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ADVANCED FOOTSTEPS POWER GENERATION SYSTEM

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Abstract: 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 increasing in many ways. So, reforming this energy back to usable form is the major solution. In this footstep power generation project, we are generating power with the help of human's footsteps; this power is then used to charge battery. The power is stored in a battery that can be used to charge a mobile phone using RFID card. This system is powered by Atmega 328 microcontroller, it consists of Arduino IDE, RFID sensors, USB cable and LCD. When we power on the system, the system enters into registration mode. We can register three users. Once all the user is entered in the system then the system asks to swipe the card and connect the charger. Initially all the user is given by 5 minutes of charging time as default. When we swipe the card and if the user is authorized, the system turns on for charging and will charge the Mobile phone. If the user is un-authorized then the system will display as unauthorized user, just in case if the user wants to stop the charging in midway the user needs to swipe the card again. As soon as the card is swiped again, the remaining time balance is displayed and the charging stops. In order to recharge a card, we need to press recharge button which is on the system, and then system will ask to swipe the card, once the user swipes the card, it adda more 5 minutes to the particular card of the user.

Keywords: ATmega328P, Piezoelectric Sensor, LCD's, Crystal Oscillator, Resistors, Capacitors, Transistors, Cables & Connectors, Transformer/Adapter, PCB.

I. INTRODUCTION

Energy is nothing but the ability to do the work. In day-to-day life, Electricity is most commonly used energy resource. Now-a-days energy demand is increasing and which is lifeline for people. Due to this number of energy resources are generated and wasted. Electricity can be generated from resources like water, wind etc. to generate the electricity from these resources development of big plants is needed having high maintenance cost. Some other energy resources are also costly and cause pollution. They are not affordable to common people. Electricity has become important resources for human being hence, it is needed that wasted energy must have to utilize, walking is the most common activity done by human being while walking energy is wasted in the form of vibration to the surface. And this wasted energy can be converted into electricity. Using the principle called piezoelectric effect. Piezoelectric effect is the effect in which mechanical vibrations. Pressure or strain applied to piezoelectric material is converted into electrical form. This project gives idea about how energy is used on stepping on stairs. The use of stairs in every building is increasing day by day even small building has some floors when we are stepping amount of this wasted energy is utilized and converted to electricity by Piezoelectric effect. Piezoelectric effect is the effect of specific materials to generate an electric charge in response to applied mechanical stress.

II. OBJECTIVE

This project aims to convert mechanical energy from footstep, walking, and running into electrical energy, thereby utilizing the wasted energy in a useful manner. The generated power can be utilized for various purposes, such as illuminating road lights, operating traffic signals, and powering electronic devices that require low power. The primary objective is to use transducers to convert the mechanical energy into electrical energy and store it in energy storage devices, which can be used later as per the requirement.

III. LITERATURE REVIEW

- **Shivani Mahesh Pandit: June 2021**

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The demand for electrical energy is expected to rise steadily in near future. Contemporary methods of generating electrical power are harmful to the environment. Footstep power generation is one of the sustainable electric energy generation techniques which is environment friendly. India can exploit its large population, to generate footstep power to satisfy the growing demand for electricity. This paper has proposed an Advanced footstep power generation system which apart from generating and storing electric energy, provides the facility of remote monitoring and controlling. ANN is used to detect the sensor location which is faulty. The system is able to charge a 12V lead battery completely within 10 minutes using a single person (weighing 45 kg) footstep. This battery then further drives two loads – a DC fan and LED for approximately 30 minutes. Charging voltage can be easily scaled up by increasing the number of piezoelectric sensors. An Android mobile app has been developed to monitor and control the system remotely. The ANN is able to detect location of the faulty sensor with 74% accuracy.

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- **Anu.R. Reddy: June 2018**

Energy consumption represents the development of the universe. Modern world requires a large amount of electrical energy to meet the current demand. But the conventional energy resources are diminishing steadily as a result of vast consumption of energy. So, alternate energy sources are required not to fill up the gap between demand and supply of electricity but also, they should be clean, Eco-friendly and sustainable. The main aim of this project is to meet the Energy crisis. This paper is about the generation of electricity through footsteps. The idea is to utilize the force (i.e., weight energy) exerted on the floor when a person walks. The power generating floor intends to translate the mechanical stress applied on the floor to electrical power using piezo sensors. This technique utilizes piezoelectric components where deformations produced by different means are directly converted into electrical energy via piezoelectric effect. In this project we are generating electrical power as a nonconventional method by simply walking or running on the piezo plates. Nonconventional energy system is very essential at this time to our nation.

- **Neha Salunke: January2020**

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 technology.

IV. METHODOLOGY/EXPERIMENTAL

In this electric power is generated as non-conventional method. Thus, the generation of power is by walking or running on foot step. At this time non-conventional energy is very important. This system introduces power generation using nonconventional energy which does not need any input to generate electrical output. In this conversion of force energy into electrical energy takes place.

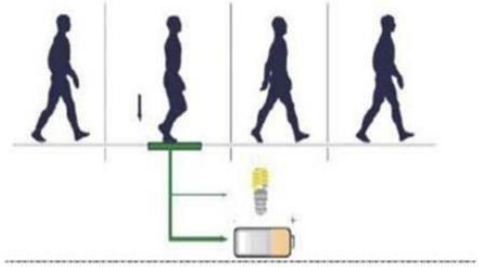

Fig. **1** schematic representation of the working model.

Working:

Key concept of working of this system is capturing unused energy from surrounding any system and converting it into electrical energy. The piezoelectric placed under insulating material like hard rubber and pressure created by foot step and water all pressure will produce electrical energy which can be stored and used for domestic purpose. The property of Piezoelectric Material is to generate electricity when we apply pressure. It has two axis, mechanical axis & electrical axis. When we apply pressure in mechanical axis, it generates power in its electrical axis. Piezo means the generation of the electrical polarization of a material as a response to mechanical strain. This phenomenon is known as direct effect or generator effect and is applied fundamentally in the manufacture of sensors (mobile phone vibrators, lighters, etc.). In these cases, piezoelectric materials, also used in actuators, undergo an inverse or motor effect, i.e., a mechanical deformation due to the application of an electrical signal.

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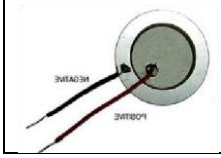
Hardware requirements:

1. Piezoelectric Sensor: 	A piezoelectric sensor is a device that produces an electrical signal when it's squeezed or vibrated. It's used for measuring pressure, vibration, and acceleration in various applications, including medical and industrial equipment. They are sensitive, respond quickly, and are affordable, but can be affected by temperature changes.

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2. ATmega328P 	ATmega328P is a microcontroller used in embedded systems with 32KB flash memory, 2KB SRAM, and 1KB EEPROM. It has various peripherals and is compatible with the Arduino platform.
3. Rechargeable Battery 	A rechargeable battery can be reused multiple times after being discharged. It can be recharged through various methods and is commonly used in portable electronics and larger applications like electric cars. Rechargeable batteries are an eco-friendly and cost-effective alternative to disposable batteries.
4. LED Stripe 	An accelerometer is a sensor that measures the acceleration of an object in motion. It can detect changes in velocity, tilt, and vibration and is used in various applications like motion sensing, navigation, and gaming.
5. PCB 	PCB is an insulating board with conductive pathways that connect electronic components, creating a complete circuit. They are used in almost all electronic devices, designed using software, and manufactured using various techniques. PCBs allow for compact, efficient, and reliable electronic circuitry.

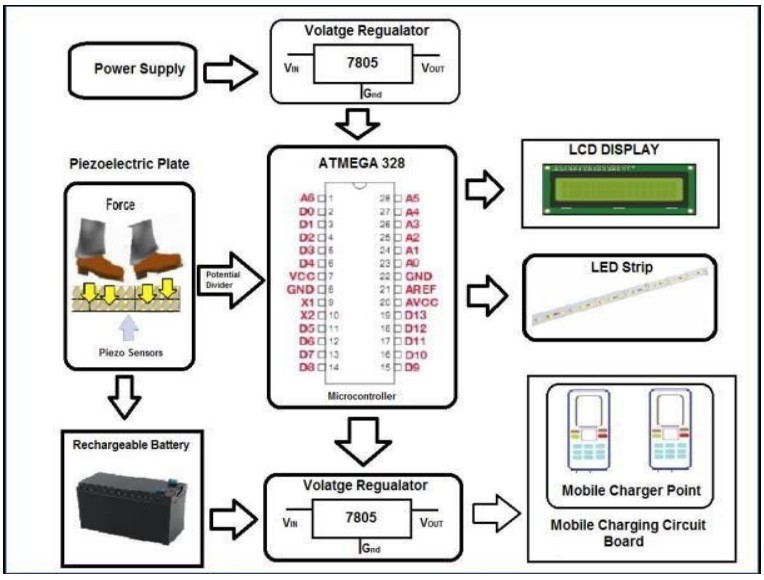

Fig. **2** Block Diagram.

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V. RESULTS AND DISCUSSIONS

In this project, a 16*2 LCD Module is interfaced with ATmega328P to display the voltage produced by a piezoelectric tile/board for each step taken, the number of steps, and the number of calories burnt. The pressure applied on the piezo board/tile due to several steps charges a rechargeable 12V lead-acid battery. This battery, with the help of an inverter circuit, can power low power AC appliances. This principle can be applied to speed breakers at highways, where the rush of vehicles increases the input torque, ultimately producing voltage. If we apply this strategy to busy corridors, we can develop efficient electricity for various purposes.

This technique can also be utilized in rural areas where power is scarce or non-existent, particularly in developing countries like India, where energy management is a major concern.

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VI. FUTURE SCOPE

- Utilizing wasted energy is relevant for highly populated countries in the future.
- Japan uses piezoelectric flooring tiles to store energy from vibrations caused by people walking on them.
- The tiles contain a piezoelectric material that generates electricity when it senses movement, and the energy is stored in a battery.
- The generated energy can be used for lighting or street lights.
- Europe has implemented piezoelectric crystals in dance floors in nightclubs, generating electricity when compressed by dancers' feet.
- Constant compression generates more energy.

VII. CONCLUSION

- The project aims to generate electrical power using a non-conventional energy system.
- The method uses the energy from walking or running on footstep for power generation.
- Waste energy from human locomotion can be utilized in highly populated countries like India and China.
- Crowded areas like roads, railway stations, bus stands, and temples can be used for power generation.
- The proposed method utilizes the energy conservation theorem and Piezo sensor for efficient power generation.

VIII. ACKNOWLEDGMENT

We cannot express enough thanks to our college GS Moze college of engineering Balewadi,Pune, for giving us this golden opportunity and platform to perform our project. We will also like to thank **Prof. Harshalata Toke** for guiding and supporting us throughout the project. We wouldn't have been able to complete this project without her guidance.

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