Node: position_velocity_approximator

Header

Team: Groep 4 RMB

Created: 28.11.2025 by Melissa

name	date	Short description
position_velocity_approximator	28.11.2025	ROS2 node that subscribes to a topic on to receive simulated IMU acceleration data and integrates these measurements to approximate the robot's position and velocity.

Node description

This node subscribes to the topic imu_sim_acceleration to receive simulated IMU acceleration data and integrates these measurements to approximate the robot's position (x, y) and orientation (yaw), as well as its linear velocities (vx, vy) and angular velocity (omega_z). The position is published on topic imu_sim_position and the velocities are published on topic imu_sim_velocity, so the database subscriber node can store the calculated data in a database.

Node sub-objects and functions (communication objects):

(timer, publisher, subscriber, service server, action server, service client, action client

publisher : pos_pub_ Provides calculated position data for downstream nodes (e.g. database subscribers).
Publisher function: publish_position Publishes the calculated position data on topic imu_sim_position

publisher : velocity_pub_ Provides calculated velocity data for downstream nodes (e.g. database subscribers).
Publisher function: publish_velocity Publishes the calculated velocity data on topic imu_sim_velocity

subscriber : imu_sim_sub_ Receives simulated IMU data on topic imu_sim_acceleration published by node sensor_simulator.

Bind function: position_velocity_callback
Integrates the simulated IMU acceleration data to calculate the velocity and position.

Node actions, messages and services:

Messages:

- Published Message Type: g425_assign4_interfaces_pkg::msg::PositionData
- Published Message Type: g425_assign4_interfaces_pkg::msg::ImuSim
- Subscribed Message Type: g425_assign4_interfaces_pkg::msg::ImuSim
- Subscribed Message Type: geometry_msgs::msg::PoseStamped

Topics:

- imu_sim_position: Calculated position data for storage
- imu_sim_velocity: Calculated velocity data for storage
- imu_sim_acceleration: simulated IMU data
- position_determinator: topic used to reset position and orientation

Custom Node functions :

Custom function: position_velocity_callback()
This function processes incoming IMU simulation data, integrates accelerations to calculate the robot's velocity and position, and then calls the functions publish_position() and publish_velocity() to publish the calculated data.

Custom function: publish_position()
Publishes the calculated position data on topic imu_sim_position

Custom function: publish_velocity()
Publishes the calculated velocity data on topic imu_sim_velocity

Custom function: reset_callback()
This function receives a message from the position_determinator topic, updates the robot's position from the incoming new message, and resets all velocity and acceleration values to zero. It reinitializes the robot's state to the new starting position.

Node dependencies :

g425_assign4_interfaces_pkg/msg/imu_sim.hpp – defines a custom acceleration/velocity message (used to publish IMU simulated acceleration and the calculated velocity).

g425_assign4_interfaces_pkg/msg/position_data.hpp – defines a custom position data message (used for publishing robot position).