NaviSafe (*Navigation and Safety System*): Sistem Pemantauan dan Keamanan Nelayan untuk Mitigasi Bencana Laut

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ABSTRAK

Indonesia memiliki perairan yang luas dengan potensi perikanan mencapai 12,01 juta ton per tahun, menjadikan sektor ini sebagai pilar ekonomi dan warisan budaya. Namun, tingginya risiko kecelakaan maritim akibat angin kencang, ombak besar, dan keterbatasan teknologi pemantauan mengancam keselamatan nelayan. Untuk mengatasi permasalahan ini, penelitian ini mengembangkan NaviSafe, sistem pemantauan dan keamanan nelayan berbasis *Internet of Things* (IoT) yang mengintegrasikan GPS, anemometer, *wind vane*, dan sensor IMU untuk mendeteksi lokasi, kecepatan angin, dan kemiringan kapal secara *real-time*. Penelitian ini menggunakan metode *Research and Development* (RnD) 3D, yang mencakup *Define, Design,* dan *Develop*. Pengujian dilakukan melalui uji efektivitas, fungsionalitas, serta validasi data dengan Tim SAR DIY. Hasil menunjukkan bahwa anemometer dan *wind vane* memiliki akurasi 99,742% dengan nilai error 0,00267%. Sistem transmisi data menggunakan LoRa memiliki delay rata-rata 0,058 detik dengan akurasi 98,6%, sementara algoritma l*ost connection handling* mampu mentransmisikan data secara 100% ke server. Uji fungsionalitas menunjukkan NaviSafe efektif dalam mendeteksi kondisi laut, dengan rata-rata kecepatan angin 5,9 m/s yang divisualisasikan dalam *dashboard* berbasis *website*. Hasil kuesioner menunjukkan bahwa Tim SAR terbantu dengan adanya NaviSafe, karena dapat meningkatkan efisiensi pencarian dan mitigasi bencana laut. Implementasi sistem ini diharapkan mengurangi risiko kecelakaan, meningkatkan keselamatan nelayan, dan mendukung keberlanjutan sektor perikanan di Indonesia.

Kata Kunci: Keselamatan Nelayan, IoT, LoRa, Pemantauan Laut, Mitigasi Bencana

NaviSafe (Navigation and Safety System): Fishermen Monitoring and Security System for Marine Disaster Mitigation

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ABSTRACT

Indonesia has vast waters with fisheries potential reaching 12.01 million tons per year, making this sector a pillar of the economy and cultural heritage. However, the high risk of maritime accidents due to strong winds, large waves, and limited monitoring technology threatens the safety of fishermen. To address these issues, this research developed NaviSafe, an Internet of Things (IoT)-based fishermen monitoring and safety system that integrates GPS, anemometer, wind vane, and IMU sensors to detect location, wind speed, and vessel tilt in real-time. This research uses the 3D Research and Development (RnD) method, which includes Define, Design, and Develop. Testing was conducted through effectiveness, functionality, and data validation tests with the DIY SAR Team. The results show that the anemometer and wind vane have an accuracy of 99.742% with an error value of 0.00267%. The data transmission system using LoRa has an average delay of 0.058 seconds with an accuracy of 98.6%, while the lost connection handling algorithm is able to transmit data 100% to the server. Functionality tests show NaviSafe is effective in detecting sea conditions, with an average wind speed of 5.9 m/s visualized in a web-based dashboard. The questionnaire results show that the SAR team is helped by NaviSafe, because it can increase the efficiency of search and mitigation of marine disasters. The implementation of this system is expected to reduce the risk of accidents, improve the safety of fishermen, and support the sustainability of the fisheries sector in Indonesia.

Keywords: Fisherman Safety, IoT, LoRa, Ocean Monitoring, Disaster Mitigation