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SMART CITY CHALLENGE 2025

City Challenge

Max 3 pages

send to smartcity@taltech.ee by Sept 30, 2025

Challenge Title – Targeting high-emitters for health

City/county and country – Barcelona (Spain)

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1. What is the future urban challenge that would need a solution to?

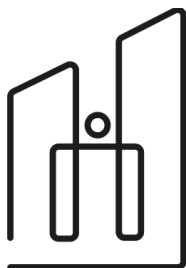
In cities and peri-urban areas of all types, vehicle transit traffic is particularly intense and is the main contributor to air pollutants. A small proportion of high emitting vehicles representing only 2 to 3 percent of the circulating fleet are responsible for over 40 percent of motorised traffic emissions according to site tests and academic studies. These emissions directly affect human health, contribute to climate change, and undermine the quality of urban life.

Barcelona has already deployed a Low Emission Zone (LEZ), but current enforcement tools are insufficient for identifying and acting on high-emitting vehicles in real time. This limitation leads to a disproportionate concentration of polluting vehicles, resulting in poor air quality, elevated noise levels, and increased health risks for residents. Therefore, we are seeking the next step: a more effective solution to accurately identify high-emitting vehicles and enable authorities to notify, sanction, and remove them from circulation.

The challenge primarily falls under the **climate resilient city** category, as it directly addresses urban environmental stressors that contribute to climate change and public health risks. At the same time, it contributes to creating a **safe and happy city** by reducing exposure to harmful air pollutants and excessive noise, improving the overall well-being of residents.

This topic is a high priority because transport-related air pollution and noise are among the most urgent environmental threats to health and well-being in European cities. Tackling this issue will help cities comply with upcoming EU legislation (2025 Roadworthiness Package), protect citizens' health, reduce healthcare costs, and strengthen climate resilience. Hence, this is not unique to a single city or only to big cities, it is for everyone and everywhere: high-emitting vehicles are a challenge shared by most European cities, especially those with high traffic density, and growing mobility demands, and the urgency is increasing due to new EU regulations and the pressing need for enforceable solutions.





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2. Innovation.

How have you solved that issue so far? Why aren't the present solutions good enough? Are there legal obstacles? Current solutions for monitoring vehicle emissions rely on isolated testing, periodic inspections, or limited remote sensing deployments. While these approaches can detect tampered vehicles or provide sporadic measurements, they are insufficient for real-time identification and enforcement of high emitters across entire urban fleets. Existing tools lack integration between emission measurement, noise detection, and enforcement-ready digital platforms. Legal obstacles include the upcoming EU 2025 Roadworthiness Package, which mandates continuous monitoring and action on high-emitting vehicles; no fully compliant, industrial-grade system currently exists to meet these requirements at city or EU scale.

What should be the main features, characteristics of the future solution to be potentially best for that challenge or problem? The future solution should combine continuous, autonomous, and real-time monitoring of vehicle emissions and noise with an integrated digital platform for alerts, enforcement, and data sharing. Key characteristics include:

- High precision detection of NO_x, CO, HC, PM, NH₃, and noise emissions at individual vehicle level.
- Automated data processing, alerts, and integration with vehicle registries and enforcement authorities.
- Scalability and adaptability to diverse urban contexts and fleet compositions.
- Minimal operational cost and robust industrial-grade hardware suitable for long-term deployment.
- Compliance with EU regulatory frameworks, enabling authorities to act on high emitters efficiently and support evidence-based policy decisions.

This combination of hardware, software, and regulatory alignment positions the solution as a disruptive and scalable innovation, uniquely capable of reducing pollution, improving public health, and ensuring legal compliance across European cities.

3. Expected impact of your pilot solution.

Impact on the city environment: The city can expect a substantial reduction in air pollutants and noise levels, particularly in areas with high traffic density at short-medium term. By targeting high-emitting vehicles, which contribute excessively to urban emissions, overall air quality will improve (mobility and transport related emissions are the highest ones in EU cities), GHG contributions from motorised transport will decrease, and the city will become more climate resilient. The deployment of continuous, real-time monitoring stations will also create a comprehensive environmental data



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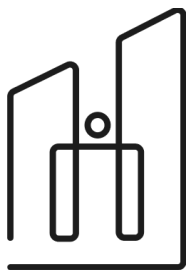


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infrastructure, enabling more effective planning and management of Low Emission Zones and other mobility-related policies.

Impact on citizens: In 2022, road transport was responsible for approximately 29.3% of particulate matter (PM10 and PM2.5) emissions in the EU-27, contributing to poor air quality and health risks, with 96% of the EU urban population exposed to PM2.5 levels above WHO guidelines. Hence, citizens will experience tangible improvements in public health and well-being. Reduced exposure to harmful air pollutants such as NOx, CO, HC, PM, and NH₃ will lower the risk of respiratory and cardiovascular diseases, while decreased noise levels will reduce stress, sleep disturbance, and related health issues. Vulnerable groups, including children, elderly, and residents in densely trafficked areas, will benefit the most. Additionally, by providing transparent, data-driven enforcement and policy measures, citizens will perceive the city as safer, cleaner, and more liveable.

Impact on city governance: City authorities will gain unprecedented access to high-resolution, real-time data on vehicle emissions and noise, enabling evidence-based decision-making. Enforcement of LEZ and other regulatory measures will become more efficient and effective, ensuring compliance with the EU 2025 Roadworthiness Package. The solution will streamline coordination between mobility and other city areas, foster cross-border data integration, and provide a replicable model in EU. Ultimately, governance will become more proactive, responsive, and transparent, supporting sustainable urban mobility planning and long-term climate and health objectives.

4. Piloting

We are interested in becoming a piloting partner because the proposed solution directly addresses one of the most pressing urban mobility challenges in our city: high-emitting vehicles causing disproportionate air and noise pollution. By participating, we can test, validate, and demonstrate the effectiveness of different devices and integrated enforcement tools in real urban conditions.

Barcelona has the necessary infrastructure, regulatory framework, and technical capacity to support pilots, including traffic monitoring systems and collaboration between environmental, transport, and law enforcement departments.

Similarly, the proposed solution is expected to be feasible in Estonian cities, which have well-organized urban planning, emerging environmental initiatives, and the capacity to integrate digital monitoring tools. This enables the provision of real-world conditions, actionable feedback, and data for performance validation, ensuring the solution is scalable and replicable across diverse European urban areas.



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