ECE 2799 - Homework 4 Outline

Problem - Define Product Interfaces

You have established your project time lines (Gantt Charts) and associated tasks, and you have partitioned your design into modules. Your task for Homework 4 is to define, to a high degree of specificity, the characteristics and specifications of the inputs and outputs of each module of your system.

To accomplish this, you must write a report which describes how each module will be developed, debugged, and tested. In addition, you must show how the individual modules will be connected together (integrated) and tested to verify compliance with your specifications.

What is expected?

Homework 4 requires you to prepare a well-written, logically organized report that contains enough detail that they could enable an engineer who is not already familiar with the project, to go ahead and design and test each hardware and/or software module required in the system. This report must include the results of calculations, simulations or other studies that were used to define the input/output behavior of each part of the system (hardware and software). The report must also include the detailed specifications (voltages, frequencies, currents, data structures, button presses, etc.) for all inputs and all outputs of all modules. These specifications must be traceable to the product specification and to the customer requirements. You must include calculations, flow diagrams and other supporting material to fully disclose the detailed requirements of each hardware and/or software module.

As always, you can plan on receiving a bad grade for a report that is written poorly, not spell checked, or incomplete. If you have difficulty writing, please see the instructors, tutors, or the WPI Writing Center for help.

To complete this assignment, your report must contain the following:

An architectural description - This description must include a block diagram that shows the major hardware (and software) modules needed in the system. For each module in the block diagram, there must be a brief explanation of:

- the purpose of that module
- the relevance of the module to meeting the customer (or other) requirements
- the preferred implementation (hardware or software)
- the justification for the preferred implementation

Descriptions of all modules - For each module discussed in the architectural description, you must present a detailed description of the specifications associated with that module. You must describe and justify the preferred implementation of the module. These descriptions must include:

- The preferred implementation (hardware or software)
- Descriptions of the module inputs including (but not limited to):
    - Input signal characteristics (hardware) such as:
        - voltages
        - currents
        - impedance
        - frequency/time waveforms
    - Input data characteristics (software) such as:
        - data type (bit, byte, fixed-point number, floating-point number)
        - data rate
        - logic definitions (active high/active low)
    - Justification for input characteristics
        - calculations
        - simulations
        - experiments
- Functional description of the module
    - What must the module do in response to an input?
    - Justification for the functional description
        - calculations
        - simulations
        - experiments
        - derivations
    - What is the transfer function (if it is a linear system like a filter)?
    - What is the efficiency (if that is an important consideration)?
    - In operation, how much time is available for performing the function?
    - What is the flow diagram?
- Descriptions of the module outputs including (but not limited to):
    - Output signal characteristics (hardware) such as:
        - voltages
        - currents
        - impedance
        - frequency/time waveforms

    - Output data characteristics (software) such as:
        - data type (bit, byte, fixed-point number, floating-point number)
        - data rate
        - logic definitions (active high/active low)
    - Justification for the output characteristics
        - calculations
        - simulations
        - experiments
- Module test and verification
    - How should the module be tested?
        - What are the test inputs?
        - What are the expected outputs?
        - How are test inputs generated?

System integration - Once all of the modules of a system are completed, they must be integrated into a complete system. Don't underestimate the time and effort needed for this essential step. You must describe the following:

- The order of integration
    - interconnection of hardware modules
    - integration of software modules
    - integration of hardware and software modules
- Testing procedures during integration
    - hardware system tests
    - software system tests
    - hardware/software tests
- System test and verification
    - verification of specifications

Sample Outline

1. **Introduction**
   1.1. Introduce the reader to the purpose of this report.
   1.2. Provide a brief summary of the "bottom line" of your conclusions
2. **Architectural Description**
   2.1. Provide the top-level block diagram of your system
   2.2. Describe the purpose of each module in the system
   2.3. Discuss hardware and software partitioning
3. **Module Detailed Descriptions (one description per module)**
   3.1. Detailed description of the module functions
   3.2. Justification of module functions
   3.3. Supporting calculations, derivations and experiments
   3.4. Discussion of module inputs
   3.5. Discussion of module operation
   3.6. Module schematics (for completed modules only)
   3.7. Discussion of module outputs
   3.8. Discussion of module testing
4. **System Integration**
   4.1. Hardware module integration
   4.2. Hardware module testing
   4.3. Software module integration
   4.4. Software module testing
   4.5. Hardware and software integration
   4.6. System testing
5. **Conclusion**
   5.1. What is the current status of each module?
   5.2. Are there any modules that may represent particular risks to budget or schedule?
   5.3. Are there any issues that must be resolved to avoid impacting budget or schedule?
   5.4. What options are available if schedule or budget problems are imminent?

Keep in mind

Neatness counts. Your reports should look like something you would be proud to show to your boss. There should be no hand-drawn figures, no spelling errors, and no grammar errors. Title pages should contain the names of the team members and their EE mailbox numbers, the project name, and the team number. If you include material from journals or other sources they should be referenced in the text and included in a "references" section at the end of the report. Copies of your Value Analysis spreadsheets or collected data should be summarized in the report and included in an appendix to the report. A table of contents is a nice touch.