

ABSTRAK

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OPTIMALISASI EFEKTIFITAS LOGIKA FUZZY SUGENO DALAM STABILISASI PADA SISTEM KONTROL SUHU *TRANSPORT BABY INCUBATOR*

xviii + 124 Halaman + 10 Tabel + 9 Lampiran

Transport baby incubator merupakan alat penting untuk menjaga kestabilan suhu bayi prematur selama pemindahan. Banyak alat yang masih menggunakan kontrol suhu konvensional dan baterai *Lead Acid* yang kurang efisien serta kurang akurat. Penelitian ini bertujuan mengembangkan sistem inkubator transport dengan mengoptimalkan kontrol suhu berbasis Logika Fuzzy Sugeno dan menggunakan baterai Lithium Iron Phosphate (LiFePO_4) berfitur *fast charging* untuk meningkatkan efisiensi daya. Sistem ini menggunakan sensor AM2315 untuk suhu dan kelembapan lingkungan serta sensor NTC untuk suhu kulit bayi. Mikrokontroler Arduino Mega 2560 Pro mengelola data sensor dan mengatur pemanas menggunakan kontrol Fuzzy Sugeno. Hasil ditampilkan melalui layar TFT Nextion 7 inci, dan sistem dilengkapi *alarm*, *coulometer*, serta proteksi seperti BMS dan thermostat untuk keamanan. Logika Fuzzy Sugeno dipilih karena efisien secara komputasi, dengan *output* berupa fungsi linier atau konstan sehingga tidak memerlukan defuzzifikasi. Proses kontrol mencakup fuzzifikasi, *inference*, dan perhitungan *output*, memungkinkan sistem merespon cepat terhadap perubahan suhu. Hasil pengujian menunjukkan bahwa sistem mampu menjaga suhu inkubator secara stabil pada rentang suhu 32°C, 33°C, 34°C, 35°C, hingga 36°C, dengan waktu respon yang cepat dan *overshoot* yang sangat minimal. Sistem dapat dengan adaptif menyesuaikan tingkat pemanasan berdasarkan kondisi aktual suhu di dalam inkubator maupun suhu kulit bayi. Kontrol Logika Fuzzy Sugeno terbukti efektif dan adaptif untuk menjaga kestabilan suhu *Transport baby incubator*, serta potensial diterapkan pada sistem kendali lain dalam lingkungan dinamis.

Kata kunci : Logika Fuzzy Sugeno , *Transport baby incubator*, kontrol suhu.

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ABSTRACT

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OPTIMIZING THE EFFECTIVENESS OF SUGENO FUZZY LOGIC IN THE TEMPERATURE STABILIZATION CONTROL SYSTEM OF A TRANSPORT BABY INCUBATOR

xviii + 124 Pages + 10 Tables + 9 Appendices

Transport incubators are essential tools to maintain the temperature stability of premature babies during transport. Many devices still use conventional temperature control and Lead Acid batteries that are inefficient and inaccurate. This study aims to develop a transport incubator system by optimizing temperature control based on Sugeno Fuzzy Logic and using Lithium Iron Phosphate (LiFePO₄) batteries with fast charging features to increase power efficiency. The Arduino Mega 2560 Pro microcontroller manages the data sensors and regulates the heater using Sugeno Fuzzy control. The results are displayed on a 7-inch Nextion TFT screen, and the system is equipped with alarms, coulometers, and protection such as BMS and thermostats for safety. Sugeno Fuzzy Logic was chosen because it is computationally efficient, with outputs in the form of linear or constant functions so that it does not require defuzzification. The control process includes fuzzification, inference, and output calculations, allowing the system to react quickly to temperature changes. The test results show that the system is able to maintain the incubator temperature stably in the temperature range of 32°C, 33°C, 34°C, 35°C, to 36°C, with a fast response time and very minimal overshoot. The system can adaptively adjust the heating level based on the actual temperature conditions inside the incubator and the baby's skin temperature. Sugeno Fuzzy Logic Control has proven to be effective and adaptive in maintaining the stability of the baby incubator transportation temperature, and has the potential to be applied to other control systems in dynamic environments.

Keywords: Sugeno fuzzy logic, Transport baby incubator, temperature control

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