IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 7, July 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007046 |

Smart Irrigation with Plant Disease Detection Using Image Processing

Ayesha Rahman Aiman, Kushal Gowda D P, Manoj H M, Monica A, Dr. R Kanagavalli

Student, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

Student, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

Student, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

Student, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

HOD, Dept. of IS Engineering, The Oxford College of Engineering, Bangalore, Karnataka, India

ABSTRACT- Agriculture is the main source of food, raw material and fuel which contributes to the economic development of a nation. Nearly 66% of the population depends on agriculture directly or indirectly. The food security remains threatened by various circumstances including climate change, crop diseases, lack of irrigation, etc. Crop diseases not only affect the food security at the global level, but it also has adverse consequences for small scale farmers whose income depends on healthy cultivation. There is an advantage that the crop diseases can be controlled by identifying the diseases as soon as it develops on crops. Due to advancement of internet, field of computer vision it has been possible to provide impactful solution to this problem. Plant disease diagnosis through optical observation of the symptoms on plant leaves, incorporates a significantly high degree of complexity. In this work, specific CNN architectures were trained and assessed, to form an automated plant disease detection and diagnosis system, based on simple images of leaves of healthy and diseased plants. The available dataset contained images captured in both experimental (laboratory) setups and real cultivation conditions in the field. The proposed deep learning approach may find more general solutions than shallow approaches, which learn with less data but are specific to few crops. The basic deep learning tool used in this work is Convolutional Neural Networks (CNNs). CNNs constitute one of the most powerful techniques for modelling complex processes and performing pattern recognition in applications with large amount of data, like the one of pattern recognition in images.

KEYWORDS : Temperature and Humidity Sensor, Plant disease detection, Smart irrigation.

I. INTRODUCTION

Agriculture uses 85% of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial, and institutional improvements. There are many systems to achieve water savings in various crops, from basic ones to more technologically advanced ones. For instance, in one system plant water status was monitored and irrigation scheduled based on the canopy temperature distribution of the plant, which was acquired with thermal imaging. In addition, other systems have been developed to schedule irrigation of crops and optimize water use through a crop water stress index (CWSI). The empirical CWSI was first defined over 30 years ago. This index was later calculated using measurements of infrared canopy temperatures, ambient air temperatures, and atmospheric vapor pressure deficit values to determine when to irrigate broccoli using drip irrigation. Irrigation systems can also be automated through information on the volumetric water content of the soil, using dielectric moisture sensors to control actuators and save water, instead of a predetermined irrigation schedule at a particular time of the day and with a specific duration. An irrigation controller is used to open a solenoid valve and apply watering to bedding plants(impatiens, petunia, salvia, and vinca) when the volumetric water content of the substrate drops below a set point. Other authors have reported the use of remote canopy temperature to automate cotton crop irrigation using infrared thermometers. Through a timed temperature threshold, automatic irrigation was triggered once canopy temperatures exceeded the threshold for a certain time accumulated per day.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007046 |

II. RELATED WORK

Title: Micro Controller Based Automatic Plant Irrigation System

Author: Venkata Naga Rohit Gunturi- The main aim of this paper is to provide automatic irrigation to the plants which helps in saving money and water. The entire system is controlled using 8051 micro controller which is programmed as giving the interrupt signal to the sprinkler. Temperature sensor and humidity sensor are connected to internal ports of micro controller via comparator, whenever there is a change in temperature and humidity of the surroundings these sensors sense the change in temperature and humidity and gives an interrupt signal to the micro-controller and thus the sprinkler is activated.

Title: Classification of Disease in Tomato Plants' Leaf Using Image Segmentation and SVM

Author:M. Z. Din, S. M. Adnan, W. Ahmad, S. Aziz, J. Rashid, W. Ismail, M. J. Iqbal - The detection and classification of tomato crops disease becomes more effective for the farmers if done efficiently. Using image processing techniques, this task is more robust and rapid. This paper presents image processing framework for plant disease identification and classification. The proposed framework can extract useful features from image and perform classification of disease type.

Title: Tomato Plant Disease Detection using Image Processing

Author: Sagar Vetal, R.S. Khule - Image processing is one of upbringing technology which is helping to resolve such issues with various algorithms and techniques. Most of the diseases of tomato plant detected at initial stages as they affect leaves first. By detecting the diseases at initial stage on leaves will surely avoid impending loss. In this paper four key diseases are identified using image segmentation and Multi-class SVM algorithm.

Title: IoT based Automatic Drip Irrigation System with Plant Disease Detection

Author: Panchami S V & M V Sathyanarayana - The proposed system identifies a plant disease called "leaf Blight" using image processing technique so that collective action can be taken if the detection is done easily. This is very important as this disease causes 30%-80% loss of agricultural crops in the many places in the country". The automatic drip irrigation system senses the moisture content of the soil and releases water whenever necessary.

Title: Development and Validation of a Deep Learning Algorithm for the Recognition of Plant Disease

Author: Sijiang Huang, Weijie Liu, Fei Qi and Kepeng Yang - Crop health is the foundation for agricultural development. In some area, due to the lack of professional botanical experts, it is difficult to correctly diagnose the plant disease in the work of planting. In this paper, this novel proposes deep neural network structure that can reliably classify plant types and plant disease using a single image of plant leaf which Department of ISE, TOCE 2021-22 6 enables the end to- end diagnosis of plant disease.

III. PROPOSED SYSTEM

The proposed agricultural system is designed to solve to find an optimal solution to the water crisis. The design implements IoT technology using an android device, a main controlling unit (MCU), sensors to measure various parameters and a water pump, which will be used to supply water to the farm. The system is used to turn the valves ON or OFF automatically as per the water requirement of the plants. The system is used for sensing, monitoring, and for controlling purpose. Moisture sensor will record the moisture level in the soil and send this value to the microcontroller. If the moisture level in the soil drops to a particular value which is predefined, the water pump will get on and the process of irrigation will begin.During this time, the moisture sensor will continually send the moisture value in soil to the microcontroller. After some time when moisture level in the soil reach to a particular level, the water pump will automatically get switched off. In this way, the circuit perform the task of irrigation.The disease detection algorithm combines information from thermal, depth and visible light images of the plants and uses classification of features extracted from these images to detect a plant as healthy or diseased.We are identifying whether the leaf is healthy or diseased and the diseased plant is infected with based on visualizing the infected regions of plant.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007046 |

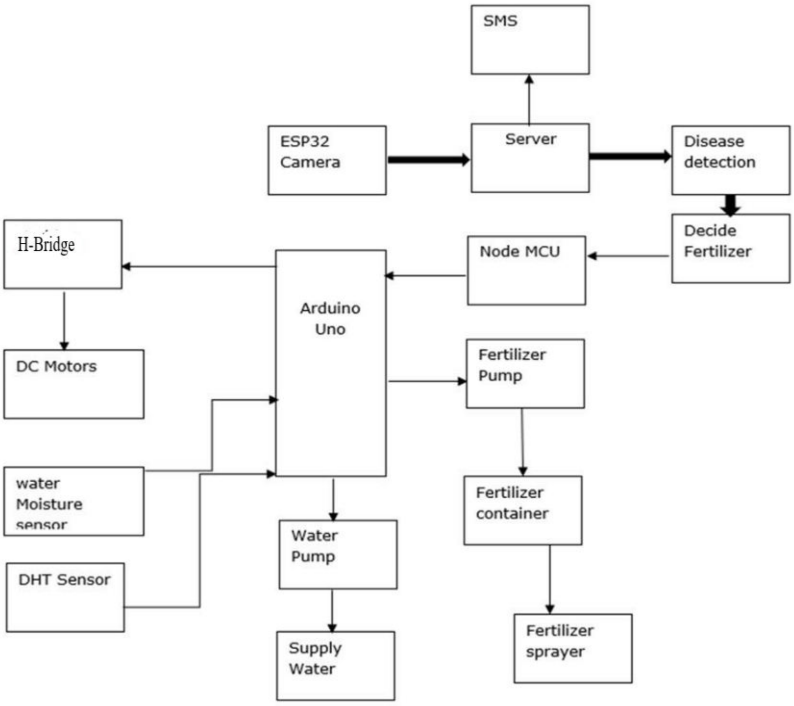


Figure 1: System Architecture

IV. METHODOLOGY

Our proposed system is divided into two parts: (i) Smart irrigation, (ii) Disease detection.

Smart Irrigation: The plant species are unique, each with a different water requirement. Based on their requirement, the flow is controlled. For this, there is a moisture sensor, which determines the amount of moisture in the soil based on the soil resistance, which varies from soil to soil. If the resistance is found to be greater than a prescribed value, the field needs to be irrigated. The water is allowed to flow through a current controlled water pump, until the soil resistance comes down to the present value. The water requirement of the plants will be stored as a database in the Arduino, and the resistance comparison will be made with respect to these values. This concept can be used for N number of plants, and the watering can be done based on their individual moisture requirement. Suppose there are two plant species. Two moisture sensors will be used in this case, which control two solenoid valves.

Disease Detection: The disease detection algorithm combines information from thermal, depth and visible light images of the plants and uses classification of features extracted from these images to detect a plant as healthy or diseased. Here the disease analysis technique is applied for mango plant leaves and identifying whether the mango plant is healthy or diseased and the diseased plant is infected with based on visualizing the infected regions of plant.
This part consists are four modules of following steps to interpret the plant leaves from the input image such as: Input Image, Pre-processing and Segmentation, Feature Extraction and Classification.

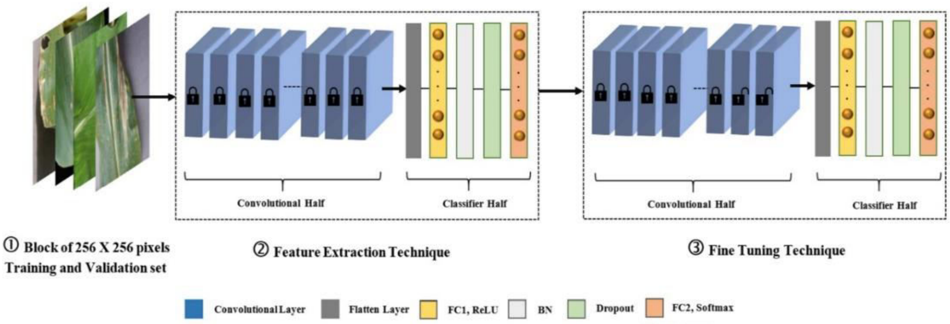


Figure 2: Working of CNN

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |
|| Volume 10, Issue 7, July 2022 ||
| DOI: 10.15680/IJIRCCE.2022.1007046 |

Input Image:

The image (plant leaves) is captured using the wi-fi camera to get better image clarity and convert the resize image. Example: (save_img = cv2.resize(rgb,(128,128)))

Pre-processing and segmentation:

Image processing is necessary for image enhancement. During Pre-processing RGB image to convert into grayscale. For a grayscale images, the pixel value is a single number that represents the brightness of the pixel. The most common pixel format is the byte image, where this number is stored as an 8-bit integer giving a range of possible values from 0 to 255. Typically, zero is taken to be black, and 255 is taken to be white. Image segmentation is basically performed to locate the disease object in leaf image.

Feature Extraction:

Feature Extraction stage is necessary because certain features have to be extracted so that they are unique for each plant leaves. After the decision is made that a plant_Diseases and Non_Diseases is present, then the last frame is taken into consideration and features. Finally, the 12 Feature Extraction is extracting the features (Size, Pixels, Labels) in all Images (Mango / banana Leaves) dataset are passed to the input layer of CNN.

Classification:

Classification of plant disease is done with the help of various features calculated previously. The five-bit binary sequence is thus generated to uniquely recognize and utilize these recognized the recognized plant disease for supporting computer interaction. By the feature extraction significant peak is encoded as 1 while insignificant peak is encoded as 0 based on intersection to the threshold line. CNN technique is used and CNN is a deep learning algorithm.

V. RESULT

	Accuracy (%)
Training Set	99.4
Prediction Set	95.33
Testing Set	89.16

We trained our CNN model for 240 leaf images and we recorded the performance criteria after the 240th time.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007046 |

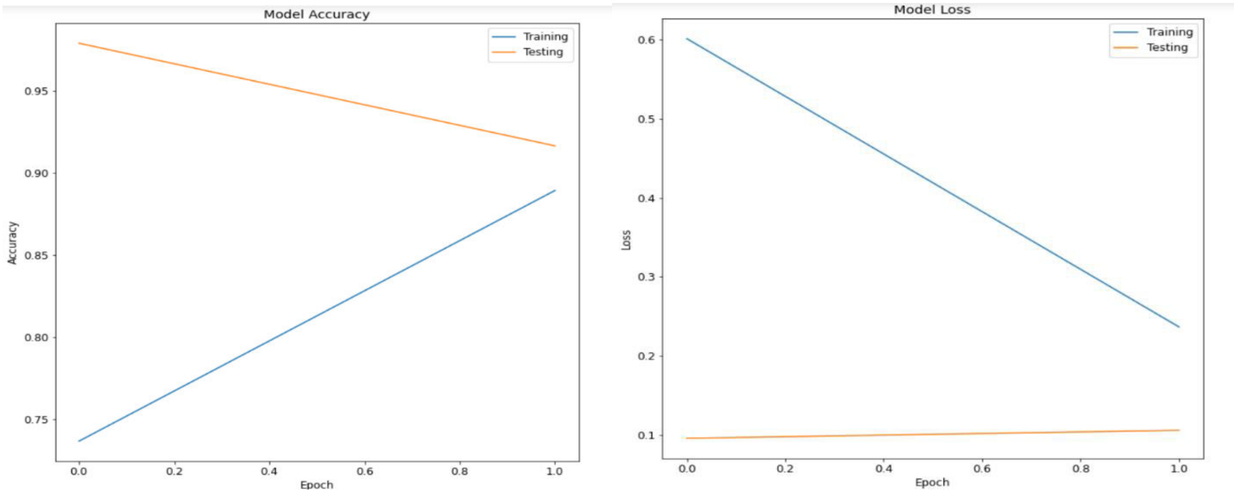
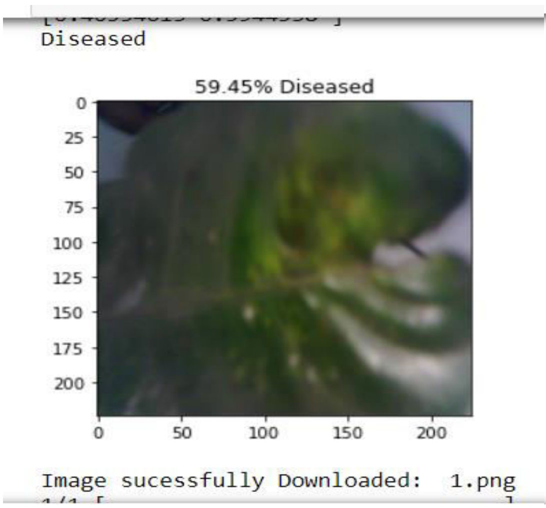
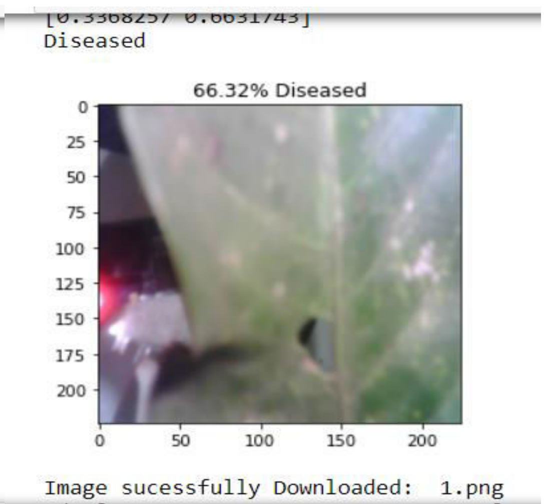
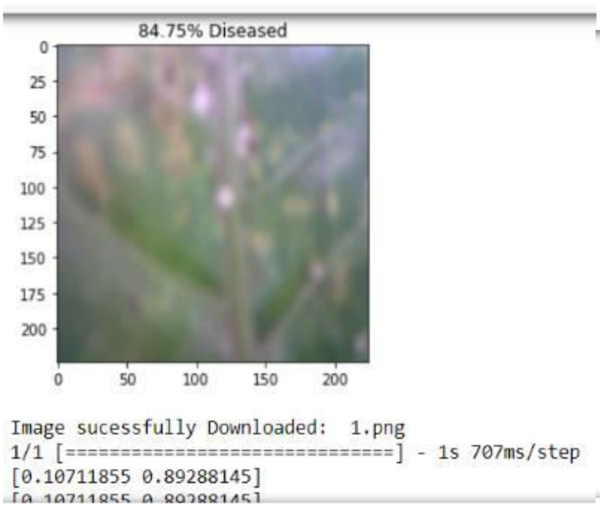


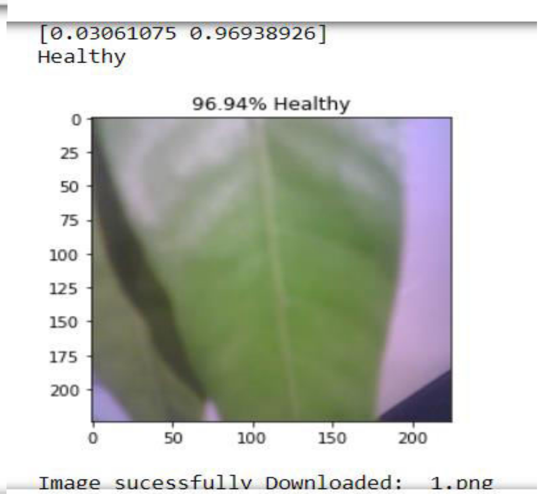
Figure 3: Training Prediction Loss and Accuracy

VI. OUTPUT









| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 7, July 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1007046 |

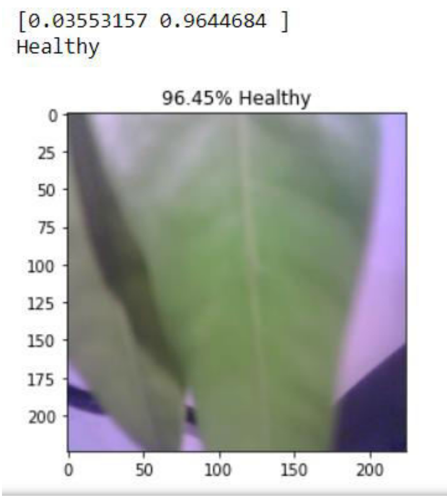


Figure 4: Output Obtained

VII. CONCLUSION

Based on that high level of performance, it becomes evident that convolutional neural networks are highly suitable for the automated detection and diagnosis of plant diseases through the analysis of simple leaves images. In addition, the high importance of the existence of real conditions images (captured in the cultivation fields) in the training data, which was indicated by the presented results, suggests that, in the development of such models, focus should be given in the maximization of the ratio of real-conditions images in the training data. Furthermore, the low computational power required by the trained model to classify a given image (about 2 ms on a single GPU), makes feasible its integration into mobile applications for their use in mobile devices. The proposed setup is used for the optimisation use of water in agricultural field without the interventions of farmers by using soil moisture content of the soil using Microcontroller that turn ON/OFF the pump automatically according to the need of water for irrigation and hence helpful in saving water.

REFERENCES

[1]. Indian Agriculture, Wikipedia.
[2]. Venkata Naga Rohit Gunturi, ”Micro Controller Based Automatic Plant Irrigation System” 2018.
[3].Vijay, Anil Kumar Saini, Susmita Banerjee, Himanshu Nigam “An IoT Instrumented Smart Agricultural Monitoring and Irrigation System” 2020
[4]. Panchami S V & M V Sathyanarayana, “ IoT based Automatic Drip Irrigation System with Plant Disease Detection” 2018
[5]. “Development and Validation of a Deep Learning Algorithm for the Recognition of Plant Disease” Sijiang Huang, Weijie Liu, Fei Qi and Kepeng Yang, 2019
[6]. Sofia Siachalou, “A Hidden Markov Models Approach for Crop Classification: Linking Crop Phenology to Time Series of Multi-Sensor Remote Sensing Data.
[7]. A Survey of Data Mining Techniques Applied to Agriculture: GreekTech.in
[8]. P.G. Adasule, Director National Research Centre for Grapes, Pune, “Good Agricultural Practises for Production of Quality Table Grapes”

INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.165

doi crossref

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details