Monitoring System for Bacterial Industry Based on ZigBee Protocol Stack and Networking

Lifen Wang, Hongyu Zhu, Mingtao Ma, and Lingyun Meng

Jilin Agricultural Science And Technology College Jilin, China

mmt800@126.com

Keywords: Smart bacteria industry; ZigBee; Environmental monitoring.

Abstract: In order to improve the production efficiency of the fungus industry, save the planting cost of the fungus industry and build an efficient production mode of the fungus industry, based on Internet plus's "smart bacteria industry" and supported by Internet of Things technology, the fungus intelligent greenhouse is constructed, and the ZigBee protocol stack and networking are used to realize the crop environmental monitoring system. The accurate acquisition and stable transmission of environmental temperature, humidity, gas concentration, light intensity and other data are formed, and the remote monitoring and management system for agricultural production is constructed.

1. Introduction

ZigBee is a two-way wireless communication protocol. Compared with other communication technologies, ZigBee has many advantages such as stable communication, low power consumption, low price, low delay, etc. Users can remotely monitor the data in the intelligent greenhouse in real time through the mobile terminal and the PC terminal. ZigBee technology has many advantages in the detection of intelligent bacteria industry, which can more effectively meet the requirements of accurate acquisition and stable transmission of environmental temperature, Humidity, gas concentration, light intensity and other data in the modern bacteria industry production process, construct a remote monitoring and management system of bacteria industry production, create a good environment for the growth of fungi crops, further enhance agricultural production efficiency, reduce labor force, save agricultural costs, realize the overall upgrade of agricultural production mode, and add a new impetus to the development of modern agriculture in our country.

2. Overall System Design:

This system is a smart bacteria industry detection platform based on ZigBee protocol stack and networking. The system is mainly composed of a coordinator and a terminal node monitoring center. We connect each sensor through ZigBee networking between the coordinator and the terminal node. The sensor nodes are composed of temperature and humidity sensors, light sensors, gas sensors, etc. and CC2530 modules. The coordinator and the terminal node are networked in a star topology. The terminal node is responsible for reading and uploading the data of each sensor to the network. The coordinator is responsible for collecting the data collected by each terminal node and sending the data to the monitoring center through WiFi. The monitoring center computer uses the visual graphical interface developed by VS tool, which can receive, process and display all the data sent from each monitoring area. In addition, the fungus crop data of the monitoring center can be viewed in real time through the mobile phone APP, so that users can view the crop information anytime and anywhere, and the number of terminal nodes can be appropriately increased according to the crop growth environment to increase the reliability of the data.

  DOI: 10.25236/icemc.2019.068

Figure. 1 Overall System Design

3. System Design:

3.1 System Hardware Design.

ZigBee networking system is composed of a plurality of terminal nodes and a coordinator. The terminal nodes are composed of a CC2530 module and a variety of sensors. The terminal nodes can realize the data acquisition of crop environment. The MCU in our terminal node uses the CC2530 chip of TI Company. As a chip for ZigBee networking, it has lower power consumption and higher performance than the previous generation chip, and is suitable for the overall adaptation of IEEE 802.15.4 protocol and ZigBee software IAR. CC2530 has an intelligent sleep mode compared with ESP8266 using WiFi of the same grade. in terms of battery usage, CC2530 is about 100-200 times longer than ESP8266. The most classic application of such timers as CC2530 is to act as a real-time counter, or change it to a wakeable timer to jump out of power supply mode 1 or power supply mode 2. CC2530 is also much larger than other chips in terms of low power consumption, so we use it as a chip for bacteria detection.

Table1 ZigBee Compared with other technologies

	WLAN	Bluetooth	ZigeBee
applied range	video	Short distance instead of Wirelin	Monitoring and control
Battery use	1-5	1-7	100-1000
Number of Network nod	30	7	255
broadband	11000	1000	20-250
distance	1-100	43475	1-75
merit	Strong adaptability	Easy to operate	Low reliability cost

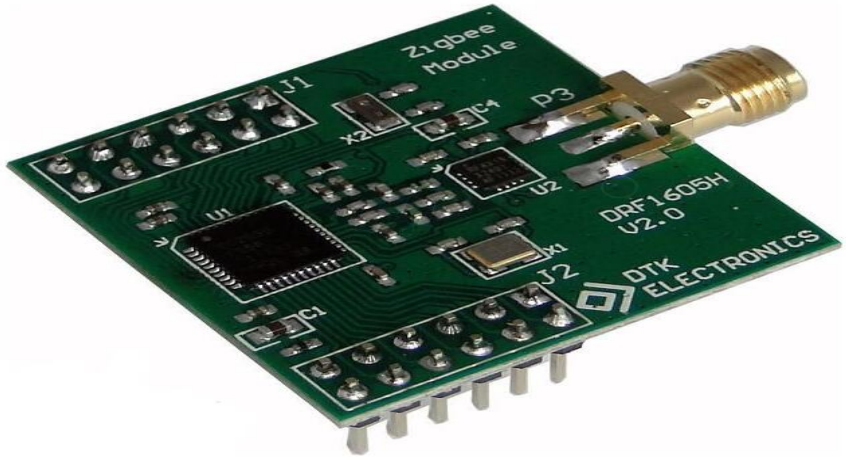

Figure. 2 CC2530

3.2 System Structure Design.

In order to ensure the stability of ZigBee network, we optimized the ZigBee network structure on

the premise of ensuring the system performance. In the various networks of ZigBee system network, we finally chose the centralized network topology structure. Star topology network has the advantages of relatively easy maintenance and management, flexible reconfiguration, easy fault isolation and convenient detection, ensuring the stable operation of ZigBee network.

3.3 Sensor Module Design.

For the environmental data needed to be collected in the current bacterial production, it is necessary to update and optimize the sensor module in real time, so as to ensure the low error detection of sensors such as temperature sensor, light sensor, Humidity sensor and so on, and to ensure the real-time acquisition of crop growth environmental data.

3.3.1 Setting of Temperature and Humidity Module

In the process of setting up the temperature and humidity module, we need to optimize each node that collects data. In the optimization process, the first thing to ensure is that the working voltage of the module should be within the range of 5V±0.3 to ensure the service life and accuracy of the sensor. The ZigBee wireless data channel is used to upload the data collected by the sensor in real time to realize the real-time monitoring of temperature and humidity information. Therefore, we use DHT11 temperature and humidity sensor to collect temperature and humidity.

3.3.2 Setting of Light Sensor

The light sensor is mainly a photosensitive module, which is mainly used to collect the light intensity. When the light intensity changes, the photosensitive module will transmit the data to ZigBee network through the network at the simulation port and carry out real-time monitoring.

3.3.3 Gas sensor

Gas sensor (MQ-2) has good sensitivity to various harmful gases and combustible gases in a wide concentration range. Due to the different internal structures of various substances, it determines their selective absorption to light of different wavelengths, i.e. substances can only absorb light of a certain wavelength. The absorption relation of matter to light of a certain wavelength obeys Lambert2Beer's absorption law. Taking CO2 analysis as an example, the infrared light source emits infrared light of 1 ~ 20μ m. After absorbing through a certain length of gas chamber, passing through a narrow band filter of 4.26μm wavelength, the infrared sensor monitors the intensity of infrared light of 4.26μm wavelength to express the concentration ofCO2 gas.

4. Conclusion

Internet of Things (IOT) is a new type of industry in China's future technology. Agriculture is the most important thing in China's development. ZigBee protocol stack and networking are new breakthroughs in the development of bacteria industry. In this scheme, ZigBee protocol stack is combined with networking and Internet of Things, and ZigBee is used to collect data on the growth environment of crops. Compared with other WiFi methods, this scheme has more convenient networking, faster transmission rate and more accurate data transmission. Compared with the traditional agriculture, the intelligent bacteria industry of this plan has realized precision and intelligence, fundamentally saved financial, human and material resources, has broad application prospects, and is of great significance for the realization of our intelligent bacteria industry.

Acknowledgment

JJKH20190975KJ, jilin provincial education department project

References

[1] Juan Zhu, Research on Intelligent Fungal Industry Monitoring System Based on Wireless Sensor Network [J]. Hunan Agricultural Machinery, 2014(3)77-79.

[2] Zhang Xi. Applied Research of Internet of Things in Smart Agriculture. Baosteel Technology. 2018(2)46-48.

[3] Xiaolu Zhao; Kun Liu. Smart Agriculture Real-time Acquisition and Remote Control System Based on Zigbee Technology. Agricultural Engineering Technology. 2017(6)35-36.