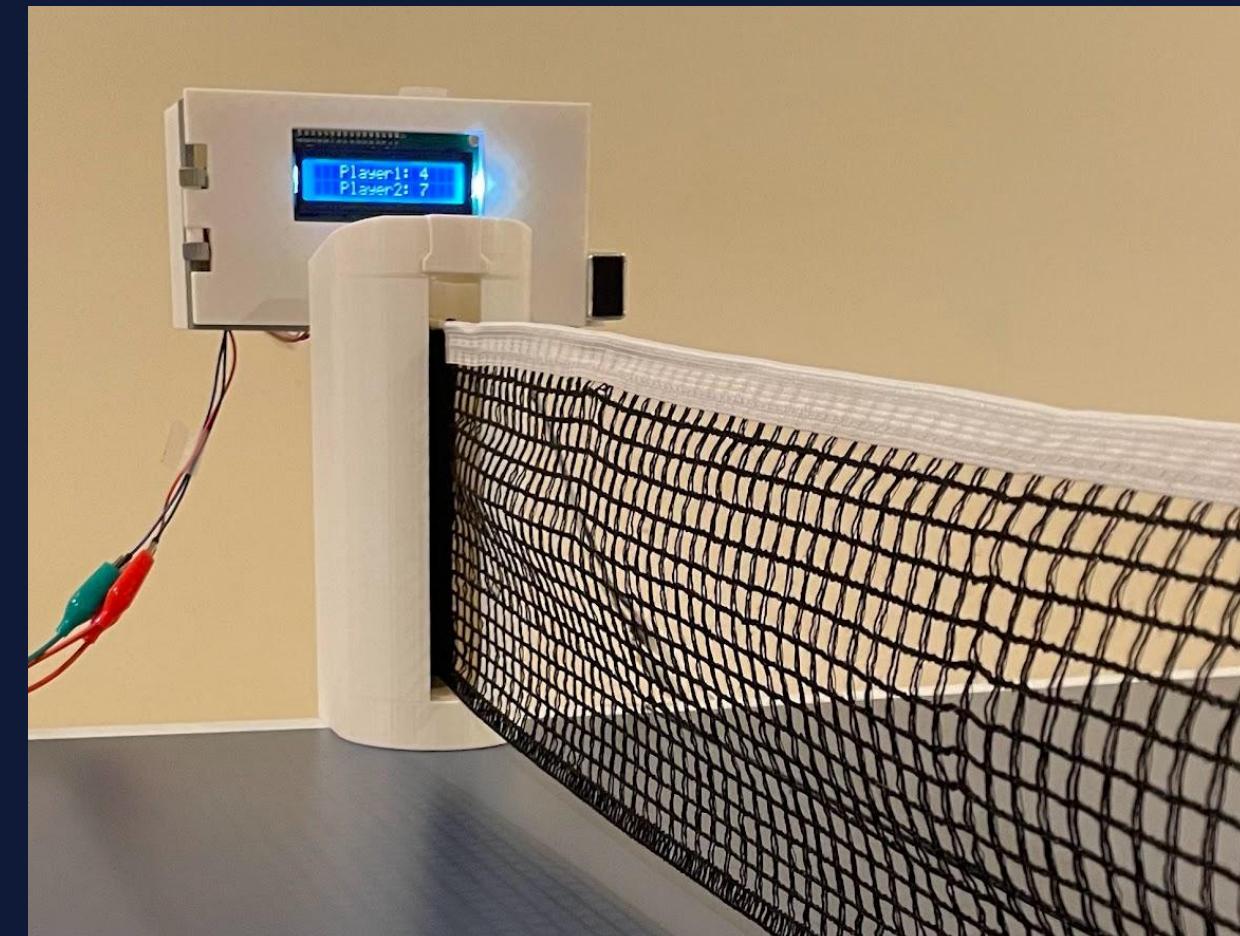


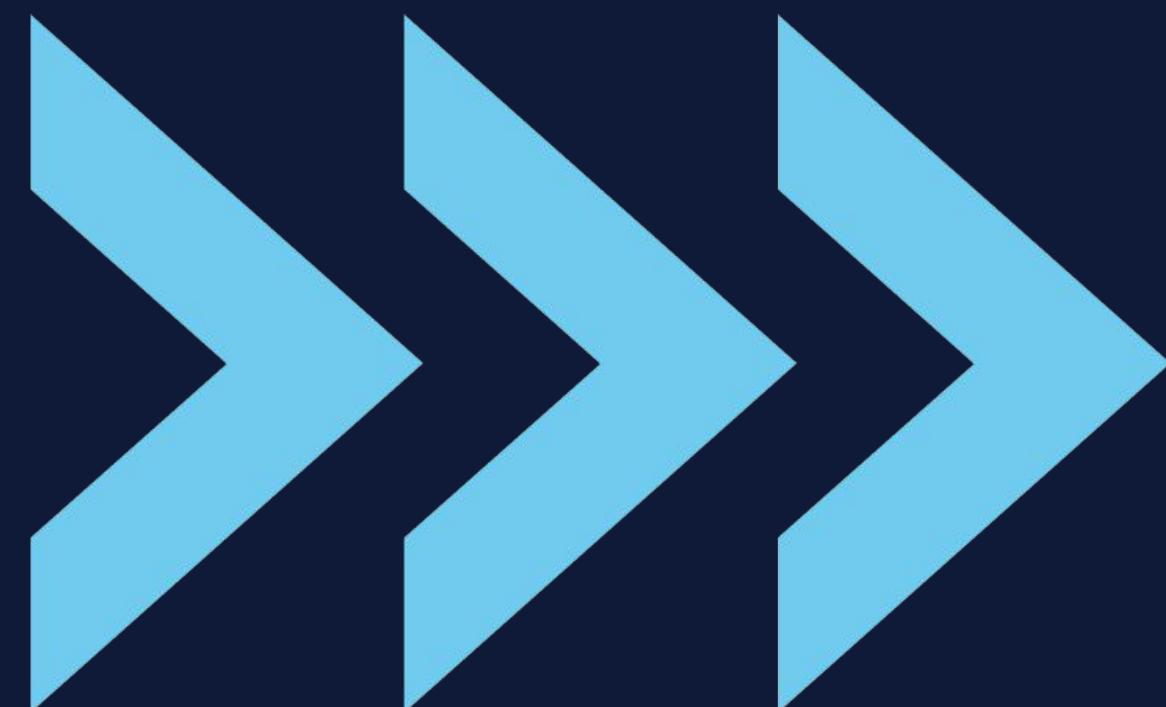
Table Tennis Score Pal

By: Shaan Iqbal

 Chatham High
School



Honors Design Studio 2024



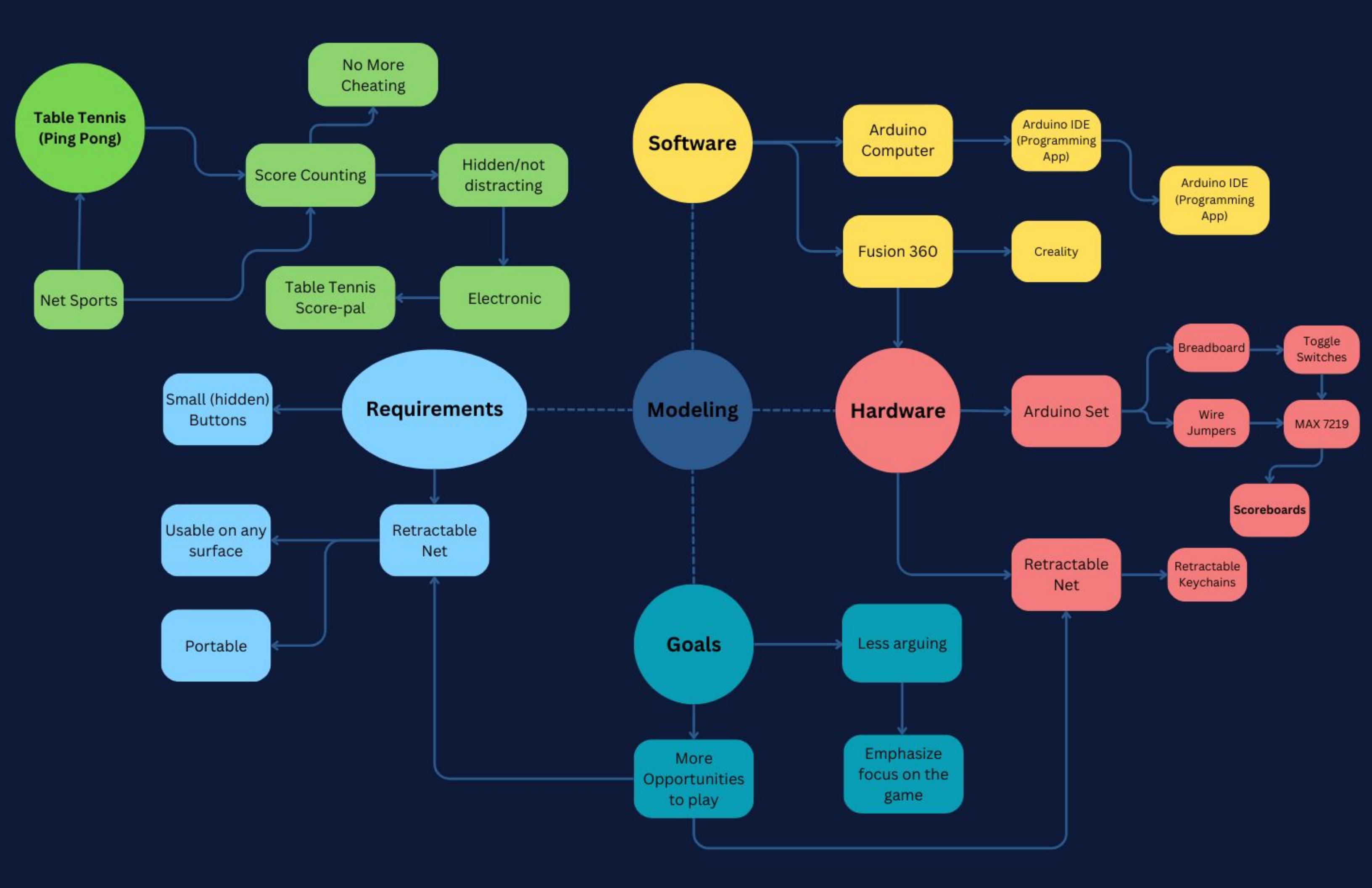
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Concept Map



2

Framing the Problem

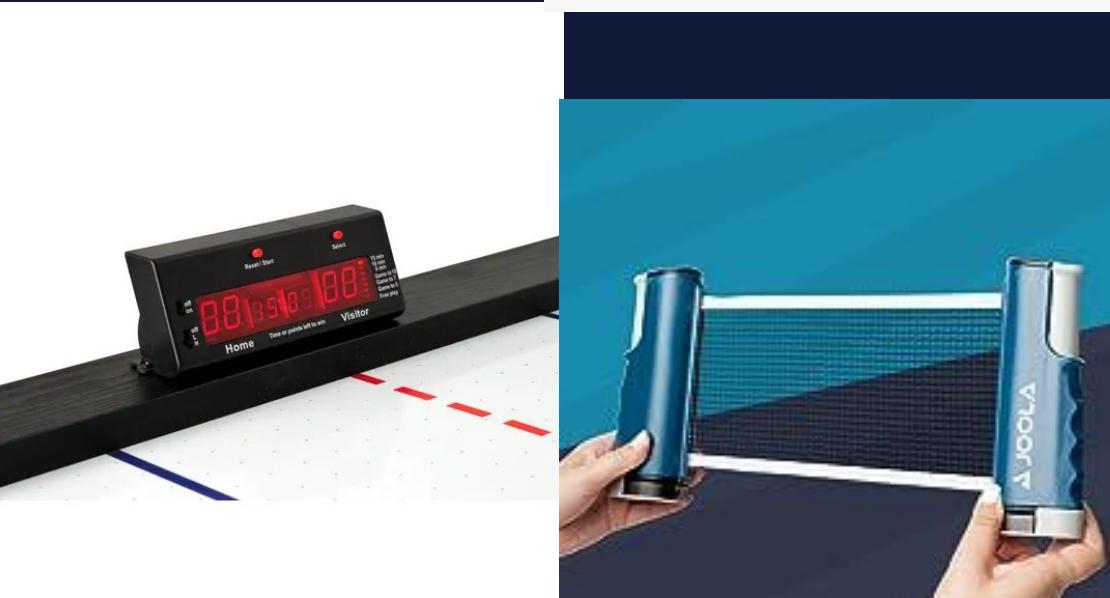
Problem Statement

I've always loved the game of ping pong, or as more competitive players call it, table tennis. However, in all the games I have played, I have always had arguments over what the score really is. You'll find particular individuals who have difficulty keeping track of the score in their head (my little brother), leading others to abuse this trait and use it as a cheating tactic to add points in their favor. Of course, I'm always right about the score but my opponents always seem to disagree.

I've looked for ways to fix this problem by using physical scoreboards used in official table tennis competitions or even just a simple iPad app that displays the score for each side. This seems like a decent solution; however, unless you have a specific person changing the score each point, this solution lacks efficiency. It forces each player to stop in between points, walk over to the scoreboard, and change their score before walking back to play the next point. Also, players often forget to change their score between points with this scoreboard system.

It wasn't until I was in an arcade playing air hockey one day that I realized the most efficient solution to this problem. On a proper air hockey table, each goal has sensors inside of them that trigger when a goal is scored. These sensors automatically change the score on the scoreboard allowing for the competitors to immediately get started on the next point. I began to wonder if a scoreboard like this would be possible in a table tennis setting. Of course, it would not use sensors due to the vast amount of ways you can score in table tennis. Instead, it would use buttons placed underneath each side of the table that, when clicked, change the score for whoever won the point.

The scoreboard aspect of this design is rather simple; however, the act of attaching it to a table could be difficult. A way around this setback could actually increase the amount of use this product can obtain. What if this product was designed as a complete net with the scoreboard that could attach to any table surface giving individuals the ability to play wherever they go.



Design Brief:

My product's goal is to increase the amount of opportunities to play table tennis while improving the score counting aspect for competitive matches.

Specifications and Limitations:

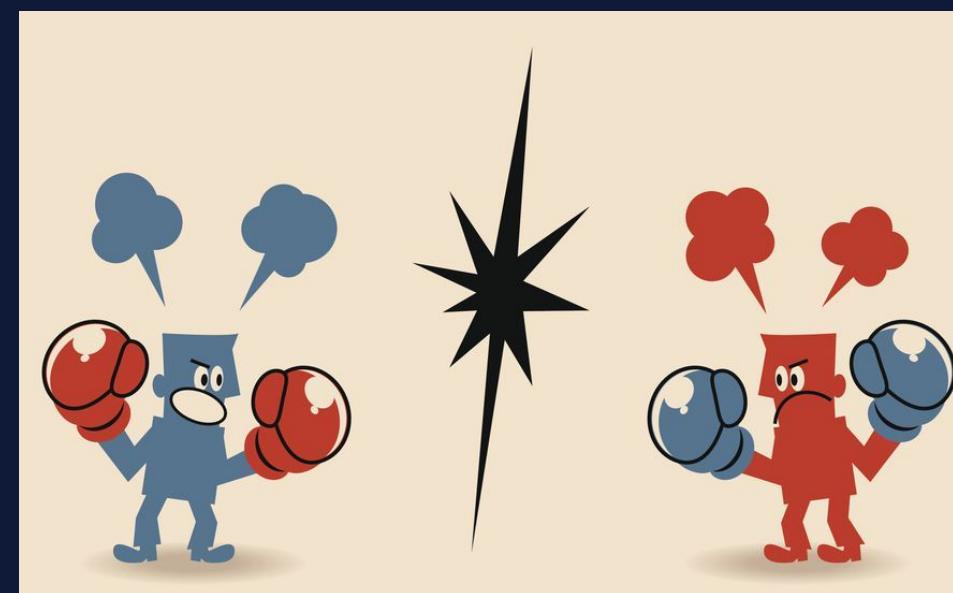
- Design necessities:

- Retractable Table Tennis Net
- Functioning scoreboard
- Hidden yet reachable buttons
- Ease of use



- Problems solved:

- Makes score counting easier
- Improves overall gameplay
- Reduces arguing and cheating
- More focus on the game



- Community improvements:

- Detachable net
- Allows table tennis to be played on all surfaces
- More opportunities to play



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Survey Results

Survey Results:

How much table tennis have you played?

- I played once or twice - 30.8%
- I play regularly - 15.4%
- I play it as a hobby - 53.8%



I ask this question to my audience to get a baseline of how much experience survey responders have in table tennis. This will make it easier to interpret the rest of the questions in the survey.

How often do you and your opponent argue over the score in the middle of a table tennis match?

- Literally every single game - 26.9%
- Not too often - 50%
- Very often - 19.2%
- I never argue over the score - 3.8%

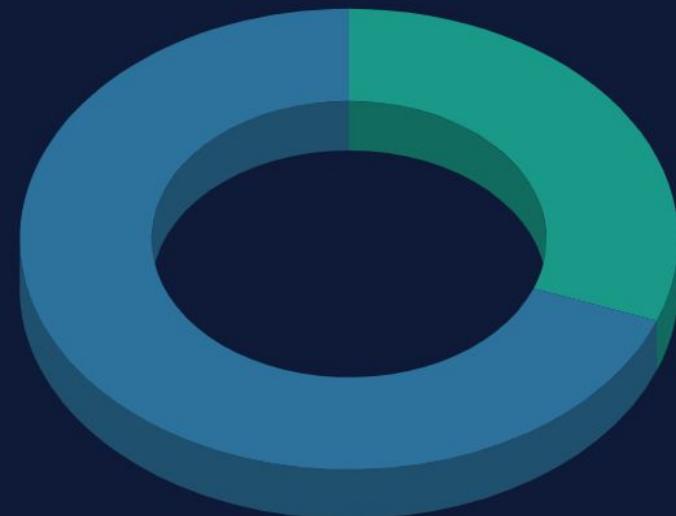


The responses from this question tell me that a significant amount of responders argue over the score during their table tennis matches. Therefore, a physical scoreboard may be useful for these players.

Survey Results:

Do you believe the trade-off of pausing midgame to use a physical scoreboard is worth the hassle in order to reduce score inaccuracy and the number of midgame arguments?

- Reduces arguments - 30.8%
- Too much of a hassle - 69.2%



My goal is to design a scoreboard that eliminates the hassle of changing the score mid-game. Would you be interested in using an electric table tennis scoreboard that improves this issue?

- Yes - 80.8%
- Maybe - 19.2%



The responses here confirm my theory that using a physical scoreboard on the side of a table can be a bit of a hassle, forcing players to pause between every point mid game. I will consider this when designing my project to ensure player's focus is on the match over the scoreboards functionality.

Here, I test to see how many of my responders would be interested in my product now that they know of the problem I am trying to solve.

Survey Results:

Do you wish you had more opportunities to play table tennis on more surfaces?

- Yes 73.1%
- No - 26.9%



Responses to this question give me insight into how I would like to design the net of my design. Because majority of responders said yes to wanting more opportunities to play table tennis on more surfaces, I will add a clamp design to the bottom of each end of the net so the net is attachable to different surfaces and tables.



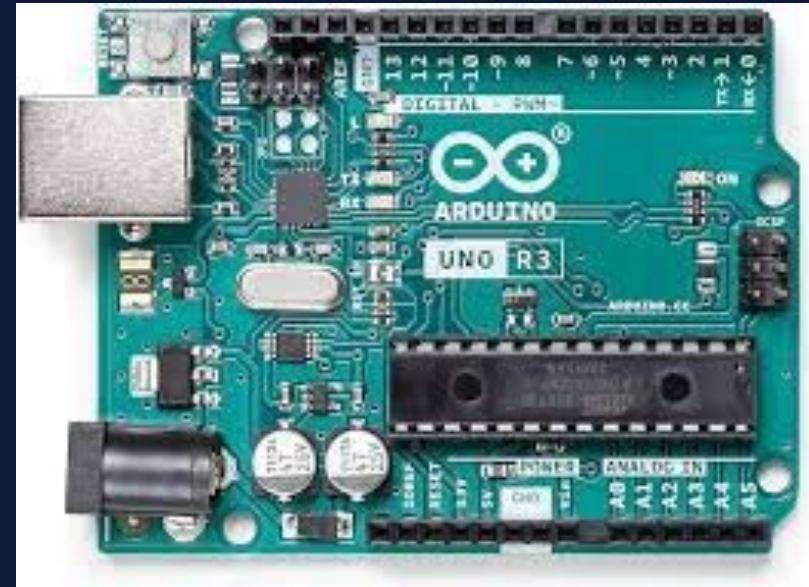
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Research

Research:

Necessary Electrical Components

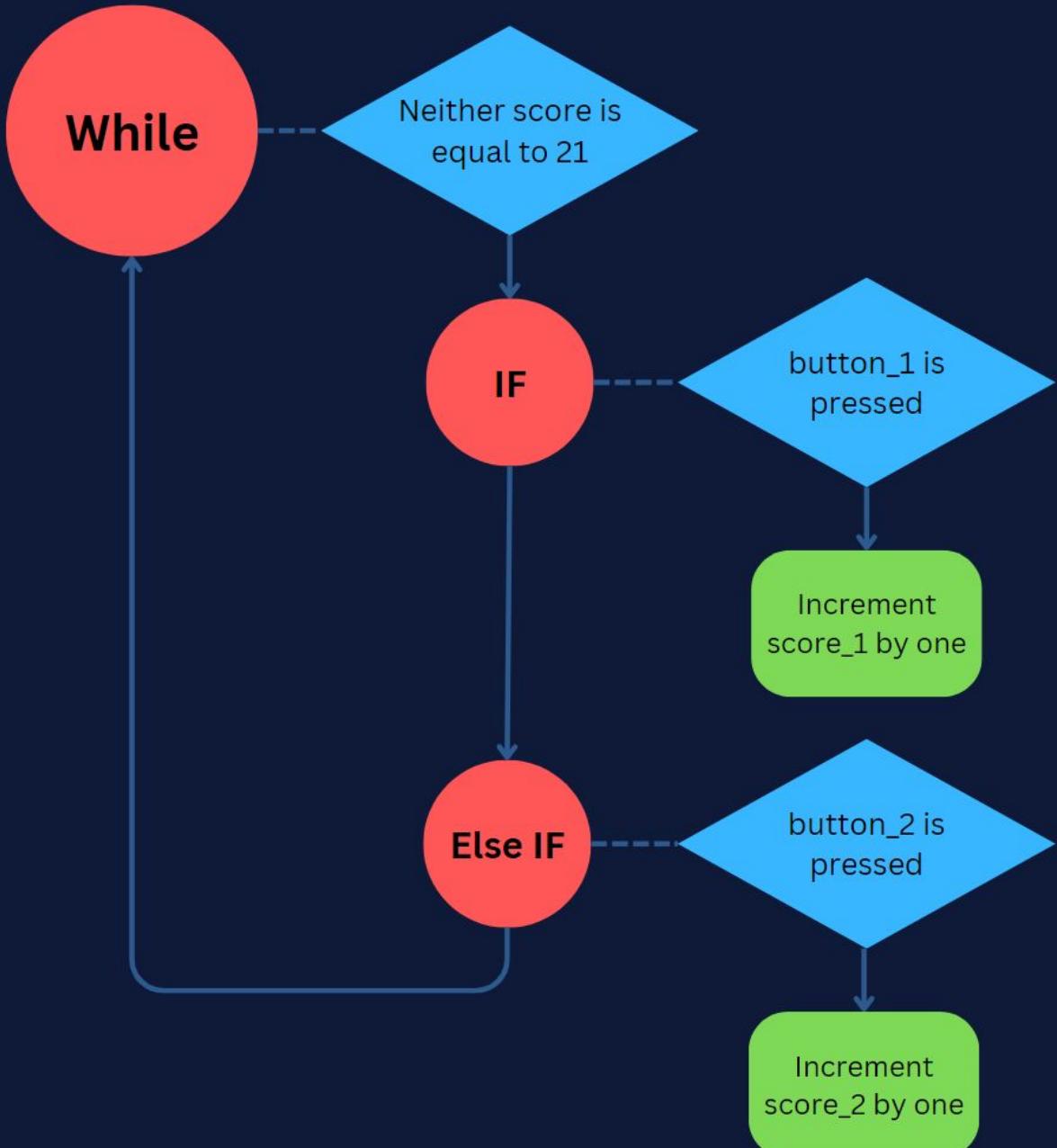
- Arduino uno R3 microcontroller to read and output necessary actions properly
- I2C LCD1602 Module to display the scores with an analog potentiometer.
- Breadboard to power and hold the necessary components for the scoreboard including the lcd display
- Wire jumpers, electrical alligator clips and resistors to pass signals between the breadboard and the computer
- SPDT Toggle Switch to be used as an increment and decrement scores button.
- To complete this project, I need to learn how to build and program a circuit board to have a computer talk to an LCD display.
- Further I must learn how:
 - A breadboard and other specific parts work when wired together,
 - To design the breadboard and microcontroller wiring on TinkerCAD,
 - To code the computer to talk to the LCD display using C++.



Research cont.:

Program Necessities

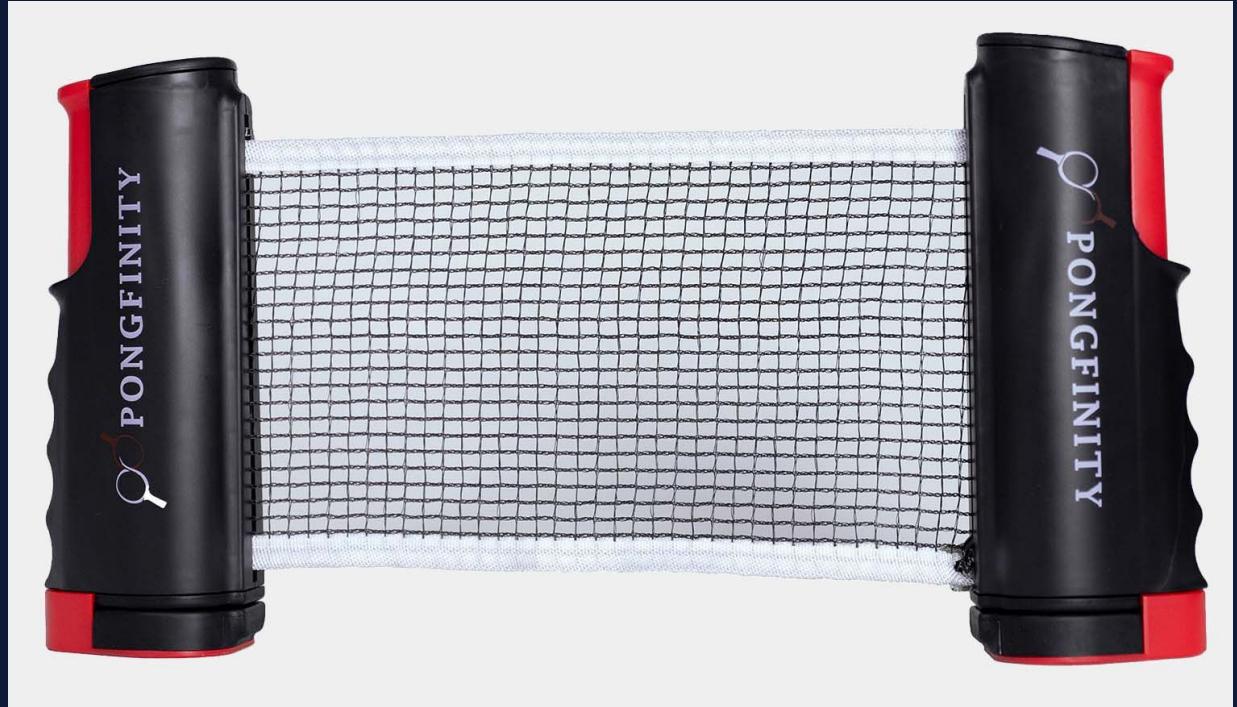
- Must be able to read 5 different buttons:
 - Player 1 increment score.
 - Player 2 increment score.
 - Player 1 decrement score.
 - Player 2 decrement score.
 - Reset all scores to zero.
- When any of these buttons are pressed the computer must read the desired input and output the changes on the scoreboard display.
- The program must understand how deuces scoring works
 - If 1 side's score is greater than 7 and greater than their opponent's score by 2 points, they win.
- When someone wins, the program must print out who.



Research cont.:

Net Base Necessities:

- In order for the net to have the ability to play anywhere, the net must be attached to a retractable base.
 - Similar to the pongfinity net.
- I will need to redesign something similar to the pongfinity net that can hold up the scoreboard on one end.
 - I will need to design using a CAD software.
 - The scoreboard will be a separate component that can slide on and off the net's base.
- Net can't just be standard table tennis table length (must be usable on many surfaces). Should stretch about 6 feet.
- Net's height must be about 6 inches tall (from the top of the net to the table)

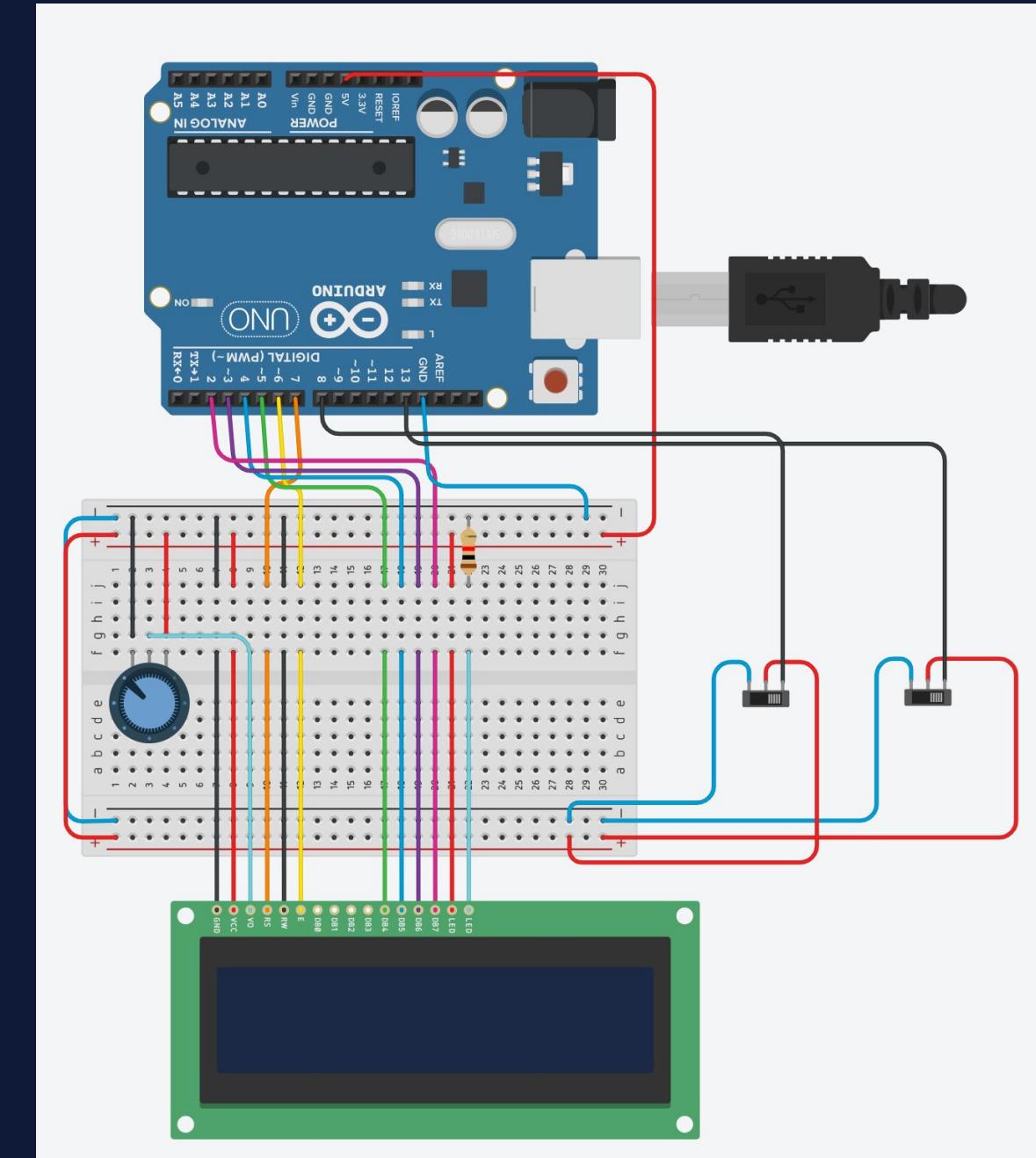


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Possible Solutions

Scoreboard Wiring Progress

- I designed and organized the wiring of the scoreboard in tinkerCAD prior to wiring by hand.
- Initially, the LCD display was going to be attached to the breadboard, however using male to female wires I was able to give the display more freedom to move around and become more visible.
- Also, I learned that each switch, and the potentiometer, must be connected to power, ground, and have a connection to the computer in order to function.
- Overall, the wiring is designed and organized correctly and is ready to be made by hand.



Program Progress

Program Overview

- Have the computer identify the different buttons hooked up to it
- Print out the scores → starts at 0 - 0.
- If player one's increment score button is pressed, add one to the integer variable `score1`. Print the new scores.
 - Same for if player two's increment score button is pressed but with integer variable `score2`.
- If player one's decrement score button is pressed, subtract one to the integer variable `score1`. Print the new scores.
 - Same for if player two's decrement score button is pressed but with integer variable `score2`.
- If the reset scores button is pressed scores are set to 0 - 0.
- Games are played to 7 and opponents must win by 2
- When the game is finished, the LCD display will print out which side wins.

```
void loop()
{
    if(digitalRead(8) == HIGH)//player 1's increment button
    {
        score1++;
        printscore();
        delay(3000);
    }

    if(digitalRead(13) == HIGH)//player 2's increment button
    {
        score2++;
        printscore();
        delay(3000);
    }

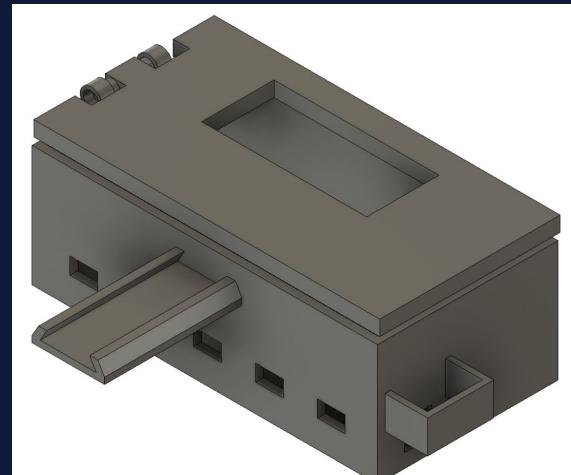
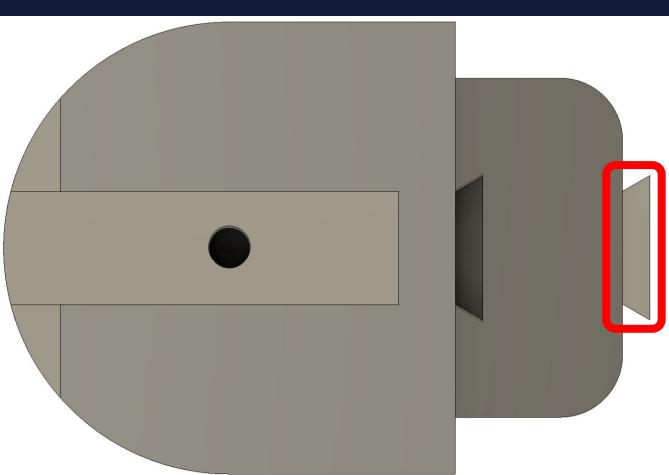
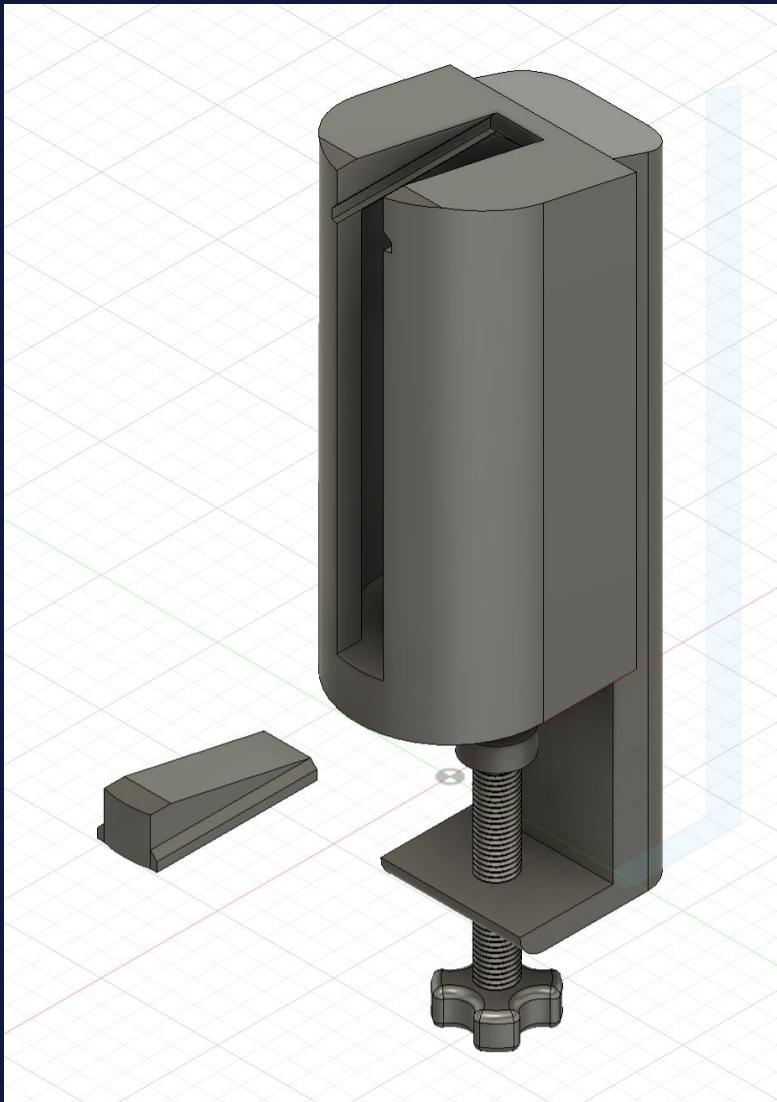
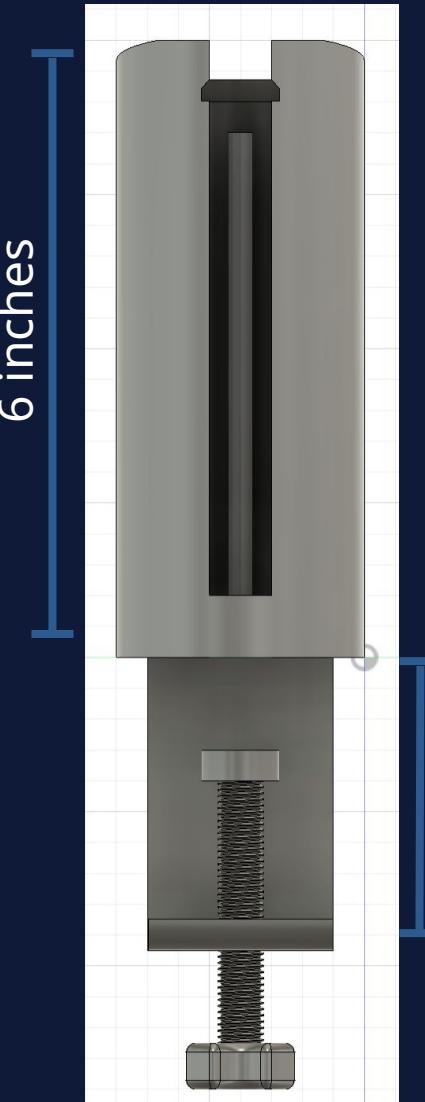
    if (digitalRead(10) == HIGH)//reset scores button
    {
        score1 = 0;
        score2 = 0;
        printscore();
        delay(50);
    }

    if (digitalRead(9) == HIGH)//player 1's decrement button
    {
        score1--;
        printscore();
        delay(1000);
    }

    if (digitalRead(12) == HIGH)//player 1's decrement button
    {
        score2--;
        printscore();
        delay(1000);
    }
}
```

Net Base Progress:

- For the redesign of the pongfinity net, I am using a C-clamp style design with the bottom expanded to hook on to different surfaces.
 - 3D printed screws will be used to clamp the base onto any surface.
- I plan to 3D print the ends of the base as well to keep the overall design lightweight but still sturdy.
- On the back of the base will be a dovetail joint for the box containing the scoreboard to hook on to the base.
- The sleeves of the net will slide on to dowels inside the base to hold the net up.
 - Dowels will be able to spin in order to manually retract the net to fit on different table tops.



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My Project Mentor

Mentor Letter

Suhaib Iqbal is a college student studying computer science and math who is currently on a co-op working for the Baltimore Orioles. He has dabbled in many different computer science projects, ranging from game and app development to working with artificial intelligence. I selected Suhaib as my mentor for this project because in his spare time away from programming, he is an avid table tennis player who consistently forgets the score to the match he is playing in. Because of this, I knew the combination of learning from Suhaib's programming background with his love for the game of table tennis could help push my project forward not only from the programming aspect of the scoreboard, but to the overall table tennis experience my product is trying to achieve.



SCHOOL DISTRICT OF THE CHATHAMS

CHATHAM HIGH SCHOOL
255 LAFAYETTE AVENUE
CHATHAM, NEW JERSEY 07928

Shaan Iqbal
Student of Design Studio
shaaniqbal@chatham-nj.org

Dear Suhaib Iqbal,

Hello! I am Shaan Iqbal and I am a Senior at Chatham High School in New Jersey. I have been pursuing interior design, along with architecture. In school, I have been taking 3D Engineering classes, but now I am taking a class called Design Studio which is more of an independent study and design class. For our project, we will be designing an electronic table tennis scoreboard that will increase the productivity and efficiency of both keeping score and competing in table tennis matches.

I was inspired to pursue this design when playing table tennis with particular individuals who have difficulty keeping track of the score in their head, leading others to abuse this trait and use it as a cheating tactic to add points in their favor. I hope to create a scoreboard using an Arduino Uno set that can easily attach and detach to a table, along with 3D printing and 3D engineering software. The score for each side will be changed by buttons from the Arduino set placed underneath the table to prevent interference with play. The scoreboard will understand the rules of a table tennis game played to 21 with knowledge of how to manage deuces. Should this process finish prior to the deadline, I would like to add different scoring adaptations to the scoreboard including scoring of a table tennis game to 11, a tennis match, or even a pickleball match.

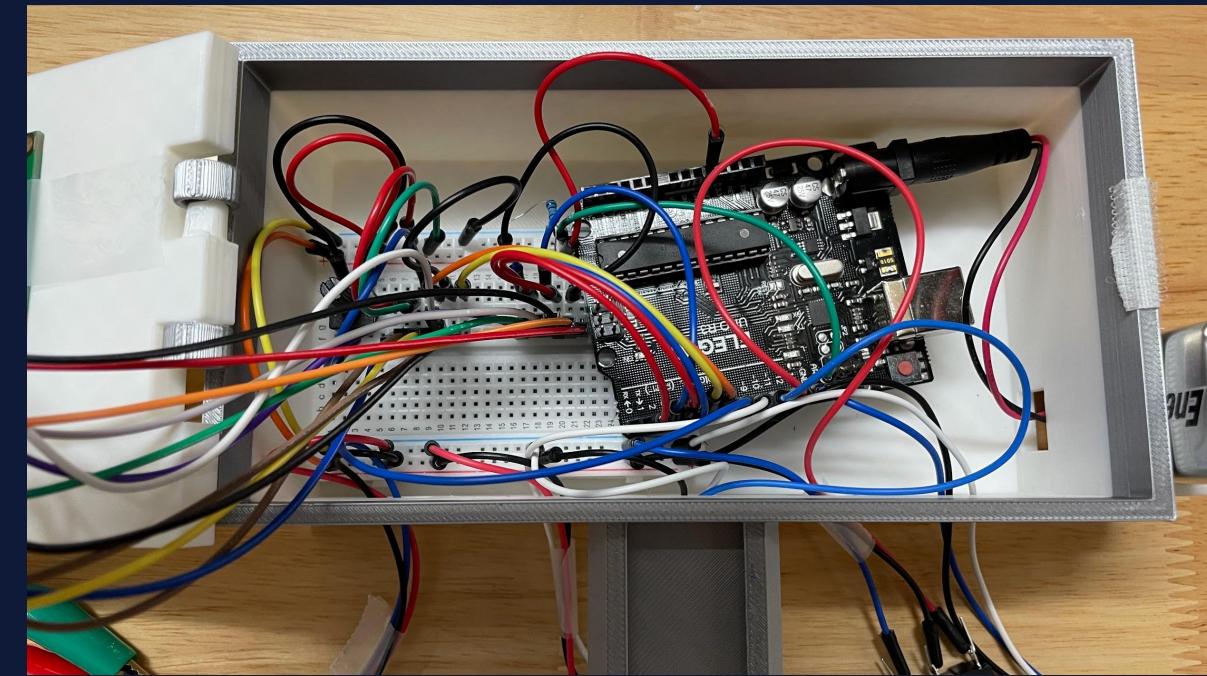
Should you agree to participate in this design process, you will be communicating with me on one or two occasions providing me feedback on the designs and features I have come up with to solve my design challenge. Having feedback from a professional will give my design a higher quality. It also gives me the opportunity to learn from you. If you were to mentor me it would be a huge success and I hope you will help. Thank you!

Sincerely,

Shaan Iqbal
Chatham High School
shaaniqbal@chatham-nj.org

Mentor Feedback

- Suhail's first recommendation was to give the computer easy access to the battery.
 - I kept his advice in mind when designing the scoreboard box which has a specific space to hold the battery.
- After taking a look at some of my code, Suhail suggested to add an effect to when someone wins.
 - With this advice, I was able to have the display look as if the text "Player 1/2 Wins!" is being typed out.
- Suhail also recommended making the base of the net smaller so it would become more portable and less in the way of the actual match.
 - Taking his advice, I decided to scale down the project by 75%, which proved to be successful in the end.



```
String p1Victory = " Player 1 Wins!";
//deuces
if (score1 >= 7 && score1 - 2 >= score2)
{
    lcd.clear();
    for (int i = 0; i < p1Victory.length(); i++)
    {
        lcd.print(p1Victory.charAt(i));
        delay(100);
    }
    delay(5000);
    score1 = 0;
    score2 = 0;
    printscore();
}

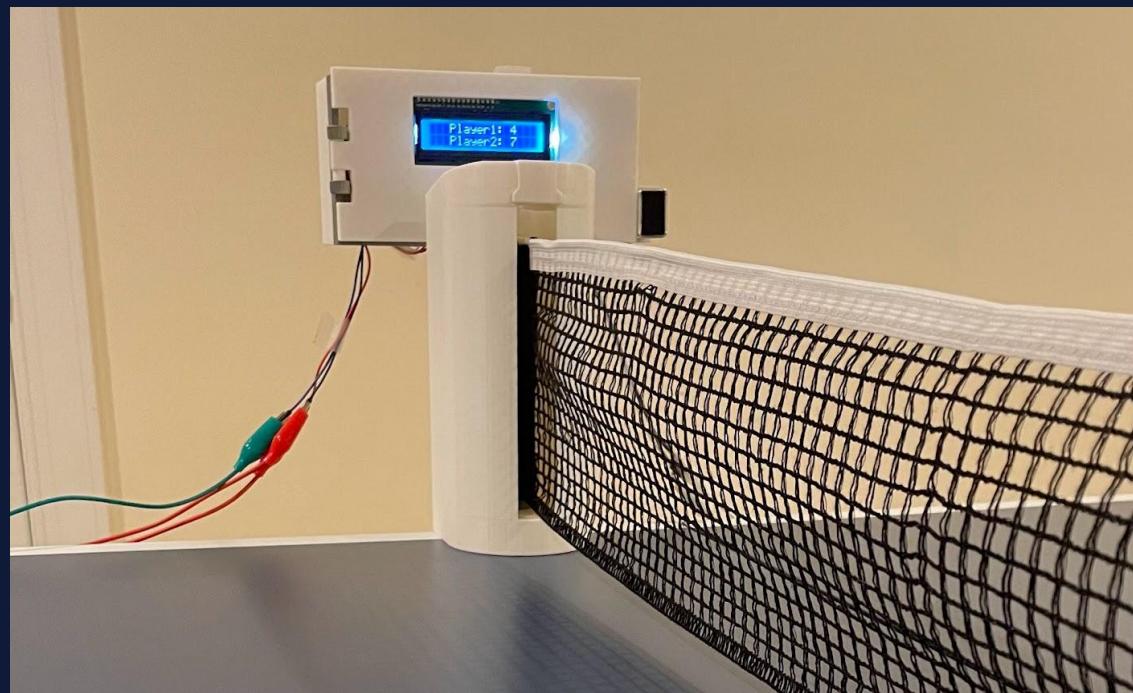
String p2Victory = " Player 2 Wins!";
//deuces
if (score2 >= 7 && score2 - 2 >= score1)
{
    lcd.clear();
    for (int i = 0; i < p2Victory.length(); i++)
    {
        lcd.print(p2Victory.charAt(i));
        delay(100);
    }
    delay(5000);
    score1 = 0;
    score2 = 0;
    printscore();
}
```

7

Final Solution

Score

Take your table tennis game to the
Pal level of competition with the
Table Tennis Score Pal!



Never worry about cheating or
arguing over the score of your table
tennis matches again when the
Score Pal is holding both
competitors accountable for the
true score of the game.



A combination of some button switches paired with an LCD display, the Score Pal brings a unique addition to the game of table tennis at both the amateur and competitive levels!



With an adjustable clamp and a manually retractable net, you can play table tennis anywhere!

8

Reflection

Project Reflection

Overall, I am very proud of the success of my final design. I feel the work I put in successfully provides the proof of concept and usefulness of a score counter in a table tennis environment. My product successfully eliminated the pause between points to change the scoreboard with the increment score switches sitting right beside each competitor, proving the product's effectiveness in keeping each player's competitive focus on the match. During my presentation, I was happy to see competitors adapt to the scoreboard aspect of the match quickly and convince people of the benefit of my design.

I'm really happy that I chose to make the score pal because not only does it benefit me and my family when playing table tennis, it also exposed me to many different areas of interest. Prior to beginning my build, I had little to no experience with working on electrical wiring and a microcontroller; however, with a bit of research and lots of testing I was able to learn the basics to make the microcontroller to function as intended. I was also able to apply what I am learning in my computer science class to program the score counter, like incorporating deuces scoring to work properly. I appreciated seeing the real world application of what I am currently learning in CS through a functional and useful product I could build myself. I really enjoyed continuing to innovate and design the base of the net through CAD and observe just how far 3D printing can take an idea to building a successful product.

In conclusion, I'm very happy to have taken Honors Design Studio. I now feel confident in my ability to take an idea and innovate it to solve any problem thrown my way. I'm excited to take my next steps in the world of engineering and design knowing that I have been prepared and provided with adequate introductory experience within the field.



Thank you for Your Interest in My Product!

I hope you enjoyed this presentation.

Special Thanks to my teacher Mr. Mariano for making this possible.

