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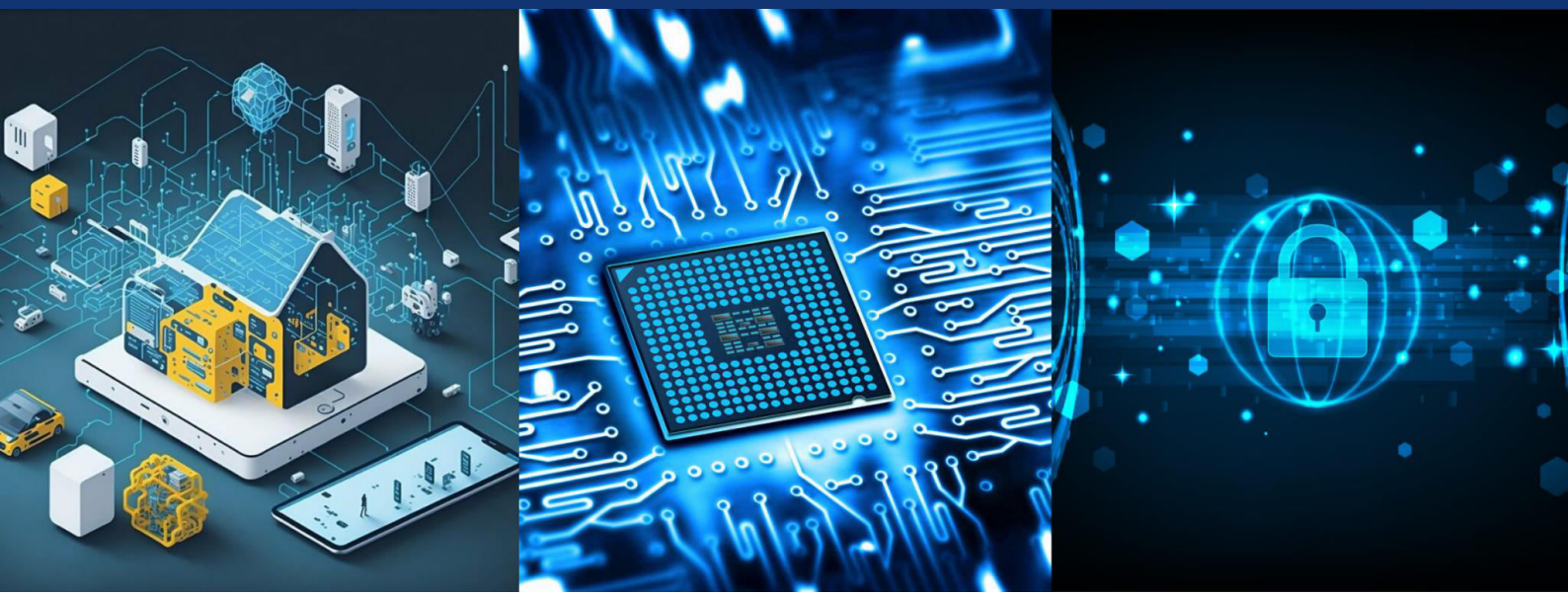

International Journal of Innovative Research in Computer and Communication Engineering

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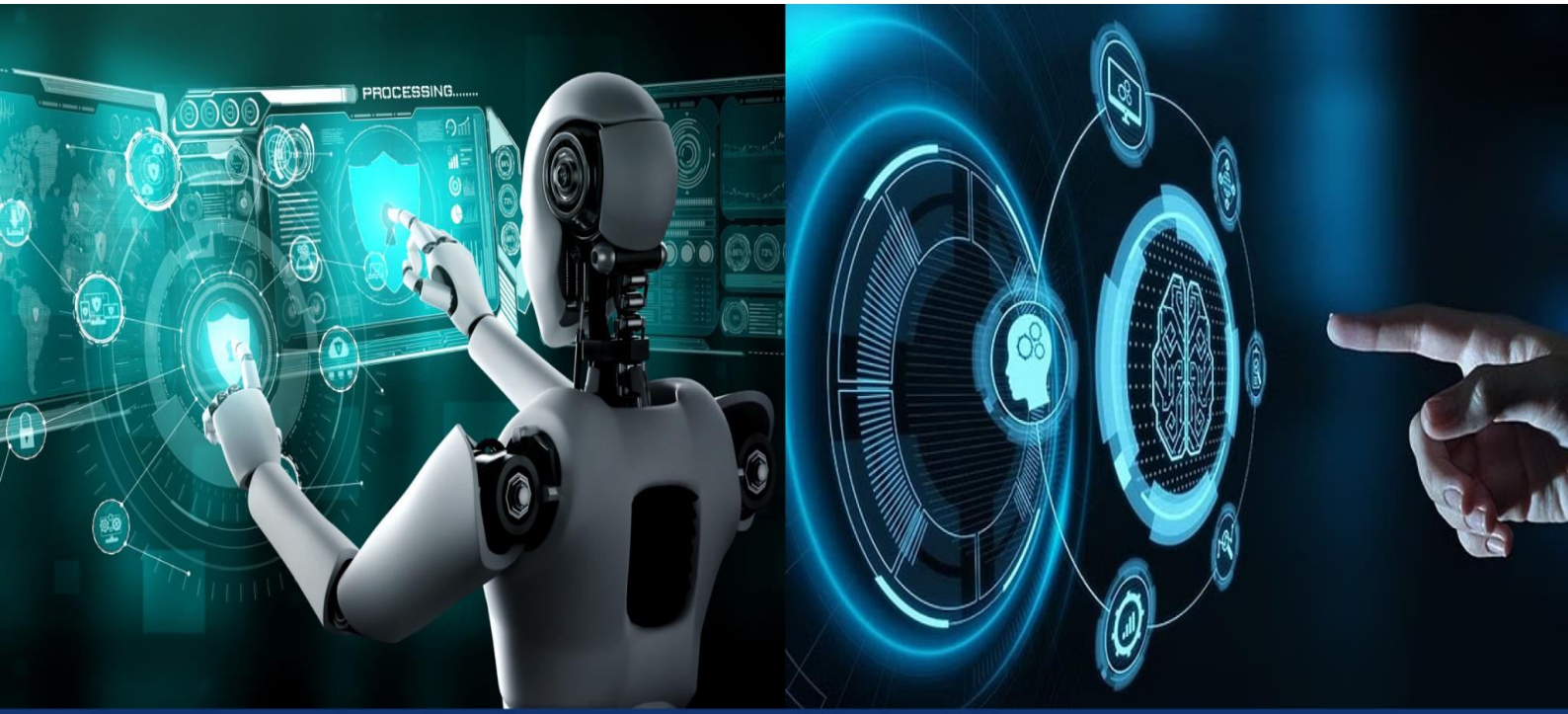

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International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

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WalkPower: Transforming Footstep Motion into Electrical Energy with Piezoelectric Sensors Using Raspberry Pi Pico

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ABSTRACT: In the modern era of sustainable energy, WalkPower presents an innovative approach to harnessing human footstep motion for electricity generation using piezoelectric sensors. This project integrates piezoelectric sensors, a fire (FIR) sensor, a battery, a solar panel, an MQ-7 gas sensor, an LDR (Light Dependent Resistor), a switch, and IoT technology to create a self-sustaining and intelligent energy harvesting system. The piezoelectric sensors embedded in walking paths or flooring surfaces convert mechanical pressure from footsteps into electrical energy, which is stored in a rechargeable battery. To enhance power generation, a solar panel is incorporated, providing an additional renewable energy source. The system also integrates safety and environmental monitoring features, including an MQ-7 gas sensor for detecting harmful gases, an LDR for automatic light control, and an FIR sensor for fire detection. A switch mechanism is used to control power distribution efficiently. The IoT-enabled system facilitates real-time monitoring and data transmission, allowing users to track power generation, battery status, and environmental conditions remotely. This project offers a sustainable, cost-effective, and eco-friendly solution for energy harvesting in high-footfall areas such as public spaces, transportation hubs, and smart cities. WalkPower represents a step forward in renewable energy innovation, addressing energy challenges while promoting smart and green technology applications.

KEYWORDS: Piezoelectric sensors, Fire (FIR) sensor, IoT technology, MQ-7 gas sensor, Battery status, LDR (Light Dependent Resistor), Raspberry pi.

I. INTRODUCTION

In the modern era of sustainable energy, WalkPower presents an innovative approach to harnessing human footstep motion for electricity generation using piezoelectric sensors. As global energy demands rise, the need for alternative and renewable energy sources has become critical. WalkPower addresses this challenge by integrating piezoelectric sensors, a fire (FIR) sensor, a battery, a solar panel, an MQ-7 gas sensor, an LDR (Light Dependent Resistor), a switch, and IoT technology to create a self-sustaining and intelligent energy-harvesting system. The generated energy is stored in a rechargeable battery and is supplemented by a solar panel, further enhancing the efficiency of power generation. Additionally, the system integrates safety and environmental monitoring features to ensure reliability and sustainability.

II. PROPOSEDSYSTEM

WalkPower introduces an innovative and sustainable solution for energy generation by harnessing mechanical energy from human footsteps using piezoelectric sensors. These sensors are embedded into flooring or walking paths and convert the mechanical pressure exerted by foot traffic into electrical energy. The harvested energy is then stored in a rechargeable battery, enabling the system to function as a reliable, renewable power source in high-footfall areas such as public walkways, transportation hubs, and smart city infrastructures.

A key advancement in the WalkPower system is the integration of an IoT module, which facilitates real time monitoring of various parameters. Users can remotely access data on power generation, battery status, and sensor

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readings through an online platform or app. This smart connectivity not only enhances user awareness and control but also allows for predictive maintenance and data-driven decision-making, making the system highly adaptive and intelligent.

To ensure safety and environmental awareness, WalkPower incorporates multiple sensors into its design. An MQ-7 gas sensor is used to detect harmful gases in the surroundings, providing early warnings in case of pollution or leaks. Additionally, an FIR (fire infrared) sensor detects the presence of fire or abnormal heat, while an LDR (Light Dependent Resistor) automatically manages lighting based on ambient light levels. These integrated sensors contribute to creating a safe and responsive environment.

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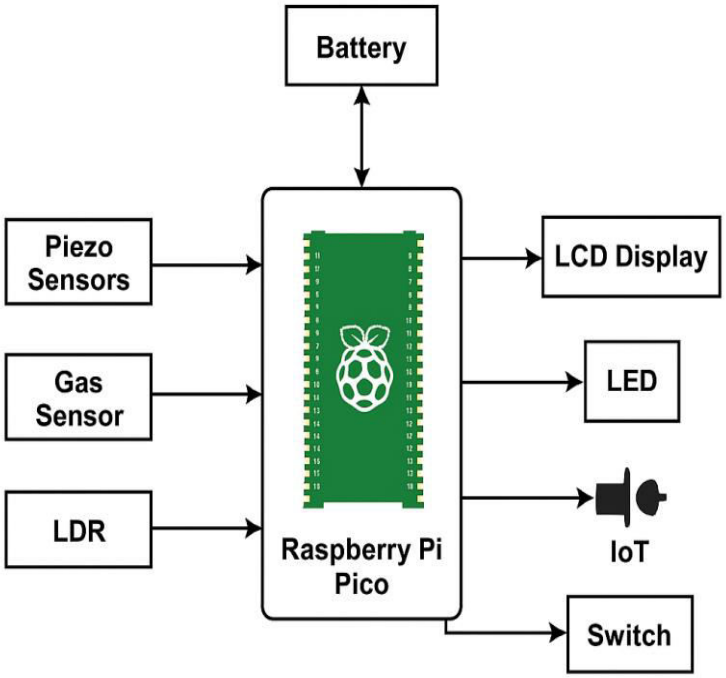
III.BLOCK DIAGRAM



This block diagram represents an IoT-based embedded system using the Raspberry Pi Pico as the central microcontroller, powered by a battery. It interfaces with various input sensors including piezo sensors (for vibration detection), a gas sensor (for detecting harmful gases), and an LDR (for measuring light intensity). The data from these sensors is processed by the Raspberry Pi Pico, which then controls multiple output devices such as an LCD display (to show sensor data), an LED (for visual alerts), and a switch (for user input or system control). Additionally, an IoT module is connected to enable remote monitoring and control of the system through the internet, making it suitable for smart home automation, safety monitoring, or environmental sensing applications.

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IV. EXPERIMENTAL RESULTS

FIG.1.HARDWARE KIT

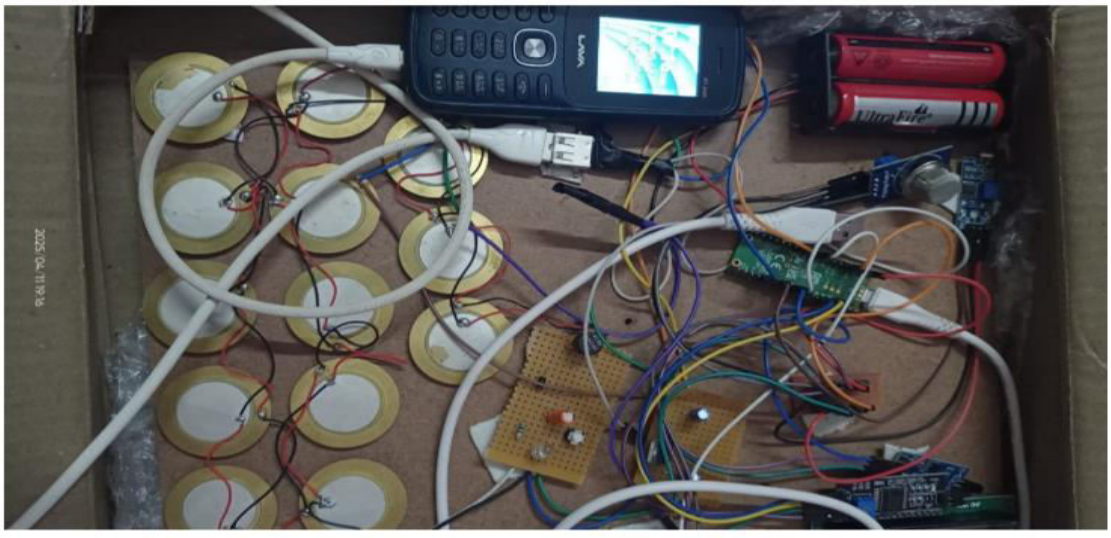

Fig.2:Generated output power is used for charging of mobile device

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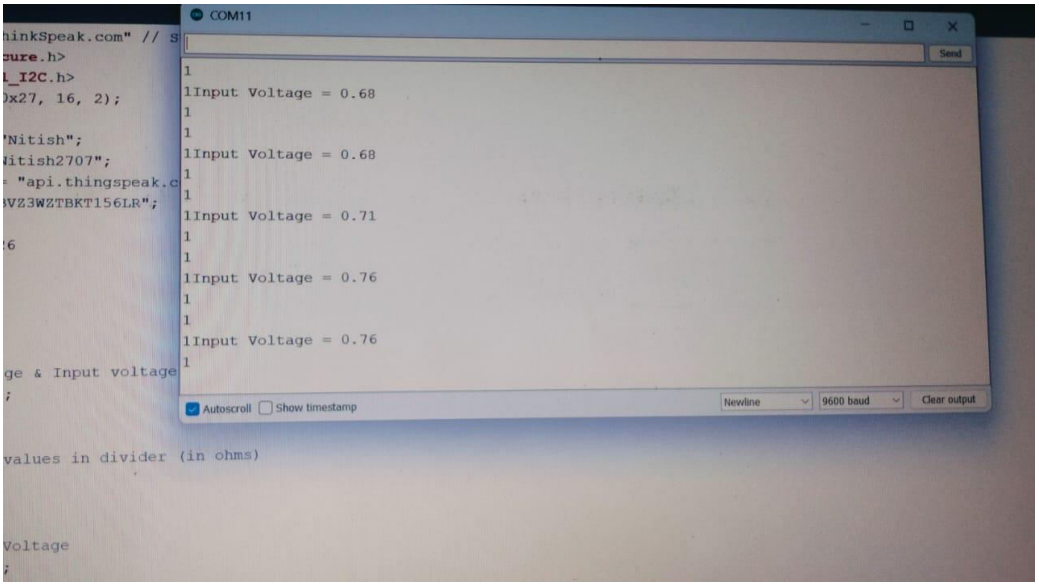

Fig.3: Generated Output values on Arduino console

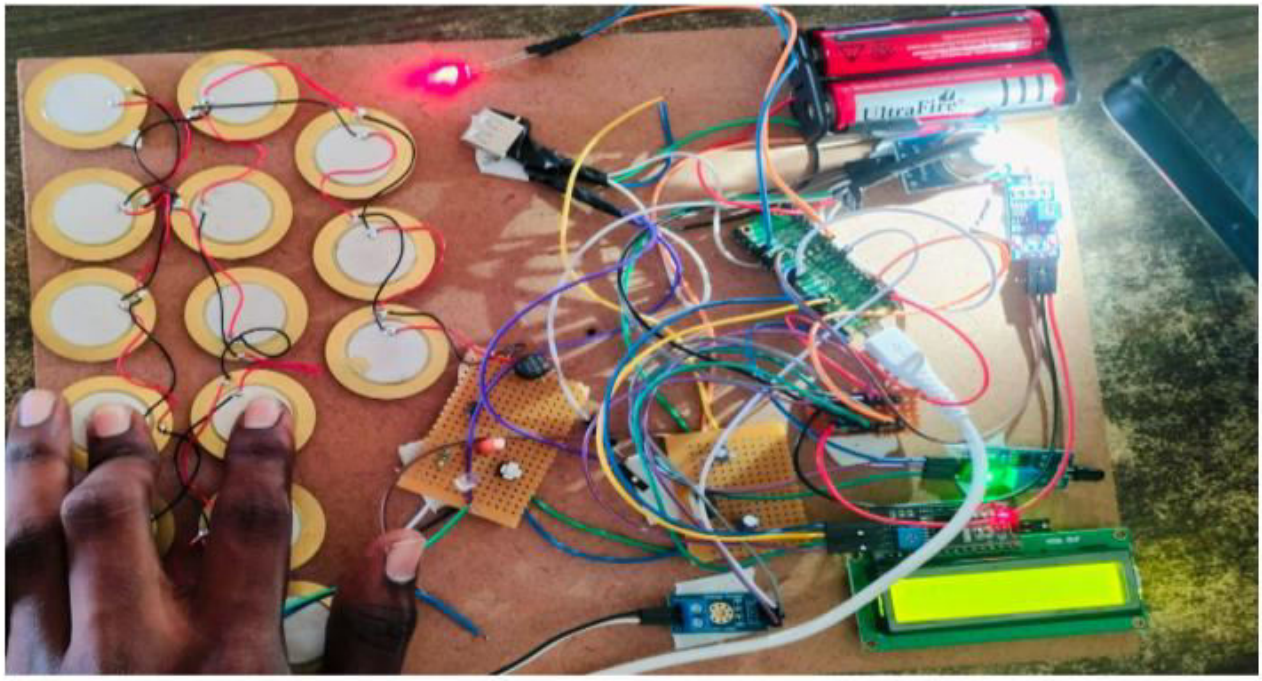

Fig.4: Hardware Kit with power generation

V. CONCLUSION

WalkPower presents a novel approach to energy harvesting, leveraging human footstep motion through piezoelectric sensors combined with solar energy and IoT-enabled monitoring. This system provides an efficient, eco-friendly, and scalable solution for sustainable energy generation in high footfall areas. By integrating safety and environmental monitoring features, WalkPower ensures enhanced reliability and applicability in smart cities and public

infrastructure. Despite some limitations, future advancements in materials and AI integration can further optimize efficiency and broaden its applications. WalkPower represents a step towards a cleaner and smarter energy future.

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