Digital Signal Processing and Audio/Video Codecs for 3G Mobile Applications

Synopsis

Image Compression/De-Compression Systems are the enabling technologies behind a new wave of communication applications. From streaming internet video to broadcast digital television and digital cinema, the multimedia codec is a key building block for a host of new applications and services. This course provides a wealth of illustrations and practical examples, including quantitative comparisons of design alternatives.

This course presents all the fundamental elements of digital audio and video signal processing, such as sinusoids, spectra, the Discrete Fourier Transform (DFT), digital IIR and FIR filters, Discrete Cosine Transforms, transfer-function analysis, and basic Fourier analysis in the discrete-time case. Matlab is used for in-class demonstrations and homework/lab assignments. The labs focus on practical applications of the theory, with emphasis on working with waveforms and spectra, "getting sound", and developing proficiency in matlab.

Predominantly intended to be taught to development teams at customer sites it is not expected that any one course would cover the full range of modules in a typical two month period. For teams without experience of digital systems and C programming it would typically require three months of intensive training to give full coverage to the topics included here. The course covers all of the important features of the C language as well as a good grounding in the principles and practices of multimedia systems development including the codec specification.

The course contains essential information for anyone developing embedded systems such as microcontrollers, real-time control systems, mobile device, PDAs and similar applications. This DSP and Audio/Video Codecs course is based on many years experience of teaching multimedia formats, extensive industrial programming experience and also participation in the JPEG and Macromedia standards bodies that produced the standard for Image Codecs and Flash Player. We focus on the needs of day-to-day users of the Multimedia Systems with the emphasis being on practical use and delivery of reliable software.

Suitable for

Programmers and engineers who already have some understanding of programming and who now wish to gain a solid experience on the design and development of Digital Signal Processing and Audio Video Codecs for 3G mobile terminals.

Prerequisites

Miracle Corporate Solutions Pvt. Ltd.
A degree (B.E., B.Tech, MCA, M.Tech) in Electronics/Electrical, Computer Science or Information Technology.

- Programming experience in C.
- Working capability on any one operating systems (Windows, Linux).

**Delivery**

This is instructor led DSP and Audio/Video Codecs training. Each section of the material covered by the tutor is followed by hands-on practical exercises for which worked examples of the solutions are typically provided.

Our DSP and Audio Video Codecs courses now have a monthly public schedule for Pennsylvania (USA) and Noida (India). Please see [www.miracleindia.com](http://www.miracleindia.com) for details.

For details of the in-house and bespoke C courses that we can provide, please email

info@miracleindia.com

**Contents**

**An Introduction to Digital World**
- Overview
- Why Digital?
- Advantage of Digital Processing.
- Disadvantage of DSP.
- Sampling theorem
- Quantization
- Encoding
- Comprising
- A Few Words about MATLAB
- Review

**Introduction to Digital Signals**
- Discrete time Signals
- Representation of Digital Signals.
- Some Important Digital Signals.
- Using the Digital Signal in MATLAB

**Understanding Digital Systems**
- Discrete Systems
- Difference Equations
- Properties of Discrete Systems
- Some Popular Discrete Systems.
- Implementing a Discrete System through C programming.
- MATLAB implementation of Discrete Systems.

**DSP Algorithms and Transformations**
- Convolution
- Correlation.
- Discrete Time Fourier Transform (DTFT)
- The Properties of DTFT
- Frequency Domain Representation of LTI Systems.
- The Bilateral Z-Transform
- Important properties of Z-transform
- Systems Representation in the Z-Domain.
- Solutions of the Difference Equation
- Discrete Fourier Transform.
- Advantage of DFT over DTFT.

**Designing an Audio Processor**
- Overview
- Understanding the Audio Processor.
- High Level Design
- Low Level Design
- Creating the effect filters.
- Echo, M-Echo Filters
- Reverberation
- Flanging
- Fade-in
- Fade-out
- Pitch Shifting
- Equalization
- Implementing Audio Processor in MATLAB

**Developing a JPEG Decoder**
- Understanding the JPEG Flow.
- Why DCT over DFT?
- Lossy and lossless compression.
- Run Length Encoding (RLE).
- Huffman Encoding.
- ZigZag Scanning.
- Scaling
- Blocking
- Understanding the design of a JPG decoder.

**Understanding Video Formats**
- Overview
- Video Specifications
- Video Algorithms
- Intra-Frame Compression.
- Inter-Frame Compression (Motion Compensation).
- Deblocking
- Audio-Video Synchronization.
- Audio-Video Multiplexing.
- Understanding File Format of MPEG1 and MPEG2.

**Developing an PNG Decoder**
- Lossless Compression.
• Properties of DFT.
• Linear Convolution using the DFT.
• Fast Fourier Transform
• Utility of DFT in Image Processing.
• Problems.

Digital Filter Design
• Basic Elements.
• Digital Filter Structures.
• Difference in Analog and Digital Filters
• Type of Digital Filters.
• Designing a Linear Phase FIR Filter.
• Window Design Technique.
• Frequency Sampling Design Technique.
• Examples and Exercise
• Designing a IIR Filter.
• Characteristics of Prototype Analog Filters.
• Analog to Digital Filter Transformations.
• Low pass filter design using MATLAB.
• Frequency band Transformations
• Comparison of FIR vs. IIR filters.
• MATLAB
• Creating GUI in MATLAB.
• Testing the Audio Processor.

Developing a BMP decoder.
• Understanding BMP File Format.
• Structures in BMP.
• Designing a BMP decoder.
• Implementing the BMP decoder in C using VC++ environment.
• 8 bit BMP decoding and display.
• 16 bit BMP decoding and display.
• Grayscale bmp decode /display

Working on Commercial Products.
• Mobile Eye (A next generation security solution).
• Jpeg Analyzer.
• Magic Click

• Understanding PNG Specifications.
• Applications of PNG image format.
• Decoding flow of a PNG image.
• PNG Vs JPG
• Implementing PNG decoder.
• Integrating the PNG decoder with Image Viewer application.

Developing a player for WAV sound files
• Overview
• Reading a WAV File.
• Data Chunk
• Format Chunk
• Optional Chunk
• Mandatory Chunk.
• Writing a WAV File.

Developing an Image Viewer Application
• Creating MFC workspace.
• Understanding the concept of DLL.
• Designing the decoders
• Integrating all DLL components with Image viewer Application.
• Implementing GUI for Image Viewer Application.
• Optimizing the Image Viewer Application.

Controlling a Media Player Application
• Understanding Windows MCI commands.
• Creating the Command Library.
• Writing an application to invoke media player.
• Using MCI library to control the Media Player.

NOTE: The trainee has to sign the Non disclosure Agreement(NDA) before joining any industrial project.

Features:
• The study material and references will be provided to the trainees by Miracle Embedded Systems.
• This reference material is developed by our corporate trainers and software engineers from top notch industries.
• There will regular attendance of the student. One has to show at least 75% attendance then only he will be eligible for certification.
• The grades will be assigned on the basis of regular test results.
• There will be recognitions and rewards for well performing candidates.
Duration 3.0 Months

NOTE:- All training will be given by Corporate Trainers only. All trainers from IIT (M.Tech.) background having four to seven years experience in respected field, working with CMM Level 5 companies.

Corporate Client: -L&T InfoTech, Motorola, Samsung Electronic, ST Microelectronic and many more.

The major aims of the Program are to:

1. Provide a strong foundation in the emerging disciplines of RTOS, Embedded Systems and its applications for professionals in the software development industry.

2. Will improve the required skill set of the system software professional.


4. Incorporates the required skills and experience on Embedded Systems and RTOS in the professionals for the exponentially growing industrials demands on this line.