FinEst Centre
for Smart Cities

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 - Responsive Acoustic Safety Network (HearMe)

Planned pilot project duration – 24 months

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

Amsterdam: Women's Safety in Public Spaces, European countries

2. The solution you are proposing

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

We propose HearMe, a network of acoustic and vibration-sensitive panels installed on secluded paths, parks, and cycle lanes. Each panel reacts to distress sounds or violent vibrations such as screams, shouts for help, or sudden impacts. When detected, the system can instantly brighten nearby lights, trigger a sound-based alarm, and send an alert to a community network. AI filters collect and analyze on-site data to avoid false alarms and, if danger is modeled with high efficiency and accuracy, automatically notify police or emergency services with the exact location.

- How does it solve the city challenge you target?

HearMe enhances safety for women, children, and citizens by turning dark, dangerous areas into active, responsive spaces. It uses brighter lighting to highlight potential threats (if available), sends instant alerts to speed up responses, and employs anonymous acoustic detection so victims don't need to call for help, which is crucial since many people freeze in stressful situations. As an alternative to light, the systems can use a sound-based alarm that mimics police approaching. The AI can automatically help detect distress signals without needing words. Alerts can be accurate, integrating geotagged sensor zones to form a smart grid that can identify incidents even without GPS. Connecting a phone or smartwatch can boost accuracy, but it is optional. Overall, HearMe safeguards privacy while ensuring quick, local responses.

3. Innovation and piloting of your pilot solution.

- What are the best solutions available now that solve the challenge you target?

Public safety measures in European cities are limited to upgrading lighting, installing CCTV networks, and using mobile emergency solutions. While better visibility and reporting technology are helpful, these measures are still primarily reactive, addressing situations only after they happen, and can be obtrusive to those who wish to maintain a level of privacy. Continuous monitoring raises ethical and privacy concerns, and safety mobile apps assume users can freely operate a phone when there's an emergency, which is often not the case.

Many urban areas have acoustic detection systems, but they are limited to monitoring gunfire, explosions, and breaking glass. They're designed for indoor settings. Detecting and recognizing distress calls and screams in

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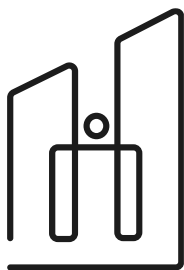
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the open, urban soundscape is a significant challenge. Traffic, weather, and crowds often mask the sounds of distress, making it easy to hide screams.

- How will your solution be better? What is the innovation in it?

HearMe will be a new material-integrated safety infrastructure that listens, analyses, and reacts in real time. HearMe panels should be designed to detect distress, trigger visible light and sound responses, and initiate community action. There are no privacy concerns, however, because on-device AI processes sound and vibration signals, making the detection completely anonymous.

HearMe can implement the following innovations:

On-device acoustic and vibration intelligence: AI analyzes short sound and vibration clips when something is close to or directly within the sensor panel. There is no continuous recording or streaming, which ensures quicker responses and privacy.

Material-integrated design (long term): TalTech materials-science research can develop/update acoustic panels made from recycled, self-cleaning, antimicrobial, and other innovative composites. Such coatings have the potential to improve acoustic clarity and durability for the rainy outdoor Baltic and North Sea climates (research phase). Alternatively, existing configurations can be assembled.

Community-linked response network: HearMe, instead of surveillance, will develop a hyperlocal guardian system that automatically notifies trained volunteers and nearby safe-haven places (before police) when something escalates. This human-in-the-loop arrangement makes safety a communal social activity. As an alternative, the system can utilize a digital alert or contact list accessible via a mobile app. When a HearMe panel detects an event, all contacts in the phone or nearby contacts from the list, along with registered citizens, receive a secure push notification with basic event information and a map quadrant, not an exact address, reducing the risk of misuse. The same platform can later integrate with smartwatches or phone sensors, enabling people's devices to act as additional mobile acoustic nodes, expanding coverage and scalability without the need for dense sensor arrays.

Each HearMe panel has a fixed location and listens to a specific area around it. When two or more panels detect the same unusual sound or vibration simultaneously, we know the event occurred in the area where their listening zones overlap. This grid approach lets us pinpoint the location without tracking anyone's GPS. It also keeps the system accurate, and alerts can be sent only when several panels detect the same pattern, helping prevent false alarms and unnecessary responses. All the above make the system quicker, privacy-respecting, and more inclusive, and community-empowering, thus introducing a new approach to gender-sensitive urban safety.

- What do the cities need to pilot the proposed solution?

To pilot HearMe, a modest physical setup and strong coordination between municipal safety, lighting, and community departments are needed. The system is designed to integrate easily into existing urban infrastructure with moderate adjustments. City needs:

- ✦ Two or three suitable locations, such as cycling routes, park paths, tunnels, or underpasses, that have been recorded as having safety concerns or low night-time use.
- ✦ Existing lighting poles or structures with access to low-voltage electricity (or solar power).
- ✦ Network connectivity for transmitting short event alerts.
- ✦ Local community and stakeholder engagement: women's organizations, neighborhood associations, and safe-haven cafés or campuses, willing to participate in the guardian network.
- ✦ Municipal support for data governance to ensure GDPR-compliant data management and safety protocols.

- How could the pilot work?
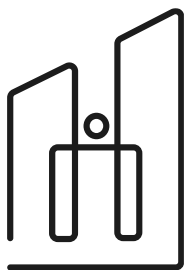
✦ *Co-development phase*: Development or upgrade of existing acoustic and vibration panels to reach predefined criteria.
✦ *Co-design phase*: Workshops with city officials, women's groups, and residents to identify high-risk zones and adapt HearMe alert thresholds, language, and visual cues.
✦ *Installation and calibration*: Install 15–30 HearMe panels per route, connect to lighting and communication networks, and test AI models to local sound and vibration profiles.
✦ *Operational phase*: system monitors routes, triggers adaptive lighting and community alerts when distress is detected, and collects anonymized event data for analysis.
✦ *Evaluation and scaling*: Assess safety improvements through surveys and incident data, refine AI models, and prepare open-source deployment guidelines for other cities.

The pilot will demonstrate how innovative materials, on-device AI, and community engagement can create a new kind of safety infrastructure. This responsive urban environment listens and reacts, without relying on surveillance. With this pilot, Amsterdam and partner cities can become European leaders in gender-responsive, privacy-preserving urban safety innovation.

Research team capabilities: The R&D team will combine expertise in materials science (e.g., S. Polivtseva, I. Husainova), physics (e.g., A. Mere), artificial intelligence (e.g., J. Belikov), and software development (e.g., J. Prokofjev), and smart-city expertise from TalTech and partners from municipal innovation lab and safety departments. The expertise from TalTech can also be widened to machine learning, signal processing, edge AI hardware, embedded electronics, acoustic modelling, privacy-preserving AI, and field testing.

4. Expected impact of your pilot solution.
• What is the potential impact on city environments, sustainability, and citizens?

Impact on the city environment
HearMe has the potential to revitalize neglected or unsafe public cycle paths, parks, tunnels, and underpasses, transforming them into active and responsive corridors. Using acoustic and vibration sensing combined with adaptive lighting, these spaces will detect distress and respond within seconds. Safety and attractiveness will instantly improve. The system enhances urban awareness without surveillance, supporting inclusive and gender-sensitive design. It also provides data on high-risk areas for future safety enhancements.

Impact on citizens
HearMe focuses on women, girls, and vulnerable individuals who often feel unsafe at night. Quick light responses and alerts to active volunteers or nearby safe locations offer immediate protection and enable fast emergency responses, reducing the risk of violence. The project encourages shared responsibility by involving residents and businesses as active guardians of the network, which helps build trust and social cohesion. HearMe aims to change attitudes and behaviors gradually through cultural transformation, lowering tolerance for harassment and promoting safe movement for all city residents.

Impact on sustainability
HearMe can use energy-efficient, circular-economy materials, including piezo harvesters, solar panels, adaptive LEDs, and low-power AI nodes. Designing for both functionality and easy maintenance includes using durable, recyclable composite panels with self-cleaning surface coatings. This approach extends the lifespan of the panels and reduces maintenance requirements. Encouraging safety and comfort promotes walking and biking, which are sustainable transportation options, and supports UN goals for creating safe, inclusive, and climate-resilient cities.