ECGR 4101/5101, Fall 2021: Lab 9

Two player Pong!

Version 1.0 – 11/22/21

Learning Objectives:

The main objective of the assignment is to replicate (as close as possible) to the classic video game Pong! This time, you will use two TIVA boards and booster packs.

Two Player Pong

This lab will use the TIVA boards and the Booster packs (joystick, screen) to play the game Pong. This lab will require that you use one of the joysticks to move a video "paddle" along the left side of the screen and the other joystick a video "paddle" along the right side of the screen. The objective of the game is to hit a 3x3 pixel "ball" that is traveling and cause it to travel back in the other direction.

Play will start with the ball moving on the screen, mostly right to left, at a random angle from exactly horizontal. The ball is bounded on the top and bottom of the screen – it should deflect off the wall at the appropriate angle. When the ball is hit by the paddle, it should travel back towards the other side of the screen.

The actual game of pong has a complex effect on ball travel after it hits the paddle. This lab gives you the option of solving a simple paddle response, or a more complex response.

Solution A: When the ball hits the paddle, it deflects off the paddle at the same angle relative to its motion, as demonstrated in class. There is no change in speed or direction/angle based on the location on the paddle it hits or the speed of the paddle.

Solution B: When the ball hits the paddle, it deflects off the paddle based on the ball's speed, the paddle's speed, the direction/angle based it was traveling towards the paddle, and the location on the paddle the ball hits. This is a complex combination of speed and angles, and is something you must search/read/discover on your own.

For the sake of finishing this lab, solve solution A first before you attempt solution B. If you attempt solution b, add only one variability of motion/location at a time and test it.

Requirements:

Req. 1. The system will consist of two Texas Instruments Tiva C Series TM4C123G LaunchPads and two Educational BoosterPacks MKII.

Req. 2. The system must be programmed in C and use Code Composer Studio (NOT Energia).

Req. 3. A "ball" (colored in circle – or as close to a circle as you can get) will move around the LCD screen depending on the walls and paddle it hits.

Req. 4. The ball will have a "diameter" of 3 pixels (will be 3 x 3).

Req. 5. The speed of the ball should be reasonable for a game of pong – not too slow, but not too fast that you cannot play it.

Req. 6. The playing arena is two walls (top, bottom).

Req. 7. The left side of the screen is “open” (will not deflect a ball).

Req. 8. The right side of the screen is “open” (will not deflect a ball).

Req. 9. The ball will not travel beyond the top or bottom walls of the screen but will instead bounce/deflect off of the walls.

Req. 10. If the ball deflects off of a wall, it should deflect at the same angle it hits (reflection from 90 degrees).

Req. 11. The paddles shall be 15 pixels by 2 pixels.

Req. 12. One paddle should move along the left side of the LCD.

Req. 13. One paddle should move along the right side of the LCD.

Req. 14. The paddles will move up and down depending on the movement of the joystick.

Req. 15. The objective of the game shall be to keep the ball in the playing field by preventing the ball from passing the left or right side of the screen.

Req. 16. When the ball hits the paddle as it travels from right to left, it will deflect off the paddle and travel left to right.

Req. 17. When the ball hits the paddle as it travels from left to right, it will deflect off the paddle and travel right to left.

Req. 18. Both of the Booster pack Buzzers will make a sound when a ball hits the paddle.

Req. 19. Both of the Booster pack Buzzers will make the same sound at the same time when a ball hits the paddle.

Req. 20. At the start of play, the ball will travel towards the left side from a random point along the right side of the screen.

Req. 21. At the start of play, the ball will travel towards the left side at a random angle of travel along the right side of the screen.

Req. 22. At the start of play, the ball will travel towards the left side at an angle between 45 and 135 degrees.

Req. 23. If the ball passed past one of the sides (is not hit by the paddle), the system will wait 2 seconds and start a new ball traveling adhering to requirements 20-22, but from the other side of the screen.

Req. 24. If the ball passed past one of the sides (is not hit by the paddle), the player who last hit the ball is awarded a point.

Req. 25. If the ball passed past one of the sides (is not hit by the paddle), the screen will show the new score of the game for two seconds.

Req. 26. The game will end when one of the players earns 10 points.

Req. 27. A new game will start when Switch S1 on the Booster Pack is pressed.

Req. 28. The angle at which the ball deflects off the paddle is up to the game designer.

Req. 29. The speed at which the ball travels after it hits the paddle is up to the game designer.

Req. 30. A competent game player should be able to move the paddle to hit the ball a minimum of 75% of the time.

Req. 31. The specific location of running code across the two boards is up to the two teams working on the lab.

Req. 32. The solution may use one or two screens, but if two screens are used, both screens must show the same location of the paddles and ball at the same time.

Req. 33. Code must be running on each Tiva board (you may not hard-wire both joy sticks to one Tiva board)

Req. 34. All members of the two teams must be present during the demonstration of the lab.

To Demonstrate and Submit:

Have the demonstration sheet below printed off. Demonstrate your working (or partially working) code to the TA. After the demonstration, the TA will take your demonstration sheet and save for grading.

ONE of the lab partners should submit a single file with your code as a text file. All code should be in this single file, with the main file (with the main function) at the top. **REMEMEBR BLOCK HEADER COMMENTS!!!** Also, if you used code you found online, you need to cite the source of that code at the beginning of the code blocks.

Advanced Embedded Systems Lab Demonstration Validation Sheet

This sheet should be modified by the student to reflect the current lab assignment being demonstrated

Lab Number:	Lab 9 – Two player Pong
Team Members	Team Member 1: emailID: Team Member 2: emailID: Team Member 3: emailID: Team Member 4: emailID:
Date:	

Lab Requirements

REQ Number	Objective	Self-Review	TA Review
	The ball travel starts correctly after each point		
	The ball travels correctly		
	The ball deflects off of the walls (up, down) correctly		
	The ball deflects off of paddles correctly		
	The paddles move correctly		
	Both buzzers play a sound when a ball hits a paddle.		
	Points are scored correctly when the ball is not hit by a paddle.		
	Points are displayed correctly		
	The game ends correctly when one player earns 10 points.		
	Game restarts on S1 press		
	A competent game player should be able to move the paddle to hit the ball a minimum of 75% of the time.		
	Solution solved: A or B		