Voice Recognition System Using Raspberry Pi and STM32F401CC

Motivation: This documentation aims to provide a comprehensive guide to building a Voice Recognition System using Raspberry Pi and STM32F401CC. The project's motivation is to create an affordable and versatile voice-controlled system for various applications.

Problem Statement: Many individuals and organizations are seeking cost-effective voice recognition solutions for improve ADAS systems, accessibility, and other applications. This project addresses the need for an open-source, DIY voice recognition system.

System Overview: The Voice Recognition System utilizes the Raspberry Pi as the core processing unit and STM32F401CC as a microcontroller for interfacing with peripherals. It can recognize and execute voice commands to control various devices and applications.

Hardware Requirements:

1- Raspberry Pi
2- STM32F401CC Microcontroller
3- USB Microphones
4- SD card
5- Jumper wires
6- Power Adapter

Hardware Connections:

1- Raspberry Pi GPIO to STM32F401CC GPIO connections over UART
2- Microphone connections to Raspberry Pi USB ports
3- Speaker connection to Raspberry Pi audio output
4- Power supply connections

Power Supply: The system is powered by a 5V/2A power adapter connected to the Raspberry Pi's micro USB port. Ensure a stable power supply to avoid system instability.

Software Setup

Operating System: The Raspberry Pi runs Raspbian OS. Detailed instructions on downloading, installing, and configuring the OS are available on the Raspberry Pi Foundation's official website.

Programming Languages and Tools:
1- Python for Raspberry Pi
2- C for STM32F401CC

Voice Recognition Algorithm

Voice Recognition Algorithm: The system employs a combination of keyword spotting and machine learning-based speech recognition. It uses a pre-trained neural network model to detect specific keywords and phrases.

Code Implementation
Code Structure: The project's code is organized into three main components: Raspberry Pi application, STM32F401CC firmware, and a voice recognition library. Each component handles specific tasks.

Code Walkthrough: In the Raspberry Pi application, the code captures audio input, processes it, and sends recognized commands to the STM32F401CC. The STM32F401CC firmware interfaces with peripherals and executes commands
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Testing

Testing Procedure: To test the system, connect the hardware as described, record voice commands, and verify that the system correctly identifies and executes the commands. A list of sample commands and expected outcomes is provided in the documentation.

Usage Instructions

Step-by-Step Instructions:
1- Assemble hardware components as per the Hardware Setup section.
2- Install the required software and libraries (import GOOGLE speech recognition)
3- Configure the system with your desired voice commands.
4- Run the system, and it's ready to accept voice commands.

Troubleshooting

Common Issues:

1- Server down
2- Unresponsive voice commands
3- Power-related issues
4- UART starvation problem make corruption in data transfer

Conclusion: This documentation provides a comprehensive guide to building a Voice Recognition System using Raspberry Pi and STM32F401CC. By following the steps outlined here, users can create a versatile and cost-effective voice-controlled system for various applications.

Future Improvements: Future enhancements may include multi-language support, advanced machine learning models, and integration with cloud services.
