

intellias

Road Intelligence: Fusing Physical with Digital Infrastructure

Empowering a convenient future for cities with
innovative and efficient mobility technologies





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1

Intro

The popular saying goes “don’t reinvent the wheel.” But the modern realities of concentrated urban living and everything that comes with it — congested roads, crowds of people, high levels of pollution, deadly car accidents — make people challenge this aphorism. Should we keep the wheels rolling the way they are today? Or perhaps we should steer the transportation industry in a new direction?

Digital technology has opened a new field for experimentation and innovation in the realm of transportation. Connectivity technologies — cellular, GIS, GPS — create a new dimension for monitoring and optimizing how vehicles, people, and other entities traverse cities and beyond. Meanwhile, processing technologies such as cloud computing, data analytics, machine learning, computer vision, and artificial intelligence enable us to turn these observations into thoughtful decisions.

Digital technologies have become new cogs in the transportation wheel. But how do you assemble a better system with their help?

This whitepaper paints a picture of how the transportation industry can be remapped around four core principles — **visibility, efficiency, safety, and sustainability** — through a combination of strategic planning, current software, and new tech solutions.





2 Visibility

“Eyes on the road” is the first lesson drivers learn. It’s also a new imperative for traffic managers. Rapid progress in connectivity already permits the installation of real-time traffic monitoring solutions, but profitable market gaps remain.



Installing good lighting, placing warning signs, and designing effective intersections are common ways to improve road visibility. Physical fencing provides essential speed guidance and trajectory optimization. Yet these measures do not always ensure traffic participants adherence to the rules.

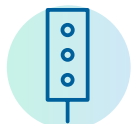
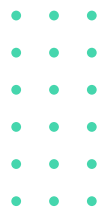
City planners lack access to real-time traffic data and the ability to exercise immediate control over

traffic flows. This constraint creates nuisances for citizens and businesses alike, from constant traffic congestion to rising pollution. In the EU, subpar transportation management costs local societies over €1 trillion ¹ a year through air pollution, congestion, and accidents, among other external costs. Other countries across many regions, from Latin America to South-East Asia, are pressed with the same concerns.



Companies offering technology solutions for better visibility on the roads will be well-positioned to benefit from the upcoming wave of public-private partnerships on road infrastructure development.

Technology solutions to achieve better road visibility



V2X connectivity

Vehicle-to-everything (V2X) connectivity is an emerging approach to developing connected road infrastructure, from CCTV cameras and smart traffic lights to vehicles and bicycles. The two main communication technologies behind this approach are dedicated short range communications (DSRC) and cellular vehicle-to-everything (C-V2X). DSRC relies on reserved Wi-Fi frequencies, whereas C-V2X is powered by 4G/5G connectivity. US automotive companies (and local regulators) prefer C-V2X. EU regulators initially favored the legacy DSRC standard, which has its shortcomings, though most have now shifted to C-V2X. China's leaders, in turn, are actively developing C-V2X standards and expect half of all new cars to support it by 2025.

Use cases

- Automated parking or road fee collection
- Transit or emergency vehicle signal priority
- Automated vehicle compliance checks
- Vehicle platooning and semi-autonomous driving



Location-based services

Location-based services (LBS) are another avenue for data collection. Cellular networks can supply insights from individual drivers and connected vehicles. With LBS technologies, road managers



can better identify concentrations of road users, calculate estimated times of arrival (ETAs), and distribute real-time traffic information among drivers. Cloud-based LBS systems also enable seamless integration of location and mapping data into existing systems — and can help establish better interoperability between edge devices and management software.

Use cases

- Real-time traffic information collection
- Hazard and road incident alerting
- Smart commercial routing
- ETA predictions
- Enhanced urban navigation
- Sensor data fusion



IoT and edge devices

Real-time data collection is the foundation of smart road visibility systems. Compact, low-cost, and programmable IoT devices (sensors and controllers) help gather a wealth of road data,

from the number of multimodal traffic units to air quality metrics. When augmented with edge computing, edge devices turn into self-sufficient, high-performance road infrastructure capable of executing real-time data analytics and subsequent remote control over roads. Edge devices are also a necessary component for creating live HD maps, which are necessary for (semi-)autonomous driving. Digital HD maps add an extra layer of navigational guidance to safely direct connected vehicles and provide real-time updates to drivers. Ultimately, both IoT and edge devices are necessary for creating a robust mobility as a service (MaaS) ecosystem, where precise control can be executed over private, public, commercial, and shared transport modalities.

Use cases

- Roadway monitoring
- Traffic pattern analysis
- Vehicle speed detection
- Emissions monitoring
- Incident detection and response
- Mobility as a service (MaaS) ecosystem





Cloud platforms

Each of the above technologies generates “road intelligence” — unstructured and semi-structured big data that can be used for subsequent analysis. This intelligence has to be securely stored, processed, and then distributed among all operational systems — and doing so requires robust cloud infrastructure.

Every road visibility solution requires a secure cloud platform for data processing and distribution, backed by a data governance strategy. Your [cloud architecture](#) should be scalable to aggregate and process data from connected hardware (via cellular connectivity) and from software modules (via API integrations) with low latency and top security.



Read more about visibility

Case study: Fleet Management Solution

Peek under the hood of a data-driven, LBS-based cargo transportation management platform we’re developing for our client.

Blog Post: Big Data in Transportation Use Cases

Discover a collection of feasible and profitable big data use cases for urban planning — with transportation in focus.

Blog Post: Key Components for Traffic Management Systems

Get a detailed look at the main software and hardware components powering intelligent traffic management systems.



3

Efficiency

Modern cities move fast. But speed is hard to achieve when multi-modal transportation nodes don't function in unison. To increase the tempo of transportation from a placid *lento* to a speedy *presto*, you need better conducting tools.



For decades, the standard answer to traffic congestion was more roads and public transit lines. But this strategy has its limits: funding, climate change, and execution speed. You can't dissolve traffic congestion in a day — but you can improve the daily throughput of traffic across locations using emerging technologies. Leverage big data analytics to determine when, why, and how congestion occurs. Then model different scenarios to remedy it. Short on data? Augment proprietary data with third-party traffic data APIs that are now widely available from public and private organizations.

Add extra data sources to your current transport management and traffic management systems to gain more operational contexts. Is High Street always crowded? Perhaps dynamic adjustments to traffic lights can help reduce the congestion. Want to get more people on board public transport routes? Model different usage and profitability scenarios by adjusting transport frequency, costs, and service routes. To make more citizens choose public transportation over private vehicles, the urban infrastructure must provide high levels of physical safety, environmental safety, efficiency, and comfort. You can tick all of these boxes with your new product.



The global transportation management system market is projected to reach \$1.1 billion by 2027.² As volatility remains high in supply chains, more businesses and public agencies are looking for data-driven management solutions.

Technology solutions to achieve efficiency



Big data analytics

Transport managers can use big data analytics to create a snapshot of day-to-day traffic flows under various conditions. By fusing historical operational data with third-party sources — geolocation data, ticketing data, CCTV streams, or even weather reports — you can identify constant and episodic traffic patterns. Then you can develop better strategies for proactively addressing current shortcomings with existing means. Or you can lay out better plans for new urban infrastructure development projects. With

a strong data management infrastructure in place, you can pursue advanced analytics projects.

Use cases

- Travel demand forecasting
- Traffic congestion management
- Commute optimization
- Parking management
- Urban infrastructure planning
- Asset & predictive maintenance



API and system integrations

Extend your closed-loop systems with new modular elements and data integrations. Application programming interfaces (APIs) are lightweight building blocks that let you embed new functional modules or extra data sources into existing software. Replace point-and-click data transfers and manual business processes with secure integrations to improve operational efficiency and ensure continuity in execution. Extend your transportation management software to cover more steps of the supply chain cycle, from parts procurement to maintenance schedule optimization.

Use cases

- Public transport APIs
- Automated freight matching
- Backend application integrations
- MaaS platforms



Intelligent transportation management system (ITMS)

Legacy transportation systems are rule-based; intelligent transportation management systems are data-driven. By pairing advanced analytics solutions with 4G/5G connectivity, edge devices, telematics, and V2X, you can monitor traffic flows and make real-time adjustments to transportation schedules. Unlock new pockets of growth by enabling multimodal journeys and partnering with private mobility as a service players and logistics businesses. Plus, you can exercise



control over the safety, efficiency, and satisfaction of complex passenger transportation scenarios from a single control panel.

Use cases

- Dynamic traffic control signals
- Urban transit management
- Road incident management
- Multimodal journey planning
- Advanced traffic analytics
- Electronic toll management



Traffic management systems (TMS)

Reconcile multiple transport modes on city roads by making your [traffic management system](#) context-aware. Extend your product with predictive capabilities to effectively direct traffic across city arteries and make every journey faster, safer, and less polluting. Tap into the current state of urban connectivity and low-cost edge device deployments to first establish better visibility and then exert real-time control over traffic signals, road pricing, and public transport routes. Make rapid decisions based on current traffic data obtained from connected infrastructure and road users, without skipping a beat.

Use cases

- Real-time video traffic detection
- Road safety analytics
- Predictive traffic planning
- Smart junction management
- Dynamic toll pricing
- Urban parking management



Read more about efficiency

Case study: Smart IoT Traffic Solution

We are helping the world's largest traffic data services provider launch an IoT-powered smart traffic management product.

Blog post: Intelligent Transportation Management System

Find an actionable guide to sharpening your product vision and approaching ITSM development.

Case Study: MaaS Solution for Urban Transit

Learn about the technical intricacies of building a robust data processing back end and convenient interfaces for a MaaS platform.

The background of the entire page is a photograph of a city street at night, viewed from a low angle looking down the road. The image is heavily tinted with a teal or cyan color. In the foreground, two security cameras are mounted on a metal pole, pointing towards the street. The camera in the upper left is a standard CCTV camera, while the one below it is a more modern, bullet-style camera. The streetlights and buildings in the background are blurred, creating a sense of depth.

4 Safety

Signs, fines, warning lines — there's no shortage of measures to enforce better road behavior. Yet the annual car accident death toll remains at 1.3 million people worldwide.⁴ We should strive to do better, and emerging technologies can help.



Modern vehicles come with built-in safety controls, from driver assist functions to emergency braking. Such systems have already proven effective in preventing direct collisions, sideswipe accidents, and blind spot accidents. Still, embedded controls cannot fully moderate reckless drivers' behavior or mitigate traffic violations. Past shortcomings in urban infrastructure design — narrow lanes, lack of regulated crossings, low-visibility intersections — remain the locus of pressure for urban managers.

As scooters and bicycles hit the streets more often, safety is becoming harder to achieve.

Pedestrians, e-scooters, and bicycles often crowd the same spaces, while the curb remains blocked by parked or passing vehicles. The expected arrival of (semi-)autonomous and platooning vehicles further raises questions of regulating drivers' and pedestrians' safety.

Let's be real: No set of rules or fines alone can make free-spirited humans always do as we should. However, prevention is always better than the cure. Intelligent nudging and real-time guidance can help us stay more aware of our surroundings and more considerate towards other road users.



Increased levels of urban connectivity open up new frontiers for real-time road safety solutions — and no shortage of likely users, ranging from government agencies to private fleet operators.

Technology solutions to achieve road safety



Computer vision

To act faster, you must see better. Computer vision — a collection of sensing and image recognition technologies — makes real-time monitoring a reality. The current state of computer vision technologies already permits low-latency object or person detection and instant processing of video data on the edge, in compliance with privacy regulations. Using computer vision, traffic managers can detect incidents in a matter of moments to rapidly alert emergency services. Or they can monitor road conditions and curbside use without dispatching yet another inspector. The possibilities are plenty!

Use cases

- Incident detection
- Pedestrian detection
- Traffic flow analysis
- License plate identification
- Road condition monitoring
- Curbside management



Video telematics

Distracted driving is the top reason for accidents worldwide. Help professional drivers remain alert and conscious of their overall well-being with intelligent video telematics. By pairing dashcam data with fleet telematics and vehicle sensing data, you can supply fleet managers with deeper insights into drivers' behavior and hardware issues. Video telematics solutions help encourage safer driving, prompt timely breaks, and prevent serious accidents (since most of these solutions are connected with onboard ADAS systems). Empower fleet owners to see what occurs during transportation.

Use cases

- Driver fatigue detection
- Distraction monitoring
- Driver behavior monitoring
- Collision prevention
- Vehicle maintenance
- Insurance data collection





Predictive analytics

When you know the past, you can predict the future. Predictive analytics solutions let you rapidly analyze large-scale datasets to detect repeating patterns in traffic flows, accident rates, congestion factors, and other events impacting road safety and efficiency. Anticipate how different events — a strike, a major football match, or a new construction project — will affect traffic flows. Estimate how busy different public transit lines get during the day to optimize scheduling without overcrowding the streets. Plan in advance for any possible disruption to the regular traffic cadence.

Use cases

- Accident predictions
- Preventive maintenance
- Traffic disruption predictions
- Emergency services scheduling



Read more about safety

Blog Post: Video Telematics for Fleets

Learn details on the benefits of video telematics in fleet management and approaches to its implementation.

Case study: Pedestrian Tracking and Predictive Collision Prevention

See how our team leveraged AI and ML to develop a highly accurate computer vision solution for detecting pedestrians and reducing accidents due to blind spots.

Blog Post: AI Use Cases in Urban Mobility

Consider market-ready use cases for AI in urban settings — with safety in the spotlight.



5

Sustainability

Lush, convenient, and inclusive for all — that's what we believe smart cities should look like. But to breathe life into this vision, we need to first curb traffic congestion and pollution. Though sustainability challenges us to rethink our connection to nature, it's a journey we can better plan with the help of technologies.



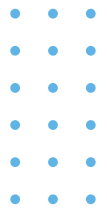
Governments worldwide have pledged to become net-zero carbon emitters in the next three decades. Individual cities plan to phase out fossil fuels in the transport sector even sooner. Copenhagen plans to become the first net-zero capital by 2025, and the EU aims to have at least 100 climate-neutral cities by 2030 ⁴. Since urban transportation remains one of the main pollutants, sweeping changes are soon to come.

New electric vehicle (EV) infrastructure development projects are underway, from eHighways in Germany and the UK to privately operated ultra-fast charging points all over the world. This presents plenty of room for innovation and public-private collaboration. The EV charging services market alone is estimated to generate \$15 billion in annual revenue and savings by 2030 ⁵. Likewise, the global electric mobility market is entering its period of peak growth, as both businesses and consumers prefer green vehicles.



Gain the early mover advantage by entering the booming EV software market ahead of other players. Demand for management, charging, and mobility solutions is soon to take an even sharper uptick.

Technology solutions for greener transportation



eMobility

Electric vehicles have lower operating and maintenance costs, making them an attractive option for e-hailing and carsharing fleets. Around 45% of European carsharing providers ⁶ already run 100% electric fleets, and this is soon to become the norm. Apart from driving consumers, e-mobility providers are also teaming up with local governments to provide public services — another promising avenue of growth worth exploring. In every case, efficient multi-stop routing trip planners and e-fleet management software will be key to success.

Use cases

- Electric carsharing and e-hailing
- Electric micromobility
- On-demand e-transportation
- Battery servicing





EV charging applications

A plug instead of a pump — that's what EV drivers look for. Make their search more effective by offering a convenient companion app for charging stations. In addition to providing multi-stop journey planning functionality and route building capabilities around available charging stations, you can deliver extra value by adding embedded payments and loyalty features — discounts, upsells, and cross-sells from selected partners — to promote faster adoption. A separate version of your product can be adapted to the B2B segment and cater to EV fleet managers who are looking to replace fuel management systems (and cards) with EV management systems.

Use cases

- Charging infrastructure management
- Dynamic pricing
- Remote diagnostics and servicing
- Fleet charging coordination
- Advanced usage analytics
- Leasing and cost-sharing management



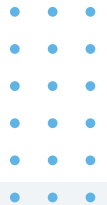


EV fleet management

Fleet electrification promises significant savings in operating costs but also poses operational challenges for fleet management. Fleet operations centers need new tools for planning routes, managing schedules, and coordinating EV charging. Now is a promising time to enter new markets with advanced EV routing software, providing data-backed range predictions along with optimized route planning for different EV models, driving conditions, and operating topography. Help more businesses go green by commoditizing access to battery life analytics, charging activity monitoring, and day-to-day EV fleet coordination.

Use cases

- Energy cost management
- Context-aware route planning
- Remote e-fleet monitoring
- EV charging management
- EV fleet analytics
- Battery performance management



Read more about sustainability

Blog Post: EV Fleet Management Solutions

Learn about the main tech components for EV fleet management software (based on users' interest).

Case study: Multi-stop EV Trip Planner

Check out our latest account of what goes into building an EV trip planning app that delights drivers.

Blog Post: Profit Pools in eMobility

Get the first mover's advantages by positioning your software product at the center of customer needs.



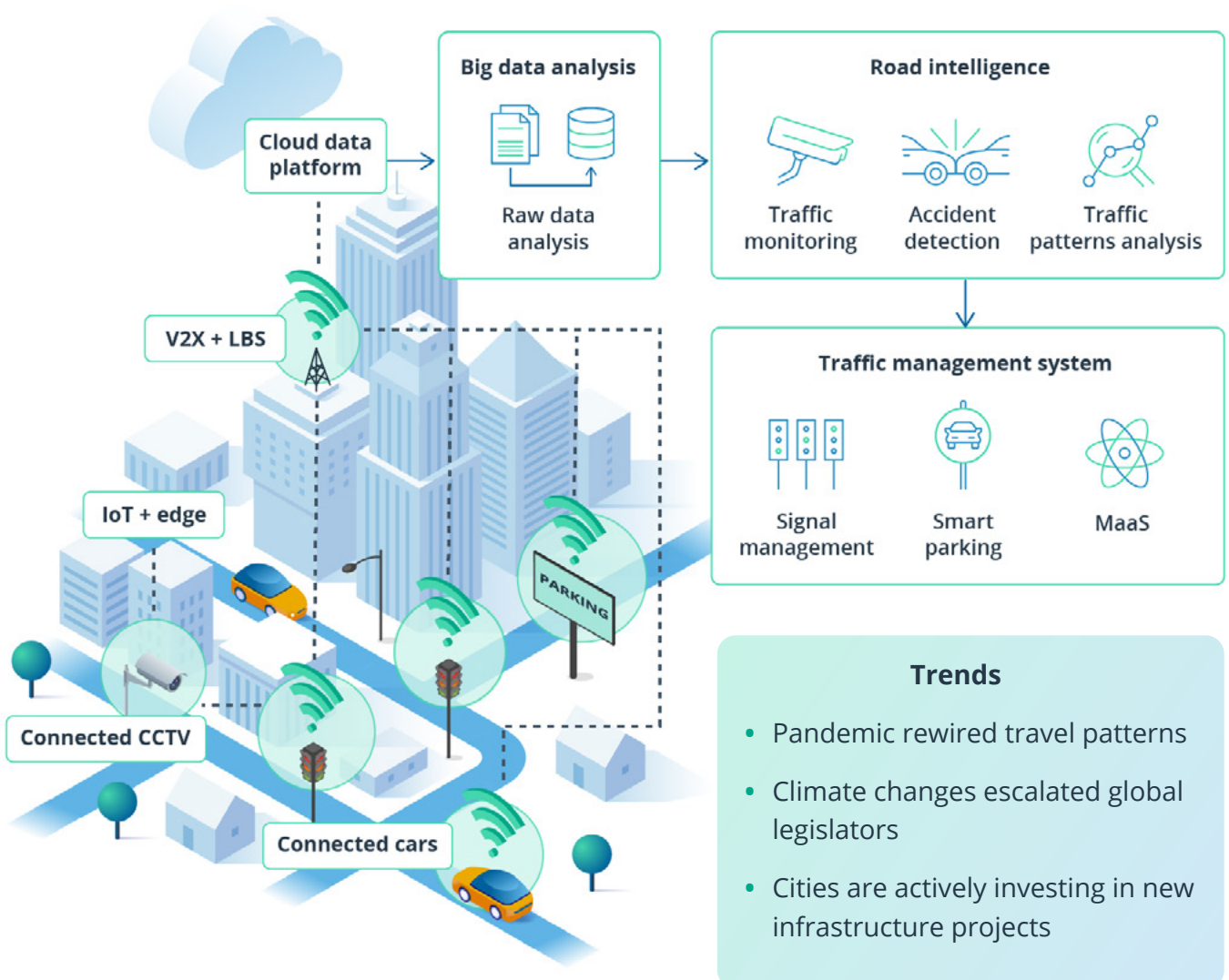
6 Time to accelerate into digital-led transportation

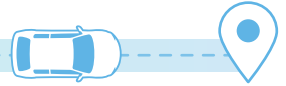


Promising pockets of growth emerge in the transportation industry everyday thanks to governmental efforts and because of ongoing shifts in consumer behavior. All the technology trends we cover in this whitepaper are emerging and developing as part of wider systemic transformations in the sector. Private companies join efforts in standardization and product development to jointly accelerate market growth. Meanwhile, cross-industry consortiums such as the 5G Automotive Association are leading

the lobby for C-V2X adoption, and the MaaS Alliance in Europe is attempting to reduce technology fragmentation and achieve better synergy between local players.

Bringing together four elements — visibility, efficiency, safety, and sustainability — can set in motion a new world of urban transportation. Better organized traffic. Faster transit. Fewer accidents and less pollution. Tech-led businesses can stand at the vanguard of this evolution if they act today.





About Intellias

We help tech innovators and Fortune 500 companies build amazing transportation and mobility products for billions of users globally.

Get to know Intellias at a glance



3100

professionals



20

years of experience



25

countries where
clients are located

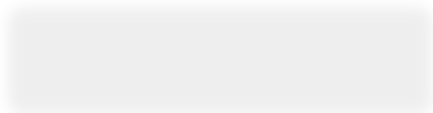
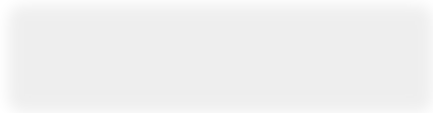


40%

year-to-year
revenue growth



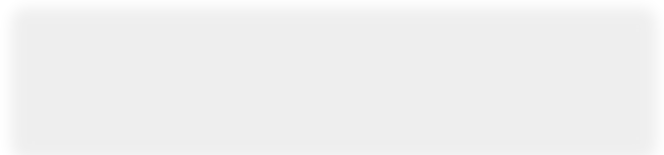
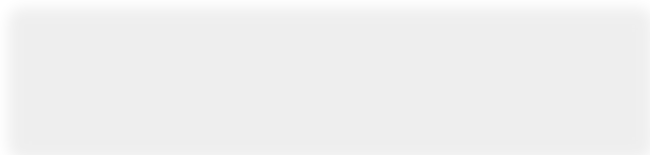
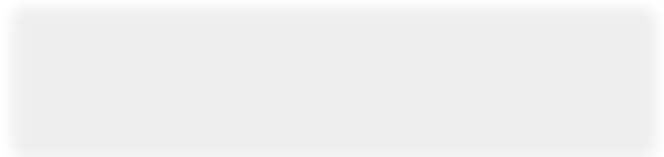
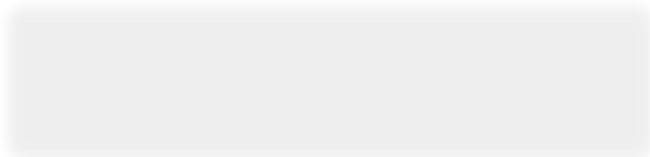
Get advice and develop mobility solutions with our services

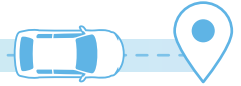


Edge processing



Benefit from our transportation & mobility technology expertise





Volodymyr Zavadko



**Delivery Director,
Transportation and Mobility**

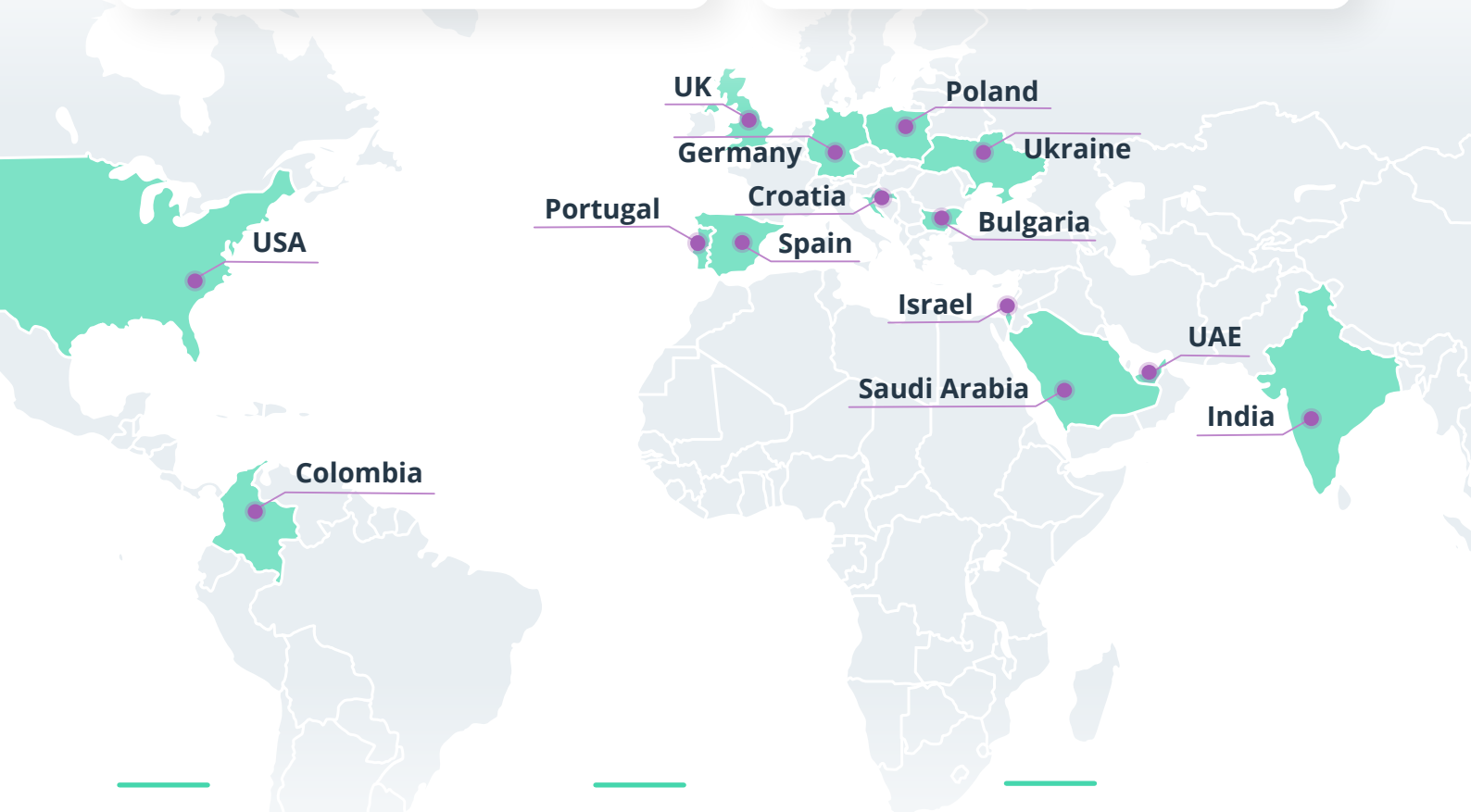
Volodymyr helps transportation and mobility service providers from around the globe improve the performance of their businesses using location, mapping, and geospatial services. With over 20 years of engineering and solution delivery experience, he leads complex projects for OEMs, enterprises, and ISVs, focusing on added value for further growth.

Vitalii Dutka



**Head of
Transportation and Mobility**

Vitalii specializes in technology consulting and software development services for global transportation and mobility leaders. With a decade of experience in data center networks and innovative R&D departments, he combines thought leadership, technological skills, and business knowledge to guide companies through digital transformation.



USA

500 West Madison Street
Chicago 60661
[+1 \(857\) 444 04 42](tel:+18574440442)
info-chicago@intellias.com

Germany

Pappelallee 78/79
Berlin 10437
[+49 \(303\) 080 67 31](tel:+493030806731)
berlin@intellias.com

Ukraine

Panasa Myrnoho Street 24
Lviv 79034
[+38 \(032\) 290 36 90](tel:+380322903690)
info@intellias.com



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