

Automated Meter Reading: Wireless Water Meter

The Client

Our customer is a leading automated meter reading solution provider for commercial buildings and multifamily dwellings.

The Challenge

Water meter is a member of a family of sensors and infrastructure that is used to transmit specific water consumption information from multifamily dwellings to a central point on the property. From there, the data is passed via commercial communications infrastructure to a central processing point where data is stored, processed and made available to customers. In addition to water consumption, diagnostic information and water heat information are stored and transmitted. The scope of the project includes design and development of application for accurate collection and reliable transfer of utilities metering data. The hardware design consists of RF, baseband controller, utilities sensors, and power supply. Key design factors include:

- Data integrity and security of the data transfer
- Long term reliability
- Low power consumption
- Low cost
- Size

The Solution

Once the water consumption is calculated and stored internally in non-volatile storage, the water meter's 2.4 GHz spread spectrum wireless data transceiver, periodically transmits information to the host computer. This component is designed utilizing the Direct Sequence Spread Spectrum modulation techniques, and is compliant with the IEEE-802.15.4 standard. The transmission mechanism utilizes Zigbee network architecture, where each water meter is configured as a mobile and sleepy reduced function device and the primary gateway as the coordinator. There are multiple other gateways configured as routers. Commands can also be sent from the gateways to the water meters, based on which certain registers are updated at the meters. The sleepy meters poll for the commands from their parents when awake. The transmission from water meter to gateway and vice versa makes use of intermediary routers/repeaters, in a secured manner. The coordinator, routers/repeaters and water meters are connected in a mesh network topology. The optimization of available bandwidth and minimization of the amount of network activity has been taken into consideration while forwarding the data. For the purpose of forwarding the data to the gateway and vice versa, the router maintains a list of best available routes in order of preference. The network re-establishes itself with a new Pan Id and un-used channel if the Link Quality and the Received Signal Strength of the meters become gradually poor. In the meters, the micro controller and the RF chip are put to sleep when not in use, in order to save battery consumption. However, the routers and the coordinators are mains powered and such considerations are not required for them.

A popular third-party ZigBee stack is used to implement the ZigBee architecture for transmission of data and for the remote server to remotely re-program one or all of the devices in the network over the air.

The Benefits

- Standards based solution without the drawbacks of proprietary wireless systems that include complexity, risk of relying on a single vendor and relatively higher system cost
- Reliable, self healing, easy to deploy network supporting large number of nodes
- Efficient power management, leading to very long battery life
- Low cost solution
- The worldwide interoperability in 2.4 GHz band

The Technology