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Foot Step Power Generation

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ABSTRACT: Theproductionofelectricpowerfromthefootstepmovementofthepeoplesandthepressureexertedduringwalkingwhichisfritteraway,isthemainthemeofthispaper.Themechanicalpowertransformationintoelectricalpowerasthepressureexertedbythefootstepandbyusingtransducersisbasicallycalledas"Footsteppowergenerationsystem".Powerisproducedbythepowergeneratingflooranditisbasicallytheproductionofelectricalenergyfromkineticenergy.Astodayelectricitydemandisincreasinganditisunabletoovercomethisglobalissuebyusingthetraditionalpowergeneratingsources.Demandandsupplygapisthemajorissueofenergycrisis.Themainaimistoovercomethepowercrisisthroughouttheworldalthoughitisnotenoughtofulfilloverexcessivedemandofelectricalenergybutitwillbeabletochangeanddecreaserelianceonoldmethodofgeneratingelectricity.Wecangenerate1megawattofpowerifwehavea100floor,asweareabletomodelapowerproductionfloorwhichcangenerateupto1000wattonjusttwelvefootstepsmeansoneunitanditiscapabletogenerate10000wpowerforjust120footsteps.Itcanbeinstalledonroadsidefootpath,parksandjoggingtracksandmanyotherpublicplace,airportetc.andhavegreatimpactofthisandwillcreategreatdifferenceintheelectricalpowergenerationsystem.WecanuseArduinoNANOtocontrolAndmonitoralltheprocess.Peizoelectricsensorsarebasedonprincipleofconvertingmechanicalenergyintoelectricalenergy.WearegoingtouseACS712,LM35aswell.

KEYWORDS: Sensors,ArduinoNANO,ACS712,LM35.

I. INTRODUCTION

For an alternate method to generate electricity there are number of methods by which electricity can be produced, out of such methods footstep energy generation can be an effective method to generate electricity. Walking is the most common activity in human life. When a person walks, he loses energy to the road surface in the form of impact, vibration, sound etc., due to the transfer of his weight on to the road surface, through foot falls on the ground during every step. This energy can be tapped and converted in the usable form such as in electrical form.This device, if embedded in the footpath, can convert foot impact energy into electrical form. Human-powered transport has been in existence since time immemorial in the form of walking, running and swimming. However modern technology has led to machines to enhance the use of human-power in more efficient manner. In this context, pedal power is an excellent source of energy and has been in use since the nineteenth century making use of the most powerful muscles in the body. Ninety-five percent of the exertion put into pedal power is converted into energy. Pedal power can be applied to a wide range of jobs and is a simple, cheap, and convenient source of energy.However, human kinetic energy can be useful in a number of ways but it can also be used to generate electricity based on different approaches and many organizations are already implementing human powered technologies to generate electricity to power small electronic appliances. Energy is the ability to do work. Alternative energy refers to energy sources, which are not based on the burning of fossil fuels or the splitting of atoms. The renewed interested in this field of study comes from the undesirable effect of pollution (as witnessed today) both from burning fossil fuel and from nuclear waste by products Fortunately there are many means of harnessing energy, which less damaging impact on our environment in India. The alternatives are solar, wind power generation, geothermal tides, hydroelectric. In addition to these we have developed a new methodology of generation power using human energy and the name of this alternative is foot step power generation.

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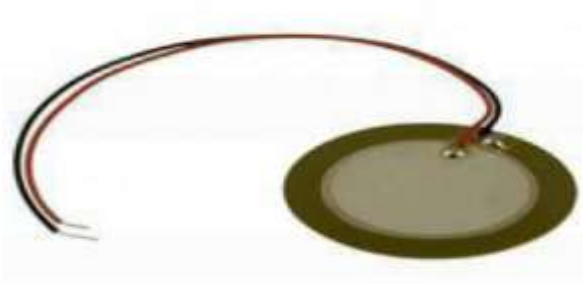

Piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal. Piezoelectric sensors have proven to be versatile tools for the measurement of various processes. They are used for quality assurance, process control and for research and development in many different industries it was only in the 1950s that the piezoelectric effect started to be used for industrial sensing applications.Since then, this measuring principle has been increasingly used and can be regarded as amateur technology with an outstanding inherent reliability. It has been successfully used in various applications, such as in medical, aerospace, nuclear instrumentation, and as a pressure sensor in the touch pads of mobile phones. The sensors are either directly mounted into additional holes into the cylinder head or the spark/glow plug is equipped with a built-in miniature piezoelectric sensor. The rise of piezoelectric technology is directly related to a set of inherent advantages. The high modulus of elasticity of many piezoelectric materials is comparable to that of many metals and goes up to 10e6 N/m²[Even though piezoelectric sensors are electromechanical systems that react to compression, the sensing elements show almost zero deflection . This is the reason why piezoelectric sensors are so rugged, have an extremely high natural frequency and an excellent linearity over a wide amplitude range. Additionally, piezoelectric technology is insensitive to electromagnetic fields and radiation, enabling measurements under harsh conditions. Some materials used (especially gallium phosphate or tourmaline) have an extreme stability even at high temperature, enabling sensors to have a working range of up to 1000°C. Tourmaline shows piezoelectricity in addition to the piezoelectric effect; this is the ability to generate an electrical signal when the temperature of the crystal changes. This effect is also common to piezoceramic materials.One disadvantage of piezoelectric sensors is that they cannot be u sed for truly static measurements. A static force will result in a fixed amount of charges on the piezoelectric material. While working with conventional readout electronics, imperfect insulating materials, and reduction in internal sensor resistance will result in a constant loss of electrons, and yield a decreasing signal.

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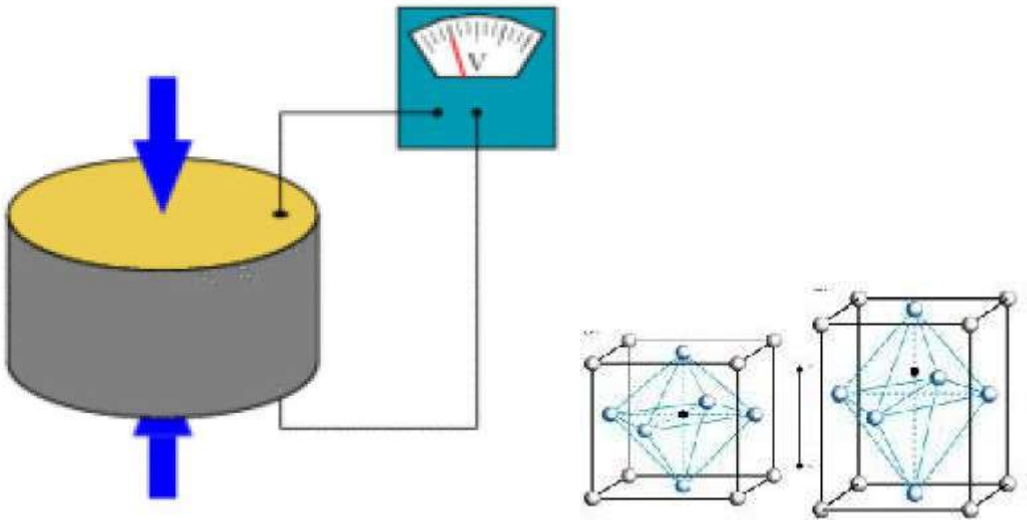

Peizoelectric sensor

II. EXPERIMENTATION

The system allows for a platform for placing footsteps. The piezo sensors are mounted below the platform to generate voltage from footsteps. The sensors are placed in such an arrangement so as to generate maximum output voltage. This is then provided to our monitoring circuitry. The monitoring circuit is a microcontroller based that allows the user to monitor the voltage generated and this voltage is given to a rechargeable battery .It also displays the charge generated on an LCD display.

WORKING DIAGRAM FOR FOOT STEP POWER GENERATION

Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India and China where the roads, railway stations, bus stands, temples, etc. are all over crowded and millions of people move around the clock. This whole human/ bioenergy being wasted if can be made possible for utilization it will be great invention and crowd energy farms will be very useful energy sources in crowded countries.Walking across a "Crowd Farm," floor, then ,will be a fun for idle people who can improve their health by exercising in such farms with earning. The electrical energy generated at such farms will be useful for nearby applications The utilization of waste energy of foot power with

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human motion is very important for highly populated countries. India and China where the roads, railway stations, temples, etc. are all over crowded and millions of people move around the clock.

When a force is applied on piezo material, a charge is generated across it. Thus, it can be as summed to be an ideal capacitor.

SOURCE CODE FOR THE MICROPROCESSOR:

```
#include<LiquidCrystal.h>
float MAX_VOLT =5.0; // maximum logic voltage
float load_resistor= 0.1; // shunt resistor value in Ohms
int opamp_gain =6; // gain of the op-amp
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
const int sensor=A5; // Assigning analog pin A1 to variable 'sensor'
float tempc;  //variable to store temperature in degree Celsiusfloat tempf;  //variable to store temperature in Fahreinheit
float vout;  //temporary variable to hold sensor reading
int k=0;
int current_sense=A1;
float vol=6.09;
void setup()
{
   pinMode(sensor,INPUT); // Configuring pin A1 as input
   pinMode(current_sense,INPUT);
   Serial.begin(9600);
   lcd.begin(20,4);
   lcd.begin(20, 4);
   lcd.setCursor(0, 0);
   lcd.print("Welcome to");
   lcd.setCursor(0, 1);
   lcd.print("Foot Step");
   lcd.setCursor(0, 2);
   lcd.print("Power Generation ");
   delay(5000);
}
void loop()
{
   lcd.clear();
   vout=analogRead(sensor);
   vout=(vout*500)/1023;
   tempc=vout; // Storing value in Degree Celsius
   tempf=(vout*1.8)+32; // Converting to Fahrenheit
   float load=read_load();
   float en=0.0;
   load=load-2;
   en=vol*load;
   Serial.print("in DegreeC= ");
   Serial.println(tempc);
   Serial.print("in Fahrenheit=");
   Serial.println(tempf);
   Serial.println(String(6.01)+" V");
   Serial.print("Battery= ");
   Serial.println(String(vol)+" V");
   Serial.print("Load=");
   Serial.println(String(load)+" A");
   Serial.print("Energy=");
   Serial.println(String(en)+"WH");
   if(k%5==0)
```

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```
  {
   lcd.setCursor(0,0);
   lcd.print("Current Temperature");
   lcd.setCursor(0,1);
   lcd.print("in DegreeC= ");
   lcd.print(tempc);
   lcd.setCursor(0,2);
   lcd.print("in Fahrenheit=");
   lcd.print(tempf);

  }
  else
  {

   lcd.setCursor(0,0);
   lcd.print("MCC= ");
   lcd.print(String(35)+" A");
   lcd.setCursor(0,1);
   lcd.print("Battery= ");
   lcd.print(String(vol)+" V");
   lcd.setCursor(0,2);
   lcd.print("Load=");
   lcd.print(String(load)+" A");
   lcd.setCursor(0,3);
   lcd.print("Energy=");
   lcd.print(String(en)+" WH");
  }
  k++;
  if(k>=1000)
  {
   k=1;
  }
  delay(3000);
}
float read_load (void){
    int average=10;
    float MAX_VOLT=6.09;
       float load_current = 0;
        for (int a = 0; a < average; a++){
        load_current = load_current + analogRead(current_sense);
       }
       load_current = load_current / average;
       load_current = (load_current* MAX_VOLT) / 1024;
       load_current = (load_current / opamp_gain) / load_resistor;
       return load_current;
}
```

No. of foot steps	Duration of lighting a 100 watt 230 Volt bulb (s)	Total energy (J)	Energy /step (J)
250	6	600	2.4
500	12	1200	2.4
750	18	1800	2.4
1000	25	2500	2.5

Fig .Energy storing table

III. CONCLUSION

Looking back on this project, the overall outcome of results to be observed. This can be evaluated by looking at how well our objectives were met. Our first objective is to produce energy by non conventional method. We are confident though that this objective of installing in an sensor can be met if more time for testing and facilities is given. There is a lot we could say about the need for energy generation timing. This design is very realistic for the future of the power industry as well as our education.

SOME OF THE ADVANAGES FROM THE ABOVE RESULTS

1.Power generation is simply walking on step.
2. No need fuel input.
3. This is a Non-conventional system.
4. No moving parts - long service life.
5. Self-generating – no external power required.
6. Compact yet highly sensitive.
7. Reliable, Economical, Eco-Friendly.
8. Less consumption of Non- renewable energies.
9. Power also generated by running or exercising on the step.
10. Battery is used to store the generated power.
11. Extremely wide dynamic range, almost free of noise

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