The world's first cellular IoT-based smart factory

Enabling factory automation by applying the latest cellular IoT technology improves efficiency and results. Early on in this case study, we showed that breakeven can be reached in less than two years, and that the first year can provide a 50% return on investment. Combining cellular IoT and Industry 4.0, the Nanjing Ericsson Panda factory is continuously exploring ways to optimize manufacturing processes with verified use cases.

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Manufacturing use cases making the factory smart

Optimizing tool maintenance

Before implementing NB-IoT, maintenance of the factory's more than 1,000 high-precision screwdrivers relied on hand-written records. The screwdrivers (which cost US$1,500 each) require routine calibration and lubrication based on utilization times, to secure the quality and performance of the radio products.

Since screwdrivers don't have counters, there is no way of knowing the number of operations an individual screwdriver has made. Thus, maintenance like calibration had to rely on assumed and fixed time intervals, and be documented on paper. This while downtime, as well as repairs or replacements due to inadequate upkeep, is costly.

Now, more than 50 % of the high-precision screwdrivers have been fitted with real-time motion sensors attached to NB-IoT modules. Every eight hours, the module transmit about 100 bytes of data indicating the utilization time.

The data is then captured in the factory's private cloud system, making automatic calculations and analysis about the tools' utilization and condition status. The cloud-based quality-monitoring system also indicates when certain thresholds are reached, enabling predictive maintenance that extends the service life of these expensive screwdrivers considerably.

The solution was developed using an integrated motion sensor from ADI, with an NB-IoT module from Simcom. As the cost is only about US$20 per device, the plan is to phase out manual tracking completely. The factory anticipates improved detection of human errors will reduce maintenance material expenses by US$1,000 each year,

while manual maintenance work will be cut in half, saving US$10,000 annually. The factory also gained significant potential benefits such as automated usage tracking as well as optimizing its maintenance.

Passive asset monitor: Smart fire hoses

Monitoring critical equipment in a high-tech factory site is tidy work. Misplacement, loss or damage to such appliances can have a severe impact on safety while entailing unnecessary costs and a decline in efficiency. A key, and typical, example of such equipment is fire extinguishers and fire hoses. Following the example of the tool optimization setup, 250 fire hose/extinguisher cabinets where equipped with liberation sensors, using NB-IoT to monitor unwanted movements (i.e. accidents, unauthorized relocations, or even theft) of equipment.

As a result, key assets now can be located immediately, while manpower needed for paperwork and regular checkups are reduced. Risk of essential equipment going missing has been significantly reduced.

Streamlining the Andon system

Andon systems are generally used for support in manufacturing, to notify management, maintenance, and other workers of a quality or process problem. The centerpiece is a device with signal lights indicating which workstation has the problem. Alerts can be activated manually by a worker using a pullcord or button or may be activated automatically by the production equipment itself. The system can include means to stop production so the issue can be corrected. Some systems also use sound alarms, text, or other visuals.

The factory installed a wireless Andon system with 50 cellular IoT devices on its production lines. The wireless system replaced a somewhat rigid wireline system where shift leaders got calls to his or her screen and then manually had to find the right engineer to address the problem. The new cellular IoT LTE-M solution uses VoLTE to make a call directly to the right engineer from the factory line, reducing lead-time for problem-solving.

With the wireless solution, the factory can enable flexible production lines, configured on-demand and with easy data collection, analysis, and optimization.

Manufacturing use cases making the factory smart

Monitoring output of workstations

The factory added 50 sensors with NB-IoT connectivity to workstations on its manufacturing lines, to enable real-time monitoring and analysis of production data. Data that can be used to guide dynamic adjustments to the production plan.

Environment monitoring

Environmental conditions, such as humidity, dust levels, and air temperature, need to be maintained within specific parameters to ensure product quality while storing. Although wired sensors can monitor the climatic conditions, NB-IoT has made it cost-effective to use wireless sensors, which can be deployed quickly and then moved from place to place, as required.

The factory has placed 50 NB-IoT enabled sensors on storage sites to perform the critical task of environment monitoring.

Optimizing test fixtures
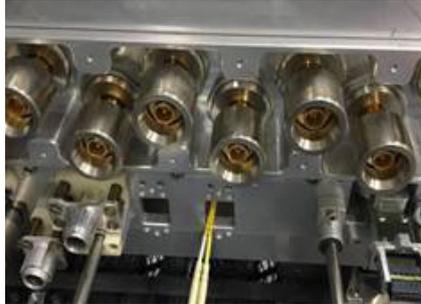
The factory added 50 NB-IoT enabled distance sensors to monitor the number of connections being handled by test fixtures. As a result, maintenance can be tracked better, and calibrations can be performed to optimize the radio frequency (RF) performance of the test fixtures. The NB-IoT-connected monitors are crucial because the number of logical tests tracked in the fixtures' software does not represent the actual number of physical connections. The NB-IoT enabled solutions thereby can prevent the fixtures from being overused, causing losses in RF performance. The result is a reduction in maintenance costs and improved testing performance.

Monitoring content of material boxes

The factory is adding NB-IoT-connected pressure sensors to storage boxes to enable real-time monitoring of their load. Previously, the material level in the boxes had to be measured manually and then recorded by scanning barcodes.

"Industry 4.0 and massive IoT over cellular networks increases operating efficiency and productivity. For instance, by connecting our high-precision screwdrivers, we see a significant reduction in maintenance material costs, and manual maintenance work costs have been cut in half, with return on investment in about 2 years."

Tomas Qvist, President
Nanjing Ericsson Panda
Communication
Co., Ltd.

Improving daily operations
with cellular IoT

Company profile
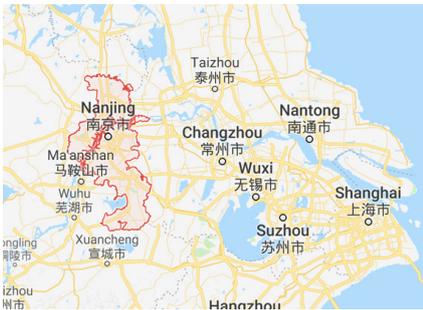
Ericsson Panda is located in Nanjing, China, and employs more than 2,000. It is Ericsson's largest industrialization factory site. Seeing the potential in cellular IoT, a gradual transformation into a Smart Factory begun. Now, more than 1000 cellular IoT devices with a range of purposes has been implemented on the manufacturing site.

Improving daily operations with cellular IoT

Working together with Ericsson China and China Mobile, Ericsson Panda has launched a series of use cases benefitting from Cellular IoT technologies, including Narrowband-IoT (NB-IoT) and LTE-M/Cat-M1 in the factory. By automating and streamlining production, maintenance, and immersed data analysis, Ericsson Panda now sees savings in both CAPEX and OPEX. Savings come from increased efficiency, fewer human errors, increased reliability, reduced downtime and improved service life for tools and equipment.

Geo-tracking steel pallets and monitoring safety equipment also streamline operations and contribute to an increasingly safe work environment.

Over time, cellular IoT technologies are set to expand its role deep into manufacturing sites. Automated and self-optimizing logistics and supply chains increasingly ensure timely arrival of resources and allow factories to reconfigure quickly in response to demand variations.

Cellular IoT—today and tomorrow

Ericsson Panda Smart Factory recently celebrated the 1000th cellular IoT device launch on the site in Nanjing. The goal, to continually streamline production and get return on investments (with interest) is exceeding expectations. What started as pilots and trials are now implemented on a large scale across the factory. The company is currently implementing several other LPWA use cases with promising results.

Cellular IoT networks offer higher reliability and security compared to its competitors, and can support a higher density of devices. The network, based on global 3GPP standards with strong security mechanisms, is designed to only admit and manage trusted identities and data in the network. Cellular IoT network allows for automation, real-time data collection, no human interaction, extended service life, reduced downtime. intelligent analytics, new services and business growth in manufacturing. Cellular IoT and transformation towards Industry 4.0 show significant gains.

Key benefits of cellular IoT

— No cabling
— Low-cost modules
— 10-year battery life of sensors
— 7x improved coverage (20dB improvement)
— Reduced maintenance staff
— Extended tool service life
— Safer work environment
— Streamlined production
— Fast return on investment
— Secured production quality

Ericsson is a world leader in communications technology and services with headquarters in Stockholm, Sweden. Our organization consists of more than 111,000 experts who provide customers in 180 countries with innovative solutions and services. Together we are building a more connected future where anyone and any industry is empowered to reach their full potential. Net sales in 2016 were SEK 222.6 billion (USD 24.5 billion). The Ericsson stock is listed on Nasdaq Stockholm and on NASDAQ in New York.

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