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AUTOMATED COCONUT PLUCKER

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ABSTRACT

Coconut cultivation is one of the mainagricultural activities inour state. The regular plucking of coconuts, which is done manually to a large extent, requires specialized labours. It is a tedious process, in order to overcome the shortcomings Image processing based coconut harvesting system is incorporated systematically.

The current machine available has the drawback of differentiating between the tender and ripe coconut which will affect the yield of coconut farming. The proposed machine will select between tender coconut and ripe coconut based on the physical features that are extracted by the machine through Image processing technology. The feature extraction includes edge and colour detection followed by Image enhancement procedures. The system captures the coconut Image through real time Image acquisition technique by using a camera which is further processed by a microcontroller

KEYWORDS: Tree climbing, coconut plucking, climbing assembly.

1. INTRODUCTION

As mankind is progressing towards development, it need not be a growth that overlooks facilitating the sector that is most important for us i.e. agricultural sector. This sector in India has various tasks that are made easier or could have been made easier with the help of latest machinery and technology, but these facilities are expensive. An average Indian farmer, according to his income, cannot afford them and thus, without having any other option, opts for manually carrying out these tasks.

This is why this project is developed on an agricultural background. viable for the planters. The standard plucking of coconuts and spraying of pesticides to coconut trees, which is done manually to a large extent, requires specialized labour.This activity is traditionally carried out by the socio-economically backward communities, where men are trained in the skill of climbing trees rapidly and plucking the coconuts or spraying pesticides. These communities are distributed wherever coconut trees are cultivated in large number as coconut plantations. viable for the planters. The standard plucking of coconuts and spraying of pesticides to coconut trees, which is done manually to a large extent, requires specialized labour. This activity is traditionally carried out by the socio-economically backward communities, where men are trained in the skill of climbing trees rapidly and plucking the coconuts or spraying pesticides. These communities are distributed wherever coconut trees are cultivated in large number as coconut plantations.

ISSN: 2277-9655
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CODEN: IJESS7

Figure 1.1– Traditional harvesting method

With the help of Robotic Coconut Plucker this traditional approach of harvesting the coconuts by risking a man's life can be transformed to an easier and safer-than-traditional approach. This method is also cheaper for the tree owners in order to harvest the coconuts as it is a onetime investment and also costs lesser in its maintenance.

2. PROBLEM IDENTIFICATION

- Machine cannot distinguish between tender and ripe coconut
- End user does not have a better control over the selection of the coconuts to be plucked.
- Risk of human lives on climbing over coconut trees.
- Economical loss due to improper harvesting.
- Lack of labours for coconut plucking in cities

3. PROPOSED SOLUTION

The Automatic coconut Plucker is a robot that will climb up the coconut tree and will pluck the coconuts based on the operating mode (Tender or Ripe) with the help of its arm assembly and Image processing components.

A. Tree Climbing Assembly

Tree climbing assembly is a part of the robot that will take it to the top of the tree i.e. near to the canopy form where coconuts are to be plucked. This assembly consists of two hexagonal aluminum frames joined by the hollow aluminum square pipes at each vertex with respective vertex of other hexagon. Each frame has three wheels placed with planes containing them at 120 degrees with respect to each other. Each wheel is attached to a bearing which is mounted on an aluminum plate as shown in structure in figure 3.1. The aluminum plate is mounted on alternate edge of the hexagon so as to get a proper alignment of wheels at 120 degrees. The mounting of aluminum plate is done by means of a rigid support and springs. The rigid support willrestrict the wheel motion in vertical directionwhile spring will give adjustments to the wheelindirection perpendicular to the trunk. Wheel shaft is then joined with a high torque motor shaft by means of a coupler which will give rotations to the wheel so as to climb up the tree.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

Figure 3.1- Tree climbing assembly

B. Coconut Plucking Element

In order to separate the coconut from the coconut tree, we are using the same tool that is used while following the traditional coconut harvesting approach i.e. we make use of sickle. Although the sickle has a sharp blade, a significant amount of force is needed to cut the coconut from the tree. Thus, here we make use of pneumatics in order to get the required amount of force. While the rest of the arm does the work of reaching to the coconuts, the sickle and the pneumatics i.e. the coconut plucking element cuts the coconut from the tree. [1]

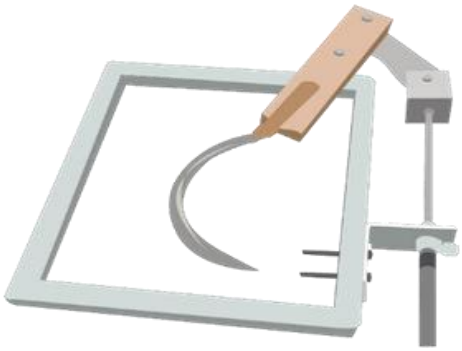

Figure 3.2 – Coconut plucking element

C. Image Feature Extraction

It is done through real-time capturing of Image by using Pi-camera and processing the Image. It has the capability to extract the colour and edge features of coconut husk. After capturing input Image it is first converted into grey scale Image. The ripe coconut will be having rough surface with sharp edges on them also the colour changes occur in ripe coconuts whereas tender coconuts exhibits bright green colour.

Figure 3.3 - Mature coconut Image and its binary

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

A 360º rotating camera is aligned parallel to the bottom end of the cutting tool with sufficient distance from the tool in order to avoid collision between them during the rotation motion of the camera.

The camera initially captures the images at every possible angle's in order to differentiate between the tender and ripe coconut. After the required type of coconut is identified the camera starts capturing images for accurately locating the cutting tool onto the base of the coconut bunch. A proximity sensor is also used to locate distance between the cutting tool and the required cutting portion of the bunch. Image Acquisition and Comparison alongwith manipulator (cutting tool) programming is employed here for accurate cutting of the coconut from the tree.

Figure 3.4 - Tender coconut and its binary level

Edge Detection is the process of identifying and locating sharp discontinuities in an image. Abrupt change in pixel intensity characterize boundary of an object and usually edges occur on the boundary of two regions. Edge detection produces a line "drawing" of a scene from an image of that scene. Important features can be extracted from the edges of an image (e.g., corners, lines, curves).

Step edge: the image intensity abruptly changes from one value on one side of the discontinuity to any different value on the opposite side.

Ridge edge: the image intensity abruptly changes value but then returns to the starting value within a short distance (i.e., usually generated by lines).

Roof edge: a roof edge where the intensity change is not instantaneous but occur over a finite distance (i.e., usually generated by the intersection of two surfaces).

Main steps in Edge Detection:
1. Smoothing: suppress as much noise as possible, without destroying true edges.
2. Enhancement: apply differentiation to enhance the quality of edges (i.e., sharpening).
3. Thresholding: determine which edge pixels should be discarded as noise and which should be retained (i.e., threshold edge magnitude).
4. Localization: determine the exact edge location.

4. FUTURE WORK SUGGESTION

The current machine can be updated with features like detection of the presence of coconut meat and the concentration of the coconut water with the help of an ultrasonic source whose amplitude gets attenuated with respect to the change in the internal volume of the fruit.

5. CONCLUSION

The existing system faces the challenge of plucking the coconut irrespective of the factor whether the fruit has reached its matured stage or not. The proposed machine overcomes this disadvantage of the existing coconut plucking machine on selecting the matured fruit through real time Image capturing and Digital Image processing technique and thereby increases the yield of coconut farming without any labour.

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