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Sugarcane Billet Classifier: A Review

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Abstract - *Now each day sugarcane is planted in a mechanized methods using billets, which are shorter segments of cane harvested and cut by a harvester. The mechanized harvesting process can damage billets, which produces disease, and overall reduction of billet quality. In most of countries, billet planting method used instead of whole sugarcane planting. By using the billet planting method, it increases the quality of sugarcane and also it rises the planting density, production and efficiency of the yield. This paper reviews and suggests the use of computer vision to check the quality of sugarcane billet.*

***Key Words*: Billets, Computer Vision for Automation, Image Acquisition, Image Pre-processing, Segmentation**

1. INTRODUCTION

Sugarcane is crucial crop grown commercially for raw sugar, bagasse, and ethanol production around the world.[1]. The extent of mechanization in production around the world is majorly variable. Especially within the developing world, sugarcane cultivation depends on highly manual labor.

For planting new sugarcane, we have to use a bud from sugarcane, which is mentioned as an eye. Eye located at rings along the length of the cane. By using these buds or seed cane planting method can be divided into two ways. One is using the whole sugarcane stalks harvested manually or mechanically and it is cut slightly above the grade. Second option is by using billets which is cut by large chopper harvester. Harvester cuts the stalk into shorter segments known as billets.

Generally billet planting is widely used as compare to stalk planting. But billet planting has some risks of its own. While making billets seed cane can be damaged because of cuts and cracks. These problems can introduce diseases. Eventually overall yield gets affected.

In sugarcane fields, weeds reduce the germination and crop growth at the initial stage which ends up in about 27% to 35% of yield loss. Therefore, in early growth phase, maintenance of the sugarcane field toward a weed free condition becomes essential.[2]

To extend the efficiency of sugarcane cultivation precision agriculture technologies are used like yield monitoring, identification of in-field bare spots with overhead imagery etc. For in-field yield monitoring fiber optic sensors which is mounted on the elevator of a sugarcane harvester.[3]

As per the current planting methods, damaged and healthy billets are unevenly distributed in the soil. So to rise the efficiency of sugarcane yield we have to set some goals as follows- 1) To identify and take away the damaged billets from planting process to recover sugar at the mill. 2)Delivering the high quality seed billets to the soil.

Figure 1 shows sketch of proposed work.

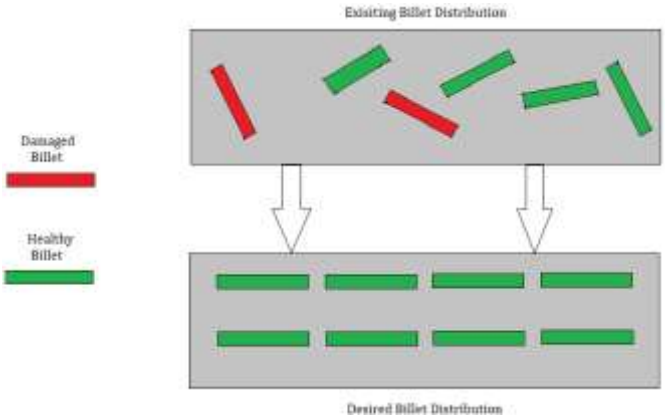

Figure 1. Identify and take away damaged billets and then consistently distribute healthy billets in the rows.

2. DATA COLLECTION

2.1 Billet Classification

In billet classification, depending on damage induced in harvesting method the billets are sorted and classified into different categories. Because of this billet classification we separate out damaged billets visually and then compare

damaged billets with new growth after planting. Classified billet was marked with colored tape. (Figure 2)

Table 1: Classification of Billets

Categories	Color tape	Description
Cracked	Red	Natural growth cracks, caused by the machine
Crushed	Blue	During harvesting, ends or a central portion of the billet was crushed
No buds	Yellow	Billets are cut such that no buds were included
Two buds	Green	Billets had one healthy bud present and one bud removed or damaged.
Single damaged bud	Orange	A bud had been scratched or crushed.
No damage	No marking	Billets had no visually evident damage. Assumed that a billet with an intact leaf sheath had a protected bud.

2.2 Image Acquisition

Acquisition is vital step of the project. Acquisition is done long before initiation, development, testing and modifications. Without acquisition project cannot be taken to further procedure. In this project image acquisition is carried out. Images of different types of billets are acquired and processed. Hence it is image acquisition. In image acquisition buds, rings, cracks, and crushed regions etc. these features to be detected. Above mentioned features are availed in image preprocessing stage.

(a) (b) (c)

(d) (e) (f)

Figure 2. Sample photos of billets classes.

(a) Cracked, (b) Crushed, (c) No buds, (d) Two buds, one damaged and one healthy (e) Single damaged bud, and (f) Single healthy bud.

2.3 Computer Vision For Billet Analysis

Computer vision includes different stages such as image acquisition, image preprocessing, segmentation, feature extraction and classification of billets. There are three main stages of computer vision.

1) First stage is the image preprocessing. To process each image various image processing digital filters and techniques applied in image preprocessing stage. So the desired features can be seek out easily. 2) To partition the images in segments of interest with homogeneous characteristics like regions, lines, circles, etc. the segmentation stage applied. Meaning of segments is dividing the object into various parts. In computer vision, image segmentation plays an important role. In image segmentation digital image divided into segments and which becomes easy to analyze. Some parts of image are redundant i.e. they do not contain any information and some parts/segments are relevant for image processing that is why image segmentation is done. 3)The last step is the classification stage processes the segments to assign labels to the segments representing the features or classes that we are trying to find within the billets[1].

Images of collected billets was used to detect the features of damaged billets. Also used for the application of learning algorithms. The ranges and averages of the means, maximums, minimums, and variances for billet pixels in both color and grayscale included in statistical calculations.

Algorithm - Collection step applied to each color image

```
for i=1 to numberOfClasses:
 for j=1 to numberOfImagesPerClass:
 load( capturedImage )
 cropImage( loadedImage )
 resizeImage( croppedImage )
 convertToGrayscale( resizedImage )
 storeImageCollection(colorImages, grayscaleImages )
 watershedSegmentation( grayscaleImages )
 for k=1 to numberOfBilletsOnImage:
 for m=eachColorOrGrayscaleMeasure:
 calculateStatistics( billetSubimages )
 end for
 end for
 end for
end for
totalStatistics( )
```

3. CONCLUSION

In this paper sample sugarcane billets were categorized consistent with sort of harvester-induced damage. Our work is to get rid of damaged billets by computer vision and increase the efficiency of sugarcane yield.

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