

# PREDICTIVE MAINTENANCE

We pride ourselves on minimizing risk and capital investment by providing a secure software platform with seamless, single data management and delivery system. EdgeScout easily integrates with enterprise resource planning, business intelligence and customer relationship management software.

Our customers monitor, control and optimize equipment and assets with real-time data anytime, anywhere.

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# RRAMAC CONNECTED SYSTEMS SIMULATION BASED PREDICTIVE MAINTENANCE SOLUTIONS

RRAMAC has been providing predictive maintenance solutions for over a decade, covering a broad range of industries and applications. There are three basic techniques for implementing predictive maintenance:

## CONDITION MONITORING

**Condition Monitoring** involves collecting data from signals that can be used as leading indicators for pending failures. Commonly used signals include vibration, temperature, motor current and pressure. These signals are logged to establish normal values; thresholds are then set manually or calculated automatically. Alerts are created when the leading indicator exceeds the threshold. Operators are alerted by emails, text messages or other methods.

## MACHINE LEARNING

**Machine Learning** uses pattern recognition of multiple variables. The machine learning algorithm flags data anomalies which can be associated with specific failures over time. This approach has the advantage of recognizing data correlations that may not be obvious even to industry experts. It also requires "Big Data." The system works best with large numbers of sensors collected over a long period of time because the ML algorithm needs to gradually learn how the machine or process operates. The downside is that the algorithm spends time learning data correlations that are already well known to operators and industry experts, and the algorithm requires equipment failures as part of the learning curve.

## SIMULATION

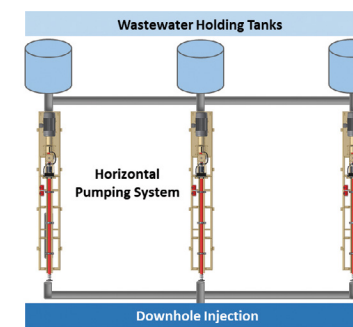
The **Simulation** approach to predictive maintenance leverages human knowledge of cause and effect relationships which apply to the specific machine or application. These relationships are applied to simulation software which then predicts failures based on the model and uses an application specific machine learning algorithm to fine tune the predictions. This approach produces much faster results and requires fewer sensors and smaller data storage requirements resulting in a much more compelling return on investment than machine learning alone.

RRAMAC is working with experts across a broad range of industries to provide simulation based predictive maintenance solutions to our customers. These systems can be hosted on the EdgeScout by RRAMAC cloud servers or configured as part of an on premise hosted solution. The simulation software runs on servers, edge nodes, or a combination of both, depending on the speed of the application.

[www.rramac.com](http://www.rramac.com)

HOW PRESCRIPTIVE ANALYTICS IN THE WATER / WASTEWATER INDUSTRY LED TO \$150K SAVINGS

## Predictive IoT Solution Case Study: Horizontal Pumping Systems in Wastewater



### CHALLENGE

A wastewater client utilizing a horizontal pumping system (HPS) for wastewater injection was experiencing catastrophic failures of individual pump components. These failures brought excessive downtime and maintenance expense every 4 months.

### SOLUTION

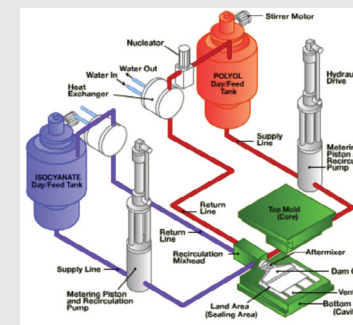
To address the frequency of catastrophic failures a custom built horizontal pumping station simulation was used to predictively detect long term failures. The IoT simulation utilized relatively few sensors and was able to quickly predict potentially dangerous failures up to two weeks in advance.

### RESULT

With immediate access to the IoT simulation data, the client is now able to prevent future failures, has improved production pad safety, and reduced operational downtime. Overall the customized IoT simulation solution improved reliability and predictive maintenance actions in the client's double redundant systems and led to a \$150,000 annual cost savings.

HOW A MANUFACTURER OF AFTERMARKET AUTOMOTIVE PARTS INCREASED MACHINE PERFORMANCE BY 7%

## Predictive Solution Case Study: Reaction Injection Molding Equipment



### CHALLENGE

A manufacturer of high-performance aftermarket automotive parts was having problems with its two-part reaction-injection molding (RIM) mixing nozzles clogging. The situation led to excessive costs in increased downtime, waste and labor.

### SOLUTION

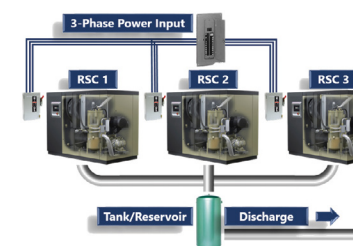
To overcome these challenges, a custom built software model was used to predict nozzle clogging in real-time and alert operators when needed and before the clogging occurred. The solution also monitored other criteria and was able to help identify the root cause of issues affecting quality.

### RESULT

With the introduction of the predictive solution, clogs were eliminated, fewer nozzle changes were experienced and part quality improved, reducing scrap. The predictive software solution led to insights that reduced raw material consumption by increasing the time between material purges and reducing purge volumes when a purge is needed. Cost savings approximated at \$450,000 annually with about a 7% increase in machine performance. The manufacturer achieved a return on investment in less than one month.

REAL TIME PREDICTIVE IOT MODEL IMPROVED MAINTENANCE ANALYTICS AND REDUCED SITE VISITS

## Rotary Screw Compressors Case Study



### CHALLENGE

A prospect company required better uptime and predictive-prescriptive condition based maintenance for generating compressed air as a service.

### SOLUTION

A real-time predictive IoT model was used to address these needs on a compact platform. This platform enabled the company to read equipment sensor and set point parameter data while combining this data with client-provided business rules. The solution was fully customized to their specific requirements.

### RESULT

The real-time solution provided maintenance insights more rapidly, reduced maintenance site visits as diagnostics were performed by the solution, improved service level agreements, and generated vastly better parts and labor demand and scheduling predictions. The predictive IoT solution enabled new business offerings previously thought impossible.