

Voice Recorder and Playback using Z8 board

Voice recorder and playback is an embedded product which is implemented using a Z8 microcontroller. Z8 microcontroller has inbuilt A/D converter and D/A converter which are the essentials of this product. An external microphone and a loudspeaker are used to record the sound and playback it respectively.

The analog sound input is given through an analog pin of the microcontroller board and is converted to digital using Analog-to-Digital converter which is an on chip peripheral. The digital data is stored as 10-bit data in the ADC data registers. This 10-bit data is used for the Digital-to-Analog conversion to playback the sound. The Digital-to-Analog conversion is done using Pulse Width Modulation, a feature of the Z8 board, where the digital data is the input to the reload value and determines the width of the output pulse and thus sound is generated at the output pin of the corresponding timer which is used for PWM.

Sigma-delta conversion method is used for the ADC on the Z8 board. Z8 board has a feature to choose an input channel from 12 multiplexed channel as the input of the ADC. An interrupt is generated once the ADC conversion is complete. Z8 evaluation board also has a significant feature of choosing the reference voltage for the ADC, either internal voltage reference or an external voltage reference can be used for the same. Z8 also has the provision of using the DMA-ADC, which is Direct Memory Access controller, which can automatically initiate the data conversion and the transfer from 1 to 12 analog input channels. The ADC works in different modes. Single conversion mode of the ADC is used to obtain the digital data from the analog input. In this mode the conversion takes place only once and after the conversion an interrupt is generated and the ADC shuts down. The digital data is then stored in the ADC data registers, which is 10-bit data. Here, the recording part is finished.

The playback of the sound takes place by converting the digital data into analog data which drives a loudspeaker. The Digital-to-Analog conversion is brought by PWM, which is also an on chip characteristic of the Z8 board. The digital data acts as the input to the PWM, which are the PWM reload values, and determines the width of the output pulse. Using PWM for DAC is an effective technique since PWM method requires only 1 GPIO pins, thus the number of

GPIO pins are not related to the number of bits the DAC unit can support. This gives us the flexibility and we can afford excellent scalability of the DAC unit. The other advantages of using the PWM is that very less external circuitry is required and that too without much restriction and the output resistance is independent of the input. The results of this type of DAC conversion are that the DC performance parameters are comparable to commercially available DAC converters making this method as the ideal for Digital-to-Analog conversion.

The working of the product is very simple and straight forward. The record button is pressed to record the sound into the Z8 board. As soon as the record button is pressed the ADC is initiated for the conversion of the analog signal. The Z8 board displays "REC", stating that recording is in progress. To stop the recording another button is pressed and the "REC" display goes off. A separate button is used for the playback of the recorded voice. When the play button is pressed the PWM is initiated and "PLAY" is displayed on the LED arrays on the Z8 board. The play button initiates the PWM for the DAC and converts the stored digital data into analog. This analog signal drives a loudspeaker which is connected to the timer output of the designated timer used for PWM. The recorded sound is played back on the loudspeaker.

" With this product you can afford to sleep in a lecture, if you press the record button, and listen to the whole lecture at your discretion"