

Advanced Footstep Power Generation System using RFID for Charging

SHRADHA PANGHATE¹, PRATIK BARHATE², HEMANT CHAVAN³

^{1,2}Student, B.E (Appearing), Department of Electronics and Telecommunication, Government College of Engineering, Chandrapur, Maharashtra, India

³Assistant Professor, Department of Electronics and Telecommunication, Government College of Engineering, Chandrapur, Maharashtra, India

Abstract- Utilization of power turns to be necessary for every work in today's world. To comfort our daily routines the devices are used in large numbers. The benefits of roadway energy harvesting systems are potentially excellent. Energy harvesting is defined as capturing minute amounts of energy from one or more of the surrounding energy resources. To generate the power through footsteps as a source of renewable energy sources that we can obtain while walking on a certain arrangement like stepping foot on piezoelectric tiles. an advanced footstep power generation system proposed here uses the piezoelectric sensors. To generate a voltage from footstep the piezo sensors are mounted below the platform. To generate maximum output voltage the sensors are placed in such an arrangement. This is then forwarded to our monitoring circuitry. The circuit is the microcontroller based monitoring circuit that allows users to monitor the charges and voltage a connected battery to it and this power source has many applications. It also displays the charge generated by our footstep and displays it on an LCD. Also, it consists of a USB mobile phone charging point where a user may connect cables to charge the mobile phone from the battery charge. The current is distributed using (radio-frequency identification) RFID cards so that only an authorized person can use the generator for charging. Thus we charge a battery using power from footsteps, display it on LCD using a microcontroller circuit and allow for mobile charging through the setup. Our project model cost is effective and easy to implement and also it is green and not harmful to the environment.

Key Words: Piezoelectric, renewable resources, microcontroller, battery, LCD, RFID, USB.

1. INTRODUCTION-

Energy is nothing but the ability to do work. Power has turned into help for the human populace nowadays. Its request is expanding rapidly. In day to day, life innovation needs an immense measure of electrical power for its different activities. Power generation is the single largest wellspring of contamination in the world. Due to which numerous energy resources are produced and wasted. Electricity is generally generated from resources like water, wind, coal, etc. for generating the electricity from these resources development of big plants that are needed having high maintenance and high cost. In like manner, it is the target of the present development to give the technique for electrical power generation from which regularly expanding human populace that does not adversely affect the natural resources. This innovation depends on a rule called the piezoelectric effect impact, in which certain materials can develop an electrical charge from having weight, the strain applied to them. The piezoelectric effect is the effect of specific materials to generate the electric charge in response to applied mechanical stress on it. It is the effect in which mechanical vibrations, pressure or strain applied to the piezoelectric material are converted into electrical form. Piezoelectricity alludes to the capacity of a few materials to produce an electric potential in light of connected weight. The inserted piezoelectric material can give the enchantment of the changing overweight applied by moving individuals into the electric current, which is stored in a battery and further distributed using RFID cards.

2. HARDWARE IMPLEMENTATION-

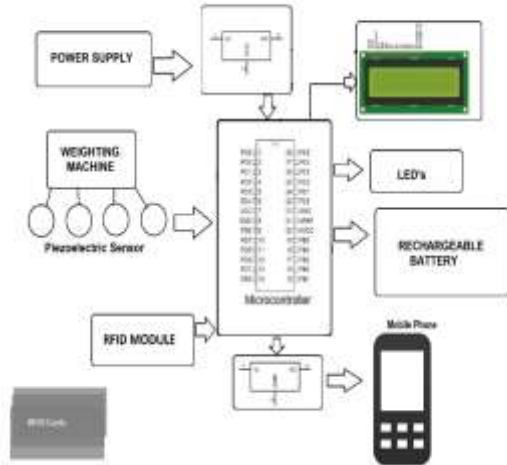


FIGURE- 1: Block Diagram of Advance Footstep Power Generating System.

The following figure shows the block diagram of an advanced footstep power generator using RFID for charging. After applying weight on piezoelectric plates voltage is developed across the plates. That voltage is applied to the battery for charging purposes. This is then provided to our monitoring circuitry. LCD is interfaced with a piezo sensor using a microcontroller that allows the user to monitor the voltage and charges a connected battery by it. Also, RFID is interfaced with microcontroller to know authorized users & it consists of a USB mobile phone charging point where the user may connect cables to charge the mobile phone from the battery charge.

3. WORKING -

The Footstep power generator works on the principle of piezoelectric effect impact. Piezoelectric Effect is the ability of certain materials for generating electric charges in response to applied mechanical stress on the piezoelectric plate. Thus, squeeze certain crystals and you can make electricity flow through them. In most crystals, the unit cell is symmetrical in piezoelectric crystals. Normally, the piezoelectric crystals are electrically neutral and atoms inside the piezoelectric plate may not be symmetrically arranged, but their electrical charges are perfectly balanced, the positive charge in one place cancels out a negative charge nearby them. However, if you squeeze or stretch the piezoelectric crystal, you deform the structure, negative, and causing net electrical charges to appear. This effect carries through a whole structure so net positive and negative charges appear on the opposite, outer faces of the crystal. Normally, the charges in the

piezoelectric crystal are exactly balanced, even if they are not symmetrically arranged. If you squeeze the crystal (massively exaggerated in this picture!), you force the charges out of balance. Now the effects of the charges are no longer eliminated one another out and net positive and negative charges appear on opposite crystal faces. By squeezing a crystal, you have produced the voltage across its opposite faces and that's piezoelectricity. In this project, we have used the same phenomenon of producing piezoelectricity from the piezoelectric crystal in the form of a coin shape disc.

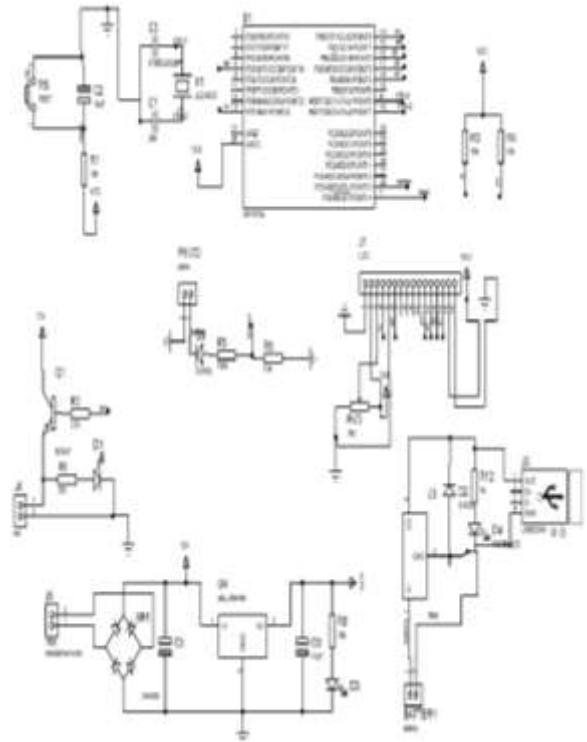


FIGURE-2: Circuit Diagram of Advance Footstep Power Generating System.

When one steps on a weighing machine the piezoelectric disc gets compressed. After the leg is lifted a crystal is decompressed. Thus a full vibration is sensed by a crystal disc and a voltage across it is produced. This voltage is sensed by a voltmeter and displayed on its display. Also, at the same time, this voltage is used to charge the 12V DC Battery. LED's have been mounted under the weighing machine that is switched on by relay through 555 timer IC whenever a voltage is generated. This event is notified by a glowing LED on the PCB. (Also one can hear the switching sound of the relay) Thus, whenever a person walks through a weighing machine the battery gets charged due to the voltage which is also displayed on the voltmeter. This event is notified by a glowing LED beneath the weighing machine.

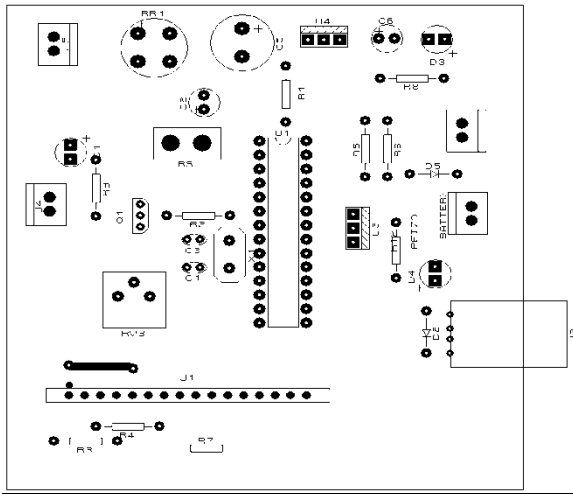


FIGURE-3: PCB Layout of Advance Footstep Power Generating System.



FIGURE -4: PCB Design of Advance Footstep Power Generating System.

4. APPLICATIONS –

- Can be broadly utilized as the part of colleges, Schools, public transport places and universities.
- This can be actualized in air terminals, transport stations, railroad stations.
- Street lights can be actualized utilizing this strategy instead of solar in the rainy season.
- This framework can be actualized in swarmed places like shopping centers, pathways and so forth.

5. ADVANTAGES –

- Power generation is strolling on the step.
- No need for fuel input.
- This is the non-ordinary technique for producing power.
- No moving parts - long administration life.
- Self-producing-no outside power required.
- The system is reduced yet exceedingly touchy.
- It is Reliable, Economical, and Eco-Friendly.
- Less utilization of Non-sustainable power sources.
- Power is likewise produced by running or practicing on the progression.
- Extremely wide powerful range, free of commotion.
- No big industries required for generation.
- Very high-frequency response.
- Simple to use as they have small dimensions and large measuring range.
- Barium titanate and quartz can be made in any desired shape and form. It also has a large dielectric constant. The crystal axis is selectable by orienting the direction of orientation.

6. DISADVANTAGES -

- The initial cost of this arrangement is high.
- Care ought to be taken for batteries.
- It isn't reasonable for estimation in static conditions.
- It is not suitable for measurement in static conditions.
- Since the device operates with a small electric charge, they need high impedance cable for electrical interface.
- The output may vary according to the temperature variation of the crystal.



FIGURE -5: Piezoelectric plate.



FIGURE -6: Advance Footstep Power Generating System.

7. FUTURE SCOPE-

The utilization of wasted energy is very much relevant and important for highly populated countries in the world in the future.

1. Flooring Tiles-

Japan has already started experimenting with the use of the piezoelectric effect impact on generating energy. They implement a piezoelectric effect on the bus stairs. Thus every time passenger steps on the tiles; they trigger the small vibration that can be stored as energy in the battery.

The flooring tiles are designed by the rubber which can absorb the vibration. This vibration generates when people are running or walking on it. Under these tiles, the piezoelectric material is placed. They can generate electricity when the movement is felt by the material. Simultaneously this generated energy is stored into the battery. The generated electricity can be used for the lighting of a lamp or street light. Energy is generated by the step of one human being is too less but if the number of steps increases ultimately energy production also increases simultaneously.

2. Dance floors-

Europe is one of the countries which implemented and started experimenting with the use of a piezoelectric crystal for energy generation in night clubs. The floor is then compressed by the dancer's feet and piezoelectric

materials make contact and generate electricity which can be used as the generator in the club. The generated electricity is nothing but 220 watts. It depends on the impact of the dancer's feet. If constant compression of the piezoelectric crystal causes a huge amount of energy.

8. RESULT -

In 1 square ft. we used a 8 piezo sensor.

As piezo sensors power generating varies with different steps, we get

Minimum voltage = 1V per step

Maximum voltage = 10.5V per step

We took an average of 50Kg weight pressure from a single person.

Considering the steps of a 50Kg weighted single person, the average calculation is:

It takes 800 steps to increase the 1V charge in the battery. So, to increase 12V in battery total steps needed

$$= (8 \times 800)$$

$$= 6400 \text{ steps}$$

As we will implement our project in a populated area where footstep as source will available, we took an average of 2 steps in 1 second. For 6400 steps time needed

$$= 6400 / (60 \times 2)$$

$$= 53 \text{ minutes. (Approximately)}$$

9. CONCLUSION -

The project undertaken is effectively tried and actualized which is the best conservative, reasonable vitality answer for average citizens of our country. This can be utilized for some applications in rustic zones where control accessibility is less or thoroughly truant. As India is a creating nation where vitality administration is a major test for the gigantic populace. By utilizing this task we can drive both A.C. and besides, D.C loads as indicated by the power we connected on the piezoelectric sensor. This technique gives an effective power generation in very populated nations as it diminishes control request without contamination. As a reality, just 11% of sustainable power source adds to our essential vitality. On the off chance that this undertaking is sent at that point not just, we can conquer the vitality emergency issue yet, besides make a solid worldwide ecological change.

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