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A 6.78 MHz Inductive WPT System Enabling Predictive Maintenance in Industrial Harsh Environments

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Using wireless sensors to perform condition monitoring in industrial equipment is a highly versatile approach, allowing convenient monitoring of even mobile platforms and large apparatuses. However, this presents a challenge to power supply, since transponders need power for both signal processing and wireless communication, but they are usually non-easily accessible for battery replacement. Therefore, wireless power transfer can play a key role in providing the required power to wireless transponders in this application scenario [1].

This abstract describes a compact 6.78 MHz inductive wireless power transfer system that provides a reliable and efficient power supply to a Blue-tooth low-energy node in harsh industrial environments, particularly for rotating platforms. The system includes a power amplifier, a coil system, a power rectifier, a DC/DC converter, and supercapacitors for energy storage. In addition, a microcontroller unit (MCU) with data wireless transmission capability is integrated into the system as the final load for monitoring purposes, providing knowledge about the output DC voltage and acting as a source for more sensing capabilities.
The system utilizes inductive coupling to deal with high-humidity environments and wirelessly transfer power to equipment, improving safety and eliminating the need for physical connections, thus reducing the risk of electrical hazards and maintenance requirements. One of the main innovative features of this system is the use of an asymmetric coil system and a pulsed power transmission, specifically designed to be used in rotating applications, where the coils might be aligned for a small fraction of the entire revolution. This feature ensures that power is transmitted only for a small but periodic interval, improving the system's efficiency and allowing for greater flexibility in equipment placement. Overall, the inductive wireless power transfer system enhances the reliability, safety, and efficiency of industrial equipment, while also reducing maintenance requirements in rotating applications.

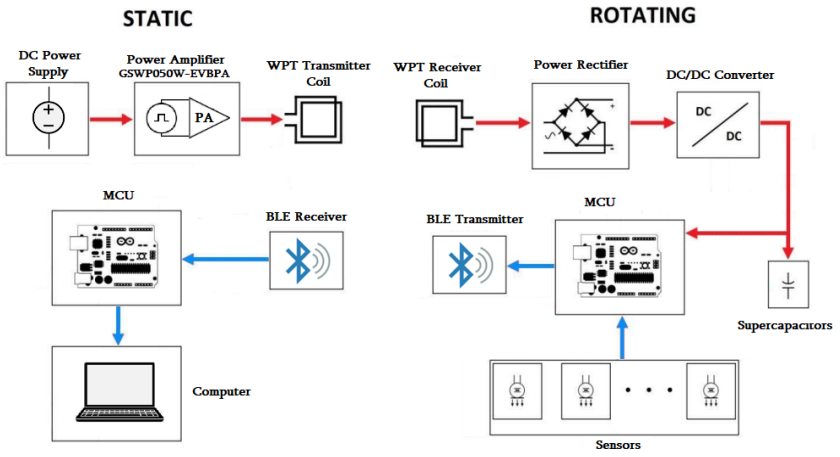

Figure 1. Block diagram of the proposed system.

References

[1] G. Lee and G. Ahn, "Wireless Power Transfer of Daisy Chain Structure on Rotating Spindle," 2020 IEEE Wireless Power Transfer Conference (WPTC), Seoul, Korea (South), 2020, pp. 384-3876, doi: 10.1109/WPTC48563.2020.9295628.