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Design of Branch Grinder Based on Motion Controller

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Abstract: With the country improves the degree of attention to environmental protection, treatment of forestry biological resources has also been highly valued. The most effective processing method of forestry biological resources at present is the use of the branch grinder, branch grinder is generally fed by man, artificial feeding has high cost and low efficiency, and also has the existence of security risks. In this paper, a kind of automatic automatically feeding branch grinder is designed, it can realize automation of the whole process, and can eliminate problems existing in artificial feeding, it has a certain practical significance.

Keywords Branch grinder; Control system; Motion controller

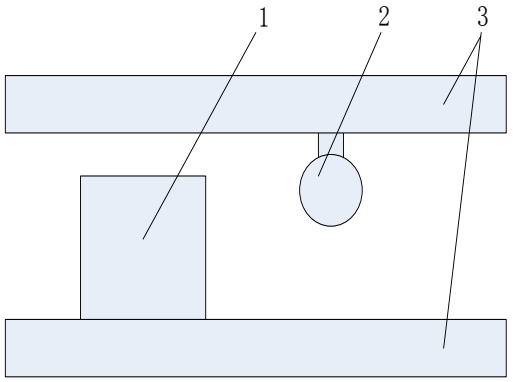
INTRODUCTION

With the development of the country, China's forestry development speed is gradually accelerated, forestry biomass including forest and forest wastes [1]. The forest is a kind of resources can be widely utilized, but the forest waste if not timely treat will cause many problems, such as the occupation of land, the breeding of pests [2]. The treatment of original waste is always direct incineration, with the growing awareness of environmental protection, waste incineration has been banned, waste disposal has become the biggest problem to the related departments. At present, the most commonly used method treatment of branches is crushing, branches will be crushed as fertilizer stacked in the city vegetation [3]. Branch crushing technology has been widely used in abroad, related technology and equipment is relatively mature [4]. At present our country branch crushing is still mostly done manually, branch is transported to the designated place for crushing, artificial feeding, the labor intensity is large, production efficiency is low [5]. Aiming at the problem of comminuted branches, a branch grinder is designed based on motion controller, the branch grinder can work in various places, it does not need to carry out a unified treatment of the branch, it is convenient and quick. Using the motion controller as the core of control system can improve the reliability of the system, the response speed and portability [6]. Branch grinder designed in this paper provides a new train of thought for the purpose of forestry waste treatment, and promoting the development of forestry.

THE BRANCH GRINDER SYSTEM SCHEME DESIGN

The overall design of the branch grinder

As shown in Figure 1, the branch grinder is mainly composed of a feeding mechanism, a crushing mechanism, driving mechanism and frame etc. The feeding mechanism, the crushing mechanism and the driving mechanism are key parts of branch grinder. The feeding mechanism is the role of feeding, it can drive branches forward, and ensure that the branches are always in the same form in the process of movement. In order to satisfy the different dimensions of the branches, the feeding mechanism adopts floating type design, the roller of feeding mechanism can fluctuate up and down to adapt to the different diameter branches, and the branches are driven forward with the friction between the rollers. The crushing device is a cutter provided with four blades, four scraper at the back of the cutter, scraper is rotating with the cutter, rotation will produce high-speed airflow, the generated high-speed airflow can smash the sawdust out through the discharge mechanism.



1. Crushing mechanism 2.Feeding mechanism 3.Frame
Figure 1.The diagram of the branch grinder

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The control system of the branch grinder

As shown in Figure 2, the branch grinder control system mainly consists of the motion controller, servo driver, the detection device and the execution device. Motion controller is the core of the whole control system, it is used for signal reception and all coordinated motion among all mechanisms. The servo driver is connected with the controller, receives signal from controller, and drives the servo motor to make the appropriate action. The detecting device includes a variety of sensors, they are used to detect the state and position of the branches grinder. Execution device includes indicators and some other device, they are used to display the working state of the branch grinder.

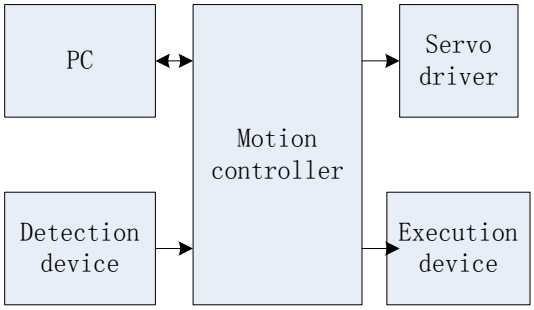

Figure 2. The diagram of the control system branch grinder

SOFTWARE DESIGN

software structure design

In order to make the control system of the branch grinder more flexible, the software design adopts modularization design way. Motion controller runs based on PC, it only has operating environment, and no development environment, so the motion controller does not have the programming condition, it need to use PC as a upper computer to carry on the programming and debugging. The modular system design is shown in figure 3. Process management module is developed on the upper computer, then the written logic control program and motion control program are transmitted to the motion controller, the motion controller is used to perform motion control module. The written programs can run independently in the controller, and it does not need to perform on a computer.

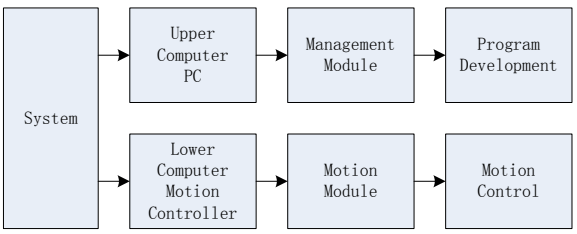

Figure3. The modular system design

Software function design

According to the characteristics and process of the branch grinder, branch grinder machine adopts sequential operation mode. Software process is shown in figure 4. After booting, the system initializes, and detects the state of branch grinder, if there is failure ,an alarm indicator will light up, if there is no fault, it continues to run. After the initialization, the system detect whether there is a branch of feeding, if there have branches feeding, system drives the branches forward for crushing, system continues to detect branches feeding, if there are branches in front, the branches behind will not continue to go forward. After the completion of this time, the next cycle runs. If there is fault in half-way, the system will prompt the fault, and the program jumps to the initialization state.

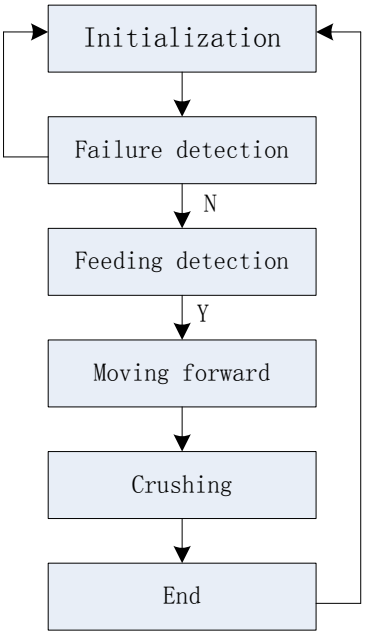

Figure4. Software process

I/O design

Detection and execution device of branch grinder system feedback and output through the I/O interface controller, sensor to detect the position of the branches is directly connected with the I/O interface of the controller. The system I/O design is shown in table 1.

Table1.System I/O design

Input		Output	
IN0	Position switch 1	OUT0	Indicator 1
IN1	Position switch 2	OUT1	Indicator 2
IN2	Position switch 3	OUT2	Indicator 3
IN3	Limit switch 1	OUT3	Indicator 4
IN4	Limit switch 2		

CONCLUSION

In view of the present situation of branch process, a branch grinder is designed based on motion controller in this paper, the branch grinder can adapt to abandoned branches processing request, improve work efficiency, and reduce production cost. Using floating type design can adapt to different sizes of branches, and improve the working range. Using the motion controller as the core of the control system has the advantages of quick response speed and high control precision, the system is stable and reliable. It has a important practical significance.

REFERENCES

Zhao Jun, Wang Shuyang. The utilization of biomass resources in China [J]. Journal of solar energy, 2008, 29 (1): 90-94.

Jin Pan. The development of branch disintegrator design [J]. Modern agricultural machinery, 2011:28-29.

Gao Rui. HLZFS430Q the branch disintegrator development [J]. Fujian forestry science and technology, 2011, 38 (3): 82-84.

Zheng Zeying. The development of FSJ-8.0 branch disintegrator [J]. Agricultural science and technology promotion, 2012, (3): 56-56.