Brazilian Sugar and Ethanol Company Uses RFID in Agribusiness

The sugar and alcohol industries have made Brazil an example of a clean energy producer since the 1970s, and also a major developer of advanced technologies. Now, radio frequency

identification and the Internet of Things (IoT) concept are contributing to sugarcane fields, to further increase the competitiveness of these segments.

During the current sugarcane harvest, the Usina São Martinho plant—a unit of São Martinho S/A, one of the largest sugarcane industry groups in Brazil—will begin to implement an advanced technological infrastructure, which includes IoT applications.

Usina São Martinho's factory

The infrastructure base is a private mobile broadband network, optimized for rural and remote areas, providing broad connectivity in the field. This technology was developed by CPqD with the support of BNDES and the participation of São Martinho and Trópico. It is part of the AgroTIC project, which focuses on increasing the efficiency of sugar and ethanol production.

In general, the localization, movement and control processes of agricultural production typically rely on manual or semiautomatic procedures, usually performed with spreadsheets or printed forms, and with analysis dependent on the expertise of experienced industry experts. In the case of sugarcane, this is still the scenario found, to a greater or lesser extent, for several producers in the country.

“RFID technologies allow a degree of automation and control of items with high accuracy, in addition to producing a quantity of information relevant to the continuous improvement of production processes,” says Luis Gustavo Teixeira, Usina São Martinho’s agricultural manager. The AgroTIC project demonstrated the effectiveness of RFID technology in the field for the detection of machine-matching events, allowing the optimization of equipment movement, thus improving harvesting productivity.

RFID readers are installed in the agricultural machines that perform collection. Using the portals, reading is performed at times of harvest, shipment, weighing and processing, in order to control the entire process of production management.

CPqD implemented a ThingMagic RFID module in the communication terminal that was transferred to the productive sector. A wide range of market tags were used to evaluate the best technology in each environment, and according to the object to which each tag would be applied. The chosen tags presented better performance in the field and during laboratory tests. Due to the nature of the application, as well as the cost and use in the field, the tags are not, as a rule, reusable.

The operating environment presents the biggest challenge, according to Fabrício Lira Figueiredo, CPqD’s business-development manager for intelligent agribusiness. All electronics must operate under extreme climatic conditions, with exposure to sunlight, rain, dust, vibration, mechanical shock and a lot of metal mass involved. This makes it difficult and restricts the selection of readers, tags, antennas and so forth.

“The project represented a great technological challenge when implementing connectivity and control of items in an agricultural environment,” Figueiredo says. “Several solutions were analyzed, and the project’s decision was to implement the

low-cost, standardized interfaces, ease of installation, management and control interfaces optimized for the agricultural sector, which drove the solution for RFID technology."

Other direct benefits were the ability to reproduce data and control processes, the automation and accurate analysis of data, and reliability of readings, which allows the optimization of processes, costs and deadlines. "However," Figueiredo says, "RFID technology provides only part of the information in the IoT architecture of the AgroTIC project, which allows the collection of data from a wide range of devices, contributing together to generate benefits for the business of the producer."

Luis Gustavo Teixeira

RFID technology, once deployed in the connectivity and reading infrastructure, is very rich in applications, according to Teixeira. It can be easily applied in the control and location of seedlings, EPI management and work safety. The collection of environmental parameters is carried out with active labels, with batteries, allowing greater data-storage capacity.

The applications are broad, Figueiredo says, and the challenges are even greater if one considers the agricultural sector as a field that is still "green," with great potential for technological growth. "As future prospects," he states, "we are working on the spread of RFID technology more widely in various segments of agribusiness, so that we can have more representative indicators of its benefits over the next two seasons."

The system is prepared for integration with any market ERP via the Dojot platform, created by CPqD. The database currently operates at the site of the plant, but a cloud version is expected in the future. “Some clients do not adopt this type of architecture,” Figueiredo notes, “preferring to keep everything indoors, for reasons of security and more efficient control of data access.”

RFID met the company’s expectations, Figueiredo reports. “As a first challenge, we have had a significant amount of lessons learned and cutting-edge technology development,” he says. “Connectivity is still one of the major challenges for technological diffusion in agribusiness, though each application case has its own rules and processes to be controlled. The objective of optimizing agricultural processes is considered very important, and RFID expertise and solutions to control the movement of items allow the adaptation of the solution in various production environments.”

The IoT middleware adopted for this project is the Dojot platform, which allows development by a client or other partners, creating specific and naturally integrated applications from the outset. “The platform supports the rapid deployment of a variety of applications,” Figueiredo explains, “including—but not limited to—RFID, such as weather parameters, soil, etc., as well as data collection, based on open IoT protocols and database enrichment.”

“The main challenges were the hostile environment, difficulty in connectivity and understanding the productive process,” Figueiredo recalls. “We already had experience with RFID technology deployment in other environments, such as industry, laboratories, item location and inventory management, but the agricultural sector brings a unique experience with all the requirements of work environments, optimization and control.”

According to Figueiredo, there is still much to be done. “But

we have a very important learning that it takes technological knowledge to be adapted—or, even better, integrated with the agricultural environment in a natural and productive way," he says. "It is not only a question of taking the technology to the sector, but of demonstrating to the producer that the benefit can be interesting and positive for its business, without creating a significant deviation of function that would create more difficulties."

Executive at CPqD recommend that all work to be done should take into account knowledge and respect for operations. "The goal can not only be focused on technology, but on the partnership and common-interest vision of improving the sector and creating national technology," he concludes.

São Martinho is among the largest sugar-energy groups in Brazil, with an approximate capacity to crush 24 million tons of sugarcane annually. It operates four plants, located in São Martinho, in Pradópolis, in the region of Ribeirão Preto; Iracema, in Iracemápolis, Limeira; Santa Cruz, in Américo Brasiliense; and Boa Vista, in Quirinópolis, 300 kilometers from Goiânia.

The company also maintains a unit for the production of ribonucleic acid, known as Omtek, located in Iracemápolis as well. The average harvest mechanization index is 99.8 percent, reaching 100 percent at the Boa Vista plant. During the 2017-2018 harvest, a total of 22.2 million tons of sugarcane were processed.

"The deployment of this private 4G network, adapted for the 250 MHz band, allows broadband coverage to be extended throughout the São Martinho power plant in Pradópolis, making it possible to use Internet of Things applications in the field," Figueiredo says. "After all, the scarcity of connectivity options available in rural and remote areas of the country is currently one of the main bottlenecks for the adoption of new technologies in Brazilian agribusiness."

This infrastructure is used in the transmission of information collected in the field, through sensors, to databases and applications, where the data will then be processed and used in decision making. Real-time data transmission is performed by intelligent vehicular terminals, also developed by CPqD in partnership with São Martinho, based on the operational requirements of the sugarcane mills. These terminals, which are being installed on harvesters, tractors and trucks that transport sugarcane, have multiple interfaces: Wi-Fi (for local connectivity), CAN (used in agricultural machines for telemetry data transmission), GPS and RFID, in addition to the LTE interface.