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A Survey Paper on Identification of Diseased Leaves in Plants with the Implementation of IOT and Image Processing

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Abstract: ***With the help of Automated system and different taxonomies, the growth of the plant can be monitored. Such kind of information will be helpful for farmers, botanists, food engineers. In this paper we combine Image Processing and Internet of Things to monitor the growth of the plant and collect the climatic factors such as humidity and temperature. In image processing, there is a recognition system which detects the growth of the plants by using the images of their leaves hence the usage of pesticides can be controlled. The system compares the image with the ones in the database by running the pre-processing and feature extraction technique to get the potential matches. In this method we extract the colour, texture and shape of the leaf. Based on the pattern recognition a leaf can be identified as healthy or unhealthy. First sensors are activated, with the help of cameras image is captured and stored for future enhancement. After identifying the diseases of the crops using the various image processing techniques, alerts can be sent to the farmers. The farmer can see the condition of his field even at sitting in his home using web or mobile applications.***

Keywords: ***Sensors, Image Segmentation, Pattern Recognition, Feature Extraction, Algorithms***

I. INTRODUCTION

In the world around us today we have devices that have the capability to listen, speak, see things and also process information. These devices are called smart devices. A network of such smart devices to share the information that they gather or process is called Internet of Things. Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. It usually refers to digital image. Digital image processing makes use of different computer algorithms to perform image processing on digital images

India is an agriculture-based country. Agriculture plays a vital role in the Indian economy. About 70% of Indian population is dependent on agriculture. Since 2010, the rate of the crop production has declined because of the weather conditions, crop disease, rodents, fertilizer misuse or low soil fertility etc. Nowadays, farmers use different kinds of pesticides for crop at regular intervals. If the pests and disease are present in the plant it will affect the rate of crop cultivation. It reduces crop yield in a significant amount and as a result there will be an increase in poverty, food insecurity and mortality rate. At present the system used to solve the problem is by visual observation which has a draw back as it is time consuming. To overcome this issue the solution for this is introducing IOT with the help of image processing. In this procedure the cameras will be installed in different places of the field and it will capture the images frequently. With cameras sensors are also introduced in many places, the sensors will collect the information about moisture in soil, temperature, humidity and various other agriculture parameters.

II. RESEARCH

This paper highlights the various studies of IOT techniques with help of image processing to detect disease of the plant they are as follows

1) According to Vijay Singh et al Automatic detection can reduce the disease of the plant using these 3 techniques

a) Image processing - It is the technique used for measuring affected area of disease, and determining the difference in the colour of the affected area.

b) Image segmentation – this involves separating or grouping of images. This can be done by simple thresholding method or advanced colour image segmentation methods. Humans can easily detect these but it is not possible for a system to detect this. Hence different methods have been developed. The process of separation is based on various features already present within the image.

c) Genetic algorithms-these type of algorithm is evolutionary in nature. They develop a set of solutions called population and these solutions develop another solution till a final response is obtained.

So, it involves the following steps: Record the image: either by using cameras, scanners etc. Study the image and obtain data by comparing with previous data. Also make predictions. Send the response to the farmer or take actions on its own by analysing the data. [8]

2) According to Sachin D. Khirade et al, disease detection can be done by image processing. There are 4 processes

a) *Image Acquisition:* can be done by using cameras and sensors.

b) *Image Pre-Processing:* this done to remove noise from the image. It is done by method of image clipping, image smoothing and image enhancement. Then histogram equalisation can be used to enhance the disease portion.

c) *Image Segmentation:"* Segmentation means partitioning of image into various part of same features or having some similarity." This can be done by boundary and spot detection algorithm, K-means clustering, Otsu threshold algorithm etc.,

d) *Feature Extraction:* this is done by colour co-occurrence method, leaf colour extraction by using H and B extraction, Classification by using ANN and back propagation. [7]

3) According to Pooja V Rao et al, image processing can be used to identify the diseases in plant. It involves 4 steps:

a) Image acquisition and pre-processing-it involves capturing the images, reduction of noise, conditioning of image

b) Segmentation- this is done by k means clustering algorithm, Otsu detection conversion from RGB and HIS.

c) Feature extraction-region of interest is selected and then separated based on colour and other features.

d) Classifiers-Support Vector Machines-it is tested with various classifiers like C-SVM, nu-SVM, epsilon-SVM regression and nu-SVM regression [3]

4) According to Rajneet Kaur et al, image processing is one of the methods to analyse the following.

a) Detect diseases related to plant leaf, stem and fruit by using sensors and cameras. Quantifying the disease affected area by use of an algorithm to read the surface of the leaves and stem.

b) Identifying boundaries of affected area this is done by comparing the previous data and the images taken. Determination of colour of affected area can also be done by this method.

c) Determining size and shape of fruits is also done.

The following techniques are used by the author Neural Networks, SVM-colour representation Fuzzy classifier Colour analysis Feature based rules K nearest neighbour [6]

5) According to Anil A. Bharate, et al, the common system architecture for plant disease detection using image processing is mentioned below

a) Image acquisition-this is done using sensors and cameras. Image Pre-processing- the image has to be customized and re-edited so that the noise has been eliminated.

b) Image segmentation-process of partitioning a digital image into segments. Feature Extraction-process of extracting the necessary parts of the image: Colour Features, Texture Features, Morphological Features

c) Pattern Matching and classification

The author also mentions the following challenges: Collection of data set, Image Background, Image capture condition, Symptom segmentation, Symptom Variations, Multiple simultaneous disorders, Different disorders with similar symptoms [4]

6) According to Bharath Mishra et al the following techniques can be used for image enhancement. Filtering with morphological operators, Histogram equalization, Wiener filter for Noise elimination, Linear contrast adjustment, Median filtering, Unsharp mask filtering, Contrast-limited adaptive histogram equalization (CLAHE), Decorrelation stretch

The disease detection follows following steps: Image acquisition, Image enhancement, Noise reduction, Image segmentation, Feature extraction, Classifier, Detection.

The author also mentions about various disease detection methods:

Hybrid method of Noise reduction, Genetic algorithm for segmentation, K-means clustering techniques, K Nearest Neighbour (KNN) for classification, Naïve Bayes Classifier, Support Vector Machine (SVM), Decision Tree classifier (DTC), Recurrent Neural Networks [9]

According to Shima Ramesh et al, modern methods such as machine learning and deep learning algorithm have been used to increase disease recognition rate. Random forests method is as a whole, learning method for classification, regression and other tasks that operate by constructing a forest of the decision trees during the training time. Unlike decision trees, Random forets overcome the disadvantage of over fitting of their training data set and it handles both numeric and categorical data.". "The

histogram of oriented gradients (HOG) is an element descriptor utilized as a part of PC vision and image processing for the sake of object detection. Here we are making utilization of three component descriptors:"

a) Hu moments
b) Haralick texture
c) Colour Histogram

It has following steps: Test image, HOG feature extraction, Load RF model, Classify HOG using mode, Display result [5]

According to author Lakshmi et al, the following steps are followed, you have an image processing step which is connected to an IOT sensing network. Both these steps are then combined together leading to data analysis and data comparison using software like MATLAB. Then the data is transferred to farmers or an automatic system which will implement the necessary actions. What the system requires is the physical hardware like camera, humidity sensors, temperature sensors and an algorithm to compare all the data. Image segmentation also needs to be. You need a setup so as to store data for future comparison.[1]

7) According to Snober Mushtaq et al, smart agriculture system needs the following parts

a) Data Collection Module consists of various set of sensors for humidity, temperature, pressure, intensity of light, pH value of soil, water level measurement and set of cameras places at regular intervals for capturing images and videos.
b) Gateway Module: This module acts as a connector for connecting various sensors and cameras by wireless communication.
c) Cloud Module: It is a data storage module here data is collected compared and analysed for decision making. After decision making the control information is send to end users (farmers) through web and mobile applications.
d) The proposed system works on the basis of user validation. When the user validates the system all the connected sensors and cameras are activated and the information is sent to cloud server for comparison with the previous results and decision making and the farmers are informed through web and mobile applications.

The process starts with Validation, Initialization of system, Sensors-temperature, moisture, water level, rain detector and cameras, Server, Data analysis, Comparison and decision making [2]

III. CONCLUSION

Agriculture is the main source of food. To improve the output, we need to control the diseases. This can be done by studying the leaf patterns, previous data on diseases, recording the present condition of leaves and comparing the data. This can be done manually but will require a lot of effort money and man power. Instead we can automate the system with the help of cameras and sensors, they can be used to collect data and this data can be compared with previously collected data with the help of an image processing algorithm. Then we can use another algorithm to directly taking action like spraying pesticide or communicating the data to the farmers directly. We can also improve the process by using temperature and moisture sensors.

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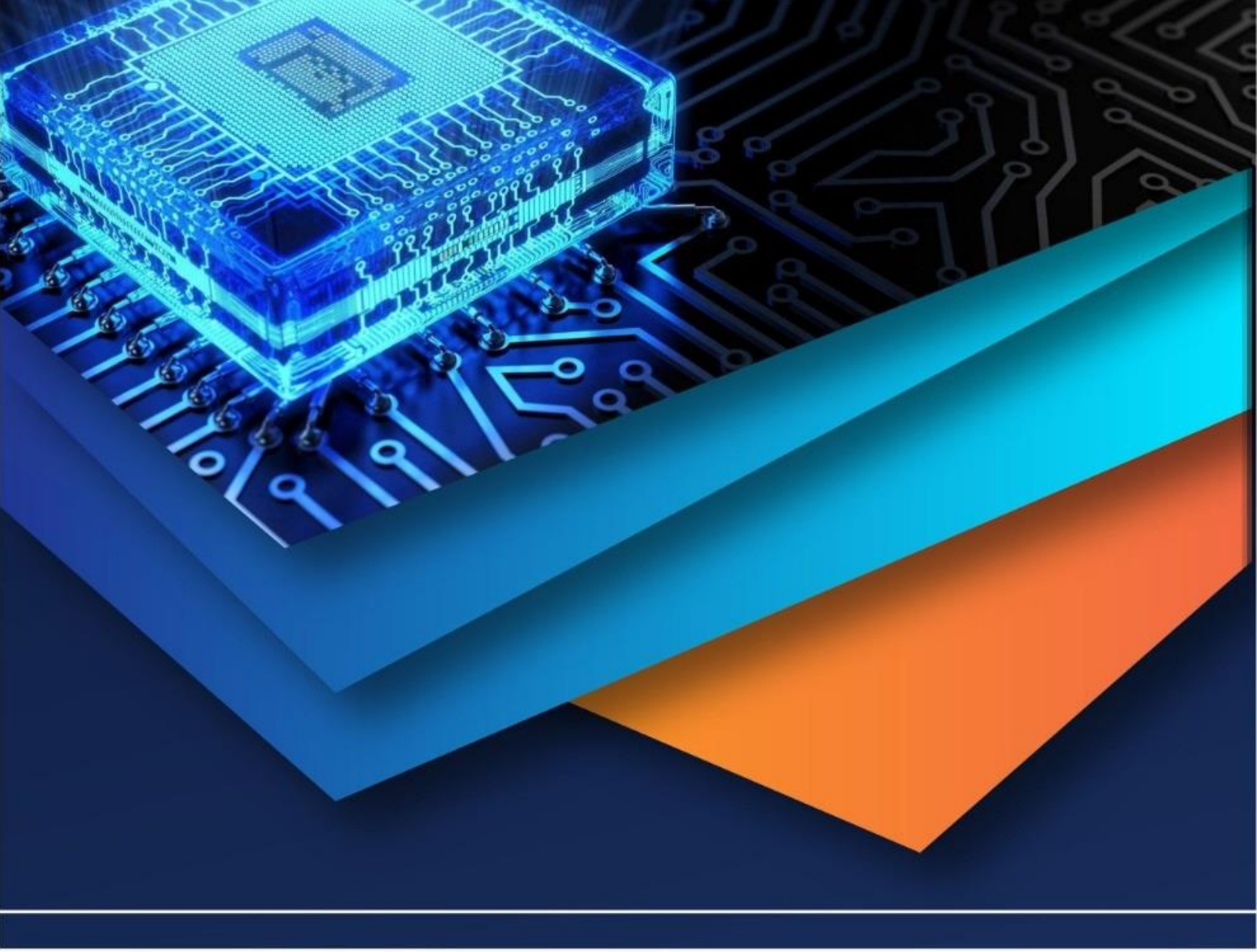

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