A Survey on Irrigation Automation and Plant Diseases Detection Using Image Processing

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Abstract – Agriculture plays important role in the development of country. In India about 70% of population Depends upon Agricultural farming. Irrigation scheduling and Diseases Detection plays a vital role to achieve better plant growth and higher crop yield. Issues concerning agriculture have been always hindering the development of the country. Generally most of the irrigation systems are manually operated one. These traditional techniques are being is replaced with semi-automated although monitoring the field data as well as controlling the field Operations which more difficult process to farmer. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. This survey gives a brief overview of the techniques with its merits and demerits. The survey includes several automated Irrigation and Diseases Detection techniques, which are proposed recently.

Index Terms – Internet of Things; Irrigation System; Smart irrigation; Image Processing; Disease Diagnosis.

1. INTRODUCTION

Internet of Things (IoT) is a broad term that describes the interconnection of different daily life real world objects into through the internet. The IoT is evolving, growing and becoming popular day by day, in the today's world, around 5 billion objects have connected through the internet. In the concept of IoT every real time object is connected with each other through a unique identifier so that it can easily transfer data over the network through protocol without any human to the human interaction interconnection of devices. The aim of IoT is to connect every person and every object through the Internet [1][2]. IoT has referred as a network of everyday objects having ubiquitous computing. The ubiquity of the objects has increased by integrating every object with embedded system for interaction. It connects human and devices through a highly distributed network.

IoT is basically the world wide interconnection of devices. The aim of IoT is to connect every person and every object through the Internet [3].Agriculture In India about 70% of population depends upon farming and one third of the nation's capital comes from farming It plays vital role in the growth of country's economy. In India there is only operated semi automated irrigation system [4].

Figure 1.0 shows the general structure of Smart Agri Infrastructures. This Iot monitoring system consists of sensor devices, controller, and control devices along with relay, WIFI modules. These are the traditional techniques are like ditch irrigation, terraced irrigation, drip irrigation system. Monitoring the environmental factors is not the complete solution to increase the yield of crops. Ditch Irrigation is a rather traditional method in recent days, where ditches are dug out and seedlings are planted in rows manner.

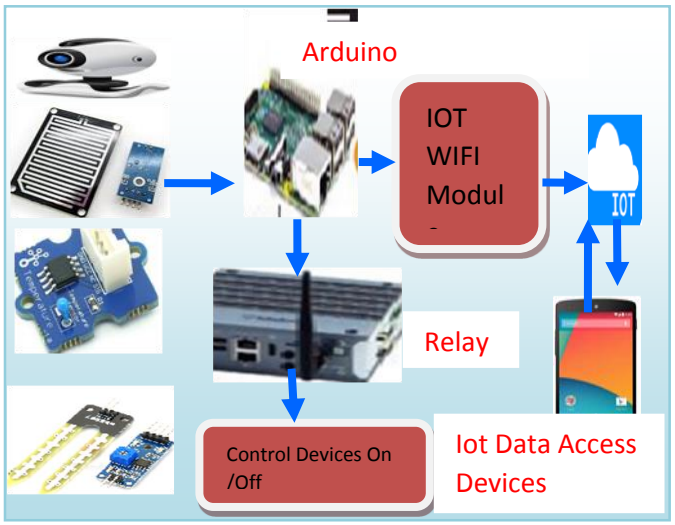

Fig 1.0 Smart Agri Infrastructures

The plantings are watered by placing canals or furrows in between the rows of plants side in proposer way. Siphon principle is used to move the water from the main ditch to the canals. . In this system keeping one end in the canal and with the other end sealed, placing it in the area to be irrigated. This system of irrigation was once very popular in some of the countries, but most have been replaced with latest technologies. Terraced Irrigation is a semi-automated technique this is very labor-intensive method of irrigation where the land is cut into

steps and supported by retaining walls. The flat areas are mostly used for planting and the idea is that the water flows down each step by step process, while watering each of the plots. This allows steep land to be used for planting crops effectively. Drip Irrigation this is known as the most water efficient method of irrigation system. Water drops right near the root zone of a plant in a dripping motion. Once this type of System is installed properly means steadily reduce the loss of water through evaporation and runoff process. Sprinkler System this is an irrigation system based on overhead sprinklers, sprays or guns, installed on permanent risers. The system mainly buried underground and the sprinklers rise up when water pressure raises very high level, which is a popular irrigation system for use on golf courses and park places. Rotary Systems this is a effective method of irrigation is best suited for larger type of areas, Rotary methods its helps to sprinklers can reach distances of up to 100 feet distance. The Rotary is a effective mechanical driven sprinklers moving in a circular motion so, it's hence reaching greater distances. This system waters a larger area with small amounts of water over a longer period of time. Here some of the other factors that decrease the productivity to a greater extent.

Hence automation must be implemented in agriculture to overcome these problems [5]. So, in order to provide solution to all such problems, it is necessary to develop an integrated system which will take care of all factors affecting the productivity in every stage. Automated irrigation and crop monitoring system is the only solution for agriculture. Digital image processing is the basic concept of processing a input image, series of images or video into simply a digital image using computer algorithms with mathematical operations and some form of signal processing practicing Fourier transforms. The input to the process is input image. It avoids problems like noise and signal distortion. It displays picture into multidimensional frameworks by defining pictures over two dimensions in digital image processing. By using this process, we would find the deficiencies in the leaf which impact the yield of the field. IoT and image processing are being used in the agriculture field to reduce the failure in crop and to increment the crop production. Hence In this paper, Irrigation Automation and Plant Diseases Detection techniques are reviewed.

2. LITERATURE SURVEY

2.1. IOT BASED Irrigation Techniques

In paper [6], authors proposed Microcontroller based Drip Irrigation embedded system, using this approach which could maintain the physical parameters uniform and also water is poured just above the roots in the form of droplets. Water is given to the roots drop by drop which means that slowly applies small amounts of water to part of plant root zone which not only saves water but also prevents the plants from flooding. In this irrigation method solenoid valve which is used to ON/OFF the water flow. These valves may be easily automated by using controllers and solenoids which minimizes the use of water and fertilizer by allowing water to drip slowly to the roots of plants. It is also called micro irrigation. Drip irrigation system is based on remote monitoring as well as controlling So that it's save manpower, allow farmers to apply the right amount of water at the right time.

In paper [7], authors concentrated on Intelligent Drip Irrigation system for agriculture so control the irrigation android mobile sends commands to computer to control drip irrigation system, here different sensors like humidity, temperature, light etc. will use for detection purpose. These sensors send the real time values to micro-controller and micro-controller send these values to Cloud server using serial communication. According to sensor reading values the graph will be show or display on computer devices and mobile device so using this graphical view user can switch on or off drip devices. It can effectively monitor the changes in soil humidity, air temperature level, light intensity level and feedback the sensor signals by wireless sensor network. Farmer can control as well as monitor the drip devices from anywhere This IoT approach mostly helps in increasing crop productivity by way of managing and controlling the activities.

In the paper [8], authors designed Automatic irrigation system using ZigBee to improve Automatic irrigation system This system is efficient for water management in the irrigated agricultural cropping systems. The implemented system is based on soil condition level identification and Its consists of hardware device zigbee module for communication purpose. Zigbee module effectively can transmit and receive over long distance. Microcontroller used for motor control.Zigbee module is a communication technology just like a Bluetooth but different that it is a full duplex communication. It is used here to have wireless link between PC unit and the main irrigation system unit. Wireless ZigBee hardware based irrigation control system is a potential most solution to optimize yields and maximize water use efficiency .ZigBee provides specifications for devices that have low data rates operating device, consume very low power and are thus characterized by long battery life. So using this technique Moisture level of soil is measured. So that system can provide water as per requirement of the soil. It prevents water clogging of soil efficient manner.

Hannaneh Hajishirzi et al [9] has proposed Microcontroller based rain gun irrigation system The modern rain gun irrigation systems, water are supplied half of the land zone of the plants by rain gun due to which a large quantity of water is saved.

Using this system pipe is connected from water pump and the other opening is kept near the root of the plant, with rain gun irrigation mechanism attached to it. The flow of the water from the pipe is controlled by a solenoid valve. The opening and closing of solenoid valve is done by microcontroller unit the microcontroller is brain of this system which dynamically gives signal to the valves which causes it to get open. The water is given to the root side of the plant drop by drop whenever the moisture content becomes sufficient level, the sensor senses this and gives back the signal to the microcontroller and the buzzer becomes off Then by pressing the button. Rain gun irrigation is popular because it can increase yields and decrease both water requirements and labors. When compared with drip systems, rain gun irrigation leads to less soil and wind erosion. Rain gun irrigation can be applied under a wide range of field conditions.

In paper [10] authors proposed novel approach uses Smart Irrigation System using Raspberry Pi this system wonderful platform that can be used to build irrigation automation. The Raspberry Pi Model 3 incorporates a number of enhancements and new features. Improved power consumption for enlarged connectivity and greater IO are among the improvements to this powerful, small and lightweight GPIO (General Purpose Input Output) pins. This system, the main agenda is to identify the area will be parameters such as temperature level and soil moisture level. This system will be a substitute to traditional farming method. A development of such a system that will effectively helps to farmer to know his field status in his home or he may be residing in any part of the world. Raspberry pi is the main part of the whole system. An automated irrigation system was developed to optimize water usage for agricultural crop field. In paper [11] authors proposed and Design an IOT alarm system based on SIM900A module of SIMCOM Company was designed for agriculture greenhouse. The system can gather live environmental parameters such as air temperature and air humidity after that these values send to controller. with the use of AT command, this system can also realize SMS automatic sending and receiving, environmental parameters overrun alarm and insufficient balance alarm. Through the system the alarm message can be sent to the user-specified mobile phone automatically no matter what the users' location is. This system as a typical application of IOT in the agriculture has got some satisfactory results in the actual operation.

2.2. Plant Diseases Detection techniques

Plant disease is one of the major important factors in agriculture field which causes significant reduction in the quality and quantity of the plant production. Detection and classification of plant diseases are important task to increase plant productivity and economic growth. To effectively detect plant disease the capture plant image should go through pre-processing, segmentation, feature extraction and classification process. In paper [12] authors proposed different n-butanol concentrations sensed by 12 metal sensors are classified by using effective multiclass support vector machine methods (SVM) technique and k-nearest neighbor (k-NN) algorithm. Focus in this paper is that the performances of these algorithms are increased with a decision tree structure. Therefore some of the proposed decision tree structure technique is effectively applied to the some electronic noise data for sensor subset selection and classification of the n-butanol concentrations process. SVM and k-NN algorithms are tested for classification of different concentrations in this decision tree structure and ordinary structure achieved by identifying the nearest neighbors. In addition to this cross-validation technique is used for both increasing success and efficiency of classification algorithms and assessing the results objectively. This study shows that the success of classification algorithms increase from 87% to 93% and 86% to 96% by using data of two sensors selected with the proposed decision tree structure for the k-NN and the SVM methods, respectively In paper [13] author's proposed that automatic methods for an early detection of plant diseases are vital for precision crop protection. The main of this proposed paper approach is a early detection of plant leaf diseases based on effective Support Vector Machines algorithms. Da-ke Wu et al. [14] have used SVM related to Leaf miner-infected leaves by radial basis kernel function and polynomial-based kernel function. These SVM classifiers are used as the indicator of degree in damage and fractal dimension for the diseased leaves. T. Rumpf et al. [15] proposed an early detection technique and classification of plant diseases with Support Vector Machines based on hyper spectral reflectance. It detects the sugar beet leaves are diseased or not, and this paper differentiates the diseases between leaf spot, leaf rust and powdery mildew and the proposed system identifies the diseases before the symptoms become visible. The classification is done by using support vector machine with a radial basis function as a kernel.

In paper [16] Kamaljot Singh Kailey et al presented a method to identify plant disease based on color value, edge detection process and histogram matching technique. In the training process first separate the layers of RGB image into Red, Green and Blue layers and then apply the CANNY's edge detection technique to detect the edges of layered images. The histogram is generated for both healthy leaf sample and diseased leaf sample, and the comparison techniques are applied The edge detection technique can not apply directly on the RGB image.

First process of the image have to be converted into grayscale image, then the CANNY's edge detection technique is applied proper way to identify the disease.

Prakash, Bed, and Amit Yerpude et.al [17] developed a system for diagnosing cotton leaf spot diseases. Segmentation is performed to find the actual segments of the leaf in the original image. In this research they have applied global threshold values, variable threshold and Otsu method for obtaining an automatic threshold value. Feature extraction process for the infected part of the plant leaf image is completed based on specific desired properties among pixels in the image or their texture. So that After this certain statistical analysis tasks are completed and to choose the best effective features that represent the given set of image information this result minimizing feature redundancy with minimum time interval. Finally classification process is completed using CANNY's edge detection. S CANNY's edge generalization performance is based on the principle of Structural Risk Minimization (SRM).

3. PROBLEM STATEMENT

Wireless Sensor Network (WSN) in recent years has gained popularity due to its usefulness in the field of distributed monitoring. In last few decades changing the dynamic weather condition and increase in global temperature and pollution has led to abnormal environmental conditions changes like raining. Traditional way of farming is unable to cope with these environmental changes. So far Issues concerning agriculture irrigation scenario is have been always hindering the development of the country.

Generally most of the irrigation systems are manually with semi automated operated one [18]. These traditional techniques are being is replaced with semi-automated although monitoring the field data as well as controlling and disease identification which more difficult process to farmer. However, there is no effective technique to utilize these Agri related problems. Agricultural land is fully maintained by human.

Human power is required for detecting the infected plant, watering the plants. This intern required adequate number of human power at the land site. diseases detection on different plant is simply naked eye observation with the help of experts through which diseases identification done but, this requires continuous monitoring which is very time consuming process and quite expensive in case of large farms. Therefore it has become very important to identify plant diseases and watering the plants accurately within specific time interval. The detection of disease accurately is the key to prevent the agriculture loss. Here are number of environment factors that decrease the productivity to a greater extent. This survey addresses and list out the above problem along with some research issues such as the issues associated semi-automated process, automatic disease diagnose from agricultural environment, which also finds environmental conditions. Every algorithm proposed in literature results in slow computation due to its uncertain huge process. Table 1.0 shows recent over all summaries of irrigation and plant disease detection technique.

No	Technique	Advantages	Dis advantages
6	Microcontroller based Drip Irrigation.	water is supplied root zone of the plants drip by drip large quantity water is saved	Slowed growth rate.
7	Android mobile based Intelligent Drip Irrigation system.	Easily switch on or off drip device using commands via android mobile	Farmer has to send commands on or off drip devices. Time consuming process.
9	Microcontroller based rain gun irrigation system.	Increase yields And decrease both water requirements and labors.	Decrease System Life and higher the power Consumption
11	Design an IOT alarm system based on SIM900A	System is completely automated. no need for any human intervention	Making cost of the system becomes too expensive.
12,15	SVM and k-NN algorithms	Easy to implement and Prediction accuracy is High.	large training data required and not robust to the Noise data.
16	Histogram matching technique.	Much faster and more Accurate.	Require more time.
17	CANNY's edge detection technique.	high and satisfactory accuracy	Require large storage space. Only local maxima should be marked as edges

Table 1.0 comparative study of the Irrigation Automation and Plant Diseases Detection techniques in IoT

4. OBJECTIVE FOR THE FUTURE WORK

From the survey, some objective of the future work is identified and gathered with the explosive growth of agriculture has its

own factors responsible for the crop destruction is infected plant, watering the plants. Therefore it has become very important to identify plant diseases and watering the plants accurately within specific time interval. The detection of disease accurately is the key to prevent the agriculture loss. Hence automation must be implemented in agriculture to overcome these problems Making agriculture smart using automation and IoT technologies gives more accuracy and its improve productivity .The objective of the further research is to improve agriculture smart using automation and IoT technologies. So that Controlling and monitoring of all these agri field operations will be through any remote smart device or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi modules. The make web application also used to monitor the dynamic crop filed information using IoT server. For apply the Plant disease detection technique which significant improve the plant productivity and economic growth to famer with easiest manner.

5. CONCLUSION

In this paper, the problem of finding agriculture irrigation process and plant disease detection techniques is investigated. Automated irrigation is an ongoing problem in the field of smart agriculture. There are numerous researches from various domains are continuously working towards developing automated irrigation problem. Automated irrigation and plant disease detection is more important for growth of agriculture crop productivity. The aim of this survey was to summarize the recent researches and its demerits in automated irrigation and plant disease detection techniques. This paper gives the merits and demerits of the recent techniques and its capabilities are studied. This paper concludes that there is not enough method to concentrate on the smart agriculture automation and as well as plant leaf disease detection with high accuracy. So, further approaches should overcome all the above issues.

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