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**University of Windsor**
**Department of Electrical & Computer Engineering**
**ELEC 4430 Embedded System Design, Winter 2022**
**Instructor: Dr. M. Khalid**

**Project 2: Arduino Project**
**Due Date: Monday April 4, 2022**

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**Part One: Reaction Timer**

The goal of this project is to implement a microcontroller-based Reaction Timer using the Arduino development board. The Reaction Timer is used to measure the reaction time of the user once the LED is lit. The students should use a LED to prompt user input, IR remote button to detect user input and display reaction time in microseconds on a character LCD module. Upon power up, the Arduino should wait for a random amount of time (**2~4 seconds**) and then turn on a LED. After the LED is on, once the user has pushed the "0" button on remote, the LED should turn off and the LCD module should display how long it took the user to react and push the push button. The Arduino should then start this process again. If the timer waits for too long (> **10 seconds**) however, the LCD should display "**TimeOut!**" skips displaying the reaction time, and then start the process again.

- Note that you can use input pin to trigger interrupt. You may want to consider using "**attachInterrupt**()" function to accomplish this.

**Part Two:**

The goal of part two of the project is to develop digital version of the "Whack a Mole game". In this version of the game, the led lights would glow to indicate the mole rising from the hole and user pressing the corresponding IR remote button to whack the mole. The students should use four LED's (LED1, LED2, LED3 and, LED4) to represent four moles, IR remote to whack every rising mole or glowing led (Button 1 corresponds to LED1, Button 2 corresponds to LED2, … and so on) and the LCD module to display game information like game start, restart, score, timeout etc.

The functionality to be programmed is as follows:
1. Upon start up, the LCD module displays the keywords "**Ready**", "**Set**", "**Go**" with an interval of 0.5 seconds.
2. Then, after a random delay of **2-5 seconds,** randomly selected led out of the four led's glows.
3. The user is then expected to press the corresponding IR remote button (1 for LED1, 2 for LED2, 3 for LED3 and 4 for LED4) within **2 seconds** time limit.
4. If the user presses the correct key within the time limit of **2 seconds,** the score is incremented by 1 and the next iteration starts, i.e. go back to Step 2.
5. If the user fails to press the correct button within the time limit, the LCD module displays "**TimeOut!**" and after a delay of **3 seconds** displays the final score on the LCD **"Your final score was: <score>**" and then restarts the game. Before restarting, the LCD displays "**Restarting…**" and then goes back to Step 1. Also, if the user presses incorrect button, the LCD module displays "**Incorrect Selection!**" and after a delay of **3 seconds** displays the final score on the LCD "**Your final score was: <score>**" and then restarts the game and goes back to Step 1. As in case of timeout, it displays "**Restarting…**" before going to Step 1.

## *Useful Hints:*

- It is highly recommended that each group writes the software code BEFORE coming to the lab. This will save significant amount of their time.
- Use timers when implementing delays
- Software development utilities & documentation will be provided for each group.
- GAs will check the functionality of the design on your Arduino setup.
- All group members should participate in developing the code.
- TAs will ask oral questions related to the project from each team member.