**Basic Speech Recognition System for Command-Based Device Control**

**System Design**

**1. Overview**

This system will use an embedded board (like Raspberry Pi) with a microphone to capture voice commands, process them using speech recognition, and control connected devices based on the recognized commands.

**2. Components**

* **Embedded Board**: Raspberry Pi 4 (or similar)
* **Microphone**: USB microphone or onboard audio input
* **Speech Recognition Software**: Python-based (Speech Recognition library)
* **Device Control**: GPIO pins for simple devices or relay modules for higher power devices
* **Optional**: LED indicators for system status

**3. Workflow**

1. Audio input captured via microphone
2. Speech recognition converts audio to text
3. Command parsing identifies action
4. Appropriate device control signal sent
5. Feedback provided (visual/audio)

**Working Demo Setup**

**1. Hardware Setup**

* Connect a microphone to the Raspberry Pi
* Connect an LED to GPIO pin 17 (or modify the code for your specific pin)
* For actual devices, use appropriate relays or control circuits

**2. Software Requirements**

**Install the necessary packages:**

* sudo apt-get update
* sudo apt-get install python3-pip python3-dev
* pip3 install Speech Recognition RPi.GPIO

**3. Operation**

1. **Run the Python script:** python3 speech\_control.py
2. **Speak one of the predefined commands:**

* "turn on the light"
* "light on"
* "turn off the light"
* "light off"
* "switch the light"

1. **The system will control the connected device based on your command**

**Enhancements (Optional)**

1. **Wake Word Detection**: Add a wake word like "computer" before commands
2. **More Devices**: Expand to control multiple devices
3. **Wireless Control**: Add WiFi/Bluetooth for remote commands
4. **Feedback**: Add audio feedback using text-to-speech
5. **Security**: Add voice authentication for sensitive controls

**Troubleshooting**

1. **If microphone isn't detected:**
   * Check connections
   * Verify microphone is selected in audio settings: alsamixer
2. **If commands aren't recognized:**
   * Speak clearly in a quiet environment
   * Adjust microphone gain
   * Add more command variations to the COMMANDS dictionary