IJBPAS, November, Special Issue, 2021, 10(11): 540-550

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

PREDICTION OF LEAF DISEASE UTILISING INTERNET OF THINGS

ASHOK KUMAR KOSHARIYA[1*], ALAGUMEENA S[2], VIJAYA SRI KOMPALLI[3], ARUNA.S[4], PRASHANT GOVINDRAO AHERAHER[5] AND FILZA FAROOQ RUNGA[6]

1: Assistant Professor in Plant Pathology, School of Agriculture at Lovely Professional University Jalandhar Punjab

2: Post Graduate Student in MSc Bioinformatics at Sri Krishna Arts and Science College, Coimbatore, Tamilnadu, India

3: Computer Science and Engineering at Koneru Lakshmaiah Education Foundation, Vaddeswaram, Andhra Pradesh, India

4: Associate Professor in MCA Department at Sona College of Technology, Salem, Tamil Nadu, India

5: PhD Scholar in CSE Department at Mansarovar Global University Sehore M.P & Lecturer in Computer Technology S.H.H.J.B. Polytechnic Chandwad Maharashtra

6: M.Sc Scholar in Plant Pathology, School of Agriculture at Lovely Professional University, Jalandhar Punjab

***Corresponding Author: Ashok Kumar Koshariya; E Mail: ashokkoshariya@gmail.com**

Received 20th July 2021; Revised 22nd Aug. 2021; Accepted 30th Sept. 2021; Available online 1st Nov. 2021

https://doi.org/10.31032/IJBPAS/2021/10.11.1047

ABSTRACT

The internet of things is a system made up of actuators, sensor systems, both of which enable indirectly / directly internet access. Advances in the Internet of things could be utilized in smart farming to improve agricultural quality. Farming, which is the Indian economy's backbone, contributes to a country's overall growth. However, owing to the usage of antiquated agricultural technology, our production is quite low in comparison to the world average, & individuals from rural areas now are migrating to metropolitan areas for other profitable companies, so they are unable to concentrate on farming. Agriculture has always been innovative, but the Internet of Things is poised to take smart farming to the next stage. An Internet of Things system comprises actuator/sensors, or even both, that enable indirect or direct internet access. This study offers capabilities such as leaf disease detection, the server-based remote surveillance system, temperature & humidity sensing, & soil moisture detecting, among others. Rather than a manual inspection, it uses networks of the sensor to assess wetness, heat, & humidity. Different sensors were put at different agricultural areas; to manage all of these sensors, a single controller is known as the Raspberry PI has indeed been employed. Leaf illness can be identified using a camera and Raspberry Pi. The current state of a field, such as a leaf disease, as well as other environmental elements impacting the crop, such as humidity, heat, & wetness, are sent to the farmers via WIFI Server & Raspberry PI. The research of internet of things approaches is presented in this research to engross the usage of technologies in agriculture.

Keywords: Leaf deficiency, IoT, Smart Agriculture, Humidity control, Soil monitoring.

INTRODUCTION

Indian peasants' principal vocation is farming. Since the dawn of agriculture, great chemical & mechanical progress had been made to boost productivity and assist farmers in dealing with difficulties such as agricultural & crop diseases. However, there's been very little digitization in this industry. With the rise of the internet of things, there is a promise for developing a digital system for farming that would assist farmers in making informed decisions on their farms & proactively addressing certain undesirable conditions. As a result, it will aid in improving the quality of crops while also benefiting farmers **[1]**. Early disease detection is a major concern in the agricultural area. Producers used to hire a huge team of experts to diagnose diseases or damage to plants; however, because this method isn't common knowledge among farmers, these experts were expensive and time-consuming. Although automatic identification is more helpful than the lengthy process of specialist inspection, the automation method of detection of disease, which reduces disease diagnosis to simply surveilling effects on a plant leaf, is both inexpensive and more efficient. As a result, the image-processing method may be used to diagnose the condition in plants earlier on, alerting farmers & saving other crops against disease **[2]**.

The integration of sensor surveillance approaches with IoT was also a focus of this research. It was accomplished by connecting various sensors to the RPi-3 component. Different sensors are utilized in farming to detect characteristics such as soil moisture, heat, & humidity, fertilizer, and contribute to a farm's production. A site had been created to allow farmers to check on the present status of their plants. Modern internet technologies also are making it easier to manage farming activities.

Literature Survey

The existing form of agricultural surveillance is the manual technique, in which the producer checks variables such as moisture in the soil, humidity, and plant disease **[3]**. Presents the results of a poll on smart agriculture, which aims to boost agricultural & agricultural production. Field surveillance could be implemented with the aid of the Internet of things and sensors. The state of the farmland could be determined from any location, including one's own home. This report includes surveys on climate change, disease detection & analysis, fertilizer computations, soil, & agricultural water calculations. It explains the precision agriculture method's revolutionary approach. Mechanical equipment, sensors, & electronic circuitry are all used. To create a smart technology, Infrared sensors, optocouplers, and a crane framework was utilized **[4]**. This device is composed of a variety of sensors, including soil moisture detectors, thermistors, humidity sensors, & obstruction sensors.

A micro-controller is utilized to create a robotic that monitors agriculture **[5]**. That's the smartphone app paradigm that farmers use to keep track of their farm's state **[6]**. The peripheral interface controller micro-controller, as well as sensors such as soil, heat, humid, and passive infrared sensor, are employed in this device. The GSM module is utilized for wireless connectivity and had a sim to communicate with the landlord **[7]**. It explains how to identify plant diseases by applying textural statistics to crop disease diagnosis. For mask green px in a recorded RGB picture, first, transform it to Hue Saturation Value and then use masking. Following masking, texture analysis was done on these sections, as well as the texture variable is matched to the ideal texture variable of a plant **[8]**. This study describes the research of image processing techniques used for a variety of crops, including fruits, veggie, industrial, & grain crops. The specifically designed is for identifying fungus disease symptoms on a variety of crops. The database is used to store the texture of fungal infections on plants **[9]**. The technology uses Global system for mobile to monitor various the plant & sends the signal to the landowner, allowing for the prevention of additional loss **[10]**. The stem's main component is an Arduino. A wifi network system is created utilizing ZigBee. When it designing the sensor, every mode does have a set of a sensor attached to Arduino & ZigBee **[11]**. Cognitive values conveyed by ZigBee were evaluated & weaknesses in farming are discovered **[12]**. This work describes a method for detecting leaf illness utilizing picture segments, as well as a classification system for leaf diseases. Picture segmentation is one of the processes in this technique. The disorders are then classified utilizing expert approaches **[13]**. This research demonstrates a system that compares an uploaded picture of a sick leaf to database pictures. If the identical characteristic picture is identified, find the picture's relevant data and detect a plant leaves disease **[14]**. The AgroTick app is described in this document, which incorporates cloud computing, embedding firmware, a hardware component, & big-data analysis. This program can also be used to exchange agricultural expertise.

Proposed Work

Different sensors, such as a soil moisture sensor, a thermometer, as well as a camera for identifying illnesses on leaves, are used on the field. Sensor information is recorded and sent to the RPi via connected or wifi devices. Variables are validated and compared with optimum data values such as heat, humidity, & soil moisture on the application server. If there is a difference between the pre-defined threshold value and the actual value, a signal is sent to the landowner via his mobile phone or webpage. Sensor data is displayed along a webpage, as well as the farmer can get extensive data on his harvest and farm's environment from everywhere.

IJBPAS, November, Special Issue, 2021, 10(11): 540-550

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

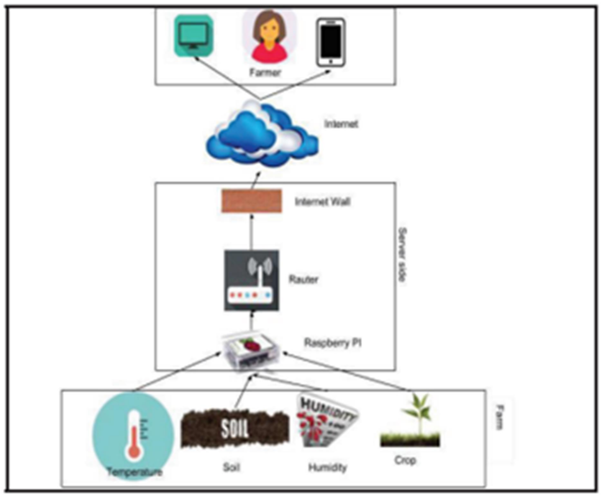

Figure 1: Architecture of detection of leaf disease using IoT

Image analysis is used to identify crop diseases. The camera is positioned close to the harvest to capture a picture of leaves. The taken picture is transferred to the server, where crop disease is diagnosed utilizing image processing algorithms **(Figure 1)**. The condition of leave is then relayed back to a farmer via the webpage & smartphone app.

Information and tools

RPI is among the most widely used industrial controllers. It functions similarly to a small computer, with USB devices, input & output ports, Wireless internet, High-Definition Multimedia Interface port, Storage device reader, as well as other features. The Rpi is powered by a Broadcom-2835 system on a chip, which comprises an ARM1176JZFS 700 MHz microprocessor, Core i5 GPU, & RAM 256 MB, which may be increased to 512MB subsequently. It lacks a hard disc or drive of solid-state, instead of relying on a Storage Device card for startup & permanent storage. Debian & Linux ARM versions are available for download from the Organization. Python is the major language of programming for the RPi board, and there are resources for it. Different types of sensors could be linked together, and sensor input is stored in the RPi by accessing sensors utilizing python/java programming, which is employed in this proto-type **[15]**.

The DHT11 sensor is utilized to detect either humidity and temperature in this setup. It is a reduced sensor that displays digital temperature and relative humidity output on the interface. It performs well when the humidity is almost 20 & 80 percent with a 5 percent accuracy as well as the temperatures is between 0-50 degrees Celsius with a ±2°C degree Celsius accuracy. After 2 seconds, the results are available. In this system, a DHT11 is connected to the RPI through adapters, and the output is sent to the server, where it is stored in a database file & displayed on the farmer's mobile at the same time. **Figure 2** shows the DHT11 sensor as well as its connection to the RPI circuit architecture.

The capacitor of a soil moisture sensor is used to determine the amount of water inside the soil. This sensor can output both analog and digital data. This works on the open-loop concept, which means that whenever the soil is wet, current passes through one port to another, as well as the loop completes, resulting in a low volt. When the soil dries, the current does not conduct current, as well as the loop acts as an open circuit, resulting in the max output. The Soil Moisture detector is platinum plated for maximum efficiency, antirust, and extended life. By tapping on the soil status bar on the farm owner's smartphone, the output of the sensor of soil moisture is displayed. Soil Moisture detector is connected to RPI via plugs as well as python language. Input & output pins of RPI are accessed, or whether the output is low or high is displayed on the port. This output is sent to the server, as well as the outcomes are saved in a data item and also displayed on the agriculture phone **(Figure 3)**.

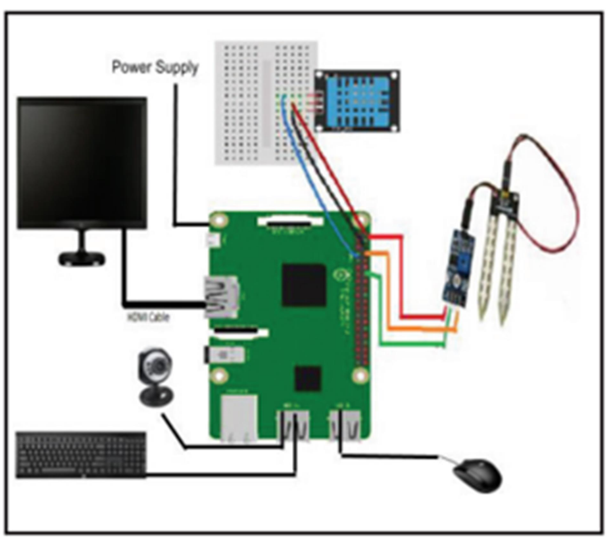

Figure 2: Sensor connected with the circuit

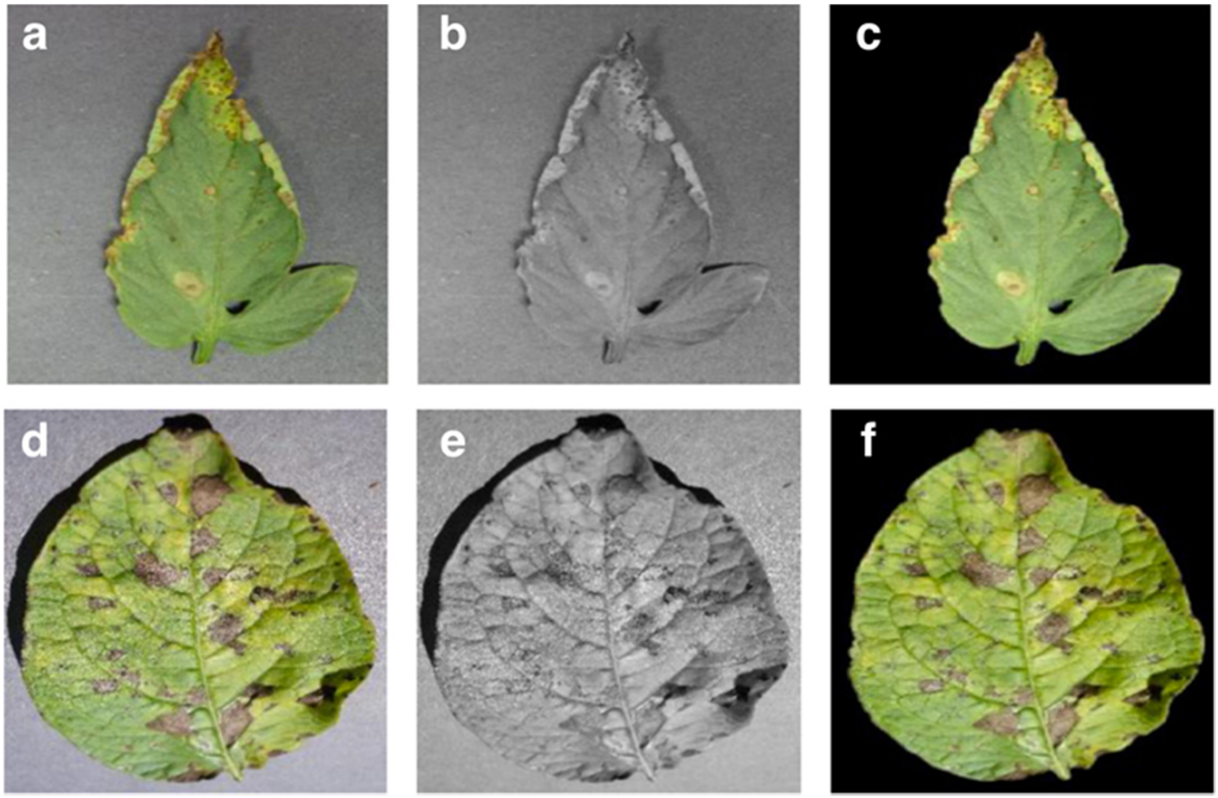

Figure 3: Variants leaf disease image

RPI uses the Raspbian os, which is a freeware os. The original RPi website has an installation manual. The ease with which OpenCV can be installed and used in Raspberry pi 3 is one of the main reasons for adopting this operating system. Python is a programming language used by processors & controllers including Arduino, RPi, as well as other similar devices. This language will be used for all sensor-related coding. Because the coding resembles that of fundamental C, this language is fairly easy to accomplish. The Python IDE ver 3.3 had been used by the system. Image processing is a technique for analyzing a picture & extracting information from it using several methods available in the OpenCV library, such as masking, classification, & extraction of features. According to the survey, nearly 99 percent of crop clinical manifestations appear on the leaves of the crop, and the health of the crop may be determined by looking at any leave of the crop.

OUTCOMES AND DISCUSSIONS

The state of the crop could be determined using techniques of image processing. The following methods are performed to detect this situation:

In a nutshell, the human visual detects light from surrounding and recognizes color. The frequency-sensitive cells of the eye are used to identify the color. There are 3 kinds of frequency-sensitive cells: Red, Green & Blue. The color picture is kept in 3 different kinds of matrices because of this. The RGB matrix is a sort of color matrix. K-mean clustering is the method that divides a picture into k clusters or kinds depending on the information supplied and the k means. When there is a need to discriminate among colors, this approach is applied **(Figure 4)**.

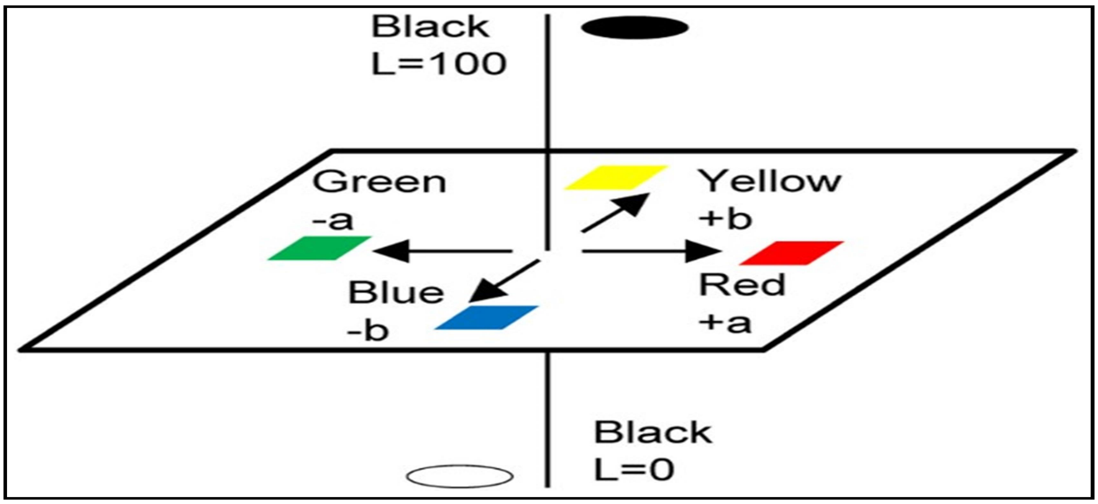

Figure 4: A color model of lab space

In this graphic, dark spots represent the center of several forms of color. The basic k-means technique is simple to understand. Initially, the k center of the cluster is chosen from a group of n data sets. After that, every point is allocated to the cluster center to which it is nearest. After then, the cluster centers are modified to reflect the median of all points allocated to that group. This procedure is repeated until the clusters are steady, as shown in Method. The cylinder coordinates representation of Red, Green & Blue model points is known as Hue Saturation Value. The full version of Hue Saturation Value is H as hue, S for saturating, & V as value; it's also known as Hue Saturation Brightness.

Disguising is used to draw attention to a specific color palette in a picture. The masking for the hue of green plays an important function in the diagnosis of leave disease. While masking a green color, other hues can be discovered, indicating which sections of the leaves are unhealthy. The idea behind such an approach is to determine the initial & final green pixels in a left picture horizontally, but then count sick pixels beneath these green pixels. If the amount of unhealthy PPI is higher than 30percent of the total group of healthy PPI, the leave is infected. Web-based application for detection of disease: This is the site's main page, which had 3 primary choices: Home, Condition, & Contact. It displays required details about harvests & corresponding figures on the main website. The condition page displays current information regarding soil, heat, humidity, & plant diseases, while the contact page displays contact information. Touching on Soil status displays soil moisture condition; clicking on Plant disease condition displays plant information; & clicking on humidity and temperature condition displays live updates **(Figure 5)**.

The outcomes of the detection of leaf disease were listed in **Figure 6**.

Figure 5: Sensors identified the leaf image using web porta;n

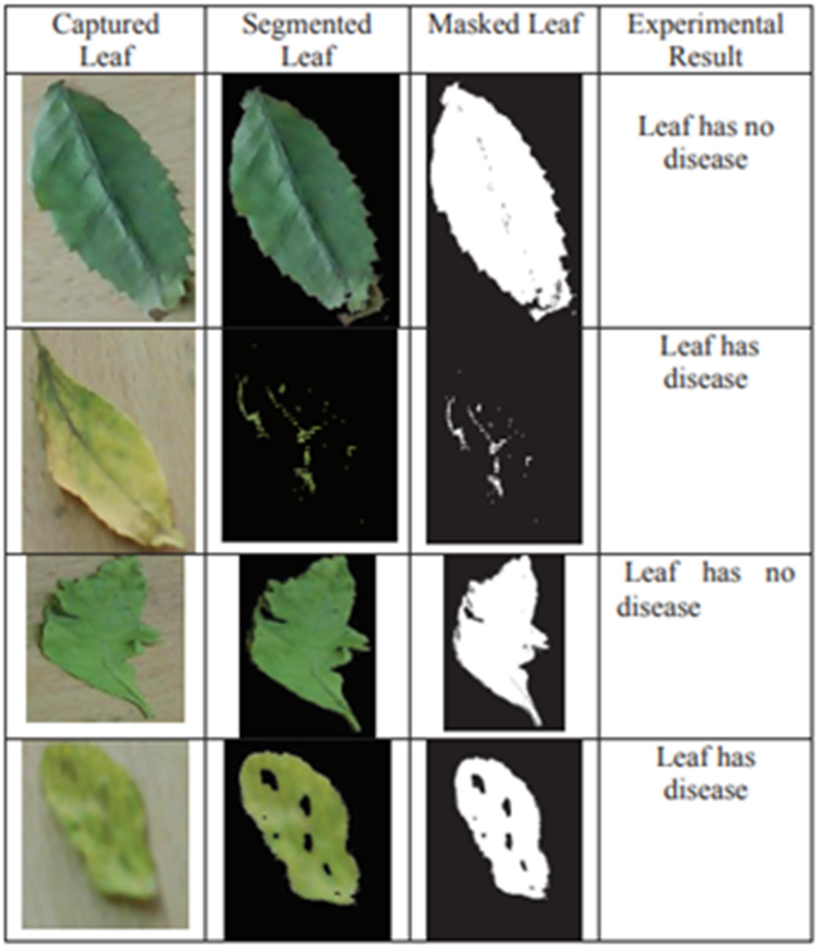

Figure 6: Leaf disease detection using different methods

CONCLUSIONS

The sensors & RPI have been successfully connected, as well as wifi communication via the internet of things has been created. Image processing methods are used to detect significant plant diseases. All inspections & analyses have been performed, demonstrating that it is the smart agriculture approach. This technique significantly boosts the landowner's total earnings by increasing crop production. To locate a plant diseases Solar energy is the key component that impacts the result when Image Processing is utilized. Pictures cannot be taken at nighttime, or if daylight is too bright to take the picture, or if light reflects as well as the color of the leaves also isn't recognized by the camera, therefore the outcomes may differ. An important factor is server energy; when there's no power, the entire system will be unable to do duties. Another key aspect of this technology is the camera quality.

REFERENCES

[1] Patil BV, Patil PS. A computational method for Cotton Plant disease detection of crop management using deep learning and internet of things platforms. In Evolutionary Computing and Mobile Sustainable Networks 2021 (pp. 875-885). Springer, Singapore.

[2] Maneesha A, Suresh C, Kiranmayee BV. Prediction of rice plant diseases based on soil and weather conditions. In Proceedings of International Conference on Advances in Computer Engineering and Communication Systems 2021 (pp. 155-165). Springer, Singapore.

[3] Terence S, Purushothaman G. Systematic review of Internet of Things in smart farming. Transactions on Emerging Telecommunications Technologies. 2020 Jun; 31(6): e3958.

[4] Zhao Y, Liu L, Xie C, Wang R, Wang F, Bu Y, Zhang S. An effective automatic system deployed in agricultural Internet of Things using multi-context Fusion Network towards crop disease recognition in the wild. Applied Soft Computing. 2020 Apr 1; 89: 106128.

[5] Fan J, Zhang Y, Wen W, Gu S, Lu X, Guo X. The future of the Internet of Things in agriculture: Plant high-throughput phenotypic platform. Journal of Cleaner Production. 2021 Jan 20; 280: 123651.

[6] Khan FA, Ibrahim AA, Zeki AM. Environmental monitoring and disease detection of plants in the smart greenhouse using the internet of things. Journal of Physics Communications. 2020 May 14; 4(5): 055008.

[7] Suma V. Internet-of-Things (IoT) based Smart Agriculture in India-An Overview. Journal of ISMAC. 2021; 3(01):1-5.

[8] Gao D, Sun Q, Hu B, Zhang S. A framework for agricultural pest and disease monitoring based on internet-of-things and unmanned aerial vehicles. Sensors. 2020 Jan;20(5):1487.

[9] Boursianis AD, Papadopoulou MS, Diamantoulakis P, Liopa-Tsakalidi A, Barouchas P, Salahas G, Karagiannidis G, Wan S, Goudos SK. Internet of things (IoT) and agricultural unmanned aerial vehicles (UAVs) in smart farming: a comprehensive review. Internet of Things. 2020 Mar 7: 100187.

[10] Delnevo G, Girau R, Ceccarini C, Prandi C. A Deep Learning and Social IoT approach for Plants

Disease Prediction toward a Sustainable Agriculture. IEEE Internet of Things Journal. 2021 Jul 15.

[11] Tianxing X, Hong G. Design of Agricultural Environmental Data Collection System Based on Internet of Things. In2021 IEEE International Conference on Power, Intelligent Computing and Systems (ICPICS) 2021 Jul 29 (pp. 150-152). IEEE.

[12] Pan A, Wang N. Design and Implementation of Crop Automatic Diagnosis and Treatment System Based on Internet of Things. In Journal of Physics: Conference Series 2021 Apr 1 (Vol. 1883, No. 1, p. 012062). IOP Publishing.

[13] Rayhana R, Xiao G, Liu Z. Internet of Things Empowered Smart Greenhouse Farming. IEEE Journal of Radio Frequency Identification. 2020 Mar 31; 4(3): 195-211.

[14] Krishnan RS, Julie EG, Robinson YH, Raja S, Kumar R, Thong PH. Fuzzy logic-based smart irrigation system using the internet of things. Journal of Cleaner Production. 2020 Apr 10; 252: 119902.

[15] Saleem TJ, Zahra SR, Chishti MA. Data Analytical Framework for Internet of Things. In2020 International Conference on Decision Aid Sciences and Application (DASA) 2020 Nov 8 (pp. 109-115). IEEE.