Mechanical Overview

Year: 2021 Semester: Fall Team: 8 Project: Sink or be Sunk

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Assignment Evaluation:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Score (0-5)** | **Weight** | **Points** | **Notes** |
| **Assignment-Specific Items** | | | | |
| **Commercial Packaging Analysis 1** | 5 | x2 |  |  |
| **Commercial Packaging Analysis 2** | 5 | x2 |  |  |
| **CAD Model Illustrations** | 5 | x4 |  |  |
| **Project Packaging Specifications** | 5 | x2 |  |  |
| **PCB Footprint Layout** | 5 | x2 |  |  |
| **Writing-Specific Items** | | | | |
| **Spelling and Grammar** | 5 | x2 |  |  |
| **Formatting and Citations** | 5 | x1 |  |  |
| **Figures and Graphs** | 5 | x2 |  |  |
| **Technical Writing Style** | 5 | x3 |  |  |
| **Total Score** | 100 | | |  |

5: Excellent 4: Good 3: Acceptable 2: Poor 1: Very Poor 0: Not attempted

Comments:

*Great job.*

1. Commercial Product Packaging

Sink or be Sunk is a modernized version of the board game Battleship, which was originally created in 1967 by Milton Bradley [1]. Thus, the two most similar commercial products to Sink or be Sunk are the non-electronic and electronic renditions. By analyzing the benefits and constraints of the packaging designs of these commercial products, our team will be able to effectively create a practical, engaging design to invigorate user experience.

* 1. Battleship (non-electronic)

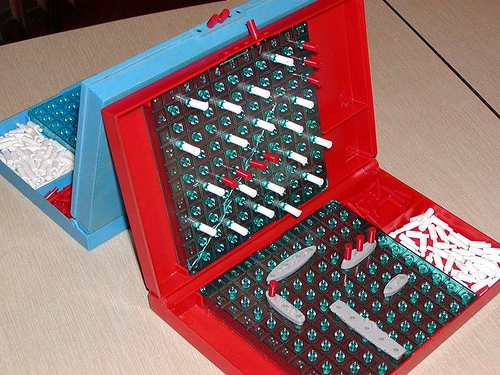


Figure : Original 1967 Version of Battleship [2]

A video game console

Description automatically generated with medium confidence

Figure : Modernized, Non-Electronic Version of Battleship [4]

In the traditional Battleship, each player has a board with convenient sections for boat and peg storage. These boards are extremely light weight and fold up for easy storage. Speaking from experience, one drawback to their storage design is that upon opening the boards, it is very possible for the pieces to fall out of their containers and end up lost or damaged.

The peg placing aspect of this game improves user engagement by allowing for maximum tactile involvement. While this is enjoyable for many users, the small pegs in the holes may be difficult for users with shaky hands or poor coordination.

Finally, the cosmetic appeal of the boards is the “life-like” depictions on the sides to emulate the feeling of being in a battleship. This adds significant character to the game and helps it stand out tremendously. However, the Ship placing board is incredibly dull, and could use a little liveliness.

By analyzing the traditional style, our proposed design will account for the poor boat storage by including a sliding-type cover to protect boats from falling out. Additionally, we will incorporate an LED based ship board to brighten the game and further engage with the user. To ensure the game is easily enjoyed by all, we will switch from peg-placing to coordinate typing (using a keypad with larger buttons) and automatic LEDs corresponding to hits and misses.

* 1. Electronic Battleship

*Graphical user interface, website

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Figure : Hasbro's Electronic Battleship

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Figure : Hasbro's Electronic Battleship - Folded for Storage

The electronic version of Battleship is another strong commercial contender. The most unique features are the sound, LEDs, and pre-programmed ship layouts [5]. Because of these features, over recent years Electronic Battleship has become increasingly more popular. One distinct difference from the original is the connected board(s). While this is creative, it limits the flexibility of gameplay and forces users to sit very close to each other. For this reason, our team will be venturing away from the use of a conjoined gameboard.

One aspect of the Electronic Battleship that our team has been inspired by is the closing compartment of the pieces. As previously mentioned, by incorporating a cover, storing the game while not play is much more convenient and less of a hassle when reopening the game.

Finally, keeping the style of the original, the Electronic Battleship exhibits a folding functionality, however it is extremely bulky and the outside is not completely sealed. For this reason, our team has strayed away from this type of folding and looked into purchasing a housing unit similar to a briefcase. In this way, the outer edges are more secure (less likely to open up on its own) and also shields out unwanted dust or dirt.

3.0 Sources Cited

[1]Wikipedia contributors, “Battleship (game),” *Wikipedia*, 24-Sep-2021. [Online]. Available: <https://en.wikipedia.org/wiki/Battleship_(game)#:~:text=Battleship%20is%20known%20worldwide%20as,by%20Milton%20Bradley%20in%201967>.

[2] “Unplugged: Battleship,” *Microsoft MakeCode*. [Online]. Available: https://makecode.microbit.org/courses/csintro/coordinates/unplugged. [Accessed: Sep-2021].

[3] “Battleship game retro series 1967 edition,” *Target*. [Online]. Available: https://www.target.com/p/battleship-game-retro-series-1967-edition/-/A-50696068. [Accessed: Sep-2021].

[4] “Battleship Classic Board Game Strategy Game Ages 7 and Up For 2 Players,” *Amazon*. [Online]. Available: https://www.amazon.com/Hasbro-A3264-Battleship-Game/dp/B00C0ULS3G.

[5] “Electronic Battleship Game Guide,” *Game.com*. [Online]. Available: https://www.hasbro.com/common/documents/DAD261471C4311DDBD0B0800200C9A66/7CDE94F219C34FDFB4D18E36CC6BDF23.pdf.

Appendix 1: CAD Model Illustrations

*A picture containing computer, electronics

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Figure 5:Gameboard Prototype

Calendar

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Figure 6: Top Down View of Gameboard

Some features to point out are the keypad, speaker holes, and LCD display on the bottom, or Ship, board and the opening to the right of the grid on the top, or Attack, board. The keypad will be used for punching in coordinates of missiles on the opponent’s grid (and initial gameplay set up). The LCD display will act as a menu screen for instantiating WiFi connection and providing gameplay options. The speaker holes are currently just an idea – once we further our testing with the speakers, we will assess whether we will need them to improve sound quality. On the Attack board, the side pocket will be designed for storing boats when not playing. We will include a 3D printed slab to cover this and act as a “sliding door” to prevent boats from falling out when the game is first opened.

To further exhibit the dimensions and configuration of modules within the board, below are additional 2D images portraying the specific internal considerations. Our team will be utilizing a “stacking” method with the help of standoffs to ensure the height constraints are being met. One thing not pictured is the acrylic (clear) sheet covering the Attack/Ship grids. This is primarily to make the CAD images less congested and to focus on the visual appeal. The grid will be clear and use small, cut pieces of black construction paper to separate into the grid “cubes”. The black paper is to prevent the leakage of LED light into other grid squares.

\*Note: more dimension specific diagrams provided in 2.3 General PCB/Attack and Ship Board Layouts.

Appendix 2: Project Packaging Specifications*.*

2.1 Materials List

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Materials | Weight | Cost | Size | Installation/Tools Required | Purchasing |
| Housing Unit (plastic Briefcase) | 1.25 lbs | $12.99 | 3.25in x 11in x 13in | N/A | EmergencyZone |
| Acrylic Sheet (frosted) | 1.46 lbs | $18.99 | 12 in. x 24 in. x 1/8 in  (need 2, 8in by 8in cuts) | * Hot glue/Screws (installing) * Drill (peg holes) * Saw/Straight Edge Cutter | Home Depot |
| Standoffs | N/A | $0.51 | 0.25in (height) | * Screwdriver | Digikey / ECE shop |
| Black cardstock/paper | N/A | $2.49 | 9in x 12in | * Scissors/Ruler to cut grid sizes | Michael’s |
| Boats | ~10-15g | N/A | See below | * 3D Printing (BIDC and ECE Shop) | N/A |
| Additional Game Panels | N/A | N/A | Various (will be used to cover any gaps due to curvature near handle and the right hand side of the Ship board. Will also be used to cover areas where the sheet acrylic is not covering. | * 3D Printing (BIDC and ECE Shop) | N/A |

2.2 Boat Specifications

|  |  |  |
| --- | --- | --- |
| Number of Boat Pegs | Total Size (l, w) | Boat Peg Coordinates\* |
| 2 | 2in x 1in | (0.5in, 0.5in)  (0.5in, 1.5in) |
| 3 | 3in x 1 in | (0.5in, 0.5in)  (0.5in, 1.5in)  (0.5in, 2.5in) |
| 4 | 4in x 1 in | (0.5in, 0.5in)  (0.5in, 1.5in)  (0.5in, 2.5in)  (0.5in, 3.5in) |
| 5 | 5in x 1 in | (0.5in, 0.5in)  (0.5in, 1.5in)  (0.5in, 2.5in)  (0.5in, 3.5in)  (0.5in, 4.5in) |

*\*Using the 2-peg boat as an example, the bottom left coordinate of the grid represents (0in, 0in)*

2.3 General PCB/Attack and Ship Board Layouts

A picture containing text, indoor

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Figure 7: Ordered Housing Unit for Prototyping

Graphical user interface, application

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Figure 8: Ship Board Modular Layout

Chart

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Figure 9: Attack Board Modular Layout

Appendix 3: PCB Footprint Layout

*Graphical user interface, diagram

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Figure 10: General PCB Layout (with board for reference)

*Chart, bubble chart

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Figure 11: Row PCB General Layout

Diagram

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Figure 12: Main PCB Layout

Our design incorporates the use of 2 different PCBs: the main PCB (Figure 10) and 16 Row PCBs (Figure 9). We will print 16 of the Row PCBs for each row in the Attack and Ship boards. The Attack board will not utilize the 4 breadboard holes placed in the center of each grid (and the sheet acrylic will not have holes drilled above the LEDs), however it is cheaper and facilitates the fabrication process to reuse the same PCB.

Each of the rows are “daisy-chained” together in order to stream the data lines between the LEDs, thus making them individually accessible. To connect the Attack rows to the Ship rows, we will use reinforced wires with some slack in them atop of the hinges to prevent damage, and allow for safe opening and closing of the board. There will be an 8:1 multiplexor on each Row PCB and on the Main PCB; the Row multiplexors will be used for the boat peg detection (from the four breadboard holes) and the Main multiplexor will be used to succinctly scan the rows by muxing down each of the Row multiplexor lines into one.

The green space on the left-hand side of the Row PCB is to account for spacing requirements for connectivity: daisy-chain lines, multiplexor input/output and select lines, power, ground, etc. In addition to the green, the Row PCBs are slightly thinner than each of the grid lines to promote more space insurance for connectivity, specifically daisy-chaining.

All PCBs will use standoffs above and below. We plan to drill holes into the briefcase and utilize standoffs to secure each of the PCBs. Then, we will use standoffs on the tops of the PCBs to create separation, but once again security, to the acrylic sheet. Ultimately, this will ensure durability throughout gameplay and while placing and remove boats from the grid, and ultimately the PCBs.