Acceptance Test Plan

Catch the Light Project



Team: Life-Support

Members: Nickolas LaForce, Alec Pimentel, Jay Votta, Dylan Souza

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1. Introduction

This document will verify that the final product meets all project requirements that were discussed with the customer. Each requirement discussed in the project requirements document will have a corresponding test to verify its completeness. This document will cover both physical and measurable tests depending on its requirement.

1.1 Scope

The Acceptance test plan will cover the two phases of the project. In phase 1, all tests will strictly serve the purpose of showing that the original version of the game was faithfully recreated on the PCB. The tests for this phase will only include what was agreed upon in the requirements document. The designed tests for the second phase of the project will cover all previously specified requirements. This document will not include tests to prove the documentation portion of the project as it does not directly affect the project’s functionality.

1.1.1 Testing Resources

Each measurable requirement will be tested in a laboratory utilizing the equipment that is available to students. The resources that will be used to test these requirements are as follows:

1. Rigol Digital Multimeter
2. Rigol DC Electronic Load Analyzer
3. TBS2000 Series Oscilloscope
4. 12V Power Supply
5. Alligator Clips

The data gathered by each resource will be recorded to demonstrate that the project operates as designed. Each individual test plan will outline the materials to be used when conducting testing.

1. Test Plan

**Phase 1 Engineering Requirement Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test Name: | Phase 1 PCB Cost | Test Number: | 1 | | |
| Requirement(s) Tested:  2.1.1 | 1: No official price cutoff for this version of  the game, the team will present the customer with a bill of material. The components will  not be ordered until permission to proceed is granted by the customer. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB Components  Other: Bill of Materials | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Analyze the Bill of Materials (BoM) and make sure every component is there with all necessary pricing and appropriate quantities listed. Have the document approved by the customer. | All components listed with necessary information to be ordered. Customer approves of the BoM. |  |  |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- |
| Test Name: | Discrete Logic Only | Test Number: | 2 | | |
| Requirement(s) Tested:  2.1.2 | 2: The game will be recreated using only 7400 series discrete logic without the use of a micro-controller. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: 7400 series chips. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Look at the schematic on Eagle and make sure there is no ATMega328PB micro-controller present. | The ATMega328PB microcontroller is not present in the build. |  |  |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- |
| Test Name: | SMD Components Check | Test Number: | 3 | | |
| Requirement(s) Tested:  2.1.3 | 3: All components on the PCB will be surface mount. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB components  Other: Bill of Materials | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Look at the Bill of Materials (BoM) and PCB schematic on Eagle and verify all components are surface mount. | All components on the BoM and PCB are surface mount. |  |  |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- |
| Test Name: | 12V Power Supply | Test Number: | 4 | | |
| Requirement(s) Tested:  2.1.4 | 4: The game will be powered by a 12V constant voltage supply | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB and 12V Power Supply. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Next turn on the power-supply, set the voltage to 12V. With two alligator clips connect one to power and one to ground on the PCB. Play the game and see if it works off of 12V. | The PCB operates at 12V. |  |  |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- |
| Test Name: | PCB Size Check | Test Number: | 5 | | |
| Requirement(s) Tested:  2.1.5 | 2: The size of the PCB will be no more than 10x10 cm | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB and ruler | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Place the PCB on a flat level surface. Use a ruler to verify that the PCB is equal to or under 10x10 cm. | The PCB is no larger than 10x10 cm. |  |  |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- |
| Test Name: | Push Button/External Connection check | Test Number: | 6 | | |
| Requirement(s) Tested:  2.1.6 | 6: One push-button with external connections will be present on the board’s schematic. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: Push-button and PCB | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Verify that the push button and external connection pins are present on the PCB’s schematic on Eagle. | Push button and external connection pins are present on the schematic. |  |  |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- |
| Test Name: | Sizing/Component Placement check | Test Number: | 7 | | |
| Requirement(s) Tested:  2.1.7 | 7: The IC chips and electronic components that will be used on the PCB will be based on the original product’s design. The components required to replicate this design can be seen in Tables 1-4. All capacitors, resistors and LEDs will be of size 0805. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Compare the components in tables 1-4 with the components present on the PCB’s schematic on Eagle. If all components in the table are present on the board, the PCB faithfully replicates the products original design. | All components are present on the board. |  |  |
| 2 | Confirm the size of the components by referencing their corresponding data sheets. | Sizes of components are 0805. |  |  |
| 3 | If all boxes in the tables are checked off, then the project faithfully used the same components as the original catch the light project. To verify the size of the components, reference the Bill of Materials and verify that the size of the components is 0805 and they are of type SMD. | All boxes in tables are checked off. Project uses the same components as the original. Sizes verified again by BoM. Sized 0805 and of type SMD. |  |  |

|  |  |  |
| --- | --- | --- |
| **IC Chips** | | |
| **Quantity** | **Type** | **Check** |
| 1 | 5V Regulator |  |
| 3 | 555 |  |
| 1 | 74138 |  |
| 1 | 7406 |  |
| 2 | 7408 |  |
| 1 | 74163 |  |

|  |  |  |
| --- | --- | --- |
| **Resistors** | | |
| **Quantity** | **Value** | **Check** |
| 8 | 330Ω |  |
| 5 | 1kΩ |  |
| 2 | 2.2kΩ |  |
| 1 | 3.3kΩ |  |
| 1 | 47kΩ |  |

**Table 1:** IC chips to be used **Table 2:** Resistors to be used

|  |  |  |
| --- | --- | --- |
| **Capacitors** | | |
| **Quantity** | **Type** | **Check** |
| 1 | 22µF |  |
| 2 | 100µF |  |

|  |  |  |
| --- | --- | --- |
| **LED's** | | |
| **Quantity** | **Color** | **Check** |
| 1 | Yellow |  |
| 7 | Red |  |

**Table 3:** Capacitors to be used **Table 4:** LED’s to be used

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test Name: | Pick’n’Place | Test Number: | 8 | | |
| Requirement(s) Tested:  2.1.8 | 8: All SMD components on the board are to be placed by the Pick and Place Machine. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: Pick’n’Place machine, soldering oven, PCB and components. | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Have the customer present while using the Pick’n’ Place machine to place surface mount components. All components are place correctly and accounted for. | Customer is present while the board is assembled by the Pick’n’Place machine.  All components are placed correctly and accounted for. |  |  |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- |
| Test Name: | Finished Product | Test Number: | 9 | | |
| Requirement(s) Tested:  2.1.8 | 8: All components are placed correctly on the PCB. Game successfully works when powered up. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB and Power Supply | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Set the power supply to 12 V. Attach the power and ground alligator clips where specified. Play the game by pushing the button and see if it works. | Game turns on and plays successfully. |  |  |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

2.2 Phase 2 Tests

**Phase 2 Engineering Requirement Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test Name: | Cost check | Test Number: | 1 | | |
| Requirement(s) Tested:  2.2.1 | 1: Cost per-unit is $3 or under in quantities of 100. Can go over with customer approval. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Other: Bill of Materials | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Reference the Bill of Materials, find the total cost per unit. Check if it is $3 or under. | Each unit is less than or equal to $3. |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test Name: | ATMega | Test Number: | 2 | | |
| Requirement(s) Tested:  2.2.2 | 2: The board operates using the Atmega328pb microcontroller | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: ATMega328PB and PCB | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Locate and identify the ATMega328PB microcontroller on the PCB’s schematic on Eagle. | ATMega328PB is used on the PCB schematic. |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | Single Coin Cell | Test Number: | 3 | | |
| Requirement(s) Tested:  2.2.3 | 3: One coin cell battery will be used to power the game. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: 3V Coin Cell and PCB | | | |

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| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Locate the ground strip on the PCB’s schematic on eagle. Make sure battery size is accounted for in thee schematic to avoid interference with other components. | Game works with a single 3V coin cell battery. |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | Capacitive Touch Button only | Test Number: | 4 | | |
| Requirement(s) Tested:  2.2.4 | 4: The capacitive touch button on the Atmega328pb microcontroller will be used in place of a push-button. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: Capacitive touch button and PCB | | | |

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| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Look at the PCB and locate the capacitive touch button. Then verify there is no push button present on the PCB. | There is no other button present on the board except the capacitive touch button. |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | LED Placement check | Test Number: | 5 | | |
| Requirement(s) Tested:  2.2.5 | 5: 16 LEDs are present on the PCB in a circle (13 Red, 2 Blue, 1 Green) | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: 16 LEDs - 13 Red, 2 Blue, 1 Green and PCB | | | |

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| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Locate and count 13 Red, 2 Blue, and 1 Green LEDs. | All LEDs are present on the PCB. |  | P |
| 2 | Check if the LEDs are aligned in a circle with the green LED at the bottom with a blue LED on either side. | LEDs are aligned in a circle with the green LED at the bottom with a blue LED on either side. |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | Coin cell durability | Test Number: | 6 | | |
| Requirement(s) Tested:  2.2.6 | 6: The coin cell battery will power the game for at least 1 hour under full load. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: Coin cell battery and RIGOL DL3021 DC Electronic Load Analyzer. | | | |

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| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Use the RIGOL DL3021 DC Electronic Load Tester to time how long it takes for the battery to drain to 2V. |  |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | Pick’n’Place | Test Number: | 7 | | |
| Requirement(s) Tested:  2.1.7 | 7: All SMD components on the board are to be placed by the Pick and Place Machine. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: Pick’n’Place machine, soldering oven, PCB and components. | | | |

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| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Have the customer present while using the Pick’n’ Place machine to place surface mount components. All components are place correctly and accounted for. | Customer is present while the board is assembled by the Pick’n’Place machine.  All components are placed correctly and accounted for. |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | Cap. Touch response time check | Test Number: | 8 | | |
| Requirement(s) Tested:  2.2.8 | 8: Capacitive touch button responds to user's press in 0.1 seconds | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: Capacitive touch button and PCB  Software: Atmel Studio, capacitive touch program | | | |

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| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Assure that the capacitive touch button is operational by pressing the button to demonstrate that the game works. The response time for the board to detect the user’s press will be tested by viewing the waveform’s pulse width using an oscilloscope and being sure that the time is within 10% error of .1 seconds. (Between 0.99 seconds and 0.11 seconds) |  |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | Sleep Mode | Test Number: | 9 | | |
| Requirement(s) Tested:  2.2.9 | 9: ATMega328PB puts board into sleep mode from no user activity | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB  Software: Atmel Studio | | | |

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| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Do not touch the board for 30 seconds using a timer. The board should go into sleep mode. Verify the board is in sleep mode with the use of a DMM. |  |  | F |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | Silkscreen check | Test Number: | 10 | | |
| Requirement(s) Tested:  2.2.10 | 10: PCB silkscreen has all component ID’s. Also has UMassD Mascot, name of university, and department name. As well as student names. All spelled correctly, no errors or defects. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB | | | |

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| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Locate and identify the silkscreen printed mascot on the back of the PCB.  Make note of any errors or defects present. | Mascot is printed on the board with no defects or errors present. |  | P |
| 2 | Locate and identify the name of university: “UMass Dartmouth” on the front of the PCB within the capacitive touch button. Make note of any errors or defects present. | The name of the university is spelled correctly with no errors or defects present. |  | P |
| 3 | Locate and identify the name of department: “Electrical & Computer Engineering” on the back of the PCB. Make note of any errors or defects present. | The name of the department is spelled correctly with no errors or defects present. |  | P |

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| 4 | Locate and identify semester “Fall 2019”, student names on the back, and github link. Make note of any errors or defects present. | Fall semester, student names, and github are spelled correctly with no errors or defects present. |  | P |
| 5 | Locate and identify all component silk screen names Make note of any errors or defects present. | All component names are listed with no errors or defects present. |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| Test Name: | Finished Product | Test Number: | 11 | | |
| Requirement(s) Tested:  2.2.11 | 11: Game successfully works when powered up. All features implemented work as designed. | Verification  Method: | V | A | T |
| Test Setup:  Hardware or Software or Both or Other  Attach Diagrams/Pictures as Needed | | Hardware: PCB  Software: Program on ATMega328PB | | | |

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| --- | --- | --- | --- | --- |
| Step | Action to be Performed | Expected Result | Observed Result | Pass/Fail |
| 1 | Press the capacitive touch button to turn on the game. Play each level to see if it works. Stop playing the game and let it power down into sleep mode. Test power consumption during all stages. If that also works, game is successfully completed. | Game turns on and plays successfully. |  | P |

**Comments:** **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Test Engineer: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Witness: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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