Studying the Optimal Control of a Non-Holonomic System using an Inverted Pendulum

Team 12

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PROBLEM STATEMENT

- An inverted pendulum on a cart is an essential optimal control problem because it is a classic example of a non-linear and unstable system that can be stabilized using control theory. It is widely used in engineering, robotics, and control systems as a benchmark for testing and evaluating control algorithms.

- The challenge lies in finding the right balance between keeping the pendulum upright while keeping the cart stable.

- The solution to this problem requires precise controls in real-time to maintain balance, which makes it a good project for future optimal control developments.

SYSTEM MODEL AND REQUIREMENTS

- Simulation:
    - MATLAB R2022b
    - Simulink 10.6
    - Laptop Specs: 12th Gen Intel(R) Core(TM) i7-12700H 2.30 GHz processor, NVIDIA GeForce RTX 3050 Ti Laptop GPU, MATLAB and Simulink R2022b
- Hardware:
    - Motor specifications: 25mm shaft, 12V, Stall Current 4.5A, 100 rpm
    - Encoder specifications: Continuous, 6 ppr
    - Accelerometer: 13-bit resolution, ±16g, 3-axes
    - Arduino Uno/ Raspberry-pi 3
    - N-wheeled cart
    - Inverted pendulum

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