

TARGET

This programme intends to provide an updated knowledge and skills on special aspects of digital information system technology.

Target groups:

- 1.) Graduates and post-graduates to specialize on special areas of digital information technology
- 2.) Professionals who require an updating and widening of their professional horizons and competitiveness

COURSE CONTENTS

1) Digital Terrestrial Interactive Television

Summary

The course of Digital Terrestrial Interactive Television covers the technologies that contribute towards the development and deployment of an Infrastructure that makes use of the Terrestrial Digital Video Broadcasting (DVB-T) standard, capable to provide Digital TV programs' distribution along with Broadband Access to Interactive Multimedia Services (i.e. Internet access, email, Video/Audio On Demand, off line TV, multicasts/datacasts, etc.). In this respect and after a short introduction to the basics of the DVB-T, the course analyses the fundamental transmission and reception principles (OFDM), besides emphasising on the multiplexing and encapsulation techniques (IP to MPEG-2) in both the IPv4 and IPv6 domain for efficient data transmission/reception. In turn, the course studies network architectures and system configurations that enable for Interactive services provision and broadband access to audiovisual applications, and analyses the operational status of the corresponding building blocks. Finally, the course concludes by focusing on the on-demand services' distribution making use of various access technologies in the reverse path (ISDN, GSM, GPRS, WLAN, xDSL, etc.), and elaborates on Bandwidth Management and Quality of Service (QoS) issues.

2) Modulation schemes and baseband processing in digital broadcasting

Summary

The technical background for digital broadcasting systems will be worked out. Transmission experiments with DVB-S and DVB-T systems will be performed. Parts of baseband-processing will be realised in VHDL for FPGA Synthesis.

The course will be held in a seminaristic manner. In addition to the lectures students have to prepare predefined themes with presentations and have to do practical experiments with DVB systems and FPGA synthesis.

3) Real-Time Communication and Quality of Service in IP Networks

Summary

For VoIP to be a realistic replacement for standard public switched telephone network (PSTN) telephony services, customers need to

receive the same quality of voice transmission they receive with basic telephone services - meaning consistently high-quality voice transmissions.

Like other real-time applications, VoIP is extremely bandwidth- and delay-sensitive. Whether a VoIP telephony system accomplishes the transmission of voice signals successfully is ultimately a subjective determination. That means, someone has to listen to the voice sent across the network and express an opinion as to whether it's of acceptable quality. The quality of a voice signal is affected by a number of characteristics, including:

- Absolute loudness. Is the volume high enough?
- Completeness. Are there gaps in the transmission?
- Loudness of the voice signal relative to background noise. Is it possible to hear the words above any hiss or other extraneous noise?
- Delay. Does it take too much time for the voice signal to get from the speaker's mouth to the listener's ear?
- Undesirable effects. Is there echo or other unwanted sound on the line?

4) Automatic Speech Recognition

Summary

Automatic speech recognition (ASR) addresses the problem of producing textual transcription of human speech utterances with a maximum of reliability by a computer. Because of the huge variability's in speech (caused by different speakers, changing voice characteristics and speed) combined with a large vocabulary (about 100.000 words) and changing acoustic input channels (different microphones, echo, back-ground noise) one has to cover a lot of different fields (speech pre-processing, feature extraction, statistical modeling of speech production and word usage, mathematical search algorithms to find the best word hypothesis) to build up a high performance ASR-system. To get a fundamental understanding of the whole, all this topics should be addressed in this course in a certain degree without going deeply into technical specialities. Nevertheless the students should have some basic understanding of DFT/FFT-analysis, stochastic signals, conditioned probabilities and probability densities.

5) Data Acquisition, Data Logging

Summary

Data acquisition (DAQ) is the process by which events in the real world are sampled and translated into machine-readable signals. DAQ, typically involves sensors, transmitters and other instruments to collect signals, waveforms etc. to be processed and analyzed with a computer. Data Loggers are data acquisition sensors, transmitters and other instruments used to collect real world signals and to translate them into machine-readable signals. Typical uses of data loggers include the measurement of temperature, humidity, light, signals, waveforms etc. to be recorded, processed and analyzed with computer software tools. Observation and measurement are central

features of practical activity in science. The course of Data Acquisition and Data Logging, will cover the subject of the collection of information, recording and ways of treatment.

The program that will be used in DAQ and in the treatment of data will be MATLAB.

6) Video and Audio Compression

Summary

Video and Audio compression remains a subject of interest worldwide and an intensive area of application. The course will begin with an introduction to the compression algorithms theory. Furthermore there will be discussed the application of compression algorithms into medias and the particular requirements raised by the media format and temporal requirements. Also, there will be discussed the application of wavelets into media compression and the contribution in quality and compression ratios improvement. Finally the participants will exchange experience in video and audio compression applications development. The outline of the course is as follows:

- Classification of Compression Algorithms
- Entropy coding (LZW, RLE, Huffman Coding)
- Source Coding Techniques (FFT, DFT, Wavelet Transform)
- Image Compression/Decompression
- Video Compression/Decompression
- Audio Compression/Decompression
- Streaming Audio and video
- Java language and Media, the JMF framework
- Applications

7) Game Design

Summary

The focus will be on understanding and designing games. There will be 3 approaches:

- Analyses: The fundamental elements of game design such as the structure of games, formal elements and dramatic elements are discussed
- Design method: A method for designing games will be introduced with the following keyword conceptualization, prototyping, playtesting and balancing.
- Prototyping in practice in computer lab

8) A/D and D/A conversion techniques

Summary

The need for conversions in digital information systems
Main characteristics of the A/D and D/A conversions
Detailed operation of the basic type of DAC (R-2R ladder)
A survey of all types of DACs used today
Short classification of ADCs
Detailed operation of 2 types of ADCs
Improving the performance/complexity relation in ADCs
Improving the resolution of ADCs by DSP techniques