TEST Engineering & Management

July - August 2020
ISSN: 0193-4120 Page No. 5319 - 5324

Application of LoRa Multipoint Communication Protocol Based on CAD Preamble Detection in Industrial Internet of Things

ZuolingNiu[1,*]
[1]XI'an Traffic Engineering Institute, Xi'an, Shaanxi, China, 710300

Article Info
Volume 83
Page Number: 5319 - 5324
Publication Issue:
July - August 2020

Article History
Article Received: *25 April 2020*
Revised: *29 May 2020*
Accepted: *20 June 2020*
Publication: *28 August 2020*

Abstract

The design principles of the LoRa intelligent industrial production system in this paper are two-way, visual and controllable, green and intelligent. In the bottom-up transmission process, the collection node collects the relevant data of industrial production, transmits it to the LoRa base station through the LoRa ad hoc network and then sends it to the data management cloud platform through the WiFi/3G/4G interconnection network. The advantages of this system are not only Reflected in the low power consumption, high efficiency and anti-interference of LoRa technology, it also realizes the refined management of industrial production, which can effectively reduce the cost of industrial production and damage to the environment. This system includes two parts: automatic management and manual management. Among them, automatic management means that the sensors on the industrial production site can monitor the factors that affect planting and breeding in real time. When the data reported by the collection node is abnormal, the system will perform intelligent prevention and control. Manual management refers to the overall management of industrial production by industrial production workers through the suggestions provided by the industrial production expert system. The combination of manual management and automated management effectively reduces the management cost of industrial production.

Keywords: *Industry, Production, Internet of Things;*

1. Introduction

Many terminal devices in smart factories, such as mobile robots, are devices that have a certain random movement capability. Although they are fixed devices in engineering, they also produce different processing conditions in a period of time. The channel environment and service mode of these devices change with the movement of nodes. In intelligent engineering, the sensor network is very complicated. There are a large number of nodes. Different parameters are collected appropriately and information is divided into different priorities based on importance. The transmission of industrial data requires certain reliability and real-time performance. The effectiveness of data monitoring of the equipment is above 1S. In addition, there are thousands of sensors distributed in the Industrial Internet of Things, which always generate a large amount of data. The processing task of the Industrial Internet of Things is to collect information and then use advanced technologies such as data mining to extract effective information from it[1]. Wireless communication in the industrial field requires flexible deployment, low cost and easy maintenance and repair. Wireless communication provides wireless links and network topology structures for many smart devices and automation equipment. Under certain conditions, wireless communication can make up for the deficiencies of wired networks. In the wireless communication industry, nowadays, there is a link load adjustment algorithm designed for Bluetooth technology, which improves the

Published by: The Mattingley Publishing Co., Inc.

TEST Engineering & Management

July - August 2020
ISSN: 0193-4120 Page No. 5319 - 5324

measurement of communication quality. Some people have also proposed WiFi-based monitoring technology, which realizes the interconnection between wireless sensors and analysis terminals through WiFi. The past communication technology has met the needs of industrial development for a long time, but with the emergence of the Industrial Internet of Things, the past technology has been unable to meet the actual construction needs of the Industrial Internet of Things[2]. The Internet of things system is in the figure below.

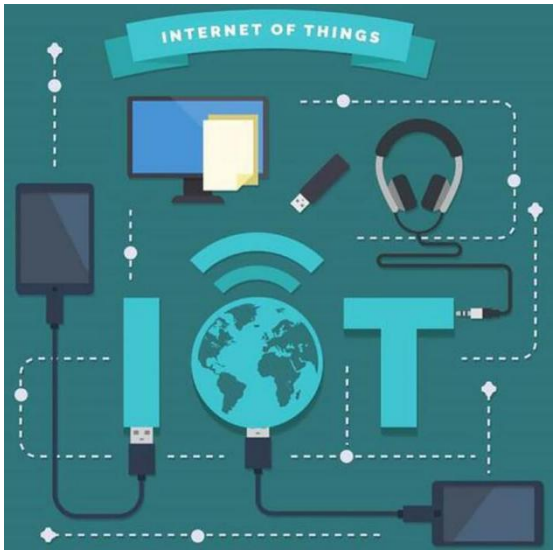

Figure1. Internet of things system.

With the rapid advancement of the industrial environment, industrialized assembly line production operations and industrial warehousing storage are moving towards a new era of Internet of Things. Billions of front-end devices and terminal products based on embedded technology have achieved seamless interconnection through wireless APs. Real-time data exchange and sharing with convenient short-range wireless communication technology. It is also based on this that the indoor high-precision positioning technology for the industrial Internet of Things is slowly being developed in the factory area to help people, materials, vehicles and visitors in the factory perform real-time high-precision positioning. Through this technology, the real-time situation in the production workshop and the storage plant is fully controlled, so as to achieve "expected, planned, organized and managed" personnel and material positioning control effects and through the real-time upload of personnel positioning data , Analyze personnel behavior data and give early warnings to possible risks, irregular operations, unreasonable behaviors and abnormal walking. The Internet of things management system is in the figure below.

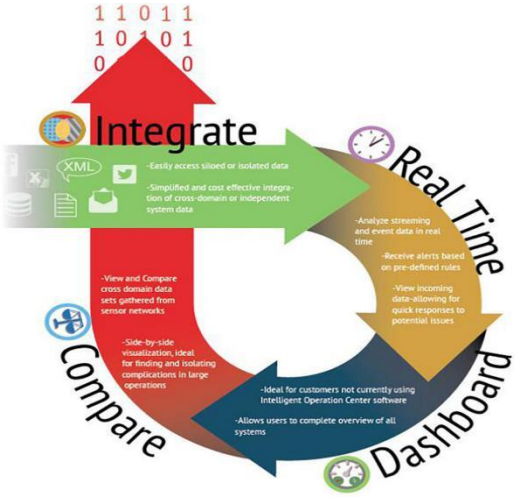

Figure2. Internet of things management system.

2. CAD inspection technology application

2.1. Application in production

The application of industrial Internet of Things CAD preamble detection technology in modern industry is first reflected in the industrial production process. Industrial production under the industrial Internet of Things CAD preamble detection technology can determine whether the equipment is in failure based on the state parameters of the equipment in different periods. Judge and forecast and then provide customers with better maintenance services. At the same time, based on a large amount of data collection on the industrial production site, these data can also be mined and then the shortcomings can be found and the production process can be optimized. In addition, the current industrial Internet of Things CAD preamble detection technology can monitor the surrounding environment, operators, machinery and equipment and safety status in real time during the industrial production process and then extract the shared element information in the production process in an all-round way. The

Published by: The Mattingley Publishing Co., Inc.

July - August 2020
ISSN: 0193-4120 Page No. 5319 - 5324

upgrading of the monitoring platform is also of great significance[3]. The Internet of things application is in the figure below.

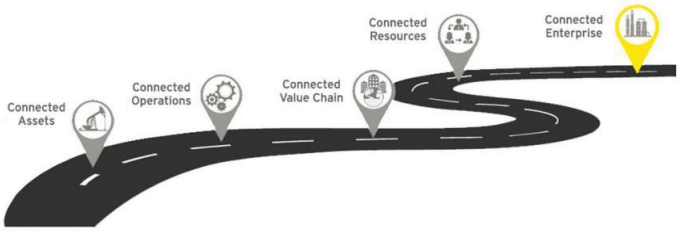

Figure3. Internet of things application.

2.2. Application in the supply chain

The application of industrial IoT CAD preamble detection technology in the industrial supply chain is mainly based on the implementation of IoT CAD preamble detection technology. Based on IoT CAD preamble detection technology, it can purchase, sell and sell industrial production raw materials, finished products and other objects. Real-time monitoring of inventory and other links and timely and effective control. Through the analysis of these real-time data, we can fully understand the supply of raw materials, price trends and other information and then can further optimize the supply chain management system of enterprise production, improve supply chain efficiency and reduce production costs. In addition, the intelligent logistics warehouse is also a typical application representative of industrial Internet of Things CAD leading code detection technology in modern industrial production and operation. Based on the industrial Internet of Things CAD leading code detection and recognition technology, it can monitor the warehouse in real time and record the entry and exit of items. Effective data such as library, inventory, selection and distribution and with the continuous expansion of these data will continue to improve the degree of intelligence of warehouse management, providing an important guarantee for the improvement of warehouse management efficiency in industrial production[4]. The Internet of things information system is in the figure below.

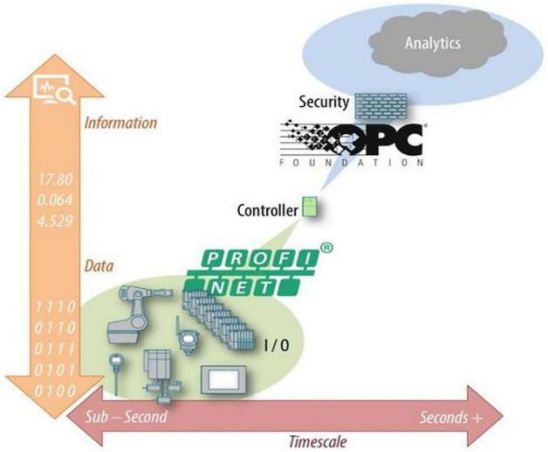

Figure4. Internet of things information system.

3. LoRa multipoint protocol analysis

3.1. Protocol overview

The system mainly relies on LoRa wireless communication technology for data acquisition communication and irrigation command communication in industrial production. LoRa is a kind of LPWAN (low power wide area network) technology. It is an ultra-long-distance wireless transmission scheme based on spread spectrum technology adopted and promoted by Semtech in the United States. Its biggest feature is long transmission distance, low working power consumption, There are many network nodes. Compared with wireless communication technologies such as ZigBee and WiFi, LoRa combines the remarkable characteristics of ultra-long-distance transmission and low power consumption. It combines spread spectrum modulation and forward error correction coding (FEC) technology to expand data transmission Distance improves the anti-interference of data transmission. LoRa technology can reach more than ten kilometers in unobstructed conditions and can reach 2 to 3 kilometers in urban areas. The ultra-low power consumption standby can flexibly adjust the power level to adapt to the requirements of distance and speed in transmission, Support multiple sleep and standby modes, battery life up to 10 years. At the same time, compared with NB-IoT technology, LoRa technology does not need to rely on existing data network base stations and can be freely

Published by: The Mattingley Publishing Co., Inc.

July - August 2020
ISSN: 0193-4120 Page No. 5319 - 5324

networked. The node capacity can reach tens of thousands and supports point-to-point communication and two-way serial data communication. It is more suitable for cellular data networks. Large outdoor scenes that cannot be covered[5]. The Internet of things wireless system is in the figure below.

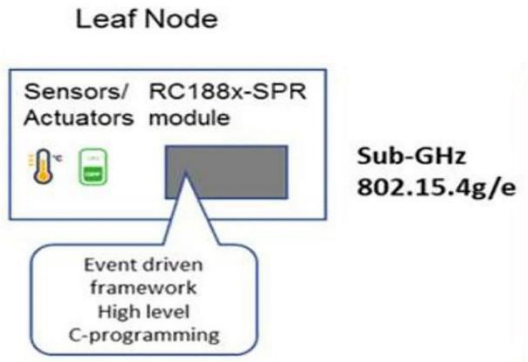

Figure5. Internet of things wireless system.

3.2. System design

The main structure of the system is divided into four parts: data acquisition node, valve control node, field controller and cloud platform server. The collection node monitors the environmental parameters of the industrial production through equipment such as temperature and humidity sensors installed inside the industrial production and then transmits the data to the field controller in a wireless manner through the MCU and LoRa module. The valve control node receives and processes the control instructions issued by the gateway controller through the MCU and LoRa module and controls the action of the solenoid valve to irrigate the crops in the industrial production. At the same time, the control node can also monitor the status of each solenoid valve. The field controller acts as a gateway, which is responsible for the centralized processing and forwarding of data. On the one hand, it uses the LoRa module to interact with the collection node and the control node and on the other hand, it communicates with the cloud platform server through the GPRS module through TCP/IP. To communicate. The cloud platform server centrally manages industrial production information through database technology and at the same time develops user application software on the cloud service platform to provide users with remote monitoring services for industrial production. Users mainly use computers and mobile phones to inquire about environmental parameters and equipment operating conditions in industrial production, formulate irrigation conditions according to the needs of crops in industrial production and support manual and automatic two irrigation modes for industrial production[6]. The Internet of things cloud system is in the figure below.

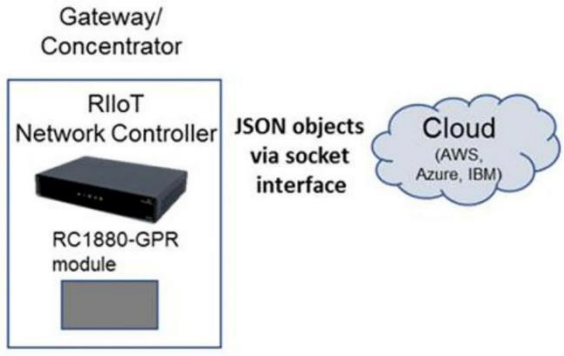

Figure6. Internet of things cloud system.

4. Related technologies of industrial internet of things

4.1. RFID technology

RFID is a radio frequency identification communication technology. Its working principle is to identify designated objects through radio signals and obtain object information. There is no need to make direct contact with the object during the scanning process. When the target object enters the coverage of the radio frequency signal When within the range, the object can be captured by receiving the signal sent by the interpretation device, or the target object actively sends out the signal and the receiving and interpreting device performs reception and information transmission. Radio frequency identification technology is not limited to bad weather or the speed of the target object's moving speed, it can be used normally, quickly identified and has the characteristics of fast scanning speed and strong durability. For example, in the express delivery industry, there are a large number of

Published by: The Mattingley Publishing Co., Inc.

July - August 2020
ISSN: 0193-4120 Page No. 5319 - 5324

express items that need to be scanned every day in the logistics link. It is difficult to rely on manual scanning one by one. The speed of the express delivery industry directly affects the quality of express delivery, which can be greatly improved through radio frequency identification technology. Express mail scanning efficiency and can ensure scanning accuracy even in a complex working environment. It can be said that radio frequency identification technology plays a very important role in the entire Internet of Things.

4.2. Architecture technology

In the actual process of networked information exchange, diversified ways can be used, which is to implement interoperability and interconnection. For example, the supply and demand parties of information exchange can develop a reasonable application of the architecture technology to build a way of information sharing and then provide various data resources and information resources for both parties. The advantage of architecture technology is that the service method is relatively simple and its disadvantage is that it can only be carried out in a non-language environment. Actual actions have certain limitations and attributes for both supply and demand parties. Therefore, in the actual operation of the Internet of Things technology, the application of the architecture technology must be strengthened to provide a reasonable operating platform for both the supply and the demand side.

4.3. Internet of things data and signal processing technology

In the actual development of industrial automation production, the Internet of Things itself must have certain information processing capabilities. The Internet of Things can collect data generated from production and sales activities in industrial automation and use computer technology to realize the processing and analysis of these data. The practical application of the Internet of Things in industrial automation can be based on relevant semantics and with the help of important technologies and equipment in the Internet of Things to carry out appropriate analysis and collection of information and data. Then on the basis of structured information, reasonable processing and analysis of the collected data are carried out.

4.4. Embedded system technology

After the integration of sensor technology, hardware software and electronic technology, an embedded system can be formed and the technical complexity is still relatively high. If the network is compared to the human nervous system, then the sensor is equivalent to the five sense organs, responsible for the collection of information and the embedded system is the human brain. Nowadays, technology is constantly being updated, the economy is constantly improving and embedded systems are constantly being improved and they are constantly infiltrating into various fields.

5. Conclusion

The Industrial Internet of Things is an important part of the construction of smart factories at this stage. The information security of the Industrial Internet of Things is very important, involving the information security of the data perception layer, application layer and transmission layer. Among them, the data in the Industrial Internet of Things is mainly derived from the perception layer and the security mainly involves the integrity and confidentiality of the data. Some vulnerabilities in the hardware must be resolutely avoided. The massive amount of information in the transmission layer, the identity Authentication, key agreement, confidentiality and many other aspects all affect the data security of the Industrial Internet of Things. The application layer analyzes a large amount of data and requires strict protection technology in processing and application data. The encryption technology is constantly updated and homomorphic encryption has become an important technological development direction.

References

[1] Semtech Says Its LoRa Devices Bolstering Crop Yield on Connected Avocado Farms[J]. Manufacturing Close - Up,2020.

[2] Information Technology - Cloud

Published by: The Mattingley Publishing Co., Inc.

July - August 2020
ISSN: 0193-4120 Page No. 5319 - 5324

Computing; Reports Summarize Cloud Computing Study Results from University of Turku (Smart Parking System with Dynamic Pricing, Edge-Cloud Computing and LoRa)[J]. Information Technology Newsweekly,2020.

[3] Networks - Wireless Communications and Networks; Researchers at North China University of Technology Report Research in Wireless Communications and Networks (LoRa-Based Smart IoT Application for Smart City: An Example of Human Posture Detection)[J]. Journal of Engineering,2020.

[4] Networking; Study Findings on Networking Are Outlined in Reports from National University Science & Technology NUST (Exploring Multi-hop Lora for Green Smart Cities)[J]. Network Weekly News,2020.

[5] Sensor Research; Studies from Federal University Espirito Santo in the Area of Sensor Research Reported (A Theoretical and Experimental Evaluation On the Performance of Lora Technology)[J]. Technology News Focus,2020.

[6] Sensor Research; Researchers from University of Antwerp Detail Findings in Sensor Research (LoRa 2.4 GHz Communication Link and Range)[J]. Information Technology Newsweekly,2020.

Published by: The Mattingley Publishing Co., Inc.