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.2026.78141

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

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

Design and Development of a Multi-Source Hybrid Renewable Energy Generation System Using Solar, Wind and Piezoelectric Power

Dr.N.Padma ,[1]V.Ramu [2]Sravya, Viruvuru Abhishek[3], Muddapati Venkata Nikhil[4], Arakonam Sesi Teja[5], Mohammed Khadeer[6]

ME,(Phd),Department of-Associate Professor[1] Mechanical Engineering, Geethanjali Institute of Science and Technology Nellore, .India

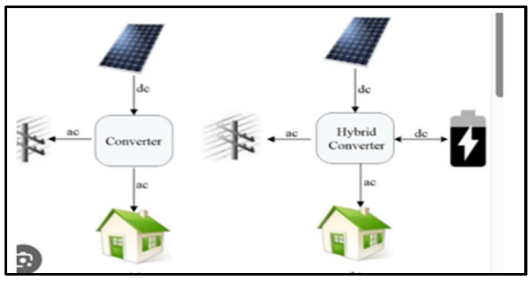
Assistant professor, Department of[2] Geethanjali Institute of Science and Technology, Nellore, India ,Mechanical Engineering

[3,4,5,6]Students(B.Tech), Department of Mechanical Engineering, Geethanjali Institute of Science and Technology, Nellore, India

I. INTRODUCTION

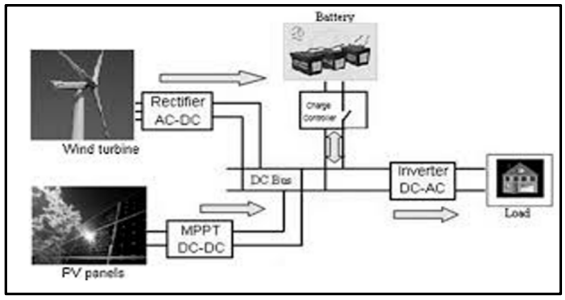
-ion system equipped with a smart energy management unit and a highThis project aims to develop a hybrid power generat ptimize efficiency inverter. The system is designed to automatically select and switch between power sources based on availability, o version. Such a system not only improves energy reliability and quality but battery usage, and ensure minimal energy loss during con effectiveness, making it suitable for rural electrification, backup power, and smart -also enhances sustainability and operational cost home applications.

ybrid systems, efficient power conversion remains a key challenge. Traditional inverters used in these Despite the potential of h ions. setups often suffer from low conversion efficiency, poor voltage regulation, and limited adaptability to varying input condit efficiency inverter system that can handle dynamic input from multiple sources and deliver -need for a high Therefore, there is a .stable, reliable AC output



II. AIM & OBJECTIVE

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



III. WORKING SUMMARY

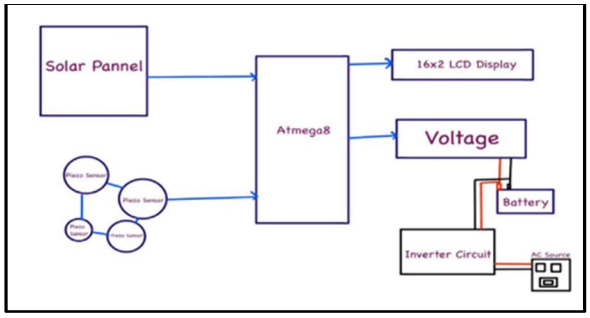
A. *Energy Collection*

ptures Vibrations from wind, footsteps, or traffic cause the piezoelectric materials to generate a voltage. The 360° wind turbine ca ect. Power wind from any direction, rotating a shaft. Sunlight hits the solar panels, creating electricity through the photovoltaic eff n is Conversion: The piezoelectric voltage might need processing to become usable DC electricity. The wind turbine's shaft rotatio .converted into AC electricity by a generator. Solar panels produce DC electricity directly.

B. *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. a power All generated AC electricity (from the wind turbine and potentially converted DC) is combined and managed by management system. This system regulates the overall power output and can be connected to the grid for distribution or used directly for local applications.

IV. BLOCK DIAGRAM



V. LITERATURE SURVEY

f electric and solar vehicles and provides and overview of a typical solar the history and future o **Anoop kumar et al. (2017) tells** .powered automobile

focuses on an idea about solar car technology and its integration into society which solves the **(Ankit Vijayvargiya et al. (2017** .a carmajor problem of pollution and fuel in now days. A complete experiment of solar car has been prepared in this paper by using

talk about the chassis technology earlier to the 1980s had been progress as a technology of **(04Yasuji Shibahata et al. (20** .mechanical engineering field of that time

hicle control present fault detection and isolation is becoming one of the most important aspects in ve (**Pierluigi Pisu et al.(2001** .posedsystem design. In order to achieve this FDI schemes, particular vehicle subsystems integrated with a controller have been pro

VI. MATERIALS REQUIRED

- WIND MILL
- SQUARE TUBE
- SPUR GEAR
- SOLAR PANEL
- WIRE
- DYNAMO MOTOR
- MULTIMETER
- SENSOR PEZIOELECTRIC
- DC TO AC CONVERTER
- BEARING
- BEARING BUSH

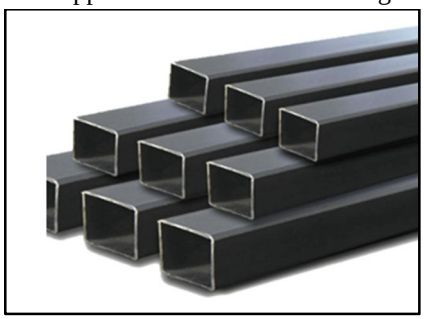
A. *Windmill*

pump water, generate ,(gristmills) grain mill to sails is a machine operated by the force of wind acting on vanes or **windmill** A the horizontal ;early modern periods and high medieval electricity, or drive other machinery. Windmills were used throughout the northwestern during the 9th century, and the vertical windmill first appeared in Persia ppeared infirst a panemone windmill or

.in the 12th century Europe

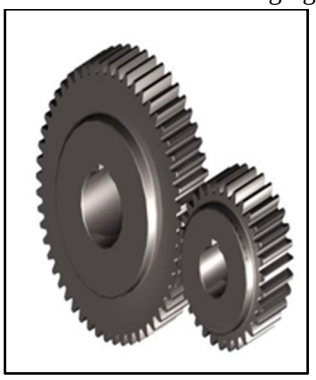
B. Square Tube

tube steel or box section. Circular HSS are sometimes mistakenly called Rectangular and square HSS are also commonly called dsteel pipe, although true steel pipe is actually dimensioned and classed differently from HSS. Square tubes are generally use maintenance and structural purposes. Some examples of applications would be building construction, railings, and sign posts for.



C. Spur Gear

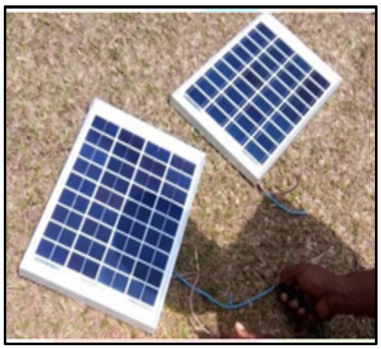
straight, parallel Spur gears are one of the most popular types of precision cylindrical gears. These gears feature a simple design of e gear is teeth positioned around the circumference of a cylinder body with a central bore that fits over a shaft. In many variants, th .machined with a hub which thickens the gear body around the bore without changing the gear face.



D. Solar Panel

Specifications Of The Solar Panel:

- Material : Silicon.1
- Wattage : 10W.2
- Type : Polycrystalline.3
- Q4.No of cells: 64
- Output Voltage: 20V.5
- Q6.Voltage at maximum power: 16.5V
- Tolerance: 5%.7



E. Wires

transmitting electrical power between the components of a hybrid power generation system, such Wire connections are essential for throughout as the solar panel, wind turbine, battery, inverter, and controller. Proper wiring ensures efficient and safe flow of current .the system.

F. Dynamo Motor

A gear motor is usually a simple DC electric motor with a gear mechanism attached to it

Volts12 –RPM 1000 –DC Motor

Specifications and Features

- RPM (revolutions per minute): 1000
- DC 12 volt Operating Voltage
- Gearbox: Plastic (spur) Gear attached
- .Internal hole with 6mm shaft dia
- cm): 0.5-Torque (kg
- (Current with no load = 60 mA (Max
- .(mA load current (Max 300

G. Multimeter

A multimeter is a test device used to quantify at least two electrical qualities, basically: voltage (volts), flow (amps) a obstruction (ohms). It is a standard symptomatic device for specialists in the electrical/electronic businesses.

H. Piezoelectric Sensor

some The piezoelectric transducers work on the principle of piezoelectric effect. When mechanical stress or forces are applied materials along certain planes, they produce electric voltage. This electric voltage can be measured easily by the voltage measuring instruments, which can be used to measure the stress or force.

I. DC to AC Convertor

can easily convert DC to AC power, which is the electric curren for all ,inverter generators An inverter, including those found in -directionally, a component called an H-ows in one direction to a current that flows biappliances. To change a current that only fl bridge constantly alters the current's flow several -Bridge within the inverter changes the polarity. Powered by transistors, the H alternating current output times a second to achieve the desired.

J. Bearing

races bearing separation between the to maintain the balls that uses element bearing-rolling is a type of ball bearing A. loads. It achieves this by using at least two axial and radial The purpose of a ball bearing is to reduce rotational friction and support races to contain the balls and transmit the loads through the balls.

K. Bearing Bush

is a simple, cylindrical component NG B used to reduce friction ,plain bearing or sleeve bearing Bush also known as a Bearing outer surface, and a lubrication film between them. Bearing between two moving parts. It consists of a cylindrical inner surface, an bushings are often made from materials like bronze, brass, steel, or polymer composites.

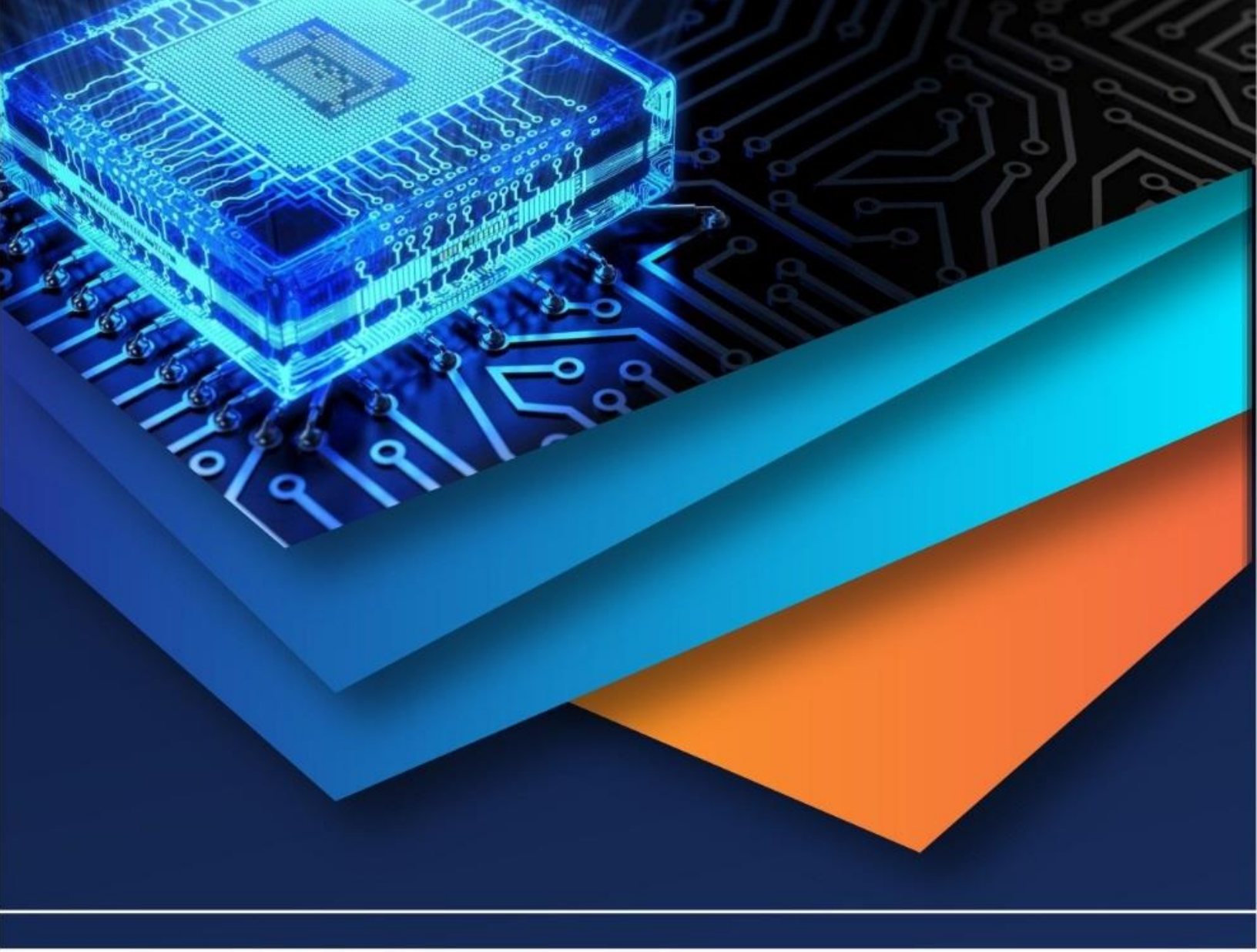
VII. PROJECT IMAGE

VIII. CONCLUSION

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

REFERENCES

[1] lectronics andNitashree, et.al., "Foot Step Power Generation Using Piezoelectric Material," International Journal of Advanced Research in E Communication 15Oct 20 ,2506-Engineering, vol. 4, pp. 2503
[2] Prof. Namrata J. Helonde, Punam Suryawanshi, ArunAnkita Bhagwatkar, Arun Wagh, Pradhnya Vetalhttps://www.ijraset.com/research -power-paper/footstep Publisher Name : IJRASET9653 -sensor: 2321-piezoelectric-using-generation
[3] 18-09-Retrieved 2015 .11-06 -ion Prototype". Earthship Biotecture. Archived from the original on 2022Vertical Axis Wind Power Generat
[4] 2020.2303209-2-Footstep Power Generation Using Piezoelectric Sensorhttps://eudl.eu/pdf/10.4108/eai.27



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY