International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 03 | March - 2024 SJIF Rating: 8.176 ISSN: 2582-3930

CROP DISEASE SOLUTION BY EXPERT AND MACHINE LEARNING

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Abstract - Considering the population growth rate of recent years, a doubling of the current worldwide crop productivity is expected to be needed by 2050.Diseases are a major obstacle to achieving this productivity outcome. Therefore, it is very important to develop efficient methods for the automatic detection, identification, and prediction of pests and diseases in agricultural crops. To perform such automation, Machine Learning (ML) techniques can be used to derive knowledge and relationships from the data that is being worked on. This paper presents a literature review on ML techniques used in the agricultural sector, focusing on the tasks of classification, detection, and prediction of diseases and pests, with an emphasis on tomato crops. This survey aims to contribute to the development of smart farming and precision agriculture by promoting the development of techniques that will allow farmers to decrease the use of pesticides and chemicals while preserving and improving their crop quality and production.The technology based modern agriculture industries are today‟s requirement in every part of agriculture . In this technology, the disease of plants is precisely controlled. Due to the variable atmospheric circumstances these conditions sometimes the farmer doesn‟t know what type of disease on the plant and which type of medicine provide them to avoid diseases. This research developed for crops diseases detection and to provides solution by using image processing techniques. We have used Android Studio to develop the system. The crops diseases solution system is compared the image of affected crops with database of Crops Diseases Detection and Solution system. If Diseases Detection and Solution system detect any disease symptom, then provide suggestion so that farmers can take proper decision to provide medicine to the affected crops. The application has developed with user friendly features so that farmers can use it easily.

***Key Words*:** Plant Diseases, Precision Farming, Machine Learning; Smart Farming, Crop Disease.

1.INTRODUCTION

ndia is an agricultural country, wherein about 70% of the population depends on agriculture. Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. However, the cultivation of these crops for optimum yield and quality produce is highly technical. It can be improved by the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life.Agriculture has become much more than simply a means to feed ever growing populations. Plants have become an important source of energy, and are a fundamental piece in the puzzle to solve the problem of global warming. There are several diseases that affect plants with the potential to cause devastating economic, social and ecological losses. In this context, diagnosing diseases in an accurate and timely way is of the utmost importance.There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms associated, or those appear only when it is too late to act. In those cases, normally some kind of sophisticated analysis, usually by means of powerful microscopes, is necessary. In other cases, the signs can only be detected in parts of the electromagnetic spectrum that are not visible to humans. A common approach in this case is the use of remote sensing techniques that explore multi and hyper spectral image captures. The methods that adopt this approach often employ digital image processing tools to achieve their goals. However, due to their many peculiarities and to the extent of the literature on the subject, they will not be treated in this system Most diseases, however, generate some kind of manifestation in the visible spectrum. In the vast majority of the cases, the diagnosis, or at least a first guess about the disease, is performed visually by humans. Trained raters may be efficient in recognizing and quantifying diseases;however, they have some associated disadvantages that may harm the efforts in many cases.Our research focuses on the crop disease solution.Agriculture and human social development go side by side as the production of crops made it possible for primitive man to settle down in selected spots leading to formation of society.Though,in Agricultural Department technology is rapidly changing, many automatic technologies are coming in the market (example, Automatic planting, cutter machines etc which helps the farmer to produce maximum products). Crop disease is an important concern for the farmers because crop disease is an impairment of the normal state of the plant that interrupts or modifies its vital functions.To get solution on Crop disease If farmers decide to take advice from agricultural expert regarding the treatment of incidence of pest /disease/trait to their crop/plant in order to increase the crop productivity then he may face following situations .

i) Sometimes they have to go long distances for approaching the expert.

ii) Even though they go such distances expert may not be available at that time.

iii) Sometimes, the expert whom a farmer contacts, may not be in a position to advise the farmer with the available information and knowledge.

In these cases seeking the expert advice is very expensive and time consuming.Hence expert systems are needed. Expert systems enable farmers in identifying type of diseases; making the right decision and selecting the proper treatment. The expert systems are intelligent computer programs that are capable of offering solutions or advices related to specific problems in given domain, both in a way and at a level comparable to that of human expert in a field. One of the advantages of using this systems is its ability to reduce the information that human users need to process, reduce personnel costs and increase throughput. Another advantage of expert system is that it performs tasks more consistently than human experts.There are various kinds of abnormality states present on the plants leaf which can be identified by mean of manual inspection. The image processing and pattern recognition techniques play the worth full role to convert manual process to automate the process. Hence we are proposing an crops disease solution system which helps a farmer to identify the disease of crops and provide treatment for his crops according to disease using image processing techniques without help of any crops diseases expert.

2. Body of Paper

Crop disease solution by expert and machine learning is an innovative approach that uses advanced technologies to detect, identify and treat crop diseases. This solution combines the expertise of agricultural experts with the power of machine learning algorithms to accurately detect crop diseases at an early stage. Crop diseases can cause significant losses in crop yield and quality, posing a serious threat to global food security. The timely detection of crop diseases can help farmers take appropriate measures to control the spread of the disease and prevent further crop damage.With the help of this solution, farmers can obtain accurate diagnosis and expert advice on how to manage crop diseases. The system uses machine learning algorithms to analyze data collected from sensors embedded in the fields and generate real-time alerts when crop diseases are detected. The data collected includes information such as temperature, humidity, soil moisture, and other environmental conditions that affect crop growth.The system then uses machine learning algorithms to analyze the data and identify patterns that indicate the presence of crop diseases. Using this information, the system can provide recommendations to the farmers on the best course of action for preventing the spread of the disease and minimizing the effect on crop yield.Crop disease solution by expert and machine learning offers a cost-effective and efficient approach to crop disease management. The solution not only helps farmers to protect their crops but also improves agricultural productivity and food security, thereby contributing to the sustainable development of the agriculture sector.

Following is System Architecture of proposed system :

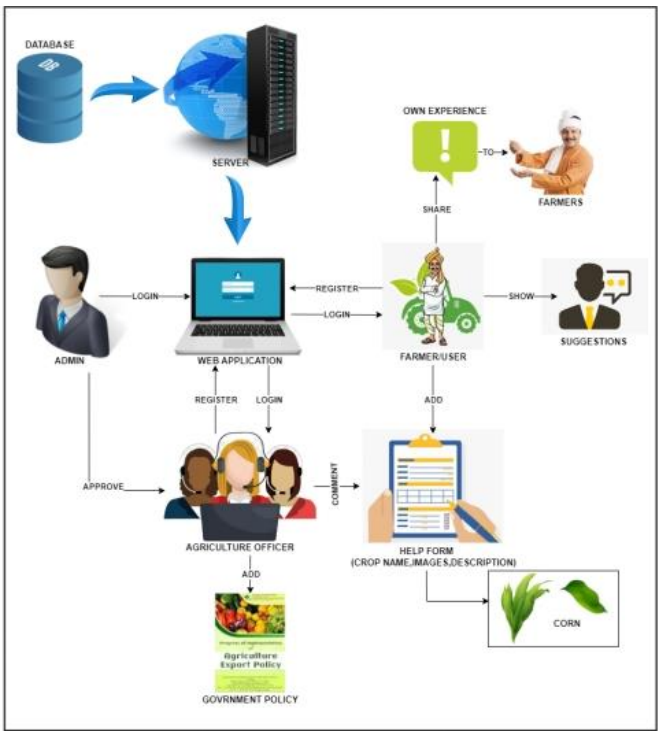

Fig -1: Figure

I. PLANT DISEASE DETECTION FOR AGROBOT

Today various means are available to increase yield in production and reduce human efforts. Technologies have been vastly developed and spread in all fields including agriculture. One of the inventions is agricultural Robot. Agrobot or agricultural robot or Agribot is an agricultural robot used for performing various agricultural tasks. It performs all sorts of agricultural tasks from seeding to spraying pesticides. This reduces human efforts, increases yield and decreases cost of labor. Due to which one gets healthy food. Thus Agrobot is boon to farmers and society. Figure.1 shows general block diagram of Agrobot

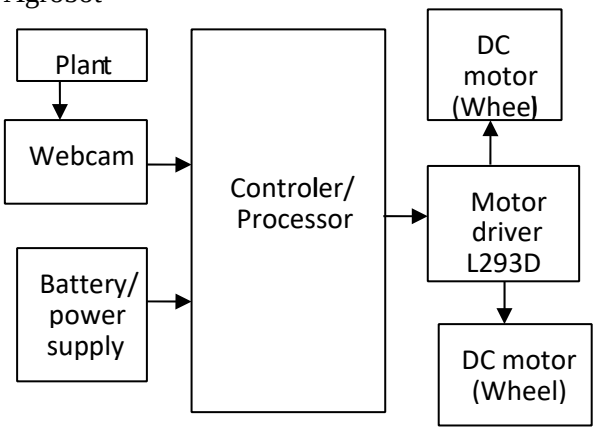

Fig 2.General block diagram of Agrobot

A. Webcam

Input to the system is given through Webcam. It captures images or video of plant and for further process is send to controller/processor. Webcam of resolution 640*480 and up to 30 Megapixel can be used.

B. Battery or Power Supply

The power supply or battery can be used to operate Agrobot. To drive DC motor 12V is required and for controller/processor it depends on which processor/controller is used. Hence 12V battery is used to drive DC motor [23].

C. Controller or Processor

Various controller or processors can be used for Agrobot. Controller or processor controls various units of robot and is heart of system.

D. DC Motor Driver (L293D)

To drive a DC motor, DC motor driver called L293D [23] is needed. The L293D driver is monolithic, high voltage and high current device. It has four channel drivers which are assembled in a16 lead plastic package [23]. For heat sink it has 4 centered pin connected together.

E. DC Motor

To physically drive the application like wheel in robot DC motors are used. These motors work on 12V [23] and needs motor driver L293D. One L293D can drive 2 DC motors.

Various diseases and their symptoms are explained in next section.

III. OVERVIEW OF PLANT DISEASES

Plants are infected by various pests. Various symptoms are seen such as color change of leaves, texture or shape change. In India various types of cash crops, vegetables or fruits are planted at different places. Hence various diseases are observed on leaves and stems of plant due to various pests. They cause damage to plant severely. Diseases on plants may be fungal, viral or bacterial.

Some of diseases and their symptoms are explained in brief as-

A. Diseases and their symptoms on foodgrains

In India major food grains are rice, wheat, maize, millets (jowar, bajra) and pulses. Few diseases on rice, wheat and maize with their symptoms are described in brief in this section. Sheath blight is major disease of rice plant with symptoms like lesions on sheaths of lower leaves and with age may grow irregular [3] tan to brown border. Figure.2 shows sheath blight in rice.

Fig.3. Sheath blight in rice

Rust on wheat are of two types mainly brown or orange rust and yellow or stripe rust both of which are found on leaves with brown and dark brown [3] in color respectively. Figure.3 shows brown rusts on wheat.

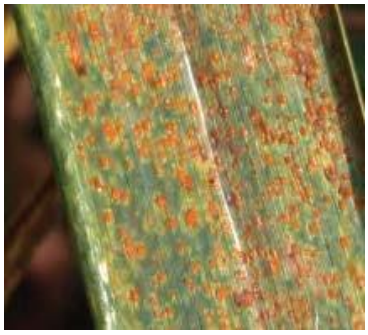

Fig.4. Brown rust on wheat

Similarly in Maize leaf blight shown in figure.4 affected by fungus causes yellowish round to oval spot on leaves and gradually turns to grayish brown [3].

Fig.5. Leaf Blight in maize

B. Diseases and their symptoms on cash crops

A cash crop grown in India consists of cotton, sugarcane, groundnut etc. In sugarcane, rust causes minute, elongated and yellow spots. It later grows dark brown to black on lower surface of leaves. Also Grassy shoot shown in figure.5 is usually seen two months after planting. Leaves become pale yellow and plants appear bushy and grass like

[3].

Fig.. Grassy Shoot in sugarcane [27]

C. Diseases and their symptoms on fruit plants

Horticulture crops like banana, mango, grapevine etc. are also grown in India. These plants are also affected by various pathogens. In banana fungus attacks young fruits by causing Anthracnose disease shown in fig.7 turns fruit skin black. It results in ripening and shriveling of fruits. Also Vascular wilt affects plant by yellowing leaf blades.

Fig.7. Anthracnose on Banana [24]

V. DISSCUSSION AND REMARK

In this paper various techniques have been discussed for detecting and classifying various diseases on plants. To increase production in agricultural sector it is necessary to detect diseases on plants and take accurate measures. Hence image processing algorithms are one of the ways to detect various diseases and can prove helpful to farmers.

Most of the methods include pre-processing followed by feature extraction in detection of diseases. Neural network classifier to classify leaves disease has been chosen as classification tools. Color Co-occurrence for feature extraction is also proved to be helpful in many of plant diseases detection based on color and texture. Table1 gives summary of few methods and their accuracy.

Table1. Summary of methods

Crops	Algorithm/ classifier/ Methods	Accuracy
Soyabean leaves	SIFT algorithm [11] And SVM classifier	Correctly recognize plant species and accuracy is as high as 93.79% [11]
Cotton leaves	PCA/KNN [19]	Overall accuracy 95% [19]
Wheat leaves	PCA & Morphological features [9]	96.7% for wheat powdery mildew, 86.6% stripe rust [9]
Grape leaf	BPNN & K-means[14] [17]	Efficient leaf disease color extraction[14] and for Anthracnose [17] 76.6%

3. CONCLUSIONS

In this system, This Crops Diseases Solution System is working nicely and the system is very useful for farmers especially who are living in rural area and where the agricultural experts are not available. User can easily use this application. Any people can get solution any time using this application. The application is free of cost and does not require any additional device.

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