

## SMART CITY CHALLENGE 2024

### Solution idea for the city challenges

Max 3 pages

send to [smartcity@taltech.ee](mailto:smartcity@taltech.ee) by Sept 16, 2024

**Solution Idea Title** (max 5 words, no acronyms) – AI-Driven Smart Bus Optimization

**Planned pilot project duration** – 24 months

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#### 1. Which urban challenge or problem are you planning to provide a solution to?

Efficient passenger counting in public buses (Jurmala, Latvia)

#### 2. The solution you are proposing

Avanti R&D, Inc. proposes the following innovative AI and IoT solutions to address the challenges of optimizing Jurmala's public bus system. These technologies are designed to enable data-driven decision making while protecting passenger privacy and supporting an efficient, environmentally-conscious public transportation system.

##### 1. Anonymous Passenger Counting System:

Utilizing Avanti's advanced anonymous re-identification (Re-ID) technology, this system accurately counts passengers getting on and off buses while complying with GDPR. It detects when passengers board and disembark, analyzing route usage trends and popular stops without identifying individuals. This enables route optimization based on actual demand.

##### 2. AI-powered Computer Vision System:

Cameras installed inside buses, coupled with AI algorithms, detect whether passengers are seated or standing. This enhances passenger's safety and optimizes bus departure timing. The system can also be used for real-time monitoring of crowding levels.

##### 3. Smart Traffic Monitoring System:

Edge computing-based roadside sensors installed at key intersections and bus stops detect pedestrians, cyclists and other vehicles in real-time. By integrating this information with the bus system, traffic safety and operational efficiency can be improved.

##### 4. Multilingual Personalized Information System:

Combining sound analytics and deep learning technologies, this system detects passenger's languages and provides personalized, multilingual information. This includes route information, next stops, and tourist information, with potential integration with Jurmala's "resident card" system.

##### 5. On-board AI Assistant System:

A Large Language Model (LLM) installed on the bus, operating without internet connection, provides real-time answers to passenger queries. This enhances support for tourists and new users, encouraging greater use of public transportation.

All of these functions are designed with strict adherence to personal data protection, fully complying with GDPR and other data protection regulations. They also contribute to environmental conservation by optimizing routes to reduce CO2 emissions.



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Avanti R&D Inc. is committed to working closely with the City of Jurmala to ensure the success of this innovative project. We are happy to provide more detailed explanations or demonstrations upon request.

This solution directly addresses Jurmala's needs by:

- ✓ Providing accurate passenger counting while respecting privacy.
- ✓ Enabling route optimization based on real demand.
- ✓ Improving the environmental friendliness of the public transport network.
- ✓ Supporting data-driven decision making in mobility.
- ✓ Enhancing passenger information and experience.
- ✓ Integrating with the existing "Jurmala residents' card" system.
- ✓ Increasing citizen satisfaction with public transport.
- ✓ Demonstrating the importance of mobility in urban planning and development.

### 3. Innovation and piloting of your pilot solution.

#### 1. Current Solutions and Our Innovation:

Existing solutions often include basic passenger counters, GPS-based tracking, and standalone route planning software. However, these typically lack integration and real-time adaptability.

Our solution innovates by:

- ✓ Integrating multiple data streams (passenger counts, traffic conditions, environmental factors) into a cohesive system.
- ✓ Using advanced AI and edge computing for near real-time decision making.
- ✓ Providing multilingual, personalized passenger information.
- ✓ Ensuring GDPR compliance through anonymous data collection.
- ✓ Offering an on-board AI assistant for enhanced user experience.

The key innovation lies in the seamless integration of these technologies, providing a comprehensive, privacy-compliant solution that adapts in real-time to changing conditions. This technology has been successfully demonstrated in Tartu, Estonia, proving its effectiveness in a real Baltic urban environment.

<https://www.tartu.ee/en/culture-bus>

#### 2. Piloting Requirements and Process:

For piloting, the City of Jurmala would need to provide:

- ✓ Access to 2-3 buses for system installation
- ✓ Permission to install roadside sensors at key locations
- ✓ Integration with existing ticketing systems (e.g., "Jurmala residents' card")
- ✓ Cooperation from bus drivers and staff for training and feedback

The piloting process could work as follows:

1. Initial installation and testing on 2 buses (1 month)
2. Pilot operation on selected routes (2-3 months)
3. Data collection and analysis
4. Iterative improvements based on feedback
5. Evaluation of results and decision on full-scale implementation.



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### 3. Team Capabilities and TalTech Collaboration:

Our proposed team includes:

- ✓ AI and Machine Learning specialists
- ✓ Computer Vision experts
- ✓ IoT and Edge Computing engineers
- ✓ Data scientists

For collaboration with TalTech, we propose to involve their researchers in:

- ✓ Local transport optimization: Leveraging TalTech's expertise in Baltic urban planning to tailor our algorithms output for Jurmala's specific needs and infrastructure.
- ✓ Environmental impact assessment: Utilizing TalTech's environmental science resources to quantify and minimize the ecological footprint of our solution both from roadside and in-vehicle environmental sensors.
- ✓ Data privacy compliance: Partnering with TalTech's legal experts to ensure full adherence to Baltic and EU data protection regulations.
- ✓ User experience analysis: Collaborating with TalTech's social scientists to conduct comprehensive user studies and improve system adoption.

This partnership synergizes Avanti R&D's cutting-edge technology with TalTech's deep local insights, resulting in a solution precisely calibrated for Jurmala and adaptable to other Baltic cities.

### 4. Expected impact of your pilot solution.

Potential Impact for City Environments, Sustainability, and Citizens:

#### 1. City Environment:

Optimized public transport reduces congestion and emissions, improving air quality. Data-driven urban planning enables more efficient infrastructure and lower noise levels, creating a healthier city environment.

#### 2. Sustainability:

Efficient routing reduces CO2 emissions. Resource optimization and promotion of sustainable transport lead to improved energy efficiency and reduced environmental impact.

#### 3. Citizens:

Enhanced service quality improves mobility, saves time, and increases public transport satisfaction. Health benefits, cost savings, and improved accessibility enhance overall quality of life.

#### 4. Economic Impact:

Improved mobility boosts the local economy and attracts businesses. New job opportunities and increased city attractiveness stimulate overall economic growth and innovation.

#### 5. Smart City Development:

Data-driven governance enables informed decision-making. IoT integration and real-time analytics improve city services and resource management, enhancing overall urban efficiency.



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