

Project Report

Ball and Beam Position Controller System

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Subject:- Control Systems Laboratory

Goal:- To stabilize the ball on the beam at its unstable equilibrium point defined by the user.

- To implement position control of the ball on a beam which can be controlled to different angle using servo motor.

Components:-

Ball and beam system with potentiometer sensor and high torque digital servo motor and stainless-steel beam and steel ball, Arduino UNO

Circuitry:-

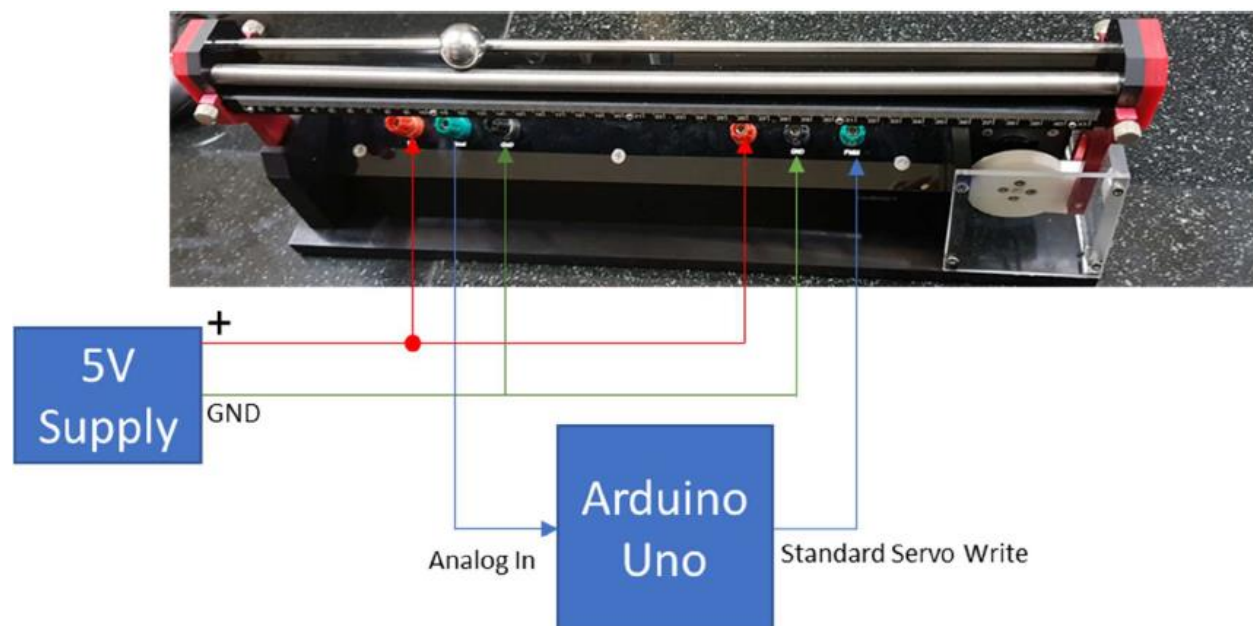


Fig:1 – Ball and Beam circuit diagram

Theory:-

Block Diagram



Fig:2 – Ball and Beam control system.

Points to Remember:-

1. Before starting the experiment, it's important to calibrate the system. For this, first take the output voltage at the two ends and then identify the linear relation between the voltage and the length based on that.
2. Similarly, we need to calibrate the servo also. Identify the actual zero and 180° of the servo. Then, identify a relation to convert the servo angle into the real angle.
3. Keep in mind that these calibration vary from system to system.
4. Don't apply any external stress on the servo motor. That may spoil it's working.
5. First implement the same circuit in Simulink to get a rough idea of the P, I, D & N values for the PID controller.

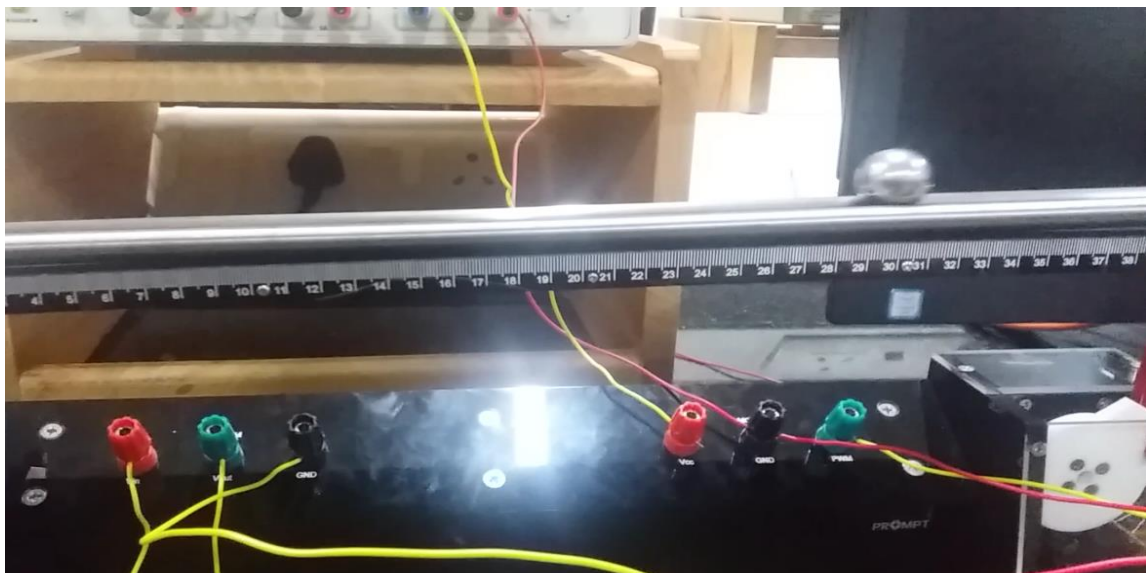


Fig:3 – Final working model of Ball and Beam.

Simulink Model:-

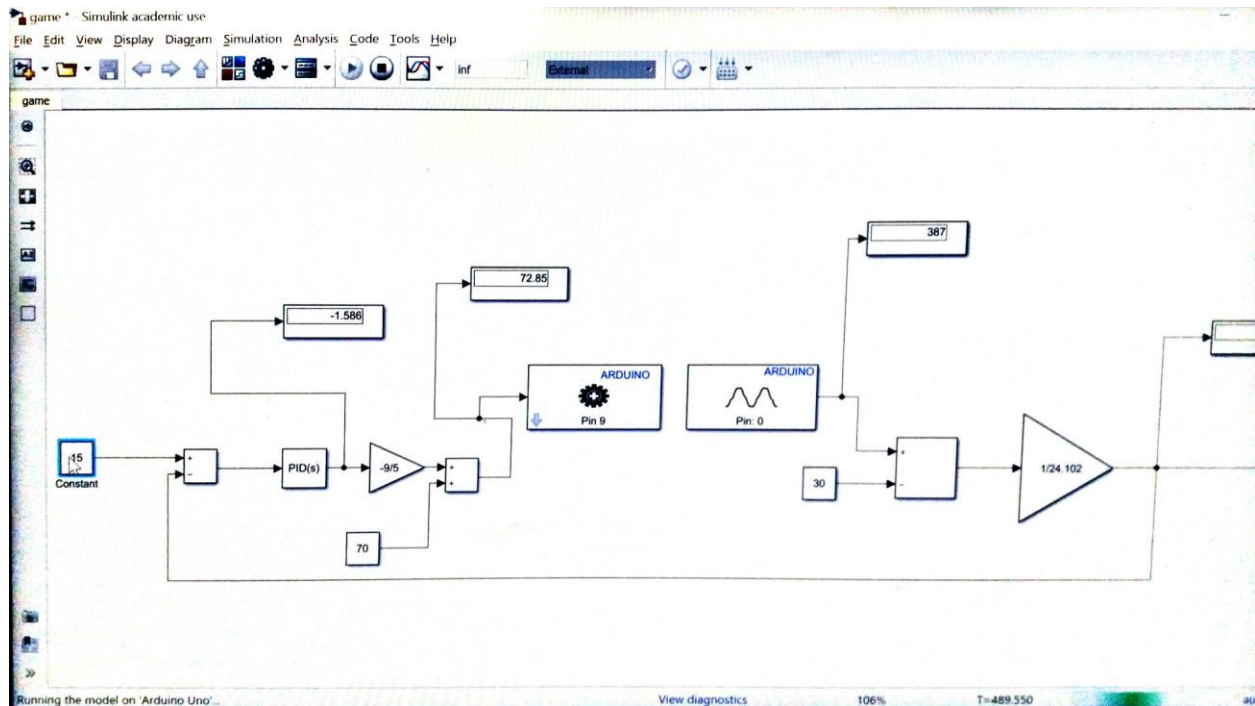


Fig:4 – Controller implementation on Simulink for the Ball and Beam.

PID Controller Parameters:-

Proportional (P) – 2.0;

Integral (I) – 0.05;

Derivative (D) – 0.65;

Filter Order (N) – 7.5;