

# Problem Statement and Goals

## The Inverted pendulum

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Table 1: Revision History

Date	Developer(s)	Change
20 Jan. 2023	Mina Mahdipour	First version of document

## 1 Problem Statement

An inverted pendulum is a pendulum upside down with its pivot point under its center of mass. This forms an inherent unstable system. While the inverted pendulum can stand up, any small disturbances will cause the pendulum to fall. Inverted Pendulums are Everywhere, from the human posture systems, Segway, to the launching of a rocket.

### 1.1 Problem

Inverted pendulum is unstable and without additional help will fall over, so it needs a controller to keep pendulum center of mass above its pivot point even when disturbances occur. The objective of the control system is to balance the inverted pendulum by applying a force to the place that the pendulum is attached to.

### 1.2 Inputs and Outputs

The pendulum's angle is the input and the calculated force to move the position of the pivot point sideways, will be the output.

### 1.3 Stakeholders

As the inverted pendulum is widely used as a benchmark for testing control strategies and algorithms, and it can be used in different applications, so the

potential stakeholders could be all the related industries. On the other hand, it is a classic problem in dynamics and control theory, so the final system can be used in high school as an educational material.

### **1.4 Environment**

The final software will be compatible with Windows 10.

## **2 Goals**

1. Designing a software system that can control and stabilize the pendulum.
2. Verifying that the controller can handle disturbances.
3. Measuring the effect of the different parameters.

## **3 Stretch Goals**

1. Visualizing the problem with an interactive graphic design.
2. Making a real model includes a rod with a weight on the bottom and the controller.
3. Simulating double inverted pendulum problem.