

Design and Fabrication of Mini Windmill

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Abstract

Renewable energy has been on an increasing demand in the recent due to over stress on non-renewable resources and their increasing cost. Thus producing electricity with the use of renewable resource Wind energy has been taken up in this project. A Windmill, which rotates when there is enough wind, generates electricity owing to magnetic coupling between the rotating and stationary coil. A horizontally rotating prototype of Windmill is being used in this project. Mini Windmill Power Generation Project harnesses the Windmill i.e., Wind Turbine Generator to charge a 12V Battery. The System is based on Atmega328 microcontroller which smartly senses and charges the battery while displaying the voltage on the LCD. The Windmill, when in enough wind to drive it, generates power enough to charge a battery. Since it can work in favorable natural conditions by itself without consuming fossil fuel, it can charge the battery automatically and that too without any harmful emissions. Thus this project is an example how natural resources like the wind energy can be efficiently harnessed to produce electricity in harmony with nature.

INTRODUCTION

The Mini Wind Mill Power Generation Project is a renewable energy initiative that aims to harness the power of wind energy to generate electricity. The project involves the installation of small-scale wind turbines, known as mini wind mills, to produce clean and sustainable energy. The project is designed to provide a reliable and efficient source of power for homes, farms, and rural communities, while also promoting energy independence and reducing reliance on fossil fuels.

LITERATURE REVIEW

Mini wind mills, also known as small wind turbines, have gained popularity in recent years due to their potential to generate renewable energy in remote and urban areas. This literature review aims to provide an overview of the current state of mini wind mill power generation, including their design, performance, and applications.

Challenges and Future Directions:

Despite the potential of mini wind mills, there are several challenges that need to be addressed. These include:

1. High upfront costs: The initial investment for purchasing and installing mini wind mills can be prohibitively expensive for some users.

2. Intermittent power output: Wind energy is an intermittent source of power, which can make it challenging to ensure a stable and reliable energy supply.
3. Noise and visual impact: Mini wind mills can generate noise and affect local aesthetics, which can be a concern for nearby residents.

Mini wind mill power generation has the potential to provide a reliable and sustainable source of renewable energy. While there are challenges to be addressed, research has made significant progress in improving the design, performance, and efficiency of mini wind mills. Future research should focus on developing more efficient and affordable turbine designs, advancing control strategies and power electronics, and investigating innovative applications and integration with other technologies.

COMPONENTS SELECTION RAW MATERIALS:

Table 1. List of components

S. NO	PARTS	QTY	MATERIAL
1	shaft	1	iron
2	wood	1	wood
3	electrical wires	2meters	

BLADES

Mini wind mill blades are a crucial component of small wind turbines, responsible for capturing wind energy and converting it into mechanical energy. Here are some key aspects of mini wind mill blades. The specific size and shape of the blades used for mini wind mill can vary depending on the design of the turbine and the specific locations where will be installed. Some common features of blades for mini wind turbines

DRILLNGPROCESS

Drilledholesare characterizedby their sharpedge onthe entrance side and the presence of burrs on the exitside (unless they have been removed). Also, the inside of the hole usuallyhashelicalfeedmarks.Drillingmay affect the mechanical propertiesof the work piece bycreating low residual stresses around the hole openingand a very thin layer of highly stressed and disturbedmaterial on thenewlyformed surface.

WELDINGPROCESS

Introduction to welding process Introduction Welding isaprocessinwhich twoormore partsare joined permanentlyattheirtouchingsurfacesbyasuitable applicationof heatand/orpressure.Often afiller materialis addedto facilitatecoalescence.Theassembled parts that are joined by welding are called aweldment. Welding is primarily used in metal parts andtheiralloys.Weldingprocessesare classifiedinto twomajor groups: 1. Fusion welding: In this process, basemetalismelted bymeansofheat.

CONTROL SYSTEMS

Control Systems of Mini Wind Mill Power Generation Project The control system of a mini wind mill power generation project plays a crucial role in ensuring the efficient and reliable operation of the wind

turbine. The control system is responsible for regulating the turbine's speed, direction, and power output to maximize energy production while minimizing wear and tear on the turbine.

Advantages of Control Systems:

The control system of a mini wind mill power generation project offers several advantages, including:

1. **Improved Efficiency:** The control system optimizes energy production by regulating the turbine's speed and direction.
2. **Increased Reliability:** The control system reduces the risk of faults and anomalies by monitoring the turbine's performance and generating alarms.
3. **Reduced Maintenance Costs:** The control system reduces maintenance costs by optimizing energy production and reducing wear and tear on the turbine.
4. **Improved Safety:** The control system ensures safe operation of the turbine by regulating its speed and direction

CONCLUSION

The primary aspire of this project will bring an eco- friendly product which can be used in house, parks, highways, apartments etc., In this product many specific empirical studies have been carried out and we have tried to improve the efficiency of mini wind mill power generation further. Our main focus was increasing efficiency and making it more reliable and durable. We will made all the blades to work simultaneously for higher efficiency. We have tried to reduce noise pollution and reduce the vibration bearing wear to increase the efficiency. With the assumption of placing the wind mill in a location with moderate wind availability with optimized blade parameters and design specifications, high power generation is achieved with mini wind mill power generation and can be serving as energy generation unit for remote areas..

Final Thoughts

1. **Renewable Energy Source:** Mini wind mills promote renewable energy, reducing reliance on fossil fuels and mitigating climate change.
2. **Cost-Effective:** Small-scale wind energy can be cost-effective, especially for remote or rural areas with limited access to traditional energy sources.
3. **Educational Opportunities:** Building and maintaining a mini wind mill can serve as a hands-on learning experience for students and enthusiasts.
4. **Community Engagement:** Mini wind mill projects can foster community engagement, encouraging collaboration and knowledge-sharing among individuals.
5. **Environmental Benefits:** By harnessing wind energy, mini wind mills contribute to reducing greenhouse gas emissions and promoting a cleaner environment.
6. **Innovation and Improvement:** Mini wind mill projects can drive innovation, encouraging experimentation with new materials, designs, and technologies.

FUTURE SCOPE

Design, develop, and deploy a mini wind mill power generation system to provide a sustainable and renewable source of energy.

Scope Statement:

The project scope includes:**1. Design and Development:**

- Design a mini wind mill with a capacity of [230] W.
- Develop a wind turbine blade design and manufacturing plan.
- Select and procure necessary components (generator, controller, tower, etc.).

2. System Installation:

- Identify a suitable location for the mini wind mill installation.
- Install the wind turbine, tower, and associated electrical infrastructure.

3. Electrical Connection and Control:

- Design and install an electrical control system.
- Connect the mini wind mill to the electrical grid or a local energy storage system.

4. Testing and Commissioning:

- Conduct performance testing and commissioning of the mini wind mill.
- Ensure compliance with relevant safety and regulatory standards.

REFERENCES**Online Resources**

1. National Renewable Energy Laboratory (NREL): A US-based research laboratory providing information on wind energy and other renewable energy sources.
2. Wind Energy Association (WEA): A trade association promoting wind energy development and providing resources on wind energy technology and policy.
3. European Wind Energy Association (EWEA): A trade association promoting wind energy development in Europe and providing resources on wind energy technology and policy.

Books

1. "Wind Energy Handbook" by Tony Burton, David Sharpe, Nick Jenkins, and Ervin Bossanyi: A comprehensive textbook on wind energy technology and applications.
2. "Wind Power Generation" by R. C. Bansal, T. S. Bhatti, and D. P. Kothari: A textbook covering the basics of wind power generation and its applications.
3. "Renewable Energy Systems" by Henrik Lund: A textbook covering various aspects of renewable energy systems, including wind power.

Government Reports

1. US Department of Energy: Wind Energy Technologies Office: Reports and publications on wind energy technology and development.
2. International Energy Agency (IEA) Wind: Reports and publications on wind energy technology and development, with a global focus.
3. European Commission: Directorate-General for Energy: Reports and publications on wind energy policy and development in Europe.

Industry Reports

1. Global Wind Energy Council (GWEC): Reports and publications on wind energy market trends and development.
2. Wind Energy Association (WEA): Reports and publications on wind energy market trends and development in the US.
3. MAKE Consulting: Reports and publications on wind energy market trends and development, with a focus on industry analysis and forecasting