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Factor Analysis of the Sydney Metro's ITS: System Integration Iteration

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ABSTRACT

This paper aspires to examine advanced rail transportation systems via the utilization of intelligent transportation systems (ITS) as the basis of the key integration. In doing so, the Sydney Metro ITS will be used as the basis for the case study. This paper also investigates the different perceptions for diverse rail transportation projects. Ordinarily, cities are composed of complex configurations which are supported by various disparate transport systems. These transport infrastructure in turn require comprehensive system thinking as the base research methodologies. ITS provides an excellent mechanism to simplify a city's complex transport configurations. Nevertheless, the core ITS components require careful integration and detailed attention to detail in their design. The ITS integration strategy would also amalgamate crucial transportation issues, including optimized system performance through increased productivity, improved road and traffic safety, and so on. Accordingly, this integration and consolidation of ITS would result in superior overall transportation planning schemes. The resulting improved planning methods will ultimately facilitate the various transportation operators to become better acquainted with the ITS, and to support the making of safer and more synchronized ITS. A synchronized ITS requires a comprehensive process to successfully integrate its components. To assess the Sydney Metro's ITS integration, this research utilized confirmatory factor analysis as the statistical method to produce a model indicating the existence of four sub-systems and emphasized safety standard as the key attribute for a successful deployment. The very high safety benchmark is the pinnacle of the Sydney's advanced rail transportation system.

KEYWORDS

Intelligent Transportation Systems (ITS), Sydney Metro, System Integration

1. INTRODUCTION

Transport performs an essential role in any economy, whether moving people or freight (Mathey et al., 2015). The highest priority transport problems are often related to insufficient services, demand driven problems like congestion, and associated environmental implications (Finnerty, 2007). While ITS refers to technological advances to enhance transportation, its exploitation can significantly assist in overcoming major issues such as congestion and environmental issues (Fries and Brummond, 2009). Importantly, the ITS also includes 'process modeling' with the endeavor to present innovative services relating to different modes of transportation. Moreover, the ITS incorporates transportation engineering

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technologies including specific systems and sub-systems development, which make up the discipline's core components. The ITS may include sophisticated products that present innovative approaches to these transportation management issues. These approaches facilitate diverse transportation users in becoming better educated and therefore more coordinated and encourage safer exploitation of the transport infrastructure networks (Morgan, 2015).

Additionally, ITS can be described as the development and deployment of advanced information and communication technologies to deliver safer, more efficient and environmentally sustainable modes of transport that are exemplified by improvements in the overall schematics and configurations of transport, infrastructure, and in-vehicles systems (Gharehbaghi and McManus, 2019). Nonetheless, traffic and mobility management need to be carefully and thoroughly integrated via interfaces with other modes of transport (Cao, 2015).

2. LITERATURE REVIEW

Traditionally, ITS utilizes computational technologies to further advance transport related knowledge towards more capable and increased system performance (Thekdi and Lambert, 2012; Gharehbaghi et al., 2020b). Such enhancements could include the evolution of in-vehicle electronics like multi-tasks computer processes to perform driver support activities. These computational technologies include artificial intelligence and holistically integrated computing (Ojha et al., 2017; Gharehbaghi and Farnes, 2018). The holistic integration of artificial intelligence as a part of complex rail transportation ITS and the verification processes such as those depicted in Figure 1 facilitate the smooth integration of artificial intelligence into the computing platforms.

As it can be observed from Figure 1, for the rail transportations and their systems, the launch of the ITS verification process is the implementation of the system's parameters to establish the principal boundary of the verification system. Following on, the ITS elements and subsequent performance indicators are established to validate its progress. Furthermore, the key functionality requirements are then determined followed by the automation stage where specific certifications are determined.

Figure 1. Overview of ITS verification process for rail transportation