

Speech recognition



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Some of interfacing applications which can be made are controlling home appliances, robotics movements, Speech Assisted technologies, Speech to text translation, and many more. Features • • • • • Self-contained stand alone speech recognition circuit User programmable Up to 20 word vocabulary of duration two second each Multi-lingual Non-volatile memory back up with 3V battery onboard. Will keep the speech recognition data in memory even after power off. Easily interfaced to control external circuits & appliances Specification

Parameter Input Voltage Output Data Value 9 to 15 V DC 8 bits at 5V Logic Level Note Use a commonly available 12V 500ma DC Adapter Any microcontroller like 8051, PIC or AVR can be interfaced to data port to interpret and implement specialized applications Applications There are several areas for application of voice recognition technology. • • • • Speech controlled appliances and toys Speech assisted computer games Speech assisted virtual reality Telephone assistance systems • • Voice recognition security Speech to speech translation Introduction

Speech recognition will become the method of choice for controlling appliances, toys, tools and computers. At its most basic level, speech controlled appliances and tools allow the user to perform parallel tasks (i. e. hands and eyes are busy elsewhere) while working with the tool or appliance. The heart of the circuit is the HM2007 speech recognition IC. The IC can recognize 20 words, each word a length of 1. 92 seconds. Complete Schematic of System VCC VCC CN1 SIP10 R1 6. 8K C3 100nF M1 MIC C1 100nF VCC DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 1 2 3 4 5 6 7 8 9 10 DATA OUT

Say the target word into the onboard microphone (near LED) clearly. The circuit signals acceptance of the voice input by blinking the LED off then on. The word (or utterance) is now identified as the " 01" word. If the LED did not flash, start over by pressing " 1" and then " TRAIN" key. You may continue training new words in the circuit. Press " 2" then TRN to train the second word and so on. The circuit will accept and recognize up to 20 words (numbers 1 through 20). It is not necessary to train all word spaces. If you only require 10 target words that's all you need to train.

Testing Recognition: Repeat a trained word into the microphone. The number of the word should be displayed on the digital display. For instance, if the word " directory" was trained as word number 20, saying the word " directory" into the microphone will cause the number 20 to be displayed.

Error Codes: The chip provides the following error codes. 55 = word too long
66 = word too short
77 = no match
Clearing Memory To erase all words in memory press " 99" and then " CLR". The numbers will quickly scroll by on the digital display as the memory is erased.

Changing & Erasing Words Trained words can easily be changed by overwriting the original word. For instance suppose word six was the word " Capital" and you want to change it to the word " State". Simply retrain the word space by pressing " 6" then the TRAIN key and saying the word " State" into the microphone. If one wishes to erase the word without replacing it with another word press the word number (in this case six) then press the CLR key. Word six is now erased.

Simulated Independent Recognition The speech recognition system is speaker dependant, meaning that the voice that trained the system has the highest recognition accuracy.

But you can simulate independent speech recognition. To make the recognition system simulate speaker independence one uses more than one word space for each target word. Now we use four word spaces per target word. Therefore we obtain four different enunciation's of each target word. (speaker independent). The word spaces 01, 02, 03 and 04 are allocated to the first target word. We continue do this for the remaining word space. For instance, the second target word will use the word spaces 05, 06, 07 and 08. We continue in this manner until all the words are programmed.

If you are experimenting with speaker independence use different people when training a target word. This will enable the system to recognize different voices, inflections and enunciation's of the target word. The more system resources that are allocated for independent recognition the more robust the circuit will become. 3 Sunrom Technologies Your Source for Embedded Systems Visit us at www.sunrom.com If you are experimenting with designing the most robust and accurate system possible, train target words using one voice with different inflections and enunciation's of the target word.

Homonyms Homonyms are words that sound alike. For instance the words cat, bat, sat and fat sound alike. Because of their like sounding nature they can confuse the speech recognition circuit. When choosing target words for your system do not use homonyms. The Voice with Stress & Excitement Stress and excitement alters ones voice. This affects the accuracy of the circuit's recognition. For instance assume you are sitting at your workbench and you program the target words like fire, left, right, forward, etc. , into the

circuit. Then you use the circuit to control a flight simulator game, Doom or Duke Nukem.

Well, when you're playing the game you'll likely be yelling " FIRE! ...Fire! ... FIRE!! ... LEFT ...go RIGHT! ". In the heat of the action your voice will sound much different than when you were sitting down relaxed and programming the circuit. To achieve a higher accuracy word recognition one needs to mimic the excitement in one's voice when programming the circuit. These factors should be kept in mind to achieve the high accuracy possible from the circuit. This becomes increasingly important when the speech recognition circuit is taken out of the lab and put to work in the outside world.

Error Codes When interfacing the external circuit through its data bus, the decoding circuit must recognize the word numbers from error codes. So the circuit must be designed to recognize error codes 55, 66 and 77 and not confuse them with word spaces 5, 6 and 7. **Voice Security System** This circuit isn't designed for a voice security system in a commercial application, but that should not prevent anyone from experimenting with it for that purpose. A common approach is to use three or four keywords that must be spoken and recognized in sequence in order to open a lock or allow entry.

Aural Interfaces It's been found that mixing visual and aural information is not effective. Products that require visual confirmation of an aural command grossly reduce efficiency. To create an effective AUI products need to understand (recognize) commands given in an unstructured and efficient method. The way in which people typically communicate verbally. **Learning to Listen** The ability to listen to one person speak among several at a party is

beyond the capabilities of today's speech recognition systems. Speech recognition systems can not (as of yet) separate and filter out what should be considered extraneous noise.

Speech recognition is not understanding speech. Understanding the meaning of words is a higher intellectual function. Because a circuit can respond to a vocal command doesn't mean it understands the command spoken. In the future, voice recognition systems may have the ability to distinguish nuances of speech and meanings of words, to " Do what I mean, not what I say! " 4 Sunrom Technologies Your Source for Embedded Systems Visit us at www.sunrom.com Speaker Dependent / Speaker Independent Speech recognition is divided into two broad processing categories; speaker dependent and speaker independent.

Speaker dependent systems are trained by the individual who will be using the system. These systems are capable of achieving a high command count and better than 95% accuracy for word recognition. The drawback to this approach is that the system only responds accurately only to the individual who trained the system. This is the most common approach employed in software for personal computers. Speaker independent is a system trained to respond to a word regardless of who speaks. Therefore the system must respond to a large variety of speech patterns, inflections and enunciation's of the target word.

The command word count is usually lower than the speaker dependent however high accuracy can still be maintain within processing limits. Industrial applications more often require speaker independent voice recognition systems. Recognition Style In addition to the speaker

dependent/independent classification, speech recognition also contends with the style of speech it can recognize. They are three styles of speech: isolated, connected and continuous. Isolated: Words are spoken separately or isolated. This is the most common speech recognition system available today. The user must pause between each word or command spoken.

Connected: This is a half way point between isolated word and continuous speech recognition. It permits users to speak multiple words. The HM2007 can be set up to identify words or phrases 1.92 seconds in length. This reduces the word recognition dictionary number to 20. Continuous: This is the natural conversational speech we use to in everyday life. It is extremely difficult for a recognizer to sift through the sound as the words tend to merge together. For instance, "Hi, how are you doing?" to a computer sounds like "Hi,. howyadoin" Continuous speech recognition systems are on the market and are under continual development.

More On The HM2007 Chip The HM2007 is a CMOS voice recognition LSI (Large Scale Integration) circuit. The chip contains an analog front end, voice analysis, regulation, and system control functions. The chip may be used in a stand alone or CPU connected. Features:

- Single chip voice recognition CMOS LSI
- Speaker dependent
- External RAM support
- Maximum 40 word recognition (.96 second)
- Maximum word length 1.92 seconds (20 word)
- Microphone support
- Manual and CPU modes available
- Response time less than 300 milliseconds
- 5V power supply

Sunrom Technologies Your Source for Embedded Systems Visit us at www.sunrom.com More information on the HM2007 chip is available in the HM2007 data booklet (DS-HM2007) which can be downloaded below. <http://www.sunrom.com/files/HM2007.pdf>

Interfacing external circuits through data bus This sample project will show how a circuit can be interfaced through the data bus of speech recognition circuit. It will show messages and error codes on LCD. It will also operate four relays as per data from speech circuit. Schematic of interfacing project