

ABSTRACT

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This work addresses wireless communication for a fleet of unmanned surface vessels, considering scenarios where there is a base station and one or more vessels that perform simple missions, such as moving to a desired location, performing sensing and surrounding a certain area. To carry out the missions, the vessels need to communicate with the base station and with each other, using a communication protocol. For this, the following were developed: (i) a fleet model with two types of elements: a base station and one or more vessels, which can act as an information sender node (obtained from local sensors, for example), an information recipient node of control received from the base station or neighboring stations, or as an intermediate node that forwards messages to the base, increasing the operating radius; (ii) an application-level communication protocol for communication between the elements considered; (iii) an implementation of this protocol, developed in the NS-3 network simulator; (iv) a simple implementation of kinematic control of vessels in MATLAB; (v) the integration between NS-3 and MATLAB to use the best characteristics of each simulation environment. Wi-Fi network in ad hoc mode has been combined with the AODV routing protocol and with limited broadcast IP messages in one jump to: (i) establish a 1–N communication mechanism (one for many) between neighboring vessels, since each message sent is intercepted by nodes with a direct link; (ii) provide a mechanism for detecting the neighborhood of each vessel; (iii) allowing greater control of the application and, with that, the possibility of aggregating information. Simulations were carried out to check the accuracy of the protocol and to identify the limits imposed by the speed of the vessels, received Wi-Fi signal strength, delivery rates and response time. The performance of the protocol was also evaluated according to the height of the antennas, the transmission power and the frequency of the signal. The results of the simulations indicate that the proposed protocol behaves satisfactorily and offers support for the development of more complete control systems, while maintaining some vessel autonomy.

Keywords: Communication on sea surface; Unmanned Vessels; Wireless Networks; IEEE 802.11; Network Simulator (NS-3); MATLAB.