# IoT in the Construction & Mining Equipment Industries

Manufacturers of heavy construction and mining equipment, often referred to as "yellow equipment," have always placed a premium on the uptime of the assets they sell. This equipment is expensive and vital to the business efforts of the customers they sell to, whether they are rental equipment operators or large construction enterprises. For precisely this reason, these manufacturers routinely provide extensive warranties covering their products and incur significant expense supporting those warranties. At the same time, in order to improve their own financial performance while also delivering superior uptime to their customers, manufacturers of construction and mining equipment are looking at Internet of Things (IoT) technology as a means to improve business outcomes. Heavy equipment used in large construction projects are essentially complex systems comprised of multiple interlocking subsystems, with the powertrain and hydraulics subsystems being the most susceptible to failure. Many manufacturers have already embedded sensor technology enabling the collection of operating data from a range of critical points within these subsystems. Thus far, the primary purpose of this data collection system has been to feed real-time and historic data to the equipment operator so that they can make more informed decisions concerning maintenance requirements.

## IoT: The Next Step in Developing Smart Construction Equipment

The principal function of IoT technology is to collect data from a broad variety of physical assets over an extended period of time and deliver that data to cloud-based (public or private) databases so that rules and analytics can be applied to the data. The end goal is always and everywhere to improve business outcomes but a variety of complimentary technologies are required in order to implement IoT systems. These include:

- **Connect.** The most foundational aspect of IoT is to connect, through whatever technology is most appropriate, physical assets to networks, cloud-based databases and applications (the cloud may be public or private, on-prem or off-prem). A key function of the connect process is to intelligently filter, compress, or combine data sets in order to reduce network costs. In many IoT implementations, as much as half the cost of the overall system is comprised of network transport costs. By taking steps to reduce the volume of upstream data, costs can be substantially reduced.

- **Monitor.** The data stream generated by physical assets is monitored in real-time in order to look for anomalous conditions. There are two important aspects to the monitor function which are often overlooked in IoT implementations. First, "monitor" does not mean to display data on a dashboard for human consumption. Rather, it means software intelligence examining real-time data feeds and applying heuristically derived (and possibly changing) rule sets. Second, aspects of the monitoring function ideally take place on the physical asset itself. This is necessary to provide faster response to critical conditions and also to facilitate operation in off-line conditions.

- **Predict.** Ultimately, one of the most valuable functions of any IoT system is to predict failures before they occur and take corrective action so that downtime is minimized or even eliminated. This is primarily a data analytics function—looking across very large data sets and extended time periods in order to determine conditions that frequently precede failures. By this means, construction equipment manufacturers can determine that a failure is about to occur, what service action and parts are required to prevent the failure, and schedule remedial actions off hours so that downtime is eliminated.

- **Automate.** A broad array of actions may be required in response to anomalous conditions detected by the monitor function. These include commands to the physical asset itself (e.g., reduce engine RPM to prevent overheating), notifications to operations and support personnel, and even commands to other enterprise applications (e.g., inventory, support and trouble-ticketing systems). Here also, it is important that a portion of this functionality reside on the physical asset in order to allow actions to be taken even when the asset is disconnected form the network.

- **Optimize.** The final step in driving better business outcomes from the data generated by physical assets is IoT USE CASE to modify to operational parameters of those assets in order to optimize efficiency. Similar to predictive failure, this is done by examining large data sets across entire fleets of equipment, determining the operational parameters of the best performing equipment, and applying those parameters to other equipment within the fleet.
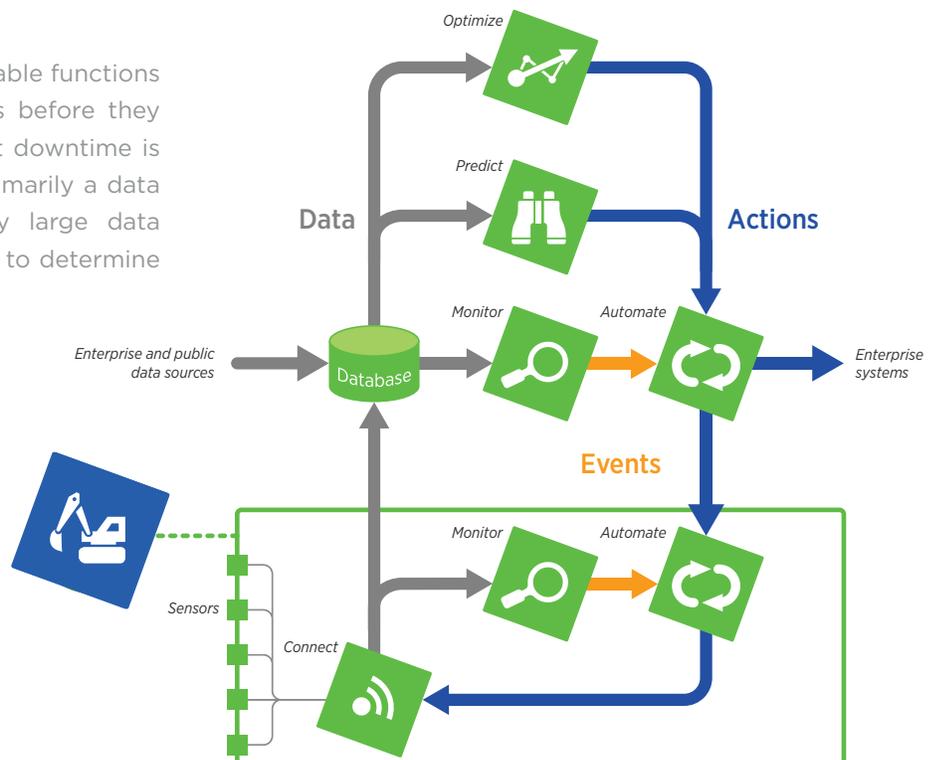
# How IoT Benefits Construction and Mining Equipment Manufacturers

There are several ways in which IoT systems benefit not only the equipment manufacturer but also rental equipment business and, ultimately, end users.

## Increased Uptime

Equipment downtime is the enemy of all participants in the construction equipment supply chain. It deprives rental companies of revenue, impairs productivity for end users, and increases service costs for the manufacturer. From the perspective of the equipment manufacturer, direct monetization of IoT benefits is primarily confined to reductions in actual service costs but indirect, and less tangible, benefits also accrue through heightened brand reputation for high reliability.

## Reduced Warranty Costs

Warranty costs represent a very significant expense for construction, frequently two to three percent of total sales. This means, for example, that as much as $4,500 could be accrued for anticipated warranty costs on the sale of a $150,000 piece of equipment. This expense, while necessary, adversely impacts gross margin and, ultimately, profitability. Correctly designed IoT systems can reduce warranty costs in a number of ways. First, real-time monitoring of equipment health instantly detects faults as they occur. Depending on severity, continued use of the equipment can lead to additional damage, increasing parts and labor costs. IoT can take immediate action by sending commands to the equipment in order to minimize further impact.

Second, many IoT systems have the ability to analyze equipment error codes and operating parameters along with historical repair information to create an optimized repair plan. The plan assigns probabilities to potential fixes, eliminating guesswork and reducing repair times.

### What is DataV?

For more than two decades, Bsquare has helped its customers extract business value from a broad array of physical assets by making them intelligent, connecting them, and using the data they generate to optimize business processes. Bsquare DataV software solutions can be deployed by a wide variety of enterprises to create business-focused Internet of Things (IoT) systems that more effectively monitor device data, automate processes, predict events and produce better business outcomes. Bsquare goes a step further by coupling its purpose-built DataV software with comprehensive analytic and engineering services that help organizations of all types make IoT a business reality.

This information allows service managers to assign a technician with the correct skills and ensures that only necessary parts are used.

Finally, IoT systems can keep track of what work was actually performed, minimizing erroneous or fraudulent warranty claims.

## Device Optimization

Construction equipment manufacturers strive to maximize the performance of their products, whether to improve output or increase efficiency. IoT systems can aggregate information from the entire fleet of equipment, identifying those that are underperforming and providing prescriptive, corrective actions. This information can be used to modify calibration or configuration settings immediately, and can serve as input to the R&D process.

## Asset Utilization

Manufacturers of construction and mining equipment, as well as rental operators and large construction concerns, are often challenged with locating assets in the field and understanding how effectively they are being used. IoT system can create geo-fence zones and apply unique logic per zone or asset. This can be used to reallocate underused assets or enforce business policies.

# Monetizing IoT

Apart from benefits, businesses of all types, but most particularly manufacturers of heavy construction and mining equipment, are keenly interested in monetizing investment in IoT systems. This is partly a function of proving a return on that investment but it is also a strategy for seeking new higher margin, service-oriented revenue streams to augment their core business.

ROI studies conducted by Bsquare have shown that for capital- intensive equipment manufacturers, reduction in warranty costs alone are more than sufficient to pay for the required IoT software and associated business process integration.

An additional point of monetization for equipment manufacturers is derived from the ability to begin offering uptime and analytics services to their rental fleet and large construction customers. What this basically entails is delivering a subset of data already being collected from construction equipment to the owners of that equipment along with analytics capabilities.

# The Bottom Line

IoT technology is finding it's way into many businesses around the word. But for industrial applications such as heavy equipment for construction, mining, and public works, IoT has been proven to provide tangible financial benefits to manufacturers while at the same time delivering superior products with greater uptime characteristics to their customers.

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