# ROB 535 Control Project Team2 Documentation

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## 1. My Contribution

My work is about task2, I write code to build constraints and implement a MPC method to solve the problem.

In this project, I implemented a Model Predictive Control (MPC) algorithm for controlling a kinematic bicycle model, which is a simplified representation of vehicle dynamics. The MPC algorithm is used to compute the optimal control inputs, steering and throttle, to follow a reference trajectory while avoiding obstacles on a track.

I complete the following part to implement the MPC algorithm:

(a) Initializing variables and setting the initial condition.

(b) Calculating the closest reference point on the reference trajectory.

(c) Iterating through time steps to compute optimal control inputs.

(d) Generating equality, and inequality constraints.

(e) Defining cost functions for states and inputs.

(f) Solving the quadratic programming problem using the quadprog function.

(g) Simulating the kinematic bicycle model using the ode45 function.

(h) Storing the final trajectory and applied inputs.

The results of the MPC implementation show that the algorithm successfully controls the kinematic bicycle model, following the reference trajectory while avoiding obstacles on the track. I repeat the experiment for 100 times with 25 obstacles, and all of them succeed, which implies the algorithm can solve the problem in task2.

## 2. Teammates Work

**Siyuan Yin:** Exploration of fmincon for Part 1 and implementation of PID for Part 1.

**Qilin He:** Exploration of fmincon for Task 1 and implementation of MPC.

**Yifan Wang:** Investigation of reinforcement learning for Task 1 and Task 2 (not ultimately chosen); implementation of PID controller for Task 1.

**Yuzhou Chen:** Investigation of PID for Task2(not ultimately chosen due to collision).