**Hardware Specifications**

**1. Introduction**

* This document provides detailed hardware specifications for the sensors used in the RESI installation, including EEG, PPG, GSR, and Temperature devices. It covers recommended sampling rates, connectivity options, maintenance guidelines, and safety considerations.

**2. EEG Sensors**

1. **Recommended Device**: OpenBCI Cyton or equivalent 8–16 channel EEG systems.
2. **Sampling Rate**: 250–500 Hz, adjustable based on latency requirements.
3. **Connectivity**: Bluetooth or Wi-Fi. Ensure stable data throughput for real-time feedback (at least 16-bit data resolution).
4. **Mounting**: Use adjustable headsets or electrode caps with conductive gel or dry electrodes depending on user comfort and desired signal quality.
5. **Maintenance**:
   * Clean electrodes thoroughly after each session.
   * Store headsets in protective cases; avoid extreme temperatures and humidity.

**3. PPG Sensors**

1. **Recommended Device**: Grove Heart Rate Earlobe clip sensors with built-in ambient light rejection.
2. **Sampling Rate**: 50–100 Hz is typical for heart rate/HRV analysis.
3. **Connectivity**: Digital or Analog input to Arduino board, connected separately via Wi-Fi; ensure minimal cable movement to reduce motion artifacts.
4. **Maintenance**:
   * Wipe sensor clips with isopropyl alcohol to maintain hygiene.
   * Regularly check cable integrity to avoid motion artifacts.

**4. GSR Sensors**

1. **Recommended Device**: Grove GSR Sensors with Florida Research Instruments snap electrode leads and touch-proof DIN connectors.
2. **Electrode Placement**: Electrode pads are placed around the neck area; near the back of the ears tends to produce the most responsive signal.
3. **Sampling Rate**: 10–50 Hz; higher rates may be useful to catch rapid changes.
4. **Connectivity**: Analog input to separate Arduino board, connected separately via Wi-Fi.
5. **Care**:
   * Clean sensor plates with alcohol swabs between sessions.
   * Encourage participants to clean their neck with a cleansing wipe before use for consistent reading.
6. **Maintenance**:
   * Single-use electrode pads should be replaced per participant.
   * Multi-use electrodes must be cleaned and stored properly to maintain adhesive quality.

**~~5. ECG Sensors~~**

1. **~~Electrode Placement~~**~~: Standard 3-lead or 5-lead configurations around the chest area.~~
2. **~~Sampling Rate~~**~~: 250–500 Hz for clear QRS detection.~~
3. **~~Connectivity~~**~~: Wired or wireless modules~~~~; ensure minimal cable movement to reduce motion artifacts.~~
4. **~~Maintenance~~**~~:~~
   * ~~Single-use electrode pads should be replaced per participant.~~
   * ~~Multi-use electrodes must be cleaned and stored properly to maintain adhesive quality.~~

**6. General Sensor Safety**

* Verify all sensor devices are certified for safe usage on human subjects (CE, FCC, or similar regulatory standards).
* Ensure that participants with known skin sensitivities or allergies use alternative materials when possible (e.g., latex-free adhesives).

**7. Calibration and Troubleshooting**

1. **Baseline Checks**: Have participants rest with closed eyes for a short period to establish baseline readings.
2. **Artifact Management**:
   * Instruct participants to minimize jaw clenching, eye blinking, or excessive movement for more accurate EEG data.
   * Use software filters to reduce line noise (50/60 Hz) and motion artifacts in PPG, GSR, and Temperature signals.
3. **Repair and Replacement**:
   * Keep spare cables, electrodes, and sensor units on site.
   * Check battery levels and connections routinely, especially before large events or multi-hour installations.

**8. Conclusion**

* High-quality hardware and proper maintenance ensure reliable, artifact-free data essential for real-time neurofeedback.
* Combine these specifications with the setup strategies in *Installation\_Environment\_Setup.docx* and the signal-mapping details in *Neurofeedback\_AudioVisual\_Integration.md* to create a cohesive, robust interactive installation.