“Vibrating Walking Cane”

**TEST PLAN**

**Document:**  TEST\_PLAN\_w\_Cane.pdf

Date of Test: / /

Approval Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Approver: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Version Date:**

**Version**  **Date**   **Author**

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Vibrating Walking Cane: System Test Plan

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**Test Plan:**

Materials and equipment Required:

* Walking Cane Detector
* 9V Battery
* Oscilloscope (for parametric testing)
* Spray bottle
* Multi-meter

Module Test

* Power
* Battery Life

Integration Test

* Interaction between Ultrasonic Sensors and Microcontroller
* Microcontroller to Vibration motor

Parametric Test

* Output voltage High Testing
* Output voltage Low Testing
* Number of Detections per Second

Functional Test

* Accuracy of Sensor within +/- 3 cm detector accuracy

Environmental Test:

* Water Resistant
* Humidity Test
* Drop Test

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| Test Case Name: | Sensor Integration Test | | | Test ID# | IT-1 | |
| Description: | Verify each sensor is detecting correctly and the microcontroller is sending a signal to power the motor vibrator output. | | | Type: | White Box | |
| Black Box X | |
| **Tester Information:** | | | | | | |
| Name of Tester: |  | | | Date: |  | |
| Hardware Version: | 1.0 | | | Time: |  | |
| Test Setup | The Cane will receive an input from the three sensors and cause a motor vibration when the ultrasensor sensor sends a signal and detects an obstruction within the close proximity of \_\_\_cms. | | | | | |
| Step: | Action | Expected Result | Pass | Fail | N/A | Comments |
| 1 | Place left sensor within the set sensor range | Vibration |  |  |  |  |
| 2 | Place middle sensor within the set sensor range | Vibration |  |  |  |  |
| 3 | Place right sensor within the set sensor range | Vibration |  |  |  |  |

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| Test Case Name: | Parameter Test | | | Test ID# | PT-1 | |
| Description: | Test the Output Voltage High and Low, and verify (Number of Detections per second) | | | Type: | White Box X | |
| Black Box | |
| **Tester Information:** | | | | | | |
| Name of Tester: |  | | | Date: |  | |
| Hardware Version: | 1.0 | | | Time: |  | |
| Test Condition | T=25 degrees celsius, | | | | | |
| Test Setup | The cane will receive output signal every 100 ms with a variable pulse width based on distance. Use a oscilloscope probe and measure the output at the digital pin (ECHO) on the board. | | | | | |
| Step: | Action | Expected Result | Pass | Fail | N/A | Comments |
| 1 | Use the oscilloscope to measure the output signal from the microprocessor to the ultrasonic sensors | Square Wave with peak to peak voltage of 3 - 5 volts |  |  |  |  |
| 2 | Use the oscilloscope to measure the number of detections per second from the echo pin of the sensors | Detect a minimum 10 cycles per second square wave |  |  |  |  |

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| Test Case Name: | Functional Cane Test | | | Test ID# | FT-1 | |
| Description: | Checks to ensure accuracy of the ultrasonic sensors within +/- 3 cms of the set sensor range. | | | Type: | White Box | |
| Black Box X | |
| **Tester Information:** | | | | | | |
| Name of Tester: |  | | | Date: |  | |
| Hardware Version: | 1.0 | | | Time: |  | |
| Test Setup | Device should be properly working before performing this test. First, move the ultrasonic sensor to just before the motor vibrates. Second, at the distance once the motor begins vibrating, mark the distance from the wall to the sensor and record the data. Thirdly, move the cane away from the wall until the motor stops vibrating and mark the distance. Lastly, ensure accuracy of the detector by comparing data to motor vibration range. | | | | | |
| Step: | Action | Expected Result | Pass | Fail | N/A | Comments |
| 1 | Program the Microcontroller and set indicated range for motor vibration | Program should be tested to make sure the sensor is sending signals to the motor at a frequency of 10 detections per second. The User sets the sensor range at which the motor vibrates |  |  |  |  |
| 2 | Perform Accuracy test moving toward obstruction | Move the cane slowly towards a wall and mark the indicated range at which the motor vibrates, accuracy should be +/- 3cms |  |  |  |  |
| 3 | Perform Accuracy test moving away from obstruction | Move the cane slowly away from the wall until the motor stops vibrating and mark the distance. The accuracy should be +/- 3cms. |  |  |  |  |
| 4 | Calibrate | Compare the information from the distance moving toward the wall and away from the wall and ensure each is within +/- 3 cms of the set sensor range. If out of range, set sensor range to even out the distances. |  |  |  |  |
| 5 | Repeat steps 2, 3 and 4 if needed | Device should accurately activate at set distance and vibrate the motors(+/- 3cms of accuracy of obstruction) |  |  |  |  |

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| Test Case Name: | Power Supply Module | | | Test ID# | PS-1 | |
| Description: | Verify the power supply voltage and the current levels on the board while turned on, and verify how long the battery will last while operating. | | | Type: | White Box | |
| Black Box X | |
| **Tester Information:** | | | | | | |
| Name of Tester: |  | | | Date: |  | |
| Hardware Version: | 1.0 | | | Time: |  | |
| Test Condition | T = 0 degrees, Input Voltage 9V, current = approximately 220mA | | | | | |
| Test Setup | Connect the battery to the multimeter while the board is on and measure the current and voltage output. Leave the cane ON until there is no current flowing out of the battery looking at the multimeter. | | | | | |
| Step: | Action | Expected Result | Pass | Fail | N/A | Comments |
| 1 | Turn on the switch | 9V and current at approximately 220mA |  |  |  |  |
| 2 | Turn off the switch | No output |  |  |  |  |
| 3 | Turn on the switch and leave it ON until it runs out. | Current must be outputting from the battery for at least 4 hours |  |  |  |  |

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| Test Case Name: | Environmental Perspiration Test | | | Test ID# | ET-1 | |
| Description: | Ensure product is usable in a high humidity environment or the rain of the outdoors. | | | Type: | White Box | |
| Black Box X | |
| **Tester Information:** | | | | | | |
| Name of Tester: |  | | | Date: |  | |
| Hardware Version: | 1.0 | | | Time: |  | |
| Test Condition | T = 0 - 25 degrees celsius, High humidity environment | | | | | |
| Test Setup | The cane is to be fully built and functional before performing this test. A spray bottle or rainy day is to be present. | | | | | |
| Step: | Action | Expected Result | Pass | Fail | N/A | Comments |
| 1 | Use the spray bottle and spray each of the sensors several times | The sensors should still accurately detect and vibrate when in sensor range. |  |  |  |  |
| 2 | Allow the cane in rainy weather for 30 minutes | Upon retesting, the cane should ensure no shorts or electrical errors by performing an functional accuracy test |  |  |  |  |

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| Test Case Name: | Cane Drop Test | | | Test ID# | ET-2 | |
| Description: | Performing a durability test by dropping the cane from various heights | | | Type: | White Box | |
| Black Box X | |
| **Tester Information:** | | | | | | |
| Name of Tester: |  | | | Date: |  | |
| Hardware Version: | 1.0 | | | Time: |  | |
| Test Setup | The cane is to be fully built and functional before performing this test. A repeated drop from the cane being vertical and a drop from a height horizontally is to be performed. | | | | | |
| Step: | Action | Expected Result | Pass | Fail | N/A | Comments |
| 1 | With the cane in an upright position tile with the bottom on the floor, allow the cane to drop naturally from the top position 3 times (onto concrete or tile) | The cane will be fully functional and vibrate when in the motor activation range |  |  |  |  |
| 2 | Drop the cane horizontally from 5 feet up from the floor (onto concrete or tile) | The cane will be fully functional and vibrate when in the motor activation range |  |  |  |  |