Project Report: Speech Recognition-Based Device Control System Using an Embedded Board

Introduction

In today's world, hands-free control of devices is increasingly popular. Speech recognition provides a natural and intuitive way to interact with machines. This project demonstrates a basic **speech recognition system** using an embedded board to control electrical devices through **voice commands**. With this system, users can turn appliances ON or OFF simply by speaking specific keywords like "light on" or "fan off".

Objectives

- To design a **speech-controlled system** using an embedded board.
- To recognize **predefined voice commands** and trigger actions (e.g., turning devices ON/OFF).
- To interface a **relay module** with the embedded system for controlling electrical appliances.

Components Required

Arduino Uno / ESP32 / Raspberry Pi Pico

Voice Recognition Module V3 (or Elechouse)

Relay Module (2 or 4 Channel)

Jumper Wires / Breadboard

Power Supply / USB Cable

Electrical devices (e.g., Bulb, Fan)

System Overview

The system uses a **Voice Recognition Module V3**, trained with custom voice commands. When the user speaks a recognized command, the module sends a signal to the Arduino. The Arduino then processes the input and toggles the state of the device using a relay.

Circuit Design Description

Connections:

- **Voice Recognition Module V3**
  - VCC → 5V
  - GND → GND
  - TX → Arduino Pin 2
  - RX → Arduino Pin 3
- **Relay Module:**
  - IN1, IN2 → Arduino Pins 4 and 5
  - VCC → 5V
  - GND → GND
- Devices (Bulb/Fan) connected to the NO (Normally Open) terminal of relay.

Note: Voice commands must be trained first on the module using the provided software tool.

Arduino Code

```
#include <SoftwareSerial.h>

SoftwareSerial voice(2, 3); // RX, TX

int relay1 = 4;
```

```
int relay2 = 5;

void setup() {
  Serial.begin(9600);
  voice.begin(9600);

  pinMode(relay1, OUTPUT);
  pinMode(relay2, OUTPUT);

  digitalWrite(relay1, HIGH);
  digitalWrite(relay2, HIGH);
}

void loop() {
  if (voice.available()) {
    int command = voice.read();
    Serial.println(command);

    switch (command) {
      case 0: // Light ON
        digitalWrite(relay1, LOW);
        break;

      case 1: // Light OFF
        digitalWrite(relay1, HIGH);
        break;

      case 2: // Fan ON
        digitalWrite(relay2, LOW);
        break;

      case 3: // Fan OFF
        digitalWrite(relay2, HIGH);
        break;
    }
  }
}
```

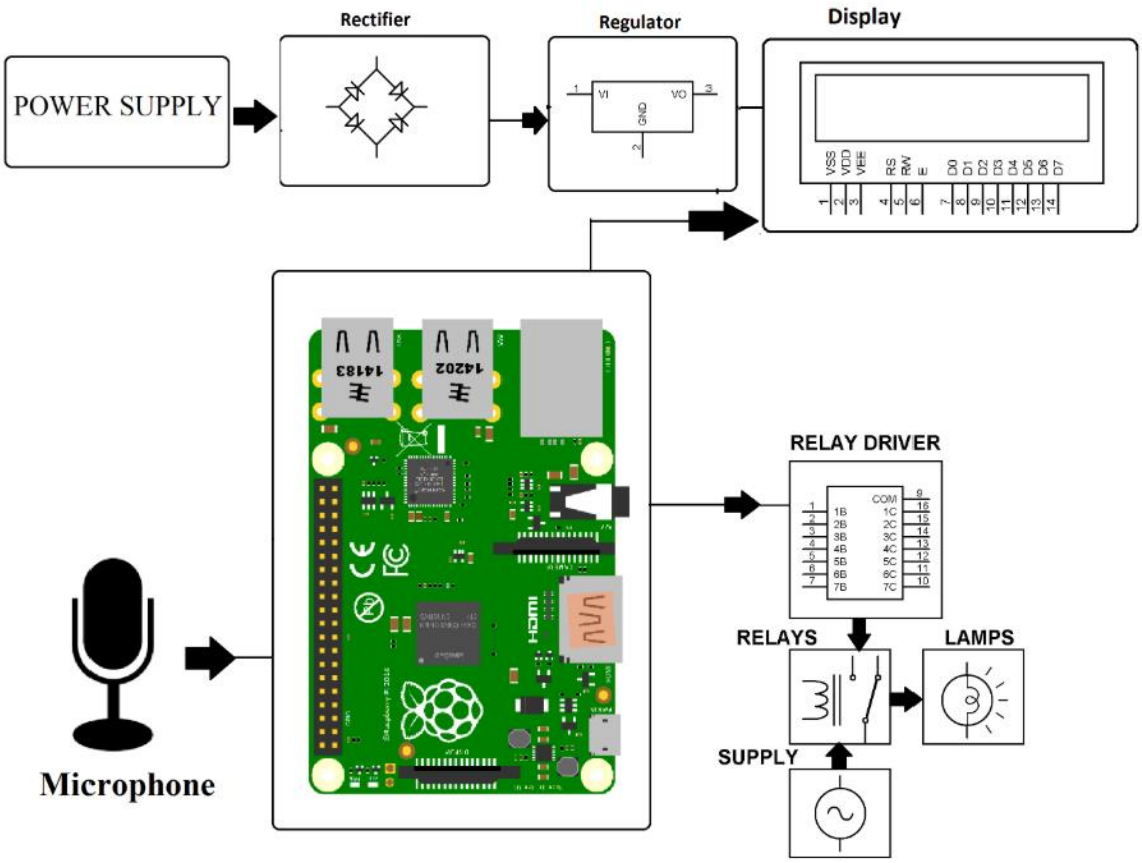
Voice Command Training (Using VR Module V3)

Use the **Voice Recognition Module software** to record custom commands:

1. Connect module to PC using USB-to-Serial adapter.
2. Open the Voice Recognition PC software.
3. Train commands like:
    - **ID 0:** "Light on"
    - **ID 1:** "Light off"
    - **ID 2:** "Fan on"
    - **ID 3:** "Fan off"
4. Save the commands to Group 1 or Group 2 as needed.

Output Demonstration

- When the user says **"Light on"**, the system turns ON the bulb.
- Saying **"Fan off"** will turn OFF the fan.
- The action can be observed via the device connected to the relay switching ON or OFF.



Conclusion

This project presents a simple yet effective **voice-controlled automation system** using an embedded microcontroller and a voice recognition module. It demonstrates a practical application of speech recognition technology in smart homes and embedded systems.