

Design of Coconut Feeding Machine Based on Motion Controller

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Abstract: Coconut is a typical tropical crops, it is widely used in social life. But before processing, the coconut needs to carry on the shucking treatment, shucking machine is commonly used in the traditional way of artificial feeding, the work efficiency is low, the cost is high. In order to realize the automation of coconut feeding, improve production efficiency, and reduce production cost, in this paper, a coconut automatic feeding machine is designed based on the motion controller, it can realize automation the whole process of feeding, transporting, transferring, it can satisfy the shucking machine feeding requirements, and it has a certain practical significance.

Keywords Coconut feeding machine; Control system; Motion controller

INTRODUCTION

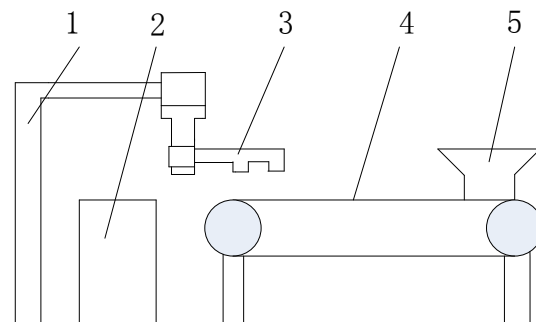
Coconut is a typical tropical woody plant, it can provide food and energy, and it can also provide oil, the application is in social life widely, it is one of high economic value crops [1]. Coconut can be used as food, can also be used for oil extraction [2]. In the coconut processing process, the removal of coconut shell has an important effect on the machining process and machining efficiency. Coconut crustaceous is hard, and it is difficult to have deformation in the hot and cold environments, which brings great difficulties for processing [3]. In the present stage, our country most of the coconut products processing also use manual and semi manual manner. This kind of work, there are many problems, such as high labor intensity, low work efficiency, hidden safety problems, a direct result of the comprehensive cost increase [4]. In order to improve the coconut products processing status, this paper a kind of automatic coconut feeding machine is designed based on the motion controller, instead of manual labor, it can improve work efficiency and reduce the comprehensive cost. Motion controller is widely used in the field of industrial control, it has the advantages of high control accuracy, good reliability, and portability strong [5]. As the core of the control system in this paper, using the motion controller can realize automatic feeding of the whole process, which can meet the requirement of feeding.

HARDWARE DESIGN

Overall design

As shown in Figure 1, the composition of coconut feeding machine is mainly composed of a motor control system, feeding system and transfer system. Fitting through the coordination among each system realizes the automation of coconut feeding. Motor

control system will transport coconut to the designated location, transfer system takes the position as a starting point, then coconut will be transported to the specified workbench, manipulator grasps coconut for processing, after the completion of processing, manipulator resets, the next cycle begins. The concrete work flow is: 1) coconut will be placed into the storage box artificially, waiting for processing; 2) the power supply opens, all parts of feeding machine return to the origin, preparing for work; 3) feeding, the system detects whether there is coconut in the hopper, if not, coconut will feed from the storage tank to the hopper; 4) after coconut deliveries into the hopper, system is ready to begin shipping coconut, belt drives coconut forward; 5) transfer belt drives the coconut arrive at the designated location, then stop moving, grasps the coconut, transports to the work table. The system also can be used to detect the hopper state, if there is no coconut in the hopper for a long time, the device will stop working. Feeding machine repeats work by manual loading, automatic feeding.



1.Body 2.Workbench 3.Manipulator 4.Belt 5.Hopper
Figure 1.The diagram of coconut feeding machine

Control system design

Machine control system is designed based on motion controller in this paper, the motion controller is the core of control system, motion controller is used for coordinating motion among the control of each mechanism, receiving feed feedback signal, and controlling the movement of various mechanism according to the feedback signal. PC serves as the host machine of the motion controller, it is used for completing the programming and debugging work. Detection sensor is used for signal detecting. The servo system receives motion command from motion controller, and controls the coordinated motion of each mechanism. The motion controller and other hardware integration are shown in figure 2.

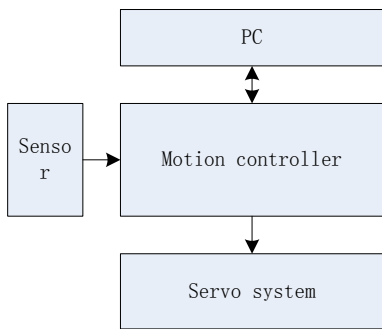


Figure 2. The hardware integration

SOFTWARE DESIGN

Software structure design

The motion controller does not have the ability of separate programming, it is a kind of open controller based on PC, it only has operating environment, program development also needs to be completed by the computer. As shown in Figure 3, program is designed by upper and lower computer form in this paper, PC serves as the upper computer for the overall program planning and management; motion controller serves as lower computer for performing motion control program. Program is written by the upper computer, the program is transmitted to the motion controller, motion controller runs the program. If the programs are transferred to the motion controller, they can run directly in the motion controller, independent from the PC.

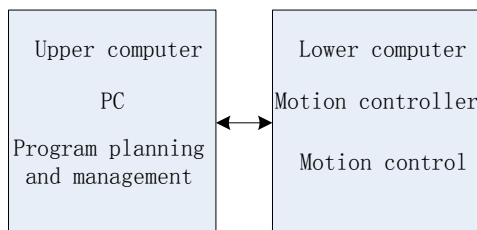


Figure 3. Software structure design

The program flow design

According to the control requirements of the coconut feeding machine, the program flow of the control system is shown in figure 4. The program initialization start before loading, the system will detect whether there are coconut in the hopper, if the system does not detect the coconut, the system won't work. When the system detects that there is coconut in the hopper, conveyor belt begins to work to drive the coconut forward. Coconut arrives at the designated location, the system continues to detect, signal is transmitted to the system, system controls the manipulator to grasp coconut for processing. The system will automatically detect any fault, if there is failure, system will stop running, and automatically return to the initialization program.

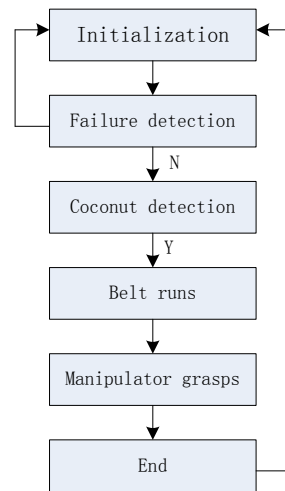


Figure 4. The program flow design

I/O design

System receives and sends signals through the I/O interface of the controller, the I/O of the system design is shown in table 1.

Table 1. System I/O design

Input		Output	
IN0	Feeding optoelectronic switch	OUT0	Indicator light 1
IN1	Transporting optoelectronic switch	OUT1	Indicator light 2
IN2	Transferring optoelectronic switch	OUT2	Indicator light 3
		OUT3	Indicator light 4

THE FEEDING TEST

After the coconut feeding machine is designed, a feeding experiment is done in a coconut processing plant, the results prove that the coconut feeding

machine can realize the whole process automation of feeding, transporting, transferring. It has good reliability and high efficiency. Using coconut feeding machine automatic feeding can improve production efficiency more than 40%, and also can decrease the safety risk, it is of great significance.

CONCLUSION

Aiming at the problem of low efficiency and higher cost in coconut feeding, an automatic coconut feeding machine is design based on a motion controller, the feeding machine can automatically realize the whole process feeding, transporting and transferring. Using the motion controller can improve the system's flexibility and scalability. The automatic feeding test is carried out on the machine in this paper, and the result proves that the system is feasible, and can improve processing efficiency, reduce the production cost. It has a certain practical value.

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