# Planting Smart Irrigation Solutions

LoRa® APPLICATION BRIEF

## Semtech's LoRa Technology Enables Vineyards to Monitor and Manage Soil Moisture

### DESCRIPTION

LoRa® devices and wireless radio frequency technology (LoRa Technology) is making it easy and affordable for irrigation management systems to transform vineyards across the globe. Climate change and dynamic weather conditions continue to present challenges in vineyard management. Until now, growers did not have an effective way to measure soil moisture other than to visually inspect grape vines. The ability to detect damage from affected plants and make necessary irrigation changes were often too late and resulted in crop loss.

The advent of affordable Internet of Things (IoT) can alter the irreversible consequences of poor irrigation management by providing farmers with real-time soil moisture monitoring. The vineyard irrigation management system provides the ability to detect water levels at various depths and automate irrigation valve controls. The decades-long practice of a weekly, long crop irrigation cycle is being replaced with frequent, shorter irrigation cycles to reach precise grapevine water stress levels. LoRa Technology has provided wine producers with actionable data, therefore enabling more efficient water management, optimized plant growth, increased crop yields, and up to a 50% savings in irrigation water usage.

### BENEFITS

Implementing a LoRa-based smart irrigation solution begins with deploying calibrated, high-accuracy soil moisture sensors in every irrigation zone. Multiple sensors are buried in a vertical column to measure the water levels at two, three and four feet deep. The goal is to supply the exact amount of water needed and delivering it only to the soil layers with an active root system. For instance, water that reaches beyond three feet is out of reach from the active roots of a grapevine and is wasted. The soil moisture sensors use LoRa Technology to communicate with a wireless gateway. The gateway can be deployed as a private network or added to an existing low-power wide-area network (LPWAN) infrastructure.

Once deployed in an agricultural field, the soil moisture sensors and sensor station platform use the LoRaWAN™ open protocol to transmit granular soil moisture data to a Cloud-based vineyard management application. The application transmits actionable information that is accessed by farmers through a customized dashboard. The system calculates and displays water requirements and can trigger solar powered irrigation valve-controllers to automatically release water at intervals and durations to accurately meet desired soil moisture levels.

### APPLICATION

A vineyard that needs a data-driven irrigation system to provide real-time moisture measurements and automated precision irrigation for the intelligent management of crops.

# SEMTECH'S LORA TECHNOLOGY FOR SMART IRRIGATION & SOIL MOISTURE MANAGEMENT SYSTEM

## HOW IT WORKS

Semtech's LoRa Technology enables connectivity for real-time soil moisture monitoring, irrigation optimization and agriculture management services.

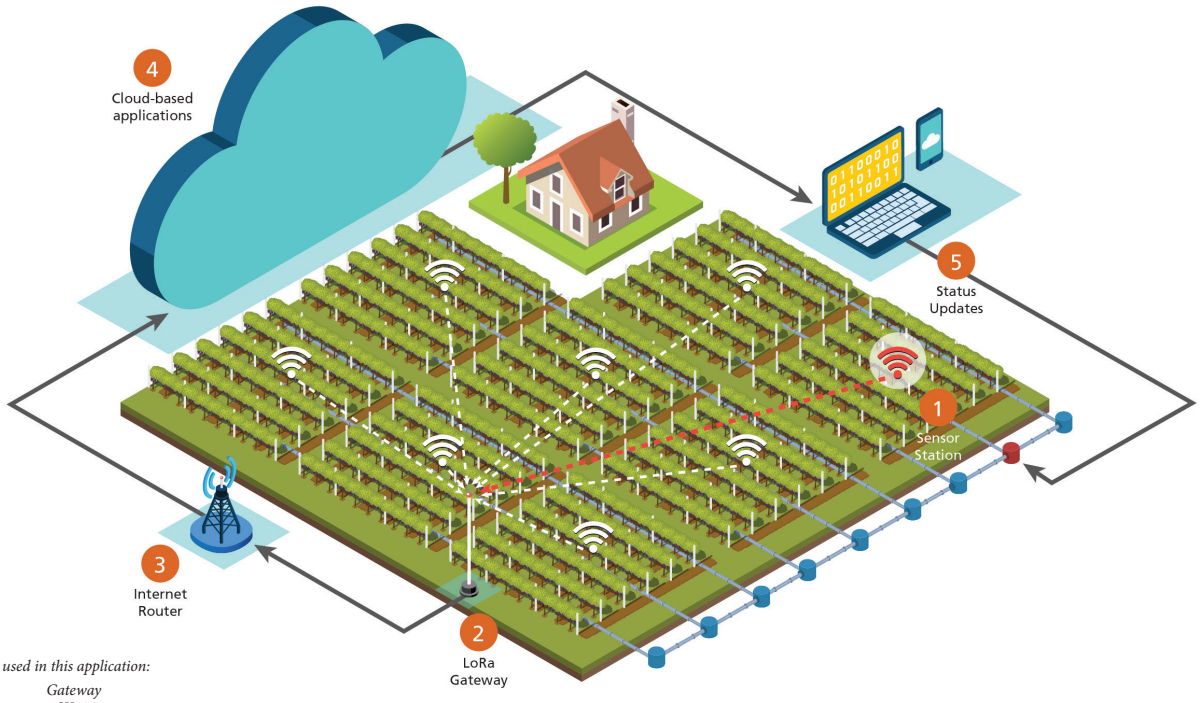
1. Each irrigation zone (or valve) is equipped with a remote sensor station platform and soil moisture sensors at various depths. The resistive solid-state sensors accurately respond to the entire soil moisture range used for agriculture (0 to 70 kPa). At pre-set intervals, the sensor station measures soil moisture levels. The sensor station's embedded LoRa transceiver sends a short message packet containing the data to any LoRa gateway within its range.
2. The gateway, designed for public or private LoRaWAN networks, supports up to 1000 sensor stations in a six-mile radius.
3. The LoRa-based gateway connects to an Internet router or cellular modem to connect to the Internet.
4. The internet router then forwards the packets to the vineyard management application that resides either on a Cloud-based or dedicated server.
5. The turnkey smart irrigation and soil moisture management solution presents the sensors' data on a web interface or mobile app. It can be customized to automatically open or close irrigation valves based upon readings.

## REAL USE CASE SOLUTION

A community of 140+ vineyard growers in Temecula, Calif., formed the Small Wine-growers Association to share information about their crops and discuss best practices to improve the quality of their grapes. Reinier van der Lee, a Temecula-based winegrower himself, aspired to develop an IoT solution to address the mutual irrigation challenges expressed by the community. In 2017 he founded Vinduino, a precision irrigation technology company. The initial soil monitoring prototype was WiFi-based, but the range limitations soon proved ineffective in covering even a small vineyard. Vinduino then evaluated LoRa Technology and achieved success. The concept of using open-source technologies for the development of affordable water saving technology has been well received within farming communities. The company has since expanded its offering to irrigation management systems for other crops such as citrus orchards. Vinduino continues to utilize LoRa Technology because it offers a combination of unique advantages.

### LOW DEPLOYMENT COST

LoRa-enabled applications are self-provisioning to simplify deployment and minimize installation labor. The sensors communicate with Vinduino's Cloud-based application over public infrastructures when they are available. For applications that require a dedicated infrastructure, LoRa Technology's robust long-range and low-power technology has excellent outdoor reach that minimizes the number of gateways needed to serve an area.




*Semtech Products used in this application:*

*Sensors*
- *SX1272/3*
- *SX1276/7/8/9*

*Gateway*
- *SX1301*

*All application elements (sensing modules, gateways, servers, software) are available through LoRa Alliance™ partners.*

## REAL USE CASE SOLUTION CONTINUED

### LOW PER-UNIT COST

LoRa Technology was designed to be affordable for hardware manufacturers and to help developers to build quickly, reliably and within budget constraints. The Vinduino soil moisture sensor target price is $15 USD and gateways are priced around $250 USD, with the price decreasing as order volume increases. A Vinduino LoRa-based sensor station can support up to four soil moisture sensors, and retails for $275 USD.

### STANDARDS-BASED

The LoRaWAN™ open protocol is a globally-approved standard that allows Vinduino to sell products that have assured global interoperability. Products based on LoRa Technology also benefit from the economies of scale that reduce unit cost and further accelerate adoption.

### SECURE

LoRa Technology secures all communications using end-to-end AES128 encryption, making Vinduino's soil moisture data and irrigation valve control access highly resistant to attacks.

### HIGH CAPACITY

A single LoRa-enabled base station can handle millions of messages per day, allowing Vinduino's application to support large growing areas.

## JUMP-START YOUR IOT DEVELOPMENT TODAY

### TRAINING OPTIONS TO GET STARTED

Learn about Semtech's LoRa Technology platform
www.semtech.com/iot

Join the LoRa Community
www.semtech.com/LoRaCommunity

Become a member of the LoRa Alliance™
www.lora-alliance.org

Attend a LoRa Boot Camp for a full-day of training featuring LoRa Technology and real world applications
www.semtech.com/iot

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