Design of Sorting Slot based on Apple Size

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Abstract: With the rapid development of science and technology, each industry has begun to enter the mechanization era to varying degrees. China has always been a big agricultural country, and fruit exports have been a large part of the world. In the domestic apple sorting has always been manual operation, the Apple size sorting system is an automatic mechanized system, which can replace artificial. This system is based on single-chip microcomputer as the core control system to control the motor and air pump. Apple passes through the sorting slot. The sorting slot has three channels. The channel opening is divided into large port, medium port and small port. Apple is stuck in the corresponding opening. The single-chip control air pump blows the apple away from the sorting tank, and controls the stepping motor on the conveyor belt to transfer the apple to the corresponding position.

1. Design purpose and significance

China has always been a large agricultural country, of which the apple industry accounts for alarge proportion of agricultural production, and its total production has always been the world's first, but China's apple production line, apple classification, apple packaging, has always been manual operation, which There are a lot of drawbacks in the mode of operation. It requires a lot of manpower, material resources, and waste of practice. Workers will be exhausted when working long hours, which will have a great impact on work efficiency. Just because China is a populous country, workers are very large. The Apple production line collapsed due to insufficient manpower. Foreign countries have already put into use automatic mechanical systems in the Apple production line, and there is no automatic mechanical system in China to replace manual operation. Apple size sorting system is a single system that is responsible for Apple size classification; because China's apple production line has always been Apple's size classification link takes up the most manpower. The apple sorting system can make up for the shortage of human resources and defects. Once it is put into the production line, it will save a lot of manpower and drive China's economic development. It has huge impact on China's agricultural production and agricultural products export significance. Therefore, research and development of the Apple size sorting system, saving a lot of manpower, time, for the country to create benefits has important economic value and broad application prospects.

2. Overview

2.1 Introduction to the principle of apple Sorting System

Apple grading system device, which includes a general pedestal, an apple conveyor, an apple output device, an apple grading device, a jet device, a driving device, a conveyor device, a display device, a button device, and a core control system. The overall workflow is roughly as follows: after the apple is detected as a mature apple by the upper level, it is transferred from the apple transfer device to the apple sorting device, and the apple sequentially enters the sorting tank installed on the base frame in the system, and the three sorting tanks. An air pump is installed under the opening, and an air nozzle is installed on the air pump. The jet device is controlled by a single-chip microcomputer. After receiving the signal, the single-chip microcomputer controls the jet device to perform jetting, and then the apples stuck in the three sorting slots are blown to the corresponding conveyor belt, and the

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conveyor belt will be further Apple's conveyor belt corresponding position, thus completing the apple sorting action. The display system mainly displays the opening size and the number of apples sorted. The whole system has a simple structure, clear classification and strong practicability. The overall device block diagram is shown in Fig. 1.

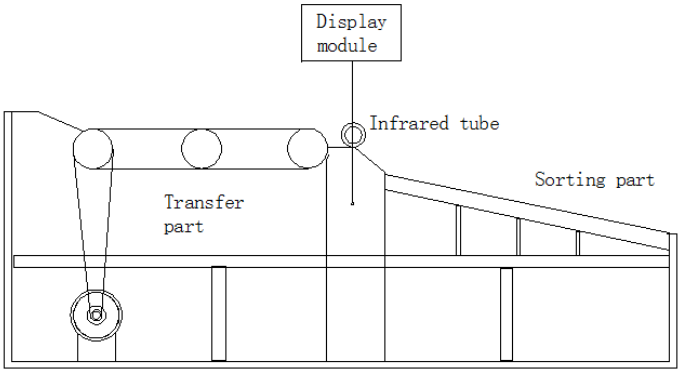

Fig. 1. System overall device block diagram

2.2 Basic composition of the system

A complete set of Apple tiered transfer devices consists of five parts as a whole. The overall block diagram of the system is shown in Fig. 2.

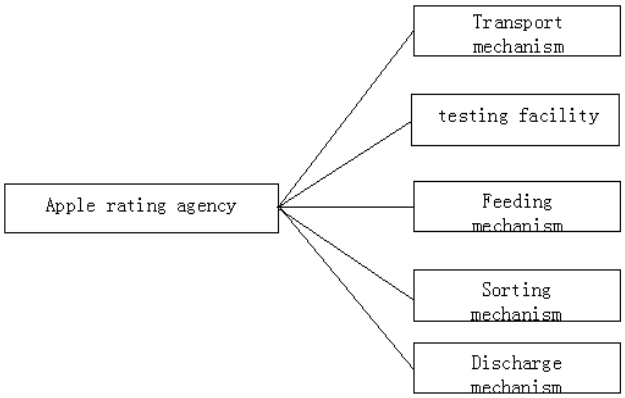

Fig. 2. System overall block diagram

2.3 Apple classification device works

The device is designed to sort apples and transfer large apples, medium apples, and small apples to corresponding locations. Apple sorting is carried out by the sorting device in the system, namely the sorting tank and the jet device. The sorting tank is a steel groove channel, and the channel outlet is equipped with three large, medium and small openings, and the opening is two baffles are formed, and the baffle is connected to the vibration motor and the stepping motor. Since Apple is a vulnerable product, it uses a ramp-in type instead of a low-drop option.From the batch into the screening device to the output one by one, the vibration motor always vibrates to ensure that multiple apples are not stuck in the opening, affecting the work of the overall Apple grading system. The apple enters the double-side chain of tapered rollers from the feed chute, and a brush baffle is installed at the entrance to ensure that the apples are transported one by one on the sorting tank without overlapping. The opening angle of the three openings is completed by adjusting the stepping motor, the stepping motor is controlled by the single chip microcomputer, the apple rolls in the sorting slot, the large apple will be stuck in the large opening, and the medium apple and the small apple are also the same. The jets in turn eject the apples.

The six baffles are connected to the channel grooves by hinges. The distance between each pair of baffles can be adjusted by adjusting the screw. The inclination angle of the sorting grooves has been proved by many experiments. The most suitable inclination angle is 25°, three outlets the distance

between the two experiments proved that the most suitable distance is 120mm. The sorting tank is shown in Fig. 3.

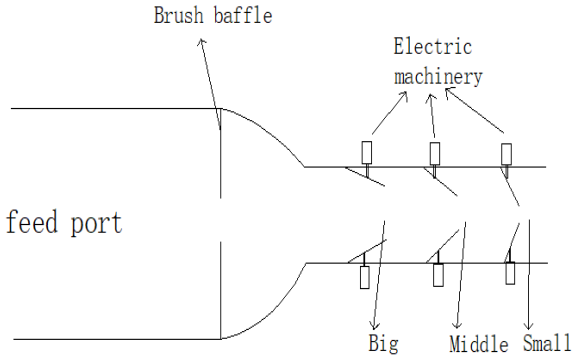

Fig. 3. Sorting slot

3. The composition of the control system

3.1 System control core

This system is controlled by 89C51 single-chip microcomputer. This kind of single-chip microcomputer is a low-power, high-performance CMOS 8-bit microcontroller with 8K system programmable flash memory. On a single chip, with a smart 8-bit CPU and system programmable Flash, the STC89C51 provides a highly flexible and ultra-efficient solution for many embedded control applications. This series of microcontrollers can be programmed; debugged and easily implemented the download is debugged with the whole machine and is cheap. The minimum system circuit diagram of the 89C51 is shown in Fig. 4.

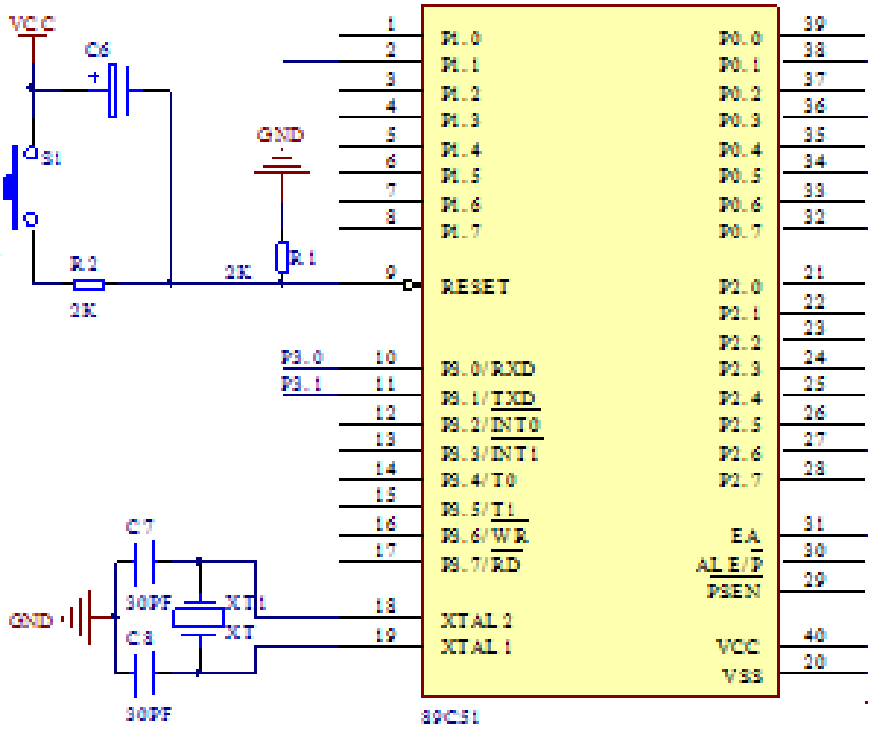

Fig. 4. Schematic minimum system microcontroller

3.2 Button control system

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figure or table is too large to fit into one column, it can be centred across both columns at the top or the bottom of the page.

3.3 Sorting slot opening adjustment control

The size of the three openings in the sorting tank of this system is controlled by the stepping motor. The stepping motor cannot be directly connected to the single-chip microcomputer, because the return current of the stepping motor is too large, which will burn out the single-chip microcomputer. Therefore, the stepping motor and the single chip need to be connected by a motor drive device. The motor drive schematic is shown in Fig. 5.

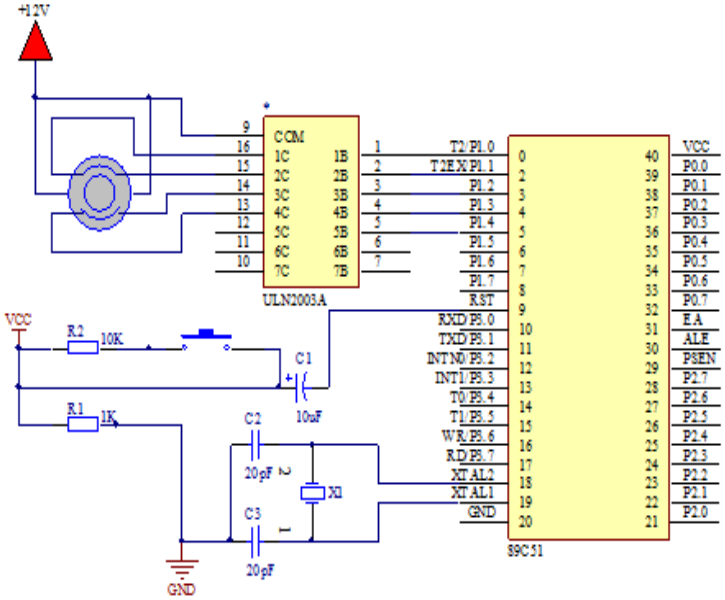

Fig. 5. Motor drive schematic

4. Apple sorting system experimental data analysis

Before the design, the apples were divided into three levels: large size, medium size and small size. 20 parameters were selected and the average values were determined. The measurement data of each parameter is shown in Table 1.

Table 1. The measurement data of each parameter

Level Types	Number	Average long diameter	Average section diameter
Big	20	89.1	60.3
medium	20	75.5	54.4
Small	20	65.1	47.0

From the data in the table, it can be analyzed that there are two main physical parameters of Apple. The system uses three openings of different sizes to distinguish its size.

After experimental data analysis, the apple grading standards are as follows: small fruit: long diameter small 65mm; medium fruit: long diameter between 65mm and 75mm; large fruit: long diameter between 75mm and 90mm.

5. Conclusion

The designed Apple automatic sorter will finish the apples one by one without rolling the damage to the polyethylene cone roller of the device, and will be transported by the sprocket. During the transmission process, the test will be detected the result is fed back to the air pressure system, and the air pressure system acts accordingly to ensure that the apple can be discharged from the corresponding level when discharging, thereby achieving the purpose of classification.

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