# A PRELIMINARY STUDY ON THE PRACTICE OF AUTOMATIC CONTROL TECHNOLOGY IN AGRICULTURAL MACHINERY

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**Abstract:** In order to improve crop yield and quality, my country actively promotes the popularization and application of agricultural machinery to improve agricultural production efficiency. But traditional agricultural machinery cannot meet the needs of the new era. To meet the needs of agricultural development, we should focus on using automation control technology to innovate, actively promote the transformation and upgrading of agricultural machinery, build an intelligent agricultural machinery production model, and improve agricultural productivity. produce benefits. In view of this, the author summarizes the connotation and advantages of automation control technology, and expounds the application of automation technology in agricultural farming machinery, spraying machinery, irrigation equipment. The application in the baler, and the future application trend of agricultural machinery automation control technology is prospected. The results show that the application of automatic control technology in agricultural machinery can improve. Improve crop yield and quality, increase agricultural economic income, and boost agricultural and rural modernization.
**Keywords:** Automation control technology; Agricultural machinery; Practical application

## 1. OVERVIEW OF AUTOMATION CONTROL TECHNOLOGY

In recent years, my country's agricultural modernization process has been accelerating, and the application of agricultural machinery has become more and more extensive, which is conducive to improving crop yield and quality, and saving labor costs and resource inputs. The continuous innovation and progress of science and technology has prompted agricultural machinery to gradually show the characteristics of automation and intelligence. Farmers can carry out unmanned production and remote management according to preset procedures and parameters, which greatly improves agricultural production capacity and efficiency.

### 1.1 Connotation

Automation control technology refers to the combination of computer technology and electric machinery to promote automatic control of machinery and achieve the goal of unmanned management of agricultural production. Usually, automation control technology is based on instructions or programs set by computer programming, and uses a series of single-chip microcomputer control components and various program control components for automatic operation [1]. In the actual application process, automation control technology is not only a separate technology, but also often involves computer technology, micro-processing technology, sensing and detection technology, information processing technology, etc., which effectively improves the intelligence level of machinery. Under the background of the current continuous innovation of automation technology, it has a relatively broad prospect for its application in the field of modern agriculture.

### 1.2 Advantages

The application of automation control technology in agricultural machinery has many advantages.
1) It is beneficial to realize real-time monitoring. Automatic control technology can accelerate the speed of information transmission between systems and improve efficiency. For example, real-time monitoring of agricultural production can keep abreast of crop production activities, monitor the status of crop growth and development, provide support for field management, and greatly improve agricultural output and quality.
2) It is beneficial to carry out self-diagnosis of faults. With the rapid development of my country's social economy, traditional manual labor methods are gradually being eliminated, and agricultural machinery is widely used in the production of various crops. However, under the influence of the natural environment, operation methods and use time, agricultural machinery is inevitable. There will be faults in the ground, which will not only affect the progress of agricultural production, but also lead to serious accident consequences. The use of automatic control technology can realize self-diagnosis of faults, timely discovery and early warning of fault information, such as using sensors to collect real-time operating status of components, when abnormal data is found, an alarm is issued, and self-control and diagnosis are adopted to help operators Identify the point of failure, carry out effective maintenance, and ensure the efficient operation of agricultural machinery.
3) Reduce the cost of agricultural production. Applying automatic control technology to agricultural machinery can increase its utilization rate, reduce traditional manual work, and save labor costs. Moreover, agricultural machinery

focuses on the use of computer and sensor technology, which can perform standardized operations according to preset parameters, greatly improve agricultural production efficiency, shorten production cycles, greatly reduce costs, and increase agricultural profit space [2].

## 2 APPLICATION OF AUTOMATION CONTROL TECHNOLOGY IN AGRICULTURAL MACHINERY

### 2.1 Application of Automatic Control Technology in Tillage Machinery

At present, the application practice of automation control technology in agricultural machinery is mainly manifested in farming machinery. In agricultural production and planting activities, soil quality will have a greater impact on the yield of agricultural products. In order to improve soil conditions, it is often necessary to use tillage machinery for plowing. When using traditional farming machinery, it is easy to lack reasonable consideration of factors such as soil cultivation depth and moisture, resulting in unsatisfactory cultivation quality and affecting crop yield and quality. In the process of modern agricultural development, the use of agricultural machinery can be effectively improved by introducing automatic control technology into farming machinery. For example, building a navigation system in a farming machine, Setting parameters such as farming route and depth in advance is conducive to realizing standardized operations and improving the current situation of farmers manually controlling farming operations in the past. Moreover, the application of automatic control driving technology is conducive to the realization of unmanned operations, saving labor input, and can also avoid the situation that a large amount of dust is generated due to deep plowing of the soil during farming, which affects safe driving. The principle of using self-control technology to establish a navigation and driving system for farming machinery, that is, integrating environmental perception technology, visual navigation technology, GPS satellite positioning technology, electromagnetic navigation technology, etc., according to the driver's habits and the requirements of farming routes, implement remote control of farming machinery. Monitor and optimize farming quality in time [3].

In addition, in order to further reduce the operation difficulty of farming machinery, automatic control technology can be used to build an intelligent operating system, such as installing a computer console, CIP intuitive control panel, touch screen monitor, etc. Integrate all operations into one simple controller for easy farming. At the same time, the use of automatic control technology can establish a sensor control system, realize differentiated farming according to different operating objects, and monitor soil structure, which is conducive to improving crop production. For example, an airflow sensor can be added to the existing farming machinery to monitor the soil environment online. After the sensor obtains the soil air permeability data, it is immediately transmitted to the mobile terminal device and compared with the preset soil standard. If the monitoring data deviates from the standard value, the system can issue instructions for process adjustment, reasonably control the tillage depth, and effectively improve soil air permeability [4].

### 2.2 Application of Automatic Control Technology in Spraying Machinery

In agricultural production, in order to ensure the healthy growth of crops, effective plant protection measures must be taken, and pest control through spraying is an important content. With the continuous expansion of the current agricultural planting area, the task of pest control is becoming more and more serious. If the previous manual spraying method is used, it will consume a lot of manpower and material resources, and the control efficiency is low. Combined with the development trend of modern agriculture, the application of spraying agricultural machinery is gradually emphasized, and chemical spraying operations are carried out in a timely manner according to the growth of crops, which will help to strengthen the effect of pest control. However, the existing spraying machinery is difficult to meet the precise operation control, and cannot meet the current requirements for pest control and plant protection. Therefore, automatic control technology can be applied to spraying machinery to improve the spraying accuracy to the centimeter level and avoid overspraying. For example, a visual sensing system can be set up in the spraying operation. When spraying herbicides, the visual sensing system can be used to effectively transmit the image of the sprayed area to the control system, and then the computer vision algorithm can be used to identify the weeds in the area and calculate the relative and absolute position, and transmit the collected image information to the control system, which can be opened quickly according to the sprayer's own angle, spraying speed and weed position, etc.

The nozzles near the weeds can effectively spray herbicides to achieve the purpose of removing weeds. Through the application of automatic control technology, it is beneficial to save the cost of manual weeding, improve the efficiency of weeding, and ensure the healthy and smooth growth and development of crops [5].

### 2.3 Application of Automatic Control Technology in Agricultural Irrigation Equipment

Agricultural irrigation is an important link in the current agricultural production process. For the use of agricultural machinery, attention should be paid to saving water and improving the utilization rate of water resources. However, traditional irrigation facilities and methods will lead to serious waste of water resources and insufficient resource utilization. Through the application of automatic control technology, it is possible to combine computer and communication technology to build an intelligent irrigation system, and implement precise irrigation according to the

monitoring conditions of farmland and future weather forecasts. For example, the automatic control system of farmland irrigation can be applied, which is composed of irrigators, moisture sensors, temperature sensors, pressure and water level sensors, etc. According to the data collection results, the computer can analyze the water demand of the farmland, and then adjust the irrigation facilities such as drip irrigation and sprinkler irrigation. Automatic control is carried out to irrigate during periods of low evaporation, so as to realize dynamic and standardized management, effectively improve irrigation efficiency, and avoid waste of water resources. For example, in a drought period, relevant personnel set automatic irrigation parameters according to the data transmission results of the soil moisture content detection sensors distributed in the farmland, which can realize regional irrigation, coordinate water consumption, and ensure the efficient use of water resources [6].

### 2.4 Application of Automatic Control Technology in Harvesting Machinery

In the agricultural production process, harvesting is a stage in which agricultural machinery is used more frequently, which helps to save labor costs and improve harvesting efficiency. In this process, using automatic control technology, such as setting up intelligent instruments to monitor the development status of crops, judging the maturity of crops, and then using intelligent systems to accurately execute operation commands, automatic harvesting of crops in the field can be realized. For example, installing equipment sensors at fixed positions in the farmland, collecting comprehensive external information, comparing the manual control program parameters of the instrument, and orderly executing program instructions can realize autonomous harvesting of crops. In rice harvesting activities, the crawler self-propelled full-feed grain combine harvester is equipped with dual cameras, AI processors, controllers, etc., which help to perceive the density and humidity of the crops, the degree of grain quality etc. Using the AI controller for intelligent adjustment is beneficial to reduce manual operation pressure, improve harvest quality, and reduce crop loss [7]. At the same time, during the driving of the harvester, road conditions, harvester operating status, obstacle monitoring, etc. can be dynamically displayed on the computer screen in the cab. If encountering complex terrain, the position of the harvester can be changed in time to realize automatic control and improve harvesting operations. efficiency and quality.

### 2.5 Automatic Control Technology Applied to Baler

In agricultural production activities, in order to achieve resource reuse, reducewaste situation, people pay more and more attention to straw recycling. In this process, baler equipment is mainly used to improve the backward operation methods such as manual harvesting and picking. In practice, an intelligent control system can be built in the baler equipment to improve the efficiency of straw recycling and minimize resource loss. For example, adding automatic control technology to the baler operating system can realize remote control and improve the operation accuracy of the baler as much as possible. The automatic control technology mainly introduces the Beidou positioning system, sensor technology, hydraulic precision control technology, etc., and combines various analysis equipment to process the sensor equipment, which is conducive to judging the operating status of each key component of the baler. Trigger conditions, effectively control the action of solenoid valves or motors, etc., to realize the automation of bundling operations. In the existing automatic baler equipment, an intensity sensor is mainly installed on both sides of the baler chamber, so as to facilitate the monitoring of the running state of the baler. If the density of straw on both sides is high, the system will generate an alarm to prompt the driver to drive to the side with low density to ensure that the bundling quality is improved. By controlling the automatic unloading of formed bales from the oil cylinder in the baling chamber, it is beneficial to automatically count the number of bales, save labor costs, and improve operating efficiency as much as possible.

### 3 APPLICATION PROSPECT OF AUTOMATION CONTROL TECHNOLOGY IN AGRICULTURAL MACHINERY

1) Personalized and differentiated design of agricultural machinery. my country is rich in agricultural resources and there are relatively many types of crops. However, due to the influence of natural environment and geographical location, the demand for agricultural machinery has differentiated and individualized characteristics. In the future development stage, we will focus on the use of automatic control technology to design and develop miniaturized agricultural machinery and equipment suitable for local operations, so as to meet the agricultural production requirements of complex terrain [8]. At the same time, government departments at all levels should increase technical support for agricultural machinery, promote and popularize automatic control technology by increasing capital investment, scientific research investment, and talent investment, and further optimize the production and operation efficiency of agricultural machinery to meet the needs of crop production management and improve crop yield and quality.

2) Improve the intelligent level of agricultural machinery operation. At present, there is still a big gap in the development of agricultural machinery in my country compared with developed countries, which is mainly reflected in the level of intelligent operation of agricultural machinery. At this stage, most agricultural machinery has not yet achieved unmanned and remote control, and its system intelligence needs to be improved.. Therefore, under the future

trend of comprehensive mechanized operations, more attention will be paid to the development of intelligent agricultural machinery, in-depth analysis of agricultural automation control and adjustment technology, to improve the efficiency of agricultural operations, to comprehensively consider the impact of agricultural natural environment, and to improve the safety and reliability of mechanical operation , to reduce the accident rate [9].

3) Meet the production needs of the new countryside and adapt to the standardization and modernization of agricultural operations. As the process of urbanization continues to advance, a large number of rural surplus laborers are pouring into cities, and the number of laborers engaged in agricultural production will further decrease in the future. In order to ensure the improvement of rural productivity, it is necessary to strengthen the results of agricultural machinery research and development, improve the level of automation Possibly saving human resources [10]. Therefore, in the future development stage, the application of automatic control technology in agricultural machinery will focus on the research and development of intensive intelligent production of agricultural machinery equipment with automatic adjustment control, which meets the production needs of rural society.

## 4 CONCLUSION

To sum up, in the process of modern agricultural development in my country, mechanization has become an important trend. In order to efficiently utilize agricultural machinery for production, we should pay attention to the use of automation control technology. In practice, automatic control technology can be introduced to farming machinery, spraying machinery, irrigation equipment, harvesting machinery, and balers to effectively improve agricultural production capacity. Moreover, in the future development stage, agricultural machinery will move towards personalized and differentiated design, improve the level of intelligence, and adapt to the needs of rural production, so as to effectively accelerate the process of agricultural modernization in my country, improve crop yield and quality, and achieve high-quality agricultural economy. develop.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

## REFERENCES

[1] Wang Xingchao. Application of PLC technology in electrical automatic control of agricultural machinery. Southern Agricultural Machinery, 2021, 52(22): 195-196.
[2] Song Chao. Application practice of automatic control technology in agricultural machinery. Agricultural Engineering Technology, 2021, 41(30): 15-16.
[3] Wang Jinguo. Application of automatic control technology in agricultural machinery. Rural Science and Technology,2020, 11(34): 122-123.
[4] Zhou Hao. Application of Automatic Control Technology in Agricultural Machinery. Guangdong Sericulture,2020, 54(10): 96-97.
[5] Wang Dongmei. Application of Automatic Control Technology in Agricultural Machinery. Southern Agricultural Machinery,2020, 51(16): 49-50.
[6] Gu Lanju. Application research of automatic control technology in agricultural machinery. Seed Section Technology, 2020, 38(15): 138+140.
[7] Wang Peng. Application Analysis of Automatic Control Technology in Agricultural Machinery. Guangdong Sericulture,2020, 54(4): 90-91.
[8] Su Lina. Application Research of Automatic Control Technology in Agricultural Machinery. Light Textile Industry and Technology, 2019, 48(10): 95-96.
[9] Zhang Zhen, Zhao Shuling. Application of automatic control technology in agricultural machinery. Production Industry and Technology Forum, 2019, 18(14): 57-58.
[10] Zhou Jianfeng. Application of Automatic Control Technology in Agricultural Machinery. Times Agricultural Machinery, 2019, 46(6): 12-13.