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Power Generation System using Piezoelectric, 360° Wind Turbine and Solar Energy

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Abstract: *This paper proposes a novel power generation system that combines three renewable energy sources: piezoelectric materials, a 360° wind turbine, and solar energy. The system utilizes the piezoelectric effect to convert mechanical energy from vibrations or pressure into electricity. A 360° wind turbine design captures wind energy from all directions, maximizing wind energy capture compared to traditional turbines. Solar panels convert sunlight into electricity using the photovoltaic effect. The combination of these technologies offers a comprehensive solution for harnessing clean and sustainable energy from various environmental sources. The paper discusses the design principles and functionalities of each subsystem. It explores how the collected energy from each source is efficiently managed and potentially integrated for grid connection or localized power needs. Furthermore, the paper addresses challenges associated with this hybrid system, such as power conversion efficiency and system optimization. Finally, the potential benefits of this design, including its environmental sustainability and adaptability to diverse environments, are explored.*

Keywords: Piezoelectric energy harvesting ,360° wind turbine, Solar power generation, Multi-source power generation, Sustainable energy, Distributed generation, Power conversion efficiency, System optimization

I. INTRODUCTION

The global energy landscape is undergoing a critical shift towards sustainable and environmentally responsible power generation. The depletion of traditional fossil fuels, coupled with rising energy demands, necessitates the exploration of innovative and efficient renewable energy solutions. Solar, wind, and geothermal energy sources have emerged as frontrunners in this paradigm shift, offering significant potential for clean and sustainable power generation. This paper presents a novel hybrid power generation system that synergistically integrates three distinct renewable energy sources: piezoelectric materials, 360° wind turbines, and solar energy. Piezoelectric materials possess the remarkable property of converting mechanical stress or vibrations into electrical energy. This unique capability allows them to capture ambient energy from diverse sources, such as human movement or traffic vibrations. Traditional wind turbine designs are limitedin their efficiency due to their unidirectional wind capture capabilities. This paper proposes the incorporation of a 360° wind turbine design, significantly enhancing wind energy capture by harnessing wind from all directions. Furthermore, the system integrates solar panels that utilize the well-established photovoltaic effect to convert sunlight into electricity. By strategically combining these diverse renewable energy technologies, the proposed system offers a comprehensive solution for harnessing clean and sustainable power from readily available environmental resources. This introduction serves as a springboard for the subsequent sections, which will delve deeper into the design principles, functionalities, and potential applications of this innovative power generation system.

II. AIM & OBJECTIVE

This paper aims to introduce a novel hybrid power system combining piezoelectric materials, a 360° wind turbine, and solar energy. Our objectives are to: Analyze the design and function of each subsystem (piezoelectric elements, omnidirectional turbine, solar panels). Explore strategies for managing and integrating harvested energy for grid connection or local use. Address challenges like power conversion efficiency and system optimization. Evaluate the system's environmental benefits and adaptability to diverse environments.

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III. INFORMATION

This system combines three renewable energy sources to generate electricity:

Piezoelectric Materials: These materials convert mechanical stress or vibrations into electrical energy. Imagine floor tiles that generate power from footsteps or wind turbine blades with embedded piezoelectric elements capturing vibrations from wind movement.

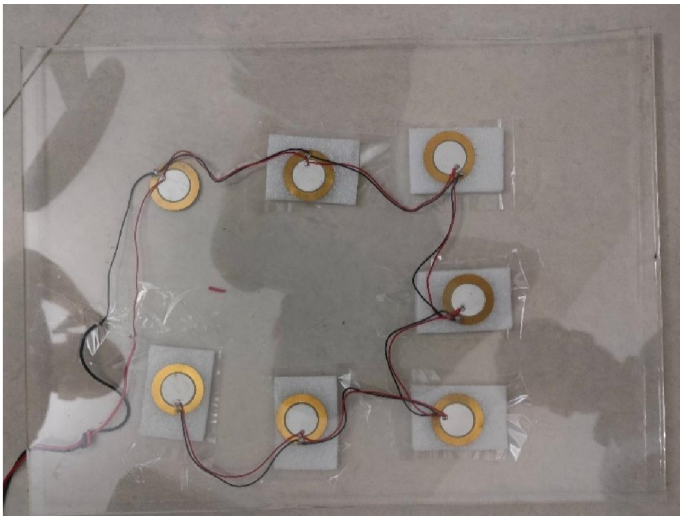

Fig. 1(Piezoelectric sensors)

360° Wind Turbine: Unlike traditional wind turbines facing a specific direction, this design captures wind energy from all directions due to its omnidirectional form. This could be a cylindrical design with wind harvesting elements all around.

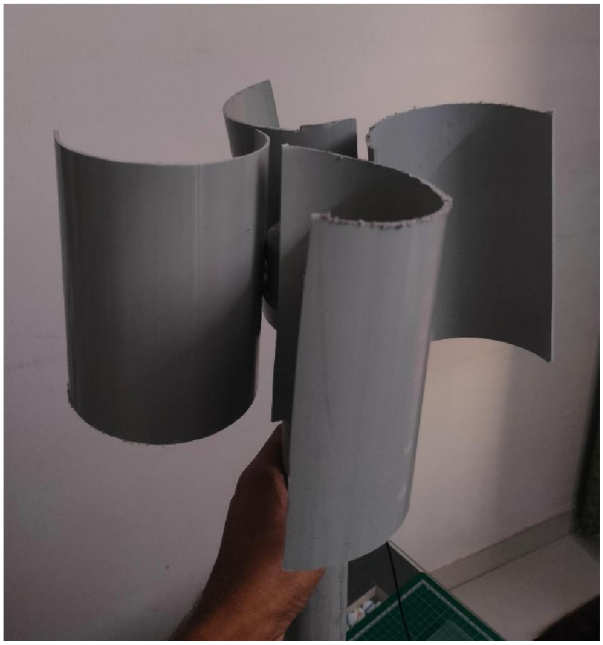

Fig. 2 (360° wind turbine)

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Solar Panels: These utilize the photovoltaic effect to convert sunlight into electricity.

Fig. 3 (solar panel)

Microcontroller and circuit : Here we are using ATMEGA 328mc for calculating the information about voltage of power generating elements like, battery, piezoelectric plate, turbine, solar, plate. Etc. also calculating the information of temperature of battery.

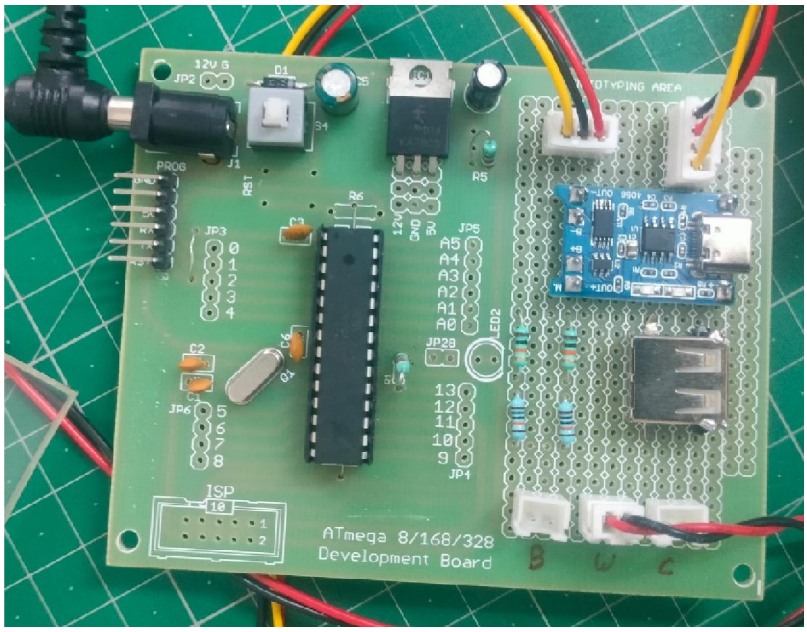

Fig. 4(ATMEGA328mc board)

LCD 16X2 : : Here we are using 16x2 LCD display for showing the information about voltage of power generating elements like, battery, piezoelectric plate, turbine, solar, plate. Etc. also shows the temperature of battery.

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Potential Benefits:

Clean and Sustainable Energy: The system relies on renewable sources, reducing dependence on fossil fuels and minimizing environmental impact.

Multi-Source Power Generation: By combining these technologies, the system can harvest energy from various environmental conditions, providing a more reliable and consistent power source compared to single-source systems.

Adaptability: The system's ability to harness energy from wind, vibrations, and sunlight makes it suitable for diverse environments, potentially providing power in remote areas or urban settings.

Working Summary

Energy Collection: Vibrations from wind, footsteps, or traffic cause the piezoelectric materials to generate a voltage. The 360° wind turbine captures wind from any direction, rotating a shaft. Sunlight hits the solar panels, creating electricity through the photovoltaic effect.

Power Conversion: The piezoelectric voltage might need processing to become usable DC electricity. The wind turbine's shaft rotation is converted into AC electricity by a generator. Solar panels produce DC electricity directly.

Integration and Distribution: Depending on the system design, DC electricity from piezo elements and solar panels might be converted to AC to match the grid. All generated AC electricity (from the wind turbine and potentially converted DC) is combined and managed by a power management system. This system regulates the overall power output and can be connected to the grid for distribution or used directly for local applications.

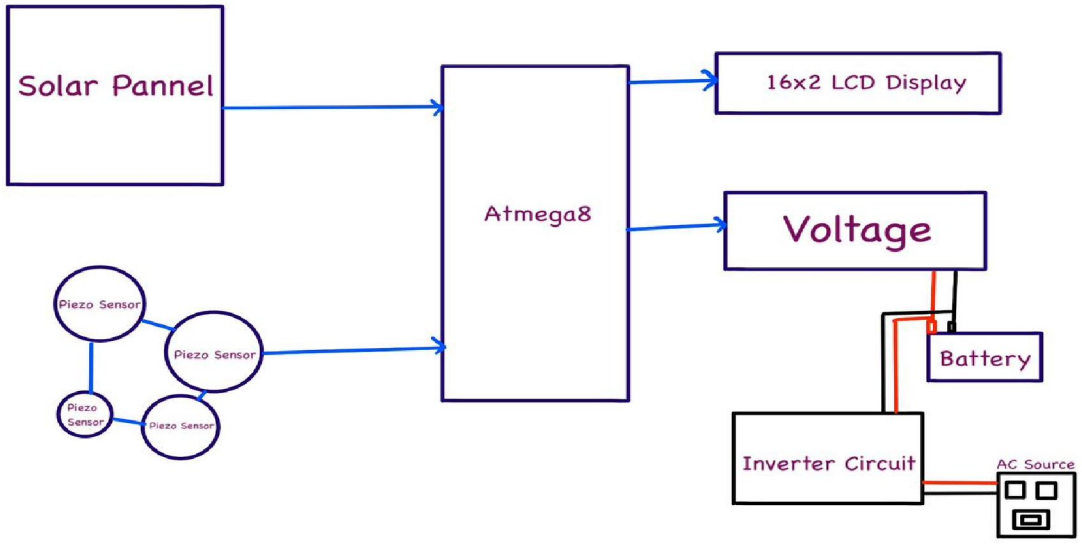

Fig. 3 (block diagram of system)

IV. CONCLUSION

The proposed system presents several potential advantages. The multi-source approach offers the potential for enhanced energy security and reliability by mitigating dependence on specific weather conditions. Furthermore, by relying on renewable sources, the system significantly reduces its environmental footprint compared to fossil fuel-based power generation, contributing to a more sustainable future. Additionally, the ability to utilize a variety of energy sources, including ambient vibrations, omni-directional wind, and sunlight, enhances the system's adaptability for deployment in diverse environments, both remote and urban

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In this project we create a power generation system using various power generating ideas (Wind turbine, Piezoelectric, and Solar energy). Under the guidance of Mr. Solunkhe sir (project guide) & Prof. A. N. Dubey (head of department) we completed this project.

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