Smart Farming for Efficient Crop Growth

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***DOI**: https://doi.org/10.34293/acsjse.v3i2.83*

Abstract - *India largely depends on the agriculture sector. Besides, agriculture is not just a mean of livelihood but a way of living life in India. India is heavily dependent on the agricultural sector. Moreover, farming is not just a livelihood in India, it is a way of life. Crop monitoring plays an important role in controlling various pests, weeds or diseases in crops. This provides information about the current state of the crop and anticipates time to predict what the next crop problem will be. Improper management and protection of crops causes more infections and affects overall production. Some factors are most important for plant growth. Monitoring plant growth and health is difficult. A variety of pathogens are present in the environment, greatly affecting plants and the soil in which they are planted, thus affecting production. The lack of current mechanisms prevents people from receiving assistance with leaf-damaging diseases and preventative measures. The suggested method offers full-field surveillance and foliar disease identification using real-time measurements of field variables like temperature, humidity, and other live monitoring. This makes tracking variables and troubleshooting simple. Users can check current data and automatically adjust the flow of water through the programme even when there isn't any water around. Finally, plant information such as temperature and humidity was transmitted to farmers through the iot platform.*
***Keywords**: IoT, Matlab, LCD, Microcontroller, Leaf Disease Detection, pH Monitoring.*

I INTRODUCTION

India is the world largest consumer of fresh water, and India total water consumption is greater than any other continent. Agriculture is the largest consumer of water, followed by household and industrial sectors. Small farming practices are gardening in the backyard or balcony of a home. Horticulture is the practice of cultivating and cultivating plants as part of horticulture. In these crowded environments, building rooftops and terraces are still valuable resources for urban gardening.Crop diseases pose a serious threat to food security, but rapid detection remains difficult in many parts of the world due to a lack of necessary infrastructure. Identification of plant diseases in agriculture plays an important role. Currently, as a method for detecting plant diseases, simple visual observation by experts is used to identify and detect plant diseases. In order to detect plant diseases early, it is useful to use an automatic disease detection method.

II LITERATURE REVIEW

The system is developed using sensors, and the irrigation system is automated based on server decisions based on the received data. Data received via wireless transmission is transferred to a web server database. When watering is automated, the humidity and

temperature fields fall below their potential ranges. Users can remotely control and manage the system using an application that presents a web interface to the user [1].

The Authors described that after early monitoring of disease using sensors such as temperature, moisture and soil moisture, recommendations for disease and fertilizer should be followed. Train and test the data set using the above method. Several images were taken from the train dataset for training and only a few image samples were used for testing. At the end of the testing phase, we try to match the images from the train dataset to the tested sample images. After that, the image of the disease is preceded by a preprocessing step.In the pre-processing step (), the image is clustered into parts using k-means clustering and then the parts are classified using a Support Vector Machine (SVM) classifier. Edge detection is performed using a genetic algorithm and provides efficient results. The proposed system evaluated the three objectives of this paper: monitoring, search and service quality [2].

Smart farms are emerging as a new concept so they can provide their farmland information through IoT sensors. This document aims to utilize new technologies such as IoT and smart farms using automation. Monitoring of environmental factors is a major factor in increasing the yield of efficient crops. The feature of this article is monitoring the temperature and humidity in an agricultural field with a sensor using one CC3200 chip [3].

The authors described the purpose of this smart agriculture or agriculture is to monitor the environment by obtaining real-time data such as temperature, soil moisture and moisture. All this is achieved with temperature, humidity and humidity sensors. The system proposed in this paper is made using a microcontroller and various sensors. The system can control parameters in different soil conditions [4].

In Smart Farming System using IoT the authors has mentioned that this new system is supposed to increase the quantity and quality of agricultural production. IoT devices provide information about the nature of the agricultural field and take action based on farmer input. This article presents an advanced IoT-based solution for soil and air monitoring for efficient crop growth. The developed system can control temperature, humidity, and soil moisture levels using the NodeMCU and several sensors connected to it. In addition, notifications about the ecological status of the field are sent to the farmers phone via Wi-Fi in the form of SMS [5].

Boobalan, V Jacintha (2018) proposed an IOT-based agriculture monitoring system in their study. This paper's primary goals are to assess the soil's moisture content and provide crops with automatic irrigation. In order to fully automate the system, this system also measures temperature, humidity, and the presence of impediments in the region in question. This reduces the need for human involvement (farmers). The soil moisture sensor measures the moisture content and regulates the irrigation of different crops. If a change in the moisture level is detected, the sensor will inform the microcontroller of the new value and store it in the cloud. The crops automatically receive water to the desired level based on the detected value, maintaining the humidity of the soil. Humidity levels in industrial areas are determined using temperature and humidity sensors and sent to the cloud via Raspberry Pi [6].

Agriculture monitoring and prediction using Internet of Things (IoT) done by Mohit Kumar Saini and Rakesh Kumar Saini has said that this model uses different types of sensors

such as soil moisture, barometric pressure, rain detection and humidity sensors for different purposes. On the cloud, data is gathered and calculations are made automatically. Crop management, useful data collecting, and automated analysis are all things that smart farming can learn from. Implementing an Internet of Things (IoT) that tracks moisture, soil condition, temperature, water supply, water level, and weather conditions in the field is the goal of this article. In order to create real-time data streams that are available through the Internet, the IoT-based smart farm system described in this study combines a variety of sensors and Wi-Fi modules [7].

III BLOCK DIAGRAM

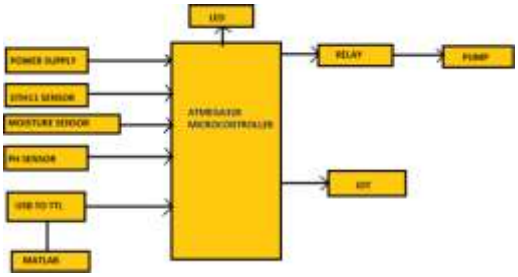

Figure 1: Overall Block Diagram

The overview of the project is shown in Figure 1.The system is modelled using Atmega 328 microcontroller which connects to temperature, moisture and pH sensor. pH sensor for to decide which crop is cultivated in this field. The crops suitable for that pH will also be identified. Common disease occurred in leaf will be identified with the use of Matlab. We can control the motor pump and the valve. The readings were also monitored continuously using blynk app.

IV PROPOSED METHODOLOGY

Significantly improving the agriculture by including the identification of leaf disease with the help of image processing. Based on the deployment range, they satisfy the challenges in the agricultural applications These wireless protocols reduce their duty cycle to save energy. They also go into sleep mode at the same time to extend battery life. The ubiquitous objects were connected to the network in the Internet of Things (IoT). IoT has so being used in the agricultural industry recently. The best choice for the development of smart agriculture is the internet of things. Since the Internet of Things (IoT) has brought a new dimension to the world of information and communication, building IoT has evolved greatly in recent years. We have implemented a plant monitoring and watering system using IOT which continuously monitors the moisture, humidity and temperature of the plant. When the moisture level in the soil goes down to a certain threshold, it automatically starts watering the plant. The notification and the moisture level is shared to user using blynk through WiFi. Not only monitoring is sufficient for plant growth. We have identified pH of the soil based on that crop will be selected.

Table 1: Ph Data Set

Table Head	Soil pH		
	Crops	Ranges (From)	Ranges (to)
1	Rice,	5.0	6.5
2	Wheat, Potato	4.0	6.5
3	Corn, Pumpkin	5.0	7.5
4	Peanut	5.8	6.2
5	Tea, Potato	4.5	6.0
6	Orange, Litchi	6.0	6.5
7	Watermelon	5.5	6.5
8	Cabbage	6.0	7.5

Table (1) shows the crops that are grow in the field based onsoil pH. Based on the pH soils can be segregated as neutral ranges from 6.5 to 7.5, above 7.5 are alkaline, less than 6.5 are acidic, and soils with pH less than 5.5 are considered as strongly acidic. Common disease occurred in leaf will be identified with the use of Matlab.There are some methods of disease identification.

Figure 2: Block Diagram for Disease Detection

Image Acquisition

The high definition camera used to capture the images of the leaves has RGB components rather than grayscale. The leaf image's shading change segments are identified, and after that, they are sent to a gadget with an autonomous shading change capability.

Image Preprocessing

Totally unexpected pre-preparing techniques are taken into consideration to eliminate disturbance in a picture or discretionary article removal. For example, picture editing can involve cropping a leaf image to reveal an intriguing location. The smoothing channel is used for image smoothing. The goal of image improvement is to increase qualification [8-10].

Image Segmentation

Segmentation, which occurs in the third step, is the division of the image into various pieces and segments with comparable intensities and similarities. The segmentation procedure is frequently carried out utilising a variety of algorithms for such as the HIS model, the k-means algorithm, and the Otsu technique.

Histogram is a graphical representation of the distribution of data. Two types of histograms are,

- Image histogram
- Color histogram

Tonal distribution in a digital image in the form of graphical represention is known as image histogram. It plots the number of pixels for each tonal value. Nowadays many modern cameras are enable of Image histograms. Image histogram are the mainly responsible tool for thresholding. Edge detection, image segmentation and co-occurrence matrix uses the threshold value.

Feature Extraction

It is a procedure in which the image can be examined using many criteria, including size, colour, etc. Following these processes, the ailment is recognised, and we may also learn the treatment options

YCBCR Colour Space

The purpose of error detection is to minimize the error rate in identifying diseased part. The importance of this part is tomeasure the position of the infected part of the leaf.

Conversion of RGB to YCBCR

RGB information can be encoded utilizing YCbCr. The sign is shown utilizing the real nature in view of the RGB primaries. A benefit of changing the picture's variety space from RGB to YCbCr to dispense with splendor during picture handling. Every component of an image that is red, green, or blue in the RGB design has a variable splendor. The Y part of the YCbCr chart exhibits how the brilliance of the Cb (blue) and Cr (red) variety parts is irrelevant to glow.

The technique for restricting pixel power changes is edge recognition. Target following, division, object acknowledgment, and different cycles have all taken advantage of this. One of the most essential parts of picture handling is it. There are various edge location procedures, as Sobel.

Table 2: Disease Dataset

S.No	Common Diseases	Pesticide
1.	Powdery Mildew	Bacillus subtilis
2	Downy Mildew	Strobilurin
3	Black Spot	Daconil
4	Fusarium Wilt	Azoxystrobin

Table (2) shows the disease that are commonly affected by plants. The pesiticide which will be effective to treat the plants will also be displayed.

The disease that are commonly affect most of the plants are described below

Black Spot

Powdery Mildew

Downy Mildew

Fusarium Wilt

V RESULT & DISCUSSION

Plants Affected by Various Diseases is shown in Figure 3 and the overall system used in this work is mentioned in Figure 4 and 5. Sensors like Temperature, Moisture and pH were used to monitor the field. Based on pH crops will be cultivated. The crops that are grow in the field based on soil pH. Younger generation farmers can come to know which crop should be cultivated in the field. Based on the pH soils can be segregated as neutral ranges from 6.5 to 7.5, above 7.5 are alkaline, less than 6.5 are acidic, and soils with pH less than 5.5 are considered as strongly acidic. Solenoid were fixed to release the water wherever it needed. That .control is on the hands of the farmers. For example if they were planned to cultivate more than two crops on the same field, then both doesn't want the same amount of water. In that case, this process so much helpful to avoid the wastage of water. At the same time it satisfy the need of the other crop. The main reason for the wastage of water is providing enormous supply of water without knowing the soil and environmental condition. Low production level in agriculture is mainly because of lack of identifying disease and steps taken to prevent spread of disease. Common disease that were affect most of the leaf nowadays are Black Spot, Fusarium Wilt, Downy Mildew, Powdery Mildew. Previous generations were just identified by their naked eye. That will be successful in some condition but not in every take. Nowadays, we have used the image processing techniques to identify reason for the infection. This can be implemented by using the matlab software. As well as, this can be informed to the farmers with some notification. For all these purpose we can use IoT platform to notify the farmers about the soil moisture, temperature, pH and also the providing the solution to prevent the spread of disease will also be notified. The below picture is a sample for that output.

Figure 3: Output Image from Blynk App

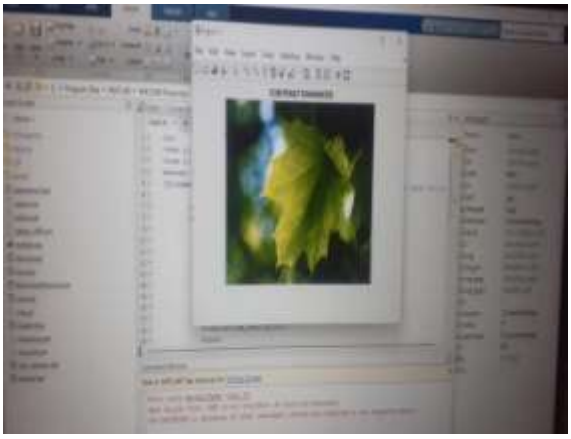

Figure 4: Output from the Matlab

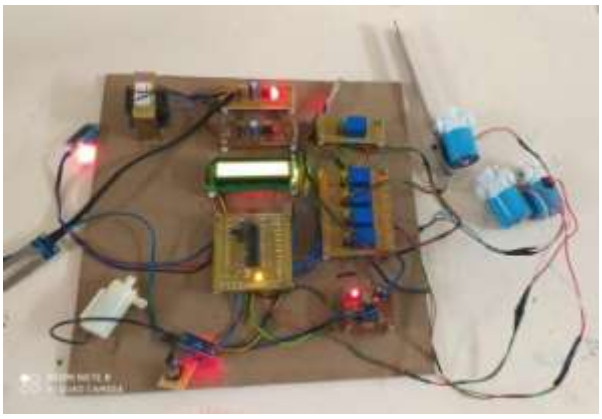

Figure 5: Interfacing Sensor with LCD Display and Atmega 328 Microcontroller

VI FUTURE WORK

Human life is completely dependent over plants and agriculture and yield of crops play a very important role in deciding the overall development and growth of the human race, for this purpose, there is an urgent need to solve the issues and problems that are related to plants and agriculture. Therefore we in this project are aiming to create a model that will help in the monitoring and well keeping of the agricultural plants from the various diseases by analyzing them thoroughly of crops. In future, we will extend our database since as we increase the training data, the accuracy of the system will be higher. We also try to make the application as user-friendly and time-saving as possible so that even a 10-year-old child may be able to use it effectively. We also plan to develop a system within the app in future that will predict and tell the farmers the best crop/plant that may be grown on their land as per the soil conditions.

VII CONCLUSION

Agricultural farming is important because that provides a large number of human opportunities and makes many people and the Indian economy. And to yield food crops and natural plant products and to raise the economy of any country. IoT has been helped to achieve the gap between the lack of quality,quantity and production We made use of a controller that has been empirically validated through research that tracks temperature and

humidity variables. We'll keep an eye on the PH level. We can grow the crop depending on the PH level. Using image processing techniques, this autonomous disease detection system finds diseases on plant leaves. Data from the sensors are fed into the controller to provide efficient output. With the help of the end to end connected data the production will be highly developed. Because of IoT the time spend by the human on the lands will be reduced and also plays vital role in smart agriculture.

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