International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 05 | May 2022 www.irjet.net p-ISSN: 2395-0072

Electricity Generation Tiles Using Piezoelectric Sensor

[1]Silvester Souza, [2]Soha Nadgouda, [3]Sammed Kallannavar, [4] Saihil Nandre,[5] Dr. Ashok M Hulagabali, [6] Dr. Rajendra M Galagali

[1,2,3,4] Student, Department of Mechanical Engineering, S.G. Balekundri Institute of Technology, Belagavi, Karnataka, India
[5] Associate Professor and Project Guide, Department of Mechanical Engineering S.G. Balekundri Institute of Technology, Belagavi, Karnataka, India,
[6] Professor & Head, Department of Mechanical Engineering S.G. Balekundri Institute of Technology, Belagavi, Karnataka, India

---

Abstract - *The consumption of electrical power is increasing rapidly at a very fast rate. We are in a situation where electricity production is not able to cover up the electricity consumption. This paper proposes a method to generate electricity by harvesting human power. Human power is defined as, use of human work for energy generation which can be used to power electronic device. In countries like India, which have a large pedestrian population human power like walking, running and jumping can be used as a power source . This paper presents a method for energy harvesting, from human motion with the use of piezo electric sensor and also exhibits the use of stored energy that is to charge mobile phone using RFID. The force exerted from walking, is converted into voltage by piezo electric sensor. This voltage built up can be used to power a storage battery.* The more people walk through these tiles, the more energy is stored in batteries and can be used to power lights, train stations, gyms and other public places. This is an environmentally friendly approach to energy productio n. The documentation provides simplified concepts and design details of the model.

Key Words: Electrical Power Generation, Piezoelectric Sensor, Energy Harvesting Technique, Environment Friendly.

1. INTRODUCTION

Energy demand in all countries is constantly increasing, and the production and import of electricity cannot meet consumption and export. We always go with wind energy or solar energy or tidal energy or other sources of energy the power production is still not sufficient. .So to cope with this situation we need to generate electricity by any ways necessary.

When people walk, they lose energy to the surface they are walking on, due to the transfer of weight on to the surface. The idea of this model is to capture this energy and convert it into a usable form. The energy generated during walking is concentrated on piezoelectric sensor, which converts this energy into electrical energy. This energy is stored and used in the battery.

The aim is to generate energy from foot step. This system provides a platform where footsteps can be placed. Whenever people walk or stand on the top plate it dips down slightly and their weight is converted to electrical power.

If we install such system in some of the busiest centers of our cities from train stations to airport, from offices,

2. SYSTEM CONFIGURATIOIN

- COMPONENTS

1 Diodes

2) Voltage regulator

3) Piezoelectric Sensor Tile

4) RFID module

5) Rectifier

6) Arduino

7) Resistors

8) Capacitors

1) Piezoelectric sensor tile

Piezoelectric materials are the central part of the piezoelectric sensor. These materials can produce electricity when mechanical stress is applied. The word piezoelectric means electricity generated by pressure. A device that makes use of piezoelectric effect is called a piezoelectric sensor. The piezo electric tile is a tile of dimension 30cm x 30cm. The number of piezoelectric sensors are installed on this tile are Eight. The sensors are connected in a series-parallel combination. Electricity is generated when the tile is subjected to compressive or tensile stress, developing a voltage gradient and a next current flow.

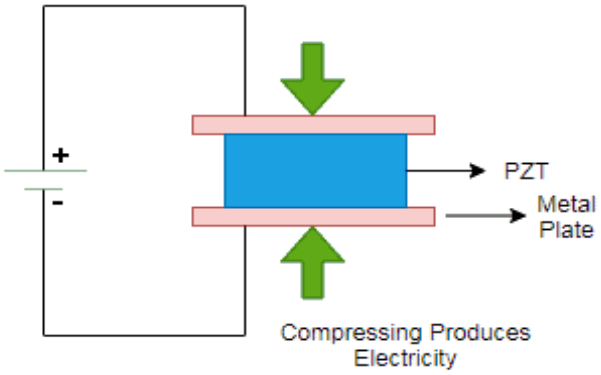

Figure 1: Piezoelectric sensor tile

2) Voltage Regulator

Voltage Regulator (LM 7805), employs internal current, restricting thermal close down and secure running area protection, making it essentially indestructible. It can provide output currents up to 1A.It has fixed output voltage of 5, 6, 8, 9, 10, 12, 15, 16, 18, 24 V. Therefore, it is useful in a variety of applications. Despite the fact that designed ordinarily as fixed voltage regulator, the device can also be used with external components to reap voltage and current.

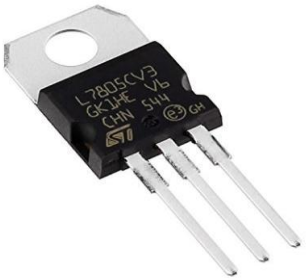

Figure 2: Voltage Regulator

3) Diode

A diode is two-terminal electronic issue which conducts electricity, primarily only in single direction. A diode has high resistance on one end and occasional resistance on the opposite end.

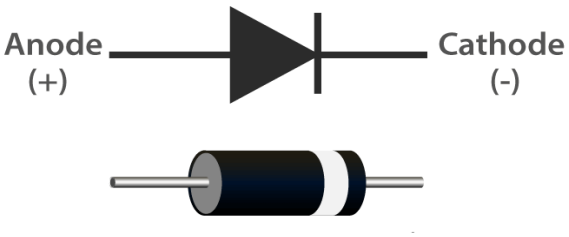

Figure 3: Diode

The arrowhead is the anode terminal which represents the path of the current flow. Another end terminal is cathode.

- **Light Emitting Diode (LED)**

"A light-emitting diode (LED) is a semiconductor light source. When a light-emitting diode is forward based, electrons are able to recombine with holes, within the device, releasing energy in the shape of photons". Colors are available based on wavelength range, voltage drop, and material. Red, green, yellow and blue LEDs are very common.[5]

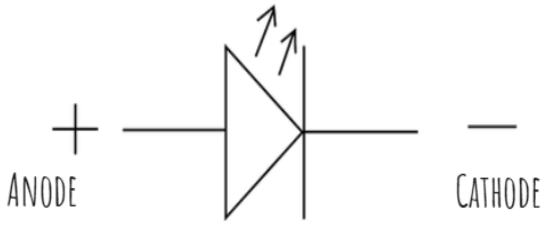

Figure 4: Light Emitting Diode (LED)

1N4007 Diode

It is a rectifier diode. It is specifically designed for circuits that need to convert alternating current to direct current how the diode is made by two dissimilar P and N semiconductors type, a junction is formed between the diodes. The identification number for this particular diode is 4007. It can pass current of up to 1A. The PIV rating is 1000 V.

Figure 5: 1N4007 Diode

4) RFID Module

Radio Frequency identification, or RFID, is an identification and logging technology. RFID system uses tiny chips, called as "tags", to transmit piece of information to an RFID reader. The tag contains a Transponder with digital memory chip with unique electronics code. RFID is a technology that communicates over radio waves to exchange signals with electronic tags and readers attached to objects for identification

and tracking purposes. We are using RFID for the authentication of the user and not compromising the accuracy and functioning of the system.

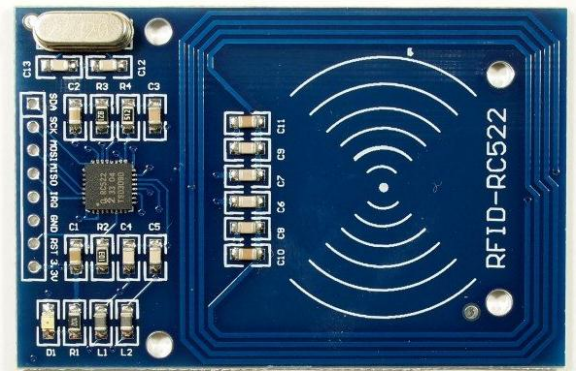

Figure 6: RFID Module

3. BLOCK DIAGRAM

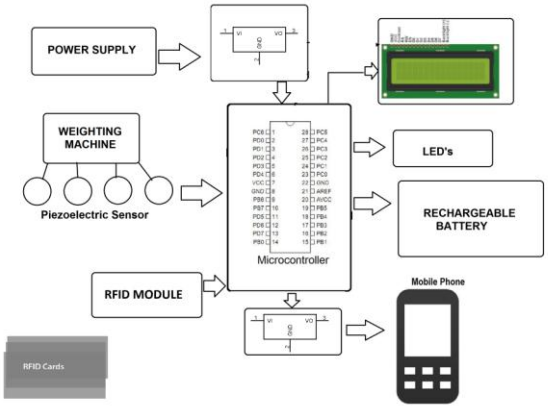

Figure 7: BLOCK DIAGRAM

4. WORKING

The piezoelectric tile in which piezoelectric sensors are installed. It displaces slightly every time a person walks over the platform,. It is designed in such a way that it dips down slightly when the weight is applied and returns back to its original state when the weight is removed. This platform channels the pressure developed by the human activity, like walking, running on it. The output given by the piezoelectric material is not steady. The charge developed by this sensor is always AC. A bridge circuit is used to convert this unsteady voltage to linear voltage. It is done to stabilize the charge and to convert AC into DC. Rechargeable batteries are used to store the output DC voltage. The battery can be utilized to charge mobile using RFID access.

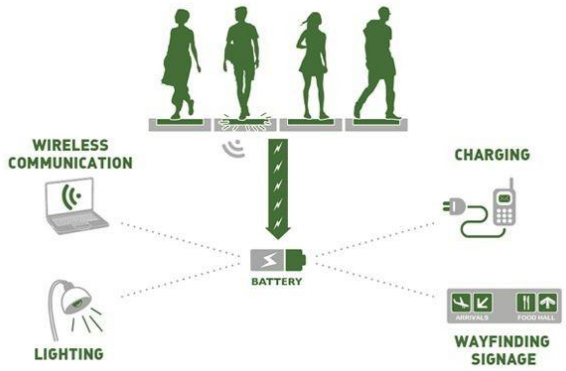

Figure 8: Working of Piezoelectric tile

The LCD display is calculated using an ATMEGA 328P microcontroller. When the system is turned on, a welcome message is displayed, which is read by the ADC on the microcontroller. Both the microcontroller and LCD are powered by 5V**.** user is required to register in the system. Once all the users are registered the system asks to swipe the card and connect the charger. Default charging time is set which can be later modified. The card can be recharged by using recharge button present in the system.

5. ANALYSIS DONE ON PIEZOELECTRIC TILE

The ability of the piezoelectric tiles to generate voltage was tested by having people weighing between 35 and 70 kg walk on them. Piezoelectric floors are best suited for areas with high floating populations. Pressure-assisted power generation technology using piezoelectric tiles is a new development. Companies in this sector are still looking for sponsors and investors. A graph of weight dependence on power generated per second is built. It can be seen that the maximum stress occurs when the maximum force/weight is applied. The relationship between a person's weight and output is shown in Figure 9

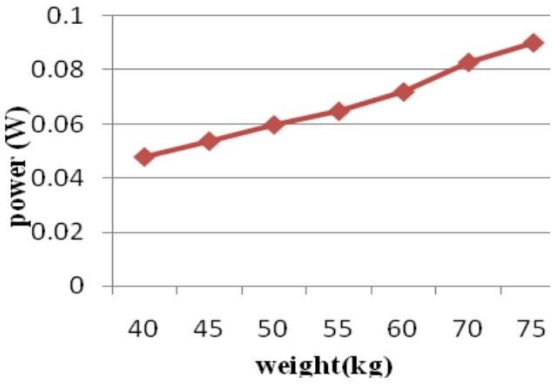

Figure 9: Weight V/s power graph of piezo tile

6. ADVANTAGES

1) Encourages use of environment friendly energy.
2) Easy to install simple installation
3) Easy to handle.

7. CONCLUSION

We have developed a system that can generate energy from stairs, and the energy generated can be used for basic applications such as charging mobile devices. Comparing the different types of piezoelectric materials, PZT has been shown to outperform them. We also compared the different types and found that the series-parallel coupled connection is more suitable. As a result of studying the weight applied to the piezoelectric tile and the corresponding generated voltage, it can be seen that there is a linear relationship. It can be used for street lights without using long power lines. It can also be used as a charging port and can provide lighting for buildings overlooking the sidewalk.

ACKNOWLEDGEMENT

We are highly thankful to **Dr. B .R. Patagundi, Principal, SGBIT, Belagavi** for providing the opportunity for building and demonstration of the project.

We would like to express deep sense of thanks and gratitude to **Dr. Rajendra M Galagali, HOD, Department of Mechanical Engineering, SGBIT, Belagavi** for providing necessary technical suggestion during project.

We are grateful to **Dr. Ashok M Hulagabali, Associate Professor and Project guide, SGBIT, Belagavi** for his continuous valuable guidance and support.

We are thankful to **Prof.Vishwanath Kadakbhavi**, **Assistant Professor, SGBIT, Belagavi** for encouraging us in conduction and generous support during the conduction of the project

Finally, we are thankful to the staff of **Department of Mechanical Engineering, SGBIT, Belagavi** for their support.

REFERENCES

[1] Roundy, S., P.K. Wright and J. Rabaey, A study of low-level vibration as a power source for wireless sensor nodes.

[2] Vibration Based Energy Harvesting Using Piezoelectric Material, M.N.Fakhzan, Asan G.A. Muthalif, Department of Mechatronics Engineering, International Islamic University Malaysia, IIUM,Kuala Lumpur, Malaysia.

[3] G. K. Ottoman"Adaptive piezoelectric energy harvesting circuit for wireless remote power supply"

[4] P.D. Mitcheson, E.M Yeatman, G.K. Rao, A.S Holmes and T.C. Green "Human and machine motion for wireless electronic devices"

[5] Marshiana. D, Elizabeth Sherine. M, Sunitha. N, , "Footstep Power production using Piezoelectric Sensors"

[6] Henry A. Sodano, Daniel J. Inman, Gyuhae Park. **"**Estimation of Electric Charge Output for Piezoelectric Energy Harvesting"

[7] Energy generation in public buildings using piezoelectric flooring tiles; A case study of a metro station Rania Rushdy Moussa, Madonna Makram Solban Architectural department, The British University in Egypt (BUE), El- Sherouk City, Egypt.

[8] Lukai Guo, Qing Lu " Potentials of piezoelectric and thermoelectric technologies for harvesting energy from pavements "

[9] T. G. Engel, C. Keawboonchuay, and W. C. Nunnally, "Energy conversion and high-power pulse production using miniature piezoelectric compressors".

[10] M. Ferrari V. Ferrari, D. Marioli and A. Taroni "Modeling, fabrication and performance measurements of a piezo electric energy convertor for power harvesting in autonomous micro system"

[11] C. Keawboonchua "Factors Affecting Maximum Power Generation in Piezoelectric Pulse Generator "

[12] Mervyn Fernandes, "Implementation of Piezoelectric Sensors for Generation of Power",