

Dearborn Electronics

Audio, Multimedia and Telematics
Expertise

Submitted by

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TABLE OF CONTENTS

1 Introduction.....4

1.1 Vehicle Audio.....4

1.2 Vehicle Multimedia4

1.3 Vehicle Telematics5

2 DE Skills5

3 DE Service Offerings5

4 Case Studies6

4.1.1 AM / FM Tuner Test Application 6

4.1.2 EQ Designer Toolkit..... 7

4.1.3 Development of Bluetooth Component Library (BTCL)..... 8

4.1.4 Vehicle Data Access through Wireless Mobile 8

4.1.5 Image Editor / Download Utility..... 9

4.1.6 Parking Aid & Blind Spot Detection System 9

4.1.7 OnStar Programming System..... 10

4.1.8 Study of wireless technologies inside Armoured Fighting Vehicles 11

1 Introduction

This document provides DE expertise in Audio, Multimedia and Telematics applications for Automotive.

1.1 Vehicle Audio

Vehicle audio systems are facing immediate and future challenges for the technology, design and functions due to boom in consumer digital music.

Consumers increasingly expect to be able to access their personal music collection wherever they are, this raises expectations of what a vehicle audio system should be able to provide, beyond the established format of an analogue radio tuner and CD player that features as a minimum in almost all new vehicles today.

These challenges to vehicle audio are responded by some of the major OEMs by providing systems which can play digital files stored on compact discs or by providing an auxiliary input to link personal music players, such as iPods and MP3 players, to the vehicle's speaker system. Options to use memory cards and USB flash drives are also being introduced.

Latest Trends

- Digital radio
- Satellite Radio Systems
- Playback media
 - MiniDisc
- Surround sound
- Digital music
 - Memory cards
 - USB flash drives
 - Removable Hard Disc Drive
 - Embedded Hard Disc Drive
- Digital music on nomadic devices
 - Wired integration
 - Wireless integration

1.2 Vehicle Multimedia

Product development for vehicle multimedia is on high surge with advances in digital technology, wireless communication, and signal processing technologies, and embedded software

Technology developments are redefining the infotainment experience with DVD-based rear-seat entertainment, voice-based navigation, and satellite radio systems.

Wireless data-link technologies can enable communication between different devices in a vehicle as well as with those at the work place, with the convergence of audio, video, and data, files stored in a home computer in these formats can be downloaded

over a wireless link and distributed over the same link to multimedia output devices in a vehicle for redefining the infotainment experience for the passengers.

Latest Trends

- HD radio
- Multimedia DVD players
- iPod connectivity
- MP3/WMA-equipped players
- BLUETOOTH & Other Local Wireless Systems connectivity
- MOST enabled products

1.3 Vehicle Telematics

Wireless technology in a car provides a constant flow of data to drivers and passengers using multimedia delivery platforms and user-friendly voice- and touch-screen-based human-machine interfaces. These devices not only provide entertainment to passengers but also improve navigation by sharing data across components in the car.

Telematics can be enabled in vehicles by integrating cellular communications system and a GPS receiver with Telematics service provider.

Latest Trends

- 3D Navigation
- Enriching Telematics service provider content
- SOS system
- MOST enabled products

2 DE Skills

DE has the following skill set for Audio, Multimedia and Telematics domain.

- DSPs from Texas TMS series and Analog Devices ADSP Series
- QNX, ProOSEK and Linux Embedded OS
- Audio and Video codec
- IDE - code composer studio
- Debugger - JTAG with spectrum digital driver
- Proficient in VC++, C++ and C with algorithms implementation
- Knowledgeable on Multimedia protocols like MOST and IEEE 1394, wireless protocols like Bluetooth and 802.11b.

3 DE Service Offerings

- Automotive Tuners
- Amplifiers & Equalizers
- HMI development
- GPS / Navigation Systems
- GSM / GPRS - In-Vehicle Gateway

- Wireless Connectivity with Bluetooth
- Radar Guidance Systems
- MOST based Network Development

4 Case Studies

4.1.1 AM / FM Tuner Test Application

Problem Description:

The aim is to develop an AM / FM Tuner Test Application to test the Radio Source Task on Windows. The Test application is the outside world and the Radio Source Task acts as an interface between the Tuner sub-system and the outside world. The Test Application provides all of the sub-components required by the Radio Source Task for its operation.

How DE Helped:

DE has developed the Test Application with the following sub-components:

- User Interface (UI)
- Operating System (OS)
- Non-Volatile Memory (NVM)
- Device Communication
- Wake Management

Both Tuner Test App software and Core Radio Source Component Manager reside on PC and communicate with the Dirana hardware based on the communication pattern specified. The communication protocol includes a set of commands and messages that initiate a specific operation in the Tuner Sub-System.

Upon user events, the ***UI sub-component*** invokes a command from the Radio Source Task. The ***Operating System sub-component*** is responsible for providing the ProOSEK OS support under Windows environment. This sub-component makes use of Windows native functions to emulate ProOSEK functionalities under Windows. The ***Device Communication sub-component*** is responsible of transfer of I2C request / response messages from PC to Dirana hardware through a parallel port interface and makes use of the Phillips I2C library for this purpose.

The ***Non-Volatile sub-component*** is responsible for the read / write of data in the EEPROM. This sub-component makes use of Windows file system to emulate this Windows. The ***Wake Management sub-component*** is responsible for maintaining the ON, OFF and IDLE states of the Radio Task sub-component.

Benefits to Customer

- This Test Application validates all the interfaces before integrating the actual HMI application.

- It eliminates the interface issues during the integration and cut short the total development time.
- It automates the testing under Windows OS.

4.1.2 EQ Designer Toolkit

Problem Description:

The aim of this program is to develop an EQ Designer Toolkit that enables DSP and acoustics engineers to rapidly equalize vehicles to meet development and production requirements for a Tier-1 Automotive supplier.

How DE Helped:

EQ Toolkit is an amplifier designed for controlling/simulating radio controls like volume, Bass, Mid, Treble, Balance, Fade etc., The Application has 8 channel audio mode and 12 channel audio mode where the user can select any of the audio mode and configure each channel. This Toolkit supports upto 25 EQs. This project supports CAN messages and Interfaces. Application communicate through the vehicle gateway using CAN (500 Kbits/sec).

Following features were developed for this application.

- **Upload flash** bank index table – Application supports opening of the saved EQ header file along with the tool configuration parameters from a component.
- **Internal Clip detect & limiters** – Application provides modifiable values for limiters and clip detects to channels.
- **DTC** – Application reads DTC for the speaker shorts, speaker open, dc offset, battery high, battery low, software checksum failures, bus faults and loss of communication with other modules set by the amplifier.
- **Flash File generation and Flashing Radios** –
The Toolkit takes input as either Header file format “. h” or Data File format “. Dat” and generates the Hex file which is used for flashing radios. Total file size of each EQ will be exactly 4K in size. Generated hex file will be flashed into the radios. Checksum comparison will be done internally. Flashing will be successful only if the expected checksum matches with the calculated checksum.

Benefits to Customer:

The major benefits of this project is

- Generic tool architecture to support the toolkit. The current EQ Designer Tool already uses base architecture for this class of tools. Enhancements may be required into this base architecture to accommodate new needs and create the reference architecture for the toolkit.
- Well-defined compatible code components to implement the architecture. A clear definition of algorithms, data and interfaces.

- And, a set of rules. These rules define the relationships among the different code components.

4.1.3 Development of Bluetooth Component Library (BTCL)

Problem Description:

The Bluetooth Component Library is a wrapper around the Bluetooth stack profiles provided by the Extended Systems Inc. BTCL uses the BlueCore series chip provided by Cambridge Silicon Radio (CSR) in order to achieve the Bluetooth functionality. The ESI stack is present in the Microprocessor (AC45) and for any Bluetooth operations, the Micro communicates the information to the BlueCore chip, which in turn performs the Bluetooth operations.

How DE helped:

- BTCL is an independent module which can be fit into a car and provides a wrapper to the following Bluetooth profiles.
 - Handsfree profile
 - Object Push profile
 - Generic Object Exchange profile
 - Phonebook access profile
 - SIM access profile
- The BTCL was first developed as a Proof of concept on the Windows platform and later ported to the QNX platform. The entire coding is done using the C language.

Benefits to Customer:

- Using the SIM access profile, the user can download the entire SIM information into the BTCL, such that the SIM information is available in the Micro which will be used by the BlueCore chip for accessing the SIM information.
- The user can connect the Bluetooth enabled Mobile Phone to the BTCL using the Handsfree profile, the calls can be answered using the headset which is connected to the BTCL module.
- Using the object push profile, BTCL can push an object from a mobile phone to the inbox of another Bluetooth device. The object can for example be a business card or an appointment.

4.1.4 Vehicle Data Access through Wireless Mobile

Problem Description:

To access the vehicle data through wireless mobile network

DE Solution:

The solution is provided through Gryphon hardware platform that can access many of the vehicle network buses with a GSM / GPRS PCMCIA modem card.

The embedded software running on Gryphon will process the vehicle network (CAN in this case) data and send it to GSM / GPRS Modem on PCMCIA slot. The software can be configured for different vehicle networks like CAN and also for the parameters to be monitored. The vehicle data gets converted into GSM / GPRS format and transmits to remote station using AT commands.

Application:

- Vehicle data including diagnostics information can be transmitted to remote station through SMS enabling the remote monitoring of the data.
- This framework can be used in the areas like Fleet Management, Remote Diagnostics and Telematics.

4.1.5 Image Editor / Download Utility

Problem Description:

To develop a PC based Image Editor and Downloading Utility

How DE helped:

The project involves the design and development of Image transfer protocol and application on top to convert the images to different bit depths and illumination and size. Transferring of the image is done via serial port using custom application layer protocol.

- A serial communication interface has been developed to interact with serial device that are connected to the host machine.
- Object Oriented Design.

Benefits to Customer:

This has been done for a leading Tier-1 Automotive supplier and the application is being used in image manipulation and transfer to the mobile systems.

4.1.6 Parking Aid & Blind Spot Detection System

Problem Description:

To develop a Parking Aid and Blind Spot Detection System for a Passenger vehicle

How DE helped:

DE has developed the system with the following features:

Audio, Multimedia & Telematics Expertise

- Provides a parking aid and blind spot object detection system utilizing TYCO / MA-COM radar sensors and a proprietary hardware.
- This was developed for a passenger vehicle and uses CAN and J1850 networks.
- The Front Parking Aid System alerts the driver of objects near the front bumper through an LED bar graph and a beeper.
- The audio/visual displays are activated when object is within software controlled detection range of 1 meter.

Benefits:

- Individual Front and Rear buzzers that beep periodically when an object is within the detection range of the bumper.
- The frequency of the beep increases in intensity, as the vehicle gets closer to the object.

4.1.7 OnStar Programming System

Problem Description:

The OnStar system, a vehicle Telematics module, is a vehicle owner information and convenience system designed to provide personal communication and data services, on demand. OnStar is a vehicle communication package (VCP) that is being used with any combination of the following: body wiring interface harness, bracket or impact detection sensor.

How DE helped:

DE has developed the Onstar programming station with the following features:

- Programs the OnStar module using GM class 2 protocol
- Logs the test data results to an ASCII file
- Interfaces a bar code reader for reading wiring harness serial number
- Interfaces a National Instruments Data Acquisition Card to the power supply of an OnStar module
- Prints test results to a label printer

Benefits to Customer:

This system is being used as a Programming as well as EOL test station for Onstar production line.

4.1.8 Study of wireless technologies inside Armoured Fighting Vehicles

Problem Description:

The project "Evaluation of Wireless Technologies (802.11b and Bluetooth) for AFV (Armoured Fighting Vehicles)" involves the feasibility study of wireless data transfer between the systems in Hull and Turret of Armoured Fighting Vehicles. The project involves conducting the measurements in the tank to evaluate the technologies available for Wireless communication namely the Bluetooth and 802.11b and checking the data integrity and reliability of the technologies.

How DE helped:

DE has done the measurements of the following parameters inside AFVs for 802.11b and Bluetooth.

- Bus throughput,
- Range,
- Response time,
- Interference and
- Security

Compare the results with that of the wired communication and identify the wireless technology that best suits to operate in the military environment.

Benefits to Customer:

DE has submitted the evaluation report on the results and recommended the wireless technology that suits best for the military environment. This has helped the customer to decide and adopt the wireless connectivity that is suitable for AFVs.