

NE 223 (AUG): Analog Circuits and Embedded System for Sensors

Project

This project is to be carried out in groups of 2. If all other partners are taken and you are the only one left, I will assign you to one of the groups. Please let me know the name of your team and your group members. You are encouraged to discuss among your team as much as possible.

Project deadlines:

	What to do	Deadline
1	First report with system schematic, circuit design and state machine diagrams/tables for the system	19 April
2	Final report (see details below)	30 April
3	Viva	1 st and 2 nd May

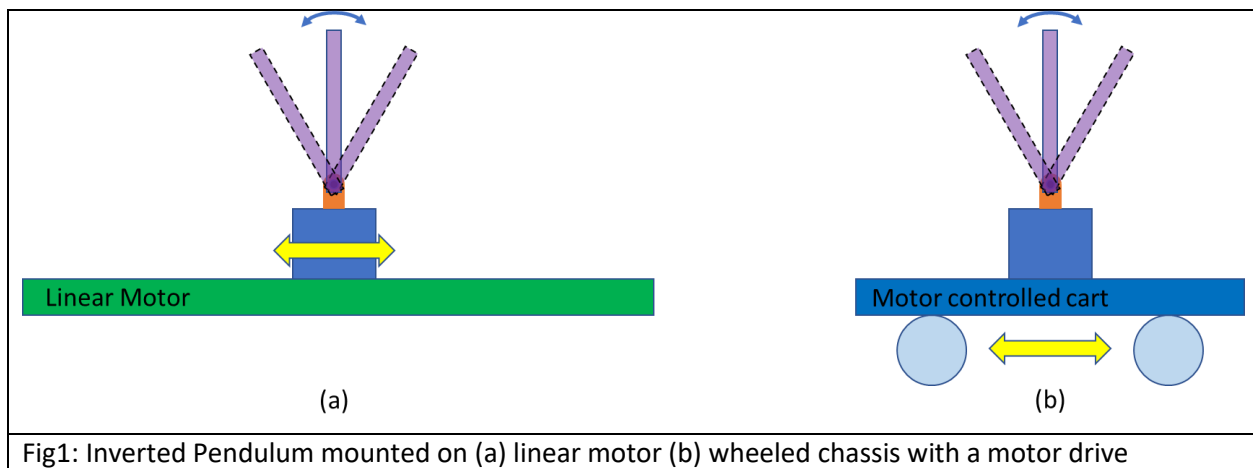


Fig1: Inverted Pendulum mounted on (a) linear motor (b) wheeled chassis with a motor drive

An inverted pendulum is inherently unstable (see Fig. 1). In this project, you will design a game that can be played by 1 person to stabilize an inverted pendulum mounted on a linear motor or a wheeled chassis with a motor drive via a pin joint which allows free rotation of the pendulum. The pendulum could be of any shape you wish. It is up to you to decide how to get the user input. The user's inputs can be used to drive the linear motor, or the wheeled chassis left or right in an attempt to keep the inverted pendulum from falling down.

The game should begin when the pendulum is set upright within $\pm 5^\circ$ and this should be indicated to the player with a green LED and a single beep of a buzzer that lasts for 2s. After the pendulum falls beyond $\pm 85^\circ$, the game is over, and the LED should turn off and 3 beeps should sound each lasting 1s with 1s interval. Use a LED display to show the time for which the player kept the pendulum upright. Develop a method to detect if the player is cheating by holding the pendulum upright by hand. If they are cheating, display red light and the game is over which is accompanied by the same indicators as stated above.

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Furthermore, add a functionality of flicking a switch to automated mode where the user input is ignored, and the program automatically controls the motor to maintain the balance of the pendulum without human input. If at any point, the switch is flicked back to manual mode, the game begins (with all the notifications to the user as stated above).

The final report should contain:

- 1) Contents of the first report, i.e., system schematic, circuit design and state machine diagram/table for both human control and automated control
- 2) Include concrete LTSpice simulations for your circuits. For each circuit, state what the objective is in 1 sentence, show the schematic with all the values and salient points of the choice of the circuit elements by comparing against other options that you considered.
- 3) A full Bill of Materials of parts that you would need to make this project
- 4) The pseudo code for both the programs (if they are different)
- 5) The final code for Arduino program for the game should be sent as a digital file to the instructor.