ISSN [Online]: 2583-2654

Tomato Plant Leaf Disease Identification and Prevention using Image Processing and IOT

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Abstract: Most of the work related to farming in India is being done manually because most of the farmers lack the technical knowledge required to do it in a modern way. The different types of diseases affect the plants, this occurs due to a variety of significant reasons such as a lack of minerals, soil humidity, and temperature changes. Farmers can gain greater benefits from this reliable, non-destructive technology by Detecting plant diseases earlier. The system for plant leaf disease identification and prevention on tomato plants using image processing and IoT is developed. Tomato plant leaf is monitored continuously and images are captured, these images are compared with database, it identifies the leaf condition as healthy and unhealthy with diseases name is sent as a message to the farmer using IoT. The soil moisture and temperature are also monitored continuously and message is sent to farmer.

Keywords: *smartphone, text message, Wi-Fi/3G/4G, motor, tomato plant leaf;*

I. INTRODUCTION

India is an agricultural country wherein most of the population depends on agriculture and agriculture is one of the major domains which decides economy of the nation. The quality and quantity of the agricultural production is affected by environmental parameters like rain, temperature and other weather parameters which are beyond the control of human beings. Another major biological parameter which affects productivity of the crop is the pests. The population of many countries in the world depends on its economy and the economy of most of the countries depends on agricultural production. In country like India the farmers have wide diversity to select their crop for cultivation to produce maximum yield depending on environment available. However, there are certain issues with field crop. Each issue has an importance. Among them one is identification of pests in real field so that when symptoms of any pest take place on crops in fields, proper action should be taken to control it leading to minimize loss to farmer. For this farmer should have proper knowledge about pests so that correct action can be taken place, secondly to identify deficiency of nutrition in plants and to identify various diseases. When any of such a condition occurs then farmers use his experience or knowledge and also refers some guide books. If they are aware about the pest, then they can take correct action to control the situation but, if a farmer doesn't have correct knowledge, then misidentification of any pests can be possible and incorrect controls measure like non- affecting pesticides can be used. Which leads to wastage of work and money and most importantly it may lead to serious problem to crops. Otherwise, they may approach to any agricultural experts who give them suggestion regarding detection of infected pests and the treatment of incidence of pest for their crop/plant in order to prevent and control crop and increase the crop productivity. In order to tackle all these issues, it is therefore necessary to establish an efficient. System that will take better care among all factors that influence efficiency at each level.

II METHODOLOGY

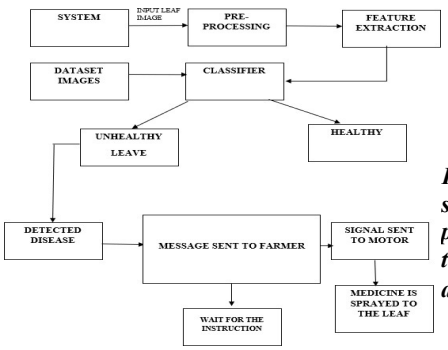

Fig 1: Layout structure of the proposed CNN-based tomato diseases detection approach.

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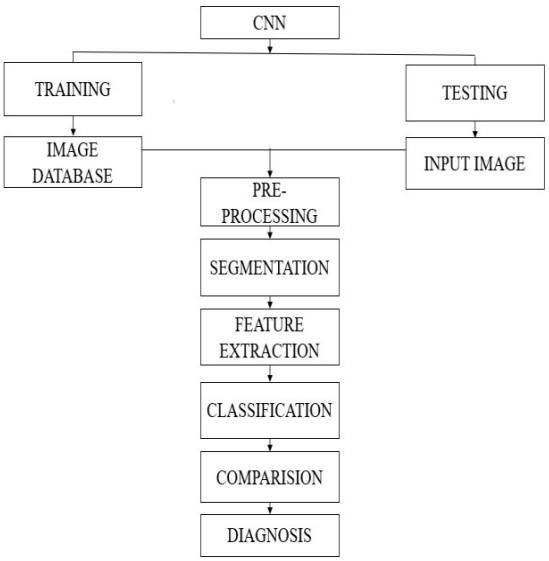
This system which takes the input leaf image where the image is pre- processed, in which it is categorize as leaf isolation, image resizing and background removal, then it extracts the feature of the leaf. Image pre-processing is to enhance smoothness removes noise that caused by the defects of camera flash or highlight and to increase the efficiency of the classification and prediction process. The proposed technique on real dataset that have been collected so most of the acquire images have more than one leaf image. So, it will isolate and extract every leaf in a single image to achieve that the image has been cropped to extract a single image. After the leaf image extraction so some small parts and shadows may be remained that would disturb the feature extraction phase, so the background subtraction technique. Feature extraction is the part of dimensionally reduction process in which initial set of raw data is divided and reduced to more manageable group. The feature extraction is easy to process, but still able to describe the actual dataset with accuracy. Using CNN classifier, the images are classified and trained dataset are stored. The captured image is compared with the image present in the database. If the leaf is unhealthy message will be sent to the registered farmer mobile number along with the name of the disease and fertilizer. The farmer gives the input to the motor to spray the fertilizer if it is necessary and the work is carried out with the help of lot.

Fig 2: CNN Classifier for Training and Testing



Training: Training data is used to teach prediction models that use machine learning algorithms how to extract features that are relevant to specific business goals. For supervised ML models, the training data is labeled. The data used to train unsupervised ML models is not labeled. The idea of using training data in machine learning programs is a simple concept, but it is also very foundational to the way that these technologies work. The training data is an initial set of data used to help a program understand how to apply technologies like neural networks to learn and produce sophisticated results. It may be complemented by subsequent sets of data called validation and testing sets. Training data is also known as a training set, training dataset or learning set.

Testing: Testing datasets is an important concept in data science, which is used to improve generalization and minimize overfitting. One way to generate test data is to split our data into two subsets: training data and testing data. The model is then fitted using the training data and tested on the unseen test data. Testing in Machine learning is way too different from the way, test software traditionally (functional tests, regression tests, etc.) where it can be checked for actual vs expected behavior of any given application. In the ML world, data sets with desired behavior are used to train the model (learn the logic) and need to check if the trained model consistently provides us with the expected output.

III WORKING PRINCIPLE

Automating the process by using image processing techniques like segmentation, morphological operations, threshold detection, gray scale conversion, image resizing, with the CNN classifier for segments of the diseased part. For successful cultivation of crops, the correct detection and classification of the plant disease and this may be done with image processing. An alert data is passed to the farmers to make them alert and take necessary precautions if any abnormal conditions are met, like dryness in the crop field, any leaves affected by diseases, with the help of deployed sensors. Therefore, there is continuous

ISSN [Online]: 2583-2654

communication with the selector, which switches the dipping system on or off to allow the water for all the areas of the ground. Later, the farmers can use the required nitrogen, potassium, and phosphorus fertilizer to sustain plant growth and achieve crop yield.

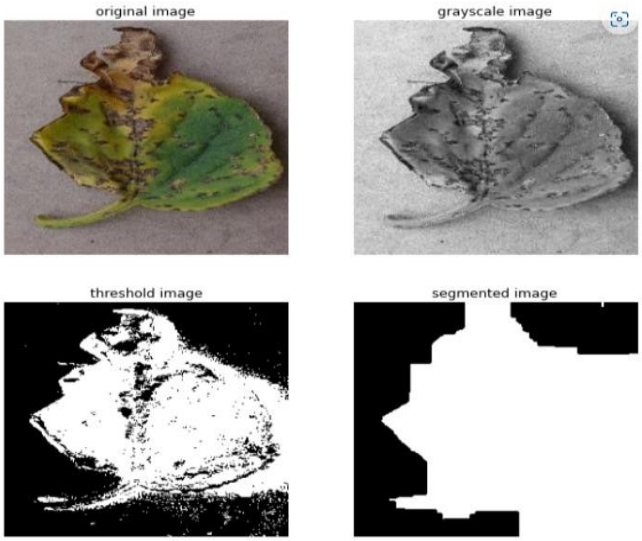


Fig 3: Original Image, Grayscale Image, Threshold Image, Segmented Image.

Fig 4: Resizing the Image

IV USAGE OF IOT

After Image Classification, the disease is identified by which the plant is affected. This is given as input to the Arduino so that the respective medicine is given to the plant through water by motors. As soon as the disease is identified. Disease name acts as an input terminal to Arduino by which Motor operates and supplies medicine to the plant.

Fig 5: Message sent to farmer android mobile throughtelegram

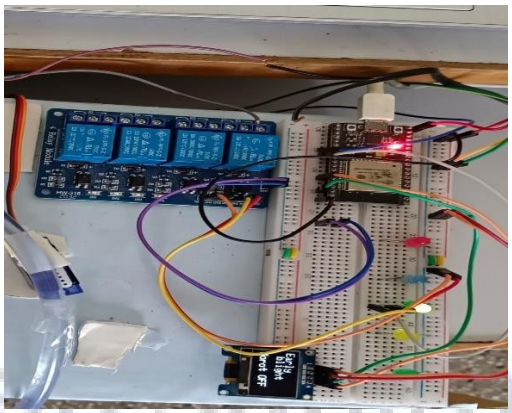


Fig 6: Hardware model

V RESULT

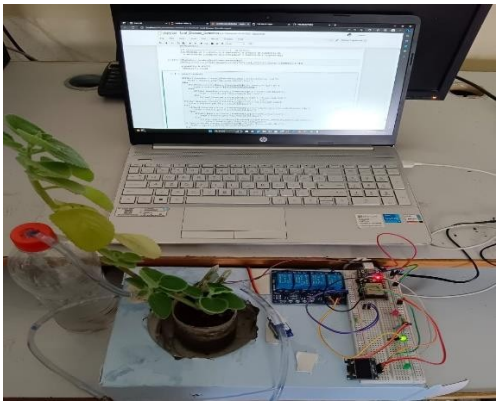


Fig 7: Model setup

As soon as the disease is detected a message is been sent to the farmers android phone through telegram, where there are three conditions that is on the motor, off the motor, stop the program. According to the farmers response the IoT will be performed.

VI CONCLUSION

The idea of detecting and monitoring leaf diseases of environmental conditions and irrigation systems is put into practice. various diseases that affect the plants used in the agricultural field, the symptoms that are observed in the plants for the respective diseases and the cause for that. Mainly, we conclude by saying that by automating the process by using image processing techniques, we can reduce the efforts, time and money that are spent in curing the disease. For successful cultivation of crops, the correct detection and classification of the plant disease are crucial, and this may be done with image processing. This present study dealt explicitly with the CNN classifier for segments of the diseased part. This paper also explored several color co-occurrence and classification methods for extracting the features of the diseased block and plant disease classification. The research paper has successfully implemented a comprehensive, complete package in the form of IoT based Smart Monitoring, Alerting and Automation and Disease Prediction using CNN.

VII FUTURE WORK AND SCOPE

Operational management of agricultural product processing based on Agri-IoT. On the one hand, the context-based online processing-and distribution collaborative scheduling for agricultural products under IoT should be resolved. The processing and distribution of agricultural products are time-critical, and every process should cooperate closely. The scheduled objects exhibit continuous and dynamic states. The essential problem of online intelligent collaborative optimization is how to drive the steps of picking, processing, sorting, packaging, and distribution to become an intelligent and continuous process in the context of IoT. On the other hand, optimizing the organizational architecture of agricultural product processing is necessary. The high intelligence of Agri-IoT improves the organizational efficiency of the agricultural supply chain and reduces labor cost. The intelligent business process requires high robustness and low risk. Establishing a trade-off among various elements, and finally presenting a suitable organizational architecture are expected. Operational management of agricultural product sale and aftersales service based on Agri-IoT.

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