Who I Am

I have a passion for all things data. I strive to consume and analyze everything around me in the pursuit of driving swift and accurate decisions and uncovering the unknown. Only once you have all the data can you truly understand what it was you were looking for. I love to diversify my knowledge by understanding as many fi­elds of study as possible. This is critical to fully understanding the world around us.

My typical day includes raw data manipulation and analytics aided by VBA, Ruby, and R. I am experienced in responsive website design - leveraging HTML, CSS, Javascript, and Bootstrap framework to drive increased conversions and richer information experiences. In my previous role, I was also responsible generating all front-facing graphics used within our business unit.

Statistical Analysis

Project dedicated to generating alarm set points for mechanical equipment through the statistical analysis and modeling of historical operational profiles. The realization of this project resulted in a reduction in new client onboarding times from over a month, to less than an hour.

While working in a monitoring and diagnostic center, I was tasked with new client onboarding. Prior to joining the team, a large influx of man-hours was required to successfully onboard a new client. Much of the work was performed manually, relying heavily on intuition and experience. Typical onboarding times spanned several months. The core workload was attributed to manually parsing through the client’s historian to identify those valuable points of which to monitor and the subsequent generation of alarm set points. My work in this area focused on both aspects but in this scope is limited to the generation of alarm set points.

To materialize alarm set points, I begin by querying a year of data from our historian, both maximum and minimum values spanning one-hour intervals for each metric. This data is then scrubbed to remove flat-lined values and NaNs. Rolling averages for each metric are then calculated to identify any recent operational profile shifts such as the degradation or repair of an asset. If this is determined to be relevant, the new operational profile is elected and all other data is truncated. Outliers are then filtered via user-defined permissives and an algorithm leveraging normalized standard deviations of each point. The remaining values are then used to materialize alarms wrapped in ceiling or floor functions respectively, with tolerances appended based on the new standard deviation of the operational profile.

POC Website Refresh

A fully responsive, fresh take on Luminant's Power Optimization Center website intended to provide a richer information experience for prospective clients and consequently increased conversions.

When Luminant’s Power Optimization Center began offering commercial services, no front-facing website existed. A quick Wordpress template was stood up and populated with basic information. No time was available consider information architecture and UX/UI design patterns. Consequently, the website only served to provide basic, unstructured information along with a way to contact the POC.

After joining the POC’s marketing team, I was tasked with generating a new brand identity. This was everything from a new color scheme to trade show graphics to a refreshed website. I began the website project by assessing the POC from the ground up. Working with key engineers and marketing staff, I identified the core business model of the POC and subsequently, the pertinent information to provide on the website. Anticipating modularity, I generated a master CSS stylesheet that worked hand in hand with the Bootstrap framework to provide the POC with a predefined set of styling attributes to use across all current and future webpages. The end result yielded a fully responsive website compliant with disability standards with support and functionality for mobile and touch devices.

Autonomous Drone Project

Drone built and programmed to be capable of autonomous flight, obstacle avoidance, and wireless charging through a purpose-built inductive charger.

The overall goal of the project was to deliver a fully autonomous quadcopter capable of full obstacle avoidance based on an array of infrared and ultrasonic sensors covering the airframe. Autonomous navigation operated in several modes. The quadcopter was capable of waypoint navigation either via GPS coordinates or a fixed distance input. It was also capable of a simple "drift mode" in which the quadcopter had no current objective but instead was capable of simply maintaining itself within its environment. Inductive power transfer was also added as a side objective. Roughly 65W of power was inductively transferred and made available to charge the onboard batteries through the team’s purpose-built inductive charger.

The quadcopter project was built over the course of a year as a team effort in coordination with Missouri S&T and was intended to be a stable test bed upon which other students could build. Maximum lift capacity was slated at 1kg – with the overall simultaneous thrust at 3.56kg. The project was designed in Autodesk Inventor and subsequently hand built. Autonomous functionality was derived from cooperation between the MultiWii II open source flight controller and a top-layer AVR microcontroller tasked with external peripheral interpretation. The project was largely successful in meeting all of the goals set forth by the team.

Statistical Maintenance Project

A data analysis project and subsequent script generation targetting a drastic reduction in man-hours spent maintaining statistically-derived alarms for mechanical equipment.

The idea of these efforts was to automate the process of identifying and eliminating those alarms deemed as nuisance alarms – as human review would prove too consumptive of resources. Two separate applications were deployed to ensure an effective effort was made. The first pass was to review the past few days of operational data for all alarms targeted. This data is parsed to uncover the absolute maximum and minimum value for each alarm tag during this time period. These values will be titled the “local min” and “local max”. Once these values have been populated, they are compared to the alarm set points established for each tag. Those alarm tags with local mins or maxes exceeding the established alarm set points are flagged and extracted – as to indicate an alarm was received in EWS. The idea of this flagged list is to determine just how far outside of the alarm set points the local mins and maxes fell. It is very common that tag values fall just outside of the established limits, generating nuisance alarms. A review therefore, is performed based on a user-defined acceptable range. That is to say, if tag values exceed alarm set point values yet are within a user-defined range, say 10%, the set points should therefore be modified accordingly to wrap the local mins and maxes within the newly-defined alarm set points.

The second methodology for alarm reduction is the deployment of appropriate delays. Many tags experience signal noise which can create nuisance alarms. This is especially true during unit shutdown and startup. These noise spikes typically have been filtered out by increasing alarm set points. This is not a sustainable practice – as it establishes alarm set points much higher than the standard operating range. This generates alarm set points which will only catch the most severe of events.

To determine appropriate delays, 24 hours of raw PI data is required, for each tag to be analyzed. This typically is anywhere from 100 to 20,000 data samples per individual point. Once this data is collected, the period between each sample is estimated based on the number of samples within the 24 hour period. The system then determines the longest time frame within this sample data that the signal exceeded alarm set points. User-defined values were established at a maximum of a five minute delay for High/Low alarms and a maximum of a two minute delay for HiHi/LoLo alarms. This process is configurable to apply to only High/Low alarms just as the alarm set point modification process. If delays are generated for HiHi/LoLo alarms, the user also has the ability to generate a tertiary alarm, set just above the local max or min with no delay appended.

Bearing Wipe Detection

Simple OSIsoft PE script to identify real-time, potential bearing wipes during transient events on large machinery - removing the lengthy manual review process.

Listed above is the Performance Equation, broken into individual portions. As PEs function similar to Excel functions, variables are not available for use and portions of the code must be repeated. The script depicted is design to identify bearing wipes on large turbo-machinery during startup and coastdown but may be applied to any equipment utilizing journal bearings. Built in are permissives to enable the code only during transient events. Hold events are also filtered through the script. This script generates very accurate detection of potential bearing wipes with few false positives. Consonants may be adjusted may be adjusted by the end user in tailoring the script for other machinery.

Bit Error Correction & Detection

By providing a simple software/hardware wrapper for low-cost wireless serial TX/RX pairs, I was able to offer a stable platform for accurate wireless data transmission.

The intended overall goal of this project was to develop and implement a reliable and cost-effective wireless transmitter/receiver pair that is available to the public. Wireless transmission costs have dropped significantly over the years but the intentions of this project are to further reduce those costs by utilizing a publicly available wireless transmitter/receiver pair and developing a software layer which will work to aggressively remove bit errors and implement an addressing system so that multiple transmitters may be used with a single receiver. Through the use of inexpensive AVR microcontrollers, this software layer was implemented and the whole transmitter/receiver repackaged on a new board allowing users a serial interface.

The error correcting code was found to be quite effective at resolving transmission errors. Transmission could be even more effective if the raw synchronization byte was able to be encoded as well but it is required to be transmitted raw to initialize the receiver. While transmitting raw data, it is noted that many times the address or data bytes appear to be corrupted while the encoded data is able to recover the data almost every single time. Under continuous transmission, many of these errors are removed. It seems that when the receiver is subjected to a constant stream of data that the output stabilizes significantly.