Detection Of Disease In Sugarcane Leaf Using IoT

Dr. Thangadurai. N[1], Dr. Vinay Kumar S.B[2], Dr. Gayathri K.M[3], Dr. R Dhanashekaran[4]

Abstract: Agriculture is one of the most important aspects of human civilization. The conventions of Internet of things (IOT) have meaningfully contributed in the space in last two eras. IOT is a technology, where actual lifetime physical objects (e.g. sensor nodes) can work collaboratively to create an information based and technology driven system to maximize the benefits (e.g. improved agricultural production) with minimized risks (e.g. environmental impact).Execution of IOT based arrangements, at each period of the region, could be a distinct advantage for entire rural scene, for example from planting to exporting and past. In this paper Fungi-caused diseases in sugarcane are the most dominating conditions which show up as spots on the leaves. In the event that it isn't treated on schedule, causes the extreme misfortune. Over the top utilization of pesticide for plant illnesses treatment builds the expense and ecological contamination so their utilization must be limited. This can be accomplished by focusing on the illnesses places, with the fitting amount and convergence of pesticide by assessing disease seriousness utilizing image handling procedure. Straightforward edge and Triangle thresholding strategies are utilized to portion the leaf zone and sore district region individually. Now a days there was more advance technology is used in agriculture field. In this paper automation robot is used to find disease in sugarcane leaf. At long last weaknesses are categories by computing the remainder of injury region and leaf territory. The precision of the analysis is seen as 98.60 %. Research demonstrates this technique to figure leaf sickness seriousness is quick and accurate.

Index Terms: Brown spot, Digital image, Disease severity, Image segmentation, Sugarcane leaf, Threshold.

1. INTRODUCTION

IoT is a mix of overall information, web related things or properties, and it is an integral component for the future of Internet. IoT centers on the mechanization of procedures by reducing human cooperation. During the time spent systematization, IoT gathers information utilizing sensors and procedures the information utilizing controllers and finishing the robotization forms by utilizing actuators [1-2]. IoT in horticulture and cultivating spotlight is on mechanizing every one of the parts of cultivating and agricultural strategies to make the procedure progressively proficient and feasible [3]. Usually they are not completely robotized and have numerous wasteful aspects, for example, higher human connection, work cost, control utilization, and water utilization [4]. The crucial idea of this review is to investigations the IoT sub-verticals, gathered information for estimations and utilized innovations to create applications [5]. It is fundamental to distinguish the most inquired about sub-verticals, information accumulations and advancements to make new IoT applications later on [6]. Fertilizer additionally assumes a significant job in the field of horticulture by expanding the efficiency of plants [7]. By utilizing IoT, farmers can oversee soil condition all the more viably and at less cost by observing them from any area [8]. The essential target of this examination is the means by which IoT and advances are utilized in saving water, compost and vitality in the farming business by consolidating new innovations [9]. This has benefits for the improvement of the economy of nations just as the abundance of the individuals [10]. With the mix of both trend setting innovations in equipment and programming, IoT can track and tally every applicable part of generation which can reduce the waste, misfortune and cost [11].

2. LITERATURE SURVEY

In this organization particle, we talk about important earlier research relating to two viewpoints. The first includes the utilization of IoT, while the subsequent viewpoint centers around agricultural information investigation dependent on IoT gadgets.

- *Dr. Thangadurai. N, Professor and Research Coordinator, Department of Electronics and Communication Engineering, School of Engineering and Technology, JAIN (Deemed-to-be University), Bangalore, Karnataka, India. PH-+91-8056975530. E-mail: mrgoldjain2015@gmail.com*
- *Dr. Vinay Kumar S., Assistant Professor, Department of Electronics and Communication Engineering, School of Engineering and Technology, JAIN (Deemed-to-be University), Bangalore, Karnataka, India.*
- *Dr. Gayathri K.M, Assistant Professor, Department of Electronics and Communication Engineering, Dayananda Sagar University, Bangalore, Karnataka, India.*
- *Dr. R Dhanashekaran, Professor and Research Coordinator, Department of Electronics and Communication Engineering, Saveetha School of Engineering, Tamilnadu, India.*

***Table 1**. Comparative study of different methods*

Sl. No.	Year/Author	Measures (Data collection)	Technologies is Used	Benefits of Proposed System	Challenges in Current Approach	Solution for Current Issues	Drivers of IoT	Application
1	Venkate et al (2017) [12]	Environment Temperature Humidity Soil moister	Raspberry pi	Can detect the temperature, humidity and moisture. Continuous monitoring all the places includes critical areas.	Human interaction Labor cost Excess of rainwater Crop from abnormal irrigation	Detect temperature, humidity, moisture using sensors. Maximize the yield of crop by monitoring agricultural parameters.	Can deploy it in any type of environment for, monitoring flexibility robust	Agriculture
2	Athiraz et al (2017) [13]	Soil monitor Temperature Water level	zig bee	Irrigation process is completely controlled by computer based systems. System analyses the weather reports.	Only works based on the commands from user	Low cost Efficient growth of crops Faster growth of plants	Predict and tackle drought situations to prevent to loss of crops. Keep monitoring climate condition	Agriculture
3	Zhao et al (2017) [14]	Water level	Lora technology	Can utilize the water usage	To identify the appropriate time and in the right amount of water. High power consumption. High cost. Low coverage of Zig Bee and Wi-Fi.	Minimize the cost of deployment and maintenance. More efficient. Cover wider area than Zig Bee and Wi-Fi. Energy consumption is low.	Users can remotely access irrigation system and check the status.	Agriculture
4	Sager S et al (2017) [15]	Water level Soil moisture	Mobile technology	Faster growth of the crop	Save water for the future. Save electricity for the future.	Flood avoidance. Power cutoff is being reduced.	Higher the revenue by faster the growth of crops. Ensure the durability of the soil.	Agriculture
5	Saraf et al (2017) [16]	Water management	Wireless sensor network. ZigBee. Mobile technology	Efficiently managed the irrigation water system.	High water consumption. Human interaction.	The water consumption is reduced. Lessen the human interaction.	Reduced water consumption.	Agriculture

3. PROPOSED METHODOLOGY

The proposed framework manages the way toward monitoring and updating information of system used for environmental parameters with the idea of IOT and Cloud Server Technology. The working model of The Design and Implementation system has designed with six blocks such as Raspberry Pi, camera, soil moisture, level sensor, humidity sensor; web-pages contains the accompanying units and sensors. The proposed block diagram is shown below figure 1.

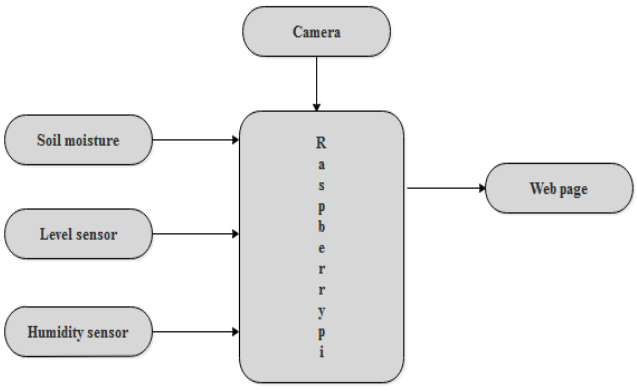

***Fig.1**.Block Diagram of Proposed System.*

The proposed framework clarifies agriculture with IOT. This planned framework includes for the rural reason, here different sensor is used to screen particularly, under the present conditions. A humidity sensor (or hygrometer) recognizes measures and reports both clamminess and air temperature. The extent of wetness perceptible all around to the most raised proportion of suddenness' at a particular air temperature is called relative wetness. Soil dampness sensors measure the volumetric water contented in soil. A level sensor is a tool for deciding the level or measure of liquids, fluids or various elements that stream in an exposed or closed framework.Camera is utilized to catch the leaf. We can retrieve the infromation throughwebpage.The significant curiosity of the proposed framework is leave diseases identification. The block diagram of the leave disease detection is shown below Fig.2.

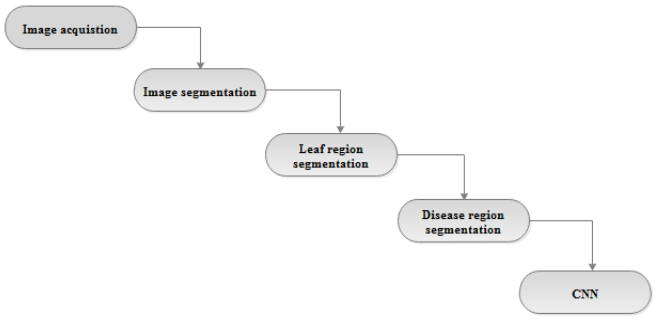

***Fig.**2. Flow of Proposed Leaf Disease Detection System.*

A. Image Acquisition

Sugarcane dark colored spot sick leaves are taken for this investigation. Images are taken in controlled condition and are

put away in the JPEG design. Contaminated leaf is set level on a white foundation; Lightsources are put at 45 degree on each side of the leaf in order to dispose of any reflection and to get evenlight all over, in this manner a better view and brightness. The leaf is zoomed on in order to guarantee that the image taken contains just the leaf and white foundation.

B. Image Segmentation

Imagesegmentation is the significant advance to isolate the various districts with unique immensity in the representation, these locales don't cross one another and every area should meet consistency conditions in explicit areas [14-15]. In this examination two distinctive division strategies are executed to get all out leaf pixels and raw zone leaf pixels.

C. Leaf region Segmentation

Input image is first changed over into grayscale picture. Since picture is taken in controlled condition set sick leaf on the white foundation, it has huge effect in dark estimations of two groups,object and base. After picture division, the paired picture containing leaf locale is acquired byregion filling and wiping out openings in the white area. To include the pixels in complete leaf , filter the picture start to finish and from left to right, the quantity of pixels in the district is PI=140940.

D. Disease region segmentation

For achievement of trial it is important to section the condition location indeed. Division might not be right a result of shallower midrib shading than leaf shading and blurring of leaf shading at beginning periods of ailment. Likewise in various phases of the ailment affected by light, water, neutrino the sore show different indications, which carry challenges to the division. In light of the above parts, the image changed from RGB concealing space to HSI concealing space, which is progressively sensible for visual qualities of people. Since the brilliance part is autonomous of the shading segment and the vision of the individual is increasingly delicate to Hue contrasted with Saturation, the shading segment can be a great idea to take out glare, shadow and other light factors during shading picture division. The comparable dim estimation of the shallow shade of the midrib and the leaf in shading segment can diminish the obstruction of the midrib in the subsequent sore picture division to a huge degree. On the off chance that the injury attributes are fluctuated the limits between the sore and the sound part are additionally differs so there is frail edge. Thus triangle thresholding strategy is utilized here for choice of thresholding estimation of grayimage.Fig.3 shows info shading picture. Fig4. Shows dark picture ie., Histogram comparing to dark picture. To choose the thresholding esteem, triangle is developed by drawing a line between the limit of the histogram at brilliance b_{max} and the least worth bmin in the picture. The distance 'between the line and the histogram h[b] is processed for all estimations of 'b' from b=bmin to bmax. The brilliance esteem 'bo' where the separation between h [bo] and the line is greatest is the edge an incentive as appeared infig.3 and fig.4.

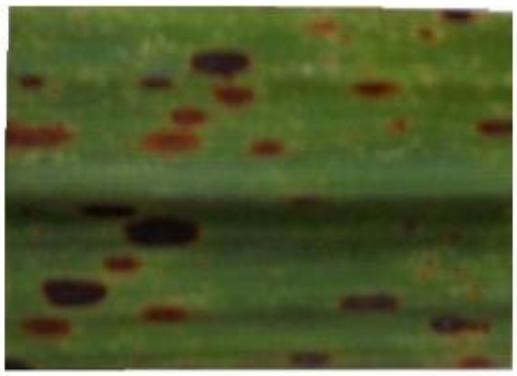

Fig.3*. Brown spot disease in sugarcane leaf*

E. Convolution Neural networks

CNN is the deep learning architecture and it's widely used in many computer vision applications such as image classification, sense labelling and etc. Conceptual structure of an image and hierarchy is recognized. The image is divided into many tiles of fixed structure and is fed into small neural network. Each and every extracted feature is represented in the form of feature map, which is formed by the set of arrays. From the spectrogram converted, scale it to 32 x 32 images. The converted input image is given to the CNN layers. In this work CNN consist of three convolution layers and three Max-polling layers [17].

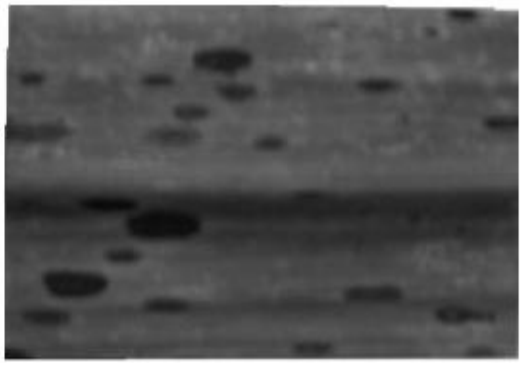

Fig.4*.Gray scale image*

4. RESULTS AND DISCUSSION

The suggested system is experimented in two different ways such as simulation and hardware. The simulation has been done with the help of python with 3.0 GHZ Intel i3 processor, 1TB hard disc and 8 GB RAM. The hardware testing has been done with the help of various sensor for determining the effectiveness of the proposed system, the performance of the proposed system is compared with the existing systems.

A. Hardware implementation and analysis

In hardware implementation and analysis there are various types of sensor is implemented. It is more efficient now a days. In future smart robot system can be implemented in various fields. Hardware implementation gives more effective results. The proposed implementation is shown Fig.5

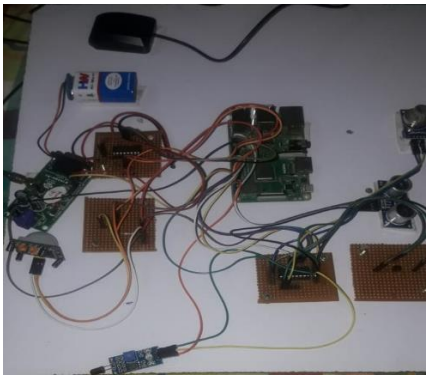

Fig.5*.Proposed Module*

B. Simulation Analysis

Simulation analysis the proposed system majorly used to find the disease identification in sugarcane leaf. The major advantage is used to evaluate the performance. The efficiency and performance metric are defined below. Proposed system is evaluated successfully.

C. Performance Metric

The performance of the proposed method is evaluated with the help of acquiring the following results

Recall

Recall is the number of True Positives (tp) divided by the number of (tp) and the number of False Negatives (fn) Recall mathematical equations show as (1):

$$R = \frac{tp}{tp + fn} \quad (1)$$

Precision

Precision is the number of tp divided by the number of (tp) and False Positives. It is also called the Positive Predictive (PP) Value. Precision mathematical equations show as (2):

$$Precision = \frac{tp + tn}{tp + tn + fp + fn} \quad (2)$$

Sensitivity

Sensitivity is a basic property of image processing the. Sensitivity is also called as tp rate. Mathematically, Sensitivity mathematical equations show as (3):

$$Sensitivity = \frac{tp}{tp + fn} \quad (3)$$

Specificity

The specificity provides, how likely the test is to come back negative characteristic. Specificity also called the true negative rate, Mathematically, Specificity mathematical equations show as (4):

$$Specificity = \frac{tn}{tn + fp} \quad (4)$$

Accuracy

By using the Specificity and Sensitivity the Accuracy of the image is calculated. Accurately represent the quantity of the image. Mathematically, mathematical equations show as equation (5):

$$\text{Accuracy} = \frac{tp + tn}{tp + fp + tn + fn} \quad (5)$$

D. SegmentationQuantitative and comparative analysis on disease in sugarcane leaf

In this section, proposed system assessed to evaluate the performance and identification of disease in sugarcane leaves. The comparative analysis are defined in the table.2.

Table.2*. Comparative analysis*

Category	Severity
0	Apparently infected
1	0 – 25% leaf Area infected
2	26 – 50% leaf Area infected
3	51 – 75% leaf Area infected
4	>75% leaf Area infected

The exactness of the calculation is tried by evaluating the rate standard realized region secured by standard realized zone shapes like Triangle, Circle, Square, and Rectangle drawn by utilizing an instrument, for example, painted. Estimated standards are linked with definite area covered to calculate Percentage Deviation (D) and Percentage Accuracy (A). The Determining the Accuracy of the Algorithm are defined in the table.3.

Where,

D= (SM – EM) × 100 / SM (1) (6)

A= 100 – D (2) (7)

Where SM- Standard Measurement, EM- Experimental Measurement

Table.3*. Quantitative Results*

Shape	Stand Measure (SM)	Expt Measure (EM)	Deviation (D)	Accuracy (A)
Triangle	2.49	2.45	1.61	98
Rectangle	0.90	0.90	0.00	100
Square	1.98	1.99	1.00	99
Circle	6.81	6.60	3.10	97
group of All	12.19	12.42	1.87	99

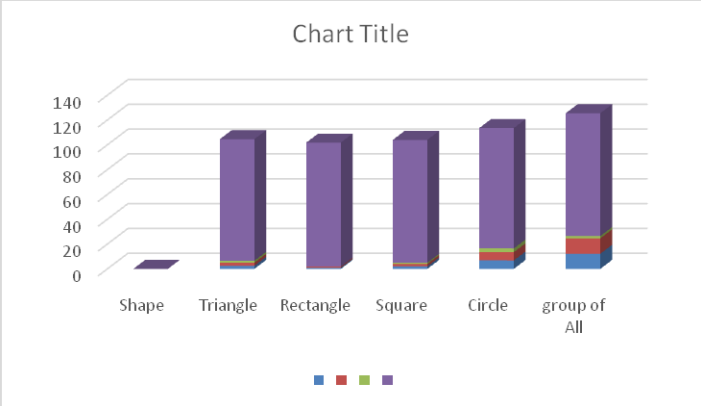

Fig.6*. Determining the Accuracy of the Algorithm.*

E. Comparative analysis

In this law features [18] this decrease was not practiced on the leaf backs where the lighter pigmentation plainly revealed the malady staining Albeit, high correctness's were accomplished when utilizing an unreduced dataset comprising of all HSI

surface highlights, the general best entertainer was resolved to be a decreased information model that depended on shade and immersion highlights. This model was chosen because of decreased computational burden and the disposal of force highlights, which are not powerful within the sight of surrounding light selection. In SVM feature [19]it order to examine the influence of attractive forces on the dynamic system in more detail a bias voltage was applied between the SFM tip and the sample, which consisted of a chromium layer on a glass substrate Inpydipai et al,[20]Typical and unhealthy citrus leaf tests with oily spot, melons, and scab were assessed. The leaf test discriminant investigation utilizing CCM textural highlights accomplished arrangement correctness's of over 95% for all classes when utilizing tendency and immersion surface features.In Vinay Kumar et al [21] these proposed features give promising results and has been compared with existing feature extraction methods. The developed model was able to distinguish healthy and diseases leaf. Based on the graphical analysis, RF performs better than other machine learning models with 98.4% accuracy. In this proposed system survey will fill the gap by the identification of the different IoT sub-verticals and data collections for the measurements in the agriculture and farming process. Results are clearly showing that most considered sub-verticals and data collections for measurements in the field of agriculture and farming gives 99% of accuracy. Determining the Accuracy is defined in the table 4.

Table 4. *Determine the Accuracy*

System	Accuracy
Law features[18]	96%
SFM Features [19]	91.9%
Pydipati et al. [20]	94.6%
Vinay Kumar et al.[21]	98.4%
Proposed method	99%

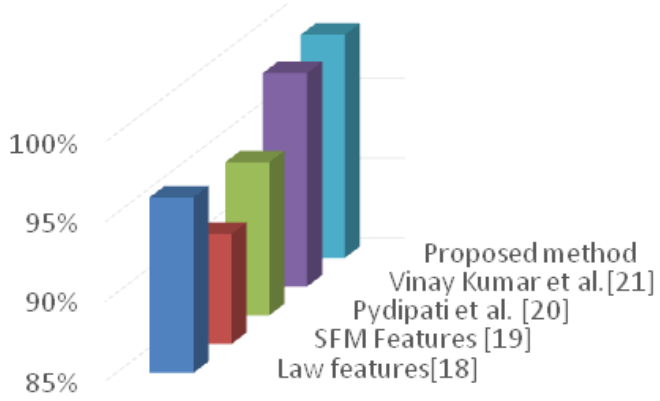

Fig.7*.Accuracy analysis*

Simulation analysis are taken from various paper. To evaluate the accuracy performance law features [18] gives the accuracy 96% compared to proposed system this law features [18] 4% is less then SFM features gives the accuracy 91.9% compared to proposed system this SFM feature [19] 8.1% is less. Pydipati et.al [20] gives the accuracy 94.6%compared to propose system this pydipati et al [20] 5% is less. Vinay kumar et al [21] gives the 98.4%. Compared to propose system is 1.1% is less and system gives 99% of accuracy.

5. CONCLUSIONS AND FUTURE SCOPE

Disease symptoms of the plant vary significantly under the different stages of the disease so to the accuracy with which the severity of the disease measured is depends upon segmentation of the image. Basic limit division is utilized to ascertain the leaf zone however this strategy isn't reasonable to compute the region of the injury area due to differing attributes of the offended district. Triangle technique for the thresholding utilized here to portion the raw place. The normal precision of the test is 99. %. In this manner representation preparing innovation to quantify plant infection seriousness is helpful and exact. This wipes out subjectivity of conventional techniques and human instigated mistakes. It will serves to ranchers to choose the particular amount for pesticide application which decreases the expense and natural contamination. This survey could be useful for researchers for finding new ways and solution to challenge in the current agricultural era and for agricultural and farming industries to make the automation process more effective and efficient, consequently, to obtain the goodresults.

Future Scope

Concentrate on to stretch out proposed work to order every disorder class exclusively and gauge the seriousness of the distinguished illnesses. An unfamiliar amalgamation of highlight extraction, include choice and learning strategies can likewise be investigated to upgrade the viability of sicknesses identification and arrangement models.

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