IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

# TECHNOLOGY BASED AGRICULTURE

[1]H C Sujan Kumar, [2]Jane Belita Dsouza, [3]Neha G Rao, [4]Sheikh Afraaz, [5]Ganesh V N
[1,2,3,4]Student, Mangalore Institute of Technology & Engineering, Moodbidri, Karnataka, India.
[5]Associate Professor, Mangalore Institute of Technology & Engineering, Moodbidri, Karnataka, India.

***Abstract :*** ***In India, agriculture along with its associated sectors is the major source of livelihood for small and marginal farmers, which occupy about 85 % of farmers in the country. Crop production must be managed for plant diseases and weeds to be sustainable. Weeds are a concern because they crowd out valuable crops and take up space, water, and nutrients. Some weeds also become tangled in equipment, which hinders effective harvesting. Water wastage is also a big concern that the world faces. Nowadays water shortage is increasing day by day as a result saving water is also a topic of concern. Tools for weed and crop detection and plant disease data have been developed using machine learning techniques such as object detection and image classification. In this we provide a method for weed and crop detection and plant disease diagnosis that integrates object recognition and picture classification approaches. For object detection and image classification, the suggested method makes use of YOLOv4 algorithm and convolutional neural networks. And for automated irrigation system estimate how much quantity of water a crop would need. As a result, weed removal systems are essential. And automated irrigation system for plants can be supplied with water in a proper time interval.***

**Keywords—YOLOv4, CNN, Machine leaning, Image processing, Android Studio, Arduino, Soil sensors, GSM.**

## INTRODUCTION

Any plant growing where it is not wanted is referred to as a weed. Since the beginning of human plant cultivation, weeds have invaded crop-designated areas, forcing humans to fight them off. Some unwanted plants were later discovered to possess qualities that were not initially suspected, and as a result, they were taken under cultivation and removed from the category of weeds. Weeds Reduces moisture in the soil many times weeds absorb the nutrients as well as moisture in the soil to grow and don't allow the main crop as well as land to be water-laden thus also making it drought-prone. As weeds are unwanted plants therefore they must be removed from the field either with expensive weedicides or manually uprooted which is a time taking process. Thus it adds up to the cost of farmers. Few weeds can even be dangerous and lead to various skin diseases and allergies and may also be fatal.

Diseases in plants can cause lots of economic as well as production losses in the agriculture industry. Management of disease is a very challenging task. Usually, symptoms of diseases like colored spots are seen on the leaves of the plant. Sometimes farmers face difficulties in identifying the plant diseases. Which can lead to loss of crops because every disease having different remedy to work out according to virus, fungi and bacteria. Normally current disease detection approach is manual. When disease got on plants, farmers have to keep eyes on the infection of the plant. This disease detection technique is time consuming and some precautions are needed while selecting pesticides for plants. Most of the plant diseases are caused by viruses, bacteria and fungi. The diseases are caused due to these organisms which are characterized by different visual symptoms. The major focus of this work is on the use of machine learning techniques to the diagnosis of plant diseases. From the segmented pictures, characteristics are retrieved that identify the affected portions of the plant leaf, and then a machine learning algorithm is used to classify the diseases.

Present day agriculture requires innovative approach and practices to help farmers to increase production efficiency with simultaneous reduction in required number of natural resources. Machine learning (ML) tools to have great scope to modernize the agriculture system to smart one.

## NEED OF THE STUDY

Our project comes forward as an attempt to provide solution to such a problem as the model developed is a smart system for agriculture and provide user with the using technology easily. The scope of technology usage in agriculture is vast and continually expanding. The use of technology in agriculture aims to increase efficiency, productivity, and sustainability in farming practices. Weed detection, Plant health monitoring, soil moisture analysis can be implemented using various technologies available which helps the farmers to analyse and eradicate the problems faced during the cultivation.

**LITERATURE REVIEW**

In'es Barbero-García [1] This paper, the author sees about the YOLO algorithm for bulldozer detection on coastal video data. The suggested method is a combination of PCA change detection and YOLO object detection. The algorithm was found to give good results with an accuracy of 0.94 and a recognition of 0.81 for the CoastScan images. Preprocessing of the change detection improved the detection by slightly increasing the recognition and greatly reducing the number of false positives compared to using YOLO directly on the original images. First, the video frames were extracted and preprocessed using principal component analysis (PCA), a well-known method for highlighting moving or changing objects in images. YOLOv5 was specifically trained to detect bulldozers on this type of imagery. Change detection computation removes most of the constant features or background from the images, reducing the areas that can be incorrectly classified as bulldozers. Change detection also allows for the automatic removal of static bulldozers that may be parked on the beach for some time but are not performing work in the sand. Later, detection was performed for the two months of CoastScan imagery dataset, and the detected sand movements performed by bulldozers were validated against the suspected anthropogenic changes detected from the 3D data.

Peiyuan Jiang [2] This paper gives us an overview of the YOLO versions. The YOLO structure is extremely straightforward. The neural network may immediately output the position and category of the bounding box. The pace of YOLO is quick since all that is required to complete time detection of videos is the feeding of an image to the network for final recognition. To recognize objects, YOLO directly leverages the global picture, which may encode global information and lower detection error for backgrounds as objects. 24 convolutional layers are followed by two fully linked layers in the original YOLO architecture. In order to suppress non-maxima, YOLO predicts several bounding boxes for each grid cell, choosing the bounding boxes with the largest intersection above the union (IOU) with the actual data.

Najmeh Razfar [3] In this paper, a system based on imaging techniques such as MobileNet, ResNet50 and three user defined The use of CNNs is suggested for successful weed detection. Using aspects like their structure and texture, machine learning systems identify different weed species. The weed detection is validated using the suggested wavelet texture characteristics. Each image underwent the created discriminating method, which was then used to feed the neural network system. To enhance model performance and computational efficiency, deep learning approaches have lately become widely employed in the most popular real-time weed detection systems. To utilize several methodologies, hybrid machine learning models are created.

Sachin Dahiya [4] The PlantVillage dataset is used in this work to identify the suitable hyper-parameters for evaluating several deep learning architectures for plant disease diagnosis. The PlantVillage dataset is employed in the study, which employs the GoogleNet architecture. It is discovered that 30 epochs and a learning rate of 0.0001 are acceptable for plant disease identification. The creation of knowledge-based agricultural systems that may boost crop output and so address all issues has numerous challenges. Deep learning, a branch of machine learning that belongs to artificial intelligence, promises to overcome these challenges.

Sumita Mishra [5] This paper presents a real-time deep Learning model for identification and classification of major cereal diseases without the need of internet. The performance analysis of the developed Deep CNN has shown an average accuracy of 98.40%. Artificial neural networks (ANN) with intelligent crop disease detection algorithms are the need of the hour to reduce the severity of losses and minimize crop health problems. While the results obtained are promising, the detection accuracy of the NCS can be further improved by adjusting and optimizing hyperparameters and increasing the diversity of the pooling operation; data augmentation can also be used. For further adaptation, we plan to diversify the data set by including additional maize diseases to increase the effectiveness of the method.

Monalisha Pramanika [6] The paper shows how an automatic control gate for the basin has been developed and connected to the Internet of Things through the soil moisture sensor network using GSM so that the farmers/users can control the opening and closing of the gate remotely with minimal manual intervention. Farmers can remotely access the real-time moisture status of the field and make a decision to start and stop irrigation based on the basic real-time moisture status. The system was successfully tested in bare clay soil. The study also attempted to determine the appropriate location and number of sensors in the field to increase the efficiency of the irrigation application. Efforts were also made to determine the appropriate location, depth, and number of soil moisture sensors in conjunction with an automatic control gate in the basin systems. This important information can help to increase in the automated water distribution network in canal-based irrigation systems.

Jesús María Domínguez-Niño [7] The outcomes of this experiment demonstrate the viability of sensor-based autonomous irrigation scheduling in orchards. The programme supplied exact irrigation dosages throughout the season, according to weather conditions and the seasonal vegetation cycle of the crop. It was based on the water balance technique and locally controlled by data from sensors. The study looked at how the autonomous system operated in areas with different types of trees and if it could deliver differential watering when the design was the same. In the same orchard, real evapotranspiration was ascertained using a weighted lysimeter, and the automatic method was contrasted with human scheduling using a traditional water balance. Capacity sensors have been successfully employed to give the scheduling algorithm automated feedback.

S. Akwu [8] The proposed model is the irrigation system is controlled by the soil moisture sensor which detects the percentage of water in the soil and updates to the microcontroller for irrigation and sends a notification to the owner, this project focuses on reducing excessive human intervention in the process of irrigation, also reduces water wastage and informs the owner about the situation in operation. This work aims to replace the manual method of irrigation with an automated one and promote human capital development and capacity building opportunities. A simple automated technique to control plant irrigation with GSM notification is proposed.

R. S. Ghumatkar [9] In this paper, an IoT-based smart irrigation architecture along with a hybrid machine learning-based approach for soil moisture prediction is proposed. Soil moisture is a critical parameter for developing a smart irrigation system. Soil moisture is affected by several environmental variables: air temperature, humidity, and soil temperature. The accuracy of weather forecasting has substantially increased because to technology advancements, and soil moisture variations may now be predicted using weather prediction data.

S. S. Harakannanavar [10] The model was developed based on the IP and ML approaches to foliar disease detection and is presented in this section. The proposed model (DWT +PCA+GLCM+CNN) uses computer vision and machine learning algorithm for leaf disease detection. To evaluate the accuracy and to detect the leaf disease as healthy or unhealthy, the tomato samples with six diseases are considered. As part of the image processing, the tomato samples are reduced to 256 × 256 pixels to keep their size the same throughout the experiment. HE and K-means clustering are used to maximize the quality and segment the leaf samples. Based on the K-means clustering response, it can be predicted at an early stage of the operation whether the leaf is diseased or not. The boundaries of the leaf samples can be extracted using contour tracking.

Revanth Yenugudhati [11] This paper is about automatic detection of plant diseases using plant leaves, which is a major breakthrough. Moreover, early and timely detection of plant diseases improves agricultural production and quality. The results obtained with models such as Support Vector Machine, logistic regression and KNN classifier have been helpful in detecting the health status of plants. Since we have limited data at the moment, we worked with the images that were available to us. In most studies, a dataset was used to test the performance of the DL models. Although this dataset contains many photos of different plant species and their diseases, it was created in a laboratory. Consequently, a large data set of plant diseases is predicted under real conditions.

## METHODOLOGY

*A. Weed and Crop detection*

The weed in the farms is detected using computer vision and alert farmers. This method helps farmers to eradicate the confusion between a crop and a weed. The weed and plant are determined by the Yolov4 machine learning algorithm which will be used to object detection, data collected will be trained first or the data which needs to be compared with the real time data is stored. The picture captured is compared with the trained data using image processing and then the classification of weed and crop is done. Training a YOLOv4 model on weed and crop detection using Colab and then using the trained weights to detect weed and crop in real-time video feed from a camera. To start, first we collected and label a dataset of images containing weed and crop. This involves detecting and drawing bounding boxes around any instances of weed or crop in the video feed.

OpenCV is a popular computer vision library that can be used to capture video from a camera and process it in real-time. We used OpenCV to display the processed video on the screen with bounding boxes around detected weed and crop instances. The working of the weed and crop detection is displayed in Fig. 1.

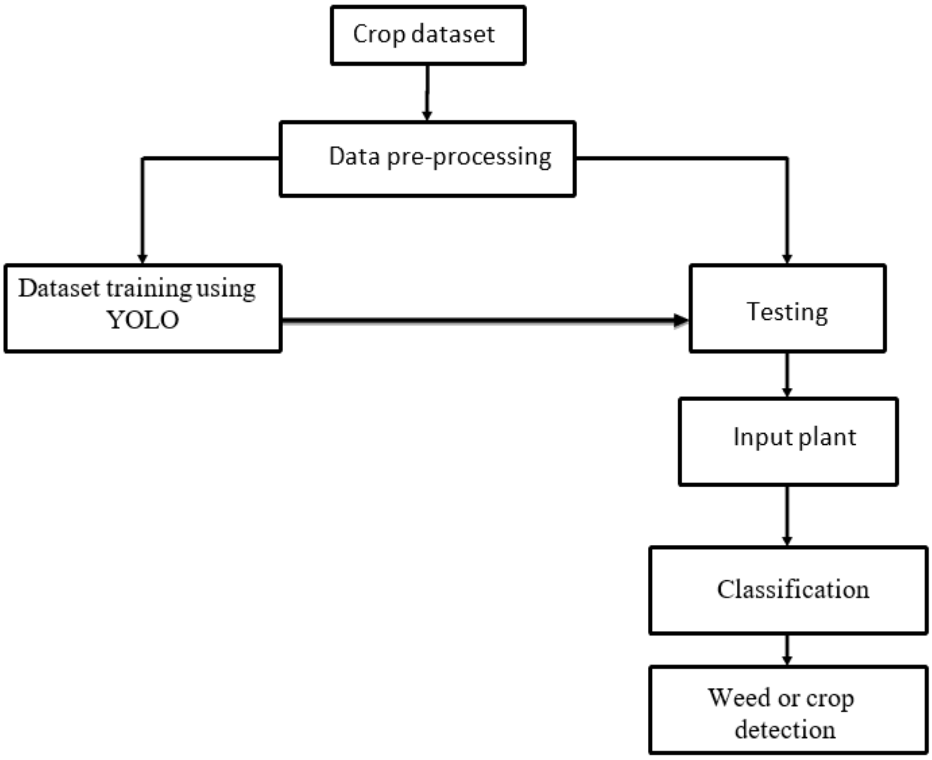


Fig. 1. Weed and Crop detection.

*B. Plant health analysis*

With the advancement in computer vision, deep learning and CNN algorithm for comparing the plant with the trained data, new promising solutions for identifying overall health status of the plants were introduced. The dataset of plant leaves are collected from the Kaggle PlanrVillage dataset. The intelligent decision support system for identifying crop diseases would lead to timely control of the panic situations and eradicating the huge losses, ultimately leading to improved plant quality. Training a TensorFlow Lite (TFLite) model in Colab and adding it to an Android app developed using Android Studio is a common workflow for developing machine learning-based Android applications. Fig. 2 displays the fundamental block diagram of plant health analysis.

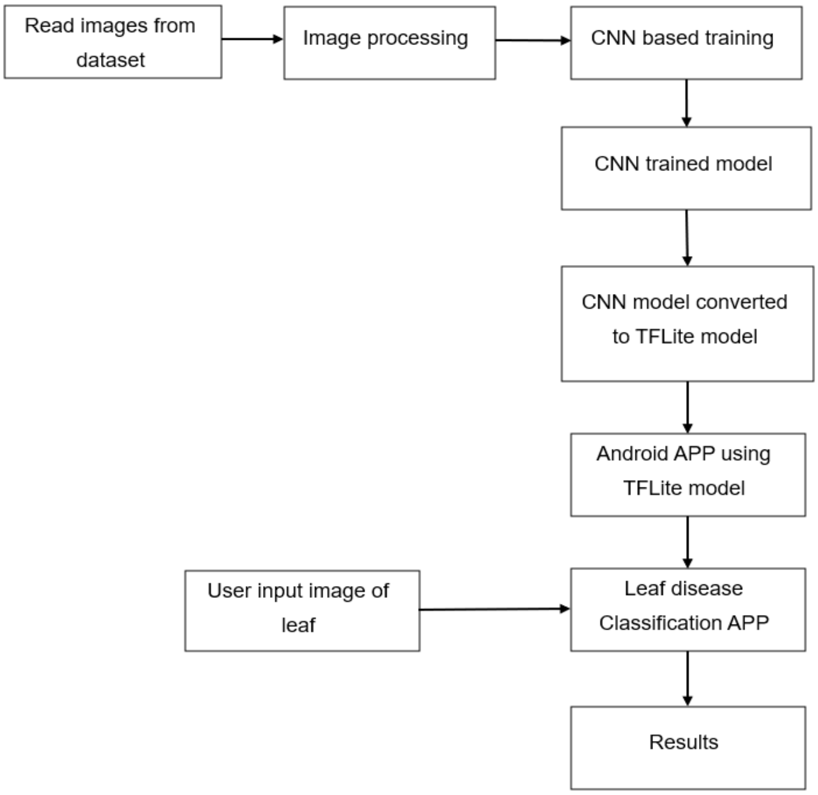


Fig. 2. Plant health analysis.

*C. Soil analysis and Irrigation technique*

The preservation and improvement of dynamic soil characteristics is the main emphasis of soil management in agriculture for increasing crop productivity by the hardware soil moisture sensor. This will help farmers to grow crops in less amount of water by smart irrigation by analyzing the soil moisture content. Arduino used is used as the controller and all the sensors and motor pump is connected to the Arduino. When the moister content in the soil is less the arduino will sends the message to turn on the motor pump and irrigate the field and sends "Motor On" text message to the user through GSM moude. When the moister content satisfies the soil sensor the arduino will automatically turn off the motor pump. Form this the user can save water and time by automatic irrigation. The basic block diagram of soil analysis is shown Fig. 3.

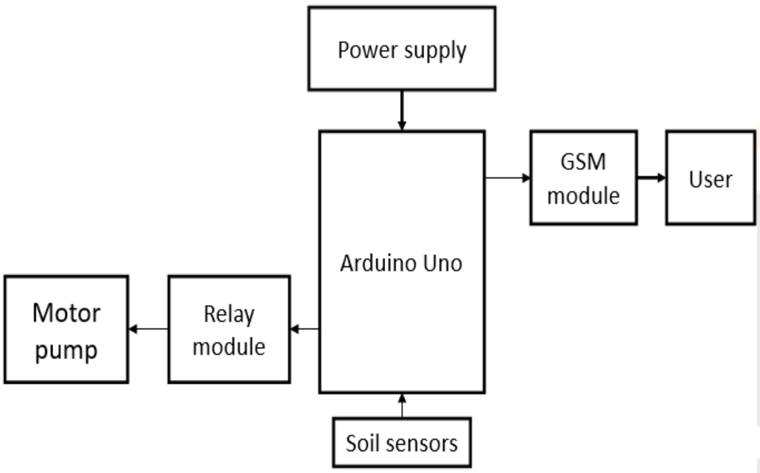


Fig. 3 Soil analysis and irrigation technique.

## RESULTS AND DISCUSSION

After the Yolov4 model has been trained on the dataset of crop and weed, we can use it to identify crops and weeds in fresh images. We need to use the trained Yolov4 model to execute the inference procedure on the fresh images. The bounding boxes and classes of the discovered objects will be the results of the inference process.

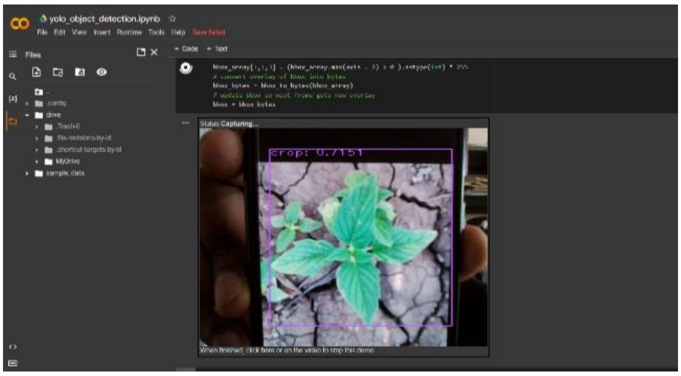


Fig.4. Weed Detection.

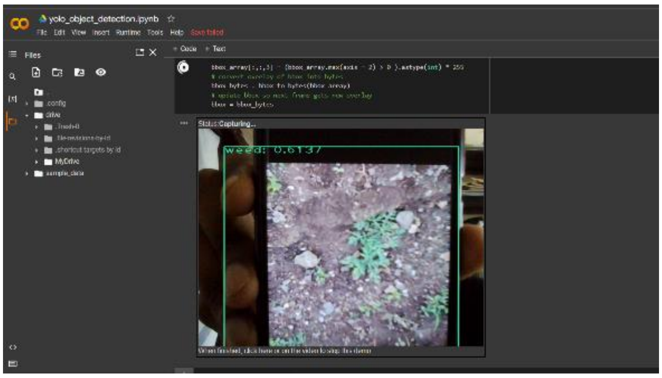


Fig.5. Crop Detection.

An app for identifying plant diseases uses computer vision and machine learning algorithm models. By taking a photo of a damaged leaf, the illness can be more easily identified. The app contains details on more than 30 plant diseases.

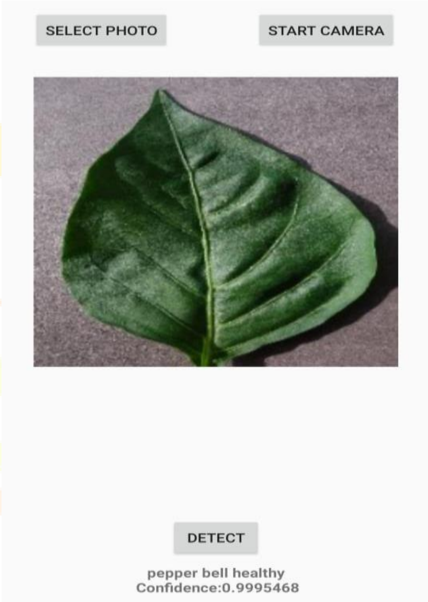


Fig. 6. Plant health analysis App.

The soil moisture is analysed by the soil moister sensor, when the soil moisture in the soil is low than the expected moisture content in the soil the motor will automatically switch on and it will water the plant. And when the plant gets the required amount of water the motor will gets off. This process is controlled by Arduino. The circuit diagram is shown in Fig. 7 and the moister percentage is shown in Fig. 8.

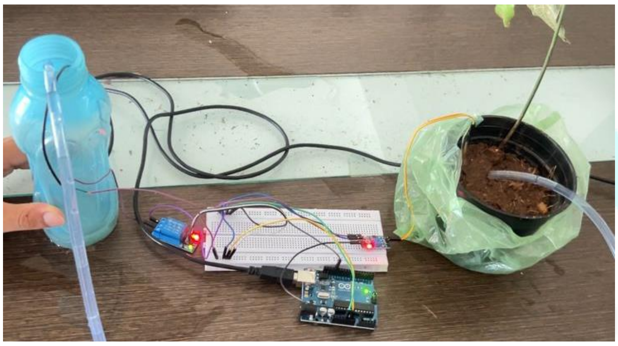

Figure. 7. Soil Analysis circuit.

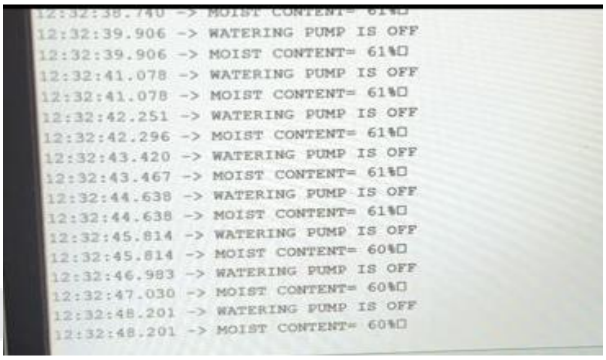


Figure.8. Moister percentage and pump status.

## CONCLUSION

With the aid of the CNN-based model for tracking the health of plants and the YoloV4 algorithm for real-time weed and crop recognition. With the use of machine learning and artificial engineering, weed detection will be useful for the user in detecting the weed more quickly. The user may classify the plant illness with great aid from the plant leaf disease detection. We can reduce further water loss and manage the excess of water in the fields by automating soil irrigation. The soil moisture sensor senses the percentage of water in the soil and updates the percentage if it goes below the threshold value for that crop/plant to the microcontroller unit for the start of the watering and updates to the user via SMS in this design. The Arduino is the main control of the system that coordinates the control to other system components.

## REFERENCES


[1] I. Barbero-García, M. Kuschnerus, S. Vos, and R. Lindenbergh, "Automatic detection of bulldozer-induced changes on a sandy beach from video using YOLO algorithm," *International Journal of Applied Earth Observation and Geoinformation*, vol. 117, Mar. 2023, doi: 10.1016/j.jag.2023.103185.

[2] P. Jiang, D. Ergu, F. Liu, Y. Cai, and B. Ma, "A Review of Yolo Algorithm Developments," in *Procedia Computer Science*, Elsevier B.V., 2021, pp. 1066–1073. doi: 10.1016/j.procs.2022.01.135.

[3] N. Razfar, J. True, R. Bassiouny, V. Venkatesh, and R. Kashef, "Weed detection in soybean crops using custom lightweight deep learning models," *J Agric Food Res*, vol. 8, Jun. 2022, doi: 10.1016/j.jafr.2022.100308.

[4] S. Dahiya, T. Gulati, and D. Gupta, "Performance analysis of deep learning architectures for plant leaves disease detection," *Measurement: Sensors*, vol. 24, Dec. 2022, doi: 10.1016/j.measen.2022.100581.

[5] S. Mishra, R. Sachan, and D. Rajpal, "Deep Convolutional Neural Network based Detection System for Real-time Corn Plant Disease Recognition," in *Procedia Computer Science*, Elsevier B.V., 2020, pp. 2003–2010. doi: 10.1016/j.procs.2020.03.236.

[6] M. Pramanik *et al.*, "Automation of soil moisture sensor-based basin irrigation system," *Smart Agricultural Technology*, vol. 2, Dec. 2022, doi: 10.1016/j.atech.2021.100032.

[7] J. M. Domínguez-Niño, J. Oliver-Manera, J. Girona, and J. Casadesús, "Differential irrigation scheduling by an automated algorithm of water balance tuned by capacitance-type soil moisture sensors," *Agric Water Manag*, vol. 228, Feb. 2020, doi: 10.1016/j.agwat.2019.105880.

[8] S. Akwu, U. I. Bature, K. I. Jahun, M. A. Baba, and A. Y. Nasir, "Automatic plant Irrigation Control System Using Arduino and GSM Module," *International Journal of Engineering and Manufacturing*, vol. 10, no. 3, pp. 12–26, Jun. 2020, doi: 10.5815/ijem.2020.03.02.

[9] R. S. Ghumatkar, M. K. Hulbatte, M. M. Gaikwad, and Mrs. R. B. Gurav, "IoT Based Temperature and Soil Monitoring System with Motor Pump Control," *Int J Res Appl Sci Eng Technol*, vol. 10, no. 4, pp. 1165–1168, Apr. 2022, doi: 10.22214/ijraset.2022.41352.

[10] S. S. Harakannanavar, J. M. Rudagi, V. I. Puranikmath, A. Siddiqua, and R. Pramodhini, "Plant leaf disease detection using computer vision and machine learning algorithms," *Global Transitions Proceedings*, vol. 3, no. 1, pp. 305–310, Jun. 2022, doi: 10.1016/j.gltp.2022.03.016.

[11] "Identification of Plant Health Using Machine Learning and Identification of Plant Health Using Machine Learning and Image Techniques Image Techniques", doi: 10.36227/techrxiv.19492034.v1.