



MDT-UTAR partner to accelerates design process for RFID antenna

RFID - the technology of the future

Radio Frequency Identification (RFID) is a technology that uses electromagnetic waves to track and identify objects automatically. This technology has received rapid development due to its many benefits and to date, has revolutionized the logistics, manufacturing, and security industries by offering enhanced and cost-saving asset tracking and monitoring solutions.

Analysts predict that the global RFID market will be valued at USD 10.87 billion in 2021, and it is expected to reach USD 14.42 billion by 2026, registering a CAGR of 5.06% during the forecast period of 2021-2026. Additionally, the rise in utilization of RFID solutions to help healthcare organizations to contain the spread of COVID-19 is expected to fuel the RFID market growth further, in the coming years.

The mechanics behind RFID

Generally, RFIDs provide a stable reading distance and fast access characteristics. An RFID system consists of a reader and a tag where the latter contains the information for a particular object.

A powerful RFID reader system can read a few hundred tags within milliseconds. Different from the conventional barcode technology, the RFID sensing mechanism does not require line-of-sight alignment, in other words, the tags can be easily tracked even when they are a distance away or not within visibility range of the antenna reader.

Addressing the complexities of antenna tag design

The RFID antennas are necessary elements in an RFID system as they convert the RFID reader's signal into RF waves that can be picked up by RFID tags. Without some type of RFID antenna, whether integrated or standalone, the RFID reader cannot properly send and receive signals to RFID tags.

The performance of the reader or tag antennas shows significant effect on the reading range and detection accuracy of an RFID system. As such, the detection range and accuracy are directly dependent on the performance of reader / tag antennas. Since these RFID systems operate at frequencies varying from low frequency to microwave frequencies, these RFID antennas are designed with distinct requirements.

No doubt, this poses a huge challenge to designing a tag antenna for different objects as its read performance is affected by the antenna structure in addition to the object that is backing it. This design process is often said to be tedious and complex, with the possibility of taking up to a few weeks for a highly experienced RFID engineer to design and optimize a tag antenna.



Partnering for success

MDT Innovations, a company focused on the IoT value chains ranging from intelligent wireless communications and IoT as a service, approached CREST back in 2013 as it was in search of a collaborator to simplify the complexities of designing a RFID antenna whilst simultaneously shortening its design process.

CREST facilitated the linkage between MDT and Universiti Tunku Abdul Rahman (UTAR) and the rest is history. Since 2013, both parties have collaborated on this project whereby a team of UTAR researchers have worked in tandem with MDT engineers to effectively produce an AI-based antenna design tool that is now able to reduce the design cycle of the antenna by at least 80%.

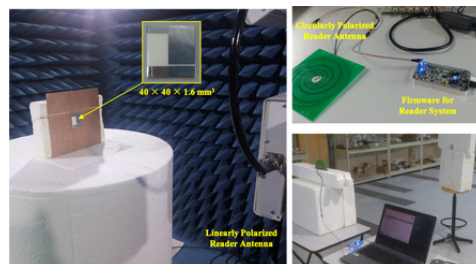
According to Sim Hon Wai, Chief Operating Officer of MDT Innovation, the company deals with highly complex use cases in IoT implementation, therefore having an AI simulated antenna allows it to dissect and provide scientific and holistic assessments on the environment where RFIDs will fully operate rather than rely on trial and error methods.

“We are immensely pleased with the progress of this project which has saved us a massive amount of time to produce these antennas. As a result of the AI-based design tool, the process of producing these antennas has shortened significantly, from two months to less than two weeks, thus enabling us to go to market with our products quicker.”

Sim added “I would like to thank Professor Lim and the research team at UTAR for collaborating with us on this initiative and we look forward to expanding our partnership, moving forward.”

Professor Lim Eng Hock from UTAR said “We were extremely motivated with this research as we acknowledge that our findings would make a significant impact to a myriad of industries who rely on RFID tag antennas. From the onset, the team at MDT provided us with ample support, including the necessary readers and firmware platforms that were required for the design process.”

“We thank MDT for the opportunity to collaborate with them on this project and for their continuous support and constructive feedback along the way.



The design process

During the course of this project, the team at UTAR applied artificial intelligence techniques to ease the RFID tag design process. By incorporating design-of-experiment with neural network and genetic algorithm to design an easy-to-use simulator, the team were able to use machine learning algorithms to learn the complex electromagnetic properties of the tag antenna, thus providing the final optimized design parameters to the designer.

Having been adequately trained, the simulator works as a competent RFID designer. As there is no access-wait time for post-processing, the simulator is able to provide optimum design parameters within a tenth of a millisecond when there are new changes in the design targets.

This newly developed AI-assisted system is easy to use as it does not require the user to have any professional qualification and is able to profoundly reduce the design cycle time and costs of up to 80%.

Looking into the future

With funding from CREST, this project has successfully built up a strong research group actively involved in RFID research. Additionally, with CREST's support, the project has now entered into its commercialization stage and plans are in the works to extend this application to solve other engineering challenges.

With high penetration of RFID into various industries, this technology sector is experiencing exponential growth. Therefore, it is the goal of both MDT and UTAR to become a one stop service provider of RFIDs, from design to fabrication, in the near future.

