**Title: American Standard Sign Language Representation Using Speech Recognition**

**Introduction**

Project aims at recognizing spoken words and represents the words using American standard sign language via a robotic arm. The application uses MATLAB to achieve it. Idea behind this project is to help the deaf and the dumb to recognize the words spoken more efficiently. To bridge the communication and expression gap between the normal people who cannot understand the sign language, and the deaf and dumb who cannot understand the normal speech.

For that this project provides a software package to convert the speech signal, (which does not have any meaning for the deaf and the dumb) into the sign language

Design of the software package is based on the principle of ‘speech recognition’ where the speech is converted to the text and passes the command as isolated words to hardware which represent the signs and also to software which animate the signs.

A-S-S-L enables the dumb and deaf to speak with their hands which represent their tongue. A-S-S-L is an American standard sign language was demonstrated around 1980 in United States and many other countries, to provide education for the people who have problem in speaking and hearing the words (the deaf and the dumb).

For this METLAB software is used for speech recognition. Speech recognition technique used is Mel-frequency cestrum coefficient refried from IEEE paper. ARM7 is used for hand assembly working, which will represent signs according to A-S-S-L. Servo motors are used in hand assembly.LCD is used for debugging purpose.

**Block Diagram**

Speech

Recognition

Running

On Matlab

Servo motors

Arm

Micro controller

Robotic

Hand

Mechanism

Power

Supply

Unit

Micro

Phone

Input

* Microphone is used to record the audio and for speech recognition.
* Matlab runs the speech recognition algorithm if voice template matches then specific data is sent to the microcontroller using RS232 interface.
* A program running on microcontroller gets interrupted by the serial data reception, and then it decodes the incoming data from matlab.
* Accordingly controller gives signals to servo motors and respected sing is made making use of robotic hand mechanism.
* DC power supply is used to provide the main supply for the microcontroller and servo motors.

**Speech recognition steps:**

* Speech is one of the worst analog signals in the world due to its instability and unpredictability.
* Speech signal completely depends on the tone of its creature, and the tone of each creature depends on the frequency, age, artifice and so many other factors which make it very variable and instable.
* Speech signal is the result of vibration of larynx and pharynx along with the brain signal, which is different from one creature to another.
* Therefore, recognition of speech signal becomes a very complex task.

**Methods**

* There are many methods available to recognize the identified features and classify them into categories. The most commonly used methods are HMM, ANN and MFCC.
* HMM: Hidden Markov Model
* ANN: Artificial Neural Network
* MFCC: MELL Frequency Cepstral Coefficient

**MELL-FREQUENCY TRANSFORMATION**

* According to psychophysical scientists, Human hearing perception of frequency contents is not linear. It is linear up-to 1000 Hz and logarithmic over 1000 Hz. This logic can be implemented by using this formula,

Mel-frequency =2595\*log (1+linearfrequency/700)

**SPEECH RECOGNITION BY MFCC**

* There are two phase involved in speech recognition process:

1) TRAINING

2) RECOGNITION

**FRAMING:**

Framaning process enable to group the samples as per to requirements. Depending on the predecided size of the frames, consequtive samples will groups in packet of frames.

**WINDOWING**

**FFT**

* To analyze the spectrum of the speech wave, apply Discrete Fourier Transform (DFT).

**DISCRETE COSINE TRANSFORM (DCT)**

* Usually, the wave should be in time domain. So, to bring back the speech wave into time domain, we apply Inverse Discrete Fourier Transform. Mathematically this can be implemented by DCT.

**COMPARISON AND DECISION**

* Comparing the input speech with the data base and finally decision is take place base on following concepts :
* VECTOR QUANTIZATION
* EUCLIDIAN DISTANCE
* **VECTOR QUANTIZATION**

Vector quantization is a classical [quantization](http://en.wikipedia.org/wiki/Quantization_%28signal_processing%29) technique from [signal processing](http://en.wikipedia.org/wiki/Signal_processing) which allows the modeling of probability density functions by the distribution of prototype vectors.

* Feature matching is done by Euclidian distance.