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 are attached to 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 provided 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 (or height sensor, depending on the type of station)
   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 (digital)
   h. Return a height measurement (analog converted to digital)

b) Write an application program that uses the testing station driver and other drivers and allows
   a. Starting and stopping the station using push buttons
   b. Displaying started/stopped status using an LED.
   c. Operating autonomously going through measurement steps as each work piece is placed
   d. Obtaining colour, material and height measurements
   e. Applying a calibration procedure for height using pieces of known height in millimetres
   f. Applying upper and lower thresholds on the height to accept or reject a piece
   g. Keeping a count of work pieces – by accept/reject decision, by colour and by material
   h. Keeping track of time and displaying calendar time
   i. Calculating the throughput (pieces processed per unit time)
   j. Displaying information such as the counts, the time, the measured data etc. using the LCD touch screen display in a real-time, user friendly manner. Use your own structure.

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 – CRA sheets for the presentation, demonstration and report have been placed on Blackboard.

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%.

Requirements that could not be demonstrated

There will be no time for improvements because the demonstrations are during contact hours in week 13 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. You can add an explanation for each failure if you have been able to figure out how you might proceed if you could do it again.

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 pages)
- Design and Implementation – Approach to design, important issues and choices and their relationships to theoretical concepts and the hardware and software platforms. You can use one subsection for the driver and another for the data logger. (approx. 10 pages). Check if you have addressed

  Provided a graphical representation for your design?
  Provided a Project folders and files diagram?
  Did you use the GPIO module? How?
  Did you use the graphics library? How?
  Did you use interrupts? How?
  Did you use multiple threads / handlers? How? Why?
  Did you use the ADC? How?
  Did you use TI-RTOS? How?

- Results – summary of evidence of functional requirements that were demonstrated and explanation of failures as learning outcomes in terms of what could have been done differently (2 pages)
- References – including vendor supplied technical documents with a table that links each document to sub-sections of your report where they are relevant with entries: the reference number, the sub-section number, topic keyword or keywords, the pages that were found useful. (2 pages)
- Appendix: Mention the name of the hardware development platform and versions of the tools used such as Code Composer Studio, Tivaware, RTOS etc. (1 page).

Further Clarification

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

Work pieces: These are small objects that look like ice hockey pucks that are metallic or plastic and coloured orange or black
Sensors: The testing station has 'work piece in place' sensor using photodiodes; it has a metallic sensor and a colour sensor that uses a photodiode also to tell the black pieces from others. These provide digital binary outputs. It also has a height sensor which is a variable resistance potentiometer device. The output is a voltage that is fed to the analog to digital convertor on the microcontroller. The height sensor must be brought down (or the piece moved up) for measurement by lowering and raising a platform.
Description of operation: Festo miniaturized production testing station pins and operation, and the interface between the station and the microcontroller (to make them 3.3V and current compatible) are described in documents placed on Blackboard.