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Using low power, wireless ad hoc local mesh network technology with cellular gateway to enhance smart sensor solutions.

Endrich's award winning E-IoT ecosystem offers a possible solution to transfer smart sensors' data directly to Cloud using NB-IoT/LTE-M cellular technologies. This is quite a perfect solution in general converting conventional devices into "Smart", in case of relatively small number of sensors in an application. Integrating NeoCortec's low power wireless ad hoc mesh network technology to the Endrich IoT Ecosystem offers a smart sensor local networking solution, which goes with highly scalable, long service life, independent, battery driven set of nodes. Instead of direct sensor to cloud communication with several exits to the internet, it is enough to have an industry safe, sub-gigahertz local mesh with a single gateway. This solution supports amongst others predictive maintenance, environmental parameter monitoring and security surveillance of industrial equipment at much lower cost, higher reliability and elevates the robustness of the sensor network in harsh environment.

The E-IOT platform

A major challenge industry faces today is digitalization of conventional processes, extending machinery with low power, feature rich microcontroller-based electronics to collect sensor readings, and forward data to a Cloud Database. Like this, it is possible to convert conventional devices to connected (SMART) devices, which report their operational and environmental parameters into Cloud Database making possible to support operational safety. Smart features support predictive maintenance, optimize energy consumption, and remote monitoring. The E-IOT eco-system helps to enter this industry by offering hardware and service solutions to convert conventional into smart devices. A mass of sensor readings needs to be organized into central database for future processing to meet the expectations of Industry 4.0., our ecosystem deals with this challenge. Our team has developed several hardware elements using various sensors and cellular communication (M2M/Narrow-Band IoT) technology to deliver sensor readings to the cloud. The beginning of the processing chain consists of sensors detecting and measuring different physical parameters, which are processed all the way to cloud

database storage and visual data representation at the end. There is a sophisticated gateway in between, which collects the sensor readings, pre-processes these data and sends it through a communication channel to a cloud-based database service, where it can be displayed after processing, or used for any purpose appropriate for a given task.

But what if the used low power wide area networking does not offer the right solution with its direct sensor to cloud concept? What if the battery service time is not sufficient due to the frequency of sending data required by the application?

The E-IOT platform combined with low power ad-hoc local network.

In this case, we call for the help of a low power ad-hoc local area sensor mesh networking solution such as offered by NeoCortec with its Neo.Mesh. Huge number of smart sensors can be then connected with ultra-low power consumption into a local network, where a data concentrator gateway is taking

care to deliver the data to the Cloud DB through the cellular network such as LTE-M or NB-IoT. Our engineering team has developed a modular sensor network infrastructure, offering either direct sensor to cloud, point to point communication or local low power sensor mesh network and multipoint to point communication to cloud using LPLAN to LPWAN gateway. With the help of the complete E-IoT ecosystem consisting of the above-mentioned smart sensor networks, the Cloud database and the visualization and data processing system, our company can offer a good solution to make conventional devices to connected, “SMART” devices to support predictive maintenance.

This solution at its core with Neo.Mesh, the Wireless Mesh Networking Protocol represents a paradigm shift from traditional network architectures. Unlike the conventional solution with a central Network Manager to control communication between nodes, this protocol employs autonomous intelligent nodes as its backbone. This feature empowers each node to act as an independent entity, facilitating direct communication between nodes without the need for a central authority. The result is a unified network that simply works, no matter how large or complex it grows. As more nodes join the network, they seamlessly link with existing nodes, forming an interconnected web of

communication that can span vast distances. This adaptability and scalability are particularly valuable as an extension of the E-IoT platform when applied in an area, which should be covered by hundreds or thousands of sensors. One of the protocol's most impressive features is its patented routing mechanism. This mechanism ensures that data travels seamlessly through the network, even in the face of

obstacles in the RF (Radio Frequency) path or the movement of nodes within the network. Traditional networks often suffer from performance issues when nodes are blocked or dynamically change their positions. However, the Neo.Mesh Networking Protocol eliminates such concerns, guaranteeing reliable data transmission at all times. In practical terms, this means that the network's performance remains unaffected by environmental factors or dynamic changes within the network itself. Whether nodes are added, removed, or repositioned, the network remains robust and fully functional, ensuring uninterrupted connectivity for all devices and users. The protocol's ability to address weak spots in real-life networks is noteworthy. By simply adding another node, assigned with the appropriate



network ID, it seamlessly integrates with the existing network, reinforcing its coverage and performance.

At the heart of the Neo.Mesh technology lies a robust protocol stack with integrated security and reliability features. A key aspect of this security measure is the encryption of all wireless communication between nodes using AES128. By employing this encryption, the payload data and the network communication remain impervious to monitoring by any untrusted entity.

The system is built for long-lasting performance. The power consumption is exceptionally low, enabling the batteries to last for several years. The Neo.Mesh network follows a time-synchronized protocol, wherein each node spends most of its time in a sleeping state. This architectural approach ensures a highly predictable power consumption pattern for every node in the network. As a result, all nodes consume nearly the same amount of energy, enabling each network node to operate efficiently for many years.

The E-IoT with its Neo.Mesh local sensor network extension operates at sub-Gigahertz frequency to overcome the problems of other protocols in harsh industrial environments. When comparing sub-GHz networking to WiFi and Bluetooth, using the same antennas

and transmission power, it becomes evident that sub-GHz networking offers a longer range. The reason behind this extended range lies in the fact, that the lower radio frequency waves are not as easily absorbed by physical matter as the 2.4 GHz signals utilized in WiFi and Bluetooth.

These capabilities of the Neo.Mesh Protocol make it an ideal solution for smart sensors installed across large-scale industrial complexes, such as factories, buildings, real-estates and shops.