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Organized by

Dhaanish Ahmed Institute of Technology, KG Chavadi, Coimbatore, Tamilnadu, India

Footstep Power Generation Using Piezoelectric Sensor

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ABSTRACT: Man has needed and used energy at an increasing rate for the sustenance and well-being since time immemorial. Due to this a lot of energy resources have been exhausted and wasted. Proposal for the utilization of waste energy of foot power with human locomotion is verymuch relevant and important for highly populated countries like India where the railway station,temples etc., are overcrowded all round the clock. When the flooring is engineered with piezo electric technology, the electrical energy produced by the pressure is captured by floor sensors and converted to an electrical charge by piezo transducers, then stored and used as a power source. And this power source has many applications as in agriculture, home application and street lighting and as energy source for sensors in remote locations. This paper is all about generating electricity when people walk on the Floor. Think about the forces you exert which is wasted when a person walks. The idea is to convert the weight energy to electrical energy The Power generating floor intends to trans- late the kinetic energy to the electrical power. Energy Crisis is the main issue of world these days. The motto of this research work is to face this crisis somehow. Though it won't meet the requirement of electricity but as a matter of fact if we are able to design a power generating floor that can produce 100W on just 12 steps, then for 120 steps we can produce 1000 Watt and if we install such type of 100 floors with this system then it can produce 1MegaWatt Which itself is an achievement to make it significant.

I. INTRODUCTION

The proposal emphasizes the increasing population and energy demand, coupled with the rise in energy wastage. To address this, the concept of converting wasted energy, particularly from human locomotion, into usable power through piezoelectric sensors is introduced. These sensors convert pressure into voltage, enabling the generation of electricity from footsteps. The project aims to implement this system in public places like bus stands, theaters, railway stations, and shopping malls, where people walk frequently. Piezoelectric sensors measure force and pressure, converting them into electric signals. The system includes components like voltmeters, LED lights, weight measurement systems, and batteries for demonstration. Overall, this approach not only generates power but also conserves natural energy resources.

II. LITERATURE SURVEY

The history of piezoelectric circuitry development showcases significant advancements in maximizing efficiency and sensitivity:

1. 1929: U.S. Navy researchers focused on crystal dimensions, leading to the design of the "Curiecut" or "Zero Cut" crystals, which effectively controlled oscillations and acted as voltage controlling devices.

2. 1985: Sandia Laboratories explored the use of piezoelectric sensors in handwriting dynamics for electronic identification. This study demonstrated high sensitivity to marginal pressure changes, distinguishing genuine signatures from forgeries.

3. 2000: Research on piezoelectric applications in wireless sensing revealed its potential in industrial and military contexts, where traditional power sources are unavailable. Techniques for efficient power conversion, usage, and storage were developed for energy harvesting data transmitters.

4. 2005: The United States Defense Advanced Research Projects Agency (DARPA) initiated a project to power battlefield equipment using piezoelectric generators embedded in soldiers' boots. However, discomfort from the

additional energy expended led to the abandonment of thiseffort.

In the current project, the focus is on utilizing piezoelectric crystals and films in high vibration systems with efficient arrangements to achieve higher efficiency. Additionally, the amplification level is designed to produce considerably higher output ratings compared to previous systems. These advancements aim to maximize energy harvesting potential while minimizing discomfort or adverse effects on users.

III. NEED OF SYSTEM

The Utilization of the Waste Energy foot Power With human motion is very important and 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.

IV. PIEZOELECTRIC SENSOR

A piezoelectric sensor operates by utilizing the piezoelectric effect, which converts mechanical stress or pressure into an electrical charge. When a force is applied to the sensor, it generates an electric charge across its faces, which can be measured as a voltage proportional to the pressure. These sensors are versatile and find applications in various industries such as healthcare, aerospace, consumer electronics, and nuclear instrumentation. Piezoelectric sensors are capable of measuring changes in pressure, acceleration, temperature, strain, or force.

They are commonly used in applications involving flex motions, touch, vibrations, and shock measurement. Due to their high sensitivity and small size, they are well-suited for integration into everyday objects and devices.

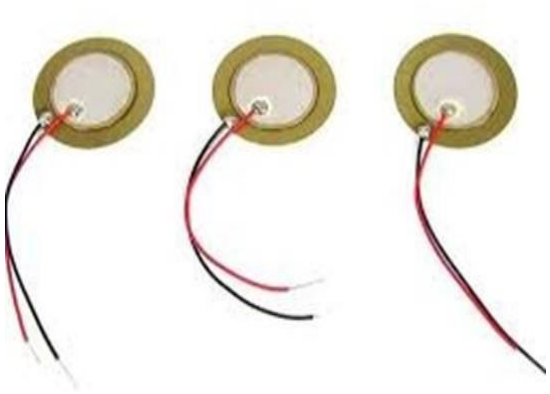

Fig .1. Piezoelectric sensor

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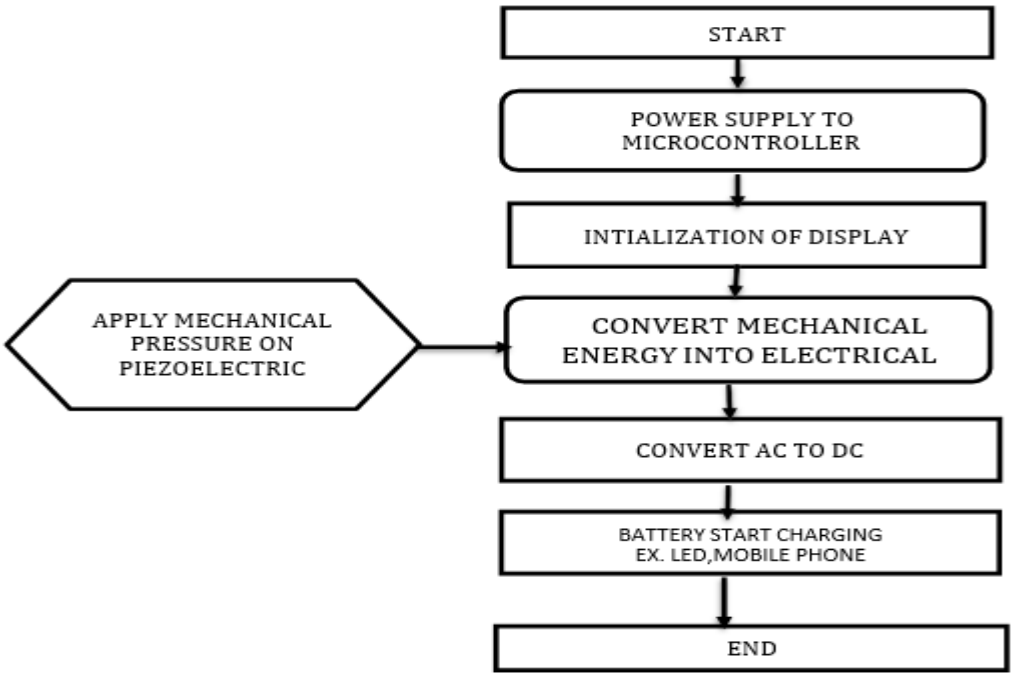
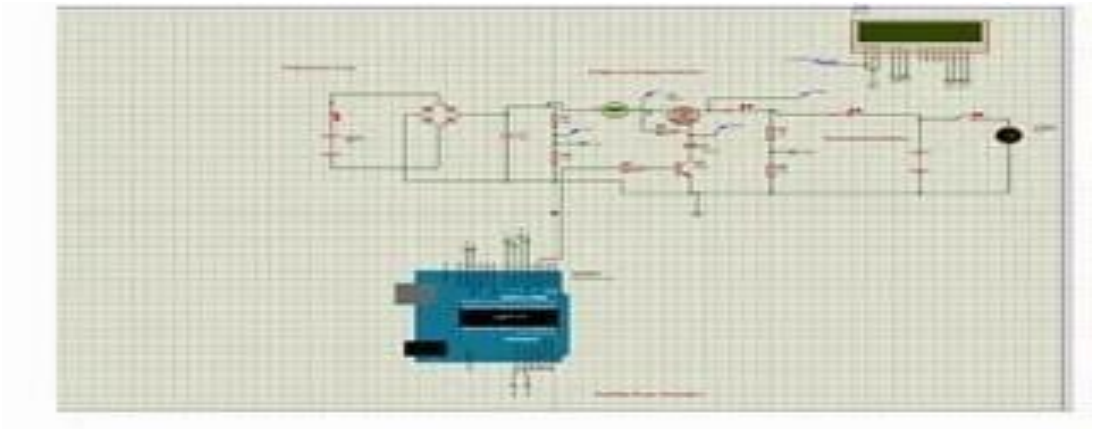
Tree Diagram:



V. STIMULATED DIAGRAM



WORKING: The described system utilizes several components to harness power from piezoelectricsensors and efficiently distribute it for various applications

1. Piezoelectric Sensors: These sensors detect pressure or force and convert it into an electricalcharge.
2. Voltage Boosters: Two voltage boosters are employed to increase the voltage output from thepiezoelectric sensors to a desired range (9V to 12V).
3. Voltage Regulator: Ensures a constant output voltage despite fluctuations, maintaining stabilityin the system.
4. PIC Microcontroller: Receives power from the battery and controls various functions of thesystem.
5. Battery: Stores the regulated voltage generated by the system.
6. Mobile Charging Socket: Provides a means to charge mobile phones using the generated power.
7. Buzzer: Alerts when the battery voltage falls below the required level for charging themicrocontroller.
8. Pull-down Resistor: Used in the mobile charging socket to regulate the voltage to the requiredlevel (5V).

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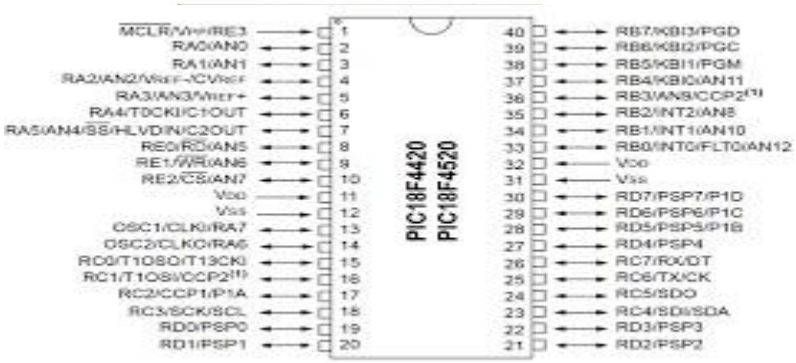
The system operates by harnessing power generated from footsteps without requiring any fuel input. It is designed for specific locations such as schools, colleges, cinema theaters, shopping complexes, temples, etc. However, it may have limitations such as the presence of mechanical moving parts, which can increase costs. Despite these limitations, the system offers a non-conventional approach to power generation and can be effectively implemented in various settings.

Microcontroller Unit: The main controlling unit of the entire system is a microcontroller. The input of the microcontroller is the output from the voltage generator. For the project PIC8F4520 is used The filter used removes the AC components from the output voltage of the sensor. It acts like a short circuit for ac voltage and open circuit for dc voltage. A LCD display is interfaced with the microcontroller**.**



PIN DIAGRAM

Voltage Booster: It is a DC to DC converter and output voltage greater than the input voltage. The device has at least to semiconductors and one energy storage element. It is a class of switched mode power supply.

Simulation Result: The simulation part of the project is carried out with the help of soft wares such as Mikro C and Proteus. LCD Display With the help of the block diagram the circuit design has been started. As the entire project has been controlled by the microcontroller; the design has been started from the controller IC PIC. The basic design now completed is the interfacing of PIC with the LCD display. Here, we are using a 16*2 LCD display. After the completion of this first step in circuit design the working is verified using the Proteus Software and coding has been written using Mikro e program for PIC.

Mobile Charging: Designed the external circuit connection the as per the block diagram by using PIC16F677.The input of the PIC is given from the piezo electric crystal. The output from 15th pin of the PIC is given as a socket input. The output from the socket is 5v which can be used for a mobile charging.

VI. FUTURE SCOPE

The piezoelectric crystals have being start better use with the positive result. In china and Japan, maximum public movement is observed in railway station, airports and shopping malls. Hence this place can be used for piezoelectric crystals for generation of electric power. Apart from all the above places attempts are made to develop energy from our daily life by initialing piezoelectric in shoes thus in each step piezoelectric crystal can be compressed which can turned enough power to charge a cell phone ,mp3 player etc. Through this we can generate electric power and used that for small electronic gadgets.

VII. USE OF PROPOSED SYSTEM

From time immemorial, human powered transport has been in existence in forms like running, walking etc. machines led to the enhanced use of human power in an efficient manner. Energy of human locomotion can be converted to electrical energy with the help of promising technologies. In this system, there is a sub flooring block of piezo electric crystals, which imparts an electrical current when people walk across it. The pressure polarizes the crystal there by separating the centers of positive and negative charges. Application of voltage on the crystal produces mechanical distortion of the material. Direct piezo electric effect, which is the phenomenon of generation of voltage under mechanical stress is employed in the system. The application of mechanical stress produces an electric polarization which is proportional to the stress. If the crystal is short circuited, flow of charge can be observed during loading.

PROBLEM FORMULATION & SOLVING:

1. As technology is developed use of electronics equipment also increased.
2. Conventional methods of power generation becoming insufficient.
3. It introduced a new problem, lack of power.
4. There is a need arises for an alternative power generation method.
5. At the same time energy is wasted in many form and one of them is due to the humanlocomotion.

ADVANTAGES AND DISAVANTAGES:

1. Advantages
2. Power generation is simply walking on step
3. No need fuel input
4. There is a non-conventional system
5. No moving parts long service life
6. Compact yet highly sensitivity
7. Self generating no external power required
8. Disadvantages
9. Only applicable for the particular place
10. Intial cost of the arrangement is high
11. Output affected by temperature variations
12. Crystal is prone to crack if overstressed

VIII. CONCLUSION

In this project, we are generating electrical power as non-conventional method by simply walking or running on the foot step. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy using foot step is converting mechanical energy into the electrical energy. By using this energy conservation theorem and Piezo sensor we are proposing a new method for 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.

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