Diploma Thesis

title:

„Implementation of a CELP encoder/decoder for PCM voice data on a dsPIC microcontroller“

motivation:

CELP (Code Excited Linear Prediction) is a high quality speech compression method for PCM voice data at a sampling frequency of 8kHz with 16bit resolution. The resulting output data rate is 4800bps. This method is described by Federal Standard FS 1016[1]. The method uses a brute-force approach to calculate the best code vector. Therefore, the encoder requires a high amount of computing power and memory. The possibility to implement such a reusable, non real-time capable encoder/decoder on a small, resource-limited microcontroller, and the limits of such an implementation will be the objective of this work.

content of this work:

The CELP encoder/decoder must be implemented as a reusable stack on an existing Spisa sensor board and as a reference implementation on a PC. The reusable stack on the sensor board should use the existing Spisa infrastructure like the Spisa terminal and the existing SD-card mass storage interface. The encoding quality should be adjustable by the user. This will have a direct impact on the working speed(computing power requirements) of the encoder. The encoder’s data rate should be fixed at 4800bps.

The existing Spisa sensor board comes with a 30MIPS fast dsPIC30F4013 microcontroller manufactured by the Microchip corporation. The controller comes with an amount of 2kbyte RAM and 48kbyte FLASH memory.

The PC reference CELP encoder/decoder must be implemented as a command-line orientated program. The program must work with RIFF-WAVE files as input data source and also decode given CELP data into a WAVE file. Both implementations have to be compared with each other based on their quality. The quality must be measured by using the ITU-T P.862[2] PESQ-standard.

Both software parts have to be implemented using the high level programming language C. In fact, this work should be accessible to a world-wide community, this work must be written in English.

The implementation of each software part needs 7 weeks, the experimental comparison of these implementations requires 2 weeks.

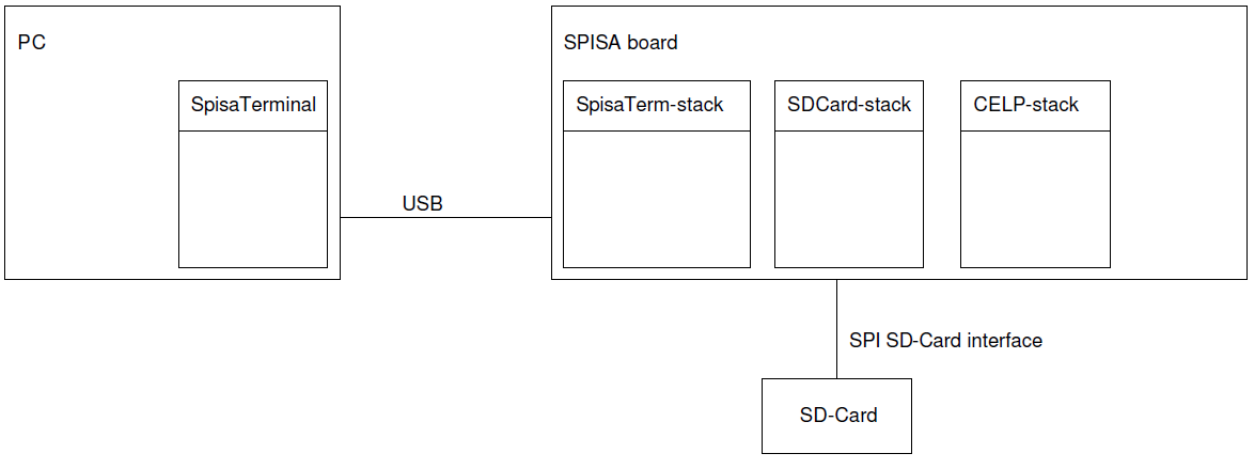

figure 1: schematic of the complete system

1 FS-1016, Federal Standard 1016, U.S. Department Of Commerce, 1991/02/14
2 ITU-T P.862, Perceptual evaluation of speech quality (PESQ), 02/2001