# Intelligent Lighting System Based on ZigBee Communication

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*Abstract:* Society is developing toward digitalization, intelligentization and networking. An intelligent lighting system based on ZigBee communication is proposed. Its low cost, low power consumption, AD hoc network and other advantages contribute to its broad market. The intelligent lighting system based on ZigBee communication arises at the right time and in the right place. Although it is faced with many difficulties, its development is bound to be unstoppable.
*Keywords:* ZigBee; Intelligent Lighting

## 1. Introduction

Lighting systems are a necessary part in our daily lives. With the continuous progress and development of human society, the lighting system has changed from the exothermic reaction of combustible and oxidant to the traditional lighting of control interruption of ordinary switching elements. Today, 5G and the Internet of things are driving more energy-efficient, more intelligent and networked lighting systems. At present, most known intelligent lighting systems adopt wired control, which is not only not universal, but also malleable. Most of them is of design defects, wiring complex, large quantities of engineering, fault troubleshooting inconvenience and other shortcomings, and is also restricted by the limitations of the site. With the development of communication field, a number of wireless communication systems have been developed rapidly. ZigBee is a new short-range wireless communication technology. The advantages are power, cost, scalability, and the ability to network with 254 nodes. It can be seen that ZigBee communication-based intelligent lighting system has the advantages of low cost, low power consumption and ad-hoc network, which makes it stand out from many wireless network control systems.

## 2. Zigbee intelligent lighting system

### 2.1 Application of ZigBee in intelligent lighting system

ZigBee technical architecture by PHY (physical layer), MAC (media access control layer), NWK (network layer) and APL (application layer), the PHY (physical layer) and MAC (media access control layer) protocol for IEEE802.15.4 standard, NWK (network layer) and APL (application layer) set by the ZigBee alliance. In APL (application layer) the user can demand for redevelopment. [1] The international union of ZigBee ZigBee Light Link, launched in April 2012, set up a common standard means that, in the world's major lighting equipment manufacturers to develop together. ZLL defines not only a kind of advanced Light control application information transmission protocol, also includes a simple configuration mechanism. "Black box", for example, to the consumer can not understand the agreement and the internal structure. Out of the box, the system configuration is simple. In addition to these new features, ZLL has all the inherent technical advantages of ZigBee networks, enabling low-cost, low-power, self-organizing, secure wireless networks based on IEEE802.15.4.

The terminal is connected with the coordinator to form a ZigBee wireless network. The PC sends the control information to the coordinator node whose node is FFD, and the control information of the coordinator node is

transmitted to the terminal. If the distance is too far with more than one router designed, the coordinator will send the information to the route. After several times of transmission, route will then send the control information to the terminal. The terminal can also feedback the current state information to the route and send it to the PC through the coordinator after multiple transmission, so as to achieve the wireless intelligent control of the lamp.

## 2.2 Features of ZigBee intelligent lighting system

### 2.2.1 Easy popularization

Traditional lighting in the early design of the network wiring, drilling and laying line. If one wants to upgrade the traditional lighting intelligently on the basis of the old house, it is difficult to achieve the wired intelligent lighting system. This is because the wired lighting system is difficult to redesign the wiring on the basis of the original house decoration, while the ZigBee communication-based intelligent lighting system, as a wireless control system, is small, portable, easy to install and has strong scalability. On the basis of the original decoration, ZigBee network can be set up by adding hardware instead of chiseling a brick and a tile. The control terminal can be the mobile phone or PC terminal, which eliminates the complexity of wiring and directly achieves intelligent life in the convenience of wireless network, letting the new generation of technology for the benefit of thousands of households.

### 2.2.2 Overall perception

Traditional lighting system usually makes the corresponding real-time or delayed response by the human action. The intelligent lighting system based on ZigBee communication retains the active control of people in the traditional lighting system and adds automatic control. Through the changes of relevant sensors in ZigBee wireless network, it can independently judge the changes of the current environment and respond to the actions ahead of people. For example, ZigBee intelligent lighting system can detect this environmental factor in time when there is no human activity in a certain area, and the information will be transmitted between terminals by the coordinator, and the command information will be sent by the control terminal to turn off the current lighting. In special cases, the ZigBee intelligent lighting system can be manually controlled to maintain or change a certain state. It can not only avoid unnecessary waste of resources, but also fully sense the current environment of the system

### 2.2.3 Ad-hoc network

ZigBee intelligent lighting system can build new sensors to join the lighting network due to its advantages of ad-hoc network and multi-node. For example, in furniture lighting, a thermoluminescence infrared sensor is built and added to the algorithm so that it can detect the presence of endotherms in the detection area and light up the lamp. On this basis, a new camera with face recognition is built and an algorithm is added to enable it to recognize the invasion of non-residents and send alarm information to the user terminal in time. AD hoc networks make systems smarter and more versatile.

### 2.2.4 Security

Security is an eternal topic, even for intelligent lighting system. Its security is also an important indicator of how far it can go in the future. In the ZigBee protocol stack architecture, ZigBee realizes the confidentiality of messages in NWK (network layer) and APL (application layer). For example, the security of NWK (network layer) is based on the hop-by-hop principle, and each level of routing will verify whether the encrypted packet is valid when the packet is received and issued. The key used in APS (application support layer) security in APL is called Link Key. When two devices communicate, the Link Key needs to be established before APS security data can be sent. ZigBee USES the AES encryption algorithm on the MAC (media access control layer) layer, which is usually aes-128 bits. Depending on the level of key provided by the upper layer, different levels of security can be guaranteed. Three layers of protection can protect users' personal and property safety in a variety of network environments.

# 3. Development of zigbee intelligent lighting system

## 3.1 Existing problems

ZigBee itself is a new system integration technology, the software development must use the network transmission,

radio frequency technology, the control technology of the underlying hardware and software together. The early development of the technical level is very difficult. At present, Zigbee technology in China adopts the same 2.4Ghz band as Bluetooth, with poor diffraction capacity, weak wall penetration force and short transmission distance. At the same time, in the overall design and development process of ZigBee intelligent lighting system, there are also mispositives and omissions of sensors in the actual system, as well as network loss of nodes.

## 3.2 Improvement measures

The transmission distance problem, Sliced, with the rapid development of 5 g network technology has a great improve. This technology can bring great change Zigbee technology, and the so-called network slice is add a few logical network to use on the Internet. Each slice can get mutual insulation between fictitious network resources. Zigbee technology of low power consumption, many nodes can play a role to the greatest extent, and the advantages of its low transfer rate of faults may also get huge optimization. If the network slice with Zigbee technology can be implemented, the short distance communication will greatly improve, and intelligent process will be greatly improved, so as to solve the sensor and the key problems such as node off network. [2]. On the one hand, the sensor precision and algorithm on optimized combination of software, hardware and the capacity of data transmission need to be improved. On the other hand, it can be formed a complete in the network, by the time the coordinator sends data to each node, node information feedback, failed to timely information feedback that if a node off net. For nodes, if they do not receive any information after the specified time, the default is that they have dropped the network, and achieve soft reset this time through the timer watchdog program. For the coordinator, if not received any information feedback beyond the time limit, it also default itself has dropped the network to achieve a soft reset this time through the timer watchdog program. Real-time detection is realized in continuous confirmation to improve the stability of the system. [3]

# 4. Conclusion

The first ray of light produced by wood fire in history proves that lighting system is a necessity of human society. Time flies, in today's changing science and technology, in the era of continuous exploration of science and technology. The pursuit of intelligence, the pursuit of high-quality life is the innovation of countless scientific and technological workers. The era of 5G and the Internet of things, which are the beautiful era we are in. ZigBee intelligent lighting system is the product of the times, which is better than Wi-Fi in low power consumption and Bluetooth in low cost and ad-hoc network. The combination of high bandwidth, high rate and ZigBee's advantages of high stability and low latency in the 5G era is not a distant prospect. Both the development of enterprises and the demand of people will determine that intelligent lighting system is the future trend.

# References

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