

# AI-Navigation Development Environment: A Research Platform for Semantic Navigation and Robot Learning with Mobile Robots in Real-World

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Abstract

We present Navigation Development Environment 2, a low-cost modularized full-stack navigation system for upstream learning-based navigation research. The system has two parts: 1) an onboard lightweight software stack for geometric navigation, including SLAM, traversability analysis, and long-horizon path planning. 2) customizable simulation environments based on Unity, featuring the same sensor and motion model as the real-world platform, photo-realistic rendering, and automatic data annotation. Our navigation algorithm relies only on a single low-cost LiDAR-IMU module and the onboard computer. This enables deployment on popular platforms with no extra costs or extrinsic calibration effort, e.g., Unitree Go2. In the experiments, we show its localization, collision avoidance, and planning performance in various environments. We also show the usage of our system in fine-tuning 3D object detection and language navigation in custom environments. Guidelines and tutorials are provided for the setup of the system on popular platforms and integration with upstream modules.