Chunghwa Telecom iEN Intelligent Environment Network Service to effectively monitor and control real-time energy consumption of its dispersed data centers. The service, which utilizes Intel® IoT Gateway and cloud computing technologies, can be applied to street lighting, environment monitoring and control, localization, and emergency reporting to save on energy costs and improve maintenance efficiency. When combined with a variety of environment sensors, the service can turn every street lamp into a basic element required for building a smart city.

Chunghwa Telecom (CHT) is the oldest and most recognized telecommunications company in Taiwan, operating 1,600 data centers and 8,000 Wi-Fi-based stations across the country. Faced with such a large number of dispersed equipment, it has become difficult for CHT to monitor, let alone control, these facilities. To effectively manage these distributed facilities, CHT developed the cloud-based iEN Intelligent Environment Network Service to monitor and control its facilities located at multiple sites in real time.

Meanwhile, the emergence of energy issues in 2008 prompted CHT to look for ways to tap the full potential of the iEN Intelligent Environment Network Service. The company saw the opportunity to expand its multi-site remote management technology into the service, thereby providing remote monitoring and control of energy facilities. Besides remote management, the service has been added with automatic energy and facilities-management technology that will make it easier to manage street-lighting facilities.

Combining cloud computing and Intel® IoT technology, iEN Intelligent Environment Network Service features centralized management and an automatic alarm reporting system to improve efficiency in managing street lights. This allows for better energy efficiency, automated problem reporting as well as an easier and much more effective way of receiving and sending environmental information. With this service, CHT takes the first step to building a smart city.

Problem: The challenges of managing street lights
In Taiwan, traditional street lamps are usually installed and managed per district or road. This has made it more difficult for the administrator to identify each lamp’s status, let alone manage all of them, especially since street lighting usually spans a large and distributed area.

On top of this, street lighting maintenance has become costly and inefficient as well. Traditional street lights rely heavily on staff patrol or passive reporting to identify maintenance needs. When a lamp has been reported faulty or malfunctioning, a maintenance personnel has to visit the site to identify the faulty one and will have to report back to the administrator for proper action. If the faulty street lamp is located far off the main road or in a rural area, it may take much longer before it can be fixed. The administrator will then have to send another personnel out to double check whether the work has been done properly. This cycle makes the entire maintenance process inefficient and increases maintenance expenses.

In addition, the energy it takes to power up street lamps has been putting a big dent on the government’s budget. Since 2008, energy has become the focus of public attention and basic infrastructures like street lighting has been identified as one of the public utilities that consume a significant amount of energy. The government, however, cannot mitigate the costs since brightness of the street lights cannot be compromised due to the requirements of road users and public safety.
Solution: Utilizing cloud-based platform for effective management of multiple site facilities

The iEN Intelligent Environment Network Service is a cloud-based platform that enables remote management of multiple street lighting facilities. Using Intel® IoT Gateway LED lighting devices, device-related information, such as exact location of the street lamps, lamp specification, and incident logs, can be transferred to the cloud platform to provide real-time monitoring and control of each lighting device’s status.

The cloud-based street lighting system also allows easy maintenance of street lamps. As it can detect the real-time status of each individual lighting device, it can automatically send alerts as soon as an abnormal power consumption or data transfer has been detected. The administrator can then notify the maintenance staff to carry out repair work, which then effectively improves street lighting maintenance efficiency.

With efficient maintenance management comes efficiency in energy consumption as well. This cloud-based street lighting system makes use of IoT features to remotely adjust the on and off times as well as the brightness of lighting based on multiple factors. For example, the system can be connected to the Central Weather Bureau in the future to set up lighting on and off times or adjust brightness levels when linked with a light environment sensor. This then allows street lights to be switched on at low brightness in daylight to reduce energy consumption.

The technology behind the iEN Intelligent Environment Network Service

Cloud computing
Each street lamp has a Zigbee lighting control module for IoT connection that can be numbered individually. The system uses the cloud platform for integrated monitoring and control, supporting intuitive map display of each lamp’s exact location, schedule, and level of daylight illuminance. The system can also group street lamps by administrator, road or district, and neighborhood to improve management efficiency and effectiveness.

In detail, the cloud-based street lighting system can undertake the following tasks:

- **Maintain and manage lighting information**: The system can file the administrator’s street lighting information and enable management with information technology. It can also provide graphic-controlled interfaces or digital maps to easily understand the distribution of street lamps and their conditions.

- **Lighting monitoring and control management**: The system monitors lighting power consumption and provides real-time lighting management of power switch and brightness schedules.

- **Management of lighting maintenance dispatch**: The system automatically sends out email or SMS notifications to the maintenance staff, while providing a mechanism for issue reporting and efficient dispatch of repair personnel.

- **Other custom features**: The system has an integrated sensor system for temperature, humidity, air quality, water level, and video surveillance. It can also conduct big data analytics and display information about neighboring stores, regions, and residents. It also allows users to scan the QR code attached to a lamp post to receive local information about travel news, shop offers, emergency contact numbers, among others.

The cloud-based street lighting system can also be configured to automatically connect to graphic displays of street lighting to monitor each lamp’s real-time status and report any abnormalities. Road users who discover a faulty street light can scan the QR code on the lamp post for quick reporting. The administrator can then inform maintenance personnel about the faulty street light and provide accurate information about its condition. The system will be notified as soon as the maintenance staff finishes their work. This streamlines the whole process of staff patrol and reporting while improving problem solving and processing efficiency.
IoT connectivity
Using Intel IoT Gateway, the cloud-based street lighting system can send and receive data via the Internet, support real-time search, remote monitoring and control, while carrying out a number of value-added applications via smart management. Through IoT technology, the system can also manage power consumption, environment, and facilities, enabling information integration and intelligent power efficiency.

Power consumption management:
Street lights have been installed with a digital meter to send real-time power consumption status. Statistics show that simply equipping the administrator with the ability to monitor real-time power consumption and allow self-management can reduce energy consumption by 5%.

Management of environment:
Street lampposts have been installed with an environment sensor to collect and read environmental information before sending the data to the cloud.

Management of facilities:
The system uses zigbee wireless network to connect the controller of a lighting device and transfer sensor-collected data to the cloud. The platform can then maximize lighting based on onsite conditions, time, and schedule to save energy and provide road user safety.

Result: Realizing the smart city vision with cloud-based, IoT-powered street lighting solution
Utilizing the iEN Intelligent Environment Network Service can transform traditional street lighting to a smart city lighting solution that offers a myriad of business benefits.

As the service can increase street lighting maintenance efficiency, this reduces overall costs and expenses on maintenance and energy consumption. Upgrade from traditional street lamps to a cloud-based street lighting system can lower management cost and provide tighter control over spending on street lighting.

In terms of sustainability and expansibility, the cloud-based system can provide centralized management of energy-efficient services, allowing the government to cut back on unnecessary facilities and maintenance expenses.

Successful case: Hsinchu takes a leap towards smart city lighting
This smart city lighting solution powered by the iEN Intelligent Environment Network Service is no longer just a theory but a reality that is now providing great advantages to the city government of Hsinchu.

Since upgrading to the cloud-based street lighting system, the number of malfunctioning street lamps in Hsinchu has declined significantly and as a result, the number of night crimes has also decreased.

After replacing 11.8% of its public road lighting with the cloud-based lighting system and converting 70% of its street lights to energy-efficient LED bulbs, the city has also saved around NT$34.35 million on energy costs, achieving a 58% energy-saving rate.

Such successful application only proves how the iEN Intelligent Environment Network Service can help the government realize its vision of achieving energy efficiency in the public sector.

Laying the foundation for a smart city
The iEN Intelligent Environment Network Service supports a variety of environment sensors that can collect environment information collected from temperature and humidity sensors, air quality detectors, water level gauges, and surveillance cameras. If environmental sensors can be installed across the entire city, they will become part of the city’s basic infrastructure, splitting the city into different streets or road zones to collect more accurate data for city management and improvement, such as road sections vulnerable to flooding, air pollution conditions, and climate changes at each district during typhoons.
Apart from street lighting, the cloud-based street lighting system can also be used for localization. Once the system has been rolled out all over a city, public authorities from public works, fire, and the police will be able to quickly locate a reporter’s position using just the street light pole number and provide service more efficiently.

As the solution offers energy savings and enhancement of management efficiency, it can integrate all environment data and use big data analytics to obtain information for long-term city energy-efficiency planning, climate monitoring, and road traffic adjustment.

Currently, CHT is working with Intel to connect the iEN Intelligent Environment Network Service’s IoT Gateway to the Wind River Helix™ Device Cloud, which will allow data to be pre-processed before sending to the iEN cloud database. This will allow the cloud platform to increase its processing speed and provide real-time notification in the future.

As the cloud-based street lighting system can incorporate both digital and IoT resources, every street in the city can function as a skin that absorbs all sorts of environmental data. Once data has been compiled into a unified cloud platform, the administrator can use this to learn, understand, make judgments, and improve city management to build a safer and more energy-efficient smart city.

Learn more about Intel’s smart city solutions

See how Intel IoT solutions are helping to spread intelligence throughout our cities, homes, workplaces, vehicles, and more, visit: www.intel.com/iot

To learn more about Chunghwa Telecom, visit: http://www.cht.com.tw/en/