

### Summary of Agile Pilot

Company name	<b>M2M SOLUTIONS</b>
Company location	<b>Žilina, Slovakia</b>
Domain	<b>Digital services, Energy efficiency</b>
Municipality	Žilina, Slovakia
Project period	July - December 2025, 6 months
Solution	<p>The project “Monitoring Vehicle Movements in the Solinky Urban Zone” aimed to assess the potential of modern smart technologies for collecting and analysing traffic data across the city.</p> <p>The Zone Monitoring module of the DYMS - Dock &amp; Yard Management System was implemented. It utilizes ANPR cameras for automatic license plate recognition and employs supplementary control cameras as required for status verifications. The system operated entirely, capturing vehicle entry and exit data, determining dwell times, and overseeing device statuses.</p> <p>The pilot verified that the solution is technically feasible, the technology is stable, and the system can reliably gather and analyse data on residents’ traffic patterns. It supplied the city with important insights regarding parking, traffic volume, and the behaviours of residents and visitors.</p>
Stakeholders	<p>The project was carried out using an agile pilot approach, fostering close collaboration among the city, the solution provider, and other stakeholders. This method enabled ongoing assessment of results in real-world settings and encouraged collective learning, thereby improving both the technical quality and practical usability of the solution for the city.</p> <p>Key stakeholders included the city of Žilina, ZMOS, MIRRI, technology providers (including the camera supplier, installer, and ANPR camera manufacturer), and M2M Solutions’ internal teams responsible for development, testing, IT infrastructure, and project management.</p> <p>These stakeholders remained engaged throughout the pilot via regular meetings, field visits, and continuous evaluation of results.</p>
Lessons learned	<ul style="list-style-type: none"> <li>• Solar ANPR Camera Operation: Continuous use during winter months isn't guaranteed, even with optimal settings. Essential systems, such as legal evidence and traffic management, should be connected to a reliable power source.</li> <li>• Connectivity - SIM card versus fixed internet line. For live operations, a fixed internet connection, such as Ethernet or Fiber, is recommended. Use SIM cards mainly for short-term pilots and projects that do not require video transmission.</li> <li>• Implementing Agile piloting in this project clearly enhanced the technical solution, boosted user and operational quality, lowered future costs and risks, facilitated collaboration among all stakeholders, and created opportunities for further innovation and development of Smart City solutions.</li> <li>• The project thus confirmed that agile piloting is an effective and appropriate approach for validating innovative solutions in urban settings, providing benefits to all stakeholders.</li> </ul>
KPI 1 Number of entries and exits	<p>At least 8,000 entries and exits over 30 days.</p> <p>Over 8,000 movements were documented. The data consisted of: arrival date and time, departure date and time, zone name, duration of vehicle stay in the zone, and records of paired and unpaired outputs.</p>
KPI 2 Number of working meetings with city representatives	<p>At least two meetings.</p> <p>More than two working meetings and discussions took place</p> <p>See: “Basic project milestones”, page 2.</p>

<p>KPI 3 Technical Feasibility</p>	<p>Provide an API for ride records. Successfully implemented - the API was available throughout the pilot phase.</p>
<p>Evaluation of the business model focusing on its viability and potential for growth</p>	<p>The project findings indicate different approaches for the pilot and production phases. Pilot deployment can use solar power, SIM communication, and limited monitoring. In contrast, long-term production requires a stable power supply (230 V or POE), reliable connectivity, and a mode ensuring guaranteed availability.</p> <p>Impact on the business model: The pilot programs continue to use the flexible “plug-and-play” approach. However, for long-term contracts, a different model, such as an investment approach or a rental with increased SLA parameters, is required.</p> <p>The impact on future planning and the solution's viability. These findings do not threaten the solution's viability; instead, they clarify the conditions required for its operation. The pilot effectively tested the technology's limits and helped develop clear recommendations.</p> <p>Main recommendations:</p> <ul style="list-style-type: none"> <li>• Provides a fixed power supply for all permanent deployments.</li> <li>• A stable internet connection is essential for video projects.</li> <li>• Solar and SIM solutions are intended solely for short-term or experimental use.</li> </ul>
<p>Impacts</p>	<p>Agile piloting in the PilotInnCities initiative provided a key benefit that extended beyond simply testing the solution's technical aspects.</p> <p>The agile pilot played a key role in enhancing both the technical solution and the process configurations:</p> <ul style="list-style-type: none"> <li>• Revealed the limitations of solar-powered cameras in winter conditions.</li> <li>• Facilitated early identification of the unsuitability of this power supply for long-term live operation.</li> <li>• Confirmed the reliability of collaboration with the technology supplier.</li> <li>• Led to the discovery of a software error in the cameras (change of MAC addresses).</li> </ul> <p>In a typical commercial deployment, these insights would have emerged only later in the project, leading to increased costs, risks, and operational disruptions. Agile piloting, therefore, immediately saved future expenses and minimized the risk of poor technological choices.</p> <p>Organizational and innovation advantages of M2M Solutions. Additionally, the project brought substantial internal benefits to the solution provider. Multiple company departments participated in the pilot, totalling approximately 45 man-days of effort, including developers, testers, IT specialists, and a project manager. The pilot allowed:</p> <ul style="list-style-type: none"> <li>• to assess whether internal teams can respond swiftly within a limited time frame,</li> <li>• to test and deploy a new technology for managing hardware components that proved successful during the pilot project,</li> <li>• to assess whether older technological solutions, which previously led to operational issues, can be replaced.</li> </ul> <p>If the project hadn't been carried out as an agile pilot, technological issues would have surfaced only during live operation. This would lead to much higher change costs, increased risk of dissatisfaction for both the city and the supplier, and the absence of a joint learning and trust-building phase.</p>
<p>Suggestions for future actions, especially focusing on sustainability and replication</p>	<p>1) Ensuring the stability of infrastructure during live operations.</p> <p>Electric power stability ensures the system remains functional during winter, prevents battery drain during long cloudy spells, and improves overall reliability.</p> <p>A fixed data connection (optics / Ethernet) ensures stable, high-speed data transfer, enabling smooth video transmission and eliminating mobile network issues like outages, peak loads, and signal interference.</p> <p>Use solar solutions only in specific cases such as temporary projects, short-term pilots, seasonal uses, and areas without infrastructure where video recordings are not needed.</p>

	<p>The pilot operation allowed us to observe the technical performance of 4G solar cameras, especially noticing an unexpected change in MAC addresses. This trial also helped the manufacturer improve and refine its system prior to broader deployment.</p> <p>Introduction of notification and monitoring mechanisms (24/7 surveillance). The pilot project demonstrated that quick detection of technical incidents is crucial. The Zone Monitoring system enables automatic alerts through SMS and email. We recommend activating these notifications during live operation.</p> <p>2) Preparing the solution for scaling to additional locations.</p> <p>The pilot project showed that the solution is technically scalable and prepared for broader deployment.</p> <p>Recommended extensions for urban environments include additional residential zones, central city areas, parking zones, regions with increased traffic load, as well as schools, hospitals, and sports complexes.</p> <p>Recommended extensions for a commercial environment include logistics yards, manufacturing plants, retail parks, and private complexes.</p> <p>Identification of residents and non-residents can utilize existing city or company databases, with automatic detection of unauthorized vehicles. The residential model can also be adapted to include employees, visitors, suppliers, and tenants.</p> <p>Additional surveillance cameras can be deployed to monitor parking lot occupancy and assist in gathering evidence.</p>
<p>Next steps</p>	<p>Strategic recommendations for upcoming projects</p> <ul style="list-style-type: none"> <li>• Conduct a technical review of the site prior to implementation.</li> <li>• Choose the correct power supply type and connectivity based on the season and the area's orientation.</li> <li>• Specify the SLA level according to each zone type for operations.</li> <li>• Implement a system for incident monitoring through SMS and email alerts.</li> <li>• Suggest implementing scaling in phases.</li> </ul> <p>From M2M Solutions' perspective, the agile piloting process facilitated direct collaboration with the city, which, under usual circumstances, might be challenging owing to budget constraints or hesitation towards new suppliers. This pilot fostered trust, showcased the practical advantages of the solution for the city, and paved the way for conversations about expanding the solution, integrating with other Smart City partners, and exploring future projects in different locations.</p>
<p>Provider's Reflection</p>	<p>The pilot effectively demonstrated the technical feasibility of the Zone Monitoring solution within a real urban setting. Testing the solution under controlled yet authentic conditions provides significant value for technological progress. Acquiring this knowledge in live operations would be more challenging, as options are limited and risks are higher. The pilot enabled us to assess the solution's scalability, optimize system settings, and incorporate the data into recommendations for future deployments.</p> <p>The pilot also provided key technical insights, particularly about how solar-powered cameras perform during winter. During extended cloudy periods, it was confirmed that battery capacity can decrease, leading to the temporary halting of operation. We find this information valuable and insightful, as it helps us determine when a solar solution is suitable and when a fixed power source is necessary.</p> <p>Based on this experience, we suggest using a fixed power supply and a stationary data connection for long-term or critical deployments to guarantee maximum operational uptime and dependable data transfer, including video recordings. For short-term or pilot projects, especially those without video transmission needs, solar power and mobile data connectivity are recommended.</p> <p>The project also verified that the solution is modular, scalable, and suitable not only for commercial use but also for urban and public areas. Our collaboration with representatives from the city of Žilina, ZMOS, and MIRRI was very positive and professional. We are confident that the results will provide a solid foundation for future decisions on developing similar solutions.</p>

<p>Municipality's Reflection</p>	<p>The city of Žilina found the agile pilot project to be beneficial and valuable for increasing understanding of traffic patterns in the residential area. Its implementation enabled the collection of data on vehicle entries, exits, and dwell times, providing the city with useful insights for planning traffic management and developing future parking policies.</p> <p>Since the system has been monitoring traffic volume entering and leaving the residential area where parking regulations started in November, the city can evaluate the regulation's effectiveness over time. This involves comparing parking occupancy before and after implementation and analysing traffic flow patterns. These patterns affect factors such as road load, intersection congestion, air quality, and road user safety.</p> <p>If the data confirm that static traffic regulation reduces dynamic traffic, the city gains an additional argument for evaluating the success of parking regulation. It can also serve as further evidence to support implementing parking regulations in other residential areas.</p> <p>The pilot enabled the city to gain a clearer understanding of modern technological solutions for traffic monitoring and confirmed their potential for application in other urban areas. It also provided valuable practical insights into the technology's performance during winter months, which is a natural part of testing new solutions under real conditions.</p>
<p>Expert's Reflection</p>	<p>External independent experts did not participate in the pilot project.</p>