoelectric effect.

The piezoelectric effect is understood as the linear electromechanical interaction between the mechanical and the electrical state in crystalline materials with no inversion symmetry. The piezoelectric effect is a reversible process in that materials exhibiting the direct piezoelectric effect (the internal generation of electrical charge resulting from an applied mechanical force) also exhibit the reverse piezoelectric effect (the internal generation of a mechanical force resulting from an applied electrical field). For example, lead zirconate titanate crystals will generate measurable piezoelectricity when their static structure is deformed by about 0.1% of the original dimension.

Conversely, lead zirconate titanate crystals will change about 0.1% of their static dimension when an external electric field is applied to the material.

Piezoelectricity is found in useful applications such as the production and detection of sound, generation of high voltages, electronic frequency generation, microbalances, and ultra fine focusing of optical assemblies. It is also the basis of a number of scientific instrumental techniques with atomic resolution, the scanning probe microscopes such as STM, AFM, MTA, SNOM, etc., and everyday uses such as acting as the ignition source for cigarette lighters and push-start propane barbecues.

ADVANTAGES:

- Power generation is simply walking on step.
- No need fuel input.
- This is a Non-conventional system.
- No moving parts - long service life.
- Self-generating - no external power required.
- Compact yet highly sensitive
- Reliable, Economical, Eco-Friendly.
- Less consumption of Non- renewable energies.
- Power also generated by running or exercising on the step.
- Battery is used to store the generated power
- Extremely wide dynamic range, almost free of noise

DISADVANTAGES:

- Only applicable for the particular place.
- Initial cost of this arrangement is high.
- Output affected by temperature variation.
- Initial cost of this arrangement is high.
- Care should be taken for batteries

VI. RESULT AND DISCUSSION

The piezoelectric material under consideration were studied to understand the output corresponds to the various pressure and strain applied on them. Voltmeters and ammeter are used for measuring the voltages developed across the piezoelectric materials and amount of current flowing them respectively the energy can be stored in the capacitor by charging the capacitor, and the capacitor may be discharged on the basis of requirement. However the energy harvesting capacity of this circuit is not very much appreciable.
To overcome this problem, after bridge rectifier stage, one may use a DC to DC converter. An improvement by a factor of seven in energy harvesting has been shown by the addition of DC-DC converter. In parallel with the piezoelectric element, it contains a switching device. The DC voltage will be stored in 6V battery, the number of battery used is 2 in number. The 6V each DC of the battery is converted into AC by power transistor T-1 (NPN). The output of the transistor is fed to the inverter transformer which will convert 12 V to 220Volt which will light up. The number of press or number of jumps on a wooden plank is shown on the 0-99 counter.

VII. CONCLUSION AND FUTURE SCOPE

Conclusion: Footsteps are the main source of power generation. There is no need of energy from conventional source of energy and there is zero percent of pollution in this type of power generation. There is no need of any kind of power from mains and it is important to the areas, all tracks where footsteps are used to generate nonconventional energy such as electricity. The contribution of Non-conventional energy to our primary energy is 11% that is a common fact. If this project is activated it will not only add and overwhelm the energy deficit problems but this will also form sound global environmental change.

Future scope:

1 Flooring Tiles Japan has already started experimenting the use of piezoelectric effect for energy generation. They implement piezoelectric effect on the stairs of the bus. Thus every time passenger steps on the tiles; they trigger a small vibration that can be stored as energy.

2 2.Dance floorsEurope is another one of the country which started experimenting use of piezoelectric crystal for energy generation in night clubs. Floor is compressed by the dancer’s feet and piezoelectric materials makes contact and generate electricity. Generated electricity is nothing but 2- 20 watt. It depends on impact of the dancer’s feet. If constant compression of piezoelectric crystal causes a huge amount of energy.

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