

MINI ASSIGNMENT #2

Path Tracking Simulation with Kinematic Bicycle Model

with Pure Pursuit, Stanley Controller or MPC

Due Date: 20.10.2025 - 00:00

ASSIGNMENT DESCRIPTION

Choose a path tracking control algorithm:

☒ Pure Pursuit ☐ Stanley Controller ☐ Model Predictive Control (MPC)

Then, test your chosen algorithm with a **path tracking simulation** using the **Kinematic Bicycle Model**. The simulation should be done at code level only; **heavy platforms like Gazebo or CARLA are not required**.

Coding can be done in **Python** or **C++**.

REQUIREMENTS

1. Theoretical Preparation:

- Technical explanation of the selected algorithm
- Kinematic Bicycle Model equations and operational logic

2. Simulation (Coding):

- Path type (e.g., straight road, curved road, sine curve)
- Code the vehicle to follow this path
- Visualize the vehicle's real-time positions and orientation
- Calculate measurements like lateral error and heading angle

REQUIREMENTS (CONTINUED)

3. Visualization:

- 2D plots showing the vehicle's progression along the path (e.g., matplotlib, OpenCV)
- Error vs. time graph (preferable)

4. Report (2-3 pages PDF):

- Introduction: Purpose, controller used, path type used
- Method: Mathematical expression of the model used
- Coding: Summary and explanation (pseudocode or basic structure)
- Results: Graphs, deviation values, comments
- Discussion: Advantages and limitations of the algorithm

OBJECTIVE

This assignment aims for students to:

- 📖 Experience a control algorithm at code level
- 📖 Learn dynamic modeling
- 📖 Learn to present results with simple graphics