Use of Piezoelectric to Power the Remote Controls

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ABSTRACT: Remote controls are used to control the functions of the appliance for which it being designed. To operate the remote control there must be some energy source which can either a battery or a cell. The lifetime of the battery or the cell is limited and after that they must be replaced with the new one which sometimes may not be possible and it is sometimes seems to be irritating if such thing happens while watching some entertainment shows. So there must be some self-charging source to charge the cell and the battery. In this research paper such technique has been proposed to charge the cell of the remote control of the home appliances with the use of the piezoelectric in the buttons of the remote control. The electrical energy generating with the pressing and de-pressing of the piezoelectric will keep on charging the cell of the remote control. This will save the cost of the replacing the cell and the remote controls will be maintenance free.

KEYWORDS: Battery, Cell, Electrical energy, Home appliances, Piezoelectric, Remote control.

INTRODUCTION

Using the remote controls to operate the devices is very easy to use and luxurious in nature but to operate these controls there is need of some energy source in the form of cell which gets discharged after some time and needs to be changed to keep the control working otherwise the control would not work in the absence of energy source operating the control [1]. So either the cell be changed in time or there must be some energy generating source which can keep the cell charging so that there is no need to change the cell. One more option is that the direct use of the energy generated from the generating source but the energy generated must be sufficient to power the control all the time so that there is no need for the storage of the energy and then using it or it can be said to be a direct usage of the energy and the firstly storing the energy generated and then using that energy is called the passive usage. Energy generating source must be like pressure based transducer means which can generate the energy on being pressurized like pressing the source for the button purpose and then automatically generating the energy for the cell [2]. Piezoelectric is best transducer because on being pressurized it generates the electrical energy.

Piezoelectric:

Piezo is used to define materials which accumulate the charge due to the piezoelectric effect. Piezo materials, including crystals and ceramics generate a voltage due to the application of the mechanical stress. But in the case of inverse effect, when the same materials are applied voltage their shape gets changed either by lengthening or by shortening in response to the applied voltage. The voltage, force and the movements produced by the piezo materials are small and usually require enlargement [3]. For example, by merely changing the thickness of the piezoelectric, these materials can be used in many far reaching applications. These are usually preferred in many applications due to their ability to get tailored to fulfil the specific requirements. Currently, PZT materials are the most abundantly used materials because they offer greater sensitivity and higher operating temperatures than the other ceramics.

The term “piezoelectricity” has been derived from two words which means from press and amber means a source of electricity or it can be said that it refers to the generation of the electricity with the application of latent heat and pressure [4]. Thus whenever a mechanical stress is applied, an electric charge can build up in the solid material, including ceramics, crystals and some biological materials like DNA, bone and certain proteins. Thus the resulting effect is that the type of electricity produced due to the pressure or the heat otherwise known as the piezoelectricity. In 1880, Pierre brothers discovered an uncommon behaviour of some crystalline minerals, when they were subjected to the mechanical force, the materials become electrically polarized.

Tension and compression generated voltages of opposite polarity in proportion of the applied force. The form of the applied energy can be knocking, squeezing, tapping or may be some other type which pressurizes the material but don't make it to fail. So, the force should be applied with utmost car.

Applications: It can be used for a range of applications like inkjet printing and the detection and production of sound. For example, it can be used in the smart phones to transform the energy of a person's voice into the electrical signals that are received by other phone and transformed into interpretable sounds. It's also used for the generation of electronic frequency, high voltage generation, driving ultrasonic nozzles, microbalances and the ultrafine concentrating of optical assemblies [5]. As this technology can be used for many applications, it's widely used across all the industries and sectors. In addition to the smart phones and the devices, it also provides keyless entry devices, airbag sensors, audible alarms such as smoke alarms fish and patient monitors and depth finders. The inverse piezo effect is used in the actuation applications, such as in motors, devices that precisely control positioning and in generating the sonic and the ultrasonic signals. In the 20th century metal oxide-based piezoelectric ceramics and other man-made materials enabled designers to employ the piezoelectric effect and the inverse piezo effect in many of the new applications. The piezoelectric materials generally are tough, chemically inactive and are also relatively inexpensive to manufacture. Ceramics manufactured from the formulations of lead zirconate / lead titanate have more sensitive and have high operating temperature, relative to the ceramics of other compositions, and "PZT" materials are very widely used piezoelectric ceramics.

- *What can piezoelectric ceramics do?*

Mechanical compression or tension on a poled piezoelectric ceramic element changes the dipole moment, creating a voltage. Compression along the direction of polarization, or tension in a direction perpendicular to the direction of polarization, generates the voltage of same polarity as the poling voltage [6]. Tension along the direction of polarization, or compression perpendicular to the direction of the polarization, generates a voltage signal having polarity opposite to that of the poling voltage. These actions are generator actions -- the ceramic element converts the mechanical energy of compression or tension into electrical energy. This behaviour is used in force-sensing devices, fuel-igniting devices, solid state batteries. Values for the compressive stresses and the voltage generated by applying stress to the piezoelectric ceramic element are linearly proportional to a material-specific stress. It also holds true for applied voltage and generated strain. If a voltage of the same polarity as the poling voltage is applied to a ceramic element, in the direction of the poling voltage, the element will lengthen and its diameter will become smaller. If a voltage of polarity opposite to that of the poling voltage is applied, the element will become shorter and broader [7]. If an alternating voltage is applied, the element will lengthen or shorten cyclically, at the frequency of the applied voltage. This is motor action -- electrical energy is converted into mechanical energy. The principle is adapted to sound or ultrasound generating devices, piezoelectric motors

BACKGROUND DETAILS

Stephen R. Platt, Shane Farritor, Kevin Garvin, and Hani Haider in their research paper proposed the use of piezoelectric in the orthopedic implants to generate the electrical energy[8]. This electrical generated can help the orthopedic in a lot of ways like sensing the abnormal asymmetric forces, early loosening of the implants, in the sensing of the implant duty, and the prior detection of the wear. This early detection will help the patient to minimize any future harm which he/she may be unaware of. This technique of generating electrical energy can be used to power the embedded sensors and the microprocessors. Further not limiting to the sensors and the microprocessors embedded in the implants this energy can also make its way to other biomedical devices. A Daniels, M Zhu and A Tiwari in their research paper proposed a new type of piezoelectric energy harvesting device known as the piezoelectric flex transducer(PFT) [9]. Finite Element Model was developed for the designing and analyzing the PFT which consists of a piezoelectric element sandwiched between substrate layers and the metal endcaps that are able to enlarge the axial force applied on the piezoelectric element. Based on the concept of the Cymbal transducer this PFT can bear higher forces. Upon application of force of 760 N and moving with a speed of 3.1 mph, the PFT produced maximum power of 2.5mW. Such a piezoelectric can be useful in the present research paper to power a remote control either in the active mode or in the passive mode so that the usage of temporary energy source can be eliminated.

METHODOLOGY

The research study of this research paper is based on the use of the piezoelectric material for the button used in the remote controls of the home appliances for their operation. It is because pressing and depressing a pressure transducer produces the electrical energy in the transducer which can be used to charge the battery or the cell used for powering the remote control to operate it. Various shapes of piezoelectric are available which can be used in different applications but for the remote control the cylindrical and disc shape will be suitable. Cylindrical shape will form the vertical portion of the button and the bottom portion of the button will be of the disc shape. Thus for each pressing of button both the piezoelectric will be pressed simultaneously and the emf generated will be used for the charging of the cell of the remote control. The emf induced for the different shapes can be calculated. The flow diagram for the process of the generation of the electrical energy, storage and usage of the electrical energy can be checked. The calculations for the piezoelectric will vary depending upon the shape and size of the button used in the remote control and the value of the generation of the voltage will depend on the number of buttons in the remote control.

RESULTS & DISCUSSION

The small amount of electrical energy will keep on charging the cell. The energy used for the operation is also small in amount. This will eliminate the need for the changing of the cell after sometime. Thus it will save the cost of changing the cell which costs around Rs.50. A comparison for the cost saving can be done. Use of piezoelectric as the button material does not make any effect on the operation of the button. The button keeps on working as it was working with the normal material in use today's remote controls. The advantage of using the piezoelectric material save the cost of changing the cell of the remote control and also making the remote control maintenance free.

CONCLUSION

Using the piezoelectric material in place of the normal material for the button has economic significance which can be seen as the minor saving but it also makes the remote control maintenance free. Remote controls of the machines having large number of buttons, use of the piezoelectric material will make a huge saving as well as the maintenance free. This research study will really beneficial for the automobile industry as well the other industries like electrical industries making fob based electrical appliances. Further choice of the shape of the piezoelectric may vary also as compared to the shape proposed in this study.

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