

Advanced footsteps power generation using RFID for charging

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Abstract: Energy is just the capacity to perform tasks. For the modern human population, power has become a source of assistance. Its demand is growing quickly. For its many operations, daily living innovation requires a significant amount of electrical power. The main source of pollution in the world is power generation. As a result, a lot of energy resources are created and squandered. Generally speaking, resources like water, wind, coal, etc. are used to create electricity.

High maintenance and expense are required for the building of large facilities in order to generate power from these resources. In a similar vein, the current work aims to provide a method for producing electrical power from which a continuously rising human population does not adversely influence natural resources. This invention is based on a principle known as the piezoelectric effect, according to which some materials can generate an electrical charge when they are subjected to weight or other strain.

The ability of some materials to produce an electric charge in response to applied mechanical stress is known as the piezoelectric effect. It is the process through which strain, pressure, or mechanical vibrations are given to piezoelectric material are transformed into electrical form. Piezoelectricity refers to a few materials' abilities to create an electric potential when subjected to a linked weight. The implanted piezoelectric material can produce the illusion of changing weight when people are moved into an electric current that is stored in a battery and then disseminated via RFID cards.

Keywords: power generation, piezoelectricity, RFID, battery

I. INTRODUCTION

Researchers and engineers are constantly searching for novel solutions to address the rising need for clean and sustainable energy in today's world. The development of footstep power production, a technique that seeks to harness the energy that's produced by human steps and transform it into electrical energy, is one such approach.

This technology has a lot of potential to offer a clean, sustainable source of energy. The piezoelectric effect serves as the foundation for the production of foot power, also known as piezoelectric energy harvesting. This phenomenon happens when certain substances, such as polymers or piezoelectric crystals, produce an electrical charge in reaction to pressure or mechanical stress. It is now feasible to harvest and transform the energy produced by footsteps into useful power by carefully positioning piezoelectric materials in areas with high foot traffic.

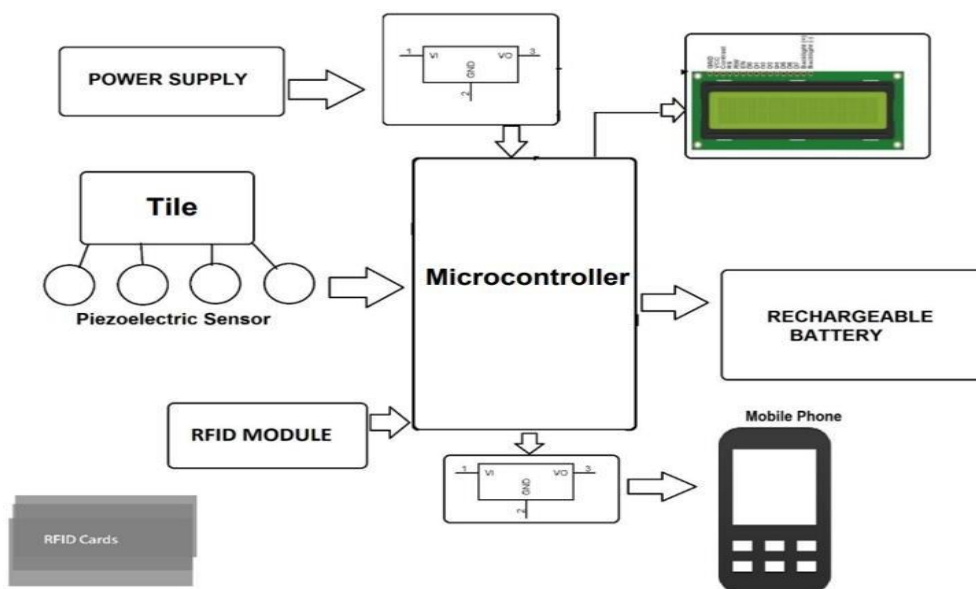
Thermal and wind energy will be used for power generation. Therefore, only these power sources are used by everyone. This technique is utilized to create an RFID-based, far more environmentally friendly manner of electricity generation, which reduces global warming and power shortages. This technology, which uses piezoelectricity, is utilized to produce electricity using renewable energy sources. The system keeps track of the piezo sensor output parameters and energy levels that are shown on the LCD. The cellphone is charged using the piezo sensor's energy. The solution employs RFID technology to charge the mobile phone battery with the aid of a USB point.

This project basically works on 3S' i.e. Step, Store, Supply. When the human step exerts its pressure on the tile then the mechanical pressure will get concentrated, by the membrane in the sensor, on the quartz crystal. Due to this strain, the positive and negative charges present in the crystal get separated thus creating potential differences. Later this generated power needs to be stored in a rechargeable battery so that it can be used at a later point in time. At last, when a registered user with sufficient balance in the account tries to access the service, they will be able to do so.

II. LITERATURE SURVEY

| Paper Title | Author names | Journal details (IEEE format) | Pros of paper | Cons of Paper |
|--|--|---|--|--|
| Power Generation Using Footsteps for Mobile Charging | S.Ganesh Prabhu, Keerthivasan.G, Naveen kumar.A, Jeevananthan.N | 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS) | The main working of this project depends on piezoelectric effect, which converts pressure into electrical energy. | Only applicable for the particular place. |
| Foot Step Power Generation System Using Electronic Device | Prabhavathi KI, Vinay Kumar K2, Channakeshava P C3, Rajesh C R 4, Puneeth Kumar C S5 | International Research Journal of Engineering and Technology (IRJET) © 2017, IRJET Impact Factor value: 5.181 ISO 9001:2008 Certified Journal 1 | . It can be used for charging devices e.g. laptop, mobile, etc. | Initial cost of this arrangement is high. |
| Advanced Footstep Power Generation System to Charge E-Vehicles | Lavanya B, Jeevan P, Sachin V Maiya, TejasKC | Published (First Online): 04-08-2020 ISSN (Online) : 2278-0181 Publisher Name : IJERT | This project describes the use of piezoelectric materials in order to harvest energy from people walking vibration for generating and accumulating the energy. | Care should be taken for batteries in case of website and app failure. |

III. BLOCK DIAGRAM



1. **Microcontroller:** The microcontroller is a vital part of this project. It used for RFID modules, taking input from the battery, for the output through the USB port, and displaying the status on an LCD display.
2. **RFID module:** it is used to make the filtration of the users approaching. Only if the user is registered and has a sufficient balance, will be able to access the service.
3. **Piezoelectric sensor:** This is the heart of the project. It will convert the mechanical pressure into the electrical power which will be further stored in the rechargeable battery.
4. **LCD display:** This will be displaying the status of the user and other relevant information.

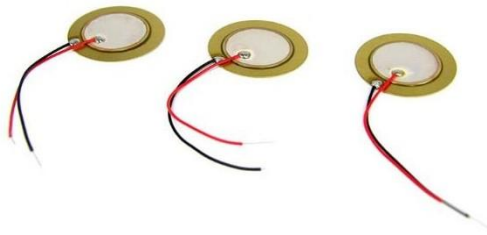
IV. COMPONENTS

1. ESP32 Microcontroller:



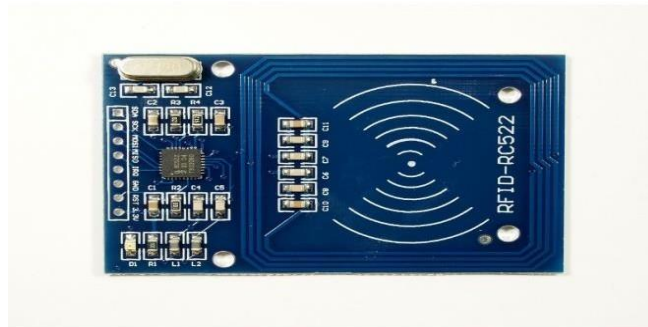
Espressif Systems created the potent microcontroller known as the ESP32. It has a dual-core 32-bit processor, integrated Wi-Fi and Bluetooth, and a large selection of GPIO ports. It is adaptable for IoT applications since it supports a variety of programming languages and development environments. The ESP32 is a well-liked option for creating linked devices because of its integrated power management and wide range of peripherals.

2. Piezo Sensor:



A piezo sensor is a type of sensor that measures changes in pressure, force, or acceleration using the piezoelectric effect. It is made of a piezoelectric substance, usually a crystal or ceramic, which, when put under mechanical stress, produces an electric charge. Piezoelectric material deforms when pressure or force is applied to the sensor, producing a voltage output proportional to the applied force. Due to their sensitivity and quick reaction time, piezo sensors are frequently employed in applications including touch sensing, vibration detection, and acoustic measurements.

3. RFID card reader:



The RFID reader is a network-connected gadget that may be carried about or fixed to a surface. It sends signals that turn on the tag using radio waves. After being turned on, the tag returns a wave to the antenna, where it is converted into information.

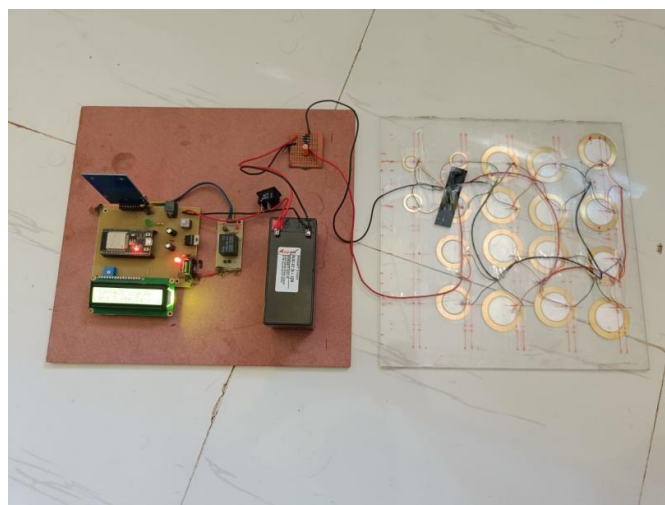
4. LCD display 16*2:



With a 16x2 LCD, there are 2 lines that can each display 16 characters. Each character on this LCD is presented using a 5x7 pixel matrix. The 224 distinct letters and symbols may be shown on the 16 x 2 intelligent alphanumeric dot matrix display. The Command and Data registers on this LCD are its two registers.

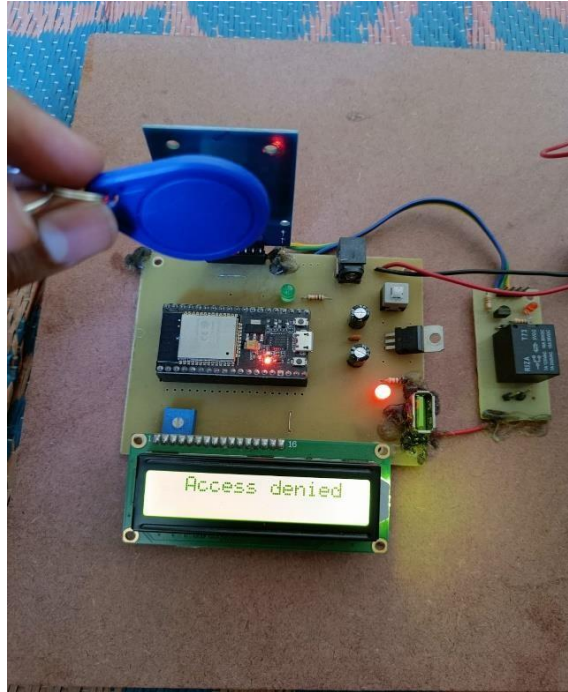
V. RESULT

The current model exhibits a feature that integrates all of the hardware elements that have been used and created in it using ESP32. Each and every module's presence has been carefully considered and positioned. As a result, the "Advanced Footstep Power Generation System Using RFID for Charging" has been built to the best of its ability. Second, only allowing authorized people charge mobile devices using RFID technology. The charge produced by our footsteps may be seen on LCD via this technology. As a result, the project's design and testing were successful.

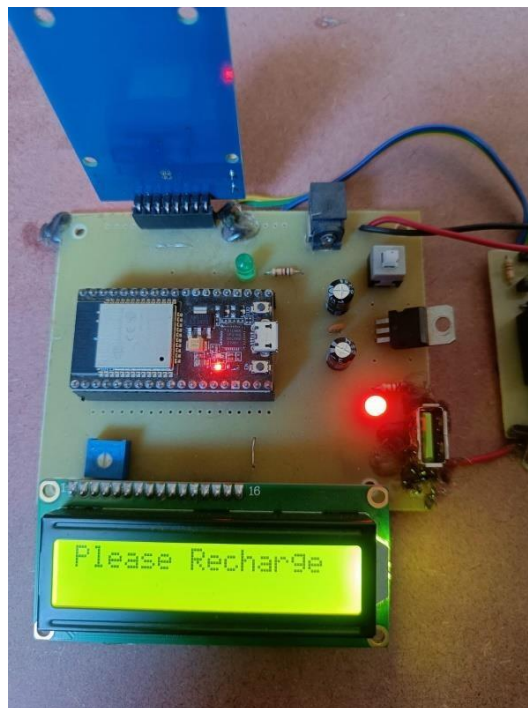


Implemented model of the project

The above figure is the implemented model of the project. As one can observe this is the condition after switching it ON. The LCD display, and microcontroller, are in ON condition.



Detection of unregistered consumer card



Detection of registered consumer card (with insufficient balance)

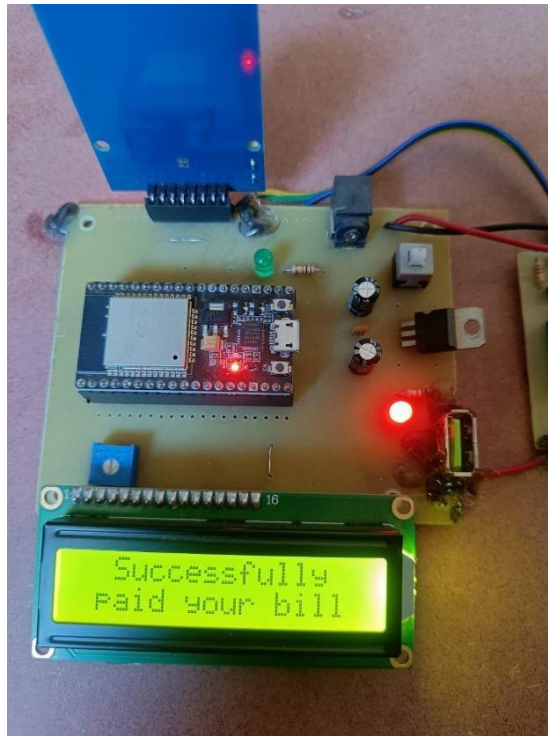


Fig. 3.3 Detection of registered consumer card (with sufficient balance)

In the above figures, one can observe that there are three conditions for an RFID card reader.

1. **Unregistered consumer:** this is the case when the consumer is unknown to the system since there is no registration done by them. In such cases, access will not be given to them to use the product service. The term “Access denied” is displayed on the LCD screen.
2. **Registered consumer (with insufficient balance):** this is the case when the consumer is known to the system but the balance, they have is not sufficient. In such cases, again access will not be given to them to use the product service. The term “Please Recharge” is displayed on the LCD screen.
3. **Registered consumer (with sufficient balance):** this is the case when the consumer is known to the system and they have sufficient balance to proceed to access the product service. The term “Successfully paid your bill” is displayed on the LCD screen.

VI. CONCLUSION

The proposal is successfully tried and actualized, making it the best conservative, practical solution for our country's regular population. This can be used in some situations where access to controls is restricted or completely absent, such as in rural areas. India is a developing country, where the enormous population presents a significant challenge for energy management. We can control both A.C. and D.C. loads with this job, depending on the power we provided to the piezoelectric sensor. This method provides efficient power generation in densely inhabited areas since it reduces control demands without contaminating the environment. Only 11% of renewable energy sources actually contribute to our vitality. If this project is successful, we will be able to solve the global energy crisis as well as bring about significant environmental change.

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