

CASE STUDY

CONDITION BASED MONITORING FOR INDUSTRIAL SYSTEMS

Industry: Aggregate Producers

Product: Wzzard Intelligent Sensing Platform



THE CHALLENGE

A large construction aggregate plant operates 10 high horsepower Secondary Crusher Drive Motors and associated conveyor belts, producing 600 tons of product per hour. All heavy equipment requires maintenance, but the aggregate producer's costs were greatly magnified any time that the necessary maintenance was unplanned and unscheduled. The product must be supplied to the customers on a tight time schedule to fulfill contracts, avoid penalties, and prevent the loss of future business. Furthermore, a sudden failure in one of the drive motors would cause rock to pile up in unwanted locations, extending the downtime and increasing the costs.

Clearly, preventative maintenance was preferable to unexpected failures. So, twice each year, the company brought in an outside vendor to attach sensors to the motors, do vibration studies, measure bearing temperatures and attempt to assess the health of the motors. But that wasn't enough. Unexpected breakdowns continued to occur. The aggregate producer decided to upgrade to a Condition Based Monitoring (CBM) sensor system that could continually monitor the motors in real time, apply data analytics to detect changes in motor behavior before they developed into major problems, and alert maintenance staff via email or text, anywhere they happened to be.

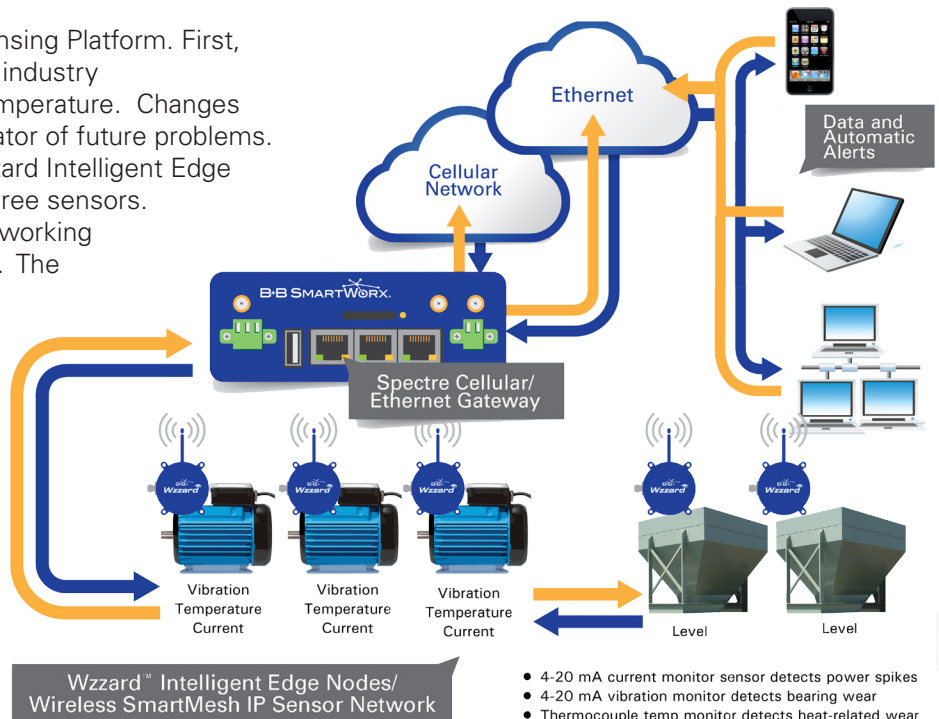
A wired sensor network would have been cost prohibitive. An aggregate plant has numerous heavy vehicles moving around, so any cabling would have to be protected. But the plant covers 400 acres, and the cable would have to be trenched to numerous locations. Cable wasn't going to work. The aggregate producer needed a wireless solution.

THE SOLUTION

Advantech B+B SmartWorx provided a complete solution.

B+B installed the wireless Wzzard Intelligent Sensing Platform. First, each of the company's was equipped with three industry standard sensors: current draw, vibration and temperature. Changes in any of these parameters can be an early indicator of future problems. Each motor was then provided with a single Wzzard Intelligent Edge node, as each Wzzard node can connect up to three sensors. The Wzzard nodes then used wireless mesh networking to publish the sensor data to a network gateway. The gateway then sent the data to the monitoring application.

Two additional Wzzard nodes were also installed, to provide data routing support and ensure that the mesh network was robust enough to provide reliable, five nines (99.999 percent) uptime and connectivity, even though the environment included many large metal surfaces.



QUICK RETURN ON INVESTMENT

Wzzard pays for itself the first time it predicts a pending failure



UNSCHEDULED DOWNTIME IS COSTLY

Costs when CBM-based preventative maintenance is not applied Unpredicted motor failure during production hours

Loss of Revenue	600 tons for 8 hours x \$10.00/ton	\$48,000
New Secondary Crush Driver Motor	1 x \$29,000	\$29,000
Labor costs	2-3 operators and electrician	\$2000

*This assumes that a new motor is readily available and can be installed in the first 8 hours, and that the quarry is running a single shift. Each additional shift adds \$48,000.00. For a quarry running three shifts, add \$96,000 per 24 hrs.

Total One-Day Cost: \$79,000

INSTALLING WZZARD IS A ONE-TIME EXPENSE

Wzzard™ Intelligent Sensing Platform Hardware Cost

Quantity	Device	Unit Price	Total
1	Spectre Network Gateway	\$600	\$600
12	Wzzard Edge Nodes	\$500	\$6,000
10	Thermocouple (current) sensors	\$300	\$3000
10	Temperature sensors	\$100	\$1000
10	Vibration sensors	\$280	\$2800
*****	External power supplies for vibration sensors	\$300	\$3000
1	Dashboard Software	\$500	\$500
*****	B+B Installation Cost	\$200/hr x 8 hrs	\$1600

Total One Time Cost: \$18,500

CBM SAVES YOU MONEY

Costs When CBM predicts a motor failure, Scenario 1

Required Maintenance: Motor Bearing Replacement

Motor Bearing Replacement	\$4,000
Wzzard Monitoring System	\$18,500
Total	\$22,500

By detecting abnormalities and predicting a failure, Condition based Monitoring enables scheduled maintenance during non-production hours.

Condition Based Monitoring Savings: \$56,500

Costs When CBM predicts a motor failure, Scenario 2

Required Maintenance: Motor Rewinding

Motor Rewinding	\$18,000
Wzzard Monitoring System	\$18,500
Total	\$36,500

By detecting abnormalities and predicting a failure, Condition based Monitoring enables scheduled maintenance during non-production hours.

Condition Based Monitoring Savings: \$42,500

Costs When CBM predicts a motor failure, Scenario 3

Required Maintenance: Complete Motor Replacement

Complete Motor Replacement	\$29,000
Wzzard Monitoring System	\$18,500
Total	\$47,500

By detecting abnormalities and predicting a failure, Condition based Monitoring enables scheduled maintenance during non-production hours.

Condition Based Monitoring Savings: \$31,500

WHY GO WIRELESS?

When sensors are spread out across a wide area, establishing a wired sensor network may be impractical. At a quarry site, for example, there will be a great deal of heavy equipment moving around, and any above ground cabling would be in constant danger. Trenching the cable would protect it, but trenching costs \$15/ft or more for cabling, conduit & installation. The quarry's farthest motor is 840 feet from the control center, so wiring that single motor would cost \$12,600, with nine more motors left to go.

A wireless Wzzard installation is not only less expensive than running cable to all of the monitoring points in the quarry, it can't be severed by mobile equipment or digging.

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THE WZZARD INTELLIGENT SENSING PLATFORM

- Wzzard wireless mesh networks cover distances where a wired sensor network would be cost prohibitive.
- Wzzard is an easy retrofit – it works with existing, industry standard sensors
- The monitored machines need no data ports – Wzzard collects the relevant information from external sensors.
- Real-time access to data through an intuitive dashboard
- Data analytics not only detects failures, it predicts failures.
- Alert levels set to provide real-time text message or email notification of thresholds exceeded
- Wzzard cuts downtime and related costs.
- Wzzard makes machine condition data available wherever it is useful.
- Wzzard enables automatic alerts on your computer, tablet or smart phone

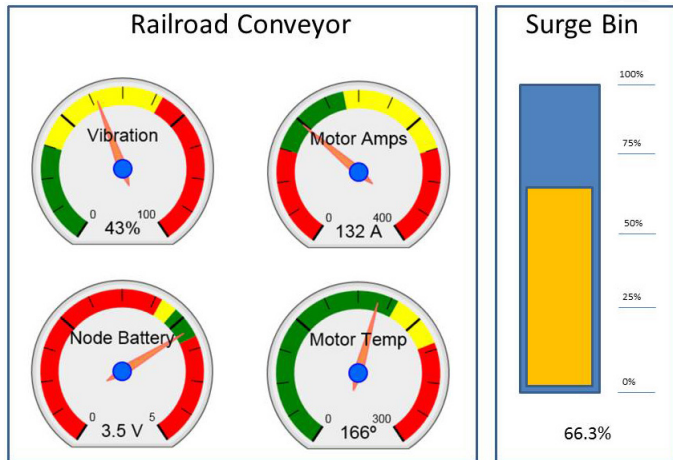


ADDITIONAL CBM QUARRY APPLICATIONS

Wzzard could monitor additional equipment in and around the quarry for better preventive maintenance and operations:

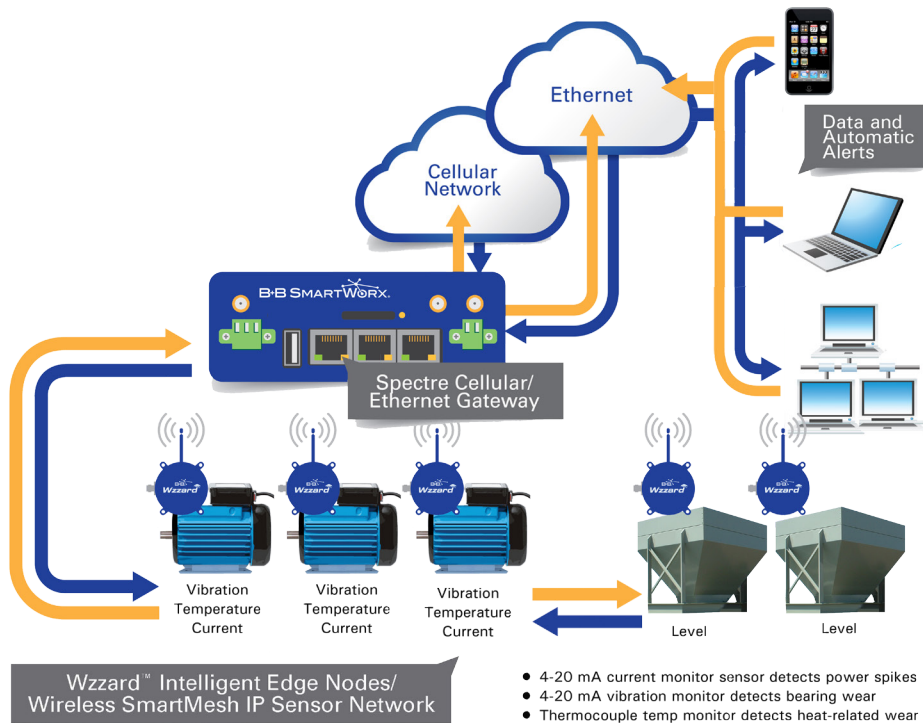
- | | |
|---------------------------------------|--|
| • Rock breaker | • Water booster pumps |
| • Apron feeder to the primary crusher | • Rock grapple |
| • Overhead crane | • Service trolleys |
| • Dust collection/suppression system | • Conveyor belt magnets |
| • Freight elevator | • Conveyor gravity take-up service winch |
| • Eccentric trolley removal cart | • Conveyor belt metal detectors |
| • Service air compressor | • Conveyor belt rip detector |
| • Man-lift elevator | • Belt monitoring systems |
| • Sump pumps | • Conveyor belt weigh scales |
| • Air cannons | • Belt feeders |
| • Air vacuum clean up systems | • Vibratory feeders |

- Motor Vibration • Motor Current Draw • Motor Temperature
- Node Battery Status • Surge Bin Level



CONNECT ANYTHING MONITOR EVERYTHING

As Wzzard Intelligent Edge Nodes will connect virtually any sensor, the aggregate producer also decided to install level meters in the surge bins. Like the sensors on the motors, these sensors were connected to Wzzard Intelligent Edge Nodes, which joined the other nodes on the mesh network. If the surge bins were in danger of overflowing, the system would send immediate alerts to the operator.



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