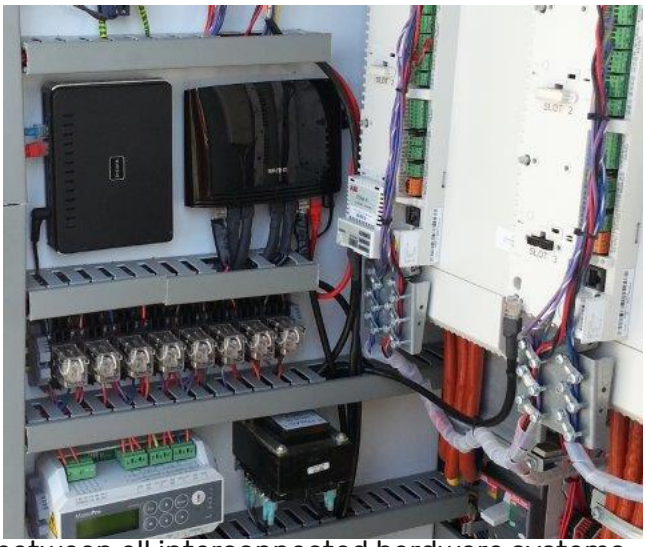
VENN Design SOLUTIONS

Cloud Based SCADA System Case Study

Venn Design Solutions provides custom low-cost cloud based SCADA system for small wind turbines.

While SCADA and intensive data monitoring of large industrial scale equipment in well-connected facilities is commonplace, developing a flexible internet and cloud based system for low cost and reliable communication links with minimal upfront, ongoing and licencing costs is still something most small companies and new entrants to the distributed industrial hardware market struggle with. It is only in the last few years industry has started to discover the benefits of using internet connectivity to provide management and data aquisition of various devices, most of which are still relegated to small footprint hardware with low sensitivity to data loss, such as internet connected doorbells, garage door openers, thermostat/HVAC systems and building security systems, where lost historical data or unreliable connectivity rarely if ever leads to operational or technical issues for the connected hardware.

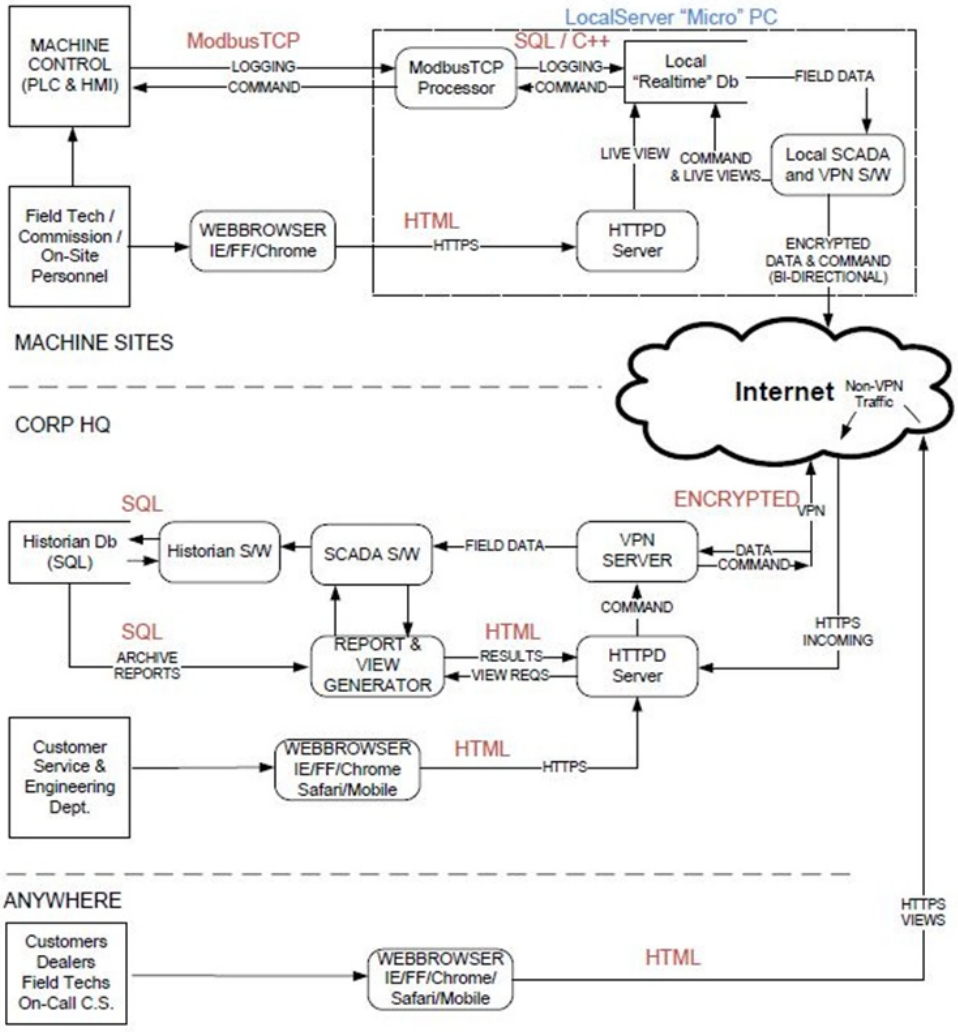


When Orenda Energy, a new entrant into the small wind turbine market, decided to move ahead with developing a 50kW wind turbine system using multiple advanced PLC controllers for both mechanical control and power conversion systems, they asked the team at Venn Design Solutions to look at controlling, monitoring, and acquiring complete comprehensive data metrics from each turbine installation. It was identified that turbine installations may use inexpensive consumer grade internet connectivity methods, such as satellite, 3G GSM, cable modem, DSL, or Wi-Fi based terrestrial links, and as such would be subject to regular, numerous and unpredictable outages, as well as relatively low bandwidth capacity and high latency in some cases.

In typical industrial settings, there's a robust infrastructure network between all interconnected hardware systems, and the SCADA systems connected to them can depend on the network connectivity to be reliable when the devices are in operation. Regular timed polling of devices and PLC/controllers can be expected to provide a relatively robust means of communication on an industrial plant floor, and a communication outage would be representative of a general production outage. This type of connectivity and reliability cannot be expected in what is essentially an "Industrial Internet of Things" (IIoT) environment. Even today's most modern commercially available IIoT SCADA systems typically fail at 100% historical data availability in the case of network outages, and that was simply not an acceptable choice for Orenda's wind turbines to operate with. Loss of energy production or historical machine data was not acceptable even in the face of faulty or lost network connectivity.

To achieve this high level of data historian completeness, along with robust command, control and logging of data from Orenda's fleet of wind turbines, Venn turned to a layered communication model using readily available low/no cost open source software options. Each individual turbine's embedded "Micro PC" local server system was designed to monitor and collect 125 pieces of data from various sensors, inputs and outputs every second, and archive them into a local "real-time" data historian in an open source MySQL database.

The local "Edge of Network" (EoN) SCADA node software within each unit was able to, on network availability, collect, queue, and upload the data from the turbine to the centralized SCADA system. The central SCADA system was able to monitor individual network connection status across the encrypted VPN tunnels that were dynamically created by the local servers, and report general on-line availability of each turbine. This would allow for "real-time" monitoring and control of turbines that were currently able to connect, yet still allow for complete historical condition monitoring, performance, and data analysis of turbines that had lost connectivity or did not have sufficient bandwidth available for real-time communication for a lengthy period of time.



"The Iris SCADA solution developed by the Venn Design team has proven to be a robust solution, which has provided excellent insight into turbine performance. This custom designed software which seamlessly supports the control and safety aspects of our systems, has given our turbine offering a real edge – appreciated by our customers and field technicians alike"

Gerry Lalonde, CEO, Orenda Energy Solutions

The above diagram illustrates the use of common open standards for each part of the communication and data transfer link, while using high level 256 bit AES encryption to maintain security over the public communication networks. Hardware and development time were the only noted costs to developing this system, allowing Orenda to roll out a relatively complete SCADA system with the very first turbine deployed to the field. By utilizing open-source open-standard communication and processing tools, Venn could work with Orenda to improve and grow the features and functionality of the SCADA system as the company grew and more units were deployed in the field, without the need for on-site in-person maintenance visits, thus greatly reducing the initial deployment costs on day one, as well as being able to provide a flexible feature-filled IIoT SCADA system by the end of development.

Optimizing a low cost, standards based, open-source tools based custom SCADA solution able to work on a variety of high and low latency, high and low bandwidth, unreliable consumer grade internet connections for complex industrial equipment with hundreds to thousands of data metrics is still today a non-trivial task for even large corporations. Watch Venn Design for a full whitepaper discussing the complex technical and innovative solutions used to create IIoT SCADA systems, and the challenges that come with them.