

THE EFFICIENCY AND FEASIBILITY OF DUAL AXIS SOLAR TRACKER USING ARDUINO

ABSTRACT

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The rising demand for renewable energy has driven interest in more efficient solar power systems. Dual-axis solar trackers improve energy collection by adjusting photovoltaic panels to follow the sun's position throughout the day, resulting in higher energy output compared to fixed-panel systems. Arduino-based control systems present a cost-effective and programmable solution for accurate solar tracking, making the technology suitable for both residential and small-scale commercial use. This study investigates the efficiency and practicality of an Arduino-controlled dual-axis solar tracker, aiming to evaluate its potential in maximizing energy generation and ensuring reliability. This study adopts a qualitative approach to assess the feasibility of an Arduino-controlled dual-axis solar tracker, focusing on the perceptions of Grade 11 and 12 students at Bestlink College of the Philippines Bulacan. Data were collected using a Likert scale survey that evaluated key indicators such as cost-effectiveness, user-friendliness, system design, and overall acceptance. Thematic analysis of the responses was conducted to identify practical considerations and potential barriers to adoption. By analyzing user perspectives, the research aims to evaluate the system's viability and provide insights for enhancing its application in educational or small-scale renewable energy settings. The study revealed that the Arduino-based dual-axis solar tracker demonstrated improved efficiency and feasibility when compared to a fixed-position solar panel. Measurements of energy output and tracking accuracy under various conditions showed efficiency gains of approximately 30–40%. Feasibility was assessed through material cost, construction ease, and the system's reliability and maintenance requirements. Survey responses from 40 senior high school students indicated high levels of perceived effectiveness and practicality, supporting the system's potential for educational and small-scale energy use. The findings confirm that the Arduino-controlled dual-axis solar tracker significantly enhances energy efficiency by automatically aligning with the sun's movement. Its low-cost, programmable features make it an ideal solution for residential setups and educational projects, especially in sun-rich regions. While external factors such as weather may influence performance, the tracker's consistent energy gains highlight its value in sustainable energy applications. Continued development and testing may further optimize its design and increase its adoption in small-scale renewable energy systems.

RECOMMENDED CITATION

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