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RESEARCH PAPER ON Foliage Health Monitoring System

[1]Kaustubh Mane, [2]Ketan Kharat,[3]Pranav Gunjal,[4]Mr.Sagar Jagtap

[1]Student, [2]Student, [3]Student, [4] Professor Instrumentation and Control Department,
AISSMS Institute of Information Technology, Pune, India

Abstract : Agriculture is an important part of our livelihoods, and by observing and recognizing the what amount of effort and time farmers giving in farming, we've engineered a system or solution which will help the farmers by observing the field activity on the farm . The farming is widely done in India, so to help the farmers developing an automation system is necessary which will helps farmers to reduce their efforts and it will also saves the time of farmers. The system which we have developed is an agriculture robot which will help the farmers to detect an accurate plant leaf diseases of crops. This system automatically identifies the crop diseases, and sends the data and output to the user to the mobile device without manual intervention With the help of Deep learning, Agriculture Robot represents a significant leap forward in enhancing productivity and efficiency in the agriculture sector.

Keywords : **Agriculture , Farmers, Deep learning, automation, disease detection.**

I. INTRODUCTION

Agriculture plays a pivotal role in the economy of nations like India, where farmers are the cornerstone of food production. With a population heavily reliant on agriculture, the sector significantly impacts both national income and employment. As the population grows and the demand for food increases, it becomes crucial to perform agricultural activities efficiently. In response to challenges like labor shortages and thenecessity to feed a growing global population, farmers are increasingly turning to agricultural robots. Despite advancements in other industries, India's agricultural sector has not progressed at the same pace, highlighting the pressing need for innovative solutions like agricultural robotics.

Creating a system that can automate agriculturaltasks proves to be a valuable asset for farmers, lightening their workload and making fieldwork more manageable. In the situation of sorghum, Tomato, Appleleaf disease detection. convolutional neural networks have been employed to develop a model aimed at providing farmers with an accessible tool for early disease detection using standard digital cameras. The advantage of using CNNs lies in their ability to automatethe process of learning relevant features from raw input data systematically, which is crucial for accurately recognizing diseases.

Image processing plays a vital role in transforming visual information into a digital format, facilitating its analysis and manipulation across variousdomains. This technology is rapidly evolving and finding applications in diverse fields. Machine learning, on the other hand, emerges as a powerful solution. Within computer science, machine learning finds extensive use in areas like image analysis, data mining,and robotics. A contemporary approach within machinelearning is machine vision, which integrates computer vision techniques with machine learning algorithms to interpret images, extract relevant data, and enable informed decision-making based on image analysis.

II.LITERATURE REVIEW

Anand.H.Kulkarni, Ashwin Patil R. K.[1] has a proposes a methodology for detecting plant diseases. By using image processing techniques and by using artificial neural network algorithm (ANN). So they develop a system which detect plant diseases. The first step istake a images using camera then use the feature extraction and apply ANN algorithm to classify thehealth and infected plants accurately. At the end theresult state that the ANN algorithm accuracy is of 91 percent.[1]

Pranjali B.Padol, Anjali A. Yadav.[2]hasdiscussed in 2016 Conference on Advances in Signal Processing about Grape. In this paper they discussed about the system which detect the diseases of grape. They have used the SVM algorithm technique which is used for the classification . They have also used the technique such as K means clustering and Feature extraction. By using the K means Clustering they detect the diseased area . Then feature extraction of color andtexture is done. And at the end by using the classification technique they get to know the leaf is health or diseased , if it is diseased this techniquealso detect that what type of disease it is. The accuracy of this system is 88 percent. [2]

Gyan Singh Sujawat[3] has proposed in this paper India's population is expected to increases and because of that the Demand for agricultural products will increase also. Additionally, the lack of awareness of the spread of diseases in crops is lowering crop yields. So in this paper he has proposed that or suggested that to focus on the agriculture part because food is the important part of the humans. In the agriculture the farmers are facing various problem which are leaf diseases and many other problems so to face or reduce this problems the humans should use the artificial intelligence system such as a robots and IOT basedsystem also.By using the AI system it will make thejob of farmers easy this is what he has suggested inthis paper. Because of variety of plants, crops and there diseases the database in the AI systems will behelp farmers accurately[3]

R.Radha,S.Jeyalakshm [4] has proposes AnEffective Algorithm for Edge and Vein Detection inLeaf Images. In this paper they have discussedabout a system which is used to find out the edge and Vein of the leaf images. This system is developed by using the canny edge detection method. This algorithm gives accurate result ofedge and vein detection of the leaf.[4]

S. Poornam et al[5] has discussed Deep learning is being used to improve the process of identifying and categorising diseases.. The Caffenetdeep learning framework is used to train the network. ReLu is used to train CNN. Transfer learning was employed in CNN's pretrained model. Through the convolution and pooling layers, CNN's convolution base creates features from images. Based onthe features that were retrieved from the convolution base, CNN's classifier component assigns a classificationto the image. The CNN will be used to collect subsequentoutput, identify diseases, and determine the kind of diseases. Based on the requirements we had, the CNN pretrained model adds the new classifier. The training step of the pretrained model will use 80% of the dataset.The test phase will employ the remaining 20% of the dataset. [5]

Vijay Kumar et al[6] he has discussed about the robotic system or robot which can be used to look for thediseases of the leaf and to check the condition of the soilby traveling or moving in the field of crops and it will continuously send the SMS to the farmer so the farmer can take a accurate action. [6]

NAGARJUN GOWDA et al[7] The Spy robots are remotely controlled, camera-equipped vehicles. Withthe use of LabVIEW and the PC's Parallel port, the Wireless Robot Car is a straightforward 2-Wheel robot that can be operated. RF-module operating at 433 MHz used to establish wireless connection. The purpose of a spy robot is to look for intriguing things from locations that are inaccessible to humans. Through the wheel encoder, it can travel to a certain place and then return to its home. It is a little robot designed for surveillance, observation, and evaluation tasks.[7]

Chen Long et al[8] has created a real-time operation data monitoring system for vehicles based inLab View. This system can record data from sensors and transmit it through the CAN bus of vehicles. This system can useful to users by gathering a data and processing it with the help of software interface and straightforward hardware. [8]

III. Objective

[1]Develop a Robust Monitoring System:-

Developing and deploying a robust monitoring system entails integrating cutting-edge technologies such as advanced sensors and data collection devices. The primary objective is to create a system that not only gathers data effectively but also maintains high levels ofreliability and resilience in diverse environmental conditions.

[2]Enable Early Detection of Diseases:-

Utilize sophisticated algorithms and machine learning models to process sensor data in real-time effectively The primary objective is to develop algorithms capable of detecting subtle indicators of leaf diseases during their initial stages, enabling prompt intervention measures.

[3]Integrate IoT and Sensor Technologies:-

The objective is to incorporate IOT devices like wireless sensors and actuators into the system to enable smooth communication channels and efficient data exchange. Utilize state-of-the-art sensor technologies such as spectral imaging or hyperspectral imaging to ensure precise and comprehensive data collection.

[4]Implement Data Analytics for Decision Support:-

The objective is to design and deploy robust data analytics methodologies to effectively process and analyze the acquired data. This encompasses the utilization of machine learning models tailored for disease prediction, the integration of decision support algorithms to derive actionable insights, andthe incorporation of visualization tools for simplified data interpretation.

[5]Develop a User-Friendly Interface:-

The objective is to design a user-friendly and intuitive interface that is easily accessible to both farmers and stakeholders. The interface should present monitoring data in a clear and understandable format, enabling users to make informed decisions regarding disease management strategies. By focusing on usability and clarity, the interface will empower users to interpret data effectively, leading to more proactive and efficient agricultural practices.

[6]Evaluate Economic and Environmental Impact:-

The objective is to evaluate the economic ramifications of deploying the monitoring system, taking into account factors such as decreased pesticide usage, enhanced resource allocation, and potential boosts in crop productivity.

Furthermore, conduct an assessment of the system's environmental impact, with a focus on fostering sustainability and adopting eco-friendly practices within the agricultural domain.

IV. Methodology

First, the system acquires digital images of plant leaves using cameras or sensors. These images are then preprocessed to enhance their quality and prepare them for analysis. Preprocessing may include tasks like noise reduction, image enhancement, and color correction. Next, the preprocessed images are analyzed using various image processing techniques. One common technique is feature extraction, where relevant features such as texture, color are extracted from the images. These features help in distinguishing healthy leaves from diseased ones. After feature extraction, machine learning algorithms are employed to train models using labeled data. The labeled data consists of images with known health conditions (healthy or diseased). The machine learning models learn patterns and relationships from the extracted features to classify new images as healthy or diseased.

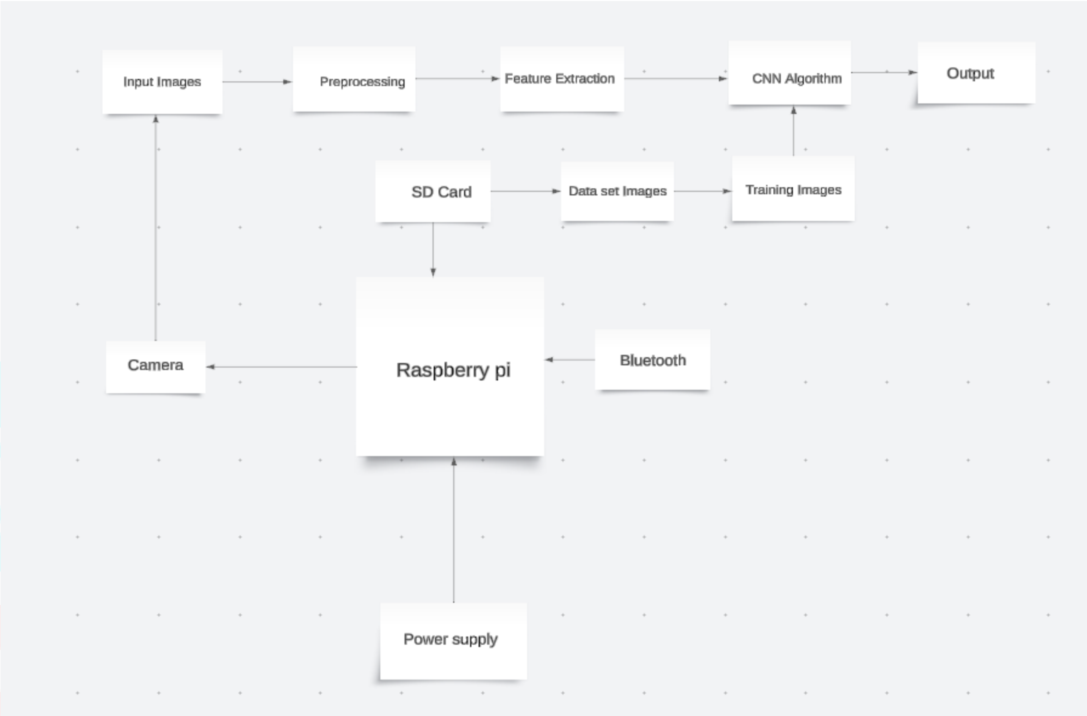

Fig 1. Block Diagram

[1] Raspberry Pi :-

In this system we have used Raspberry pi model 3b+. We have use it as a brain of an image processing system that analyzes images of plant leaves to identify diseases or anomalies. This system typically involve connecting a camera to the Raspberry Pi for capturing images. The Raspberry Pi's computational capabilities allow it to run machine learning algorithms, such as convolutional neural networks (CNNs), which are used for image recognition tasks. Researchers and developers can train these models using datasets containing images of healthy and diseased leaves, enabling the system to learn and distinguish between different leaf conditions.

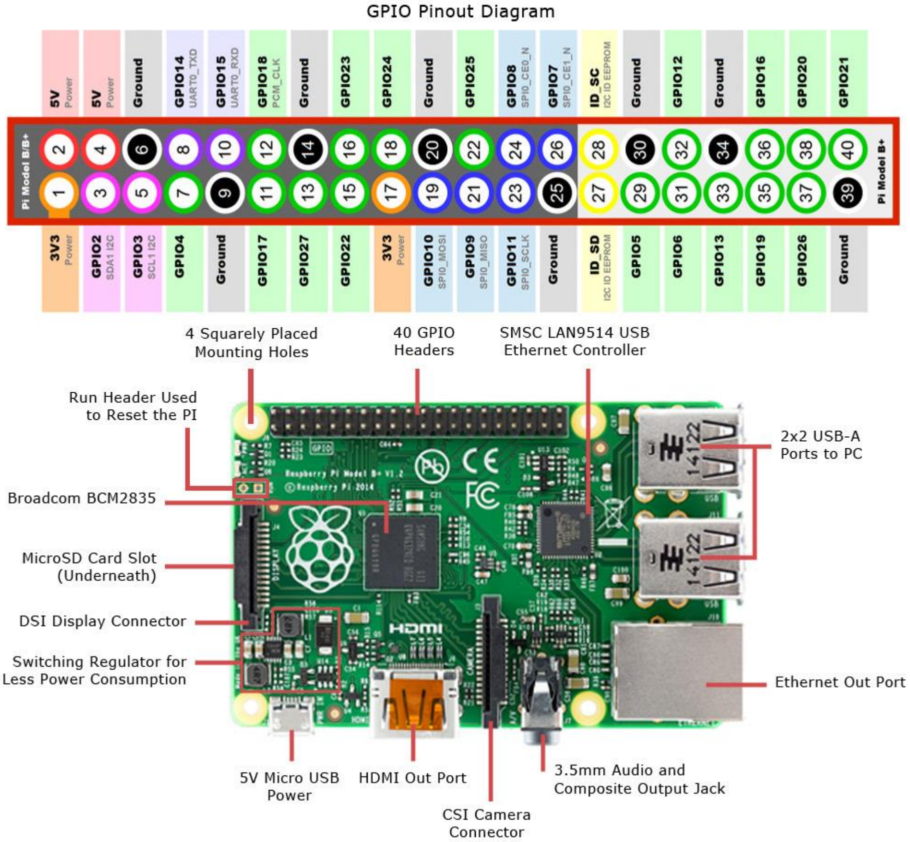

Fig 2.GPIO pinout diagram of Raspberry Pi

[2] Camera :-

A camera is used to capture the real time leaf images of a plant. And those images will be taken as an input for compare with data set images.

[3] Pre-processing of image :-

Before we input our data into the algorithm, we perform a series of adjustments known as pre-processing. This step is crucial in converting raw data into a refined dataset suitable for analysis. Various techniques fall under pre- processing, including point processing methods like power law transformations, histogram equalization, global thresholding, contrast stretching, and log transformations. These methodsfocus on enhancing individual data points to improve overall data quality. pre-processing plays a vital role in preparing data for accurate and meaningful analysis by the algorithm.

[4] Feature Extraction :-

Feature Extraction involves identifying and extracting relevant characteristics or features from images of plant leaves. These features could include shape descriptors, texture patterns, color, histograms, or other measurable attributes that help distinguish between healthy and diseased leaves. Feature extraction is a critical step because it reduces the complexity of the data.

[5] Convolutional Neural Network :-

A deep neural network is like a super smart tool for sorting through arrays of information. It's especially great for tasks like figuring out what's in pictures or making sense of written words. For images, these networks can spot patterns directly without needing special prep work. They work in a straight line from input to output, and they're made up of lots of layers—up to 20 or 30! Inside these layers, there are special ones called convolution layers that are fantastic at recognizing complex shapes, a bit like how our brains see things. These networks are handy in computer vision and text sorting because they're built to understand intricate details.

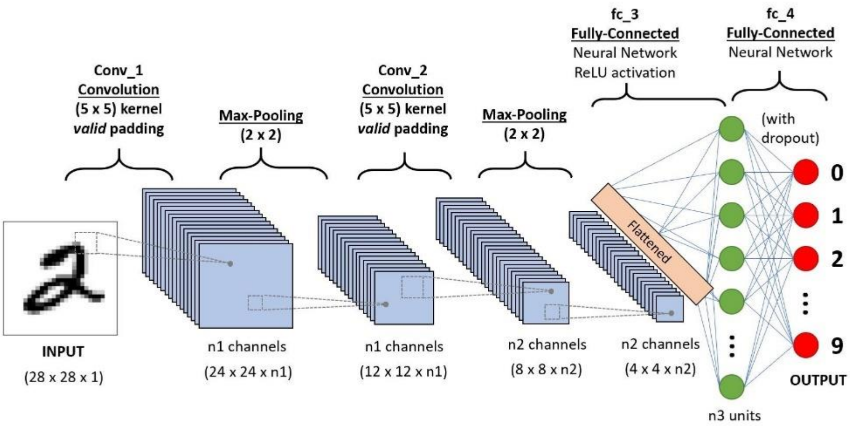

Fig3. Convolution Neural Network

[6] Convolutional Layer:-

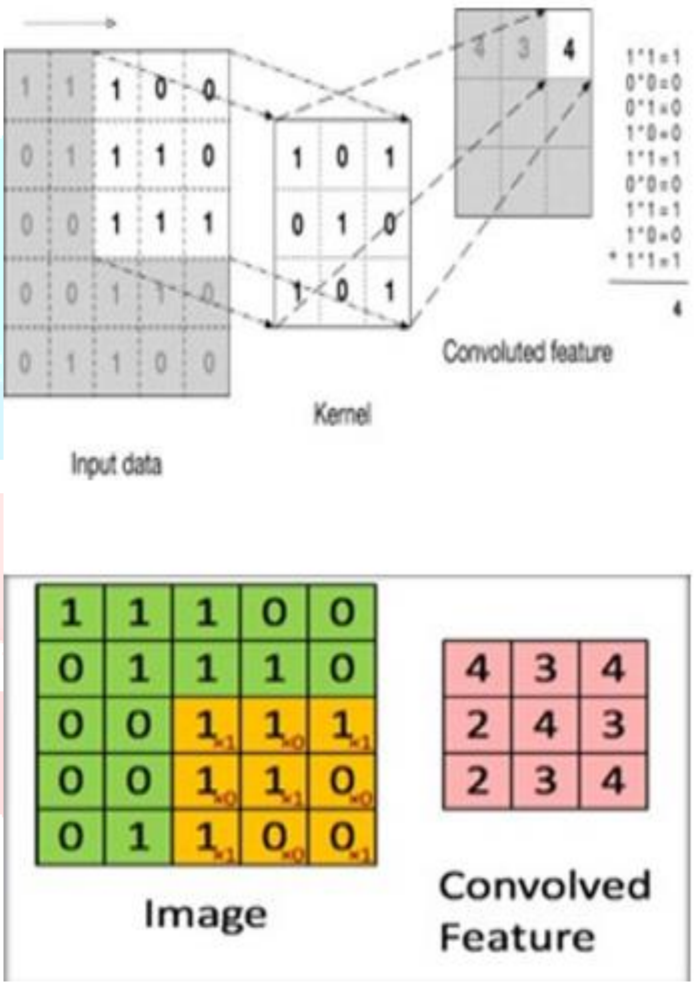

Fig4. Convolution Layer

The input image's grid of pixels goes through a process where it's matched up with a smaller grid called a kernel. This matching, called convolution, helps pick out important details. Each time this happens, the resulting features get smaller, but we keep doing it until we've got the most crucial info. Convolution can create lots of data, which can be tricky to handle. To manage this, we use pooling, which sort of condenses the data. We also use padding to add extra pixels around edges of a image grid. This helps maintain its size during convolution. After convolution, we do two types of operations on these features to make them really useful and those features are Valid padding , Same padding.

[7] Pooling Layer:-

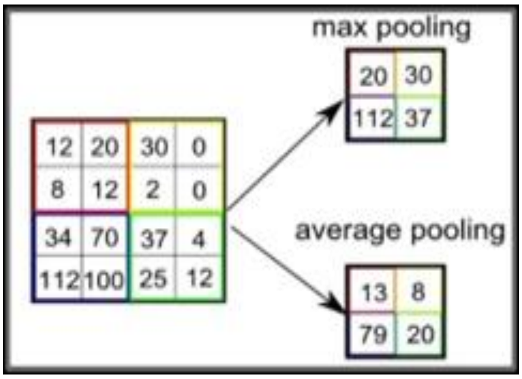

Fig5. Pooling Layer

In the convolutional neural network Pooling layers down samples the feature maps and reduce the complexity of the operation..

[8] Fully Connected Layer:-

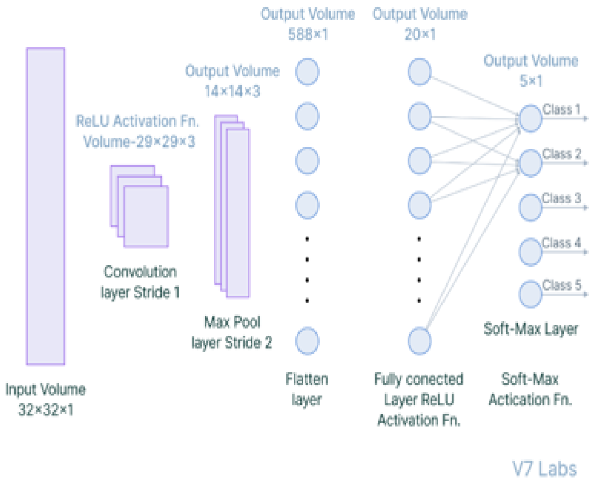

Fig6. Fully connected Layer

The Fully connected layers combine extracted features to make final prediction . This is how each layer of this algorithm work for image processing and provide and accurate result to the user.

[9] Detection and classification of image :-

Decision trees are a powerful tool in machine learning for predictive modelling. They work by iteratively splitting a dataset into smaller subsets based on certain criteria, creating a tree- like structure in the process. Each split, representedby a decision node, aims to maximize the homogeneity of the resulting subsets regarding the target variable, whether for classification or regression tasks. As the tree grows, then it forms branches (decision paths) leading to leaf nodes, which represent the final prediction or outcomes. This structure allows decision trees to efficiently organize data and make interpretable prediction.

V. Working

We have taken the dataset of healthy and infected leaf as a training data set in a sd card which is connected to our raspberry pi 3b+ . We have connectedcamera to the Raspberry pi model 3b+ which is used forcapturing a real time images of leaf which we are takenas an input images. After capturing of an image of leaf we apply the CNN algorithm to that image by comparing it with our data set which we have taken. Andby performing this algorithm we get an output as leaf isinfected with a particular disease such as leaf blight , Zonate leaf spot , sooty strip etc. and it also suggest pesticides which farmer will spray on the plant leaf. Here is the detailed explanation .

Grayscale of an input images:- In grayscale images, pixels represent different shades of gray, ranging from black to white. Each pixel value corresponds to the intensity of light at that point in the image, capturing variations in brightness without color information. Black pixels have the lowest intensity and appear darker, while white pixels have the highest intensity andappear brighter. Grayscale images are essentially monochromatic, allowing for a simpler representation of visual data compared to colored images. The range of shades between black and white enables the depiction of subtle details and contrasts, making grayscale images valuable in various applications such as medical imaging, digital art, and photography.

Edge Detection of an images:-

Edge detection includes the canny edge detector is used for edge detection to detect various types of edge detection.

Thresholding:-

In the thresholding. Thresholding is used to change a binary image from a grayscale image. In this system It is used to change binary image of leaf from a grayscale image.

Noise Reduction :-

It is used to remove or reduce the noise from the image. In this system it will remove the noise from leaf image.

At the end by applying the Alex-net algorithm which isconsist of three linked layer and five convolution layer so in this stage the extracted co-occurrence features from the leaf images undergo comparison with predefined feature values stored in the feature dataset. Using a classifier, the system assesses whether the features extracted from a leaf image align with those associated with healthy or diseased leaves. Based on thisanalysis, the classifier determines the health status of theleaf, providing valuable insights into whether it is infected with a disease or not and it will also suggest the pesticides.

VI. Result

The proposed system achieved promising results inleaf disease detection during experimental evaluations. Using a dataset containing images of multiple leaf diseases, including powdery mildew,rust, and blight, our system achieved an accuracy of over 90% in classifying diseased leaves correctly. The combination of feature extraction techniques and machine learning models proved effective in distinguishing between healthy anddiseased leaves, demonstrating the system's potential for practical implementation in agriculture.

[1] Model Accuracy:-

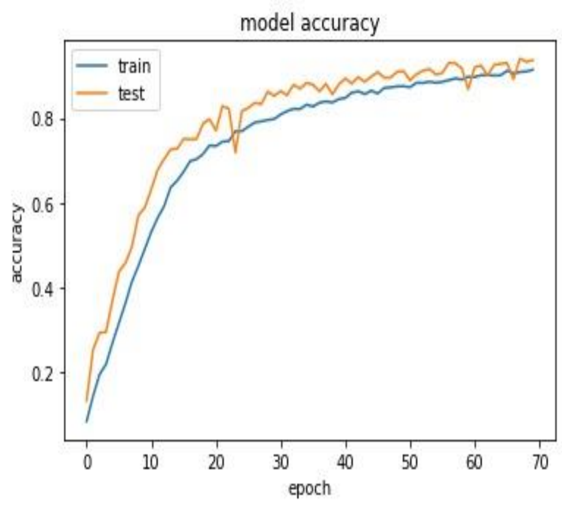

Fig7. Model accuracy

[2]Model Loss:-

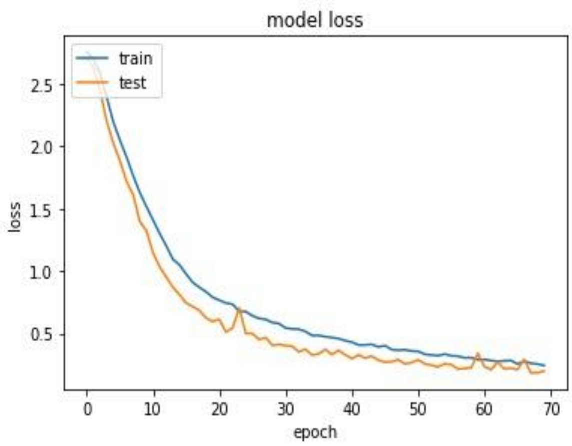

Fig8. Model Loss

Leaf Disease Detection Result:-

Fig9. Image Capturing

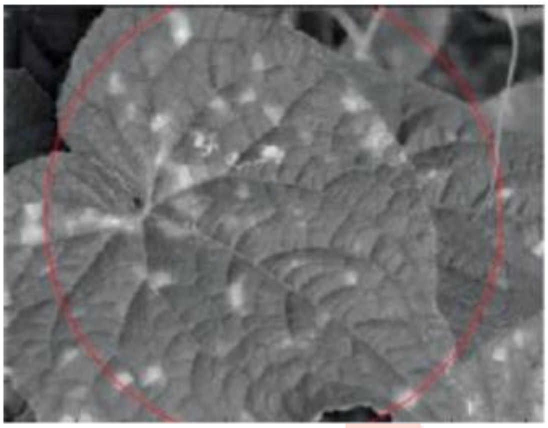

Fig10. Initial zero level set

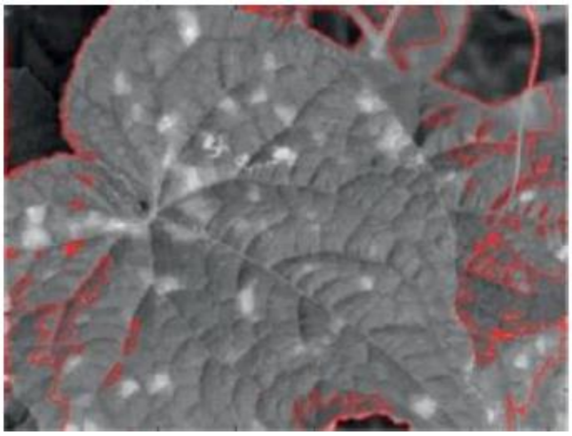

Fig.11 Contour image after 500 iterations

Fig.12 Segmentations Results

VII. Conclusion

In conclusion, this project demonstrates the significant potential of combining image processing and machine learning to enhance agricultural practices. By enabling early and accurate identification of plant diseases, this technology can significantly improve crop health and yield. Despite the challenges such as initial setup costs and the need for technical expertise, the benefits, including cost savings, scalability, and real-time monitoring, make it a valuable tool for modern agriculture.

VII. Reference

[1] Dilip et.al Speech Based Biomedical Devices Monitoring Using LabVIEW Publication IEEE :- DOI10.1109/CITSM52892.2021.9588853

[2]Gaurav Soni Implementation of LM35Interfacing of Temperature Sensor withArduino using LabVIEW 2015 Publication:- IEEEDOI: 10.1109/DELCON54057.2022.9753030

[3] Kunja Swain, Murthy Cherukuri, Sunil Kumar Mishra, Bhargav Appasani LI- Care: A LabVIEW and IoT Based eHealth Monitoring System publication:MDPI

[4]THAMER ALQUTHAMI,MUHAMMAD ZULFIQAR,MUHAMMAD KAMRAN,AHMAD H.MILYANI,AND MUHAMMAD BABAR RASHEED APerformance Comparison of MachineLearning Algorithms for Load Forecastingin Smart Grid Publication: IEEE Access

[5] Leo Wang, Haiying Shen, Kyle Enfield, Karen Rheuban COVID-19 Infection Detection Using Machine Learning Publication: IEEE DOI:10.1109/BigData52589.2021.9671700

[6] NAGARJUN GOWDA, Dr RAVIKUMAR A V, SHREENIDHI H SImplementing of RF Controlled .

[7]Chen Long, Li Zhuo LabView-based CAN bus data acquisition and monitoring system for automobiles Publication: IEEE DOI:10.1109/ICETCI55101.2022.9832200

[8] Jinwei Lin Design of High Speed RelationalDatabase Based on Labview TDMS Format Publication: IEEE DOI:10.1109/ICSP54964.2022.9778835

[9]Ionel Pavel; Marius Brânzilă; Constantin Sărmășanu; Costel Donose LabVIEW Based Control and Monitoring of a Remote Test-Bench Experiment for Teaching Laboratories Publication: IEEE DOI:10.1109/SIELMEN53755.2021.9600348

[10] Punitha Nicholine J; Preethi D M D Artificial Intelligence and Machine Learning Techniquesfor COVID-19 Prediction Publication: IEEE DOI:10.1109/ICACTA54488.2022.9753434

[11]Youyou Guan; Yuxuan Han; Siqi Liu Deep Learning Approaches for Image ClassificationTechniques Publication: IEEE DOI:10.1109/EEBDA53927.2022.9744739

[12]Yinglong Li Research and Application of Deep Learning in Image Recognition Publication: IEEE DOI:10.1109/ICPECA53709.2022.9718847