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An Automated Weed Expropriation System for Agriculture

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Abstract— **In recent years, a fully automated system has been receiving increased attention because of high efficiency and accuracy. Robotics is a rapidly growing field. The development in the robotics make an intelligent robot and user friendly which has found jobs in several fields. Robots are introduced in the area of agriculture too. Weed expropriation is the paramount process in paddy cultivation. In this paper weed expropriation is done by robotic arm. A visual texture based image processing technique using MATLAB® software is utilized to detect the weed. The robotic arm and its moment are controlled by FPGA controller**.

Index Terms— Image processing, FPGA controller, Weed Expropriation, Robotic arm.

I. INTRODUCTION

In India 52% of populace are associated with paddy cultivation [6]. Control of weed is the consequential process where numerous procedures like tillage, planting, fertilizer application, irrigation etc., are utilized for engendering propitious condition for crop. These practices are carried opportunely it availed in controlling weeds. In earlier days, weeds are identified by human. They check each and every places of field then pluck out the weed physically and furthermore work deficiencies have prompted higher expenses for hand weeding.

The conventional technique cannot control weeds however it diminishes the weed population. Later weed control is accomplished by chemicals which mean herbicides utilized to slaughter the weed. The herbicide is to be showered all through the crops. Some herbicide may kill a wide range of vegetation, not simply weeds and it influence nature, people and other living life forms. So an intellective weed control system is needed. An automation based weed expropriation system is utilized to differentiate the weed from crop and expel the weed. The proposed system is utilized to supersede the shortage of labor.

The required amount of herbicide is spread into the field [1] where weed exist. The plant health is checked and the specific infection in a plant is identified with the assistance of image processing technique in MATLAB® software [2]. Predicated on the colour, the need of plant is recognized ahead of time by contrasting the crop leaf colour with the leaf colour chart in image processing [3]. The different biometric features are available to classify the plant species. The plant with healthy leaves can be identified. The fungal disease in the crop is detected by image processing techniques based on the spots on leaves.

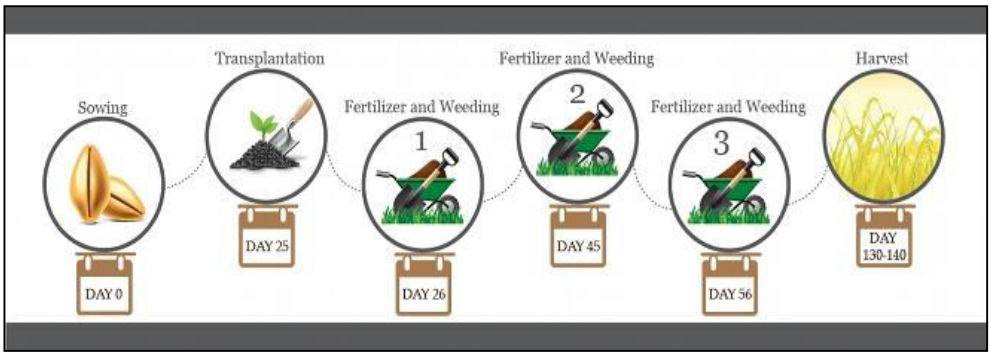

Fig.1. Cultivation Process of Paddy

The nature, colour, size, depth and location of fungus are also identified; then the quality of the crop is evaluated based on the fungus level [4]. Here the shape of leaves are extracted for plant classification. The leaf is extracted from the image by using image processing techniques [5]. Fig.1 demonstrates the development procedure of paddy. It is expounded as follows,

A. Preparation of Field

To start with the field is set up for cultivation before the blustery season. The weeds are cleaned and the field is tilled by tractors to few inches. At that point the manures are added to the soil and entire surface is topped with water off to 2.5cm. Presently, the field is prepared for accepting seedlings from the nursery.

B. Transplantation

Regularly, paddy seedlings are first arranged in nursery and after around 25 days it is transplanting to the field. Despite the fact that in a few territories direct seeding is taken after however paddy from transplanting is superior to anything the direct sowing. The transplanted paddy matures within a shorter period.

C. Field Maintenance

The consistent support is requiring in paddy development like intermittent weeding. To start with weeding ought to be done in day 26 after the transplantation. Second weeding completed in day 45 from the weed sowing time. At last the weed is expelled at day 56. The water level is to be kept up according to the growth. At that point the fields are depleted dry to collect the harvest.

II. PROPOSED SYSTEM

This paper demonstrates the image processing technique is recognized to identify the weeds and it is evacuated by the utilization of robotic arm. It constantly expel the weed from the field does not need any breaks. FPGA minimizes the time for weed removal due to its high speed operations. Here the driver circuit is used to boost up the input voltage of FPGA, required for the operation of DC motor in the robotic arm. FPGA is the core of the framework. In the proposed

system, FPGA is designed to control the robotic arm and wheel. Battery supply is given to all the units. Fig.2 shows the block diagram of proposed system.

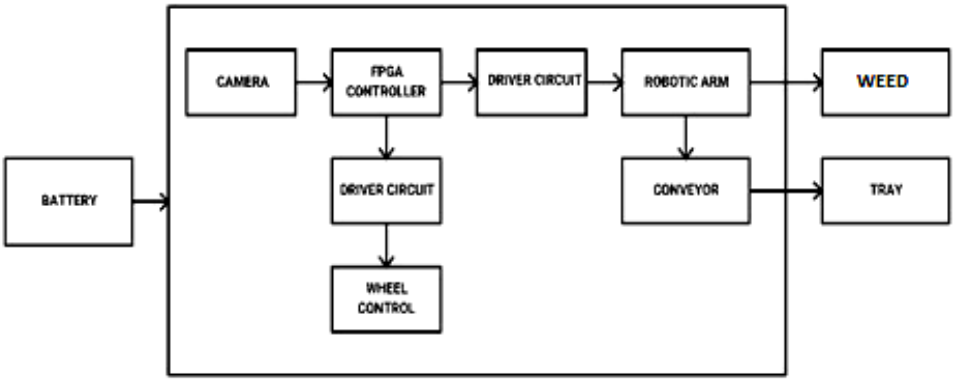

Fig. 2. Block diagram of the proposed system

Digital camera is used for taking the image from the agricultural field and it is stored in JPG format. It is send to the FPGA controller. Then the FPGA processes the captured image and identity the weeds in the field and send signal to operate wheel and robotic arm through driver circuit. Predicted on the signal, the robotic arm expropriates the weeds and placed it on the conveyor. It carries the weeds and put it into the tray.

III. METHODOLOGY

A. Input

The field image is taken by using digital camera and it is stored in jpg format. The initial captured image is shown in Fig.3.

Fig.3.Original Image

B. Pre-processing

The soil background soil in the captured images is removed by using excessive green colour algorithm. Later, only the green colour information is present in the image. The obtained RGB image is transformed into grayscale image as shown in Fig.4.

Fig.4.Grayscale Image

C. Filter

After the conversion, noises in the greyscale image are eliminated by median filter which is shown in Fig.5 as filtered gray scale image.

Fig.5.Filtered image

D. Segmentation

Then the binary image of weed and crop is extracted from the pre-processed image. Fig.6 shows the binary image.

Fig.6.Binary image of crop and weed

E. Texture Features Extraction

The wavelet transform is used to extract the size based feature. Major axis length and minor axis length parameters are used to differentiate the paddy crop and weed. Fig.7 shows the flowchart of automated weed expropriation system.

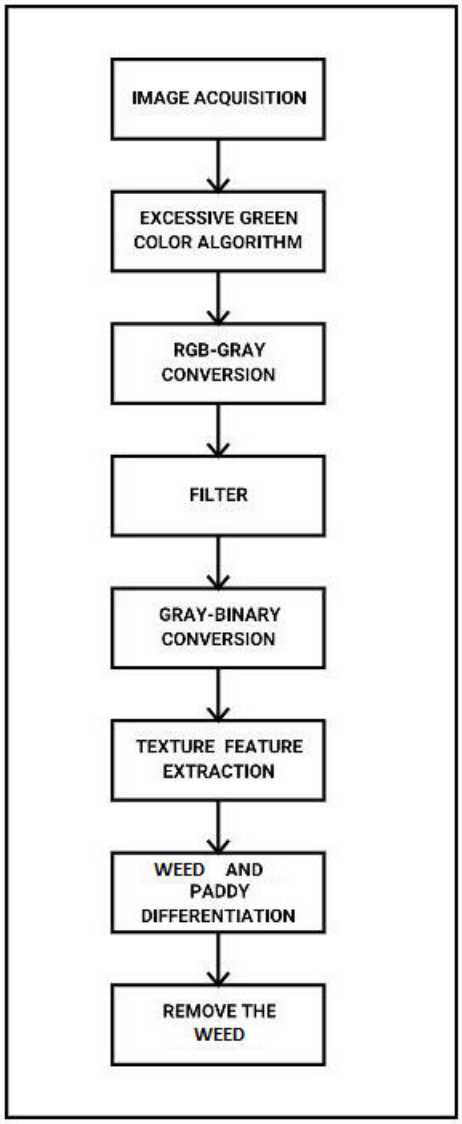

Fig.7. Flowchart of automated weed expropriation system.

IV. CONCLUSION

The automation based weed expropriation system is very helpful in paddy cultivation. Weeds are detected by image processing technique using MATLAB® software and it is removed by robotic arm. It increases the production and profit in agricultural field where as minimizes the labor charges. This framework can be implemented for other crops also.

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