Smart Tint – Test Plan Document

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Gold Squadron

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Revision History

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-	Initial Release		
1	Initial Development	4/8/2018	
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Reference Information

1.1 Product Reference Information

Summary located on document 001-1.1

1.2 Summary of hardware elements (ONLY ONE OF THESE)

Summary located on document 001-1.1

1.2.1 Specifications

[1]   No Syllabus Provided.

Dates Required:

1) Final Design Documentation: May 4th, 2018

2) Final Oral Presentation: May 4th, 2018

3) Final Poster: May 4th, 2018

4) Final Peer Reviews: May 4th, 2018

1.2.2 Abbreviations

The following abbreviations are used within this document (this includes everything that even seems obvious to you. Do not count on your audience to see an acronym the same way you do):

Term	Definition
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LSB	Least Significant Byte
Max	Maximum
CR#	Customer Requirement Number
RML	Requirement Met Location
TP#	Test Plan Operation
nRF	Nano Radio Frequency
SSR	Solid State Relay

2. <u>Test Plan</u>

Initial Definitions:
State of System (At start of test process):
        Arduino Main: Off
        Arduino Mini: Off
        Window Tint: Off
        LED 1: Off
        LED 2: Off
        LED 3: Off
        Phone Connect: No
        Main Send: No
        Main Receive: No
        Mini Send: No
        Mini Receive: No
Window: Non-Transparent
System Memory: Stored (non-volatile)

2.1) Main hub, window hubs, and film setup and are all connected to power.

        2.1.1) Definitions:
        State of System (Status is after step process):
                Arduino Main: On
                Arduino Mini: On
                Window Tint: Off
                LED 1: Off
                LED 2: Off
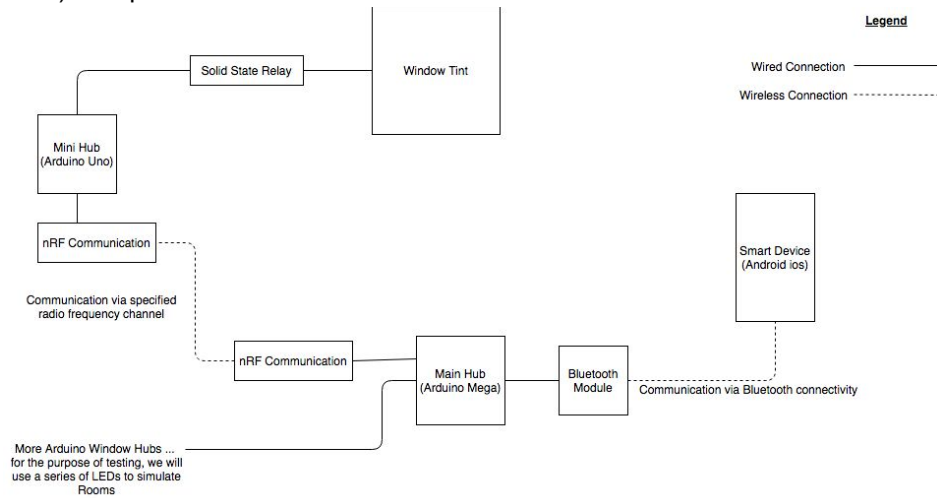   LED 3: Off
                Phone Connect: No
                Main Send: No
                Main Receive: No
                Mini Send: No
                Mini Receive: No
        Window: Non-Transparent
        System Memory: Stored (non-volatile)

2.1.2) Setup:

- Main hub wired as specified in hardware document 002.
- Mini hub wired as specified in hardware document 002.
- Three Standard American wall outlets.

2.1.3) Process:
1) Connect Main hub arduino device to 9V power brick.
2) Connect 9V power brick to standard wall outlet.
3) Connect Mini hub arduino device to 9V power brick.
4) Connect 9V power brick to standard wall outlet.
5) Connect Window Tint 9V power brick to standard wall outlet.
6) Flip Switch on Window Tint device to On position

2.1.4) Conclusion: This step will review the power requirements of the project and outline the safety precautions used for the design.

2.2) Connect Smart Device to Main hub via bluetooth (Smart Device is an Android Phone) [Testing Requirements 4, 6].

2.2.1) Definitions:
State of System (Status is after step process):
Window Tint: Off
LED 1: Off
LED 2: Off
LED 3: Off
Phone Connect: Yes
Main Send: No
Main Receive: Yes
Mini Send: No
Mini Receive: No
Window: Non-Transparent
System Memory: Stored (non-volatile)

2.2.2) Setup:

PAIRED DEVICES	
🎧 Mpow Cheetah	⚙️
🎧 Samsung Wireless Speaker SB330	⚙️
🎧 Stereo	⚙️
※ Sunrise Simulator	⚙️

- Main hub wired to bluetooth device as specified in hardware document 002.
- Cell Phone within range of Bluetooth (Approximately within 100 meters according to official Bluetooth datasheets).

2.2.3) Process:
1) Go to Bluetooth settings on Android Device.
2) Search for and Select Sunrise Simulator in Bluetooth devices.
3) Wait for connection (roughly 3 seconds).
4) Open Sunrise Simulator Application that has been previously uploaded.
5) Application will verify that the device is connected properly.

2.2.4) Conclusion: This step confirms that the bluetooth subsystem is functioning confirming requirement 4 and requirement 6.

3) Select Window from Smart Device [Testing Requirements 2, 3, 5].

2.3.1) Definitions:
State of System (Status is after step process):
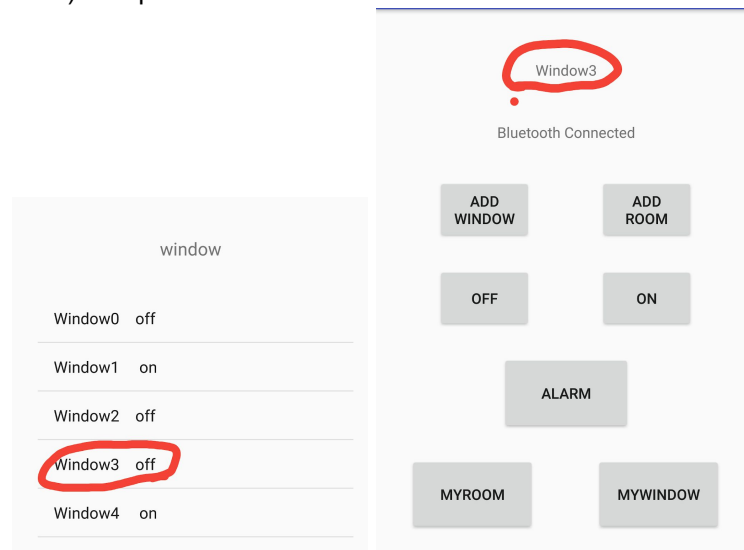   Window Tint: Off
      LED 1: Off
      LED 2: Off
      LED 3: Off
      Phone Connect: Yes
      Main Send: Yes
      Main Receive: Yes
      Mini Send: No
      Mini Receive: No
Window: Non-Transparent
System Memory: Stored (non-volatile)

2.3.2) Setup:

Window3

Bluetooth Connected

ADD WINDOW	ADD ROOM
OFF	ON

ALARM

MYROOM	MYWINDOW

window

Window0   off

Window1   on

Window2   off

Window3   off

Window4   on

- Cell Phone within range of Bluetooth (Approximately within 100 meters according to official Bluetooth datasheets).
- Cell Phone connected to Bluetooth Device successfully.

2.3.3) Process:
1) Have Sunrise Simulator App open.
2) Make sure device is still connected.
3) Press the "MYWINDOWS" on button.
4) Select "Window3" from list of available windows. (This is the Main Window)
5) Return to home screen.

2.3.4) Conclusion: During this step, we demonstrate the full pathway of communication, as we are seeing the window device communicate all the way through to the smart device. Confirming requirement 2, 3, and 5.

4) Turn on Window from Smart Device (Make window transparent)
[Testing Requirements 1, 2].

2.4.1) Definitions:
State of System (Status is after step process):
        Window Tint: On
        LED 1: Off
        LED 2: Off
        LED 3: Off
        Phone Connect: Yes
        Main Send: Yes
        Main Receive: Yes
        Mini Send: No
        Mini Receive: Yes
Window: Transparent
System Memory: Stored (non-volatile)

2.4.2) Setup:
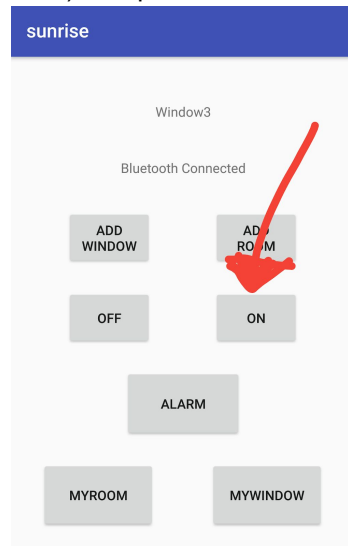
- Cell Phone within range of Bluetooth (Approximately within 100 meters according to official Bluetooth datasheets).
- Cell Phone connected to Bluetooth Device successfully.
- Both Arduino devices connected as specified in document 002.

2.4.3) Process:
1) Have Sunrise Simulator App open.
2) Make sure device is still connected.
3) Window3 is still selected.
4) Select "On" button from main screen.

2.4.4) Conclusion: This step serves as a confirmation for requirement 1, and 2.

5) Turn off Window from Smart Device (Make window non-transparent) [Testing Requirements 1].

2.5.1) Definitions:
State of System (Status is after step process):
Window Tint: Off
LED 1: Off
LED 2: Off
LED 3: Off
Phone Connect: Yes
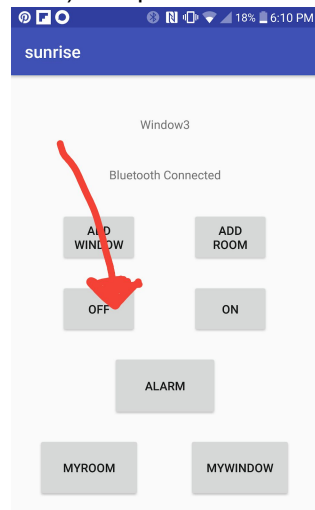Main Send: Yes
Main Receive: Yes
Mini Send: No
Mini Receive: Yes
Window: Non-Transparent
System Memory: Stored (non-volatile)

2.5.2) Setup:

- Cell Phone within range of Bluetooth (Approximately within 100 meters).
- Cell Phone connected to Bluetooth Device successfully.
- Both Arduino devices connected as specified in document 002.

2.5.3) Process:
1) Have Sunrise Simulator App open.
2) Make sure device is still connected.
3) Window3 is still selected.
4) Select "Off" button from main screen.

2.5.4) Conclusion: This step serves as a confirmation for requirement 1.

6) Add New Window (New window will be LED1) [Testing Requirements 7].

2.6.1) Definitions:
State of System (Status is after step process):
        Window Tint: Off
        LED 1: Off
        LED 2: Off
        LED 3: Off
        Phone Connect: Yes
        Main Send: No
        Main Receive: Yes
        Mini Send: No
        Mini Receive: No
Window: Transparent
System Memory: Stored (non-volatile)

2.6.2) Setup:
- Cell Phone within range of Bluetooth (Approximately within 100 meters).
- Cell Phone connected to Bluetooth Device successfully.
- Both Arduino devices connected as specified in document 002.

2.6.3) Process:
1) Have Sunrise Simulator App open.
2) Make sure device is still connected.
3) Select "NEW WINDOW" button (Which will automatically add new window setup for LED1).

2.6.4) Conclusion: During this step, we showcase the system's ability to add a new window which confirms requirement 7.

7) Turn on Window1 (LED Test Module) [Testing Requirements 1].

2.7.1) Definitions:
State of System (Status is after step process):
        Window Tint: Off
        LED 1: On
        LED 2: Off
        LED 3: Off
        Phone Connect: Yes
        Main Send: Yes
        Main Receive: Yes
        Mini Send: No
        Mini Receive: Yes
Window: Transparent
System Memory: Stored (non-volatile)

2.7.2) Setup:
- Cell Phone within range of Bluetooth (Approximately within 100 meters).
- Cell Phone connected to Bluetooth Device successfully.
- Both Arduino devices connected as specified in document 002.

2.7.3) Process:
1) Have Sunrise Simulator App open.
2) Make sure device is still connected.
3) Press the "MYWINDOWS" on button.
4) Select "Window5" from list of available windows. (This is the LED "window")
5) Return to home screen.
6) Make sure that "Window5" is selected.
7) Press the "On" button.

2.7.4) Conclusion: By turning on the LED we can prove requirement 1.

8) Turn off Window1 [Testing Requirements 1].

2.8.1) Definitions:
State of System (Status is after step process):
        Window Tint: Off
        LED 1: Off
        LED 2: Off
        LED 3: Off
        Phone Connect: Yes
        Main Send: Yes
        Main Receive: Yes
        Mini Send: No

Mini Receive: Yes
Window: Transparent
System Memory: Stored (non-volatile)

2.8.2) Setup:
- ● Cell Phone within range of Bluetooth (Approximately within 100 meters).
- ● Cell Phone connected to Bluetooth Device successfully.
- ● Both Arduino devices connected as specified in document 002.

2.8.3) Process:
8) Have Sunrise Simulator App open.
9) Make sure device is still connected.
10) Window5 is still selected.
11) Select "Off" button from main screen.

2.8.4) Conclusion: This step serves as a confirmation for requirement 1.

9) Create Room1 and Add Window and Window1 [Testing Requirements 7].

2.9.1) Definitions:
State of System (Status is after step process):
    Window Tint: Off
    LED 1: Off
    LED 2: Off
    LED 3: Off
    Phone Connect: Yes
    Main Send: Yes
    Main Receive: Yes
    Mini Send: No
    Mini Receive: Yes
Window: Transparent
System Memory: Stored (non-volatile)

2.9.2) Setup:

				sunrise	
Window0	off	☐		Room	
Window1	on	☐			
Window2	off	☐		Room1	windows: 23
Window3	off	☑		Room2	windows: 124
Window4	on	☐		Room3	windows: 23
Window5	off	☑		Room4	windows: 124
Window6	off	☐		Room5	windows: 23
				Room6	windows: 124
				Room7	windows: 23
	SUBMIT			Room8	windows: 35

- Cell Phone within range of Bluetooth (Approximately within 100 meters).
- Cell Phone connected to Bluetooth Device successfully.
- Both Arduino devices connected as specified in document 002.

2.9.3) Process:
1) Have Sunrise Simulator App open.
2) Make sure device is still connected.
3) Select the "ADD ROOM" button.
4) Select "Window3" and "Window5".
5) Select the "Submit" button.
6) Navigate to "MY ROOMS".
7) Select latest Room.
8) Return to Home Screen.

2.9.4) Conclusion: This step serves as a confirmation for requirement 7.

10) Turn on Room1 [Testing Requirements 1, 7].

2.10.1) Definitions:
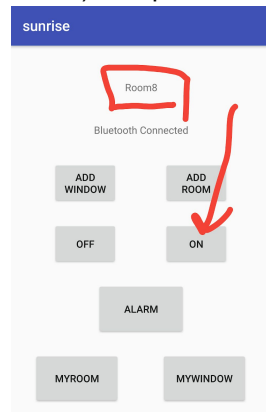State of System (Status is after step process):
        Window Tint: On
        LED 1: On
        LED 2: Off
        LED 3: Off
        Phone Connect: Yes
        Main Send: Yes
        Main Receive: Yes
        Mini Send: No
        Mini Receive: Yes
Window: Non-Transparent
System Memory: Stored (non-volatile)

2.10.2) Setup:

- Cell Phone within range of Bluetooth (Approximately within 100 meters).
- Cell Phone connected to Bluetooth Device successfully.
- Both Arduino devices connected as specified in document 002.

2.10.3) Process:
1) Have Sunrise Simulator App open.
2) Make sure device is still connected.

      3) Room is still selected.
      4) Select "On" button from main screen.

2.10.4) Conclusion: This step serves as a confirmation for requirement 7 and 1.

11) Turn off Room1 [Testing Requirements 1, 7].

2.11.1) Definitions:
State of System (Status is after step process):
      Window Tint: Off
      LED 1: Off
      LED 2: Off
      LED 3: Off
      Phone Connect: Yes
      Main Send: Yes
      Main Receive: Yes
      Mini Send: No
      Mini Receive: Yes
Window: Transparent
System Memory: Stored (non-volatile)

2.11.2) Setup:
- Cell Phone within range of Bluetooth (Approximately within 100 meters).
- Cell Phone connected to Bluetooth Device successfully.
- Both Arduino devices connected as specified in document 002.

2.11.3) Process:
      12) Have Sunrise Simulator App open.
      13) Make sure device is still connected.
      14) Room is still selected.
      15) Select "Off" button from main screen.

2.11.4) Conclusion: This step serves as a confirmation for requirement 1, and 7.

Conclude Testing Demo.

3. Traceability Matrix

CR#	Name	Description	Component	TP#
1	Film Control	Develop device that will control amount of light coming through a window.	Hardware	003-TP5
2	Hub Communication	Have the device communicate to a main hub via nRF configuration.	Firmware	003-TP4
3	Data Storage	Have a main hub that stores information of all window controllers and controls the windows.	Firmware	003-TP8
4	Device-System Communication	Have the main hub communicate with smart device via bluetooth communication.	Firmware	003-TP3
5	Window/Room Selection	Have the smart device be able to select a window/room and control the tint on selected window(s).	Software	003-TP5
6	Software Application	Create smart device application to communicate with main hub and serve as a user interface.	Software	003-TP4
7	System Modualization	The system must be able to add/delete a window or a room. Effectively making the system expandable.	Software	003-TP7