

Solution Brief

Product Inspection
Artificial Intelligence



Empowering Smarter Inspection with Vision Intelligence from Ignitarium

Ignitarium TYQ-i Helps Increase Accuracy, Cost Savings, and Safety by Partnering with Intel for Infrastructure Inspection

Infrastructure Inspection is in Desperate Need of Innovation

Imagine using a crew of workers to inspect a major railroad for defects and anomalies. Employees would walk miles on the side of the track all day and eyeball whether something looks damaged or out of place.

Now, imagine inspecting wind turbines by using rope access or cranes to lift employees. The employees would slowly circle the different areas of each individual turbine to look for wear and tear while hovering up to 280 feet above the ground.

Seem effective? Understandably not, yet this method of manual inspection is still used by most infrastructure operations. It results in significant labor costs with mediocre levels of accuracy for maintenance companies—and it's costing the communities who use the infrastructure as well.

According to the American Society of Civil Engineers' 2021 Infrastructure Report Card, United States civil infrastructure as a whole received a grade of C-, meaning that it shows consistent signs of deterioration and requires attention to avoid risks. A failure to act on this infrastructure will cost the nation economically amounting to \$10 trillion in GDP and \$2.4 trillion in exports over the next 20 years.¹ By 2039, America's overdue infrastructure bill will cost the average American household \$3,300 a year, or \$63 a week.¹

Deteriorating infrastructure is not the only problem. With increasing sustainability initiatives, new infrastructure is required to replace environmentally harmful methods of energy creation. The European Commission's 2030 Climate Target Plan aims to cut net greenhouse gas emissions by at least 55% by 2030.² One major method of doing so has been to increase investment in wind energy.



About Ignitarium

Ignitarium provides innovative, optimal and relevant solutions for enabling and assisting their customers in product development and optimization.

Ignitarium is built around a core team of technologists, who share a collective industry experience of over 150 years with expertise in system architecture, logic design and verification, signal processing, FPGA design, embedded system design and associated software development.



In 2021 Europe installed a record amount of wind power capacity, 17.4 gigawatts, representing an 18% increase compared to 2020 and will require even greater investment for the EU to meet its goals.³ But record amounts of wind power means record amounts of new infrastructure, which all require consistent inspection and maintenance.

Compounding the issue of high labor costs is the exodus of workers from these industries. Companies simply cannot find and maintain the levels of staffing required to adequately inspect growing infrastructure needs. With thousands of miles of U.S. railroads in dire need of thorough inspection and European countries rapidly installing new energy infrastructure, addressing the widening gap between labor demand and supply is critical.

Without a strategy to implement efficient and regular inspection, infrastructure will not only be deprived of urgent upgrades but also miss the opportunity to set itself up for increased economic success over the course of the 21st century.

Infrastructure inspection needs a solution to overcome challenges in the industry and improve efficiencies in a way that can scale – be it early discovery of wear and tear on a railroad or improving the output of a wind farm. That’s where Ignitarium’s TYQ-i defect detection platform comes in. Ignitarium is using cutting edge AI and computer vision techniques that can help solve for typical challenges and vastly improve inspection and quality assurance processes.

Challenges in Infrastructure Inspection

- Aging and deterioration of infrastructure
- Labor shortage
- Resource intensive and error-prone manual inspection
- Inaccuracy of data
- Lack of scalability in inspection solutions

Solution Overview

Ignitarium’s TYQ-i is a visual deep learning-based infrastructure inspection platform aimed to improve inspection and quality assurance processes. It blends classical computer vision techniques with advanced custom neural nets for enhanced accuracy and performance. The highly scalable solution, primarily used for rail and wind turbine maintenance, captures visual data and uses AI models to detect defects and anomalies and can be deployed to inspect infrastructural assets over hundreds of miles, or even detect a defect in a tiny part on a high-speed conveyor line.

Key Benefits

- ↓ \$ ↓ Reduce labor costs
- 🎯 Reduce subjectivity in data collection and improve accuracy
- ⚙️ Increase speed of operations and analysis
- 🔍 Create audit trail and traceability of data points
- 🛡️ Reduce danger to employees



What Sets TYQ-i Apart

1 Simplified deployment with custom AI models

Ignitarium’s pretrained models are built for custom use cases, and have been honed for high levels of accuracy and efficiency with minimal datasets from the customer. Instead of having to feed thousands of images to train a model, handcrafted custom neural networks (not just Open Source CNNs) can be trained for high accuracy inference with minimal data sets. This reduces the time to deployment without losing accuracy and performance. Intel® Distribution of OpenVINO™ Toolkit is used to optimize these AI models for even better performance on Intel hardware, from Intel Core™ based Edge boxes to Intel Xeon® based cloud servers.

2 Faster visual processing – Pre-processors and post-processors

Before the AI starts working, the input sensor data needs to be converted into optimal formats to help it work more efficiently and effectively. The pre and post processors in TYQ-i do just that, resulting in faster and more accurate results.

3 Increased scalability

TYQ-i uses modular architecture, can work with a variety of low-cost sensors and cameras, and has multiple deployment modes to meet customer needs—even when they are ever-changing.

4 Reduced bottlenecks with built-in benchmarking frameworks

The TYQ-i framework has a native benchmarking framework that allows quick identification of bottlenecks in the pipeline – be it registration, classification, inference or sub-stages in between.

Use Cases

What started as a defect detection solution for manufacturing, has evolved to focus on improving inspection of rail tracks, telecom towers, transmission towers, wind turbines, solar farms, and roads.



Rail Track Inspection



Telecom Tower Inspection



Transmission Tower Inspection



Wind Turbine Inspection



Solar Panel Inspection



Road Surface Inspection

How It Works

To start a customer's journey with the TYQ-i platform, Ignitarium specialists consult with the end customer, maintenance intermediary, or system integrator to understand their specific situation and desired outcomes, then recommend what hardware or configuration they should use. While Ignitarium's AI models are well-honed for several inspection use cases, for customers with unique needs Ignitarium offers a proof-of-concept phase where they collect data and retrain for a customer's requirement, then deploy the solution on the recommended deployment configuration.

Depending on a customer's use case, compute power required, and physical situation, there are two types of deployment options to achieve desired results:

On-Premise Edge-only box

Ignitarium's software is ported on an edge device, such as one based on 11th Gen Intel® Core™ Processors, that can operate completely stand alone. Customers deploy the edge box and connect a sensor to it for imagery and video feed to enter. Ignitarium's TYQ-i software processes the image data using their custom AI models and the generated results are made visible on a screen that is attached to the edge device. Results can also be accessed remotely from a browser connected via the internet. This option is ideal for use cases that have a lighter workload. It enables faster processing in real-time, a lower cost, and superior data security.



Cloud Option

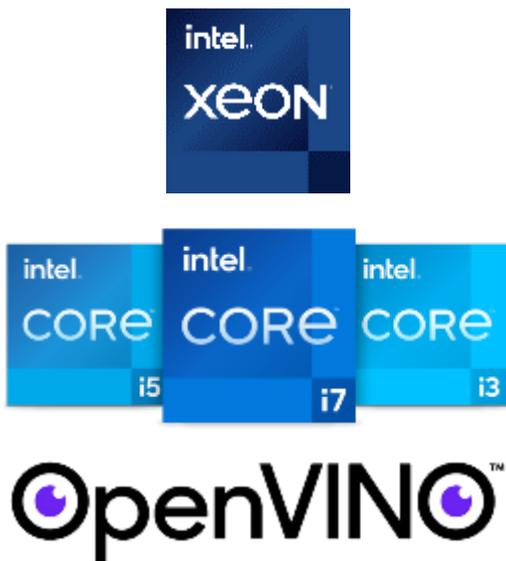
This option is ideal for use cases that need higher compute power, such as processing larger images, detecting dozens of anomalies in the same frame, or infrastructure inspections that cover large distances like miles of rail. In these cases, the edge box alone would not have the processing power to analyze the significant amount of data collected. For customers in these use cases, Ignitarium offers a cloud option. For cloud deployments, the edge box is used as a front-end collection unit for sensor imagery and video data. The acquired data undergoes an initial level of pre-processing on the edge box before it is transferred to the cloud for analysis where servers run on Intel® Xeon® Scalable Processors, which are designed to handle larger workloads and larger compute, process the data through Ignitarium's custom AI models. Generated results are then sent to an internet browser where users can view them. Edge devices can also be placed on vehicles for inspection to collect sensor data and then transfer it to the cloud for analysis. This is ideal for scenarios that require inspection across long distances.

Intel Solution Components

11th Generation Intel® Core™ Processors: This set of processors features high-performance CPU/GPU compute with integrated AI acceleration, along with real-time capabilities for critical applications that demand high-speed processing, computer vision, and low-latency deterministic computing.

Intel® Xeon® Scalable Processors: Intel® Xeon® Scalable processors feature built-in accelerators and advanced security technologies for the most in-demand workload requirements — all while offering the greatest cloud choice and application portability.

Intel® Distribution of OpenVINO™ Toolkit: After optimizing with 11th Generation Intel® Core™ Processors, the natural extension of the solution was to integrate OpenVINO™ to optimize performance. The OpenVINO toolkit is a comprehensive toolkit for deploying edge machine learning applications such as computer vision, speech recognition, natural language processing, recommendation systems and more on Intel hardware. With support for modern neural network architectures including convolutional neural networks, recurrent and attention-based networks, OpenVINO was designed as an end-to-end solution that standardizes, optimizes and deploys Edge machine learning workloads effectively, all while enabling scalability.



“

Ignitarium’s TYQ-i solution has enabled significant reduction in manual eyeballing of power transmission tower image footage captured by drones. The elimination of subjectivity during human analysis has enabled creation of a reliable audit trail which is very critical in our industry.”

— VP of Operations,
Global Tower Installation
Company

Deployment Example: Wind Turbines

To collect wind turbine data, a maintenance company would drive around the wind farm in a custom van, release drones, and collect imagery associated with each turbine. To locate the exact wind turbine to be inspected, the company can use the Google Maps-powered dashboard. When the drones come back, the data gets transferred to the van, which has an edge device in it. The edge device can provide instant results and information for the maintenance company to act on. If the wind turbine fleet is large and results are needed quickly, the edge device acts as a conduit to a cloud or on-premise server. The company can then analyze footage, stitch images for 2D or 3D rendering, and identify and categorize defects such as blade edge corrosion, overheating, surface cracks, and more.

Conclusion

The way we take care of our infrastructure today has a direct impact on our quality of life tomorrow. Why not do it efficiently and accurately? Ignitarium TYQ-i can transform inspection into an accurate and efficient process using AI and vision intelligence. Reach out to business@ignitarium.com today to discuss how their solution can help you scale an accurate and safe alternative to manual inspection.



Learn More

- [Ignitarium TYQ-i Product Page](#)
- [Ignitarium Company Website](#)
- [11th Gen Intel® Core™ Processor](#)
- [Intel® Xeon® Scalable Processors Product Page](#)
- [Intel® Distribution of OpenVINO™ Toolkit Product Page](#)

intel®

Sources

1. [2021 Report Card for America's Infrastructure](#), American Society of Civil Engineers, 2021
2. [2030 Climate Target Plan](#), European Commission, 2021
3. [Europe installed a record amount of wind power last year. But industry says it's not enough](#), CNBC, 2022

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