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Mobile charger using piezoelectric material

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ABSTRACT

In today's world it can be observed that a large amount of inactivity and laziness is taking over mankind. It can be observed among human beings that doing small works or some activity easily tires them. Nowadays it can also be observed that people get highly impatient if they have to work for long time or have to wait for a task to be done. In today's world as new technologies are overtaking and being brought up in order to ease the work for human beings, the mankind is getting used to or addicted to the technology for making their work easily done and in very small amount of time. There is no doubt that technology play a vital role in in modern world and more or less has become our basic necessity and is very much required to make our tasks to be completed easily and save a lot of time for us. As it is well said a coin has two sides, so with ample amount of advantages there are also various disadvantages so it's up to us and the designer of new technologies to make it productive for their users. Our project is basically one such example of using technology for wellbeing of individual and for the Society. The basic idea of the project is to generate power by converting kinetic energy into electric energy. So, we will prepare a piezo electric device which will convert kinetic energy into electric energy and this further will lead to charging of device like mobile which is one of the basic

Keywords: Piezoelectric, Mobile Charger

1. INTRODUCTION

The bustling way of life of the present world has made individuals disregards their wellbeing. As individuals are buckling down, and have an inactive way of life. As it can be observed all over the world people are becoming lazy day by day as there is more and more advancement made all over the world. It can be said so, as technologies are being more and more advanced it is becoming fatal for human beings. It can be observed all over the world that people are facing crisis such as obesity, spinal cord injury, acid reflux, head pro, hypertension, etc. due to large amount of inactivity in them. This is basically

one aspect of life that needs to be taken care of in order to improve the life style of an individual being. The project made by us is basically an idea of taking human kind to a next level as the idea is make everyone fit and provide them with the gift of producing energy through the hard work, they have done which can be used by an individual to charge their cell phone. As we all know in today's world mobile phones are no more a need now, it's now become a necessity for each and every individual. It's one of the most important part of an individual's life and what's better is to provide someone with a chance to use one of the most important technology in their life without any kind of disturbance. As the project deals with charging phone using piezoelectric energy stored in a machine which can be easily generated by few hours of walking or jogging or some kind of movement done in a day. It can be used worldwide as we can take example of trekkers or mountaineers those who have to send there times in woods or mountain where there is hardly supply of energy and these are the places or the conditions where there is high need of phones which can be used to contact with someone or we can say cellphones are the only way through which they can be in contact with someone or they can find ways if anything goes wrong. These are the conditions where our project can play a vital role by providing them with at least amount of energy which can help in keeping their mobile phones charged and can use it if there's any needs. As of late, a ton of exchange implies have been proposed to give crisis capacity to charging cell phones. The methods with inexhaustible and economical highlights have pulled in as expanding enthusiasm for most recent couple of the times. In our project the process starts as a particular person starts to run or do a task related to movement and as soon as person starts moving the piezoelectric device present in the souls of the shoes receives the vibrations or the energy generated due to movement of a person and start converting it into some electrical energy, which means the kinetic energy get converted into electrical energy which is the basic task of a piezoelectric device and further on these energy is transferred to device which is built in order to store energy which can be located in our arms, wrist anywhere and will

store energy until required to be used. Acquired vitality is amended with 65% productivity and controlled to 4V. Be that as it may, it fills just a solitary need of accusing cell phone of a lesser proficiency. Additionally, in some past work, scaled down portable electronic framework, for example, biomedical medication conveyance inserts, speeding up and pressure observing sensors have been recommended. As per its needs, it did require extra room. The user, with the help of this device can easily share their phone just by strolling.

2. DESIGNS AND DEVELOPMENT OF DUAL WORKING GADGET

2.1 Principle

PTZ piezoelectric sensor is used because of its high-energy storage density as a small scale energy harvesting system. This sensor converts the mechanical stress into electrical voltage. Electrical charge is accumulated on the crystal surface when a mechanical stress is applied onto this sensor this charge can be extracted with the help of a wire. When a mechanical energy is applied to a crystal it is known as a direct piezoelectric effect the working of which is as follow:

- The piezoelectric crystal will be placed between two metal plates then the mechanical pressure is applied onto the material by the help of the metal plates which will force the electric charge within the crystal to go imbalance.
- Also there are other crystals that can be combined together as a piezoelectric material they have an asymmetrical structure but still there exist in an electrically neutral balance. Even though if you can apply mechanical pressure to this piezoelectric crystal the molecular structure of these crystal builder form and the atoms will be pushed around and then you will get a crystal that can conduct electrical current. If this same crystal is taken an electric current is applied to it the crystal will conduct the electrical current and convert it into mechanical energy.
- This application of mechanical energy to a crystal is known as a direct piezoelectric effect.



Fig. 1: Piezoelectric disc

2.2 Design

The basic structure of project consists of various elements, and each and every element have their own part, so that they can help in functioning of device correctly. So, first of all this project can be divided into 2 parts:

1. The signal generator
2. The signal receiver

2.2.1 Signal generator: This part consists of the main part of this project, which is the piezoelectric device. The piezoelectric device helps in converting the kinetic energy into electrical energy. The device is placed beneath the sole of the shoes, in such a way that the presence of it does not affect the

user. As the most important part is receiving of the kinetic energy, so it should be obvious that the placement of piezoelectric electric device should be in such a manner that it receives the most amount of the energy or where the energy can be detected easily. There are 2 parts where the most energy can be generated that is the front part of the shoes and the back part or end part of the shoes. The signal generator also consists of an oscillating device and a transmitting device. The work of transmitting device is to basically transfer the energy generated to the signal receiver and it is done wirelessly.

2.2.2 Signal receiver: This is the second part and a part, which helps in receiving the transferred energy and storing it until required by the user to use. This part consists of a rectifier, which corrects the charge of current. It consists of a receiver, which receives the wireless current. It also consists of a device, which will help, in transferring of this rectified current to mobile.

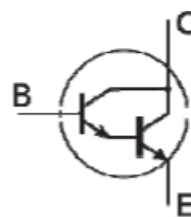


Fig. 2: Darlington transistor

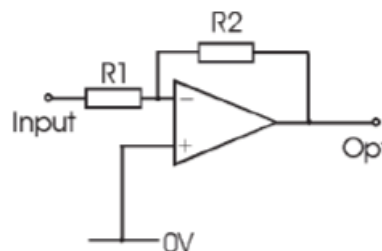


Fig. 3: Voltage amplification circuit

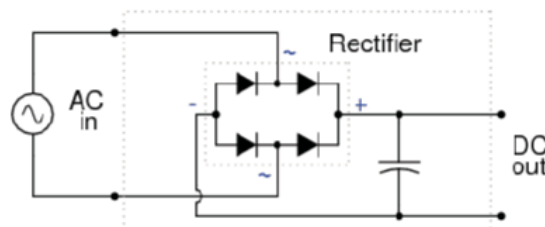


Fig. 4: Rectification circuit

2.3 Working

The implementation of this project completely depends upon the movement of the user, as soon as the movement starts the basic functioning of the electrical device present inside starts to function automatically. So as discussed earlier first, all the operation takes place in the signal generator part of the device. As the pressure is exerted or applied on the piezo-electric device, the device begins to function and start converting that kinetic energy or the pressure to the electrical energy. So, a basic phenomenon of electromagnetic takes place in order to transfer energy from one part of the device to another part of it. So, as we know that the 2 different parts of device consists of transmitter and receiver and as we know the energy is being generated using electromagnetic effect which is important because the current gets easily transferred without any kind of wires or connections and also there is no wastage of energy. In our device consist of magnetic coil which is the transmitter and the receiver is also magnetic in nature as both transmitter and receiver are present inside the magnetic field which will lead to

production of current in the second loop which is the receiver tool and as soon as the energy is generated in the energy receiver part, the current gets converted into a suitable charge which can be used to charge a phone. This process of generation of energy continuously takes place as long as there is movement. The energy receiver part consists of energy storage place, which stores the current and when the user requires it it can be easily used.



Fig. 5: Mobile phone charging circuit

3. EQUATIONS

The voltage produced by a single piezoelectric disc is given by

$$StPV \times \times = \quad (1)$$

Where, P = pressure applied,
 t = thickness of the disc,
 S = rating of the piezoelectric material.

The voltage gain factor of the amplification circuit is based on the choice of 2 resistances and is given by

$$\text{Gain} = \frac{R_f}{R_i} + 1 \quad (2)$$

Where,

R_f = resistance connected in parallel,
 R_i = resistance connected in series.

The voltage that is given out by an individual piezoelectric disc is expressed as

$$V = P \times T \times S \quad (1)$$

Where,
 P = pressure,
 t = thickness,
 S = rating of piezoelectric material.

The voltage gain factor is based on the choice of 2 resistances and is given by

$$\text{Gain} = R_f/R_i + 1 \quad (2)$$

Where, R_f = resistance that is connected in parallel,
 R_i = resistance that is connected in series.

4. EXPERIMENT

Offering the activation of piezoelectric plate does the analysis. Many different types of activation to the piezoelectric circle illustrate best walking and running condition by various vibration that is given to the materials plate. An 800mA limit lithium particle battery is used in the given test. The test gives out the rate at which charging of the battery takes place for various interims and the time comparison is recorded by the

help of a stopwatch. For any regular excitation it is seen that it takes 2.6 hours to get completely charged. If the excitation has to take place at a quicker rate i.e. high recurrence, the charging time will get diminished to 1.8 hours. The outcome of the experiment on a cell phone is illustrated below. Table 1 Charging time for walking condition with normal excitation.

Table 1: Charging time for walking condition with normal excitation.

Charge (in %)	Time lapsed (in minutes)
10-11	1.50
11-12	1.52
12-13	1.52
13-14	1.54
14-15	1.53
15-16	1.56
16-17	1.54
17-18	1.58
18-19	1.55
19-20	1.6

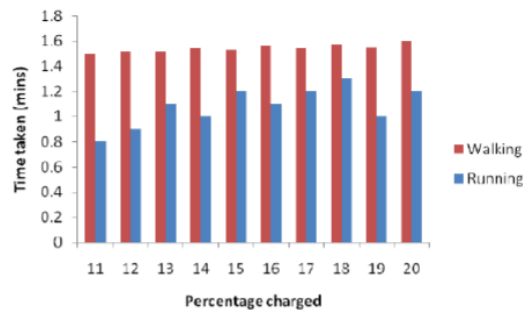


Fig. 6: Comparison of charging time using the designed device for excitation corresponding to walking and running

Table 2: Charging time for running condition with excitation at high frequency

Percentage charged (in %)	Time taken (in minutes)
10-11	0.8
11-12	0.9
12-13	1.1
13-14	1
14-15	1.2
15-16	1.1
16-17	1.2
17-18	1.3
18-19	1
19-20	1.2

Table 3: Charging time for walking condition with normal excitation for extended charging

Percentage charged (in %)	Time taken (in minutes)
10-15	7.4
15-20	7.8
20-25	7.7
25-30	7.2
30-35	7.5
35-40	7.6
40-45	8.1
45-50	8.3
50-55	8.5
55-60	8.5

Table 4: Charging time for running condition with normal excitation at high frequency for extended charging

Percentage charged(in %)	Time taken (in min)
10 - 15	4.9
15 - 20	5.1
20 - 25	5.2
25 - 30	5.2
30 - 35	5.5
35 - 40	5.4
40 - 45	5.5
45 - 50	5.6
50 - 55	5.4
55 - 60	5.7

At the point when the device was utilized as a crisis burn by squeezing the switch, the LED was help up. It was watched, for ordinary charging of piezoelectric circle for 10 minutes, LED gleams for 10-12 minutes. At higher speed the LED sparkles for 15 - 16 minutes.

5. RESULTS

The examination that was taken over the structure contraction provide us with the accompanying outcomes that the excitation compared to an individual strolling at typical velocity of 324 km per hour the time that will be taken by the utility model which will charge 800 milliamper lithium ion battery will be 2.5 hours In addition at higher level compared to that at 10 to 12 kilometer per hour, the same type of battery was being charged in 1.8 hour. Now when the device was read to check the capacity of crisis burn, it was noticed that in typical strolling for 10 minutes the light was glowing for 10 -12 minutes. Similarly, when the running was done for 10 minutes, now the LED was glowing and giving light for 15-16 minutes. Therefore, this investigation proves that the light force as well as the battery force is straight forwardly related to the user speed.

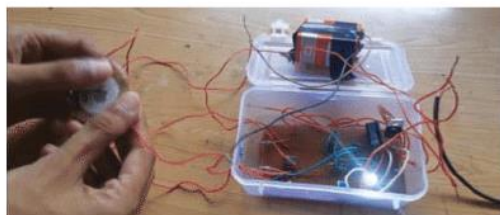


Fig. 7: Device powering the emergency torch

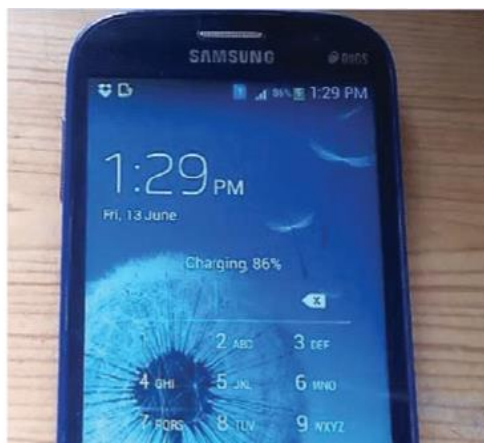


Fig. 8: Mobile shows charging

6. CONCLUSION

This journal shows a dual piezoelectric based contraption being created as well as read just because the utility's contraption is dependent on strolling, tentatively assessed and introduced right now a proper voltage to charge a lithium battery. Moreover, the piezoelectric based strolling device can do double capacities; the first is to fuel the mobile battery and second is to give a crisis burn. It was noticed that the excitation vibration compared to an individual strolling at a medium speed, the total time taken by the device to charge the mobile was more. Hereafter after this information was noted for the running condition now the time taken by the mobile to get charged decreased immensely. In this way, it is presumed that the adequacy of the gadget relies upon client's strolling movement, for example how well he is in playing about his morning walk or run. Hence, the gadget is by implication ending up benefit for human wellbeing by empowering a famous wellness action named as strolling. This can be the most useful and solid info, an e-contraption can ever take making it a wellbeing-advancing gadget. Henceforth, the individuals can without much use of a stretch, will be able to charge their batteries and use crisis burn in their daily lives by simply strolling to an ever-increasing extent.

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