Development AI based Agri Robot for Weed Management

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Abstract - **This project strives to develop a robot which is capable of performing operations to detect weed and remove weed by spraying(chemical) and mechanical methods. The mobile operated ROBOT is a concept where a human being can control a ROBOT by an android app by remote or wireless operation, without physical intervention of human being. The motion of the robot will be controlled by remote buttons and voice commands in the android app. After that Robot remembers the route that is trained using android app. Density of grass is sensed by robot and based on that decision is taken to apply method of removing weed. Boundary areas of field are provided to robot using android app. The main controller is the microcontroller (Rasberi Pi 4B) that supervises the entire process. Farmer can utilize this robot to decrease the labour and increase yield of crops so that the profit and efficiency will be higher and also water and soil pollution will be less. This method is the best solution to remove weed and save environment.**

Keywords: weed, agrirobot, Artificial Intelligence, spray, herbicides.

1. Introduction

Agriculture is the backbone of the Indian economy. Presently a number of researches are being done to increase the application of robotics in agriculture. Farmers cultivate vegetables with manual farming technologies. But obviously, weeding removal is also manual. Farmers use a tractor for removing weeds if distance between plant is large which involves direct involvement of human. The inhalation of pesticides sprayed earlier causes permanent damage to the lung tissues. In recent years, the development of autonomous vehicles in agriculture has experienced an increased interest. This robot is a multipurpose application robot that will automate the slow, repetitive and dull tasks for the farmers. Replaces the manual removing weed method by an automated one's thereby reducing use of harmful chemical on humans. System provides an additional feature of grass sensing using image sensing by camera for detection of type of grass and it density for removing mechanically.

G. Kavitha et.al.[1] done work on weed removal using robotic arm by using image processing. Xiaolong Wu et al.[2] proposed a robotic weed control system using multiple cameras. In their work, they utilized both mechanical and chemical methods for weeding. Victor Partel et al. [4] conducted an experiment on smart weed management using artificial and real plants. They tested two types of GPU cards for image processing and found that one of the cards was better. The aim of the experiment was to reduce the cost of weeding and improve precision weeding. Rekha Rajaa et al. [5] developed a weed-crop classification system using crop signaling techniques. They achieved a sprayer weed detection accuracy of 98.11% using a micro jet nozzle for spraying. This technique could potentially address labor problems in countries like the US. David Reiser et al.[7] worked on an autonomous robot used for intra-row weeding in vineyards. The robot was tested in the inner field and then in the outer field, and it uses terrain wheels for this purpose. Wedding is a labour intensive task and is often done manually which can be time consuming and costly. Robotics method has the potential to improve efficiency and accuracy of wedding. This system is useful in rainy season.

Anirudha et al. [8] developed autonomous herbicide spraying system. They used a GPS for navigation of system. They measured online, the amount liquid sprayed to farm area. U. Farooq et al. [9] used YOVO v4 light model of deep learning to detect weed using hardware. They used Rasberry PI 4B model for that. While preparing model Kaggle data set was used. R. Aravind et al. [10] used for detection of weed and herbicide is only on weed not on crop. So that it will not harm to the crop. B. Maram et al. [11] used remote computer for classification of weed and crop image. They used CNN for image classification and crop observation time is reduced. Y. Du et al.[12] developed low cast system for spraying herbicide for row crop. It automatically connected to the charging station. This robot is useful for particular crop for optimum use of herbicide. S. Fatma et al. [11] used method selective weed management. They have used shape based weed detection method. Autonomous robot is helpful smart farming.

2. Proposed Methodology

Fig.1is block diagram of proposed system. The proposed system is specially designed for detecting weed and spraying herbicide based on detection and can also be used for removal wedding on different crops such as onion and fruit farm. Camera is interface to the system using microcontroller. Motors are interfaced to port of microcontroller. (Raspberry Pi 4 B). Development of software to detect weed in python. Analysis of grass and its density using image processing and based on that activate the spraying pump using relay. Wireless interface is required to perform remote activity. The spraying path coordinate are stored for doing routine work. Mechanical assembly is prepared to carry 10 lit drum to carry herbicide Testing is done indoor. Latter on it can be checked outer field. Tem and humidity is sensed through ADC interface. Based on tem and humidity herbicide solution is prepared.
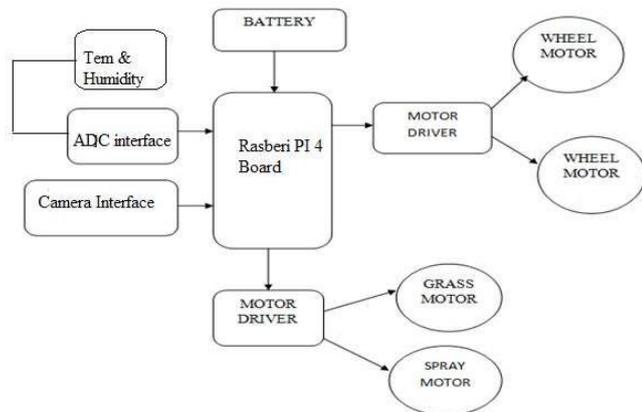

Figure 1: Block Diagram of Weed Agri-robot System

Weed detection using Image processing crop

Crop is not at ground level. It is 2 feet above ground. So detection of green grass is present or not. If weed is present switch on motor and spray herbicide. If in running heighted weed is present it will be sensed and cut by cutter. Following Steps are used to detect the weed:

1) Read the image
2) Convert colour image into a grey image
3) Prepared Mask green part of the image
4) Obtain eroded or dilated image
5) Find no of total boxes indicated by yellow colour
6) If Sum greater than threshold weed detected otherwise no weed
7) Process is repeated for next detection

3. Experimental Results

Fig. 1(a) prototype prepared to spray herbicide. Fig 1(b) shows android app by wireless operation. Right, left, forward

and backward operation possible by using 4 motor. Pump can be ON or OFF by using front display. Fig 2 shows detection of weds with camera. Here it is greater than the threshold value. Yellow dot indicate presence of weed.

(a)Weed as Grass

(b) After Weed detection

Figure 1 (a) Prototype of aggri robot without Camera and (b) android app to control robot

Figure 2: (a) Image of grass in grape wine yard and detection of grass, (b)Yellow square indicate detection of weed

4. Conclusions

Robot senses the tem and humidity of field. That will be useful for preparing mixture of herbicide. This robot works effectively and efficiently to control weeds while minimizing harm to the environment. This experiment will be useful in determining the effectiveness of weed control in agriculture. A real-time robot is needed for effective herbicide spraying in all seasons. In future robot will memorise the location up to where herbicide is sprayed and tank of herbicide is filled automatically.

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