

Smart Glove for Near-Field UHF RFID Applications

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Smart Gloves have been extensively used in various domains such as medical and industrial applications since they are lightweight and comfortable to wear. Among others, Radio Frequency Identification (RFID) technology integrated into protective gloves is suitable for helping workers during their activities, minimizing human effort and accident risk. An UHF-RFID Smart Glove [1, 2] is required to detect tagged items that are close to the hand (Figure 1) yet avoiding the detection of tags placed few tens of centimeters beyond (false positive events). Given the typical size of an antenna integrated into a glove, the far-field region starts beyond 70-80 cm, which means that the tag and Smart Glove reader antennas are in the near-field region of each other. Thus, the conventional far-field antenna parameters like radiation pattern and antenna gain cannot be considered as effective figures of merit [3]. In some papers, the electric and magnetic field distributions are considered as key performance parameters to optimize the near-field antenna, but they are not directly related to the characteristics of the tag antenna which can be of different shapes and sizes [3]. For these reasons, new parameters have been proposed, such as the Power Transfer Efficiency (PTE). As demonstrated in [4], PTE is a good candidate to qualitatively predict the Received Signal Strength Indicator (RSSI) distribution and then the overall system performance. PTE can be estimated by means of numerical tools; it depends on the reader and tag antenna shapes as well as on the surrounding environment.

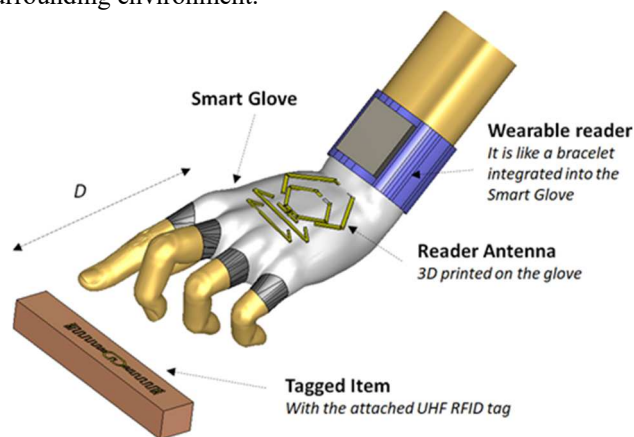


Figure 1. Schematic representation of the operational scenario.

References

- [1] R. K. Singh, A. Michel, P. Nepa, A. Salvatore, M. Terraroli and P. Perego, "Compact and Wearable Yagi-like Textile Antennas for Near-Field UHF-RFID Readers," in *IEEE Transactions on Antennas and Propagation*.
- [2] R. K. Singh, A. Michel, P. Nepa and A. Salvatore, "Wearable Dual-Band Quasi-Yagi Antenna for UHF-RFID and 2.4 GHz Applications," in *IEEE Journal of Radio Frequency Identification*, vol. 4, no. 4, pp. 420-427, Dec. 2020.
- [3] A. Michel, P. Nepa, X. Qing, and Z. N. Chen, "Considering high performance near-field reader antennas: Comparisons of proposed antenna layouts for ultrahigh-frequency near-field radio-frequency identification," *IEEE Antennas Propag. Mag.*, vol. 60, no. 1, pp. 14-26, Feb. 2018.
- [4] A. Michel, M. Rodriguez Pino and P. Nepa, "Reconfigurable Modular Antenna for NF UHF RFID Smart Point Readers," in *IEEE Transactions on Antennas and Propagation*, vol. 65, no. 2, pp. 498-506, Feb. 2017