Benefits of advanced predictive maintenance in enhancing regional industrial growth

by Alexander Timofeev, CEO and Founder & Eugene Zetserov, VP Marketing and Business Development POLYN Technology

Predictive maintenance not only extends the life of machinery and industrial equipment, but it enhances safety. Preventing equipment failures means preventing potentially dangerous incidents that could injure not only the operators of the machines but also those around them. By recognizing troubles in advance, a company can schedule machine maintenance and perform any repairs or tuning before the asset fails. This approach became a buzzword during the last decade, but like any other advancement it must resolve the economic barriers – in this case relative to the huge amount

Alexander Timofeev is CEO and Founder of POLYN Technology.

Alexander is a serial entrepreneur in high tech, with more than 20 years in the industry. He previously founded iGlass Technology, which developed a novel electrochromic smart glass technology. He is also managing partner at an early stage venture investment management company.

Eugene Zetserov VP Marketing and Business Development

Eugene has more than 25 years in the telecom/datacom industry, with experience in a range of mobile and fixed network, IoT, cloud, and applications technologies and a career that features key positions at successful semiconductor companies.

An efficient and productive industrial base – manufacturing, mining, and power and energy production – is the foundation for progress and growth in developing economies. By leveraging advanced predictive maintenance technologies, companies and governments can keep the equipment that is essential to these industries operating safely and efficiently, overcoming an obstacle to growth.

Typically in lesser-developed regions, the equipment used in industry is older and consequently more prone to breakdowns. Every time there is an equipment failure, work stops, productivity is hampered, and people can get hurt. For these regions, predictive maintenance – knowing when a piece of equipment needs repair or tuning before it fails – is particularly important.

Predictive maintenance is enhanced by placing sensors on equipment, vehicles, and other assets. This makes it possible to discover and resolve maintenance issues before they cause real problems. If sensor data is indicating that the equipment performance is deteriorating, repairs can be taken care of immediately.

The traditional method of maintenance involved inspections and tuning at regular intervals, perhaps every six months. But a failure can happen anytime, not on a regular schedule. By gaining data about equipment performance, issues can be addressed whenever they occur.

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A New Approach

To maximize the value of predictive maintenance, a new paradigm is needed to analyze machine data. This involves a blending of real-time data processing and sensor node optimization, as well as new forms of data disaggregation computation. The objective: to minimize both data transmission cost and resources spent on the analysis of massive amounts of sensor-provided information.

A report jointly authored by Pricewaterhouse-Coopers and Mainnovation found that the use of predictive maintenance in factories can generate enormous value, especially for companies that lack advanced maintenance functions. A survey in connection with the report found that 60 percent of companies that implemented leading-edge Predictive Maintenance 4.0 saw a clear improvement in equipment uptime, while just about half of surveyed companies noted the approach extended the life of the equipment, reduced risks related to safety, health, and the environment, and lowered their costs.

The key is leveraging this IoT sensor data in order to gain the advantage of proactive decision-making and its economic benefits.

With the rollout of 5G technology, it would seem nothing can slow the growth of predictive maintenance. But installing predictive sensors on equipment is only half of the story; maximizing the efficiency of data utilization is the other half. In the cloud, data scientists must develop models which can be fed with sensor data but not require huge amounts of power and resources at the point of processing. Ideally, disaggregating the data processing function is the answer.

New devices and analytic tools have driven Industry 4.0 to new industries, niche markets, and regions. They enable the revolution in robotics, automation, and the use of data itself. The main challenge for Industry 4.0 is how to integrate and effectively use all of these devices in our industries and create a new paradigm of human and machine interactions.

There are a few issues that need to be addressed in Industry 4.0: security, the tsunami of data, energy efficiency in data processing, and solution cost.

There is no question that predictive maintenance data must be secure and reliable. In some ways, that is the least of the three challenges. With sensors deployed to monitor so many key functions in industrial machinery, equipment fleets, and elsewhere, such large volumes of data are generated that it becomes impractical to constantly transfer all of that data to the cloud.

The current solution requires expensive infrastructure and significant capital and operational expenditures, a major hurdle for regions with low government support for Industrial IoT. As a result, the ability to handle more data at the sensor edge (that is, right at the sensor node) is a crucial element for the effectiveness of widely deployed predictive maintenance solutions. Such precise optimization will require specific hardware beyond a typical processor.

The Neural Network Solution

Neural network computing can drastically improve robustness, reduce sensor failure, and bring down the prices of sensors in order to enable the wider adoption of predictive maintenance solutions in developing regions.

The combination of smarter and cheaper sensors, optimization of data propagation, and better analytic tools opens up opportunities for a new generation of predictive maintenance. A real-time data-driven approach can minimize unplanned downtime and improve employee and factory efficiency and safety. The result is that factories, mining companies, and other equipment-intensive industries can prevent unplanned downtime, have better visibility into their operations, and automatically sense the warning signs that indicate equipment failure or improper machine operation.

By connecting equipment with Tiny AI chips that can pre-process sensor data and reduce "noise" (irrelevant or less relevant data), then only the useful information that matters most needs to be transmitted over communications channels. This reduces processing time and the demands on battery life. This will help enterprises of all sizes in developing economies capture the significant information about their equipment in order to vastly reduce unplanned downtime and its associated costs. They can create new operational efficiencies, exploit new opportunities, and accelerate their overall digital transformation strategies.

On-Sensor Intelligence

In the connected world, devices are becoming ever more intelligent, allowing their users to leverage the data to make decisions as close as possible to where the device is located. This is the "intelligent edge," where data obtained from sensors on connected devices and pre-processed with Tiny AI processors can provide essential improvement to analytics solutions.

Advances in sensor data processing and declining costs allow organizations to put more power where the devices are located in order to gain real-time insights or to analyze data that often lacks a quality connection to centralized data analytics. To make this happen we need to solve four challenges:

- Reducing the amount of data sent to the cloud
- Increasing battery life
- Reducing costs
- Ensuring high resiliency

As an example, if each vibration-based sensor generates almost 1 Mbps of data through sampling, it aggregates into truly huge volumes of data that must be forwarded over the communication channels. This requires expensive, battery-hungry technologies. And yet, most of that data is "noise" and transporting it in its entirety is inefficient. There is also the danger that many of the algorithms implemented today for predictive maintenance can actually create points of failure themselves.

Neuromorphic computing can address all of these challenges. With specialized hardware, designed to run neural network paradigms, systems can reduce the amount of data by about 1000 times. This enables the use of narrower communication channels, significantly reducing power requirements and providing much higher levels of resiliency than traditional algorithms.

Conclusion

Rising demand for predictive maintenance and increased investment in manufacturing, energy and utilities, automotive, transportation, and other industries is driving the global market for predictive maintenance. But that market is uneven. There are obstacles to rapid adoption, especially in developing regions where infrastructure is less developed and both enterprise and government budgets are more limited.

Companies and service providers looking for the types of disruptive technologies that can optimize power consumption, reduce data transmission needs, and ease the burden of capital and operational expenditures need to consider neuromorphic technology to be applied right on the sensor node. These new technologies can resolve the issues limiting predictive maintenance deployment everywhere, especially in developing nations.