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A Survey on Crop Identification Technologies

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ABSTRACT—

Most crop losses in agriculture are the result of incorrect crop choices for a given plot of land. In general, farmers are unaware of the crop's needs in terms of soil moisture, nutrients, and other factors. Farmers may experience distress as a result, both emotionally and financially. A farmer also frequently deals with pests and diseases that might harm the crops they raise but that they are typically ignorant of at an early stage. To determine if the plant is healthy or sick, a framework has been developed. Plant disease does have a real impact on the normal growth of the plants, their production, and their nature as horticultural products. The endeavour to develop a robotized system that can detect the presence of illness in plants. Based on the diversity in plant leaf health status, a mechanised disease recognition framework is developed using sensors like temperature, moistness, and shadowing. To determine the proximity of plant disease, characteristics related to temperature, mugginess, and shade are used.

Keywords—Plant diseases; IoT; temperature and humidity sensor; NPK and Ph sensor.

I. INTRODUCTION

A. Background and Motivation

An essential component of the Indian economy is agriculture. A significant indication of the importance of agriculture to the overall economy is the sector's approximate 18% contribution to India's Gross Domestic Product (GDP), which on average employs 50% of the workforce. Poor agricultural results can result in intensification, pain and suffering for farmers, as well as social and political misery. All of these things can cause a crisis and have an impact on the economy. Agriculture has been in decline recently. With advance in technology, many updated technology has been applied in agriculture sector to improve the health of crops named Precision agriculture. A better name for precision agriculture might be “site-specific agriculture”. Indian farmers tend to choose unsuitable crop for their soil and this problem can the problem to precision agriculture where the soil characteristics like soil type, texture, pH value etc are employed to determine that which crop is suitable for cultivation in that soil. This minimizes the risk of cultivating inexact crop which collectively results in better crop yield from a particular land holding . Once the seeds are sown it's important for farmers to prevent it from insects and weed. Generally Indian farmers prevent their crops by detecting the pest manually and removing them which requires intense labour At various stages of plant development, a thorough examination of the plant's health is necessary to detect any potential problems. Agriculture experts and farmers have the most stringent requirements when it comes to disease identification in plants.

B. IoT in Plant Disease Detection and crop identification

The most stringent requirement for farmers and agricultural specialists is the diagnosis of illnesses in plants and crops. The suggested framework's main goal is to use the Internet of Things (IoT) to identify crop and identify plant illnesses. According to the needs of the soil and minerals, the farmer must choose the crop. On plant leaves, the disease first manifests itself. Therefore, we have taken into account the location of plant disease that is present on leaves in the suggested work. Based on variations in temperature, moisture, and shadowing, it is possible to assess the separation of healthy and diseased plant leaf.

The NPK sensor is what we are employing. The NPK sensor measures the soil's levels of nitrogen, potassium, and phosphorus. To estimate the PH in the soil, a soil PH metre is employed. The DHT11 temperature sensor was used. The temperature of the leaf under consideration is determined by the DHT11 sensor. Through the wifi shield attached to the Arduino UNO board, the sensor's parameters are transmitted to the cloud platform. the data that has been saved for analysis at the cloud stage. When the temperature of the leaf is considered, if it does not fall within that range, the leaf is considered unhealthy.

Plant illness is frequently detected by changes in the shade of plant tissue. These colour changes are caused by the characteristic green tissue becoming yellow due to the destruction of chlorophyll or an inability to produce chlorophyll. The shade of the leaf being considered is detected by the shading sensor, which is another characteristic used to determine if the leaf is healthy or unhealthy.

II. LITERATURE REVIEW

This study demonstrates crop identification using soil PH, mineral needs, and pest detection using leaf chlorophyll content. Ayurveda and other plant-based medical systems employ the identification of plants by their leaves for a variety of purposes, including ecology, horticulture, disease detection, rare plant preservation, and Ayurvedic medicine. Our goal in this project is to use neural networks to digitally identify different plant species from an image of a single leaf. Convolutional neural networks, Tensorflow, and Keras will be used to approach our project. The aforementioned method produces good outcomes with great precision. [1]. In addition to maintaining the earth's ecosystem plants provide us with oxygen, food, medicine, and fuel. The accurate identification of plant species is a very challenging task because plant species identification requires specialized knowledge and in-depth training related to botany. Even for botanists themselves species identification is often a difficult task. Therefore, there is an urgent need to develop an automatic plant leaf recognition system. Many researches focuses on plant leaf based identification, since its easier to access as compared to other pieces of a plant. This paper provides a survey on the methods and classifications used to identify the various plants in the recent years [2]. The agriculture industry has great potential to reduce food shortages and supply wholesome, nutritious food. Farmers face a difficult task in identifying crop insects since pest infestations cause significant crop damage and quality degradation. The disadvantage of traditional insect identification is that it requires skilled taxonomists to correctly identify insects based on physical characteristics[3]. Digital image processing has made significant strides thanks to deep learning, which is significantly superior to conventional techniques. Researchers' top research concerns now centre on how to identify plant diseases and pests using deep learning technologies. This paper defines the difficulty with detecting plant diseases and pests and makes a comparison to conventional techniques for doing so. This study describes recent deep learning-based research on plant disease and pest detection from three perspectives: classification network, detection network, and segmentation network. The benefits and drawbacks of each approach are briefly discussed[4]. Finding diseases on crops is a time-consuming and vital task in agricultural practises. Both a lot of time and competent labour are needed. In this study, computer vision and machine learning approaches are proposed as a smart and effective method for crop disease identification. The proposed approach has a 93% accuracy rate for detecting 20 distinct illnesses in 5 popular plants[5]. Life is basically dependent on plants. Identification of plant species, weed categorization using hyperspectral imaging, tracking of leaf growth, plant health monitoring, and semantic interpretation of leaf information are all included in the field of plant science. Botanists can distinguish between different plant species by comparing the texture of the leaf, the arrangement of the leaflets in compound leaves, and the form of the leaf, tip, base, edge, and vein. Since computers are unable to understand visual information, it is necessary to independently analyse image shapes, colours, textures, and moments before turning them into features. It is possible for identical images to differ in terms of geometric and photometric variances[6]. We explore categorising the white bean, red bean, and soybean species of legumes in particular. By using a CNN, which is a standard component of modern pipelines, bespoke feature extractors are avoided. Additionally, the accuracy of the pipeline alluded to is greatly improved by this deep learning approach. We also demonstrate how deepening the model allows for the claimed accuracy. Finally, we are able to identify pertinent vein patterns by using a straightforward visualisation technique to examine the resultant models. [8].

III. MATERIALS AND METHODOLOGY

The suggested framework includes crop identification based on soil moisture, PH, minerals, and other requirements. A appropriate field must be used to raise a suitable crop. The suggested framework consists of sensors for temperature, moisture, and shading that collect data from plant leaves based on the variation of plant leaf temperature, mugginess, and shade. The data gathered from the leaves includes details on the present environmental conditions, such as temperature, moisture content, and shading. With the help of the Arduino programming, sensors for temperature, moisture, and shading were analysed together with crop identification. After being specified for an Arduino UNO unit, the data obtained from crop identification, temperature, moisture, and colour sensors is then sent to the farmers. The system makes use of WiFi shield to transfer data from the host system to the cloud platform for analysis. To determine whether the leaf under consideration is typical or affected, the data collected in the cloud step is subsequently compared to the dataset as a whole. The Figure.1 indicates the plant leaf affected by the disease. The Figure.2 indicates the proposed methodology.

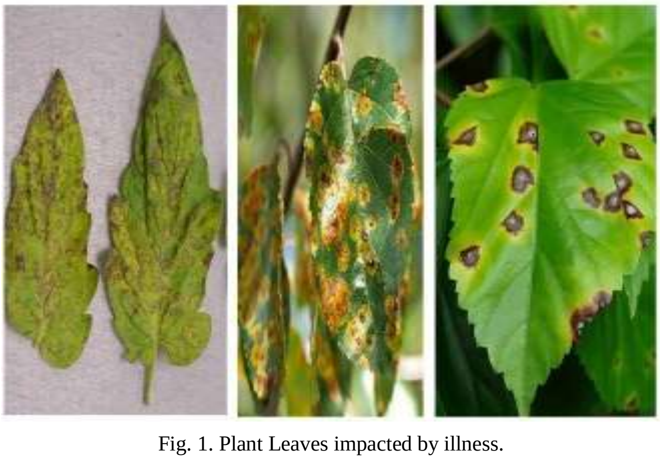

Fig. 1. Plant Leaves impacted by illness.

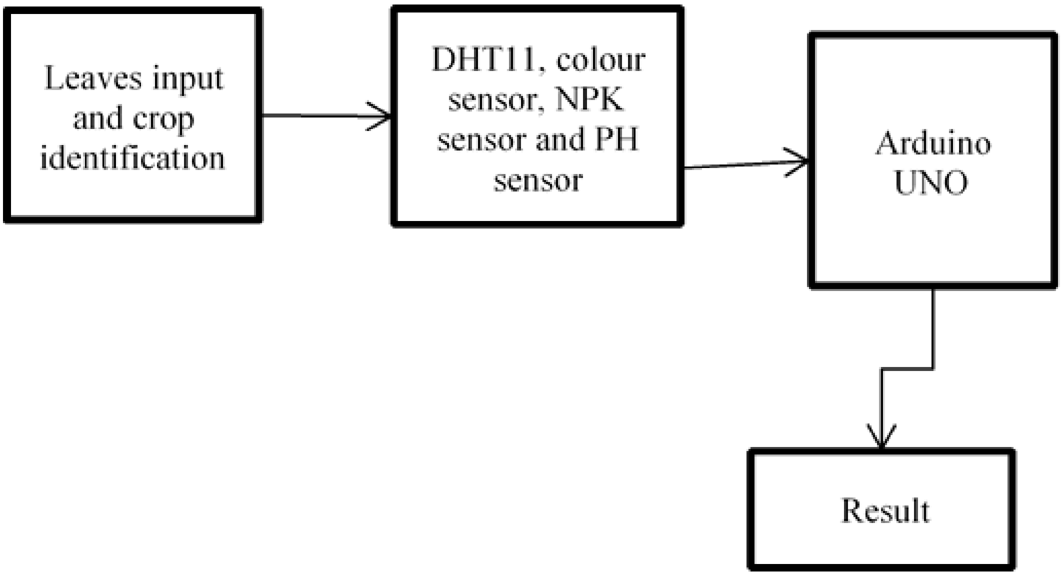

Fig 2 Proposed methodology

1) *Information obtaining:* Here, we categorise the crops based on the minerals, soil PH, and soil requirements, and we draw our conclusions from testing of various leaves. The sensors then identify these leaves and determine whether they are healthy or harmful.

2) *Temperature sensors:* The DHT11 is used to detect the temperature in the leaves. Based upon the temperature we can predict the leaves is affected or not.

3) *Humidity sensor:* The DHT11 is used detect the humidity in the surrounding environment.

4) *Color Sensor:* The TCS3200 A single monolithic CMOS integrated circuit houses adjustable silicon photodiodes, a current-to-frequency converter, and a programmable colour light-to-frequency converter. The output is a square wave with a frequency that is directly proportional to light intensity (irradiance) and a duty cycle of 50%.

5) *Arduino:* Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

6) *NPK Sensor:* The soil NPK sensor is suitable for detecting the content of nitrogen, phosphorus, and potassium in the soil. It helps in determining the fertility of the soil thereby facilitating the systematic assessment of the soil condition.

7) *PH meter:* A pH sensor, also called probe or electrode, is an important tool that allows a user to determine the alkalinity or acidity of a solution. The glass membrane at the end is sensitive to H^+ ions.

Fig. 3. DHT11 sensor.

Fig. 4. Tcs3200 to extract colour from leaves .

Fig. 5. Arduino UNO

Fig.6. NPK sensor

Fig.7. PH sensor

8) *Cloud stage:* Here we utilize "ThingSpeak" cloud stageto send the detected information to the cloud.

Algorithm 1: Identification of the crops and the plant disease using NPK sensor, PH sensor, temperature and color sensor.

Input: Soil**,** leaf (infected or Normal)

Output: Minerals in the soil and ph of the soil, Normal or diseased plant leaf

Description: Given mineral is nitrogen and temperature range for the leaf to be healthy is 15-300C

Start

Step 1: Get soil and leaf for acquisition.

Step 2: measure soil using the NPK and PH sensor and temperature, color of the leaf using the DHT11and TCS3200 sensor.

Step 3: calculate the soil contents and color, temperature of the leaf. Display " Nitrogen is detected and Leaf is Normal"

else

Display " Nitrogen is not detected and Leaf is Diseased" Stop

IV. CONCLUSION

In this paper, a framework is created to identify the crops and nature of the leaves. The proposed strategy utilizes the sensor gadgets to recognize the parameters like minerals, PH, temperature, stickiness and shade of the leaves, which are then contrasted with the informational index with check whether the gathered qualities falls in to the range determined in the informational collection. The proposed model utilizes the identification of the crops. The proposed model can be utilized in various territories by ranchers, botanists, nourishment designers and doctors. The roads for further work here is the point to utilize the picture handling methods alongside the proposed framework to make it progressively proficient and furthermore exact to decide the qualities and to characterize whether the leaves are unhealthy or healthy. Here we can fabricate a mechanized framework with the goal that it is valuable for the enormous scale creation and furthermore helps for identification of the crops and early discovery of the sicknesses that helps the customers for the better execution and upgrades the harvest yield. The proposed framework is constrained to identify the crops which crop grown on what soil and what are the requirements for the crop to be grown and identify whether the leaf under thought is solid or infected.

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