Trends in Automotive Infotainment

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Automotive infotainment is growing at the pace of consumer products, there is increasing desire to have latest and greatest Video and Audio capabilities in an In-car infotainment systems. There is need to have video input and output capabilities, graphics and animation processing capabilities and high fidelity audio systems for in car infotainment. Protocols such as MOST and AVB are becoming prevalent for automotive infotainment. Also there is an increasing requirement to have all these blocks integrated in one chip. Unlike a usual consumer market, the Auto market still needs high quality standards to adhere to and work in more rugged environment. The article covers the recent trends in automotive infotainment from the way the landscape is changing in view of “connected cars“ to the different blocks and features driving those.

Integrating Mobile devices

A “Connected Car” is a car that is well connected to the inside and outside world. Connectivity within the vehicle includes providing connectivity to devices that are brought into the vehicle. Connectivity outside the vehicle primarily involves the Internet connection via Wi-Fi, LTE, or some other means.

There are many challenges associated with the implementation of connectivity as it pertains to today’s connected car, and these challenges involve both connectivity within the vehicle and connectivity outside the vehicle. Some challenges in automotive connectivity are:

- Android Apps
- The Internet
- Streaming Multimedia Content
- Security

There are some solutions already available for connected car e.g. MirrorLink, Miracast, DLNA and Ford AppLink.

Figure 1 indicates how to connect a smart phone or media player through any of above solutions to car e.g. MirrorLink transforms Smartphone into automotive application platforms where apps are hosted and run on the Smartphone while drivers and passengers interact with them through the steering wheel controls, dashboard buttons and touch screens of their car's In-Vehicle Infotainment
Software Defined Radio

Countries or regions have chosen different standards for a variety of reasons (commercial, political, financial, network considerations, etc). Hence, a customizable option is demanded which can be software configurable and easily ported across nations and regions. This is being achieved through a technology recognized as Software Defined Radio (SDR). The principle behind SDR is to run software on a multi-purpose processor to handle the functions of the radio reception path that are typically realized in hardware, as for example, the demodulation and audio decoding. Effectively, the software defines what kind of processing is applied to the signal coming in from the antenna.

The block diagram below (Fig 2), demonstrates an abstract level implementation of the design that has an on chip radio processing (defined by Software) and audio playback capabilities. Here we have blocks that interface to external radio tuners and receive radio data. Then the audio is recovered from this radio data by the processes of demodulation and harmonic filtering. The recovered audio data is transmitted to a DAC converter unit which converts the digital input into an analog audio signal which then can be played via an external speaker. There is demand for having an on chip Audio mixer which can mix two or more audios. Also it is required that the chip has IP that supports I2S and S/PDIF audio protocols. It will be good if we have an on chip sample rate converter to convert the audio data samples from one rate to another.
Multiple Video Input Sources

Sources of video inside of a car include:

- Single ended or differential analog video input converted by Video ADC to digital stream.
- Parallel Data Interface Camera data is directly read through this interface and stored in System RAM.
- MIPI CSI-2 Interface used to receive data from a CSI-2 compliant camera interface.
- Encoded streams (e.g. h.264) via Ethernet that requires an on chip video stream decoder (h.264) to recover the video.

Multistream and Multilayer Graphics Processing with different displays

Two basic engines required inside chip for graphics processing and enablement are GPU (Graphics processing unit) and DC (Display controllers). GPU’s are used for image creation and image enhancement. DC’s are used for adding overlays and enabling display on TFT.

Below are the two most important use cases described that explains how Graphics and Animation processing is utilized inside car:

Surround view camera system: Here all the 4 cameras (in the mirrors, front, back) are read in through the parallel camera port or MIPI CSI-2 or Ethernet; the 3D GPU is used to dewarp the camera pictures and to combine the images to one or more surround views. Then additional overlays are added using GPU or Display controller (Fig 3). The image then can be displayed using Display controller. A typical example is DC capable of maximum output of 720P as shown.

Cluster display controller: The 3D GPU generates the background and the media content display. The OpenVG accelerator takes care of the needles of instruments.
MOST and AVB as emerging protocols

MOST (today this is mostly MOST150 and for audio only also MOST50) is still being used as a standard audio/video backbone network. MOST50 is often used to connect a head-unit to an external audio amplifier. Most150 can also transfer video and contains an Ethernet channel for example for data transfer between system components. Some manufacturers are switching to Ethernet already. In this case cameras are using Ethernet as a backbone, and audio is also transferred using this medium. The AVB extension becomes necessary in this case to keep the audio/video clocks in sync.

Conclusion

This article discusses the challenges in connectivity and solutions available for them. It is discussed how to enable on chip radio and audio processing. Also we have discussed various video and graphics enabling options. With the growing demand there is a need to have all of these blocks integrated in one chip. One thing that also needs attention is the software framework that enables all audio and video to play.