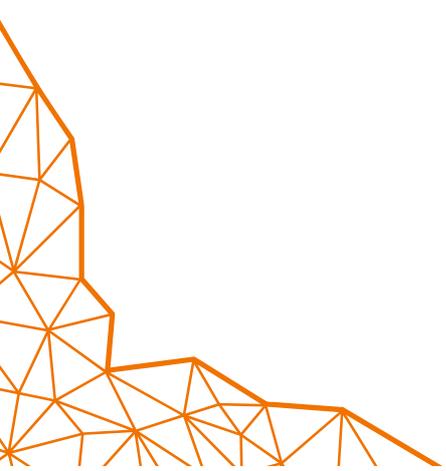# Case Study

Agriculture

**Smart Irrigation System
Cuts Water Waste By 70%**

Smart Irrigation System Cuts Water Waste By 70%

Challenge

The World Bank estimates that, on average, agriculture accounts for 70 percent of all freshwater withdrawals globally. According to the United States Environmental Protection Agency (EPA), as much as 50 percent of the water we use outdoors is lost due to wind, evaporation, and runoff caused by inefficient irrigation methods and systems. The United Nations' Food and Agriculture Organization further estimates that as much as 60 percent of the water diverted or pumped for irrigation is wasted with the excess water often seeping back into the ground, causing waterlogging and salinity, which affects nearly one-quarter of all irrigated land in developing countries. Moreover, stagnant water and poor irrigation drainage increase the incidence of water-related diseases, resulting in human suffering and increased health costs.

Aardra Systems (www.aardra.co.uk) is dedicated to creating smart irrigation systems that sense the moisture in the soil and automatically replenish sufficient moisture for the plants, thus preventing unnecessary loss of precious resources. The precise amount of water is delivered according to soil composition and the plants' needs. The Aardra smart units are designed for gardens, landscaping projects, and large farms and can be integrated into existing irrigation systems.

For maximum scalability, flexibility, and efficiency, the system uses wireless communication links. Individual moisture sensor units, Sentors, are positioned in the field to monitor and regularly transmit the accurate moisture levels at preset time intervals. Each Sentor unit is connected to a solar-powered Sencom unit that powers it and transmits the sensor data to the IoT network gateway. To regulate water flow, Aardra developed Valtor valve control units powered by Valcom units featuring solar batteries. Each Valcom unit is connected to a wireless IoT network. When it receives a command from the main IoT controller, it instructs the actuator to open or close the valve.

All Sentor, Sencom, Valcom, and Valtor units are part of a wireless IoT network controlled by a Cloud-connected IoT controller gateway that collects the moisture sensor data and controls the water flow. Using an app on a mobile device or via a web browser, a user can control multiple IoT controllers from a single cloud account and easily set up different irrigation zones for various crops. All the important data is conveniently visualized and readily available.

A.N.Solutions

Sentor

The IoT controller connects to the cloud using NB-IoT/Cat-M1 and GPRS cellular networks. The IoT network itself is based on the 2.4 GHz IEEE 802.15.4/Zigbee communication protocol, which is ideal for low-power sensor data transmission. Aardra used to design and produce wireless RF transmission modules in-house that used up a lot of internal resources. It used to take six to seven months to design an RF module, perform lab tests and optimize the RF performance, and then certify the product for CE and FCC compliance. This process was not only time-consuming and costly but also distracted the Aardra team from focusing on their core business of creating efficient irrigation systems.

Solution

A strategic decision was made to find an RF design house that could take over the RF engineering tasks. Since the original RF modules were built on an industry-leading Atmel/Microchip chipset, Aardra searched for an engineering service provider with a strong knowledge of this platform as well as a proven track record of building reliable IoT products. A.N. Solutions emerged on top of the shortlist. A.N. Solutions boasted an in-depth knowledge of the Atmel/Microchip hardware platform, and they also built an entire range of their own high-performing Microchip-based RF modules, development tools, and embedded software to enable quick and cost-effective IoT product creation.

One of A.N. Solutions' core competencies is in complex system design with seamless RF integration and an intuitive user interface, according to the strictest application requirements and challenging environmental conditions. A great variety of factors such as PCB design, choice of RF components, enclosure size and material, operating environment, etc., affect the RF performance. Other major considerations are the system maintainability, battery life, and over-the-air software update capability. While focusing on the overall system performance, A.N. Solutions' engineers consider all relevant elements such as interfaces, PCB layout, embedded software, power optimization, humidity, temperature, moisture, and other environmental parameters that may affect the entire system's performance.

Finding the right antenna design approach is an art in itself. RF impedance matching is of paramount importance. Depending on a particular design, additional passive components, such as baluns, LNAs, or filters, need to be added. The next step is to thoroughly evaluate and optimize the antenna performance figures to create the optimal radiation pattern.

A good RF design is not as simple as picking the components with the right characteristics off the shelf. Sometimes, it can be counter-intuitive when for a particular RF design, an external antenna performs poorly compared to a PCB antenna, even when it completely outspecs the latter.

A significant advantage in performance and range can be gained by selecting the right antenna design and placement and optimizing embedded software settings. Furthermore, A.N. Solutions developed RF modules, such as @ANY2400SC-3-2, with dual external antenna connectors featuring antenna diversity that provides adjustable optimized range and leading-edge RF characteristics such as exceptional link-budget. The @ANY2400SC-3-2 RF modules were selected to power the IoT controller wireless transmission.

By outsourcing the RF design, system integration, and certification to A.N. Solutions, Aardra was able to cut the product development time by 80%! The RF module's performance was so outstanding with a range up to 600-700 meters that they even discontinued their X-Com range extender as there was no need for it anymore. Before, they had to use the range extender because the RF modules embedded in Sencom and Valcom units didn't provide sufficient range.

"We clearly needed to focus on our core business and decided to partner with the experts to help us with the RF engineering. A.N. Solutions fully met our criteria. While they were not the cheapest provider, our investment quickly paid off as our systems now require less equipment because of the superior wireless range. A.N. Solutions products' quality is outstanding, and their engineering support is top-notch. We look forward to continuing our cooperation and further upgrading our system, as well as developing advanced new products supporting multiple communication protocols."

Dharmesh Joshi, CEO of Aardra Systems

Results

- Product development time reduced by **80%**!
- RF range increased to **600-700 meters** – no need to use an extender!
- Water waste reduced by **70%**!

A.N.Solutions

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