Chapter 11
An ITS-G5 Antenna for Vehicle Communication

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ABSTRACT

Intelligent Transportation Systems (ITS) represent a revolutionary integration of advanced information and communication technologies into transportation infrastructure and vehicles. This integration aims to significantly enhance the safety, efficiency, and sustainability of transportation networks across the globe. ITS is transformative, moving beyond mere enhancements of existing frameworks to leverage a broad spectrum of cutting-edge technologies, including real-time traffic monitoring, adaptive signal control, sophisticated vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication systems, alongside advanced public transit solutions. This chapter offers an extensive overview of ITS, encapsulating its diverse technologies, widespread applications, and profound impact on global transportation systems. It introduces a paradigm shift in the conceptualization and management of transportation systems, addressing pressing urban challenges such as congestion, safety, and sustainability.

INTRODUCTION

Intelligent Transportation Systems (ITS) represent a revolutionary integration of advanced information and communication technologies into transportation infrastructure and vehicles. This integration aims to significantly enhance safety, efficiency, and sustainability of transportation networks across the globe. ITS is transformative, moving beyond mere enhancements of existing frameworks to leverage a broad spectrum of cutting-edge technologies, including real-time traffic monitoring, adaptive signal control, sophisticated vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication systems, along-

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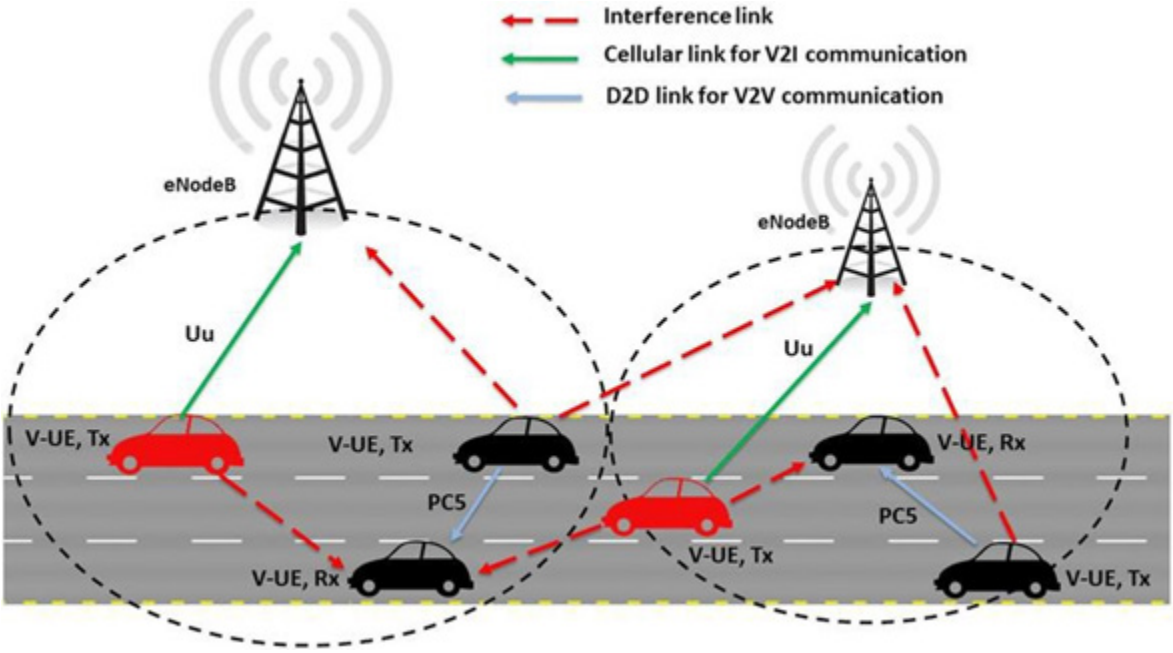
side advanced public transit solutions. This chapter offers an extensive overview of ITS, encapsulating its diverse technologies, widespread applications, and profound impact on global transportation systems.

ITS introduces a paradigm shift in the conceptualization and management of transportation systems, addressing pressing urban challenges such as congestion, safety, and sustainability. By integrating these advanced technologies, ITS enhances the capacity of transportation systems to handle increasing urban demands effectively. This literature review aims to compile, synthesize, and analyze the extensive body of knowledge surrounding ITS, providing readers with a comprehensive exploration of its multifaceted (Salami et al.,2019;Ahmad et al.,2024) aspects. Through meticulous examination, this review highlights the transformative impact of ITS technologies on transportation infrastructure and explores their potential to reshape future mobility, thereby offering readers a thorough understanding of the ITS landscape and its critical role in addressing contemporary transportation challenges.

Figure 1. Future map of intelligent transportation systems (Designed in Canva Pro)



Central to the advancements in ITS is the development of ITS-G5 technology, operating within the 5 GHz frequency band, which has been specifically engineered to optimize vehicle communication. ITS-G5 technology introduces several pivotal enhancements to vehicular communication systems:

- **Enhanced Safety**: ITS-G5 facilitates real-time V2V communication, allowing vehicles to instantaneously share critical data such as location, speed, and potential hazards. This rapid exchange of information is crucial for enhancing road safety, enabling vehicles to preemptively respond to potential dangers and effectively avoid collisions.
- **Reduced Latency**: The technology is designed to minimize communication delays, which is essential for the execution of safety-critical applications where time is of the essence. Rapid re-

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