Final Testing Report for Item Tracker

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## Introduction

In testing the various features that were requirements for the project, we took the approach that if we were unable to test the functionality for any reason then that requirement was an automatic failure. As many environmental metrics would not reasonably affect the outcome of the various tests, we deemed that an aggressively controlled environment was not particularly needed for this battery of tests.

For an approach to testing, we took the approach of a guided user experience to ensure that all product requirements, as well as native navigational options were available to the user. This would help to design a complete testing suite for complete coverage of the features that should exist for the product and whether they were implemented satisfactorily. To facilitate this, we decided it was best to divide our testing into two complete phases namely, device physical tests and application logical tests.

## Tools Used

1. Yardstick
2. Phonic Handheld audio analyzer
3. Elevated Temperature Testing Device
4. Reduced Temperature Testing Device
5. Android Studio
6. Development Laptop

## Requirements Tested

The project requirements here have been split into two groups for ease of matching Device, and Mobile application.

**Device**

|  |  |  |
| --- | --- | --- |
| Req No. | Obj No. | Requirement |
| 1 | 1 | Device shall comply with IEEE 802.11 communication standard |
| 2 | 1 | Device shall use an open source positioning system over Wi-Fi |
| 3 | 1 | Device shall communicate with a mobile application |
| 4 | 2 | Device shall adhere to surfaces that meet SPI standards A-3, B-1, B-2, B-3, C-1, C-2, C-3 for molded plastic with Velcro© pads |
| 5 | 4 | Device shall contain an attached LED light that conforms to ANSI C82.16-2015 standard |
| 6 | 1 | Device shall include a mobile application |
| 16 | 5 | Device shall provide the user access to the battery through a folding panel |
| 17 | 5 | Device shall accept a replacement battery of the same form factor |
| 18 | 6 | Device shall function in temperatures above 32­­­­0F |
| 19 | 6 | Device shall function in temperatures not exceeding 1500F |
| 20 | 6 | Device shall function if exposed to 8 fl oz of water |
| 21 | 6 | Device shall function following a 3 ft exposure to unaccelerated gravity |

Mobile Application

|  |  |  |
| --- | --- | --- |
| Req No. | Obj No. | Requirement |
| 7 | 3 | Mobile application shall be usable on a mobile device running Android 4.4 or newer |
| 8 | 3 | Mobile application shall email the user provided email address when battery voltage drops below 80% of factory listed voltage |
| 9 | 3 | Mobile application shall allow the user to configure a visual alarm for an input date and time |
| 10 | 3 | Mobile application shall allow the user to configure an audible tone of at least 60dB for an input date and time |
| 11 | 3 | Mobile application shall allow the user to configure the LED light to turn on for an input date and time |
| 12 | 3 | Mobile application shall allow the user to see location information for the device |
| 13 | 3 | Mobile application shall allow the user to define a custom name for the device |
| 14 | 3 | Mobile application shall store user defined email |
| 15 | 3 | Mobile application shall store user defined wi-fi network credentials |

## Device Tests

Testing the physical device produced results that satisfied several requirements we had for the device.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Step | Action | Expected Output | Result | Requirement(s) | Met | Unmet |
| 1.00 | Tracker Device Tests |  |  |  |  |  |
| 1.01 | Inspect Device package for LED | Device has working LED | LED lights are present on the device | 5.0 | x |  |
| 1.02 | Connect Device to attached battery pack | Battery pack will power Device | Device powered on |  |  |  |
| 1.03 | Disconnect Device from attached battery pack | Device powers off | Device powered off |  |  |  |
| 1.04 | Access battery compartment flap | Device has battery compartment | Device has battery compartment | 16.0 | x |  |
| 1.05 | Remove battery and replace with similar form factor battery | Battery is removable and replaceable | Battery is removable and replaceable |  |  |  |
| 1.06 | Connect Device to attached battery pack | Battery pack will power Device | Device powered on | 17.0 | x |  |
| 1.07 | Connect device to FTDI cable attached to testing computer | Device connected notification message appears on testing computer | Device connected notification message appears |  |  |  |
| 1.08 | Open arduino ide by clicking icon on the testing computer desktop | Arduino IDE program opens | Arduino IDE program opened |  |  |  |
| 1.09 | Minimize the Arduino IDE program window to show the desktop on the testing computer | Arduino IDE program window minimizes | Arduino IDE program minimized |  |  |  |
| 1.10 | Navigate to WifiTest folder to reveal WifiTest.ino file | WifiTest.ino file located in WifiTest folder | WifiTest.ino located |  |  |  |
| 1.11 | Double click on WifiTest.ino to open in Arduino IDE | Arduino IDE will display the contents of WifiTest.ino | Arduino IDE displays code from WifiTest.ino in the main window and WifiTest.ino filename is displayed at the top of the window. |  |  |  |
| 1.12 | Press and hold the Reset button on the device chip attached to the testing computer | Nothing verifiable will happen | Button held |  |  |  |
| 1.13 | While still pressing the Reset button press and hold the GPIO0 button on the device chip attached to the testing computer | The red LED will light up and stay lit | The red LED lit up and remained lit |  |  |  |
| 1.14 | Let go of the reset button while GPIO0 button still held | The blue LED will blink | The blue LED blinked |  |  |  |
| 1.15 | Let go of the GPIO0 button | The red LED light will dim | The red LED light dimmed |  |  |  |
| 1.16 | Move back to the Arduino IDE and click on the circle with an arrow pointing to the right to upload the program to the device. | Arduino IDE will display upload progress info until upload complete. | Arduino IDE displayed upload information until upload complete. |  |  |  |
| 1.17 | In the Arduino IDE toolbar, from the tools menu, select "Serial Monitor" to show chip output | Arduino IDE will open a new window named after the connected port ex. COM4 | New window opened |  |  |  |
| 1.18 | Observe serial monitor for device output | Message will be sent saying "This is a test of the CC3000 module! If you can read this, its working :)" | Saw described message | 1.0 | x |  |
| 1.19 | Close Serial Monitor window | Serial Monitor window closes | Serial monitor window closed |  |  |  |
| 1.20 | Start test server on laptop |  |  |  |  |  |
| 1.21 | TCPServerTest -> TCPServerTest.ino |  |  |  |  |  |
| 1.22 | Repeat steps to program chip and open monitor |  |  |  |  |  |
| 1.23 | Observe test server for traffic sent from device | Traffic contains TCP packets with location information (JSON format) | No location information sent | 2.0 |  | x |
| 1.24 | Open Android Studio |  |  |  |  |  |
| 1.25 | Run build of program |  |  |  |  |  |
| 1.26 | Observe test server for traffic sent from application | Traffic contains TCP packets with heartbeat information from application | Application traffic sent | 3.0 | x |  |
| 1.27 | Measure 3ft in the air | Measurement will be accurate | Measurement is 3ft in the air |  |  |  |
| 1.28 | Hold device at measured point and drop | Device falls 3ft without damage | Device fell 3ft without damage |  |  |  |
| 1.29 | Device powers on | Device powers on | Device powered on | 21.0 | x |  |
| 1.30 | Measure 8oz water into cup | Cup filled with 8oz water | Cup filled with 8oz water |  |  |  |
| 1.31 | Pour water onto device | Device will stay powered and connected | Device did NOT stay powered and connected | 20.0 |  | x |
| 1.32 | Preheat elevated temperature testing device (ETTD) to threshold temperature of 150 degrees Farenheit | ETTD reaches designated 150 degree Farenheit state | ETTD reached 150 degrees Farenheit. |  |  |  |
| 1.33 | Insert device into ETTD | Device fully enclosed into ETTD | Device in ETTD |  |  |  |
| 1.34 | Connect to Device | Device connects | Battery ceased operation | 19.0 |  | x |
| 1.35 | Remove Device from ETTD | Device removed from ETTD | Device removed from ETTD |  |  |  |
| 1.36 | Connect to Device | Device connects | Device did NOT stay powered and connected |  |  |  |
| 1.37 | Pre-cool reduced temperature testing device (RTTD) to threshold temperature of 32 degrees Farenheit | RTTD reaches designated 32 degree Farenheit state | RTTD reached 32 degrees Farenheit |  |  |  |
| 1.38 | Insert device into RTTD | Device fully enclosed into RTTD | Device in RTTD |  |  |  |
| 1.39 | Connect to Device | Device connects | Device connected | 18.0 | x |  |
| 1.40 | Remove device from RTTD | Device removed from RTTD | Device removed from RTTD |  |  |  |
| 1.41 | Connect to Device | Device connects | Device connected |  |  |  |
| 1.42 | Collect samples of SPI standard plastics conforming to A-3, B-1, B-2, B-3, C-1, C-2, C-3 | Samples will be available for testing purposes | Samples not available for testing |  |  |  |
| 1.43 | Attach Device by Velcro pad to each sample from 1.42 | Device attaches to each sample | Samples not available for testing | 4.0 |  | x |

## Mobile Application Tests

Our mobile application testing proceeded as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Step | Action | Expected Output | Result | Requirement(s) | Met | Unmet |
| 2.00 | Application Tests |  |  |  |  |  |
| 2.01 | Open application by selecting the Tracker application icon | Tracker application will open to login dialogue | Tracker application opened to login dialogue |  |  |  |
| 2.02 | Select sign in with email on the login screen | Email sign-in dialogue opens | Email sign-in dialogue opened |  |  |  |
| 2.03 | Enter a new email address | Sign-up dialogue opens | Sign-up dialogue opened |  |  |  |
| 2.04 | Enter Name credentials and password | Entered name credentials and password, be returned to log-in dialogue | Credentials accepted and returned to log-in dialogue |  |  |  |
| 2.05 | Select sign in with email on the login screen | Email sign-in dialogue opens | Email sign-in dialogue opened |  |  |  |
| 2.06 | Enter previously used email | Welcome back dialogue asking for password to appear | Welcome back dialogue asking for password appeared | 14.0 | x |  |
| 2.07 | Enter previously entered password | Password is accepted and user is directed to application navigation home | Password entered and user was forwarded to a blank screen | 6.0 |  | x |
| 2.08 | Navigate to device location by clicking the application icon | List of registered devices appears showing registered devices and locations | Blank screen |  |  |  |
| 2.09 | Select a device to see the specific location/metrics for that device | Map will filter to the selected device and metrics registered to the device will be displayed | Blank screen | 12.0 |  | x |
| 2.10 | Navigate to the configure alerts feature of the application | List of upcoming device alerts will be displayed | Blank screen |  |  |  |
| 2.11 | Set up Phonic handheld audio analyzer according to instructions | Phonic Handheld audio device will start tracking nearby sounds | Phonic Handheld audio device is tracking sounds |  |  |  |
| 2.12 | Select icon to add an alert | Alert dialogue will appear | Blank screen |  |  |  |
| 2.13 | Select date and time, and device to bind the alert to | Nofication message that alert has been created | Blank screen |  |  |  |
| 2.14 | At specified date and time, phone alert will sound, and selected Tracker LED will blink | At specified date and time, phone alert will sound, and selected Tracker LED will blink | Blank screen | 9.0, 11.0 |  | x |
| 2.15 | Alarm from phone will emit sound of at least 60dB | Audio analyzer will display 60dB or more | Since the application wrapper was unavailable, we set the alarm function on the phone manually. Audio analyzer displayed 63.1dB | 10.0 | x |  |
| 2.16 | Navigate to the registered devices by clicking the application icon | Registered list of devices appears | Blank screen |  |  |  |
| 2.17 | Select a device to edit | Meta-data for the specific device appears | Blank screen |  |  |  |
| 2.18 | Change the displayed name of the device to a name of your choosing and save | Device display name will update | Blank screen | 13.0 |  | x |
| 2.19 | Navigate to network connection information in the app by clicking the application icon | WiFi network information will appear | Blank screen |  |  |  |
| 2.20 | Select add a network | Network configuration dialogue will appear | Blank screen |  |  |  |
| 2.21 | Insert network credentials for the trackers to connect to in the dialogue and save | Network information will be stored in the database for retrieval by the trackers to connect | Blank screen | 15.0 |  | x |
| 2.22 | Let battery for a Tracker drain to under 20% remaining | Battery drained to under 20% | Battery drained to under 20% |  |  |  |
| 2.23 | Application detects low battery | Application detects low battery | Blank screen |  |  |  |
| 2.24 | Application emails user an email regarding battery replacement | Email appears in the mailbox of the registered user with a battery warning | Blank screen | 8.0 |  | x |

## Results

Following our battery of tests, we found the final product to be severely lacking in functionality. Most of the requirements that we failed to meet were directly impacted by the lack of data connection and features programmed into the chip as well as a lack of platform to view the data in the application. This is a result of lack of communication between team members, a lack of resolution of concrete duties, and a lack of understanding of the scope of what was required for the project. Some of these functional pieces started to come together near the end of the project but the realization came too little, too late to save the project.