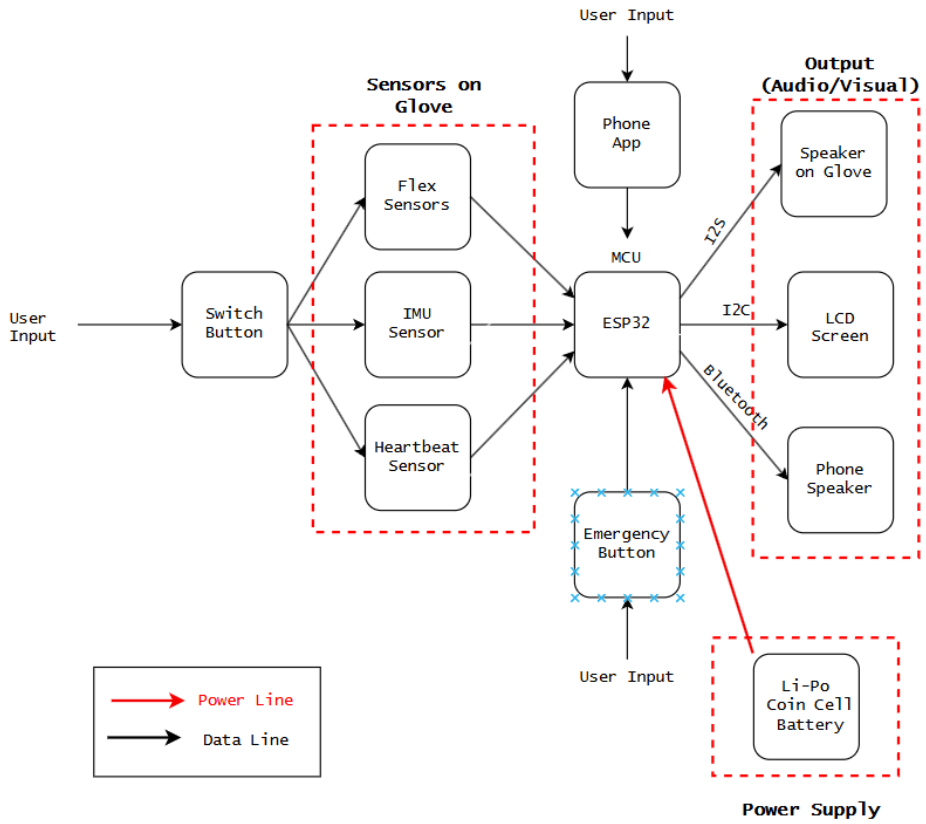
AUSIGN - An AUSLAN Interpreter

Product Functions (Summary List)

1. Detect finger bending positions (sign gestures)
2. Detect hand orientation and motion (gesture context)
3. Detect emergency signals via a panic button
4. Measure heart rate for emotional context
5. Convert gestures into audio messages
6. Display information to the user (feedback)
7. Transmit sensor data wirelessly to a host system (e.g., smartphone)
8. Provide power to the entire glove system

High-Level Block Diagram



Technical Components

1. Microcontroller Unit – ESP32-WROOM-32

- **Manufacturer:** Espressif Systems
- **Justification:**
  - Integrated Bluetooth and Wi-Fi for communication
  - Rich peripheral set (ADC, I2C, UART, PWM) enables interfacing all sensors without external chips
  - 3.3V operation matches sensor logic levels
  - Dev board form factor suitable for breadboarding and prototyping
  - Extensive community support and low cost

2. Flex Sensors – 3" 25kΩ-100kΩ variable resistance

- **Manufacturer:** Adafruit

- **Justification:**
    - Widely used, robust component specifically designed for detecting single-axis bending, perfect for finger gesture recognition.
    - Resistance changes from ~25kΩ (flat) to ~100kΩ (fully bent), easily measurable using a voltage divider circuit with ESP32's ADC.
    - Readily available

3. IMU Sensor – MPU6050

- **Justification:**
    - Integrates 3-axis accelerometer and gyroscope
    - I2C interface supported directly by ESP32
    - Compact and well-documented, with sample code and libraries
    - Low power consumption, ideal for wearables

4. Heartbeat Sensor – MAX30102

- **Manufacturer:** TZT
- **Justification:**
    - Optical pulse oximeter and heart-rate sensor in one package
    - Integrated LED driver and ADC simplifies design
    - I2C communication and low power use align well with ESP32

5. Speaker – Mini Speaker 3W, 4Ω, 4cm diameter

- **Manufacturer:** YTDMEN
- **Justification:**
    - Compact and lightweight for glove mounting
    - Suitable for low-power PWM/I2S audio output from ESP32
    - Easily driven with audio amplifier if needed

6. Emergency Push Button - Mini Push Button Switch

- **Manufacturer:** Sparkfun

- **Justification:**
    - Simple digital input to MCU with internal pull-up/down
    - Small tactile form factor suitable for glove

7. LCD Display – Freenove I2C 20×4 LCD Module

- **Manufacturer:** Freenove
- **Justification:**
    - Low power I2C interface with ESP32
    - Provides clear user feedback in compact form
    - Widely supported libraries for display text and icons
    - Reasonably priced and readily available

8. Power Module – TP4056 + 3.7V LiPo Battery + Boost Converter (MT3608)

- **Justification:**
    - TP4056 for USB charging and battery protection
    - LiPo battery offers lightweight portable power
    - MT3608 boost converter supplies stable 5V to speaker and peripherals as needed
    - Cost-effective and widely available modules