

Vein Bionic Fruit Picker

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Abstract

At present, picking apples and other fruits in China rely mainly on manual labor. There are many problems such as heavy workload, wide operation scope and selective picking. In order to improve apple picking efficiency, reduce labor intensity and picking cost, and ensure the quality of fruit products, a portable automatic apple picking device is designed in this paper. In the scope of enlarging the operation range, using the telescopic rod of 1.8m~3m, let the fruit farmers extract apples directly under the tree without the aid of the ladder or the tree climbing, which improves the efficiency of the fruit picking, enlarges the scope of artificial picking and ensures the safety of the picking. In terms of guaranteeing fruit quality, vein bionic bag is adopted. This bag imitates the structure of the human vein, divides the bag into several sections, and has a cushioning device that can be adjusted and tightened at the section of the cloth bag, slowing down the speed of the apple descent, and transporting the apple from the fruit tree safely to the ground after the harvest, reducing the damage to a great extent. In picking apples, a sharp mechanical head controlled by a handle is used to assist the picking of apples. This product is easy to operate and maintain, and has the advantages of high adaptability, low cost and easy popularization. It is a portable picking device that fruit growers can afford.

Keywords

Efficient, safe, bionic bag, automatic picking machine, low cost, easy maintenance.

1. Introduction

China is the world's largest fruit producing country. However, with the rapid development of science and technology, fruit picking in China is far behind the pace of the times. At present, the apple picking in China is still mainly artificial, the labor force is large, the labor intensity is big, the work efficiency is low, the labor cost is big, the high place Apple needs the high ladder assistant, the operation is inconvenient, the transportation process is easy to cause the fruit damage. It is found that although some achievements have been made in agricultural robots in China, the robot fruit picker with complex intelligence is mainly composed of manipulator and terminal actuator. However, because of the complexity and uncertainty of the actual working environment, its intelligent level is far from the level of agricultural production and its cost is high. The price is too high for the growers to afford.

In view of the above problems, a fruit picking device is designed, which uses the handle opening and closing to control the cutting of the cutter head and is not affected by the dense fruit branches. It can save time, ensure safety and improve picking efficiency and picking quality.



Figure 1 Artificial picking



Figure 2 Robot picking

2. Domestic and Foreign Research Overviews

According to the investigation, the fruit picking robot developed in some developed countries is only suitable for large workspace, and is influenced by technology, price, market and so on. It has long distance from practical and commercialized. In China, because of the limited cultural level of fruit farmers, it is difficult to operate, and the cost of fruit picking robots is higher. Agriculture is difficult to accept, so the generality is poor, in addition, there is little centralized modern orchard suitable for mechanization, and fruit picking robot can not be put into practical application for a long time.

3. Brief Introductions of the Principle of Work

The portable automatic grab fruit picking device is composed of a telescopic support rod, a mechanical cutter head and a vein bionic transmission cloth bag. Through the hand-held fruit picking device, the fruit is put into the fruit picking device, the handle is pinched, the sharp knife head can cut the fruit, and the fruit is safely dropped into the fruit collection box through the buffer and falling track, and the fruit is picked. The device has the advantages of simple structure, flexible operation, and small size, which can adapt to the complex situation of the orchard. At the same time, using fruit picking device does not need to climb fruit trees artificially, reducing the risk of picking high altitude fruits, ensuring the safety of life and protecting fruit trees. Moreover, the fruit picking device is simple in operation, easy to use, low in cost, and can be carried. It can effectively improve the working environment of fruit picking industry and speed up picking.



Figure 3 Vein bionic fruit picker.

3.1 Overall Design

The fruit picking device is high 180cm. The telescopic rod is made of non aluminum alloy. The strength is light and easy to handle. The telescopic rod can easily adjust the best fruit picking length

according to the height of the fruit tree and improve the adaptation range of the fruit picking device. The fruit picking part is the bottom handle to control the mechanical cutter head. The transmission part of the apple, which uses a transmission bag with a vein like structure, can effectively slow down the decline of the apple and minimize the damage to the apple in the transmission process.

3.2 Plucking Part

The picking part of the fruit picking device is completed by a mechanical tool head controlled by a metal handle. When the fruit is picked, the cutter heads are aligned with the fruit, the telescopic rod is adjusted to the appropriate height, the handle of the handle is pinched and the scissors are closed, the fruit handle or the fruit branch is cut off under the action of the force, and the broken handle fruit automatically falls into the cloth bag on the rod.



Figure 4 Mechanical cutting head



Figure 5 The controlling handle

3.3 Vein Bionic Transmission Cloth Bag

The transmission bag is made of soft, smooth cloth and processed into cylindrical shape. In the middle of the cloth bag, there are several fruit falling buffer layers made of extensible knot material, like the human vein, using the adjustment point to adjust the size of the cross sections. In the process of apple falling, the adjustment section is slightly smaller and the apple is resistant to the apple, so that the apple has been at a steady and slow motion in the course of falling. The state reduces the speed of fruit dropping and reduces the collision.



Figure 6 A lightweight vein bionic transmission bag

3.4 Retractable Transmission Rod

The telescopic rod is composed of two telescopic supporting rods to form the skeleton of the picking device, which plays an overall supporting role for the picking device. The fruit picking device can be retracted from 1.8 meters to 3 meters, thus achieving the picking of fruits with different heights. In the telescopic rod, the transmission lever can be adjusted with adjustable length through ingenious design. As shown in the Figure 7:

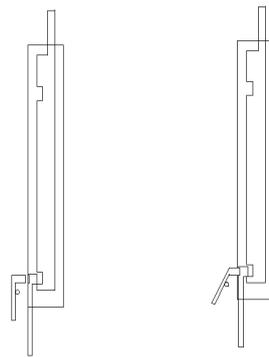


Figure 7 Retractable transmission rod

In the telescopic state, the button safety switch is detached from the fixed transmission rod, and the fixed transmission rod is separated from the telescopic transmission rod due to the spring tension. Through the adjustment of the upper and lower parts, the elongation of the telescopic rod and the transmission rod is shortened. When the telescopic rod is locked, the button type safety switch is stuck to the telescopic rod through the telescopic circular hole on the upper end of the telescopic rod, and combines the fixed part of the drive rod with the retractable sag of the transmission rod, and is combined into a transmission structure and a telescopic transmission rod.

4. Innovative Points of the Works

- 1) The vein bionic transmission bag has the fruit drop buffer zone with a vein like flap, which effectively slows down the speed of the apple drop, reduces the high-speed bump damage caused by the falling apple, and makes the fruit picking independent of the picking and transmission, and improves the picking efficiency.
- 2) The light picking structure allows the harvester to be used flexibly in the scattered trunk. The telescopic supporting rod and the transmission part are skillfully combined with telescopic and transmission so as to realize the perfect combination of telescopic and transmission.
- 3) This product is low cost, simple structure, simple operation, no bump of fruit, easy to promote and maintenance, can greatly improve the efficiency of picking and ensure the safety of the fruit farmers.

4) This product has two kinds of working modes, which can be switched according to the actual flexibility. The electric cutting can be taken automatically, saving time and saving time. The mechanical cutting type is suitable for picking fruit with dense fruit branches. It has a wide range of use.

5. Application Prospects

The fruit picking device has great development potential, flexible and portable, greatly improving the efficiency of fruit picking, liberating the labor force, ensuring the safety of the personnel and ensuring the quality of fruit picking. It is a light, simple and convenient fruit picking machine which meets the working conditions. It has two kinds of working modes, and it is easy to use in all kinds of conditions, and the product can be light at the same time. It can be changed into twig scissors, which can prune high branches, and bring the gospel to fruit farmers.

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