AUTOMATIC SUGARCANE BUD CUTTING USING IMAGE PROCESSING

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Introduction:

In contemporary agriculture, sugarcane cultivation remains a pivotal sector, contributing significantly to the global sugar industry. However, the traditional methods of sugarcane bud cutting involve labor-intensive processes that are time-consuming and often result in inefficiencies. The manual nature of this task not only demands considerable manpower but also poses challenges in terms of precision and consistency.

The existing manual bud cutting methods are characterized by their inherent drawbacks, including a heavy reliance on human labor, which is not only physically demanding but also susceptible to variations in precision. The inconsistency in cutting lengths and the potential for damage to the sugarcane plant during the process contribute to reduced yield and increased production costs. Additionally, the manual approach proves to be a bottleneck in large-scale agricultural operations, hindering overall productivity and competitiveness.

After the manual bud cutting methods, the semi automated system came into existence to overcome the damaging of the sugarcane bud indirectly by using manual method. This system is designed not to harm the bud of sugarcane without compromising on its efficiency and this system cuts one bud per two second which reduces the labor work of farmers which better safety at reasonable price.

As the revolutionary change occurs the machine vision technique has been implemented in semi automated system. The system includes a mechanical part, electrical part, and visual processing part. The core of the system uses machine vision to identify the segments of sugarcane stalks. The feasibility of the system and the identification effect can be better verified based on designing a prototype for seed cutting. The results of the off-line identification of sugarcane stalk segments show that the recognition rate is 93% and the average time is 0.539 s. The disadvantages of this system was, it faces some difficult in identification of different colors of sugarcane stalk.

The proposed automatic sugarcane bud cutting using image processing seeks to revolutionize traditional practices by introducing a technology-driven solution. Automation ensures a more precise and standardized bud cutting process, reducing human errors and optimizing efficiency. By leveraging cutting-edge technology, such

as sensors and algorithms, the system can identify and cut sugarcane buds with a level of accuracy unattainable through manual means. This not only streamlines the cutting process but also enhances the overall yield and quality of sugarcane crops.
In overcoming the present challenges, this project envisions a future where sugarcane cultivation becomes more sustainable, economically viable, and less dependent on manual labor, ultimately contributing to the advancement of modern agricultural practices. This project addresses the pressing need for a more efficient and automated solution to sugarcane bud cutting, aiming to overcome the limitations of the current practices.

Objectives:

The objective of the project is to design and develop a system that automates the process of bud cutting in sugarcane cultivation.

Methodology:

Conveyor belt system is designed for the transporting sugarcane and it is controlled by the DC gear motors and the dummy wheels. DC gear motors are controlled by the Arduino Nano microcontroller through the relay module. High-resolution digital images of sugarcane are captured using camera module (Webcam). These images undergo pre-processing techniques to improve quality and remove any distortions. Image processing algorithms are applied to the pre-processed images to detect and locate sugarcane buds accurately. Neural Network classifier is used to classify the images of the sugarcane to with buds and without buds. A neural network classifier in image processing could be trained to detect buds by analyzing features like color and shape within images. Initially, a dataset of sugarcane images with various bud types is collected and preprocessed. Neural Network architecture is then chosen for its ability to extract features from images effectively. The model is trained on this dataset, learning to associate specific features with different bud types.

The algorithms are integrated into a larger system that controls the automated bud cutting process. Integrate cutting devices with the image processing system to automate the cutting process based on the detected bud locations.

After cutting, the segregation of sugarcane buds and the sugarcane stalk takes place. While segregating, the number of sugarcane buds and the sugarcane stalk is identified. The counting can be done by using the proximity sensor such as IR sensor. And finally the number will be displayed on the display unit.

Conclusion:

Initially the data set is created with two different sections namely sugarcane with bud and sugarcane without bud. The data set consists of 100 total images with 50 images in each section. All the images in the data set are uniform length on all sides. The

created data set is used to train the system. The complete setup of the automatic sugarcane bud cutting using image processing is given in the figure 2.

Figure 2: Setup of the Automatic Sugarcane Bud Cutting using Image Processing.

Automated sugarcane bud cutting through image processing is a systematic approach designed to make the process more efficient. Initially, images of sugarcane are captured by the webcam and undergo pre-processing to improve their quality. This involves cleaning up the images to enhance clarity and resizing of the images to the size same as the size of the images in the data set. Following this, segmentation techniques are employed to isolate the sugarcane buds from the background and other parts of the plant. The goal is to precisely identify the buds for cutting. To determine which sugarcane part has buds and which do not, a neural network classifier is utilized. This sophisticated computer program analyzes the images, considering factors like color and shape of the sugarcane, to classify the sugarcane accordingly. This classification process is executed using Matlab software, which provides the necessary tools for image analysis and classification. Once the classification is complete, the identified buds are targeted for cutting using cutter blades. After the cutting mechanism, the IR sensor will count the sugarcane bud and displays the count on the LCD display. Throughout the entire process, the computer system tracks and displays the results, indicating which part has buds and facilitating the cutting process.

During the testing time, more than 80 images including three varieties of sugarcane was trained. It gave the correct output for more than 92% of the tested samples. It gives almost 8% error in identifying the bud of the sugarcane. It is because of the light colour of the sugarcane.

Figure 3 is the snapshot of the output window which is obtained when the test image contains the bud part. When the testing image contains bud, the neural network classifier will identify the bud and displays on the as sugarcane with bud.

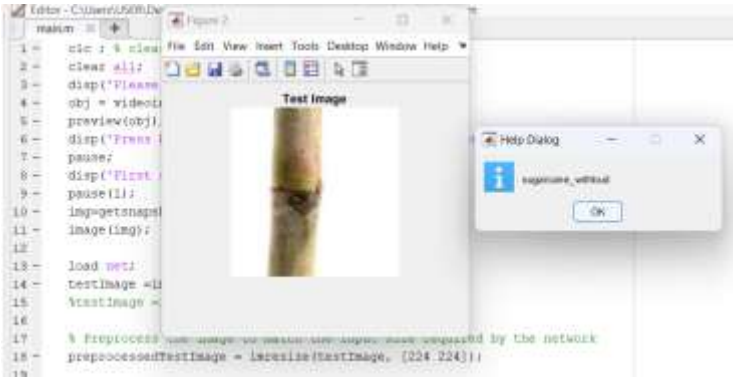

Figure 3: Snap shot of image with bud.

Figure 4 is the snapshot of the output window which is obtained when the test image does mot contains the bud part. When the testing image does not contains the bud, the neural network classifier will identify that it doesn't contain bud and displays on the as sugarcane without bud.

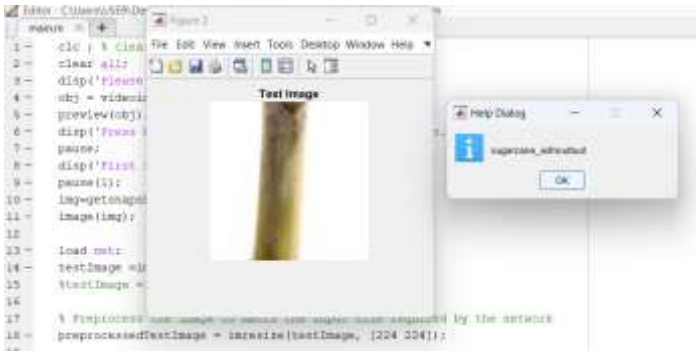

Figure 4: Snap shot of image without bud.

The interfaced IR sensor will count the sugarcane bud and displays that number on the LCD display and it is shown in the Figure 5.

Figure 5: Photograph of count displayed on display unit.

Scope for future work:

- Detection of the disease can be done to maintain the overall crop health.
- It can be trained for the different varieties of the sugarcane.
- Mobile application can be developed for the real time monitoring in the field.