



APPLICATION SPOTLIGHT

Farms Gain Greater Insights over Irrigation Systems Using SignalFire Wireless Telemetry System



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Pictured is a SignalFire Sentinel node that both powers and extracts data from sensors installed on the various components (motors, pumps, pipeline) of irrigation systems for transmission to a gateway.



SignalFire Gateways can accommodate hundreds of transceiver inputs from field sensors, enabling the network to cover a geographic range of a mega farm of 10,000 acres that roughly equals 15 square miles.



The Ethernet interface integrates the data from sensors to web-enabled interfaces.

APPLICATION:

Irrigation systems are critical to farm operations to ensure water distribution to crops and livestock. Drip and sprinkler systems, specifically those with center pivots, are most commonly used on farms to irrigate land based on crop, water source, and field size.

Farmers are adopting wireless technology to work smarter in managing the different aspects of these irrigation systems. With a network that operates over the wide expanse of a large farming operation, a remote monitoring and control system provides real-time visibility into the operating status of motors, pumps, valves, and other critical components of the irrigation system. Farm workers can retrieve information from a control center or the convenience of a smartphone or laptop rather than visually inspecting the irrigation system.

In addition to automating data collection regarding the performance of the irrigation system, these wireless telemetry systems are configurable to shut down operations and send notifications of a change in operating status. Alerted to abnormal conditions, operators can make immediate adjustments for proper functionality. Collected data is downloadable into analytics software for calculating and analyzing water and electrical usage that represent significant expenses related to irrigation systems.

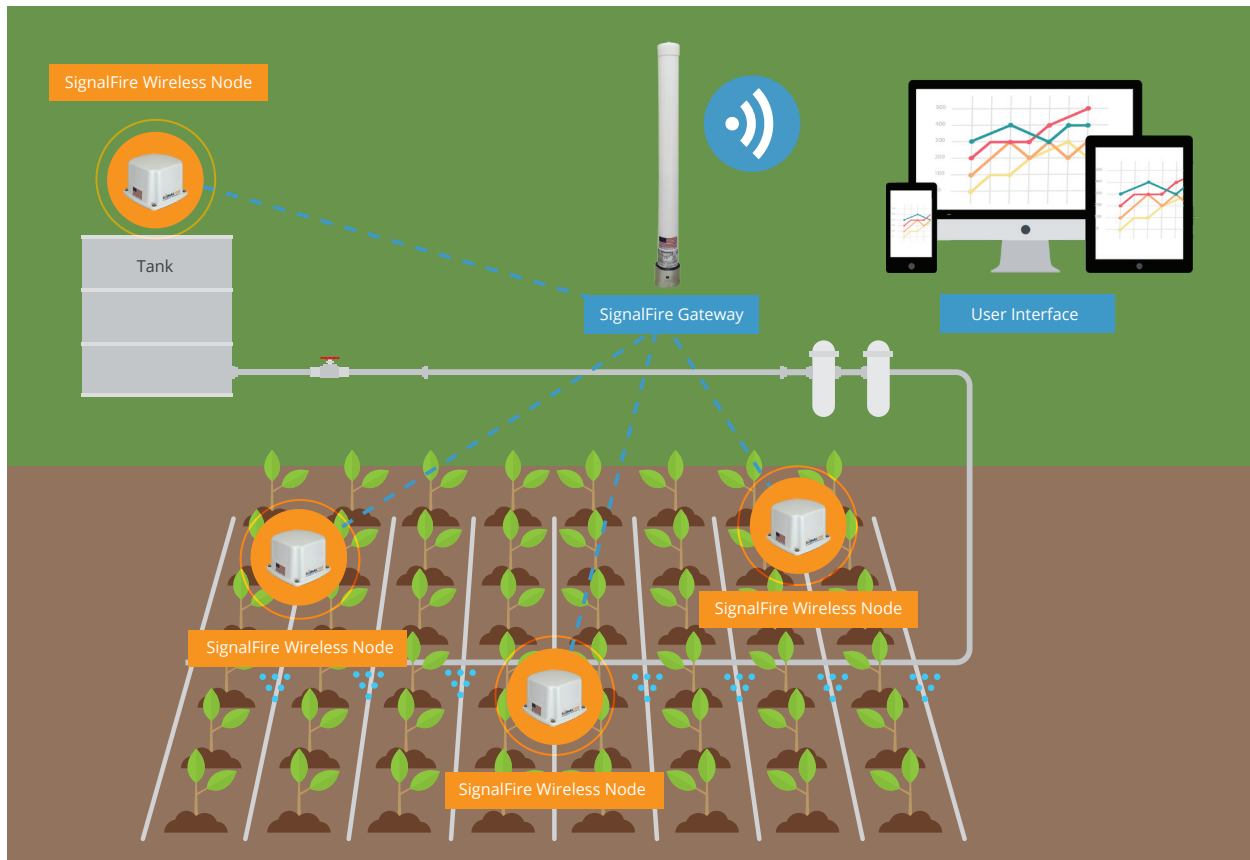
PRODUCT SUPPLIED:

A SignalFire Remote Sensing System:

- Sentinel radio nodes (battery and solar) power and extract data from sensors that monitor different irrigation system components (motor, valves, pumps) for transmission to a Gateway
- Gateway serves as central hub that formats and transmits data to a supervisory system
- Mesh network allows nodes to operate over large areas of the farm
- Ethernet module connects the Gateway to LAN, Internet or cellular modem

CHALLENGE:

Many irrigation systems are monitored manually on farms, requiring workers to travel throughout the land to check meters and record measurements on a daily basis. Farms can be very large, covering thousands of acres, with tracts divided into smaller lots often separated by miles. With irrigation systems located in disparate lots, a number of farm hands are required to conduct inspections.



Shown is a configuration of a remote monitoring and control system for a drip irrigation system that operates by dripping water onto the soil at very low rates to provide high moisture levels for crops. Sensors installed on the various components of the drip irrigation system (water source, pumps, pipelines) provide data to radio nodes for transmission to a central Gateway. The hub of the wireless telemetry system, the SignalFire Gateway Stick stores the most recent readings of all the nodes in a network in Modbus format then manages outbound communications by formatting data for delivery to a control center. An Ethernet Interface Module can tie information from the Gateway into a local network for local access or a cellular modem that connects the Internet and a cloud service provider.

In most cases, farm workers make visual inspections to determine if motors are running, pumps are connected to motors and water is flowing through pipelines. A mechanical breakdown or variation that occurs before the next review can result in downtime or damaged equipment such as a burned-out motor that can require thousands of dollars to repair.

Manual inspections cannot provide insights into power or water usage to determine run status or flow rates. As a result, farm operators cannot readily identify potential electrical issues such as an abnormally high electric current draw from pumps or quantify the amount of water or chemicals used to feed crops.

SOLUTION:

A SignalFire Remote Sensing System (SFRSS) empowers farmers to remotely monitor and

control different aspects of the irrigation system from the convenience of a tablet, computer or even a mobile phone. Instead of traveling to multiple locations to manually inspect the motor and pumps, operators can retrieve real-time status of water pressure, pump usage, pump water flow and other critical operating parameters of irrigations systems located throughout the farm remotely on their phones and laptops by using the SRSS.

In addition to providing visibility into operations, the SRFSS is configurable to provide alerts on abnormal conditions so technicians can quickly diagnose problems such as motor failures and pipeline leaks to return irrigation systems to optimal operation and avoid adverse scenarios such as flooding.

Farmers can review hourly, daily, and long-term historical information on water usage to determine



trends in volumes, levels, and rates of application. For example, should a farmer discover that yield is the same whether using 50 or 100 gallons a day to water a specific crop, a decrease in water usage can reduce power consumption, saving on electrical costs and energy usage throughout the farm.

As proper fertilization produces high-quality crop yields, an accurate application is critical. The SFRSS works with flow meters to optimize the amount of chemicals dispersed with water to ensure crops are not overdosed or under treated that can effect crop yield.

THE SFRSS CONFIGURATION:

The SFRSS radio nodes extract and transmit data from sensors to a Gateway that serves as the central processing hub. Either battery or solar powered, the nodes power sensors for a truly wireless system. The Gateway delivers the intelligent information to an off-the-shelf supervisory system using Modbus protocol over Ethernet.

Sensor agnostic, the SignalFire Wireless Telemetry system sensors, allows farm operators to specify different sensors, gauges, and other instrumentation to monitor various aspects of an agricultural irrigation system. In one network, farmers can use:

- Pressure sensors to track pump and spray nozzle pressure
- Current meters to measure the pump current draw
- Flow meters to measure water and chemical usage
- Level sensors to monitor tank levels
- Soil moisture sensors to monitor water content

In a farming environment, a wireless system must operate over many square miles. Wireless sensor networks are easy to establish without using cables and offer greater coverage. The mesh network of the SFRSS permits nodes to self-configure into a web-like structure over large areas regardless of hills, buildings, and other structures. The nodes can hop from one crop field to another and back to a gateway located at the point of monitoring.

Robust gateways can accommodate hundreds of transceiver inputs from the multiple field sensors,

enabling the network to cover a geographic range of a mega farm of 10,000 acres that roughly equals 15 square miles. An Ethernet Interface Module connects the gateway to a local area network (LAN), a WI-FI network, or a cellular modem, bringing the information to the field operators.

RESULTS:

Using the SFRSS to monitor and control irrigation system operations, farmers can work smarter to be more cost-effective:

- Use a broad range of sensors to assess the activity of different irrigation system components such as pumps and motors to ensure proper performance
- Broadcast information over long distances
- Receive alerts to abnormal conditions to make immediate adjustments
- Download and integrate sensor data to web-enabled monitoring system
- Conduct analytics to improve irrigation system operations and water usage
- Reduce costs by operating with lower energy requirements
- Ensure optimum crop fertilization
- Use knowledge to drive innovation

By implementing the SFRSS, farmers gain better control and visibility over the operations of their irrigation systems to make better decisions regarding water, chemical, and electrical usage that leads to more precise irrigation to generate a more significant return on investment.

