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Research and Design of Intelligent Agricultural Robot Based on Image Recognition Technology

Yucan Sun and Xinyi Ma

School of Science, Lanzhou University of Technology
Lanzhou, Gansu 730050, P. R. China

Abstract

With the development of economy and society, agricultural modernization has affected the development pace of Chinas overall modernization, and there is an urgent need to accelerate the development of modern agriculture. The application of high technology to modern agriculture has become the most basic and critical way out and measures for China's agricultural development. The intelligent agricultural robot based on image recognition technology is a set of online and offline decision-making systems based on Internet of Things technology and intelligent optimal scheduling algorithms. It is based on intelligent agricultural robots, aimed at improving the level of mechanization, information digitization, and automation of agricultural production, freeing manpower from agricultural production as much as possible, and striving to build a resource-saving and environment-friendly agricultural ecology . Operators can realize multiple functions only by using smart phones, which provides great convenience for agricultural development.

Keywords: Smart agriculture; Image Recognition; AI Smart Vision PTZ

1 Introduction

With the rapid economic development and the advancement of the countrys urbanization process, high-tech technologies are difficult to integrate with

traditional agricultural production[1], the quality of rural agricultural production has declined sharply, and smart agriculture and precision agriculture are difficult to achieve. The progress of science and technology application is inseparable from the development of academic research, and the production scheduling of precision agriculture is a typical combined optimization problem[2]. By improving the intelligent agricultural robot based on image recognition technology, the utility model has reasonable structure design, can flexibly adjust the height of the arable land rake to realize precise seeding, and has comprehensive functions.

2 Introduction to Smart Agriculture

Smart agriculture is a new term eliminated in the agricultural field under the premise of continuous development of new technologies such as Internet of Things technology, big data, and cloud computing. Its purpose is to make the agricultural production links green, standardized, data-based, networked, and intelligent, until the agricultural production links are closed-loop controllable according to needs, and develop in the direction of optimization that is beneficial to human needs. Compared with traditional agriculture or the introduction of simple informatization methods in agriculture, smart agriculture belongs to the advanced stage of agricultural informatization, and is the in-depth application of information technologies such as the Internet of Things[3].

3 Specific design

The specific examples of smart agricultural robots based on image recognition technology are shown in Figure 1 as follows.

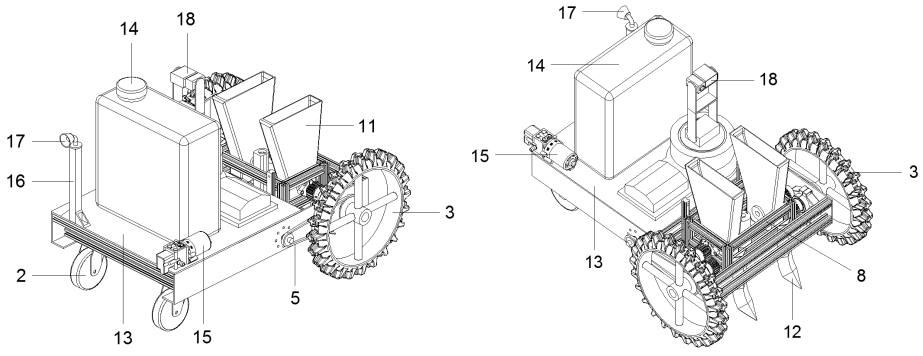

Figure 1: Design side view(left) and design front view(right).

In the Figure 1: body 1, universal wheel 2, all-terrain wheel 3, drive motor 4, belt 5, bottom beam 6, hydraulic cylinder 7, bracket 8, slide rail 9, sliding seat 10, hopper 11, cultivating rake 12, bottom plate 13. Water storage tank 14, water pump 15, sprinkler bracket 16, sprinkler 17, AI intelligent vision platform 18.

A smart agricultural robot based on image recognition technology, the universal wheel is fixedly installed at the bottom of the rear end of the body by bolts, and the all-terrain wheel is installed on both sides of the front end of the body through a bearing seat. The driving motor is installed on the bottom of the machine body by bolts, and the driving motor is connected to the all-terrain wheel by a belt. The bottom beam is fixedly installed at the bottom of the front end of the machine body by bolts. The bracket is fixedly installed on the hydraulic cylinder by bolts, and the telescopic rod at the bottom of the hydraulic cylinder is fixedly installed on the bottom beam. The sliding rail is fixedly installed on the machine body by bolts, and the bracket is installed on the sliding rail by a sliding seat. The hopper is fixedly installed on the upper part of the bracket, and the cultivating rake is fixedly installed on the bottom of the hopper. The bottom plate is fixedly installed above the rear side of the machine body by bolts, and the water storage tank is fixedly installed above the bottom plate. The water pump is fixedly installed on the bottom plate by bolts. The nozzle holder is fixedly installed at the rear end of the bottom plate by bolts, and the nozzle is fixedly installed on the top of the nozzle holder by bolts. The AI smart vision PTZ is installed above the bottom plate by bolts, and the AI smart vision PTZ is located on one side of the water storage tank. Among them, the AI intelligent vision pan-tilt realizes information transmission with the smart phone through the ATK-HCO5 Bluetooth serial port module.

4 Specific implementation

The driving motor 4 drives the all-terrain wheel 3 to rotate through the belt 5 to realize the movement of the body 1. By controlling the different speeds of the two driving motors 4, the steering of the body 1 is realized, which is more flexible and convenient to use, and moves the device to the farmland. Inject seeds into the hopper 11, control the hydraulic cylinder 7, push the support 8 up and down through the hydraulic cylinder 7, adjust to a proper planting height, start the drive motor 4, the body 1 moves, and the rotation of the all-terrain wheel 3 drives the rotation in the hopper 11 The wheel rotates to complete precise seeding. When water or pesticides are filled in the water storage tank 14, the water pump 15 pumps the water or pesticides out of the water storage tank 14, and sprays them through the nozzle 17, so as to complete the operations of watering, irrigation, and pesticide spraying.

The device uses the color tracking function of the AI intelligent vision PTZ 18 to achieve directional and precise spraying of pesticides. The working mode of the AI intelligent vision PTZ 18 is switched by the mobile app through wifi to transmit different commands. In addition, in order to ensure the safety of farmers' property, the device uses the target tracking function and face recognition function of the AI intelligent vision platform 18 to realize a relatively complete safety early warning system. When a suspicious person is detected approaching the robot, the robot will automatically send a voice announcement and send an email alert to the robot owner.

5 Innovation

(1) Using the optimized differential evolution algorithm as the optimizer at the bottom of the controller, the optimal solution can be quickly found in the combinatorial optimization problem of path optimization. According to the above mechanism, it can effectively serve multiple agricultural household users or large-scale farms.

(2) According to the production concept of precision agriculture, this intelligent agricultural robot uses the color tracking function of the AI vision pan-tilt to achieve directional and precise spraying of pesticides. The working mode of the AI Vision PTZ is switched by different commands transmitted by the mobile app via wifi. In addition, in order to ensure the safety of farmers' property, the robot uses the target tracking function and face recognition function of the AI vision platform to realize a relatively complete safety early warning system.

(3) The utility model improves the intelligent agricultural robot based on image recognition technology, has a reasonable structural design, and can flexibly adjust the height of the arable land rake to achieve precise seeding. And it has comprehensive functions as a whole and can be used for multiple purposes.

(4) It combines existing computer vision technology, Internet of Things computing, artificial intelligence AI algorithms and automated agriculture to innovate, and obtain artificial intelligence agricultural robots based on computer vision and self-learning. Among them, the method of combining computer simulation and theoretical analysis of the algorithm is mainly used, and the intelligent optimization algorithm used is studied from two aspects of experiment and theory. For crop growth environments affected by multiple factors, orthogonal experiments are used to correct the core factors.

6 Conclusions

Through the research and improvement of the overall design system of the intelligent agricultural robot system based on image recognition technology, the robot has a reasonable structural design. In addition, the robot can flexibly adjust the height of the arable land rake to achieve precise seeding, comprehensive functions, and one machine for multiple purposes. It can also achieve watering and irrigation, spraying pesticides, and has the advantages of reducing use time limitations and strong practicability.

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