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PHYS 580

Dr. Kwon

9/29/20

<div align="center">Project 1: Development and Management Plan</div>

Define the Problem (Scenario):

(From the Boiler problem on the CLD Sample Exam) Design a boiler startup controller using LabVIEW. The boiler startup controller allows a user to start up and shut down a boiler. The user interacts with controls on the front panel to start up and shut down the boiler and simulate conditions in the system. Indicators on the front panel display the status and the current step in the startup and shutdown process. The controller also logs events as they occur during the process.

Design

- Inputs:
    - Boiler Controls
        - Boiler Reset
        - Start Sequence
        - Pilot
        - Shutdown
        - Fuel Control Valve Position (% Open)
    - Boiler Simulation Controls
        - Flame Sensor Value (%)
        - Run Interlock

- ▪ Forced Draft Fan

  - • STOP

- • <u>Outputs:</u>

  - • Boiler Status Indicators

    - ▪ Status

    - ▪ Primary Fan

    - ▪ Natural Gas Valve

    - ▪ Pilot

    - ▪ Fuel Valve

    - ▪ Forced Draft Fan

    - ▪ Time Count

- • <u>Additional Requirements:</u>

  - • The Front Panel given in the CLD sample exam Boiler folder should be used

  - • The sequence of operation must be run properly in order or else no indicators will change

  - • The event log file should be in a file named "Boiler Log.txt" in the same location as the main VI as a .csv file with a header and should append to itself newly generated data

- • <u>Algorithm:</u>

  1. Status indicator displays "Lockout"

  2. All indicator LEDs are turned off

  3. All controls are initialized to the state they were in when the folder was first opened

4. Log the following to the event log file

   ▪ Time string: Absolute date and time at event

   ▪ Event string: "Boiler Initialized"

   ▪ Event data string: 0

5. If the Run Interlock switch is closed and the Boiler rest button is clicked, display "Ready" on the Status indicator and log the following to the event log file:

   ▪ Time string: Absolute date and time at event

   ▪ Event string: "Boiler Ready"

   ▪ Event data string: 0

6. If step 5 was executed and then the start sequence button is pressed, the Primary Fan LED should turn on for 10 seconds with the Time Count indicator displaying the elapsed time in seconds, the Status indicator should display "Pre-Purge", and the following should be logged to the event log file:

   ▪ Time string: Absolute date and time at event

   ▪ Event string: "Start Pre-Purge"

   ▪ Event data string: Pre-purge elapsed time

7. If steps 5 and 6 were executed, the Status indicator should display "Pre-Purge Complete", the Primary LED fan should be off, the Time Count indicator should display 0, the Pilot button should blink, and the following should be logged to the event log file:

   ▪ Time string: Absolute date and time at event

   ▪ Event string: "Pre-Purge Complete"

   ▪ Event data string: Pre-purge elapsed time

8. If steps 5-7 were executed and the Pilot button is clicked, the Natural Gas Valve and Pilot LEDs should be turned on, the Status indicator should display "Pilot On", and the following should be logged to the event log file:

   - Time string: Absolute date and time at event

   - Event string: "Pilot ON"

   - Event data string: True

9. If steps 5-8 were executed and the Flame Sensor Value is greater than 30%, the Status indicator should display "Boiler Ready", and the following should be logged to the event log file:

   - Time string: Absolute date and time at event

   - Event string: "Pilot Proved"

   - Event data string: Value of Flame Sensor Value

10. If steps 5-9 were executed and the Forced Draft Fan control is switched on, the Forced Draft Fan LED should turn on and the following should be logged in the event log file:

    - Time string: Absolute date and time at event

    - Event string: "Forced Draft Fan ON"

    - Event data string: True

11. If steps 5-10 were executed and the Fuel Control Valve Position is greater than 10% but less than 75%, the Fuel Valve indicator should turn on, the Natural Gas Valved LED and Pilot LED should turn off, The Status indicator should display "Boiler Running", and the following should be logged to the event log file:

    - Time string: Absolute date and time at event

- ▪ Event string: "Boiler Running"

- ▪ Event data string: Value of Fuel Control Valve Position

12. If steps 5-11 and either the Boiler Shutdown button is pressed, the Fuel Control Valve Position is less than 10% or greater than 75%, the Run Interlock switch is opened, or the Forced Draft Fan is switched off, then the Fuel Valve indicator is turned off, the Primary Fan indicator is turned on, the Status indicator should display "Purge", the Time Count indicator should display the elapsed time in seconds for 10 seconds, and the following should be logged to the event log file:

    - ▪ Time string: Absolute date and time at event

    - ▪ Event string: "Start Shutdown Purge"

    - ▪ Event data string: Purge elapsed time

13. If steps 5-12 are executed, then the Status indicator should display "Lockout", all indicator LEDs should be turned off, and the following should be logged to the event log file:

    - ▪ Time string: Absolute date and time at event

    - ▪ Event string: "Shutdown Purge Complete"

    - ▪ Event data string: Purge elapsed time

- Front Panel:
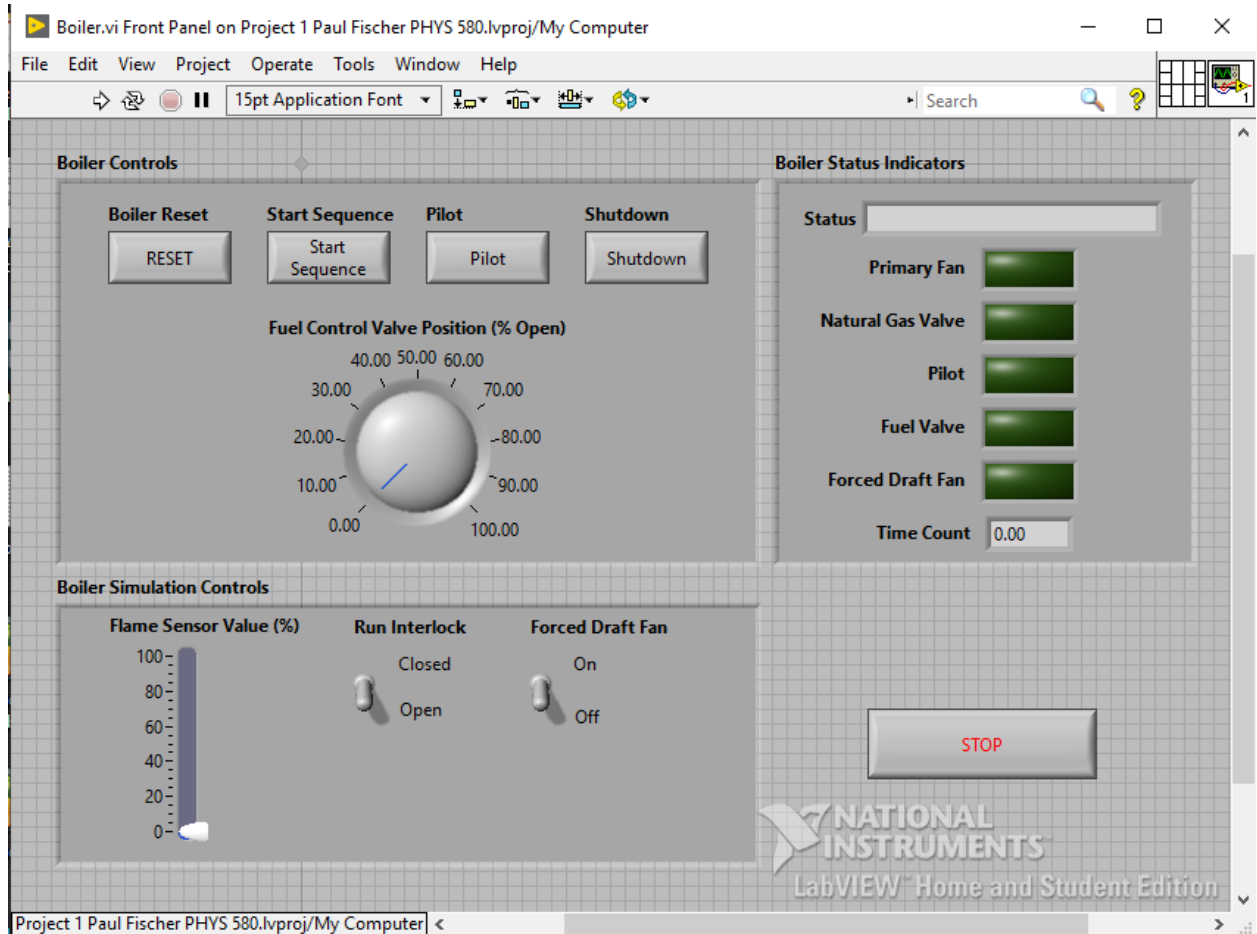
Management and Testing plan including Milestones, Timeline, and Tracking plan

Format:

- Milestone: Timeline

  - Tracking Plan

- Development Plan: Sept. 29, Tuesday (A single pdf file to Dropbox)

  - Read the PDF and use it to create development plan and submit on Sunday, Sept.

    27

- VI: Oct. 6, Tuesday (to Dropbox)

- o Start working on "Start" step of VI Wednesday, Sept. 30 after PHYS 550A

  lecture

- o Try and finish other sections Thursday morning Oct. 1 before lab and submit to

  Dropbox

- (Final) VI Screenshot and Description: Oct. 8 or 9, before the lab class to Discussion

  - o Double check all steps and event log file, write documentation (including labeling

    wires), and clean up block diagram in the morning on Tues, Oct. 6 before PHYS

    562 lecture and submit to Dropbox

- VI Demo: Oct. 8 or 9 in the lab

  - o Prepare the demo and double check that everything works Oct. 8 morning before

    lab

- Submit the final VI to Dropbox: After the presentation and before 4pm, Oct. 9 (to

  Dropbox)

  - o Triple check everything and submit to Dropbox immediately after demo on Oct. 8