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Trainable Automatic Wireless Controlled Robot for Removal of Agricultural Weeds

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***Abstract*: Indian agriculture has a very long history dates back to Indus Valley Civilization. India ranks second worldwide in agriculture. Though India ranks second position in agriculture it has many problems. One of the main problem is removal of weeds in agricultural fields. In agriculture, weed control is essential for maintaining high level of crop production. The aim of the proposed system is to detect and remove the weed plants in the agricultural land. Image processing is used to detect the weeds. The weeds are removed from the robotic arm. Therefore, it helps to improve the crop yield.**

***Keywords*: Weed detection, Image processing, Renesas Microcontroller, Four-wheel robot.**

1. Introduction

In the fast growing world with including basic needs agriculture which is the most basic entity of industries, is also going through a lot of reforms with the rising of technologies. Now due to a shortage of labour and increasing need to feed the large population around the globe, Agriculture Robots have entered into the picture. Agricultural robots are used to increase productivity while lowering overall costs, the agriculture industry has been actively working to adopt different forms of robotic technology. Robots can automate operations performed on the agricultural field like pruning, spraying, and weed removal. Use of herbicides and pesticides may destroy the crops and becomes very harmful thus reducing the yield of the crop. So the proposed system, aims to remove the weeds from the agricultural land. Thus it reduces the workload of the farmer. The robot consists of an arm mounted on the rover which will pick the weeds from the soil. This robot is very easy to handle and affordable for farmers doing even small scale agricultural activities, thus it increases their production.

2. Literature Survey

[1] Computer Vision Based Segregation of Carrot and Curry Leaf Plants with Weed Identification in Carrot Field, Anjali Rani K. A, P. Supriya, Sarath T. V.

The algorithm is implemented to detect the weeds by using erosion and dilation segmentation. In this project distinction of two types of crops carrot and curry leaf field weed identification is done using image. Image processing is done to detect the presence of weed, based on the class to which it belongs. Image is preprocessed to it clear, enhanced and noiseless. Image segmentation is done for identifying the vegetation index from soil background. Thus a binary image is produced from an RGB image. Once this is obtained, morphological reconstruction is done to identify weeds from crops. The choice of structuring element varies according to the class of crop. Shape features are considered for identifying the leaves as crop leaves or weeds. Initially a binary classification is done in order to detect the field contains weeds or not. The final image obtained contain some white pixels. The number of white pixel contain in the image clearly indicate whether weeds is present or not. The threshold value is taken for comparison count of white pixels. Threshold value indicates the weeds are present in the region.

[2] Computer Vision Based Robotic Weed Control System for Precision Agriculture, Megha. P. Arakeri, Vijaya Kumar B. P., Shubham Barsaiya, Sairam H. V.

This proposed method aims to develop a computer vision based robotic weed control system (WCS) for real-time control of weeds in onion fields. This system will be able to identify weeds and selectively spray right amount of the herbicide. The proposed WCS is an inexpensive and portable wireless system of handheld equipment's which can be controlled remotely through a user friendly web interface. It is designed to automate the control of weeds and thus reduces the difficulties of farmers in maintaining the field. The proposed system is based on a combination of image processing, machine learning and internet of things. The proposed system consists of an automated robot for detecting the presence of onion weeds in the field of onion crop and spraying required amount of herbicide based on the density of the weed. The system was designed with various hardware components like microcontrollers, sensors, Raspberry Pi. In this method farmer is not required instead he can control and monitor the system remotely.

[3] Investigation of Different Sensor Systems to Classify Plant and Weed in Organic Farming Applications, Florian

Johannes Knoll Tim Holtorf.

This proposed system aims to evaluate various sensors to find out which sensor and which configuration can be used. Another wanted information is at what time of the plant growth period the plants can be distinguished. Too small plants give too little information to distinguish them. If the plants are too large, they overlap each other so much that the individual plants can no longer be separated good enough. The first step is to evaluate if the sensors provide the information that is needed for the plant classification. Color cameras and 3D cameras are investigated. It must also be borne in mind that the pixel coordinates could be insufficient for a subsequent destruction unit, so maybe the metric 3D coordinates are needed.

[4] Weed Removal in Cultivated Field by Autonomous Robot using LABVIEW, Abhishek Patnaik.

The main objective of this proposed work is to cut the weeds precisely which is present near to the cultivated plant and collect it separately. A static camera is mounted for taking the images of a segment of the field and the coordinates of the weeds present in that segment is detected by image processing. The coordinates of the weeds obtained from camera are communicated through XBee module to the robot finally for cutting the weeds. This system includes a Static Camera which is mounted over the field and an autonomous robot having a gripper mechanism for cutting weeds. The image processing techniques for weed detection is done by NI VISION in LAB VIEW software where the characteristics of weed is defined for further detection. The Static Camera mounted over the field acquires the sample of images from the segmented field and based on image processing the location of weeds are identified defining the exact coordinates of weeds present in the field. The camera is connected to the laptop which receives frames of images and the processing is carried out in the software. The image location and its coordinates are observed using the NI VISION and this is sent to the Xbee receiver for communicating with the robot for further navigation.

[5] Design and Development of Automatic Weed Detection and Smart Herbicide Sprayer Robot, Aravind R, Daman M.

In this proposed system, an image processing algorithm is used to take images of the plantation rows at regular intervals and upon identifying the weeds in the image, the herbicide is sprayed directly and only on the weeds. The algorithm predominantly uses an Erosion and Dilation approach to detect weeds. The colour image is converted to binary by extracting the green parts of the image. The amount of white pixels present in the region of interest is determined and regions with higher white pixel count than the predefined threshold are considered as weeds. The herbicide is stored in a container fitted with water pump motors attached to spray nozzles. Once the weeds are identified, a signal is sent from Raspberry-Pi to the motor driver IC controlling the water pump motors to spray the chemicals over the weeds. The first step is image acquisition which is accomplished by the Raspberry-Pi Camera. The camera is mounted facing downwards on an extended arm from the chassis of the robot at a height of about 30 centimetres from the ground. Image acquisition is done in the presence of natural light. The next step is the processing of the image is subjected to morphological m thresholding, erosion and dilation to the plants in the Region of Interest determining whether it is a weed or the plant. The final step is the directed spray of the weeds in the ROI.

[6] Design of Paddy Weeding Robot, Byungho Yoonl, Soohyun Kim.

In this proposed work, a robot is developed for weeding. Water depth during rice transplanting seasons, interval that rice planted, size of paddy for deciding velocity needed to implement in real and soil status to determine actuator. Different actuator and sensor can be adapted for various tasks. This robot can be spraying pesticides using nozzle, weeding using weeding actuator and harvesting using harvest actuator under the robot. Initially the water in the paddy field is 15cm. During 15-30 days after transplanting weeds actively grow. During this time weeds actively grow so this robot would work in this period intensively. At that time water in paddy have 15cm height. In this robot contains side weeper that will kill the weed which is perpendicular direction on direction of move. It consists of elastic body to uproot the weed easily as to protect paddy. Paddy is not affected because paddy have taken root in the ground deeper than weeds.

[7] Development of Small Weeding Robots for Rice Fields, Atsunori Maruyama and Keitaro Narus.

The objective of this proposed work is to develop a robotic weeding system for a rice field. We took the approach of moving a large number of robots around in a field, thereby preventing weed seeds from sprouting. This paper presents the developed robotic system, in particular the robot hardware and radio communication network, and verification of the system use in an actual rice field. In this approach large number of robots are moved around in a field thereby preventing weed seeds from sprouting. This is inspired by an existing rice farming method that utilizes natural ducks. In this a mobile robot is designed with specially designed wheels that can stir up the soil and water therefore preventing the weed seeds from sprouting. This robot stands as a bridge over a planted line of rice, and its moves are finely controlled so that it does not cross the line. It uses the concept of weeding by mimicking ducks and thereby preventing weed seeds from sprouting.

[8] Detection of Weed and Wheat Using Image Processing, Sarmad Hameed, Imran Amin.

The proposed method facilitates the extraction of weed, wheat, and barren land in the wheat crop field using background subtraction. Wheat crop takes around 6 months to get mature. The detection of wheat and weed has been done in this research by using image processing. In this regard background subtraction method has been used to detect the wheat and weed area. To obtain image Unmanned Guided Vehicle was used to take the aerial images of the wheat crop of certain area that was focused under research. The format in which it captures the

photos can be in JPEG or in DNG which is a raw format. Once the image acquisition done by the drone camera the acquired image is then fed in to the MATLAB code for the image processing. For the first phase data acquisition from the drone which was done when the crop was matured around 50% of its overall growth. In the next step drone is used again to acquire the status of the crop that was done in the 18th week of the growth of the wheat crop. The acquired image fed in to the MATLAB code and using background subtraction the desired output would be obtained with some trial and error method. In the next step which was the third and the last one i.e. to obtain the image with the help of drone camera in the 22nd week of the crop growth when the crop was matured around 85%.

3. Methodology

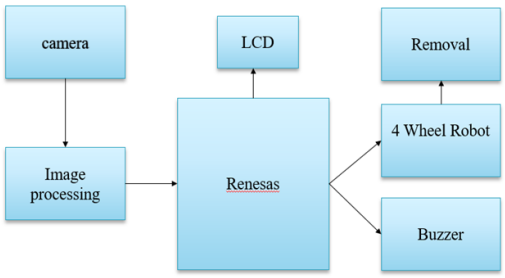

Fig. 1. Block diagram representation of the proposed system

Camera is used to capture images of weed and plants (laptop camera). Image processing is done to identify weed and plant using shift and surf Algorithm. 64 pin Renesas Microcontroller takes input from different devices they are controlling and it retains the control by sending the signals to different parts of devices.

LCD: JHD162A Alpha numeric LCD is used to display the message regarding detection of weeds.

L293D: Integrated circuit motor driver. used for simultaneous bidirectional control of two small motors.

Buzzer is used once weed is detected.

Initially the static images are given to the system. Using image processing weeds are detected and removed. The robot captures images from static camera. If there is weed, then there is a glow in LCD. also there is sound in buzzer. And finally the robot removes it.

4. Proposed System

Algorithm:

SIFT Algorithm

This used to speed up robot features and handling images with blurring and rotation. Build difference of gaussian images at different scales. Basically this has four stages,

- Build difference of gaussian image(dog) images at different scales.
- Key point detection and localization.
- Orientation assignment.
- Key point descriptor.

Scale space extrema detection: First we do blurring of the image to get more insights about it. Then we get several octaves generally 4 octaves. Two consecutive images in an octave are picked and one is subtracted from the other. Then the next consecutive pair is taken, and the process repeats. This is done for all octaves. The resulting images are and approximation of scale invariant laplacian of Gaussian Key Point localization: Key points generated in the previous step produce a lot of key points. If it's magnitude is less than a certain value, we reject the keypoint.

Orientation assignment: Orientation is assigned to each key point. Orientation is histogram is created. Highest peak above 80%. It contribute to stability of matching.

Key Point Matching: Key points between two images are matched by identifying their nearest neighbours. But in some cases, the second closest-match may be very near to the first. It may happen due to noise or some other reasons. In that case, ratio of closest-distance to second-closest distance is taken. If it is greater than 0.8, they are rejected.

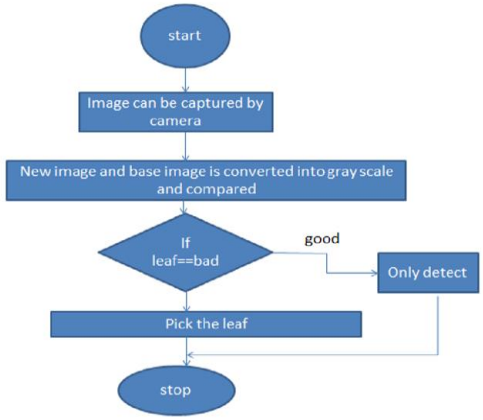

Fig. 2. Flowchart representation

5. Result

Fig. 3. Different stages of image processing

Fig. 3 shows the stages of image processing from base image to grayscale image.

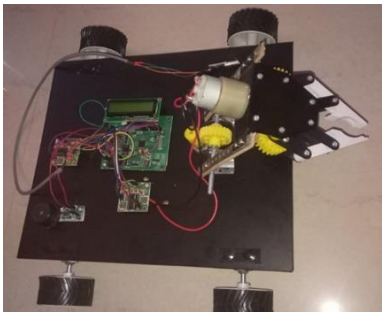

Fig. 4. Four-wheel robot

Fig. 4 shows the four-wheel robot which is used to remove the weeds.

6. Conclusion

The weed removing robot is been built using image processing technique, renesas microcontroller, dc motor etc. Image processing detects the weed leaf and removes it from the soil. The designed robot can be operated on laptop. The robot can reduce up to 80% farm's of use of pesticide. It reduces the time required by the farmer to identify and remove individual weeds among crops in agricultural fields. It is also cost effective. It helps to increases the crop production.

References

[1] Anjali Rani K. A, P. Supriya, Sarath T. V "Computer Vision Based Segregation of Carrot and Curry Leaf Plants with Weed Identification in Carrot Field" Proceedings of the IEEE 2017 International Conference on Computing Methodologies and Communication (ICCMC).

[2] Megha P. Arakeri, B. P. Vijaya Kumar, Shubham Barsaiya, H. V. Sairam, "Computer vision based robotic weed control system for precision agriculture," 2017 International Conference on Advances in Computing, Communications and Informatics (ICACCI).

[3] Florian Johannes Knoll Tim Holtorf "Investigation of Different Sensor Systems to Classify Plant and Weed in Organic Farming Applications," SAI Computing Conference 2016.

[4] Abhishek Patnaik, R. Narayanamoorthi, "Weed Removal in Cultivated Field by Autonomous Robot using LABVIEW," IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication SystemsICIIECS'15.

[5] Aravind R, Daman M, "Design and Development of Automatic Weed Detection and Smart Herbicide Sprayer Robot," 2015 IEEE Recent Advances in Intelligent Computational Systems (RAICS).

[6] Byungho Yoonl, Soohyun Kim, "Design of Paddy Weeding Robot"

[7] Atsunori Maruyama and Keitaro Narus, "Development of Small Weeding Robots for Rice Fields," Proceedings of the 2014 IEEE/SICE International Symposium on System Integration.

[8] Sarmad Hameed, Imran Amin, "Detection of Weed and Wheat Using Image Processing," 2018 IEEE 5th International Conference on Engineering Technologies & Applied Sciences.