Wind Turbine Gearbox Fault Test System
using WebDAQ 504

Introduction

Shanghai PH Edge Intelligent Technology Co., Ltd. is a custom solutions provider that focuses on health assessment and fault diagnosis of industrial equipment. They specialize in Industrial Internet of things (IIoT) platform design, edge computing system architecture, and industrial level hardware platform design.

A customer in the wind power industry had a need for a testing solution for wind turbines. A comprehensive fault simulation test bench was needed to perform diagnostics on turbine drivetrain gearboxes by collecting and analyzing vibration data on bearings and other components.

Predicting gear and bearing failures in wind turbines can reduce maintenance costs, shorten downtime, and prevent disruptions in renewable energy production.

The Challenge

The drivetrain is the heart of a wind turbine. It contains the generator and gearbox which converts the rotation of the blades into electricity. Wind turbine gearboxes can undergo severe strain and torque conditions making component durability a challenge.

While a typical turbine rotates at only 10-18 RPM, the induction generator can reach speeds above 1000 RPM. At these speeds large forces are produced, putting a tremendous burden on each component. Because of the remote nature of wind turbines, reliability of the drivetrain is a priority.

The required gearbox fault test system simulates common bearing failure conditions. By simulating different operating and load conditions it can help detect situations where bearing and gear failures may happen.

The customer required a vibration measurement and analysis solution that was not only functional, but also flexible enough to meet their requirements. The solution would need to be used in two modes. In standalone mode, the solution would collect data as part of a test bench, simulating different operating modes. In IIoT mode, the DAQ solution would be deployed along with the turbine, logging and analyzing data in real time.

The test bench simulates multiple operating conditions, providing valuable feedback to the operator. Load analysis data gives engineers the ability to detect bearing and gear fault situations.

The Solution

The WebDAQ 504 was selected as the data acquisition portion of the system. Two IEPE-based accelerometers are connected directly to the WebDAQ, with no added signal conditioning required. These two channels are sampled simultaneously. The built-in anti-aliasing filtering functions are also used. The horizontal and vertical accelerometers are pre-installed on the gearbox bearings of the test bench and are sampled at up to 25 kS/sec per channel.

Measurement Computing • 10 Commerce Way • Norton, MA 02766 • (508) 946-5100 • info@mccdaq.com • mccdaq.com

The WebDAQ 504 includes an easy-to-use, web browser-based application that allows the user to set up an acquisition, log and display data, enable alarms, and export data to third party applications. For this solution the end customer required additional functionality, so directly programming the WebDAQ was preferred.

The computing engine of the WebDAQ 504 is a Raspberry Pi® computer module. By using the WebDAQ open-source code, the programmers accessed the Raspberry Pi directly, which made the system a true edge computing solution. The included Python example programs allowed the programmers to quickly build their application and interface the custom displays and analysis portion of their program.

Operation

In stand-alone mode, data is collected from the test bench setup. The vibration data is analyzed under different operating conditions (load and speed) in real time.

In IIoT mode the WebDAQ 504 is deployed with the turbine and communication is made via Ethernet. The system supports connecting the WebDAQ 504 to the public/private cloud. Through a custom interface, applications such as device management, remote monitoring, and health assessment can be implemented which are suitable for distributed online monitoring and health management application scenarios. The data can also be uploaded through the MQTT protocol to be used with secondary data applications.

Result

The completed system is a flexible platform that collects and analyzes vibration data. It meets the customers specialized software needs and has resulted in both increased reliability and reduced maintenance time for the customer.

Peng Cui
General manager
Shanghai PH Edge Intelligent Technology Co., Ltd.
No. 800, Naxian Road,
Pudong District, Shanghai
www.phengine.com