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CLASSIFICATION OF PLANT LEAF DISEASES USING MACHINE LEARNING AND IMAGE PREPROCESSING TECHNIQUES WITH SMART AGRICULTURE

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***Abstract*— Farm crops are often ruined by various diseases. This means the farmers have to incur huge losses. They can't barricade their entire fields or remain on the field all day. We propose here a leaf disease detection system with smart agriculture. In this system, the various sensor detects wildlife and environmental conditions on the eld, as well as possible intruders. When any suspicious activity or condition is detected, it reports to the owner of the field. It acts as a system that is adaptable and provides farmers with a practical means of protecting their crops from major diseases and land from attacks. This system proposes a machine learning approach that is based on improved convolutional neural networks (CNNs) for the real-time detection of leaf diseases. The smart Agriculture part checks the water level in the soil if it is low the system will automatically send readings to farmers. It also has a smoke sensor if smoke is detected the system will automatically sprinkle water in the field. This ensures the complete safety of crops thus protecting the farmer's loss.**

***Keywords*—machine learning, CNN algorithm, detection, monitors, report, moisture, smoke, sensor**

I. INTRODUCTION

India is agricultural land. In India, framing was the most critical economical sector. Around 50%-60% of the Indian population's income is based on farming, but the farmers still experience too many issues with it. Accordingly, changes in environmental conditions, as well as an increasing percentage of toxic gasses, raised various unhealthy conditions step by step which is influencing the forest, crops, and wildlife property that makes struggle among humans and creatures. Agriculture is the foundation of the economy putting a contribution of around 18%-20% of GDP. nevertheless, would bring about gigantic harvest misfortune due to crop disease on agricultural land. Crop disease and other creatures entering into people's place of residence have bought adverse consequences in different ways, for example, crop annihilation, harm to food stores, water supply, homes, and other properties, injury, and human demise. In many different surveys, it is founded that due to unwanted storms, unhealthy conditions give rise to various plant diseases which leads to farmers in difficult situations. These issues where huge amounts of cash are squandered and life is in danger. Conventional techniques trailed by farmers aren't much viable and it's not achievable to recruit monitors to focus an eye on the yields and prevent nature creatures. Consequently, this zone is to be checked consistently to forestall this sort of disease.

II. LITERATURE SURVEY

A. REAL-TIME DETECTION OF APPLE LEAF DISEASE USING DEEP LEARNING

In The work, the deep learning approach is used which is based on improved convolutional neural networks (CNNs) most probably used for the real-time detection of apple leaf diseases. The apple leaf disease dataset having images of around 26,377 is trained to detect apple leaf disease. The experimental results show that the INAR-SSD module provides a detection performance of around 78.80 which is high- a performance solution for early diagnosis of leaf disease.

B. USING DEEP LEARNING FOR IMAGE-BASED PLANT DISEASE DETECTION

This project aims to train a deep convolutional neural network to identify crop species as well as diseases. The trained module achieves an accuracy of 99.35% which is a higher than expected range.

C. SMART AGRICULTURE AND ANIMAL DETECTION SYSTEM IN FARM AREAS

In this project, the ultrasonic sensor is used to detect the movement of the animal, depending on its distance from the plant as well as the range from the sensor. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound.

D. A SMART AGRICULTURE USING RASPBERRY PI WITH THINGSPEAK FOR MONITORING REAL-TIME DATA

In this project, think speak is used for real-time monitoring of the data of various sensors used in the project. The Raspberry Pi 3B+ has an inbuilt Bluetooth and wifi module which helps to connect and share data with thingspeak.

III. LITERATURE SUMMARY

As mentioned in the above research papers, it can be seen that this system will enable the farmers to detect the diseases and protect their fields effectively, without any human intervention. Some of the projects used LCD displays which

failed to implement remote monitoring. It is better to use cloud-based applications for remote monitoring. For users to communicate with the system.

IV. SMART AGRICULTURE :

A. *Hardware used :*

1)Raspberry Pi 3B+ :

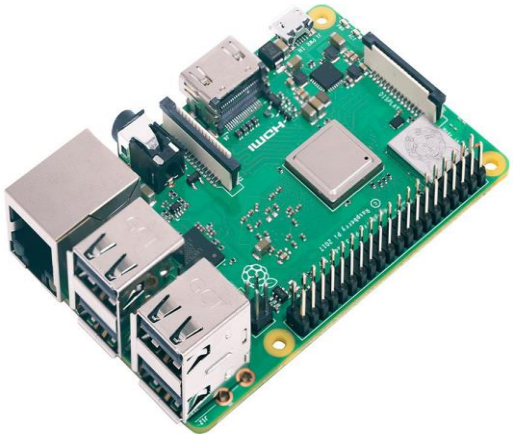

Fig 1: Raspberry Pi 3B+

The Raspberry Pi is Quad Core 1.2GHz Broadcom BCM2837 64bit CPU. It has 1 GB RAM and comes with wireless LAN and Bluetooth low energy (BLE) o board.it also has 40-pin extended GPIO,4 USB 2 ports used as a small CPU.

2)Ultrasonic Sensor :

Fig 2: Ultrasonic Sensor

The ultrasonic sensor is a device that is used for measuring the distance between target objects with help of ultrasonic waves and coverts reflected waves into electronic signals. It has a Measurement Range of 3cm – 350cm 2cm – 400cm and required a Working Voltage of 3.3V / 5V and an Operating current of 8mA-15mA

3)DHT11 Sensor :

It is a basic ultra-low-cost digital temperature and humidity sensor. sensor readings can be up to 2 seconds old. It required a Working voltage of 3.3 or 5V Dc as well as an Operating Current of 3.3 or 5V DC. The measurement range is 20-95 percent RH0-50°C

Fig 3: DHT11 sensor

4)MQ135 Gas Sensor :

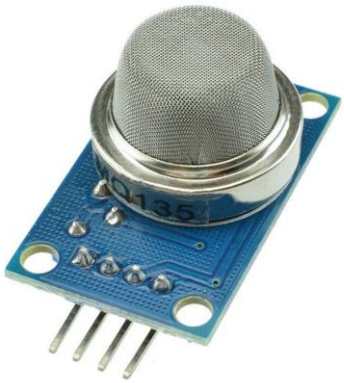

Fig 4: MQ135 sensor

It is used for detecting gases like NH3, NOx, alcohol, benzene, smoke, and CO2. It is High sensitivity to Ammonia, Sulfide and has a Stable and Long-Life Detection Range: 10 - 300 ppm NH3, 10 - 1000 ppm Benzene, 10 - 300 Alcohol Dimensions: 18mm Diameter, 17mm High excluding pins, Pins - 6mm High

5)MQ9 Somke Sensor Module

Fig 5: MQ9 Gas Sensor

Gas detectors can be used to detect combustible, flammable, and toxic gases, and oxygen depletion. This type of device is used widely in industry and canbe found in locations, such as on oil rigs, to monitor manufacturing processes and emerging technologies such as photovoltaic

6)Rain sensor :

Fig 6: Rain sensor

Rain sensor switching device activated by rain.it required a 5V VCC supply and GND connected to the ground. D0 is the digital pin used to get digital output while A0 is the analog pin used to get analog output

7)Moisture sensor

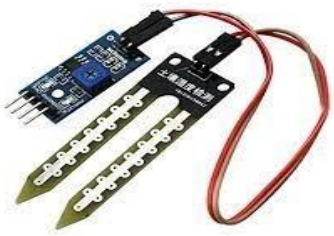

Fig 7: Moisture Sensor

The main function of sensors is to measure the volumetric water content in the soil. It uses properties like electric resistance and dielectric. The operating voltage required is DC 3.3V - 5V and a current of 35mA

B. ***Software used :***

*1)**Proteus 8.10 :***

Proteus is used for designing the circuit diagram and also for simulating it. We used the 8.10 version which is very efficient for the work. It is also used for PCB designing.

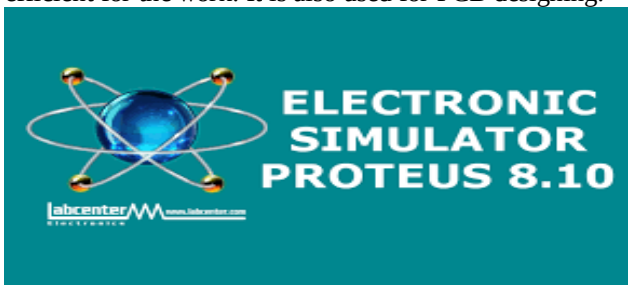

Fig 7: Proteus

2) ***ThingSpeak:***

Fig 8. ThingSpeak

Thinfspeak is used for representing sensor data in graphical format. The live data can be monitored through thingspeak

C. ***Block Diagram :***

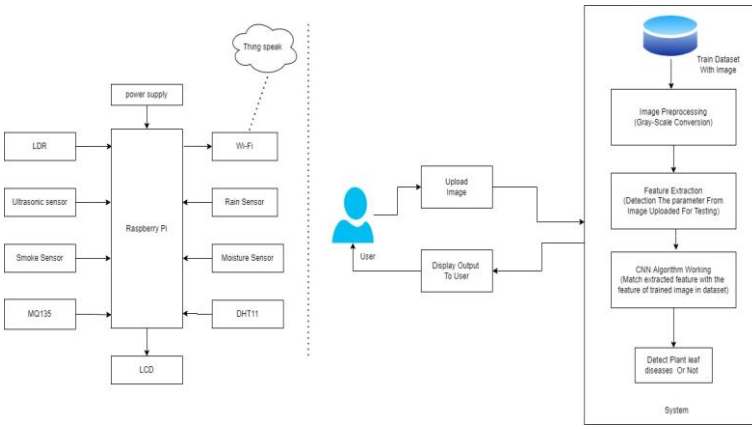

Fig 9: Block diagram

The block diagram is divided into two parts. One is for hardware and the other is for software. In hardware, all sensor collects the information and converts it into digital data, which is displayed on Thingspek.In software, the user uploads an image which goes under the Image processing phase. After converting the image to a grayscale image and feature extraction it undergoes CNN algorithm working and finally we will get the final output.

D. ***Schematic Diagram :***

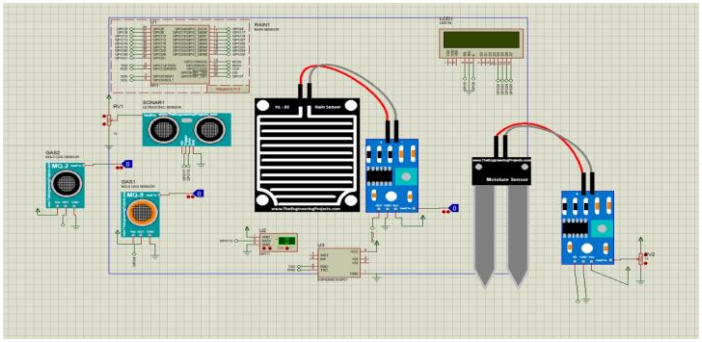

Fig 10: Schematic Diagram

E. ***Hardware Implementation :***

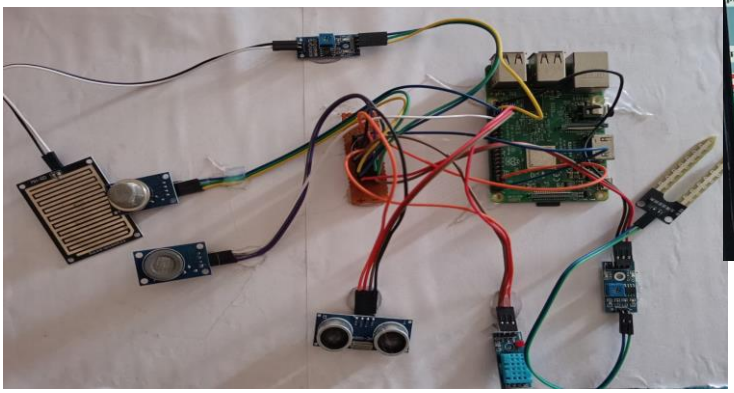

Fig 11: Hardware implementation

V. IMAGE PROCESSING AND ALGORITHM

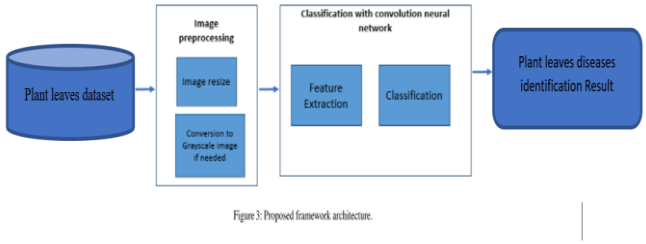

Fig 12: The proposed framework architecture

In local or global repositories, we can store our dataset containing large numbers of healthy and infected leaves image samples. In this phase, the selected image from a dataset is resized to 60*60 pixels and then converted to a grayscale image.

Algorithm:

1. Deep learning-based classification has been done in which neural networks having multiple neurons which are in the adjacent layer are connected to each other.
2. CNN has three parts convolution, pooling, and fully connected layers which are used for the classification and identification of leaf diseases.
3. In the features extraction part network learns how to detect the new features of the input image through sequence convolution and pooling layer. For convolution, we use the activation function which is ReLu. While pooling layer helps to reduce the size of the feature map.
4. In the proposed system the input images undergo the above process and the image is getting classified through a classifier.

Results:

A) Plant leaf diseases detection result (fig 13.a)

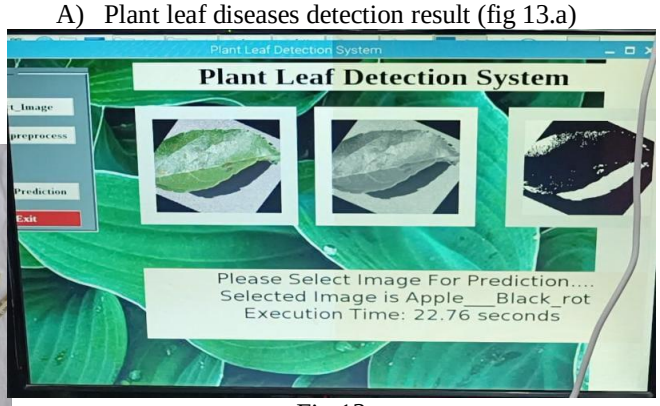

Fig 13.a

B) Sensor results (13.b)

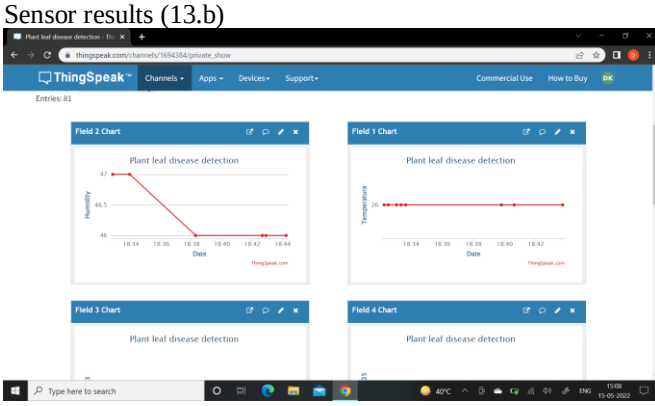

Fig 13. b

Conclusion:

In India, Agriculture is the main source of income, which plays a major role in the Indian economic sector. But nowadays, farmers do not have any idea about new emerging technologies for the agriculture sector. Machine learning is one of the technologies that is causing a revolution in the agricultural sector. Our system predicts diseases and assists farmers in monitoring with less manpower, allowing them to increase production and income.

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