Research on the Design and Optimization of Intelligent Electronic Communication System Based on the Internet of Things Technology

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Abstract: With the development and progress of science and technology, the Internet of Things technology has become the key technology for the innovation and development of various industries, especially in the electronic communication industry has played an important role. This study designed and optimized the intelligent electronic communication system based on the Internet of Things technology. Firstly, through the deep understanding and analysis of Internet of Things technology and electronic communication system, the feasibility and necessity of applying Internet of Things technology to electronic communication system are determined. Secondly, according to the needs of the electronic communication system, intelligent design, including hardware selection, software programming, and network protocol customization. Then, the optimization strategy of the electronic communication system based on the Internet of Things is proposed, which mainly involves the key fields such as energy saving, security and data processing speed improvement. The experiment proves that the optimized electronic communication system not only has higher transmission efficiency, but also can effectively reduce energy consumption and enhance the security of the system, thus greatly improving the effect and performance of electronic communication. This study enriches the application of Internet of Things technology in the field of electronic communication, but also provides useful reference and enlightenment for research in other related fields.

Keywords: Internet of Things Technology; Electronic Communication System; Intelligent Design; Transmission Efficiency; System Security

1. Introduction

The development of science and technology promotes the progress of all walks of life, among which, the Internet of Things technology as a new generation of information technology began to play an important role in various fields. Especially in the electronic communication industry, the application of the Internet of Things technology not only greatly improves the communication efficiency, but also helps to improve the security and stability of the system. The cutting-edge research and application of the Internet of Things technology show that, through the introduction of the Internet of Things technology, the complex problems encountered in the use process of the electronic communication system can be effectively solved, reducing the inefficiency and improving the data processing capacity. However, in order to further optimize the electronic communication system, it is still necessary to study the Internet of Things technology deeply and explore its application potential in the electronic communication system. Although many studies have been conducted on the Internet of Things technology, how to combine it with the electronic communication system to achieve more efficient and secure communication is still an urgent problem to be solved. To this end, this study aims to carry out in-depth design and optimization analysis for intelligent electronic communication system with the help of Internet of Things technology, in order to improve the efficiency of electronic communication system, enhance security and reduce with the help of Internet of Things technology to reduce energy consumption.

2. In-depth Analysis of the Internet of Things Technology and the Electronic Communication System

2.1 The Basic Principle and Development

Status of the Internet of Things Technology

The Internet of Things technology, namely Internet of Things (IoT), aims to connect various physical devices to the Internet through sensors, radio frequency identification (RFID), wireless transmission and other means to realize automatic collection, real-time transmission and intelligent processing of information[1]. The basic principles of Internet of Things technology include three parts: perception layer, network layer and application layer[2]. The sensing layer is mainly responsible for the collection of information, including the detection of physical parameters such as temperature, humidity and location; the network layer uses network equipment to transmit and exchange data, and the application layer performs data processing and intelligent control according to specific requirements.

The development of iot technology has gone through several stages. Since the concept was first proposed by Kevin Ashton in 1999, iot technology has received wide attention and research. Early studies have mainly focused on the practical application of RFID and sensing network technologies. In the development process of the Internet of Things, the development of key technologies such as wireless communication technology, computer technology and embedded systems has played a promoting role. With the rise of cloud computing, big data, artificial intelligence and other new technologies, the Internet of Things technology has entered a stage of rapid development, and its application scope has expanded from smart home, smart city to intelligent transportation, industrial Internet and other fields.

In the intelligent electronic communication system, the Internet of Things technology collects data by sensing equipment, uses the wireless network to transmit information, and then realizes intelligent application through data processing, which has important application value. For example, by setting up sensors in the communication base station, the equipment operating status and environmental parameters can be monitored in real time, and the system power can be automatically adjusted to achieve energy saving and consumption reduction. The standardization and protocol unification of the Internet of Things technology also provide technical support for the popularization and interconnection of electronic communication systems, and effectively promote the intelligent development of communication networks. These technological advances and application practices make the application of the Internet of Things in the electronic communication system not only feasible, but also has great necessity and potential.

2.2 Basic Knowledge and Requirements of the Electronic Communication System

Electronic communication system is a key component of modern information society, covering many aspects of information transmission, and reception and processing. Its basic knowledge mainly includes communication principle, modulation technology, coding technology and channel transmission. The communication principle is the core of the electronic communication system. Modulation technology is designed to improve the quality and efficiency of signal transmission, and the commonly used methods are amplitude modulation, frequency modulation, and phase modulation. Coding techniques encrypt and compress the information to ensure the integrity and reliability of the data.

In terms of demand, electronic communication systems need high efficient transmission rate and stability to meet the transmission requirements of huge information flow. The security of communication systems is also crucial, especially in the commercial and military fields, where the confidentiality and immunity of data cannot be ignored. The system also needs low energy consumption and high efficiency to achieve long time stable operation in a resource-limited environment.

With the development of science and technology, the demand for electronic communication system is increasing and diversified. They require not only efficient transmission and security protection, but also intelligence, sharing, and scalability. Driven by the Internet of Things technology, this series of demands have been made with new breakthroughs and improvements, which further promotes the innovation and development of electronic communication system.

2.3 Application Possibility and Necessity of Internet of Things Technology in Electronic Communication System

The application possibility and necessity of Internet of Things technology in electronic

communication system are reflected in many aspects. The Internet of Things can realize the information interaction between devices and devices through sensors, communication modules and data processing technology, and improve the intelligence level of the system. The application of Internet of Things technology in electronic communication system helps to optimize resource allocation, improve data transmission efficiency and reduce energy consumption. The Internet of Things technology provides a more secure communication environment, can effectively prevent information leakage and network attacks, and improve the overall security of the system. In general, the application of the Internet of Things technology to the electronic communication system is not only the demand of technological development, but also the inevitable trend of market competition.

3. Design of an Intelligent Electronic Communication System based on the Internet of Things Technology

3.1 Hardware Selection and Its Combination with the Internet of Things Technology

In the design of intelligent electronic communication system based on Iot technology, hardware selection and its combination with Iot technology is a key link. The hardware platform must have high efficiency, low power consumption and good compatibility, in order to give full play to the advantages of the Internet of Things technology in the electronic communication system.

To meet these requirements, common hardware components include high-performance microprocessors, low-power wireless communication modules, sensors, and data storage devices. High-performance microprocessors, such as the ARM Cortex series, are widely used in Internet of Things devices, capable of processing large amounts of data and supporting a variety of communication protocols. Low-power wireless communication modules such as LoRa, Zigbee or NB-IoT are suitable for different communication requirements, provide wide area coverage and low power consumption characteristics, and effectively extend the service life of the device. There are many kinds of sensors. According to the specific application scenarios, they can collect environmental data in real time and provide accurate information input for the system. A data storage device can be a flash memory or micro memory card used to store large amounts of data for post-processing and analysis.

Hardware selection also needs to take into account the compatibility with the Internet of Things platform. IoT platforms such as Azure IoT, AWS IoT, or Google Cloud IoT all require hardware devices to seamlessly connect to their ecosystem. The communication modules embedded in the hardware design must support standardized IoT protocols, such as MQTT, CoAP, etc., to ensure that the data can be statically, quickly and securely transmitted to the IoT platform.

Through reasonable selection and design, the selected hardware can not only provide powerful computing and communication capabilities for the intelligent electronic communication system, but also realize the deep combination of the Internet of Things technology and the electronic communication system, laying a solid foundation for the optimization of the system performance. This process emphasizes both the performance of the hardware itself and its collaborative design with software systems and network protocols to achieve the optimal performance of the overall system.

3.2 Software Programming Scheme under the Internet of Things Technology

Software programming scheme is crucial in the design of intelligent electronic communication system driven by the Internet of Things technology. System software programming requires a modular design to ensure the flexibility and scalability of the system[3]. Different functional modules are developed independently and inter-module communication through well-defined interface standards. In the programming language selection, C / C + +, Python or JavaScript are usually suitable for embedded development and network communication.

In order to realize the efficient processing of sensor data, the common MQTT (message queue telemetry transmission) protocol is adopted, which can significantly optimize the real-time performance and reliability of data transmission. The data processing module should have data compression and abnormality detection functions to improve the data transmission efficiency and system reliability[4]。

In the network protocol layer, a secure

encryption algorithm needs to be introduced to ensure the security of data transmission. Enencrypt user data with AES (advanced encryption standard) or TLS (transmission layer security protocol) to ensure that the data is protected during transmission. In the programming process, the fault detection and recovery mechanism should be designed to improve the overall stability and fault tolerance of the system. Through the implementation of the above software programming scheme, the Internet of Things technology can better provide the support for the intelligent electronic communication system.

3.3 Customization of Network Protocol of Internet of Things Technology Services

Network protocol customization of Internet of Things technology service is a key link in the design of intelligent electronic communication system. Through the thorough analysis of the characteristics and deficiencies of the existing network protocols, select the best suitable protocol for the system requirements or make protocol improvement to ensure the efficiency and reliability of data transmission. In the specific customization process, multiple dimensions such as transmission delay, bandwidth demand, node level, and security should be considered to ensure the smooth communication between the Internet of Things devices, and flexibly adjust according to the actual application scenarios, so as to improve the overall performance of the electronic communication system.

4. Optimization Strategy of Intelligent Electronic Communication System based on the Internet of Things Technology

4.1 Energy-Saving Strategy of Electronic Communication System under the Application of Internet of Things Technology

Under the application of the Internet of Things technology, the energy-saving optimization strategy of the intelligent electronic communication system is particularly critical. By analyzing the characteristics and working mechanism of the Internet of Things devices, a series of effective energy saving strategies are proposed to significantly reduce the energy consumption in ensuring the performance of the communication system.

Energy management strategy is the core of energy-saving optimization[5]. IoT devices typically use low-power sensors and chips, which makes dynamic power management possible. In the non-working state, close some hardware modules or enter the hibernation mode to reduce the power consumption. An advanced battery management system is used to predict and manage the battery life through intelligent algorithms to help maximize the use of each unit of electricity.

In terms of wireless communication, the energy consumption in the communication process is reduced by optimizing the transmission protocol and the communication frequency. Low-power wide-area network (LPWAN) technology, such as LoRa and NB-IoT, is adopted to achieve long-distance and low-rate data transmission, which can effectively reduce power consumption. Combined with multi-hop communication technology, the transmission distance of a single node is reduced, thus further reducing energy consumption.

The optimization of the scheduling algorithm is also an important way to achieve energy saving. The intelligent scheduling algorithm is used to dynamically adjust the working state and communication frequency of the equipment according to the actual communication requirements to avoid unnecessary energy waste. Especially in the process of data acquisition and transmission, data compression and data aggregation technology are introduced to reduce the number of redundant data transmission, so as to save the transmission energy consumption.

Through the establishment of energy consumption model and energy efficiency evaluation system, the energy consumption of the system is monitored and evaluated in real time. Using big data analysis and machine learning technology, the energy management strategy is continuously optimized to ensure that the system can operate with low energy consumption and high efficiency under different load situations.

These energy-saving strategies under the application of the Internet of Things technology can not only significantly improve the energy utilization efficiency of the electronic communication system, but also extend the service life of the system equipment, and improve the overall performance and stability of the system.

4.2 System Security Improvement Strategy

based on the Internet of Things Technology

The application of Internet of Things technology in electronic communication systems not only improves the efficiency of information transmission, but also brings new security challenges. The multi-level security mechanism can effectively improve the security of the electronic communication system. Establish an identity authentication system based on the Internet of Things technology, and ensure the authenticity and uniqueness of the identity of devices and users through multi-factor authentication and encryption algorithm. Use the dynamic key update mechanism to avoid the risk of key leakage and reuse, and enhance the confidentiality of data transmission. Implement real-time monitoring and abnormal detection, use the perception ability of Internet of Things devices to detect and respond to abnormal activities in time, and avoid the expansion of potential risks. The built-in intrusion detection system (IDS) can be continuously optimized by machine learning algorithm to improve the identification and response ability of complex attack means. Data secure storage and backup strategies are also key, using distributed storage technology and redundant backup solutions to ensure the integrity of data and recovery in case of data center failures or attacks. The comprehensive application of these strategies can not only effectively deal with the current and future security threats, but also provide a solid foundation for the sustainable development of intelligent electronic communication system.

4.3 Strategies to Improve the Data Processing Speed with the Internet of Things Technology

Strategies to improve the speed of data processing include multiple improvements. By introducing edge computing, we can reduce the data transmission time to the central server, and improve the real-time performance and processing efficiency. Distributed data processing technology is adopted to disperse data processing tasks to multiple nodes to reduce the load of a single node and improve the overall processing speed. Use an efficient data compression and uncompression algorithm to reduce the delay of data transmission. Artificial intelligence and machine learning algorithms are used to preprocess and optimize the data to further improve the response speed and data processing capability of the system. Together, these strategies can significantly improve the data processing speed of intelligent electronic communication systems.

5. Performance Evaluation of Electronic Communication System under the Application of Internet of Things Technology

5.1 Assessment of the Transmission Efficiency

In the electronic communication system, the transmission efficiency is one of the important indicators to measure the system performance. After the application of the Internet of Things technology, the improvement of the system transmission efficiency is mainly reflected in the following aspects.

The Internet of Things technology improves the data acquisition and transmission process through intelligent sensors, edge computing and other means. Smart sensors can collect data in real time and efficiently, and conduct preliminary processing through edge computing technology, reducing the burden of data transmission. Thus, it reduces the delay during the data transmission process and improves the transmission efficiency.

Network protocol customization of Internet of Things technology also optimizes transmission efficiency to a large extent. Traditional network protocols often have the problems of unbalanced resource utilization and high time delay in data transmission. The network protocol can be tailored to better coordinate and manage data transfer processes in the IoT environment. In particular, the efficient data compression and transmission strategy significantly improves the data transmission rate in the case of limited bandwidth.

The optimization of the data flow is also the key to improve the transmission efficiency. IoT technology allows the classification and priority assignment of data, determining the transmission order according to the importance and urgency of the data. This data flow optimization strategy can not only ensure the rapid transmission of key data, but also effectively improve the overall transmission efficiency. In the high data load state, the priority strategy can significantly reduce the load pressure of the system and improve the overall efficiency.

The distributed system design under the Internet of Things technology can effectively disperse the data processing pressure. By establishing multiple data transmission nodes, parallel data processing and transmission are realized,

making the transmission path more diverse and efficient. Distributed system not only reduces the burden of a single node, but also greatly improves the flexibility and reliability of data transmission.

Based on the above improvement measures, the transmission efficiency of the electronic communication system with the application of the Internet of Things technology has been significantly improved. The experimental results show that the optimized system is better than the traditional electronic communication system in both the data transmission speed and the processing efficiency. This result fully demonstrates that the application of Internet of Things technology in electronic communication systems has great potential and value.

5.2 Assessment of the System Safety

System security is one of the key factors of the Internet of Things technology applied in the electronic communication system. When evaluating the security performance, the key areas include the confidentiality of data transmission, the ability of the system to resist malicious attacks, the reliability of user authentication and so on. In order to improve the system security, the multi-level encryption algorithm is adopted to protect the data, and the integrity and confidentiality of the data in the transmission process are ensured through the dynamic secret key exchange mechanism. An intrusion detection system based on behavioral analysis is used to effectively identify and prevent potential network threats. Combining biometric identification technology and multi-factor authentication mechanism, enhance the accuracy and anti-counterfeiting ability of user authentication. Through the analysis of practical application data, the optimized intelligent electronic communication system has significantly improved the ability to resist in the face of various network attacks, significantly enhanced the security of the traditional system, and comprehensively guaranteed the security of user data and communication content.

5.3 Evaluation of Energy-Saving Performance and Data Processing Speed

Energy saving performance and data processing speed are crucial for evaluation in intelligent electronic communication systems. Energy saving performance is mainly evaluated by monitoring the energy consumption performance of the system in different working conditions. In various states such as idle, low load and high load, energy consumption mapping tools are used to record and analyze the energy consumption data of the system to find out the peak and trough of energy consumption, optimize hardware and software configuration, and reduce power consumption.

Data processing speed is assessed by testing the reaction time of the system under different data transmission and processing tasks. Select a variety of data sets, and use standardized test and performance evaluation tools to measure the processing speed and transmission delay, so as to verify the efficiency of the system, and optimize the algorithm and network protocol to improve the efficiency of data processing.

The comprehensive evaluation of the two indicators can fully reflect the performance of the intelligent electronic communication system in practical application, ensuring that it has a significant improvement in energy efficiency and data processing speed.

6. Conclusion

This study takes the Internet of Things technology as the starting point, and carries on the comprehensive design and optimization of the intelligent electronic communication system. The research first analyzes the in-depth understanding and analysis of Internet of Things technology and electronic communication system, and proposes the necessity and feasibility of applying Internet of Things technology to electronic communication system. Then, according to the requirements of the electronic communication system, we carried out the intelligent design of the system, including the hardware selection, the software programming, and the customization of the network protocol. Later, we proposed the optimization strategy of the electronic communication system based on the Internet of Things, mainly including energy saving, security, data processing speed improvement and other key contents. After the experimental certificate, the optimized electronic communication system not only has a higher transmission efficiency, but also effectively reduces the energy consumption and enhances the system security. The experiment also proves that the Internet of Things technology can greatly improve the effect and performance of electronic communication. However, there are still many

challenges and problems to be solved in the application of the Internet of Things technology in the field of electronic communication, such as how to further improve the stability of data transmission and how to deal with the storage and processing of large-scale data. Next, we will continue to deepen the research to explore the deeper and wider application of the Internet of Things technology in the field of electronic communication. The results of this study are of great practical significance for promoting the application of iot technology in the field of electronic communication, and also provide a useful reference for research in other related fields.

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