Smartrac Group and RFMicron to Develop Passive Sensor Tags

Smartrac has announced a partnership with RFMicron to create passive radio frequency identification tags with low-cost and simple, built-in sensors using what RFMicron calls its

Chameleon technology. The tags resulting from the new partnership (announced at the RFID Journal LIVE! 2014 conference and exhibition, held last week in Orlando, Fla.) will enable users to read a tag's unique ID number, as well as the pressure or humidity conditions around the tag. Smartrac intends to begin releasing tags using the RFMicron chips for sensor functionality later this year.

Based in Austin, Texas, RFMicron was launched in 2006 by Shahriar Rokhsaz, the company's CEO. The firm spent several years developing chips that offer improved performance and inexpensive sensing capabilities. The result of that work, he says, is a passive ultrahigh-frequency (UHF) chip coupled with sensing circuits that detect a variety of environmental stimuli. Tags made with this chip will initially feature humidity and pressure sensors, but in the future, they could be used to measure temperatures and include other sensing capabilities as well, such as detecting specific fluids or gasses.

RFMicron ’s Shahriar Rokhsaz

As with all EPC RFID tags, the RFMicron IC, known as the Magnus S chip, harvests energy from UHF signals transmitted by an EPC Gen 2 tag. The Magnus S chip, however, has a self-tuning circuit that keeps a tag tuned in situations that would detune other tags, such as the presence of liquid or metal. This self-tuning feature provides two benefits, Rokhsaz says. First, it can be used to boost read rate. “The Chameleon self-tuning circuit will keep a tag tuned in situations where non-Magnus tags would normally be detuned,” he explains. “In those

situations, the Chameleon circuit allows more energy to be transmitted into the harvesting circuit.” In addition, the on-chip sensing circuits monitor changes in humidity and air pressure levels, based on changes to the antenna’s impedance—the measurement of the opposition that a circuit presents to a voltage current—resulting from changes in the amount of moisture or pressure to which the antenna is exposed. To improve tag functionality, the tag’s received signal strength indicator (RSSI) circuit adjusts the chip’s input impedance to correct for impedance mismatches resulting from these environmental changes.

In addition, the tag can share its sensor data with an RFID reader, providing users with information regarding the external environment around a tag.

The potential use cases cross many industries, Rokhsaz reports. For example, he says, a tag made with the Magnus S chip could be installed in tires to measure air pressure, thereby enabling owners of vehicle fleets to determine a given tire’s inflation status via a simple RFID read. The same tag, embedded in tires, would also enable the firm to locate a specific tire, by using an RFID reader to search for that tire’s unique ID number. In addition, an automotive manufacturer could utilize the tag to determine the moisture content of an object to which it is attached, so that the company could learn, during quality-control processes, if sensitive components were being exposed to excessive moisture levels.

The chip’s pressure-sensing capability could be used to measure strain on buildings, bridges and steel, Rokhsaz says, and its moisture sensor could assess conditions that could lead to mold or mildew during construction, such as in dry wall.

In the health-care industry, the moisture sensors would be of

use for identifying dampness in clothing worn by a patient with incontinence issues. For the energy sector, the tag could be installed under a pipe's insulation in order to sense the type of moisture that could promote corrosion, or detect natural gas and provide that data for environmental or safety inspections. Finally, the tags could be employed in the food industry to measure the moisture content of goods being transported or stored, or to detect moisture in wood for the forestry industry.

As use cases are further developed, the company plans to provide additional sensor capabilities, such as natural gas detection, all based on the antenna's impedance. Or, the company reports, it may develop an antenna with a coating that reacts with specific gasses and changes the antenna's characteristics as a result. "Developing different sensors simply becomes a matter of designing an antenna that responds in a useful way to whatever stimulus you are looking to sense," Rokhsaz states. "We have demonstrated antennas that respond to moisture and pressure, and are thinking about others—though typically, our tag-producing customers, such as Smartrac, will lead the development."

For passive sensing, Rokhsaz adds, "the RFMicron approach is… quite unlike any previous approach to sensors. This is the first time that sensors can be as simple and inexpensive as ordinary passive RFID tags—which opens up a panoply of opportunities that simply haven't existed before."

Most sensor-based tags require a battery to power the sensor built into them. Alternatively, Farsens is one company that has already developed passive sensing tags (see Spanish Startup Focuses on Passive RFID Sensors for Manufacturing and Other Industries); however, Farsens' sensor tags require small printed circuit assemblies with multiple interconnected components, making them somewhat more expensive than most passive. The RFMicron chips are a less expensive and less complex option, Rokhsaz says, explaining that the Magnus S

chip offers a low-cost alternative to other passive tags containing built-in sensors. He adds that the company believes tags with sensors, such as Farsens' products, offer a viable option for sensing use cases in which very precise sensing may be necessary and cost is not as great a concern. "We consider their products to be complementary, not competitive, to products using RFMicron chips, operating in a different price and performance realm," he states.

Samuli Strömberg, Smartrac's VP of business development for medical, pharmaceutical, logistics, automotive and supply chain applications, says the firm has been working with RFMicron for approximately a year to develop the Magnus S chip, and to determine how it could be used in a Smartrac inlay. "We think this technology will take RFID to the next level," Strömberg says, noting that Smartrac has been testing tags made with the Magnus S chip in-house, and that its customers—mostly industrial companies with manufacturing facilities—have been testing the tags as well. What's more, he adds, Smartrac is currently in the process of developing RFID inlays containing the chip, that intends to release sometime during the next six months. "We are working on practical tag products," he says, that should resolve problems for industrial, agricultural, construction and retail environments.

According to Strömberg, specific use cases have yet to be determined, and the company is presently considering options for how to utilize the technology, while also seeking input from potential partners and customers. Smartrac opted to announce the partnership before any products are released, he explains, to enable end users to consider potential use cases—and to bring those ideas to Smartrac.

"So far, RFID has been mostly an identification technology," Strömberg states, "Now, we're bringing a new capability to the equation," by allowing users to gain quality-related data that could be viewed or shared online. In addition, he says,

because the sensors are passive (requiring no batteries), the tags' maintenance requirements are minimal, and the tags could theoretically be used for many years without requiring replacement or repair.