

HandWave

A wearable glove system for translating hand movement to audio queues

Project

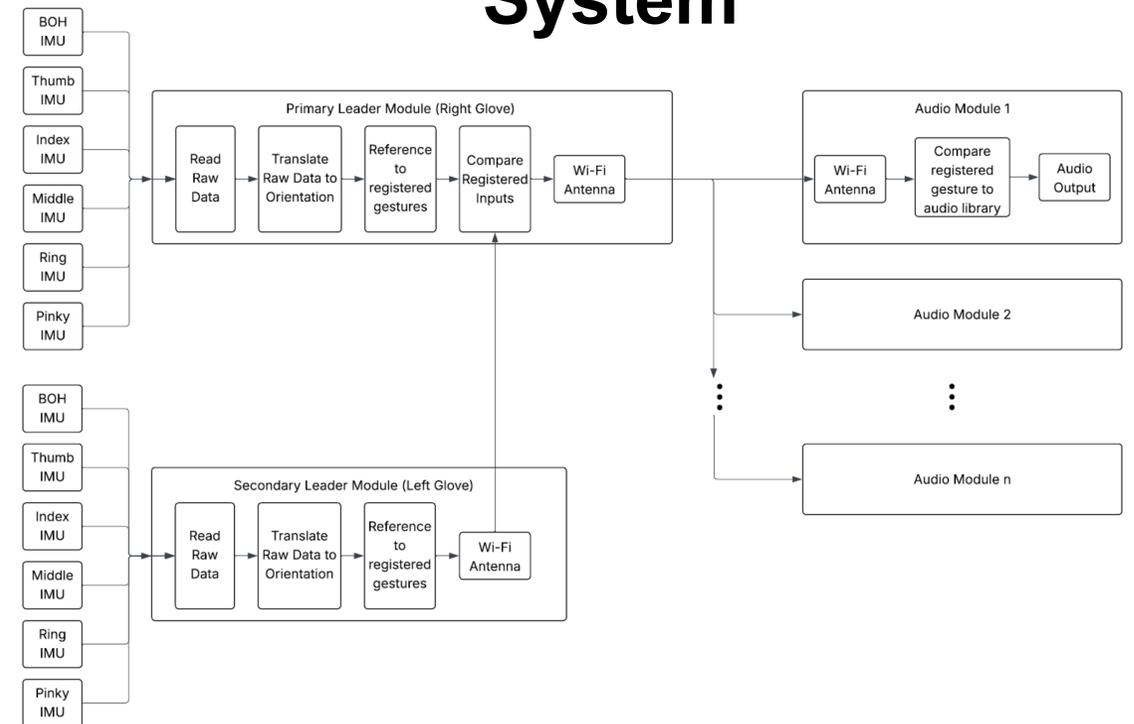
- Capturing 9-axis data (accel, gyro, mag) from 6 IMUs placed on key hand joints
- Translating human hand motion into digital data
- Referencing and translating digital data to a recognized gesture
- Sending the recognized gesture over Bluetooth to a wearable earpiece system that plays the associated audio signal

Applications in tactical situations, sign language translation, VR input, robotics, and motion capture

Methods

- Hardware Input: 6 ICM-20948 IMUs connected via SPI to ESP32S3 microcontrollers
- Six IMUs are sampled through Free-RTOS-based tasking
- Gesture recognition is based on a combination of sensor fusion and sequential analysis
- Communication between microcontrollers is over Bluetooth
- Audio files are stored on RAM on audio microcontroller

System



Conclusion

- Demonstrated end-to-end capture and transformation of hand motion to related audio output
- Accurate sampling, translation, referencing, and transmission
- Interfaced with 12 high-fidelity IMUs, reading 220,800 bits per second
- Built libraries of gesture data in MATLAB to reference against using sequential analysis
- Built a code library to communicate efficiently with the IMUs

Future Usage:

- Expand registered data to include ASL
- Integrate with various programs and hardware (Virtual Reality)