**Test Plan for Interactive Sensor-Activated Light Based on Distance**

**Introduction**

This test plan is designed to thoroughly evaluate an interactive sensor system that activates a light based on the distance of an object or person. The sensor system should be tested for accuracy, reliability, and performance under various conditions.

**Objectives**

* Ensure the sensor activates the light at the correct distance.
* Validate the sensor’s accuracy across different distances.
* Test the sensor’s responsiveness to various speeds of approach.
* Verify the system’s performance in different environmental conditions.
* Check the sensor and light for durability and reliability over extended use.

**Test Environment**

* **Test Location:** Controlled indoor environment, outdoor environment, and varying lighting conditions.
* **Equipment:** Distance measurement tools, speed measurement tools, various objects of different sizes and materials, environmental simulation tools (e.g., heaters, humidifiers, fans).

**Test Scenarios**

1. **Distance Accuracy Test**
   * **Objective:** Verify the sensor accurately activates the light at specified distances.
   * **Method:** Measure and mark distances from 0.5 meters to 10 meters in 0.5-meter increments. Approach the sensor with a standard object and record the activation point.
   * **Pass Criteria:** The light should activate within a tolerance of ±0.1 meters from the specified activation distance.
2. **Response Time Test**
   * **Objective:** Evaluate the sensor’s response time when an object approaches at different speeds.
   * **Method:** Approach the sensor at speeds ranging from 0.1 m/s to 2 m/s. Measure the time taken for the light to activate from the moment the object enters the activation range.
   * **Pass Criteria:** The response time should be consistent and within 0.5 seconds of the expected activation time.
3. **Object Size and Material Test**
   * **Objective:** Ensure the sensor can detect objects of various sizes and materials.
   * **Method:** Use objects of different sizes (small, medium, large) and materials (metal, plastic, wood, fabric). Approach the sensor with each object and observe the activation.
   * **Pass Criteria:** The sensor should consistently activate the light regardless of the object’s size or material.
4. **Environmental Condition Test**
   * **Objective:** Test the sensor’s performance under different environmental conditions.
   * **Method:**
     + **Light Conditions:** Test in complete darkness, normal indoor lighting, and bright sunlight.
   * **Pass Criteria:** The sensor should function correctly and activate the light in all environmental conditions.
5. **Continuous Operation Test**
   * **Objective:** Assess the sensor and light’s durability over extended use.
   * **Method:** Operate the sensor continuously for 48 hours with periodic activations (every 5 minutes). Monitor for any malfunctions or performance degradation.
   * **Pass Criteria:** The sensor and light should operate without failure or significant performance loss over the test period.
6. **False Trigger Test**
   * **Objective:** Determine the sensor’s resistance to false triggers.
   * **Method:** Create scenarios with potential false triggers, such as:
     + Rapid movements near but outside the activation range.
     + Background movements (e.g., moving fans, passing shadows).
     + Multiple objects moving simultaneously.
   * **Pass Criteria:** The sensor should not activate the light in the presence of false triggers.

**Test Execution**

* **Test Schedule:**
  + Distance Accuracy Test: Day 1
  + Response Time Test: Day 2
  + Object Size and Material Test: Day 3
  + Environmental Condition Test: Day 4-5
  + Continuous Operation Test: Day 6-8
  + False Trigger Test: Day 9
* **Personnel:**
  + Test Engineer

**Reporting**

* **Data Recording:** Use a structured template to record the results of each test scenario, including:
  + Date and time of test
  + Environmental conditions
  + Test method and parameters
  + Observations and measured data
  + Pass/Fail status
* **Final Report:** Compile the data into a comprehensive report detailing the test results, any issues encountered, and recommendations for improvement.

**Risk Management**

* **Potential Risks:**
  + Sensor malfunction or failure
  + Inaccurate measurements due to human error
  + Environmental simulation inaccuracies
* **Mitigation Strategies:**
  + Calibrate equipment before each test
  + Use automated data collection tools where possible
  + Conduct preliminary tests to validate environmental simulation tools

**Conclusion**

This test plan aims to rigorously evaluate the interactive sensor system’s performance in activating a light based on distance. By covering a wide range of scenarios and conditions, the plan ensures a comprehensive assessment of the sensor’s accuracy, reliability, and durability.