Quality Monitoring System In Agriculture Using Image Processing

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Abstract- Agriculture is very essential for human existence on this world. These days with growing population we need the productivity of the agriculture to be increased to meet the demands of larger population. In earlier days formers used natural methods of farming to increase the productivity, such as using the cow dung as a fertilizer. That resulted increase in the productivity enough to meet the requirements of the population. But later they started thinking of earning more profit by getting more production of crops. So, there came "Green Revolution". After this period usage of deadly poisons as herbicides has increased to a drastic level. With the usage of chemicals the productivity increased but more damage was done to the environment., which will arise a doubt in our sustenance on this beautiful earth. So, in this paper we implemented some methods Which actually reduce the usage of herbicides by spraying them only in the areas where weed is found . we implemented image processing techniques using MATLAB to detect the weed areas in an image taken from the fields

Keywords: Image Processing, Agriculture, edge detection ,weed detection, patch spraying, Aurdino UNO.

I. INTRODUCTION

In earlier days detection of weed was done by employing some labour. especially for that purpose. They used to detect the weed by checking each row and column of the crop. Then they used to pluck weed out manually using their hands. Later with the advancement in the technology they started using the chemicals such as herbicides to remove the weeds.

In this paper we used image processing techniques to detect the weed. Then weed detected areas will be given as input to the automatic sprayer which is the robotic vehicle and it sprayer the weedicide only in weed detected areas .To get good accuracy we need to take a better picture of the field. The camera can be attached to tractor to take a image of the field in aerial view.
The image is then processed using MATLAB with different image processing techniques.
There are two types of weed detection we implemented, they are
1. Inter row weed detection
2. Inter plant weed detection

The weed detected blocks are given as input to the automatic sprayer which is implemented by using arduino uno micro controller, which spray the chemicals only in the weed detected areas.

II. WEED DETECTION

Weed is an undesirable plant . It has no specific botonical classification. Since it competes with plant of our interest for nutrients, water, sunlight, it is a major issue in the field of agriculture .Classification of weeds based on physical appearance can be made in so many ways but There are two types of weed based on the frequency of the edges present in them. They are:

1.Weed with narrow leaves (have less edge frequency).

Figure1: weeds with narrow leaves

2. Weed with wide leaves (have more edge frequency).

Figure 2: weed with wide leaves

The edge frequency is the key parameter in weed detection.Edge frequency is nothing but the count of number of edge pixels .if the weed and crop edge frequencies are nearly same then we should be careful about the value of the threshold. The accuracy of weed detection dependence on the value of the threshold that is selected. Since we have chosen maize, the edge frequency of maize was less and the edge frequency of the weed was more .

III. INTER PLANT WEED DETECTION

Inter plant weed detection is nothing but detecting the weeds present between the plants. Using image processing techniques it can be is carried out this manner:

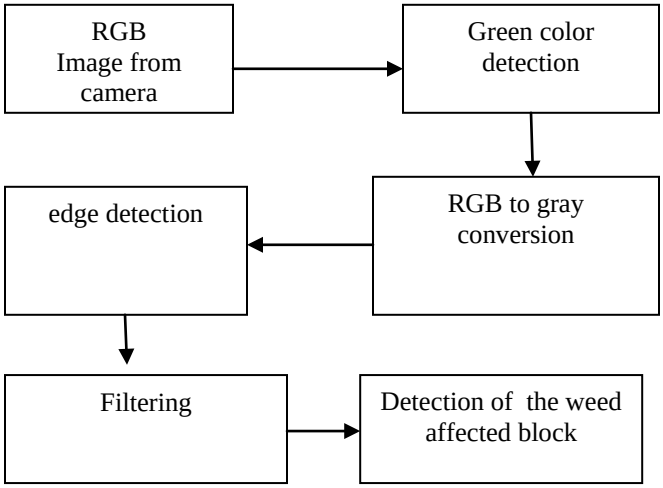

Figure 3: Algorithm showing steps followed in inter plant weed detection

This part of the algorithm prepares an image for further advanced processing and is consists of: Loading the image from source, color segmentation and edge detection.

Figure 4:Input Image

Color segmentation is one of the image segmentation method used to separate the crop (which also include weed)from the background. This is done through Kmeans clustering. The method helps in separating all the visually distinguishable colors from one another. The L*a*b* color space (also known as CIELAB or CIE L*a*b*) enables to quantify these visual differences. The L*a*b* space consists of a luminosity layer 'L*', chromaticity-layer 'a*'indicating where color falls along the red-green axis, and chromaticity-layer 'b*' indicating where the color falls along the blue-yellow axis.

All the colour information is in the 'a*' and 'b*' layers. The difference between two colours can be measured using the Euclidean distance metric. Colour segmentation here helps to remove all the other colours except green.

Clustering helps in grouping the pixels with the same colour. the output image after the colour segmentation will have only two colours ,the black(indicates the background) and green (indicates the crop and weed). The image is then used for next level of processing which is edge detection

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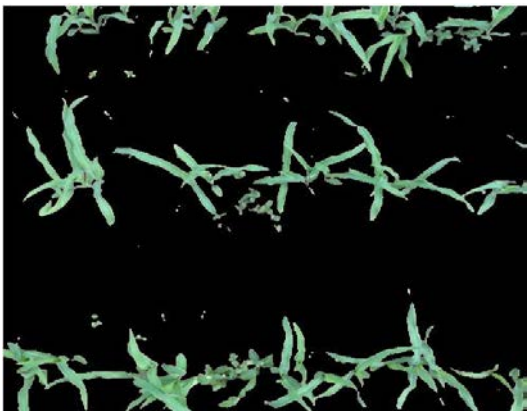


Figure 5:Output image after color segmentation

Edge detection is also a method of image segmentation .It gives the number of edge pixels of the image .It uses the fact that the edge frequencies of veins in both the crop and the weed have different density properties to separate the crop from the weed.

The image after both color segmentation and edge detection is left with the edges and veins of both the crop and the weed in white and the remaining part completely black.

Figure 6: Output image after Canny edge detection.

There are several methods of edge detection in image processing. But many of them are not applicable in real time .Canny edge detection is the best one because of its accuracy. The edge detected image is then given to the next stage that is Filtering.

Filtering process helps in recognizing regions in which the edge frequency appears in the specific range. Before filtering the image must be divided into blocks .There is a inverse relation between the block size and the accuracy. If the block size is more than the accuracy will be less
Choosing the threshold value of edge frequency depends mainly on two factors they are:

1.Type of weed
2.Type of crop

The above factors affect the threshold value in this way: if we have narrow crop leaves and wide weed leaves then we can say that weed has more edge frequency than the crop, so here the threshold value will be more. Otherwise threshold value will be less. In this paper we take the case of maize crop where the edge frequency of weed is more than that of crop. For knowing the value of the edge frequency here, first we took a image which contains pure weed and calculated the number of edges in it by using "for" loops and then we have calculated the number of edges per block for pure weed. That turned out to be approximately 900. Then we did the same by taking pure plant image and its edge frequency is approximately 400.So in this paper we took 600 as threshold value so that all weed can be detected. Coming to our case in this project we have taken an image of the size approximately 500 x500 pixels. And we have divided it into 25 blocks each of size 100x100 pixels. In the program which we wrote, we have used for loops for counting the number of pixels and if loop for keeping greater than the threshold value then we detect that block as weed block and again by using for loops we convert all the pixels in that block into white pixels. As a result we will be getting an image which contain weed blocks as total white blocks and other blocks remains unchanged. We will also display the block number by using display function in
MATLAB. The resulting image will look like :

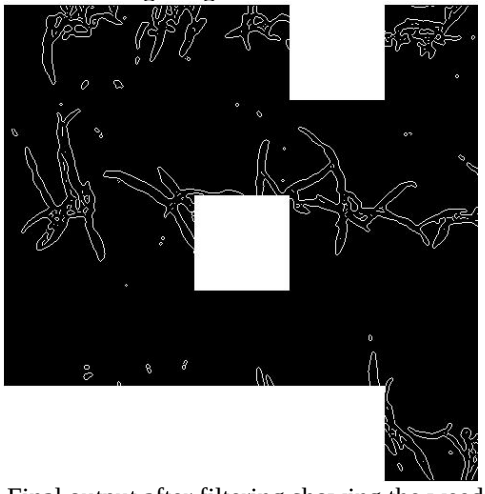
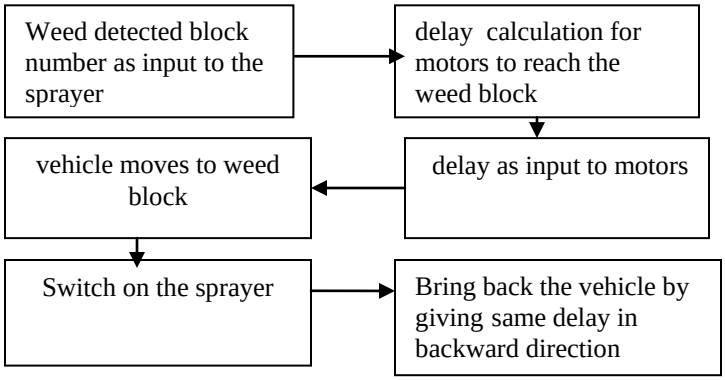


Figure 7: Final output after filtering showing the weed affected areas as white blocks

IV. AUTOMATIC SPRAYER

Our ultimate aim is to spray the pesticide only in the weed detected areas. To do this we need to give the weed detected block number as input to the spryer. The working of the sprayer is summarized in the following block diagram



The Arduino Uno is a microcontroller board based onthe ATmega328 chip. It contains everything needed to support a microcontroller, simply connect it to a computer with a USB cable or power it with a AC to DC adapter or abattery to get started.

First we will check the first row of the filtering output to find any weed blocks. . If any blocks are found we will give inputs to the controller in a way that the sprayer goes
to that block and sprays the herbicide. The only input we need to give to the sprayer is the time for which the motor has to move to get to the weed block site. This can be given to the sprayer by using the function "delay" available in the arduino UNO.
Time delay is the time motor travels in a direction

V.CONCLUSION AND FUTURE WORK

In this paper we have implemented a method in which weed in the maize crop can be detected using the image processing and the weed detected block is given as input to the sprayer which sprays the pesticides only in those areas thus saving environment from harmful chemicals

The idea can be further improved like setting different threshold values in order to detect more types of weeds. Instead of computers the image processing DSP's can be used.

VI. REFERENCES

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