ELC018 Real-time software engineering

Task 3 - Washing Machine Control System (40%)

Introduction

Based on the design developed in task 1, and using the device drivers written for task 2, refine your design and implement the high-level control system for a washing machine based on the ARM evaluation board and the Bytronic Simulator. Work in the same groups as in tasks 1 and 2.

If necessary you can amend your design from task 1, but the changes you make should be fully documented in the report for task 3.

Specification

The specification given in task 1 also applies to the current task. This is repeated in the Appendix.

The following also forms part of the specification.

- You do not need to add the design of the device drivers to your task 1 design, but **all other code** should be fully designed.

- As you are using an object-oriented design approach, all your code should be object oriented.

- The design and the code should be consistent.

- You are producing code for an embedded system - the software you deliver should be stand alone and no interaction with the host should be apparent.

- The different speeds of operation of the drum should be achieved by control using pulse width modulation. It is recommended that you assign a member of your group to implementing this functionality.

- To permit your software to be used with a range of different washing machine models, make sure your solution will make it as easy as possible to allow additional washing programs to be added. Try to separate the description of the washing machine programs from the code.

The following two washing machine programs should be added to your task 1 design and implemented in the code (note that cycle durations have been shortened for the purpose of simulation).

Colour wash	
cycle	duration (s)
Fill	5
Heat	2
Wash (slow speed)	3
Empty	4
Fill	4
Rinse (slow speed)	4
Empty	3
Spin (high speed)	6
Dry	5
Complete	-

White wash	
cycle	duration (s)
Fill	5
Heat	6
Wash (slow speed)	4
Empty	4
Fill	4
Rinse (slow speed)	5
Empty	3
Spin (high speed)	8
Spin (low speed)	4
Dry	5
Complete	-

Deliverables

The report should include the following.
- Title page.
- Statement of group members' contribution using standard Coursework cover sheet (link on LEARN). You will be deemed to have signed the form and to agree with the split of effort by submitting.
- Design documentation for the control system in a brief report. If you have amended your design from task 1, describe the changes in the report.

Also submit the following electronically to the LEARN server.
- Fully commented and carefully structured code.
- ARM executable image of working control system

Marking scheme

Functionality meets the specification (10%). Design documentation (10%). Properly constructed C++ code (10%). Consistency between the design and the code (10%).

Submission

The code and executable should be submitted to the LEARN server in a single zipped archive. Submit only one report and one zip file per group.

Appendix - Design specification from task 1

In the simulator, the program is to be selected by means of the three program selector buttons. The selected program is indicated on the three program LEDs as a binary encoded number.

Pressing the accept button will start execution of the relevant program. The system should use timers to define the duration of each stage. Further use of the accept button should cause the program status to advance by one stage for each press.

As the program executes, the 7 segment display should indicate the stage the program has reached.

Pressing the cancel button will interrupt the program, causing it to pause. Pressing the accept button at this stage will cause the program to resume. Pressing the cancel button for a second time will cause the machine to reset.

If the door is not closed (this will be indicated by a door indicator LED embedded in the door switch becoming illuminated) when the accept button is pressed the machine will not start and a brief warning will be sounded on the buzzer.

If the door open/close switch is operated during a wash program, the buzzer sounds briefly and the program is suspended until the door is closed again. If the user presses cancel during the suspension, the machine resets.

If you need clarification of any aspect of the specification please consult with the customer (me). Make sure you document in your report any agreed additions or changes to the specification.