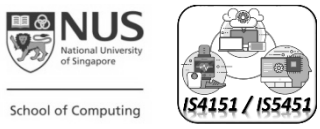

IS4151/IS5451 – Pervasive Technology Solutions and Development

AY 2019/20 Semester 2

Individual Assignment 1

Objectives

At the completion of this individual assignment, you should:

1. Develop a better understanding on how to employ single-board microcontrollers in various roles to create useful real-world solution.

2. Acquire a deeper technical skillset on working with the wireless data communication and computational capabilities of general purpose microcontrollers such as micro:bit.

3. Acquire a deeper technical skillset on using microcontrollers to control external sensors and devices.

General Requirements

You are required to develop a two-player game system known **TicTacToe** using micro:bit as the primary microcontroller in conjunction with the Grove shield device and various Grove modules. This is an individual assignment and you are required to complete all project tasks on your own. The submission deadline is the end of Week 9, i.e., **Sunday, 22 March, 11:59 pm**. You will do a simple demonstration during one of the lab class starting from Week 10 onwards.

The TicTacToe system consists of three main components:

- A pair of game devices.

- A game controller that also acts as the score display device, i.e., the scoreboard, and wireless receiver.

- A game board display program.

The general game flow begins when a player presses Button A+B on the controller to start a new series. The scoreboard will be reset to "00-00". A player then presses Button A on the controller to start a new game in the series, and then presses Button A to select the size of the game board from 3 to 10 before pressing Button B to commence game play. For each new game, Player 1 and Player 2 will be randomly selected to make the first move. At any juncture during game play, a player can press Button B on the controller to stop the current game without any winner.

Each player will take turn to mark a cell on the game board with his/her symbol. Player 1's symbol is X and Player 2's symbol is O. A player can select a cell to mark by pressing Button A on his/her game device to move horizontally across the game board, Button B to move vertically across the game board, and Button A+B to confirm the marking. The game device should show the currently selected grid using the 5x5 LED. The first two columns and last two columns will be used to show the X and Y coordinates of the currently selected cell, respectively. The middle column, i.e., the third column (3,1) to (3,5), is not used. The 5x5 LED should be turned off when it is not the player's turn.

A player can only mark a cell that is currently empty. After successful marking, the controller should sound a success audio tone and update the game board. Otherwise, the controller should sound an error audio tone.

The first player to get n in a row, where n ranges from 3 to 10 depending on the size of the game board selected, will win the current game. The game devices will show a win, lose or draw icon depending on the respective player's outcome. The scoreboard will also be updated at the end of each game.

To end the current series, a player will press Button A+B on the controller. The game devices will show the final outcome, either win, lose or draw, depending on the respective player's outcome. The scoreboard will also show the final outcome with "88" on the winning side and "00" on the losing side. If the final outcome is a draw, the scoreboard will show "00-00".

A high-level schematic diagram of the TicTacToe game system is depicted in Figure 1 below.

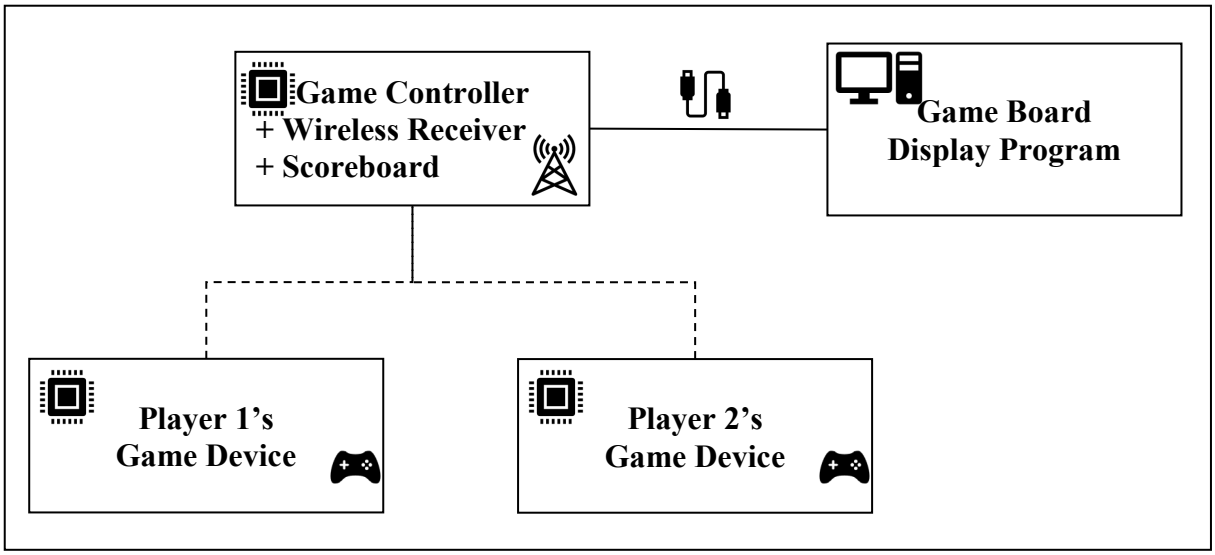

Figure 1 – High-level schematic diagram of the TicTacToe game system.

Basic Reference Game Protocol

The basic reference game protocol is shown in Table 1 and it also serves as the main evaluation criteria. However, you are allowed to enhance the protocol in your own implementation as desired.

S/N	Stage	Game Controller	Game Board	Player 1's Game Device	Player 2's Game Device
1	Handshaking	- Initiate pairing with game devices - Initiate pairing with game board display program			
2			- Accept pairing request		
3	Splash Screen	- Shows a welcome splash screen. - Prompt players to press Button A+B to start new series.		- Shows a welcome splash screen.	
4	Series Initialisation	- Reset score board to "00-00" - Prompt players to press Button A to start new game.	- Prompt players to press Button A to start new game.		
5	Game Initialisation	- Player presses Button A to start new game.			
6		- Player presses Button A to select game board size.			
7		- Player presses Button B to commence game play.			
8		- Randomly determine starting player.	- Display empty game board		
9	Game Play			- Players take turn to mark cell with respective symbol.	
10				- Current player presses Button A and Button B to select (X,Y) coordinates of cell to mark.	
11				- Shows currently selected cell.	
12				- Current player presses Button A+B to confirm marking of cell.	
13		- Sound success or error audio tone.	- Display updated game board.		
14		- Check for n in a row. OR - Presses Button B to end game prematurely.		- Change over to the other player. - Repeat from (9).	
15	Game End	- Update score board.	- Show final state of game board.	- Show win, lose or draw icon depending on the respective player's outcome.	
16		Repeat from (5)			

S/N	Stage	Game Controller	Game Board	Player 1's Game Device	Player 2's Game Device
17	Series End	- Player presses Button A+B to end current series			
18		- Show final outcome.	- Clear game board.	- Show final win, lose or draw icon.	

Table 1 – Basic reference game protocol.

Overall Assessment Criteria

The overall assessment criteria are listed below.

Criterion	Maximum Possible Marks
Implementation of the Game Controller	4
Implementation of the Game Device	3
Implementation of the Game Board Display Program	2
General Coding Techniques and Design Considerations	1
Total	**10**

Assignment Deliverables Submission

The deliverables to be submitted to LumiNUS Files tool at the end of Week 9 are to be placed in a single zip archive file with the following folders structure:

- **docs** subfolder containing:
  - Softcopy of a Microsoft Word document in DOCX format briefing explaining the design of your system.
  - Special instructions for setting up and running your system.
- **source** subfolder containing:
  - All project folders/source files that constitute your system.
- **readme.txt** containing:
  - Full name
  - Matriculation number.
  - Email.
  - Contact number.

Upload this zip archive file to the designated LumiNUS Files tool folder: "Deliverables Submission > Individual Assignment 1".

Your assignment deliverables must be submitted latest by **Sunday, 22 March, 11:59 pm**. No assignment will be accepted for assessment after this date/time. For the demonstration, you will be given the source files from your LumiNUS submission.

-- End of Individual Assignment 1 Specification --