Demonstration Zone

2024

Inspection & Maintenance Robot

Demonstration Project: Sidewalk & Cycle Lane Inspection

Innovator: Kevares Inc.
Product: Pavement Visual Inspection Robot Service
Demonstration Period: October 3 – November 14, 2024

VAUGHAN   OVIN   Ontario   vaughan ECONOMIC DEVELOPMENT

Executive Summary

The City of Vaughan is testing leading-edge technology to evaluate how innovative solutions can address real-world mobility and transportation challenges.

Through the Ontario Vehicle Innovation Network (OVIN) Demonstration Zone, Kevares Inc. tested their maintenance robot to evaluate their solution along identified road segments, inspecting cycle lane and sidewalk surface conditions.

The OVIN Demonstration Zone is an initiative that is part of Vaughan's Transportation Innovation Program (TIP), which aims to test smart mobility solutions in real-world environments. This demonstration was completed in partnership with **Vaughan's Public Works – Transportation and Fleet Management Services** team.

The Innovator

Kevares Inc. (Kevares) is a company that has been in business for more than five years and is creating the future of property maintenance services with autonomous robots that are fully electric, with swappable batteries and service modules (or pods, as they call them). These modular pods enable year-round operation and allow for different tasks to be performed by the same autonomous robot in a single day, simply by hitching different towed pods or attaching service modules to the front and trunk of their robotic system.

Kevares designs both the proprietary hardware and the artificial intelligence-powered software that powers its autonomous robots, offering flexible, multi-season maintenance solutions for high-circulation environments such as sidewalks, bike lanes, parks, and parking lots. The robots are equipped with embedded collision and obstacle avoidance systems, and are optimized for safe operation in shared public spaces, including sidewalks, cycle lanes, parking lots, and lawn fields. Their solutions are designed for versatile applications of commercial and municipal property maintenance tasks.

The platform supports interchangeable service pods, allowing for scalable deployment across seasons and service types. Kevares' autonomous services are designed to help municipalities do more with less – reducing the need for manual labour in routine or hazardous tasks, lowering carbon emissions through electric operation, and freeing up staff to be allocated to more critical work. Kevares' autonomous services are offered under a "Robot as a Service" model for a flat monthly fee, enabling municipalities to access a diverse range of robotic functions without upfront capital investment. These services include pavement inspections, snow removal, salting, lawn mowing, and other routine or seasonal maintenance tasks. By reducing the need for manual labour in routine or hazardous tasks, lowering carbon emissions through electric operation, and freeing up staff to be allocated to more critical work, Kevares is targeted to help municipalities do more with less. The system is designed to operate reliably in high-traffic areas, providing a safe and efficient alternative to traditional maintenance methods.

Demonstration Overview

The demonstration project aimed to evaluate the effectiveness of an autonomous robot in identifying and categorizing surface deficiencies—such as gaps, pavement heavings, potholes, and cracks—along municipal sidewalks and cycle lanes. The Kevares' robot was deployed

across three segments: a 2.2 km sidewalk and two cycle lane sections measuring 1.6 km and 2.2 km, respectively. Outfitted with sensors capable of measuring the size and depth of surface irregularities, the robot collected data that was then processed by Kevares' inspection analysis software and visualized through a backend dashboard. This dashboard was intended to help City staff review the findings and verify them against known deficiency data to support asset management and maintenance planning.

The demonstration was structured in two phases. Phase one focused on testing the robot's ability to detect surface conditions while operating in two modes: "follow-the-master," where the robot trails a human guide; and a teleoperated (or piloted) mode controlled by an operator. Phase two was designed to evaluate the robot's autonomous capabilities, including object detection and collision avoidance. While the first phase was successfully completed, the second phase was only partially executed due to development constraints, and the time constraints of the OVIN Demonstration Zone program. Nonetheless, the project demonstrated the robot's potential to streamline data collection and support proactive infrastructure maintenance.

This demonstration project evaluated the maintenance robot on:

- The reliability of the robot and its technology to identify pavement deficiencies;
- Its ability to operate in two driving modes: a "Follow-the-Master" mode, and a tele-operated mode where a local operator controls it;
- Its ability to recognize and avoid small and large obstacles including moving objects; and
- The accuracy of the data collection and analysis software by comparing manually collected data to that collected and categorized by the robot.

Key Outcomes

The demonstration was evaluated as successful. The evaluation confirmed that the robot could operate in both the "follow-the-master" and the piloted teleoperated modes, and it successfully collected pavement condition data at both sidewalk and cycle lane locations.

- Kevares' inspection robot detected 11,979 deficiencies along a 2.2 km sidewalk segment and 3.8 km cycle lane segments.
- 3,192 were classified as meeting the Minimum Maintenance Standards (MMS).
- Kevares' solution was able to capture and collect deficiencies on Vaughan's sidewalk and cycle lanes and was able to share the images to the City.
- Kevares' autonomous AI processing deficiencies identification process 1) was able to identify selected deficiencies and 2) continues to evolve/learning model to be more precise (precision) and in development. Partnership with the City through this demonstration was helpful in the development process.
- Kevares' software to display the inspection data review was a new feature developed for this demonstration.
- The Project Advisory Team provided insights to Kevares on municipal operations for routine pavement inspection practices.
- The demonstration provided the City with insights on how autonomous maintenance could be potentially incorporated into operations, and allowed for an understanding about how it affects our best practices.

Exclusions

Demonstration projects through the OVIN Demonstration Zone are temporary and limited in scope and duration due to the time constraints of the OVIN Demonstration Zone program. The project evaluated key features of Kevares' solution, as determined by the Project Advisory Team.

The fully autonomous mode of the Kevares' robot was not tested as part of this demonstration. The City and Kevares did not intend to test out this mode in a public right of way due to public safety during the demonstration time frame.

Although some obstacle avoidance was evaluated, the results were not fully documented, primarily due to the time constraints imposed by the demonstration project's resources.

Additionally, the backend dashboard for City staff to review the deficiencies identified by the robotic system was not fully accessible, and the Project Advisory Team was not able to compare the results against known deficiencies for accuracy.

Obstacles

Constraints such as time availability, dedicated staff resources, and the conditions of a limited demonstration affected the availability of evaluating the full features of Kevares' autonomous robot inspection pod, inspection analysis software, and suite of autonomous safety features. However, the demonstration was not built to evaluate all the product's services and features.

Conclusions and Recommendations

Through its "follow-the-master" and teleoperated modes, the robot successfully identified, categorized, and classified pavement deficiencies – such as gaps, heaves, potholes, and cracks – on sidewalks and cycle lanes. The data was geotagged and made accessible through a backend dashboard, with deficiencies categorized according to Ontario's Minimum Maintenance Standards (MMS). This demonstration highlighted the potential of AI-powered robotics to support municipal asset management and inform future adoption of autonomous technologies in public spaces.

To fully realize this potential, future demonstrations should allow more time for partnership collaboration, setup, calibration, and evaluation. Leveraging artificial intelligence innovation requires iterative learning to continue to improve precision and accuracy for applications in the City of Vaughan.

Municipalities and innovators alike are encouraged to introduce new technologies gradually, ensuring adequate time and resources for safe integration into public environments. This approach supports both public familiarity and the successful adaptation of emerging technologies to municipal processes.

Demonstration Zone Project Profiles: www.vaughanbusiness.ca/demozone/projects