Test Plan

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CORE COMMUNICATION AND ALERTS

This test will cover the following requirements matrix items:

- #1 - Devices communicate with base station.
- #2 - Base station communicates with MQTT server.
- #12 - Historical data logged on base station SD card.
- #13 - Base station can send email warnings and alerts to users when received by devices.

Items required to complete the test

- Base station will ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- Node controller with cat5 or 6 cable.
- Computer running Visual Studio Code with Platform IO extension and MQTTX.

- Access to the alert email account specified in the base station configuration.
- USB-UART converter with USB cable and appropriate jumper cables to connect to base station.
- Access to Project FishWorks GitHub repositories.

Test Setup

1. Power on the base station and ensure that it is connected to WiFi following on-screen prompts as necessary.
2. Clone the CoreCommunicationTestNode firmware repository from GitHub and open it in Visual Studio Code and Platform IO.
3. Start the MQTTX application and connect to the same MQTT broker as the base station.
4. Connect the USB to UART converter to node controller via the GPIO headers (RX to TX, TX to RX, GND to GND) and connect the converter's USB to the computer.
5. Use the "monitor" command in Platform IO to connect to the USB to UART converter and monitor the serial output of the node controller.
6. Plug the node controller into the base station using the cat5/6while holding down the "boot" button down on the node controller.
7. Ensure that the serial from base station shows "waiting for download".
8. Use the "upload and monitor" function in Platform IO to upload the base station CoreCommunicationTestNode firmware.

Test Execution

Once started the test program running on the node controller will perform the following actions:

1. Send 50 messages to the base station in quick succession with the data payload counting from 0 to 50(0x00 to 0x32).
2. Pause for a few seconds.
3. Send 10 messages per second for 10 seconds to the base station with the data payload counting from 0 to 100(0x00 to 0x64).
4. Pause for a few seconds
5. Send an alert message to the base station to trigger it to send an email alert.

To run the test:

- Switch the USB to UART converter to monitoring the base station using the same connection as for the node controller.
- While monitoring the serial output from the base station and with the MQTTX application running and connected to the broker, restart the node controller to start the test program. Start a timer when the base station indicates that it has received an alert message from a device. Stop this timer once the email alert has been received to the configured email address.
- Once the test program has completed. Power off the base station and remove the SD card.
- View the contents of the SD card using a computer.
- Open the .csv corresponding with the data and hour that the test was performed.

- **Requirements matrix item #1** (Devices communicate with base station) is met if all messages from actions 1 and 3 are received by the base station with no error messages on the serial output. Verify this by ensuring data received to the base station (printed to the serial output) include all numbers in order from 0x00 to 0x32 for the first test then all numbers in order from 0x00 to 0x64 for the second test.

- **Requirements matrix item #2** (Base station communicates with MQTT server) is met if all messages are received to MQTT broker. Verify this by ensuring data received to the MQTT broker (viewed using the MQTTX application) includes all numbers in order from 0x00 to 0x32 for the first test then all numbers in order from 0x00 to 0x64 for the second test in the "data" field of the JSON MQTT message payload.

- **Requirements matrix item #13** (Base station can send email warnings and alerts to users when received by devices) is met if the alert email was received to the configured email address within 1 minute of the alert message being received by the base station from the device.

- **Requirements matrix item #12** (Historical data logged on base station SD card) is met if the .csv file shows a log off all messages received by the base station during the test with no missing data or file corruption. Verify this by ensuring data logged to the .csv file includes all numbers in order from 0 to 50 for the first test then all numbers in order from 0 to 100 for the second test.

WEB-APP COMMUNCATION

This test will cover the following requirements matrix items:

- #3 - Web app connects to MQTT server.
- #11 - Web app UI has widgets for all connected devices

Items required to complete the test

- Base station will ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- A manifest that includes the tester hat device with the correct device ID (see user manual for instructions).
- A node controller running the tester hat firmware with cat 5/6 cable to connect to base station.
- Device to connect to web app.

Test setup

- Power on the base station and ensure that it is connected to WiFi following on-screen prompts as necessary.
- Connect the node controller running the test hat firmware to the base station using the cat5/6 cable.
- Open the web app and login.

Test Execution

- Ensure that the app is on the dashboard page.

- **Requirements matrix item #11** (Web app UI has widgets for all connected devices) is met if the tester hat device shows on the dashboard page.

- Navigate to the tester hat device page by clicking the more info button in the tester hat widget.

- **Requirements matrix item #3** (Web app connects to MQTT server) is met if the device shows the correct potentiometer value and button states and changing the LED brightness sliders on the page changes the brightnesses on the tester hat LEDs.

DEVICE –HUMIDITY

This test will cover the following requirement matrix items:

- #4 – Device – Humidity Sensor

Items required to complete the test

- Base station with ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- Node controller with cat5 or 6 cable.
- Device to connect to web app.
- Humidity Sensor

Test Setup

1. Ensure the base station is powered on and connected to the configured WiFi and MQTT server.
2. Connect the humidity sensor to the node controller using appropriate GPIO headers.
3. Open the Web app on a phone or computer that is connected to the same MQTT server as the base station.
4. Ensure that the humidity sensor is reporting data to the web app.

Test Execution

1. Test the humidity sensor by altering the ambient humidity. Blow hot air on it from your mouth to increase humidity and or shine a bright halogen light on it to decrease the humidity.
2. Observe the humidity readings on the web app.
3. Check if the sensor detects changes in humidity within the defined range (+/- 2%).
4. Ensure that the web app correctly reflects the humidity changes and logs them without any delays.
5. Repeat the test multiple times, checking for consistency in results.
6. The test passes if the humidity sensor detects changes within the specified range and logs the data correctly in the web app without missing updates.

DEVICE – AIR TEMPERATURE

This test will cover the following requirement matrix items:

- #5 - Device – Air Temperature Sensor

Items required to complete the test

- Base station with ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- Temperature humidity device with cat5 or 6 cable.
- Device to connect to web app.

Test Setup

1. Ensure the base station is powered on and connected to WiFi and the MQTT server.
2. Connect the temperature humidity device using the cat 5/6 cable.
3. Ensure the web app is connected and displays data from the air temperature sensor.

Test Execution

1. Use your hand to gently hold the air temperature sensor to increase its temperature.
2. Observe the temperature change in the web app.
3. Check if the sensor detects changes in air temperature within the defined range $(+/-0.2°c)$.
4. Make sure the web app reflects these changes in real-time.
5. Allow the sensor to cool down naturally and verify the readings decrease accordingly.
6. Repeat this process several times, ensuring consistent results each time.

7. The test passes if the sensor responds to changes within the defined range and the web app accurately displays the data in real-time without any errors or delays

DEVICE – TANK TEMPERATURE

This test will cover the following requirement matrix items:

- #6 – Device – Water Temperature Sensor

Items required to complete the test

- Base station with ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- Temperature humidity device with cat5 or 6 cable.
- Device to connect to web app.

Test Setup

1. Power on the base station and ensure it is connected to WiFi and the MQTT server.
2. Connect the temperature humidity device using the cat 5/6 cable.
3. Prepare a water tank or container filled with water at room temperature (within the range of $18 - 23°C$).
4. Ensure the web app is connected and displays live data from the water temperature sensor.

Test Execution

1. Hold the water temperature sensor in your hand or place it in warm water to simulate an increase in water temperature.
2. Monitor the temperature readings in the web app.

3. Ensure that the sensor detects changes within the specified range $(+/-0.5°C)$.
4. After the sensor adjusts to the new temperature, allow it to cool or return to the tanks base line temperature.
5. Ensure the readings adjust accordingly, both increasing and decreasing within the specified range.
6. Repeat the process to verify the consistency of the readings.
7. The test passes if the sensor detects water temperature changes within the correct range and logs the data in the web app without any errors.

DEVICE – SUMP TEMPERATURE

This test will cover the following requirement matrix items:

- #6 – Device – Sump tank Water Temperature Sensor

Items required to complete the test

- Base station with ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- Temperature humidity device with cat5 or 6 cable.
- Device to connect to web app.

Test Setup

1. Power on the base station and ensure it is connected to WiFi and the MQTT server.
2. Connect the temperature humidity device using the cat 5/6 cable.
3. Prepare a water tank or container filled with water at room temperature (within the range of

4. Ensure the web app is connected and displays live data from the water temperature sensor.

Test Execution

1. Hold the water temperature sensor in your hand or place it in warm water to simulate an increase in water temperature.
2. Monitor the temperature readings in the web app.
3. Ensure that the sensor detects changes within the specified range
4. After the sensor adjusts to the new temperature, allow it to cool or return to the tanks base line temperature.
5. Ensure the readings adjust accordingly, both increasing and decreasing within the specified range.
6. Repeat the process to verify the consistency of the readings.
7. The test passes if the sensor detects water temperature changes within the correct range and logs the data in the web app without any errors.

DEVICE – AC OUTLET CONTROL

This test will cover the following requirement matrix items:

- #7 – Device – AC Outlet Control

Items required to complete the test

- Base station with ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- AC outlet control device.

- Device to connect to web app.

Test Setup

1. Ensure the base station is powered on and connected to WiFi and the MQTT server.
2. Connect the AC outlet control device to the base station using the cat 5/6 wire.
3. Ensure that the web app is connected to the MQTT server and can access the AC outlet control.

Test Execution

1. Open the web app and send a command to turn the AC outlet on.
2. Physically verify that the AC outlet powers on and note and changes in the web app's outlet status.
3. Send a command via the web app to turn the AC outlet off.
4. Physically verify that the AC outlet powers off and ensure the outlet status is updated in the web app.
5. Simulate a global alert (e.g. high temp or leak) and verify that the AC outlet responds as programmed.
6. Test for responsiveness and speed, ensuring that commands are executed within a reasonable time frame
7. The test passes if the AC outlets turn on/off in response to commands from the web app and respond to global alerts correctly.

DEVICE – LEAK DETECTION

This test will cover the following requirement matrix items:

- #8 – Device – Leak Detection

Items required to complete the test

- Base station with ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- Leak Sensor device with cat 5/6 wire.
- Device to connect to web app.

Test Setup

Put leak sensor on table in dish to contain water

1. Ensure base station is powered on and connected to WiFi and the MQTT server.
2. Connected the leak detection device to the base station using the cat 5/6 wire.
3. Place the leak detection sensor in a shallow dish or container to contain the spill
4. Open the web app to monitor the sensor in real-time.

Test Execution

Spill water on leak sensor, wait for alert from web app to tell us its leaking and maybe shut things down depending on other settings.

1. Spill a small amount of water near or on the leak detection sensor.
2. Wait for the system to detect the leak and trigger an alarm state.
3. Monitor the web app to see if it receives an alert about the leak within 10 seconds of detection.

4. Verify that the system triggers the buzzer and sets the device into the alarm state, as expected.
5. Test multiple spills in different positions around the sensor to ensure reliable detection.
6. The test passes if the leak sensor detects water within the expected time frame, triggers the Alarm state and buzzer, and sends alerts to the web app.

DEVICE – PH SENSOR

This test will cover the following requirement matrix items:

- #9 – Device – PH Sensor

Items required to complete the test

- Base station with ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- PH sensor device with cat 5/6 wire.
- Device to connect to web app.
- pH Sensor

Test Setup

1. Ensure the base station is powered on and connected to WiFi and MQTT server.
2. Connect eh pH sensor device to the base station using the cat 5/6 wire.
3. Prepare the pH sensor's calibration solution based on the required levels for the environment.
4. Ensure the web app is connected and displays data from the pH sensor.

Test Execution

1. Place the pH sensor into the calibration solution and monitor the readings in the web app.
2. Verify that the sensor detects the correct pH level for the chosen calibration solution.
3. Repeat the test using different calibration solutions with varying pH levels to check for accuracy across the range.
4. Log the results and ensure that the pH values are accurately reflected in the web app.
5. The test passes if the pH sensor correctly detects the pH levels in all tested solutions and displays them accurately in the web app.

DEVICE – LED LIGHTING CONTROL

This test will cover the following requirement matrix items:

- #10 – Device – LED Lighting Control

Items required to complete the test

- Base station with ac-dc power supply that has been configured with a WiFi and MQTT connection and alert email account (see user manual for procedure).
- Lighting control device with cat5 or 6 cable.
- Phone to connect to web application

Test Setup

1. Ensure the base station is powered on and connected to WiFi and the MQTT server.
2. Connect the LED lighting control device to the base station using the cat 5/6 wire.
3. Open the web app and login.

Test Execution

1. Use the web app to change the LED lighting brightness settings (increase/decrease).

2. Observe the lights and verify that they dim or brighten according to the commands from the web app.
3. Turn the LED lights on and off using the web app and confirm that the lights respond accordingly.
4. Repeat these steps multiple times to ensure consistent operation.
5. The test passes if the lights respond to brightness adjustments and the on/off commands work as expected.

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