

Mechanical Overview

Year: 2025 **Semester:** ___Spring___ **Team:** __1__ **Project:** _Electronic Skee Ball_
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Assignment Evaluation: See Rubric on Brightspace Assignment

1.1 Commercial Product Packaging

The nostalgic game has been a staple in arcades for decades. For this analysis, I examine two commercial products, “The Classic Skee-Ball Home Arcade” [1] and “The Big Sky Roll and Score Arcade Game” [2], and then I analyzed the positive and negative aspects of their packaging, in addition to how Team 1 plans on adapting similar/different aspects to our machine packaging.

1.2 Product #1



Figure 1: Classic Skee-Ball Home Arcade

Our team’s project draws inspiration from the “Classic Skee-Ball Home Arcade”, with some adjustments to size and the launching mechanism. The commercial version features a 6mm cork ramp for enhanced durability and a metal cage that encloses the scoring board. With dimensions of 30”W x 123”L x 85”H and a weight of 630 lbs, it is primarily constructed from wood, with metal and plastic components. The machine utilizes a standard 10-foot alley and includes a ball collection system with auto-return on the right side of the machine. The game uses 3.25” resin balls and features five scoring holes.

In our scaled-down version, the entire machine, will be constructed using $\frac{3}{8}$ ” plywood, with the ramp also made of plywood instead of cork. The dimensions of our design will be 14”W x 48”L x 28”H, significantly more compact. The ram will measure 28” long, including a designated area for the launching mechanism. Instead of using 3.25” resin balls, our design will incorporate 2” wooden balls, while retaining the five scoring holes. Our design doesn’t

include the metal cage surrounding the scoring board, and while we maintain an internal ball return system, the return will be positioned at the front of the machine rather than on the right side.

1.3 Product #2



Figure 2: Big Sky Roll and Score Arcade Game

The “Big Sky Roll and Score Arcade Game” is a smaller, more compact version of the classic Skee Ball game, with dimensions of 20.5”W x 7’3”L x 48”H. Its 5mm laminated wood ramp provides a smooth roll for the 63mm plastic balls. The structure is predominantly wood, with plastic and metal components, and features an automatic ball return that directs the ball to the front of the machine for easy retrieval.

Our rendition will similarly employ a ball return mechanism, ensuring that balls automatically roll to the front of the machine. However, our design will use $\frac{3}{8}$ ” thick plywood for the ramp and will use 2” wooden balls instead of plastic ones, providing enhanced durability. Additionally, while the commercial model includes a stand for the machine to sit on, our version will not include its own stand and is intended to be placed on a tabletop.

2.0 Project Packaging Description

The packaging for our version of the classic Skee Ball game (Figure 3) will primarily consist of $\frac{3}{8}$ ” plywood (refer to Table 4 for the project packaging specifications), with the machine resting on a 48” x 14” wooden base. These sides of the machine will be made from two distinct pieces (refer to Table 1 for dimensions and Figure 4 for the side view) that will be securely screwed together.

For the front and back sections of the machine (refer to Figure 6 and Table 3), as well as the ramp and the launching mechanism stand, refer to Figure 5 and Table 2. The ram will not be

continuous like traditional Skee Ball games; instead, we've incorporated a 9" x 14" launching pad where the servo motor will sit. This motor will be housed within an 8" diameter circular section and will rotate an 8" diameter plastic turntable to angle the launching system. The launching system, positioned on top of the motor, will propel the ball up the ramp toward the scoring section.

When the ball enters one of the five scoring holes, it will travel down a corresponding pipe equipped with an ultrasonic sensor. This sensor will detect the ball and trigger a sound effect to acknowledge the score increase. These plastic pipes will be glued to the bottom of the scoring board but will not touch the bottom of the machine, allowing the ball to drop freely from the pipe and roll down the ramp back to the user, aided by gravity (refer to Figure 7 and Figure 8 for the CAD models of the ball return).

To ensure that the ball's movement doesn't interfere with the PCB (refer to Figure 9 for the PCB footprint layout) and other components, all of the electronics will be positioned outside of the pipes and shielded off by a slanted piece of wood (the wood ensures that the ball returns to user) at the front of the machine. Specifically, the PCB will be located behind the slanted piece of wood at the front of the machine, ensuring it is safe from interference.

3.0 Sources Cited

[1] Skee-Ball Inc., "Skee-Ball Classic with Free Play," available at:

<https://skeeball.com/skee-ball-classic-with-free-play/>

[2] Big Sky MD Sports, "7.3 ft. Roll and Score Compact Arcade Game, Blue," available at:

<https://www.walmart.com/ip/Big-Sky-MD-Sports-7-3-Roll-and-Score-Compact-Arcade-Game-Blue/422006767>

[3] The Home Depot, "3/8 in. x 4 ft. x 8 ft Sheathing Plywood," available at:

<https://www.homedepot.com/p/3-8-in-x-4-ft-x-8-ft-Sheathing-Plywood-Actual-0-344-in-x-48-in-x-96-in-19837/206821410>

[4] The Home Depot, "10 x 1 in. Stainless Steel Phillips Pan Head Sheet Metal Screw (20-Pack)," available at:

<https://www.homedepot.com/p/Everbilt-10-x-1-in-Stainless-Steel-Phillips-Pan-Head-Sheet-Metal-Screw-20-Pack/304561410>

[5] Pololu Robotics and Electronics, "Pololu 2118," available at:

<https://www.pololu.com/product/2118>

[6] Adafruit Industries, "Adafruit 3006," available at: <https://www.adafruit.com/product/3006>

[7] STMicroelectronics, "STM32F091CC datasheet – ARM Cortex-M0 Microcontroller," available at: <https://www.st.com/resource/en/datasheet/stm32f091cc.pdf>

[8] Texas Instruments, "SN74HC08," available at: <https://www.ti.com/product/SN74HC08>

[9] Texas Instruments, "SN74HC393," available at:

<https://www.ti.com/lit/ds/symlink/sn74hc393.pdf>

[10] Texas Instruments, "SN74HC151," available at:

<https://www.ti.com/lit/ds/symlink/sn74hc151.pdf>

Appendix 1: CAD Model Illustrations

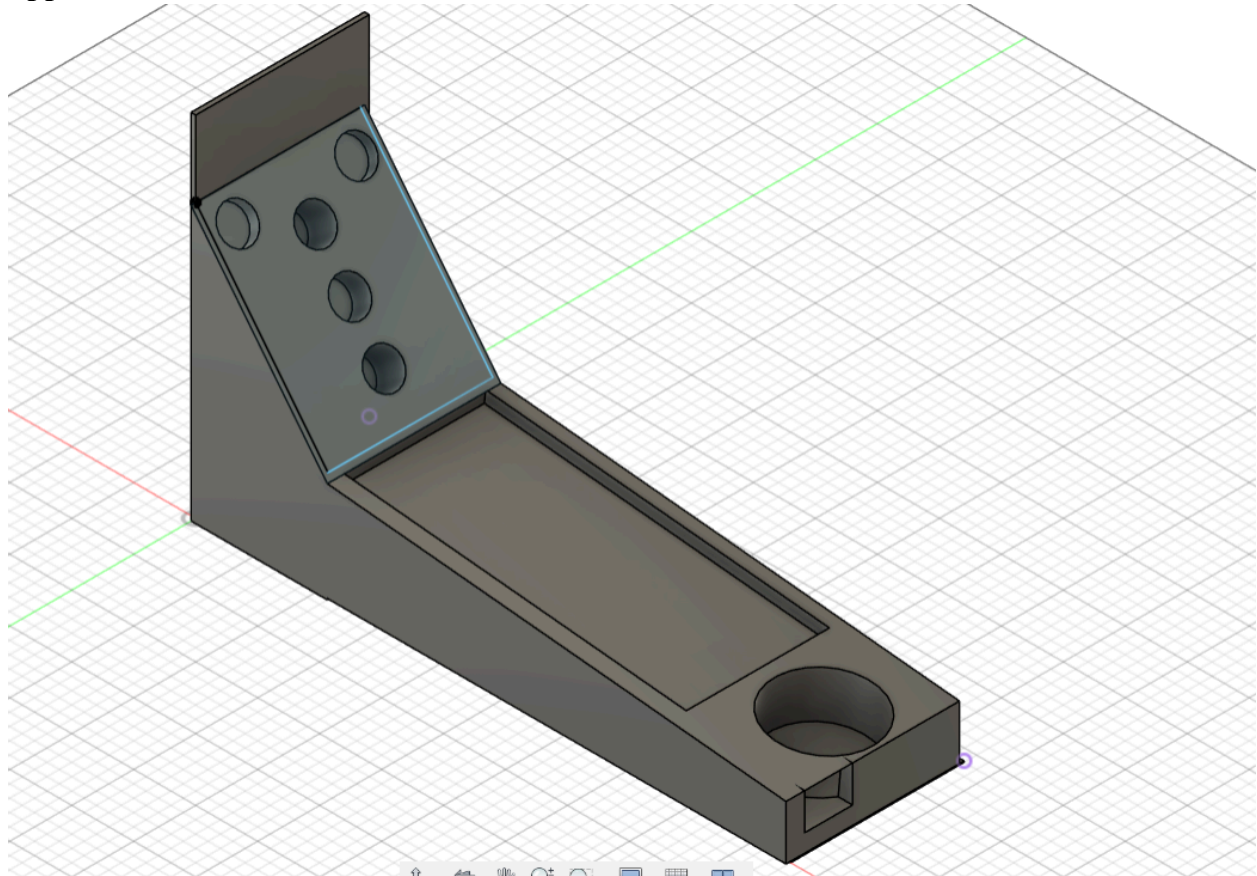


Figure 3: Electronic Skee Ball Machine



Figure 4: Electronic Skee Ball Machine Side View

Table 1: Electronic Skee Ball Machine Side View Dimensions

Piece	Length (in)	Height(in)	Angle (degree)
Side piece 1	11	22	51.84
Side piece 2	37	8	3.87

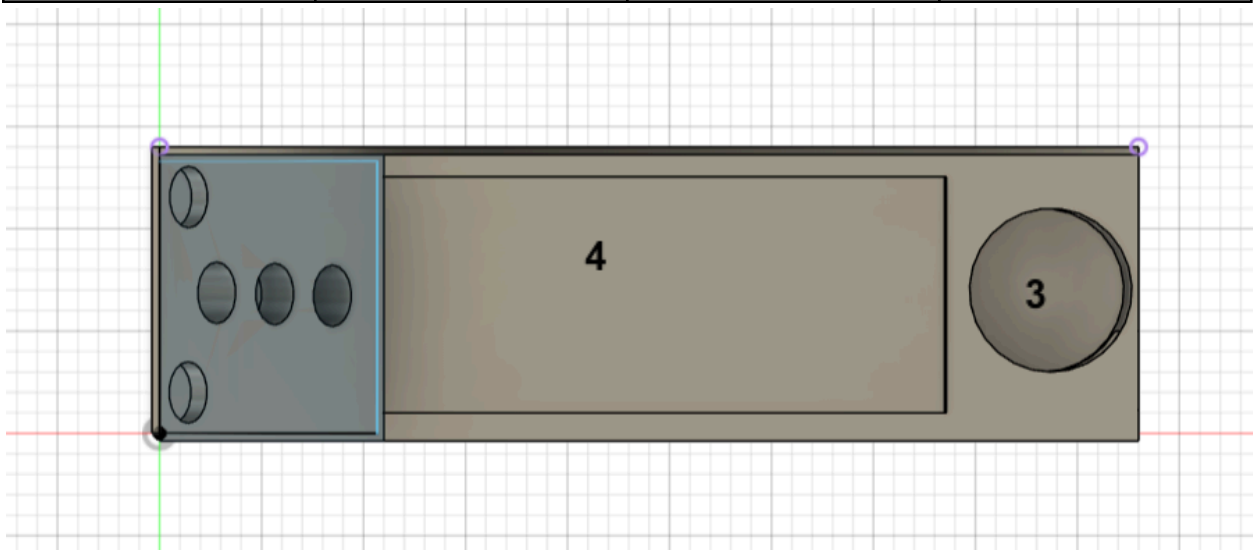


Figure 5: Electronic Skee Ball Machine Top View

Table 2: Electronic Skee Ball Machine Top View Dimensions

Piece	Length (in)	Width(in)
Entire bottom piece of machine	14	48
Launching Mechanism Stand (with a 8" diameter hole for the launching mechanism) (3)	14	9
Ramp (4)	14	28

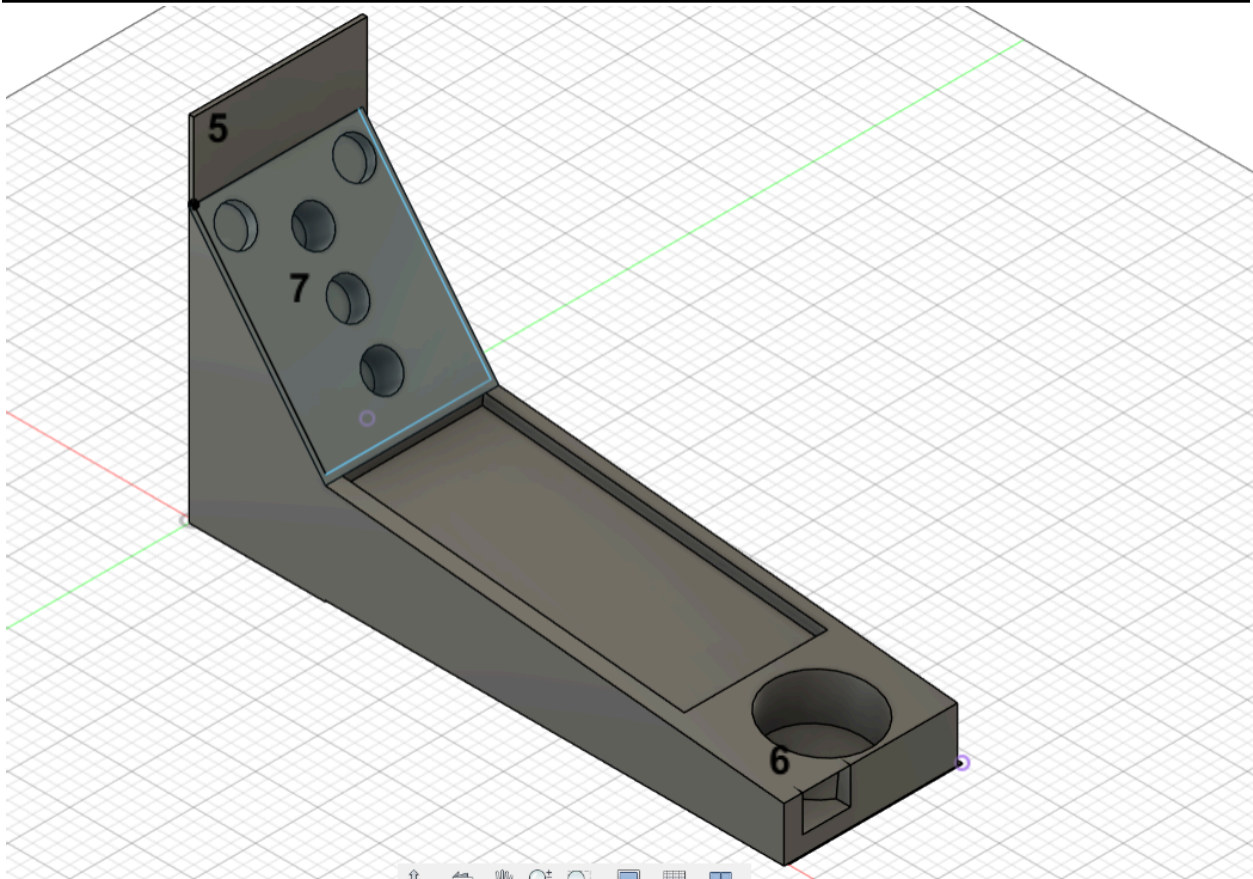


Figure 6: Electronic Skee Ball Machine with labels

Table 3: Electronic Skee Ball Machine with labels Dimensions

Piece	Length (in)	Height(in)
Entire back piece of Machine(5)	14	28

Front Piece of Machine (with 2.5" x 2.5" cutout for ball return)(6)	14	3.5
Scoring Board(with 5 3" in diameter holes) (7)	14	17

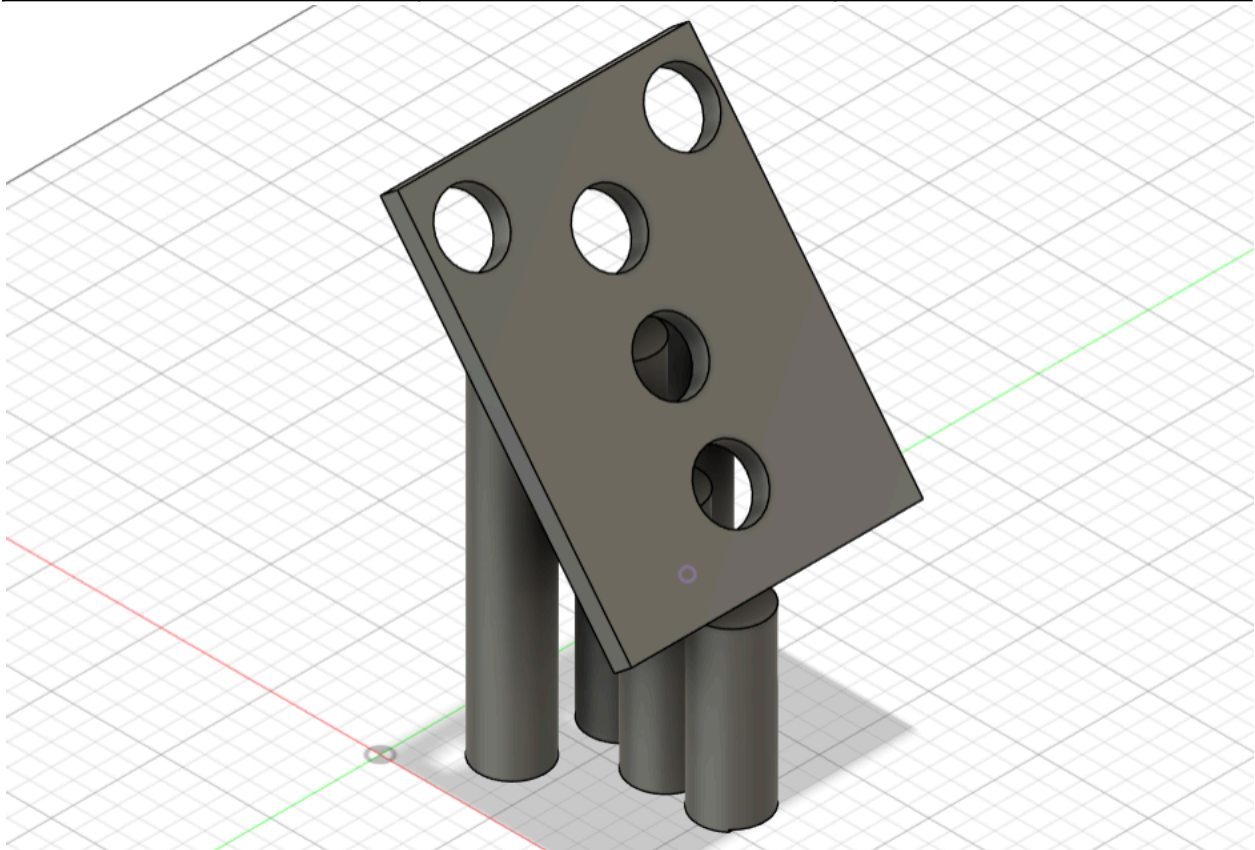


Figure 7: Electronic Skee Ball Machine Internal Ball Collection

Attached to each scoring hole, will be a 3" diameter plastic pipe, that will house an ultrasonic sensor to ensure the sensor senses the skee ball in its respective hole. In addition, the pipes will be attached to the back of the scoring board, and will not be connected to the ground of the machine, so the ball will fall down the tube, and with the orientation of the machine, the ball will roll down to the front due to gravity.

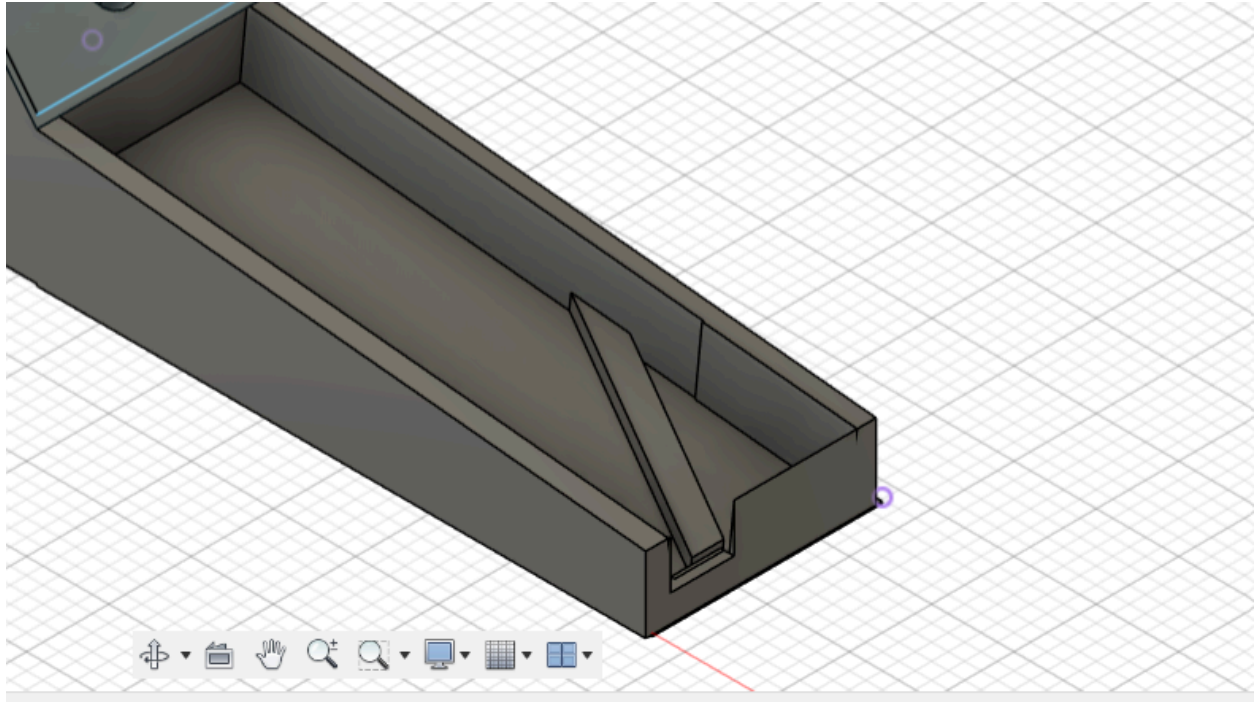


Figure 8: Electronic Skee Ball Machine Internal Ball Return

With the help from gravity, the ball will roll down the ramp to end up at the ball return for the user to grab the ball. In addition, there will be a piece of wood to block off the ball from interfering with any of the launching mechanism components.

Appendix 2: Project Packaging Specifications

Material	Tool Requirement	Estimated Weight	Estimated Unit Cost
96.5" x 37.75 $\frac{3}{8}$ " plywood [3]	Panel Saw/ Table Saw/ SR-100 Gantry Router	20 lb	\$22.33
8 in diameter plastic for the launching mechanism	Band Saw, Lathe, Drill Press, Tap, Tap Handle	0.25 lb	\$4.78
Plastic Pipes for ball return	Hot Glue Gun and Scissors	0.5 lb	\$11.45
Screws(20) [4]	Drill	0.01 lb each	\$6.87
Wood Glue	Paint Brush	2 ounces	\$5.48

Table 4: Electronic Skee Ball Machine Project Packaging Specifications

Appendix 3: PCB Footprint Layout

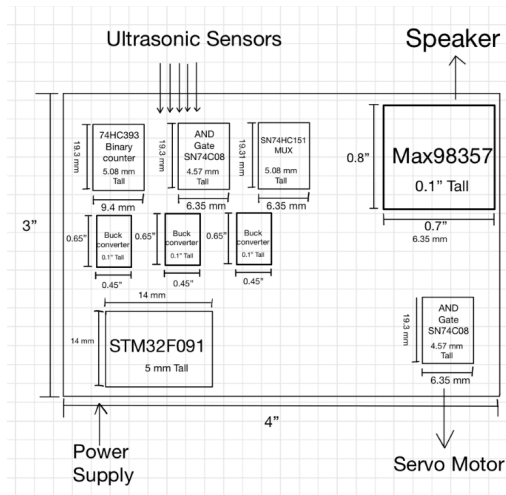


Figure 9: Electronic Skee Ball Machine PCB layout

Figure 9 is the PCB footprint layout of the PCB Team 1 will be using in our electronic skee ball machine. There will be three buck converters [5], the Max98357 I2S amplifier [6], the STM32F091 microcontroller[7], two separate SN74C08 AND gate [8], the 74HC393 counter[9], and the SN74HC151 multiplexer. Overall the PCB will be 3" x 4" and at least 0.5" tall. The PCB will be located at the front of the machine, behind the slanted piece of wood, and next to the launching system.