

Wireless Machine to Machine Networking and Remote Sensor Monitoring for Pivot Irrigation

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As the automation of both private and corporate farms is embraced, the use of machine to machine (M2M) networking technologies is used to enable sophisticated pivot irrigation systems and smart agriculture practices (see Figure 1). The human imagination continues to create new ways to use this technology and push those technology providers for more powerful tools. Ten to 15 years ago, even the most advanced automated pivot systems seldom used telemetry, and, if they did, the data throughput was extremely slow and seldom provided coverage to all the pivot irrigation sites. Some of the wireless communications technology also was expensive. Therefore, the telemetry technology was difficult to use effectively because only some sites could be remotely monitored or where farms were paying by the data byte or monthly usage fees to the technology provider. Today, wireless M2M technology has created new opportunities for advanced remote monitoring capabilities thanks to stronger end-to-end IP connectivity that enables traffic aggregation over a single link.



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With new wireless M2M technologies available today, it is common to have 100 percent communication to all farm pivot locations and see data throughput from pivot sites into the Megabits per second range. Improvements in mesh technologies, which follows the best path from the field site to the control center, maximizes efficiency by reorganizing flow traffic around breakages. High speed wireless M2M communications are available with both serial, and Ethernet connectivity. Hybrid wireless M2M systems can be utilized where needed to combine different M2M technologies over large geographic areas and/or remote locations. This can include both cellular, satellite and microwave products that can be deployed for remote areas, or if a higher speed backhaul of data is required.

New wireless M2M networking solutions keep shrinking in size – but are growing in complexity and performance ability. New products on the market incorporate both traditional serial and Ethernet interfaces, along with greater wireless networking capabilities, including WiFi in remote locations. Hybrid systems that use a mix of technologies can help save costs by using one technology that has monthly costs or fees and piggy-backing on to that network with a license-free system that can collect all the data from the local pivot irrigation sites back to that location. The use of GPS tracking devices is quite common to help with the location of the trailing end sprinkler on the pivot line and this information can be displayed on a computer screen or a smart phone.

Wireless M2M Technology for Pivot Irrigation

The latest telemetry trend is high speed wireless, which provides a broad range of applications for connectivity between the field and the control center. High speed wireless M2M solutions today utilize multiple unlicensed frequencies, operating in the band that best suits the application. These frequencies enable high-speed data transmission that may be used to communicate to and from the pivot to the farm to check moisture and temperature sensors, chemical soil samples, wind speed for the best time to water, the actual pivot location and pump power usage that can be viewed anytime. With high speed wireless internet access, the entire pivot system to be viewed via a smart telephone, enabling the farm manager to remotely operate the pivot system, report/view status changes, and see the remote sensors' status.

Until recently, field devices had to be hard-wired or use cellular or satellite communication hardware. The cost of cellular and satellite can begin to add up with monthly usage fees. Now, this can be done wirelessly and without any reoccurring fees by using technologies that incorporate unlicensed spread spectrum 900MHz, 2.4 GHz, and 5 GHz platforms. M2M networking solutions can also combine IO (input/output) control functions into a remote terminal unit (RTU) or some other type of control device.

Wireless M2M devices with IO capabilities can send analog and discrete information back and forth from the radio to the host or SCADA software. The most common way of doing this is using Modbus protocol and assigning Modbus register values to the input and output required. These devices include pressure, temperature,



Figure 1 Installing a pivot control box.



Figure 2 and 3 Installation of a control box with a wireless M2M communication device.

flow sensors or valves that can be remotely turned on or off. Pump status and GPS coordinates can be carried back to the host computer and displayed with the SCADA software.

Today, several pivot irrigation companies offer some type of wireless M2M communication service that might include cellular, satellite, unlicensed or licensed radios or a combination of technologies, depending on the farm location. The use of wireless M2M connectivity has created an influx of technology that has impacted the speed, size and variety of devices that can be embedded into the controllers, sensors and remote devices. Many of these devices have very small power requirements and can run on lithium batteries or small DC power sources. The new wireless solutions have become smarter and have the capability to work in several different field environments.

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Conclusion

The use of wireless M2M networking and communications will only continue to grow. With commercial farms trying to conserve water resources, manage power use, have access to the health of the pivot system and handle the crops that grow at anytime and anywhere – they will need more wireless connectivity for monitoring and control. The bandwidth requirements will increase too, and IP devices will be added and become more common place. New embedded products will help save costs and be part of the system instead of being an afterthought. The use of different radio frequencies, field sensors, faster connection speeds and other wireless products will continue – software and other services will help the farm and farmer have all the information they need at their fingertips.

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