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HW 10: Test Plan **Prof. Andrew Greenberg**
ECE 411: Industry Design Processes **12/06/2023**

Part 1:

Unit Tests

1. Power Supply Checks:
   - Test that the 9V battery outputs a consistent 9V.
   - Verify that the 9V-to-5V voltage regulator outputs a stable 5V supply.
   - Measure the current draw from the power supply to ensure it's within expected limits.

2. Microcontroller (ATmega328p) Tests:
   - Upload a simple sketch to blink an LED to ensure the microcontroller is functioning.
   - Test all I/O pins for correct operation by toggling them high and low.

3. LCD Tests:
   - Test the LCD display initialization and confirm that characters are correctly displayed.
   - Verify SPI bus protocol communication between ATmega328p and the LCD.
   - Validate contrast and clear display functions of the LCD.

4. User Interface Components:
   - Test that the 10k linear potentiometer properly adjusts the LCD backlight across the entire range.
   - Confirm that each push button registers a press and causes an interrupt in the microcontroller.

5. Physical Structure:
   - Inspect the housing for structural integrity and fit for the components.
   - Ensure the printed circuit board has no shorts or openings and that all solder joints are secure.

Verification Tests

1. Power Connectivity:
   - Confirm that the power switch transitions power without interrupting the circuit.

2. Display Operation:
   - Test the LCD for correct display of game information upon microcontroller command.
   - Verify that the potentiometer effectively dims the LCD backlight.

3. User Interaction:
   - Validate that the 'Up' button increases a value on the display, such as score or time.
   - Ensure that the 'Down' button decreases a value on the display.

4. Gameplay Experience:
   - Simulate a game scenario and verify that all components interact as expected.
   - Check that the actuator (LCD) updates in real-time with user input.

Validation Tests

1. System Requirements:
   - Validate that the entire system operates continuously under battery power for a set duration.
   - Confirm that the user can interact with the game through push buttons and receive visual feedback on the LCD.
   - Ensure that the brightness adjustment feature meets the user's need for visibility under different lighting conditions.

2. Performance and Reliability:
   - Test that the system can be operated multiple times without failure.
   - Validate that the game reacts within acceptable time limits to user input.

3. Aesthetic and Protective Housing:
   - Verify that the housing meets the aesthetic design specifications.

Part 2:

Test 1:

Test Author: Alexandrea G, and Sam H.						
	Test Case Name:	Power Output Verification Test			**Test ID #:**	PO-VT1
	Description:	*This test verifies the output of the 9V battery and the 5V regulator output under normal conditions using a multimeter.*			**Type:**	□white box ☑ black box □ _____
Tester Information						
	Name of Tester:	Sam H.			**Date:**	11/28/2023
	HW/SW Version:	V.1			**Time:**	4:50PM
	Setup:	*Fully assembled game device with a 9V battery connected to the power input module and a multimeter set to measure DC voltage.*				
STEP	**Action**	**Expected Result**	**PASS**	**FAIL**	**N/A**	**Comments**
1	Power up the device using the 9V battery.	LCD screen powers on with welcome message and microcontroller's red led lights up.	☑			
2	Measure the output voltage directly from the 9V battery.	The multimeter should read close to 9V, within a tolerance of ±0.5V for the battery output.	☑			
3	Measure the output voltage from the 9V-to-5V voltage regulator.	The multimeter should read 5V, within a tolerance of ±0.25V for the regulator output.	☑			
4	Measure the voltage at the power input pin of the microcontroller.	The multimeter should read 5V, within a tolerance of ±0.25V at the microcontroller power input.	☑			
5	Measure the voltage at the power input of the LCD display.	The multimeter should read 5V, within a tolerance of ±0.25V at the LCD power input.	☑			
6	Measure the voltage at the	The multimeter should show a variable voltage from 0 to 5V as	☑			

	terminals of the 10k linear potentiometer.	the potentiometer is adjusted.				
7	Measure the voltage at the input of each push button when pressed.	The multimeter should read 5V at the push button terminals when pressed and 0V when not pressed.	☑			
	Overall test result:		☑			Test passes 100%.

Figure 1: Test 1 passed.

Test 2:

Test Author: Paul C. and Eduardo S.						
	Test Case Name:	User Interface Functionality Test			**Test ID #:**	UI-FT1
	Description:	*This test verifies the User Interface functionality of the gaming device, specifically testing the LCD display and push-button inputs.*			**Type:**	☑white box □ black box □ _____
Tester Information						
	Name of Tester:	Eduardo S.			**Date:**	12/01/2023
	HW/SW Version:	V.1			**Time:**	10:00PM
	Setup:	*Arduino Nano with attached LCD display and push buttons setup on the breadboard as per schematic. 9v Battery plugged in. Arduino Nano encoded with game.*				
STEP	**Action**	**Expected Result**	**PASS**	**FAIL**	**N/A**	**Comments**
1	Power up the device using the 9V battery.	Device powers on without issues.	☑			
2	Adjust the potentiometer to set the LCD backlight to mid-brightness.	Backlight brightness changes visibly.	☑			
3	Press the 'Up' button to move the game character up.	Game character moved up on the LCD display.	☑			
4	Press the 'Down' button to move the game character down.	Game character moved down on the LCD display.	☑			
5	Check if the LCD updates correctly in response to button presses.	LCD consistently shows correct game character placement in response to button presses.	☑			
	Overall test result:		☑			Test passes 100%. A video was recorded of this test being

					performed and passing.

The video of the software working can be found here.