

# Smart Portable Cotton Picking Machine

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**Abstract** – Cotton picking is completely manual in India. The cost of picking cotton has increased substantially due to increasing labour costs. The project proposes a smart cotton-picking machine which will increase the rate of cotton pickup per day compared to manual picking. This work also proposes a new algorithm in Image processing of the cotton plant to extract the features. The Intelligent Cotton-picking Robot consists of motion control subsystem and machine vision subsystem. The motion control subsystem uses a degree of freedom robotic arm. The strength of the cotton ball will not be affected by proposed system. It will also reduce the wastage of cotton. The farmers can also be benefited with higher profit level. This machine picks only the cotton ball without affecting the cotton.

**Keywords-** Cotton picking, Image Processing, Robot

## I. INTRODUCTION

Cotton is one of the important commercial crops in India occupying the first place in cultivated area and the second biggest crop production of the world. There is so much conventional procedure and heavy requirement of labour with cotton picking. It is high time to make the automation of cotton picking aboard. During mature period of cotton, thousands of workers are to be employed from other regions so that the cost of cotton-picking increasing day by day. The delay in picking time critically influences both the quality of cotton and the quantity. Weather uncertainty like sudden rains, is also a major factor which decides the maximum useful cotton production. Though mechanization of cotton picking including advanced cotton pickers in USA and EUROPE as shown in Fig. 1, and other cotton-picking tools as shown in fig. 2, have already been existing but they resulted in unsatisfied yield due to high cost and problems in importing such huge machines by the low-income farmers in India. Also due to the low-quality level of the picked cotton, the old method of hand picking is still being adopted. In view of the automation, an assumption for cotton harvesting based agricultural robot has been proposed by some agricultural scientists and specialists.



Fig.1 Cotton Harvesting Machine1 in USA, EUROPE.



Fig.2 Cotton Picking Tools2 with Hand held.

Researches on cotton picking robot based on machine vision had been done in last few years and established the visual model of discrimination of mature cotton according to the edges in early cotton field, on the basis of the statistical analysis and experiments. Also researchers established the visual model that recognizes the mature cotton in natural outdoor scenes by using the chromatic aberration information based on the statistical analysis. A new method of cotton identification was also established by studying the differences between cotton fruit, cotton leaf and cotton stem, based on which a vision model was set up to identify ripe cotton from its surroundings. In this paper, by structuring Automated Cotton-Picking Robot

(ACPR) based on machine vision, an optimized method to identify cotton is proposed on the basis of Image processing techniques together with Microprocessor.

## II. LITERATURE SURVEY

Let's have a brief overview of the various papers, which I have referred for implementation of my project. Mulan Wang et al. proposed a new design of Intelligent Cotton-Picking Robot (ICPR) based on machine vision including the motion control subsystem and machine vision subsystem. The former adopts the YASKAWA MP2100 as the core, which can control the robot of 4-DOF and X-axis. The latter based on the interface module of SEED-VPM642 with 2-CCD cameras, can get an efficient and precise recognition. The results demonstrate that the method for cotton recognition is well done and the recognition correctness rate is high up to 85%. [6]

Liu Zhen-yu et al. described sorting technology based on Industrial robot of machine vision, applies monocular vision technology in industrial robots. They also explained the characteristics of three main function model (image pre-processing, corner detection and contour recognition), and proposed algorithm of multi-objective center and a corner recognition. The simulated results show that the sorting system can effectively solve the sorting problem of regular geometric work piece, and accurately calculate center and edge of geometric work piece to achieve the sorting purpose.

S. K. Pilli et al. designed a robot for crop disease detection using image processing. The ground based agricultural robot called eAGROBOT was presented for monitoring cotton and groundnut fields. The pictures of the plant were captured by the eAGROBOT. The captured image was pre-processed and transformed by artificial intelligence (AI) based embedded algorithms. Then the transformed images were clustered for detecting the cluster image of interest. Then the selective features were classified based on the neural network algorithm to identify the types of symptoms and differentiate early and late leaf diseases. However, the cost to end user and complexity of maintenance were high. [10]

## III. AUTOMATED COTTON-PICKING ROBOT(ACPR)

### A. Cotton Field Environment

Fig. 3 shows the picture of a general cotton field in Guntur region of Andhra Pradesh State in India.



Fig.3 General Cotton Field in Guntur

This type of cotton has height ranging from 60cm to 150cm. In general, the cotton mature period is very long, which can span over several months. As seen from fig. 4, the cotton field at the time of picking there are cotton flowers, buds and also cotton balls. In general, the mature cotton balls have four or five petals.



Fig.4 Cotton Plant

### B. Construction of Automated Cotton-Picking Robot (ACPR)

The ACPR consists of three major parts i.e., Base, Camera and Robotic Control Unit. The Base encases Battery Source, Raspberry pi, sensors and other circuit elements in order to realize the automatic traveling, motion control. The base is mounted on Gyroscope for free movement in the field considering the soft and rugged fields. The Camera, usually a Range Imaging Camera which gathers image data and 3D surface data simultaneously can be incorporated. The unit is responsible for analyzing parameters and completing related picking and placing operations. The control cabinet operates robotic arm to complete tracking and picking assignment, and places the cotton into a bag to collect and to repeat for next task.

### C. Electrical Control System

The electrical control system of ACPR consists of motion control subsystem and machine vision subsystem. The motion control subsystem adopts the Raspberry pi as the core, which can control the robot arms. The machine vision subsystem based on the interface module of SEED-VPM642 with CCD camera, can reach an efficient and precise Recognition.

### IMAGE PROCESSING

In every harvesting position, the camera collects a pair of stereo images. The first step is to recognize cottons in the two 2-D images, Including taking, preprocessing and segmenting. This step is probably the most critical, since errors at this stage may be reflected all the way through the processing chain. Next step is matching between cottons seen on cameras.

#### Cotton recognition

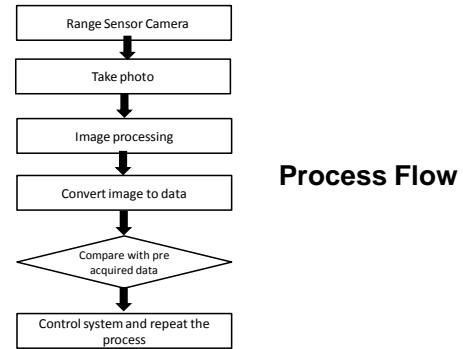
With the Algorithms available for Image segmentation, it has been shown that the Cotton Image can be segmented in three color formats i.e., R-G, R-B, G-B. Though the algorithm gives good efficiency in recognizing the cotton from surroundings. The time required to analyze the cotton photos given from these two cameras by using the image processing, segmentation and recognition algorithms are quite long.



**Fig.5 Edge Detection of Cotton Flower**

### V. Algorithm Proposal for Cotton Picking

Algorithm is proposed to increase the speed of operation and reduce the overall cost without compromising overall yield of the Cotton-Picking process.



**Fig.6 Flow Diagram**

### IV. TECHNOLOGIES

OpenCV stands for Open Source Computer Vision. It is an open source computer vision and machine learning software library .It is a library of programming functions mainly aimed at real-time computer vision.

#### Python

Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse.

#### Control Mechanism for Robot Pick and Place

This can be easily achieved by the different manipulator robots . This part of the work is still in progress and needs calibration.

### CONCLUSION

A new cotton recognition method using a single camera is proposed, which is based on edge detection of different parts of cotton Plant. Canny's edge detection coding is used to increase accuracy. However, in order to process an image, it is necessary to load it into the external memory of the DSP processor C6713 DSP, because there is no available peripheral expansion to communicate with a camera. In future Automated Cotton-Picking Robot will replace the required labour at low cost and as and when needed.

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