
Open Thesis / Project

Modular UWB Plugin for Gazebo Ignition: Towards a Realistic Simulation Framework

Thesis Type

Bachelor Thesis / Master Project / Master Thesis

Motivation

Ultra-Wideband (UWB) is a wireless technology that can measure distances accurately and provide reliable communication. This makes it useful for mobile robots that need to know their positions and communicate with other robots or control systems, especially in indoor environments or places where GNSS signals are weak or unavailable.

Gazebo Ignition is a widely used, open-source robotics simulator that lets developers test and improve their algorithms before trying them on real robots. It helps reduce costs and risks in robot development. ROS2 is common middleware used to connect these simulations with real robot systems, allowing software developed in simulation to be easily transferred to actual robots.

Currently, there is no modular UWB radio plugin for Gazebo Ignition that can realistically simulate important signal behaviours like noise, distance bias, and non-line-of-sight (NLOS) effects. These factors have a big impact on how well UWB works in real life, affecting localization accuracy and communication reliability in robots. The plugin will provide a realistic simulation framework to support accurate testing of localization and communication in mobile robotics scenarios.



Goals and Tasks

Within this context, students can perform different tasks, such as:

- Develop a modular UWB radio plugin for Gazebo Ignition that simulates realistic UWB signal behaviours including noise, distance bias, multipath, and NLOS effects for mobile robotics scenarios;
- Enable flexible configuration of anchors and tags, supporting a range of deployment scenarios within the simulation environment;
- Integrate the plugin with ROS2 to provide compatible UWB ranging and communication data streams for use in mobile robotics systems;
- Validate the simulation model by comparing its outputs with analytical models and experimental measurements to ensure accuracy and reliability.

Target Group

- Students of ICE/Telematics;
- Students of Computer Science;
- Students of Electrical Engineering.

Required Prior Knowledge

- Solid skills in Python and/or C++;
- Experience with robotics, wireless communications and Linux;
- Basic understanding of signal modelling, propagation and signal processing.

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