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FUTURE OF THE DRIP IRRIGATION SYSTEM: A PROPOSED APPROACH

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Abstract : *Rain has never been a reliable source of water for agriculture. Drip irrigation allows water to drip slowly to the roots of plants, through a network of valves, pipes, and emitters. The major challenge in front of researchers is to make drip irrigation system completely automatic and free from manual intervention.*

This paper presents a smart drip irrigation system that uses a low cost temperature and soil moisture sensors to manage and control water supply in water deficient areas. Data acquired from a sensor node is sent through ADC Controller to a centralized cloud server that controls water supply. Moreover, the proposed system has the ability to check the availability of necessary resources like water tank, pesticides storage tank etc. and based on that, it takes decisions.

Use of this system will result in overall cost effective, scalable and robust implementation of drip irrigation.

Keywords*: Drip irrigation, sensors, cloud server, microcontroller, Naïve Bayes.*

1. INTRODUCTION

Agriculture plays a vital role in the development of country's economy. In India, Agriculture is the largest livelihood provider as the economy is mainly based on it and the climatic conditions are isotropic, still people are not able to make full use of available agricultural resources. The main reason is the lack of rain water and shortage of land reservoir water to agriculture fields. The continuous extraction of water from earth is reducing the groundwater level due to which lot of land is coming slowly in the zones of un-irrigated land. Another very important reason of this is due to unplanned use of water due to which a significant amount of water goes waste. At the present era, the Agriculture sector heavily relies on human interaction with the physical space and entity. The farmers in India have been irrigating the land at the regular intervals manually. The efficiency of an irrigation management system is

highly dependent on irrigation methods and schedules utilized such as surface irrigation or drip irrigation.

Drip irrigation is an artificial method of supplying water to the roots of the plant. This system is at times called trickle irrigation system and includes trickling water onto the soil at low rates (2-20 liters/hour) from an arrangement of small measurement plastic funnels fitted with outlets called emitters or drippers. Drip Irrigation prevents soil erosion, saves water and fertilizer can also supplied by it. The high efficiency of drip irrigation results from two primary factors. The first is that the water soaks into the soil before it can evaporate or run off. The second is that the water is applied near plants so that only part of the soil in which the roots develop is wetted, not at all like surface and sprinkler irrigation, which includes wetting the entire soil profile. With drip irrigation system water, applications are more frequent (generally every 1-3 days) than with different techniques and this gives great high dampness level in the soil in which plants can flourish.

While drip systems are simple and pretty forgiving of errors in design and installation, there are some guidelines that if followed, will make for a much better drip system. To handle drip system, always there is need of human intervention. If the respective person is unavailable to switching the system ON or OFF, it may leads to starvation or overwatered plants. To deal with such type of problems, there is need of making the entire system automatic. The system should be capable enough to identify the situation and based on apply some intelligent decisions. This paper mainly focuses on achieving the above mentioned goal.

The remaining paper is organised as follows: Section 2 discusses the literature survey done in existing domain. The proposed system is explained in section 3 and modes of operation in section 4. Finally benefits of system in section 5 and concluding remarks are discussed in section 6.

2. LITERATURE REVIEW

With water becoming a scarce resource, Drip Irrigation is the answer to modern agricultural needs. Baltej Kaur, Danish Inamdar in their proposed system [1], used an android mobile application to remotely control the drip irrigation system. The different sensors like humidity, temperature, soil are deployed in the field to monitor the environmental conditions. The information based on environmental conditions is transferred to android app via base station. User features such as spatial views, custom charts, real-time data access, remote access, irrigation control, alerts, and plant models help to create a smart irrigation system that is user-centric.

The smart drip irrigation system proves to be a useful system as it automates and regulates the watering without any manual intervention. Nikhil Agrawal and Smita Singhal[2] developed an automation system devices including raspberry pi, arduino microcontrollers, xbee modules and relay boards.

Similarly, Angel C and Asha S [3] focused on the reduction of energy consumption by the sensors during communication. In their research they used sensors like Soil ph Sensor, Moisture Sensor and Humidity Sensor etc. Based on the sensed data, their system will automatically decide about the necessary action for irrigation and also notifies the user.

The authors of paper [4] present a mobile application that is android based, to control drip irrigation system. In this a mobile sends command to PC to control drip irrigation. Here also they used different sensors like humidity, temperature, light etc. for detection purpose. These sensors send real time values to microcontroller and microcontroller send these values to PC via serial communication. According to sensor values graph will be display on PC and Mobile side and by using this graph user can on or off drip devices.

Similar type of approach is used by Karan Kansara1, Vishal Zaveri1[5] in their research aiming to save time, money & power of the farmer. The traditional farm-land irrigation techniques require manual intervention. With the automated technology of irrigation the human intervention can be minimized. Whenever there is a change in temperature and humidity of the surroundings these sensors senses the change in temperature and humidity and gives an interrupt signal to the micro-controller. The drip can be then controlled automatically as well as manually.

3. PROPOSED SYSTEM

The aim is to design computer driven automated drip irrigation system. The system model uses sensor technology with microcontroller to make a smart switching device. An ADC connected to microcontroller gather the humidity values for soil at various points. Below figure shows the complete system architecture.

In this proposed system various sensors are required which includes humidity, temperature etc. for capturing the data. These sensors send the real time values to micro-controller and these values send to Cloud based server by microcontroller via serial communication. According to the sensor values, logs are maintained at the server side. On server side an algorithm is applied which sets the threshold value for physical entities that are to be measured by sensors and checks the collected logs against these preset thresholds. In this system, threshold value is maintained for every sensor. The drip irrigation technique can be control by mobile from anywhere and also can change threshold values of sensors via mobile.

The proposed system architecture contains following components:

1. ***Sensors:*** (Light, Temperature, level): Sensor Sense the different physical parameters like light, PH value of soil, temperature and converts these sense data into electrical signals.

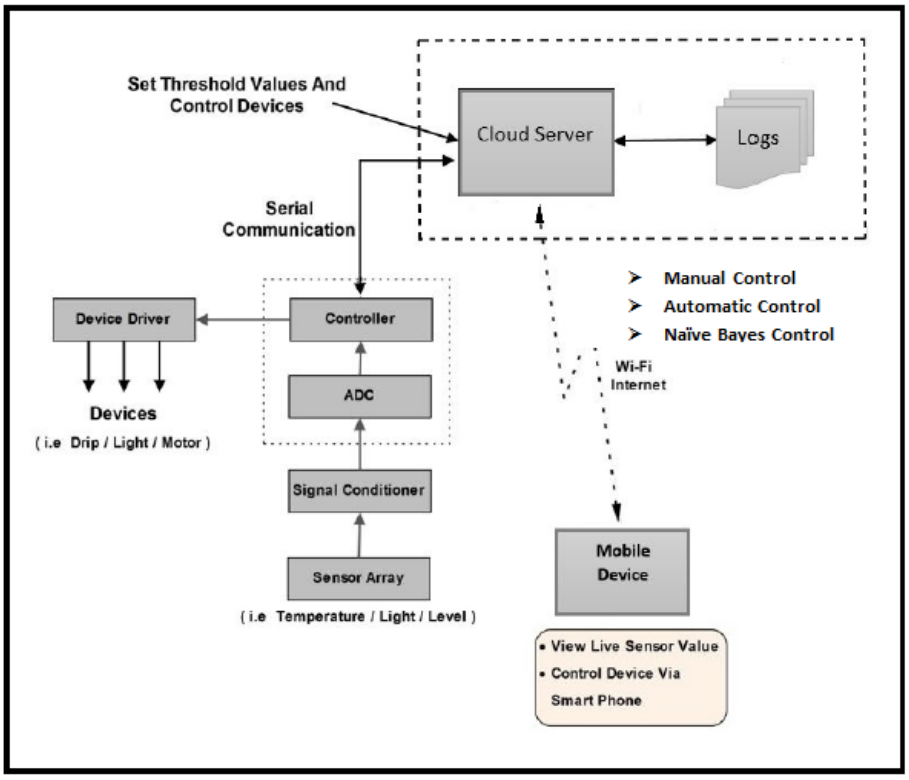

Fig.1 Architecture of the proposed system.

2. ***ADC:*** (Analog to Digital Converter) It Converts analog signal into digital signal and give that digital signal to the micro controller as an input.
3. ***Micro-controller:*** It is heart of the entire system, which means it controls all the activities of the system. It has memory in which control programs are saved.
4. ***Server:*** (Cloud Server) It collects the sensors data. All the algorithms and logics are applied on that data and appropriate predictions and decisions are made. These servers are also connected with users for confirmation of those decisions.
5. ***Mobile:*** (Client) The android mobile is act as client which gets all the data captured by sensors and some graphical or pictorial representation of that data. The user then can take decisions like switch ON or OFF the drip devices etc.

4. MODES OF THE OPERATION

1. Manual Control

In this mode the system can be manually make ON or OFF depending on the user need.

2. Automatic Control

All the available sensors periodically send data to the centralized server. Based on threshold values set for the temperature, humidity and water resources, appropriate decision is taken by the cloud server. This decision is then responsible for making Drip system ON or OFF.

3. Naïve Bayes Control

All the sensor data is captured and stored at server's database. This data is used to train the Naïve Bayes Prediction Algorithm. After training, system becomes capable of differentiating the sensor data into three categories mainly low, medium and high. These rules will be responsible for future predictions regarding making system ON or OFF.

5. BENEFITS OF THE SYSTEM

- Human intervention with system is avoided and provides an automated drip irrigation system. The system also has an ability to reschedule activity after a specific time slot.
- Authorization is done so that only valid person can operate on this system.
- Save water, energy and manpower in the agriculture sector.
- Efficient and effort reducing system design.
- Increases the crop production and it uses the different sensors like temperature, light, humidity, soil moisture so it can be used in area where water resources are less.

6. CONCLUSION & FUTURE SCOPE

In this study, a drip irrigation automation system is proposed which tries to tackle problems related to traditional irrigation systems. The temperature and humidity sensors capture the data and send it to centralized cloud server where it gets processed. Moreover, farmers get all the information about their farm and also can interact with drip from their mobile devices. The developed system can also transfer fertilizer and the other agricultural chemicals (calcium, sodium, ammonium, zinc) to the field with adding new sensors and valves. The smart drip system can be used in commercial as well as agricultural use.

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