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Weed Eradication Equipment And Classification Utilizing Image Processing.

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Abstract:
Weed control in agriculture presents a significant challenge for farmers. Furthermore, present farming techniques make extensive use of herbicides and other chemicals, which might have a negative impact on the environment. These can have an impact on soil fertility as well as water contamination when agricultural runoff enters bodies of water, adversely impacting aquatic ecosystems. It can also have an impact on our health if we consume agricultural products that are produced using unscientific methods and a high concentration of pesticides. These disadvantages can be avoided by creating a system that can detect and eradicate weeds automatically, either by plucking or spraying herbicides exclusively in the targeted areas.

KEYWORDS: Weed Control, Advanced machine

I. INTRODUCTION

Weeds absorb the fertilizer, water, and sunlight that reach the field or garden, limiting the amount of these resources accessible to crops. Handpicking is a traditional method of weed control, although it is arduous and time-consuming. Another technique is to spray herbicides across the entire garden or field, which needs a big amount of chemicals and may potentially pose health risks and pollution.These disadvantages can be avoided by creating a system that can detect and eradicate weeds automatically, either by plucking or spraying herbicides exclusively in the targeted areas. Weed-killing robots can thereby reduce the need for herbicides. It detects and identifies weeds using cameras and image processing algorithms that have no negative impact on crops. The camera's information is sent to the Raspberry pi module, which may be configured to recognize the plant. When a weed is detected, it activates the robotic arm, which has a weed-cutting instrument connected to its gripper. Thus, weeds are removed. Weed control is the primary focus in small-scale gardens.

Image processing is a technique for performing numerous operations on an image in order to produce an enhanced version or extract useful information from it. It is a type of signal processing in which the input is an image and the output can be another image or attributes or characteristics of the input image. Image processing is one of the most rapidly increasing technologies. It is also an important study topic in engineering and computer science. Image processing consists of three steps: importing the image using image capture equipment, such as a camera, evaluating and modifying the image, and creating a report.

Image Processing

The detection of plants involves five key procedures. picture acquisition via a digital camera or the internet is followed by feature extraction, categorization, and picture pre-processing, which includes image enhancement and image segmentation to separate the affected from the useful areas of the image. Finally, it will be determined whether any diseases are present on the plant leaf. Leaf sample RGB photos were selected as the first phase. The detailed process is as follows:

1) Image acquisition
2) Image preprocessing
3) Feature Extraction

Image acquisition

The images of various leaves were taken with a digital camera that has the requisite resolution for better quality. It is apparent that the application will influence how an image database is developed. The picture database is responsible for improving the classifier's performance, which defines the method's resilience.

Image pre-processing

The second phase is pre-processing the image to remove undesired distortions and improve certain aspects that are critical for later processing and analysis. It includes image augmentation, segmentation, and color space conversion. Color space representation is created using RGB photos of leaves. The color space is intended to make it easier to specify colors in a way that is widely understood. The Hue Saturation Value (HSV) color space is depicted using RGB photographs. Because RGB generates colors and he describes them. The HSV model is an excellent color perception tool.

Feature extraction

Following segmentation, the area of interest was extracted. The meaning of a given sample can be determined by examining the relevant qualities gathered in the subsequent phase. Picture features often include color, form, and texture. The majority of academics are now focusing on plant leaf texture as the most essential characteristic for identifying plants. As shown below, there are numerous methods for feature extraction.

Objectives of the proposed work

1. 1. Develop an automated weed management system for small-scale farming.
2. 2. Promote chemical-free agriculture and reduce or eliminate the use of herbicides for weed management.

II. LITERATURE REVIEW

Nidhi, utilizing the open source computer vision library, an image can be captured based on its hue, saturation, and color value (HSV) range. The fundamental library functions for image handling and processing are utilized. Basic library functions are used to load photos, create windows to hold images during runtime, save images, and distinguish images based on their color values. I also implemented a method to threshold the output image in order to reduce distortion. During processing, the images are changed from their fundamental scheme, Red, Green, and Blue (RGB), to a more suited one, HSV.

Ganesh Bhogade, describe plant disease identification via image processing. According to the paper, the automatic identification of illnesses on plant leaves is an important topic since it may be used to monitor large fields of crops. Various image processing algorithms are utilized to detect illnesses that appear on plant leaves.

The provided system is a software solution for the automated identification and classification of plant leaf diseases.

Varsha Sawarkar, present an idea for detecting rose plant diseases using image processing. In this research, the diagnosis of rose plant diseases is critical to preventing yield and quantity losses in agricultural products. Diseases impair plant productivity and growth, resulting in decreased plant quality and quantity. Disease detection on plants is crucial for sustainable agriculture. It is quite difficult to monitor plant diseases with the hands. It requires a significant amount of work, specialized understanding of plant diseases, and enough of processing time.

Adams Begue, investigate the automatic recognition of medicinal plants using machine learning and image processing approaches. Proper plant species identification serves a wide range of stakeholders, including forestry services, botanists, taxonomists, physicians, pharmaceutical laboratories, conservation organizations, the government, and the general public. As a result, there is increased interest in developing automated systems for recognizing various plant species.

Nisar Ahmed, in this paper, they proposed approach will automatically identify a plant species by its leaf. The algorithm will extract features basedon shape, color and texture of leaf and carefully blend them for optimized results. Feature normalization and dimensionality reduction will be used to counter the effect of dominant feature and increased processing speed. Different classification methods are studied empirically and some best suited classification algorithms will be used for optimized speed and accuracy.

III.PROJECT DEFINATION AND METHODOLOGY

The automated weed management methods available now are more advanced and not cheap to small-scale farms. They use advanced programming techniques such as artificial intelligence and machine learning. Because of the complexity needed and the high cost of implementation, most of these solutions are limited to large-scale agriculture. So, if we minimize the cost of implementation, it will be accessible to small-scale farmers and gardeners. The initiative aims to provide a low-cost automated weed control system, specifically for small-scale farmers. The initiative makes it possible by lowering hardware costs and relying solely on image processing and identification techniques to detect weeds to the greatest extent possible.

The project offers an intelligent agricultural solution by using artificial intelligence techniques such as image processing, detection, and machine learning. Thus, the research emphasizes the necessity for agricultural methods to be automated as the population grows and the demand for food supply increases.

IV.Working Principle

The Raspberry Pi is pre-programmed with the essential datasets, including the training models against which the image must be compared. The dataset contains several leaf and plant photos of the target plant, which we use to train the Raspberry Pi using appropriate training algorithms. Programs for image identification and processing are also uploaded to the Raspberry Pi module.

After powering up the robot, it will move forward until it detects and recognizes a weed. This detection is using the Raspberry Pi camera that is placed under the robot. Soon after detecting a weed using the color sensor, the robot stops its motion and the image of the weed is captured.

Components required

1.Data Server
2.Raspberry pi
3.PI Camera
4.Motar Driver
5.DC motor
6.Sprayer

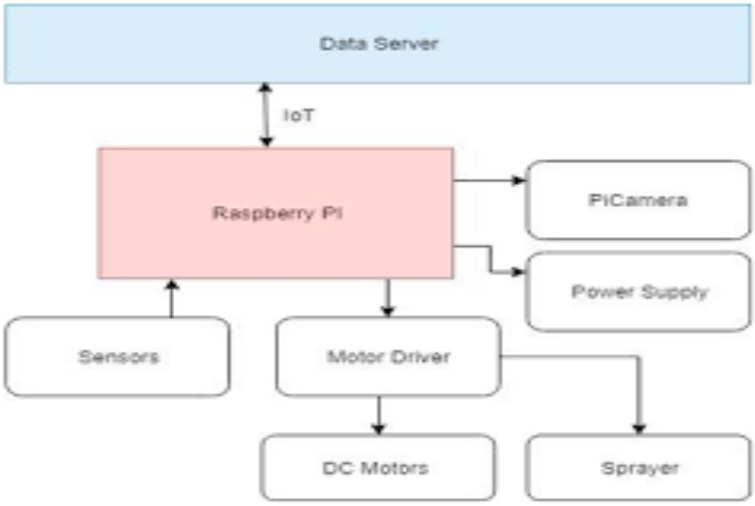

Fig 1: Block diagram of a weed killing robot

Components used:

Data Server :

A data server is a computer or platform for storing, managing, securing, and processing data. It is also capable of running apps, hosting webpages, and responding to device requests. Data servers are central repositories for storing, organizing, and retrieving data. Multiple users or programs can interact with the database simultaneously. Data servers can hold both organized and unstructured information. Structured data follows specified patterns, making it easier to search and manage.

Raspberrypi

The Raspberry Pi's top edge features a row of GPIO (general-purpose input/output) pins. All current Raspberry Pi boards include a 40-pin GPIO header (the Pi Zero and Pi Zero W do not). Before the Pi 1 Model B+ (2014), boards had a shorter 26-pin header. Every GPIO pin can be designated as an input or output pin in software, allowing for a wide range of applications. The board includes two ground pins (0V), two 3V3 pins, two 5V pins, and additional non-configurable ground pins.

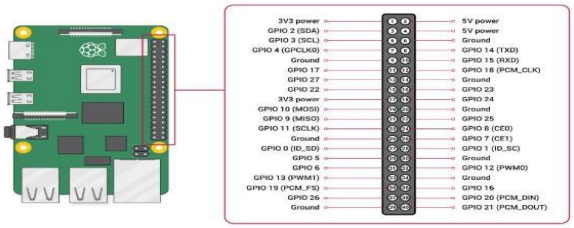

Fig 2: Raspberry Pi

PI Camera;

The pi Camera module is a camera that can capture both still images and high-definition video. The Raspberry Pi Board contains a CSI (Camera Serial Interface) interface, which allows us to directly connect the Camera module. This Pi Camera module connects to the Raspberry Pi's CSI port via a 15-pin ribbon cable.

Motor Driver

A motor driver, also known as a control motor, is an electronic device or module that regulates and supervises the performance of an electric motor. It acts as a link between a microcontroller or other control system and the motor, allowing precise control over the motor's speed, direction, and other properties.

DC Motor

A DC motor is an electric machine that uses direct current (DC) to create mechanical force. It works by converting electrical energy into mechanical rotation.

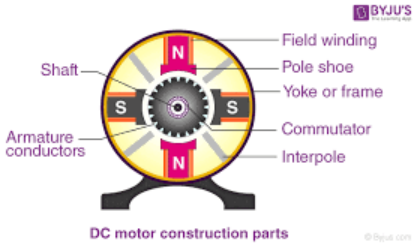

Fig 3: DC Motor

Sprayer

A sprayer is a device that disperses liquids like water, chemicals, or other things. Sprayers are used in agriculture and industrial, among other applications.

V.Results and Discussion:

TESTING AND RESULTS

A weed-killing robot, utilizing computer vision and machine learning, demonstrated high efficacy in selectively identifying and removing weeds within a crop field, achieving significant weed control with minimal crop damage, highlighting the potential for precise, herbicide-reduced weed management in agriculture; however, challenges remain regarding complex field conditions, weed identification accuracy in diverse environments, and optimizing robot movement for efficient. Herbicide treatment can aid in weed detection in crops, but in this case, image processing was required because it was difficult to generate the mask and identify the regions of interest because light intensity in different locations is not always consistent. To create an opportunity to detect potential for weed control, the crops photographed must be in their early stages.

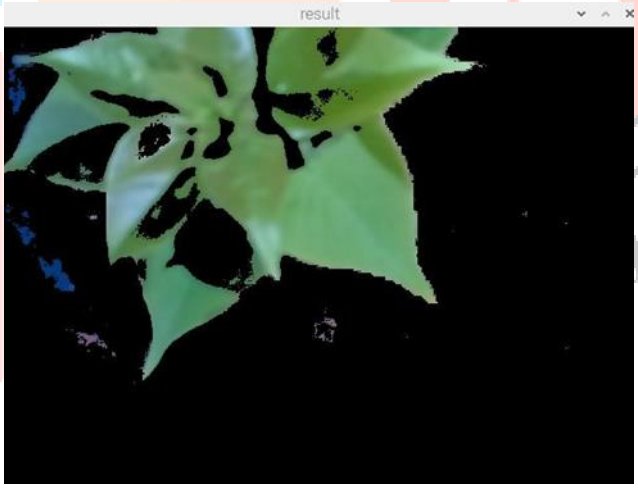

Fig 4: Screenshot of the output showing the weed plant

VI . CONCLUSION

Weed detection in crops can be improved during the herbicide application process; in the case of this application, image processing was critical because obtaining the mask and identifying regions of interest, while keeping in mind that you do not have the same levels of light intensity, was a significant challenge. It is critical that the photographs taken are of crops in their early stages in order to produce a chance of detecting potential weed control.

These disadvantages of traditional weeding techniques are overcome by a system that can automatically detect weeds and eradicate them either by plucking or spraying herbicides exclusively in the required areas. Weed-killing robots can thereby reduce the need for herbicides. It detects and identifies weeds using cameras and image processing algorithms that have no negative impact on crops. The camera's information is sent to the Raspberry pi module, which may be configured to recognize the plant. When a weed is detected, it activates the

robotic arm, which has a weed-cutting instrument connected to its gripper. Thus, weeds are removed. Weed control is the primary focus in small-scale gardens.

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