Amplifying In-Vehicle DTV Entertainment: ATSC 3.0 Broadcast Signal Relay via WiFi Gateway

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Abstract—This paper presents the relayed distribution of ATSC 3.0 broadcast signals to mobile users in moving vehicles. The gateway relay featured in this work seamlessly converts received ATSC 3.0 signals into a WiFi interface. This proposal exhibits the use of an ATSC 3.0-to-WiFi gateway to amplify broadcasting media in automotive, allowing personalized experience on individual seat positions.

Index Terms—ATSC 3.0, in-vehicle entertainment, mobile broadcasting, ATSC 3.0-to-WiFi gateway.

I. INTRODUCTION

IN recent years, the demand for in-vehicle entertainment and connectivity has surged, fueled by the rising prevalence of self-driving technology and the ubiquitous consumption of digital media on mobile devices. The community's approach, as a response, has first focused on developing technologies that facilitate direct-to-vehicle (D2V) content delivery. The major concern in this development has been building sufficient reliability to cope with dynamic channel situations. Notably, the use of multi-antenna diversity [1] and broadcast-broadband cooperation based on dual connectivity [2] have been proposed as solutions.

Within dynamic automotive environments, it is known as quite demanding to serve rich video content to every passenger. Considering the cellular networks these days, various physical obstacles and traffic problems incur frequent streaming interruptions. Moreover, from the user's view, it is also demanding to rely on paid data channels for streaming huge amounts of video data during a long journey on the road. Advanced Television Systems Committee (ATSC) has long remarked on such issues and has made careful efforts to support vehicle broadcasting from the very first stage of developing a new standard, ATSC 3.0. The broadcasting-based solutions such as [1] have hence been highlighted for this use case.

In fact, specific ideas to serve each individual passenger's device have been less identified so far. Such sort of detail has been recognized as the next step after building the D2V connectivity. Nonetheless, since the D2V supply is actually being embodied in the real world, it is no more a future work to hold off. This paper, in this context, introduces a feasible solution to build a bridge from air ATSC 3.0 signals to the end devices inside a vehicle.

Particularly, this is a showcasing of a WiFi gateway operating as an ATSC 3.0 relay with interface conversion ability. The presented gateway system seamlessly captures the received broadcast signals and converts them into a format compatible with WiFi-enabled devices, ensuring a smooth and uninterrupted streaming experience. Accordingly, the individual users at the seat are allowed to enjoy content on their own personalized displays in convenient positions. This paper presents the architecture design of the ATSC 3.0-to-WiFi gateway and its actual use in automotive systems. With the advent of this gateway system, the momentum of D2V broadcasting will be amplified, as it allows passengers to access a diverse array of ATSC 3.0 broadcast content on their personalized devices and displays while on the move.

II. DESIGN AND THE USE FOR MOBILE BROADCASTING

Fig. 1 illustrates the concept of the ATSC 3.0-to-WiFi gateway. Detailed design and applications will be included in the final manuscript.

The benefits extend beyond entertainment alone. The gateway system also opens up possibilities for educational content delivery, emergency broadcasts, and location-specific information dissemination to enhance the overall in-vehicle experience.

III. CONCLUSION

This paper addressed the challenge of delivering ATSC 3.0 broadcast signals to mobile users within a moving vehicle, leveraging the concept of a gateway system that converts these signals into a WiFi interface. The presented gateway system is a compact solution to provide terrestrial broadcast content to personal mobile devices, acting as a bridge between the ATSC 3.0 over the air and the WiFi network within the vehicle. Penetration loss, cabling burden, and position-dependent accessibility problems are hence resolved, thereby offering an enjoyable media experience condition. With the assistance of this vehicle gateway system, digital terrestrial broadcasting will be pleasantly embraced into infotainment systems in automotive, and would subsequently propel the expansion of D2V opportunities beyond media entertainment.
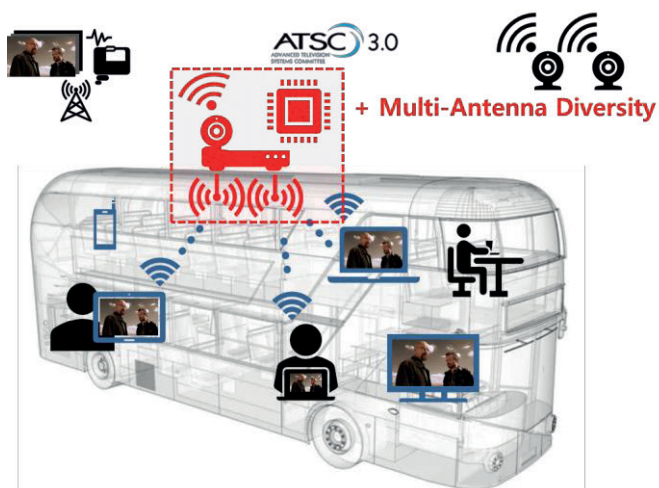
Fig. 1. Conceptual description of the ATSC 3.0-to-WiFi gateway mounted on vehicle: Mass transportation case.

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