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DEVELOPMENT OF A LOCAL ITS PROJECT ARCHITECTURE FOR SOLVING RURAL AREAS TRANSPORT ACCESSIBILITY

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Abstract. Intelligent Transport Systems Architecture (ITSA) is a main architecture for intelligent transport systems, where the system architecture provides the most complete picture of what an ITS implementation will look like from a design perspective. It may also provide users with the easiest and most common knowledge about ITS and its prospect in traffic management development. This research explores the adaptation of ITSA principles for rural areas by aligning with established ITS frameworks while introducing rural-specific modifications.

Keywords: Intelligent Transport Systems Architecture, Transport accessibility, Intelligent Transport Systems, ITS service, Traffic Management

РАЗРАБОТКА АРХИТЕКТУРЫ ЛОКАЛЬНОГО ПРОЕКТА ИТС ДЛЯ РЕШЕНИЯ ПРОБЛЕМЫ ТРАНСПОРТНОЙ ДОСТУПНОСТИ СЕЛЬСКИХ РАЙОНОВ

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Аннотация. Архитектура интеллектуальных транспортных систем дает наиболее полное представление о том, как будет выглядеть реализация системы с точки зрения проектирования. В данном исследовании рассматривается архитектура ИТС с учетом специфики транспортного обслуживания сельских районов.

Ключевые слова. Интеллектуальные транспортные системы, транспортная доступность, архитектура интеллектуальных транспортных систем, сервисы ИТС, организация дорожного движения

Ensuring transport accessibility in rural areas is one of the key socio-economic challenges nowadays. Despite the active development of Intelligent Transport Systems (ITS), most architectural solutions are focused on urban conditions and don’t take into account the rural areas specifics, such as low population density, limited infrastructure and economic feasibility. In this regard, there is a need to develop a specialized local ITS architecture adapted to the unique needs and constraints of rural areas [1-8].

Such services as Traffic Metering, Regional Traffic Management and ITS Communications were identified and elaborated in detail. Let's look at their purpose and architectural implementation, demonstrating how each of them contributes to the goal of increasing transport system mobility and efficiency.

1. ITS service Traffic Metering

This service should provide accurate traffic metering. It ought to utilize advanced sensors and algorithms to precisely measure traffic flow rates, vehicle densities and speeds across different road segments. By traffic conditions monitoring in real - time, the service can detect congestion hotspots promptly and adjust traffic signals, ramp metering rates, or provide dynamic route guidance to manage the traffic flow effectively. It should also generate detailed traffic reports and analytics, helping transportation authorities and planners understand traffic patterns over time, optimize infrastructure functioning and make informed decisions to enhance overall traffic efficiency and reduce travel delays within the ITS framework.

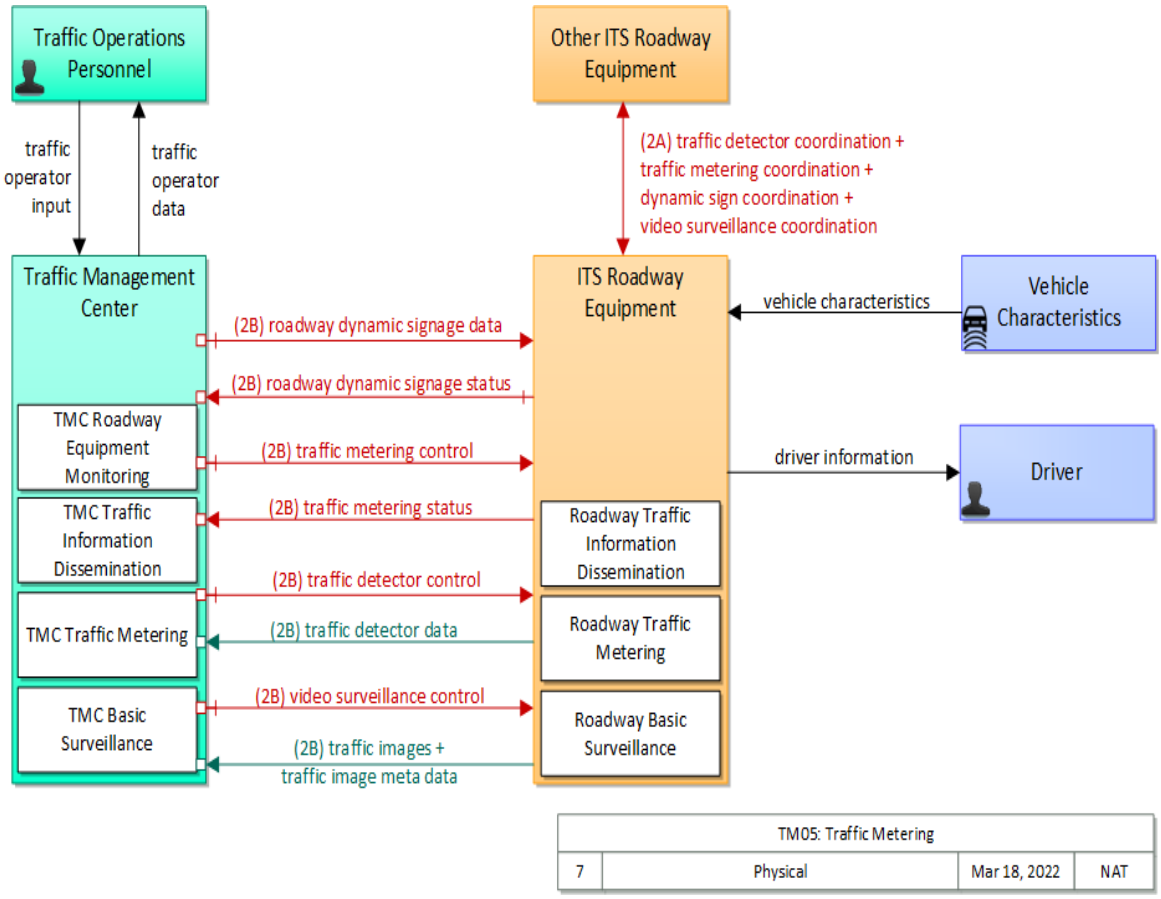

Figure 1- Physical architecture for ITS service Traffic Metering

Рисунок 1 - Физическая архитектура для учета служебного трафика ITS

2. ITS service Regional Traffic Management

This service is necessary to ensure comprehensive traffic management in the region, including rural areas. Its functions include integrating data from a wide range of sources, including road sensors, cameras, and GPS-enabled vehicles, to gain a holistic view of the road conditions in the region. By analyzing real-time traffic data, the service allows you to predict congestion, accidents, and other disruptions, which allows you to use proactive management strategies such as dynamically setting the time for traffic lights at multiple intersections, coordinating public transport schedules in addition to traffic flow, and sending drivers targeted warnings and suggestions. by changing the route. In addition, this service facilitates communication and cooperation between various traffic management authorities, providing a unified approach to solving regional traffic problems and optimizing the transportation process for all road users.

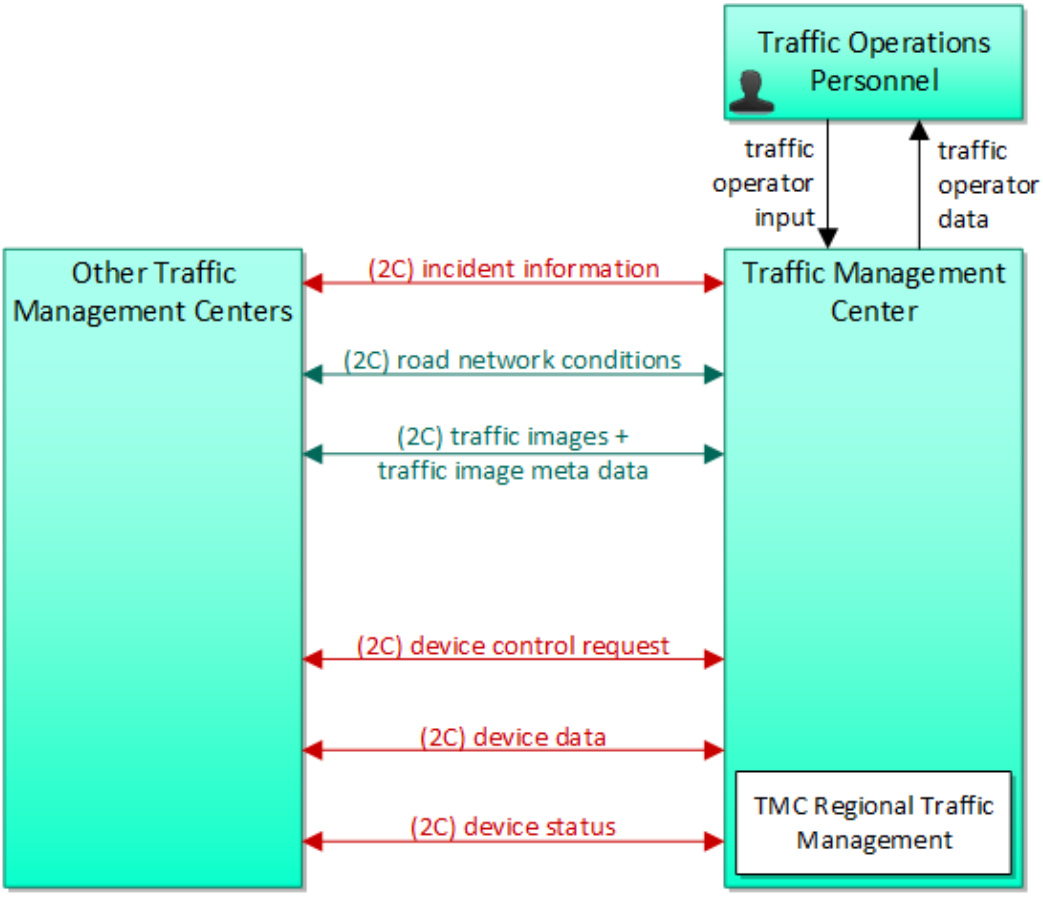

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Figure 2-Physical architecture for ITS service Regional Traffic Management
Рисунок 2 – Физическая архитектура для управления региональным трафиком службы ITS

3. ITS service ITS Communications

The function of this service is to ensure uninterrupted data exchange between various components of the transport infrastructure, allowing vehicles, road sensors, traffic control centers and mobile devices to interact effectively. High-speed, low-latency communication channels are essential for real-time information exchange. In addition, this service must support multiple communication protocols for working with various devices and systems, and include reliable security measures to protect confidential data during transmission, ensuring the integrity and confidentiality of ITS operations.

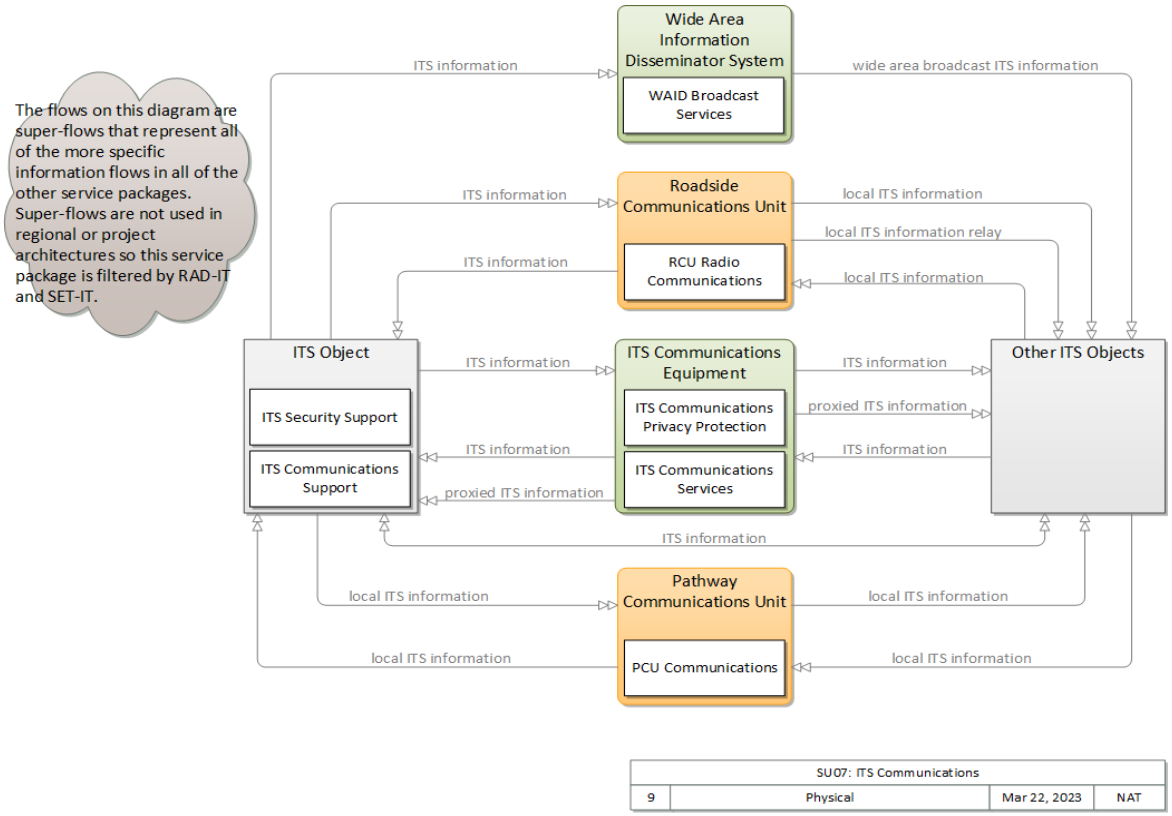

Figure 3 – Physical architecture for ITS service ITS Communications
Рисунок 3 – Физическая архитектура для обслуживания СВОИХ коммуникаций

In conclusion, it should be stated that the development of the architecture of a local project of an intelligent transport system for rural areas is a complex, strategically important task. The presented description of ITS services is characterized by completeness and depth, revealing the variety of their functional content and significance. Services such as bus location tracking, dynamic management of their operation, and prioritization of travel through traffic lights contribute to improving the efficiency and reliability of public transport. Coordination of different types of transportation and guarantees of non-stop routes improve the overall passenger experience of the trip and increase the attractiveness of public transport.

The functions of monitoring and managing Vehicle Internet (IoV) systems, data distribution, location and time determination, and ITS communications form the technical basis for the smooth functioning of the entire ecosystem, ensuring data security, accurate positioning, and effective communication. Traffic accounting and regional traffic management play a key role in optimizing traffic flows at the local and regional levels, while micro-forecasting the traffic situation provides valuable information for active traffic management and increased safety.

Thus, the proposed architecture of the local ITS project has significant potential for transforming the transport situation in rural areas. The introduction of advanced technologies and innovative service models makes it possible to increase the mobility of the population, improve access to basic services and stimulate the economic development of rural areas. However, the successful implementation of the project requires close cooperation between all stakeholders, including local governments, transport agencies, technology providers and the public. Promising areas of research and development should focus on adapting the proposed architectural solutions to the specific needs of various rural communities, addressing issues of economic efficiency and ensuring long-term sustainability. The implementation of these

measures will contribute to the creation of a more intelligent, efficient and inclusive transport system for rural areas.

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