



International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Special Issue 7, October 2015

Tricharger using Microcontroller

Vishal Verma¹, Shalu Agarwal², Latha A.P³

Department of Information Science and Engineering, Dayananda Sagar College of Engineering, Bengaluru, Karnataka, India^{1,2,3}

Assistant Professor, Department of Information Science and Engineering, Dayananda Sagar College of Engineering, Bengaluru, Karnataka, India³

ABSTRACT: Generating electrical voltage for charging any electronic gadget from the combination of piezo sensor, solar panel and motor which is connected to microcontroller-Arduino, which acts as a brain of the device which controls the flow of current and regulates it for the lithium ion battery. The lithium ion battery takes 2-3 hours to charge and once it's full, it can recharge device completely for two times. Since all the components use in implementing this device are light weight, portable and can be used anywhere under any circumstances and climate. This device is especially advantageous for handicapped people who can use simply by pressing the piezo sensor.

KEYWORDS: Piezoelectric sensor, DC motor, solar panel, portable electric power.

I. INTRODUCTION

With the introduction of many hand-held portable electronic gadgets, energy harvesting has become one of the fascinating subjects of interest to provide electrical power. The commonly used sources are: solar power, wind energy, mechanical energy and piezoelectricity. This study is focused on piezoelectricity, solar energy and mechanical energy.

A **solar cell**, or **photovoltaic cell**, that is an electrical device which uses light energy and converts it directly into electric charge by the photovoltaic effect, which is a consolidation of both chemical and physical phenomenon. It is a structure of photoelectric cell, whose electrical tendency, such as voltage, current, or resistance; differ when exposed to light energy. Solar cells are the ingredient of photovoltaic modules, otherwise known as solar panel.

Solar cells are described as being photovoltaic regardless of whether the source is an artificial light or sun. They are used as a light detector, measuring light intensity or other electromagnetic radiation near the visible range, or detecting light.

The working of a photovoltaic cell requires:

- The absorption of light, which generates electron.
- The disjunction of charge carriers of opposite polarity.
- The extracted carriers of those are than used to produce charge.

Some illustrations of cell phones have built in solar chargers which are commercially available for Global System of Mobiles.

Solar cell chargers use solar cells to charge the devices. They are an alternative to conventional electronic chargers and in some cases can be plugged into an electrical outlet.

Piezoelectric Energy Harvesting: It is defined as using the Piezo effect for energy supply to generate power from the environment.

The term "energy harvesting" refers to the generation of energy from various physical sources such as ambient temperature, vibration or air flow. Conversion of energy available from the environment allows a self-sufficient energy

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Special Issue 7, October 2015

supply for small electric devices such as sensors or radio transmitters. Kinetic energy can be converted into electrical energy by **piezoelectric effect**. Piezo elements convert the kinetic energy into electrical energy using mechanical energy. Taking the advantage of suitable electronics, this effect can be used for creating a **self-sufficient energy supply system**. Mechanical deformation of a piezo crystal due to strain or pressure which will generate electrical charges that can be measured as voltage on the electrodes of the piezo element.

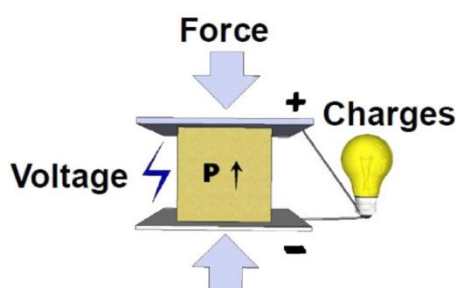


Fig. 1: Piezo Working Application

Piezoelectricity is the charge that compile in assured solid materials in return to applied mechanical pressure. The word piezoelectricity means electricity produce by pressure. The piezoelectric effect can be defined as linear electromechanical interaction between the mechanical and the electrical nature state in a crystalline material Fig. 1. The piezoelectric effect is a process that is reversible, illustrate the explicit piezoelectric effect (the internal generation of electrical charge resulting from an applied mechanical stress). It also exhibits the reverse piezoelectric effect. Piezoelectricity is found useful in applications such as the production and detection of sound, generation of high voltages, electronic frequency generation, to drive an ultrasonic module, and ultrafine focusing of optical assemblies.

Piezoelectric sensor

It is a device that uses the piezoelectric impact, to measure changes in force, strain, acceleration, pressure, or force by converting them to an electrical charge. Piezoelectric sensors are versatile tools for the measurement of various processes. They are used in controlling processes, assuring the quality and for research and development in many industries. In the 1950s manufacturers began to use the piezoelectric effect in industrial sensing applications. Since then, this measuring principle has been used increasingly, and has become a widespread technology with excellent inherent reliability. The spark/glow plug is equipped with a built-in miniature piezoelectric sensor or the sensors are directly mounted into additional holes into the cylinder head. In spite of piezoelectric sensors being electromechanical systems that react to compression, the sensing elements show almost zero deflection. Piezoelectric sensors have an extremely high natural frequency and an excellent linearity over a wide range of amplitude. In addition, piezoelectric technology does not respond to electromagnetic radiations and fields, enabling measurements under harsh conditions.

Piezoelectric generators work due to the piezoelectric effect. When compressed, expanded or otherwise deformed, a piezoelectric material will output some voltage. This effect is also possible in reverse, in the sense that putting a charge through the material will result in mechanical stress or deformation. Piezoelectric materials are useful in many applications. Certain type of piezoelectric materials can handle high voltage extremely well and are useful in transformers and other electrical components. These are also used to make motors and reduce vibration in sensitive environment. The electric charges produced by piezo crystals are low. Piezo crystals are so small that they can be embedded in everyday apparel like shoe. Over time, small charges build up until the amount becomes significant.

DC motor

It is an electrical machine that converts direct current to electrical power into mechanical power. Almost all categories of DC motors have some internal mechanism which systematically change the direction of current flow. A DC motor's speed can be controlled over a large range, either by altering the strength of current within its field windings or by



International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Special Issue 7, October 2015

using a variable supply voltage. Small DC motors that are used in tools, toys, and appliances. Whereas the Larger DC motors are used in propulsion of electric vehicles and so on. Due to the limitations of DC motors, it has been replaced by AC motors in many applications. We can reverse the function of DC Motor that can act like a generator to produce electricity using the mechanical rotation of the motor. It can be used to charge or switch on any device.

Arduino

It is an open source based prototype platform, easy-to-use hardware and software. This board can read any form of input from any emitting sensor and generate its value either in numeric form or in the form of a graph. Since the code source is easily available and the programming software (which is Arduino Uno) is easily accessible for any version of operating system. This board acts as 'the brain' of the device to control the power supply, for voltage regulation and so on. The board has numerous pins which can be used to connect multiple devices to it simultaneously.

Lithium-ion Battery

Lithium-ion Battery is a rechargeable battery, lithium compounds are present, which are capable of accepting and releasing lithium ions. It consists of a positive and a negative electrode and an electrolyte. Generally, the negative electrode of a conventional lithium-ion cell is made from carbon. The positive electrode that act as metal oxide, and the electrolyte which is lithium salt in an organic solvent. This battery is used in mobiles or any other device that we use in our day to day life.

II. RELATED WORK

Lithium-ion Battery[1] The power output characteristic for long-duration discharges is a key factor in designing lithium-ion batteries for use on environmental vehicles such as electric vehicles and series hybrid electric vehicles. The major parameters impacts the long span power output characteristic are the electrode thickness, lithium-ion diffusion in the active materials and lithium-ion diffusion in the electrolyte.

Piezoelectric [2] the process of acquiring the energy surrounding a system and converting it into usable electrical energy is termed power harvesting. In the last few years, there has been a growth of research in the field of power harvesting. This boost in research has brought modern advances mainly in wireless technology and low-power electronics such as micro electromechanical systems.

Solar panel [3] Thin-film flexible photovoltaic's are paving the way for a low cost electricity. Organic, inorganic and organic-inorganic solar cells get deposit over flexible substrates by high technologies to afford lightweight, economic solar modules that can be combined into, various surfaces. under standard conditions Current the conversion efficiencies are in the 3-15% range, but in real applications the overall productivity is high.

DC Motor Charger [4] Charging mobile batteries of different manufacturers using wind power, human power and electrical power has been designed for travellers, rural and remote areas where the current supply is not available all the time.

Arduino [5] Charging Lithium-ion battery with different option used with Arduino to make it a portable device. One or more battery is charged using these devices with a display and regulation. When one cell gets below the Under Voltage sense then consider it a failed cell. But putting it on a 5ma source for about a minute will Charger the cell for any other devices.

III. RESEARCH AND DEVELOPMENT

Mechanical charger: In Fig 2. The mobile charger which uses and handle which is attached to the motor which when is rotated converts the mechanical energy produced to electrical energy which is stored in a battery or can be used directly to charge a device. [6] A **mechanically powered emergency flashlight** that is powered by electric charge generated by the muscle power of the user, so it replacement of batteries are not needed.

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Special Issue 7, October 2015



Fig. 2 Mechanical charger

Piezo sensor charger [7] this device is available for generating the value of pressure in different fields such as medical, aerospace, nuclear instrumentation.

Solar Mobile Charger [8] Solar cell a charger that uses solar panels for charging cell phone batteries. They are an alternative to conventional electrical cell phone chargers and in some cases can be plugged into an electrical outlet.

IV. PROPOSED IDEA AND DESIGN

By adding all this components shown in fig 3, which are available easily that is piezo sensor that can use a pressure, DC motor that uses the mechanical energy, and solar panel through Arduino board and a lithium-ion battery connected to it. The Arduino will act as a brain to control the voltage flow and in regulation of the device, in any condition this device can use as a charger.

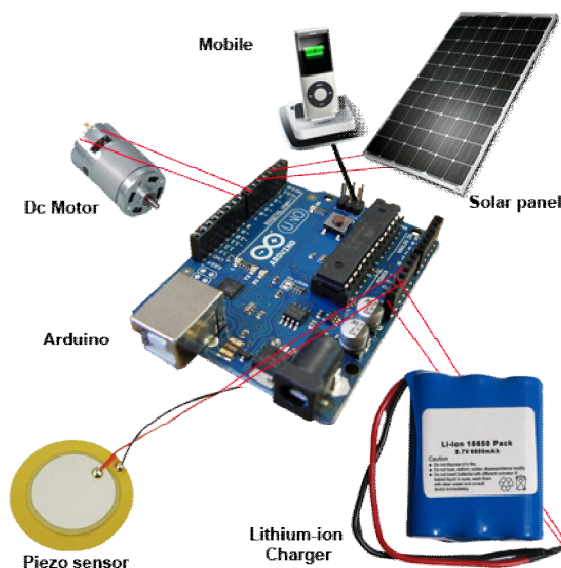


Fig. 3 Tricharger using microcontroller

1. Advantage of this model:

- It can be used with renewable a source that is solar.
- It can be charged by using a finger pressure using piezo sensor.
- It can charge using a small rod to rotate and produce charge
- Lithium ion battery which can store enough power to charge the device multiple times



International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Special Issue 7, October 2015

- Arduino which will control and indicated the level and flow of current
 - The handicapped people can use the device easily.
- 2. Disadvantage of the model:**
- The Case has to be well designed to keep the components in proper place.

V. CONCLUSION

Since we cannot always rely only upon renewable resources such as solar energy, or cannot expect the electricity to be available all the time in case of emergency condition such as earth quake, Tsunami, and so on. The components which are used to make this device such as motor, piezo sensor and solar panel are easily available and combining them in one, can give a powerful charger which can be used as a back up to charge any devices of day to day life. Arduino which we are using for regulation and safety purpose to give the user the indication of the voltage and can increase the life of the battery. This device is handy and can be used by any handicap people too.

REFERENCES

- [1] Takaaki Abe, Kazuki Miyatake, Yoshio Shimoida and Hideaki Horie, "Article Title Research and Development Work on Lithium-ion Batteries for Enviromental Vehicles", Japan, Stavanger, Norway, May 13-16, 2009.
- [2] Henry A. Sodano, Daniel J. Inman and Gyuhae Park, "A Review of Power Harvesting from Vibration using Piezoelectric Materials", May 12, 2004.
- [3] Bialasiewicz, J.T., ,Dept. of Electr. Eng., Univ. of Colorado, Denver, "Renewable Energy Systems with Photovoltaic Power Generators: Operation and Modeling", Industrial Electronics, IEEE Transactions on (Volume:55, Issue: 7), July 2008.
- [4] N Raghu Ram Reddy al. Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, Vol. 3, Issue 6, Nov-Dec 2013, pp.1705-1708
- [5] Adam Dally, "Arduino Runing On && Charging NiMH batteries" , May 18 2013
- [6] "Tiny Dynamo Operates New Batteryless Flashlight". Popular Science (New York: Popular Science Publishing Co.) 114 (2): 74. February 1929. Retrieved 2012-01-30.
- [7] Ludlow, Chris (May 2008). "Energy Harvesting with Piezoelectric Sensors", Mide Technology. Retrieved May 21, 2008.
- [8] "Charge Controllers for Stand-Alone Systems", part of A Consumer's Guide to Energy Efficiency and Renewable Energy, U.S. Department of Energy. Retrieved on 2007-08-20.