iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** III **Month of publication:** March 2026

DOI: https://doi.org/10.22214/ijraset.2026.78208

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

Foot Step Power Generation Using Arduino

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Abstract: ***People just keep multiplying. Cities get bigger, factories never seem to stop, and all that progress chews throughmoreenergyeveryday.Mostofour electricitystillcomesfromburningcoal,oil,and gas.Notonlyare those fuels running out, they're wrecking the planetthink smog, rising temperatures, wild weather, the whole climate change mess. So, we've got to get smarter about where our power comes from. This paper digs into a prettyclever idea: making electricityfrom footsteps. Thewhole setup uses piezoelectric plates hooked up to an Arduino. Step on a plate, and the pressure turns into a tiny burst of electricitythat's the piezoelectric effect in action. The system smooths out those jolts and stores the energy in a battery or capacitor, so it's ready to use. The Arduino tracks how much power the system collects and shows the numbers on a small LCD. One step doesn't give you much, but drop a bunch of these sensors in busy placestrain stations, malls, schools, sidewalks and suddenly you're collecting real energy. The best part? It's simple, cheap, and actually green. Perfect for running LED lights, sensors, or other small gadgets. Bottom line: harvesting energy from footsteps could help future cities get smarter and cleaner. It's a small stepyeah, pun intendedbut it points toward amore sustainable way to power our lives.***

I. INTRODUCTION

Electricity is basically the backbone of our lives now. It lights up our rooms, keeps hospitals running, powers schools, moves buses and trains, and charges all those devices we can't live without. As cities keep spreading out and technology keeps evolving, we just want more and more power. The catch? Most of it still comes from the usual suspectscoal, oil, and gas. That's where things get messy. These fuels aren't just running low; they're also wrecking the environment. Burning fossil fuels doesn't just use them up it chokes the air with pollution and pumps out greenhouse gases, which heat up the planet and mess with the climate. So, we really have to get serious about cleaner, renewable energy. And soon. But here's something people barely notice:every time we walk through busy spots like train stations, malls, airports, or stadiums, we actually createenergy. Most of it just disappears wasted without a second thought. This is where things get interesting. Footstep power generation is all about capturing that leftover energy. It relies on the piezoelectric effect, which is just a fancy way of saying some materials make electricity when you press or step on them. Put a layer of these piezo plates under the floor, and suddenly every footstep gives off a little bit of power. One step isn'tmuch on its own, but in a crowd, those little jolts add up. You can use that energyto run LED lights, sensors, or small screens stuff that doesn't need a ton of power. Now, add Arduino to the mix and things get even better. Arduino helps you collect and control the energy as it comes in. It's cheap, easy to set up, and works pretty much anywhere classrooms, research projects, or out in the real world. So, using footstep power with piezo plates and Arduino isn't just some science fair project. It's a practical way to make our spaces cleaner, smarter, and more efficient for everyone.

II. LITERATURE SURVEY

Let's get into where this idea really starts. For years, researchers have explored footstep power generation, piezoelectric energy harvesting, and using microcontrollers to handle everything. Digging through older studies gives you a pretty good sense of what's possible, what mistakes people made before,and how you can actuallyimprove yourown design.Piezoelectricityitself? That's not new. Back in 1880, Jacques and Pierre Curie discovered that if you squeeze certain crystals, like quartz or Rochelle salt, they give off an electric charge. Since then, people have found all sorts ofuses forpiezoelectricmaterials sensors,actuators,vibration detectors,and of course, energy harvesting. Lately, everyone's trying to turn movement vibrations, pressure, even just footsteps into electricity with these materials. Lots of teams have tried to grabenergy from everyday actions like walking or running. One footstep won't power much, but if you connect a bunch of piezo sensors together, you can boost the voltage or current. For example, research like Power Generation Using Piezoelectric Materials shows that wiring discs in parallel raises the current, and series connections push the voltage higher. People have built all kinds of experimental footstep power systems and tested them in busy places. Take the study Piezoelectric Floor for Energy Harvesting they installed piezo tiles in spots with heavy foot traffic, like train stations and malls. What did they learn? These systems do best where people are constantly walking by. Adding microcontrollers really changed the game. Arduino boards are a go-to because they're cheap, easy, and flexible.

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Researchers use Unos, Nanos whatever works to measure voltage, store energy, and even display results onscreens. Microcontrollers let you track things in real time, analyze data, and use the harvested energy way more efficiently. There's also the question of storing that energy. Most setups rely on capacitors or rechargeable batteries, so you still have power even when nobody's around. You also need voltage regulation circuits to keep everything stable and protect your electronics from sudden spikes. When you look at all of this, it's clear that piezoelectric footstep power systems are really meant for low-power stuff: LED lighting, sensor networks, maybe small gadgets. They're not going to replace the grid, but they do give you a green, extra source of energy.Thisprojectbuildsonall that pastwork bycreatingasimple,affordable, Arduino-based footstep power generator something anyone can use in schools, labs, or even out in the real world..

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III. PROBLEM STATEMENT

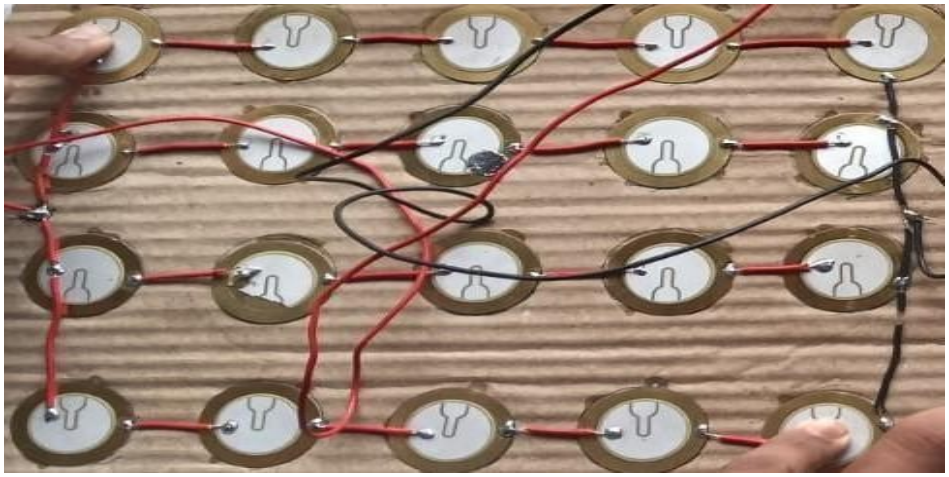
Energy use keeps going up, and everyone's getting more concerned about the environment. We really needfresh sources of power stuff that's clean, renewable, and doesn't cost a fortune. Just picture all the energylost from footsteps in crowded areas. It's everywhere, but we let it slip by. At the same time, old-school powerplants are expensive, dirty, and still depend on fuels that won't last much longer. We have to do better. Findinga straightforward, low-cost way to turn footsteps into electricity? That could actually change things..

IV. PROPOSED METHODOLOGY

Step on the walkway, and those hidden piezoelectric plates get to work. Your weight pushes them down, and— thanks to the piezoelectric effect theykick out an alternatingvoltage. That voltage doesn't stayAC for long; it goes straight into a bridge rectifier, which flips it into DC. Then a voltage regulator steps in to keep everything niceand steady, and the energygets tucked awayin acapacitoror arechargeablebattery. There's an Arduino in the mix, too. It keeps an eye on the voltage and flashes the numbers live on a 16×2 LCD screen. So, with this setup, you get efficient energy capture, smooth storage, and real-time data all in one tidy system.

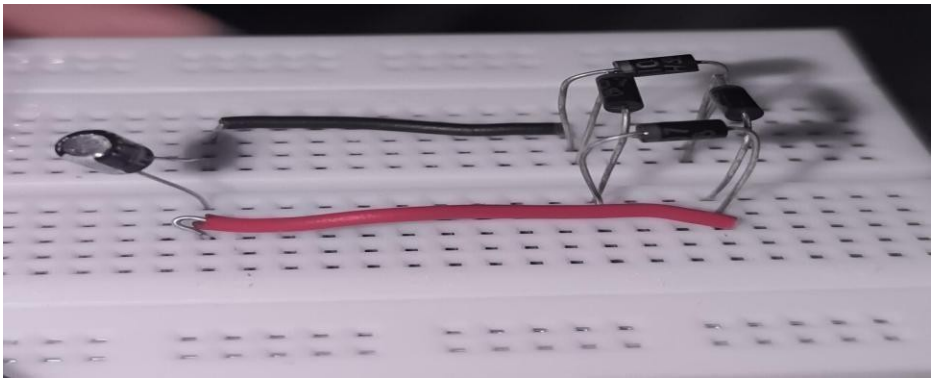
V. COMPONENTS USED

1) Piezoelectric Plate: These plates are where the magic happens. When someone steps on them, they squeeze out a little burst of electricity, all because of the piezoelectric effect. Stack a bunch of plates together and, just like that, you get more power. It's simple, really.



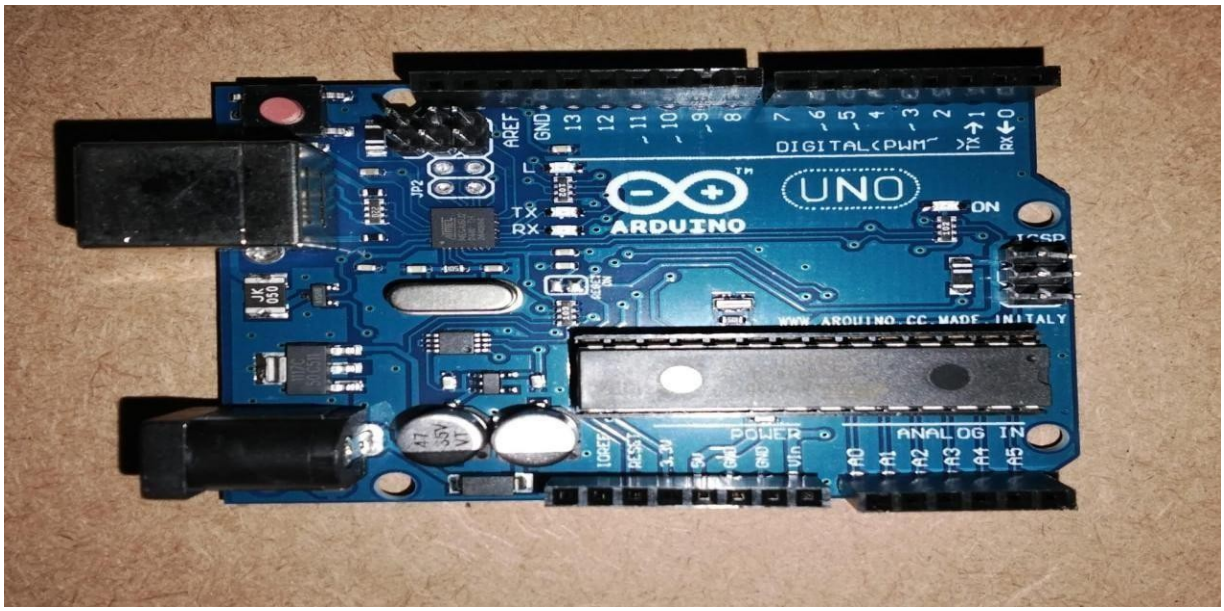
2) Bridge Rectifier:

Here's the deal—the electricity from those plates isn't exactly plug-and-play. It jumps back and forth, but most batteries want a steady, one-way flow. The bridge rectifier fixes that. It takes the wobbly current and straightens it out so everything works the way it should..



3) Arduino Uno Microcontroller:

ThinkoftheArduinoUno asthebrainsbehind it all. Itkeepstabsontheincomingvoltage,does the math, and pushes the results to the display. On top of that, it makes the whole setup easy

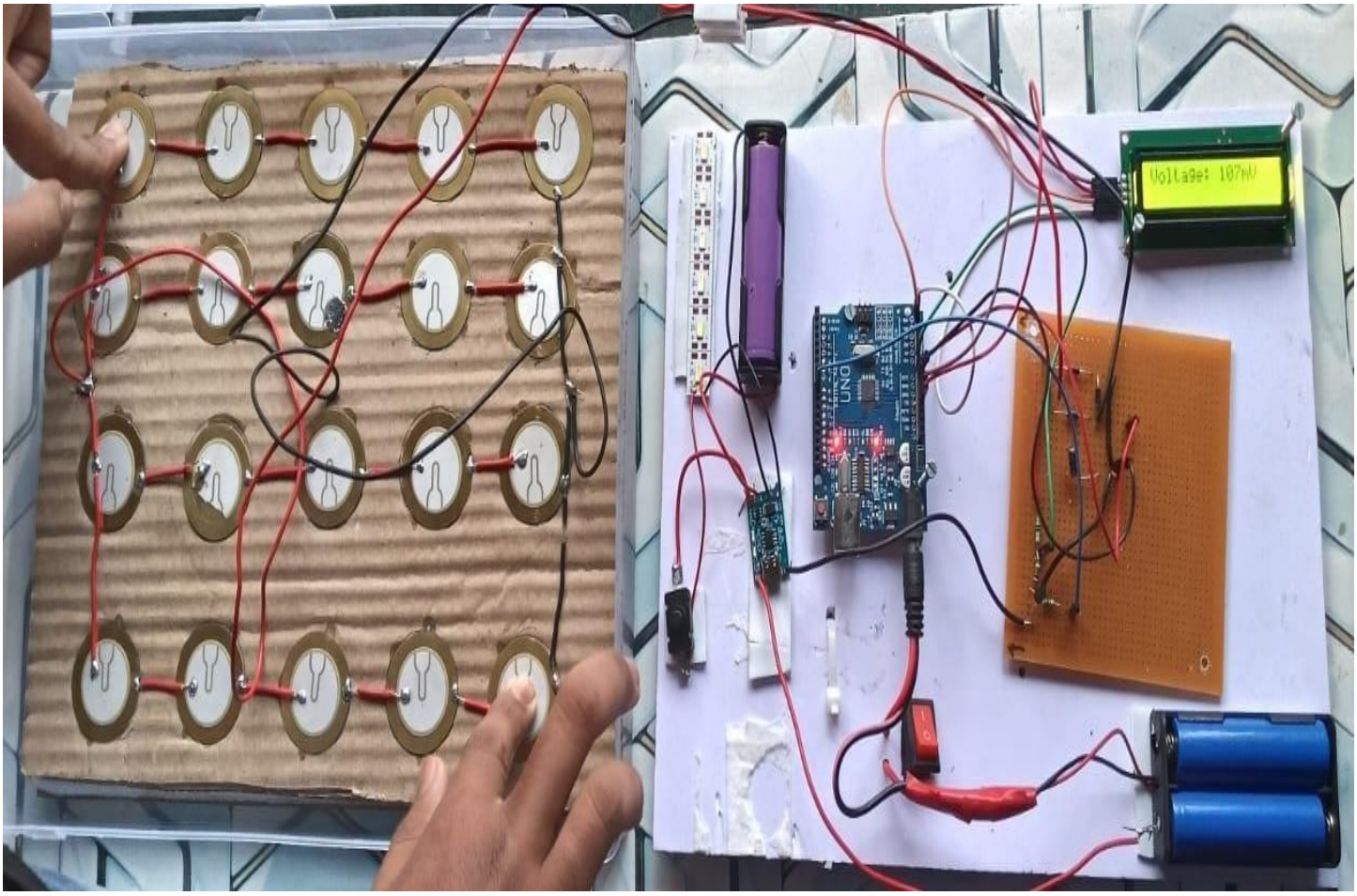


4) LCD Display(16×2):

This little screen lets you see what's going on. It tells you, right away, how much voltage those footsteps are producing. Nothing fancy, just a straightforward readout so you always know what's happening.



VI. RESULT



The Footstep Power Generation system was tested successfully. When pressure was applied to the piezoelectric plates, electrical voltage was generated because of the piezoelectric effect. A rectifier circuit converted the generated voltage from AC to DC, and it was stored in a rechargeable battery. The Arduino Uno measured the voltage through its analog input pin and displayed the value on the 16x2 LCD screen. The LCD showed real-time voltage readings whenever the plates were pressed. It was noted that the output voltage increased with the amount of pressure applied. Pressing multiple plates together produced a higher voltage than pressing a single plate. After storing enough energy in the battery, the connected LED light turned on when the switch was flipped. This confirmed that the system successfully generated, stored, and used electrical energy from mechanical pressure. Thus, the project effectively demonstrated small-scale renewable energy generation using human footsteps.

VII. FUTURE SCOPE

Footstep power generation has a lot of real-world potential, especially in busy spots where people are always on the move. Think about train stations, bus stops, malls, airports, schools, stadiums, or even just crowded sidewalks these places can actually turn all that foot trafficinto extra electricity. You can use the power for things like LED lights, digital displays, emergency lights, or charging small gadgets.

Looking ahead, there's room to make this system even better. Using newer, more efficient piezoelectric materials can boost how much energy you get from each step. The way the plates are arranged and how many you use makes a big difference, too. Tweak the platform's mechanical design and you'll squeeze out even more power from every footfall.

Energy storage matters as well. High-capacity batteries or supercapacitors help store more energy, so you get a steady power supply even when the crowd thins out. Hooking the system up to IoT tech lets you monitor and manage everything remotely, spot issues, and keep performance high. And if you combine this setup with other renewables, like solar panels, you end up with a hybrid system that's more reliable and efficient.

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All in all, with better technology and smart planning, footstep power generation can play a real role in making future cities greener and more sustainable. It's not just an idea it's something that can help power the places we live and move through every day

VIII. CONCLUSION

The footstep power generation system takes a simple, almost playful idea using piezoelectric plates andan Arduino to turn walking into electricity and makes it work. Just think about it: every step you take could help power something. It's a clever, earth-friendly way to use the energy we spill with every stride.

Youdon'tneedafancysetupordeep pocketsto buildthisthing. It's straightforward, soevenclassrooms or small public spaces can get in on the action. The piezoelectric sensors grab the pressure from yourfootsteps, and the system takescare oftherest rectifying, regulating, and storing the electricity so you get clean, usable power. The Arduino keeps tabs on everything as it happens, making the whole thing more reliable and easy to tweak.

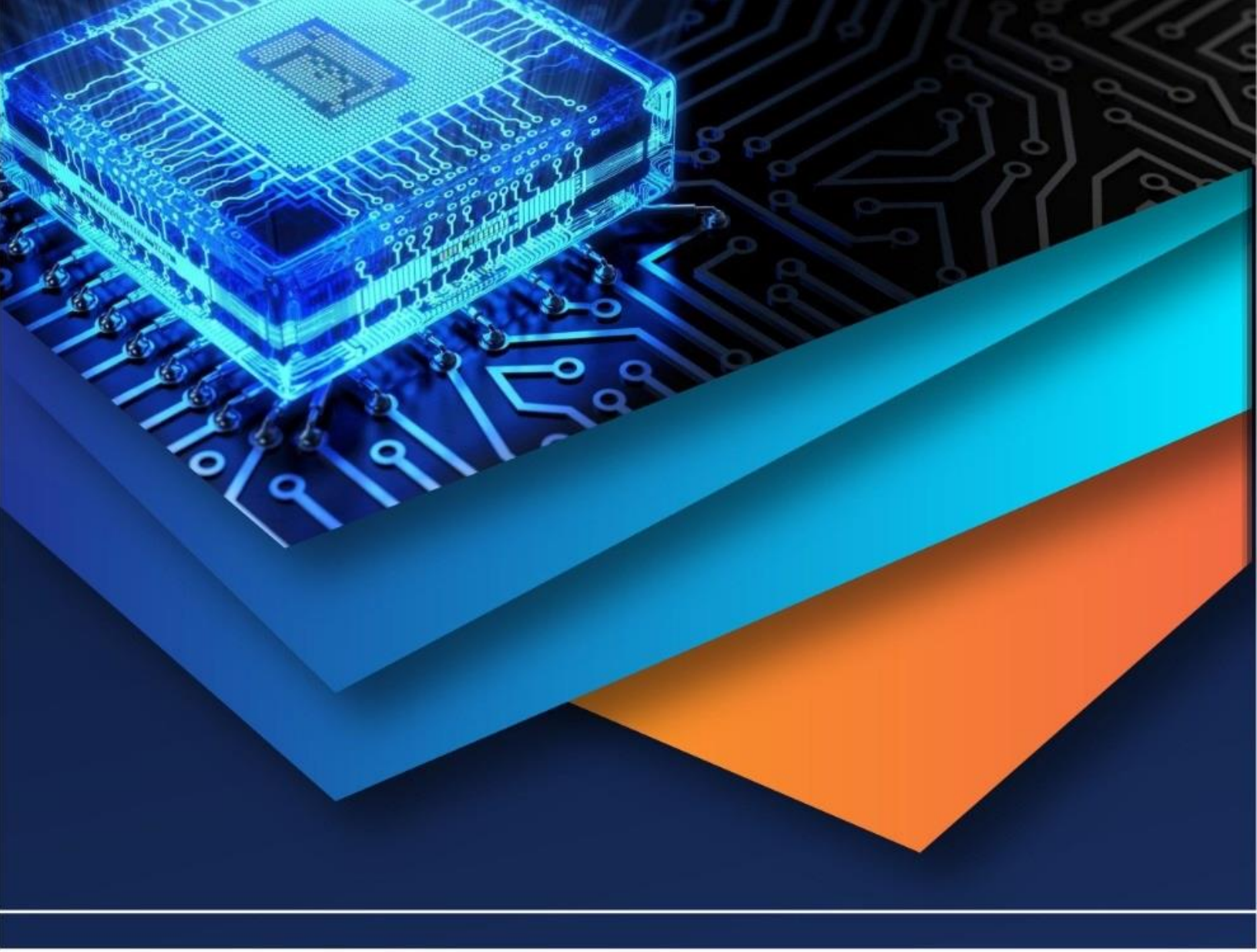
No, you won't light up a city with a single step. But put this system somewhere crowded like a train station, a school hallway, or a shopping mall and suddenly all those little sparks add up. It's perfect for powering LEDs, display screens, or basic sensors and gadgets.

But honestly, the tech is just one part of the story. This project sparks bigger ideas about how we useenergy and why renewables matter. It pushes people to think about ditching fossil fuels and cutting down pollution. With better materials, smarter storage, and sharper design, footstep power could play a real rolein smarter, greener cities. At the end of the day, it does exactly what it promises and gives people a hands- on way to make clean energy part of daily lif

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