Product Test Plan

Smart Home Appliance Control System (SHACS)

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Approval:

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PRODUCT TEST PLAN

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PRODUCT TEST PLAN

I. INFORMATION REQUIRED FOR EXECUTION

A. Purpose

The purpose of this test protocol is to verify the full and complete operation of the Smart Home Appliance Control System (SHACS).

B. Scope

This test protocol should be executed to verify that each principal feature and function performs within specification called out by the engineering requirements document. In addition, other necessary specifications shall be tested such as specific and necessary user, installation and power requirements. The testing called out in this protocol is subject exclusively to those selected specifications provided for the SHACS. It shall not include any specification for future versions of the SHACS <only if applicable>

C. Responsibilities

It is the responsibility of the assigned test engineer to execute all tests included herein to the best of their ability. If necessary, seek additional assistance to execute tasks.

D. References

Not Applicable at this time.

E. Definitions

- SHACS: Smart Home Appliance Control System.
- Modules: The SHACS will have four different control modules: the main control, light control, blind control, fan control, and thermostat control module(s).
- XBee: Wireless communication modules
- TRIAC: Switch used to turn on power supply for appropriate module.
- Lux: SI unit for measuring the intensity of outside light.
- PIR: Passive Infrared Sensor for light control module.
- UART: Universal Asynchronous Receiver/Transmitter to communicate between XBee and different modules.

F. Equipment/Supplies

- 1 x STM32F4Disco board with TFT LCD
- 4 x STM32F3Disco board
- 5 x XBee wireless module
- 1 x 120V light bulb
- 1 x fan
- 1 x thermostat
- 1 x Light/Lux Sensor
- 1 x Servo Motor
- 1 x set of blinds
- 1 x PIR Sensor
- 1 x multimeter/oscilloscope

G. Precautions & Warnings

This test plan contains certain warnings and cautions designed to alert the test engineer while performing tests. The following illustrates each of these messages and how to recognize them.

WARNING: Dealing with High Voltages (120V AC)

The “WARNING: Message” alerts the user about safety issues that are of the highest importance, such as possible injury to the operator.

CAUTION: High Voltage should be separated from Low Voltage Parts and circuits.

The “CAUTION: Message” alerts the user to issues concerning possible damage to the equipment or that can lead to erroneous test results.

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II TESTING FEATURES AND FUNCTIONS

A.) Standalone Main Control Module: The purpose of this test is to demonstrate a standalone main interface module. This test in particular is going to test the user interface with corresponding outputs.

i. Equipment Required:
Logic Analyzer
STM32F4 Disco Board/ TFT LCD

ii. Input:
Screen will be programmed so with different Screen Presses yields different outputs.

iii. Output:
Screen press include:
Turn on/off/dim light command in form of output
Turn on/off AC/HEAT for thermostat/ be able to set thermostat in form of output
Shut/Open blinds in form of output
(Output refers to pushing on the screen and getting a specific response on a specific GPIO pin to show that the press corresponds to the correct module.)

Pass: Each screen press results in correct output from correct GPIO pin

Fail: The system outputs differ from test plan outputs.

iv. Test Description:
The main module will be tested by programming each icon on touchscreen with a certain GPIO pin. A logic analyzer will be used to make sure the press corresponds with the correct GPIO pin. This is important to test because this module will eventually be sending out instructions to the other modules via XBee telling them what to do and who should do it.

v. Test Results:

Pass/ Fail	Results / Data
Pass	As predicted

vi. Test Analysis:
The StemWin Library provides a nice platform to perform the needed actions to pass this test.

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II TESTING FEATURES AND FUNCTIONS

B.) Standalone Light Control Module: The purpose of this test is to demonstrate a standalone light control module. The module should be able to turn on and off a light, along with being able to dim the light. It will also test the automated part of the module which includes turning on the light with the input from a PIR sensor.

vii. Equipment Required:
Multi-meter/Oscilloscope
STM32F3 Disco Board
120V Light and Light Adapter

viii. Input:
Button press for user input
Triggering PIR sensor in automated mode

ix. User Output:
First Button Press turn on light 100% power
Second Button Press dim light to 75% power
Third Button Press dim light to 50% power
Fourth Button Press dim light to 25% power
Fifth Button Press dim light to 0% power
Automated Output:
Light turns on based on PIR triggering

Pass: The system outputs correct power for corresponding button press.

Fail: The system outputs a power output that differs to corresponding button press

x. Test Description:
The module will first be turned on by connecting power to the STM32F3 board. When the button on the board the first time, the light will have full power and turn on. With each press of the button, the light will dim by reducing 25% of the lights power until the 5th button press in which the light turns off. Second test for the module will required triggering the PIR sensor and then turning on the light.

xi. Test Results:

Pass/ Fail	Results / Data
Pass	Button press outputted correct power to light And pir sensor was triggered by movement

xii. Test Analysis:
The test passed, but to the naked eye, the lights brightness doesn't seem to change when going from 75 to 100 percent power. Also PIR originally didn't take into account if the person stays moving in the pir range, it is fixed and works as predicted.

II TESTING FEATURES AND FUNCTIONS

C.) Standalone Blind Control Module: The purpose of this test is to demonstrate a standalone blind control module that will open and shut blinds according to the intensity of light from a lux sensor.

i. Equipment Required:
Multi-meter/Oscilloscope
STM32F3 Discovery Board
Lux/light sensor
Servo Motor
Blinds

ii. Input:
Lux reading from sensor and/ button press to open or shut blinds

iii. Output:
If the Lux rating is < 500 lux then blinds will close, else blinds will open. When button is pressed open blinds, when pressed again close.

Pass: Servo motor opens/shuts the blinds at the appropriate sensor readings

Fail: Servo motor does not open/shut the blinds at appropriate sensor readings

iv. Test Description:
On power up from the power source, the board will initialize the sensor. I will use a light to simulate sunlight so the sensor reads above 500 lux. Once the blinds have been opened by the servo motor, then I will cover the sensor making it read lower than 500 lux to make the servo motor shut the blinds.

v. Test Results:

Pass/ Fail	Results / Data
Pass	Test passes, but 500 lux is an arbitrary number

vi. Test Analysis:
Test passes although I didn't use the sun for the autonomous mode, I used the flashlight on my cell phone. Also, the way I hooked up the servo to the blinds is a little awkward so opening and closing may vary, but still does the job.

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II TESTING FEATURES AND FUNCTIONS

D.) Standalone Thermostat Module: The purpose of this test is to demonstrate a standalone Thermostat module that will be able declare a set point and turn the thermostat on/off in both AC/Heat modes.

i. Equipment Required:
Multi-meter/Oscilloscope
STM32F4 Discovery Board
LCD display screen
Temperature sensor
Humidity sensor

ii. Input:
Programmable input will come from STM32F3 Discovery board

iii. Output:
According to each test case in the program, the system shall see a different set of results on the thermostat. For ex, in the program on the board the input might be set to set the thermostat to turn the AC on at 74 degrees. Also correct temp from thermostat into microcontroller. I will also see if the temperature and humidity is correct on the LCD screen

Pass: Correct display will show up on thermostat according to predefined inputs written in code

Fail: The display does not display proper results for predefined inputs.

iv. Test Description:
When the module is powered on it will also turn on the thermostat. A testing program will be used to ensure that the given inputs results in the given outputs. Test might include a series of tests that put the systems through different situations and scenarios.

v. Test Results:

Pass/ Fail	Results / Data
Pass	Passed standalone tests

vi. Test Analysis:
Test passes, different test situations included setting temp above and below set points and turning on LED appropriately. Also, I didn't really have a means of providing my own A/C or Heat to bring the temperature up or down, so I have to use unconventional methods to test that, ie breathing on temperature sensor to increase temp.

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II TESTING FEATURES AND FUNCTIONS

E.) Xbee Wireless Module test: Make sure that two XBee modules are able to talk with each other. Test will keep adding XBee until the whole network can talk with each other.

i. Equipment Required:
PC
Xbee (4)

ii. Input:
Set of characters that will be transmitted from XBee to XBee to ensure communication with each other.

iii. Output:
Xbee should be able to send and receive given output from transmitter XBee.

Pass: All 4 Xbee are talking to the coordinator XBee and sending and receiving correct packets.

Fail: Xbee network fails to communicate with one another.

iv. Test Description:
First I will test two XBee modules, making sure that the receiver and coordinator are able to communicate with each other. Then I will add another Xbee to the point to multipoint network and testing and making sure it is able to talk and communicate with the coordinator. I will keep doing this until all Xbee's have been tested and are sending and receiving packets with the coordinator.

v. Test Results:

Pass/ Fail	Results / Data
Pass	Xbees correctly send data back and forth to coordinator

vi. Test Analysis:
Took some time to get this test to pass due to my unfamiliarity of Xbees, but with the help of their software and a logic analyzer, I got it done.

PRODUCT TEST PLAN

II TESTING FEATURES AND FUNCTIONS

F.) Complete System Test: Test to connect the whole system together and ensures that everything works as defined.

i. Equipment Required:
Main module
Light bulb Module
Thermostat Module
Blind control Module

ii. Input:
Will test each input from Touchscreen on main module.
This includes:
1.) Turning on/off/dim light bulb, as well as testing automated mode
2.) Setting set point for thermostat/turning on/off AC and HEAT and requesting temp from module
3.) Telling blind module to shut/open blinds and requesting lux information
4.) Having Blind act autonomously using LUX to activate blind controller.

iii. Output:
Each input above has the expected correct output.

Pass: All systems inputs correspond with correct system outputs.

Fail: System doesn't output correct output with corresponding input of system.

iv. Test Description:
By this time, all modules should be complete and ready to be connected with their XBee. Once they are connected with the right XBee, I will power the system on and start to go through the listed inputs above. This is the last test in testing my system.

v. Test Results:

Pass/ Fail	Results / Data
Pass	Everything works as predicted

vi. Test Analysis:
Although everything passes, there can and still are improvements that can be made to the system to make it run smoother and consistently.