MISRA compliant PID Coding Test

Assignment Description:

Write a C program that implements a PID controller to control the position of a simulated system. The system is a simple linear system with a single input and a single output. The goal is to control the position of the system to a desired setpoint.

Requirements:

1. Implement a PID controller with proportional, integral, and derivative terms.
2. The simulated system should have a position that can be controlled.
3. The controller should take as input the current position of the system and output a control signal.
4. The controller should be able to drive the system to a desired setpoint.
5. Implement appropriate data structures and functions for the PID controller.
6. Test the controller with different setpoints and disturbances to demonstrate its effectiveness and robustness.
7. the code must be MISRA C compliant.

Bonus (Optional):

1. Implement anti-windup mechanisms to prevent integral windup.
2. Implement a user interface to set desired setpoints and visualize the system response.