

EPRI DATA ANALYTICS CASE

Predictive Health Index for Distribution Line Regulators

The Data Challenge

Health assessment of distribution line voltage regulators is rare because of the lack of communications to the device and the limited use of sensors to monitor the thermal, electromagnetic, and environmental stresses imposed on it. The lack of any visibility into these stresses typically leads utilities to implement time-based maintenance or to forego any maintenance.

Solution Overview

Algorithms in combination with condition-based maintenance applications, such as the asset management system, can be developed to determine whether a distribution regulator device is being exposed to overload conditions or its tap-changing mechanism is being operated more than desired. These two parameters permit the utility to better estimate the health of the regulator and schedule maintenance based on data from other distribution devices with communications and measurement capabilities on the same circuit. Therefore, a health index can be developed with these parameters and others that can be estimated from available data.

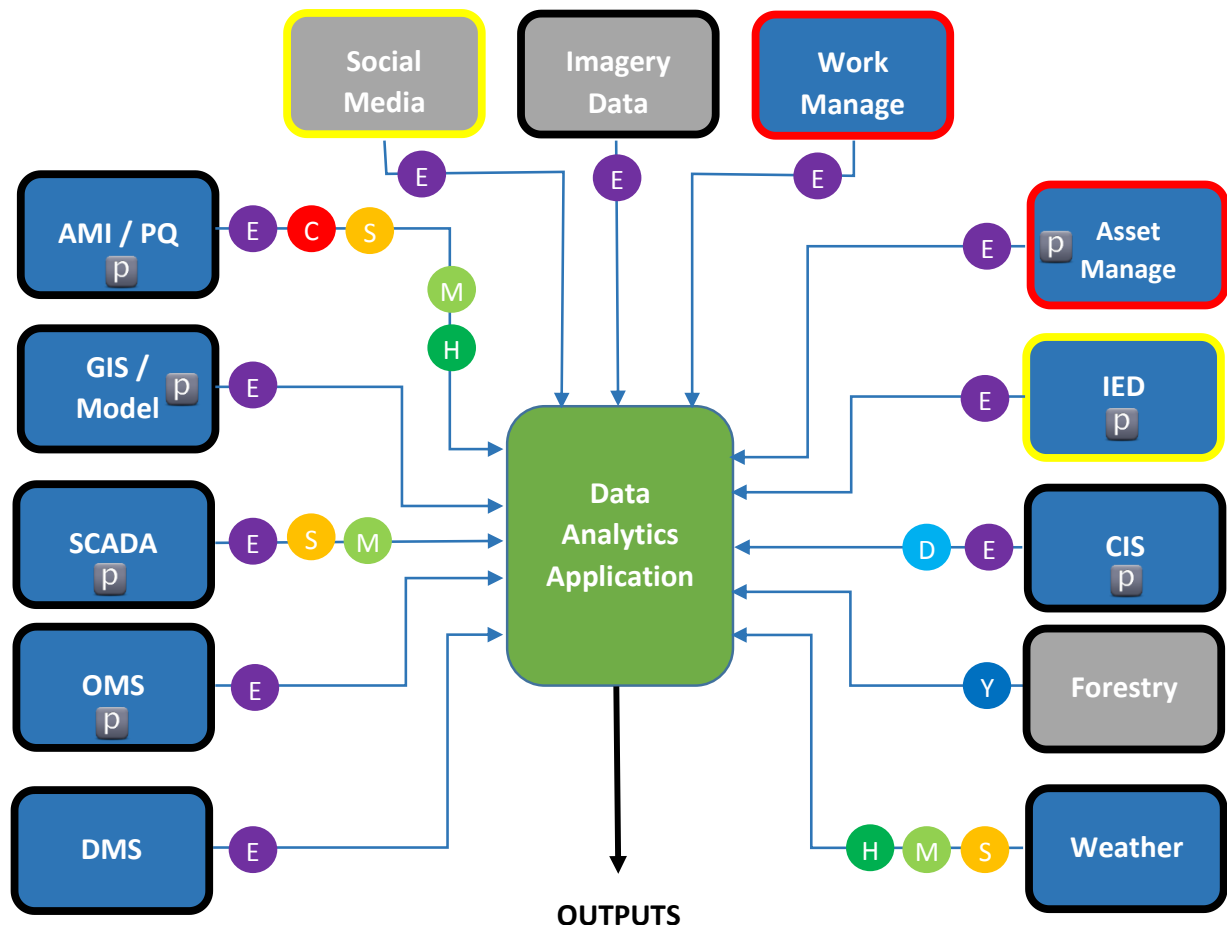
Potential Methods for Solving the Problem

This data analytics case proposes to replace or supplement field inspections with data-driven solutions. Because many voltage regulators do not have communications to easily provide critical feedback data for the data analytics solution, the following potential methods use data from other devices downstream of the voltage regulator to develop a health index to project the condition of the regulator:

- **Step counter:** the algorithm(s) would count the number of steps that a regulator takes over a given period of time. A secondary benefit of the counter would be to monitor the absence of step changes over a short period of time, which might indicate an issue with the voltage regulator or its controller.
- **Overload indicator:** the algorithm(s) would determine the frequency, duration, and severity of overload conditions over a given period of time.
- **Controller malfunction:** the algorithm(s) would compare the bandwidth settings to the output of the voltage regulator. A drift of voltage outside of the defined bandwidth would likely indicate an issue with the controller or the voltage regulator.

Available Data Sets

The data sets highlighted in the following figure are available in the EPRI Data Repository to solve this data analytics case.



Classifications of Data:

- Traditional Data Set
- New Data Set
- Structured Data
- Un-structured Data
- Format of Data Varies

p Denotes a primary data set used to solve this data analytics case.

Frequency of Measurement

- C Cycles
- S Seconds
- M Minutes
- H Hours
- D Days
- Y Months to Years
- E Event Driven