MICROPROCESSORS & INTERFACING (ENSC332)

COURSE PROJECT

I. OBJECTIVES

To integrate the material discussed in the course and develop assembly/C language programs for a microcontroller-based embedded application.

II. Required Components

- CodeWarrior IDE software.
- Dragon12 Trainer (manual posted on WEBCT).
- Your choice of hardware: (a) Traffic light platform from Bytronic (manual provided on WEBCT); (b) Industrial Control Technology from Bytronic (manual provided on WEBCT); (c) Batch Processing Unit from Bytronic (manual provided on WEBCT); or (d) Simulated hardware platform using the Dragon12 peripheral hardware such as push button switches, Light Emitting Diodes (LEDs), infrared transceiver, LCD display, and photo-transistor as described below.

III. Project Description

The aim of this project is to simulate a *demand-actuated* traffic light controller using the Dargon-12 board as follows:

1- Crossroad traffic lights: Six LEDs connected to PB0-PB5 represent different traffic lights (i.e., green, amber, red) for the east-west and the north-south roads. Although the on-board LEDs are red in color, we can imagine some of them to be green or amber!

2- Traffic sensors: Traffic flow on each road coming through the junction can be simulated by pressing a traffic flow push button switch. For example, SW4 and SW3 on Dragon-12 can be chosen as traffic flow sensor outputs for east-west and south-north directions, respectively. In an advanced *demand-actuated* traffic light system, the traffic light will turn green when a vehicle is sensed, for example to allow the vehicle to cross a street or make a left turn. The sensor is usually an inductive loop of wire with proper electronics which acts like a ferrous metal detector. The device is buried in the pavement of the road near the stop line. In this project, the sensor can be simulated by a switch that turns ON/OFF when a car is detected.

3- Pedestrian crossing: Two LEDs (e.g., PB6 and PB7) can be used to simulate one pedestrian crossing. A push button switch (e.g., a switch on the keypad of Dragon-12 board) can be used to acts as a pedestrian stop request button. You may also utilize the infrared transceiver to build an intelligent controller that can detect a person waiting to cross the street.

You have to properly define the duration and timing of different traffic lights (outputs) based on the "traffic flow/presence" and/or "pedestrian stop request" (inputs). Make reasonable assumptions in your design. For instance, you may use the guidelines below for operation of the controller:

1- Traffic lights should operate in a default mode when there is no traffic on the road. The default values for the duration of different lights can be set by the programmer.

2- If the traffic flow pattern changes, i.e., when a traffic flow sensor is triggered, the duration of lights on each side of the crossroad should be changed accordingly.

3- While the intersection traffic light sequence is running, if the pedestrian stop request is pressed, or the infrared sensor detects presence of a pedestrian, the pedestrian crossing red light should be turned off and the green light turned ON for a certain amount of time.

With the background material covered in previous labs the students should be able to implement a preliminary version of the above traffic controller and modify it as new material is discussed in the course. You may utilize material discussed so far in the course such as subroutines, modules and macros, combined assembly/C programming, and upcoming topics such as interrupts, timers, etc.

Note: If you choose to do any of the projects (a) to (c) indicated in section II, please contact the instructor.

Project Demonstration and Reporting

The project should be demonstrated to the Teaching Assistant of your section upon completion. Please refer to the schedule for project demonstrations on WEBCT. An extended report is required for each group with the format indicated in the course outline. The percentage of each person's effort in a group should be identified in the report by including his/her role. For example, if all members in a group of 3 feel that they have equally contributed to the project, they should indicate 33.3% for each member in addition to indicating their roles. Alternatively, if one person did 40% of the work and others contributed 30% each, it should be clearly indicated in the report.