Smart bolts - cutting maintenance costs and improving safety

Internet-of-things-enabled bolts allow safer structures like wind turbines, while reducing maintenance costs as compared to current solutions

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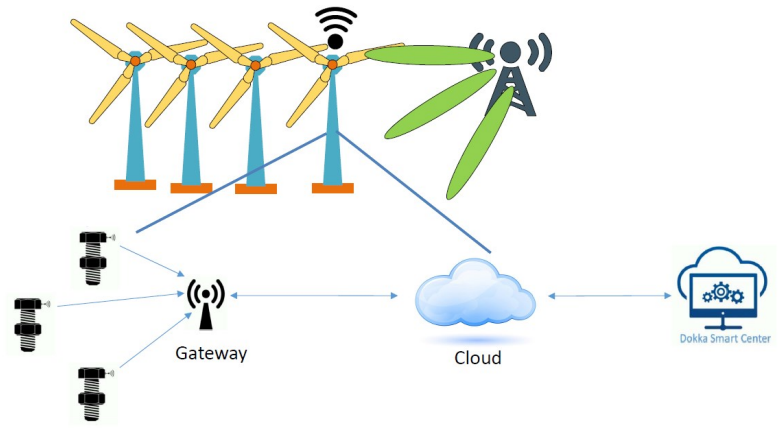

SMART BOLTS DEVELOPED BY DOKKA FASTENERS WITH COLLABORATORS AT NTNU GJØVIK CAN ENABLE SAFER WIND TURBINES AND REDUCED MAINTEN

Bolt connections are commonly used structural fasteners in many types of industries including mechanical, aerospace and civil engineering. Bolts are fastened to maintain specific preloads during service to ensure the safety and reliability of structures. However, in many structures (e.g., wind turbines, oil & gas installations), maintaining the primary load might be difficult due to external impacts (such as wind force) resulting in high vibrations followed by reduced tension which loosens the bolt connections. Periodic maintenance of the multipoint bolts is thus crucial for proper operations and avoidances of structural failure. However, measuring the condition of every single in-service bolt is often very costly and almost impossible in most applications due to the large number of bolts involved. Developing an effective (technological and economical) bolted joint monitoring system is thus an important engineering significance.

A PROTOTYPE SMART BOLT

In this project, we developed and patented a wireless enabled intelligent bolted joints for automatic load monitoring. The monitoring can be used for preventing accidents (warning if a bolt is broken or loosened) and improved maintenance cycles where re-loading only the bolted joint that needs it. The novel aspect of the project was to present and develop the paradigm of power-efficient, radio integrated, load-sensing intelligent bolted joints for large scale monitoring of critical structures. This is an important research topic as current methods are highly time-consuming and expensive involving regular manual operations for checking and maintaining the bolt loads.

The system includes a low-power load sensor, a radio transceiver and a power source component. It is compact enough to be integrated as part of the bolt joint component. The research and development work involved cross-disciplinary activities covering areas on electrical and mechanical engineering.