Intro to ACA Lab project, 2018.

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Contents

1. Introduction

For our project, we decided to attempt to implement a crude autoparker under specified conditions. The main feature which has been implemented is that when an object is detected within a vicinity κ, but larger than a vicinity ℓ_{min}, of either end of a small car, to both of which are attached a small distance measuring sensor, the car will automatically move itself towards the object and stop at a distance ℓ_{min} from it. This creates the basis for expanding the project to include two dobjects, and making the car find the midpoint, as the routine employed is the same, the difference being delay and system effects introduced by having more going on at the same time.

The car is desired to move away with a constant speed so the primary purposes of pole placement and adaptive control routines, in this project, is to control the acceleration required to attain the desired constant speed ,v_0, and to control the deceleration as the car reached it's target distance, such that it does not overshoot or undershoot (the former perhaps being more important to get right in a real life implementation).

We keep the system to first order, not considering integrators within implemented control schemes, as the only differentiated quantity is the speed, v_0, which is constant most of the time, leaving us only to consider the relative distances, even allowing neglection of the length of the car for now.

2. Overview of Scenarios

The left-right symmetry of the problem eliminates half of our cases instantly. The largest disctinction between all cases is whether or not one or two objects are involved.

2.1. One Object

2.2. Two Objects

3. Physical Set Up

3.1. Pen