Tata Consultancy Services (TCS)

AI-Powered Drawing Review Automation for Substations

Industry: Energy & Utilities | Solution Brief

Background & Challenge

Modern electrical substations comprise multiple operational units called bays, each supported by a detailed drawing package - averaging 240 pages per bay. With approximately 12 bays per substation, this results in over 2,800 pages of engineering drawings that need to be manually reviewed for correctness, completeness, and compliance.

Manual review of these drawings is resource-intensive, error-prone, and slow, often leading to delays, missed errors, and costly redesigns.

Use Case 1: AI-Based Drawing Error Detection

TCS proposes an AI-driven engine that automatically analyzes the drawing package using pre-trained machine learning models. These models are trained using feedback from past manual reviews, enabling the system to detect common issues such as:

- Missing or incorrect labels
- Inconsistent component symbols
- Layout misalignments
- Non-compliance with engineering standards

This system acts as a virtual design reviewer, dramatically improving speed and reducing dependency on human effort.

Use Case 2: Repeated Error Identification and Contractor Notification

When a particular type of error (e.g., incorrect component naming) is detected across multiple instances, the system:

- Groups similar errors into a single category
- Automatically generates a summary report or notification
- Sends actionable insights to the contractor or design team for correction

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This reduces back-and-forth communication and ensures faster resolution of systemic issues.

Solution Architecture & Technology Stack

TCS will deliver this solution leveraging the following technologies:

- Optical Character Recognition (OCR): Extract text and annotations from PDFs
- Computer Vision (CV): Detect visual patterns, symbols, layout consistency
- Machine Learning (ML): Trained on historical error data and human validation
- Natural Language Processing (NLP): Summarize findings and auto-generate reports
- Tech Stack: Python, TensorFlow/PyTorch, OpenCV, Streamlit
- Cloud Infrastructure: Deployed on Microsoft Azure or AWS with scalable processing and secure storage

Customer Involvement

Client participation is essential to ensure system relevance and accuracy. Involvement includes:

- Providing drawing datasets and historical error annotations
- Validating AI results during the learning phase
- Reviewing generated reports and confirming resolution workflows
- Participating in feedback loops to improve model precision

Business Benefits

- ~90% reduction in drawing review time
- Early error detection minimizes rework and cost overruns
- Automated and auditable reports streamline compliance
- Improved contractor coordination through grouped issue insights
- Scalable across multiple substations and projects