CSE211 Introduction to embedded systems:
Project for Fall 2022

Introduction

During this course, you studied microcontroller architecture along with basic embedded C programming. You have addressed project building process, digital I/O, timers, and interrupts 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 simple calculator with 2 extra features: a timer and a stopwatch. The calculator shall do the basic operations that are addition, subtraction, multiplication, and division. The timer and stopwatch features will be both handled separately by the hardware.

By the end of this project, you must master the following:
1. Timers: You will be using at **least two timers** one for the stopwatch mode and the other for the timer mode.
2. GPIO: You will be using the LCD and a keypad and some push buttons.
3. Interrupts: You will use interrupts also in this project for the push buttons and timers

Features

In this project you will have 3 main Modes. You will need to have a keypad for all number inputs. You will need a push button to switch between these 3 modes. You are free if you need to add more push buttons.

1. Calculator

In this mode you will be asked to take inputs from the user and print that input on the LCD. You will take two numbers (each more than 1 digit) and a sign between them. Use the keypad numbers to get the numbers.
A button: +
B button: -
C button: /
D button: =
* button: x

Print the numbers and the sign on the LCD before printing the result.

2. Timer Mode

In this mode the user will set a time using the keypad, the timer will start counting down and as soon as it reaches the time zero it will trigger a buzzer.

When you switch to this mode initially present 00:00 on the LCD then take the input from the user as minutes and seconds. Write the input as minutes and seconds then start the timer as soon as the user presses on the D button on the keypad.

3. Stopwatch Mode

In this mode the user will be using three buttons, one to start the stopwatch, one to pause the stopwatch, and one to reset the value back to 00:00.

When you switch to this mode initially present 00:00 on the LCD. Whenever the user presses on the start button start incrementing the stopwatch.

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 maximum are allowed to share project development. One pdf file should contain names, IDs, individual contribution, and link to the videos mentioned above.

Evaluation Method

Project marks are 15 marks. The percentages are shown along with deliverables.

Project submission: To be uploaded on lms before 23/12/2022

Project Due/Uploads/Format: pdf

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