Generation of Electricity by Using Multiple Resources

Kamble Prajka R.¹, Phule Pallavi G.² & Kokate Komal L.³
B.E. (Electrical), Asst Prof Daphale D¹, Asst Prof Sunanda D³ Asst Prof Jadhav R⁶
S.M.S.M.P.I.T.R.Shankarnagar, Akluj .Solapur University, Maharashtra, India.

Abstract: The demand of electricity in our day to day life is continuously goes on increase but the most terrible fact is that the rate of production continuously goes on decrease. To meet the energy demand, renewable energy and some unconventional sources of energy can provide the necessary amount of clean energy for climate stabilization and reduce the consumption of fossil fuels. The maximum power output can be obtained by using solar panels. Piezoelectric technique utilizes piezoelectric components where deformation produced by different means can be directly converted into the electric charge via piezoelectric effect. Rotating Door can generate the energy by amplifying the initial RPM of door shaft. Peltier plate generates the electrical energy by using the thermoelectric effect; in which the direct conversion of temperature differences to electric voltage and vice versa.

1. Introduction:
Renewable energy is rapidly gaining importance as energy resources as fossil fuel prices fluctuate. Solar energy is the most abundant stream of energy. Sun sends out energy in the form of electromagnetic radiation. Its potential is 178 Billion MW, which is about 20,000 times the world’s demand. Solar energy is free, practically inexhaustible and involves no polluting residues or green gases emissions. Solar panels are the medium to convert solar energy into the electrical energy. Solar panels can convert the energy directly or heat the water with the induced energy.

The vibrations are converted into electricity via piezoelectric element. The electricity produced is thereafter formatted by a static converter before supplying a storage system or the load (electrical device). Piezoelectric generators work due to the piezoelectric effect. This is the ability of certain materials to create electrical potential when responding to mechanical changes. To put it more simply, when compressed or expanded or otherwise changing shape piezoelectric material will output some voltage. The overall conversion of charges to electric energy is takes place with help of piezoelectric transducer. The piezoelectric transducers are a type of electroacoustic transducer that converts the electric charges produced by some forms of solid materials into energy. The word piezoelectric means the electricity caused by pressure.

The revolving door can be used as new energy sources of energy. That not only saves energy, the door uses a generator that harvests the kinetic energy when the door spins and a super capacitor to store the energy. The generator controls the rotating speed of the door for safety. The ceiling of the revolving door is made of safety glass and gives a clear view of the technology. A set of super capacitors stores the generated energy and provides a consistent supply for the low energy LED lights in the ceiling. When the lights use the stored energy from the door the main energy supply takes over. The objectives of this project are to construct of a revolving door model and to develop a mechanism to increase the speed of the shaft connected to DC motor; Moreover, to store and find out the energy generation per revolution.

A peltier element is a simple tool that has no moving parts and can be used to heat or cool or generate electricity. They are a solid state device which means they will last a very long time. They are flexible in that they can be used to do things such as but not limited too, charging batteries, running small electrical devices such as LED’s as well as heating and cooling. The peltier effect occurs whenever electrical current flows through two dissimilar conductors. The flow of electricity causes one side to get hot and the other to get cold. The degree of heating or cooling that we get is determined in large part by the type of metal that is used. Bismuth Telluride is a very commonly used peltier element metal.

2. Literature Survey:
[1] C. Hemalatha, A. Archana.al[1] In this paper the implementation of solar panels in indoor application with the consideration of effective utilization of the waste energy from lighting sources in household areas are taken in to account. This paper deals with the electricity generation using solar power.
[2] U. K. and R. H. Middleton.al [2] This paper presents a model of a piezoelectric transducer, a mechanical vibration spectrum, the simulation of the
model, prototype of the power scavenging circuit, experimental results and its future perspectives.

[3] Raju Ahamed, M. M. Rashid. The objectives of this paper is to design and fabricated of a prototype revolving door which can generate energy by amplifying the initial RPM of door shaft. In this paper, prospect and feasibility of power generation by using revolving door has been investigated.

[4] Ajitkumar N. Nikam, Dr. Jitendra A. Hole. The research and development work carried out by different researchers on development of novel thermoelectric R&AC system has been thoroughly reviewed in this paper.

3. Existing system:

In present situation, the generation of electricity by using separate resources as solar panels, piezoelectric transducers, revolving door and peltier plates are possible. But still the need cannot be fulfilled. So by using our research i.e. by combining those sources the generation capacity can be increased which helps to fulfill the need of energy.

4. Proposed System:

4.1 Solar Panels:

Solar panel refers to panel designed to absorb sun’s rays as a source of energy for generating electricity or heating.

Figure 1. Block Diagram for Generation of Electricity by Using Multiple Resources

Figure 2. Solar Panels

Solar panels consist of photovoltaic cells that generate electricity in residential and commercial application. Solar modules use light energy (photons) from sun to generate electricity through photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. Each solar cell is divided in individual photovoltaic segments, or “sub-cells” that are electrically connected in series by laser etching and lift-off masking technology. Cells must also be protected from mechanical damage and moisture.

When the light hits and electron in first layer, the electrons jumps to second layer. That electron makes another electron move, which makes another electron move, and so on. It was the sun light that started the flow of electrons or electricity. One solar panel is made up of many small solar cells. Each of these cells uses light to make electrons move. The cell is made up of two different layers that are stuck to together. The first layer is loaded with electrons, so that electrons are ready to jump from this layer to the second layer. That second layer has had some electrons taken away, so it is ready to take in more electrons. Light striking a silicon semiconductor causes electrons to flow, creating electricity. Solar panels (also called “solar modules”) produce direct current (DC), which goes through a power inverter to become alternating current (AC) electricity that we can use in the home or office, like that supplied by a utility power company. Most solar modules are rigid, but semi-flexible ones are available, based on thin-film cells.

4.2 Piezoelectric Transducers:
Piezoelectric transducers are a type of electroacoustic transducer that converts the electrical charges produced by some forms of solid materials into energy. The word “piezoelectric” literally means electricity caused by pressure. Piezoelectric is the ability of certain materials to generate electric charges in response to applied mechanical stress. One of the unique characteristics of piezoelectric effect is that it is reversible, meaning that material exhibiting the direct piezoelectric effect (the generation of electricity when stress is applied) also exhibit the converse piezoelectric (generation of stress when an electric field is applied).

When piezoelectric material is placed under mechanical stress, a shifting of positive and negative charge centers in the material take place, which then results in an external electric field. When reversed, an outer electrical field either stretches or compresses the piezoelectric material. The piezoelectric effect is a special material property that exists in many single crystalline materials. Examples of such crystalline structures are Quartz, Rochelle salt, Topaz, Tourmaline, Cane sugar, Berlinite (AlPO4), Bone, Tendon, Silk, Enamel, Dentin, Barium Titanate (BaTiO3), Lead Titanate (PbTiO3), Potassium Niobate (KNbO3), Lithium Niobate (LiNbO3) etc.

There are two types of piezoelectric effect:
1. Direct piezoelectric effect and
2. Inverse piezoelectric effect

The direct piezoelectric effect is derived from materials generating electric potential when mechanical stress is applied whereas the inverse piezoelectric effect implies materials deformation when an electric field is applied.

4.3 Revolving Doors:

The revolving door energy generator is the innovation that combines three major components: people, technology, and architecture. This revolving door generator combines the architecture of a revolving door with the technology of an electric generator to capture the unused energy created when people enter and leave a building. This idea, introduced by Flux lab, is similar to the idea of a hydroelectric dam or a wind turbine. The door is equipped with a special generator, gears, and battery. First, when a person passes through the door, the gear that connects to the core of the door will turn the smaller gear that connects to the power generator. This power generator consists of a special DC magnetic motor. This gear system uses a technique called piezoelectricity, which converts the kinetic energy into electric energy. The gear system is limited by the speed of the power generator, which is set at 450 rpm in order to ensure the safety of users. With this speed, the revolving door is able to generate a power of 3-4.5 volts with 200mA to be collected in the battery. The estimated calculation shows that this revolving door can power a 10W light bulb for 100 hours if the door runs continuously for one day. Thus, the revolving door can potentially save approximately $1.52 per day in electricity costs. Another factor that affects the amount of energy that can be generated is the weight of the revolving door. With a heavier revolving door, more power is generated through the generator because more kinetic energy is required to operate the door. However, a heavier revolving door might deter people from using it.
4.4 Peltier Plate:

Figure 7. Peltier Plate

Figure 8. Working of Peltier Plate

Peltier plate allows turning heat into electricity. It works on peltier effect. In this effect direct conversion of temperature differences to electric voltage and vice versa. The peltier effect is the presence of heating or cooling at an electrified junction of two different conductors and is named after French physicist Jean Charles Athanase Peltier, who discovered it in 1834. Peltier found that the application of a current at an interface between two dissimilar materials results in the absorption/release of heat. At the subatomic level, this is a result of the different energy levels of materials, particularly n and p-type materials. As electrons move from p-type material to n-type material, electrons jump to a higher energy state absorbing energy, in this case heat, from the surrounding area. The reverse is also true. As electrons move from n-type material to p-type material, electrons fall to a lower energy state releasing energy to the surrounding area.

Two unique semiconductors, one n-type and another p-type, are used because of need to have different electron densities. The semiconductors are thermally placed in parallel to each other and electrically in series and then joined with a thermally conducting plate on each side. When a voltage is applied to the free ends of the two semiconductors there is a flow of DC current across the junction of the semiconductors causing a temperature difference.

Acknowledgements

We would like to express our regards to Prof. Daphale D. D. for guiding us thorough the entire B.E. final year project. We would also like to thank Prof. Sunanda Dodamani (Head of Department), and for giving his valuable time to guide through the project. This work was supported in part by, Prof. Jadhav R.S.

References:


[6] Syed Faizan-ul-Haq Gilani1, Syed Ihtsham-ul-Haq Gilani2, Zuhairi Baharudin1 and Rosdiazli Ibrahim1 “Development of Energy Harvesting System Using Rotation Mechanism of a Revolving Door” 1Electrical and Electronic Engineering Department, Universiti Teknologi Petronas, Bandar Seri Iskandar, Tronoh, Malaysia Mechanical Engineering Department, Universiti Teknologi Petronas, Bandar Seri Iskandar, Tronoh, Malaysia