TO DESIGN AND ANALYSIS OF PLANT DISEASE DIAGNOSTIC USING MACHINE LEARNING

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ABSTRACT

Background:
Agriculture is most vibrant field because most of the people having agriculture are main source of living. This field provides food to all living bodies on earth.

Need and Methods:
Here we discussed a system using machine learning model for the detection and prevention of diseases of plants. For the image processing and analysis, the CNN algorithm is used. It has many advantages for the use in big farms of crops. It automatically detects symptoms of disease whenever they appear on leaves of the plant. In pharmaceutical research, leaf disease detection is necessary and an important topic for research because it has advantages in monitoring crops in the farm and thus it automatically detects signs of disease by image processing by CNN algorithm.

Results:
This Paper provides the best method for detection of plant diseases using image processing and also shows fertilizer to be use to recover from its symptoms. And also shows sensor results in particular areas, displaying the name of the disease, fertilizer and sensors result on the monitor display.

Conclusion:
To upgrade agricultural products, automatic detection of disease symptoms is useful. This will lead to an increase in productivity of farming. Keywords: Plant Disease, CNN algorithm, Image detection, Machine learning.

1. INTRODUCTION

Agriculture is the backbone of India and about 70% of the population depends on agriculture. Farmers have large range of diversity for selecting various suitable crops and finding the suitable pesticides for plant. Disease on plant leads to the significant reduction in both the quality and quantity of agricultural product. The studies of plant disease refer to the studies of visually observable patterns on the plants. Monitoring of health and disease on plant plays an important role in successful cultivation of crops in the farm. In early days the monitoring and analysis of plant diseases were done manually by an expert person in the field. This requires tremendous amount of work and also requires excessive processing time. Our system uses ML Model to detect healthy and unhealthy leaves by training images and finding accurate results.

2. METHODOLOGY

ML Model

Machine learning trained and tested models which detect crop leaf disease are stored on operating device. You can check if a leaf is diseased or not on a locally hosted website by uploading an image on it. 2.2 Operating Device The operating device serves as the central processing unit for the system. It stores the machine learning (ML) model, which was trained to detect plant leaf diseases.

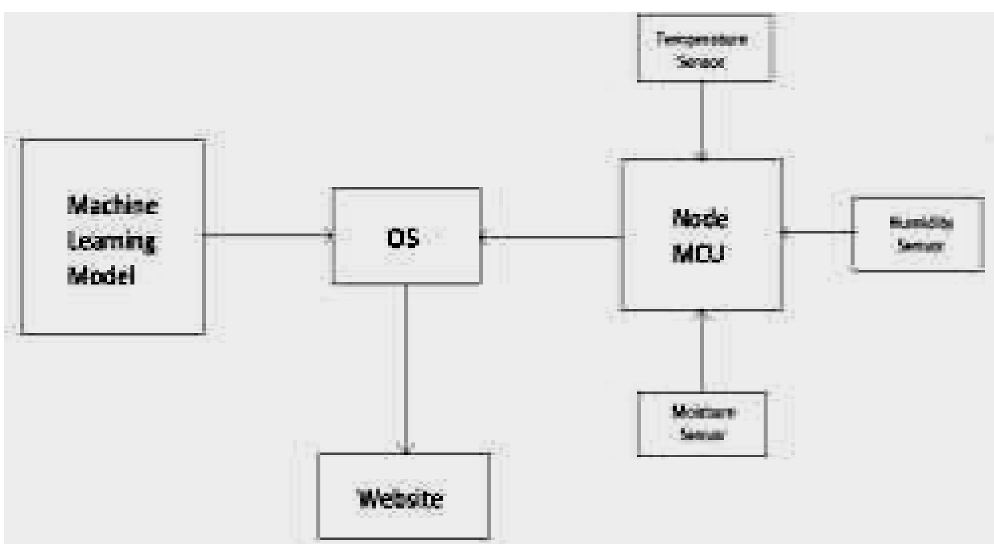

Figure 1: Block Diagram of crop disease detection.

The operating device can be a personal computer (PC) or a similar device with sufficient computational power. It runs the necessary software, such as a Python IDE, to handle ML model inference and data processing.

Node MCU

The Node MCU is a microcontroller board based on the ESP8266 Wi-Fi module. It acts as the interface between the sensors and the operating device, providing connectivity to the internet. The Node MCU is equipped with a Wi-Fi module, allowing it to establish a wireless connection to the internet and communicate with the operating device.

Temperature, Humidity and Soil moisture sensor

The temperature and soil moisture sensors are connected to the Node MCU. The temperature sensor measures the ambient temperature in the environment. The soil moisture sensor measures the moisture level in the soil. These sensors provide real-time data on temperature and soil moisture, which are crucial for monitoring plant health and irrigation optimization.

Website

The operating device sends the sensor data, ML model output, and other relevant information to a website. To enable website integration, you can use software tools like XAMPP to set up a local web server or host the website on a remote server. The operating device communicates with the website using appropriate protocols and APIs to transmit the data securely. The website can display real-time information, such as temperature, soil moisture, and disease status, in a user friendly manner. Users can access the website through their web browsers and view the data remotely, enabling them to monitor plant health and make informed decisions. Overall, the block diagram illustrates the flow of data and interactions among the operating device, Node MCU with Wi-Fi module, sensors, ML model, and website. This system enables real-time monitoring of environmental conditions, disease detection, and data visualization through a web interface, enhancing agricultural practices and facilitating informed decision-making.

3. MODELING AND ANALYSIS

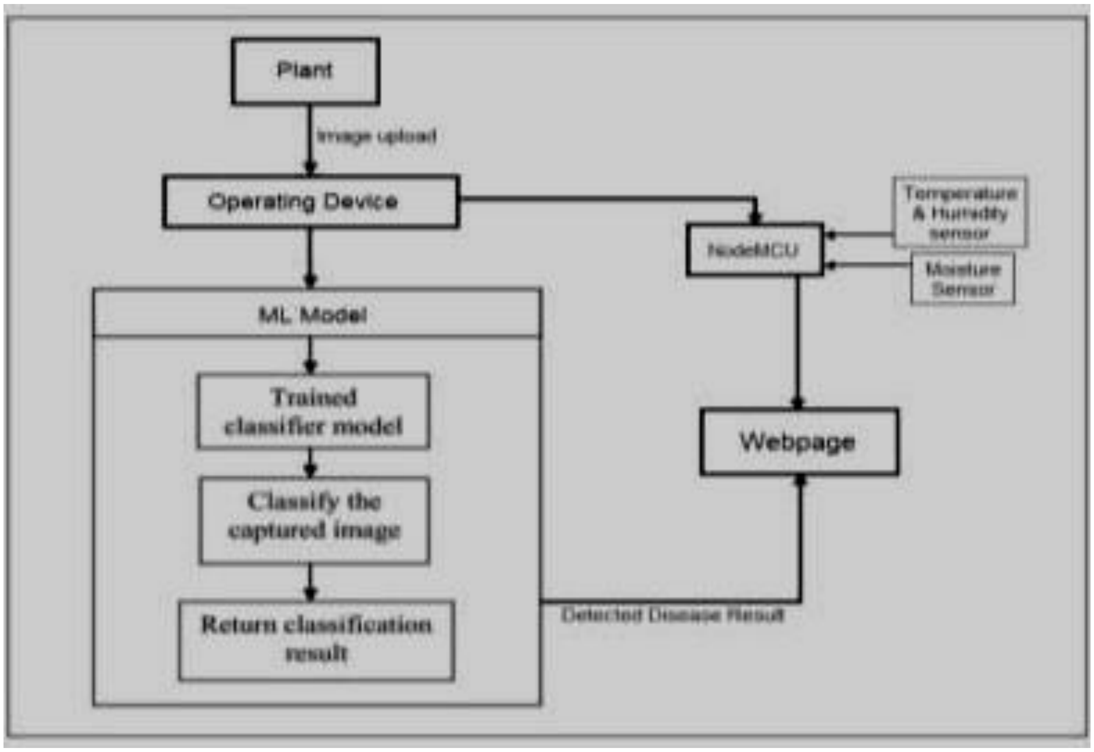

Figure 2: System architecture of crop disease detection

This figure shows how different components work together to make the whole system Function properly.

A Convolutional Neural Network (CNN) is a deep learning algorithm primarily used for image recognition and computer vision tasks. It consists of several interconnected layers that learn to extract meaningful features from input images. Here's a concise explanation of how CNNs work:

1. Convolutional layer: The input image is convolved with a set of learnable filters, also known as kernels or feature detectors. Each filter scans the image in small regions, performing element-wise multiplication and aggregation to produce a feature map. Convolutional layers capture local patterns and spatial hierarchies.
2. Activation function: The feature map is then passed through a non-linear activation function (e.g., ReLU) to introduce non-linearity, allowing the network to learn complex

relationships between features.

3. Pooling layer: To reduce spatial dimensionality and make the learned features more robust to variations, a pooling layer is applied. Common pooling methods include max pooling, which selects the maximum value in each region, and average pooling, which calculates the average value. Pooling reduces the computational complexity and helps with translation invariance.

4. Fully connected layer: The output of the convolutional and pooling layers is flattened and connected to a traditional Neural network architecture, typically composed of fully connected layers. These layers learn high-level representations and make predictions based on the extracted features.

5. Output layer: The final fully connected layer is followed by an activation function suitable for the specific task, such as soft max for multi-class classification or sigmoid for binary classification. It generates the network's output probabilities or class predictions.

6. Training: CNNs are trained using back propagation and optimization algorithms (e.g., stochastic gradient descent) to minimize a loss function. The loss is computed by comparing the predicted output with the true labels using appropriate metrics like cross-entropy.

7. Optimization: The network's weights and biases are updated iteratively during training to minimize the loss. This process is typically performed on batches of input images to improve computational efficiency.

8. Evaluation and prediction: Once trained, the CNN can be used for inference on new, unseen images. The forward pass through the network applies the learned filters and computes predictions based on the learned representations.

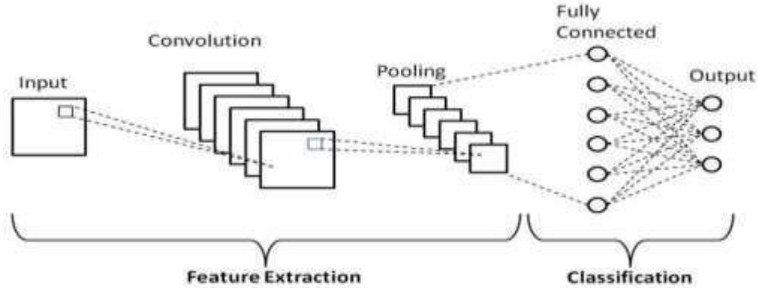

Figure 3: CNN layers

4. RESULTS AND DISCUSSION

In this research, we developed a crop disease detection system to identify common diseases in different types of plantlike potato, wheat, corn etc.

Figure 4: Crop disease detection setup

Figure 5: Webpage showing results of various diseases detected.

Figure 6: Webpage showing sensor results.

5. CONCLUSION

In conclusion, the crop leaf disease detection project utilizes advanced technologies and machine learning algorithms to accurately identify and classify diseases affecting crop leaves. By leveraging computer vision techniques and a comprehensive dataset of leaf images, the project aims to improve disease detection and provide timely interventions for farmers. The implementation of this project has the potential to significantly enhance crop management practices, reduce yield losses, and ultimately contribute to food security and sustainable agriculture.

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