DEVELOPMENT OF MODEL PREDICTIVE CONTROL FOR HVAC SYSTEMS IN COMMERCIAL BUILDINGS.

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Introduction

Model Predictive Control (MPC)

- Model predictive control is an Online optimisation algorithm.
- It controls the system based on current state of the system while taking the future states of system into account.
- Model predictive control is a feedback control technique based on repeatedly solving optimal control problems.

Literature Survey

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Methodology

Existing Methodology:

There are many control techniques available in the field of control systems. Among these, the existing air conditioning systems use simple PID or On - Off which is also known as Bang Bang controllers. The On - Off control technique is used in thermostat based control of HVAC and Refrigeration systems.

Proposed Methodology:

Model predictive control is an advanced technique for process control which is used to control a process while satisfying certain constraints. Process control is a discipline that uses industrial control systems to achieve a high level of consistency, safety and accuracy that cannot be done with the sole help of humans. The model predictive control works using the dynamic model of the system. The models are designed using system identification, which is a process of deriving mathematical models of dynamic systems from data using statistical methods.
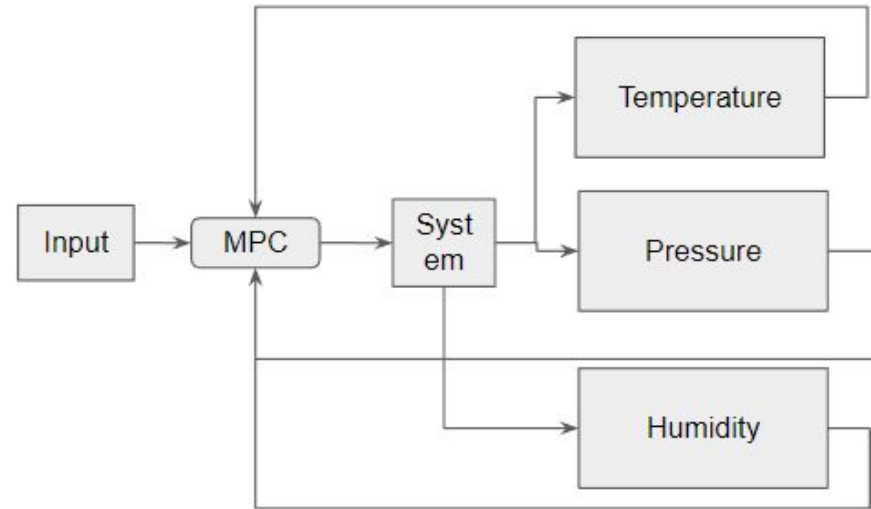
PID vs MPC

PID
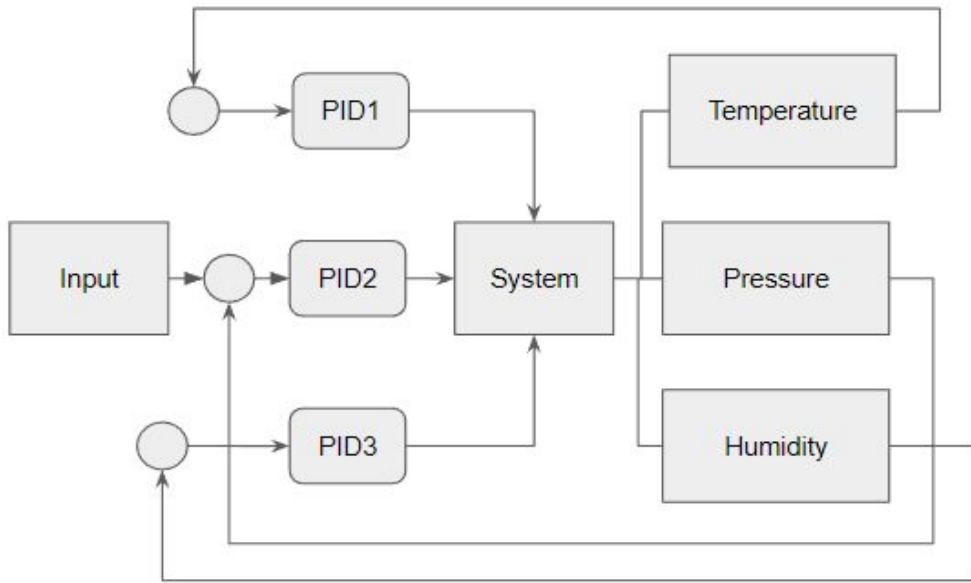
Multiple control loop

MPC

Single control loop

Advantages of MPC

- The Main advantage of the MPC technique is that it allows one to optimize the current state of the system, while considering the future states of the system. The MPC has the ability to estimate the future events and act accordingly.

- Model predictive control is an advanced process control technique that is better suited for Multi Input Multi Output systems(MIMO) than PID control techniques.

- In MPC we can have constraints for the input and output of the controller, which cannot be achieved using PID.

- Model Predictive control is an online optimization technique, which makes it resilient to dynamic changes in feedback.
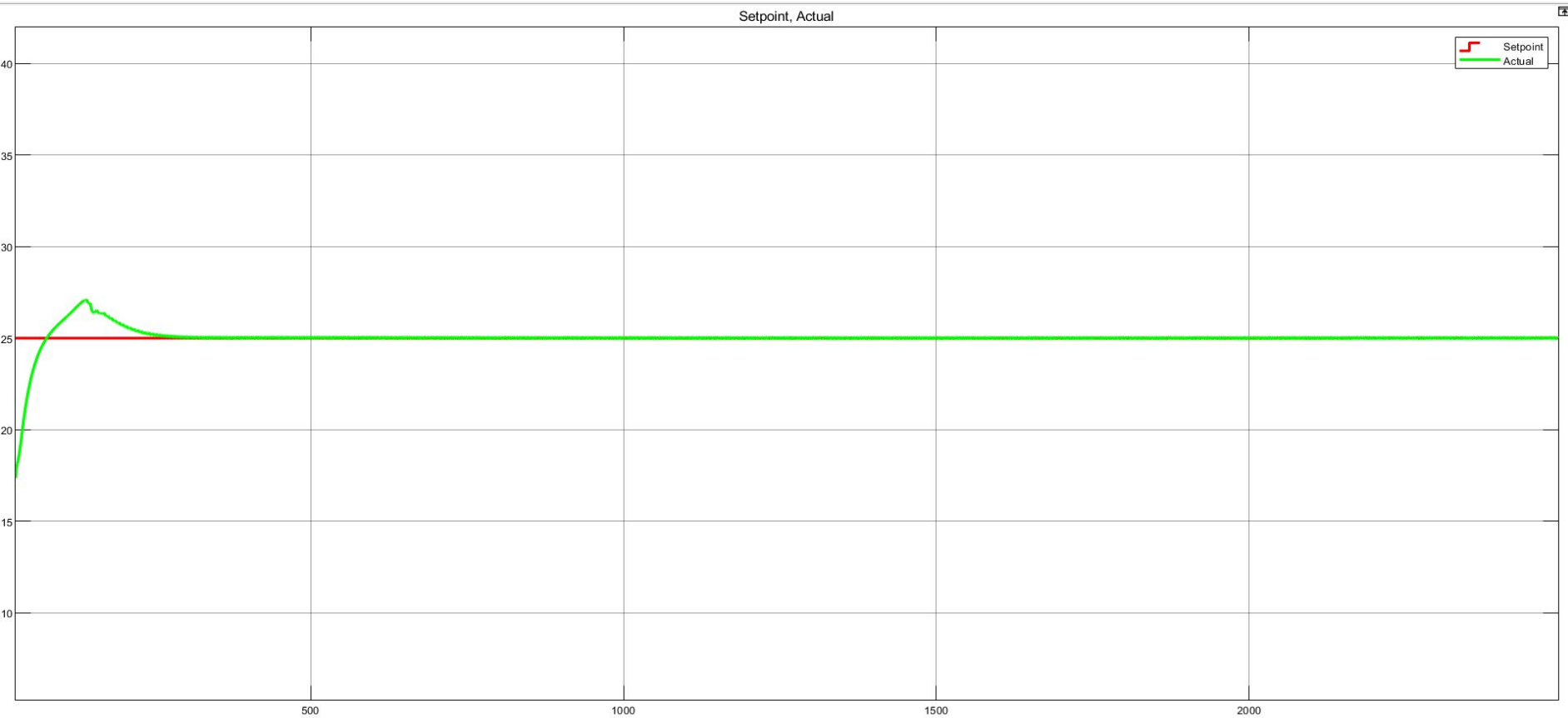
Design of MPC in MATLAB Simulink
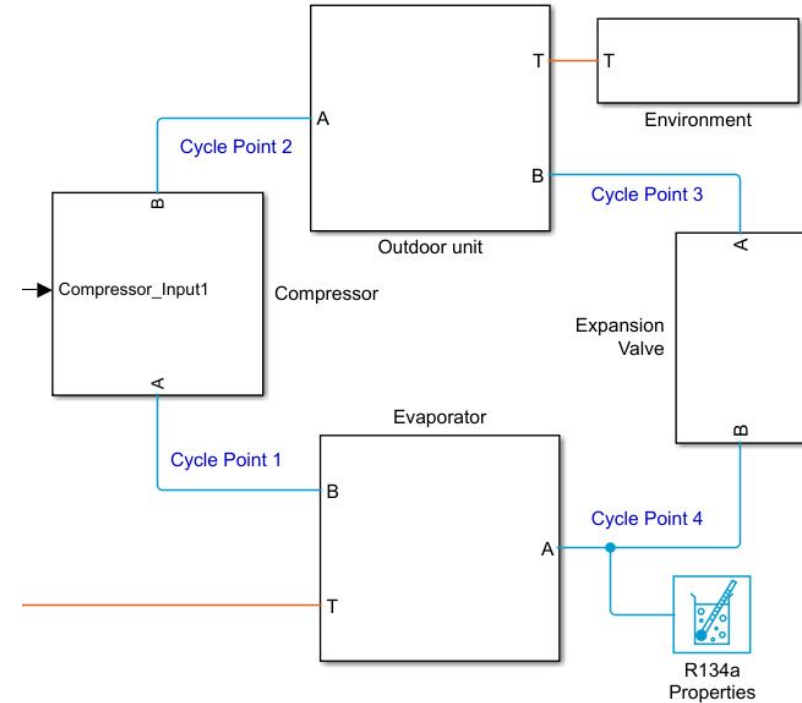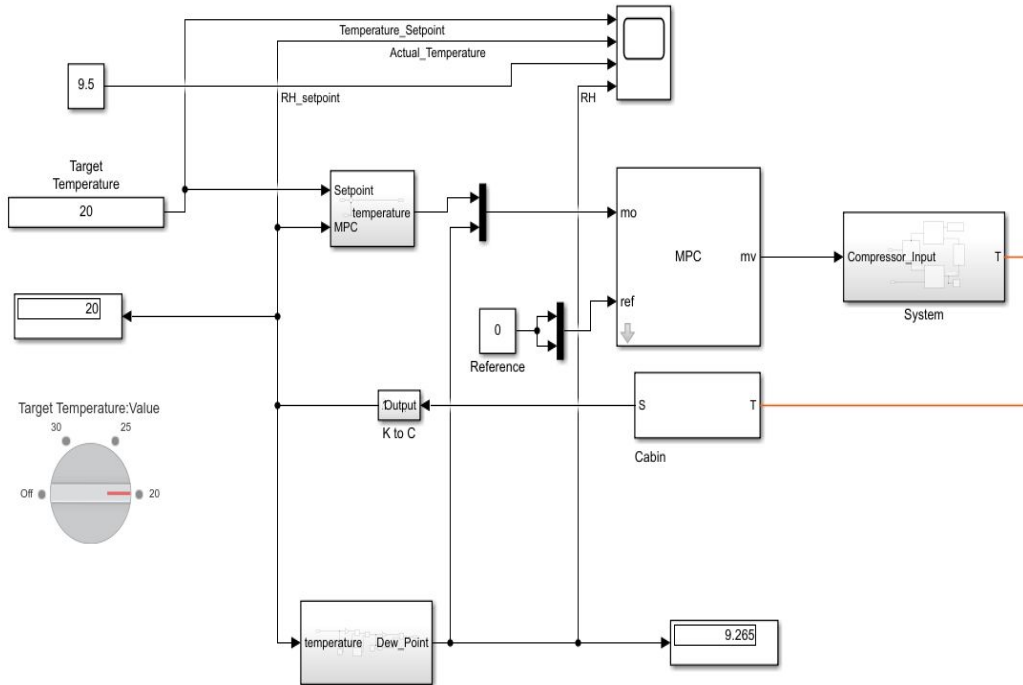
Response Graph
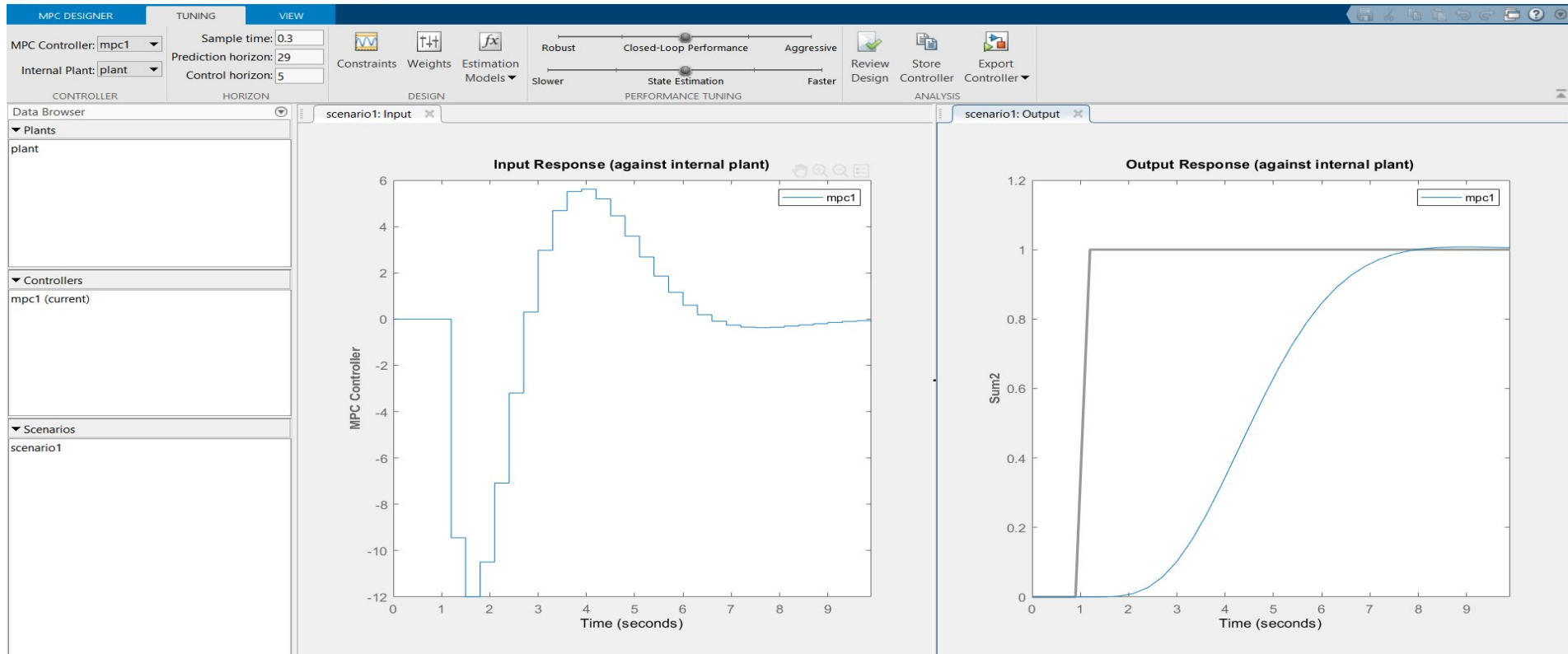
Set Point vs Actual point Graph

Conclusion

- The primary challenge and goal of HVAC is to regulate the air quality in enclosed spaces. An MPC, which stands for Model Predictive Control Algorithm, is used in the proposed work.

- Model predictive control offers numerous advantages for temperature control. An internal plant model is used to generate control inputs based on sensor feedback to control the HVAC system in order to maintain the air quality of an enclosed space with a volume of 1800m3 (6m X 4.5m X 4.5m).

- The proposed system is also evaluated in comparison to existing controllers such as PID. The MPC controller is created in Matlab Simulink using the Model Predictive Control Toolbox, which aids in the creation of model predictive controllers for linear and nonlinear control systems.