

Assignment 5

Issued on: 04.06.2007

Due dates: G1-22.06.2007, G2-22.06.2007

FlexRay Practice

This assignment illustrates a common scenario encountered in practical distributed real-time systems, by means of a simple example. This will involve designing and implementing a distributed application running on the two-node FlexRay cluster in our department. The scenario has two stages:

Stage I: Initial application development

A simple application must be implemented, consisting of two tasks: T1, which runs on node A, and T2, which runs in node B. T1 controls a LED on the front panel of the node according to a bit value read from the bus. If this value is 1, the LED should be turned on, otherwise it should be turned off. T2 reads the status of one of the push-buttons on the front panel of the node B, and sends to T1 the value 1 if the button is pressed and 0 if the button is released. The task T2 is executed every 32 ms, and its execution time is at most 2ms. Task T1 is executed every 2ms. To allow for future possibilities of controlling the LED, the bit value read by T1 is transmitted every 2ms from node B over the network.

Stage II: Application update

We need now to control the same LED from another push-button of node B, in addition to the one used with by T2. We don't want to change the existing application (i.e., the two tasks, and the bus cycle), so we decide to add another task T3 on B, which reads the status of another push-button on the front panel of node B, and sends to T1 the corresponding value. Before reading the button status, T3 executes other operations, and the execution time of these operations is variable. To simulate this situation, we establish the following sequence of operations for T3:

1. Reading the value of an A/D converter whose analog input is connected to a potentiometer system;
2. Counting down from this value to zero in a loop, where at each iteration a floating point operation is executed: the current value of the loop counter is divided by 45 and the result is added to a global variable of type float.
3. Reading the button status and sending to T1 the value 1 if the button is pressed, or 0 if the button is released.

Thus, one can use the potentiometer to vary the execution time of T3 and also the delay between the moment when T3 starts executing and the moment when it sends data to T1. T3 is executed every 32ms, as soon as possible after T2 finishes its execution. The worst case execution time of

T3 is 30ms. We emphasize that the tasks T1 and T2, as well as the structure and period of the bus cycle must remain the same as in stage I.

Study the behavior of the system in both stages of development by pressing the buttons and changing the potentiometer position. Determine the circumstances when the system behaves as expected and when it does not. Explain your conclusions.

Remarks:

- You should use the DesignerPro tool to create the bus configuration for the application. The necessary work steps in this respect are briefly described in StepsInDESIGNERPRO.pdf.
- A description of the prototyping cluster is found in NODE_RENESAS.pdf. The potentiometer is connected to pin AN0.
- The API for the FlexRay controllers is in FRDriver_UserManual.pdf. The functions that are relevant to this assignment are 3.7.2, 3.7.3, 3.8.2, 3.8.3. The controller index at each node is 0.
- Stub source files for the application are in a5_Template.zip.

Installation of the DeComSys software:

- enter the site <http://www.decomsys.com/download/>

Username: JOHuniPLE

Password: U30zer1joh

- download and install DECOMSYS::DESIGNER PRO<LIGHT> and COMMSTACK<CONFIGURATOR>

- use this license file (DECOMSYS_0012f027a37d.lic).

Note: Before installation, check first that the MAC address of the computer is in the license file. The file should contain at least one address for each team.