East Japan Railway Company
Forging ahead on efficiency and safety with condition-based maintenance technology

Railways are an essential means of transportation in Japan. The East Japan Railway Company, one of the major companies in the country, serves more than 6 billion passengers a year across 7,500 kilometers of track. Railways in Japan are also among the most punctual in the world, making the efficient maintenance of trains and tracks a critical matter.

Challenge
In recent years, the East Japan Railway Company, or JR East, has faced the challenges of an aging infrastructure, reduction in the number of candidate new maintenance specialists due to the aging and decreasing population, and rising costs alongside shrinking budgets. JR East was in search of true innovation to address these problems and ensure their trains continue to run reliably each and every day for their passengers.

Why PARC?
Condition-based maintenance (CBM) is a concept in which maintenance of machinery is performed when the need arises, as opposed to traditional practices of time-based maintenance (TBM) and reactive “fail and fix” or planned maintenance, which can be costly, prone to human error, and in worst case lead to downtime or accidents. JR East turned to PARC to deploy PARC’s CBM technology suite, which employs model-based algorithms that enable 90% or higher accuracy and low false alarm rates, and need only minimal data sets in some cases. Together with their open innovation model
and breadth of interdisciplinary expertise in system sciences and materials, PARC was the perfect choice for JR East.

**Solution**
With PARC’s partner Nomura Research Institute (NRI), PARC interviewed JR East engineers, R&D teams and maintenance technicians to understand the problem and discover exactly how the CBM technology could be used. After gaining an understanding of the available data to train the machine-learning algorithm, as well as the need for data-driven versus first-principle or hybrid models, PARC suggested an analytics approach to JR East. PARC then created dashboard mock-ups, gathered feedback from JR East end users, and began rapid iterations of algorithm and software development.

The end solution? PARC developed customized fault detection and diagnosis pilot software, leveraging advanced machine-learning and model-based system analyses approaches, to test an initial CBM pilot for JR East focusing on train door and railway track maintenance. Additionally, PARC developed dashboards for JR East engineers to visualize and better understand the obtained data. PARC and NRI are now working with JR East Technical Center teams to test and implement these solutions in some of the most heavily used train lines in Japan.

**Results**
Initial tests for both the railway fault detection and train door detection indicated very high true positive rates and very low false positive rates. Further tests are currently being conducted to validate findings and prepare for field implementation. Once installed, the CBM dashboards would enable JR East to detect and repair upcoming train failures before they happened—all with remarkable confidence. This would allow JR East to improve efficiency, cost-effectiveness and most importantly, keep trains running safely, optimally, and on time. This would be no small feat in a country that’s home to 45 of the world’s 50 busiest railway stations.

Condition-based maintenance technology has great potential in transportation and many other industries like energy storage and smart manufacturing, and is one step toward PARC’s broader quest to enable self-aware, self-adaptive systems.

**More information**
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