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Grid Connected Solar And Wind Hybrid Power System Based On Iot

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ABSTRACT: The integration of renewable electricity resets with clever tracking structures has emerged as an answer to full fill growing electricity needs at the same time as minimizing environmental impacts. This paper gives the layout and implementation of a grid-related sun and wind hybrid device included with the Internet of Things (IoT) for real-time tracking and green electricity management. The device carries photovoltaic panels, a wind turbine, a rate controller, an inverter, and a grid-tie unit, all interconnected with IoT-primarily based totally sensors and a cloud platform. The outcomes reveal progressed electricity reliability, green information acquisition, and more desirable device renovation thru predictive analytics.

KEYWORDS: Hybrid Energy System, Solar, Wind, IoT, Grid Connection, Renewable Energy, Smart Monitoring.

INTRODUCTION

Growing electricity needs and environmental issues necessitate the transition closer to renewable electricity resets. Hybrid structures, combining sun and wind electricity, provide progressed reliability over single-supply structures. However, the range of those resets calls for green tracking and manipulate mechanisms, which may be performed thru IoT integration. This examine goals to layout and expand an IoT-primarily based totally sun and wind hybrid device related to the grid.

LITERATURE SURVEY

System Components:

- Renewable Energy Sources: Solar photovoltaic (PV) systems and wind turbines are used to generate electricity.
- Energy Storage: Battery storage systems are often integrated to stabilize the grid and provide backup power.
- IoT Monitoring: Internet of Things (IoT) systems are used to monitor electrical parameters, such as voltage, current, and power output, in real-time ^{1 2}.

System Design and Implementation:

- Hybrid Power Systems: Grid-connected solar wind hybrid power systems are designed to optimize energy production and reduce reliance on fossil fuels.

- Smart Grid Integration: These systems are integrated with smart grid technology to enhance energy efficiency, reliability, and sustainability.
- Vehicle-to-Grid (V2G) Technology: Some systems incorporate V2G technology, allowing electric vehicles to supply energy back to the grid ³.

Benefits and Applications:

- Improved Energy Efficiency: Hybrid systems can optimize energy production and reduce energy losses.
- Enhanced Reliability: IoT monitoring and smart grid integration can improve system reliability and reduce downtime.
- Smart Campus Applications: IoT-based hybrid renewable energy systems can be used in smart campus settings to promote sustainability and energy efficiency ².

Research and Development:

- Optimizing Renewable Energy Integration: Researchers are working on optimizing the integration of renewable energy sources, such as solar and wind power, into the grid.
- IoT-Based Monitoring: IoT-based monitoring systems are being developed to enhance system performance, reliability, and sustainability ⁴.

Some notable research papers and projects on this topic include ^{5 2 3}:

- "IoT Based Wind/Solar Hybrid Inverter" on ResearchGate
- "IoT-Based Hybrid Renewable Energy System for Smart Campus"
- "Design and Implementation of Grid Connected Solar/Wind/Diesel Generator Powered Charging Station for Electric Vehicles with Vehicle to Grid Technology Using IoT"



METHODOLOGY

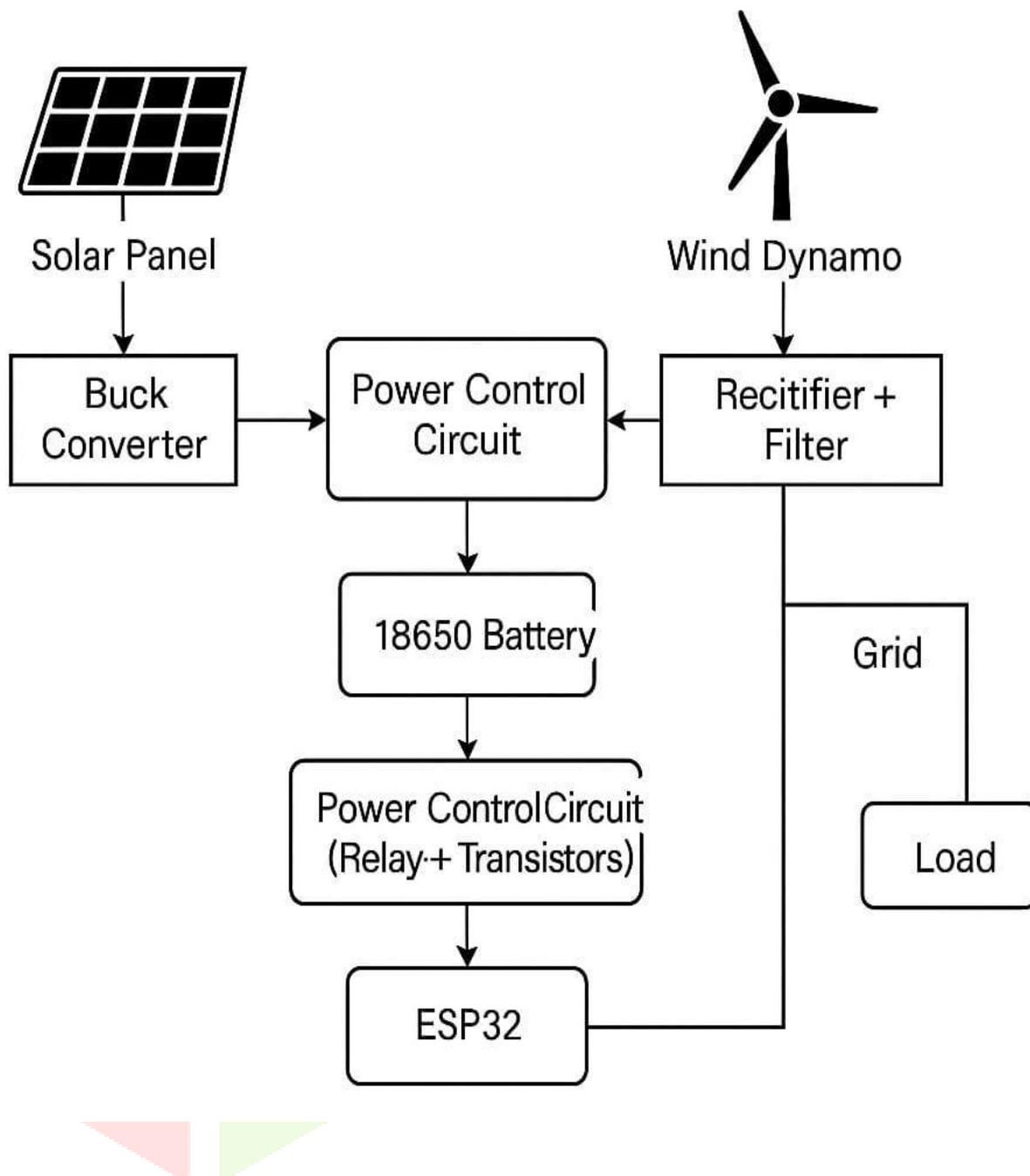


Fig.(a) Proposed system block diagram

Sizing of sun and wind additives primarily based totally on electricity necessities and location assessment. Implementation: Setting up the bodily device and integrating IoT modules. Data Acquisition: Collecting real-time information from sensors. Cloud Visualization: Using dashboards for visualisation and alerts. Performance Evaluation: Analysing system, and responsiveness to various climate conditions.

System Architecture: The proposed device is composed of: Solar Photovoltaic Panels: Capturing sun electricity and changing it into electric energy. Wind Turbine: Harnessing wind electricity to generate power. Charge Controller: Managing the electricity waft among technology units, batteries, and loads. Inverter: Converting DC power to AC for grid compatibility. Grid-Tie Unit: Allowing electricity change with the principle application grid. IoT Sensors and Gateway: Monitoring parameters like voltage, current, temperature, and wind speed, and transmitting information to a cloud platform.

IoT Integration: IoT sensors accumulate real-time information on energy technology, device health, and environmental conditions. A microcontroller (e.g., ESP32 or Raspberry Pi) serves as a gateway to method and ship the information to cloud offerings like AWS IoT, Azure, Thing Speak. The device allows far off tracking, predictive renovation alerts, and ancient information analysis.

RESULTS

The applied hybrid machine effectively mixed sun and wind electricity with grid connectivity. Solar panels produced 6.8V–7.2V and wind generators generated 4V–6V, ensuing in a mixed output of 5–6W daily. The battery (18650) maintained a solid fee among 3.7V and 4.2V. IoT-primarily based totally tracking through ESP32 enabled real-time monitoring of temperature, humidity, and electricity metrics on Blynk/Thing speak. The machine mechanically switched among resets the use of a relay, making sure non-stop electricity. Efficiency changed into recorded at about 70%, and the danger detection module functioned reliabl

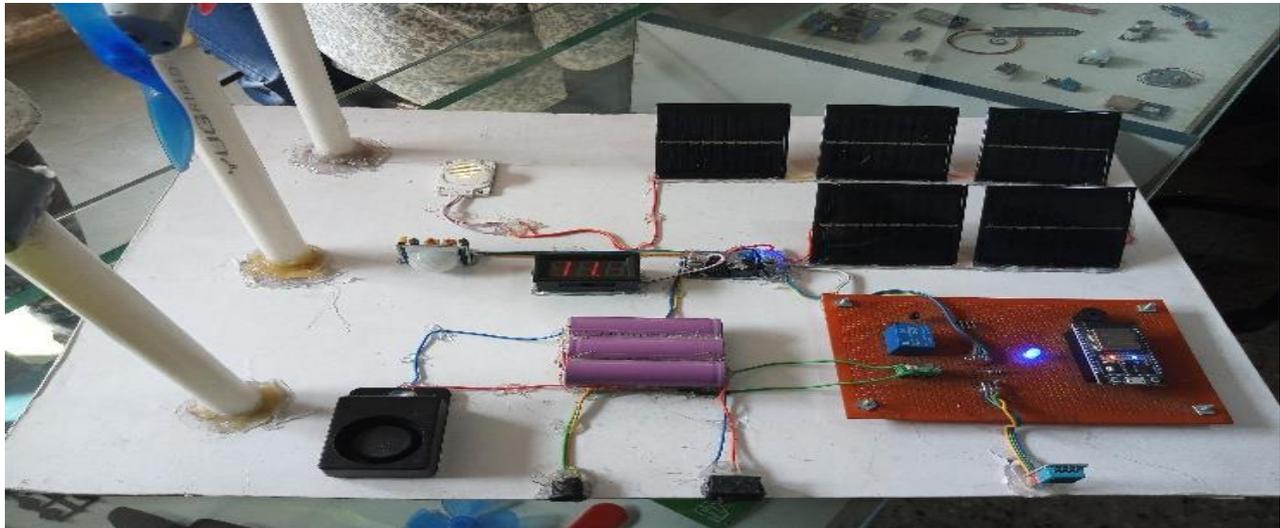


Fig. (b) Grid linked Solar and Wind Hybrid Power machine Based on IOT

FUTURE SCOPE

The grid-linked sun and wind hybrid strength gadget with IoT has notable capacity for destiny improvements. With enhancements in renewable electricity generation, performance may be improved via way of means of the usage of superior sun panels and high-overall performance wind turbines. The integration of AI and gadget gaining knowledge of can similarly optimize strength control via way of means of predicting electricity era and intake patterns. Additionally, battery garage generation improvements will permit higher electricity garage and utilization. Expanding IoT competencies can decorate far off tracking, fault detection, and predictive maintenance, making the gadget greater dependable and user-friendly. As clever grid generation develops, such hybrid structures can play a key function in growing decentralized and self-maintaining strength networks, lowering reliance on conventional strength grids.

CONCLUSION

The grid-linked sun and wind hybrid strength gadget primarily based totally on IoT is an effective and sustainable answer for contemporary-day electricity needs. By making use of each sun and wind electricity, the gadget guarantees non-stop strength era at the same time as lowering dependence on fossil fuels. The integration of IoT lets in real-time tracking and control, making electricity control greater green and user-friendly. This generation now no longer most effective facilitates in lowering energy expenses however additionally helps environmental conservation via way of means of selling using smooth electricity. With similarly improvements in renewable electricity and clever grid generation, such hybrid structures can play a critical function in reaching a greater sustainable and electricity-green destiny.

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