Research on the Technology of a Multifunctional Intelligent Rural Work Machine

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Abstract: Based on a full study of the agricultural mechanization market, a three-step strategic development plan for the intelligent rural management machine is formulated. The first generation of our products is now on the market. This rural business machine does not require manual driving, but still requires manual remote field remote control. The research of the project is centered on a cruise intelligent rural operation machine with satellite positioning system. This type of intelligent rural work machine equipped with a navigation system uses GPS satellite navigation, so the positioning accuracy can reach 5 cm. Therefore, we only need to set the work area, and then the machine's measurement and control system can automatically plan the work route. We change different agricultural implements, such as: harvesters, tractors, pesticide sprayers, etc. After the navigation system is installed on these agricultural implements, the main agricultural operations such as planting, spraying, and harvesting of farmers can be completed automatically, which saves labor costs and improves operation efficiency. This rural work machine truly realizes the precision and intelligence of work.

1. Research Background
At present, China is in a critical period of transition from traditional agriculture to modern agriculture. In the process, new professional farmers are increasingly demanding agricultural equipment, and the shortcomings and shortcomings of traditional agricultural machinery are gradually emerging.

First of all, as the process of industrialization and urbanization continues to accelerate, the problems of "difficult labor" and "expensive labor" in agriculture have become increasingly prominent, and the demand for mechanization in various agricultural fields has become more urgent. The dependence of farmers on agricultural machinery and equipment has become increasingly apparent. "Mechanized substitution" has become an inevitable choice to solve the question of "Who is going to farm? How to farm?" However, China's traditional agricultural equipment has the disadvantages of high noise, large dust, low intelligence, and single function, which causes farmers to experience noise or dust when they operate traditional agricultural machinery in the field. Therefore, many young people stay away from agriculture, especially Young people with knowledge and education are reluctant to return to farming in the countryside.
Secondly, green and efficient agriculture has become the general direction of China's agricultural development. However, with the increasing number of greenhouses in the north and the development of the country's forestry and fruit industry, agricultural machinery suitable for cultivation in low, narrow, and closed environments is scarce. Some traditional agricultural machinery products cannot meet the demand, especially the spraying work is difficult to carry out by manual operation and endangers the health of farmers. Fruit farmers and vegetable farmers urgently need intelligent and efficient agricultural machinery equipment instead of manual production operations.

In the critical period of China's agricultural supply-side reform, new agricultural operators and new professional farmers have become the leading forces in the development of agricultural modernization. Therefore, their first choice is new high-end agricultural machinery products with diverse, intelligent, efficient, energy-saving and environmental protection characteristics.

2. Research content
This project mainly researches, develops and produces a new type of high-end rural management machine that is intelligent, efficient, energy-saving and environmentally friendly, improving the degree of mechanization and automation of farming, reducing labor costs, and comprehensively improving China's agricultural productivity.

3. the main technology

3.1 Technical field
This research project belongs to the field of intelligent agricultural motor vehicles. The project will use some kind of intelligent hydraulic remote control driving system.

3.2 Background technology
At present, agricultural machinery requires manual operation on the vehicle to achieve corresponding actions. In some toxic operating environments (such as spraying drugs), it will cause harm to the operator's health, and some small enclosed spaces are not suitable for the operator to enter the operating environment. Therefore, a system capable of remotely controlling agricultural vehicles without requiring an operator to enter the job site is urgently needed.

3.3 Invention content
The object of the present invention is to provide an intelligent hydraulic remote control driving system, so that an operator can remotely control a vehicle to perform operations without entering a work site.

3.4 Technical scheme
In order to achieve the above-mentioned object, the technical solution adopted by the present invention is as follows.

This intelligent hydraulic remote control driving system mainly includes a hydraulic integrated valve, a transmission cartridge hydraulic electronic control valve, a clutch cartridge hydraulic electronic control valve, a brake device cartridge hydraulic electronic control valve, and a lifting system cartridge hydraulic electronic control valve, drop system plug-in hydraulic electronic control valve, signal receiving processor, hydraulic pump, gearbox, clutch, brake device, lifting system, drop system and control device. Among these devices, the transmission cartridge hydraulic electronic control valve, the clutch cartridge hydraulic electronic control valve, the brake device cartridge hydraulic electronic control valve, the lifting system cartridge hydraulic electronic control valve, the drop system cartridge hydraulic electronic control valve, and the drop system through the signal line. Cartridge hydraulic electric control valve connects hydraulic integrated valve with gearbox cartridge hydraulic electric control valve, clutch
cartridge hydraulic electric control valve, brake device cartridge hydraulic electric control valve, lifting system cartridge hydraulic electric control Valve, drop system plug-in hydraulic electric control valve, hydraulic pump connection. There is a wireless signal transmitting module in this control device, and there is a wireless signal receiving module in the signal receiver, and the signal of the wireless signal transmitting module matches the signal of the wireless signal receiving module.

As a preferred technical solution, the signal mode of the wireless signal transmitting module is a 4G network.

As a preferred technical solution, an anticorrosive coating is applied on the connection part of each component.

As a preferred technical solution, the hydraulic pump, the hydraulic integrated valve, the transmission cartridge hydraulic electronic control valve, the clutch cartridge hydraulic electronic control valve, the brake device cartridge hydraulic electronic control valve, and the lifting system cartridge hydraulic The connection between the electronically controlled valve and its drop system cartridge hydraulic electronically controlled valve is completely sealed.

What are the benefits of this invention?

A. The system can be applied to the intelligent unmanned driving device of agricultural motor vehicles, so that the operator can remotely control the agricultural vehicle for operation without going to the job site.

B. The intelligent hydraulic control provided by this system has the advantages of simple structure, convenient and safe operation, and low cost.

C. The components of this system are coated with anticorrosive coatings to ensure that the components are not attacked by chemicals such as pesticides.

D. The system's hydraulic integrated valve device ensures the normal operation of each cartridge type hydraulic electric control valve.

Fig 1. Intelligent hydraulic remote control driving system design chart
In the figure, 1. hydraulic integrated valve, 2. gearbox, 3. gearbox plug-in hydraulic control valve, 4. clutch, 5. clutch plug-in hydraulic electric control valve, 6. signal receiving processor, 7. Brake device, 8. Brake device plug-in hydraulic electric control valve, 9. Control device, 10. Lift system, 11. Lift system plug-in hydraulic electronic control valve, 12. Drop system, 13. Drop system plug Hydraulic electric control valve, 14. hydraulic pump, 15. wireless signal receiving module, 16. wireless signal transmitting module.

3.4 Specific implementation

Figure 1 shows: this intelligent hydraulic remote control driving system is composed of these components: including hydraulic integrated valve 1, transmission cartridge hydraulic electronic control valve 3, clutch cartridge hydraulic electronic control valve 5, brake device cartridge hydraulic Electric control valve 8, plug-in hydraulic electronic control valve for lifting system 11, drop-in hydraulic electronic control valve for drop system 13, signal receiving processor 6, hydraulic pump 14, gearbox 2, clutch 4, brake device 7, lift Lifting system 10, falling system 12, and control device 9. Among these components, the transmission cartridge hydraulic electronic control valve 3, the clutch cartridge hydraulic electronic control valve 5, the brake device cartridge hydraulic electronic control valve 8, the lifting system cartridge hydraulic electronic control valve 11, drop the system plug-in hydraulic electronic control valve 13 is connected to the gearbox 2, the clutch 4, the braking device 7, the lifting system 10 and the falling system 12, respectively. This signal receiving processor 6 is respectively connected to the gearbox plug-in hydraulic electric control valve 3, the clutch plug-in hydraulic electric control valve 5, the brake device plug-in hydraulic electric control valve 8, and the lifting system plug-in hydraulic pressure through signal lines. The electric control valve 11 and the drop system plug-in hydraulic electric control valve 13 are connected. This hydraulic integrated valve 1 is equipped with a transmission cartridge hydraulic electronic control valve 3, a clutch cartridge hydraulic electronic control valve 5, a braking device cartridge hydraulic electronic control valve 8, a lifting system cartridge hydraulic electronic control valve 11, The drop system plug-in hydraulic electric control valve 13 and the hydraulic pump 14 are connected. A wireless signal transmitting module 16 is installed in this control device 9, a wireless signal receiving module 15 is installed in the signal receiver 6, and the wireless signal transmitting module 16 matches the signal of the wireless signal receiving module 15.

When the controller 9 issues an instruction through the wireless signal transmitting module 16, the wireless signal receiving module 15 of the signal receiving processor 6 receives the instruction, and the signal receiving processor 6 processes the different instructions and converts it into an electrical signal through the signal line. Gearbox plug-in hydraulic electronic control valve corresponding to the command 3, clutch plug-in hydraulic electronic control valve 5, brake plug-in hydraulic electronic control valve 8, lifting system plug-in hydraulic electronic control valve 11, drop system The plug-in hydraulic electric control valve 13 sends action commands to control the gearbox 6, clutch 4, brake device 7, lifting system 10 and drop system 12 to complete shifting, shifting, parking, lifting or lowering of agricultural implements, etc. The integrated valve 1 ensures the gearbox plug-in hydraulic electric control valve, clutch plug-in hydraulic electric control valve, brake device plug-in hydraulic electric control valve, and lifting system plug-in hydraulic electric control under the power of the hydraulic pump 14. Valve, drop system, plug-in hydraulic electric control valve runs smoothly.

4. Effectiveness and promotion

The Chinese government attaches great importance to the development of agricultural mechanization and has promulgated laws and regulations such as the "Promotion Law for Agricultural Mechanization" and "Articles for the Supervision and Management of Agricultural Machinery Safety" and formulated and issued the "State Council's Opinions on Promoting the Sound and Rapid Development of Agricultural Mechanization and the Agricultural Machinery Industry ". Listing the development of agricultural machinery and equipment as the key areas involved in the" Made in China 2025 "document. The Chinese government promulgated a series of policy measures to support the
development of agricultural mechanization, mobilized the enthusiasm of farmers to purchase and use machines, and promoted the sustained and rapid development of agricultural mechanization across the country. These measures have become prominent highlights in the development of agricultural modernization in China. The Ministry of Rural Agriculture stated that by 2020, the comprehensive mechanization rate of crop cultivation and harvesting in China will reach 70%, the production process of major food crops will be fully mechanized, and the production of major cash crops will be fully mechanized. By 2025, the comprehensive mechanization rate of crop cultivation and harvesting in China will reach 75%. Mechanization of the main crops in the production areas of dominant agricultural products has basically been mechanized.

The intelligent field management machine developed by the project team belongs to the small tractor. According to data from the National Bureau of Statistics, in 2017, China’s output of small tractors was 1.2 million units, and small tractors were equipped with 5 million sets of agricultural machinery, with a total output value of about 60 billion yuan. Nowadays, tractor factories basically adopt the strategy of “production by sales” Based on this calculation, the annual market capacity of small tractors and supporting agricultural machinery is about 60 billion yuan.

The domestic target customers of the intelligent rural management machine are mainly targeted at farmers in rural complexes, fruit farmers who contract large tracts of woodland, and greenhouse growers, etc., and the foreign target customers are mainly targeted at agricultural countries along the “Belt and Road” and the SCO.

5. Conclusion
The project researched a cruise intelligent rural working machine for satellite positioning system. This intelligent rural work machine equipped with a navigation system, because it uses GPS satellite navigation, so we only need to set the work area, and then the machine's measurement and control system can automatically plan the work route. By replacing different agricultural implements, after installing the navigation system on these agricultural implements, the main agricultural operations can be completed automatically. This rural work machine truly realizes the precision and intelligence of work.

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