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Human Motion Based Energy Harvesting System for Low Power Applications

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Abstract — Energy demand is increasing rapidly due to the growth of electronic devices and modern technologies. This project presents a Human Motion Based Energy Harvesting System for Low Power Applications using Arduino. The system converts mechanical energy generated from human leg movement into electrical energy through a simulated footstep mechanism. A push button is used to represent human movement, and the generated energy is monitored using an LCD display. LED and buzzer indications are provided to demonstrate energy generation status. The proposed system is low-cost, eco-friendly, and suitable for small-scale applications such as mobile charging, emergency lighting, and portable electronic devices. This project highlights the importance of renewable energy and sustainable power generation techniques.

Keypoints — Energy Harvesting, Arduino, Human Motion, Renewable Energy, Footstep Power Generation, Embedded System

I. INTRODUCTION

In recent years, the demand for electrical energy has increased significantly due to the rapid development of electronic devices and smart technologies. Conventional energy resources are limited and may create environmental pollution. Therefore, renewable and sustainable energy generation methods are becoming increasingly important.

Human motion is one of the most easily available sources of mechanical energy. During walking or leg movement, a considerable amount of energy is produced in the form of pressure and motion. This energy can be converted into electrical energy and utilized for low-power applications.

The proposed project presents a Human Motion Based Energy Harvesting System using Arduino. The system demonstrates the conversion of mechanical energy into electrical energy using a simulated footstep mechanism. A push button is used to represent human movement, while the generated energy is monitored using an LCD display. LED and buzzer indications are included for status monitoring.

This project provides a simple, low-cost, and eco-friendly solution for small-scale energy generation and highlights the importance of renewable energy technologies.

II. PROBLEM STATEMENT

The increasing demand for electrical energy and the depletion of conventional energy resources have created a need for alternative and sustainable energy generation methods. Large amounts of mechanical energy produced through human movement, such as walking and leg motion, are wasted in daily life without being utilized effectively.

Existing renewable energy systems such as solar and wind power depend on environmental conditions and may not always provide continuous energy generation. Therefore, there is a need for a low-cost, eco-friendly, and portable system capable of converting human mechanical energy into usable electrical energy for low-power applications.

The proposed Human Motion Based Energy Harvesting System aims to utilize human leg movement as a source of renewable energy by

converting mechanical motion into electrical energy using an Arduino-based system. The generated energy can be used for small-scale applications such as mobile charging, emergency lighting, and low-power electronic devices.

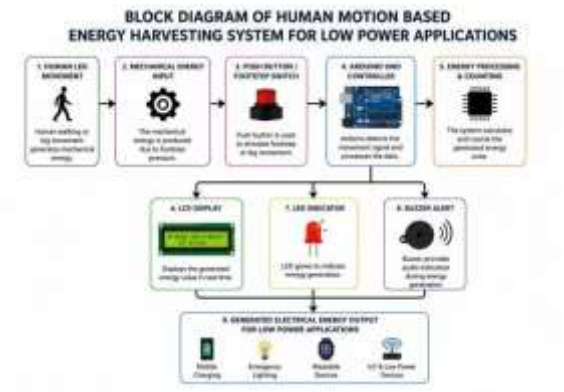

Fig. 1. Block diagram of Human Motion Based Energy Harvesting System for Low Power Applications

III. OBJECTIVES

The main objectives of the proposed Human Motion Based Energy Harvesting System are as follows:

1. To develop a system capable of converting human mechanical motion into electrical energy.

2. To demonstrate the concept of renewable energy harvesting using human leg movement.

3. To design and implement a low-cost Arduino-based energy harvesting model.

4. To monitor and display generated energy values in real time using an LCD display.

5. To provide visual and audio indications during energy generation using LED and buzzer modules.

6. To promote sustainable and eco-friendly energy generation techniques.

7. To utilize generated energy for low-power electronic applications.

8. To create a simple and portable system suitable for educational and research purposes.

9. To reduce dependency on conventional energy resources by utilizing wasted mechanical energy.

10. To demonstrate the practical implementation of embedded systems in renewable energy applications.

IV. LITERATURE REVIEW (SUMMARY)

Several researchers have developed energy harvesting systems that convert human motion and mechanical vibrations into electrical energy. Piezoelectric and vibration-based methods are commonly used for generating small amounts of power in public places. Existing renewable energy systems such as solar and wind depend on environmental conditions, whereas human motion energy harvesting utilizes the naturally available mechanical energy produced during walking. Arduino-based systems are widely used due to their low cost and simple implementation. The proposed system provides a simple and eco-friendly

solution for low-power energy generation using human movement.

The literature survey indicates that human motion energy harvesting is an effective and sustainable approach for future low-power energy generation systems.

V. SYSTEM ARCHITECTURE

The overall architecture demonstrates the conversion of human mechanical motion into usable electrical energy through sensing, processing, monitoring, and low-power energy utilization.

Fig. 2. Taxonomy diagram of Human Motion Based Energy Harvesting System for Low Power Applications

Human Motion Input Layer

This layer represents human walking or leg movement, which acts as the primary source of mechanical energy for the system.

Mechanical Energy Generation

The pressure produced during footstep movement generates mechanical energy that can be converted into electrical energy.

Footstep Sensing Layer

A push button or footstep switch is used to simulate human motion and detect movement input for energy generation.

Arduino Processing Layer

The Arduino Uno receives the movement signal, processes the input data, and controls the overall system operation.

Energy Processing and Counting

The system calculates and counts the generated energy units based on the detected movement activity.

Monitoring and Indication Layer

This layer provides real-time monitoring and indication of energy generation using:

- LCD display for energy value monitoring
- LED for visual indication
- Buzzer for audio alert

Power Output Layer

The generated electrical energy can be utilized for low-power applications such as:

- Mobile charging
- Emergency lighting
- Wearable devices
- IoT and embedded systems

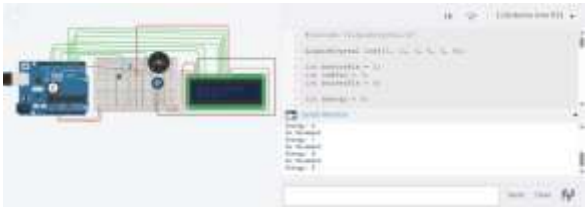

Fig. 3. Implementation of Human Motion Based Energy Harvesting System for Low Power Applications

VI. METHODOLOGY / ALGORITHM

Methodology:

The system follows these steps:

1. Human leg movement is considered as the primary source of mechanical energy.

2. A push button mechanism is used to simulate footstep or leg movement.

3. Mechanical pressure generated during movement is detected by the sensing unit.

4. The detected movement signal is sent to the Arduino Uno for processing.

5. The Arduino controller processes the input signal and increments the energy count.

6. The generated energy value is displayed on the 16x2 LCD display in real time.

7. LED indication is provided to show successful energy generation.

8. A buzzer alert is used for audio indication during system operation.

9. The complete system is designed and tested using Tinkercad simulation software.

10. The generated electrical energy can be utilized for low-power applications such as mobile charging, emergency lighting, and IoT devices.

11. The proposed methodology provides a low-cost and eco-friendly renewable energy solution.

VII. ADVANTAGES

Utilizes renewable human mechanical energy for power generation.

Provides an eco-friendly and sustainable energy solution.

Low-cost and easy-to-implement system design.

Reduces dependency on conventional energy resources.

Real-time monitoring using LCD display.

VIII. LIMITATIONS

The proposed system generates only a small amount of electrical energy and is suitable mainly for low-power applications. Continuous human movement is required for energy generation. The current model uses a simulated push button mechanism instead of real energy harvesting sensors, and large-scale power generation is not possible with the existing setup.

IX. RESULTS AND DISCUSSION

· The proposed Human Motion Based Energy Harvesting System was successfully designed and simulated using Tinkercad software.

Human leg movement was simulated using a push button mechanism.

The Arduino Uno successfully detected movement input and processed the generated energy count.

The generated energy value was displayed in real time on the 16x2 LCD display.

LED and buzzer modules provided visual and audio indications during system operation.

The system demonstrated the conversion of mechanical energy into electrical energy for low-power applications.

The energy count increased continuously with repeated movement input.

The proposed system operated effectively with low-cost electronic components.

The simulation results proved that human motion can be utilized as a renewable energy source for small-scale electronic devices.

The developed model is suitable for educational, research, and sustainable energy applications.

X. FUTURE SCOPE

Integration of piezoelectric sensors for real-time energy harvesting.

Implementation of rechargeable battery storage systems.

Enhancement of energy conversion efficiency.

Integration with IoT and wireless monitoring technologies.

Deployment in public places such as railway stations and shopping malls.

Utilization in smart city and sustainable energy applications.

Development of mobile charging and wearable power systems.

Extension for powering low-power embedded and sensor devices.

Implementation of automatic energy management systems.

Improvement of system scalability for larger energy generation applications.

XI. CONCLUSION

The proposed Human Motion Based Energy Harvesting System was successfully designed and simulated using Tinkercad software.

The system demonstrated the conversion of human mechanical energy into electrical energy.

The Arduino Uno effectively processed and monitored the generated energy.

Real-time energy monitoring was achieved using the LCD display.

LED and buzzer modules provided proper visual and audio indications during operation.

The project proved that human motion can be utilized as a renewable energy source for low-power applications.

The proposed system is low-cost, eco-friendly, and suitable for educational and research purposes.

The developed model can be further enhanced for practical real-world renewable energy applications.

REFERENCES

[1] S. Pasika and S. T. Gandla, “Smart Water Quality Monitoring System with Cost Effective Using IoT,” *Heliyon*, vol. 6, no. 7, 2020.

[2] M. Mukta, S. Islam, and M. S. Hossain Khan, “IoT Based Smart Water Quality Monitoring System,” in *Proceedings of IEEE ICCCS*, 2019.

[3] S. Geetha and S. Gouthami, “Internet of Things Enabled Real Time Water Quality Monitoring System,” *Smart Water*, vol. 2, no. 1, 2017.

[4] A. N. Prasad et al., “Smart Water Quality Monitoring System,” in *Proceedings of Asia-Pacific World Congress on Computer Science and Engineering*, 2015.

[5] B. Sengupta et al., “Water Quality Monitoring Using IoT,” *International Research Journal of Engineering and Technology (IRJET)*, vol. 6, 2019.

[6] A. Jerom B. et al., “An IoT Based Smart Water Quality Monitoring System Using Cloud,” in *Proceedings of International Conference on Emerging Trends in Information Technology and Engineering*, 2020.

[7] S. Gupta et al., “IoT Based Underwater Robot for Water Quality Monitoring,” *IOP Conference Series: Materials Science and Engineering*, vol. 1033, 2021.

[8] M. K. Amruta and M. T. Satish, “Solar Powered Water Quality Monitoring System Using Wireless Sensor Network,” in *Proceedings of iMac4s*, 2013.