# CROP FIELD MANAGEMENT BASED ON IOT USING RASPBERRY PI

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**Abstract— Sustainability of Agriculture is important during the soil degradation, scarce water resource and climate change. Improving the efficiency of water use and its productivity practiced by farmers are not sufficient nowadays. We can get solution by making use of several real time experiments. By referring to this paper it can solve problems like monitoring of water, soil degradation etc. In this paper, by using Pi it can monitor all other application like GSM, digital sensor and DC motor with pump. The device, digital sensor provides you better solution in accurate level measurement and automatic processing water levels. By using GSM it can send the information about moisture content to the field owner since field owner cannot monitor the water content every time. A digital sensor measures the moisture content in the soil and is accessed through Pi. Soon after sensing the moisture content, by using dc Motor we can make water to flow to field, if the content of moisture is low and at the same time the message is sent to the field owner. . We can also use led and buzzer to indicate moisture content, also DTH sensor and LCD to display temperature and humidity. Thus, this paper helps the farmers to yield even when there is water scarcity.**

**Keywords— GSM, Raspberry Pi, Digital sensor, DTH sensor, DC motor, LCD.**

## I. INTRODUCTION

In India the major source of income is from the field of Agriculture. It alone contributes for about 22% of the country's income. Farmers can select the required crop for their field with the use of appropriate fertilizers for their crop. The major reason for the decrease in the yield is due to the diseases which are present in the plants. Due to the disease there will also be reduction in the quality of the products [1].As the technology is growing up, it can be implemented in the agriculture too. The use of IOT in agriculture provides solution to all the problems faced in the traditional agriculture method. Controlling the field condition is a tedious task. By the use of wireless system in the field of agriculture various issues can be solved [2].

Till now the identification of disease was done manually, in all of these techniques the digital domain is widely being used. The use of digital system gives intuitive judgment. The early judgment of disease makes the farmers to avoid losses. The agriculture will provide good result in return. The use of non-applicable fertilizers can be avoided. In most of the case the disease symptoms are seen in the parts of leaf, stem and the fruit. In this system we are develop a system that detects the disease present in the plant leaf [3].

## II. LITERATURE SURVEY

[2] The paper aims to accumulate the readings from multiple nodes and assist the farmers cope with diverse operations wirelessly presenting a smart agricultural field for farmers. They have developed smart Agro Mobile Application. This application provides details about weather forecast and also provides features like Agro Calendar and Agro News. The disadvantage is point-to-point communication can be affected by topology of the wind, rain and land.

[3] The paper aims at designing a complete device which helps to automize the agricultural field, which reduces the work load on the farmers. This proposed system provides an automatic irrigation device and rooftop control

system for the farmer on the premise of Wi-Fi sensor community. They have developed a mobile application. They have used KNN classification to find whether the leaf is healthy or diseased. The disadvantage is it is costly.

[4]The paper aims to controlling the supply and demand of agricultural products. Their proposed methodology involves automated irrigation system and rooftop management system. The disadvantage is, field automation in agriculture and rooftop system is, costly to implement.

[5]The paper aims the real time observation with efficient use of cheapest security system. This paper uses Raspberry Pi, sensors, IP camera and cost effective laser shield for their methodology. The difficulty faced is in the use of strong and cost effective security system for both day and night.

[6]The paper aims the idea of combining of IOT and DIP(Digital Image Processing). This paper uses sensor, IOT module, Aurdino and Cloud Computing in their proposed methodology. The challenge faced by them is to turn traditional method of irrigation to modern method by introducing extent of automation to monitor the field.

[7] The paper aims the detection and prevention of disease of plants from getting spread. The methodology in this paper involves Raspberry Pi, GSM module and K-clustering algorithm. Attaining the accuracy in the plant disease detection but at high speed was the biggest challenge faced by them.

[8]The paper aimed to make a smart agriculture system by the use of a technique called as Precision Agriculture (PA). In the methodology they have made use of LoRa WAN as they require less energy for the communication and also the protocol provides long range communication. The major disadvantage of this paper was that the strategy which they use did not save energy. Data fusion problem was present.

[9]The main of the paper was to reduce one of the major agriculture problems that is turning the motor on and off. To avoid this wireless monitoring irrigation system was developed. In the methodology they have made use of NRF24L01 trans-receiver. But the disadvantage was the system was not fully automated and the system which was designed could not exactly tell about the crop which was affected.

## III. METHODOLOGY

The moisture content and humidity and temperature are measured using Soil Moisture Sensor and DHT11 Sensor respectively. This data is fed into Raspberry Pi to monitor the water level. Raspberry Pi compares the given data with saved data and gives the result. Based on Raspberry Pi result it will decide the water quantity that should be given to field using motor. Motor runs only when the water content is less than the value of threshold in the soil. A Water level Sensor is used to measure the water level in the tank to reduce the over flow of water. The information about the field's water content is also sent to the field owner using GSM module as shown in Fig.2. As an implementation we are using pH sensor and Robot for better growth of plants. The Ph value of picture is measured by pH sensor without human intervention to the field to yield more productivity.

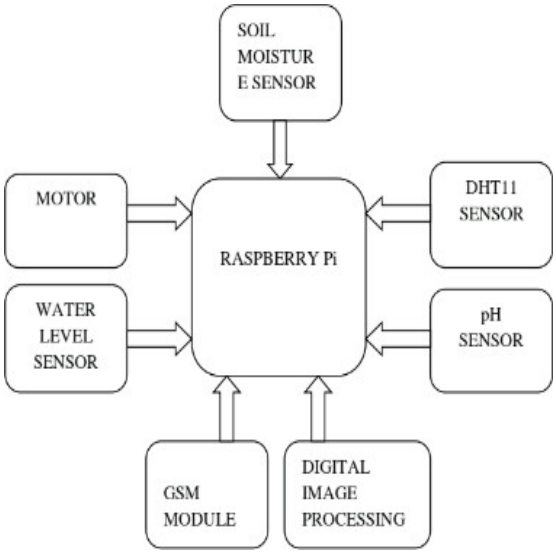


Fig.1: Block Diagram of the System

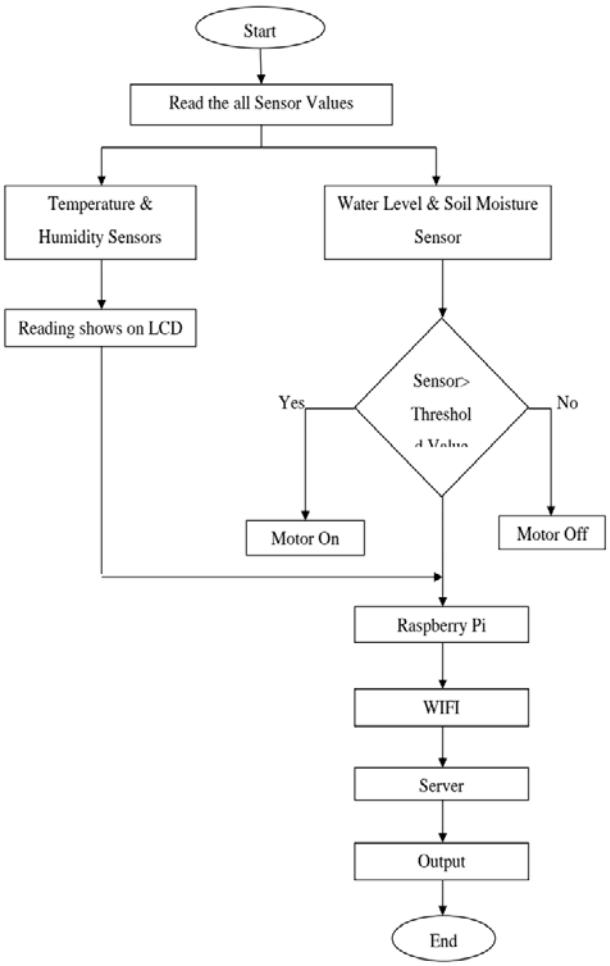


Fig.2: Flow Chart for Soil Reading

The digital image processing is done using Pi cam. A Pi cam is used to capture the diseased plant picture without human intervention to the field to yield more productivity as shown in Fig.3. Robots are used to help the entire system of crop productivity.

Fig.3: Flow Chart for Detection of Disease

## IV. IMAGE PROCESSING

Here the image is converted into digital form and performing some operations on it. It helps in getting enhanced image. By using image processing, the basic steps are shown in figure.

Fig.4 Block Diagram for Plant Disease Detection and Identification

**Image Acquisition**

It means capturing the images with the help of digital camera and it will be in RGB form. Generally, it involves pre-processing, such as scaling etc.

**Image Enhancement**

It adjusts a photograph so that the end result is greater suitable for an in addition application. Example includes:

- Brightening of an out of focal point image.
- Highlighting the edges.
- Improving distinction of an picture and eliminating noise

**Image Segmentation**

It includes subdividing of an image into large number of small parts. By performing this one, we can identify following things:

- Finding particular shapes, lines, or circles in an image
- In an aerial photograph, identifying roads, cars, or buildings.

The clustering of segmented images uses K-means Clustering Algorithm and Otsu's Classifier. Before clustering, the RGB image

is converted into 'Lab' refers to radiance layer 'L', chromaticity. Layer 'a' (Color falls along the red-green axis) and chromaticity layer 'b' (Color falls along the blue- yellow axis). The Lab color model helps in easy clustering of subdivided images.

**K-means Clustering Algorithm**

a)Input image is loaded.

b)Convert the input RGB image into L*a*b color space.

c)To the agricultural science RGB image feature Pixel Counting technique is extensively applied.

d)Using K-mean method the variant colors are clustered.

e)Between two objects the Euclidean distance is found.

f)Based on its estimated variant cluster-centre each pixel is labeled under clusters.

**Otsu's Classifier**

To perform clustering based an image threshold is done by Otsu's Classifier. This algorithm says that an image will have two classes of pixels and it constitutes bi-modal histogram. The optimum threshold is calculated by isolation of their combined spread/intra-class variance.

**Feature Extraction**

Identification of an object is done by Feature Extraction. The Feature means, it is a function of one or more measurements, specifying quantifiable property or significant characteristics of an object. In an algorithm, if the input data is very large to be processed and it is suspected to be redundant. Then the original image is converted into a reduced set of features. The plant disease detection use color, texture, morphology, edges etc. as the features. The infected areas in plants can also be detected using Feature Extraction.

## V. RESULTS

Robot is made for yielding better results compared to previous versions. By using Pi Camera Module, we are able to capture a picture of affected plant and the constructed robot is shown below:

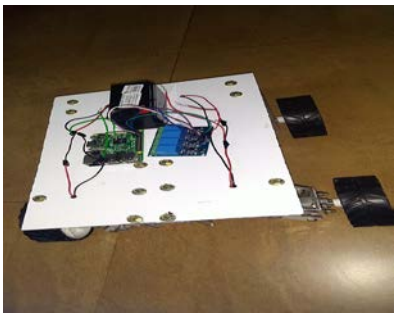

Fig.5: Constructed Robot

In this paper by applying image processing technique on the input image using MATLAB helps to find the diseased plant. Whenever a plant leaf containing disease appears corresponding disease is detected by the use of K-means clustering algorithm and Otsu's Classifier as shown in Fig.6. This method gives appropriate result and also it takes less amount of time when compared with the other methods.

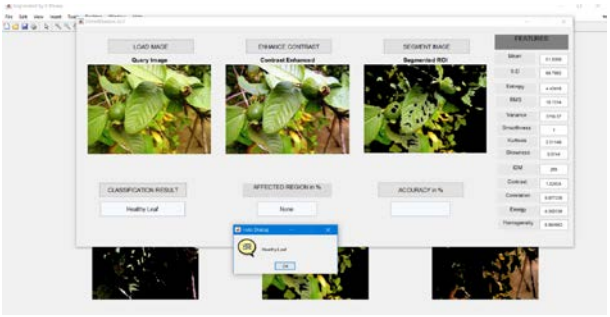

Fig 6: Detection of Plant Leaf Disease

## VI. CONCLUSION

We have designed this system to help the farmers to improve their crop production in a modern way. This system is user-friendly and it introduces latest technology into agriculture. Smart agriculture can be achieved by the Intelligent Management System. Reducing the water consumption is a big challenge for the farmers. So this Automated Irrigation System having DHT11 sensor and soil moisture sensor helps the farmers to reduce water consumption in digital way. The motor will ON/OFF automatically based on the values obtained from the sensors which automatically monitor irrigation. Robots monitor the entire system by moving around the field. Plant disease is the major factor that has lead to series of losses to farmers. Here plant detection is done by using image processing. ANN methods can be used for the classification of disease in plants. Image processing enhances the plant image and

performs image segmentation and feature extraction is used finally to detect the disease of the plants. Hence this smart system is proposed to monitor the agriculture which improves yield and it also saves time since no human intervention is needed.

## VII. FUTURE SCOPE

Each crop requires different variety of fertilizers. When the field needs fertilizer, we can spray automatically without the help of human being. But in this system we cannot analyze the required fertilizer that is needed for each and every variety of crops. Also, we can put in force net primarily based photo processing technique. In the case of web based picture processing, classification of algorithm will be carried out in the cloud itself. Real time monitoring information will be there if we use the cloud platform.

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