

Networked Control for the future

Networked Controls Systems (NCS) are closed-loop feedback control systems with a network as the communication medium between the controller and the plant.

NCS have a lot to offer commercially as the communication networks like Ethernet are already laid down and waiting to be used for this purpose.

The focus of most academic study on NCS, including ours, has been on finding ways to utilize already installed networks.

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Networked Control System

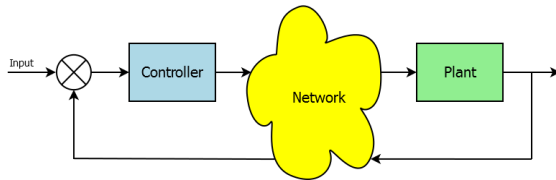
A system for implementing and analyzing closed-loop control of plants over an IP network

Project Title:

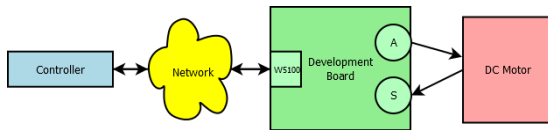
Design and Development of a Reconfigurable Networked Control System for Feedback Control of Diverse Processes Distributed over an IP Network

Pakistan Navy Engineering College
National University of Sciences and Technology





Closed-loop control over a Network



A diagram depicting the system with a single plant

Features

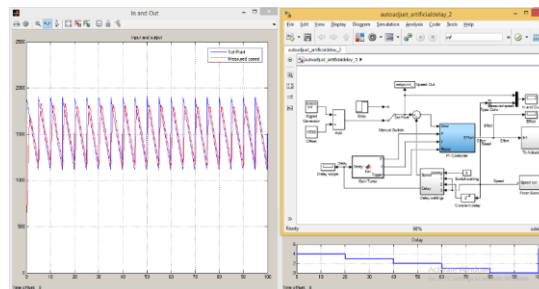
- A MATLAB-based controller capable of controlling plants distributed over a LAN
- Controller is reconfigurable at runtime
- Capability of generating artificial delays
- PI Controller can tune its gains automatically to maintain performance over Networks
- Primary plant: DC Motor Speed Control
- Secondary plants: Aero-pendulum, Position Control
- A development board for each plant

Results

- Effects of delays on responses were analyzed in both simulations and real-time measurements
- Tuning PI gains affected the transient and steady state response
- A gain-set of each delay was condition used
- System performance was regained appreciably
- Thorough simulations were done for Speed Control Plant, PI gains were tuned in this way

Further work in academia

- The setup can support further UG or PG projects to study packet losses
- We have worked on three different plants that can be almost readily used in future projects about control systems, even if they are not related to NCS



A screenshot of the Simulink model in running condition

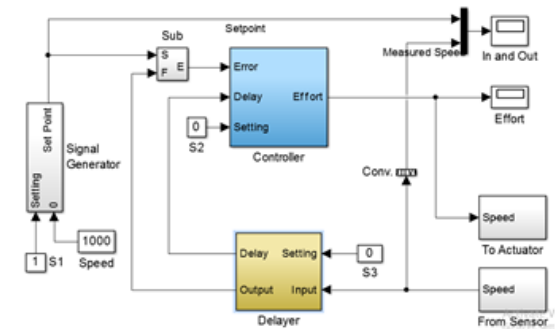
FAQ

Q. What platform has been used for creating software?

A. All programming for the development board's MC has been done in C. On the controller side, most of the software has been made using Simulink's block diagrams, while m-code has been used for a few purposes.

Q. How is network communication made possible?

A. UDP datagrams are used. On the development board, W5100 chip is used for interfacing with the network.



A view of the re-configurable controller in MATLAB/Simulink