A PROJECT REPORT

ON

# “FOOT STEP POWER GENERATION”

SUBMITED UNDER ESTEEMED GUIDENCE OF

KANDULAL NAGRAJU

DEPT. OF ELECTRICAL AND ELECTRONIC ENGINEERING

QULI QUTUB SHAH GOVT. POLYTECHNIC

HYDERABAD

IN FULLFILMENT OF THE REQUIREMENT FOR THE AWARD

OF DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGIEERING

-BY-

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# CERTIFICATE

This is to certify that the project entitled **"FOOT STEP POWER GENERATION"** has been successfully submitted by

**SYED MERAJ**

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In fulfillment of the award of the Diploma in Electrical And Electronics Engineering

**SRI.A THARA SINGH** (HEES) **KANDULAL NAGARAJU**(GUIDE)

**EXTERNAL EXAMINER** **PRINCIPAL**

# CERTIFICATION

This is the project report entitled **"FOOT STEP POWER GENERATION"**

Is the bonafide record of the work carried and controlled by the

Diploma in Electrical And Electronics Engineering

By

State Board Of Technical Education And

Traning During **2021-2024**

We also clarify that this project was done under the able guidance of

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For the completion of the project

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**k.NAGARAJU** for his able guidance , whole hearted co-operation

and constructive criticism for the completion of this project

we also express our sincere thanks to our head of the department

**A.THARA SINGH** sir for the completion of

**“FOOT STEP POWER GENERATION “**

With full co-operation and support

Last but not the least we thanks all our friends who have supported us till the end of the project

**THANK YOU…**

# DECLARATION

We hearby declare that the project entitled

**“FOOT STEP POWER GENERATION”**

Was carried out by under the guidance of

**SRI. KANDULAL NAGRAJU**

Department Of Electrical And Electronics Engineering

QULI QUTUB SHAH GOVT. POLYTECHNIC

HYDERABAD

This work has not been previously formed on the basis of

The award for diploma or degree or certificate or has

Been submitted else.

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# ABSTRACT

Foot step power generation the system generates voltage using footstep force. The system serves as a medium to generate electricity using no- conventional sources(force) and /store/use it. The project is designed to be useful at public places like railway stations where a lot of people keep walking through all day. At such places these systems are to be placed at any entry points where people travel through entrance or exits and they have to step on this device to get through. These devices may then generate a voltage on every footstep and when mounted in series they will produce a sizeable amount of electricity. For this purpuse we here use piezoelectric sensors that use piezoelectric effect in order to measure acceleration, force, pressure by Its conversion into electric signals. We here attach a voltmeter in order to measure its output and small led lights for demonstration. We also use a battery and weight measurement unit for better demonstration of the system.

# TOOLS TO BE USED IN FOOT STEP POWER GENERATION

*PLIERS

*SCREW DRIVER

*WIRES

*SCREWS AND NUTS

*TEST LAMP

*SOLDERING KIT

# PLIERS:

PLIERS : Pliers are a hand tool used to hold objects firmly, possibly developed from tongs used to handle hot metal in Bronze Age Europe. They are also useful for bending and compressing a wide range of materials. Generally, pliers consist of a pair of metal first-class levers joined at a fulcrum positioned closer to one end of the levers, creating short jaws on one side of the fulcrum, and longer handles on the other side. This arrangement creates a mechanical advantage, allowing the force of the hand's grip to be amplified and focused on an object with precision. The jaws can also be used to manipulate objects too small or unwieldy to be manipulated with the fingers.

# SCREWDRIVERS

A screwdriver is a tool, manual or powered, for screwing (installing) and unscrewing (removing) screws. A typical simple screwdriver has a handle and a shaft, ending in a tip the user puts into the screw head before turning the handle. The shaft is usually made of tough steel to resist bending or twisting. A screwdriver is classified by its tip, which is shaped to fit the driving surfaces ----slots. grooves, recesses, etc. on the screwdriver's tip engage the head of a screw of the same size and type designation as the screwdriver tip. Screwdriver tips are available in a wide variety of types and size (List of screw drivers). The two most are the simple 'blade' for slotted

# wires

Wire is a long, thin and flexible piece of metal. Wires are made in many different metals and sizes, and are used for many purposes. Wire rope has been used for centuries.

Electrical wire is wire used to carry electricity. When people touch wire that is carrying electricity, they get shocked, which is bad, so the outside coating of electrical wires is colored. Most electric wires are black, but some wires have a differently colored coating. Different colors indicate different purposes, for example, in the United States. green or bare is a ground (earth) wire, white is a neutral wire, and black, blue, red, brown, yellow, and orange are hot (live) wires.

# SOLDERING KIT

Soldering is a process in which two or more items are joined together by melting and putting a filler metal (solder) into the joint, the filler metal having a lower melting point than the adjoining metal Unlike welding, soldering does not involve melting the work pieces. In brazing, the work piece metal also does not melt, but the filler metal is one that melts at a higher temperature than in soldering In the past, nearly all solders contained lead, but environmental and health concerns have increasingly dictated use of lead-free alloys for electronics and plumbing purposes.

Jewelry components, machine tools and some refrigeration and plumbing components are often assembled and repaired by the higher temperature silver soldering process. Soldering is used in plumbing, electronics, and metalwork from flashing to jewelry and musical instruments.

Soldering provides reasonably permanent but reversible connections between copper pipes in plumbing systems as well as joints in sheet

# GLUE GUN KIT

**Hot-melt adhesive** (**HMA**), also known as **hot glue**, is a form of thermoplastic adhesive that is commonly sold as solid cylindrical sticks of various diameters designed to be applied using a **hot glue gun**. The gun uses a continuous-duty heating element to melt the plastic glue, which the user pushes through the gun either with a mechanical trigger mechanism on the gun, or with direct finger pressure. The glue squeezed out of the heated nozzle is initially hot enough to burn and even blister skin. The glue is sticky when hot, and solidifies in a few seconds to one minute. Hot-melt adhesives can also be applied by dipping or spraying, and are popular with hobbyists and crafters both for affixing and as an inexpensive alternative to resin casting.

In industrial use, hot-melt adhesives provide several advantages over solvent-based adhesives. Volatile organic compounds are reduced or eliminated, and the drying or curing step is eliminated. Hot-melt adhesives have a long shelf life and usually can be disposed of without special precautions. Some of the disadvantages involve thermal load of the substrate, limiting use to substrates not sensitive to higher temperatures, and loss of bond strength at higher temperatures, up to complete melting of the adhesive. Loss of bond strength can be reduced by using a reactive adhesive that after solidifying undergoes further curing, whether by moisture (e.g., reactive urethanes and silicones), or ultraviolet radiation. Some HMAs may not be resistant to chemical attacks and weathering HMAs do not lose thickness during solidifying, whereas solvent-based adhesives may lose up to 50–70% of layer thickness during drying.

# TEST LAMP

A test light, test lamp, voltage tester, or mains tester is a piece of electronic test equipment used to determine the presence of electricity in a piece of equipment under test. A test light is simpler and less costly than a measuring instrument such as a multimeter, and often suffices for checking for the presence of voltage on a conductor. Properly designed test lights include features to protect the user from accidental electric shock. Non-contact test lights can detect voltage on insulated conductors.

# WOODEN BOARD

plank is timber that is flat, elongated, and rectangular with parallel faces that are higher and longer than wide. Used primarily in carpentry, planks are critical in the construction of ships, houses, bridges, and many other structures. Planks also serve as supports to form shelves and tables.

# MATERIALS REQUIRED FOR FOOT STEP POWER GENERATION

| S.NO | MATERIALS REQUIRED FOR FOOT STEP POWER GENERATION |
|---|---|
| 1 | PIEZO ELECTRIC SENSORS |
| 2 | BATTERY |
| 3 | LCD DISPLAY |
| 4 | UNO ARDINO CIRCUIT BOARD |
| 5 | RELAY |
| 6 | BATTERY HOLDER |
| 7 | USB PORT |
| 8 | PCB BOARD |
| 9 | LED LIGHT |
| 10 | AC SUPPLY ADAPTER |
| 11 | MACRO USB CABLE |

# DETAILS OF MATERIALS

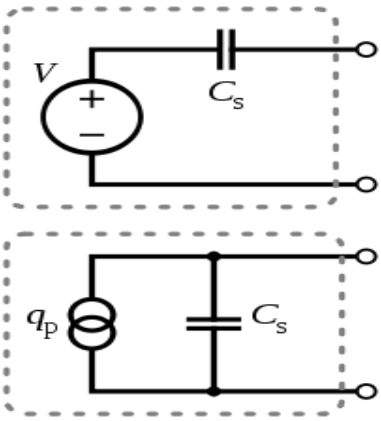
## PIEZO ELECTRIC SENSORS:

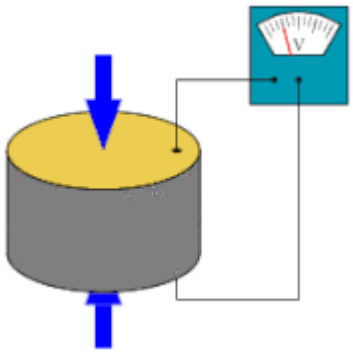
A **piezoelectric sensor** is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. The prefix *piezo-* is Greek for 'press' or 'squeeze'

piezoelectric transducer has very high output impedance and can be modeled as a proportional voltage source and filter network. The voltage $V$ at the source is directly proportional to the applied force, pressure, or strain.[10] The output signal is related to this mechanical force as if it had passed through the equivalent circuit.

Frequency response of a piezoelectric sensor; output voltage over applied force versus frequency

A detailed model includes the effects of the sensor's mechanical construction and other non-idealities.[11] The inductance $L_m$ is due to the seismic mass and inertia of the sensor itself. $C_e$ is inversely proportional to the mechanical elasticity of the sensor. $C_0$ represents the static capacitance of the transducer, resulting from an inertial mass of infinite size.[11] $R_i$ is the insulation leakage resistance of the transducer element. If the sensor is connected to a load resistance, this also acts in parallel with the insulation resistance, both increasing the high-pass cut



In the flat region, the sensor can be modeled as a voltage source in series with the sensor's capacitance or a charge source in parallel with the capacitance

For use as a sensor, the flat region of the frequency response plot is typically used, between the high-pass cutoff and the resonant peak. The load and leakage resistance must be large enough that low frequencies of interest are not lost. A simplified equivalent circuit model can be used in this region, in which $C_s$ represents the capacitance of the sensor surface itself, determined by the standard formula for capacitance of parallel plates

## ADVANTAGES :

They have been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation, and as a tilt sensor in consumer electronics[1] or a pressure sensor in the touch pads of mobile phones. In the automotive industry, piezoelectric elements are used to monitor combustion when developing internal combustion engines. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built-in miniature piezoelectric sensor.

# BATTERY ;

A **lithium-ion** or **Li-ion battery** is a type of rechargeable battery which uses the reversible intercalation of Li+ ions into electronically conducting solids to store energy. In comparison with other rechargeable batteries, Li-ion batteries are characterized by a higher specific energy, higher energy density, higher energy efficiency, longer cycle life and longer calendar life. Also noteworthy is a dramatic improvement in lithium-ion battery properties after their market introduction in 1991: within the next 30 years their volumetric energy density increased threefold, while their cost dropped tenfold.[9]

The invention and commercialization of Li-ion batteries is considered as having one of the largest societal impacts in human history among all technologies,[10] as was recognized by 2019 Nobel Prize in Chemistry. More specifically, Li-ion batteries enabled portable consumer electronics, laptop computers, cellular phones and electric cars, or what has been called e-mobility revolution.[11] It also sees significant use for grid-

scale energy storage, as well as military and aerospace applications.

Although many thousands of different materials have been investigated for use in lithium-ion batteries, the usable chemistry space for this technology, that made into commercial applications, is extremely small. All commercial Li-ion cells use intercalation compounds as active materials:[12]

1) The anode (or negative electrode) is usually graphite, although silicon has been often mixed with graphite in commercial cells since ca. 2015.

2) The solvents in commercial Li-ion batteries comprise organic carbonates, such as ethylene carbonate and dimethyl carbonate, that form solid electrolyte interphase on the negode, which allows for Li+ ion transport but not for electron transfer.[13][14]

3) In addition to carbonate solvent(s) the battery electrolyte comprises a lithium salt. Lithium hexafluorophosphate is most commonly used, because it passivates the positive aluminium current collector.

4) There is more diversity among positive electroactive materials (cathodes). They are selected from a group comprising layered LiCoO2 and LiNiO2, spinel LiMn2O4, olivine LiFePO4, and their combinations/ derivatives. Many other posode materials have been studied, but they all suffer either from a high cost, poor durability (Li+ for M ion place exchange) or too high voltage incompatible with known electrolytes.

# LCD DISPLAY:


A **liquid-crystal display** (**LCD**) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly[1] but instead use a backlight or reflector to produce images in color or monochrome.[2] LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden: preset words, digits, and seven-segment displays (as in a digital clock) are all examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white

on blue LCDs to give them their characteristic appearance.

LCDs are used in a wide range of applications, including LCD televisions, computer monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in LCD projectors and portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. LCD screens have replaced heavy, bulky and less energy-efficient cathode-ray tube (CRT) displays in nearly all applications. The phosphors used in CRTs make them vulnerable to image burn-in when a static image is displayed on a screen for a long time, e.g., the table frame for an airline flight schedule on an indoor sign. LCDs do not have this weakness, but are still susceptible to image persistence.

# ADVANTAGES :

- Very compact, thin and light, especially in comparison with bulky, heavy CRT displays.
- Little heat emitted during operation, due to low power consumption.
- No geometric distortion.
- Sharp image with no bleeding or smearing
- Can be made in almost any size or shape.

# UNO ARDINO CIRCUIT

The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino.cc and initially released in 2010.[2][3] The microcontroller board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts, such as a rectangular 9-volt battery. It has the same microcontroller as the Arduino Nano board, and the same headers as the Leonardo board.[5][6] The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The word "uno" means "one" in Italian and was chosen to mark a major redesign of the Arduino hardware and software.[7] The Uno board was the successor of the  release and was the 9th version in a series of USB-based Arduino boards.[8] Version 1.0 of the Arduino IDE for the Arduino Uno board has now evolved to newer releases.[4] The ATmega328 on the board comes

preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.[3]

While the Uno communicates using the original STK500 protocol,[1] it differs from all preceding boards in that it does not use a FTDI USB-to-UART serial chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter

## CODES USED IN UNO ARDINO

This is the code i currently have:

```
#define analog Pin      0          // analog pin for measuring capacitor voltage

#define charge Pin      13         // pin to charge the capacitor - connected to one end of the charging resistor

#define discharge Pin   11         // pin to discharge the capacitor

#define resistor Value   998000.0F   // change this to whatever resistor value you are using

                                   // F formatter tells compiler it's a floatingpoint value


unsigned long Time;

unsigned long elapsed Time;
```

```
float microFarads;                // floating point variable to
preserve precision, make calculations

float nanoFarads;


int chargeStateCounter = 0;

int chargeState = 0;

int lastChargeState = 0;


void setup(){

 pinMode(chargePin, OUTPUT);     // set chargePin to
output

 digitalWrite(chargePin, LOW);


 Serial.begin(9600);              // initialize serial
transmission for debugging

}


void loop( ){

 digitalWrite(chargePin, HIGH);  // set chargePin HIGH
and capacitor charging
```

# RELAY :

A **relay** is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional electromechanical form of a relay uses an electromagnet to close or open the contacts, but relays using other operating principles have also been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called *protective relays* or *safety relays*.

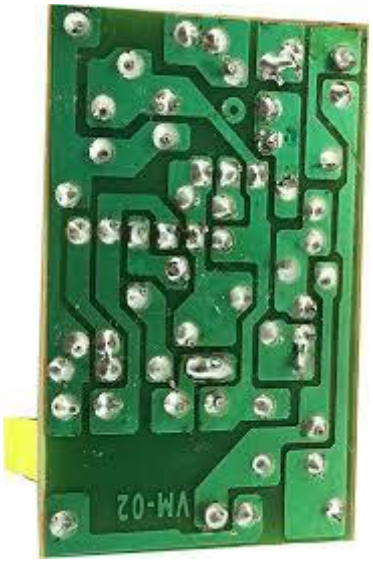
# BATTERY HOLDER

A **battery holder** is one or more compartments or chambers for holding a battery. For dry cells, the holder must also make electrical contact with the battery terminals. For wet cells, cables are often connected to the battery terminals, as is found in automobiles or emergency lighting equipment.

# USB PORT :

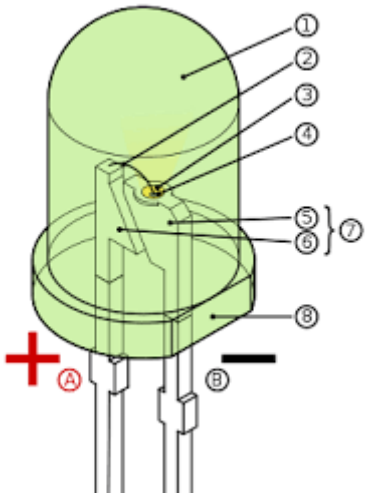
The initial versions of the USB standard specified connectors that were easy to use and that would have acceptable life spans; revisions of the standard added smaller connectors useful for compact portable devices. Higher-speed development of the USB standard gave rise to another family of connectors to permit additional data paths. All versions of USB specify cable properties; version 3.*x* cables include additional data paths. The USB standard included power supply to peripheral devices; modern versions of the standard extend the power delivery limits for battery charging and devices requiring up to 240 watts. USB has been selected as the standard charging format for many mobile phones, reducing the proliferation of proprietary chargers.

# PCB BOARD :




A **printed circuit board** (**PCB**), also called **printed wiring board** (**PWB**), is a medium used to connect or "wire" components to one another in a circuit. It takes the form of a laminated sandwich structure of conductive and insulating layers: each of the conductive layers is designed with an artwork pattern of traces, planes and other features (similar to wires on a flat surface) etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate.[1] Electrical components may be fixed to conductive pads on the outer layers in the shape designed to accept the component's terminals, generally by means of soldering, to both electrically connect and mechanically fasten them to it. Another manufacturing process adds *vias*, plated-through holes that allow interconnections between layers.

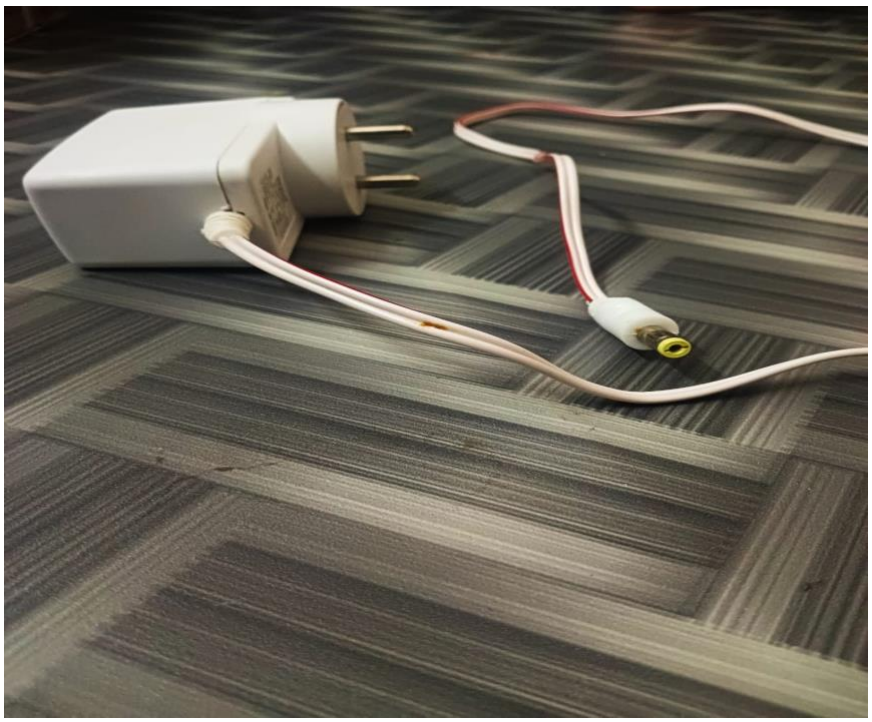
# LED LIGHT :




A **light-emitting diode** (**LED**) is a semiconductor device that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.[5] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.[6]

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared (IR) light.[7] Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red.

# ICSP ADAPTER :



**In-system programming** (ISP), or also called **in-circuit serial programming** (ICSP), is the ability of some programmable logic devices, microcontrollers, chipsets and other embedded devices to be programmed while installed in a complete system, rather than requiring the chip to be programmed prior to installing it into the system. It also allows firmware updates to be delivered to the on-chip memory of microcontrollers and related processors without requiring specialist programming circuitry on the circuit board, and simplifies design work.

# MACRO USB CABLE :

Unlike other data buses (such as Ethernet), USB connections are directed; a host device has "downstream" facing ports that connect to the "upstream" facing ports of devices. Only downstream facing ports provide power; this topology was chosen to easily prevent electrical overloads and damaged equipment. Thus, USB cables have different ends: A and B, with different physical connectors for each. Each format has a plug and receptacle defined for each of the A and B ends. A USB cable, by definition, has a plug on each end—one A (or C) and one B (or C)—and the corresponding receptacle is usually on a computer or electronic device. The mini and micro formats may connect to an AB receptacle, which accepts either an A or a B plug, that plug determining the behavior of the receptacle.

# CONSTRUCTION OF FOOT STEP POWER GENERATION

## THIS CONSTRUCTION IS DIVIDED INTO TWO PARTS

1 weight machine

2 micro controller circuit

## 1 wight machine

In this device we have set all the piezoelectric sensors in series of 2 sets they are connected in parallel. make a single input and output from it

use a white foam sheet to cover it

## 2 micro controller circuit

take the output of piezo electric sensors and connect it to the small PCB

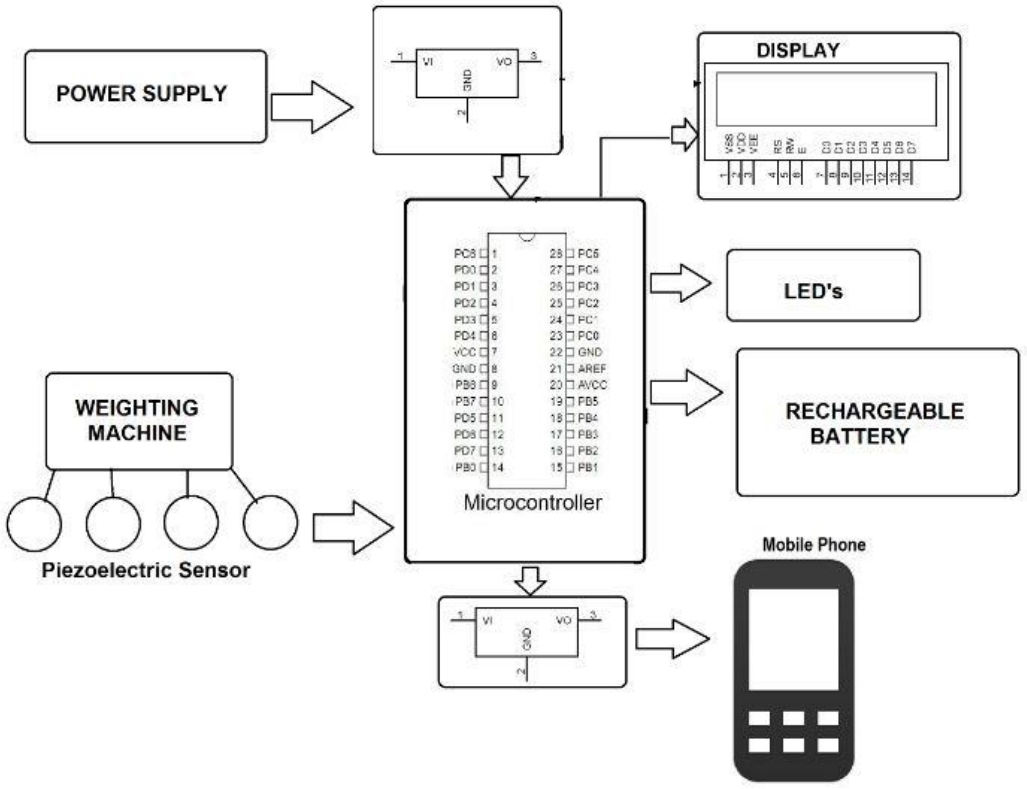
the board which contains a led and an output this connection is made in series

the output of the small PCB is directly taken to the uno circuit.

From the uno-ardino circuit the output is taken to multiple output like LCD display, relay, battery

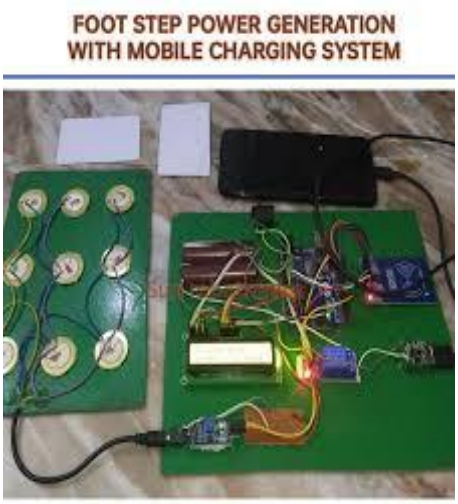
holder and to the output of the battery is given to the usb port and the output is taken from

the usb to the desired area




# BLOCK DIAGRAM OF FOOT STEP POWER GENERATION

# WORKING OF FOOT STEP POWER GENERATION PROJECT




The system generates voltage using footstep force. The system serves as a medium to generate electricity using non-conventional sources(force) and /store/use it. The project is designed to be useful at public places like railway stations where a lot of people keep walking through all day. At such places these systems are to be placed at any entry points where people travel through entrance or exits and they have to step on this device to get through. These devices may then generate a voltage on every footstep and when mounted in series they will produce a sizeable amount of electricity. For this purpose we here use piezoelectric sensors that use piezoelectric effect in order to measure acceleration, force, pressure by its conversion

into electric signals. We here attach a voltmeter in order to measure its output and small led lights for demonstration.

# ADVANTAGES AND DISADVANTAGES OF FOOT STEP POWER GENERATION PROJECT

## . ADVANTAGES

1. Some notable advantages offered by the mechanical footstep power generator include the simplicity of its assembly process.
2. There are many types of combination for mechanical footstep power generator in the market
3. NO fuel cost is required
4. lesser transmission lost

## DISADVANTAGES

1. High initial cost
2. Can only be used in public places
3. Risk of failure of circuit when heavy weight is applied
4. High maintain cost

# APPLICATIONS

In this system the power generated has been used for two applications such as lighting a street light and charging a mobile phone. An LDR is used to indicate the street light application. A buzzer is used to alert when the battery voltage falls below the required voltage for charging the microcontroller.

# REFRENCES


1. GUARDIAN
2. WIKIPEDIA
3. YOUTUBE
4. PROFESSOR
5. SOCIAL MEDIA

# CONCLUSION

The previous methods of power generation require a lot of capital to set a stable and reliable power generation system. In addition, some of the methods have various negative effects on environment such as air pollution, noise pollution among others. For this reason, coming up with a system that is ecosystem friendly was a nice idea. Therefore, the thoughts of coming up with the best power generation system that is silent, cost efficient, ecofriendly and reliable led to evolution of Mechanical Footsteps Power Generator that meets all the above requirements