

PROJECT SPIDEY SENSE

Team Pickle @ MIT Reality Hack 2025 - 23rd - 27th Jan, 2025

Max Chen, Mahdi Edraki, Yashaswi Prasannakumar, Cheyenne Amil, Marie Leung

Hardware Components

1. ESP32

Purpose: Acts as the central microcontroller for the project, enabling communication between the vibration motors and Unity via WiFi.

Justification:

- Chosen for its powerful processing capabilities and built-in WiFi support.
- Its compatibility with Unity makes it ideal for real-time communication and control.

2. DRV8833 Motor Drivers (3 Units)

Purpose: Used to control and power 6 pancake vibration motors.

Justification:

- The ESP32 alone cannot safely handle the current demands of multiple motors.
- Motor drivers enable precise control of the motors through Pulse Width Modulation (PWM) signals, ensuring smooth and responsive vibration patterns.
- They allow for the use of an external 9V battery as the power source, preventing overloading and potential damage to the ESP32.

3. Pancake Vibrating Motors (6 Units)

Purpose: Deliver tactile feedback for the haptic headband.

Justification:

- Preferred over eccentric rotating mass (ERM) motors due to their compact design and lack of external moving parts.
- The absence of exposed oscillating masses reduces the risk of accidental injury and ensures a safer user experience.
- The pancake design provides consistent vibration feedback, enhancing the overall effectiveness of the haptic experience.

4. Micro USB to Breadboard Connectors (2 Units)

Purpose: Simplify the connection between the ESP32 and the custom electronics box.

Justification:

- Allows for a user-friendly interface by enabling quick and hassle-free setup.
- The connectors minimize wiring complexity, reducing potential errors and making the device more robust and reliable.

PROJECT SPIDEY SENSE

Team Pickle @ MIT Reality Hack 2025 - 23rd - 27th Jan, 2025

Max Chen, Mahdi Edraki, Yashaswi Prasannakumar, Cheyenne Amil, Marie Leung

5. Meta Quest 3

Purpose: Provides the virtual reality platform for the project, enabling immersive experiences and integrating real-time haptic feedback with virtual environments.

Justification:

- Meta Quest 3 offers advanced VR capabilities with high-resolution visuals and accurate motion tracking, making it ideal for demonstrating haptic interactions.
- Its open ecosystem allows seamless integration with Unity, enabling efficient development of VR experiences synchronized with the haptic headband.

6. Potentiometer

Purpose: Enables manual control of the vibration intensity of the motors.

Justification:

- Allows users to dynamically adjust the strength of the haptic feedback, providing a customizable and user-friendly experience.
- Ensures adaptability for different use cases and user preferences, enhancing the usability of the device.

Summary of Design Choices

- **Safety:** Pancake vibrating motors were chosen to eliminate external moving parts, ensuring user safety.
- **Reliability:** Motor drivers offload power demands from the ESP32, enhancing system durability.
- **User Convenience:** Micro USB connectors were used for a plug-and-play setup, simplifying the user experience.
- **Performance:**
 - ESP32 for real-time wireless communication and control.
 - Meta Quest 3 for immersive VR integration, offering a synchronized experience between visual cues and haptic feedback.

Software Stack:

- **Technologies**
 - Blender
 - Arduino IDE
 - Unity
 - Solidworks
 - Free CAD
- **Libraries/frameworks**
 - Singularity
 - Meta SDK all in one