

# LoRa-Based IoT Solutions for smart cities and smart farming

**Daniel Yoon**

Director /  세종솔루텍(주) Sejong Solutech Co., Ltd.

# Company Overview

Connecting people and things

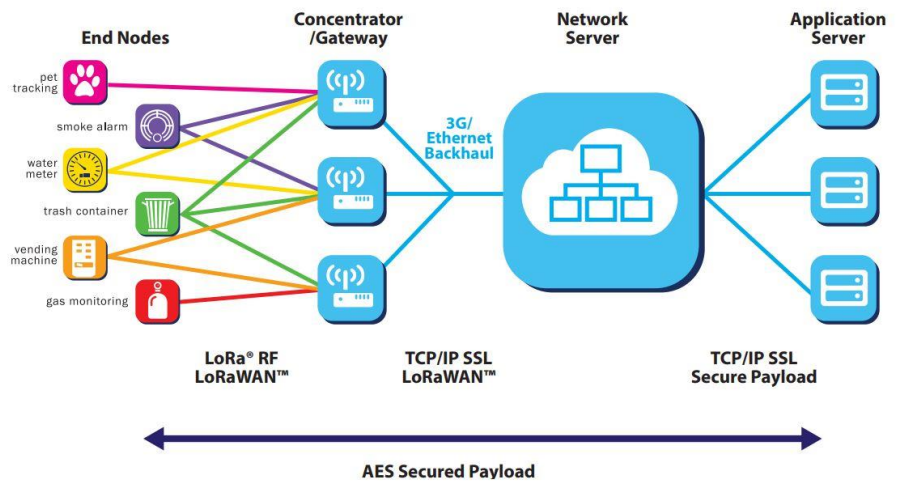
- Company Name: Sejong Solutech Co., Ltd.
- CEO & President: Tae-jin Kang
- Established: June 7, 2018
- Address: Bldg. C, 41-7 Techno 11-ro, Yuseong-gu, 34036, Korea.
- E-mail: admin@sjsolutech.com
- Tel. +82-42-933-7700
- Fax. +82-42-933-7701
- Web: www.sjsolutech.com

A sensor network specialist opening a new world of Internet of Everything

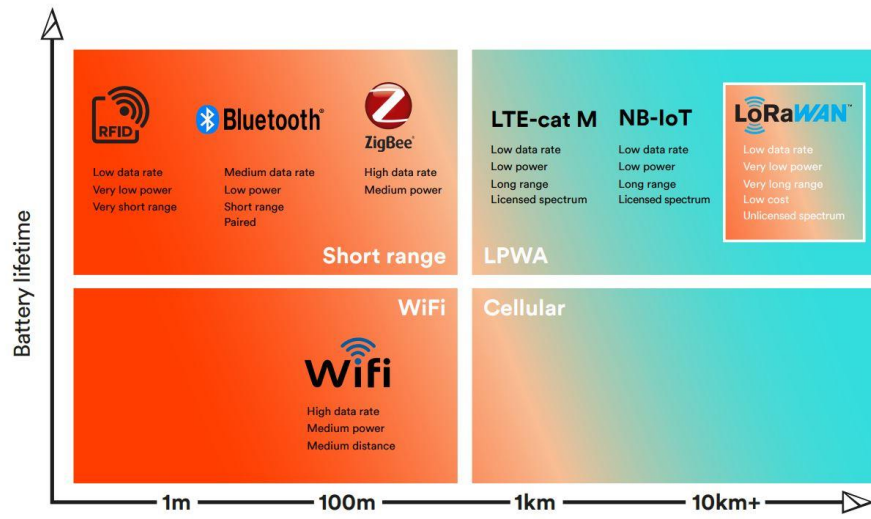


# Overview

- The LoRaWAN<sup>®</sup> specification is a Low Power, Wide Area (LPWA) networking protocol designed to wirelessly connect battery operated 'things' to the internet in regional, national or global networks
- LPWANs are great solutions for certain kinds of use cases requiring periodic or inconsistent data transfer over long distances for a significant amount of time



[LoRa LPWAN Architecture]



[Positioning of LoRa LPWAN]

# Key benefits

## Long Range

LoRaWAN provides long range (up to 15km) communication between sensors and base stations, resulting in networks with 2-3x times fewer base stations compared to cellular.



## Battery

LoRaWAN data transmission and reception requires low current (less than 50 mA), dramatically reducing power consumption of the devices and allowing battery life of up to 10 years.

## Bidirectional

Fully bidirectional communication enables a wide variety of use cases requiring uplinks and downlinks: for example, street lighting, smart irrigation, energy optimisation or home automation.



## Indoor penetration

The LoRa radio modulation allows deep indoor penetration and adds the ability to reach sensors monitoring water or gas meters located underground.

## Open source standard

The LoRaWAN standard is based on an open protocol approach managed by the LoRa Alliance™ which supervises the development of the standard and ensures interoperability between all LoRaWAN networks.

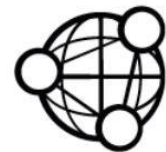


## Unlicensed band

LoRaWAN networks are deployed on cost-free ISM bands (EU 868, AS 923, US 915 Mhz) allowing any service provider or company to deploy and operate LoRaWAN networks without having to acquire a license for any frequency.

## Cost

The LoRaWAN open standard combined with cost-free operation frequencies and low-cost base stations allows operators to roll out networks in a just few months and with minimum investment.



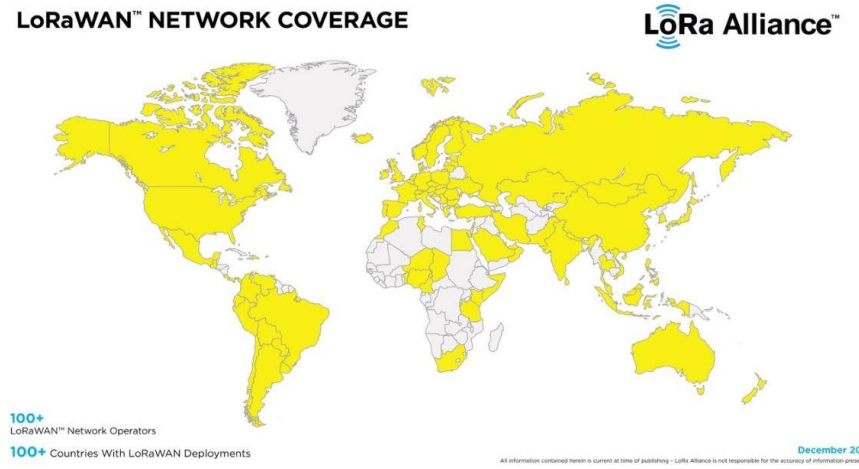
## Network geolocation

LoRaWAN can use network triangulation to passively locate any LoRa device. This enables new tracking applications, lower cost and battery life optimisation compared to GPS.

# Regional Specification

Channel Plan	Common Name
EU863-870	EU868
US902-928	US915
CN779-787	CN779
EU433	EU433
AU915-928	AU915
CN470-510	CN470
AS923	AS923
KR920-923	KR920
IN865-867	IN865
RU864-870	RU864

**“More than 100 network operators have deployed and operate LoRaWAN networks, which are both public and private.”**  
Source: LoRa Alliance (December 2018)



# Applications of LoRa LPWAN

## Smart city

- Smart parking
- Structure health monitoring
- Urban noise mapping
- Smartphone detection
- Magnetic field level
- Traffic congestion
- Smart lighting
- Waste control
- Smart Roads
- Smart fire detection

## Security

- Access control
- Liquid detection
- Radiation level
- Explosives and toxic gases

## Retail

- SCM Management
- NFC payment
- Intelligent shopping app
- Smart product management

## Logistics

- Shipping Control and monitoring
- Product location
- Storage compatibility
- Fleet tracking

## Smart farming

- Climate condition monitoring
- Green house automation
- Crop management
- Cattle monitoring and management

## Industrial

- Indoor air quality
- Temperature monitoring
- Ozone existence
- Indoor location
- Car diagnosis

## Smart environment

- Forest fire monitoring
- Air pollution
- Snowfall level monitoring
- Landslide prevention
- Earthquake early detection

## Smart water

- Water quality monitoring
- Leakage detection of chemicals in rivers
- Remote pool assessment
- Marine pollution level
- Water spill
- River overflow

## Home automation

- Energy & Water usage
- Remote control of home appliances
- Intrusion detection
- Others

## Smart metering

- Smart Grid
- Tank Level
- PV cell Installation
- Water flow

# Solution products

## Sensor Node Controller



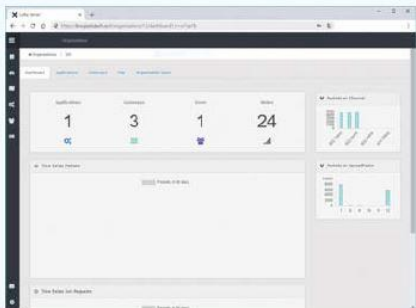
Collects digital inputs and outputs from various sensors  
Supports RS-232 interface  
Supports LoRa interface

## LoRa Gateway



High performance gateway that supports up to 65,535 nodes  
Max output 23dBm and max sensitivity -143dBm  
Supports PoE

## LoRa Server



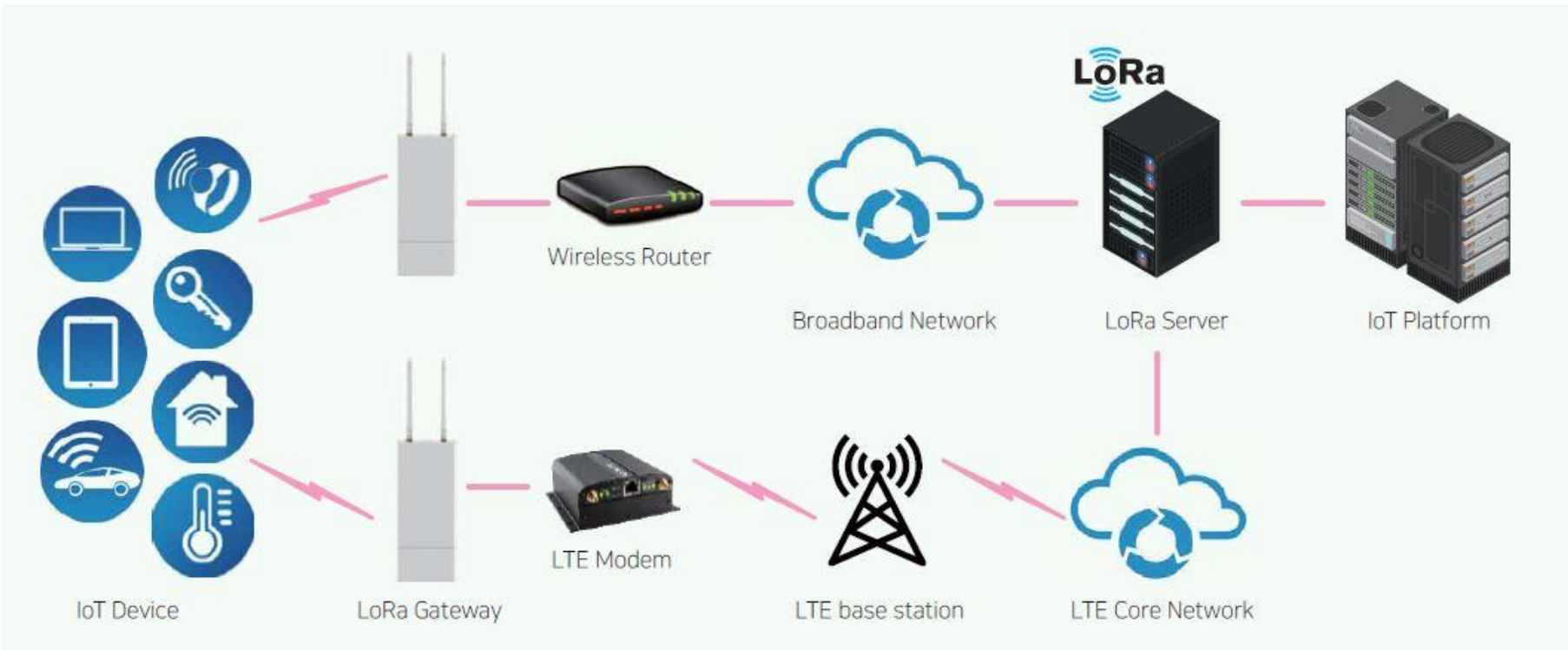
Open source based LoRa server  
Supports Class A, B, C

## IoT Service Platform



Web based IoT service platform  
Customization available for various applications

# Solution Diagram





# Use case: Smart Parking

- Use cases
  - Road traffic control
  - [Smart parking](#)
  - Public transport
  - Utilities
  - Street lighting
  - Waste management
  - Environment
  - Public safety
- With the help of GPS data from drivers' smartphones (or road-surface sensors embedded in the ground on parking spots), smart parking solutions determine whether the parking spots are occupied or available and create a real-time parking map.
- When the closest parking spot becomes free, drivers receive a notification and use the map on their phone to find a parking spot faster and easier instead of blindly driving around.

# Smart parking solution

## Parking Cop



### Features

- Impact protection
- Powered by 12V 7A battery
- Built-in car presence sensor
- Wired power supply (option)
- RS-232C control (option)

## Car Presence Sensor



### Features

- Powered by battery
- Adapts dual vehicle detection sensors (magnetic, radar)
- Supports additional sensors (Ground surface temperature, flood detection sensor)

## Smartphone app



### Features

- Shared parking registration
- Empty parking space search
- Opening/closing parking cop
- Auto blocking upon departure

## Web-based parking space sharing platform



### Features

- Car park registration & mgt
- User/member management
- Empty parking space info
- Parking lot usage statistics

# Use case: Street lighting

### ■ Use cases

- Road traffic control
- Smart parking
- Public transport
- Utilities
- **Street lighting**
- Waste management



- IoT-based smart cities make maintenance and control of streetlights more straightforward and cost-effective. Equipping streetlights with sensors and connecting them to a cloud management solution helps to adapt lighting schedule to the lighting zone.
- Smart lighting solutions gather data on illuminance, movement of people and vehicles, and combine it with historical and contextual data (e.g., special events, public transport schedule, time of day and year, etc.) and analyze it to improve the lighting schedule. As a result, a smart lighting solution “tells” a streetlight to dim, brighten, switch on or switch off the lights based on the outer conditions.
- For instance, when pedestrians cross the road, the lights around the crossings can switch to a brighter setting; when a bus is expected to arrive at a bus stop, the streetlights around it can be automatically set brighter than those further away, etc.

[From Semtech’s LoRa Whitepaper]

# Use case: Waste Management

## ■ Use cases

- Road traffic control
- Smart parking
- Public transport
- Utilities
- Street lighting
- **Waste management**

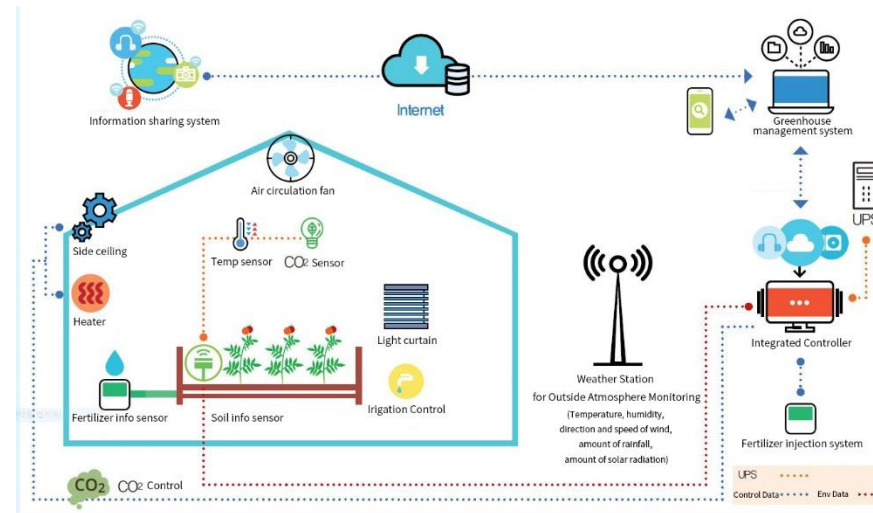


- IoT-enabled smart city solutions help to optimize waste collecting schedules by tracking waste levels, as well as providing route optimization and operational analytics.
- Each waste container gets a sensor that gathers the data about the level of the waste in a container.
- Once it is close to a certain threshold, the waste management solution receives a sensor record, processes it, and sends a notification to a truck driver's mobile app.
- Thus, the truck driver empties a full container, avoiding emptying half-full ones.

[From Semtech's LoRa Whitepaper]

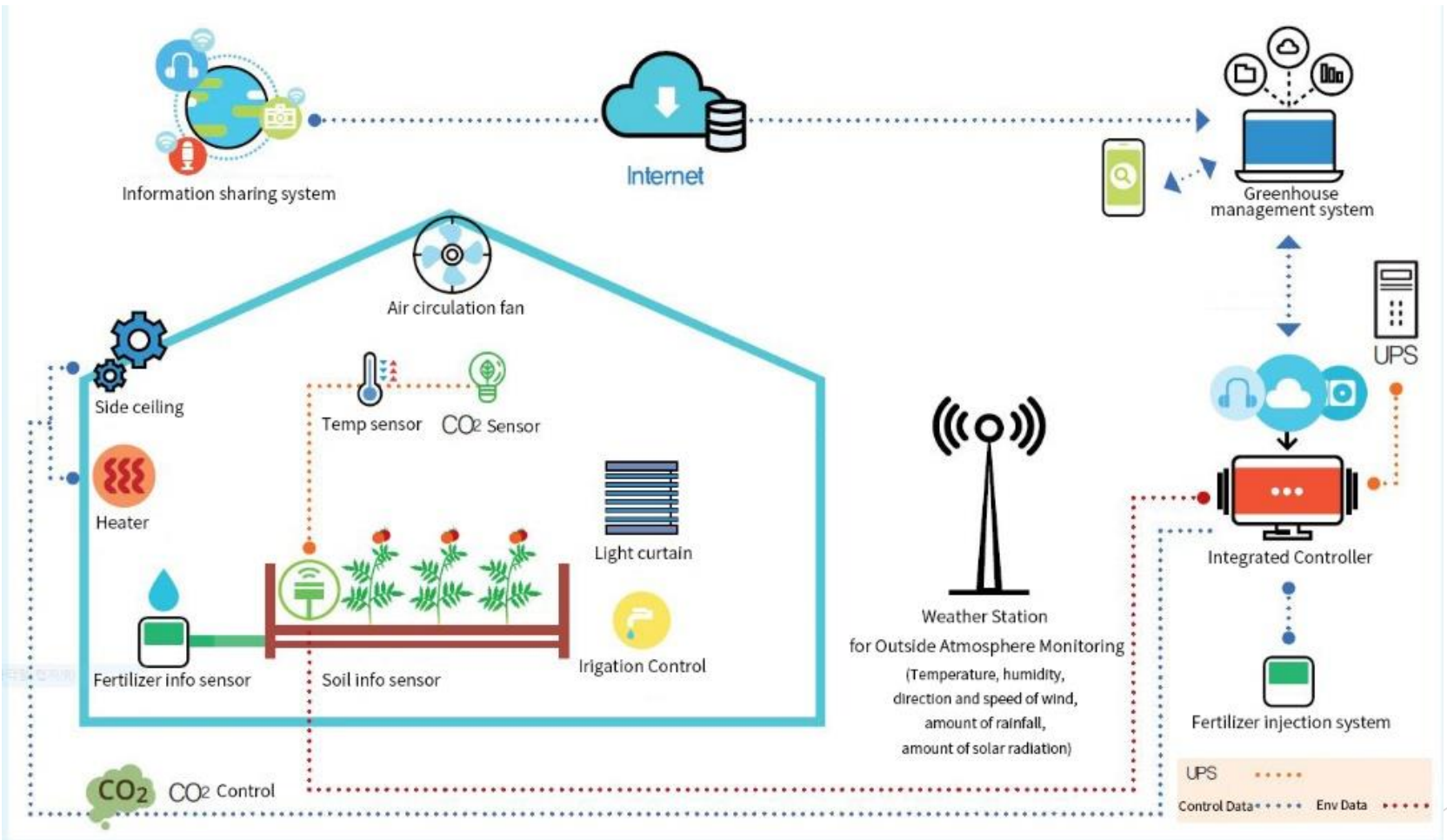
# Use case: Greenhouse automation

- LoRa-based sensor IO controller can accommodate various sensors to collect environmental data from and send to the integrated controller
- Can have temperature sensor, humidity sensor, wind direction and speed sensor, CO2 sensor, rainfall detection sensor, solar radiation sensor, soil moisture sensor, soil temperature sensor etc.



[From Best Practices of smart farming 2019, MAFRA]

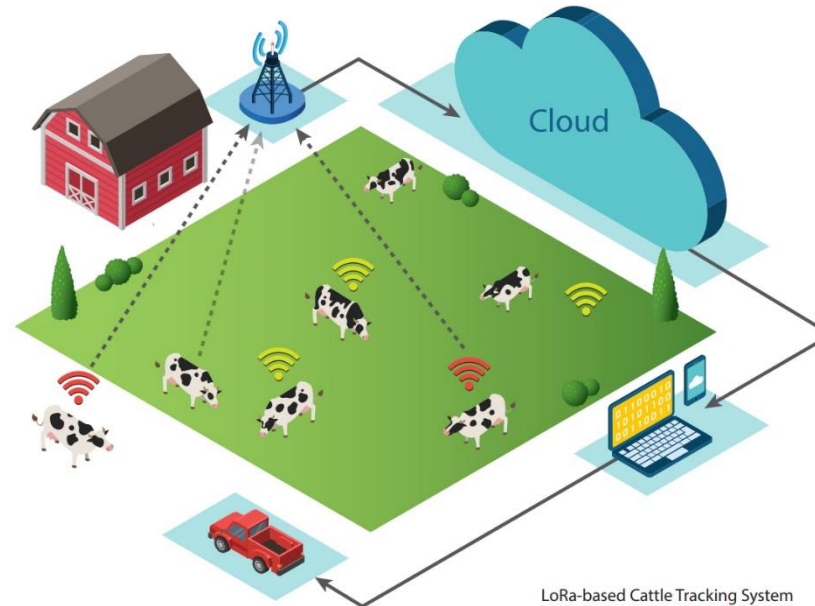
# Use case: Greenhouse automation



# Use case: Livestock tracking

- Ranchers can use technology to enhance and simplify their operations while they continue to focus on their financial growth.
- Various sensors are coming into the market including the one that can measure cow's body temperature, head movement and general mobility, etc.

[From Semtech's LoRa Whitepaper]



# Thank you

For more details, please feel free to contact me at [daniel.yoon@sjsolutech.com](mailto:daniel.yoon@sjsolutech.com)