

ABSTRAK

Vitanova, Yovani. 2025. Pemantauan Kecepatan dan Arah Angin Berbasis IoT Berdasarkan Skala *Beaufort*. Skripsi. Tanjungpinang: Program Studi Teknik Elektro. Fakultas Teknik Dan Teknologi Kemaritiman. Universitas Maritim Raja Ali Haji. Pembimbing I : Dr. Rozeff Pramana, S.T.,M.T, Pembimbing II : Ir. Sapta Nugraha, S.T., M.Eng.

Penelitian ini mengembangkan perangkat pemantauan kecepatan dan arah angin berbasis Internet of Things (IoT) untuk memantau kondisi angin secara real-time dan berkelanjutan. Perangkat terdiri atas sensor kecepatan dan arah angin yang terintegrasi dengan mikrokontroler serta modul komunikasi nirkabel yang mengirimkan data otomatis ke platform Thingspeak. Sistem menyediakan informasi langsung melalui indikator LED dan buzzer sebagai peringatan visual dan audio. Panel surya digunakan sebagai sumber daya utama agar perangkat dapat beroperasi mandiri di berbagai kondisi lingkungan. Pengujian dilakukan selama sepuluh hari dan menghasilkan data kecepatan angin yang diklasifikasikan ke dalam enam kategori berdasarkan skala Beaufort. Proses prapemrosesan meliputi normalisasi dan pelabelan data untuk memastikan kualitas serta kesiapan dalam pelatihan model *machine learning*. Algoritma *Random Forest* digunakan sebagai model klasifikasi karena kemampuannya dalam mengolah data kompleks dan memberikan hasil yang stabil. Evaluasi model menunjukkan akurasi tertinggi sebesar 96,98% pada proporsi data training dan testing 70:30. Hasil *cross validation* sebesar 97,05% menunjukkan kestabilan model terhadap variasi data. Rata-rata nilai precision sebesar 97,54%, *recall* sebesar 96,98%, dan F1-score sebesar 97,16% mencerminkan kemampuan model dalam mengklasifikasikan data secara seimbang dan akurat. Sistem pemantauan yang dikembangkan mampu memberikan informasi angin secara real-time sekaligus mendukung klasifikasi berbasis *machine learning*. Penerapan sistem ini dapat digunakan dalam pemantauan lingkungan, mitigasi cuaca ekstrem, sektor pertanian, maritim, serta energi terbarukan. Perpaduan antara efisiensi energi, akurasi klasifikasi, dan kemudahan akses data menjadikan perangkat ini sebagai solusi pemantauan angin yang presisi, efektif, dan berkelanjutan.

Kata kunci: Internet of Things, pemantauan angin, *Random Forest*, Thingspeak, *machine learning*

ABSTRACT

Vitanova, Yovani. 2025. *IoT-Based Wind Speed and Direction Monitoring Based on the Beaufort Scale*. Bachelor. Tanjungpinang: Study Program of Electrical Engineering, Faculty of Engineering and Technology. University of Maritim Raja Ali Haji.. Supervisor I: Dr. Rozeff Pramana, S.T., M.T, Supervisor II: Ir. Sapta Nugraha, S.T., M.Eng.

This study developed a wind speed and direction monitoring device based on the Internet of Things (IoT) to monitor wind conditions in real-time and continuously. The device consists of wind speed and direction sensors integrated with a microcontroller and a wireless communication module that automatically transmits data to the Thingspeak platform. The system delivers direct alerts through LED indicators and a buzzer for visual and audio notifications. A solar panel serves as the primary power source, enabling the device to operate independently under various environmental conditions. Testing was conducted over a ten-day period and produced wind speed data categorized into six classes based on the Beaufort scale. The preprocessing stage included data normalization and labeling to ensure data quality and readiness for machine learning model training. The Random Forest algorithm was used as the classification model due to its capability to handle complex datasets and provide stable results. Model evaluation achieved the highest accuracy of 96.98% using a 70:30 training-to-testing data ratio. Cross-validation accuracy reached 97.05%, indicating model stability across data variations. Average precision, recall, and F1-score were 97.54%, 96.98%, and 97.16% respectively, reflecting the model's ability to classify data accurately and consistently. The developed monitoring system provides real-time wind information while supporting classification through machine learning. Implementation of this system is applicable to environmental monitoring, extreme weather mitigation, agriculture, maritime sectors, and renewable energy. The combination of energy efficiency, classification accuracy, and data accessibility makes this device a precise, effective, and sustainable solution for wind condition monitoring.

Keywords: *Internet of Things, wind monitoring, Random Forest, Thingspeak, machine learning*