AN EFFICIENT IOT BASED SMART IRRIGATION AND PLANT DISEASE DETECTION

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Abstract-*The* population in India depends on agriculture and farming. Our Indian economy directly depends on the the agricultural production and agriculture is the sector which contributes the highest to India's Gross Domestic Process(GDP). Though the economic production is highest from agriculture the methods used are traditional and are not tremendous. Traditional way of farming is not efficient and unreliable. Managing water supply to the plants for better yield manually is difficult and this can be overcome through smart irrigation system which can employed by using Iot technique. Most of the crops are affected by disease and the production goes down as the yield of the crop decreases. According to a survey, in India 18% of the crops are affected by pest and the GDP decreases. To overcome this we are employing a method of it effected with disease can image processing where the plan be detected. The project involves smart irrigation system which is used for monitoring the water supply to the plants according to the yield requirement after the detection of moisture, humidity and temperature of the environment. It also detects the disease in the plant through image processing by open computer vision process.

Keywords:**IOT, ESP12, Raspberry Pi, Blynk server, Dropbox**

i. INTRODUCTION

Internet of Things is the extension of internet connectivity into physical device and everyday object. India has large range of cultivable land where the output produced by it does not do justice for the Indian economy. Even though the use of technology in agriculture sector is increasing but the large portion of it especially irrigation is still exercised manually. Manual irrigation have drawbacks like insufficient water supply or over watering of plants. There are many types of traditional irrigation methods out of which drip irrigation is one of the type which has potential to overcome many disadvantages of all other irrigation techniques. Drip irrigation allows water to drip on the roots of the plants slowly both on the surface of the soil or directly to root zone of the plants through a system of network pipes valves and tubes. For implementation of this idea an Internet of things system is designed to monitor a smart drip irrigation system where the system calculates the water requirement for crop based on soil moisture level. In order to remove the drawbacks of traditional systems, automated irrigation system along with plant disease by visually seen symptoms using Internet of Things technology has been done. With help of temperature and moisture sensors inputs which will be deployed in the fields using internet of things technology irrigation system works. Consequently, detection of plant diseases is an essential research topic as it may prove useful in monitoring large fields of crops, and thus automatically detect the symptoms of diseases as soon as they appear onplant leaf. On the other hand plant disease symptoms are visually identified by image captured by camera and corresponding treatment is suggested for the identified disease which is suggested in Hindi and English on theandroid mobile application used by the farmers. Drawbacks in consumption of water resources and plant disease identification by the farmers manually can be overcome.

ii. LITERATURE SURVEY

K.K Namala [1] have made the irrigation system more feasible using embedded systems. This type of irrigation system uses RPi and Ardino UNO which are user friendly . At the transmitter side Ardino is used and at the receiver side RPI is used, RPI is used to control the flow meter. As previous works this system is also monitored using an app and webpage, the main component of the emended system is RPI which is user friendly, programming language used here is "Python" which is feasible and efficient. RPI used not only for controlling, it can be used for image, video, speech processing also we can make use of these capabilities to improve agricultural activities.

AmeyaBhale, SuryakantSawant, Surya Durbha and J.Adinarayana [2] these authors presented a paper entitled "IOT based automatic drip irrigation system". This system consists of a base station, actuator node and irrigation module. XBee radio is used to communicate between actuator and base station. Actuating the electromagnetic valves is based on stress condition due to soil moisture, temperature and humidity. Main controllers used here are Arduino and Rasberry Pi.

S.G.Manoj guru [3] have shown that embedded systems are most sophisticated to achieve any Specific task, by this aspect a paper with title "Smart irrigation system using Arduino" has published, here the authors have presented a embedded system design to implement smart irrigation system. In addition to it details of irrigation process was made to reach user with the help of GSM.

Suhas D.S. ,saianusha,Shraddha, Abhishek D [4] this group of four authors have come across The detection and classification of the healthy tomato plant leaves and various tomato plant diseases detection are achieved with an accuracy of around 80 to 84% for various selected diseases among the five categories such as Powdery mildew, Verticillium Wilt, Leaf miners, Septoria leaf spot and Spider mites diseases which are commonly affecting the tomato plant in growing period.

Shivani K. Tichkule, Prof. Dhanashri. H. Gawali [5] has presented an overview of the idea of using a processor to detect the diseases of the plants which can be used as real-time system. Here they have discussed many solutions by the means of techniques to detect the leaf disease in many crops. One of the prototypes called "Agrobot" shows a method to make use of a processor to achieve smart Irrigation with Disease detection. Agrobot or agricultural robot or Agribot is an agricultural robot used for performing various agricultural tasks. Significantly this ides has been used in our project.

iii. COMPONENTS

1. Node MCU: Node MCU is an open source IOT platform. It includes firmware which runs on ESP8266 Wi-Fi SoC. The ESP8266 has 17 GPIO pins (0-16). You can only use 11of them, because 6 pins (GPIO 6 - 11) are used to connect the flash memory chip.
2. Sensors: DHT11 is a temperature humidity sensor which generates calibrated digital output. DHT11 can be interface with any microcontroller like Aurdino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability.
3. Soil moisture sensor: The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value.
4. Motor water pump: It is a centrifugal pump of 15v which is used to pump water to the field after the moisture condition detection by the sensor.
5. Motor driver L298: The L298 is an integrated circuit in a 15-lead Multi watt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels. It drive inductive loads such as relays, solenoids, DC and stepping motors.
6. Raspberry Pi: Is a small single board computer. By connecting peripherals like Keyboard, mouse, display to the Raspberry Pi, it will act as a mini personal computer. Raspberry Pi is popularly used for real time Image or Video processing, IOT based applications and Robotics applications.
7. PI camera: Is a camera which can be used to take pictures and high definition video. Raspberry Pi Board has CSI (Camera Serial Interface) interface to which we can attach Pi Camera module directly.This Pi Camera module can attach to the Raspberry Pi's CSI port using 15-pin ribbon cable.

iv. PROPOSED SYSTEM

The architecture of the proposed system is as shown in the figure. The main concept used here is to combine both image processing techniques and internet of things to get the required results. Plants are monitored continuously and if they are affected by disease ,their changes will be captured by the camera of 1028resolution and will be analyzed using image processing in order to detect the disease and take preventive precautions. And another phase of our project is about smart irrigation where we use a moisture sensor to detect the moisture content of the soil and based on the result the motor pumps water to the field. We have used a Raspberry Pi-3 module in order to integrate image processing techniques with a ESP12 wifi module to automate the irrigation process. Moisture sensor and DHT11(temperature and humidity sensor) are used at the input side of irrigation process, camera is used to take images of plants and leaves. Smart phone installed with Blynk and drop box server are required to monitor the outputs of smart irrigation and disease detection process.

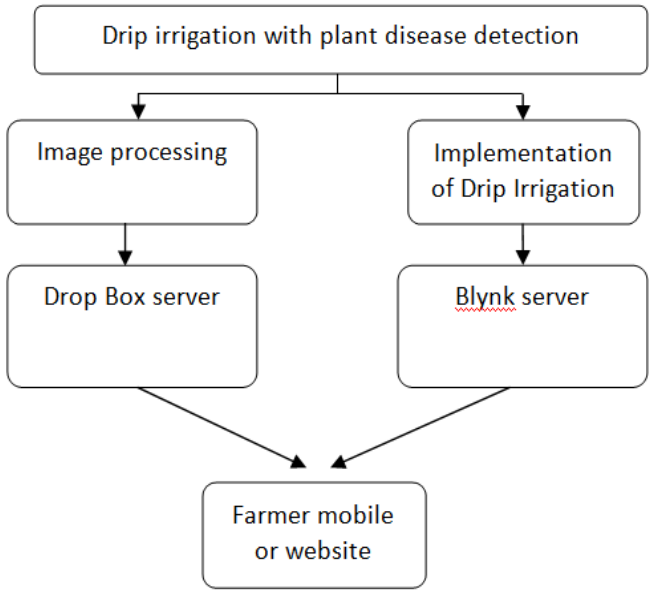

fig 1 : proposed block diagram

v. METHODOLGY

In order to implement image processing at agricultural land we have make use of Raspberry Pi with Raspberry Pi camera to capture images and to process it and to perform irrigation process we have make use of ESP12 as shown in the figure. This figure will explain the block diagram of Implemented system, at the cultivating land we can setup Moisture sensor, DHT11 and Motor pump which will be the input for the system, RPi and ESP12 will be the main processor where RPi will master processor and ESP12 will be slave processor in order to avoid damage which will cause to RPi this is done by online authentication process to connect them virtually, and hence ESP12 will be used as slave to it where both are interconnected with cloud.

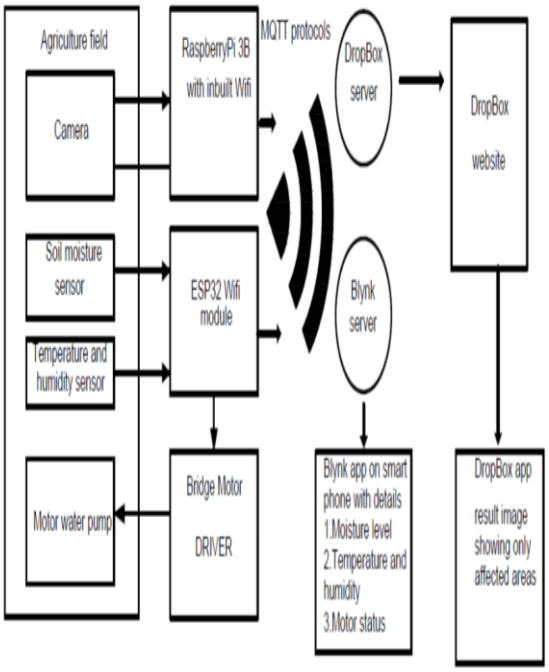

fig 2 : block diagram.

Image processing is efficiently used to detect the diseased area of the plant leaves affected by Leaf scald disease. A 5Mp Pi camera is used to capture the images of the leaves. A preview can be seen on monitor itself. The flow chart for disease detection is as shown in figure.

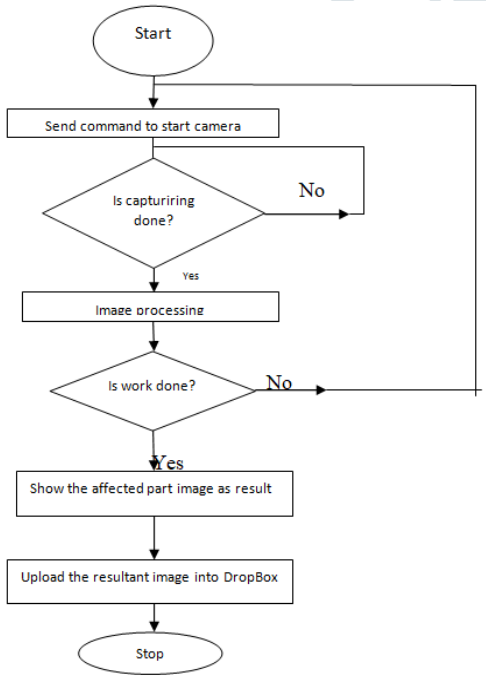

fig 3 : flow chart of disease detection

Whole process is executed in python. Programming for Image Processing is done using Python. Initially before doing the program there is a need to download the libraries of Open CV, Num Py, Pi Camera, libraries to call Delay function, mathematical operations, and to use Drop Box. Algorithm for Image processing is as given below:

1. Import the libraries needed to complete the task.
2. Take the picture with preview of 10 seconds and save it in memory.
3. Reshape the image and make it to 32bit format.
4. Apply K means clustering by keeping k=4 for original image.
5. Convert RGB image to HSV.
6. Define range of diseased colour in HSV.
7. Threshold the HSV image to get only diseased colour.
8. Mask the image by AND operation with original image.
9. Show the captured, segmented and resultant images.
10. Upload the final resultant image which shows the affected part of the leaf into Drop-Box.

Drip Irrigation system will have main pipe followed by perpendicular sub pipes with dripping nozzle and main pipe will be circulated with many bendings in order to slow down the speed of water flow as in figure, so that water can drip slowly. Block design of the motor driver circuit for irrigation is as in figure:

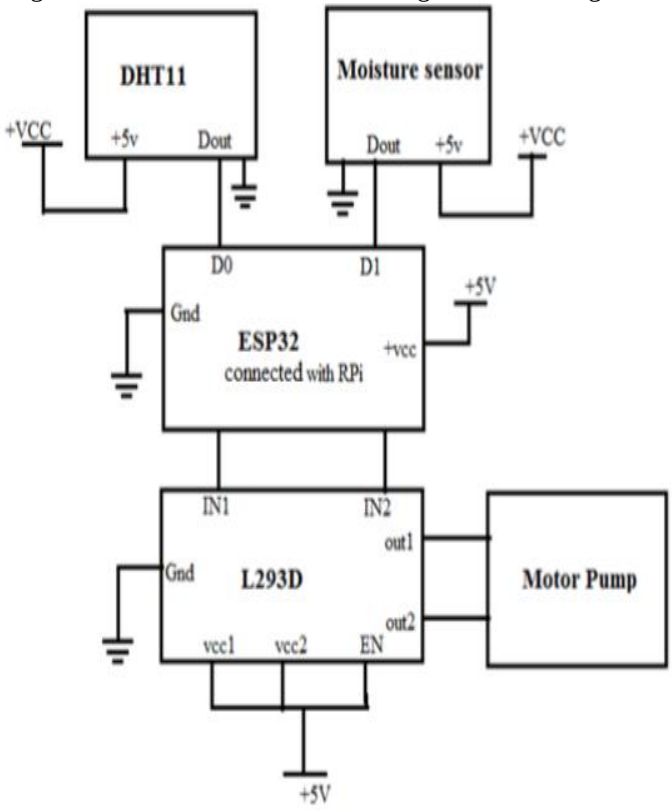

fig 4 : smart irrigation system

DHT 11 and Moisture sensor will be used as input, according to sensed values of moisture sensor, motor will automatically turn on and off, whenever ESP gets activated the system will start working. The flow of Drip Irrigation is as shown in the figure:

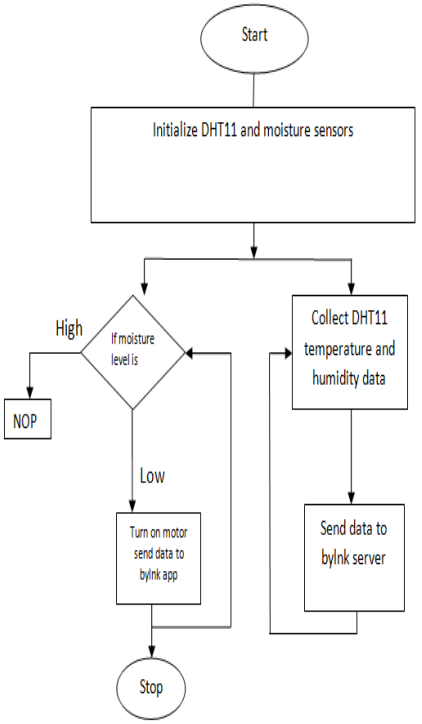

Fig 5 : Flow Chart of Smart Irrigation

Blynk app will be on user side, either on desktop or in smart phone, it will be linked through authentication process where request from Blynk app from user will be sent to server and a long authentication code will be sent to user email id. This authentication code should be used in C++ programming in Arduino IDE to connect RPi and ESP32 with Blynk app and set the app to monitor the parameters required.

vi. RESULTS

Fig 6: original image of disease leaf

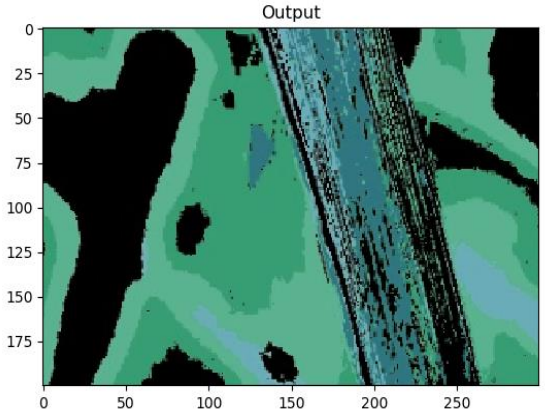

Fig7: final output

We can also change the colour wanted to detect based on the colour features of other diseases and also we can use classification methods of Image Processing, hence we can easily detect other diseases also by making simple changes in programming using Python.

vii. CONCULSION

A survey says that there will be need of 70% more food production in the year 2017 than in the year 2018, hence to meet this demand, agricultural companies using IoT statistics in order to increase the rate of production of the yield of food crops. In this aspect proposed work will be really helpful, this prototype not only used for Drip irrigation purpose but also we can implement sprinkler and channel irrigation process also by making use of different pipes available for irrigation in the market. This is the best way of scheduling the accurate way of irrigation to the plants.

Disease detection is one of the most useful part of this project, usually Blast disease will occur in winter season, farmers who are willing to use technology and who have lack of knowledge in disease detection and where there are chances of plants affected by Blast disease can go ahead to make benefit of this work.

viii. FUTRUREWORK

Since most of the farmers are of lack of education, using websites and smart phones will be difficult for them, hence by getting subscription pack of GSM from any service provider to RPi, SMS alerts can be provided. We have used still camera for Raspberry Pi for experimental purpose, angular cameras can also be used for better results, and this part of project will be best suited to implement on agricultural drones. Since we have used Open CV and Num Py libraries which are highly prioritized and optimized it is difficult to implement all other libraries which are of lower priority, research is still going on to overcome this problem. During the programming if image processing we can also change the colour wanted to detect based on the colour features of other diseases and also we can use classification methods of Image Processing, hence we can easily detect other diseases also by making simple changes in programming using Python.

ix. .REFERENCES

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