

Ackermann Steering Robot PD Controller

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Objective:

We plan to design and implement a Ackermann kinematic model controller module for an 4 wheeled mobile robot developed by Acme Robotics.

Ackermann steering performs better than skid steering in rough terrains and has less slippage. Ackermann steering requires less power than skid steering while cornering.

Technology and assumptions:

The project will use test driven pair programming and agile iterative process.

The programming language C++ 14 or above will be used for the development. The layout of the project is from cpp-boilerplate. Travis-CI and Coveralls will be used for checking build status and code coverage. Valgrind will be used for undefined behavior check and memory leaks. Git will be used for version control. Cpplint and cppcheck will be used for code style checks.

Center of the robot is assumed to be the geometric center. SI units are used for measurements. All measurements are taken in the world frame.

Approach:

Forward Kinematic analysis is performed on the Ackermann mechanism. The transfer function is then calculated and convolved with the controller transfer function to yield the closed loop form. By tuning the controller parameters, we can achieve a situation where the mechanism will provide a bounded output for any bounded reference input.

Given the inputs as the target velocity and heading, the controller will produce the desired output that will drive the Ackermann steering to allow the robot to reach the desired state.

Deliverables:

We will create a project backlog based on the proposal. After each sprint, an iteration update will be provided along with code repository and documentation.

Final documentation will be provided upon completion of the project. The code repository, a video explanation, results of cpplint and cppcheck, unit test results and code coverage report will also be provided.