ToP Business AG
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Curriculum Car Telecommunications

Enhancement to existing
Car Mechatronic Training Programs

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Curriculum

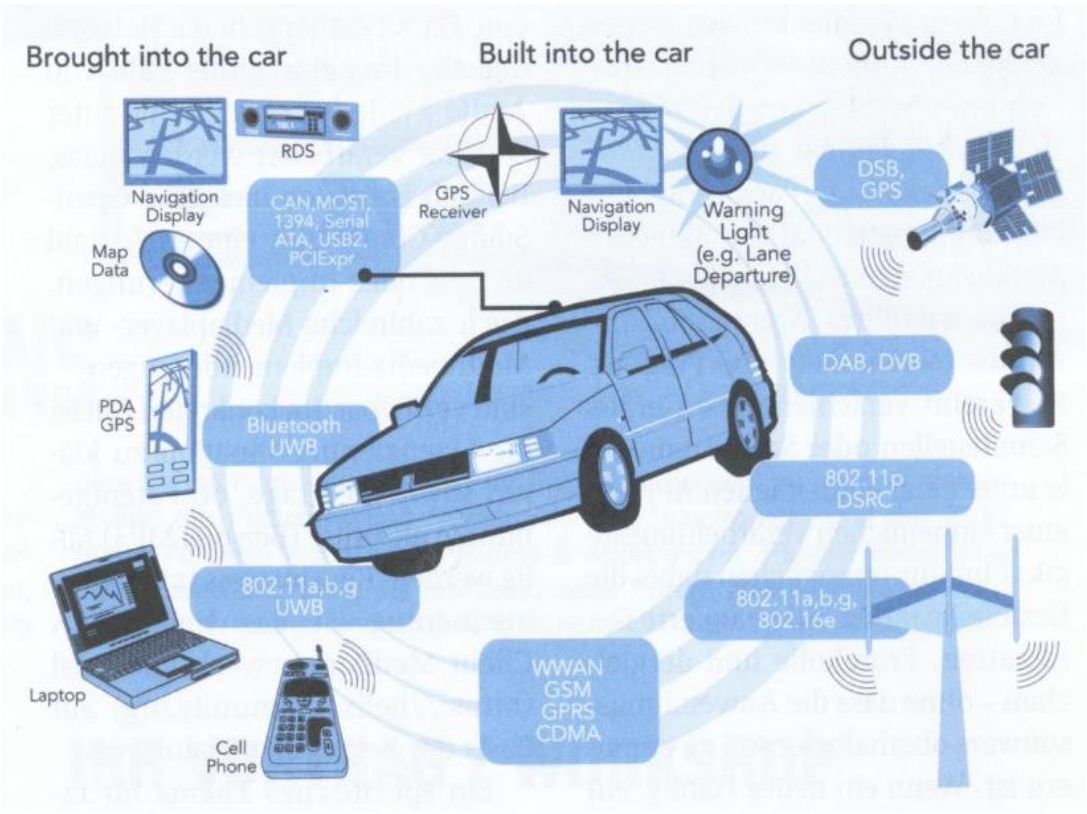
Curriculum

1 PURPOSE

The curriculum presents a modular approach to enhance a car mechatronic training program with

Information Technology & Telecommunications Aspects

dedicated to vehicular applications and implementations. It responds to the increasing demand for information and telecommunication technology knowledge for floor workshop staff in the automotive branch.



Thus, an added value is created to any core car mechatronic curriculum.

2 SCOPE

The 25 days' curriculum includes aspects on

- Public mobile network standards (GSM, EGPRS, UMTS, CDMA, HSPA, WLAN, DAB and GPS) as an information carrier to cars
- SRR (Short range radio) systems, i.e., Bluetooth (IEEE802.15.1), Ultra Wide-band (UWB) and RF Identification (RFID) as wireless communication media within cars
- Generic data network topology and protocols
- Specific network standards as wire-line communication media within cars (MOST, CAN bus, FlexRay, LIN bus)
- Device implementation (Mobile phones with hands-free kits, navigation systems and multimedia components)

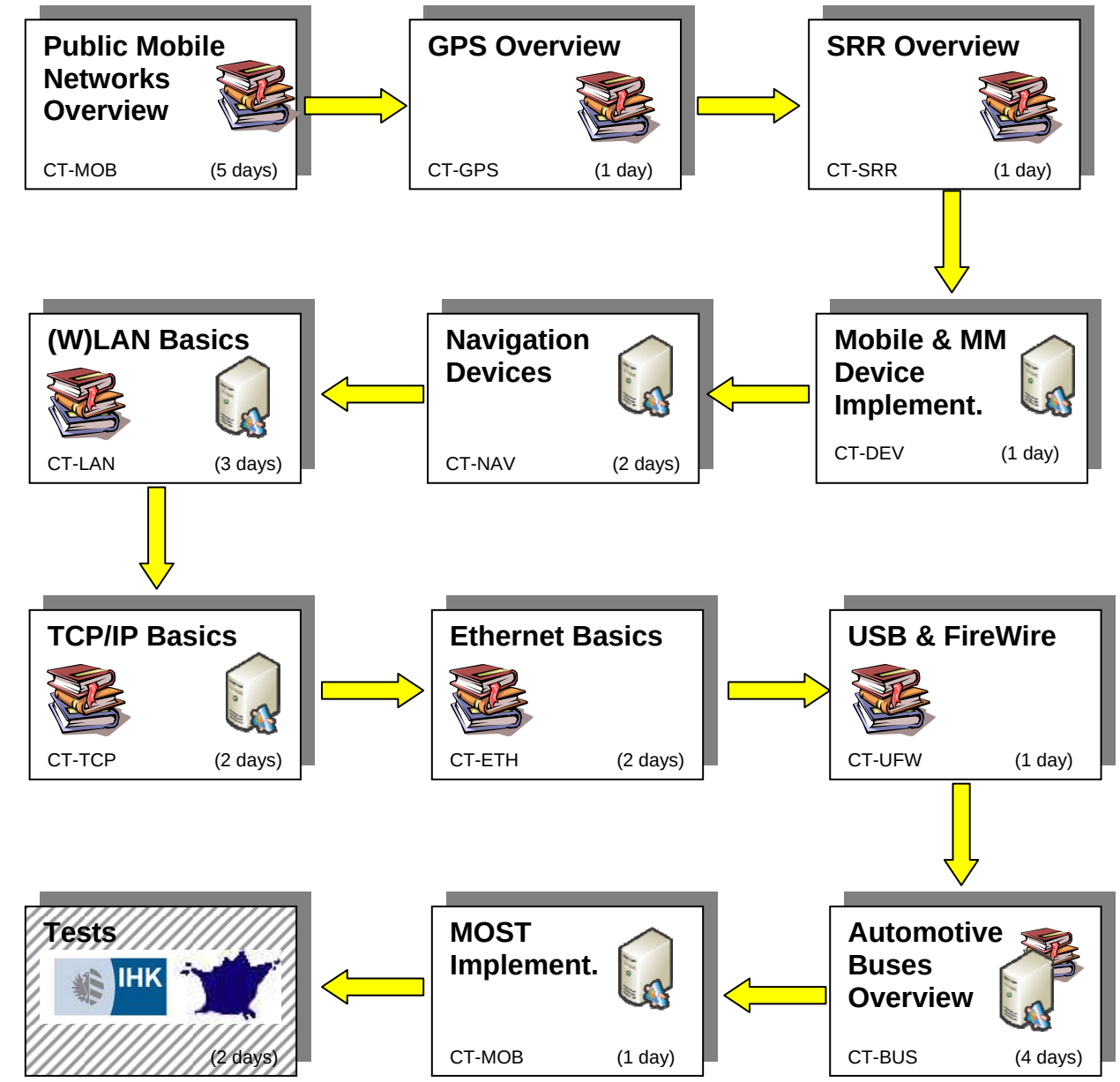
Knowledge transfer is provided through lectures and practical demonstrations / hands-on labs. The training stream concludes with a written and practical test that both have to be passed with a certain score (t.b.d.).

3 OBJECTIVES

After successfully passed the training the students are able to

- Identify different public mobile networks and GPS as suitable carriers for multimedia information transport to vehicles, describe their basic architecture and components and distinguish between different communication scenarios with car devices
- Identify different SRR networks as suitable wireless carriers for multimedia information transport within vehicles, describe their basic architecture and components and distinguish between different communication scenarios with car devices
- Understand working principles of wired data transport systems
- Describe automotive buses standards including architecture, components and communication scenarios with car devices
- Have an impression on sample multimedia installation in cars

4 MODULE OVERVIEW



= Core lectures

= Practical demonstrations / hands-on labs included

5 DELIVERY

All modules can be delivered by TOP Business' Malaysia-based representative at partner's facilities using a standard IT classroom environment.

This dramatically reduces organizational costs and makes this additional valuable knowledge package available to all students (in contrast to all previously discussed models at Grundig Akademie in Nuremberg).

6 CERTIFICATION

This training should be terminated by a test sequence (written and practical test) controlled by the Malaysian German Foreign Chamber of Commerce and Industry. This has yet to be established, but TOP would use its experience recently acquired with Nuremberg-based technical training certification to add a lot of additional value to this training.

7 MODULE DESCRIPTIONS

7.1 PUBLIC MOBILE NETWORKS OVERVIEW

- GSM
  - Architecture and components (BTS, BSC, TRAU, MSC/VLR, HLR/AC)
  - GSM air interface characteristics and in-car problems
  - Basic communication scenarios
  - Services (speech, SMS, car telematics)
- (E)GPRS
  - Architecture and components (PCU, SGSN, GGSB, BG, LIG, CG)
  - (E)GPRS air interface characteristics and in-car problems
  - Data communication scenarios
- UMTS and HSPA
  - Architecture and components (NodeB, RNC)
  - WCDMA air interface characteristics and in-car problems
  - Basic communication scenarios
  - UMTS evolution: HSPA+, EPS

- CDMA2000
  - Architecture and components
  - Air interface characteristics
  - Basic communication scenarios
- Mobile WiMAX
  - IEEE 802.16-2005 Architecture
  - Network entities and functionalities
  - Mobile WiMAX Physical Layer
  - Mobile WiMAX MAC Layer
  - Mobile WiMAX Procedures
  - Mobile WiMAX Mobility Management
- DAB
  - Architecture and components
  - Air interface characteristics
  - Basic communication scenarios

7.2 GPS OVERVIEW

- GPS concept
- GPS architecture
  - Triangulating
  - Measuring distance
  - Getting perfect timing
  - Satellites positions
  - Error correction
- Differential GPS
- Advanced Concepts
- Putting GPS to work
  - Location
  - Navigation
  - Tracking

7.3 SRR OVERVIEW

- Bluetooth
  - Architecture and components
  - Bluetooth air interface characteristics and in-car problems
  - Basic communication scenarios
  - Bluetooth profiles

- UWB
  - Architecture and components
  - UWB air interface characteristics and in-car problems
  - Basic communication scenarios

- RFID
  - Active / passive systems
  - Architecture and components
  - Implementation scenarios

7.4 MOBILE & MULTIMEDIA DEVICE IMPLEMENTATION

- Mobile phone / hands-free kit installation preparation
- Prerequisite car activities
- Used Bluetooth profiles
- Device implementation
- Additional components
- Repairing theft damages
- Sample car implementation (preferred: Mercedes or BMW)
- Video and audio options (iPod / USB / AUX in)
- Pin-Layouts and interface points

7.5 NAVIGATION DEVICES

- Navigation device hardware
- Navigation device software
- Software upgrades
- Auxiliary components

7.6 (W)LAN BASICS

- ISO OSI communication model
  - Layer tasks and contents
  - Communication procedures

- Network topologies: Bus, Star, Ring
  - Logical and physical topologies
  - Structured cabling

- Transmission media: twisted pair, fiber optics, IEEE802.11a/b/g
- Modulation and coding
- Media access procedures: CSMA/CD, Token Passing, etc.
- Error detection and correction
- Ciphering and compression
- Switching technologies: circuit switching, packet switching, label switching
- Network standards: Ethernet, Token Ring, FDDI
- Protocols: NetBIOS, NetBEUI, IPX/SPX, TCP/IP
- Network interconnection components
  - Repeater
  - Bridge
  - Switch
  - Router
  - Gateway
- WLAN access
  - Access point and device configurations
  - Security implementations (cyphering methods)
- Wireless Access for Vehicular Environment (WAVE)
  - IEEE 802.11p enhancements
  - ETSI approach for Intelligent Transportation Systems (ITS)

7.7 TCP / IP BASICS

- Terminology, Data transfer types
- Link Layer Technologies
- IP Addressing
  - Address classes
  - Subnet mask, subnetting, variable length subnetting
- Internet Layer
  - Address Resolution Protocol (ARP)
  - Internet Protocol Basics (IPv4)
  - IPv6 modifications
  - Mobile IP
  - Internet Control Message Protocol (ICMP)
  - Internet Group Management protocol (IGMP)
- Transport Layer
  - Ports, sockets
  - User Datagram Protocol (UDP)
  - Transmission Control Protocol (TCP)
  - Interworkings

- Application Layer
  - Dynamic Host Configuration Protocol (DHCP)
  - Simple Management Network Protocol (SMNP)
  - (Trivial) File Transfer Protocol (FTP, TFTP)
  - Telnet
  - Simple Mail Transfer Protocol (SMTP)
  - Domain Name Server (DNS)
- Security Aspects
  - Network Address Translator (NAT)
  - Proxy Server, Firewall
  - Remote Authentication Dial-In User Service (RADIUS)
  - IP Security Architecture (IPsec), tunneling, encapsulation
  - Virtual Private Networks (VPN)

7.8 MOST BASICS

- MOST concept
- Application Aspects
  - Basic principles of MOST
  - Device model
  - Application Messages in a MOST Network
  - Controller / Slave Communication
  - Structure of MOST Messages
  - Function classes
  - Handling message notification
- Network Aspects
  - MOST data
  - Dynamic device behavior
  - Network management
  - Diagnosis
  - Error management
  - Network layer protocol
  - System startup
  - Addressing
  - Priority Levels
  - Low Level Retries
  - Handling Overload in a Message Receiver
  - MOST Message Services
  - Packet Data Handling
  - Streaming Data Handling
  - Connections
  - Time Definitions

- Most Asynchronous Medium Access Control (MAMAC)
  - Packaging frames
  - Handling Frames
  - MAMAC48 rules, segment flow, mode detection, segment frame format, data flow

7.9 MOST IMPLEMENTATION

- Sample MOST bus implementation (preferred: Mercedes or BMW)
- MMI-High functions
- MOST video options
- MOST audio options
- Voice control
- Backward camera
- Mobile phone integration
- MOST software update

7.10 CAN BUS

- Automotive applications
- Technology
- Data transmission & bit timing
- Layers & Frames
  - Data frame
  - Base frame format
  - Extended frame format
  - Remote frame
  - Error frame
  - Overload frame
- Interframe spacing
- Bit stuffing
- Standards
- Higher layer implementations

7.11 LIN BUS

- LIN advantages and applications
- Network topology
- LIN Message frame

- LIN hardware
- LIN protocol
  - Header
  - Response
- LIN API

7.12 FLEXRAY BUS

- Features
- Details
  - Clock
  - Bits on the bus
  - Sampled bits
  - Frame
  - Clock synchronization
- Test scenarios

7.13 ETHERNET BASICS

- Introduction
- Ethernet Physical Layer
  - Basic IEEE 802.3 Frame Format
  - Data Field
  - Frame Checking Sequence
  - Interframe Gap
  - Frame Format Extensions
  - Frame Tags
  - VLAN Tagging
  - Traffic Priority
  - Frame Bursting
  - Jumbo Frames
  - 10/40Gbit Ethernet
- Ethernet Data Link Layer
  - Half-Duplex and CSMA/CD
  - Transmission Flow
- Ethernet Equipment
  - Bridges
  - Routers
  - Hubs
  - Switches
  - Spanning Tree Protocol

- Ethernet Applications
  - Ethernet in LANs
  - Ethernet for Access Networks
  - Ethernet in Metro Networks
  - Ethernet in WANs
  - Ethernet Service Types

7.14 UNIVERSAL SERIAL BUS

- Overview and releases types
- Device classes
- USB signaling
- USB packets
  - Handshake packets
  - Token packets
  - Data packets
  - PRE "packet"
- USB protocol analyzers
- USB connector properties
  - Usability
  - Durability
  - Compatibility
  - Interface
  - Cables
- Types of USB connectors
  - USB-A / USB-B
  - Mini / micro
  - USB OTG Sockets: Mini-AB, Micro-AB
  - Proprietary connectors and formats
- USB cables, maximum useful distance
- Power issues
  - Non-standard devices
  - Powered USB
- USB compared with FireWire

7.15 IEEE1394 FIREWIRE

- Node hierarchy
- Standards and versions
  - FireWire 400 (IEEE 1394-1995 superseded by 1394-2008)
  - Enhancements (IEEE 1394a-2000)
  - FireWire 800 (IEEE 1394b-2002)

- FireWire S1600 and S3200
- FireWire S800T (IEEE 1394c-2006)
- Future enhancements

- Comparison to USB
- IEEE 1394 use in automotive environment
- Networking over FireWire
- Security issues