EE497 Real-time Applications of Digital Signal Processing

Course Description: This course teaches the theory and practice of signal processing on real world problems. Particular emphasis is given to the practical applications and real-time processing in embedded systems. Students will apply the Signal Processing theory on real world problems and hence this course will provide extensive hands-on experience for real-time processing with embedded systems. The course aims to strengthen the student's understanding of the foundations of Digital Signal Processing. Students will get acquainted with the professional hardware and software. This course allows students to gain knowledge and experience to implement complete DSP projects and improve skills on embedded platforms through intense laboratory experiments. Interactive teaching of the DSP applications and practical evaluation of the students' progress will improve students' background continuously. Students are expected to gain important engineering skills by implementing signal processing systems in MATLAB and real-time embedded hardware by writing efficient programs in LabVIEW and C.

Instructor: T.Engin Tuncer [office: E-109]
Course Assistants: to be determined
Grading: Preliminary %, Midterm %, Final %, Laboratory Performance %.
Textbook: Digital Signal Processing System-Level Design Using LabVIEW, N.Kehtarnavaz, N. Kim Elsevier, 2005.
Reference: LabVIEW Signal Processing, M.L.Chugani, A.R.Samant, M.Cerna, 1998.
Matlab Ref.: Mastering MATLAB: A Comprehensive Tutorial and Reference, D. Hanselman, Prentice Hall,1996.

Course Outline and Schedule

WEEK	LECTURE TITLE (Section from the textbook)
1.	Experiment 1: Programming simple functions in LabVIEW on a PC
2.	Experiment 2: Programming both myRIO cpu and FPGA
3.	Experiment 3 Part1:Signal generation, filtering, cross correlation, A/D, D/A, DMA, MATLAB implementation.
4.	Experiment 3 Part2: Realization of the experiment in real-time, demo and evaluation.
5.	Experiment 4 Part1: Decimation, Interpolation, Phase-Locked Loop, MATLAB implementation.
6.	Experiment 4 Part 2: Realization of the experiment in real-time, demo and evaluation
7.	Experiment 5 Part1: System Identification with Adaptive Processing, design and implementation of LMS filter. MATLAB implementation.
8.	Experiment 5 Part 2: Realization of the experiment in real-time, demo and evaluation
9.	Experiment 6 Part 1: Optimum filtering: FIR Wiener filter implementation for noise removal, MATLAB implementation.
10.	Experiment 6 Part 2: Realization of the experiment in real-time, demo and evaluation.
11.	Experiment 7 Part 1: Image processing, 2D FFT, filtering, edge detection, MATLAB implementation.
12.	Experiment 7 part 2: Realization of the experiment in real-time, demo and evaluation

Software: In this course, MATLAB and LabVIEW are used for implementing the signal processing tasks on PC and real-time embedded platform myRIO.
Hardware: NI myRIO is the real-time embedded system where the signal processing algorithms are implemented. This hardware has a CPU with floating point computation and a FPGA.
Max. Number of Students: The number of students who can enroll to this course is limited due to the limited number of NI myRIOs.