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Classification of Sugarcane Billet Using Computer Vision

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***Abstract*: One of the widely taken crop is sugarcane. Sugarcane is very important raw material for the production of sugar, ethanol, and bagasse. In most of countries harvesting machines are used. Recently plantation of sugarcane is done by using billets. But it has disadvantage also because when forming billets by harvesting machine it gets damaged and causes billet quality degradation and spreading of diseases. Here we developed a prototype model to classify the good and damaged billets separately. This model runs on Python program which segregate healthy (good) and damaged billets with the help of image processing technique after taking pictures of these billets using USB camera. So, the good billets goes for next planting method and remaining billets i.e. damaged billets used for sugar recovery and other by-products.**

***Keywords*: Arduino Uno, Billet, HSV model, Image processing, RGB model.**

1. Introduction

One of the widely taken crop is sugarcane. Sugarcane is very important raw material for the production of sugar, ethanol, bagasse. Globally the use of machines during production process differs time to time [1]. Still plantation of sugarcane is done manually. But, after a long period, there will be degradation of yield and scenario of replanting occurs. Currently, sugarcane planting is done manually which is more time consuming and costly and also requires labours and high volume of sugarcane stalks. But the main difficulty is that when the stalks are cut manually or either by machine, they both do not have control on cutting location. After cutting, some sugarcane billets have buds or eye and some do not. These billets (with or without buds) get planted as it is. So it becomes necessary for new planting to fill the gap in yield and becomes time consuming. So it directly reflects on the production of sugarcane stalks and also on yield. There is no facility to identify the damaged nodes. By considering all this problems we developed a model to segregate healthy and damaged billets separately. It runs on Python program and segregate healthy and damaged billets using image processing technique. So, healthy billets used for planting and damaged billets used for sugar production. So the production rate increases as compared to manual planting. The reason of this segregation procedure is to compare the fields with and without segregation procedure. The objective of this project is to show how to take out damaged billets during this test.

There are two methods for plantation of sugarcane. One method is harvesting of full sugarcane stalks. Another method is by using billets which is cut by chopper harvester. For the most part billet planting is broadly utilized as contrast with stalk planting. But billet planting has disadvantage also. Because of cuts and cracks seed cane may have got damaged and there will be spreading of diseases. The main difficulty is that when the stalks are cut manually or either by machine, they both do not have control on cutting location. After cutting, some sugarcane billets have buds or eye and some do not and results the less production of sugarcane stalks. Overall it gets affected on field.

Farmers distributed healthy and damaged billets unevenly relying on the present planting strategy. To enhance the productivity of sugarcane field we have to decide objective as follows, 1) To determine and expel damaged billets in planting strategy and convey to the plants for sugar recuperation. 2) Healthy billets utilized for planting new sugarcane.

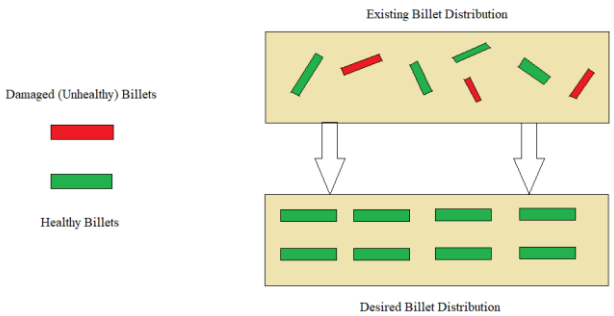


Fig. 1. Determine and expel damaged billets and disseminate healthy billets in the rows

2. Literature Survey

Moises Alencastre-Miranda et. al., In his investigation the examination of sugarcane billet quality can be checked utilizing PC vision. The sugarcane is gathered precisely and cuts into

shorter fragments which is called as 'Billets'. But since of motorized reaping billets get harmed and presents sicknesses. So it influences on nature of billet and yield creation. Contingent on the kinds of billet harmed presents illnesses during reaping, a sugarcane master group ordered the billets into various classes and these harmed billets separate out outwardly and contrast and new development in the wake of planting. At that point by utilizing PC vision and picture preparing strategies the examination of sugarcane billet quality should be possible. Thus, their point is to isolate out harmed billets by PC vision and expands the sugarcane yield.

Anup Vibhute, S. K. Bodhe, Image processing will become domain in agricultural field. In various fields and applications image processing analysis will be effective tool with great accuracy. In image processing various parameters should be analysed e.g. in agricultural field weed detection, fruit/food grading system and it's classification, quality of product, yield etc. At this time different developing technologies are entered in agricultural field which enrich the farm inputs as well as enhance farm outputs and is profitable, safe to environmental. So these new precision techniques save the time, reduces errors, achieve ecological and economical sustainable cost. Also to improve decision making image processing tool can be effective.

Shaochun. M, Manoj. Karkee et. al., In sugarcane creation framework, the most basic part is collecting of the sugarcane. This paper clarified, at present what gathering innovations are utilized in business sugarcane creation. In sugarcane reaping strategies, different kinds of hand blades are utilized in manual collecting techniques before the mechanical gathering strategies. Up to this circumstance, still the creating and immature nations around the globe utilized this manual collecting strategy for enormous scope. At long last, for improving the presentation and adaptability in gathering the sugarcane the new advances were proposed.

Sugarcane growers faced many problems during the development of crop and also after harvesting. Due to various types of pathogens, it has been recorded that out of complete zone roughly 10% of sugarcane can be disintegrate [4]. It can be affect on the farmers as well as millers. Sugar industries faced many problems like low yield, short crushing season, high production cost, low per capita utilization etc. Also farmers faced many problems as availability of seeds and fertilizers, water supply, fertility of land, labour etc. Marketing problems arises like loss due to dry age, delay in harvesting, lack of transport facilities. To recover these problems we decided to segregate and classify healthy and damaged billets by image processing techniques.

3. Construction

In ‘Sugarcane billet classifier’ model firstly sugarcane billet comes on platform from storage when the pneumatic cylinder moves up. It acts as stopper. Image of billet is taken by using USB camera and sends to PC. The main aim of paper is that to determine and expel damaged billets from planting method and use healthy billets for cultivation. Parts used in this model are described as follows,

Fig. 2. Model of Sugarcane billet classifier

1. The setup has two pulleys of same diameter in which motor is main part mounted on one pulley.
2. Motor acts as main driving unit of the setup.
3. Drive from one pulley to the other pulley is transferred through a timing belt.
4. Double acting pneumatic cylinder acts as stopper. They have two ports at each end and by alternating the port, the piston is moving in forward and backward direction which receives high pressure air. The piston moved inside the cylinder as per the application of air pressure and moves to each port alternately.
5. Arduino Uno consist of microcontroller(Atmega8) which has a programmable integrated circuit and programming software called Arduino IDE is utilized to compose and transfer the PC code to the physical board [5]. They utilized microcontroller of Atmega8 type which is control gadget.
6. USB camera connected to PC is used to take images of billets.

4. Flowchart

Working flowchart of prototype model can be seen as follows

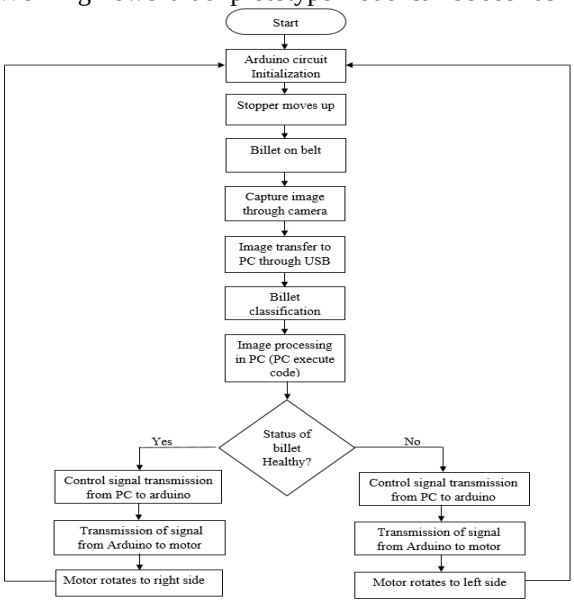


Fig. 3. Flowchart

5. Working

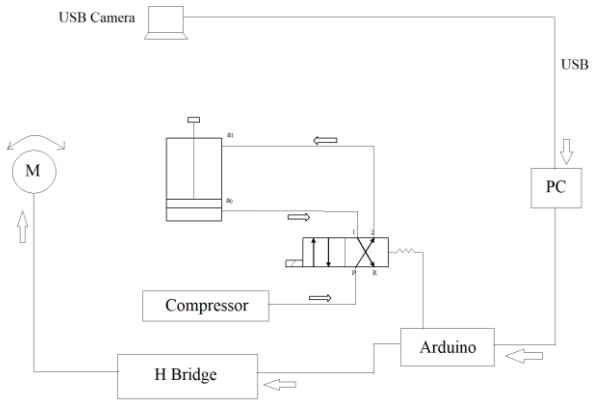


Fig. 4. Working of sugarcane billet classifier

From the above figure, the working of sugarcane billet classifier can be described as follows -

When the electricity supplied to the valve, high pressure air from compressor enters into port P. From port P it will enters to port 1 and then port a_0. The piston moves up and the billet moves on the platform (i.e. left envelop mode activated). Now billet come on platform and the camera is activated by PC. Camera capture the image of billet and it sends to the PC (collecting of images) through USB cable.

- *Collection of Images*: Acquisition is an assortment of information and necessities to be satisfied by ventures. This progression is done before beginning, advancement, testing and alteration. In picture procurement different features can be perceived like bud, rings, split or squashed areas and so forth.

Image processing is done on PC. Various features of billet is analyzed by PC vision.

- *Analysis of billet features by PC vision*:
  Image acquisition, image pre-processing, segmentation, feature extraction and billet classification these various stages included in computer vision. These stages can be explained as follows -
  A. *Image pre-processing:* This is the initial step of PC vision. To get billet features various techniques about image processing are applied on image [2]. Due to image processing, it becomes easy to detect billet features.
  B. *Segmentation, feature extraction:* Depending upon homogeneous attributes like regions, lines and circles etc. billet images can be split-up. Definition of segments is partitioning the article into different parts. To analyse images easily segmentation of digital images done. In this stage, some sections/fragments are pertinent for image processing and some parts are not. So to reduce processing time image segmentation becomes necessary.
  C. *Billet classification*: After image segmentation, classification is done depending upon segments features and respective segments are tagged accordingly.

After image processing the next important part is separation of healthy and damaged billets. So our main aim is to classify healthy and damaged billets separately.

- *Classification of billets on the basis of image processing*: In billet classification, here the billets are segregated and classified into two groups i.e. Healthy and damaged (cracked) billet. The purpose of this segregation procedure was to create different classes of cane damage with particular visual highlights and field taken with segregation procedure can be compared with field taken without segregation procedure.

(a) (b)

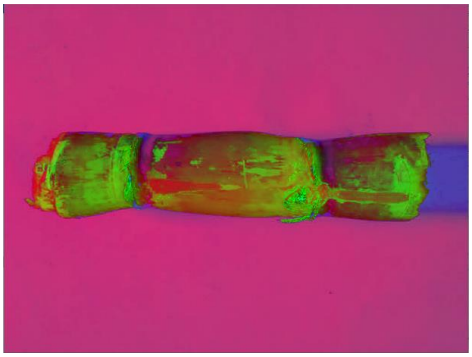
Fig. 5. Sample photos of billet classes (a) Healthy billet (b) Cracked billet

This process is done by using Arduino and motor assembly. After image processing, control signals from PC are given to Arduino. And Arduino controls direction of rotation of motor. H bridge is used to make connection between Arduino and motor. So the engine is constrained by utilizing Arduino. If the billet is healthy then motor rotates to the right side and if the billet is damaged, then the motor rotates to the left side. For next billet again piston moves down i.e. high pressure air from compressor enters into port P. From port P, it will go to port 2, from port 2 it will be admitted on the port a_1 and it will cause the piston to return. The air from other side i.e. from port a_0 it will come to port 1 and then from port 1 to port R and then it is exhausted to atmosphere (i.e. right envelop mode activated). So process is done and repeated.

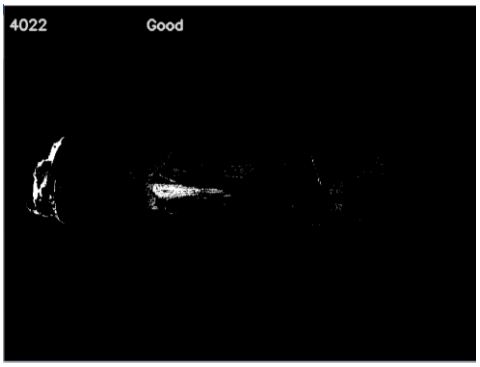
6. Results

A. Sample 1:

(a)



(b)

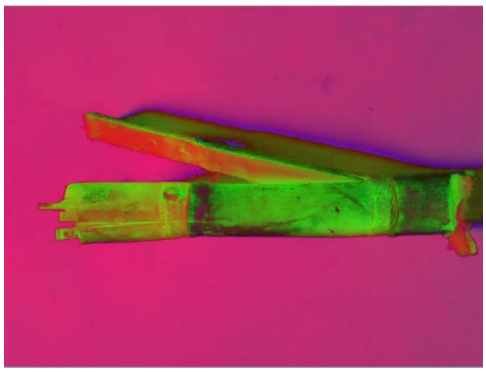


(c)

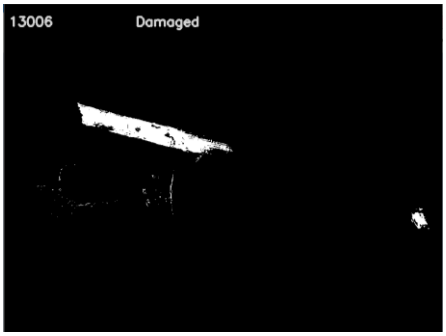
Fig. 5. Computer vision of billet (a) Good sugarcane billet (b) HSV image of good sugarcane billet (c) Masking image of good sugarcane billet

B. Sample 2

(a)



(b)



(c)

Fig. 6. Computer vision of billet (a) Damaged sugarcane billet (b) HSV image of damaged sugarcane billet (c) Masking image of damaged sugarcane billet

The RGB shading model is known by an added substance shading model. In RGB color model, to produce broad array of colors red, green, blue light are mixed together. The model name formed from initials of these three colors i.e. red, green, blue. Pictures taken are stored in electronic devices are in RGB color model on the basis of human perception of colors. We process that pictures in RGB to HSV model.

The shortened forms of HSV model is Hue, Saturation, Value. The HSV model is one type of color palette [6]. In HSV model different colors are mix together. Hue represents various colors i.e. it varies from red, yellow, green, blue and magneta and again it comes back to red. Saturation represents color shades means it shows white components in colors. This implies colors change from unsaturated to fully saturate without any white component. Value indicates brightness of different colors.

Now we apply masking procedure with the help of band pass filter. The values between HSV [71, 77, 261] and HSV [-9, -3, 181] are considered as white paints. Total count of white paints is taken.

Applying the condition that, if count of white paint is greater than or equal to 9800 (≥ 9800) then “Damaged” label will shown. If count of white paint is less than 9800 (< 9800) then “Good” label will shown.

7. Conclusion

1. Time required for testing is minimum.
2. Increases the efficiency of sugarcane planting.
3. Segregation of healthy and damaged billets effectively.
4. Important key features of sugarcane like rings, buds or any damage on sugarcane billets are recognised with the help of image processing technique.
5. Image processing technique is very effective and non-intrusive tool which is applied to analyse agricultural parameters accurately.

8. Future Scope

The setup can be modified for testing more billets at a time which will reduce the overall testing time. Another opportunity

is that, after few years, image processing will become domain in agricultural field. In weed detection, fruit/food grading system segmentation and classification can also be achieved by image processing techniques. Because of image processing farmers can use exact herbicides as per their field so it will become helpful to save the environment and also cost.

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