EPRI DATA ANALYTICS CASE

Distribution Capacitor Bank Problem Detection

The Data Challenge

Detecting the failure of distribution capacitor banks is an uncommon practice, especially for un-switched and non-communicating capacitor banks. Internal failures of the capacitor typical blow the protective fuse. For switched capacitor banks, other issues with the switch and the associated controller can contribute to a capacitor bank not operating properly. Without sensors and associated communications installed with the capacitor bank or on nearby devices on the same circuit as the capacitor bank, a damaged or malfunctioning capacitor bank will typically remain out of service until the next inspection.

Solution Overview

Algorithms, some as simple as correlation algorithms to determine the change in voltage before and after a capacitor failure, can be developed to comb through available data to identify common problems with a capacitor bank and its controls when present. The detection of a problem could expedite repairs to a matter of a few days so that the feeder voltage is restored to a desirable level and system losses are reduced.

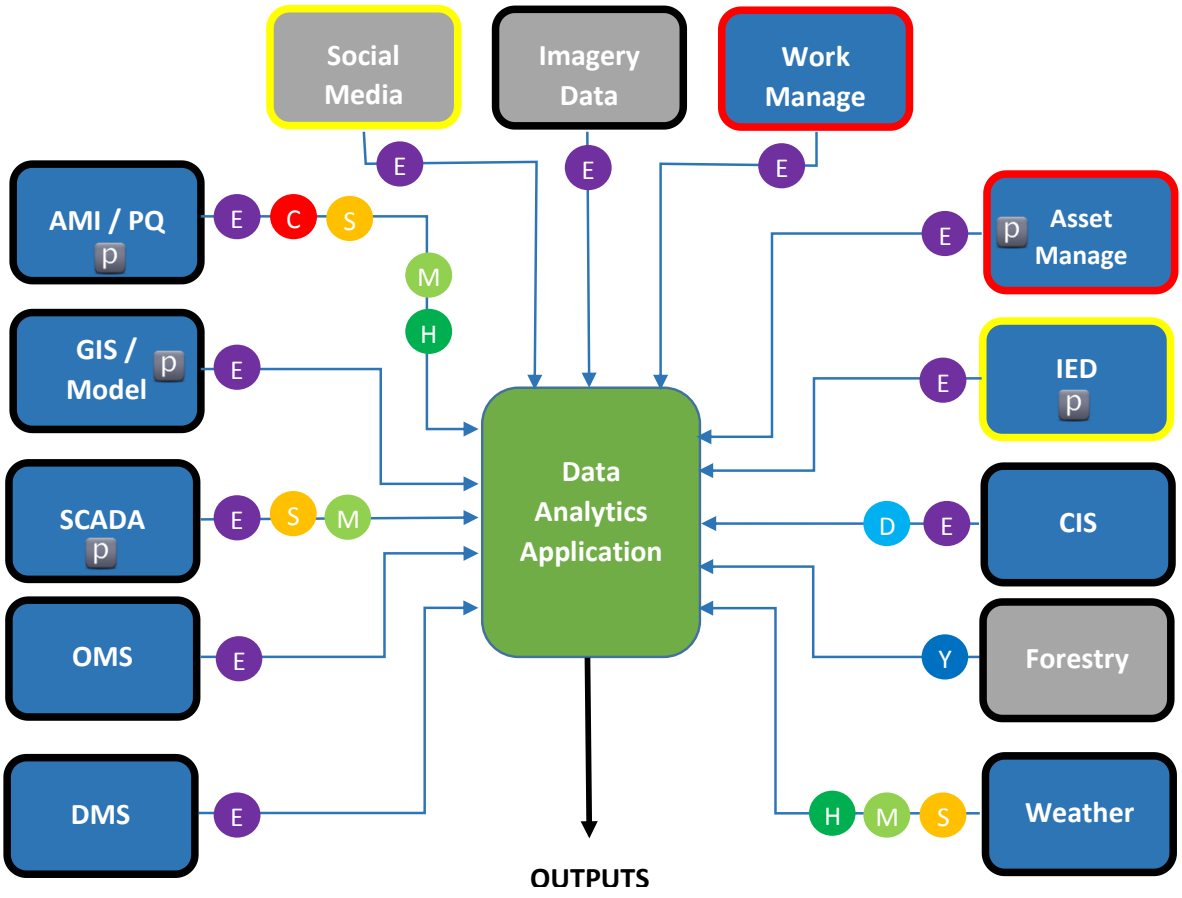
Potential Methods for Solving the Problem

This data analytics case proposes to replace or supplement field inspections of capacitor banks with data-driven solutions. The focus of this data analytics case is to identify the required analytics for non-communicating capacitor banks. The potential methods below utilize data from other smart grid devices on the same circuit as the capacitor bank being evaluated in order to identify a problem or substandard condition and/or failure.

- Blown-fuse detector – The algorithms would monitor the reactive power measurements of other smart grid devices to determine when a step change in reactive power and single-phase voltage occurs, an abnormal voltage imbalance is present, an abnormal change in harmonics is observed, or a combination of these.
- Malfunctioning controller indicator – The algorithms would monitor the power readings, especially reactive power, current, voltage, as well as other status, analog and control measurements of other smart grid devices to determine abnormal operation conditions that would be a direct result of a malfunctioning capacitor bank controller. Excessive operations or operations outside of the settings in the controller would be examples of a malfunctioning capacitor bank controller.
- Malfunctioning switch – The algorithm(s) would monitor the power readings and waveforms, especially reactive power, current, voltage, as well as other status, analog and control measurement of other smart grid devices to identify abnormal readings and waveform signatures that would be indicative of a malfunctioning or damaged capacitor bank switch.
- Arcing in a capacitor bank switch (failure of switch to open or close completely), switch bounce (switch contacts open and close more than once while “sealing in” during a closing operation), and capacitor bank restrikes (the switch closes one or more times while attempting to open) are commons issues with capacitor bank switches.

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

Frequency of Measurement

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

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