IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 8, May 2023

Safeguarding Crops and Increasing Yields with IoT-Based Plant Protection and Monitoring System

Dr. Bharathi M, Jyothi D S, Meghana K S
Department of Computer Science and Engineering
S J C Institute of Technology, Chickballapur, India

Abstract: *In many countries, agriculture is the main occupation, and the livelihoods of many people depend on it. However, agricultural crops are often vulnerable to diseases, which can cause a reduction in both the quantity and quality of the crops. In this paper, we propose a computationally efficient approach for detecting and analyzing paddy diseases and selecting fertilizers. This proposed system utilizes various concepts related to image processing, such as image acquisition, image preprocessing, feature extraction, and convolutional neural network-based training for classification, diagnosis, and treatment. Additionally, we aim to develop a Smart Farming System using IoT technology that will allow farmers to access live data via a mobile app. The system will provide real-time information on temperature, humidity, and water levels, which will enable farmers to monitor their environment more efficiently, resulting in increased yields and better product quality. Ultimately, this system will assist farmers in improving their overall crop yields and quality, enhancing their livelihoods, and contributing to food security.*

Keywords: Plant protection system, convolutional neural network algorithm, image processing

I. INTRODUCTION

Agriculture has been a vital practice for sustaining human populations for over a thousand years. India holds the fourth position globally, accounting for 7.39% of agricultural output. However, the agriculture sector in India and globally faces several challenges, including drought, climate change, global warming, and population growth. To overcome these challenges and improve agricultural production, technology has emerged as a potential solution. Big data and cloud computing play a significant role in enhancing agricultural production by providing farmers with sufficient data to make informed decisions. Farmers can now adjust their production based on market demand and improve their yield and profitability. With the help of cloud-based apps, farmers can monitor and control all farming activities efficiently.

Moreover, CNNs have revolutionized the field of Artificial Intelligence and are being used extensively in various industries, including computer vision applications, facial recognition software, image search, and even augmented reality. In the medical field, CNNs are used for detecting various diseases, and well-trained Neural Networks can outsmart experts in identifying relevant patterns.

The global population is expected to exceed nine billion by 2050, and agricultural production must increase by 70% to feed everyone. With resources becoming scarce, there is a need for more efficient ways to improve productivity. Technology, specifically big data and CNNs, can play a crucial role in this regard. By leveraging these technologies, farmers can make data-driven decisions, improve harvest yield, and increase efficiency in agriculture.

To overcome this challenge, an automated disease detection system has been developed using sensors like temperature, humidity, and color to detect variations in plant leaf health conditions. This system allows for the early detection of diseases, which can help farmers take immediate actions to prevent the spread of diseases and minimize crop loss.

Various disease management strategies are used by farmers at regular intervals to prevent plant diseases. However, the use of an automated disease detection system can significantly improve the efficiency of disease management strategies. It can also reduce the use of pesticides and other harmful chemicals, which can have a negative impact on the environment and human health.

II. LITERATURE SURVEY

"Review on Research and Application of Variable Rate Spray in Agriculture" by Yangang Guan, Dexin Chen. According to weed information source, variable rate spray is divided into two types: mapbased spraying and real-time sensor-based spraying that weed detection and spraying are carried out simultaneously.The disadvantageof thissystem is less accuracy.

"Development and Automation of Robot with Spraying Mechanism for Agricultural Applications" by Mitul Raval, Aniket Dhandhukia. Proposed the design and construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial farm the effectiveness of this platform is shown by the ability to successfully navigate itself down rows of a Farm, spray the pesticides effectively while the farmer controls it from a far distance. The disadvantage of this system isoccurrence of time delay.

"Smart Herbicide Sprayer Robot for agriculture fields" by G.Bhanumathi1, B.Subhaker. This paper is to develop a new weed detection and classification method that can be applied for autonomous weed control robots. In order to achieve this goal plants must be classified into crops and weeds according to their properties which is done by a machine vision algorithm. The disadvantage of this system is it works based on position of weed.

"Internet of things (IoT) embedded smart sensors system for agriculture and farm management" by Arshad Ali, Sami Alshmrany. In the proposed framework, several features are embedded, e.g., remote monitoring, intruder caring, temperature, and moisture sensing, security, leaf wetness, and irrigation facilities. The disadvantage of this system isit does not contain plant disease identification system.

"A smart farming concept based on smart embedded electronics, internet of things and wireless sensor network" by Mobasshir Mahbub. This paper has prescribed farming systems based on the embedded systems, IoT and wireless sensor networks for agri-farm field and livestock farms. The disadvantage of this system is it has to Sensors units occupy more Power and Circuit is complex .

III. METHODOLOGY

An automated leaf disease recognition system is proposed using MATLAB to detect leaf diseases through image processing. The system focuses on recognizing paddy leaf diseases to help farmers take proper measures and increase production. The K-means clustering segmentation algorithm is used to segment the image, and visual-based features such as color, texture, and shape are extracted. A CNN classifier is applied to classify the diseases. The system offers a proper guidance containing instantaneous remedies based on the severity of the disease.

Additionally, a Smart Farming System using IoT is being developed to assist farmers in getting live data via a mobile app. The system monitors the temperature, humidity, and water level to enable farmers to increase their overall yield and product quality efficiently. This system can help farmers make better decisions and take appropriate measures to prevent crop loss due to disease, pests, and environmental factors. Overall, this system can revolutionize the agriculture industry by providing farmers with the necessary tools to improve production and promote sustainable practices.

IV. ARCHITECTURE

An intelligent plant protection system can be designed with the use of several sensors and a control system that monitors the environmental conditions and applies necessary actions to protect plants. The system architecture can be divided into the following components:

1. Sensor Module: The sensor module includes several sensors such as temperature and humidity sensor, ultrasonic sensor, and rainwater sensor. These sensors are responsible for collecting data related to environmental conditions that affect plant growth.
2. Control Module: The control module processes the data collected from the sensors and applies necessary actions to protect plants. It includes a microcontroller, communication modules, and power management circuits.
3. Actuation Module: The actuation module is responsible for controlling the actuators that apply necessary actions to protect plants. It includes devices such as water pumps, fans, heaters, and sprinklers.
4. User Interface Module: The user interface module is responsible for providing a graphical interface for users to monitor and control the system. It includes displays, LEDs, and push-buttons.

The temperature and humidity sensor monitors the environmental temperature and humidity and sends the data to the control module. The ultrasonic sensor is responsible for detecting the presence of insects or other pests that could damage plants. The rainwater sensor detects the amount of rainfall and sends data to the control module.

The control module analyzes the data and applies necessary actions, such as turning on the sprinklers if the rainfall is low or turning on the fans if the temperature is high. The control module also sends alerts to the user's smartphone or email if the environmental conditions reach a critical level.

The actuation module controls the actuators based on the actions decided by the control module. For example, if the temperature is low, the heater will be turned on to keep the plants warm.

Finally, the user interface module provides a graphical interface for the user to monitor and control the system. The user can monitor the temperature, humidity, and rainfall data in real-time and control the system through the interface

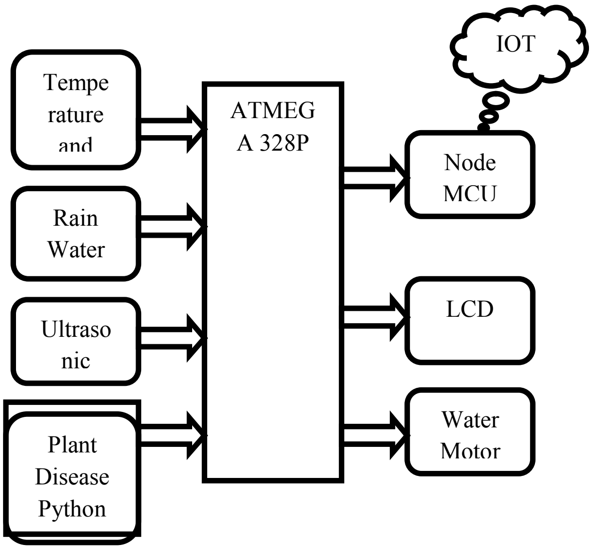
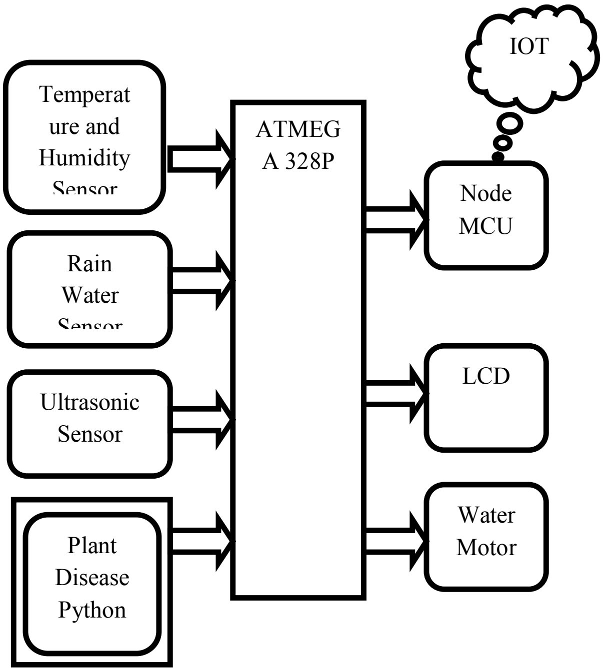


Fig.1. View of system architecture

4.1 Data Flow Diagram



IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 8, May 2023

Data Flow Diagram A data-flow diagram is a way of representing a flow of data through a process or a system (usually an information system). The DFD also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow — there are no decision rules and no loops. Specific operations based on the data can be represented by a flowchart.

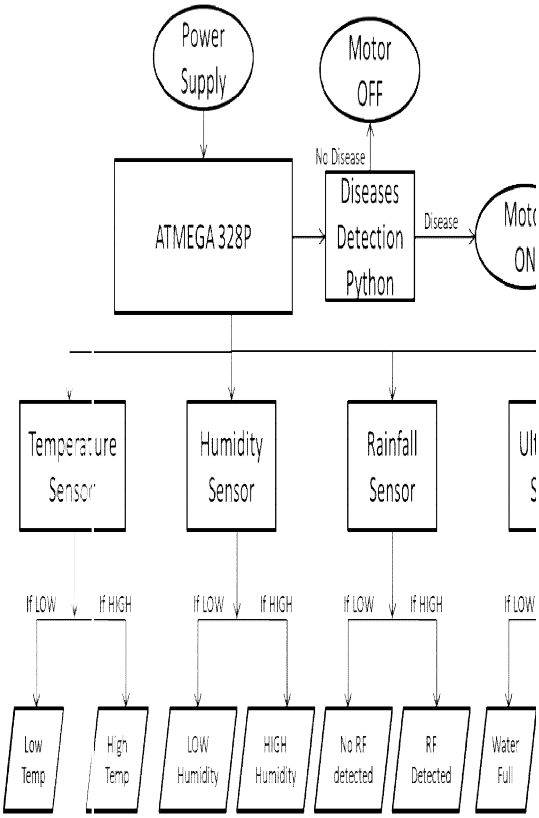


Fig.2. Dataflow Diagram

V. SYSTEM IMPLEMENTATION

Modules Descriptions:

Water Level Detection Module:

An Ultrasonic Sensor is used to check the water level of tank. Sensor transmits Signals which is been received back once the signals hits water. Using duration of transmitting and receiving of signals, distance between the sensor and water in the tank is been calculated. The water level is been updated to IOT using Node MCU.

Rainfall Detection Module:

The fundamental functioning concept of rain sensors is resistance testing, and the sensor has two distinct conduction printed leads on its whole surface. Sensor transmits Signals which is been received back once the signals hits water. The detected data is then transferred to the Arduino UNO. The Data is been updated to IOT using Node MCU.

Temperature and Humidity Module:

The electrodes on the surface of a moisture-holding substrate make up the DHT11 humidity sensor. The relative humidity has an impact on how much the resistance between the two electrodes changes. In order to function, humidity sensors must be able to detect changes in electrical currents or air temperature. The detected data is then transferred to the Arduino UNO. The Data is been updated to IOT using Node MCU.

Plant Disease Detection Module:

Steps Involved in detecting plant disease are:

DOI: 10.48175/IJARSCT-10257

- Collect the dataset: The first step is to collect a dataset of images of healthy and diseased plants.
- Preprocessing the dataset: Before building the machine learning model, you need to preprocess the dataset. This involves resizing the images, dividing the dataset into training and testing sets, and normalizing the pixel values.
- Building the model: The next step is to build a machine learning model. You can use various machine learning algorithms like SVM, CNN, or KNN. CNN is the most commonly used algorithm for image classification problems.
- Training the model: Once the model is built, you need to train it on the training set. This involves passing the images through the model and adjusting the weights of the model to minimize the loss function.
- Evaluating the model: After training the model, you need to evaluate its performance on the testing set. This involves passing the images through the trained model and calculating the accuracy, precision, recall, and F1 score.
- Deploying the model: Once the model is trained and evaluated, you can deploy it for real time plant disease detection. You can build a web or mobile application that takes images of plants as input and passes them through the trained model to detect the disease.

VI. CONCLUSION

In conclusion, the intelligence plant protection system developed with temperature and humidity sensor, ultrasonic sensor, rainwater sensor with plant disease detection project is a valuable and useful tool for protecting plants in a controlled environment.

The system is designed to monitor and control the temperature and humidity levels within the greenhouse or indoor growing environment, ensuring optimal growing conditions for the plants. The ultrasonic sensor is used to detect any obstacles or intruders that may pose a threat to the plants, while the rainwater sensor ensures that the plants receive the right amount of water.

Furthermore, the plant disease detection system is an essential feature of the project, providing an early warning system to detect any signs of plant disease, allowing for prompt action to be taken to prevent the spread of disease and minimize plant damage.

The system is easy to use and can be operated remotely, allowing growers to monitor their plants from anywhere at any time. The data collected by the sensors is analyzed and presented in a user-friendly format, making it easy for growers to make informed decisions about the health and growth of their plants.

Overall, the intelligence plant protection system with temperature and humidity sensor, ultrasonic sensor, rainwater sensor with plant disease detection project is a significant step forward in the field of plant protection and cultivation. The system offers an efficient and effective way to protect and care for plants, ensuring maximum yield and healthy growth. With further development and refinement, this project has the potential to revolutionize the way we grow and protect plants, benefiting growers, the environment, and the global food supply.

REFERENCES

[1] T. M. Song, Z. Ren, et al., “Design of spraying system for plant protection UAV,” Agricultural Mechanization Using &Maintenance, Heilongjiang, no. 4, pp. 12-12, 2018.

[2] Q. C. Chen, J. G. Feng, “Application Status and Prospect of Agricultural Plant Protection UAV in China,” Pesticide Market News Jiangsu, no. 13, pp. 6-8, 2017.

[3] J. P. Pan, Z. H. Chen, et al., “Application Test of Different Plan Protection Machines on Rice Planting,” Agricultural Technology & Equipment, Shanxi, no. 2, pp. 16-17, 2017.

[4] C. P. Zhao, “Development status and trend of agricultural aviation plant protection in China,” Agriculture and Technology, Jilin, vol. 37, no. 6, pp. 255, 2017.

[5] H. Wang, X. Li, et al., “Classification of breast cancer histopathological images based on ResNet50 network,” Journal of China University of Metrology, Zhejiang, vol. 30, no. 1, pp. 72-77,2019