Predictive Reliability Intelligent System Monitor

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Introduction

For the transmission industry, full system awareness and monitoring has been a major topic for many years. This paper will outline LCRA developed Predictive Reliability Intelligent System Monitor also known as PRISM, a tool to help achieve total system awareness. One of the main reasons for this discussion is the effort to mimic the predictive maintenance approach for substation and asset monitoring. The predictive maintenance approach stems from the shortcomings of its predecessors, reactive maintenance and proactive maintenance. Reactive maintenance is mainly based on real-time equipment failure alarms. Such failure alarms are only good for damage control, the time for corrective actions and damage mitigation is prior to equipment failures. Proactive maintenance approach introduces the ability to implement corrective actions and prevent equipment failures. With proactive maintenance, scheduled maintenance and the recognition of past failure signatures will generate warnings of imminent asset failures. The desired predictive maintenance approach builds on the methods of the proactive maintenance approach while introducing some new key elements. The main element of the predictive approach is the continuous health monitoring of each individual asset within the fleet. Asset specific health rankings can justify investments for risk reductions and help predict equipment issues prior to the need to perform corrective actions. This will allow the asset owner to prepare and schedule for any related corrective maintenance.

Design Considerations

There are many desired front-end and back-end characteristics that were taken into account when designing PRISM. On the front-end, we wanted modern dynamic visuals to display any and all back-end data. The ability to easily create interactive dashboards was a key factor when deciding on the data analytics platform to use for this project. For LCRA's purposes, this tool needed to generate reports or have the means through which findings and even thought processes could be shared within the organization. Finally, the tool must provide system administrators the ability to limit access and control to the interactive views and the underlying data sources.

On the back-end, the most important characteristic is the ability to accumulate data from numerous network locations. Along with data centralization, the back-end database needed to have the ability to automate data dumps from its various sources. Tableau, a data analytics software, was chosen to accommodate for the front-end design criteria and SQL Server to implement the back-end solution. With the ability to automatically update and restructure SQL Server tables and to intuitively build Tableau dashboards, LCRA design team had everything it needed to build PRISM.

Obstacles and Resolutions

Just like any other design project, the PRISM team encountered many unforeseen obstacles and roadblocks. From the front-end point of view, the Tableau platform as a whole is very user-friendly and it only takes a few hours from the time of install to the time a computer savvy user can generate some visually impressive dashboards. However, to capitalize on the entire data analytics arsenal that Tableau has to offer, it takes many hours of trial and error along with training offered by Tableau developers. To accommodate for Tableau's steep learning curve, training videos are available that cover a wide array of topics to help jump start the user's familiarity with the platform. The PRISM team also took advantage of the interactive instructor taught courses to better understand how back-end data is processed and displayed via Tableau. One of the biggest benefits of Tableau is that there is no shortage of dashboard functionalities or work-arounds to achieve a desired result.

From the back-end prospective, there was no shortages of available data, however, gathering the necessary data from the many network locations and organizing it into a usable format was one of the biggest challenges. The first step was to identify the actual data that we would need to make PRISM work. Once the relevant asset data and metering points were identified, it was critical to establish methods which would allow the SQL Server database to grab that data automatically via scheduled data pulls.

PRISM Today

The development of PRISM allowed as to have a deeper insight into our data and to substantially improve system reliability. The process of data gathering and centralization allowed as to see where data cleanup was needed within the network. Furthermore, we are able to apply data analytics on data sets that were never analyzed or even viewed for anything other than investigative purposes. Now yearly, quarterly, and even monthly asset inspection data is being used for trend analysis and the development of new alarming schemes. PRISM's ability to analyze test reports and alarm SMEs about undesirable results is on the verge of saving countless man hours by eliminating the need to manually inspect test reports. The development of asset dashboards allows the user to view all relevant asset information and test data on a single interactive screen. Finally, PRISM's geographical view allows the user to view asset alarms and warnings based on user set thresholds across the entire system.

Next Steps

In its infancy stage, PRISM has improved reliability, recognized data input errors, and identified asset related issues in the field. The next step in achieving the predictive maintenance approach is to incorporate LCRA developed ranking and asset health algorithms into PRISM. With the centralization of all asset related data, ranking algorithms will be fine-tuned to incorporate all relevant asset data that previously was not considered. The prediction of asset failures and necessary maintenance will be possible via redesigned health algorithms, data trending, and advanced data analytics.