Data Transmission in Vehicular Audio Systems

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ABSTRACT

Automotive audio ECUs have been connected by either individual analog cables or existing digital bus architectures - both of which present limitations, inefficiencies, and unnecessary expenses. Car audio systems that use analog wiring require dedicated, expensive, shielded cables for each audio signal or channel. The Automotive Audio Bus (or A2B) is an innovative and application tuned technology that is proven to reduce the weight of cable harnesses by up to 75% while delivering high fidelity digital audio.

Keywords: *Automotive; A2B; ECUs; UTP;*

1. INTRODUCTION

Traditionally, automotive audio ECUs have been connected by either individual analog cables or existing digital bus architectures - both of which present limitations, inefficiencies, and unnecessary expenses [1]. Car audio systems that use analog wiring require dedicated, expensive, shielded cables for each audio signal or channel. Additionally, the required analog-to-digital converters (ADCs) and digital-to-analog converters (DACs) will increase the total system cost while introducing potential areas of audio performance degradation. Digital bus standards such as MOST or Ethernet AVB have been widely adopted in current generation infotainment systems. The Automotive Audio Bus (or A2B) is an innovative and application tuned technology that is proven to reduce the weight of cable harnesses by up to 75% while delivering high fidelity digital audio [2]. The Automotive Audio Bus is optimized for audio applications delivering superior audio quality relative to analog connectivity at significantly lower system cost than existing digital bus standards. In its simplest form, A2B is a high bandwidth (50 Mbps) digital bus capable of transporting I2S audio and I2C control data together with clock and power using a single 2-wire, unshielded, twisted pair cable over significant distances - up to 10 m between nodes.

2. EXISTING SYSTEM

In the traditional systems, the automotive audio ECUs use I2S and I2C which requires many expensive cables and results in lots of connections. These connections are analog connections[4] and the cable which is used to connect the audio ECUs is shielded twisted pair(STP) cable and these cables are expensive compared to unshielded(UTP).This technology has a limitation with respect to the number of slave to host connection.

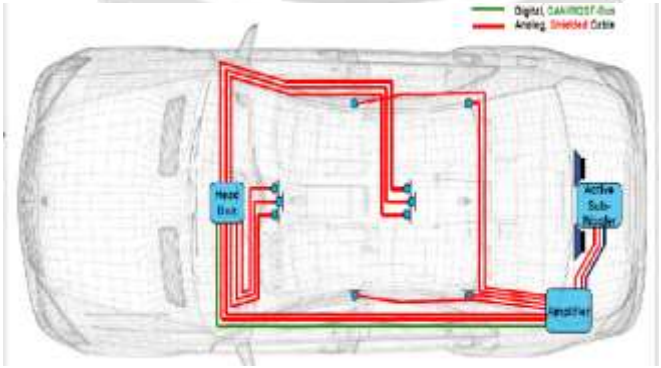

Fig 1: Existing Approach

3. PROPOSED SYSTEM

The Automotive Audio Bus (A2BTM) provides a multi-channel, I2S/TDM link over distances of up to 10 meters between nodes [3]. It embeds bi-directional synchronous data (for example digital audio), clock and synchronization signals onto a single differential wire pair[3]. A2B supports a direct point-to-point connection and allows multiple, daisy chained nodes at different locations to contribute or consume time division multiplexed channel content. Hence connecting the Automotive Audio ECUs by using A2B transceiver will reduce the connections, increase the number slaves that can be connected to the host system and makes it cost effective.

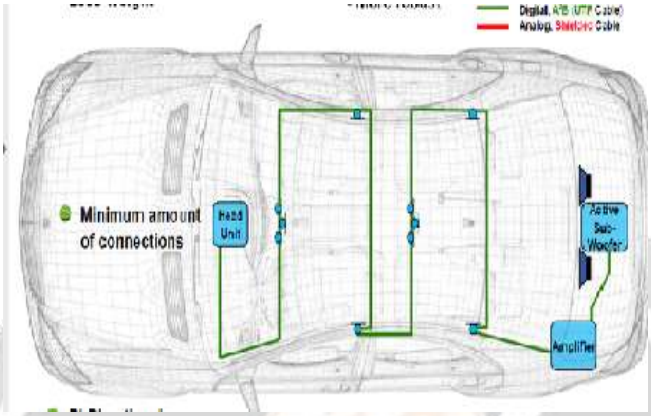

Fig 2 : A2B Approach

3.1 A2B Topology

A2B uses the line topology which consists of single master and multiple slaves where the transceiver chip at the host controller is the master. It provides a multi-channel, I2S/TDM link over distances of up to 10 meters between nodes. Overall topology length will be up to 40 meters. The communication over the distance will be a synchronous and phase aligned and it also transmits the control and status information over the distance. As shown in the figure 3, for primary evaluation we are using the one A2B master and 4 slaves. The slaves are connected in daisy chain manner. Here the devices used are microphones. From the slaves microphones are connected through the I2S bus as indicated in the figure and the A2B slaves are connected via the A2B unshielded twisted pair bus.

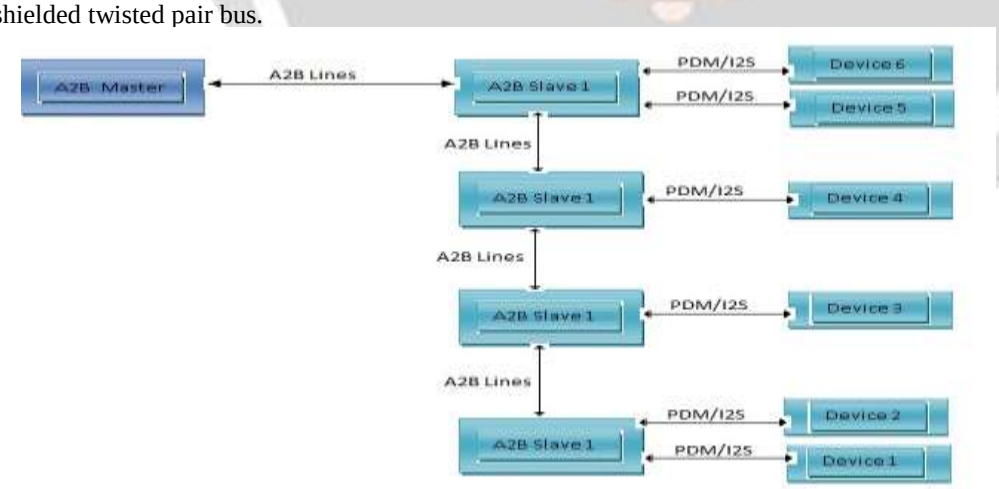

Fig 3 : A2B Topology

3.2 A2B interaction

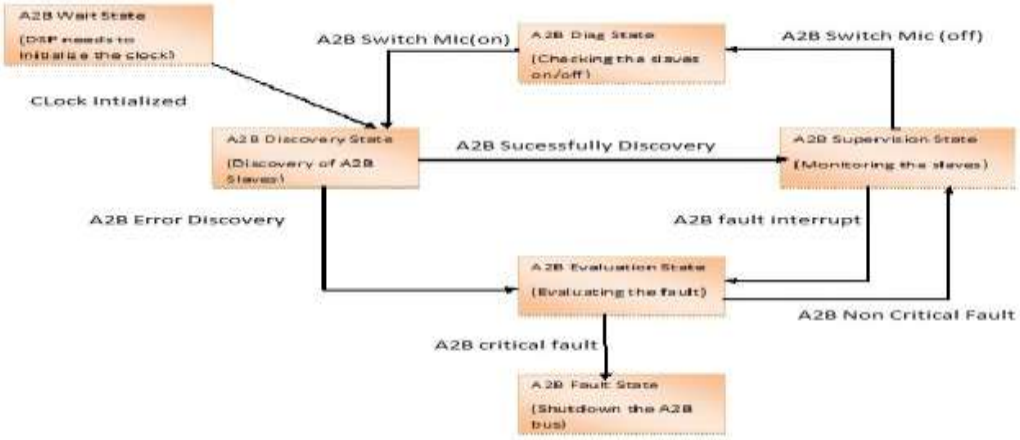

Fig 4 : A2B States

The States of A2B working is shown in the above diagram. Initially, A2B waits for DSP to initialize the clock. In the A2B discovery state, it waits for drivers to discover all the A2B slaves. After discovering the all slaves, it switches to the A2B supervision state. If any faults are detected in the A2B slaves it will go to the A2B faulty state. In the A2B supervision state, it monitors whether all the slaves for working properly. Based on whether the fault state is critical/non-critical, the A2B bus will be shut down or again switch back to supervision state. Diagnostics state will request the microphones to turn ON/OFF. Except the Supervision state, all are rolling state.

3.3 A2B application

A2B is mainly used to connect to the Automotive Audio ECU in the Car Infotainment system. The applications are:

1. Microphones
2. Speakers
3. Sensors and actuators
4. I2C Peripherals

REFERENCES

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