

Footstep Power Generation

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Abstract— Nowadays the utilization of power turns to be crucial for every work. This system proposes a unique way of generating electricity. This system does not depend on the climate conditions. It helps in the creation of power by utilizing piezoelectric sensors kept along the lobbies, which in turn charges the battery. This stored energy can be used to power a floor of a building or can be used to supply electricity when required. The footstep power generation method produces electric voltage by converting change in pressure of the individual's footstep on the floor to electrical energy. The benefits of electricity generation framework is that it's protected and secure to utilize. Footstep power generation technique has mechanical half and additionally electrical half. This framework additionally has the ability to charge the battery. The power produced by this technique can be used to solve many electricity issues of the country. This a renewable energy resource for the production of electricity.

Keywords: Piezoelectric, Energy Harvesting, Buck converter, Storage, Supercapacitor.

I. INTRODUCTION

Power is an important factor. Nowadays, the production of electricity is a matter of concern because of less non-renewable resources. Because of the increased production cost of electricity, numerous weaker sections of the public do not get electricity. Human can be the source of electricity. Walking is the most common activity in human life. When someone walks, he loses energy to the surface in the form of impact, vibration, sound etc, due to the transfer of his weight on to the surface, through foot falls on the bottom throughout each step. This energy are often tapped and born-again as the usable kind like electrical energy. This device, if embedded in lobbies or walkable surfaces, can convert foot impact energy into electrical form. And can then be stored for further use. This is a technique to produce electricity by utilizing piezoelectric plates, which can produce voltage from the pressure applied to it. Thus power can be generated effortlessly.

II. LITERATURE REVIEW

According to Patel Kamlesh's paper, it deals with generation of the power without polluting the environment. The objective of this work is to produce power through footsteps as a source of renewable energy. Electricity is the one of the basic necessity of life but due to lack of the non-renewable resources they have tried to implement using the rack and pinion arrangement and piezoelectric crystal. When the force is applied on the piezo sensor the mechanical energy is converted into electrical energy and with the use of rack and pinion, chain sprocket and flywheel. A voltage of 12V DC is generated. This voltage is stored in battery. The battery is connected to inverter. This inverter is used to convert the 12V DC to the 230 Volt AC.

In "Generation of Electrical Energy from Foot Step Using Rack and Pinion Mechanism" by Md. Azhar, Zitender Rajpurohit, Abdul Saif, Nalla Abhinay, P. Sai Chandu, the authors used regulated 5V power, 500mA power supply. Step down transformer and a bridge rectifier are used to convert AC to DC. A rack and pinion arrangement is used. A rack and pinion is a type of actuator with gears, which convert rotational motion into linear motion. The power from such sensors are renewable and pollution free. It is very useful where human movement is the highest.

III. EXPERIMENTAL SETUP

A. Piezoelectric Sensors

In the proposed system, Piezoelectric sensor is the main component. Piezoelectric sensors are used to measure changes in pressure, acceleration or force by converting it into electrical energy. It is made up of materials like PbTiO₃, PbZrO₃ and PZT. The amount of energy produced by the sensors depends on the type of effects acting on it, like transverse, longitudinal and shear. The Piezoelectric sensor works as shown in the below figure.

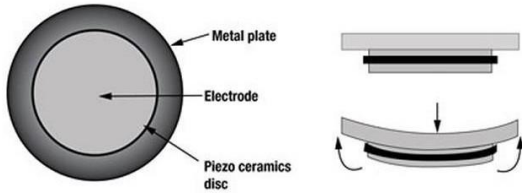


Figure - 1 : Piezoelectric Sensor

B. . LTC 3588

The LTC 3588 module integrates a low-loss full-wave bridge rectifier with a high efficiency buck converter to form a complete energy harvesting solution. It can be used to harvest energy while using piezoelectric sensors, solar panels etc. It basically reduces the voltage and gives out four output voltages - 1.8 V, 2.5V, 3.3V, 3.6 V. And it provides upto 100mA of continuous current

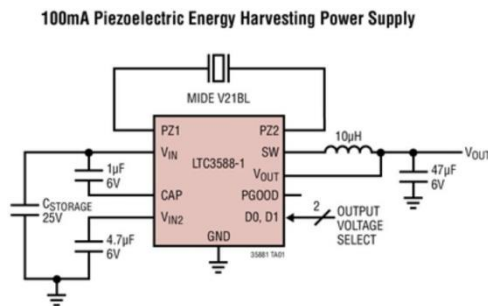


Figure - 2: LTC3588 Connection Diagram

C. Super capacitor

Super capacitors are high capacity capacitors that can store upto 10 to 100 times more charge than the electrolytic capacitors. The charging time for these capacitors are low

IV. THE SETUP

In the system, the foot interface is connected. The foot interface consists of wooden plank on both sides. The sensors are sandwiched between the planks, with the spring above and below the sensors. The sensors are connected in series-parallel fashion in order to obtain high current and high voltage. A total of 30 sensors are used in the proposed system. The output voltage of the sensor is AC. It is converted into DC by using Buck Converter LTC3588. Super capacitors and a Battery are used to store the electricity.

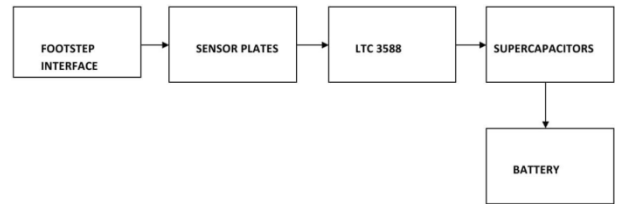


Figure - 3 : Block Diagram of proposed system

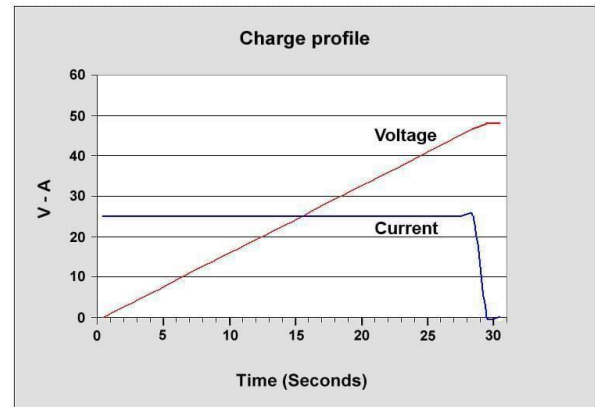


Figure - 4 : Supercapacitor charge cycle

V. WORKING

The piezoelectric sensors are installed inside the wooden board . When pressure is applied on the board because of the footsteps , the sensors are pressed due to the springs , producing energy. The sensors gives out AC voltage. This AC voltage is converted to DC voltage and is amplified to obtain high amount of current by using a buck converter called LTC3588 as the output from the sensor is low. The LTC3588 module consists of a bridge rectifier circuit, which rectifies the AC voltage. The module then boosts the current upto few mA by lowering the voltage. It also multiplies the frequency. This produced current is used to charge the super capacitors which are connected in parallel. The charging time of the super capacitors are less. After the super capacitors are charged, it discharges to the battery. And the battery can be used in future when needed.

VI. RESULTS

The result shows that more the pressure asserted on the sensors, more is the change in the pressure, hence more voltage is produced. The produced voltage at the end is enough to drive few dc loads. With rapid change in pressure, the energy produced will be more. The following table shows power generated for different weights

Sl.No	Weight(kg)	Power(W)
1.	10	0.010
2.	20	0.019
3.	30	0.550

Table - 1: Power Description

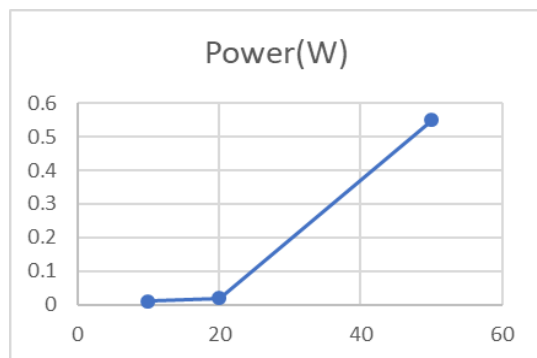


Figure - 5 : Weight vs Power relationship

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VII. CONCLUSION

This technique for generation of power is extremely prudent. This technique used here is inexpensive source of energy. It can be utilized as a part of Rural zones additionally where accessibility of power is less or exceptionally low. It can be utilized to drive both AC and in addition DC load. It can be installed on dance floors, temples, railway station where the movement of human being is more. More the pressure asserted on the floors, more is the energy production and faster the charging of the capacitor. In Developing nation like India we can utilize this strategy for power generation with a specific end goal to uncover the heaps from renewable and non-renewable wellspring of energy

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