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ADVANCED POWER GENERATION USING PIEZO-SENSOR

Saloni Kadam[1], Kirti Karli[2], Kajal Patil[3], Prof. B. H. Pansambal[4]

[1,2,3]Final year students, E&TC Department, TSSM's BSCOER, Pune, Maharashtra, India
[4]Professor, Department of Electronics and Telecommunications Engineering, TSSM's BSCOER, Pune, Maharashtra, India

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Abstract - Electrical power is the rate at which electrical energy is converted to another form, such as motion, heat, or electromagnetic field. Usage of power turns to be necessity for every work in today's world. To make our daily routines comfortable, the electronic devices are used in large numbers. To generate voltage from footsteps or vehicles the piezo sensors are mounted below the platform. To generate maximum output voltage the sensors are placed in series-parallel arrangement. This is then given to our monitoring circuitry. The circuit is the micro-controller based circuit that displays output voltage on Liquid Crystal Display. Also, it consists of a USB port where a user can connect cables to charge his/her cell phone. The current is then distributed using (radio-frequency identification) RFID cards so that only an authorized person can access to the system. Thus, we charge a battery using power generated from the footsteps and is display it on LCD using a micro-controller circuit and allow for mobile charging. Major components of our system are Piezo-Sensors, micro-controller ATMEGA328P, LCD and RFID tags.

Key Words: Piezo-Sensors, ATMEGA328P, LCD ,RFID tags, Rechargeable Battery, Quartz.

1. INTRODUCTION

Energy is the ability to do work. Its consumption is increasing rapidly. Electricity is generally generated from resources like water, wind, coal, etc. for generating the electricity from these resources big plants are needed which requires high maintenance and high cost. It is the responsibility of the present development to give alternative solutions for electrical power generation from which the expanding human population that does not affect the natural resources. For an alternate solution to generate electricity there are number of methods by which electricity can be generated, out of these methods piezo-sensor energy generation can be an effective method to produce electricity.

1.1 Aim of project

The aim of our project is to generate power using non-conventional method due to shortage of coal, oil, natural gas and utilize the produced power for charging.

2. METHODOLOGY

2.1 Working Principle

The system in our project works on piezoelectric effect. It is the ability of certain materials to generate an electrical charge in response to applied mechanical stress. we are using piezoelectric sensors, which is a device that uses the piezoelectric effect to measure the changes in pressure, acceleration, strain, or force by converting them to an electrical charge.

2.2 System Model

In the our proposed system we are using piezo sensors and RFID tags. This system is installed at crowded places like railway platforms, roads, shopping malls, schools etc. In this system we have used piezo sensor plate. After applying pressure on piezoelectric plate, voltage is developed across the plate. That voltage is stored in the battery for charging purpose. This is then provided to our monitoring circuitry. LCD is interfaced with a piezo-sensor using a micro-controller that allows the user to monitor the voltage and displaying purpose.RFID(radio-frequency identification) is interfaced with the micro-controller to give access to the authorized users & it consists of a USB mobile phone charging point where the user can connect cables to charge the mobile phone.

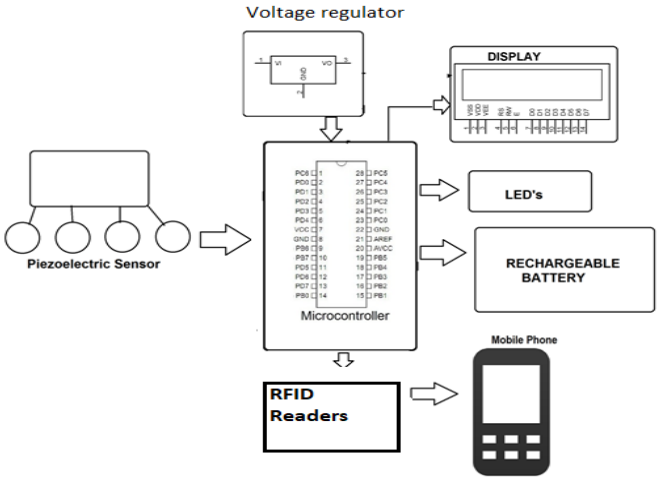

Fig -1: System Model

3. MODELING AND ANALYSIS

Main components of our project are LCD, RFID tags, Piezo-sensors, Lead acid battery.

3.1 16x2 LCD Display

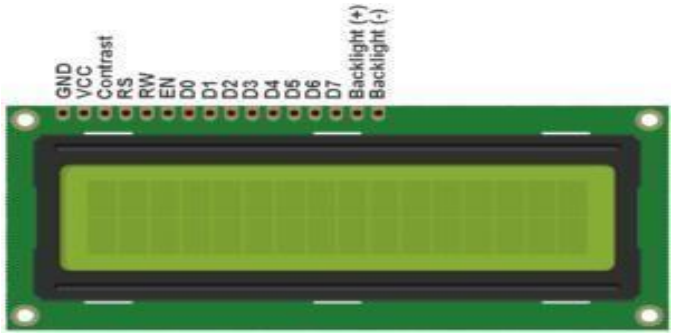

Fig -2: 16x2 LCD Display

The term LCD stands for liquid crystal display. This is an alphanumeric LCD display module, which means it displays alphabets as well as numbers. It consists of two rows and each row can print 16 characters. It has an operating voltage of the LCD is 4.7v – 5.3v.

3.2 Atmega328p

Fig -3: Atmega328p Microcontroller

Atmega328p is 8-bit RISC-based microcontroller combines 32 KB ISP Flash memory with read-while-write capabilities, 1KB 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 Two-Wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-and 5.5 volts.

3.3 Piezo-sensor

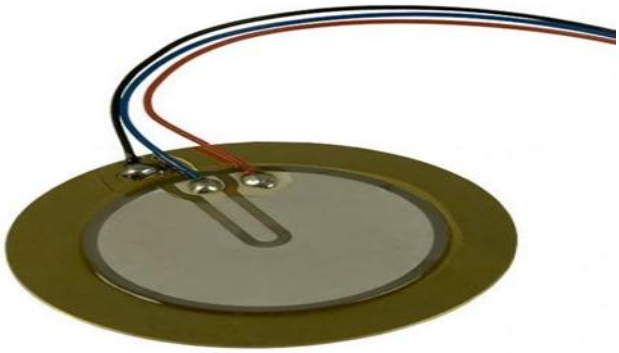

Fig -4: Piezo – Sensor

A piezoelectric sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge. The prefix piezo- is Greek for 'press' or 'squeeze'. It uses quartz material. Piezo sensor is made by Quartz crystal which is made up of Sio2 atom structure.

3.4 RFID reader

Fig -5: RFID reader

A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader. It has an operating frequency of 13.56MHZ.

4. Prototype Model

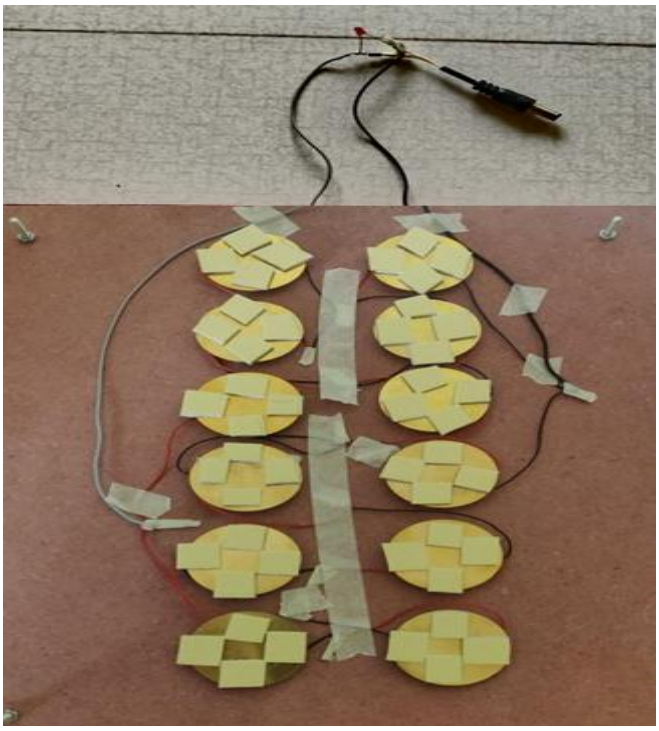

Fig -6: Piezo – Array Plate

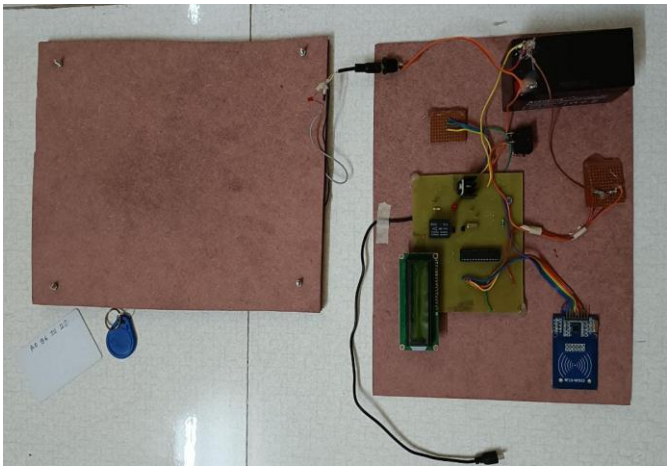

Fig -7: Prototype Model

In the above prototype model, We have used Piezo-Array which consists of 12 piezoelectric sensors in a wooden plank connected in a series-parallel combination. Serial connection increases the voltage and parallel connection increases the current so obtain stable voltage and current used series-parallel combination connection also connected diode to convert generated AC voltage to the DC voltage and block reverse flow of the current and LED is used for indication purpose if voltage generates by pressing the wooden plank then LED glows. This generated voltage is stored in a 12v DC lead-acid rechargeable battery. The battery input is given to the voltage divider circuit to divide the voltage and readable to the Atmega328p microcontroller and the voltage regulator is connected which provides a specific range of voltage that can be tolerated by the microcontroller(5v) also relay is used for switching purpose to turn on and off the circuit. When switching on the circuit, the voltage regulator gives a specific voltage to the microcontroller, and the LCDs voltage is stored in a battery. Here implemented mobile charging application using power generated by piezo sensors, hence we have connected the RFID reader if the user is authorized then the user can charge their mobile otherwise LCDs access is denied.

5. CONCLUSIONS

Hence, we have developed a small-scale prototype which will generate the power using piezo sensors. By utilizing this prototype we can drive both A.C. and D.C. loads. This technique gives an effective power generation in very densely populated places. If this project is deployed then not only we can overcome the energy crises but this also contributes to create a healthy global environment.

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