

Semi-Autonomous Ground Convoy

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ABSTRACT: The Convoy is a set of Turtlebot 4 Lites that are capable of follow-the-leader and obstacle avoidance behavior on designated targets. Convoy members engage this behavior on both human and convoy targets. The convoy system integrates ROS2 with computer vision ATR (Automated Target Recognition), and tracking with NAV2 using LiDAR and SLAM algorithms as a pathfinding backbone. ATR modules were trained on a YOLO architecture with a curated dataset for recognizing HI VIS vests as designation.

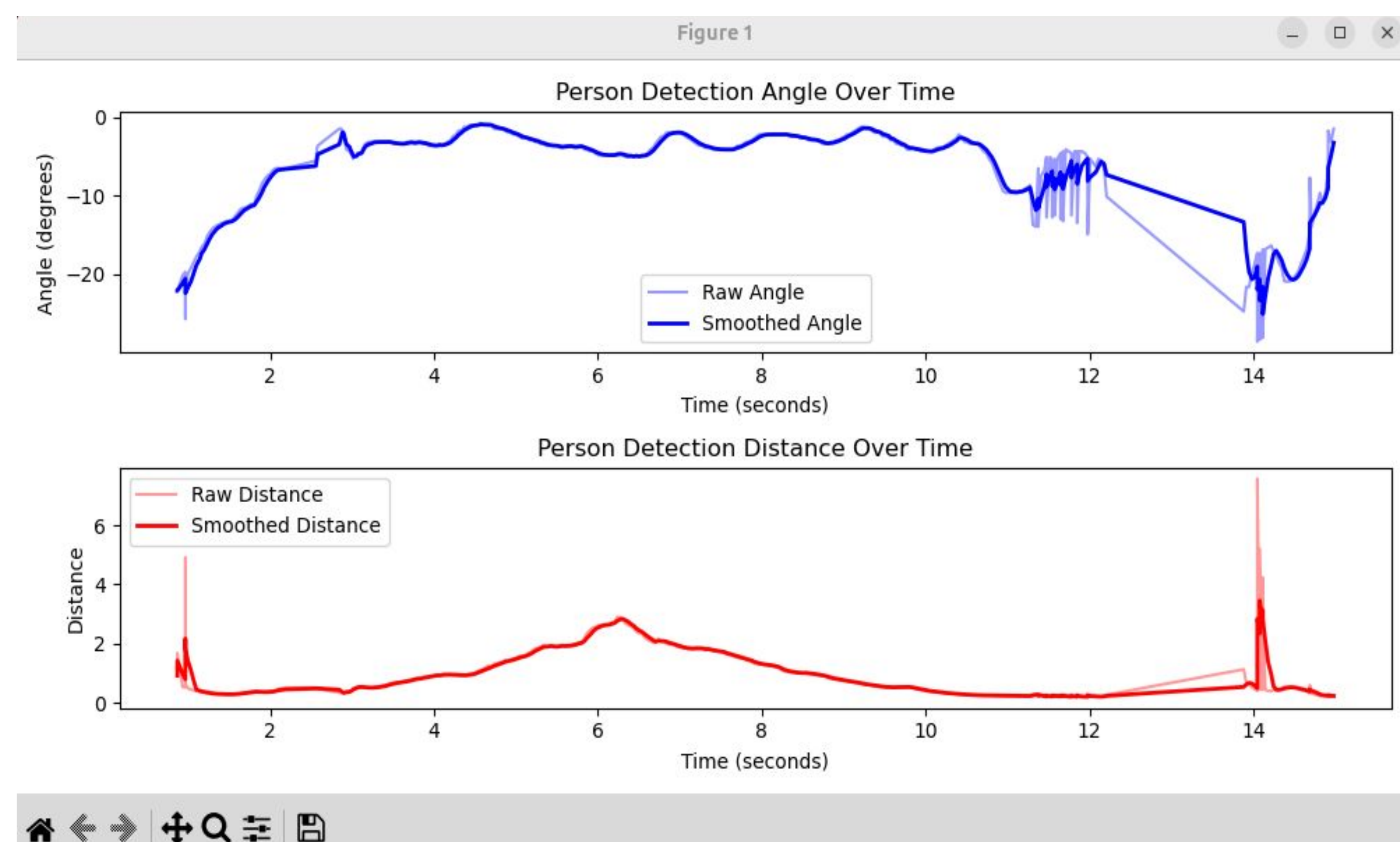


Fig. 1 Detection module implements a weighted average of detected positions to smooth information sent to motor control and path planning, eliminating outlier caused jitter.

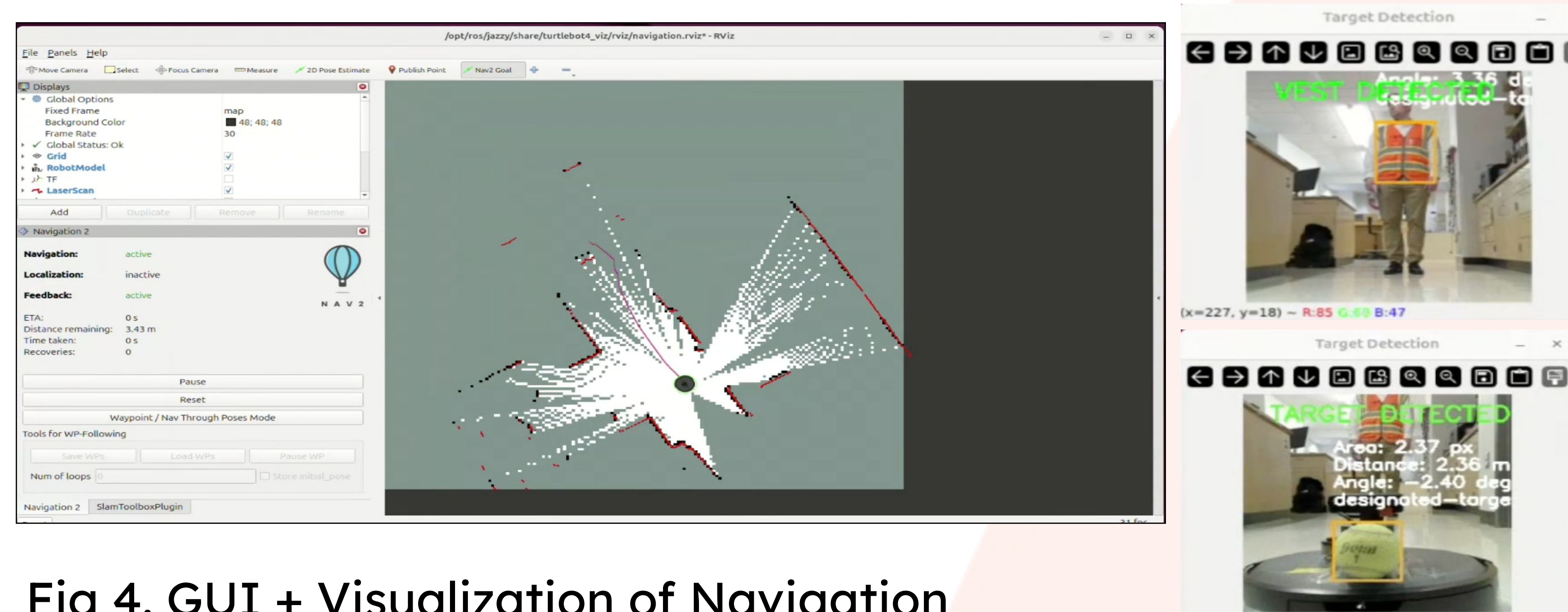


Fig 4. GUI + Visualization of Navigation and Detection modules working in real time.

Fig 2.

Training/Validation loss over time during retraining of neural network for ATR (Automated Target Recognition).

Model ultimately trained over 100 epochs with 7000 image samples.

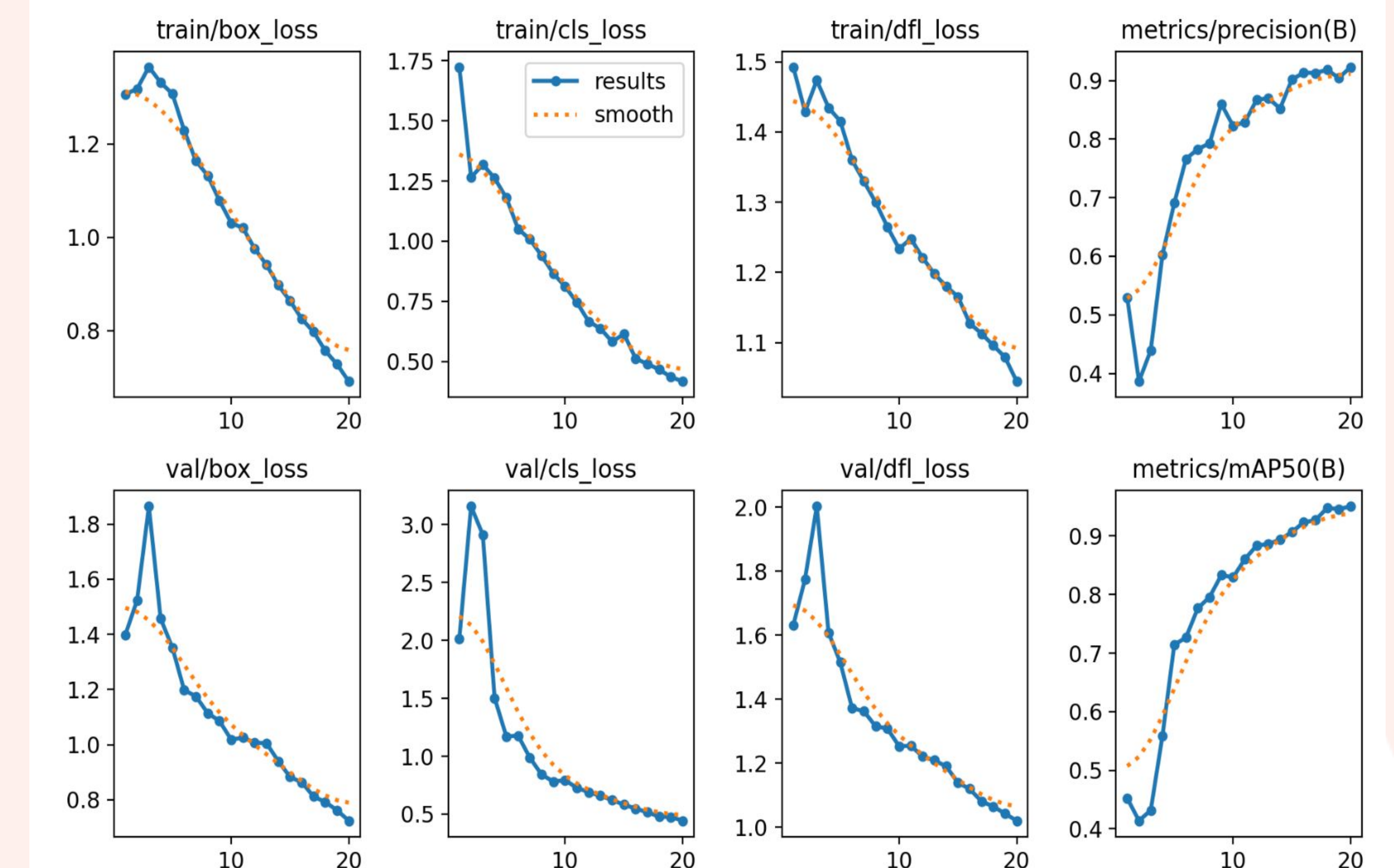


Fig 3.

Within our ROS2 codebase is a very important multiplexer that switches the motor control from our homemade navigation protocol and the Nav2 predictive and obstacle avoidance protocol.

The select input for this mux is distance from the target.

