

ECE315 Introductory Microprocessor Laboratory

Lab 4

Project Software Specification

1. Introduction

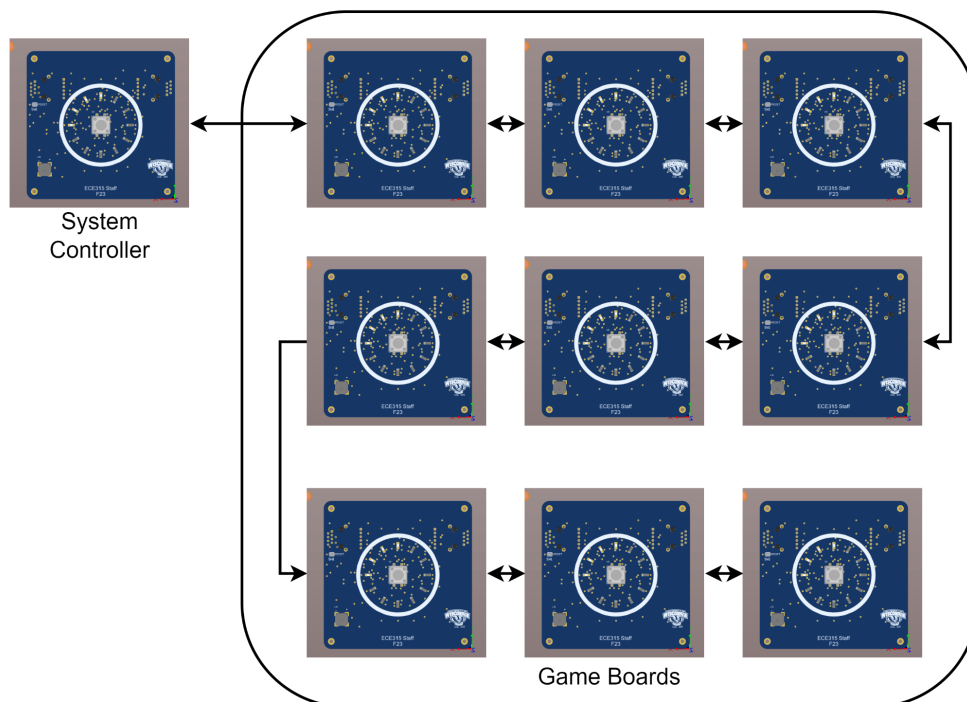
Note: Lab 4 attendance is Mandatory!

In Labs 1-3, you completed the design of a single square of the ECE315 Whack-A-Mole game.

In Lab4, you will be working in small groups to define the software specifications for the Whack-A-Mole game. You will work with your group to define a discovery strategy and game requirements when you attend Lab 4. Your lab session will work to define the overall behavior of the system that will be implemented for the final demo in Lab 6.

2. Overview

In order to implement the Whack-A-Mole game, the PCBs you designed in class this semester will be “daisy chained together” using ethernet cables. Each PSoC4 MCU has 2 UART interfaces that are connected to one of the ethernet jacks on the board. This will allow the MCU on each board to transmit and send data packets to the two other boards that it is directly connected to.



The image above shows a 3x3 grid of ECE315 boards that this document will refer to as Game Boards. In addition to the Game Boards, there will be one additional ECE315 board that will act as the System Controller. The System Controller and Game Board programming images will be generated from different PSoC4 software projects.

3. Operational Modes

Discovery Mode

When the system is powered on, the system enters the Discovery Mode to determine how many Game Boards are present in the system. The Discovery Mode must support the following requirements

- The System Controller will begin a discovery process that will discover the number of Game Boards.
- Discovery supports a variable number of Game Boards that shall not exceed 128.
- The discovery process should take less than 10 seconds to complete.
- The discovery process MUST not involve any human interaction.
- Once the discovery is completed, the system is placed into Game Mode.
- The UART interface will be operating at 115200, 8N1.
- The System Controller can “reset” the system at any time by issuing a software reset (not a push-button reset).

Game Mode

After the discovery process has completed, the system will be placed into Game Mode. The game mode will support the following requirements:

- The UART interface will be operating at 115200, 8N1.
- Game Boards will utilize LEDs, push buttons, and the buzzer to interface with the user.
- The game must provide a scoring system that rewards quick reflexes.
- The game will support a series of levels that will get progressively more difficult
- The game must support the ability to display a “High Score” to the user. The High Score will be reset to 0 every time the system is powered off.

4. Focus Groups

During the first hour of the lab, each section will have four (4) different focus groups that will specify a key aspect to the overall operation of the system. These focus groups will consist of one (1) member from each team. Each team can decide which team member will work with each focus group. The next section will describe each of the four focus groups.

During the second hour of the lab, the focus groups will meet as one large group and discuss their design choices. The focus groups will adjust their requirements based on the feedback provided.

The goal of this lab is to generate a requirements document that all teams in your section will then implement a software solution for your lab 6 submission. The requirements document should include enough detail to remove any ambiguity in the implementation of the system requirements. Each section will need to produce a state diagram of the Discovery and Game modes, along with defining various data packets used by the System Controller and Game Boards.

5. Operational Modes

System Controller Discovery Mode

This focus group will specify the behavior of the System Controller during the Discovery Mode. The group will need to define the behavior of the System Controller as it interfaces with the Game Boards. The System Controller will send a Discovery Request Packet to the first Game Board in the daisy chain. The number of bytes and structure of the Discovery Request Packet will be determined by this focus group.

Example Discovery Request Packet

Byte #	Byte Description	Value
0	Start	0x53 (S)
1	Mode Discovery	0x44 (D)
2	Packet Type Request	0x52 (R)
3	Defined by Group	
4	Defined by Group	
.	Defined by Group	
n	End	0x45 (E)

Game Board Discovery Mode

This focus group will specify the behavior of the Game Board during the Discovery Mode. The group will need to define how an individual Game Board responds to a Discovery Request Packet. A Game Board should respond with a Discovery Acknowledge Packet that will be returned “upstream” to the System Controller. The Game Board must also forward the Discovery Request Packets to any Game Boards that are “downstream” in the daisy chain.

Example Discovery Acknowledge Packet

Byte #	Byte Description	Value
0	Start	0x53 (S)
1	Mode Discovery	0x44 (D)
2	Packet Type Acknowledge	0x41 (A)
3	Defined by Group	
4	Defined by Group	
.	Defined by Group	
n	End	0x45 (E)

System Controller Game Mode

This focus group will specify the behavior of the System Controller during the Game Mode. The group will need to define the behavior of as the System Controller interfaces with the Game Boards while the Game is being played. Information sent from the System Controller to Game Boards will be sent in a Game Request Packet. The number of bytes and structure of the Game Request Packet will be determined by this focus group.

Example Game Request Packet

Byte #	Byte Description	Value
0	Start	0x53 (S)
1	Mode Game	0x47 (G)
2	Packet Type Request	0x52 (R)
3	Defined by Group	
4	Defined by Group	
.	Defined by Group	
n	End	0x45 (E)

Game Board Discovery Modes

This focus group will specify the behavior of the Game Board during the Game Mode. The group will need to define how an individual Game Board responds to a Game Request Packet. A Game Board should respond with a Game Acknowledge Packet that will be returned “upstream” to the System Controller. The Game Board must also determine if it needs to forward the Game Request Packets to any Game Boards that are “downstream” in the daisy chain.

Example Game Control Packet

Byte #	Byte Description	Value
0	Start	0x53 (S)
1	Mode Game	0x47 (G)
2	Packet Type Acknowledge	0x41 (A)
3	Defined by Group	
4	Defined by Group	
.	Defined by Group	
n	End	0x45 (E)

6. What You Need to Turn In

There are no individual submissions required for this lab.

Each section will need to complete a Requirements Document that will be made available during the lab session. The permissions of this document will be changed to Read-Only after the conclusion of the lab.

Attendance will be taken at the beginning and end of the lab section. Students who are present in the lab will be awarded full credit for Lab 4.