System Test Case Document

ECSE 421 - Embedded Systems

Green House System

Group 1

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Introduction

The Green House System is quite complex, and as with all complex systems, much can go wrong. Errors can be caught prior to deployment through proper testing and documentation. This document describes test cases which can be applied to the system to ensure proper functionality.

The traceability matrix can be used to match each functional requirement with its corresponding test case(s). This matrix guarantees that if all test cases are applied and the system responds accordingly, then all functional requirements for the system are satisfied.

Each test case describes the required inputs and the expected outputs of the system. The use of this document and the included test cases is the first step in determining whether the system is operating correctly. Its use can also be of help in pin-pointing the location of bugs or faults within the system.

Traceability Matrix

The traceability matrix is shown below, in table 1.0.

Functional Requirements	SRS Section	SDD Section	Test Cases
Room Lights (Bedroom 1, Bedroom 2, Kitchen and Bathroom)	Section 4.1	Section 4.1 , 4.4	Cases 1, 2
Room Lights (Living-room and Kitchen)	Section 4.2	Section 4.1 , 4.2, 4.4	Cases 3, 4
Bed Lamps	Section 4.3	Section 4.1 , 4.2, 4.4	Cases 5, 6
Motion Detection	Section 4.4	Section 4.1 , 4.2, 4.3, 4.4, 4.7, 6.1	Cases 7, 8
Refrigerator	Section 4.5	Section 4.1 , 4.2, 4.6, 6.1	Cases 9, 10, 11
Power Consumption – Excess	Section 4.6	Section 4.1 , 4.2, 4.5, 4.6, 4.8, 6.1	Case 12
Power Consumption – Shortage	Section 4.7	Section 4.1 , 4.2, 4.5, 4.6, 4.8, 6.1	Case 13
Temperature	Section 4.8	Section 4.1 , 4.2, 4.5, 6.1	Case 14
Scheduler	Section 4.9	Section 4.1 , 4.2, 4.5, 6.1	Case 15
Night Power Mode Saving	Section 4.10	Section 4.1 , 4.2, 4.5, 6.1	Case 16
Electricity Failure	Section 5.1	Section 4.1 , 4.2,4.4, 4.5, 4.6,4.7, 4.8,6.1 6.1	Case 17
PC Failure	Section 5.2	Section 4.1 , 4.2, 4.4, 4.5	Case 18

Table 1.0: Traceability Matrix

Test Cases

1. Room Lights (Bathroom, Bedrooms, Living room and Kitchen) – Turning ON

Description:

The room lights control signals are controlled by the room lights button signals. For this test case only signals shorter than two seconds are considered.

Input:

(a) Room light is initially turned OFF
(b) Room light button is pressed for a short amount of time (less than two seconds)

Expected output:

(a) Corresponding room light is turned ON

2. Room Lights (Bathroom, Bedrooms, Living room and Kitchen) – Turning OFF

Description:

The room lights control signals are controlled by the room lights button signals. For this test case only signals shorter than two seconds are considered.

Input:

(a) Room light is initially turned ON
(b) Room light button is pressed for a short amount of time (less than two seconds)

Expected output:

(a) Corresponding room light is turned OFF

3. Room Lights (Living room) – Intensity

Description:

For this test case only the living room is considered. When the corresponding button signal is pressed for more than two seconds, a specified number of room lights will turn ON based on the desired light intensity (that can be controlled by the user via the GUI).

Input:

(a) User selects the living room intensity level to the middle value using the GUI
(b) Room lights initially turned OFF (Initial condition)
(c) The room light button is pressed for more than two seconds

Expected output:

(a) Living room lights 1, 2 and 3 gradually turning ON to satisfy the luminosity level

4. Room Lights (Kitchen) – Intensity

Description:

For this test case only the kitchen is considered. When the corresponding button signal is pressed for more than two seconds, a specified number of room lights will turn ON based on the desired light intensity (that can be controlled by the user via the GUI).

Input:

(a) User selects the living room intensity level to the middle value using the GUI
(b) Room lights initially turned OFF (Initial condition)
(c) The room light button is pressed for more than two seconds

Expected output:

(a) Living room lights 1, 2 and 3 gradually turning ON to satisfy the luminosity level

5. Bed Lamps (Bedrooms) – Turn ON

Description:

The bed lamps are control by their respective press button. Turning ON a given bed lamp is tested.

Input:

(a) Bed lamp is initially turned OFF
(b) Bed lamp button is pressed for a short duration (less than 2 seconds)

Expected output:

(a) Corresponding bed lamp turns ON

6. Bed Lamps (Bedrooms) – Turn OFF

Description:

The bed lamps are control by their respective press button. Turning OFF a given bed lamp is tested.

Input:

(a) Bed lamp is initially turned ON
(b) Bed lamp button is pressed for a short duration (less than 2 seconds)

Expected output:

(a) Corresponding bed lamp turns OFF

7. Motion Detector (Bedroom 1)

Description:

When someone moves in a room, the motion detector signal is set to 1. If there is no motion in a given room for 5 minutes (meaning the signal was kept to 0), the according devices in this room are turned off. Therefore, by waiting 5 minutes while there is no motion in each room, this functional requirement can be tested. The proper devices should then turn OFF.

Input:

(a) Bedroom 1 room light is initially turned ON
(b) Bedroom 1 bed lamps are initially turned ON
(c) There is no motion in bedroom 1 for 5 minutes

Expected Output:

(a) Bedroom 1 room light is turned OFF
(b) Bedroom 1 bed lamps are turned OFF

8. Motion Detector (Bedroom 2, Bathroom, Kitchen and Living room)

Description:

When someone moves in a room, the motion detector signal is set to 1. If there is no motion in a given room for 5 minutes (meaning the signal was kept to 0), the according devices in this room are turned off. Therefore, by waiting 5 minutes while there is no motion in each room, this functional requirement can be tested. The proper devices should then turn OFF.

Input:

(a) All room lights and devices are turned ON in bedrooms, living room, bathroom and kitchen

(b) There is no motion in the bedrooms, in the living room, in the bathroom, and in the kitchen for 5 minutes

Expected Output:

(a) In each bedroom: Room light and the two bed lamps turned OFF
(b) In the living room: Room lights 1, 2 and 3 and the television turned OFF
(c) In the bathroom: Room light, hair blower dryer and fan turned OFF
(d) In the kitchen: Room lights 1, 2 and 3 turned OFF

9. Refrigerator (Kitchen) – Turn OFF

Description:

In the initial stage, the refrigerator has to be turned on for 30 minutes and then waits for any special request to be turned ON or OFF. If it gets a request to be turned ON, it automatically turns ON, but if it is asked to be turned OFF, it checks to see if the ratio time has been satisfied (i.e. the refrigerator has to stay ON for at least 30 minutes out of one hour). According to the result, the refrigerator is either turned OFF as required or kept ON to satisfy the requirements.

The first thing we need to test is that the refrigerator has to be initially turned ON for 30 minutes no matter what request it gets. Therefore, let us reset the time and ask the refrigerator to be turned OFF only after 15 minutes.

Input:

(a) Let the refrigerator be ON for one hour
(b) Wait 15 minutes
(c) Generate a “Turn OFF” request

Expected Output:

(a) Refrigerator staying ON for the first 30 minutes at least

10. Refrigerator (Kitchen) – Turn ON

Description:

The second thing to test is that refrigerator turns ON as soon as it is asked to.

Input:

(a) Generate a “Turn ON” request

Expected Output:

(a) Refrigerator turns ON

11. Refrigerator (Kitchen) – Turn OFF more than allowed

Description:

The last thing to test is asking the refrigerator to turn OFF although the ratio time has not been satisfied.

Input:

(a) Let the refrigerator turned ON for 1 hour
(b) Generate a “Turn OFF” request during 40 minutes

Expected Output:

(a) Refrigerator should turn back OFF when it receives the turn OFF request
(b) Refrigerator should turn back ON 30 minutes after it received the turn OFF request

12. Power consumption - excess

Description:

When power consumption exceeds the power produced by the solar panels, the system must respond appropriately. Actions should be taken to reduce excess power being used so as to maintain appropriate power consumption levels. Testing of this requirement is done by manually increasing power consumed using the system GUI interface, to make it greater than power produced.

Input:

(a) Move the power dial in the simulator window to display an increase in the power consumption to be greater than power produced from solar cell.
(a) Apply motion in the simulator for rooms with no motion.

Expected Output:

(a) When the power is increased in the simulator window, the system will respond in the following ways:
- The refrigerator light is turned off for 30 minutes or less.
- Temperature in rooms with no motion will drop by 3°C.

(b) When motion is detected in a room that had no motion previously the following occurs:
- The temperature is set back to the desired level of the user.

(c) If after step (a) the power does not go down:
- The display will show a decrease in the charge of the batteries.

13. Power consumption - shortage

Description:

This case occurs when the power produced by the solar cells exceeds the power consumed by the devices. This test ensures that the battery is charged and discharged at the proper times.

Input:

(a) Move the power dial in the simulator window to display an increase in the power produced by the solar cell that should exceed the power consumed by the devices.

Expected Output:

(a) The system will check two conditions: (1) if the battery is not discharging, (2) if the battery is not full, and will start charging the battery.
- The display will show an increase in the charge of the batteries.

(b) The system will check two conditions: (1) if the battery is discharging, (2) if its not below 100 Wh.
- The display will show a decrease in the charge of the batteries as the consumption goes on.

(c) The system will check if the charge of the battery has reached 100 Wh.
- The display will show an increase in the charge of the batteries.

(d) The system will check if the battery charge is full.
- Refrigerator light is turned on.

14. Temperature

Description:

This test is used to make sure the system works properly to enable users to configure temperatures in each room as they desire , by controlling the function of the heating units via their corresponding control signals.

Input:

(a) Enter a higher temperature in the desired room, than the current temperature.
(b) Enter a lower temperature in the desired room, than the current temperature.

Expected Output:

(a) The system will compare the current temperature in the room with the temperature desired by the user. The temperature is lower than the desired level.
- The light display of the heating in that room will turn on.

(b) The system will compare the current temperature in the room with the temperature desired by the user. The temperature is higher than the desired level.
- The light display of the heating in that room will turn off.

15. Scheduler

Description:

Users can configure the times when they are not at home and the expected time of their return so that the system acts in a way that power consumption is reduced and temperatures are regulated accordingly. This function is tested by manually configuring the system simulator (GUI interface)on the PC.

Input:

(a) Set the scheduler to display a status of not being at home.

Expected Output:

(a) The system will check the time of the users return, and save the current temperatures in the rooms.
- The temperature display of the rooms will drop by 5°C.
- The temperature displays the saved temperatures 1 hour before the users return.

16. Night power saving mode

Description:

Students living in the house should be able to activate night power saving mode to reduce unnesscary power consumption when they are asleep. This funciton is tested manually using the system simlator (GUI interface) on the PC.

Input:

(a) Click on the night power saving mode check box to activate the system.

Process:

(a) The system will save the current temperatures in the kitchen, the living room and the bathroom.
- The temperature display of the kitchen, the living room and the bathroom will drop by 5°C, at 11 PM.
- The temperature displays the saved temperatures at 6AM.

17. Electricity Failure

Description:

In the case of electricity failure, the electricity failure signal takes prescedence above all other signals. This signal is set only when no more power is provided from the Hydro-Quebec network. This limits the house's power supply forcing some actions to be taken in order to save power for higher priority uses. Since the temperature of the house must be maintained at a certain level, heating units are given the priority of functioning over lighting and the use of other devices or accessories in the house. The system test for this requirement ensures that the system acts to cut back power supply on some devicesaccording to battery and solar cell dischrges. The test is done by stoping the power supply from the Hydro-Quebec network by unchecking the box in the system simulator (GUI interface) manually.

Input:

(a) Uncheck the Hydro-Quebec is OK box in the simulator window to stop the supply of
electricity from the Hydro-Quebec network and induce electricity failure.

Expected Outputs:

(a) When the power is no longer supplied from the Hydro-Quebec network, the system will respond in the following ways such that all devices are turned off except heating units, lights and the refrigerator :
- The Hair Blow dryer and fan in the bathroom are turned off.
- The Oven, microwave and extra accessory in the kitchen are turned off.
- The Television in the Living room is turned off.

(b) The system will check if the battery is half discharged.
- The Lights in Bedroom 1, Bedroom2, Kitchen, Bathroom and Living room are turned off.

(c) The system will check two conditions: (1) if the battery is fully discharged, (2) if the the solar cells are fully discharged.
- All heating units are turned off.

18. PC Failure

Description:

A protection system on the board ensures that the basic functions are still handled in case the serial link between the PC and the board is broken or disconnected. The protection system no longer tries to optimize the power consumption; rather a unique temperature of 21°C will be maintained in all rooms and lights and independent devices can be turned ON or OFF. Finally, to signal this failure the LED on the board will blink.

Input:

(a) Disconnect the cable linking the PC and the board
(b) Try turning any light ON or OFF

Output:

(a) Observe the LED (on the board) turning ON
(b) Observe the corresponding light(s) turning ON
(c) Observe a temperature of 21°C in all rooms