

NavIC Sentinel: AI-Driven Maritime Border Safety & Navigation System

S Razikur Rahman , Shyam T A

Corresponding Author Email ID: rrazik487@gmail.com

Jain Deemed-To-Be University

Abstract

Enhancing Maritime Safety and Preventing Unauthorized Border Crossings Using Indigenous Navigation Technology (NavIC).

Ensuring maritime safety and preventing unauthorized border crossings remain significant challenges for coastal fishermen and national security agencies. Traditional methods, such as GPS-based tracking, coast guard surveillance, and mobile GPS applications, suffer from low accuracy ($\pm 15\text{-}30\text{m}$), delayed alerts, and dependency on mobile networks, making them unreliable in deep-sea navigation. To address these issues, we propose NavIC Sentinel, an AI-driven maritime border safety system that leverages India's indigenous NavIC satellite navigation system for high-accuracy tracking ($\pm 10\text{m}$), real-time alerts, and automated safety mechanisms. The system features NavIC-based satellite tracking for precise positioning, a multi-stage alert system that provides real-time warnings via OLED display, mobile notifications, and wearable vibration alerts, and an automatic engine cutoff system that prevents unauthorized crossings by disabling the vessel's engine upon border breach. It also integrates multi-sensor fusion technology, including gyroscope, accelerometer, temperature, and barometer sensors, ensuring adaptive tracking and environmental adaptability. Unlike mobile GPS solutions that rely on network coverage, NavIC Sentinel operates offline, making it highly effective in remote sea regions, and utilizes AI-driven route optimization to predict safe fishing zones and ensure compliance with maritime safety regulations. Compared to existing solutions, NavIC Sentinel outperforms traditional GPS and coast guard surveillance in accuracy, response time, offline capability, and intervention efficiency. The global maritime navigation market is projected to grow at a CAGR of 6.5%, reaching \$30 billion by 2030, and in India alone, over 9 million fishermen and 250,000+ registered fishing vessels can benefit from this innovation, reducing legal risks and improving border security. The system is also scalable for applications in defense, logistics, and international maritime surveillance. NavIC Sentinel is a revolutionary navigation and safety solution that integrates AI, NavIC satellite technology, and automation to prevent border violations, enhance maritime security, and promote sustainable fishing. With real-time alerts, multi-sensor fusion, and autonomous intervention, it provides a reliable, cost-effective, and highly accurate alternative to traditional GPS tracking.

Keywords: NavIC, Maritime Navigation, Border Safety, AI-Driven Geofencing, Multi-Sensor Fusion