

# Research and Application of Assembled Adaptive New Sliding Mode System Based on Internet of Things Technology

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**Abstract:** With the rapid development of the Internet of things technology, people have higher and higher requirements for intelligence and automation. In this paper, a combined adaptive new sliding mode system based on IoT technology is studied, aiming to improve the stability and control accuracy of the system. Through literature research, system design and experimental verification, this paper shows the advantages and effects of the system in solving the problems existing in the traditional sliding mode system. The research results show that the combined adaptive new sliding mode system based on Internet of Things technology can significantly improve the stability and control accuracy of the system, so as to better meet the practical application requirements. This research result is of great significance for the application of sliding mode system, and also provides reference for the application of Internet of Things technology in other fields.

**Keywords:** Internet of Things Technology, New Sliding Mode System, Assembled Adaptive, Sliding Mode System

## 1. Introduction

The Internet of Things technology has been gaining prominence in recent years due to the ongoing advancements in science and technology as well as the ongoing growth of society. The Internet of objects technology makes objects interconnected by fusing together sensor, network, and data processing technologies. This greatly improves people's quality of life and productivity. The development and implementation of the integrated adaptive new sliding mode system, based on Internet of Things technology, has raised people's expectations for intelligent and adaptive demands [1].

People's need for intelligence and self-adaptation is growing as a result of the Internet of Things' widespread application and quick development. The newly built adaptive sliding mode system is a significant use of Internet of Things technology with a broad range of potential applications and significant impact.[2].

In this paper, A novel sliding mode system is put forth that can achieve adaptive

control and is built on Internet of Things technology. A stable assembly process can be achieved in a variety of assembly environments by installing sensors and actuators on the assembly equipment. This allows for the real-time monitoring of various assembly process parameters and the automatic adjustment of the sliding mode controller's parameters in response to the monitoring data. In contrast to the conventional sliding mode control approach, the system exhibits more adaptability to a variety of assembly conditions.[3] and raise the calibre and efficiency of assembly. In order to meet people's demands for intelligence and self-adaptation, as well as to enhance the assembled sliding mode system's performance and dependability, this paper aims to perform extensive research and application on the new assembled adaptive sliding mode system based on Internet of Things technology. The use of an Internet of Things-based assembled adaptive sliding mode system can facilitate intelligent manufacturing, enhance production efficiency and quality, and save costs. Subsequent investigations may delve deeper into the use of sliding mode systems in other domains and foster the advancement of intelligent manufacturing.[4].

## 2. The main content and development of Internet of Things technology

### 2.1 The Main Content of Internet of Things Technology

Internet of Things technology refers to a technology that connects various physical devices, sensors, software and networks through the Internet to realize intelligent interconnection and data interaction between devices. By connecting various devices with the Internet, it can realize communication and data exchange between devices, thus realizing intelligent control and management of devices. The main contents of Internet of Things technology include the following aspects (Table 1).[5].

Internet of Things technology is a technology that connects various devices and sensors through the Internet to realize intelligent interconnection and data interaction between devices. It includes technologies related to sensors, wireless communication, big data and cloud computing, edge computing, security and privacy protection, and many more areas. The advancement of Internet of Things technology will significantly impact people's lives and work styles, bringing with it a wealth of opportunities and significant changes.[11](Figure 1).

**Table 1.** Main technologies of Internet of Things

Main technology	main content
sensor technology	Sensors in the Internet of Things technology play an important role. They can sense and collect environmental information around devices, and convert these information into digital signals for other devices or systems to process and analyze.[6].
Wireless communication technology	Internet of things technology needs to connect various devices through wireless communication technology to realize data transmission and communication between devices.[7]-[8].
Cloud computing and big data	A lot of data will be produced by Internet of Things

technology	devices, and this data has to be processed, stored, and analysed. In addition to offering strong processing and storage capacities, cloud computing and big data technologies may support the Internet of Things system's data processing and analysis to enable intelligent management and control of devices and systems.[9].
Edge computing technology	Edge computing in the Internet of Things technology refers to relocating the computer and data processing power closer to the apparatus in order to lessen bandwidth demand and data transmission latency. Edge computing technology may lessen reliance on cloud computing, increase reaction time and real-time performance of the Internet of Things system, and achieve more effective data processing and administration.[10].
Security and privacy protection technology	There is a danger to security and privacy while using Internet of Things technology, thus various security and privacy protection measures must be implemented. By using technological techniques like access control, identity authentication, encryption, and identity verification, Internet of Things technology can safeguard the security and privacy of devices and data.
Applications and services	Smart cities, smart homes, intelligent transportation, intelligent manufacturing, and many other areas may all benefit from the application of Internet of Things technologies. The intelligent control and administration of Internet of Things technology can result in more convenient, efficient, and intelligent applications and services.



**Fig.1** Development of Internet of Things Technology

## 2.2 The Internet of Things Technology Development in All Fields

The old physical world and the digital world are connected by internet of things technology, which has enormous implications and prospects for a number of businesses. The Internet of Things is being widely utilised across several sectors. A few of them will be introduced here, along with the progress of their applications.

(1) Manufacturing: Factory asset tracking and equipment maintenance are the primary areas where IoT is being used in manufacturing. Factories may increase equipment efficiency and streamline production processes by utilising smart sensors and machine learning. Furthermore, research is being conducted to enhance the effectiveness and efficiency of all production processes by examining the "smart manufacturing" concept.

(2) Automotive industry: The integration of IoT technology in the automotive sector is demonstrated by enhanced vehicle performance and intelligent driving. Automotive businesses may enhance vehicle performance, update software, and respond to mechanical concerns in real-time using data communication networks, therefore preventing safety dangers and accidents.

(3) Financial industry: The Internet of Things can improve the security of banks and customers, and change the way the banking industry operates. For example, through mobile banking, ATMs, smart cash points, etc., customers can make transfers, deposits and other financial transactions at home or on their mobile phones, making banking more convenient.

(4) Healthcare industry: IoT can increase the amount of data in the healthcare industry and generate more insights through artificial intelligence deep learning. At the same time, IoT technology can assist in human resource management and pharmacy services.

(5) Tourism and leisure industry: IoT technology can provide more personalized services through applications such as chatbots, changing the business model of the tourism and leisure industry. For example, IoT devices enable airline staff to track passengers' journeys through terminals, improving the quality of service. (Figure 2).



Fig.2 Application of Internet of Things technology in various industries

### **2.3 Advantages of Internet of Things Technology in Various Industries**

Internet of things technology can realize automation and remote control between devices, thus improving production efficiency and work efficiency. For example, in industrial production, the Internet of Things technology can realize automatic management of equipment and workflow, and reduce labor and time costs. Internet of things technology can help enterprises realize intelligent management of equipment and reduce the maintenance and operation costs of equipment. For example, the running status of equipment can be monitored in real time through sensors and monitoring systems, and problems can be found and solved in time to avoid downtime and maintenance costs caused by equipment failures. Internet of Things technology can realize data sharing and real-time monitoring between devices, and improve the safety and reliability of devices. In smart home, the Internet of Things technology can realize remote monitoring and alarm of home security system, and help users protect the safety of their homes. Internet of things technology has brought new business opportunities and value-added services to all links in the industrial chain. The Internet of Things technology in the field of smart home can provide users with personalized home management and services, such as smart home appliance control and home health monitoring, to meet the individual needs of users. Promote sustainable development: Internet of Things technology can help realize the rational utilization of resources and the sustainable development of the environment. For example, in the agricultural field, the Internet of Things technology can realize real-time monitoring and analysis of soil moisture, meteorology and other data, help farmers manage farmland scientifically, reduce the use of water and fertilizer, and improve the yield and quality of crops. Enhance user experience: Internet of Things technology can realize intelligent interconnection and data sharing between devices, and improve users' experience and quality of life. For example, in smart cities, the Internet of Things technology can realize intelligent management of traffic, energy, environment and other aspects, and provide more convenient, comfortable and environmentally friendly urban life. Data-driven decision-making: Internet of Things technology can collect and analyze a large amount of equipment data in real time, and help enterprises and individuals make data-based decisions. In industrial production, the Internet of Things technology can monitor the running status and production data of equipment in real time, help enterprises optimize production plans and resource allocation, and improve production efficiency. Realize customized services: Internet of Things technology can realize personalized customization of users' needs and provide more accurate and personalized services. In the field of medical care, the Internet of Things technology can realize real-time monitoring and analysis of patients' health data, and provide personalized health management and medical services for patients. Promote innovation and development: Internet of Things technology has brought new innovation opportunities and development space for various industries. For instance, the Internet of Things technology may produce more intelligent and intelligent applications and encourage industrial innovation and development by integrating with big data analysis, artificial intelligence, and other technologies. Encourage social progress: The widespread use of Internet of Things technology will encourage society's digitization and intelligence while also enhancing its general effectiveness and standard of living. The Internet of Things can enable real-time tracking and analysis of students' behaviour and learning

progress in the field of education, help teachers to guide and optimize teaching methods, and improve the quality of education and students' learning effect.

### **3. The research and Development of the Assembled Adaptive New Sliding mode System**

Assembled adaptive new sliding mode system is a novel control method. By combining assembled and adaptive control technology, it can effectively deal with the uncertainty and external interference of dynamic system and improve the robustness and performance of control system. The main contents of the system will be introduced in detail below. Assembled adaptive new sliding mode system is a novel control method integrating assembled control and adaptive control technology, which has the advantages of fast response, strong anti-interference and good robustness. The main contents of the system include system modeling and parameter estimation, sliding surface design and sliding law selection, subsystem design and assembly, adaptive parameter updating, performance evaluation and optimization. Through the research and application of these contents, the robustness and performance of the control system can be improved, and it can adapt to the uncertainty and external interference of dynamic systems.

(1) Establish a model: First, a set of mathematical models need to be established to describe the working process and influencing factors of the sliding mode system, such as the dynamic model or control model of the system. This can help researchers better understand the behavior of the system and provide a basis for subsequent improvements.

(2) Design control system: According to the established model, design a set of advanced control system to ensure the stability and performance of the sliding mode system. This may include the optimization of sliding mode control algorithms, the development of control strategies, etc.

(3) Introduction of Internet of Things technology: Introduce Internet of Things technology into the sliding mode system to achieve deep integration between the system and the Internet of Things. For example, remote monitoring, data collection, information interaction and other functions can be realized through Internet of Things technology to improve the intelligence level of the system.

(4) Assembled design: In order to facilitate the maintenance and upgrading of the system, the assembled design can be adopted to modularize and standardize the various parts of the sliding mold system, making it easy to replace and expand.

(5) Experimental verification: The performance and stability of the system are verified through experiments. By comparing the experimental results, the effectiveness of the system and the direction of improvement are evaluated.

(6) Optimization and improvement: According to the experimental results and actual needs, the system is further optimized and improved. For example, adjust control strategies, optimization algorithms, etc.

(7) Industrial application: When the system performance is stable and meets the actual application needs, it can be promoted and applied to industrial production, giving full play to its advantages of efficiency, stability and intelligence, and improving the efficiency and quality of industrial production. (Fig. 3).

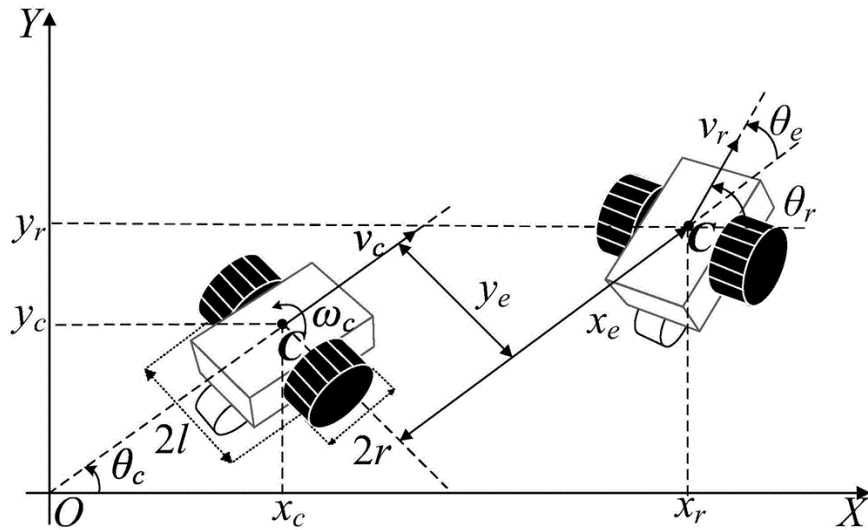


Fig.3 Trajectory of Mobile Robot with Adaptive Sliding Mode Control

### 3.1 Technological Development Significance of Assembled Adaptive New Sliding Mode System

The technical development significance of the assembled adaptive new sliding mode system is as follows (Table 2):

Table 2. Development significance

Significance of technological development	Specific content
Improve the performance and reliability of assembled sliding mode system	The traditional sliding mode system has some limitations in dealing with complex environment and uncertainty. By introducing the Internet of Things technology, the new assembled adaptive sliding mode system can sense the environmental changes and system state in real time, thus realizing the dynamic adjustment and adaptive control of the system, further improving the performance and reliability of the sliding mode system.[12].
Promote the development of intelligent manufacturing	The development and use of the newly constructed adaptive sliding mode technology provide critical assistance for intelligent production. The integration of Internet of Things technology with the assembled sliding mode system may facilitate real-time production process monitoring and control, enhance production efficiency and product quality, and foster the advancement of intelligent manufacturing.

Promote the progress of industrial automation	Developing and implementing a newly built adaptive sliding mode system can help advance industrial automation. The use of Internet of Things technology can lead to the realisation of intelligent and automatic control of industrial equipment, enhancement of production efficiency and worker safety, reduction of labour costs and energy consumption, and promotion of industrial automation advancement.
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## 4. Existing Problems and Related Applications

### 4.1. Main Problems Existing in the Development Process of Assembled Adaptive New Sliding Mode System

There are still some problems in the development of the assembled adaptive new sliding mode system, as follows (Table 3):

**Table 3.** Problems in the Development of Internet of Things

main problem	The specific content of the problem
The use of Internet of Things technology is not widely enough adopted.	Although the Internet of Things technology has been widely used in various fields, its application in assembled sliding mode system is still relatively rare. At present, most assembled sliding mode systems still use traditional control methods, which lack intelligence and adaptability.[13].
The reliability and robustness of the system need to be improved.	The reliability and robustness of assembled sliding mode system are the key problems in its research and application. At present, many fabricated sliding mode systems are prone to failure in the face of complex environment and uncertainty, and their reliability and robustness need to be further improved.[14].
The performance and efficiency of the system need to be improved.	There is still room for improvement in performance and efficiency of assembled sliding mode system. At present, many assembled sliding mode systems have slow response speed and low control accuracy, which need to be further improved and optimized.[15].

### 4.2. Related Applications

Assembled control is a method to decompose the system into several subsystems and realize the overall control by assembling these subsystems. It can improve the expansibility and maintainability of the system, and can flexibly cope with the changes of the system structure. Assembled control can be used in various fields, including mechanical control, electrical control, chemical control, etc. Assembled adaptive new sliding mode system combines the characteristics of assembled control and adaptive sliding mode control, which can realize distributed control and adaptive performance optimization of the system at the same time. Specifically, it decomposes the system into several subsystems and realizes the overall control by assembling these subsystems. At the same time, it adopts adaptive sliding mode control method to automatically adjust the sliding surface parameters to adapt to the dynamic changes of the system. Through on-line parameter estimation and adaptive compensation, system model error, external interference and uncertainty can be suppressed, and the stability and robustness of the



system can be improved. ASAST is widely used in the field of industrial automation. The following are some specific application cases:

Applications related to the prefabricated adaptive new sliding mode system based on IoT technology include but are not limited to the following:

**Industrial manufacturing:** In the field of industrial manufacturing, this new sliding mode system can be widely used in condition monitoring, fault diagnosis and intelligent maintenance of various equipment. Through the Internet of Things technology, the equipment can transmit the working status data in real time, the system can automatically analyze these data and give early warning, when the equipment fails, it can automatically diagnose and prompt maintenance personnel the best solution.

**Energy management:** In the field of energy management, the new prefabricated adaptive sliding mode system can help optimize the smart grid and improve the stability and efficiency of the grid. IoT technology can help realize real-time energy data collection and monitoring, making energy scheduling and management more refined.

**Agricultural applications:** In agriculture, such systems can help enable intelligent agricultural production. For example, through the Internet of Things technology, real-time monitoring of soil moisture, nutrients and other data, sliding mode system can automatically control irrigation, fertilization and other operations according to these data, which not only improves production efficiency, but also reduces resource waste.

**Medical services:** In the field of medical services, the prefabricated adaptive new sliding mode system based on IoT technology can help realize telemedicine and intelligent medical equipment management. For example, by monitoring a patient's health data in real time, the system can automatically warn of possible health problems and help doctors make remote diagnosis and treatment.

**Environmental monitoring:** In the field of environmental monitoring, this new sliding mode system can be used to realize real-time monitoring of environmental factors such as atmosphere and water quality. Through IoT technology, sensors can be remotely deployed for data collection, and then the data can be processed and analyzed through the sliding mode control system to provide accurate monitoring results.

Prefabricated adaptive new sliding mode systems that are based on Internet of Things technology are generally employed because they may increase the efficiency and stability of various tasks while achieving the goals of intelligence and adaptability in a variety of industries. is a system with excellent stability, speed, and precision. In addition to being multivariable, strongly coupled, and nonlinear, the manipulator system is also impacted by parameter uncertainty and load disturbance. To provide precise control over the manipulator's position and attitude, ASAST can be included into the control system. ASAST, for instance, can be used for force control while grabbing objects and trajectory tracking control of manipulators.

## **5. Conclusion**

The use of Internet of Things technology is deepening and broadening in many spheres of life, providing more ease and advantages to everybody. However, there are some obstacles and issues that the Internet of Things technological growth must overcome, necessitating the cooperation of pertinent agencies and businesses. It is anticipated that as technology continues to advance and innovate, Internet of Things applications will become more widespread and complex. This will present both possibilities and difficulties for the growth of the social economy and changes in people's lifestyles.

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