Team 7: Anti-Squirrel Birdwatch/feeder

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**Hierarchical Test Plan**

*Unit Tests*

- Microcontroller
  - Verify the microcontroller powers on when connected to the power supply.
  - Test pin 3 output voltage levels to confirm proper MOSFET gate control.
  - Confirm the microcontroller can interface with the Time of Flight (ToF) sensor and receive distance measurements.
  - Test the microcontroller's ability to process the camera module image capture commands.

- Power Supply
  - Test power supply outputs 5V consistently under load.
  - Test microcontroller outputs 3.3V consistently under load.
  - Verify battery charging circuit functionality when the bird feeder is connected to an external power source.
- Sensors
  - Test the ToF sensor to ensure it detects objects within its specified range.
  - Verify the ToF sensor produces and interrupt when an object is within its sensing range.
  - Test the load cell to ensure it detects weight changes accurately when different objects are placed on the feeder.
- Actuators
  - Verify the servo for the door actually allows access and closes off when receiving control signals.
  - Test the servo for proper response time (door closes within 1-3 seconds when signaled).
- Camera
  - Test that the camera module captures clear images of objects within 2 feet.
  - Confirm the camera transfers images to the microcontroller for processing.

*Verification Tests*

- Sensors
    - Confirm that the ToF sensor accurately detects an animal approaching the feeder within the specified range.
    - Verify that the load sensor distinguishes between a bird (lighter weight) and a squirrel (heavier weight).
- Actuators
    - Test that the door closes when a squirrel (above the weight threshold) is detected.
    - Verify the door remains open for lighter weights (birds).
- System Integration
    - Confirm that the microcontroller processes ToF sensor input and commands the door actuator correctly.
    - Verify that the microcontroller saves an image whenever an animal is detected.

*Validation Tests*

- System Requirements
    - Confirm that the device closes the door when something/one is detected.
    - Validate that the system captures and stores images when an animal is near the feeder.
    - Test that the system operates autonomously without user intervention for 24 hours.
    - Ensure that the feeder does not drain the battery under normal operation for at least 48 hours.
    - Validate that the bird feeder functions correctly in outdoor environmental conditions.

**Matrix Test 1 (for varying parameters)**

| | | | |
|---|---|---|---|
| **Test Author** | | | |
| **Test Case Name:** | Load cell evaluation. | **Test ID #:** | A001 |
| **Description:** | Evaluate the load cells' response to known weights. The purpose of this test is to evaluate the sensor's basic functionality and accuracy. | **Type:** | ☑ white box<br>☐ black box<br>☐ _____ |
| **Tester Information** | | | |
| **Name of Tester:** | Test Engineer #56567345675600001 | **Date:** | 12/7/2024 |
| **HW/SW Version:** | Load Cell Test Program. | **Time:** | 16:30 |
| **Setup:** | Load cell should be fixed to a mount. The AFE/ADC daughter board should have the sensor leads connected to its inputs. The AFE/ADC daughter board's I2C and power pins should be connected to the MCU's I2C and power pins. Three weights under 1kg, preferably evenly spread from 0 to 1 kg with weight #1 being the lightest and weight #3 the heaviest. | | |

| STEP | INPUTS | EXPECTED OUTPUTS | PASS | FAIL | N/A | Comments |
|---|---|---|---|---|---|---|
| 1 | Power on test setup | MCS's power indicator led will be illuminated. | | | | |
| 2 | Flash MCU with Load Cell Test Program | Programmer should return no errors and a successful flash. | | | | |
| 3 | Connect serial monitor to MCU | Monitor should be a sensor value being repeated. | | | | |
| 4 | Record sensor value with no weight | This value should be at or near 0. | | | | |
| 5 | Place weight #1 on load cell | N/A | | | | |
| 6 | Record sensor value with weight #1 | This value should be greater than the reading with no weight. | | | | |
| 7 | Remove weight #1 from load cell | N/A | | | | |
| 8 | Place weight #2 on load cell | N/A | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | Record sensor value with weight #2 | This value should be greater than the reading with weight #1. | | | | |
| 10 | Remove weight #2 from load cell | N/A | | | | |
| 11 | Place weight #3 on load cell | N/A | | | | |
| 12 | Record sensor value with weight #3 | This value should be greater than the reading with weight #2. | | | | |
| 13 | Remove weight #3 from load cell | N/A | | | | |
| 14 | Place weight #2 on load cell | N/A | | | | |
| 15 | Record sensor value with weight #2 | This value should be less than the reading with weight #3. | | | | |
| 16 | Remove weight #2 from load cell | N/A | | | | |
| 17 | Place weight #1 on load cell | N/A | | | | |
| 18 | Record sensor value with weight #1 | This value should be less than the reading with weight #2. | | | | |
| 19 | Remove weight #1 from load cell | N/A | | | | |
| 20 | Record sensor value with no weight | This value should be less than the reading with weight #1. | | | | |
| | | | | | | |
| **Overall test result:** | | | | | | |

**Test Case 1**

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|---|---|---|---|---|---|---|
| **Test Author: Nitin Suryadevara** | | | | | | |
| **Test Case Name:** | Power Board Evaluation. | | | | **Test ID #:** | A002 |
| **Description:** | Evaluate the operation of the Solar Power Manager board, ensure that it receives and supplies power to the correct pins, at the correct specification. | | | | **Type:** | ☐ white box<br>☑ black box<br>☐ _____ |
| **Tester Information** | | | | | | |
| **Name of Tester:** | Nitin Suryadevara | | | | **Date:** | 12/8/2024 |
| **HW/SW Version:** | Power Board Test Program | | | | **Time:** | 18:00 |
| **Setup:** | | | | | | |

| **STEP** | **Action** | **Expected Result** | **PASS** | **FAIL** | **N/A** | **Comments** |
|---|---|---|---|---|---|---|
| 1 | Connect Battery to battery input connector (JST) | Cable plugs into connector tightly, no looseness | | | | |
| 2 | Connect solar panel via labeled solar screw terminal, reverse polarity | Onboard REV SOLAR LED it on to indicate reverse polarity | | | | |
| 3 | Connect solar panel via labeled solar screw terminal | Onboard CHG LED is lit while the panel if panel provides power to the board. If a battery is connected, then the battery is charged too. | | | | |
| 4 | Connect USB A male cable to female USB A output port on board, with a load. | Onboard ON LED is lit when the 5V regulated output is being used | | | | USB output can be tested with a USB tester to ensure 5V 1A output. |
| 5 | While board is on, test onboard jumper pins with DMM | 5V pins will read at or near 5V, GND pins as grounded. | | | | |
| | | | | | | |
| **Overall test result:** | | | | | | |