Waste Management by Robots

Transforming Urban Waste Collection for Cleaner Cities

By Helsingborg City, NSR and Robot Minds

Background of the Project

Project Context:

- Traditional waste collection methods rely on garbage trucks navigating dense urban areas, causing traffic congestion, air pollution, noise, and accidents.
- Oceanhamnen, Helsingborg, serves as the testing ground for a new, robot-based waste collection system to mitigate these issues.

Objective:

- Develop and evaluate a prototype for autonomous waste collection robots capable of transporting bins from recycling rooms to centralized collection points.

Vision:

- Create safer, quieter, and cleaner urban environments by integrating robotics into waste management.

Needs We Address

Urban Challenges:

- **Traffic:** Garbage trucks contribute to peak-hour congestion.
- **Pollution:** Diesel trucks cause air and noise pollution.
- **Safety Risks:** Increased chances of accidents in busy city areas.
- **Space Usage:** Large waste collection room occupy valuable space.

Alignment with Urban Sustainability Goals:

- Addressing low-emission and car-free zone mandates in cities like Stockholm, Copenhagen, and Paris.
- Promoting safer, more pedestrian-friendly urban areas.

Social and Legal Needs:

- Regulations for autonomous robots in public spaces.
- Ensuring public acceptance and comfort with service robots.

The Solution

Technical Approach:

- Robots equipped with advanced AI and SLAM-based navigation for precise localization and obstacle avoidance.
- Vacuum suction gripping system for safe and secure waste bin handling.
- Simulations for testing and optimizing robot performance.

Infrastructure Adjustments needed:

- Retrofitting recycling room doors with APIs for robot access.
- Streamlining room layouts and pathways for smooth navigation.

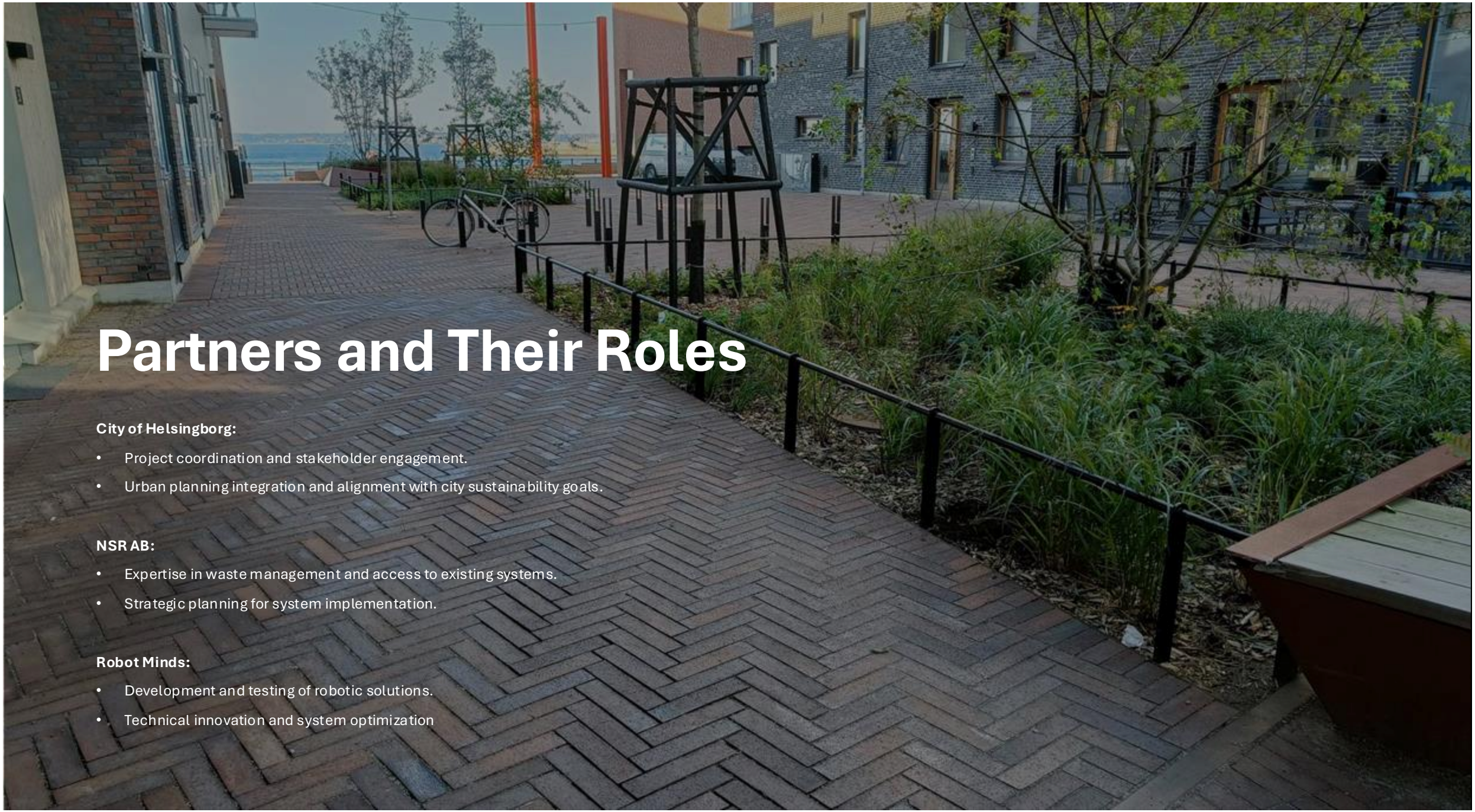
Project Status and Challenges

Current Progress:

- Prototype robot developed and tested for navigation, gripping, and waste bin transportation.
- Integration of SLAM navigation and LIDAR systems to address GPS signal issues in urban environments (ongoing).
- Evaluation of Oceanhamnen’s infrastructure, identifying upgrades needed for full-scale deployment.

Challenges:

- Infrastructure limitations, such as manual locks, narrow doorways, and uneven surfaces in recycling rooms.
- Navigational complexities due to dynamic outdoor environments and reflective surfaces.
- Social and regulatory readiness for autonomous robots in public spaces.



Partners and Their Roles

City of Helsingborg:

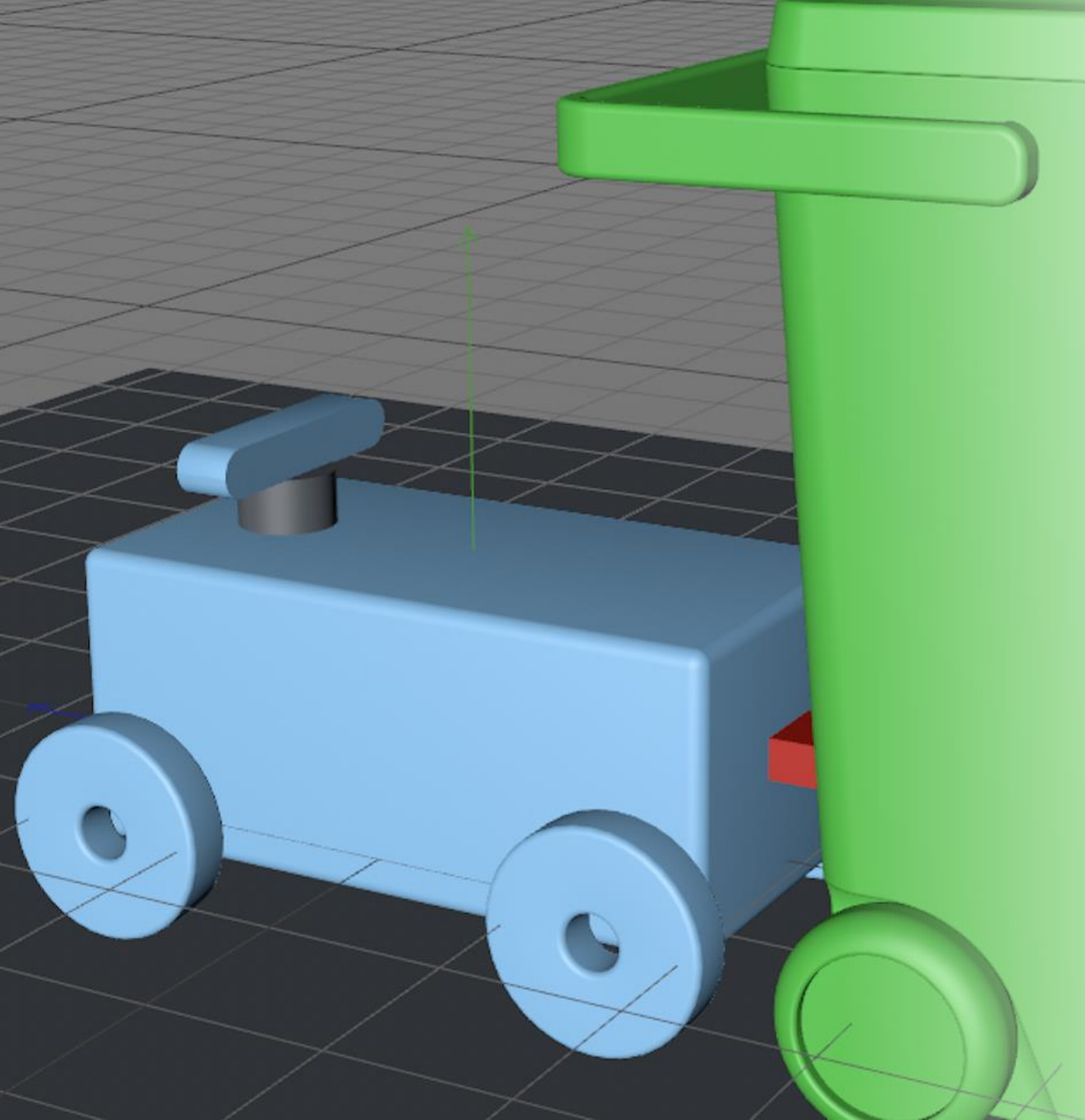
- Project coordination and stakeholder engagement.
- Urban planning integration and alignment with city sustainability goals.

NSR AB:

- Expertise in waste management and access to existing systems.
- Strategic planning for system implementation.

Robot Minds:

- Development and testing of robotic solutions.
- Technical innovation and system optimization



Goals for August 2025

Field Trials in Oceanhamnen:

- Conduct comprehensive tests of the robotic waste collection system in Oceanhamnen
- Focus on navigation, waste bin handling, and system reliability.

Infrastructure Improvements:

- Collaborate with property owners to look into retrofitting recycling room doors with API-enabled systems.
- Discuss how we can streamline waste room layouts to facilitate robot access and manoeuvrability.

Feedback and Refinement:

- Gather input from stakeholders, residents, and operators during the trial phase.

Community Engagement:

- Work with local residents to promote understanding and acceptance of autonomous service robots.
- Address concerns about safety, noise, and interaction with robots in shared spaces.

Future plans

Co creation project with more partners

- Test the robotic solution in additional cities across Sweden
- Focus on urban areas implementing low-emission and car-free policies.

Collaborative Business Model Evaluation:

- Partner with Swedish cities and waste management companies.
- Conduct detailed assessments of the RaaS model and optimize operational workflows.
- Align services with the specific needs of municipalities and logistics companies.

Smart Operation Solution Development:

- Create an integrated platform for waste management workflow optimization.
- Features include real-time bin monitoring, predictive maintenance, and route optimization.

Future Innovations:

- Expand use cases for service robots, such as urban maintenance and public data collection, aligning with smart city initiatives.

Scaling for Impact:

- Build strategic partnerships to test the system across Europe.

Conclusion – Creating Impact

Environmental Sustainability:

- Reduced emissions and noise pollution, contributing to cleaner and quieter cities.

Urban Transformation:

- Optimized waste collection frees up urban spaces for greener, more liveable environments.

Ethical Impact:

- Alleviating physically demanding tasks for waste management employees.
- Creating safer and healthier work environments through automation.

Innovation and Collaboration:

- Advancing robotics solutions in partnership with cities and waste management companies.

Scalable and Future-Ready:

- A flexible model ready for expansion across Sweden and Europe, supporting sustainable development.

Social Benefits:

- Safer, greener cities that prioritize resident well-being and align with global sustainability goals.