SEMTECH

LoRa®

Calgary

Smart Agriculture for Indoor Botanical Gardens

DEVONIAN GARDENS EXPLORES IoT TO MAINTAIN ACRES OF PLANTS

A BOTANICAL OASIS IN DOWNTOWN CALGARY

The Devonian Gardens are a three-acre horticultural refuge on the top floor of The CORE Shopping Centre in Calgary, Alberta, Canada. One of the largest indoor gardens of its kind, it boasts more than 10,000 ground cover plants, 250 trees, a 900 square foot living wall, koi ponds, and a children's play area.

This impressive green space, perched above 116 retail stores, is maintained by The City of Calgary Parks. Since 1977, Devonian Gardens, with its imported exotic plants and tropical trees, has served as an alluring retreat for Calgarians and tourists – especially during the long winter season.

"It's not a greenhouse environment, but a massive 'Winter Garden' sharing the same airspace with a shopping area. Malls are designed for human comfort, not for exotic plants."

Colin Adderley, IT Engineer, The City of Calgary

The City completed a major renovation of the facility in 2012. Changes included a "punch through" of the floor space onto the mall below leaving a wider, taller open-air circulation space. The mall was renovated to include a two block long, continuous skylight. The modern version of the gardens incorporates multi-user space for meetings and performances.

DATA-DRIVEN WATER, LIGHT AND HUMIDITY

The plants and trees within Devonian Gardens are precious assets and some are irreplaceable. Others have been recently transported great distances and craned onto the fourth-floor roof to be brought into the garden. The main challenge for the indoor garden is creating a healthy environment for 43 planter beds, some with multi-levels, of tropical indoor plants and 27 different species of trees within a three-acre area.

Devonian Gardens has beds varying in size and depth. A soil monitoring sensor is part of the Proof of Concept (PoC) to measure volumetric water content (VWC), soil temperature and electrical conductivity (EC). VWC provides the ability to understand irrigation performance against the species' requirements. EC measures the salinity of the soil which helps in fertilization for optimal plant health. The combination of light, water, air, and soil characteristics helps reduce disease and penetration of pests. By utilizing Semtech's LoRa® devices and the LoRaWAN® open protocol to gain an understanding of these fundamental characteristics, Calgary can better provide more efficient and predictive outcomes for managing these assets given the environmental challenges.

LoRa®
Use Case

IoT Challenge

- Ability to capture plant health data
- Measure integral daily light readings across different varieties
- Maintain tropical conditions indoors

LoRa Devices Used

- Key features of LoRa devices include open standards, security and proven reliability
- City-owned LoRaWAN® network achieves unrivaled range and scale
- Battery operated sensors installed throughout acres of gardens

Business Value

- Adjust lighting scheme and humidity to optimize growth conditions
- Integrate sensor data with smart irrigation schedules
- Fewer maintenance issues and less plant attrition

For More Information

About Semtech's LoRa devices for agriculture applications, visit

semtech.com/LoRa

About Devonian Gardens

calgary.ca

The step-by-step process of Devonian Gardens' LoRa-enabled solution

"By far, my most difficult challenge is keeping the plants well lighted, so they can experience consistent and healthy growth throughout the year."

Danielle Zadunayski, Devonian Gardens'
Horticulturist, Calgary Parks, The City of Calgary

Danielle Zadunayski, horticulturist at Devonian Gardens since 2011, noticed some trees were exhibiting signs of light stress. What appeared consistent and healthy growth, was, in fact, the canopy compensating for low light levels. The leaves grew to much larger surface areas in order to receive more light, causing the trees to become top heavy and list dangerously to the side.

"Light, but more specifically PAR, photosynthetic active radiation, is a spectrum that is critical for plants to thrive," explained Zadunayski. "If they receive the right spectrum for the right length of time during the day, and this continues over the course of a few years, we have created healthy growing conditions."

To test the technical capability of LoRa-enabled PAR sensors in creating and maintaining appropriate lighting throughout the seasons, Devonian Gardens installed a PAR sensor in one flower bed as a PoC. With PAR readings from different positions, specialists are able to quantify light spatially in the garden. A spatial representation helps in future species selection and placement, maintenance, and in future lifecycle of lights for optimal plant health. Temperature, humidity and barometric pressure sensors measure vapor pressure

deficit (VPD) and characterize this over the physical space to further help plants thrive. VPD is the difference between the amount of moisture in the air and maximum amount of moisture the air can hold. The positive results of the PoC has led to the development of a business case to implement sensors across the entire gardens. The industrial-grade sensors for the smart agriculture application were provided by Decentlab, while the temperature and humidity sensors and gateways were supplied by TEKTELIC Communications, a local manufacturer of high-performance wireless products.

"Now we have an opportunity to manage these precious gardens with science. We are understanding various light models and fitting them with the right species."

Nan Xie, IT Senior Engineer, The City of Calgary

CITY-OWNED LoRaWAN NETWORK

The City of Calgary is one of the first cities in North America to build a municipality-owned, carrier-grade LoRaWAN network. LoRa-based applications have been in place for over a year and are the foundation of the City Network of Things (CNoT) platform created by the Innovation & Collaboration team at The City of Calgary.

Calgary envisions CNoT will be used by many of the City's 32 business units. PoCs using LoRa devices and LoRaWAN-based infrastructure are currently underway, with Devonian Gardens serving as the first use case. CNoT can also be used as part of Living Lab pilot projects, a city initiative to offer infrastructure and assets to companies, researchers and individuals. This initiative offers the ability to test ideas in a real-life environment, helping products grow and supporting investment in the local economy.

"Previously, it would have been too expensive to trench wiring into each planter to power devices. LoRa-based wireless sensors with high battery lifetimes are perfect. It's almost too good to be true."

Colin Adderley, IT Engineer, The City of Calgary

For more information on Devonian Gardens visit calgary.ca

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Semtech's LoRa devices are a widely adopted long range, low power solution for IoT that gives telecom companies, IoT application makers and system integrators the feature set necessary to deploy interoperable IoT networks, gateways, sensors, module products, and IoT services worldwide. IoT networks based on the LoRaWAN® specification have been deployed in over 100 countries and Semtech is a founding member of the LoRa Alliance®, the fastest growing IoT Alliance for LPWAN applications.

Semtech Corporation is a leading supplier of high performance analog, mixed-signal semiconductors and advanced algorithms for high-end consumer, enterprise computing, communications, and industrial equipment. Semtech, publicly traded since 1967, is listed on the Global Select Market under the symbol SMTC and has more than 32 sales and application support offices in 14 countries as well as representatives and distribution support locations in more than 30 countries. Semtech is dedicated to providing proprietary platforms, differentiated by innovation, size, efficiency, performance, and reach.

The LoRa Alliance is an open, nonprofit association that has become one of the largest and fastest-growing alliances in the technology sector since its inception in 2015. Its members closely collaborate and share experiences to promote the LoRaWAN protocol as the leading open global standard for secure, carrier-grade IoT LPWAN connectivity. With the technical flexibility to address a broad range of IoT applications, both static and mobile, and a certification program to guarantee interoperability, the LoRaWAN protocol has already been deployed by major mobile network operators globally and connectivity is available in over 100 countries, with continuing expansion ongoing.