

Sugo.

# LORA Communication-based

# **Data Acquisition and**

# **Wireless Irrigation Control**

# **System Solutions**



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# Chapter 1 Project Overview

# **Project Background**

China is a large agricultural country, and farming is the most widespread planting method in traditional agriculture in China. Based on the wide distribution of agricultural fields, high labor cost, long time consuming, crippling and untimely collection of farming information, the emergence of new IoT planting has made traditional agriculture begin to transform to precision agriculture and smart agriculture.

The traditional farmland environment management system has a lot of cable laying, cable exposure, long communication lines and other problems, thus leading to time-consuming and power-consuming networking, weak anti-interference ability and construction difficulties. With the rapid development of electronic technology and wireless communication technology, long-range wireless data transmission is also used in agricultural production. At present, most of the agricultural environment monitoring using ZigBee, WiFi and other wireless communication technology, but in the face of the vast territory, the distribution is not concentrated, the natural environment of agricultural applications, its communication distance, power consumption, anti-interference and network scale limitations. LORA can spread farther than other wireless methods with the same power consumption, realizing the



unification of low power consumption and long distance, and expanding the communication distance 3-5 times than traditional wireless communication RF with the same power consumption, which can be applied in agricultural field management to effectively save manpower and material resources and realize remote intelligent management in agriculture.

# **Construction Goals**

The general goal of the construction of data collection and wireless irrigation control system solution based on LORA network communication is to achieve intelligent management of agricultural production by using LORA wireless transmission technology to remotely monitor the soil moisture and meteorological environment closely related to crop growth, remotely and intelligently control the field irrigation solenoid valve, and realize remote and precise irrigation, in response to the wide distribution of agricultural fields, many monitoring points, and difficulties in wiring and power supply.

#### System architecture:

The whole solution combines the actual environment of agricultural fields, divides agricultural fields into several areas, adopts LORA wireless networking, multi-point, long-distance, distributed principle, and installs the corresponding equipment in different areas, the specific architecture is as follows. LORA collector, LORA wireless irrigation controller and LORA gateway use **LORA wireless networking communication**. The communication distance is up to



3km line-of-sight.

2. The LORA gateway device can communicate with 32 LORA controllers within the effective communication distance, and send wireless control commands for the LORA controllers to execute actions, while collecting 64 elements of environmental monitoring data.

**3.** The LORA gateway device uploads the collected environmental monitoring data to the monitoring software platform as 4G/RS485/Ethernet .

**4**. The whole system supports **remote control, timing control**, **automatic control** and other work modes, data in real time in the computer side, cell phone APP side views and other functions.

# 1.3 Design Principle

According to the environmental characteristics of agricultural fields, as well as the status and direction of the development of LORA wireless communication technology at home and abroad, and drawing on the experience of excellent domestic and foreign intelligent agricultural construction projects, with "advanced technology, practical system, reasonable structure, low cost and easy maintenance" as the guiding principle, the entire program follows the following principles.

• Low power consumption: Due to the working environment in which the sensor nodes need to be battery-powered, energy is limited to ensure the normal operation of the system hardware and proper transmission distance, and power consumption should be minimized and battery life extended.



• Long Distance: Due to the vast geographical area of farmland site, the limitation of communication distance and the influence of environmental factors such as obstacle blockage makes the transmission quality deteriorate and affects the data transmission distance, which requires wireless communication with strong anti-interference ability and long communication distance to improve the network coverage.

Easy to extend: Node data can be uploaded wirelessly to the gateway, while ensuring network capacity, which should reduce networking difficulties, improve networking efficiency, be flexible in use, and be able to expand to more application areas.

Reliable and stable: Only a stable running system can ensure the smooth operation of data transmission, and the role and significance of the monitoring system can be reflected. The overall solution has been designed with stability and reliability as the first goal at all levels, from solution architecture to product design.

Better system efficiency: The solution design is based on the importance of improving the overall operational efficiency of the system as much as possible, and choosing more suitable products and more suitable technical solutions to achieve it.

- Flexible hardware configuration: Users can upgrade and replace the controlled hardware devices at will without replacing the software.
- **Easier to use and maintain system:** Program design according to the project



construction rules and so on to choose the appropriate monitoring products and technical solutions to achieve, and strive to make the system easier to use



# **Chapter 2 Project Introduction**

# 2.1 Introduction to the LORA data acquisition and wireless irrigation control system

For the characteristics of LORA wireless communication, the solution of **data** acquisition and wireless irrigation control system based on LORA network communication uses the ultra-long-range, low-power LORA wireless transmission technology based on spread spectrum communication, intelligent sensor network technology, anti-interference technology and automation control technology. The traditional environmental data collection equipment is upgraded and transformed to build an intelligent and efficient monitoring and control management system, relying on various LORA sensor nodes and wireless communication networks deployed in the field to achieve intelligent sensing, intelligent alarm and intelligent analysis of the field environment, providing accurate monitoring, visual management and intelligent decision-making.

LORA data collection and wireless irrigation control system consists of LORA wireless collector, LORA wireless irrigation controller, LORA gateway and agricultural four conditions measurement and reporting platform. Through LORA wireless spread spectrum communication technology, the environmental temperature, humidity, illumination, soil moisture and other



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parameters collected by the LORA collector are transmitted to the **LORA gateway**, which is then uploaded to the cloud platform via 4G/Ethernet to analyze and process the environmental data information. The set threshold or human intervention operation is used as the control condition for irrigation equipment operation to achieve **intelligent irrigation**, which changes the previous problem about the contradiction between transmission distance and power consumption of farm management system.

The system adopts **LORA wireless networking technology**, which is very easy to deploy for construction, considerate in details and convenient for capacity expansion. The monitoring software platform is also very user-friendly, with friendly interface, simple operation and comprehensive functions, which is convenient for users to invest in the project according to their own needs and investment budget, and will not cause wasteful duplication of investment.

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# 2.2 System Topology



# 2.3 System Advantages

#### Concentration so professional

Our company has been focusing on environmental monitoring industry for many years, striving to provide customers with the best and most cost-effective environmental monitoring products and solutions, and is a well-known manufacturer in the environmental monitoring industry. We have a complete range of products and solutions, supplying 300+ regions and serving 110k+ customers worldwide.

#### LORA wireless transmission without wiring

Unlike traditional wired signal transmission, the system uses LORA wireless output method, which **eliminates the need for wiring** and enables **wireless connection** between measurement points and gateways, avoiding problems



such as massive cable laying, cable exposure, and long communication lines. The reason for using LORA wireless communication technology is its long distance data transmission capability, its communication distance can reach up to 3,000 meters of line-of-sight and can penetrate 3~4 floors indoors. LORA technology has the characteristics of **high performance**, **long distance**, **low power consumption, support for large-scale networking, ranging and positioning**, which makes this solution an ideal technology choice for large-scale promotion and application of IoT.

#### Intelligent Control

Support **remote manual control, automatic control, timing control** and other irrigation modes, and remotely realize the on/off control of the solenoid valve in the irrigation system. Meet the needs of accurate water control even in the case of unattended, saving manpower and water resources.

#### Provide a free cloud platform with powerful features

The platform adopts professional database, which is stable, reliable and easy to expand, supports software and hardware hierarchy, and supports multi-level user management authority. With multi-level alarm mode, it supports voice, SMS, email and on-site sound and light alarm mode. The cloud platform automatically collects the data collected by LORA gateway and displays it on the platform page through GPS map, list, icons and curves to meet the users' multi-dimensional and multi-level view of real-time monitoring information.



#### NFC configuration parameter

All devices in the system support the mobile phone "NFC configuration software" and equipment touch, fast and easy to configure parameters, read real-time values and equipment status, to improve the convenience of user access to data.

#### Unified management across regions

Through the establishment of a unified monitoring and management station, multiple devices and information distributed in different areas are fully digitalized and centrally monitored and managed to meet the unified supervision needs of the modernized measurement points.

#### Remote management

The system supports a variety of control methods on Web side and mobile APP side. It supports remote viewing of real-time data, online analysis of historical data, online viewing of operation records, remote issuance of commands to modify valve status and working mode, etc.

#### • With a wealth of automatic alarm mode

The system supports mobile phone, SMS, e-mail and other alarm methods, and has a variety of alarm methods can be selected to meet the needs of most users.

#### Wide range of application

The system can be widely used for environmental data collection and intelligent irrigation in agricultural fields, greenhouses, landscaping, scenic spots, etc.



#### High integration of software and hardware

The system hardware and software products according to the needs of industry development, keep pace with the times, constantly update the corresponding products, eliminate obsolete and redundant functions, and constantly integrate effective new functions, so that the product has a higher and higher degree of integration, to provide customers with more cost-effective products.

#### Unique features to fit customer needs

The LORA data acquisition and wireless irrigation control system integrates many of the more practical functions with customer requirements, and can also be customized to support them. From the customer's point of view of use, it makes application and maintenance as easy and hassle-free as possible.

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# **Chapter 3 Project Solution Design**

# **3.1 Environmental Data Collection Subsystem**

# 3.1.1 LORA Wireless Sensor

Various environmental data acquisition is mainly done by various LORA acquisition devices. Such as LORA temperature and humidity sensor, LORA soil sensor, LORA illumination sensor, LORA 485 sensor, etc. Using various sensors to collect air temperature and humidity, soil temperature and moisture, illumination, carbon dioxide and other environmental indicators of the farmland, and upload data to the monitoring software platform through the LORA gateway.

LORA sensors adopt LORA wireless communication protocol, communication not only to avoid mutual interference between measurement points in the process of signal transmission, but also to avoid the traditional wireless equipment communication transmission distance is too short, lack of penetration, high power consumption problems.

	Style	Device Name	Model
S	Cona 設施 定来 注 Cona State の にの の の の の の の の の の の の の の の の の の	LORA Temperature and Humidity Sensor	RS-WS-LORA-2-*

建大仁科	Shandong R	enke Control Technology Co.,Ltd.
	LORA Soil Sensor	RS-TR-LORA-2-*
	LORA Illuminance Sensor	RS-GZ-LORA-2-200000
	LORA 485 Sensor	RS-485-LORA-2

# 3.1.2 Functional Features

- Adopting LORA spread spectrum technology communication, the farthest communication distance with LORA gateway can reach up to 3,000 meters line-of-sight and can penetrate 3-4 walls.
- Built-in battery can be replaced, universal 3.6V lithium sub-battery, 5min upload once data can be used continuously for 3 years.
- It can monitor its own power, signal and real-time data and upload it

through LORA wireless communication.

- IP65 protection level for long-term outdoor use.
- LORA 485 sensor can connect all of our RS485 type transmitters (CO2, wind speed and direction, solar radiation, rainfall, etc.) to the collector via the 485 bus. Up to four 485 type devices can be connected and the data can be



uploaded to the LORA gateway in real time.



# **3.2 Wireless Irrigation Control Subsystem**

The monitoring software will analyze the soil water requirement through the data collected and uploaded by each sensor, and then send wireless control commands to the LORA wireless irrigation controller through the LORA gateway to control the solenoid valve of the relevant node to water automatically and stop watering when the set threshold value is reached. It supports a variety of irrigation control modes such as remote manual control, automatic control and timing control, realizing the irrigation system to open or close the valve automatically according to the remote command,



so as to control the irrigation pipeline, satisfying the demand of accurate water control even in the unattended situation and saving human resources; in addition, the soil moisture value can be collected through our network type collection terminal and uploaded to the back-office system, so that different watering strategies can be set according to the different requirements of crops for watering, realizing personalized watering and saving water resources.

Style	Device Name	Model
	LORA Wireless Irrigation Controller	RS-WIC-*

## 3.2.1 LORA Wireless Irrigation Controller

LORA wireless irrigation controller (RS-WIC-\*) is a new type of valve

controller developed by our company based on LORA wireless spread

spectrum communication technology. The product shell is strong, waterproof,

anti-theft, adopting LORA wireless communication technology, the

communication distance can reach up to 3000 meters, through the pulse or

relay output signal to control the irrigation valve switch, with our LORA gateway

it can be provided with our company's pulse valve to complete the



platform-based remote manual, automatic, timing open/close remote control

functions, to achieve intelligent linkage of various systems, accurate irrigation.



### **3.2.2 Functional Features**

- Adopting LORA wireless spread spectrum communication technology, the transmission distance can be up to 3,000m line-of-sight.
- It can be used with LORA gateway to achieve manual, automatic and timed operation on the platform.
- Battery power supply and 10~30V DC wide voltage range power supply are available.
- Battery-powered for 3-4 times daily control and 3-4 years of life.
- The shell is strong, waterproof and anti-theft.
- Uploads its own power, signal, and real-time data via LORA wireless communication.



It can be configured by mobile phone configuration software "touch NFC configuration", read the controller real-time data, valve switch test, etc.

Convenient and fast.

■ IP65 protection for outdoor use.

## **3.2.3 Technical Parameters**

	Parameter Name	Range or Interface
	Communication Method	Lora Spread Spectrum Communication
	Maximum Communication	Sight Distance 3000m
	Distance	
	Relay Output Load	3A 30V-DC/255V-AC
	Capacity (Optional)	S
	Pulse Output (Optional)	±9V (Duration: 20ms/80ms)
	Power Supply (Optional)	DC10-30V or lithium sub-battery power
	Control Response Time	<2S
2		NFC, Neutral configuration software
Dev	Device Configuration	available
	Protection Level	IP65



## 3.3 LORA Gateway

### **3.3.1 Product Overview**

Style	Device Name	Model	
	LORA Gateway	RS-LG-100/200-*	2

LORA Gateway (RS-LG-100/200-\*) is a product launched by our company in order to solve the use environment of agricultural fields, orchards, medicine gardens, and parks with difficult power supply, vast areas, high wiring costs and high maintenance costs. Using LORA communication technology, data can be uploaded to the agricultural four-factor measurement and reporting platform in real time via Ethernet port, 4G wireless and 485 wired.

# 3.3.2 Functional Features

- DC 10~30V wide voltage power supply. Field can be powered by power adapter or solar power system.
- Metal sheet metal shell with self-shielding, high anti-interference capability and more stable operation on site.
- With communication and operation indicators, you can easily determine equipment problems on site.

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- Adopt LORA spread spectrum communication technology, multi-channel communication, enhance link communication stability, increase penetration and transmission capability.
- LORA communication distance can reach up to 3000m line-of-sight and can penetrate 3~4 floors indoors.
- With our LORA wireless irrigation controller, the control response can be achieved within 2S by switching the valve on and off.
- Up to 32 LORA measurement points and 32 LORA wireless irrigation controllers can be connected to our company at the same time.
- The communication process uses a unique encryption technology to ensure that it is not listened to, ensuring reliable control and eliminating false actions.
- The device has three different data upload methods, Ethernet, 4G and RS485, which users can choose according to their needs.
- With remote upgrade function, the function can be customized on site for remote upgrade.
- With 1 RJ45 network port for uploading monitoring data to remote monitoring software platform.
- With 1 multi-functional 4G communication interface, simply insert a mobile phone card to upload data to the remote monitoring software platform.
- With 1 Modbus-RTU slave interface for external monitoring host, PLC, configuration screen or configuration software.



# **3.3.3 Technical Parameters**

Parameter Name	Range or Interface	Description
Power Supply	DC 10~30V	DC wide voltage power supply
Power		
Consumption	ĨW	
		Using the neutral phone APP
Device	NFC	"Touch NFC Configuration" to
Configuration		configure the gateway
		parameters
		Uploading data through the
	RJ45 Network Port	network port (ETH Only)
	NO NO	
	4G	Upload data via 4G (4G Only)
Communication	RS-485 Slave	Data upload via RS485
	Interface	
3ndon's		Communication with LORA
		measurement points by LORA
	Communication	communication
Data Upload	5-65535 S	Default 20S
Interval		



			Outdoor open area gateway and	
	LORA	Indoor penetration	temperature and humidity	
		of 4 walls or 3	measurement point	
		floors	communication distance can	
	Distance		reach more than 3000 meters	5
	Distance	$O_{\text{man}} \wedge r_{\text{max}} > 2000$	Interior penetration of 4 common	
		motors	walls or 3-story concrete floor	
		meters	slabs	
S		Renke		

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# **Chapter 4 Conclusion**

The solution of data acquisition and wireless irrigation control system based on LORA networking communication realizes real-time acquisition, monitoring and remote control of environmental parameters of agricultural planting sites based on ultra-long-range and low-power LORA wireless transmission technology of wireless spread spectrum communication. It has the advantages of long communication distance, high stability, low cost and easy construction, and can be widely used for wide-range information collection and remote control in agricultural fields, greenhouse, landscaping and other fields, with broad shandono application prospects.