Title: Development of an IoT-based control system to be used for yaw axis actuation of a micro horizontal axis wind turbine (HAWT)

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Abstract:

Purpose:

Nowadays renewable energy becomes the most practical source to reduce the carbon footprint. Therefore, a very rapid increase in renewable energy penetration in electric power generation is expected. In renewable energy harvesting wind turbines play a critical role in energy conversion because of their reliability. In this research, an automated yaw drive mechanism for a horizontal axis wind turbine was utilized to adjust the nacelle position to face the wind direction so that maximum power can be extracted from wind energy. The potential power extraction efficiency of such wind turbines depends on proper yaw control. In this study, a servo mechanized automated control system has been developed and analyzed applicable for small off-grid HAWT (Horizontal Axis Wind Turbine).

Methodology: To demonstrate the technical feasibility and superiority of the proposed solution, a mathematical model along with sensory calibration was developed and tested using an analog potentiometer.

Findings: The system responses were recorded in an Internet of Things (IoT) server and the mathematical model was validated by comparing the calibrated values with the experimental values which showed about 97% accuracy.

Originality: This system architecture uses low powered NodeMCU v.2 LoRa (Long Ranged) wireless controller for data transmission and the 'Thingspeak' server along with the MATLAB coding environment has been utilized for data analytics and system response correction.

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Ethical Compliance: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Keywords

Automated Wind Turbine, Smart Systems, Information Technology, Internet of Everything

Biography

Utpal Mozumder received the B.S.E.E. from Rajshahi University of Engineering and Technology, Bangladesh in 2018. He received his M.S. Degree in Electrical Engineering from the University of Alaska Fairbanks, USA in 2021. His research interests are in Renewable Energy, Electrical Machine design and Electrical Control systems, and Signal Processing.

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