The INDUSTRIAL ETHERNET Book

Enhancing Automation and Internet Connectivity

WE'VE DECIDED that pulling weeds and harvesting crops is enough work, so we'll automate the watering system of our garden. In fact, our goal is to create an automated irrigation system that is more efficient than watering by hand.

Our garden has a number of features. It will not rely on any existing infrastructure. Water will be collected from rain and the ground, and power will be collected from a series of sun tracking solar panels. In order to know when to water, we will install soil moisture sensors into the soil. Given these design features, we will need to divide our garden design into three distinct sub-systems: irrigation, power and soil monitoring. Next, we need to determine what information we will collect from each subsystem and how we will collect it.

Throughout all of our sub-systems we will need a variety of sensors and control devices. For ease of deployment, each of these sensors and control devices will be wirelessly enabled using ZigBee technology. ZigBee's low-power characteristics enable sensors and control devices to be either hard-powered or battery powered.

For our soil condition monitoring sub-system, we will choose an adequate off-the-shelf wired soil moisture sensor and make it wireless and battery powered using an XBee module from Digi. The XBee can be configured to autonomously wake on a periodic cycle, power the sensor, take a sample from the sensor, and transmit the sample to a centralized point. By making our soil moisture sensors wireless and battery powered, we increase our deployment flexibility and minimize the chance that garden tools will disable our sensor subsystem by breaking any wiring. Our garden will require many sensors in order to correctly determine the soil conditions. Distributing them in groups allows us to break the garden into zones.

Our irrigation subsystem shall contain a series of rain barrels plumbed to collect rainwater and to accept water from a secondary water collection system. In our case, we have determined that water is available within range of a 'driven point well' just over 3 metres below the soil surface. Water will be collected from the driven point well and stored in the rain barrels. In order to determine the availability of water in the system we will install an ultrasonic tank level sensor upon one of the rain barrels and a float sensor in the well tied to an XBee Digital I/O adapter. The pump from the well to our bank of rain barrels will be controlled by a second I/O port on the same XBee Digital I/O adapter.

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