

ENB 350 Problem based learning Assignment

Work piece Testing Station

(A) Testing Station Driver

(B) Data Logger

Date Available on Blackboard: Week 4

Date Demonstration due: Week 13 at scheduled time for your group

Date Report due: before Week 14 Monday 5pm

Weight: 30%

Problem Description

You are automating one unit of a production line, the testing station – where work pieces arrive, are measured, and pieces are sorted into accept and reject bins. Inputs and outputs of sensors and actuators on the unit (the testing station) are compatible with the requirements of the microcontroller ports, with an electrical interface to achieve this. Pins on the development board collect on a DB-25 connector between the board and the interface. The mapping of the microcontroller pins (GPIO) and the testing station inputs and outputs is in a header file. You have a description of the operation of the testing station and a statement of the functions of the testing station inputs and outputs.

Requirements

Your tasks are to

- a) Write a device driver for the testing station to provide an application program interface that will
 - a. Initialize and configure data structures
 - b. Raise or lower the platform that holds the piece
 - c. Extend or retract the ejector
 - d. Bring the platform to its initial position
 - e. Enable or disable movements
 - f. Sense a work piece in place or not
 - g. Return a colour and material measurement
 - h. Return a height measurement
- b) Write an application program that uses the testing station driver and other drivers and allows
 - a. Starting and stopping the station using a push button or push buttons
 - b. Operating the testing station continuously after starting without user intervention
 - c. Obtaining colour, material and height measurements
 - d. Applying a calibration procedure for height using pieces of known height in millimetres
 - e. Applying upper and lower thresholds on the height to accept or reject a piece
 - f. Keeping a count of work pieces – by accept/reject decision, by colour and by material
 - g. Keeping track of time and displaying calendar time
 - h. Calculating the throughput (pieces processed per unit time)
 - i. Displaying information using the LCD touch screen display in a real-time, user friendly manner

Groups

Each assignment group should comprise of 4 students – preferably 2 groups of 2 students who have worked together for laboratory exercises. In an exceptional circumstance, a group of 3 may be permitted. Group member names have to be emailed to the unit coordinator as soon as possible after week 5. This will allow the unit coordinator to facilitate the process of placing those students who have been unable to form the required size groups in merged groups. Before week 13, a schedule of presentations/demonstrations will be placed on Blackboard using the final list of groups. Each group of 4 students will be allocated 25 minutes for demonstration and presentation. Demonstrations will be during the lecture and lab session times in week 13.

Demonstration and Class Presentation

The duration is strictly 3 minutes per student for presentation (come prepared for this) and 13 minutes for a demonstration. You should prepare only one PowerPoint slide per student.

Assessment

PRESENTATION (5%) – based on effectiveness of oral communication and quality of the one visual slide presented by each student.

ACHIEVEMENT (15%) -- This is based on demonstration of evidence that requirements are met.

REPORT (10%) – A suggested report format is provided at the end.

Criterion Referenced Assessment Sheet – A marking sheet will be placed on Blackboard by week 8. Roughly, each of the minor requirements (b through e) is worth 0.5 mark each and (g and h) are worth 1 mark each. For the application, (a through d) is worth 1 mark, (e through h) are each 0.5 mark each and (i) is worth 2 marks. 2.5 marks are for correctness, completeness and overall quality.

Late demonstration

This **will not be permitted** except for strongly valid medical reason with presentation of a medical certificate. Regardless of the state of completion of your assignment work, you are required to make a presentation as scheduled describing your work up to that time.

Penalty for late submission of the report

QUT policy for late submission of assignments will apply. A late report, without an approved exemption, will receive 0%.

Improvements after demonstration

There will be no time for improvements because the demonstrations are on Friday and the report is due the following Monday. It is advised that you spend any extra time that you may have in finishing the report. If you describe your work well enough – and your demonstration marks were low – you could be given partial credit to compensate for an inability to demonstrate when it was required.

Suggested Format of the Report

The report should contain the following items. The content and style are flexible as long as these are separately identifiable. Approximate page guidelines are given in parentheses.

- Cover page – names, student id numbers, course and unit information (1 page)
- Table of Contents – section headings, list of figures, list of tables (1 to 2 pages)
- Introduction – problem statement and context, requirements, , statements on the individual contributions by each team member (2 to 4 pages)
- Design – Approach to design, important issues and choices and their relationships to theoretical concepts and the hardware and software platforms. Include graphical representations as appropriate, ports, data structures, initialization, real-time aspects, information about threads and handlers and priorities. You can use one subsection for the driver and another for the data logger. (5 to 20 pages)
- Results – summary of evidence of functional requirements that are met, explanation of failures and any further work (post demonstration) (3 to 10 pages)
- References (1 page)
- Appendix A: Festo Testing Station Driver – Description in the same format as the modules in the Tiva Peripheral Driver Library User Guide. (0.5 to 1 page per API function).
- Appendix B: Data Logger – Brief description of use in the same format as the example projects. (2 to 5 pages).
- Appendix C: Explanation of the code submitted – names of folders, files and their contents. There is no need to explain the code here. Comment the code. The design section should provide the overview explanation and any relevant code fragments. (1 page).

Further Clarification

This document is a draft and further clarifications will be added depending on student queries. The requirements will not change in essence.

Alternate project(s) as the problem based learning assignment

Exceptional circumstances may be taken into consideration for an alternate assignment provided this is negotiated by week 5 and all the following conditions are met in a project plan by week 7.

1. You are in a group that has purchased hardware for the project
2. The group members have work commitments or other exceptional circumstances that make it difficult to access the laboratory after hours.
3. You sign a declaration that you have undertaken health and safety requirements and are individually responsible for work done outside the laboratory – for your safety, safety of others around your work and for any losses resulting to equipment and facilities.
4. You have a written project description that can be checked by laboratory technical staff, along with your risk assessment.
5. The project covers an equivalent set of learning components – such as the use of GPIO, timers, ADC, threads and handlers, graphical display, device driver concepts, application interface concepts and software development and documentation concepts, presentation, demonstration and written report.
6. The alternative assessment plan is approved by the unit coordinator.