CSE211 Introduction to embedded systems:
Project for Fall 2021

Introduction

During this course, you studied microcontroller architecture along with basic embedded C programming. You have addressed project building process, digital I/O applied on Arm Cortex M4 TivaC. Group of course assignments delivered by individuals are considered as the first corner stone in this project. It is intended to assess all these engineering design aspects along with other skills.

Objectives

The goal of this project is to design a traffic light control system. The system contains simply two traffic lights. One allows cars to move from north to south, and the other one allows cars to move from east to west. Beside each traffic there is also a pedestrian traffic light. The pedestrian has to press on a button to have his light green to cross the street safely.

By the end of this project you have to master the following:
1. Timers: You will be using at least two timers to configure the span of the traffic lights.
2. GPIO: You will be using LEDs as outputs, and push buttons as input.
3. Interrupts: You will use interrupts also in this project for the push buttons and timers

Features

Set the normal traffic Light

Use one of the timers to have the two car traffic lights working. The traffic light shall stay GREEN for 5 seconds, then YELLOW for 2 seconds, then turns RED. When one of the traffic lights is set to RED the other one has to go GREEN exactly after 1 second. The same sequence then is repeated again.

GREEN : 5 seconds YELLOW: 2 seconds Then RED.

Wait 1 second, then start the sequence on the other traffic.

Implement the pedestrian Traffic Light

Use two push buttons and 4 LEDs for this system. There will be two pedestrian traffics, each with a push button and 2 LEDS: GREEN and RED. Whenever a pedestrian presses the button, the traffic light that is green shall be interrupted, and the pedestrian traffic light will be green for 2 seconds. Then it will be back to RED and the traffic light that was interrupted will resume from when it was paused.

Example: If the car traffic light was green for 2 seconds and interrupted it will then resume the remaining 3 seconds to finish the 5 seconds.

BONUS PART :

Handle the case if two pedestrians pushed the button together in two different traffics.

Handle the case if the same button was being pressed more than one time during the same period of pedestrian crossing. (Period of pedestrian crossing is from when the button is pressed for the first time till the pedestrian traffic gets back to RED again.)

Handle the case to delay the request of the pedestrian to cross if the button was pressed after 1 second from the end of the Period of pedestrian crossing.

UART (Bonus)

Send the current state of the whole system via UART whenever the system changes its state. The possible states for example are : CARS NORTH SOUTH, CARS EAST WEST, PEDESTRIAN NORTH SOUTH, PEDESTRIAN EAST WEST.

Deliverables

1- Design document that may include flow chart and description of files and functions used. (30%)
2- One project that has all functions distributed on .c and .h files. (50%)
3- Video file of maximum 5 minutes showing operation and project features uploaded on OneDrive (10%)
4- Documentation should be in two forms; code embedded comments and project report/thesis (10%)

Project Teams

Up to 5 students are allowed to share project development.

Evaluation Method

The percentages are shown along with deliverables.

Project submission: on Campus and through LMS.