AUTOMATIC FERTILIZER SPRAYING ROBOT FOR PLANT LEAF IDENTIFICATION USING COMPUTER VISION TECHNOLOGY

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Abstract : In this work, an automated fertilizer spraying robot has been developed to determine whether the plant is affected by disease or not and takes corresponding actions. The normal growth of the plants also depends upon the health and quality of leaves by it means disease affected or not yield and quality of agricultural products is seriously affected similarly. This paper attempts to develop an automated compact robot module that detects the disease present in the plants with lots of feature like disease recognition. Here, the IOT framework also makes user-friendly communication

Keywords: Internet of Things (IoT), Image Processing, Disease Diagnosis, Raspberry Pi, Robotic Setup

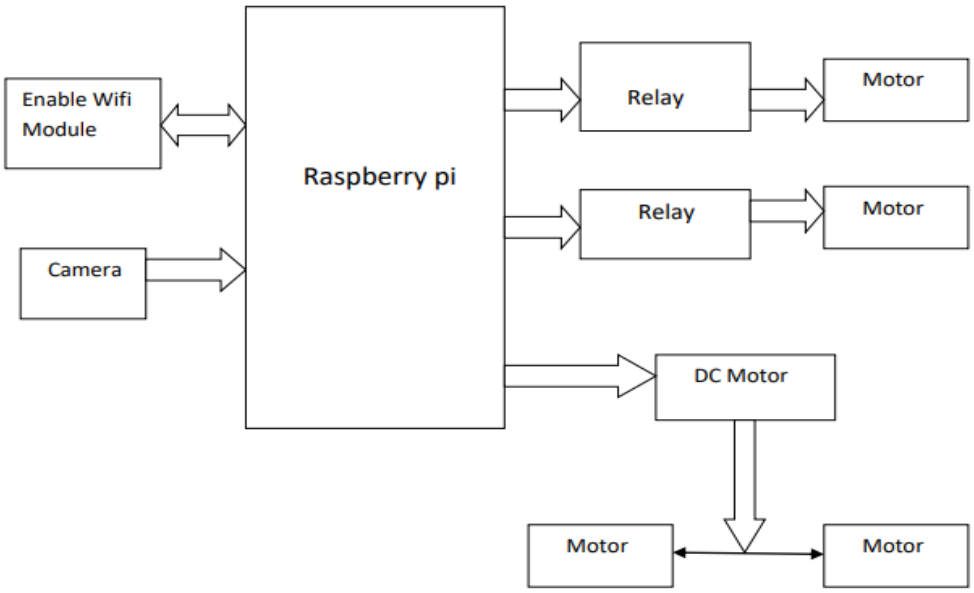
I. INTRODUCTION

Agriculture is a boon to tropical countries like India. However, due to the changes in climatic conditions the productivity and sustainability of the farming systems are under high risk. In agriculture applications, pests and diseases cause great economic loss to farmers through reduced yields and increased costs of pesticides and other control measures. Plant disease detection by the visual way is a difficult task, and it is less accurate hence automation techniques are developed to ease the task and provide high accuracy. The image processing techniques have been used to increase the cultivation yield by building a decision support system which can detect and classify the disease.

Detection of a disease in the plant is the utmost need for farmers and agricultural experts. In most of the plants, the disease inception takes place on plant leaves. The main aim of the proposed system is to detect plant diseases using IoT. Hence, the proposed work has considered the detection of plant disease present on leaves. The discrimination of normal and affected plant leaf can be measured based on variation in temperature, humidity, and color. The camera node captures the image of the plants and processes it to detect and segment the disease. The segmented image can be transmitted to the monitoring site using internet from which the features are extracted for further analysis. The expert at the monitoring site classifies the diseases based on the features received and provides solutions to the farmers. Precise knowledge of areas where diseases have spread would help the farmer to apply appropriate amounts of pesticides to the affected areas, thereby yielding both economic and environmental benefits. In the vision-based disease detection system, segmentation plays a vital role. For extracting the features, the image must be segmented efficiently. The automation system available at the monitoring site makes use of the classifiers to classify the disease after which the farmers are alerted.

Methodology

The design of Automatic Detection and order of leaf infection. First, the continuous pictures of different leaves are obtained utilizing a camera. Through Image Processing the features of the image are extracted and the output is given to Microcontroller. Then various image-processing methods are applied to the acquired images to getting useful features that are important for the next analysis process. Feature extraction process will consist of actual disease detection from an image by comparing the image with non-defected images. After that, numerous systematic procedures are completed to characterize the pictures as per the specific issue close by.



The proposed working process is leaf disease identification using automation robot. In this work, the robot module moving one plant to another plant through the guidelines of the Micro-controller.At that point as indicated by the illness, the sprayer will shower the bug spray to the leaves of the plant.

Working principle:

This work is designed for the automatic robot module and image processing to identify leaf diseases.

Our working step process is three modules.

- Robot modules
- Camera
- Raspberry Pi

Camera

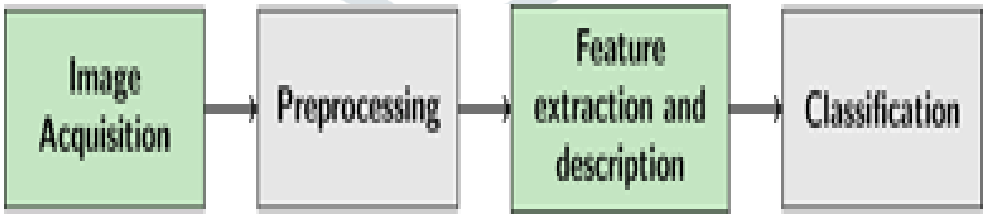


Image acquisition

The reason for this progression is to get the picture of an entire plant or its organs with thegoal that investigation towards features can be performed.

Digital Image Processing

Digital image processing is used to do some computer vision applications by manipulating the image using mathematical & computer algorithms The image processing aims to manipulate images in order to benefit AI development. Generally In that

image manipulations are an enhancement, recognition, edge detection, and segmentation. An Image is Two Dimensional array of pixels which vary too (0,255). The advanced level in manipulating the image processing gear up with some fields such as Medical, Automation, Remote sensing, and Computer vision. And some Top products from tech-geeks companies such are Google, Facebook and Snap chat are mainly depends on image processing which is used in our daily life. Google has a Driver-less Automatic Car which is based on Computer Vision.

Feature extraction and description

Feature extraction is nothing but the vector representation of image characteristics of edge information, contrast level, and texture information. This vector representation basically gives the pattern of the images which can be further recognized for different applications. There are hundreds of pattern algorithms and descriptor methods available to manipulate the images. And also machine learning technology contributes a milestone on recognition.

Classification

In the previous time's statistical methods and similarity matching algorithms are used classification. However, due to poor precision, machine learning and its predecessor deep learning methods get much attention in classification more specifically, focusing on the Image Acquisition and the Feature Extraction and the vector values being classified, i.e., plant species. A detailed analysis of the pre-processing and the Classification steps is beyond the possibilities of this review. Support Vector Machine algorithm is used to leaf disease identification and it has more accuracy for a larger dataset.

Result Discussion

This section mainly explains about two parts are I) Leaf Identification II) Spraying Fertilizer.

Hardware Setup of Robot

The leaf disease is identified by the image processing technique using Python OpenCV library module. OpenCV means Open Computer Vision is created by Intel for CV applications. The 4GB RAM & 300GB ROM with Intel i3 processor powered PC is used for CV processing. The next is the Spray Fertilizer Control System which connected to PC through UART communication protocol.

First, the CV module Capture image and process the image to identify the leaf disease. After identification of the disease the robot module operates the fertilizer to spray on leaf otherwise the robot module moves to the next leaf and continues the process from the beginning.

Raspberry Pi 3

For larger embedded applications, integrating microprocessor and micro-controller become more complex and difficulty too. After the development, SoC makes the microprocessor more compact and small. Raspberry Pi is the SoC design which designed in order for all the people must have a computer. For the first time, Raspberry Pi version starts with Rpi Zero and now this still on Rpi3. Rpi 3 is a microprocessor with GPIO Programming which to do all fun with that also it comes with an inbuilt configuration of 1GB RAM, IEEE 802.11n Wi-Fi, Bluetooth, Ethernet, 3.5 mm Audio Jack, HDMI port and 4 USB ports.

Fig: Raspberry pi 3

With the USB ports, the keyboard, the mouse or web camera can be interfaced. The monitor could be interfaced with either HDMI port or Display Connector. There is also One Pi Camera Connector in that Rpi. A Debian based Linux OS specially developed for Rpi is known as Caspian OS. This OS has come with all features available in Debian OS. It has lots of Open Source Applications.

In Rpi, to boot the system is done by just connecting with the USB power plug and just unplug the cable to shut down the system. The SoC Configuration of Rpi is Broadcom BCM2837 System-on-Chip (SoC) includes four ARM Cortex-A53 core processor is running at 1.2GHz. One Video Graphics Processor integrated with 1GB DDR2 RAM.Camera Image

Sensor

The camera is a sensor which senses the light intensity of surrounding by photo-diode elements. The camera lens capturing around an image is reshaped as rectangular by Frame. The Analog light intensity information is converted into digital by using an A/D converter. The continuous light intensity signal converted to digital pixels values which range(0,255)

Fig: Web camera

Python has lots of libraries to do the image capturing/videorecording and manipulating process. The Webcam comes with a 10MP specification, Autofocus and LED Flashlights.

Conclusion

The smart agriculture using IOT has been experimentally proven to work satisfactorily by monitoring & controlling the leaf diseases in the agricultural on-field. Mostly identification and curing of plant disease will be done by robot module. Then also disease will be identified at the severe stages only. The mainobjective of the paper is to automatically detect and cure the plant disease by providing fertilizer. In the agricultural field, plant disease plays a vital role to cause loss economically. The plant disease is identified by image processing using the concept of local binary pattern. The pattern extraction concept is used to identify the affected part with more accuracy. Then the severity of the disease is identified by comparing the value with the trained dataset using machine learning technology and provides medicine accordingly. In this proposed system the detection and curing of plant disease will be done automatically. The medicine will be provided through the RASPBERRY PI microprocessor. The microprocessor is serially connected with the system. The proposed system will reduce the manual work and used to increase the yield by identifying the disease in an earlier stage. Hence the agricultural field efficiently saving the lost.

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