The implementation of the IOT in agriculture industry in china

Wu Yin
Wissea Electronic Technoloyg
2017-11-02

The situation of agricultural development

- The existing domestic greenhouse planting mode:

  extensive cultivation, according to the farmers' personal experience

- Crop growth environment relies mainly on the sensory experience, rather than precise and reliable quantitative data, successful experience of planting is not easy to summarize and replication

- Totally dependent on manual control process, unable to supervise and control the process.especially in scientific research institutions and large-scale planting base, for example, greenhouse planting is often hire migrant workers, because of the lack of effective means of information technology, makes difficult to control the quality of their work.

The IoT and modern agriculture combining site

Traditional agriculture

- The farmer gets the farmland information is limited, mainly through the senses, the process is time-consuming, but not in real time
- Agricultural production mainly rely on human, livestock, machinery, large-scale production capacity is low, and lack of unified standards and procedures

Iot agriculture

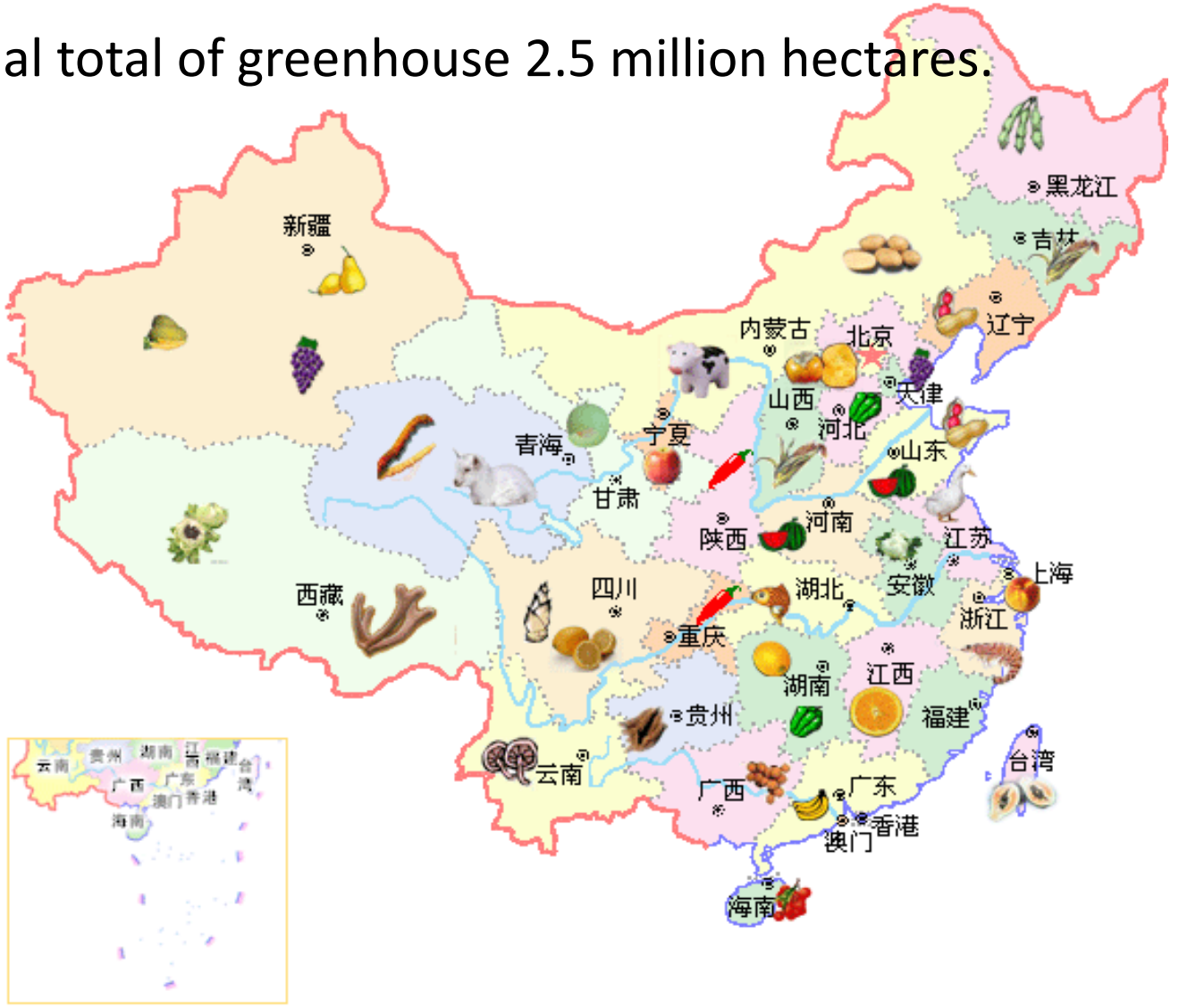
- Using sensor network can quickly obtain farmland environment data, real-time and accurate
- Sensor network to collect information is transmitted to the background processing center, after analysis can be precise, large-scale, automation management and control

Market Overview

- The development of China's agriculture has been from the manual agriculture gradually transition to a mechanical agriculture, and gradually realize the ndustrialization of agriculture
- The application of information technology for the development of modern agriculture, intelligent agriculture inject new itality
- Intelligent, networked, digitized become the main features of a new round of agricultural infrastructure

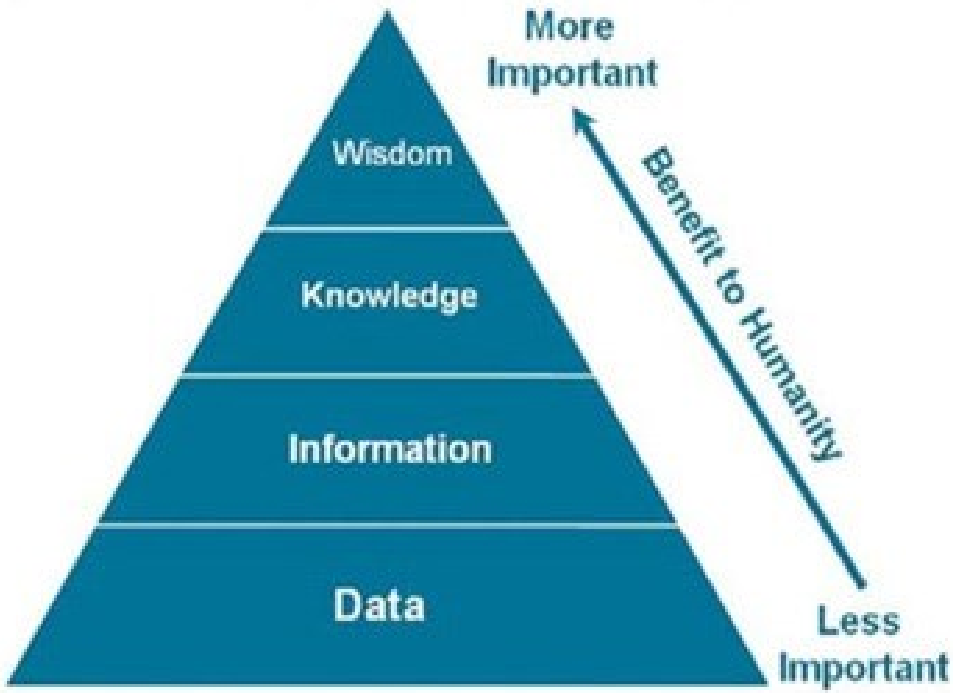
Analysis of the market capacity

- The greenhouse,for example: the national total of greenhouse 2.5 million hectares.
- 2000 hectares in greenhouse was large.
- The demonstration garden,for example: there are 5000 large demonstration base.
- Farms,for example: only around Beijing has 20000 poultry production base.



The structure and principle of IoT agricultural

- Agriculture greenhouse production environment measurement and control system is made up of terminal link, business link and M2M support platform.
- Wire sensors can join with communication terminal directly, and then communicate with M2M support platform. Wireless sensors can communicate the M2M support platform through Radio Frequency.
- Operation management is charge of the service support platform, and the agriculture production monitoring system can get the greenhouse real time data which can send to the mobile terminal through wireless gateway.



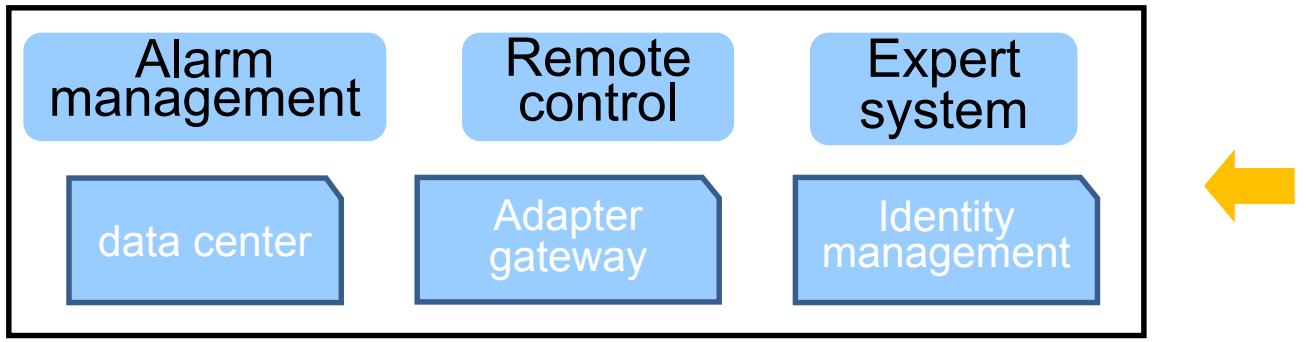
The structure and principle of IoT agricultural

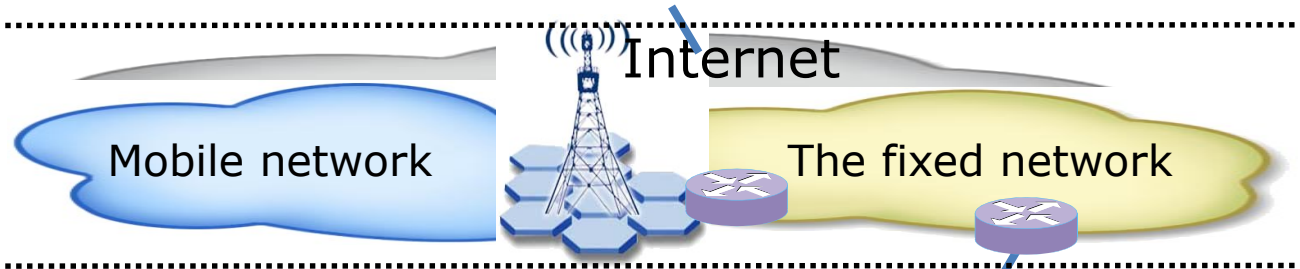

Regulation

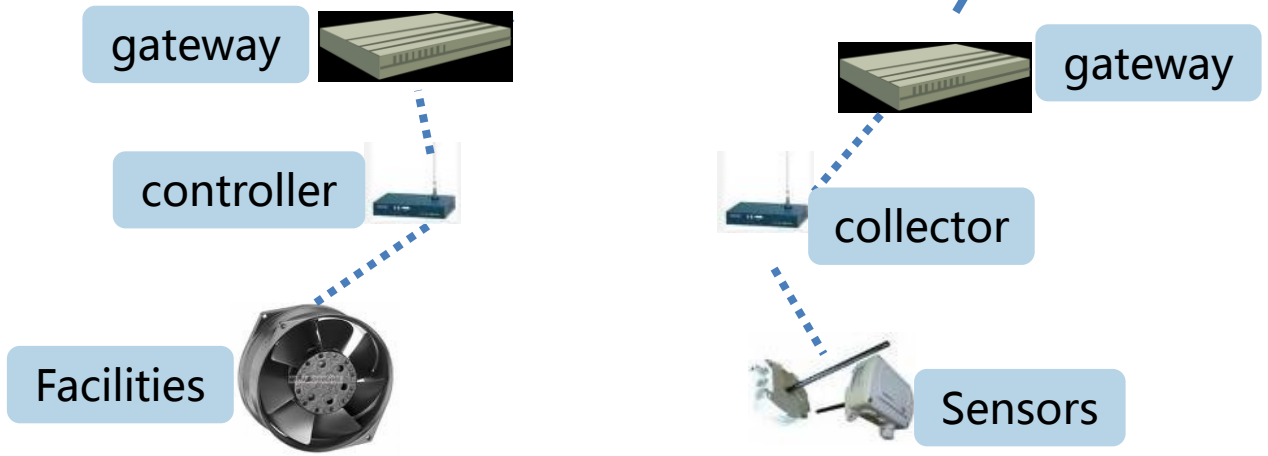

irrigation


storage


raceability

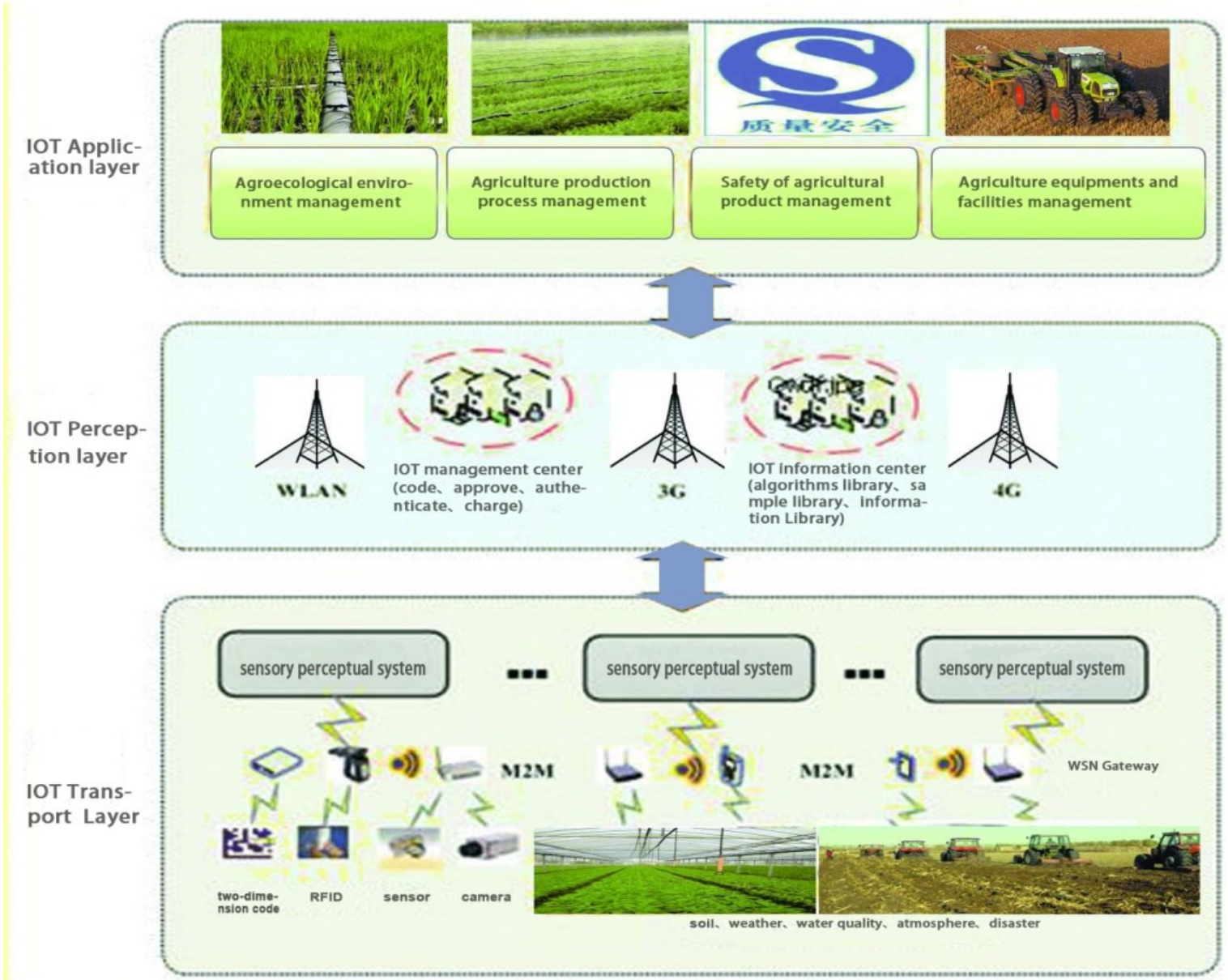






- ✓ Personalized portal
- ✓ Common service platform
- ✓ Communication service + information operations
- ✓ The convergence of fixed and mobile Internet capabilities

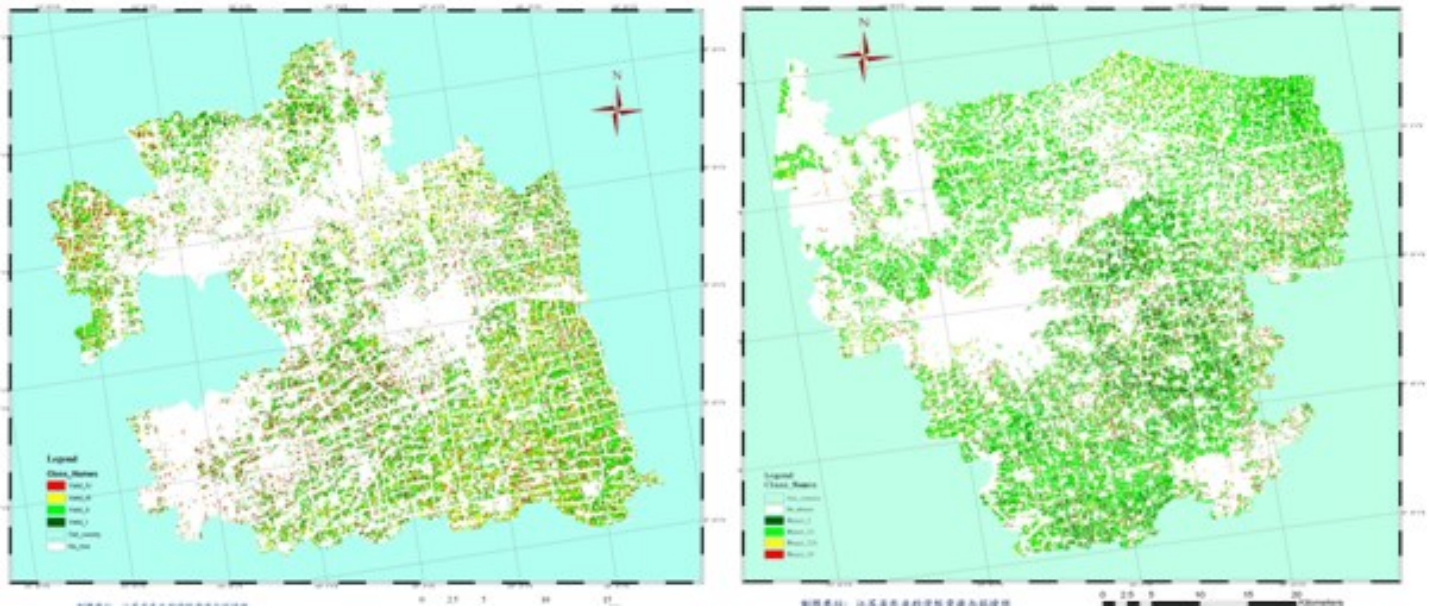
Standardization of the underlying sensor and controller interface, support hierarchical domain networking


IOT Applic-ation layer
Agroecological enviro-nment management
Agriculture production process management
质量安全
Safety of agricultural product management
Agriculture equipments and facilities management
IOT Percep-tion layer
WLAN
IOT management center (code、approve、authe-nticate、charge)
3G
IOT information center (algorithms library、sa mple library、informa-tion Library)
4G
IOT Trans-port Layer
sensory perceptual system
sensory perceptual system
sensory perceptual system
M2M
M2M
WSN Gateway
two-dime-nsion code
RFID
sensor
camera
soil、weather、water quality、atmosphere、disaster

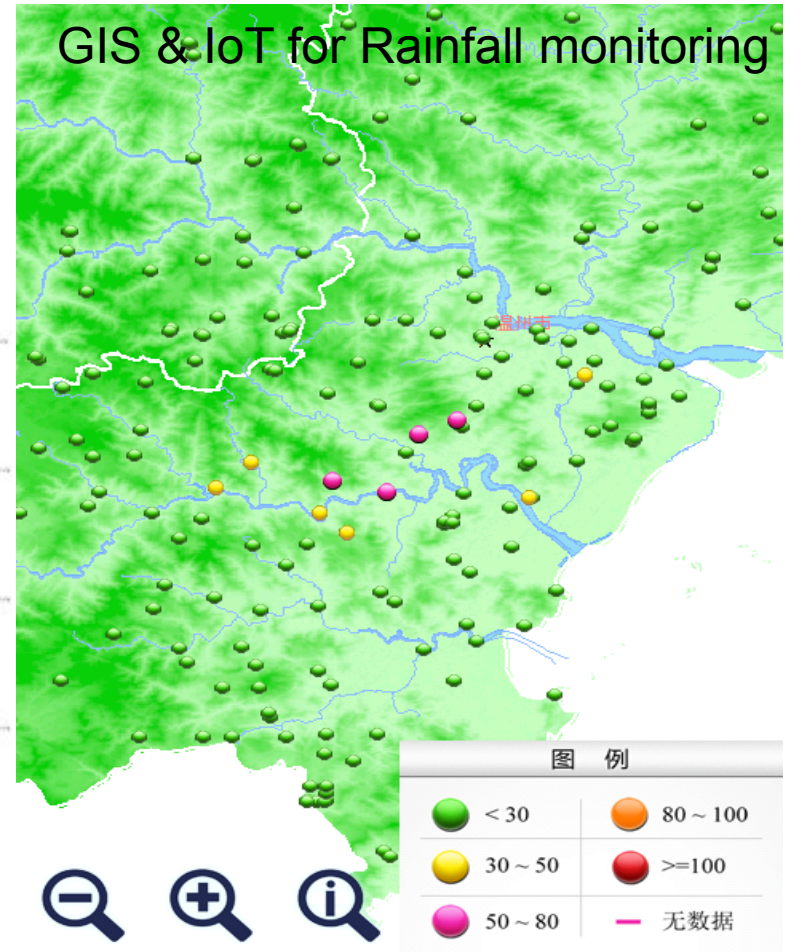
Technical innovations

◆1.GIS and IOT technology applied in large-scale agriculture

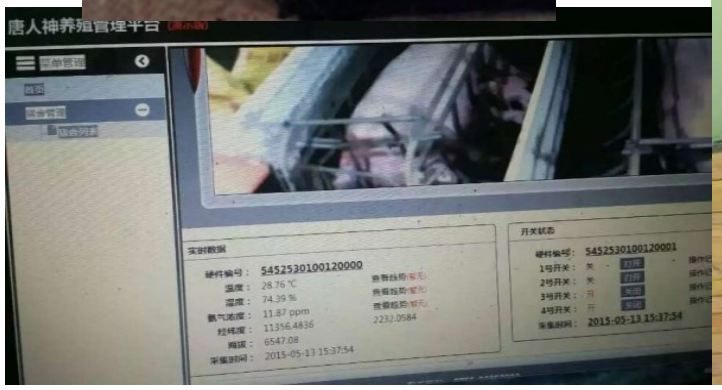
GIS technology itself has strong statistics, analysis function, has a good image demonstration function, but implementation is the premise of vast amounts of test data, we use the scale distribution of the Internet of sensor nodes make up a short board.

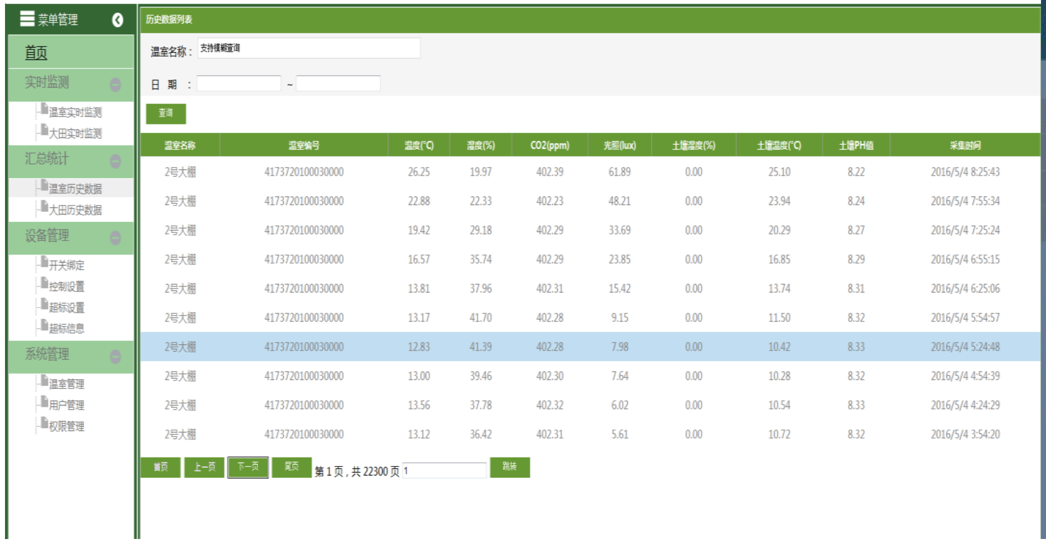


IoT provide accurate data for GIS



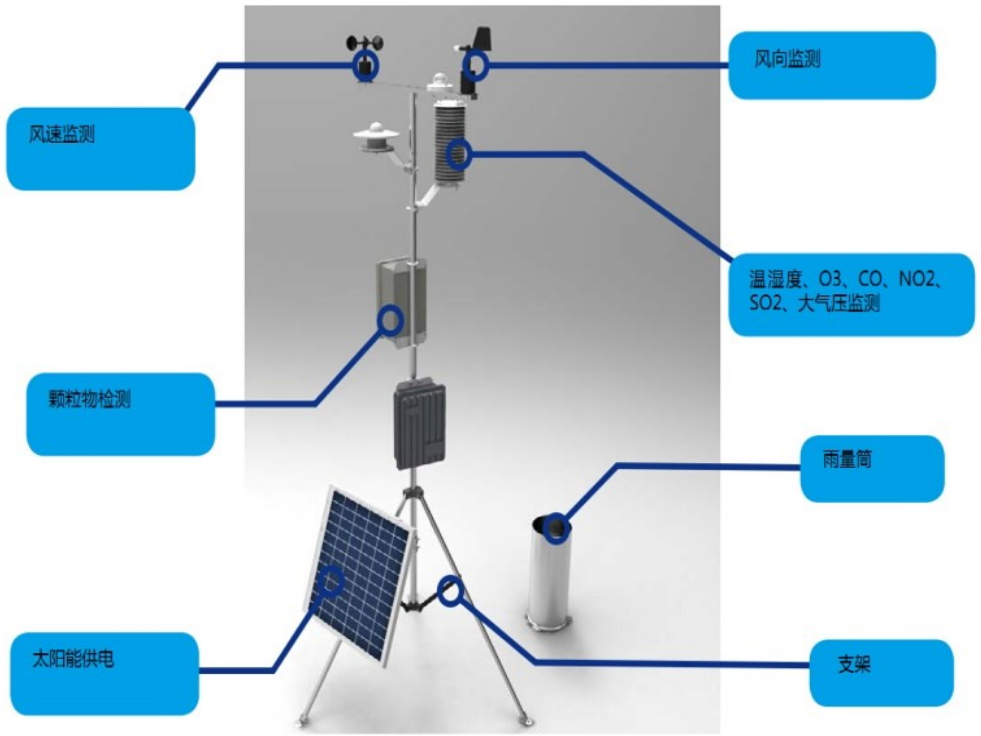
IOT application in farming and poultry



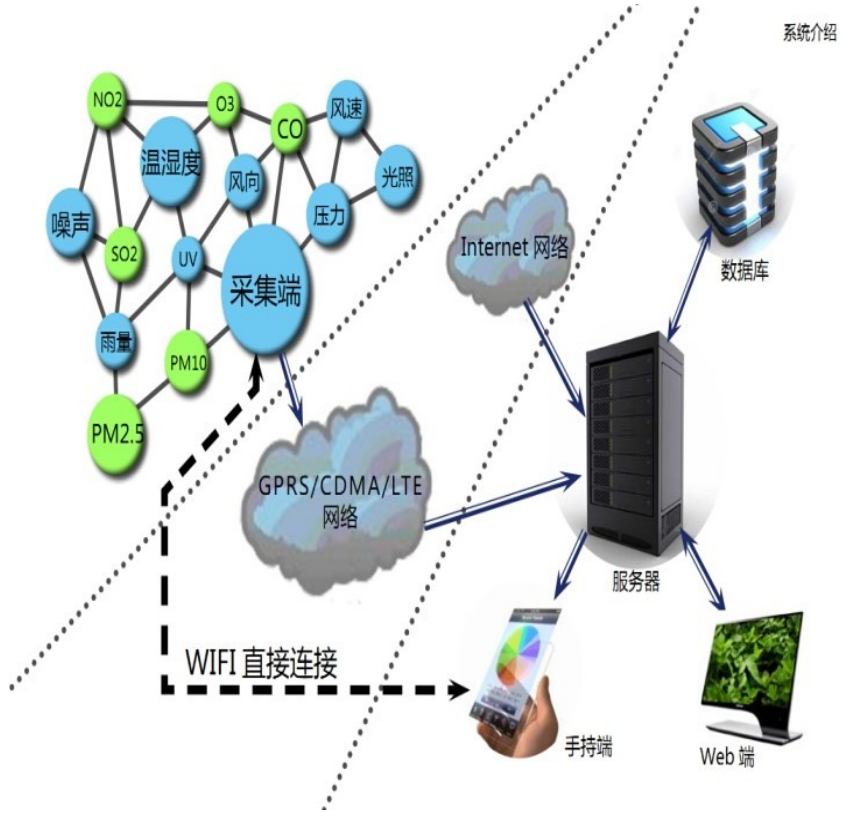


温室名称	温室编号	温度(℃)	湿度(%)	CO2(ppm)	光照(lux)	土壤湿度(%)	土壤温度(℃)	土壤PH值	采集时间
2号大棚	4173720100030000	26.25	19.97	402.39	61.89	0.00	25.10	8.22	2016/5/4 8:25:43
2号大棚	4173720100030000	22.88	22.33	402.23	48.21	0.00	23.94	8.24	2016/5/4 7:55:34
2号大棚	4173720100030000	19.42	29.18	402.29	33.69	0.00	20.29	8.27	2016/5/4 7:25:24
2号大棚	4173720100030000	16.57	35.74	402.29	23.85	0.00	16.85	8.29	2016/5/4 6:55:15
2号大棚	4173720100030000	13.81	37.96	402.31	15.42	0.00	13.74	8.31	2016/5/4 6:25:06
2号大棚	4173720100030000	13.17	41.70	402.28	9.15	0.00	11.50	8.32	2016/5/4 5:54:57
2号大棚	4173720100030000	12.83	41.39	402.28	7.98	0.00	10.42	8.33	2016/5/4 5:24:48
2号大棚	4173720100030000	13.00	39.46	402.30	7.64	0.00	10.28	8.32	2016/5/4 4:54:39
2号大棚	4173720100030000	13.56	37.78	402.32	6.02	0.00	10.54	8.33	2016/5/4 4:24:29
2号大棚	4173720100030000	13.12	36.42	402.31	5.61	0.00	10.72	8.32	2016/5/4 3:54:20

功能结构分析


风速监测
风向监测
温湿度、O3、CO、NO2、SO2、大气压监测
颗粒物检测
雨量筒
太阳能供电
支架

系统介绍

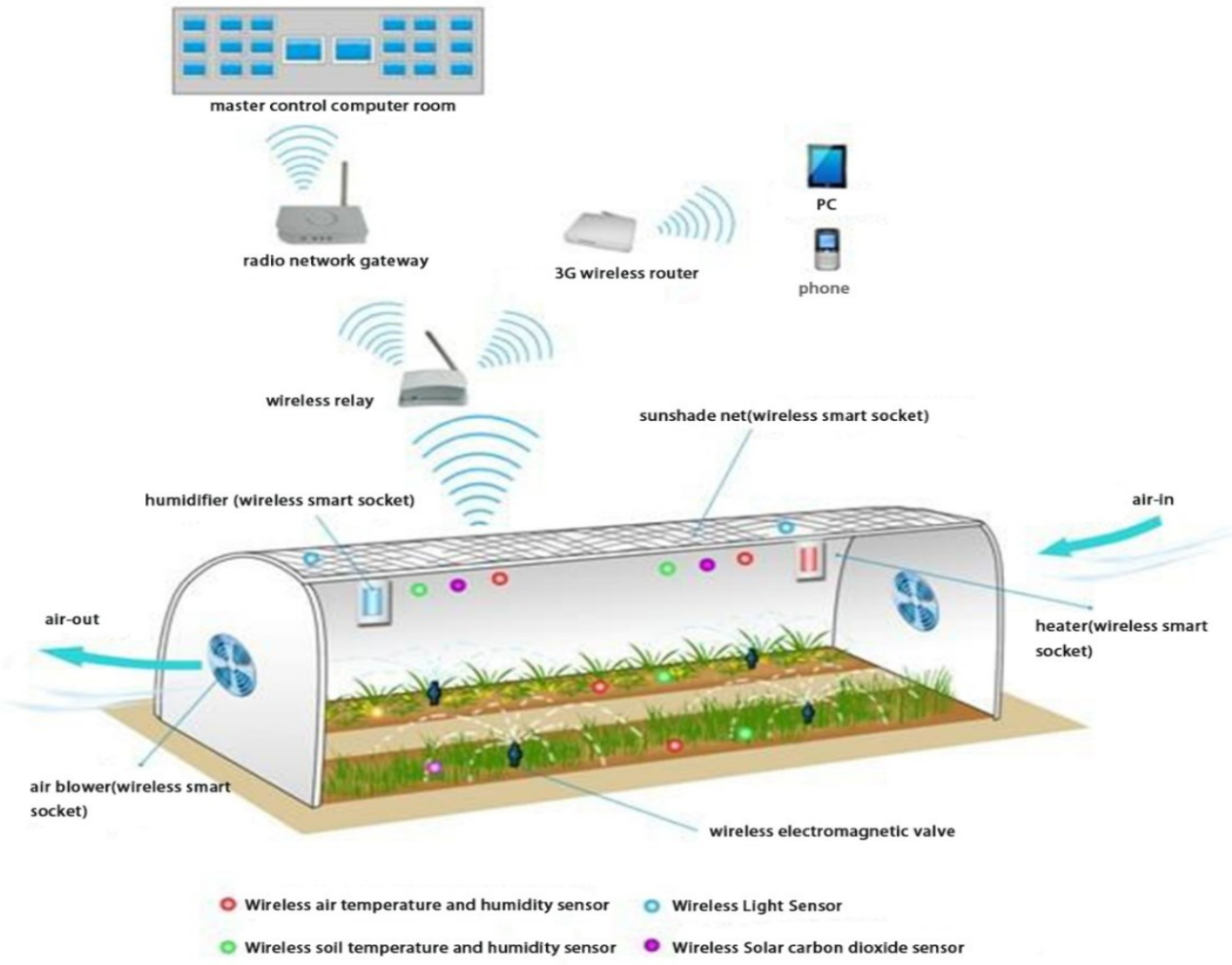

NO2
O3
CO
风速
温湿度
风向
光照
噪声
压力
SO2
UV
采集端
雨量
PM10
PM2.5
Internet 网络
数据库
GPRS/CDMA/LTE 网络
服务器
WIFI 直接连接
手持端
Web 端

Benefits Analysis

The expenses of Infrastructures of the IOT green-house with an area of 20000 square meters： .The annual cost of system operation and maintenance: 12,000 RMB.	
merits	Saving expenses
Through measuring related parameters by the IOT scheme， water resource can be saved significantly by accurate irrigation.	Compared to conventional irrigation, the IOT scheme can save water resource up to 67%.
Saving human resource expenses， i.e, reducing one management staff and one worker.	Saving human resource expenses of 50，000 RMB dollars annually.
Measuring mixed rate of integrated soil chemical fertilizer and water. Compared to conventional method, the farm IOT scheme can reduce waste of chemical fertilizer as well as soil pollution dramatically.	Saving chemical fertilizer expenses 3000 RMB dollars and increase fertilizer utilization rate up to 40% annually.
Improve green house live rate and reduce growth period as well as improve product volume significantly.	Farm live rate can be improved from 20% to 80%. growth period reduced up to 30%， production volume improved 7 to 10 times, respectively.
Improving labor efficiency significantly, reducing labor intensity, farmers. In addition, farmers no longer long time working inside farms, instead at home or in trip for farm management.	This application can get back the IOT investment and gain profits within one year.

IOT application --revolution

Environment surveillance



Realtime surveillance

Soil information analysis

Alarm analysis

Remote device control

Policy support

Sensor layer | Transmission layer | Processing layer | Application layer

Environment surveillance

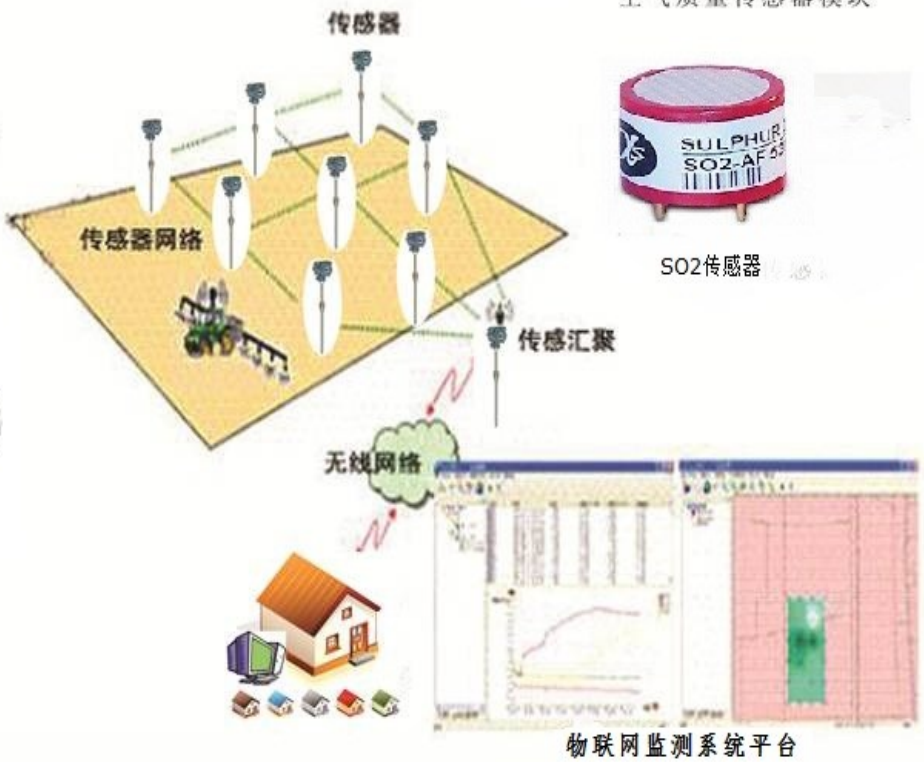

co2传感器


光照度传感器


噪声传感器


空气质量传感器模块


温湿度传感器



SO2传感器


风速传感器

Realtime surveillance

Fault alarm

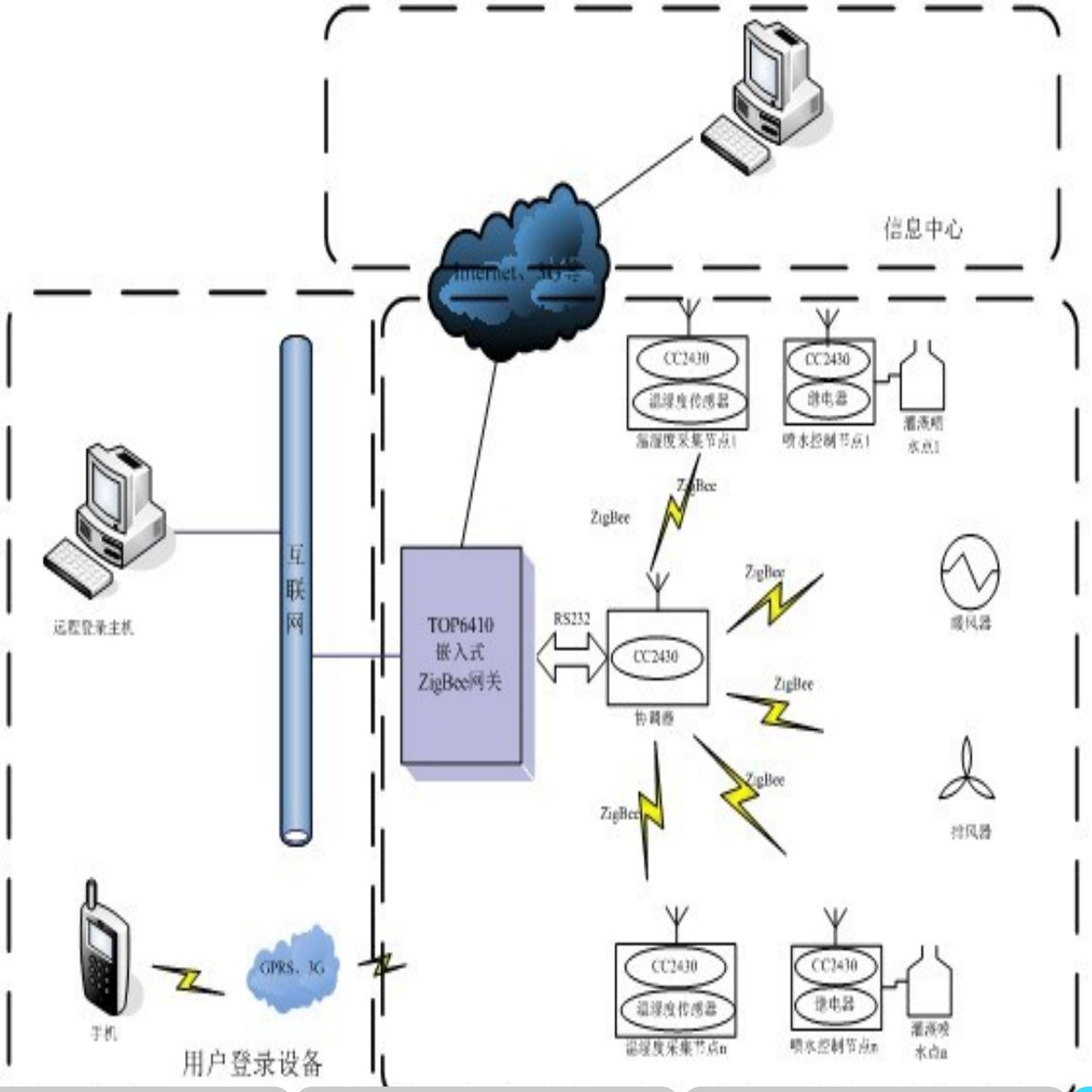
Soil information analysis

Automatic control

distributed management

Sensor layer | Transmission layer | Processing layer | Application layer | Display Layer

Green irrigation



Water calculation

Auto irrigation

Fault analysis

Smart management

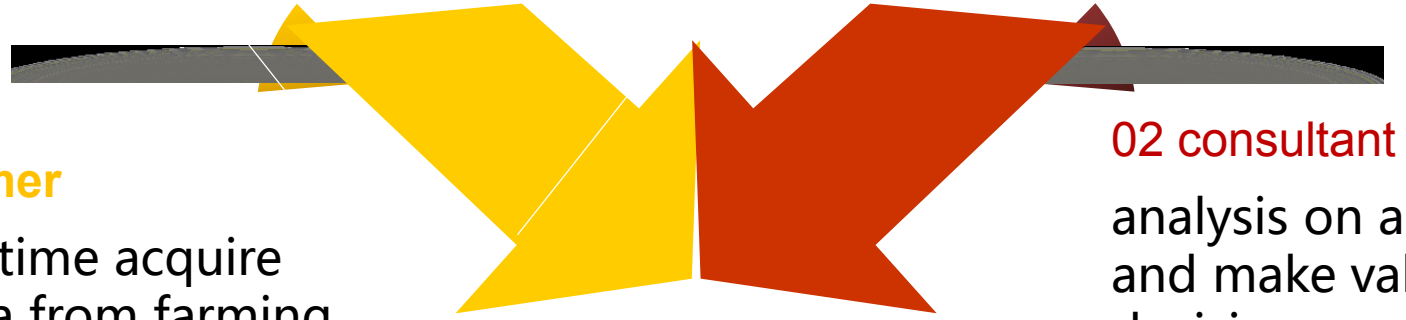
Sensor layer | Transmission layer | Processing layer | Application layer | Display Layer

mobile APP platform

realtime control

CAICT
中国信息通信研究院
China Academy of Information and Communications Technology

Sensor layer	Transmission layer	Processing layer	Application layer	Display layer



01
farmer

realtime acquire
data from farming

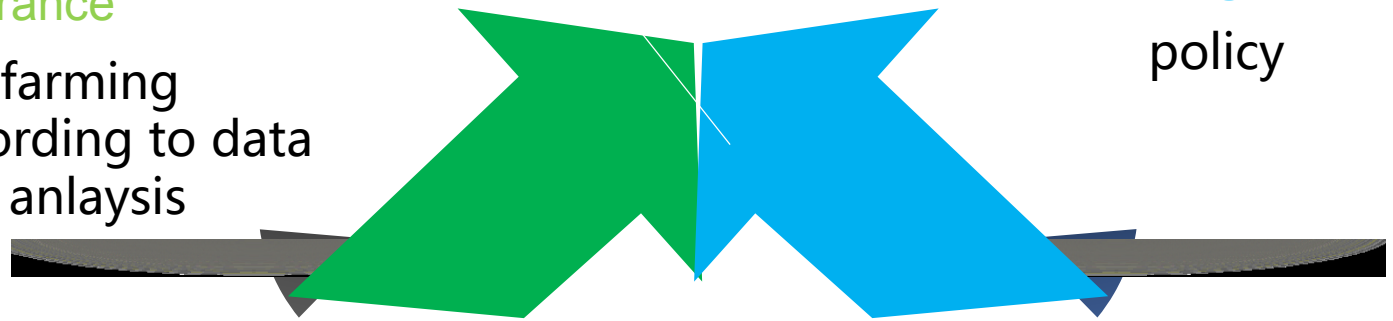
02 consultant

analysis on acqisited data
and make valuable
decision

realtime,dynamic,automatic
control,survillance

03 inverstment &
insurance

IOT farming
according to data
and anlaysis



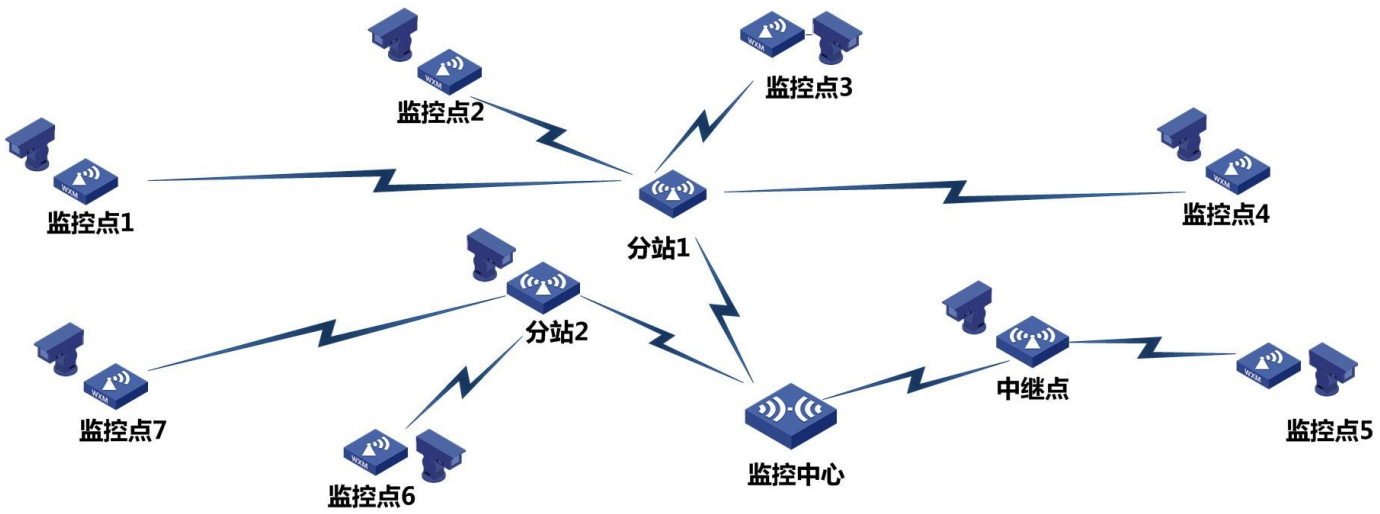
04 goverment

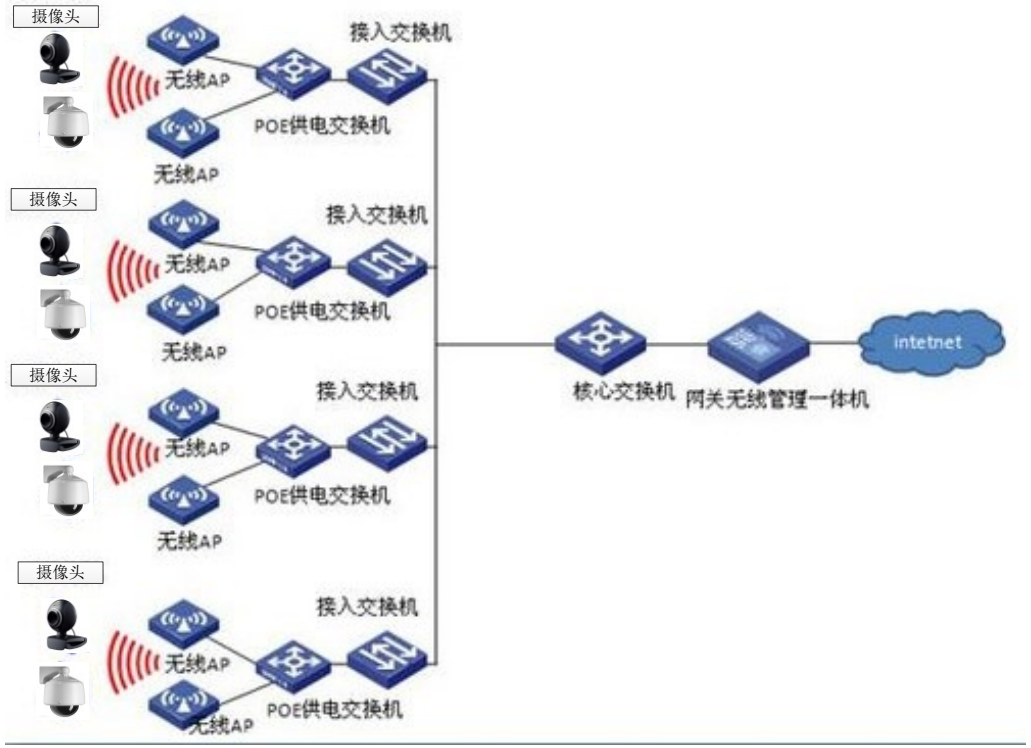
policy

Technical innovations

◆2.Point to multiple nodes of wireless video monitoring system（P-MP+Wlan）

wireless local-area network (WLAN) mesh networking technology, in addition to all adopt wireless communication, point to multi-point wireless technology, erference each other, thus it can be applied in agriculture.

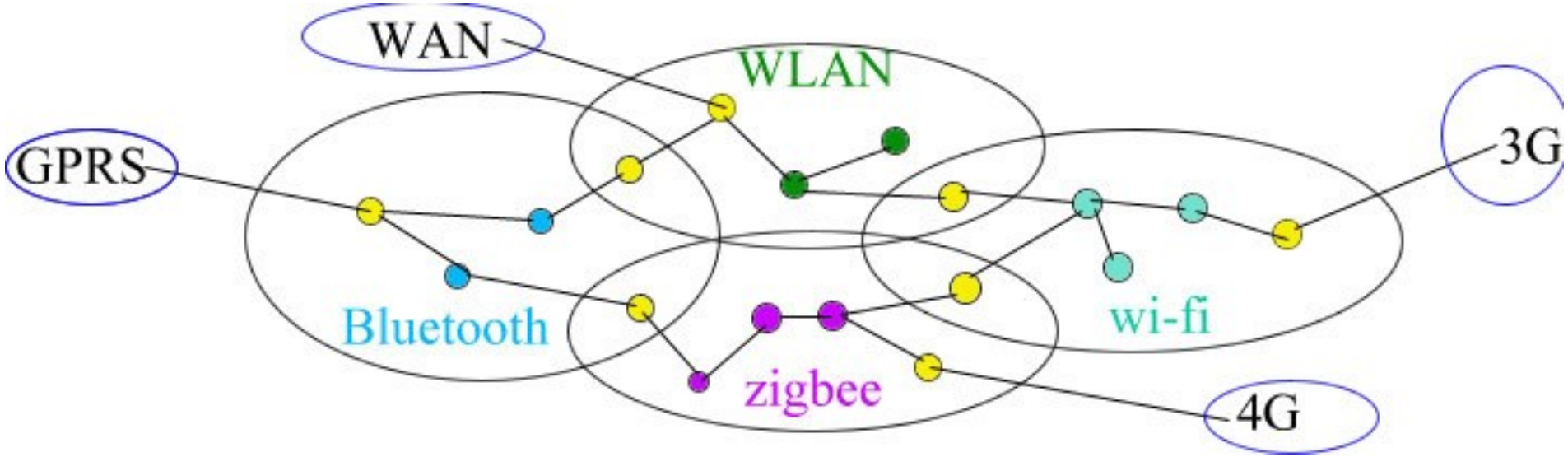




Technical innovations

◆3.Heterogeneous network and multiple modular fusion and efficient interface control

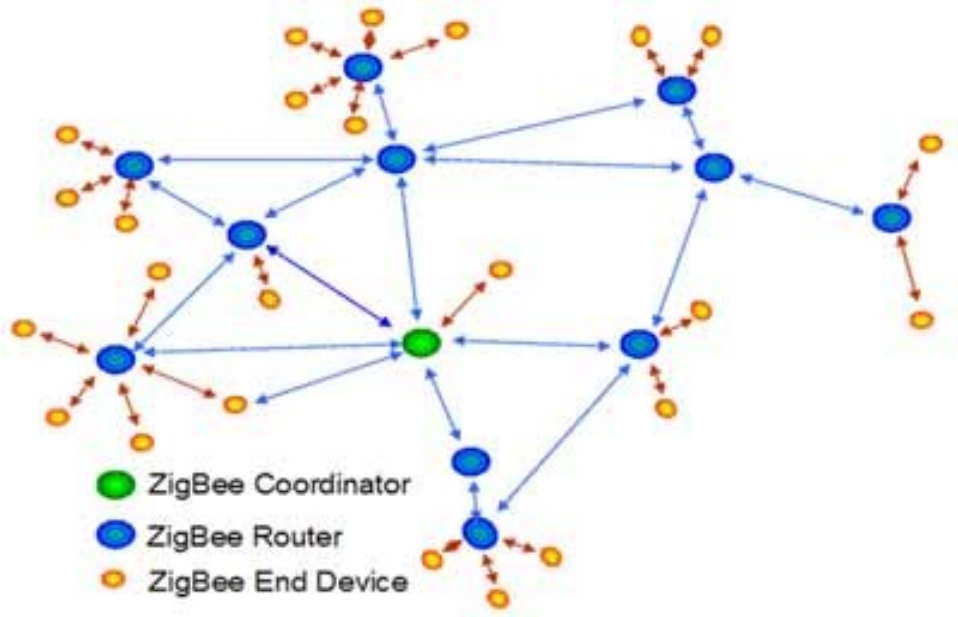
employ Zigbee,3G mobile communication,GPS,3D GIS,WSN mesh,i.e. wireless sensor network technology, breakthrough the limitation of time and place.



Technical innovations

◆4. Large-scale network nodes

Zigbee and Wlan, such as Zigbee network node in the low power consumption, cost, maximum transmission node number and stability on the indicators in the industry with strong competitiveness.



Large-scale network nodes

RHZ-WSN is a blend of sensors, embedded, distributed information processing, wireless communication, network security, intelligent control and a series of advanced technology of Internet of things technology platform.In the network security protocol, large-scale sensor networks node mobility management, network of self-organization, self-healing and system power consumption problem and a series of key technologies in the technological frontier.

Major function

- 1.Real-time data:

  Agricultural field, i.e temperature, humidity, light, soil moisture data network is passed to the data processing system for intelligence analysis and processing;

- 2.Real-time surveillance

  Users can watch anytime and anywhere through mobile terminal, i.e. PAD, handset or laptop to agriculture field actual images, remote monitoring of crop growth process

Real-time data and video to make managers more at ease.

Data collection

The video monitor

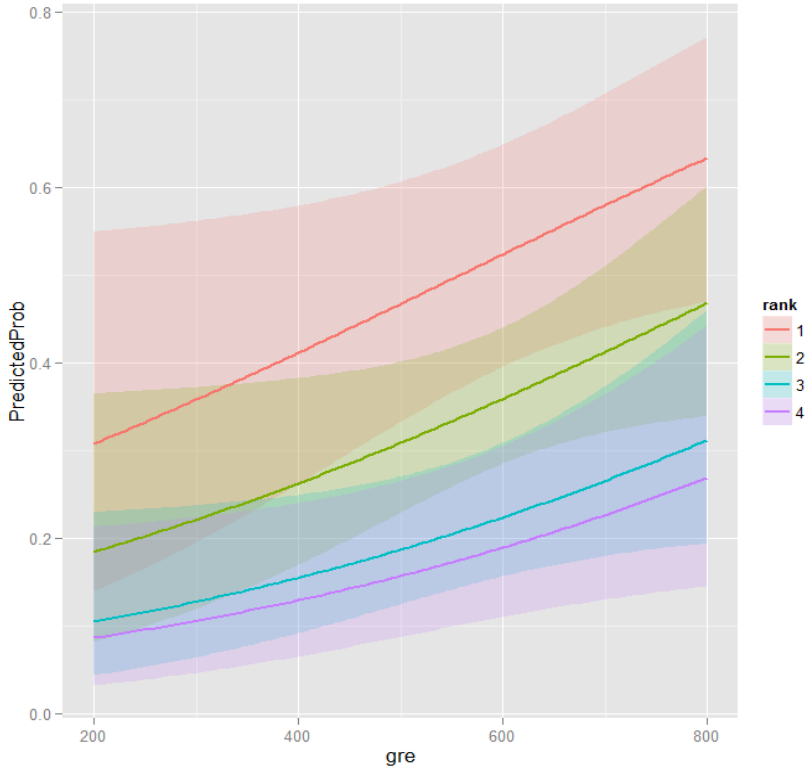
Major function

- 3.Data storage

  Based on historical data can be stored, form a knowledge base, at any time in processing and query;

- 4.Data analysis

  System through the intuitive form to when the data chart and spatial distribution, which can provide daily, monthly and other review as well as analysis.



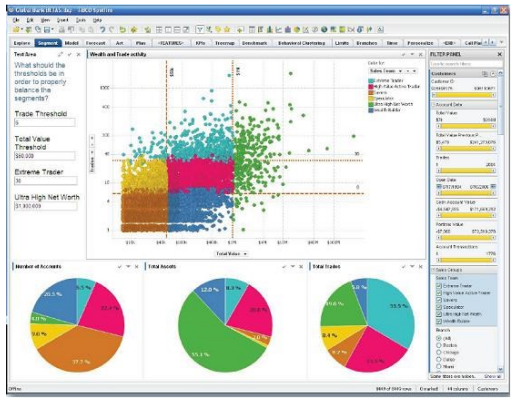
Major function

- 5. Remote control

  Users can at any time, anywhere, by any Internet terminal can be implemented to the agricultural field devices of all kinds of remote control switch;

- 6. Intelligent decision

  Platform system has self learning ability, according to expert system, user database, user settings, intelligent control on farm equipment.



A 10 hectares of vegetable greenhouse earnings

- Save manpower cost, one managers and four workers, costs RMB 360'000 Yuan per year.
- Improve work efficiency, reduce labor intensity, managers can not keep on farm, at home or on holiday can be carried out on farm management.
- Accurate irrigation in smart agriculture can help farms saving water supply up to 57% compared to conventional irrigation mode.
- Soil testing and fertilizer, fertilizer integration to reduce waste of fertilizer, improve utilization rate of 29%, save fertilizer cost RMB 98'000 Yuan per year.

(Trainer information)

Trainer: Yin Wu

E-mail: yinwu@wissea.com

Department: Wissea Electronic Technology

Address:

Photo：

(End Page)

中国信息通信研究院 http://www.caict.ac.cn