Speech Recognition ALTERA DE2-70

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Content

- Introduction
- Theory
- Hardware
- Modifications
- Block Diagram
- Results
- Conclusion

Introduction

- Speech Recognition is becoming more popular as technology keeps advancing. Today we have million device products that consumers are interacting at a regular basis.
  - Bluetooth speaker phones have voice command features.
  - Cellular phones that have voice recognition for searching websites, making a call, or sending texts.
  - Modern vehicles that have Microsoft Sync that will search traffic control, weather broadcast, music, directions to particular destination etc.

Theory

- Taking a vocal sound signal via MIC input and have the Audio Coder-Decoder converting from analog to digital signal.
- Acquisition the digital sound signal data into memory and have it stored as a fingerprint data.
- Repeat the Audio Coder-Decoder process for another vocal sound signal. Call this digital data as Recognition and have it stored into a separate memory block.
- Compare the two memory blocks and have it displayed on the DE2-70 board if it's the same or different digital data.

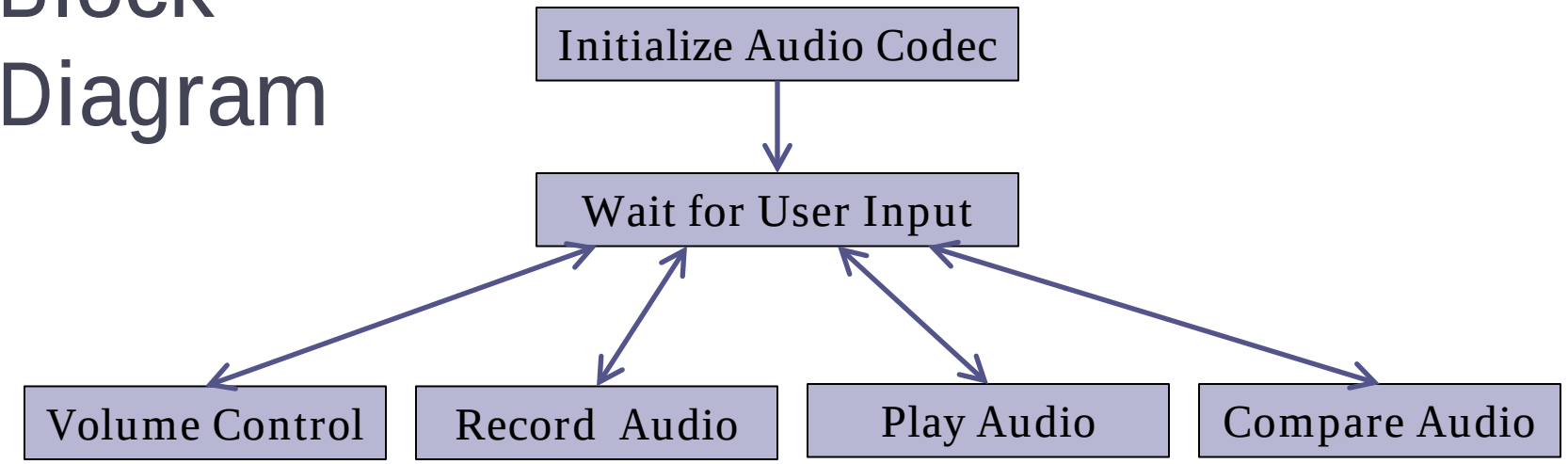
Hardware Implementation

- Wolfson Interface
- I2C Bus Controller
- Sound Fetcher
- Memory Management
- Systems Management

Modifications

- Changed the MIC input data and used Matlab to get the analog data of a wave file.
- Wave file has a right and left channel audio data and changed it to read only one channel for simplicity.
- Shifted the analog data to above 0 value and converted into a 8 bit binary data.
- Captured 16384 samples of the speech waveform and stored the samples into a excel spread sheet.
- Manually stored the 16384 samples into MIF file
- Built a M4K memory block to store in memory and have it output to a VGA connector.
- Finally used an oscilloscope to connect on the VGA outputs and display the speech analog data signals on the screen.

Block Diagram



- **Initialize Audio Codec :**
  - Use of I2C Bus to configure the codec by setting the correct registry parameters to use the mic in and line out at a sampling rate of 8KHz and 16-bit data
- **Volume Control :**
  - Use of I2C Bus to set the line out volume
- **Record Data :**
  - Convert 1-bit serial data from the codec ADC to 16-bit data and save into memory
- **Play Data :**
  - Convert 16-bit data from memory to 1-bit serial data and send to the codec DAC
- **Compare Data:**
  - Not Implemented

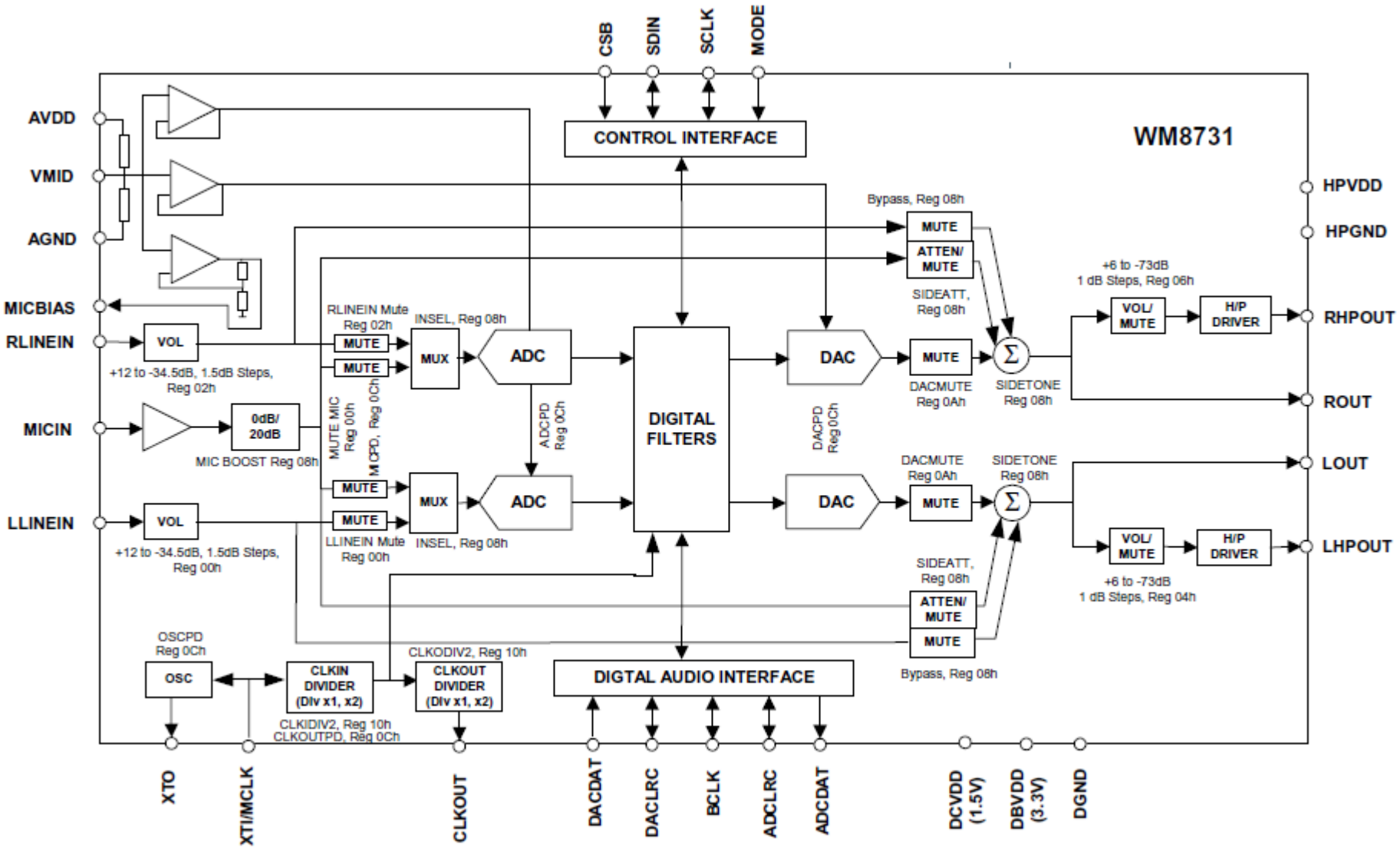


Figure 9 Functional Block Diagram

Results

- **Accomplished:**
  - Finite State Machine controlling the main system
  - Coding the I2C Bus to interface with the Wolfson WM8731 audio CODEC (with some issues)
  - Saving audio to memory and playing it back from memory
  - Saving multiple audio memory blocks ((3) 16,000 word 16-bit data samples)
- **Not Accomplished:**
  - Speech Recognition algorithm

Conclusion

- We were able to use many peripherals on the DE2-70 Development Board:
  - LEDs
  - 7-Segment Display
  - Switches
  - Audio Codec
  - Memory Blocks
- We were also able to use the Altera Signal Tap II Logic Analyzer to debug our code in real time
- Unfortunately we did not have enough time to apply the speech recognition algorithm