NVIDIA

SOLUTION SHOWCASE

Alerion Wind Energy Inspection

Challenge

- Current drone technologies limit image quality and compute power
- Autonomous real-time reactions to minute details of inspection are required
- A small, lightweight form-factor is essential
- Integration capabilities to high-end sensor technology is paramount

NVIDIA Solution

- Rich inputs and outputs to integrate multiple sensors
- Strong support for deep-neural-net (DNN) computing and acceleration
- High power efficiency

Results

- Nearly eliminated the margin of error in turbine inspection
- Dramatically reduced costs to a fraction of traditional solutions
- Eliminated safety risks associated with manual inspection

ALERION ADVANCES AI-DRIVEN INSPECTION DRONES FOR WIND FARMS

> *"Early drone technology was a big leap forward in reducing costs and danger during turbine inspection but…inaccuracy [was an issue]. [The WEGOOI drone is] fully autonomous while providing high-resolution and precision damage detection. For a task that would…take 2-3 hours, the WEGOOI drone will complete the full inspection in about 10 minutes.*
>
> **— Oier Peñagaricano,** CEO at Alerion

Wind Energy Onshore and Offshore Inspection

Manually inspecting a single wind turbine is a long and dangerous operation, typically carried out by ground telescopes and specialized technicians. Early drone technology cuts down on time, but produces inaccurate imaging that results in costly re-inspections. Alerion designed a fully autonomous drone (WEGOOI) to perform inspections of wind turbines, relaying real-time damage identification and drastically reducing the time and cost involved. Using both an auto-pilot program and AI damage detection, WEGOOI can navigate and orient itself to each turbine, generating a 3D image to detect even submillimeter levels of damage.

NVIDIA Platform

Alerion uses both an auto-pilot program and AI damage detection for the drone to correctly orient itself and identify any damage to the turbine. To achieve the accuracy within a fully autonomous system, the drone's inspection module requires significant computing power. The NVIDIA Jetson AGX Xavier GPU provides 32 TOPs of performance using a 512 CUDA® core Volta GPU with 64 Tensor cores, making it the ideal GPU for this project. Paired with Connect Tech's Rogue-X Carrier Board, the system was able to integrate a XIMEA 50 MP camera and Ouster OS1 3D LiDAR laser within the edge device. Deep neural networks calibrated the information provided by the LiDARs and combined it with the high-resolution images. The end result is a full-color, 3D image of every turbine–which is analyzed in real-time to detect damage.

Products Used

> Jetson AGX Xavier™

Processing Engines Used

> Detection, segmentation, and tracking on GPU and DLAs
> Image recognition on GPU
> CPU for control and management
> Mapping, localization, control, and planning on ARM processors
> GPU and DLA for accelerated image processing

Software Used

> NVIDIA JetPack™ SDK for OS and control software
> FastVideo: raw image processing on GPU
> SwiftPilot Autopilot: autonomous navigation
> NVIDIA® TensorRT™ to accelerate models for deployment
> Pytorch and Caffe to design the neural network
> OpenCV for the vision system

Alerion Results

Manual inspection of a single wind turbine used to take an operator from 2-3 hours to complete. Initial drone technology cut that inspection time down to 1-1.5 hours per turbine, but limitations in camera technology caused between 20-30% of the assessment to be repeated to ensure accurate results. Early drones also typically needed to be flown by an operator on the ground, making this task a labored and expensive way of performing inspections. The WEGOOI drone completes the entire inspection in approximately 10 minutes and will identify submillimeter levels of damage to the turbine's blades.

About Alerion www.aleriontec.com

Alerion was born in 2014 in Munich (Germany) and incubated at ESA Business Incubation Centre-Bavaria through the European Space Agency's Technology Transfer Program. Its dynamic team comprises engineers with research and industry experience in developing high-performance drones for extreme environments, advanced computational software, and computer vision.

Since 2016, Alerion has been offering custom automated industrial inspection solutions for wind energy infrastructures using its patent-pending laser navigation technology that permits high-precision, close-proximity navigation to structures.

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Learn more: **www.nvidia.com/robotics**

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