

ECE 115 – LAB 5 REPORT

5.1 OVERVIEW:

1. We decided to add motors to rotate the starfishes on top of the pinball machine. We have attached pictures below of the machine and where we placed the fishes so you can see how it was done.



2. Improve the presentation and robustness of your pinball machine:

For our machine, we have encountered a couple issues when playing the game, but it was just some flaws that we could fix if we had more time. So technically, for the 3 Pin IR sensors, we had the ball hanging on the sensor and not moving until we shake the machine for the ball to roll in the correct direction. Secondly, we have some issues from the slope of the machine where the ball is not sliding easily to the feeder. Also, we have some issue with our plunger as well where it is difficult for player to get the ball in the playfield.

If we had more time, we would fix those issues and make it more functional. But at the end of the day, we are all happy with how everything turned out because we tied our best already.

5.2 ACTIVITIES

5.2.1 Add the proposed functionality to the pinball machine:

During today's open house, we showed the Professor and classmates our machine and we all got to play with our machine. In fact, we got to play our classmate's machines as well.

5.2.4 FINAL WRITE-UP AND SUBMISSION:

Summarization of additional functionality:

Functionality requirements:

1. Changing the length of the plunger since it was longer than the lower slope and the ball is not fitting so well. However, if we have more time, we will have to redo the lower slope so the ball can flow thru easily.
2. Adding an awesome feature to feed the ball to the plunger. We also decorated that, so it fits more to our theme.
3. Added an ON/OFF button to the side of the machine so it is easier for player to operate the machine.
4. Added more decorations to the machine so it fits more to our theme as stated above. We will attach some pictures below, so it is easier for readers in terms of visualization.
5. We also added the sensor motor to be one of the features as the gate for the ball to get in the play field.

Those are the following requirements of the pinball machine that we had fulfilled:

Requirements:

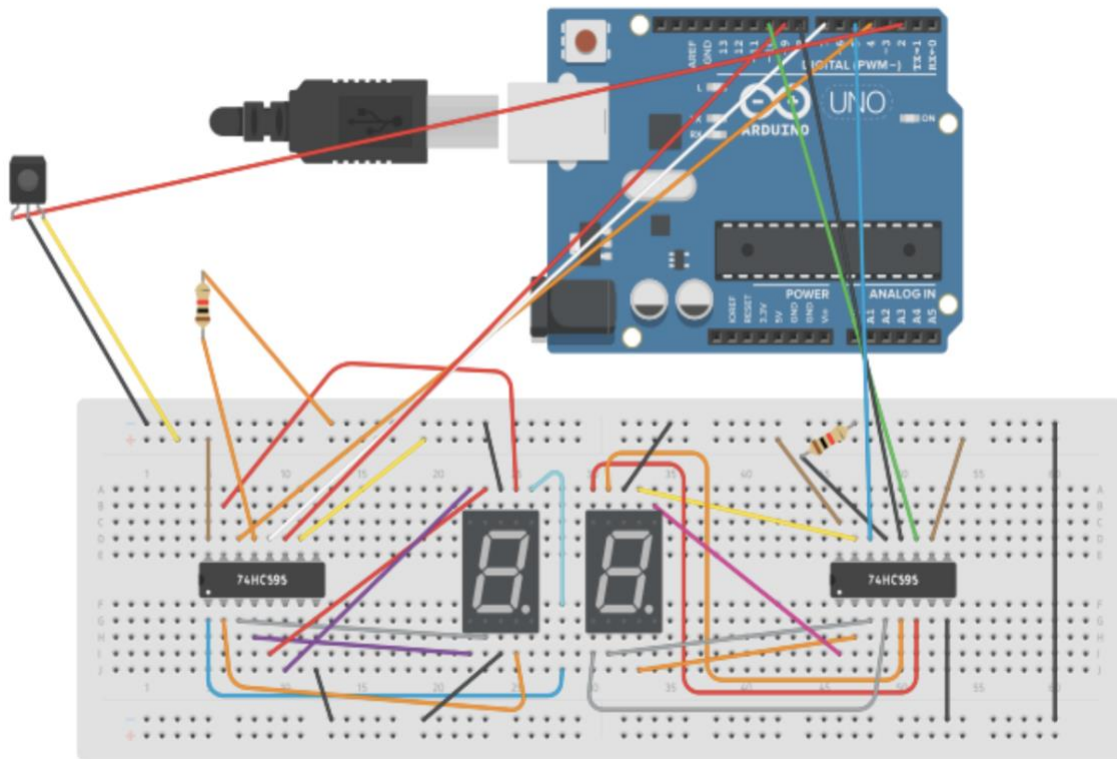
1. Paddle should be able to propel ball through the length of playfield. (checked)
2. A method to introduce ball into the field of play. (plunger)
3. Multiple scoring mechanisms. (we had 2 IR sensors)
4. Display and keep score. (We had our 7 segment to keep track of score on the top of the machine)
5. Recognize when a round is lost. (we established the flat piezo for the player to push whenever the ball is fell in the losing zone, the score will be reset to 0)
6. Start/stop button to control system. (checked)
7. Game resets itself when system turns on and when all rounds are complete. (checked)
8. Ball naturally moves toward paddles. (checked)
9. Device must be visually appealing. (checked)

Special Requirements*:

1. Paddle(s) are activated electronically (i.e., cannot be a manual mechanism) (checked)
2. Auditory feedback for score. (checked)
3. Actuator that fires / moves when it detects ball. (flippers)
4. Uses optical sensors for at least two applications. (checked)
5. Uses at least one of each: electric motors, solenoids, RC servos (checked)
6. Automated gating mechanism that introduces ball into play, or stops the ball once all rounds are over. There should be handling of the ball by the user between rounds. (checked)
7. Visual Appeal (we painted the entire machine and to be honest it looked so cool)

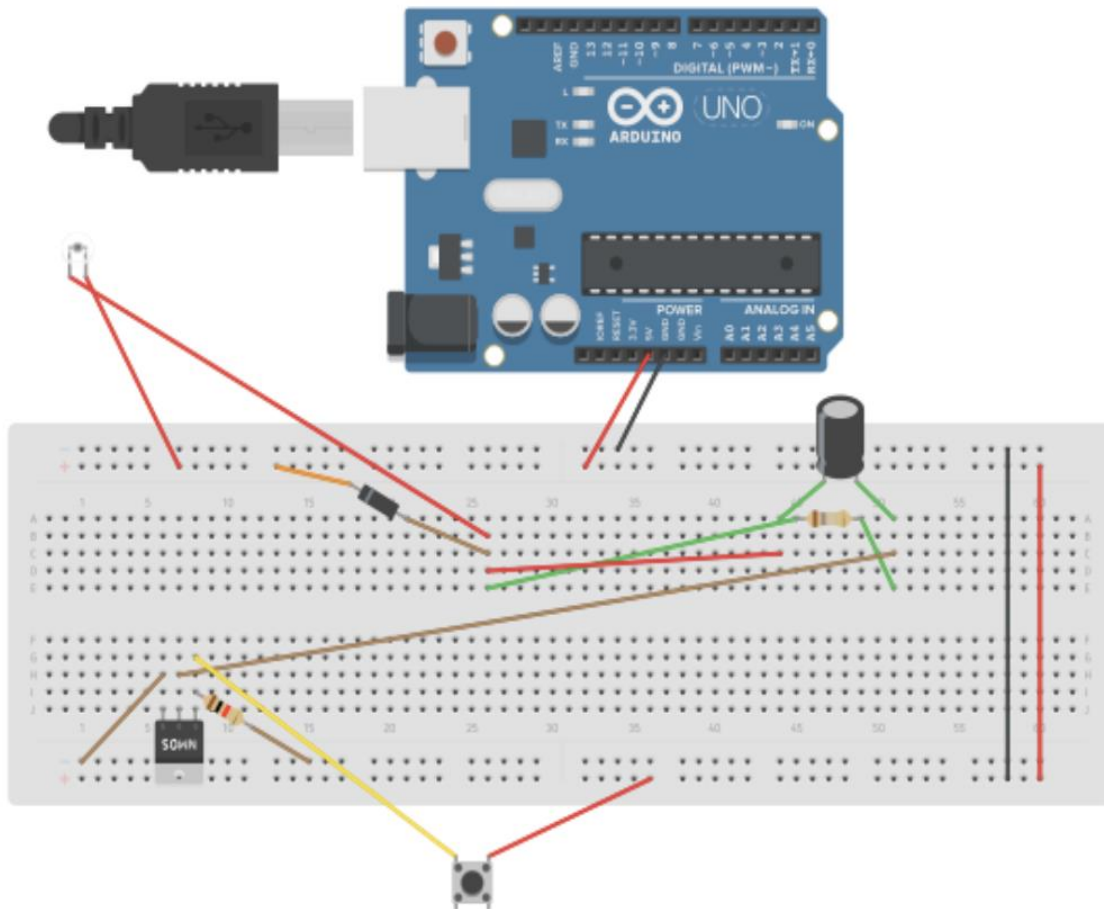
The following circuits schematic are the ones we put underneath the machine. Again, we could not find the exact components that match the one we actually using, but we will add the description so the readers can understand it as well.

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Note: this is the circuit of out 7 segment. The IR sensor we are using in the real machine was the 3 pin one.

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has Flinn

Note: this is the circuit that we use for the flippers and the button we use is the regular push button, not the one in the picture. Also, we used the solenoids, not the light sensor like in the picture. This is just for wiring purposes.

• Final trace matrix

Mandatory requirements:

Spec. Number	Spec. Description	Test to perform	Relevant req.	Spec units	Measured values
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1	Refer to “system requirement”	Testing the flippers	N/A	mm	The flippers work better than expected. The ball reach far end to the target
2	Refer to “system requirement”	Start game button is installed	N/A	N/A	The plunger worked as expected
3	Refer to “system requirement”	Testing the sensor	N/A	N/A	Current score and current factor will increase as designed.
4	Refer to “system requirement”	7 segment testing	N/A	N/A	The score is going up as expected and the buzzer goes off every time. Also, when it reaches 99, the buzzer will go off all the way
5	Refer to “system requirement”	Testing loosing feature	N/A	N/A	Player will have to push the flat buzzer which is covered by a black octopus to reset the point to 0 (meaning you lost the game, play again)
6	Refer to “system requirement”	Start/stop button	N/A	N/A	We encountered the on/off button on the side of the machine
7	Refer to “system requirement”	This feature is included in feature 5	N/A	N/A	When the player presses the flat buzzer, the sensor gat will be opened, and the ball will enter the play field again.
8	Refer to “system requirement”	Place pinball on 10 random	N/A	N/A	The pinball always moves towards the flippers.

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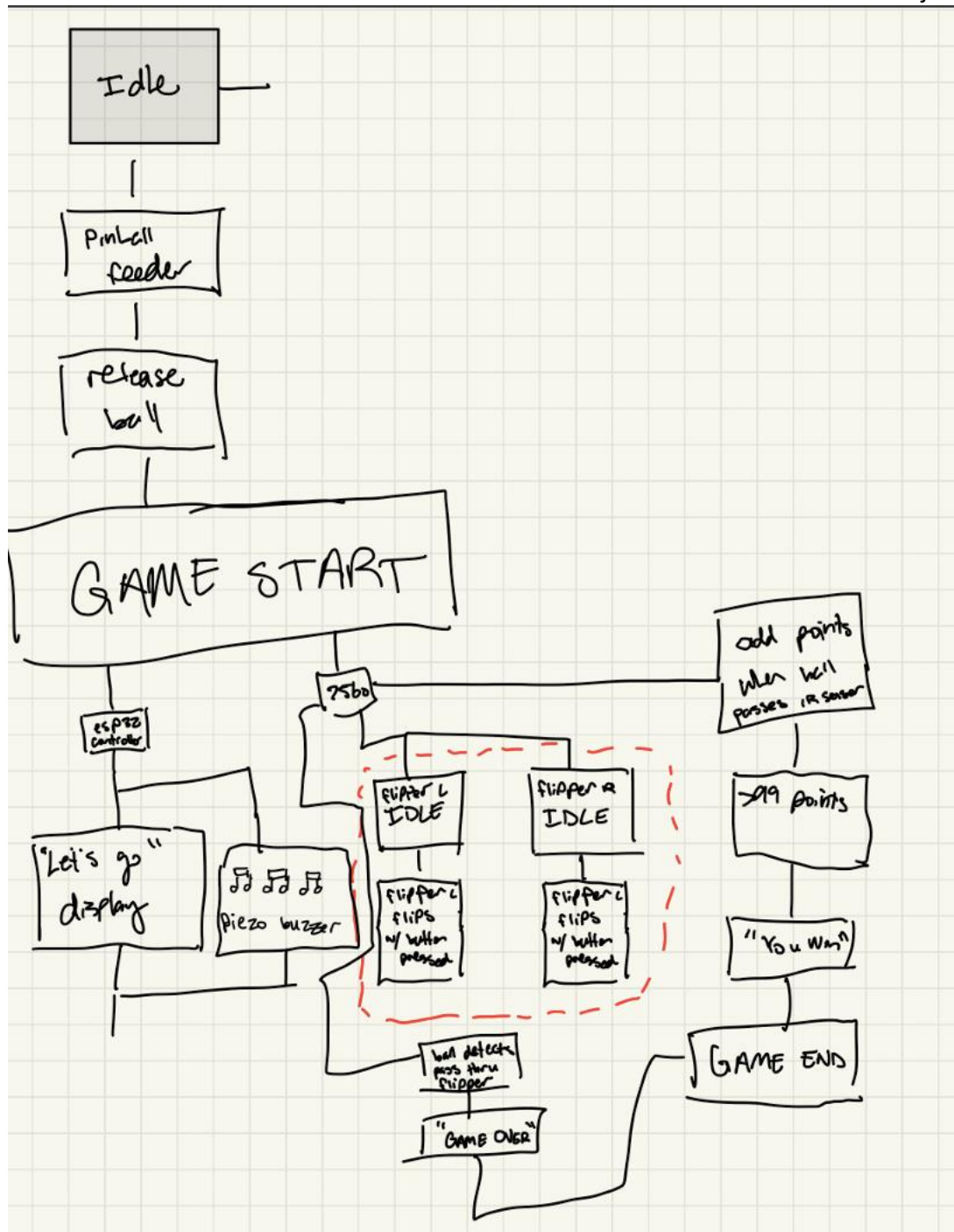
		spots of the playfield			
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Special requirements:

Spec. Number	Spec. Description	Test to perform	Relevant req.	Spec units	Measured values
9	Making the flippers work electrically	Apply the right amount of voltage	N/A	Voltage	24V
10	Auditory feedback for feedback	Trigger sensors and listen to the buzzers	N/A	N/A	The sound effects are played when: scored; multiplier triggered; won; lost.
11	IR sensor read the ball and increase the score	Put the ball to the IR sensor	5	n/a	The score goes up following with the sound
12	At least 2 IR sensors	Observe playfield	N/A	N/A	Work as expected
13	At least 1 DC motor, solenoid, RC servo	We have them all in the playfield	12	N/A	A total of 1 DC motor, 2 solenoid, 1 RC servos are used in the pinball machine

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14	Automated gating mechanism	Start and lose a game	5	N/A	Observe by the flat piezo.
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State diagram of the entire machine

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This is the CAD design of our final machine.

Photos from the Final Pinball Machine of our group:

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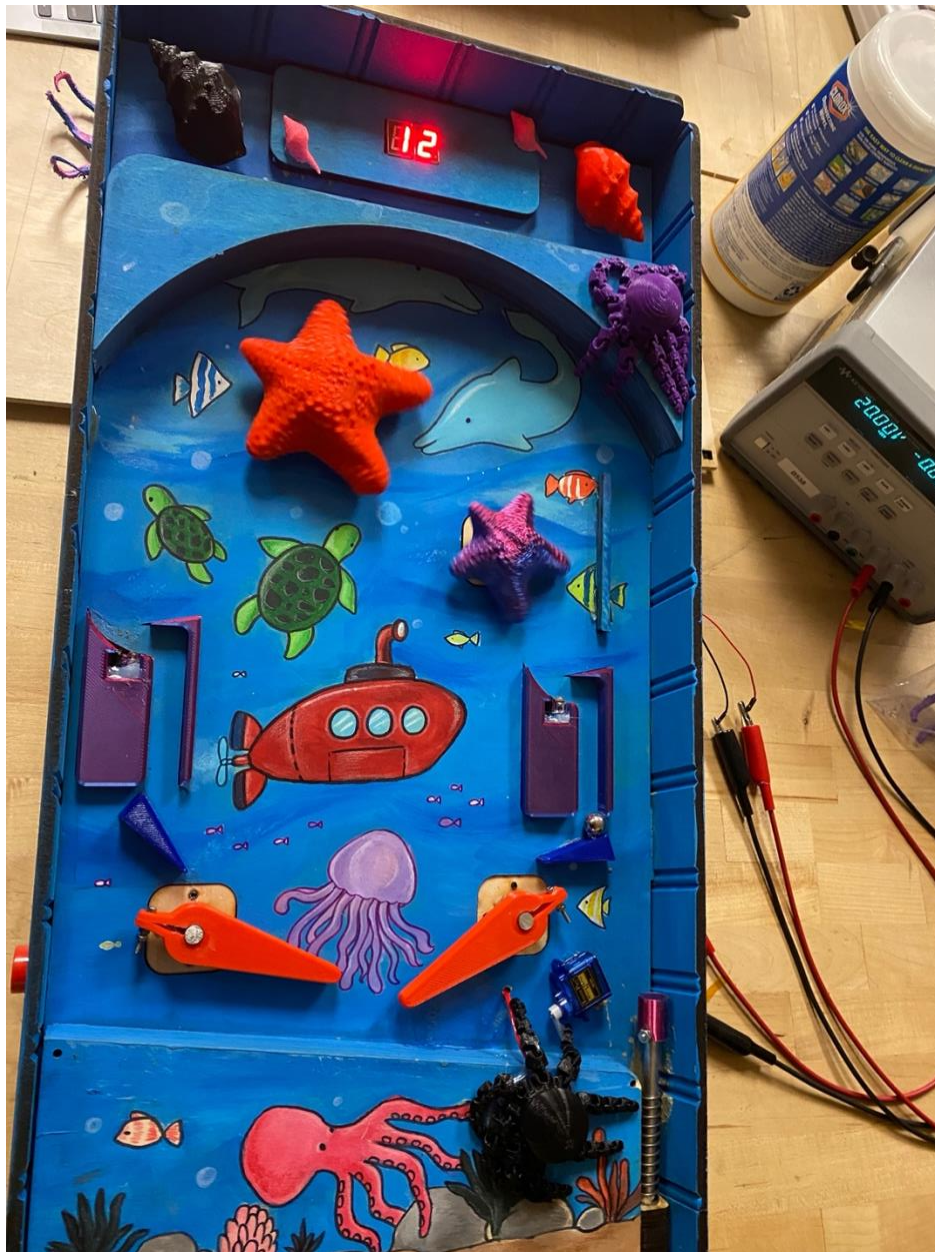
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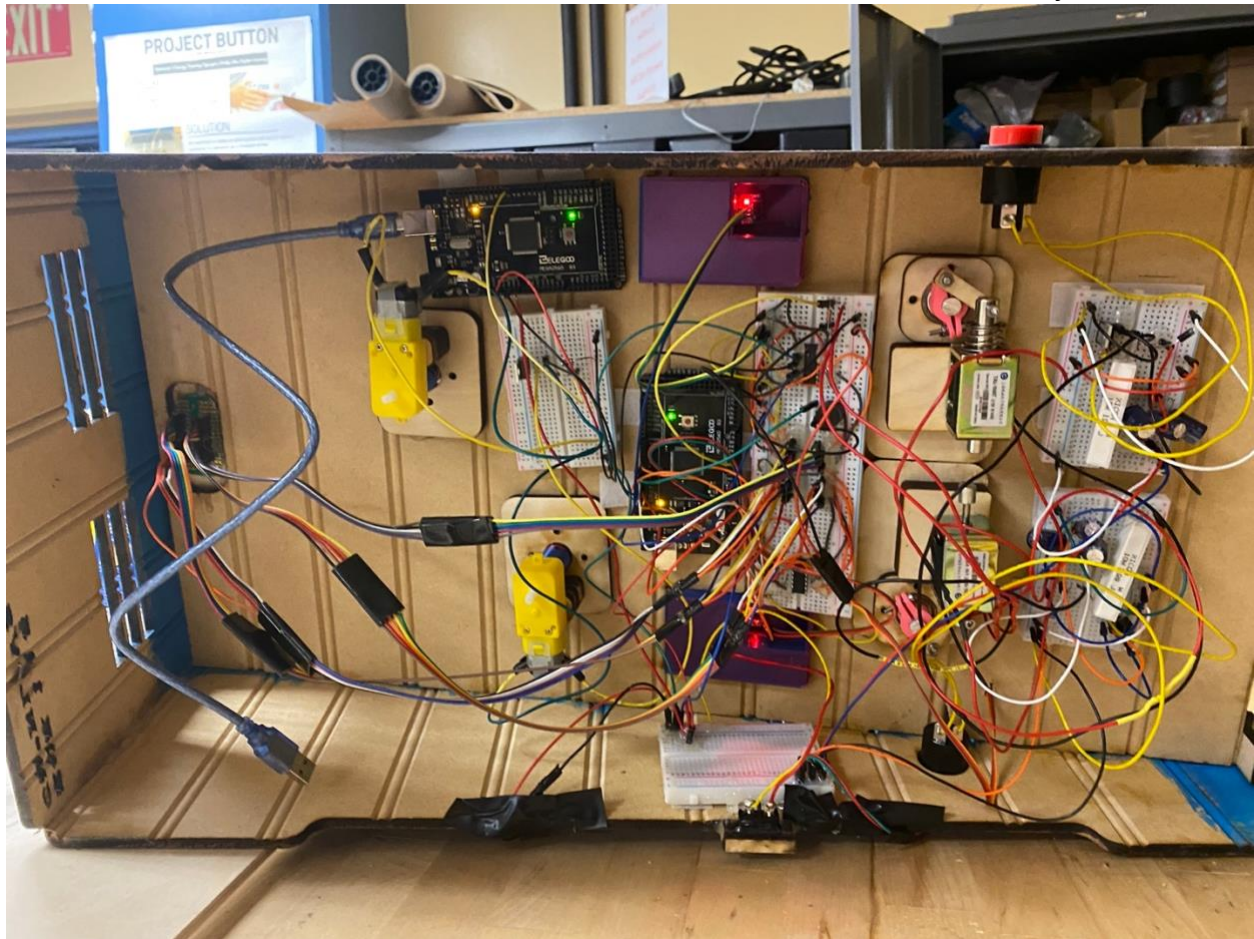
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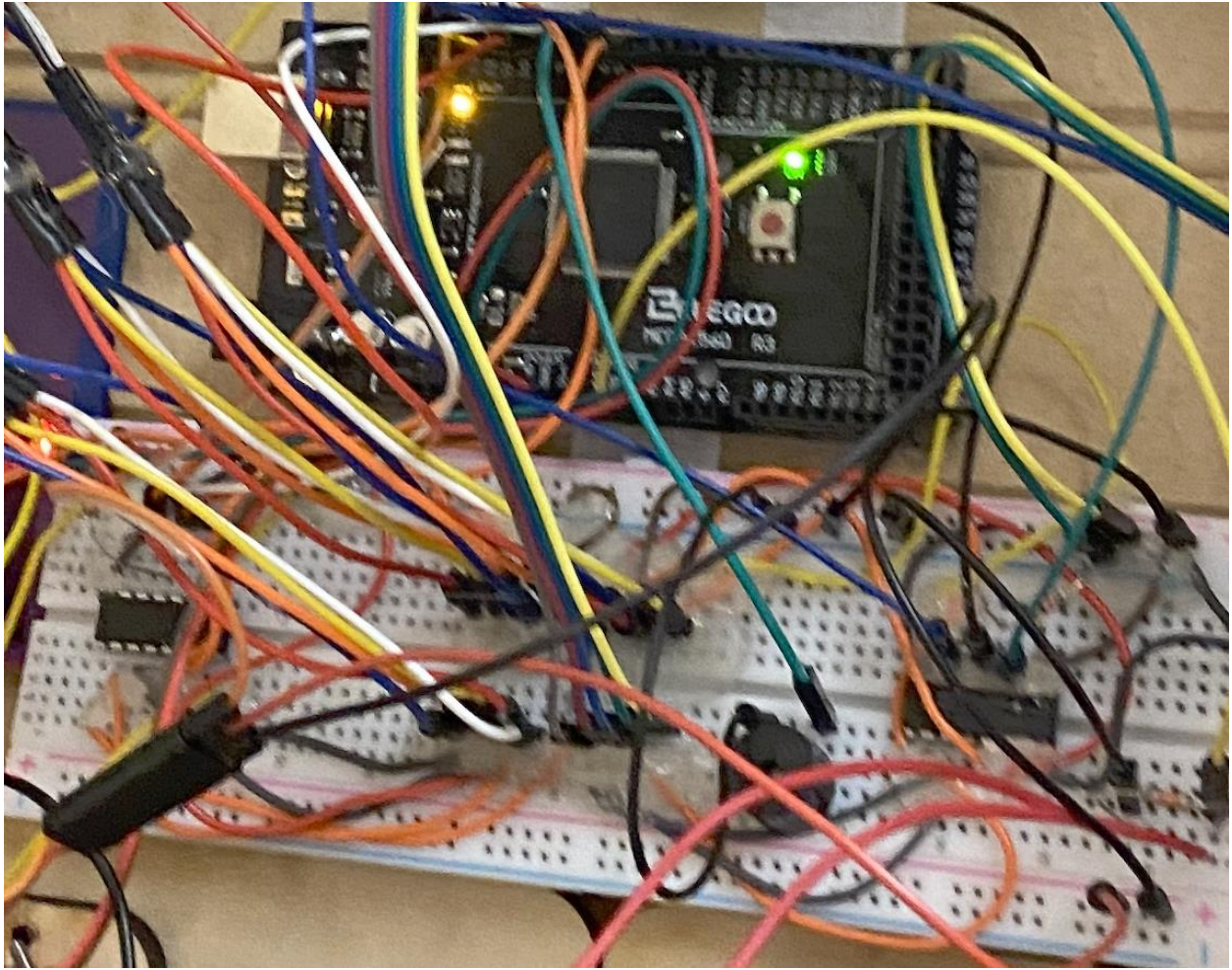


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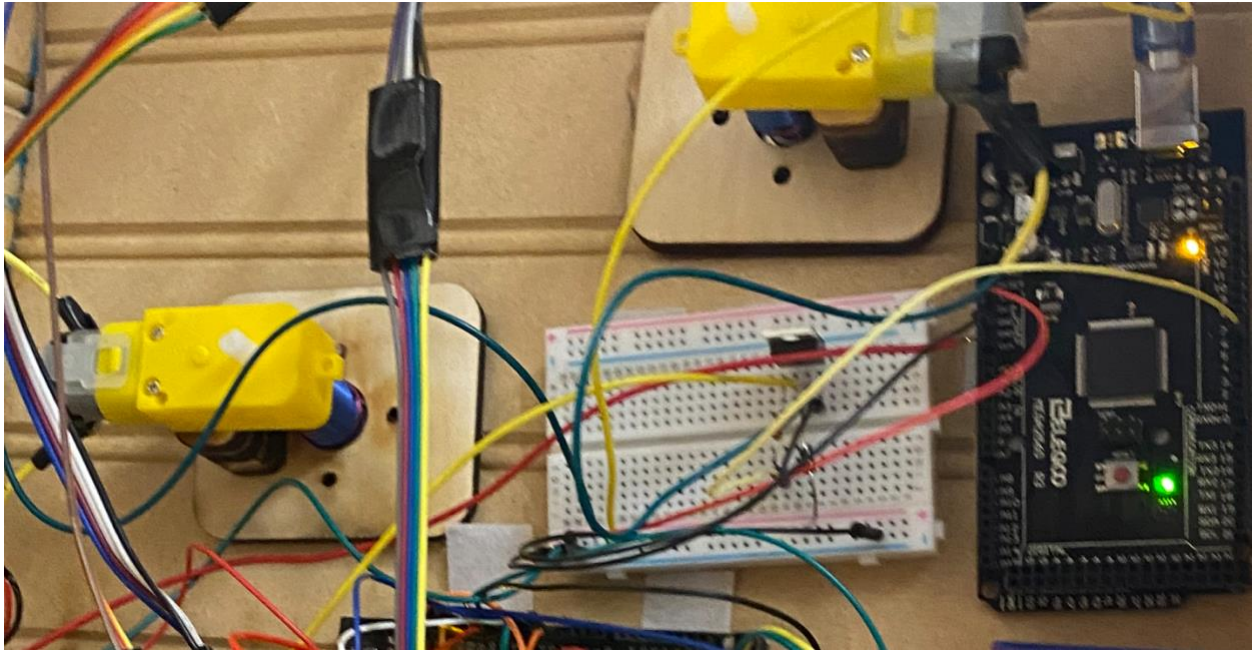
Wiring situation underneath the machine

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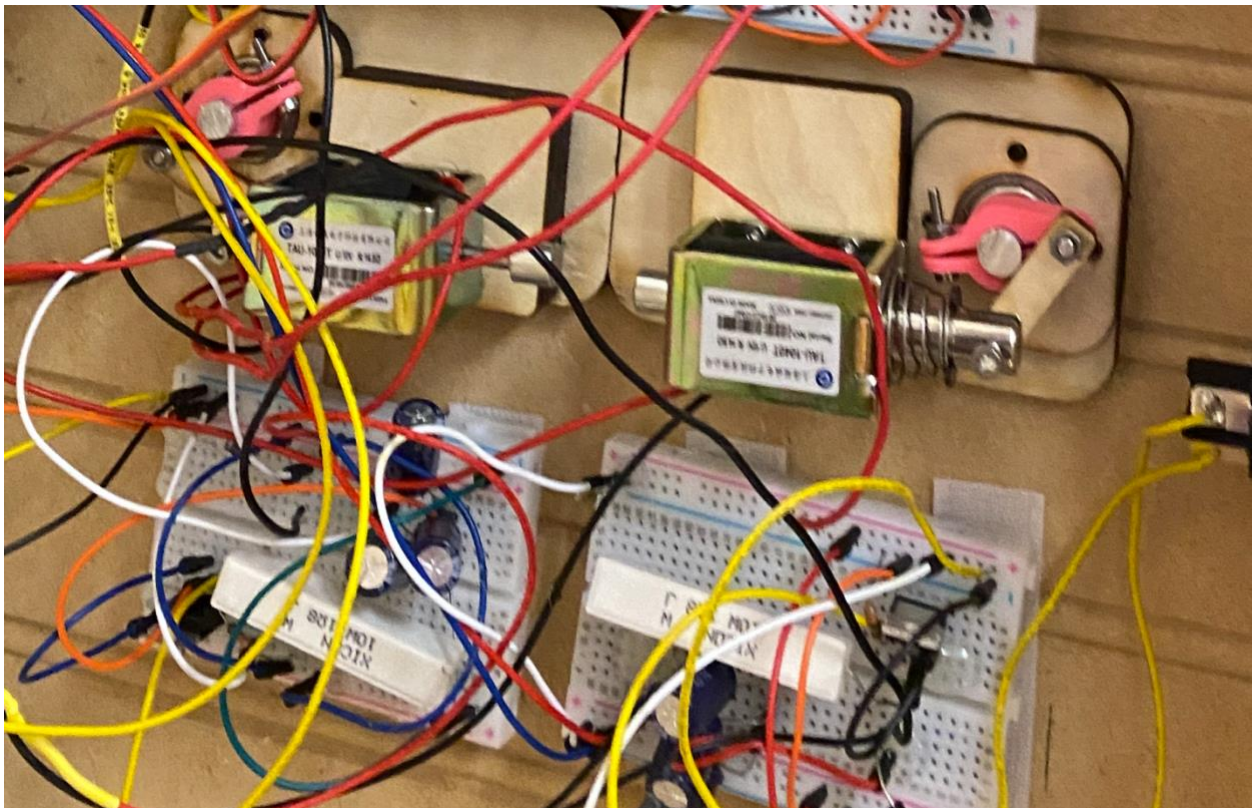


Seven segment and IR sensor wiring

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Motor for starfishes wiring



Flippers wiring

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The entire machine from far away

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Honestly, we had such good experience taking this class and we learned a lot from it too. We learned how important teamwork is and how communication to each other is a need in all situations. Although, this project took a lot of time to complete. But at the end of the day, it is all worth it. We are glad we all made it to the end. At first, we were so unclear of how we could make it and what the pinball would look like, we had a lot of challenging in terms of finding the wood to cut since the wood we had were a lot smaller than the design we came up with. Luckily, we went to a lumber place to ask if they had left over wood that we could have. Guess what, they gave us their left-over wood and it happened to be the right kind of wood. We were so grateful for that. Then, we wanted to paint it to match more with our ocean theme. Nghì's brother was helping us to paint the entire machine, that's why it took sometimes for us to put everything together. But it all worked out at the end. We created our own pinball machine with different features attach to it and it even looks so aesthetic. We decided to donate it so the next class can somehow have some inspirations to make their own pinball machine. Lastly, we would like to thank you all for a wonderful quarter, specially to Professor and Zhaowei.