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Detection and Classification of Various Diseases in Arecanut Plantation Using Artificial Intelligence and Machine Learning

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Abstract: A tropical crop called areca nuts, sometimes referred to as betel nuts, is grow. India is the world's second-largest producer and consumer of areca nuts. The early monsoon winds from the Indian Ocean and the Bay of Bengal bring heavy rain, which causes a range of illnesses to afflict the areca nut throughout its life cycle, including Yellow Leaf, Nut Split, and Fruit Rot. The only method of disease detection currently available to farmers is observation with the naked eye, and they must periodically examine each crop carefully in order to identify any diseases. Furthermore, without a farmer who is well-versed in these diseases and areca nuts, it will be difficult to detect diseases. This system incorporates several machine learning and image processing principles that will make this vision a reality. As the system concentrates on early detection so the issue might be eliminated at the starting stage in order to avoid the barriers later, it may accept inputs from areca nuts (including the tree) and transport them there for pre-processing. Otherwise, it poses a serious risk.

Keywords: Areca nut**,** yellow leaf, fruit rot, machine learning, image processing.

I. INTRODUCTION

Agriculture is India's main profession. India is the world's second-largest producer in agricultural products. In developing countries like India, the economy mainly depends on agriculture. Farmers in India grows a diverse range of crops. Crop development is influenced by a variety of factors such as climatic conditions, soil conditions, disease, and so on, the seed of the areca palm is known as an areca nut, available in most throughout much of the tropical Pacific-ocean, South-East and South-Asian country, and Eastern Africa place. Betel nut is the common name for it, Karnataka is the larger producer of areca nut in India mainly in Dakshina Kannada and Uttara Kannada district and Malnad regions, now days Tumkur, Davangere, Hassan, Mysore districts cultivate areca nut. It thrives in the 140℃ to 360℃ temperature range but is harmed by temperatures below 10℃ and above 40℃. Temperature extremes and large diurnal changes are not favorable to healthy palm growth. Areca nuts can be farmed in places with annual rainfall ranging from 750 mm in Maidan to 4,500 mm in Malnad in Karnataka. Areca nut plants have large, evergreen leaves that are either palmately ('fan-leaved') or pinnately ('feather leaved') compound and spirally arranged at the top of the stem. The leaves have a tubular sheath at the base that usually splits open on one side at maturity. The inflorescence is a spadix or spike surrounded by one or more bracts or spathes that become woody at maturity. The flowers are generally small and white, radially symmetric, and can be either uni or bisexual. The sepals and petals are three each, and may be distinct or joined at the base. The stamens are six, with filaments that may be separate, attached to each other, or attached to the pistil at the base. The fruit is usually a single-seeded drupe (sometimes berry-like) but some genera (e.g. Salacca) may contain two or more seeds in each fruit. Finding diseases is an important part of managing areca nut crops. Visual inspections of the crop by experts are a traditional method of disease detection, but they can be time- and money-consuming. Additionally, the inspector's expertise can have an impact on how accurate visual inspections are. The detection of arecanut diseases has recently been investigated using machine learning (ML) and artificial intelligence (AI) techniques. These methods may increase the precision and effectiveness of disease detection, enabling farmers to take the necessary precautions to stop the spread of the disease and reduce crop losses.

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II. METHADOLOGY

A rapid emerging field is artificial intelligence (AI) and machine learning methodology for detecting and classifying disease on area nut plantation. This field is experiencing tremendous growth and could revolutionize the way we manage these crops. By analyzing symptoms and other characteristics of disease in areca nut plants, artificial intelligence and machine learning algorithms can identify and classify them accurately. Analyzing large datasets of images and other information gathered from areca nut plantation, these algorithm use techniques such as deep learning and convolutional neural networks to identify patterns and correlations. A computer algorithm is able to accurately identify and classify various diseases in areca nuts based on the patterns and correlations it finds between these symptoms and characteristics. By using these techniques, growers can identify and respond to outbreaks of disease quickly, reducing the need for time-consuming and costly manual inspections. Additionally, they can help growers determine when to apply pesticides and fertilizers and make better crop management decisions. Machine learning and artificial intelligence may greatly improve the efficiency and sustainability of areca; nut plantations, while reducing the environmental impact of farming practices.

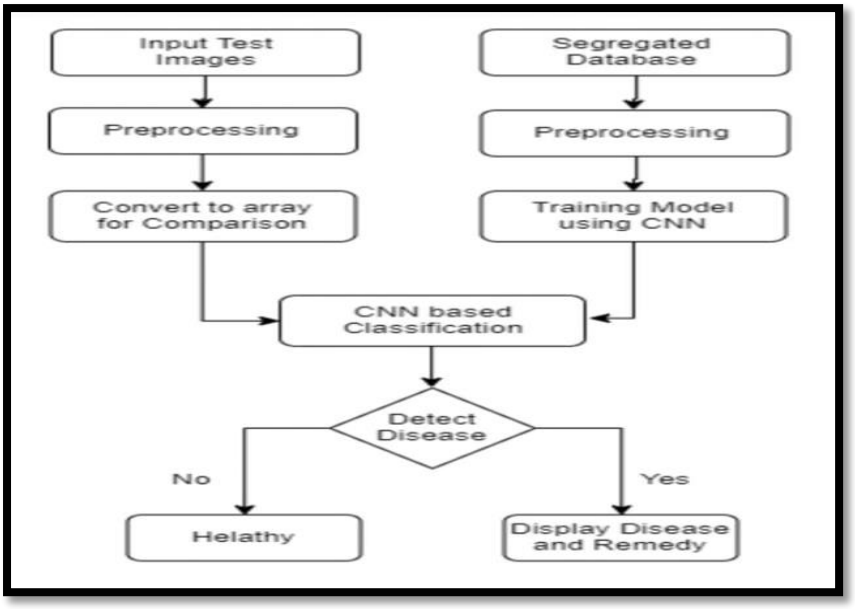

Fig.1 Data processing

The datasets are collected and stored in a database which is further processed to a standard format. The pre-processing includes reshaping, resizing and array conversation, same process is done for input images.

A. Pre-processing Techniques

- Resize the images to a standard resolution to ensure compatibility and optimize computational efficiency during model training and inference.
- Convert the images to a suitable color space (e.g., RGB, grayscale) depending on the requirements of the selected AI and ML algorithms.
- Perform noise reduction and image enhancement techniques, such as denoising filters or histogram equalization, to improve image quality and clarity.
- Consider applying image segmentation techniques to isolate and extract the diseased regions more precisely, if required.
- Split the dataset into batches or mini-batches for efficient training and processing.

The basic process as it begins with loading the images (input data). As data will be mixed with other noisy data it's major process to remove everything I e pre-processing. Segmentation and feature extraction takes place in-order to process the data in proper way. Classification of all the input data takes place. Finally jumping towards the basic soft part of the process in order to find out if the data is accuracy is proper for all the applied cases.

The major contributions of this technology are to provide a single platform whereall people can communicate freely as there is no single platform which achieves the detection, classification mainly for areca nut and provides the solutions at

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the end for concerned input of areca given by the user as this system involves lot of conversion of one to another while dealing with image processing moreover also it uses CNN based classification

Fig. 2 Pre-processing image

III.MODELING AND ANALYSIS

Climbing an arecanut tree relies on the fundamental concept of friction, which is the relative lateral motion of two solid surfaces in contact. The machine was built with a base frame and 2 nylon wheels powered by 2 high torque geared motors. The machine is vertically shaped, and each link has a hinge that allows it to move with the growth of the tree as it changes. It is possible to open the arecanut tree climber's frame and hold it over the tree. This tree climbing machine gets its power from a 12V battery, which energizes the driving motors. The motor turns the shaft when power is applied, and the shaft then causes the wheels to revolve in a clockwise motion. as a result of the driving wheels' friction and the tree machine's bark rises up along the tree's length. With the aid of a screw and grippers on the wheels, the contact friction between the wheel and tree is maintained. The wheels, which are composed of nylon, are the only part in touch with the tree. Consequently, it doesn't harm the tree's bark in any way. The camera scans the arecanut once it has a particular height, uploads the photographs to the computer through Wi-Fi, and displays the arecanut's health status. Changing the switch's polarity causes the drive motor to revolve in the opposite direction from the wheels, which reverses the direction of rotation of the entire arrangement. When the setup reaches the ground, it is detached from the first tree and fastened to the second one to begin scanning.

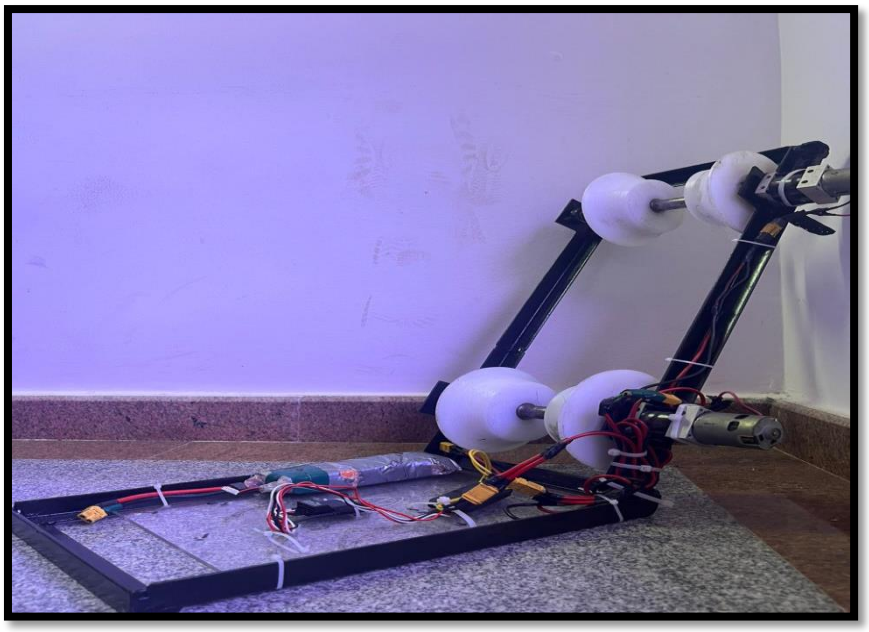

Fig. 3: Tree climbing Machine

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IV. RESULT

The test accuracy after model training was 80.1%. The model trained using CNN received the input of the areca nut image shown in Figure 8. The trained model recognises diseases in areca nut and prints the likelihood of the recognised disease, as shown in Figure below Additionally, the treatment for the condition with the highest likelihood of occurring is displayed for user reference.

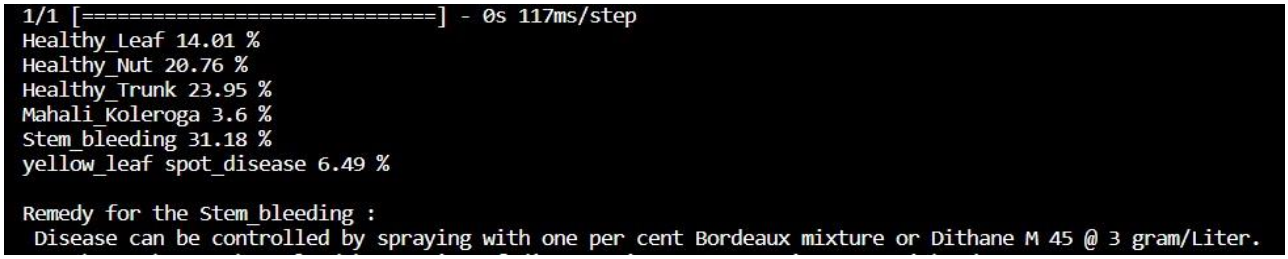

Fig. 4: Prediction result

V. CONCLUSION

This research focuses on the use of convolutional neural networks for the early identification of diseases in areca nut, leaves, and trunk. A collection of 1100 photos of healthy and unhealthy areca nuts is used for testing. After pre processing the input image, feature extraction, training, and classification are performed. The suggested System identifies areca nut problems including Fruit rot/Koleroga, Stem bleeding, Nut split yellow leaf spot disease, and offers treatments for them. The experimental results reveal variable degrees of disease identification accuracy depending on the level of the input image and the disease stage. According to estimates, the system's total accuracy is 80.1 percent.

The results demonstrated the effectiveness of the AI-based system in accurately detecting and classifying various diseases in areca nut plants. The trained model showed promising performance, providing reliable identification and classification of diseases. The integration of the system with user-friendly interfaces, such as mobile applications or web platforms, enables easy accessibility for farmers and agricultural experts. Thus, this approach progresses in the direction of encouraging farmers to practice intelligent farming and empowering them to make more informed decisions about yields

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