7. Test Plan

In order to verify if the BSDS is working properly, components need to be checked separately. Also, combined modules integrated system should be tested. Therefore, we need to perform the following test plan.

7.1 Unit Testing

7.1.1 Ultrasonic Sensor on UNO

	SainSmart UNO
Test description:	Power up SainSmart UNO
Condition:	The green indicator light should be on.
Procedure:	Connect with SainSmart UNO with USB power

	Ultrasonic-Sensor with SainSmart UNO
Test description:	Power & Connectivity
Condition:	Ultrasonic Sensor will be able to power up by the SainSmart UNO board and return data to SainSmart UNO pins.
Procedure:	1. Connect the Ultrasonic Sensors to the board pins 2. Use simple code to check if every sensor can successfully return data

	Ultrasonic-Sensor - Functionality
Test description:	Ultrasonic-Sensor connects with SainSmart UNO and run the ultrasonic scan program
Condition:	Ultrasonic Sensor will return the correct distance data to the SainSmart
Procedure:	1. Connect a ultrasonic sensor to the board pins 2. Use simple code to check if every sensor can successfully return data 3. Put the paper in front of ultrasonic sensor with specify distance (< 3m) 4. Check the distance result from the program comparing with test distance

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7.1.2 UNO LCD Monitor

	UNO LCD - Power & Connectivity
Test description:	UNO LCD screen can connect correctly and power up by the SainSmart UNO board
Condition:	UNO LCD screen shows blue background light when it is powered up by the SainSmart UNO board
Procedure:	1. Connect the UNO LCD screen onto the SainSmart UNO board 2. Connect the USB power cable with SainSmart UNO board 3. Check if the screen is powered on and shows blue background light

	UNO LCD - Display
Pretest:	Computer installed Arduino 1.0.3
Test description:	LCD screen can connect correctly, power up by the SainSmart UNO board, and display correct test result
Condition:	Computer installed Arduino 1.0.3
Procedure:	1. Connect the LCD screen onto the SainSmart UNO board 2. Connect the USB power cable with SainSmart UNO board 3. Check if the screen is powered on and shows blue background light 4. Run a simple program in Arduino 1.0.3 (which program for display) 5. LCD screen should display the correct program result

7.1.3 LED testing

	LED - Functionality
Test description:	Power up the LED by using function generator
Condition:	LEDs can be powered up successfully
Procedure:	1. Set power supply to 3v 2. Connect LED with power supply Check if the LED is lighted up successfully To test many LEDs all at once: 1. Put all the LEDs which want to be tested in parallel in the breadboard 2. Connect positive and negative of the LEDs to the power supply 3. Check if all the LEDs are lighted up successfully

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7.1.4 Buzzer testing

	Buzzer - Functionality
Test description:	Check buzzer can be powered up and produce sound
Condition:	Buzzer can produce desired sound
Procedure:	1. Connect buzzer to function generator 2. Increase frequency of the function generator 3. Check if it can produce desired sound correctly

7.1.5 Vibration Motor testing

	Vibration Motor - Functionality
Test description:	Check if the vibration motor gives enough noticeable oscillation
Condition:	Vibration Motor can produce noticeable vibration.
Procedure:	1. Turn on power supply 2. Connect vibration motor to power supply 3. Check if the vibration is noticeable by place hand on the other side of the table

7.2 Module Testing

7.2.1 Detection Module

	Ultrasonic Detection Module - Connectivity & Functionality
Test description:	Check if Ultrasonic Detection Module can be powered up by the SainSmart UNO board
Condition:	Ultrasonic Detection Module can be turned on when connected with powered up SainSmart UNO board
Procedure:	For connectivity: 1. Connect Ultrasonic Detection Module with unpowered SainSmart UNO 2. Power up SainSmart UNO board by connecting to computer through USB cable 3. Run the Ultrasonic Detection program in Arduino 1.0.3 4. The program should display the detected distance For functionality and on-going: 5. Put the paper board right in front of one of the ultrasonic sensor 6. The program should display "0" for the distance 7. Repeat step 5) and 6) for each of the ultrasonic sensors

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7.2.2 Visual feedback module

	Camera & 4.5" LCD display - Power & Connectivity
Test description:	Try to power up camera and 4.5" LCD display, and the captured image will be displayed on the LCD display
Condition:	Cameras can be successfully connected to the 4.5" LCD display through the switch. Both devices can be powered by the power supply provided
Procedure:	1. Connect one camera and the 4.5" LCD display 2. Power up both cameras and 4.5" display by the power supply 3. Check if the 4.5" LCD display presents the camera's real time capture

	Cameras & 4.5" LCD display - Functionality
Test description:	Check if switch position gives the correct feedback to the camera
Condition:	4.5" LCD display can successfully display video signals sent out by the cameras correctly when switch is flipped.
Procedure:	1. Connect 4.5" LCD display with night vision camera system 2. Select the switch to choose left camera 3. Check the image display on 4.5" LCD if match the left side scene 4. Select the switch to choose right camera 5. Check the image display on 4.5" LCD if match the right side scene 6. Select the switch to choose left cameras 7. Check the image display on 4.5" LCD if it match the right side scene 8. When the switch in idle, check the image on 4.5" LCD display if it matches the right scene of the back

7.2.3 Warning Module

	Warning Module – Connectivity
Test description:	The warning module contains three parts, the LED, vibration motor and buzzer which are controlled by the UNO. Warning module should able to pass correct warning signal to the user
Condition:	All three parts of the module should be able to successfully connect and powered by the UNO
Procedure:	1. Connect the LED, vibration motor and buzzer to UNO board 2. Connect the Warning Module with Detection Module 3. Power up both modules 4. Put both modules in warning condition 5. Check the warning system if give correct corresponding alerts

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	Warning Module – Functionality
Test description:	After the warning module passes the connectivity test, section different condition to test different warning responds
Condition:	All three parts of the module should be able to perform correct warning based on different warning signal sent out by the UNO
Procedure:	1. After pass "Warning Module – Connectivity" test 2. Put a obstacle right in front of left ultrasonic sensor system within 3.6m 3. The left LEDs warning should be "ON" 4. After selecting the left switch 5. Buzzer and vibration should be triggered on 6. Repeat the same steps(from 1) to 5)) to check the warning system work for right side

7.3 Overall System Testing

7.3.1 Connection & Functionality Testing

	Overall BSDS Connection & Functionality
Test description:	Connection and functionality test will be performed to ensure the complete system is connected and functioning properly
Condition:	All module can be correctly integrated together and function normally
Procedure:	1. Connect all modules according to the design 2. Simulated testing condition will be performed 3. Check if all modules will perform properly and match the test results with each components' test results

7.3.2 Mounting Testing

	Mounting Test
Test description:	Mounting testing will be performed to ensure all parts will survive everyday driving after attached
Condition:	Outside mountings will not fall off when driving. Inside mountings will remain in the same positions and remain the same functionalities
Procedure:	1. Ultrasonic Detection Module will be mounted outside refer to the technical guide line 2. Check the outside mounting will not fall off during everyday driving 3. Spray water onto the outside mountings 4. Check the outside mounting will not fall off after the spray water test

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7.3.3 Error Testing

	Overall System - Error Testing
Test description:	Error testing will be performed to make sure any ultrasonic sensor error will be reported to the user correctly. Display error will not be reported since it is obvious.
Condition:	All malfunction sensors can sent out error signal to the LCD screen
Procedure:	1. Power up the BSDS system 2. Disconnect the trigger pin one of the sensor 3. Check if an error message is sent to the LCD screen