JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY

Department of Electronics and Communication Engineering

The Project Report is on

"Power Generation Using Footsteps for Mobile Charging"

Submitted in partial fulfillment of the requirement for the degree of

Bachelor of Technology In Electronics and Communication Engineering

SUBMITTED BY

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SUBMITTED TO

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CERTIFICATE

This is to certify that the work titled “Power Generation Using Footsteps for Mobile Charging” submitted by Kavya Tiwari and Kartikey Nawab in partial fulfillment for the award of the degree of B-Tech of Jaypee Institute of Information Technology, Noida has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

Signature of Supervisor ……

Name of Supervisor …….

Designation …….

Date ……..

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to our supervisor Dr. Akansha Bansal for providing her invaluable guidance, comments, and suggestions throughout the course of the project. She consistently motivated and guided us towards the completion of the project. We our highly indebted to ma'am for her constant supervision as well as providing necessary information regarding the project. However, it would not have been possible without the kind support and encouragement of our parents and colleagues who have helped us out with their abilities in developing the project.

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Date ……

ABSTRACT

Generally, to perform an operation in our life, we need some external energy. So spending amount on energy is necessary in our day to day life. Producing energy without any supply or external source is the major idea and best innovation in our future. So with help of piezoelectric sensor, we'll be able to generate power with our footsteps. The main idea is with the piezoelectric tiles(which is placed under footsteps),we can produce energy that can be stored in a rechargeable battery, so that we can use it for our later purposes and it can be also placed in public places like street light, mobile charging etc. The amount of energy stored can be displayed in a liquid crystal Display. Noting that it is an energy regeneration device it encourages walking and thus can also be acknowledged as an electrical health gadget which endorses physical fitness. One more feature which has been incorporated into this gadget is a battery bank which is used to store the charge when the phone is 100 percent charged or there is no need for emergency lighting. The piezoelectric crystals are incubated into the sole and the heel of the shoes as they are considered as the maximum pressure points and via trotter moment and vibrations on the crystals, so that while walking or jumping they generate voltage pulses and minute quantities of current which is stored in the battery and can be used to charge mobile devices.

Chapter 1

1.1 INTRODUCTION

1)Project Definition

To design a system that generates voltage by the humane footsteps force. Using non-conventional sources and stores it for usage. The system will have piezoelectric sensors that will convert the measurements of acceleration, force and pressure into electrical signals. It will fully depend on the human footsteps pressure and convert it into useful power.

2) The working principle of the proposed device is - to convert kinetic energy into electrical energy and store it until it is transferred to another device via the provided output. To do this, we create articles that meet this obligation and at the same time meet other specific requirements.

- Our key business practice is to incorporate innovative piezoelectricity into shoes so that when walking, the wearer's active energy is stored as potential energy and later transferred as electrical energy.

-The final device consists of a shoe and an energy harvesting gadget hybrid that is capable and has no effect on the wearer's comfort and health. The frame uses piezoelectric strips placed and attached under the insole of the shoe to convert the mechanical energy generated as a result of the device wearer's activity into electrical energy.

- People should be able to fully charge their devices after walking a few kilometers. Interfaces include but are not limited to shoes, soles, floors, piezoelectric strips, wires, capacitors, other wires, and finally USB output. A USB port allows electrical energy, which the converts to mechanical energy, to be transferred to a connected device,

3)PTZ piezoelectric sensor

- is used because of its high-energy storage density as a small scale energy harvesting system.

- The piezoelectric crystal will be placed between nne metal plates then the mechanical pressure is applied onto the material by the help of the metal plates which will force the electric charge within the crystal to go imbalance.

- This application of mechanical energy to a crystal is known as a direct piezoelectric effect.

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1.2. LITERATURE REVIEW

1)Background

Day by day, the population of the country increases and the requirement of power also increases. At the same time, the wastage of energy also 7 increases in many ways. So reforming this energy back to usable form is a major concern. As technology is developed and the use of gadgets, electronic devices also increase. Power generation using conservative methods is becoming deficient. There is a need for a different power generation method. At the same time, the energy is wasted due to human locomotion. To overcome this problem, the energy wastage is converted to usable form using the piezoelectric sensor. This sensor converts the pressure on it to a voltage. By using this energy saving method, a foot step power generation system we are generating power. 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

2) Previous Work 1

Foot step power generator (International Journal of Scientific & Engineering Research, Volume 8, Issue 3, March-2017, Footstep Voltage Generator using Piezo-Electric Transducers) Connection of the piezo sensor is in series but we need the connections to be in parallel so that the piezo sensor can generate more current.

3) Previous work 2 Foot step power generator (Prince Mohamed Bin Fahad, 2015)

- Different type of Piezo Electric Sensor.
- Multiple plates connected in series.
- But we need the connections to be in parallel so that the piezo sensor can generate more current Used a wood plate and we used a fiber glass

4) Comparative Study

Setup	Maximum current
4 piezo connected in series	Up to 30 uA
4 piezo connected in parallel	Up to 45uA
1 piezo unit	Up to 40uA

1.3 PROBLEM STATEMENT

The increase in energy consumption of portable electronic devices and the concept of harvesting renewable energy in human surrounding arouses a renewed interest. Generally, to perform an operation in our life, we need some external energy. So spending amount on energy is necessary in our day to day life. Producing energy without any supply or external source is the major idea and best innovation in our future. Our project focuses upon one such advanced method of energy harvesting using piezoelectric material.

PROBLEM OBJECTIVES

Generating power out of free energy. To spend less money on power generating. To encourage people to use different economical ways of generating power.

- Low configuration advances open up the possibility of harvesting energy from nature to drive electronic circuits. The aim of current theoretical efforts is to study energy sources for controlling portable devices through physical human actions, including latent energy or heat.
- Electrical energy derived from human movement supports a variety of transducers: Piezoelectric materials, variable capacitors, induction generators Thermoelectric generators are the It is the best approach for generating electrical energy from temperature differences. Earth.

Other possible outcomes in this area of exploration, such as the removal of electrical energy from the temperature difference between a portable device and the earth or human body, are also subject to requirements.

1.4 METHODOLOGY

1) Environmental constraints: The piezoelectric sensor design was addressed with respect to the waste the generator produces. The intent is to minimize power consumption of this design. The power consumption level is an environmental concern because the more power the users. We will lower power parts by generating power from free source.

2) Ethical constraints: The designs were considered in relation to common morals. The project is able to perform basic tasks that reinforce important EE concepts in footpaths, hospitals, factories etc…

3) Health and safety constraints: Our design was considered with respect to assembly in the lab environment. There are no additional health and safety risks involved with the advance capabilities module.

4) Proposed Methodology

The approach we took on this mission is to separate the system into two subsystems. A sub system to work on this semester and another to work on the second semester. Starting with the weighing machine for this semester and the microcontroller for the second semester. Planning to get it done by the end of this semester to be ready to work on the second subsystem in the upcoming semester. Plate: for the weighing plate we considered Plastic, Glass, Fiberglass, wood. Sensors: We considered the large piezoelectric transducers and the small sized piezoelectric transducers, but we chose the small ones because the large ones are

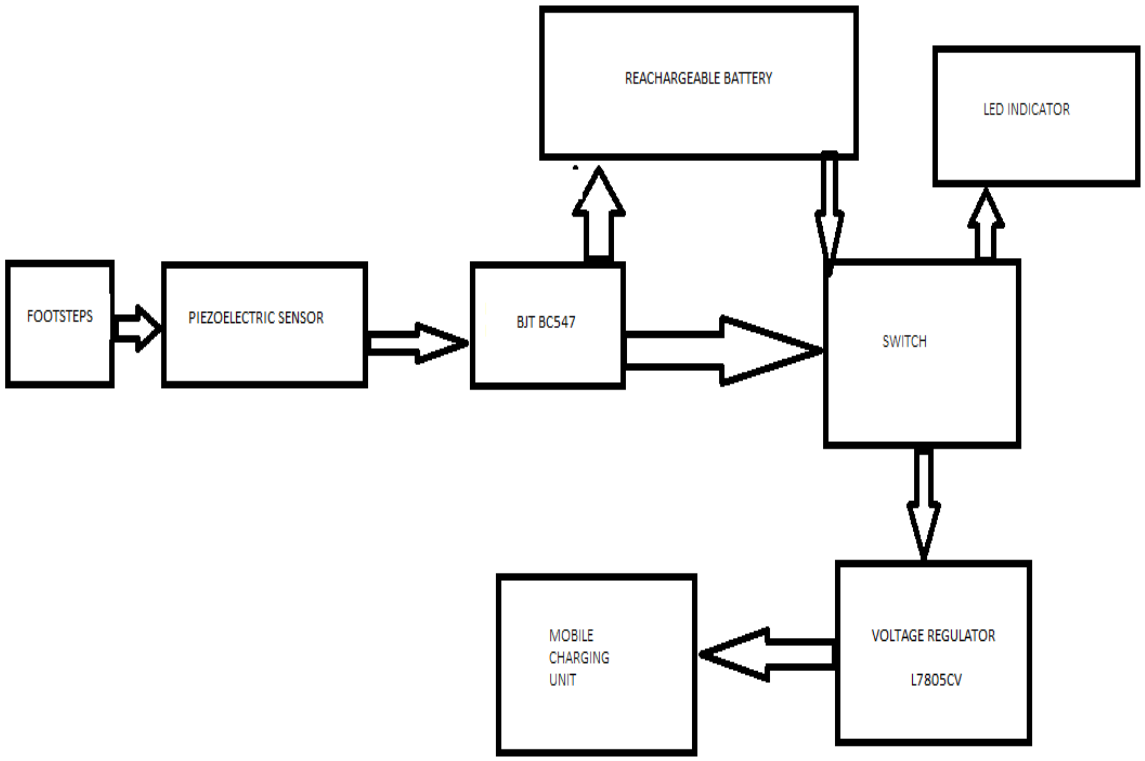
much more expensive and require a lot more mechanical pressure in order to generate very small power.

5) Implementation

When we integrated our system we simply connected the output of the piezo sensors to a rectifier circuit to convert the voltage to DC and then we fed that voltage into the micro controller in order to display the number of steps and voltage generated across the capacitor. We set our target specifications based on the results of experimenting and research on previous projects. We implemented our design at PMU labs with the help of the lab assistant and our advisor Dr. Samir, as well as group meetings outside the university. We verified our system performance using digital multimeters and the oscilloscope.

CHAPTER 2

2.1 ARCHITECTURE



2.2 CIRCUIT DIAGRAM

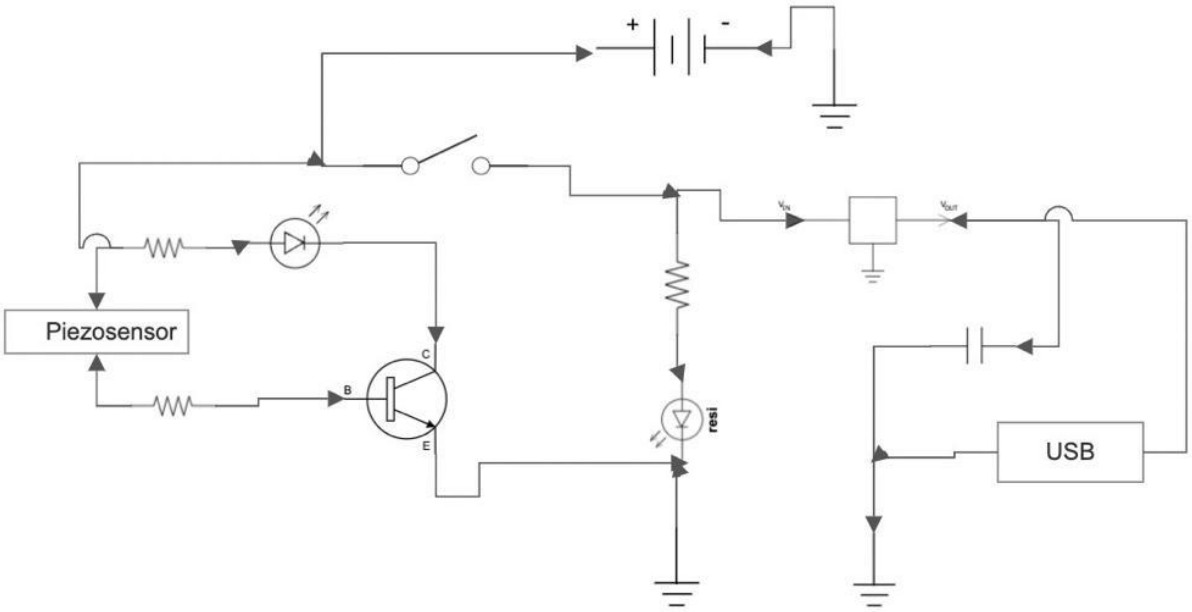


fig 1

PIEZOELECTRIC SENSORS IN SERIES

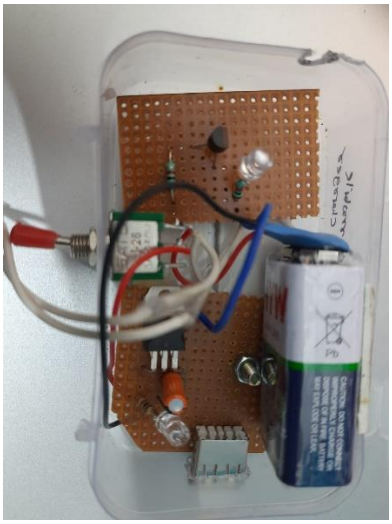


Fig 2

PORTABLE BATTERY BANK CIRCUIT

WORKING MODEL

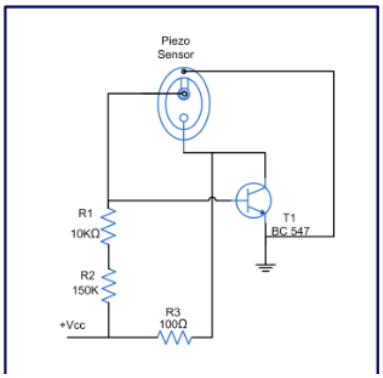
2.3 WORKING

The basic principle by which this device works is to convert a human's mechanical force into an electrical signal. The mechanical force generated is due to the active and constant movement of the ankle. A person who runs or walks on has a certain amount of kinetic energy, and along with that, he targets the pressure on the ground with his shoes on, which he uses in developing the product. Piezoelectric disk transducer driven by mechanical energy in the form of vibration vibrating a piezoelectric crystal. Excitation of this piezoelectric crystal produces a voltage of V. This figure shows a piezoelectric plate where the gold layer is the baseplate and the embedded crystal is the center of the disk. The application of this project is completely dependent on human pressure and foot movements. Mechanical stress and strain generate electricity through a piezoelectric transducer placed in the sole of the shoe. A converter helps convert vibrational energy into electrical energy. When a 70 kg man walks, the piezo disc produces a voltage of 1.5V to 2V. With proper resistance management of 20 ohms and 5 ohms this voltage increases to 8V.

The generation of pressure variation or strain by the application of electric potential across a piezoelectric material is the underlying principle. The voltage drop across resistors R1 is provided to the piezoelectric diaphragm. Due to the applied potential, the diaphragm starts vibrating. These vibrations are fed to the base of a transistor T1 (BC547). T1 acts as an amplifier to amplify these vibrations and the output appears across the collector resistor R2.

Circuit Diagrams

Piezo-sensor-as-output



The voltage is continuously coming out from the source we connected an Led indicator in the circuit which will be controlled by a two way switch which will shift the supply from regulator to LED when we are using the LED for testing and again shift the supply from LED to regulator when it will be pressed at the opposite end.

2.4 COMPONENTS USED

1)PIEZOELECTRIC SENSOR

A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal. Piezoelectric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and for research and development in many different industries it was only in the 1950s that the piezoelectric effect started to be used for industrial sensing applications.

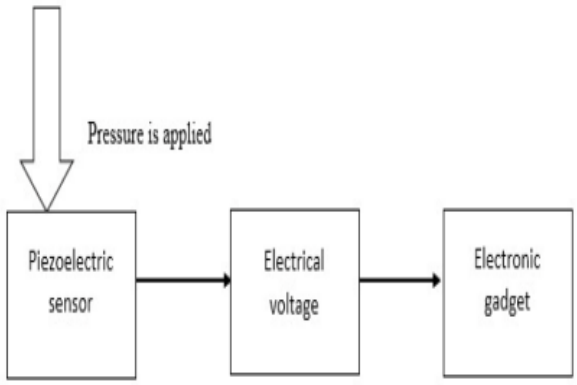
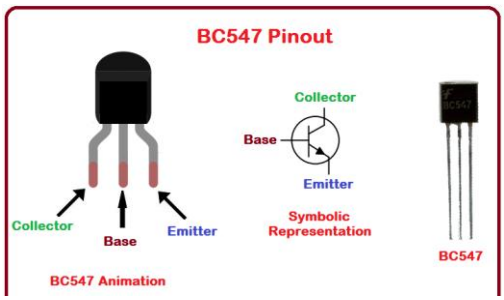


Figure 3. Piezoelectric energy harvesting process.

2)BC547

The BC547 transistor is an NPN transistor. A transistor is nothing but the transfer of resistance which is used for amplifying the current. A small current of the base terminal of this transistor will control the large current of emitter and base terminals.



3)SWITCH

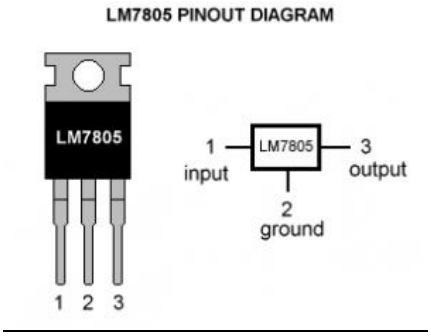
Our device has a switch that shifts the supply to the indicator path and regulator path.

4) 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.

5)VOLTAGE REGULATOR

As the name itself implies, it regulates the input applied to it. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 05, 12 represent the required output voltage levels. These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type employs internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible.

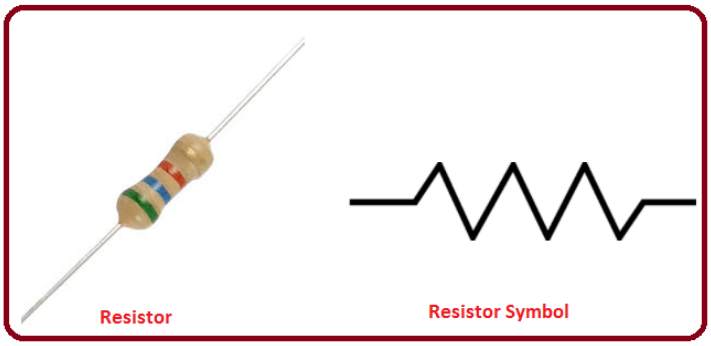


6)LED INDICATOR

To show the output from the source. It's a two lead semiconductor light source. It's a pn-junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes withing the device , releasing energy in the form of photons. This effect is called as electroluminescence and the color of the light is determined by the energy band gap of the semiconductor.

7)RESISTOR

It's a passive two way electrical component that implements elecytrical resistance as a circuit element. Resistors act to reduce current flow , and at the same time act to lower voltage levels within the circuits. In electronic circuits they are used to limit current flow, to adjust signal levels, bias active elements, termin ate transmission lines among other uses.



8) STORAGE DEVICE(OUTPUT)

The load that is used for storing the harvested electrical energy is mobile phone battery.

CHAPTER 3

APPLICATIONS

➢ Foot step generated power can be used for agricultural, home applications, street-lighting.

➢ Foot step power generation can be used in emergency power failure situations.

➢ Metros, Rural Applications etc.

➢ It can be used as a source for both A.0 and D.0 applications

➢ It is also used in universities

➢ It can be used in emergency power failure situations like hospitals.

3.1 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

3.2 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

CHAPTER 4

4.1 OBSERVATIONS

S.No.	Activity	Duration(min)	Voltage difference(V)
1	Walking	40	+0.80
2	Running	20	+0.65
3	Walking	30	+0.70
4	Standing	10	+0.15

4.2 RESULT

The necessary voltage required for charging a mobile phone battery is successfully generated and the output is shown in the picture. The output current that is generated from the piezoelectric sensor may be less, which may increase the time taken for charging a battery. But it can be used for charging an electronic device battery for emergency purpose where there is no direct source of electricity. This can be used as an efficient source for portable electric power for portable devices. This work is a low cost approach to demonstrate the application of piezoelectric sensor to meet the need for portable electric power.

CONCLUSION

1. The project "POWER GENERATION USING FOOT STEP" is successfully tested and implemented which is the best economical, affordable energy solution to common people.

2. This can be used for many applications in rural areas where power availability is less or totally absent. As India is a developing country where energy management is a big challenge for a huge population. By using this project we can drive both A.C. as well as D.0 loads according to the force we applied on the piezoelectric sensor.

A piezo tile capable of generating 40V has been devised. Comparison between various piezoelectric material shows that PZT is superior in characteristics. Also, by comparison it was found that series- parallel combination connection is more suitable. The weight applied on the tile and corresponding voltage generated is studied and they are found to have linear relation. It is especially suited for implementation in crowded areas. This can be used in street lighting without use of long power lines. It can also be used as charging ports, lighting of pavement side buildings. As a fact only 11% of renewable energy contributes to our primary

energy. If this project is deployed then not only we can overcome the energy crises problem but this also contributes to creating a healthy global environmental change.

MODEL:

4.3 FUTURE SCOPE

The analysis of the voltage stored in the battery with respect to the force applied can be done and the efficiency of this work can be calculated. Efficient storage of the generated voltage can be achieved by using the circuit shown in Figure 7. An array of piezosensors can be connected in series to get larger output and can be used for higher load applications. A rectifier-free piezoelectric energy harvesting circuit can be used for charging efficiently8. Piezoelectric energy harvesting can be used as a cleanest form of alternate energy source in future. This work is an example illustrating one of its applications. It can also be used as an energy source for wearable electronics.

A. Staircases The best to save lots of energy in our day to day life is to place the piezo electric tiles below the stair cases so that lots of power can be stored in a rechargeable battery and it can also be used for mobile charging purposes in buses. This piezo electric tile can also be placed in public places like staircases in malls, temples and even in shops where lots of footsteps are produced and it can also be used for street lights, warning lights etc..

B. Side walks This can also be an alternate scope for placing this idea of generating power using piezoelectric tiles are the sidewalks. When peoples walk on these sidewalk, we can easily generate power and store them for future use. In India we can see many road side shops, all these pressure on the road sides could generate power in a very efficient manner. And these generated powers can be used for signal lights and street lights.

C. Escalators This idea is also very similar to the previous cases The escalators of the malls can be installed with these piezoelectric tiles. Malls are one of the most crowded areas, so we can generate power from the crowd and use the same power for the crowd by lighting up and switching ON the airconditioners.

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