EPRI ARTIFICIAL • INTELLIGENCE

PowerAI Platform for Automated Visual Inspection of Grid Infrastructure

Buzz Solutions

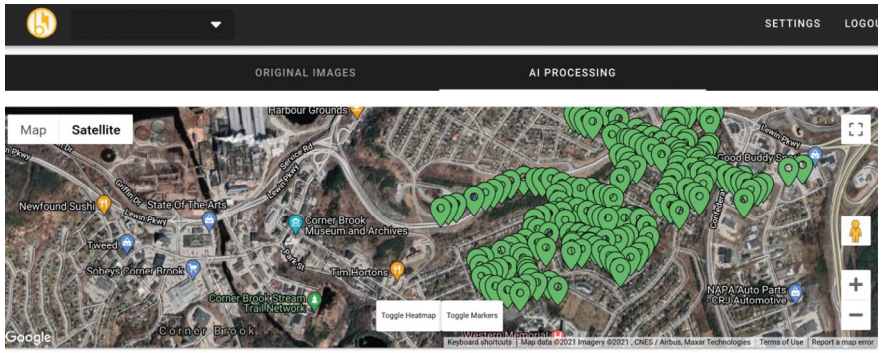
Startup
Buzz Solutions
Palo Alto, CA

Host
Newfoundland Power

NEWFOUNDLAND POWER
A FORTIS COMPANY

Technology Solution

Today, visual inspection of transmission and distribution (T&D) infrastructure can involve the review of millions of images captured in the field by workers, surveillance systems, drones, helicopters, fixed-wing aircraft, and other means. Analyzing these images to turn raw data into actionable inspection information currently requires technical expertise and substantial labor investment, and this can hamper timely response.



The PowerAI platform's geolocation functions allow easy visualization of, and access to, distribution pole inspection results.

This pilot project's objective was to demonstrate the PowerAI system developed by Buzz Solutions for supporting rapid, automated review of drone-based distribution inspection imagery. This software platform provides an end-to-end solution for cost- and time-efficient visual data management, processing, and analytics. Machine vision technology extracts and ingests imagery data for AI-based analytics to detect and map faults, anomalies, and risks relating to T&D equipment, including vegetation management along rights-of-way. Insights and analysis into the location of existing asset management issues or concerns and the potential location and timing of future problems can help T&D network operators in preventing failures, outages, and wildfires.

Project Overview

This project team involved a collaboration among Buzz Solutions; Newfoundland Power, a Fortis company, as the host utility; EPRI as subject-matter expert; and Altomaxx Technologies as the drone service provider. The PowerAI technology platform was applied with the goal of demonstrating the following:

- Scalable and secure visual data ingestion and management,
- Mapping of visual data to field assets and structures with GIS functionality,
- Machine vision algorithms for AI-based asset health assessment and anomaly detection,
- Customer-in-the-loop workflow allowing continuous process improvements,
- Actionable inspection insights and accurate predictive capabilities, and
- Integration of exported results with work order management systems, GIS systems, etc.

Major tasks included collection of drone-based inspection imagery of distribution assets, integration of drone-collected imagery into PowerAI software, integration of the platform with utility systems, model development and deployment within PowerAI, model

evaluation and retraining based on inspector feedback, and assessment of inspection and predictive capabilities.

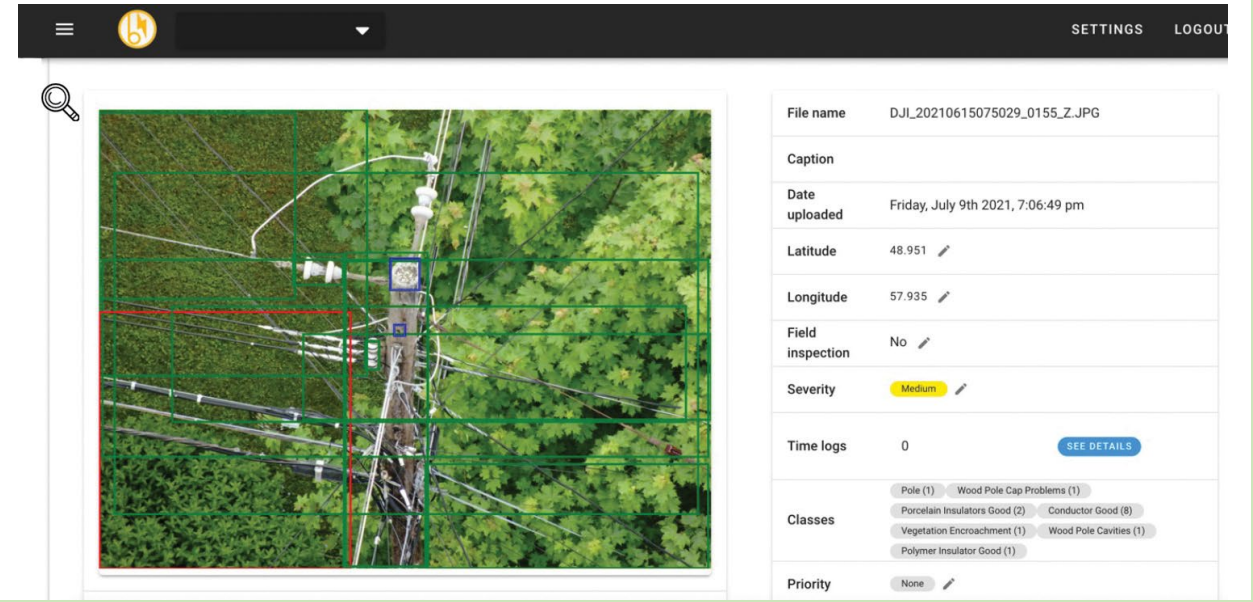
Results & Learnings

Drone data were collected on utility infrastructure per guidelines set to align the volume and resolution of data to be captured and the data capture methodology with the PowerAI platform. Over 30,000 images were collected. PowerAI ingested, modeled, and analyzed imagery data to generate maps, labeled images, and other information products.

Newfoundland Power team members evaluated the platform's ability to identify distribution assets, characterize health, and identify issues and anomalies. With 100 hours of time devoted to this project, five work planners leveraged PowerAI to geospatially manage and inspect about 5000 distribution poles and performed their own visual inspections of the imagery for 275 poles.

Through the PowerAI interface, they were able to evaluate the AI-developed fault detection labels and to update, add, or remove them. Some mismatches in GIS mapping were encountered. Performance improved over time, but the source(s) of error could not be identified. More broadly, user feedback helped in model retraining to increase inspection accuracy. Post-pilot survey results are summarized below:

- All five participants indicated that their suggested feedback was implemented, making PowerAI more useful for their workflow.
- All five indicated that the AI-based predictions improved over the short-duration project.
- Three of five identified the PowerAI tool as "promising to essential" for drone data management and review.



AI-based deficiency detection, severity assessment (as indicated by the red circle), and labeling help automate and streamline the visual inspection process.

Buzz Solutions performed internal benchmarking throughout the pilot and also noted improved accuracy in AI-detected labeling. Generally, the performance of AI models improves with more training data and when feedback is added, but longer-duration testing and more detailed analysis are required to assess predictive capabilities.

In addition to recognizing the value of PowerAI's inspector-in-the-loop workflow, utility participants identified platform enhancements, such as faster processing capabilities and additional components and diagnostic indicators beyond the default inputs.

Implications & Next Steps

The PowerAI solution demonstrated innovative capabilities as an alternative to traditional methods for performing image-based visual inspection of T&D assets. Newfoundland Power's feedback enabled improvements in the user interface, pole mapping, and deficiency prediction for distribution applications. Buzz Solution's AI-based diagnostics, along with the inspector-in-the-loop and other features, result in a flexible platform capable of advancing utility asset management programs.

Follow-on tasks involve implementation of advanced clustering algorithms for improving locational accuracy and asset tracking, as well as integration of PowerAI with Newfoundland Power's legacy GIS system to support continued technology evaluation, including for inspection of a transmission line segment. In addition, the imagery collected in this pilot is being added to EPRI's growing database to support the development and advancement of AI-based innovations for T&D and other applications.

Resources

Vikhyat Chaudhry, *Co-Founder & Chief Technology Officer, Buzz Solutions,* vikhyat@buzzsolutions.co

Brett Belbin, *Electrical Engineer, T&D Engineering, Newfoundland Power,* bbelbin@newfoundlandpower.com

Dexter Lewis, *Principal Technical Leader, EPRI,* dlewis@epri.com

TESTIMONIAL: Buzz Solutions

With AI-based systems and new business cases bringing about a digital transformation in how utilities monitor their infrastructure, the Buzz Solutions team was excited to work with Newfoundland Power and EPRI in demonstrating our technology for efficient inspection of grid assets.

TESTIMONIAL: Newfoundland Power

We service a large territory, which makes it challenging to capture detailed information about the health of our infrastructure. Throughout this pilot project, Buzz Solutions was responsive to our feedback, facilitating an enjoyable experience and improving AI-based deficiency detection. PowerAI enhanced our inspection process, and use cases could expand into other utility workflows.

TESTIMONIAL: EPRI

Seeing PowerAI being applied to improve asset health assessment in real time was very exciting, as visual inspection is very complex, and significant training data are required. Sharing the imagery collected and insights gained during this demonstration will support continued advancement of AI technology for the electric sector. If you are interested in sharing your data, please reach out at AI@EPRI.com!

Resources

Erik Steeb, Incubatenergy® Lead
esteeb@epri.com; 650.680.6530

Annie Haas, Incubatenergy® Challenge Lead
ahaas@epri.com; 704.608.6314

incubatenergy labs

labs.incubatenergy.org

2021 Incubatenergy Labs Sponsors

Ameren
TVA
conEdison, inc.
DUKE ENERGY®
enel
FirstEnergy®
FORTIS INC.
NEW YORK STATE OF OPPORTUNITY. NY Power Authority
PG&E®
PGE
SRP
SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company
vermont electric power company VELCO
Xcel Energy®

3002023014

March 2022

EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com

© 2022 Electric Power Research Institute (EPRI), Inc. All rights reserved. Electric Power Research Institute, EPRI, and TOGETHER...SHAPING THE FUTURE OF ENERGY are registered marks of the Electric Power Research Institute, Inc. in the U.S. and worldwide.