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Real Time Plant Leaf Disease Detection System with Raspberry Pi

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Abstract: *This project presents a real-time plant disease detection system using deep learning and computer vision. The system captures live images of plant leaves through a camera and processes them using a trained convolutional neural network (CNN) model. It accurately identifies diseases by analysing patterns and symptoms on the leaf surface. The system provides instant feedback to farmers via a user-friendly interface. This aids in early diagnosis and improves crop management and yield.*

Keywords: Raspberry pi, SD Card, Camera, HDMI cable

I. INTRODUCTION

Agricultural sector in the world is crucial for growing food required by humanity. This field makes the highest contribution towards food and the economy as well. Farmers spend their lives in agricultural activities and work hard in production of different food items besidesother commercial products like cotton. However, farmers are suffering from high expenditure involved in cultivation and also plant diseases. Particularly certain crop diseases lead to significant losses to farmers leading to crisis in agricultural domain. Technology innovations such as AI are shaping unprecedented solutions in different real-world applications. ML and DL techniques could improve state of the art in solving problems. However, technological innovations in several countries are helping governments and organizations but actual benefits of technologies could not reach farmers. In other words, in spite of innovations in agriculture, technology benefits are not really changing the lives of farmers. To state it differently, at the farmer level the technologies are not exploited. In this paper, our endeavor is to build a system that helps farmers to have automatic detection of plant diseases in a user-friendly fashion.

There are many existing methods dealing with the problem of automatic plant disease detection. CNN is specifically applied for Computer Vision applications that involves image detection and classification among various network architectures used in deep learning.

The challenges for CNN to detect and classify plant disease is to create a deep network such that nodes, structure of the network and edge weights map the input (the image of a diseased plant) to the output (plant disease pair) correctly. Object classification is mainly used by deep convolutional neural networks (DCNN) and their variations. DCNN is built upon stacked convolutional neural networks (CNNs) which is a variant of feed-forward network (FFN).

Many deep learning models perform badly once the model is tested on independent data. Therefore, various studies on how segmented images can improve accuracy of the model are conducted.

II. LITERATURE SURVEY

Verma, Gaurav, Taluja, Charu, and Saxena, Abhishek Kumar. "Vision Based Detection and Classification of Disease on Rice Crops Using Convolutional Neural Network" (2019). The study by Verma, Taluja, and Saxena utilized a convolutional neural network (CNN) for the accurate detection and classification of diseases in rice crops [1]. By training the CNN on a large dataset of diseased and healthy rice leaves, the model achieved promising results in identifying and categorizing various diseases affecting rice plants.

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Shah, Nikhil and Jain, Sarika. "Detection of Disease in Cotton Leaf using Artificial Neural Network" (2019). Shah and Jain conducted research on disease detection in cotton leaves using an artificial neural network (ANN) [2]. Their study aimed to develop an efficient system for identifying diseases in cotton crops based on leaf images. By training an ANN using features extracted from the images, the authors achieved satisfactory accuracy in disease detection.

'Kumari, Ch. Usha. "Leaf Disease Detection: Feature Extraction with K-means clustering and Classification with ANN" (2019). Kumari proposed a two-step approach for leaf disease detection, involving feature extraction using K-means clustering and disease classification using an artificial neural network [3]. The study demonstrated the effectiveness of this method in accurately identifying leaf diseases, contributing to improved accuracy and efficiency in disease detection systems.

D.M., Akhilesh, S. A. Kumar, R. M.G., and P. C. "Image based Plant Disease Detection in Pomegranate Plant for Bacterial Blight" (2019). At the 2019 International Conference on Communication and Signal Processing (ICCSP), S. D.M. and colleagues presented research on image-based plant disease detection in pomegranate plants for bacterial blight [4]. Their approach utilized various image processing and machine learning techniques to extract relevant features and classify diseased and healthy samples, showcasing the potential of image-based methods in accurate disease diagnosis.

Al-Hiary, H., Bani-Ahmad, S., Reyalat, M., Braik, M., and ALRahamneh, Z. "Fast and Accurate Detection and Classification of Plant Diseases" (2011). Al-Hiary et al. aimed to develop a fast and accurate system for detecting and classifying plant diseases using digital images [5]. Their work incorporated image processing techniques, feature extraction methods, and machine learning algorithms, demonstrating the ability to diagnose various plant diseases with high accuracy.

II. METHODOLOGY

Hardware Setup:

- Detailed description of the hardware components (Raspberry Pi, camera module, power supply, heatsinks).
- Explanation of the hardware connections and setup.

Image Acquisition:

- Description of the camera module setup and image capture process.
- Explanation of image pre-processing techniques (e.g., resizing, noise reduction, color correction).

Machine Learning Model:

- Selection of an appropriate machine learning algorithm (e.g., CNN).
- Description of the model training process, and Explanation of the model evaluation metrics (e.g., accuracy, precision, recall).

Disease Diagnosis and Remedy Display:

- Implementation of the trained model on the Raspberry Pi. Development of a database or knowledge base for disease remedies.

Software and Programming:

- Programming language: Python.
- Machine learning libraries: TensorFlow, Keras, OpenCV, scikit-learn. Operating system: Raspberry Pi OS.

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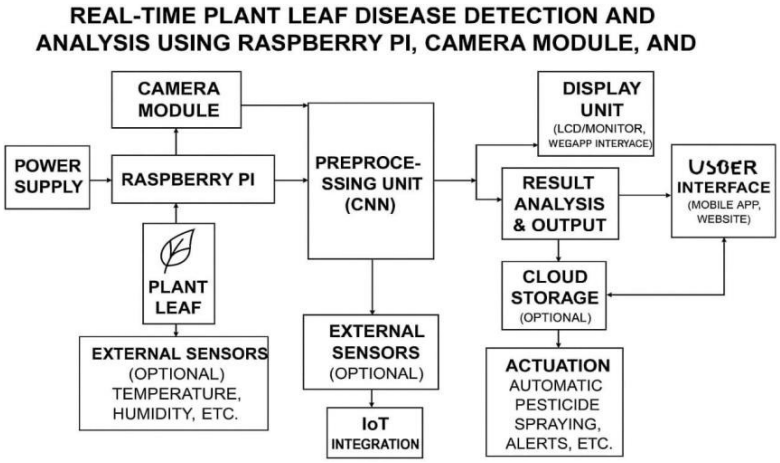
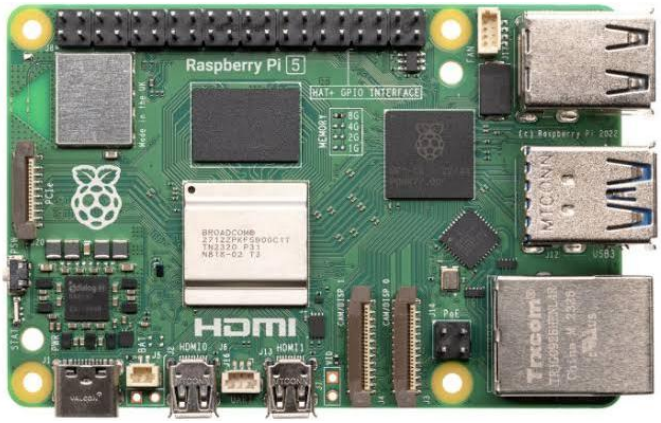
Block Diagram



Component Details



Raspberry Pi

The Raspberry Pi is a small, affordable, single-board computer developed for educational and hobbyist purposes. It contains essential computer components like a processor, RAM, USB ports, HDMI, audio jack, and GPIO pins. Users can connect a keyboard, mouse, and monitor to use it like a regular PC. It runs on Linux-based operating systems such as Raspberry Pi OS. The board is widely used in school projects, home automation, robotics, and Internet of Things (IoT) systems. Different models like Raspberry Pi 3, 4, and Zero offer varied performance levels. It supports Wi-Fi and Bluetooth (on newer versions), making it versatile for wireless applications. The GPIO (General Purpose Input Output) pins allow users to control hardware components. Power is supplied through a micro-USB or USB-C port. It requires a memory card to boot and store data.

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Memory Card (microSD): -

A microSD memory card is essential for operating the Raspberry Pi. It serves as the main storage medium, housing the operating system, applications, and user files. Before use, the card must be formatted and flashed with a compatible OS image using software like Raspberry Pi Imager. A Class 10 card with a minimum of 16GB capacity is typically recommended to ensure smooth performance. Faster cards, such as A1-rated ones, improve loading times and responsiveness. Users can easily swap microSD cards to switch between different operating systems or projects. The card is inserted into the microSD slot on the underside of the Raspberry Pi board. Brands like SanDisk, Samsung, and Kingston are commonly used. Without the memory card, the Raspberry Pi cannot boot or function. It acts like the hard drive of the Pi.

Raspberry Pi Camera Module: -

The Raspberry Pi Camera Module is a small and lightweight camera specifically designed for Raspberry Pi boards. It connects to the Pi using the CSI (Camera Serial Interface) port, which provides high-speed communication. The camera is capable of capturing still images and high-definition video, and it supports various resolutions like 5MP, 8MP, and 12MP depending on the model. It is widely used in projects involving photography, security systems, facial recognition, and video streaming. There are versions with and without infrared (IR) support, as well as high-quality modules for professional imaging. The camera requires software setup, typically done using the raspi-config tool. It can be programmed using Python and libraries like PiCamera or OpenCV. Compact and powerful, it brings vision to Raspberry Pi projects. Mounting options include using stands, cases, or robotic arms.

HDMI Cable

An HDMI (High-Definition Multimedia Interface) cable is used to connect the Raspberry Pi to an external monitor or TV. This cable transmits both video and audio signals, allowing users to see the Pi's graphical interface. Depending on the Raspberry Pi model, the board will have either a full-sized HDMI port (like Pi 3) or micro-HDMI ports (like Pi 4). During setup, an HDMI connection is essential to view the boot screen and configure the operating system. HDMI cables come in various lengths and support different resolutions, such as 1080p and 4K. High-quality cables with gold-plated connectors offer better durability and signal quality. This connection is vital for programming, gaming, or using the Raspberry Pi as a media center. Some users also use mini-HDMI adapters if needed. It forms a basic but necessary link in the Raspberry Pi setup.

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III. CONCLUSION

The Plant Leaf Disease Detection project successfully built a deep learning system that identifies plant diseases with 99% accuracy. It uses image processing and machine learning to help farmers manage crops better. Tools like Jupyter Notebook, Python IDEs, and FastAPI were used for development and deployment. The project shows strong potential for real-world agricultural use.

REFERENCES

[1]. Computers and Electronics in Agriculture" and "IEEE Access." Mohanty, S. P. (often involved in work using the PlantVillage dataset)

[2]. DIANA SUSAN JOSEPH 1 , (Student Member, IEEE), PRANAV M. PAWAR 1 , (Member, IEEE), AND KAUSTUBH CHAKRADEO. Pranav M. Pawar (pranav@dubai.bits-pilani.ac.in)

[3]. Kumar, M., Gupta, P., Madhav, P., & Sachin, "Disease Detection in Coffee Plants Using Convolutional Neural Network", 2020.

[4]. International Journal of Engineering Research & Technology (IJERT) 1Mr.V Suresh, 2D Gopinath, 3M Hemavarthini, 4K Jayanthan, 5 Mohana Krishnan 1Assistant Professor, CSE Department, Dr.NGP Institute Of Technology