RBE 595 — FAIR-AV
Week 6 Homework #2

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Problem 1

Assume your AV has been officially rolled out in a hilly city like San Francisco. But suddenly you find that, in some of the steep streets, your AVs cannot parked well, namely, the AV would roll away when parked. What is the quickest way to fix the problem with minimum cost?

Solution

One very simple and quick way to fix this problem would be to issue a software update that will use the AV's on-board inclinometer readings to avoid parking on steep streets, or turn the wheels in a way that the AV will not roll away when parked. The software update could be as simple as a threshold check on the inclinometer readings, and if the readings exceed a certain threshold, the AV will not park on that street, or will turn the wheels in a way that the AV will not roll away. This solution is quick and can be implemented with minimal cost, as it only requires a software update to the AVs.

However, this solution is not sustainable in the long run, as avoiding steep streets would limit parking options for the AVs, and turning the wheels in a way that the AV will not roll away may not be a foolproof solution. A more sustainable solution would be to design the AVs with a parking brake system that can be engaged when parked on steep streets.

The parking brake system would be designed to engage when the AV is parked on a steep street, preventing the AV from rolling away. The parking brake system could be activated automatically by the AV's software when the inclinometer readings exceed a certain threshold. This would make it so that the angle α of the street would be taken into account when parking the AV, as shown by the following equation:

$$-\frac{a_1}{h}\cos(\alpha) \leq \frac{\dot{v}}{g} + \sin(\alpha) \leq \frac{a_2}{h}\cos(\alpha) \tag{1}$$

where a_1 and a_2 are the minimum and maximum acceleration of the AV, h is the height of the center of mass of the AV, $\dot{v}$ is the velocity of the AV, and g is the acceleration due to gravity.