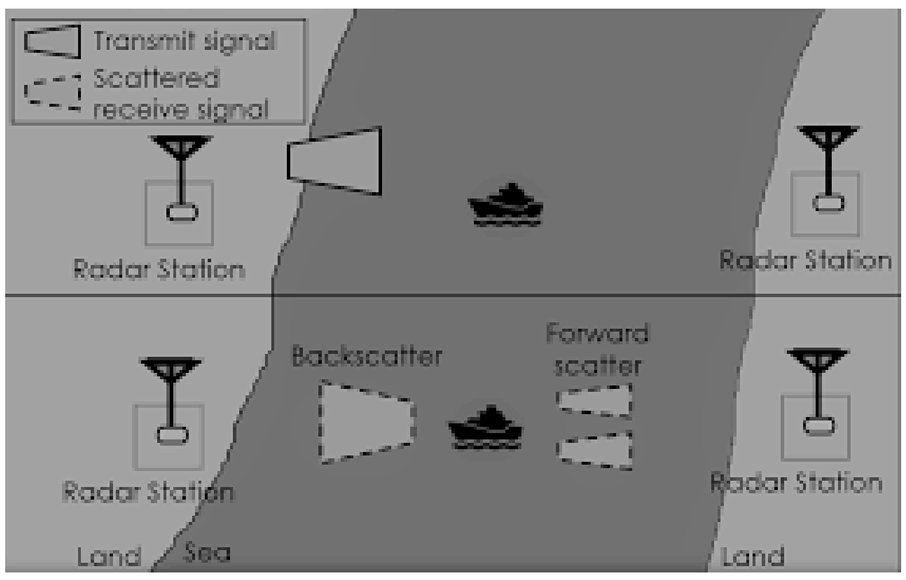
TECHNOMART Malaysia - Navigating The Future Through Drone-Related Technologies

10 & 11 June 2024

AN ADAPTIVE WIDELY DISTRIBUTED MIMO RADAR IN UNMANNED SURFACE VEHICLE (USV) NETWORKS FOR MARITIME SECURITY

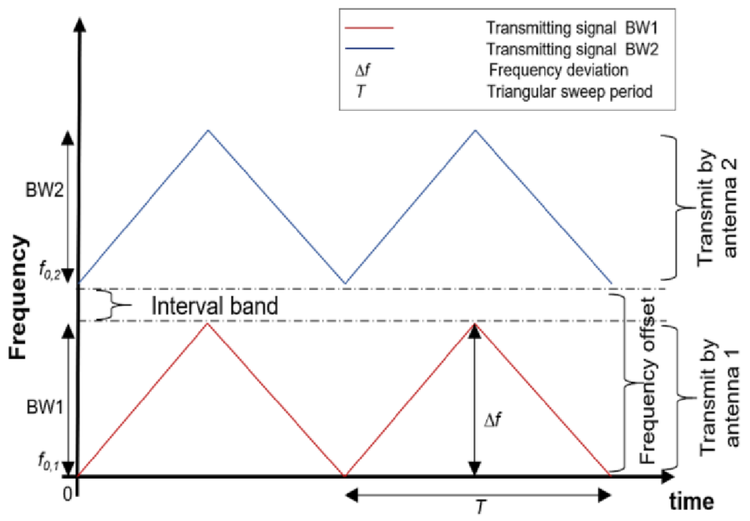
Problem Statement

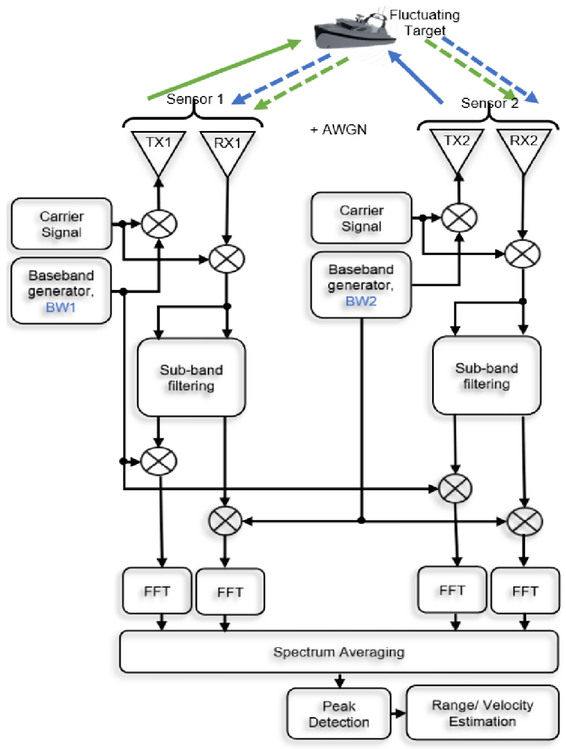
The detection of small vessels is crucial and one of the vital tasks of maritime radar. However, a known issue in maritime monitoring is that small vessel attributes reduce the probability of detection of modern radars, including ship-borne radar. This is due to their low radar cross section (RCS) and low signal-to-noise ratio (SNR). Meanwhile, a vessel-mounted radar system known for its reliability has a limitation due to its single radar coverage.

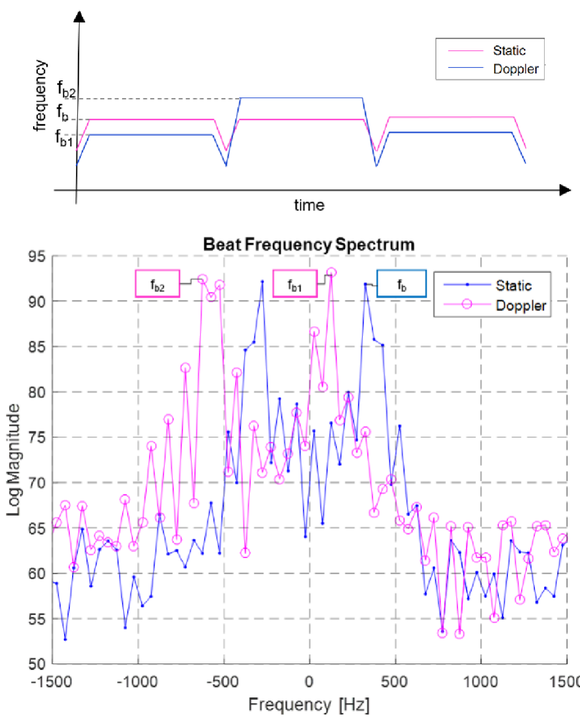


Invention / Methodology

The invention revolves around a co-located frequency modulated continuous waveform (FMCW) maritime radar for small vessel detection utilising a multiple-input multiple-output (MIMO) configuration. The radar behaviour is numerically simulated for detecting a Swerling 1 target which resembles small maritime's vessels. The simulated MIMO configuration comprised two transmitting and receiving nodes.

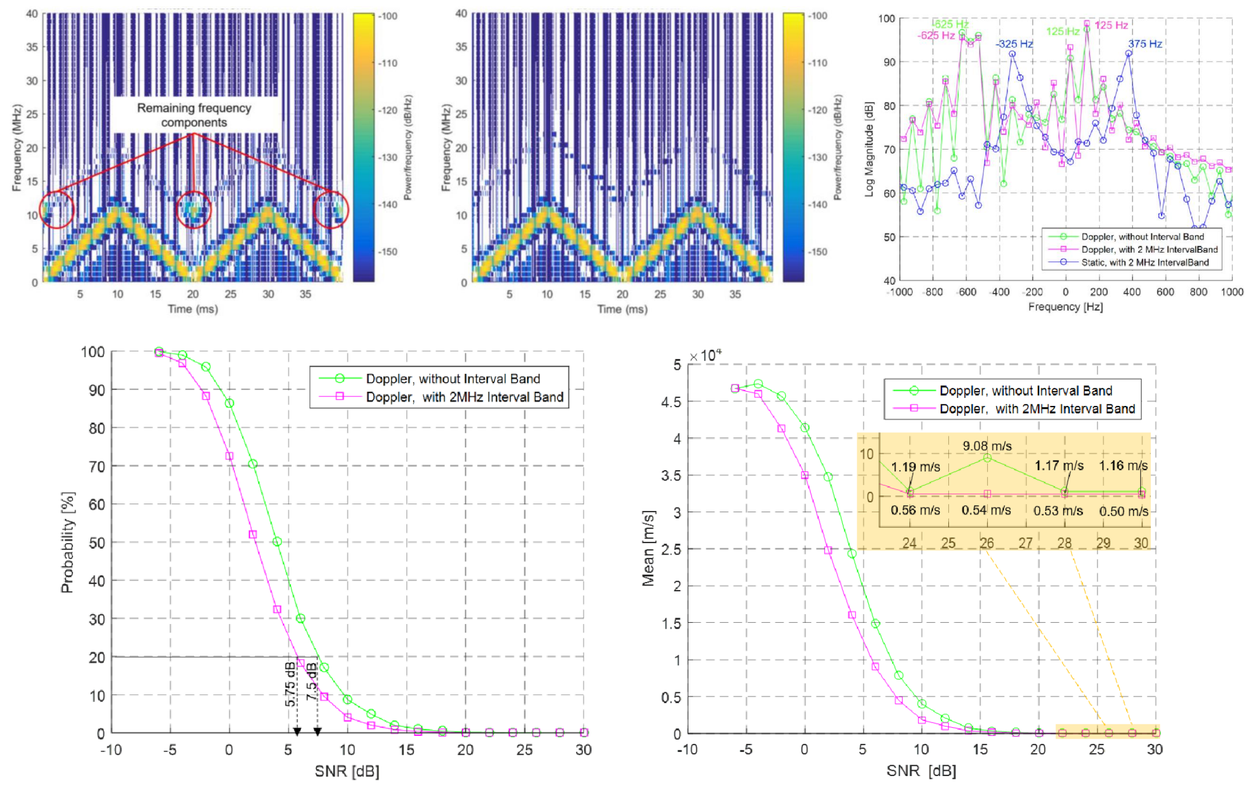






Findings

An improvement of 2.2 dB for a static target, and 0.1 dB for a moving target, in resulting the 20% probability of range error with the MIMO setup. A moving vessel's effect was observed to degrade the range error estimation performance between 0.6 to 2.7 dB. Meanwhile, the proposed method was proven to improve the 20% probability of velocity error by 1.75 dB. The impact of multi-frequency MIMO was also observed to produce better average error performance.



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