2025

Traffic Analysis Innovation

Demonstration Project: Real-Time Incidents Intelligent Transportation System

Innovator: AirMatrix Inc.
Product: Libra Traffic v2.3
Demonstration Period: June 3 – June 4, 2025

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, Air Matrix Inc. conducted a demonstration of its Libra ITS platform – an AI-powered Intelligent Transportation System (ITS). The demonstration aimed to evaluate how the drone footage and software could analyze traffic patterns and safety conflicts during peak travel periods, supporting the City of Vaughan's efforts to enhance safety and mobility in school-zones.

This demonstration was completed in partnership with **Vaughan's Transportation and Fleet Management (Traffic Engineering)** team. 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.

The Innovator

AirMatrix Inc. (AirMatrix) is a Canadian AI software company supporting the transportation and infrastructure analytics sectors. With over eight years of experience, the company specializes in delivering intelligent, sensor-agnostic solutions that support traffic management, safety analysis, and operational efficiency. They've developed their technology to seamlessly integrate with legacy systems, allowing organizations to harness real-time intelligence without costly hardware replacements.

Their approach is grounded in fast setup, privacy-conscious data handling, and scalable workflows – positioning AirMatrix as a valuable partner in Ontario's push toward Vision Zero and resilient urban mobility.

Demonstration Overview

The objective of the demonstration was to assess the effectiveness of drone technology in a live operational setting. Specifically, the evaluation focused on monitoring traffic flow, as well as the accumulation and dissipation of vehicle queues at the two driveways serving Maple High School and the Creditstone Road rail crossing north of Highway 7.

Using a combination of drone footage and software analysis, AirMatrix captured traffic behaviour data during peak travel times. Specifically, the demonstration evaluation was constructed to look at how the footage and AirMatrix software analysis could provide insights into driver behaviours during morning drop-off and afternoon pick-up periods at the school, and while trains were passing at the rail crossing. The Libra platform processed this footage offline to identify information such as traffic counts, vehicle speeds, vehicle queue lengths and near-miss incidents.

The demonstration temporarily piloted a drone to capture traffic data and use AirMatrix's AI-powered analysis software to monitor traffic patterns and behaviours in front of Maple High School and at a railway crossing at Creditstone Road (north of Highway 7). The drone was equipped with a camera and temporarily installed at the two locations for a traffic study to evaluate the solution's effectiveness in analyzing traffic behaviours. The Libra Traffic software then processed this footage offline to extract key traffic metrics, including:

- Queuing length
- Micromobility device counts
- Near miss incidents
- Vehicle Speed
- Turning movements
- Traffic safety behaviours

While the Libra Traffic platform is designed with a software-based dashboard that displays the analysis results, the dashboard was not evaluated during this demonstration due to the time constraints of the OVIN Demonstration Zone program. This demonstration served as a foundational test to evaluate:

1. The potential of utilizing a camera-mounted drone for in-field traffic analysis
2. The performance and setup conditions for drone technology
3. The effectiveness of artificial intelligence in identifying traffic safety metrics.

Key Outcomes

Libra ITS successfully collected traffic data. Although the demonstration proved the concept of the innovator's technology, it was revealed that further data manipulation was needed to confirm the usefulness of the data for inclusion in decision-making. At the time of the demonstration, the Libra ITS dashboard was transitioning to a new version, and its reporting features were not flexible, so the demonstration data was exported in a spreadsheet for manipulation.

Key findings included:

- Over 750 vehicle trajectories and 39 conflict events were recorded.
- Queue lengths and delays were mapped to support infrastructure planning.
- Near-miss events were quantified using post-encroachment time (PET) metrics.
- The drone demonstrated its effectiveness in capturing footage for the software to detect traffic behaviours. The demonstration showed constraints to consider for the use of this type of technology, including:
    - Field of view
    - Camera stability
    - Battery life & flying time
    - Timing of battery changeovers
    - Speed to deploy a drone for in-field analysis
- The drone battery life and flying time were sufficient for a short-term field study and supported the use case designed for this demonstration.
- The Project Advisory Team provided insights to AirMatrix on parameters for traffic safety standards for product improvement.
- The demonstration provided the City with insights on how drone-mounted cameras could be deployed for in-field analysis, and what the potential optimal conditions are for data quality.

- The demonstration provided the City with insights on how AI-powered traffic analysis 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 AirMatrix, as determined by the Project Advisory Team.

- To streamline the demonstration and reduce resource demands on the participant, real-time analysis was intentionally excluded from the scope. As a result, AirMatrix conducted all traffic data processing offline, and the demonstration did not evaluate the platform's live reporting capabilities.
- Data collected by the footage from the pole-mounted camera was not analyzed for the results of the demonstration, as the data collected is limited in quality due to suboptimal camera height.
- At the time of the demonstration, the Libra Traffic dashboard (to display the results of the analysis) was under development. As such, the demonstration was designed to provide the data through a generated report for the demonstration evaluation.
    - The dashboard was not evaluated as part of the demonstration

Obstacles

As Libra Traffic software's dashboard interface was in transition to a new software version at the time of the demonstration, the OVIN Demonstration Zone team could not access all the features and coordinated with AirMatrix on how to manually manipulate the data to interpret the results of the report.

The scope of the demonstration was designed to review the results in a different format. AirMatrix is already working on the next version, but the time constraints of the OVIN Demonstration Zone are not sufficient to allow for the testing of the next iteration.

Conclusions and Recommendations

The demonstration confirmed the potential of the Libra Traffic technology in enhancing traffic analytics that can inform future infrastructure decisions. AirMatrix's offline analysis provided valuable insights into traffic flow, congestion, and safety risks in a school-zone context. Therefore, the demonstration provided insights into key opportunities to use camera-mounted drones.

The camera-mounted drone was successful in capturing field analysis. It was deployed in bursts over 2-3 hours and demonstrated its ability to be airborne and recording within minutes. The demonstration showcased the flexibility of the drone to capture on-demand footage for traffic data – with a capacity to record in various locations without a need for existing built infrastructure.

Adjustments for positioning, considerations for wind, and site checks for visible obstructions were required to initiate setup, and could potentially affect the timing to get the drone in the air or the quality of the footage captured.

While the scope of the project was comprehensive enough to validate the accuracy and potential of Libra Traffic, it also provided the City with an opportunity to learn more about optimal positioning and timing for using camera-mounted drone technology in field analysis. The Project Advisory Team gained valuable insights into a drone's limited field of view and battery constraints, and how this could affect the duration for flying time, and therefore the duration available for in-field data capture.

The demonstration was additionally designed to evaluate how battery changeovers could potentially affect continuity in the data capture. AirMatrix showcased how to synchronize necessary battery changes in the field.

Although the pilot revealed areas for refinement – such as camera placement and dashboard usability – it demonstrated the potential of AI-powered analytics to reduce manual data collection, enhance situational awareness, and support smarter, more responsive traffic management.

To fully activate this technology on municipal infrastructure, regulatory updates may be required to enable camera analysis in selected field locations.

Further demonstrations would be recommended to evaluate the effectiveness of real-time analysis using drone-mounted camera technology for traffic studies.

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