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Cotton Crop Disease Forecast and Cure Using Deep Learning

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Abstract: *Cotton is one of the most important cash crops in India, as many farmers grow it in big numbers. In the previous few decades, cotton diseases have caused a considerable loss in productivity. It's crucial to diagnose cotton diseases as early as possible. The objective of this research is to develop a system that can automatically identify illnesses in cotton leaves using a convolutional neural network technique. separation of images produced using deep learning techniques using the proper attributes, such as color and texture. The images come from a variety of web resources*

Keywords: Convolutional neural network (CNN), Cotton leaf disease detection, Feature extraction, Image recognition.

I. INTRODUCTION

Agriculture is the backbone of the Indian economy, as our nation's father Mahatma Gandhi famously observed. The second largest producer of agricultural goods in the world is India. There are no limitations on the variety of crops that Indian farmers can grow. It employs about 41.49 percent of the Indian population and contributes 18 percent to the nation's overall GDP. Agriculture needs to be expanded quickly to become self-sufficient as well as to earn valuable foreign currency. several factors affect crop yield, including the climate, the soil, various illnesses, and so forth. In the future, identifying plant diseases will be crucial to a crop's overall productivity. The only approach currently used to identify plant diseases is basic naked-eye observation, which requires additional labor, facilities with specialized equipment, and expensive prices. Additionally, incorrect pesticide application due to incorrect disease detection may have limited the crop's ability to defend itself by allowing viruses to develop long-term resistance. Plant diseases can be identified by inspecting many portions of a diseased plant. The approach used to detect plant illnesses is image processing with a Convolution Neural Network (CNN). Cotton leaves included eighty to ninety percent of the diseases and bugs found. Plant disorders are anticipated to cost a 16 percent economic loss in India. If control measures are not implemented, it might result in a 30-50 percent loss. Cotton pests and illnesses can be difficult to identify by eyesight.
Recently, advanced new technology has attracted a lot of researchers working in the fields of cotton leaf disease and pest detection and classification. In India, many limitations lower the quantity and quality of the produced goods. Cotton crop cultivation receives only intermittent scientific attention despite the abundance of farmland that is suited for cotton planting. Plant diseases and pests have always been recognized and identified by experts. The use of the naked eye is seen to be a loss of poor accuracy while trying to identify any illnesses. To increase the accuracy of any remedial treatments, which were in high demand, various advanced technologies were used to help create the systems to support the non-automated detection of plant diseases and pests. Thanks to improved technology, plant sicknesses were reduced, increasing productivity and, as a result, output, which in turn helped to stimulate the economy. As a result of the use of information technology-based solutions in the agricultural sector, increased cotton crop output significantly impacts India's growth in social, economic, and environmental development.

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II. PROPOSED WORKFLOW

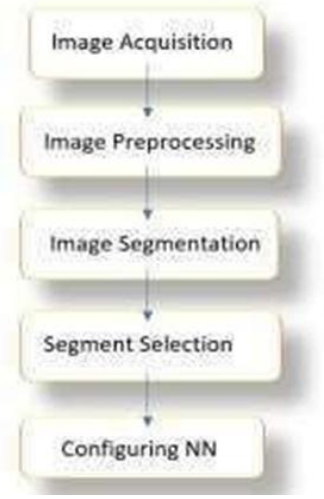

Fig. Proposed Workflow

The suggested system consists of two stages. Training datasets are the focus of the initial phase. We collect images of both healthy and diseased leaves. Once the dataset containing samples of the healthy and ill images is available, the threshold is determined for both aging and diseases. Regular photo acquisition is accomplished by remote sensing. The monitored images' RGB values are gathered and contrasted with the threshold images. If the threshold is more or less than a specified value, edge detection methods and histogram analysis are employed to identify specific plant diseases.

Pre-processing image :

Pre-processing is a technique used to enhance repressed image data. improves some image elements that are necessary for later processing. Other functions include edge recognition and sharpening as well as noise reduction. The manual procedure of disease identification is automated or partially automated by this.

Dataset:

From the training stage to evaluate the performance of vision algorithms, appropriate data sets are necessary for all stages of object recognition research. Every piece of information gathered from the database was retrieved from the Internet, and numerous sources were examined for diseases and plant names. The Dataset will be divided into healthy and sick leaves. To train the Dataset, a Deep Learning model will be used (Convolutional Neural Network). To distinguish between adjacent leaves, a deep neural network can be trained.

CNN:

CNN is a machine learning system that uses an image as input to classify and distinguish between various characteristics and objects in the image. On the extraction of features from photos, it is based.

Tree of Decisions :

The decision tree is a clear visual representation of decision-making. It has a tree-like structure, as suggested by the name, with each internal node denoting a test on an attribute, each branch reflecting the test's outcome, and each leaf node denoting the class label.

Random Forest:

Random Forest increases the unpredictability of the model by looking for the best feature from a random collection of features rather than the most significant feature.

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Formulas :

Accuracy=TP+TN(TP+FN)+(FP+TN)

III. SYSTEM ARCHITECTURE

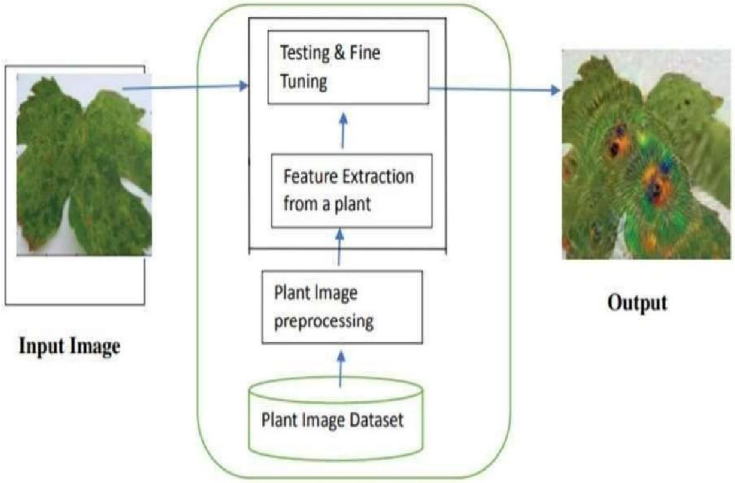
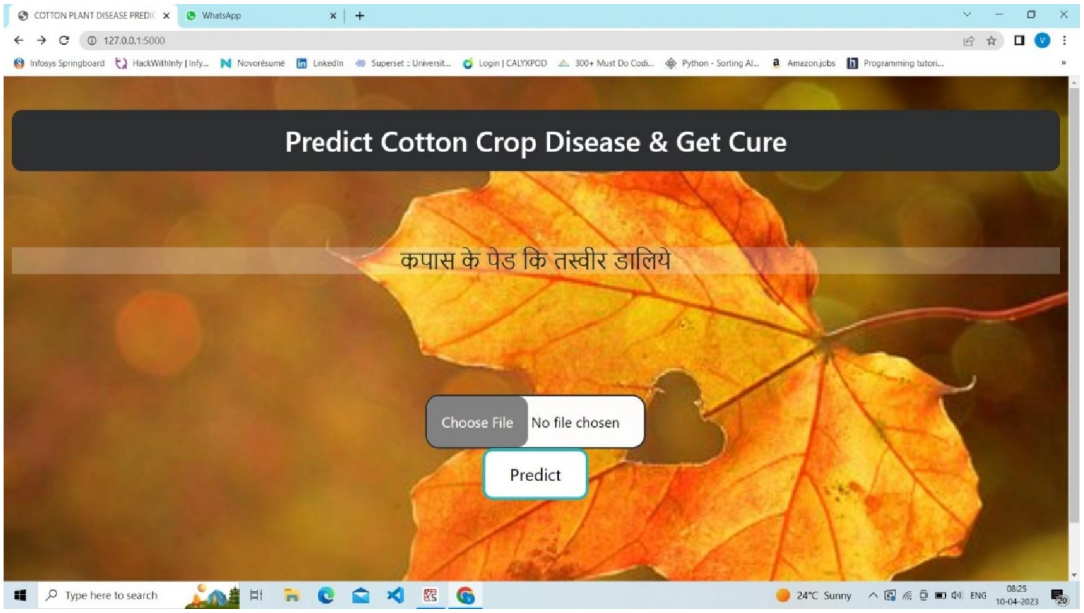


Fig. System Architecture

(a) Normal leaf (b) Red Spot (c) White Spot (d) Leaf Cr

IV. IMPLEMENTATION RESULTS



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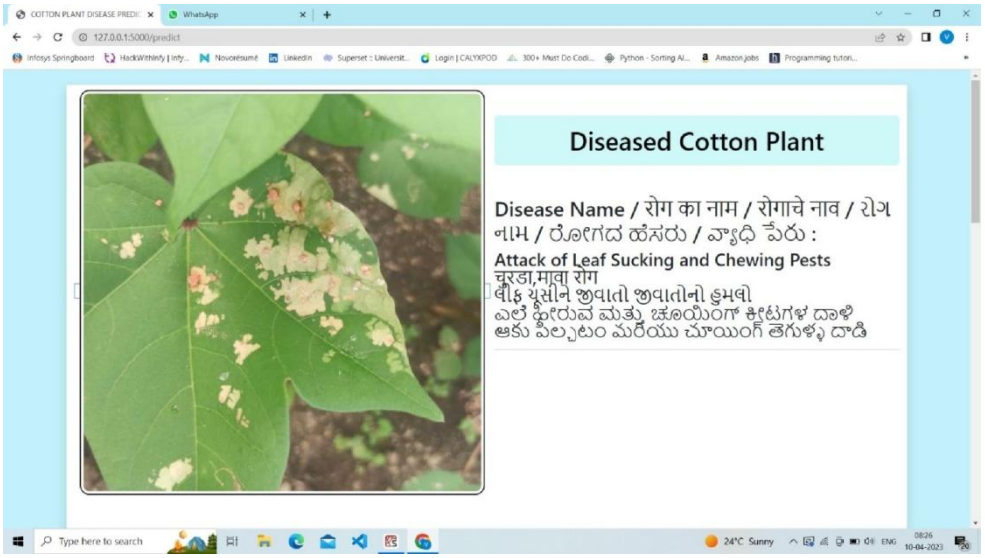

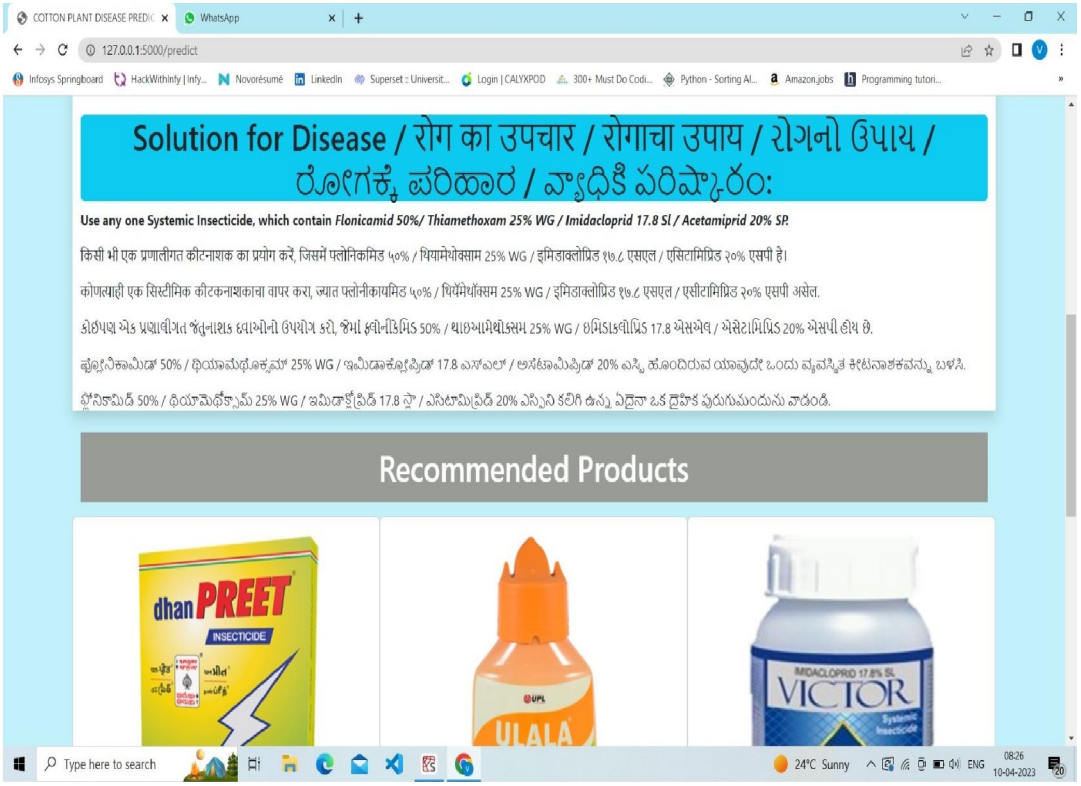

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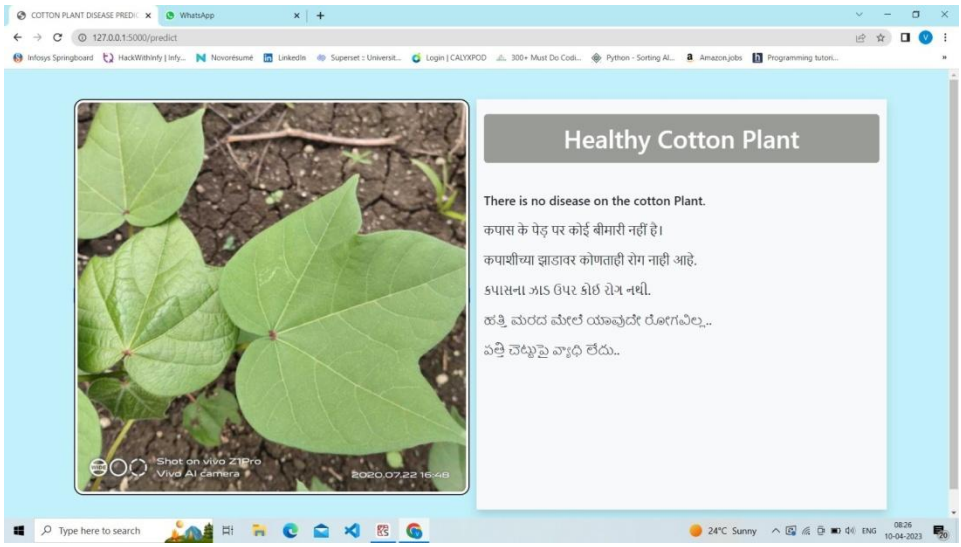

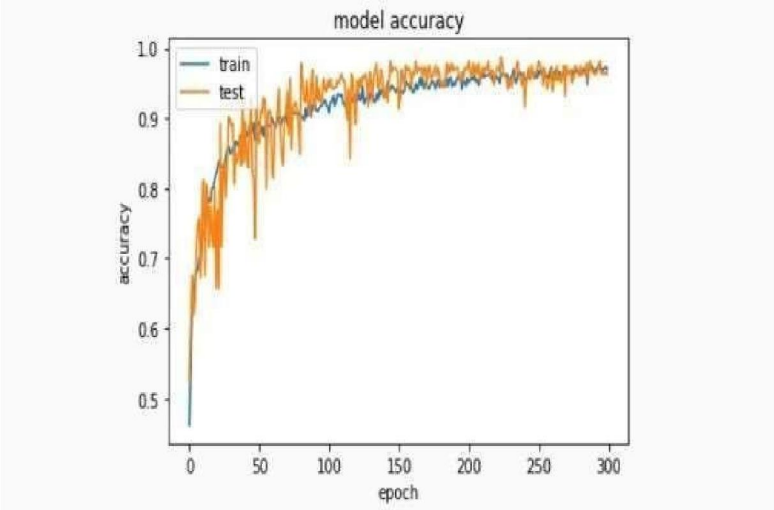

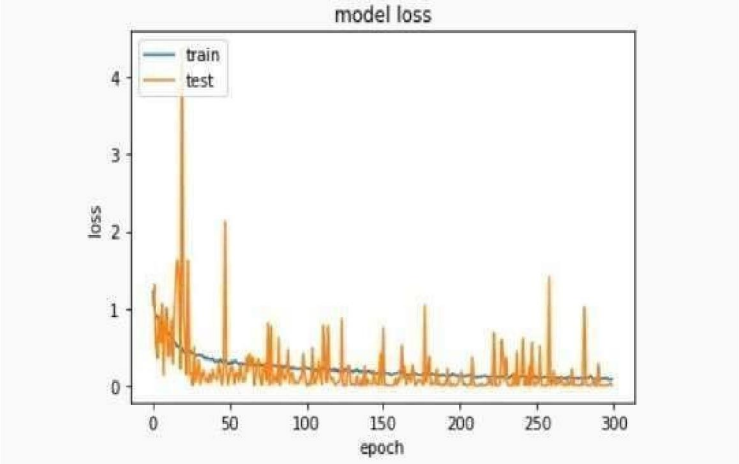

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V. TOOLS AND TECHNOLOGIES USED

Tools / IDE For model training, we utilized Pycharm.On the local system, I used Pycharm to deploy models.

Software Requirements:

a. Python version3.8.10
b. TensorFlow version 2.7.0
c. Keras version 2.6.0
d. NumPy version 1.19.0
e. Flask version 1.1.2

Scope

The goal of this project is to create a system for detecting crop illnesses. The user must first load an image onto the system, with image processing beginning with adigitized color image of the sick leaf. Plant disease can eventually be predicted using CNN data.

VI. CONCLUSION

An application for detecting plant diseases and providing disease-specific recommendations has been created. As a result, the targeted objective was accomplished on the cotton facility. Cotton plant infections were investigated as part of the algorithm's evaluation. Experiments show that the proposed method is capable of distinguishing diseases while requiring minimal computational effort. With this technology, plant diseases may be discovered early on, and problems can be treated with pest control equipment while offering minimal dangers to people and the environment. The training samples can be improved by employing the best features as input conditions for disease recognition and crop fertilization management to increase disease identification rates at various stages. As part of Future Enhancement, the whole procedure discussed in this study can be automated, allowing the outcome to be generated in a relatively short period. Upgrades to the user interface, the precision of diagnosing certain diseases, and product recommendations are all possibilities.

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