SMART CITY CHALLENGE 2025

Solution idea for the city challenges

*Max 3 pages | send to **smartcity@taltech.ee** by Nov 30, 2025*

Solution Idea Title: AI Urban Planning Assistant

Planned pilot project duration: 24 months

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

Which city challenge/-s proposed by the cities/counties you are targeting?

Target Challenge: Multiple City Infrastructure Management Systems (Tallinn, Estonia)

Tallinn's Urban Environment and Public Works Department manages separate information systems across multiple departments. The city seeks to consolidate and utilize growing urban data volumes to improve planning, development, and investment prioritization. Currently, fragmented data limits comprehensive analysis—investments rely on partial information, maintenance remains reactive, and insights stay siloed.

UrbIA offers a practical AI platform connecting these systems without replacement, enabling natural language queries that yield data-driven, prioritized recommendations with transparent analysis. This supports Tallinn's **Happy City** vision by making infrastructure investments more transparent, justified, and efficient—delivering better citizen value through smarter resource use.

2. The solution you are proposing

What is the solution you are proposing for the challenge above?

UrbIA (Urban Intelligence Agent) is an AI platform bridging fragmented city data and actionable decisions. Built on complex systems principles, UrbIA treats cities as **M³ systems—Multilayer, Multiscale, and Multimodal**—integrating semantic, spatial, and temporal reasoning in a unified framework. Specialized AI agents work in concert: for example, one searches regulations, another analyzes infrastructure spatially, a third visualizes results. Together they integrate information from separate municipal systems without requiring consolidation.

For Tallinn, UrbIA will deliver three core functions:

- **Investment Prioritization Calculator:** Scores projects analyzing construction site data—traffic, utilities, demographics
- **Maintenance Management Intelligence:** Identifies infrastructure needs based on age, condition, usage, and inspection history
- **Urban Vision Layer:** Interprets street imagery, orthophotos, LiDAR, measured (owned by the city or publicly available) and predicted microclimatic data and satellite data for infrastructure assessment including green infrastructure.

Officials query conversationally—"Which neighborhoods need pedestrian improvements?" or "What maintenance fits this year's budget?"—receiving transparent, explainable answers tracing to source data. The human-centered interface requires no specialized training, ensuring accessibility for both technical staff and decision-makers.

How does it solve the city challenge you target?

UrbIA directly addresses Tallinn's needs through:

- **Breaking Data Silos:** A multi-agent architecture that integrates separate systems without requiring data consolidation.
- **Automated Analysis:** Agents continuously examine data, support officials in problem-solving, and operate like real data analysts: they follow task lists, run Python code, fact-check sources, and verify the internal consistency of their results. They deliver clear, explainable reports with all data sources and references.
- **Error/Allucinations-Proof Workflows:** Multiple mitigation strategies ensure source-grounded and reliable analysis, mitigating hallucinations. Every step of the workflow—including sources consulted and code executed—is documented.
- **Full Transparency:** Agents collaboratively produce detailed, auditable accounts of their analytical process, giving users complete insight into how results were obtained.
- **Objective Prioritization:** A transparent scoring framework replaces subjective manual assessments, supporting both short-term (e.g., road maintenance) and long-term (e.g., vegetation cover expansion) planning.
- **Predictive Maintenance:** Pattern detection highlights early signs of potential issues, enabling proactive intervention.
- **Democratic Access:** A natural-language interface removes the need for specialized training, making data and insights accessible to all stakeholders.

3. Innovation and piloting of your pilot solution

What are the best solutions available now? How will your solution be better? What is the innovation?

UrbIA's multi-agent architecture combining Large Language Models with Retrieval-Augmented Generation (RAG) and cartographic reasoning enables true cross-departmental integration. Unlike dashboards that display data, UrbIA actively reasons across semantic, spatial, and temporal dimensions.

Current solutions fall short: GIS systems excel at visualization but lack semantic reasoning. Digital twins replicate systems without explaining relationships. Urban-aware LLMs (CityGPT, UrbanGPT) require retraining per city and cannot dynamically access live data or external tools.

UrbIA's five key differentiators:

1. Agentic Architecture: Coordinated agents adapt to new cities without retraining, unlike monolithic models

2. M³ Framework: Simultaneously processes meaning, location, and evolution—answering complex questions traditional systems cannot

3. Tool-Using Intelligence: Agents employ computational tools and connect to existing city systems, creating a meta-layer over infrastructure

4. Urban Vision: Interprets imagery, available and future microclimatic data to assess infrastructure condition and morphology and, later in the development, propose scenarios beyond text and numbers

5. Explainable AI: Every recommendation traces to source data through RAG, ensuring transparency and accountability

What do the cities need for piloting? How the piloting could work?

24-month pilot phases: (1) System learning—integrate Tallinn's data and information systems; (2) Core development—build prioritization and maintenance modules; (3) Testing—pilot with Urban Environment Department; (4) Evaluation—formal assessment with knowledge transfer to partner cities.

City requirements: Access to municipal data systems, dedicated liaison, sample projects and historical data, expert validation panel.

Please provide short information about the capabilities of the research and development proposed team.

Our team combines expertise in complex systems physics, urban science, AI/ML, and high-performance computing:

- **University of Bologna:** Complex systems modeling, LLM architectures, urban data science (Departments of Physics and Department of Architecture)
- **CINECA:** Italy's largest supercomputing center—cloud infrastructure, scalability, security
- **TalTech Department of Civil Engineering and Architecture: Estonia digital twin expertise, local microclimate and green infrastructure,** smart city and digital governance expertise.

The team has developed a working UrbIA prototype tested on Bologna, demonstrating core architecture feasibility. We seek TalTech partners with expertise in *urban planning systems, GIS integration, Estonian digital infrastructure, and smart city governance*.

4. Expected impact of your pilot solution

What is the potential impact for city environments, sustainability and citizens?

UrbIA enables data-driven governance delivering measurable outcomes: cross-department fusion across infrastructure domains, 40-60% reduction in prioritization time, and establishment of verifiable AI-supported workflows. At completion, the platform (TRL 6-7) will be operational for municipal departments with expansion foundation for other European cities.

City Environment: Maximum value per infrastructure euro through comprehensive analysis and proactive maintenance reducing failures

Citizens: Transparent demonstration of optimized public investments creating better-planned, well-maintained environments with faster implementation

City Governance: Automated analysis frees officials for creative problem-solving while breaking silos enables coordinated action. Predictive insights reduce failures and emergency spending

Sustainability: Intelligent prioritization maximizes infrastructure lifespan. Vision analysis assesses environmental vulnerabilities (heat islands, flood risk) for proactive adaptation. Temporal reasoning enables multi-decade strategies aligned with sustainability goals

Finally, Our proposal might also correlate positively with the other challenge *“City services do not reach right citizens at right time”*

Quantifiable Success Metrics:

- 40-60% reduction in manual project evaluation time
- Increased data-informed decision confidence (expert surveys)
- Improved investment ROI through optimized prioritization
- Decreased emergency maintenance costs via predictive interventions
- Citizen satisfaction improvement in urban services delivery