Distributed Real-Time Control Systems

MSc in Electrical and Computer Engineering

Winter Semester 2015/2016

Project: Distributed Lighting Control

First Stage Demonstration

This part will be evaluated through a demonstration of the local illumination control in the middle of the semester (30th October). Students should demonstrate the ability to set LED dimming values, read illuminance values in Lux, define setpoints for local control, demonstrate the performance of the control system in step changes in the reference setpoint and under external disturbances.

Guidelines to Document the First Stage

There is not required a report of the first stage. However, it is highly recommended that the information required to write the report at the final stage be collected right now. Note that the information to collect, listed in the following paragraphs, is mostly documenting intermediate steps necessary to complete the project.

D1. Take pictures of the interior and of the exterior of the box enclosing the luminaires. The arrangement of the LED, the LDR and the emission / reflection path, is an indicator of the PWM to the steady state voltages measured at the capacitor.

D2. Show in a plot the steady state voltage at the capacitor, as measured by the ADC (values 0..1023), given various PWM references (values 0..255). Draw the same plot in Volts.

D3. Set various PWM levels, e.g. [0:10:255] in Matlab notation, waiting 0.1sec at each level. Plot the time response obtained at the capacitor.

D4. Using the just described PWM stairs signal, plot the estimated intensity of illumination (Lux) by estimating at each moment the LDR resistance and then using the LDR datasheet to estimate the intensity. Note that the LDR datasheet indicates a range of resistances for each illumination intensity. In order to have a one-to-one mapping, it is suggested that for each luminance is considered just the middle resistance value (in logarithmic units).

D5. Assuming that local step responses observed as intensity illumination changes (Lux) can be modelled as first order systems $G(s)=K_0/(1+s\tau)$, indicate an estimate of the static gain and the time constant. Comment the use of illumination intensity (Lux) vs voltages observed at the capacitor.

D6. Indicate the parameters of the PID controller designed for the system.

D7. Print the Arduino code implementing the PID controller.

D8. Test the controlled system and comment how it runs. In particular, demonstrate the performance of the control system in step changes in the reference setpoint and under external disturbances.

PS: Please fill free to use this MS-Word document to fill in your annotations.

Wishing a good work,

A. Bernardino and J. Gaspar