Integration Testing

Hardware Testing

Test Case ID	HWT-01
Objective	To ensure that the camera is securely mounted on the robotic arm and that the camera's power and data cables perform reliably at all operational positions of the FarmBot.
Preconditions	• The camera and its mounting bracket are ready and interfaced with the robotic arm. • Custom extended power and data cables are connected to the camera. • The FarmBot's auxiliary power interface switch is turned on and set to maximum output.
Test Steps	1. Mount the camera onto the robotic arm using the 3D-printed decorative fixtures to secure it in place. 2. Connect the custom extended power and data cables from the camera to the appropriate interfaces on the FarmBot and the Raspberry Pi. 3. Perform a power test: Turn on the power for both the FarmBot and the camera, and check if the camera powers up normally. 4. Activate the camera through the Raspberry Pi’s interface and conduct basic functional tests, such as image capture. 5. Move the robotic arm to several different positions within its range of operation, repeating the image capture test at each position to check if the power and data connections remain stable. 6. Observe and record the image quality at each position to confirm there are no disruptions in power or data transmission.
Expected Result	• The camera should be securely mounted on the robotic arm without any wobbling. • The camera should power up and capture images correctly at all operational positions, with the power and data cables providing a stable connection throughout the movements of the mechanical arm. • Image quality should be consistent across all test positions, without any noticeable interference or interruptions.

Test Case ID	HWT-02
Objective	To verify the connectivity and data handling between the camera and the Raspberry Pi, ensuring that the data captured by the camera is correctly recognized and preliminarily processed by the Raspberry Pi.
Preconditions	• The camera is correctly connected to the Raspberry Pi. • The Raspberry Pi has the necessary software and scripts installed to receive and process data from the camera. • All equipment is powered on and in standby mode.
Test Steps	1. Confirm that the physical connection between the camera and the Raspberry Pi is secure. 2. Boot the Raspberry Pi and run the initialization script to start data reception.

	3. Begin transmitting data from the camera and monitor the data reception on the Raspberry Pi's software. 4. Check that the Raspberry Pi’s software can correctly parse the camera data and perform preliminary data formatting. 5. Record the status of the processed data to confirm that the data quality meets expectations.
Expected Result	• The connection between the camera and the Raspberry Pi is stable and correct. • The Raspberry Pi correctly identifies and receives data from the camera. • Data is appropriately processed on the Raspberry Pi, meeting the requirements for transmission and display.

Software Testing

Test Case ID	SWT-01
Objective	To verify that the data transmission from the Raspberry Pi to the server is secure and efficient, and to ensure that the server's web application correctly displays the processed data.
Preconditions	• The Raspberry Pi has completed data processing and is ready for transmission. • The server is configured to receive data and display it through the web application. • A stable network connection has been established.
Test Steps	1. Start the FRP (Fast Reverse Proxy) script to initiate data transmission from the Raspberry Pi to the server. 2. Monitor the status of the data transmission across the network, checking for any data loss or delays. 3. On the server side, verify that the data is correctly received and stored. 4. Access the received data through the server’s web application and check if the data is displayed correctly. 5. Perform interactive operations on the web application to test its responsiveness and data updating capabilities.
Expected Result	• The data transmission from the Raspberry Pi to the server is fast and error-free. • The server processes and displays the data from the Raspberry Pi correctly. • The web application accurately displays the data, and user interactions are smooth with no noticeable response delays.

Test Case ID	SWT-02
Objective	To successfully set up the FarmBot web app on our custom server and ensure it can operate in an offline state (without connecting to FarmBot). Additionally, to update the Raspberry Pi's connection script to transmit camera data to our server, integrating this data into a new tag within the web app. This tag will allow users to access thermal imaging data, including real-time thermal imaging, manual capture and save of thermal images, and conversion of saved thermal images into data matrices for analysis and download.
Preconditions	• The FarmBot web app is installed and configured on our custom server. • The Raspberry Pi and the camera are adequately powered and connected.

	• The updated connection script is deployed on the Raspberry Pi. • The server is set up to receive and process data from the Raspberry Pi.
Test Steps	1. **Setup and Offline Operation:** ◦ Start the FarmBot web app on our custom server in offline mode (without connecting to FarmBot). ◦ Verify that the web app operates correctly in this offline state. 2. **Update and Data Transmission:** ◦ Deploy the updated connection script on the Raspberry Pi. ◦ Start the script and confirm it successfully transmits camera data to the server. 3. **Web App Integration:** ◦ On the server, integrate the received thermal imaging data into a new tag within the web app. ◦ Ensure users can click this tag to access thermal imaging data. 4. **Thermal Imaging Functionality:** ◦ Verify real-time thermal imaging display in the web app. ◦ Implement and test a button for users to manually capture and save thermal images. ◦ Enable conversion of saved thermal images into data matrices and provide a download option for these matrices. 5. **Validation:** ◦ Ensure the web app correctly displays real-time thermal images. ◦ Confirm users can capture, save, and download thermal images as described. ◦ Verify the conversion and download functionality for data matrices derived from thermal images.
Expected Result	• The FarmBot web app runs successfully in offline mode on our custom server. • The updated connection script on the Raspberry Pi transmits camera data to the server without issues. • The web app integrates thermal imaging data into a new tag, allowing users to access this data. • The web app supports real-time thermal imaging, manual capture and save of images, and conversion of images to data matrices for download. • All functionalities perform reliably, with the web app providing accurate thermal imaging data and a seamless user experience.

Final Integration Testing

Test Case ID	INT-01
Objective	To validate that the thermal imaging data captured by the camera is accurately transmitted to the Raspberry Pi, processed, and then displayed correctly on the remote server's web application.
Preconditions	• The thermal imaging camera is properly connected to the Raspberry Pi. • The Raspberry Pi is configured to receive data from the camera. • The server is set up for internal network penetration and configured to receive and display data from the Raspberry Pi.

Test Steps	1. **Setup**: Ensure the camera and Raspberry Pi are powered on and correctly connected. Confirm the server web application is accessible. 2. **Data Capture**: Initiate the camera to start capturing real-time thermal imaging. 3. **Data Transmission**: Monitor the system to ensure data is being transmitted from the camera to the Raspberry Pi without errors. 4. **Data Processing**: Check that the Raspberry Pi processes the incoming data correctly. 5. **Data Display**: Access the web application on the server to verify that the thermal imaging data is displayed as expected. Check for any latency or inaccuracies in the display. 6. **Interaction Check**: Perform actions on the web app (e.g., zooming, switching views) to ensure the interface responds correctly and updates the thermal image accordingly.
Expected Result	• The camera successfully captures and transmits thermal imaging data to the Raspberry Pi. • The Raspberry Pi processes and sends the data to the server without any loss or significant delay. • The server displays the thermal images accurately and allows for real-time interaction through the web application interface. • All operations respond promptly and updates are accurate.

Test Case ID	INT-02
Objective	To successfully establish a connection between the FarmBot web app hosted on our own server and the local FarmBot system, allowing for both FarmBot operation and the display of thermal imaging functionality from the camera.
Preconditions	• The Raspberry Pi and the camera are adequately powered and have established a data transmission connection. • The server is correctly receiving image data from the Raspberry Pi. • The FarmBot web app on the server is correctly set up to interact with the FarmBot system, including re-flashing the FarmBot's Raspberry Pi system and updating configurations to our custom server web app.
Test Steps	1. Start the FarmBot and log in to our custom server. Verify if the FarmBot web app establishes a connection with the FarmBot. 2. Once connected, start the FarmBot's auxiliary power to supply power to the Raspberry Pi and the camera. 3. Initiate the data transmission script on the Raspberry Pi. 4. On the server side, confirm that the web app correctly receives and stores data. Also, verify the trusted connection with the FarmBot. 5. Attempt to control the FarmBot using our custom web app, moving the robotic arm. 6. Ensure that the thermal imaging data updates in real-time as the robotic arm moves.
Expected Result	• The FarmBot web app on our server successfully establishes a connection with the local FarmBot. • The auxiliary power supplies the Raspberry Pi and the camera correctly. • The data transmission script runs successfully, and the server's web app receives and stores the data without issues. • The web app maintains a trusted connection with the FarmBot.

	• The FarmBot can be controlled via our web app, and the thermal imaging data updates in real-time during the robotic arm's movement.