ABSTRACT

This final project aims to develop a simulation-based autonomous ship navigation system that is able to move towards targets sequentially and avoid obstacles independently. This project implements a ship named Heron in a 3D virtual environment using the Webots simulator. The system is controlled by a Python-based controller with the support of virtual sensors such as GPS, cameras, and IMUs to obtain position, orientation, and obstacle detection data. Navigation is designed so that the ship can circle each flag from the starting point, through the pre-flag, flag, and post-flag points, before continuing to the next target and finally returning to the starting point. The development process was carried out iteratively through the stages of controller design, sensor integration, test scenario modeling, and performance testing and evaluation. The test results showed that the ship successfully completed all missions with a high success rate, including detecting and avoiding oil barrel obstacles more than 30 times in one navigation session, and maintaining a stable navigation sequence. This simulation successfully demonstrated the ship's ability to make real-time decisions based on sensor input, and proved the effectiveness of Webots as an initial testing application before the system was implemented in the real world.

Keywords: Autonomous ships, Webots, Navigation, Obstacles, Simulation, Python controller, Virtual sensors