

Remote monitoring of irrigation systems

Wireless remote monitoring and control systems enable farmers to gain better control and visibility over the operations of their irrigation systems and to make better decisions regarding water, chemical, and electrical usage.

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Irrigation systems are critical to agricultural operations to ensure water distribution to crops and livestock. Drip and sprinkler systems are used most commonly on farms to irrigate land based on crop, water source, and field size. To work smarter, farmers are adopting wireless technology to manage the different aspects of their different irrigation systems.

Functional over the expanse of a multi-acreage farm with varied terrain and structures, a wireless sensor control system provides real-time visibility into the operating status of motors, pumps, valves, flow rate, and other parameters of the irrigation system. Farm workers can retrieve information remotely from a control center with the convenience of a smartphone or laptop.

In addition to automating data collection, 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 to ensure proper system functionality.

Collected data is downloadable into analytics software for calculating and analyzing water and electrical usage, which represents significant expenses related to irrigation system operation. Users can trend information on an hourly or daily basis about volumes, levels, rates of applications, etc. to get greater insights into irrigation operations and make appropriate adjustments.

Moving to wireless automation

Many farms still monitor irrigation systems manually. To do so, workers must travel to different sites to check motor run status, water volume, meters, and pump connections as well as to record measurements daily. Farms can be vast, covering thousands of acres, with tracts divided into smaller lots. As farms can contain a number of irrigation systems located many miles from each other, inspections can require multiple workers.

While a site inspection can ensure systems are working, they cannot provide detailed insights into power or

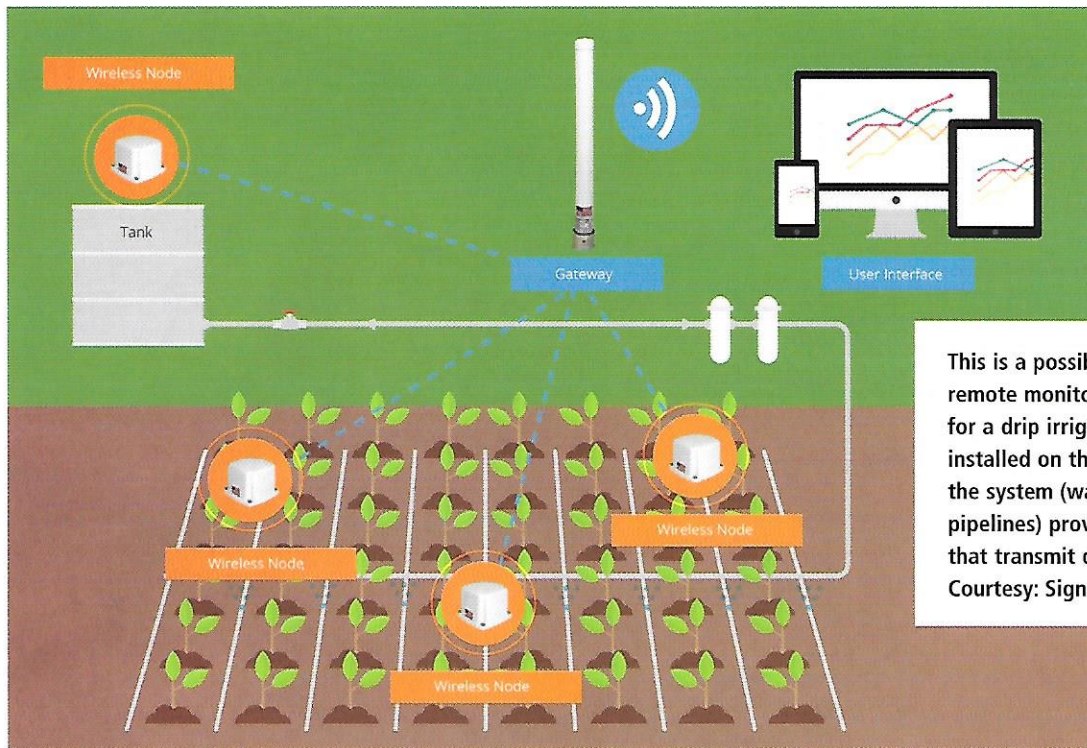
water usage to readily identify potential issues, such as an abnormally high electric current draw from pumps, nor can they quantify the amount of water or chemicals used to irrigate or treat crops. And a malfunction that occurs between inspections could result in a great loss to operations.

A wireless remote monitoring and control system empowers farmers to monitor remotely and control different aspects of the irrigation system from the convenience of a tablet, computer, or even a smartphone. Instead of traveling to multiple locations to manually inspect the motor and pumps, the wireless telemetry system reduces labor by providing an automatic and real-time status of water pressure, pump usage, pump water flow, and other critical operating parameters by collecting data from instrumentation located on different components of the irrigation system.

The wireless monitoring and control system is configurable to provide alerts on abnormal conditions so technicians can diagnose problems, such as motor failures and pipeline leaks, quickly. They can return irrigation systems to optimal operation, as well as 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, if a farmer discovers that yield is the same whether using 50 or 100 gallons a day, a decrease in water usage for specific crops can reduce power consumption, saving on electrical costs and energy usage throughout the farm.

As proper fertilization produces high-quality crop yields, accurate application is critical. The telemetry system works with flowmeters to optimize the amount of chemicals dispersed with water to accurately treat crops while saving money by not overusing expensive fertilizers. Overdosing or undertreating crops also can affect yield.

The figure shows a configuration of a remote monitoring and control system for a drip irrigation system. Sensors installed on the various components of the drip irrigation system (water source, pumps, and pipelines) provide data to radio nodes that transmit data to a central gateway. Either battery or solar-powered, the nodes power the sensors. Serving as the central processing hub, the gateway stores the most recent readings of the nodes in a network



This is a possible configuration of a remote monitoring and control system for a drip irrigation system. Sensors installed on the various components of the system (water source, pumps, and pipelines) provide data to radio nodes that transmit data to a central gateway. Courtesy: SignalFire Telemetry Inc.

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 web-based tool such as a laptop or cell phone.

Tracking different parameters

Versatile telemetry systems are sensor agnostic, allowing users to specify different sensors to monitor various aspects of an irrigation system. In one network, farmers can use:

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

inputs from 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. Bottom line, the telemetry system can broadcast information over long distances.

Data is key to an educated farmer. Smarter operations lead to greater cost efficiency. A wireless remote monitoring and control system enables farmers to 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. In addition to reducing costs, farmers can operate with lower energy requirements related to power and water usage.

Covering large acre farms

A wireless sensor control system can operate over many square miles of different terrain without using cables that limit the use of wired systems. Wireless telemetry systems working in a mesh network permit 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, such as the headquarters of the irrigation district. Robust gateways can accommodate hundreds of transceiver