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Footstep Power Generation using Piezoelectric Transducers

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***Abstract*—** everywhere a person goes, some amount of energy is used by them. Since time is immemorial energy is needed for the well-being and sustenance of our lives. The utilization of waste energy used in the foot power is very much useful and important for place where there will be a huge crowd each day. When the flooring is engineered with piezoelectric technology, the electrical energy produced by the pressure is captured by floor sensor and converted to an electrical charge by piezo transducer, then stored and used as a power source. This power source is used in home application, street light, school and colleges.

Keywords— *Piezo transducer, Inverter, PIC16F877A microcontroller, PZT.*

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I. INTRODUCTION

The demands of electricity are increasing day by day and its use has become so advanced and applicable in the present lifeline of a human being. The arising value of new technology each day demands more power of electricity.as the population of human beings is increasing day by day and hence the energy demand is increasing linearly. This technology is on simply based on a principle called the piezoelectric e effect, in which certain materials have the ability to build up and electric charge from having pressure and strain applied to them. Now, piezoelectricity is generally referred to as having the ability of some materials to generate an electric potential in responds to the applied pressure on them. So, the piezoelectric material can converts the exerted pressure into and electric current. The main component of this project is piezoelectricity, where the piezoelectric effect is understood as the linear electromechanically interaction between the mechanical and the electrical state in crystalline materials with no inversion symmetry. The piezoelectric effect is a reversible process in that material exhibiting the direct piezoelectric effect also exhibit the reverse piezoelectric effect.PIC is a family of modified Harvard architecture microcontrollers made by the Microchip Technology, derived from the PIC1650 originally developed by General Instrument Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller.PIC devices and popular with both industrial developers and hobbyists due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, series programming and re-programmable flash memory capability

The PIC16F877A CMOS FLASH-based 8-bit microcontroller is upward compatible with the PIC16C5x, PIC12Cxxx and PIC16C7x devices. It features 200 ns instruction execution, 256 bytes of EEPROM data memory,[1,2] self-programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port.

PIC16F877A has RISC architecture. This term is often found in computer literature, and it needs to be explained here in more detail. Harvard architecture is a newer concept than von-Neumann. It rose out of the need to speed up the work of a microcontroller. In Harvard architecture, data bus and address bus are separate. Thus a greater flow of data is possible through the central processing unit, and of course, a greater speed of work. Separating a program from data memory makes it further possible for instructions not to have to be 8-bit words. PIC16F877A uses 14 bits for instructions which allows for all instructions to be one word instructions.[3] It is also typical for Harvard architecture to have fewer instructions than von-Neumann's, and to have instructions usually executed in one cycle.

II. OUR PROJECT

Our project is all about saving human energy and converting it to electrical energy. Day by day, the population of the country is increasing and the requirement of the power is also increasing at the same time the wastage of energy is also increased in many ways. So reforming this energy back to usable form is the major solution. This project is used to generate voltage using footstep force. This project is useful in public places like theatres, railways station, shopping malls, temples, school, college, hospital, etc. so, these systems are placed in public places where people walk and they have to travel on this system to get through the entrance or exist. Then this system may generate voltage on each and every step of a foot and for this purpose, piezoelectric sensor is used in order to measure force, pressure and acceleration by its change into electric signals [4]. This system uses voltmeter for measuring output, led light, weight measurement system and a battery for better demonstration of the system.

III. BLOCK DIAGRAM

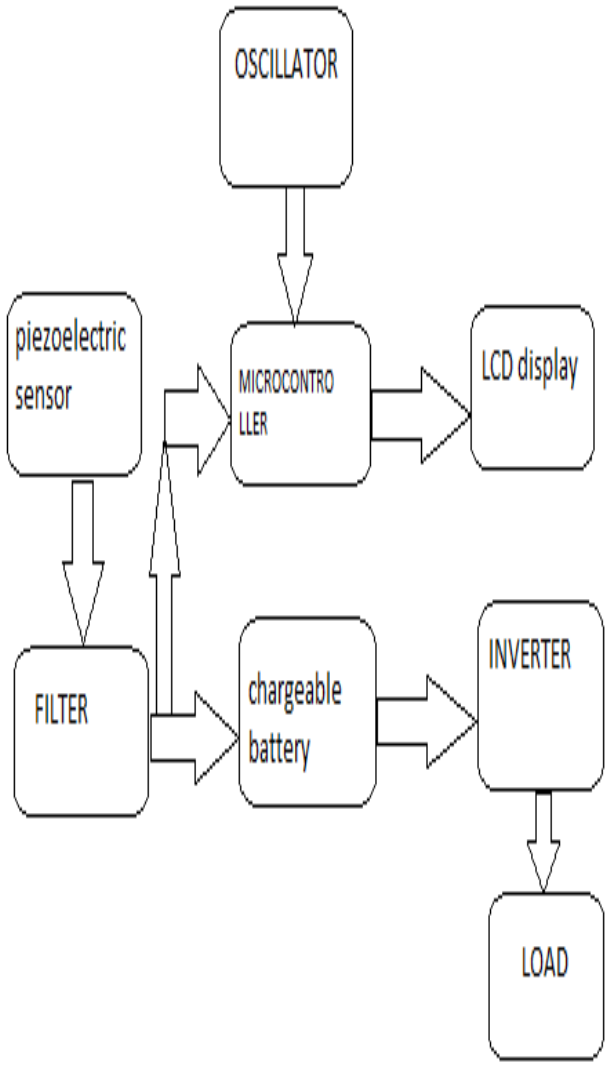


Fig1: Block Diagram

Block Description

A. OSCILLATOR:

This produces a periodic, oscillating electronic signal, often a sine wave or a square wave. Oscillator converts direct current (DC) from a power supply to an alternating current (AC) signal. Oscillator designed to produce a high power AC output from a DC supply are usually called inverter.

B. PIC 16F877A:

The PIC Microcontroller use flash memory for program storage and newer models allow the PLC to reprogram itself. In pic microcontroller we already burn Program inside program memory and data memory are separated. Data memory is 8-bit, 16-bit and in latest models, 32-bit wide. *PIC16F877A has RISC architecture*.

C. INVERTER:

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (dc) to alternating current (ac).The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry does not produce any power; the power is provided by the dc source. A power inverter can be entirely electronic or may be combination of mechanical effects (such as a rotary apparatus) and electronic circuitry [5-6]. Static inverters do not use moving parts in the conversion process.

D. CHARGEABLE BATTERY:

A rechargeable battery, Storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged with the help of small circuit. This battery is very helpful when the AC power is not there.

E. LCD DISPLAY:

A Liquid crystal display is a flat panel display or other electronic visual display that uses the light modulating properties of liquid crystal. There is 16 pin in the LCD. If we used Liquid crystals display it means we already know about all pin functions.

F. PIEZOELECTRIC SENSOR:

A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, on force by converting them to an electrical charge. The prefix piezo- is Greek for ‘press’ or ‘squeeze’. Piezoelectric sensors are versatile tools for the measurement of various processes. They are used for quality assurance,[7] process control, and for research and development in many industries. Pierre curie discovered the piezoelectric effect in 1880.

G. FILTER (BRIDGE RECTIFIER):

A bridge rectifier is used for conversion of an alternating current (AC) input into a direct current (DC) output. A bridge rectifier provides full-wave rectification from a two-wire AC input, resulting in lower cost and weight as compared to a rectifier with a 3-wire input from a transformer with a centre-tapped secondary winding[9-10].

H. LOAD:

In this circuit we refer the load as an electrical load. We are using the load as a bulb here.example of a journal article in

IV. CIRCUIT DIAGRAM

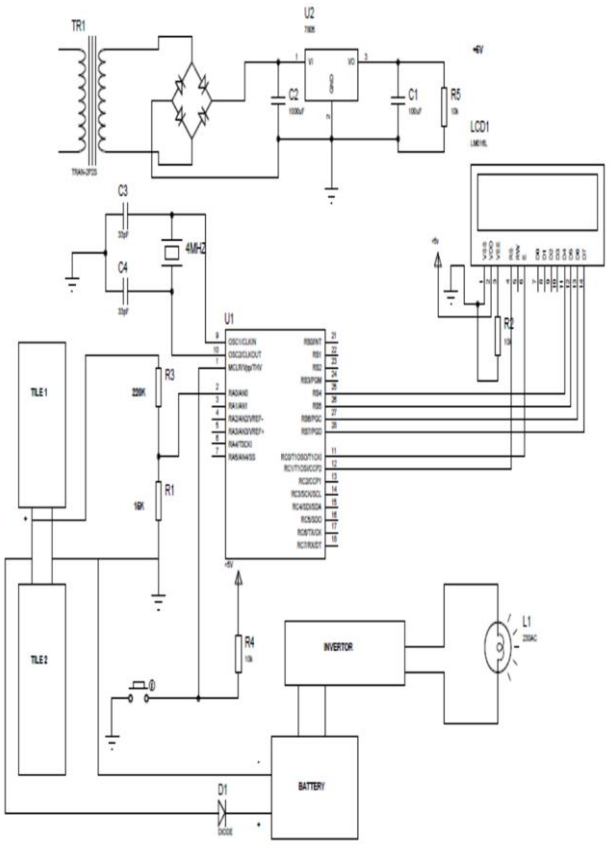
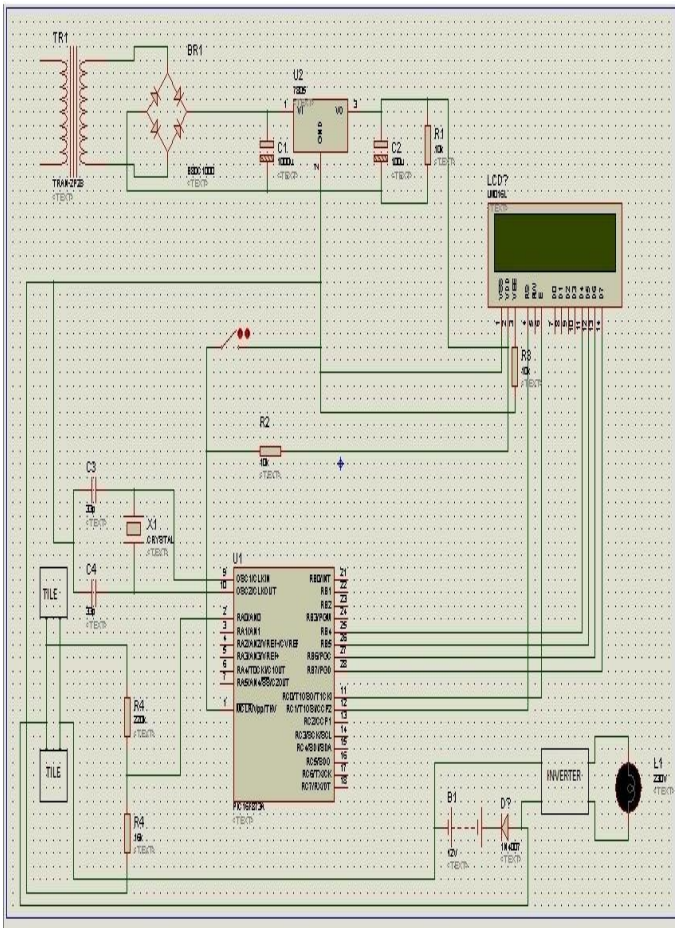


Fig 2: Circuit Diagram



CIRCUIT DESCRIPTION

In this circuit the piezoelectric material converts the pressure applied to it into electrical energy. The source of pressure can be either from the weight of the moving vehicles or from the weight of the people walking over it. The output of the piezoelectric material is not a steady one. So a bridge circuit is used to convert this variable voltage into a linear one. Again an AC ripple filter is used to filter out any further fluctuations in the output. The output dc voltage is then stored in a rechargeable battery. From battery provisions are provided to connect dc load. An inverter is connected to battery to provide provision to connect AC load. The voltage produced across the tile can be seen in a LCD.[8] For this purpose microcontroller PIC16F873A is used. The microcontroller uses a crystal oscillator for its operation. The output of the microcontroller is then given to the LCD which then displays the voltage levels.

V. RESULT

Footstep Power Generation using Piezo Electric Transducer is applicable in highly populated places. It can be used in theatres, temples, offices, hospitals, shopping malls and schools and colleges. The piezo transducer is the main component of this project.

VI. CONCLUSION

This paper discusses about the importance of the energy wasted and converted it to renewable energy. It mainly deals with the voltage produced by the force applied through the piezo transducer. demands of electricity are increasing day by day and its use has become so advanced and applicable in the present lifeline of a human being.

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