Power Generation By Human Locomotion

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***Abstract*— The process of converting mechanical energy into usable electrical energy is defined as power harvesting. Few years ago, there has been a surge of power generating. And this increase has brought vast advances in wireless technology. Numerous doors has been opened for generation of electricity in practical. The use of piezoelectric material for generating electricity by human locomotion is one method that has been dramatically rised in use of power harvesting. Piezoelectric sensors has the strength to convert mechanical energy into electrical energy and vice-versa. This property of piezoelectric sensors has ability to absorb mechanical energy from vibration of human locomotion and convert it into electrical form, that can be used to power other devices. In this paper we discuss the research that has been performed in the area of power harvesting and the future goals that must be achieved for power harvesting systems to find their way into our day to day life.**

Keywords*— *Power Generation, Renewable Energy, Piezoelectric sensor , Piezoelectric Effect, Security.

I. INTRODUCTION

It can't possible to do any kind of work without energy. Every work consumes certain amount of energy. Now a days the human bio-energy being wasted if it can be made possible for utilization then it will be very useful energy source. Walking is the most common activity in day to day life. While walking, the person loses energy to the surface in the form of vibration. This energy can be tapped and converted to electrical form. Considerable amount of energy can be generated in populated area. Piezoelectricity is the charge that accumulates in certain solid materials certain ceramics, and biological matter such as bone in response to applied mechanical stress. The word piezoelectricity means electricity resulting from pressure. It is derived from the Greekpiezo or piezein , which means to squeeze , and electric which stands for amber, an ancient source of electric charge. Piezoelectricity is the direct result of the piezoelectric effect.

II. Block Diagram:-

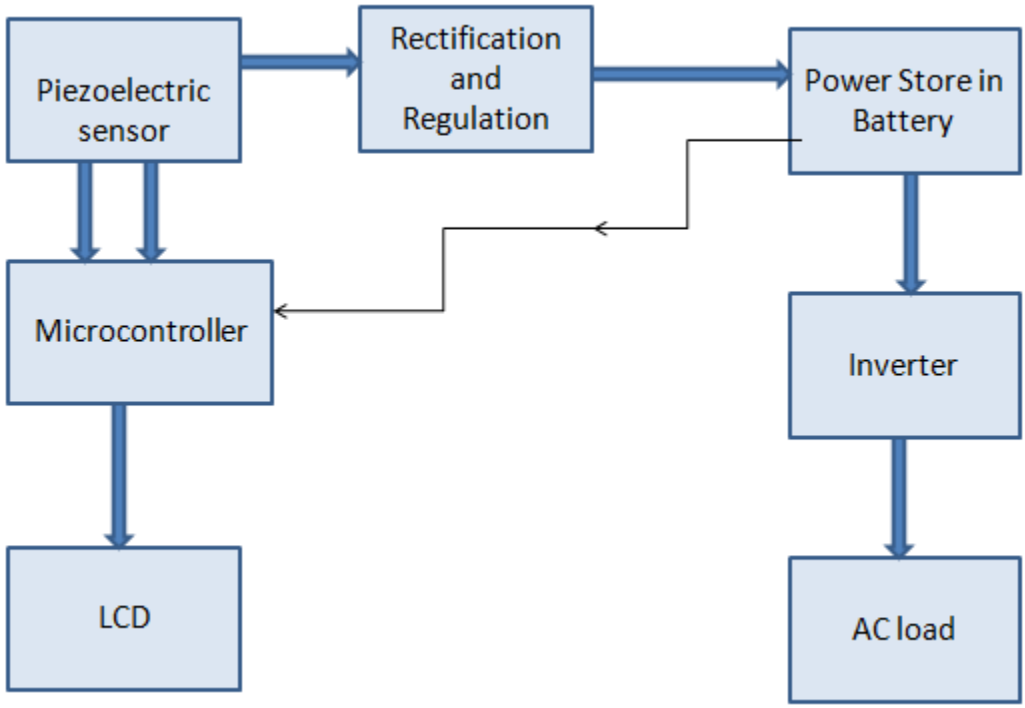

Fig:-Block Diagram of Power Generation System

Description of Block Diagram:-

Piezoelectric sensors has property to convert mechanical force into electrical energy. The output of the piezoelectric sensor is nothing but in ac which is approximately 5v, is given to the next block which is of rectification and regulation. In this rectifiers converts ac into pulsating dc which is unregulated varying dc output. It has some ripple and noise. To remove this ripple and noise, we use filter and resistor gives constant dc output. The next block is battery, which stored the dc output which is generated by the rectifiers.

For dc devices, we can directly connected to the battery. For ac devices, we use here inverter which converts dc into pulsating ac. The next block is microcontroller, which is ATmega 328P microcontroller. To drive microcontroller, we give supply from battery for measuring voltage and current and show data on LCD. IT is working on the 16MHz frequency, 1Kb of RAM, 32Kb of ROM, 14 digital input-output, 6 analog input-output which are connected to LCD which can display 32 characters at a time.

2) *circuit diagram:-*

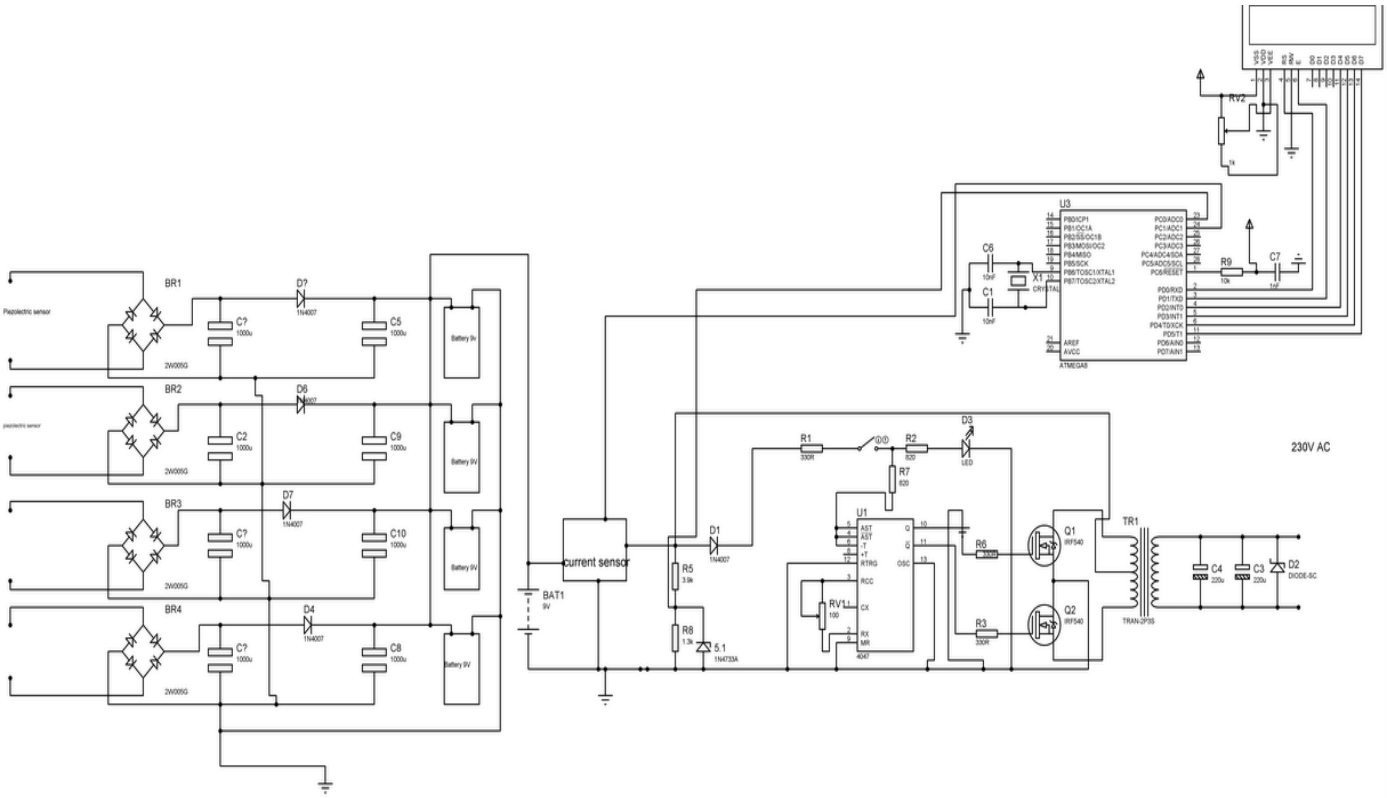

Figure 3.2.1:-Circuit Diagram Of Power Generation System

Description of Circuit Diagram

Our circuit diagram mainly consist of three part

1) *Power Harvesting Circuit:-*

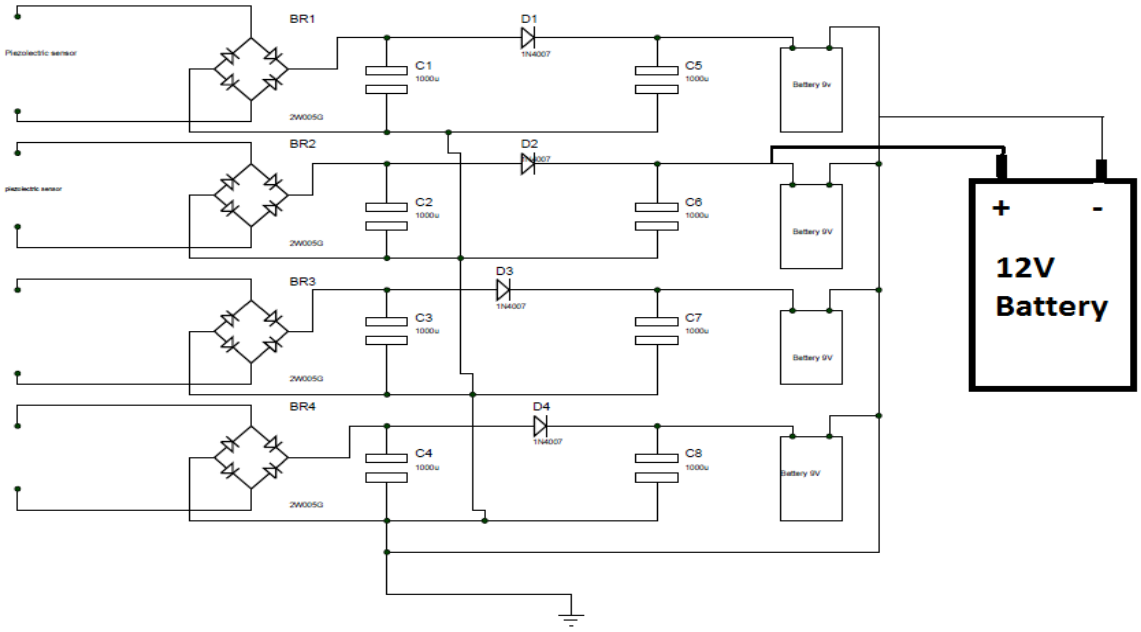

Fig:- Power Harvesting Circuit

Our circuit diagram mainly consist of piezoelectric sensor network. In which, number of piezo sensors are connected in series and parallel. The output of this piezoelectric sensors is given to power harvesting circuit. Power harvesting circuit is nothing but battery charger circuit which consist of forward bridge rectifier which convert incoming AC from piezoelectric into pulsating dc. As incoming power is in the pulse form so we use a capacitor for filtering purpose. Which convert pulsating DC into a filter DC supply. After that we are using a diode which maintain the unidirectional current towards battery and prevent reverse current flowing from battery to piezoelectric sensors.

The second capacitor is use for charge storage. Here we use four suppliers which having 9v battery for storing small amount of electrical energy for piezoelectric. The power from the battery given to the 12v battery for further use.

2) Inverter Circuit:-

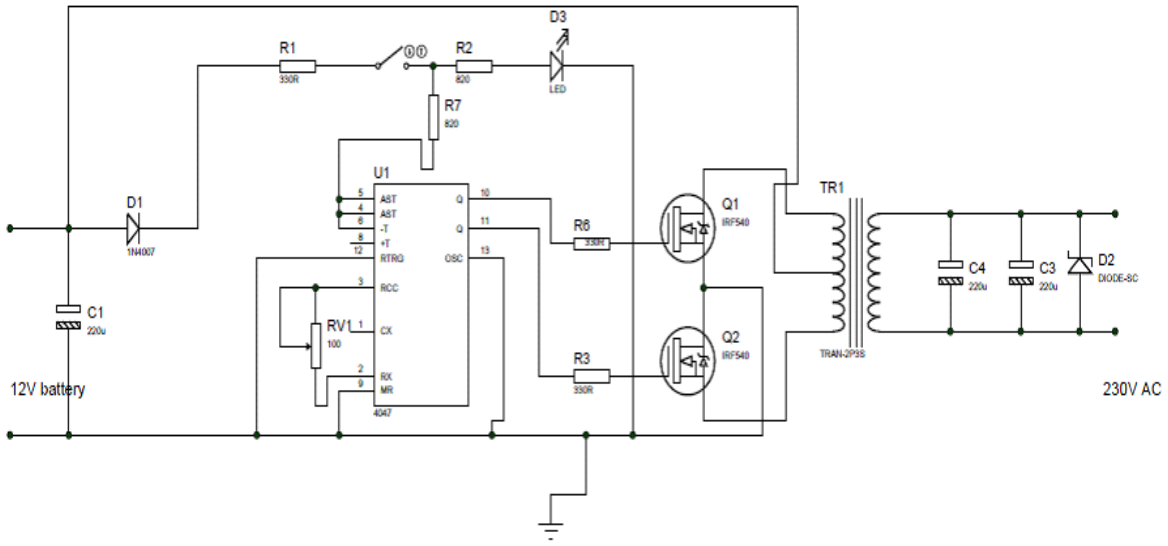

Fig:- Inverter Circuit

Our second circuit consist of inverter, current sensor is connected in series and this is hall effect current sensor. The output of current sensor is given to pin no. ADC1 of microcontroller. The voltage measurement circuit is connected in parallel which consist of a voltage divider made up of two resistances 3.1killo-ohm and 1.3 killo-ohm. A zener diode of 5.1v is connected in parallel with 1.3 killo-ohm resistor to prevent voltage exceeding from 5v. As microcontroller works on 5v. The inverter circuit consist of IC 4047 which acts as a astable multivibrator. The output of the astable multivibrator of Q and Q0 are given to the MOSFET. The MOSFET which according to the output state of Q and Q0 which produce a AC wave which is fed to the primary of step up trasformer to drive the power of tranformer we connect 5v DC to the centre of transformer. At the second area of transformer we get the AC output by using filtering capacitor. Here is the circuit diagram of a simple 100 watt inverter using IC CD4047 and MOSFET IRF540. The circuit is simple low cost and can be even assembled on a veroboard.CD 4047 is a low power CMOS astable / monostable multivibrator IC. Here it is wired as an astable multivibrator producing two pulse trains of 0.01s which are 180 degree out of phase at the pins 10 and 11 of the IC. Pin 10 is connected to the gate of Q1 and pin 11 is connected to the gate of Q2. Resistors R3 and R4 prevents the loading of the IC by the respective MOSFETs. When pin 10 is high Q1 conducts and current flows through the upper half of the transformer primary which accounts for the positive half of the output AC voltage . When pin 11 is high Q2 conducts and current flows through the lower half of the transformer primary in opposite direction and it accounts for the negative half of the output AC voltage.

3) Microcontroller Circuit:-

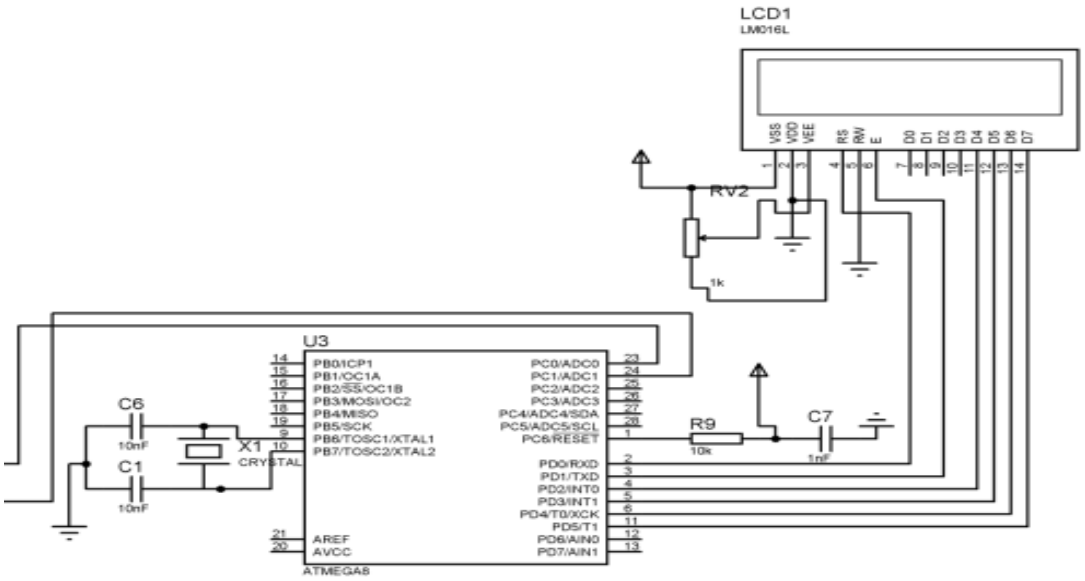

Fig:- Microcontroller circuit

We are using Atmega328P microcontroller for measuring voltage and current and show data on LCD. It is working on 16MHz frequency has 1kb of RAM, 32kb of ROM, 14 digital input-output, 6 analog input-output, we are connected LCD which is 16/2 LCD which can display upto 32 characters at a time and we are using 4 bit mode of LCD.

The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS per MHz.

IV.CONCLUSION

Piezoelectric materials have the ability to transform mechanical energy into electrical energy and vice versa. This system will be a revolution in power producing and curb down the energy cost thereby improving our country's economy. This energy is produced by human locomotion without requiring any kind of input energy. This system is useful in public places. Future work may include more number of sensors in a single system to provide flexibility. Hence the main goal of this paper is to generate electricity by using piezoelectric sensors.

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