

# Smart BRT: Requirements for the Implementation of a Smarter Transport System

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**Abstract**—This paper proposes an infrastructure planning for Smart Bus Rapid Transit (BRT), focusing on network infrastructure requirements, and explores the essential elements for implementing a Smart BRT system. We discuss how network technologies, especially 5G and Wi-Fi, ensure continuous connectivity between buses, stations, and control centers. Moreover, we highlight the roles of Network Slicing and Edge Computing in managing data traffic and processing information. The article emphasizes that beyond adopting advanced technologies, the successful implementation of a Smart BRT demands strategic planning, public policies, and collaboration among various stakeholders, pointing towards a future where Smart BRT emerges as a promising solution for smart and sustainable urban mobility. Finally, we intend to comprehend and propose the scenarios considering a smart BRT and, in the future, could evaluate the system regarding some metrics and smart city criteria.

**Index Terms**—Smart BRT, network infrastructure, 5G technology, Wi-Fi connectivity, smart urban mobility

## I. INTRODUCTION

Optimizing travel time in daily commutes is directly related to the means used to reach our destination, highlighting traffic and its impact on daily activities. Population growth and the increase in personal vehicles in large urban centers, combined with disorderly growth and lack of structural planning, lead to chaotic scenarios that directly impact people's mobility [1].

Public transportation is an efficient and sustainable alternative, where the *Bus Rapid Transit* (BRT), for example, is a flexible and low-cost solution that prioritizes the use of segregated lanes, has level boarding, with prepaid fares, along with other components that significantly differentiate it from traditional urban buses [2]. Furthermore, technological advancements have provided significant opportunities to enhance public transportation systems, such as the BRT.

Another important factor that has become essential in modern society is connectivity [3]. Today, we have a ubiquitous environment, mainly due to the high penetration of mobile devices and the use of technologies such as the Internet of Things (IoT), with sensors and connected devices collecting data in real-time, directly assisting in optimizing routes, public transportation, and safety in urban roads [4].

Smart BRT emerges from this scenario as an innovative system, incorporating advanced traffic management, information on vehicle health and safety, and assisting in accident prevention and proper functioning. It can offer users more confidence and comfort, with access to always up-to-date travel information, entertainment during the trip, and payment

options, transforming this transport choice into a pleasant experience and promoting integration between different modes of transport, such as subway, trains, bicycles, and regular buses, playing a crucial role in the advancement of smart cities. This system represents a significant step towards improving urban mobility, reflecting the commitment to creating smarter and more adaptable transportation infrastructures to the dynamic needs of modern cities.

This article offers a high-level view on using mobile networks in public transport to provide better quality and comfort in mobility services in large urban centers, focusing on a Smart BRT system. The main objective of this article is to present an infrastructure that benefits both system managers and users, offering real-time information to enhance the system's safety, maintenance, reliability, comfort, and convenience.

Among the main contributions of this article are:

- An overview of a BRT system;
- The current panorama and state of the art on the use of mobile networks for communication and management of BRT systems;
- Definition of a Smart BRT system and its advantages and challenges;
- A planning model for the deployment of a Smart BRT system, defining the components necessary for its operation;
- Proposal for applying the Smart BRT model to a real environment.

The subsequent sections of this article are organized as follows. Section II presents related works and their main differences compared to what is proposed in this article. Section III presents the fundamental concepts for understanding this article, including public transportation systems, urban mobility, and mobile networks. Section V presents the proposed deployment model for the Smart BRT and how it relates to the necessary network technologies through two application scenarios. Section VI presents the main challenges for the deployment of the proposed model. Finally, Section VII encapsulates the conclusions and final considerations.

## II. RELATED WORKS

Intelligent transportation systems have been widely discussed in recent years. Many researchers have evaluated their main characteristics and practical applicability, especially in autonomous systems and smart cities.