ABSTRAK

IMPLEMENTASI SERABUT SAWIT SEBAGAI PENDINGIN PASIF UNTUK PEMANTAUAN DAN PENGENDALIAN LAMPU JALAN BERBASIS ENERGI SURYA

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Energi matahari merupakan salah satu sumber energi terbarukan yang banyak dimanfaatkan, namun efisiensi panel surya sangat dipengaruhi oleh suhu operasionalnya. Penelitian ini bertujuan untuk meningkatkan efektivitas panel surya dengan menerapkan sistem pendingin pasif menggunakan serabut sawit serta mengintegrasikannya dengan sistem lampu jalan berbasis Internet of Things (IoT). Serabut sawit dipilih karena memiliki kemampuan menyerap dan mempertahankan kelembapan, sehingga dapat menurunkan suhu panel melalui proses evaporasi. Sistem dirancang menggunakan panel surya polikristalin 100 WP, sensor suhu (DHT22 dan DS18B20), sensor cahaya (BH1750), sensor hujan, serta mikrokontroler ESP32 yang terhubung ke aplikasi MIT App Inventor. Pengukuran dilakukan untuk membandingkan efisiensi panel dengan dan tanpa pendingin serabut sawit. Hasil menunjukkan bahwa penggunaan serabut sawit mampu menurunkan suhu panel dan meningkatkan efisiensi konversi energi. Sistem IoT yang dikembangkan juga memungkinkan pemantauan dan pengendalian lampu jalan secara real-time melalui smartphone. Dengan integrasi teknologi ini, penelitian membuktikan bahwa pemanfaatan limbah serabut sawit tidak hanya ramah lingkungan, tetapi juga efektif meningkatkan kinerja panel surya dalam aplikasi penerangan jalan otomatis.

Kata kunci: serabut sawit, panel surya, pendingin pasif, Internet of Things, efisiensi energi, lampu jalan.

ABSTRACT

IMPLEMENTATION OF PALM FIBER AS A PASSIVE COOLER FOR MONITORING AND CONTROLLING SOLAR BASED STREET LIGHTS

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Solar energy is one of the most widely utilized renewable energy sources; however, the efficiency of solar panels is significantly affected by their operating temperature. This study aims to enhance solar panel performance by implementing a passive cooling system using palm fiber and integrating it with an Internet of Things (IoT)-based street lighting system. Palm fiber was selected due to its high moisture retention and absorption capabilities, which facilitate evaporative cooling and reduce panel temperature. The system is built using a 100 WP monocrystalline solar panel, temperature sensors (DHT22 and DS18B20), a light intensity sensor (BH1750), a rain sensor, and an ESP32 microcontroller connected to the MIT App Inventor platform. Measurements were conducted to compare panel efficiency with and without palm fiber cooling. Results indicate that the palm fiber significantly lowers the panel's temperature and improves energy conversion efficiency. The developed IoT system also allows for real-time monitoring and control of street lights via smartphone. This integration demonstrates that palm fiber, a natural waste product, can be effectively utilized to improve solar panel performance in an environmentally friendly and energy-efficient street lighting application.

Keywords: palm fiber, solar panel, passive cooling, Internet of Things, energy efficiency, street lighting.