



# Pinball Game

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For our final embedded system, we chose to create a pinball game using the Arduino and a variety of components as shown in Figure 1 and Figure 2. To start the game, press the leftmost start/stop button, as shown in Figure 3. The game has started once you see the point value begin to increase on the LCD. After dropping the ball at the top of the board, keep it from escaping by triggering the left and right flippers using the two buttons to the right of the LCD. The flippers will push the ball upward, keeping it from escaping. The game is over when the ping pong ball falls between the flippers. To stop the game at any point, the start/stop button can be pressed again.

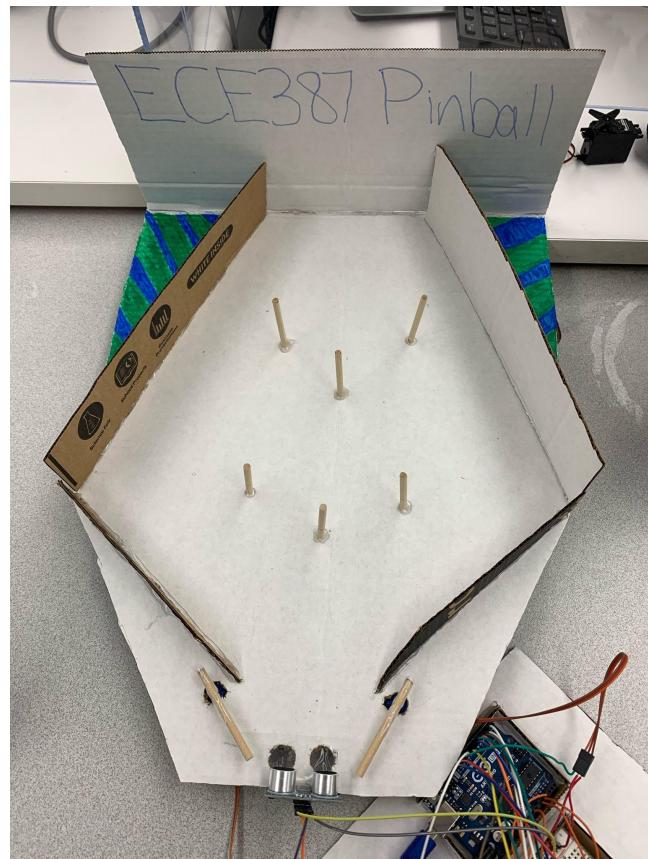


Figure 1: *The game board*

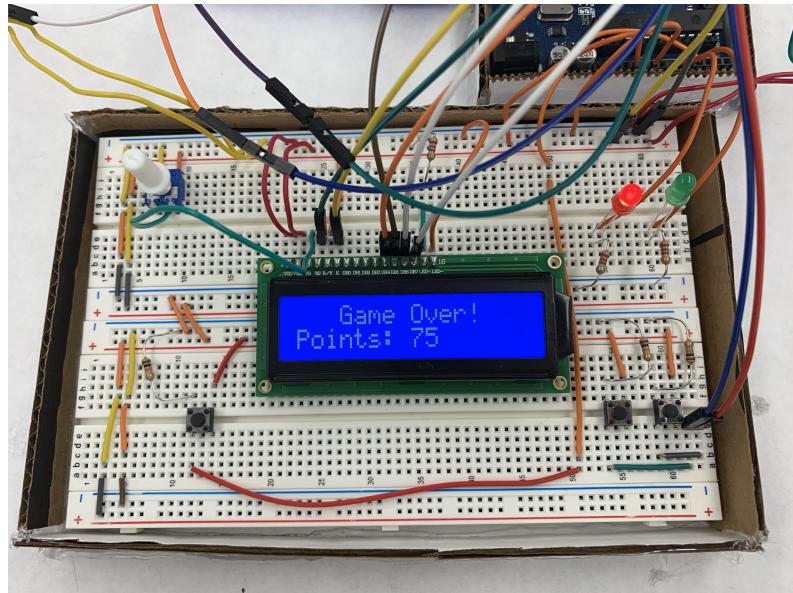


Figure 2: The game controls

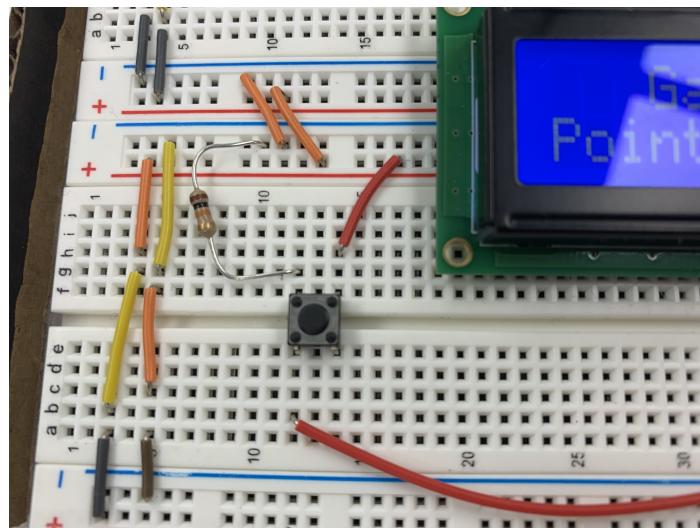


Figure 3: The start/stop button

The pinball game features two flippers controlled by Continuous Servo Motors. Each motor has an arm attachment to flip the ball upwards in a swinging motion. The motors can be triggered by pressing either the left or right button, as shown in Figure 3.

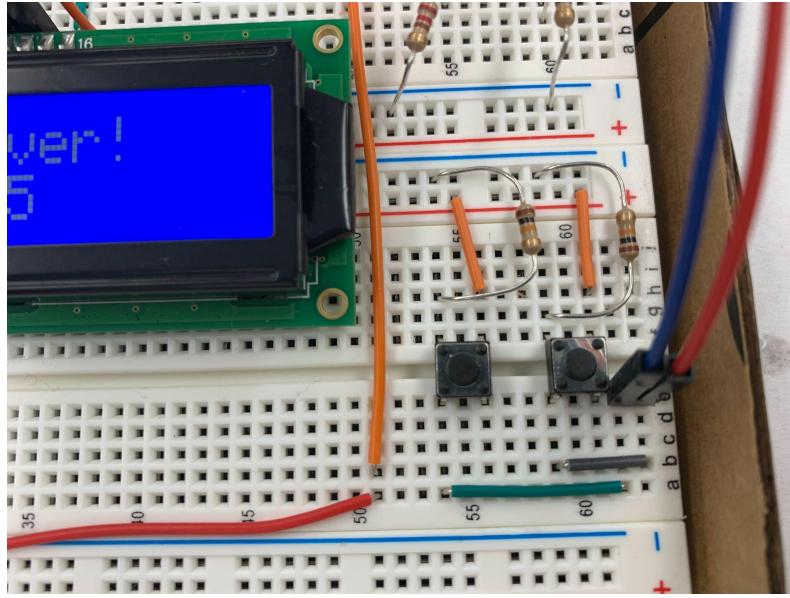


Figure 4: The left and right flipper buttons

To keep track of the score and alert the player when the game is over, an LCD is connected and displays such information. When the game is over, the LCD will display “Game Over!” and the amount of points earned. Points are earned by how long the player lasts and the number is determined by the amount of milliseconds have passed. Additionally, the green and red LED are located beside the LCD to help indicate the status of the game as shown in Figure 5. Green being the game is on and going, and red meaning off and the game is over.

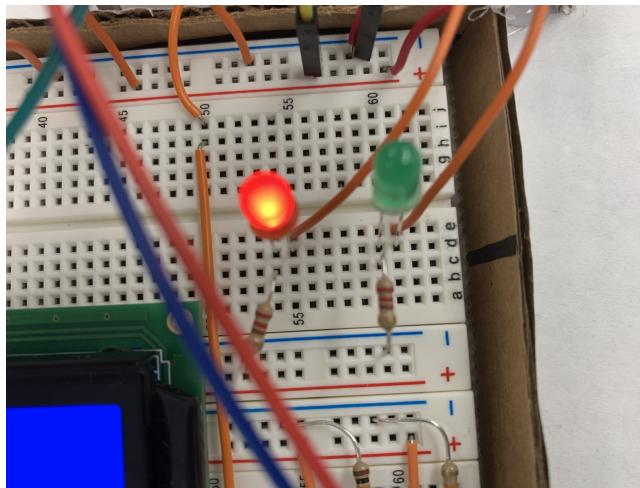


Figure 5: The red and green LEDs

Finally, an ultrasonic sensor is used to detect when the ball has fallen below the flippers. This sensor is located just below the narrow gap between the flippers. After detecting the ball, it stops the game and displays the player’s points as shown in Figure 6.



Figure 6: A closeup of the “Game Over!” sign

When researching our components and potential designs, we referenced the Arduino website several times. One component in particular, the ultrasonic sensor, required special functions for determining the distance it would begin detecting. To assist with this, we utilized a tutorial from TutorialsPoint.com ([Source](#)). To eliminate inconsistencies when detecting a button press, we referenced a debounce program from an Arduino tutorial ([Source](#)). Additionally, an Arduino tutorial was referenced for controlling and setting up the LCD ([Source](#)).

While we utilized a variety of components, there is still plenty of room to expand this project. To begin the game and drop the ball, an additional motor can be used to release it. Alternatively, an additional sensor can be used to start the game once the ball has entered the board. More powerful servo motors can also be implemented to push the ball with a greater force. While our board size was constrained to the distance at which the ball could be pushed by the flippers, a larger board could be utilized with stronger motors. Lastly, the dowel bumpers we used can be replaced with a more sophisticated mechanism to increase points or move the pinball. If given the time and more access to resources, these were our ideas for building a better prototype of a pinball game.

Link to Github: <https://github.com/beyap/FinalProjectEmbeddedSystem>

Video Tutorial: <https://youtu.be/0uZFGgph3Cs>

Note: The left flipper servo used in the demonstration is slightly damaged and would need to be replaced in the future to avoid creeping.

Schematic:

