Automation In Water Irrigation

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Abstract- *Agriculture plays vital role in India's economy. Over 58% of the rural households depend on agriculture as their principal means of livelihood. Smart farming is a concept quickly catching on in the agriculture business. Offering automated farming techniques are clearly many advantages a networked farmer has to offer. Water act as back bone in agriculture infrastructure and its availability is totally depends on rains and water storage. Estimating correct amount of water needed to plant plays an important in its growth.*

The Internet of things (IoT) is the network of physical devices, vehicles, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data. There is also growing opportunity in the agriculture sector that stands to improve lives, make India a true leader in agricultural IoT & revolutionize the way farmer's plant, fertilizers, & harvest in the next decade.

Smart irrigation systems are specifically suited for arid & semi-arid regions, smart irrigation technology can ensure efficient use of water resources based on the humidity of the soil, the needs of the crop & weather patterns which when integrated with the right type of sensors & connectivity will result in optimal usage of scare resources with the help of IoT & cloud we can build a system which monitor and informed about the status of irrigation to the farmer. System uses the machine learning algorithm to take the decision related to the irrigation on the data received from sensor and real time weather forecasting data and at same time. Farmer is then receiving the notification by SMS about its decision on water distribution. Basic aim of system is to make effective use of water not as per time based but need base.

Keywords- Water Irrigation, Soil moisture, Temperature, Humidity, IoT, Machine Learning, Decision Tree.

I. INTRODUCTION

Food is the basic need of human beings that means humans cannot live without foods! Human get the food from farms so as to fulfill the need of food, farming is necessity in every corner of the world.

Agriculture is the branch of science or farming practices which includes cultivation of farm to grow various crops. In India, agriculture began by 9000 BC as a result of early cultivation of various types of plants. Agriculture plays most crucial role in India's economy. 58 percent of the rural population is depend on agriculture as there source of income and livelihood. Agriculture along with fisheries and forestry is contributing major role in Gross Domestic Product (GDP).

India comes in largest countries which produces, consumes and exports spices and spice products. India is second largest fruit producer country in the world. India is largest producer of milk; it contributes over 18.5 percent of total world production. It is second largest exporter of sugar and contributes over 14 percent of global exports.

To give the importance to agriculture sector, the government of India, planned many steps in its Budget 2016-17. It proposed good deal to enhance agriculture and farmer's welfare. Over 2.85 million hectares to be brought under irrigation targeted by May 01, 2018 Government has taken steps regarding two most important factors soil and water to improve soil fertility to support farming scheme

'Paramparagat Krishi Vikas Yojana'. And also taken other steps include improved access to irrigation such as

'Pradhanmantri Gram Sinchin Yojana'. Government alsoenhanced water efficiency through 'Per Drop MoreCrop'. The state governments are impelled to allocate sufficient amount of funds to develop the agriculture sector, it takes measures to achieve the targeted agricultural growth rate and to address the problems of farmers.

Some of the recent and major government initiatives in agriculture sector are as follows:

1. Prime Minister Mr Narendra Modi has announced the operational guidelines for the 'Pradhan Mantri Fasal Bima Yojana' which has the aim to provide crop insurances to the farmer.
2. Mr. Piyush Goyal, Minister of Power, Coal, New and Renewable Energy has announced that government's plans to invest Rs 75,000 crore (US$ 11.08 billion) in

an energy-efficient irrigation scheme over the next three to four years.

3. The Government of India has allocated Rs 200 crore for electronically linking 585 major wholesale agriculture markets across the country, thereby creating a National Agriculture Market (NAM) in July 2015 for three years.

Due to the increment in the investments in agricultural infrastructure such as irrigation facilities, warehousing and cold storage in India is expected to generate grate momentum in next few years. Parameters such as reduced transaction costs and time, improved port gate management, enhanced fiscal incentives will contribute to sector's economic growth. Increment in genetically modified crops will improve the yield for farmers.

In Agriculture, There a lot of farmers who have to wake up early in the morning to start the water supply to the farm and farmers take the decision based on random guess.

If they think water supply is enough then they switch off the button. And these things are so time consuming and not good for farm to give sufficient yield.

There are some parameters to determine irrigation of crops. Evapotranspiration (ET) is a technique in which of moisture from the earth is transferred to the atmosphere by evaporation of water and transpiration from plants. It depends on climatic changes.ET controllers can be used to schedule irrigation. It has been proved that using ET method the water savings is up to 47%. [1]Soil moisture and temperature of the field are the most essential parameters.

The basic functionality of the system is to automate the sprinklers network deployed in the farm as per need of the plants. This way water will be saved for other usage.

A hardware unit will be deployed in farm to sense temperature, soil moisture and humidity values. This data will be sending to server periodically .Server application will fetch these values and also collect weather forecast data of that area/city.

Server will decide how much water needed to plant and when using decision tree algorithm (machine learning). Accordingly server will inform field hardware unit to start/stop sprinkler. Farmer is then receiving the notification by SMS about its decision on water distribution .Controlling field from mobile application and irrigation control are work very well. The water usage is 90% more efficient than any other traditional and other modern irrigation methods

II. LITERATURE REVIEW

This section provides a survey on the domain and gives more brief idea about the smart irrigation system which automates the irrigation using IoT and machine learning approach.

In [1], DHT-11 humidity and temperature sensor gives information about the sensors which sense the temperature and humidity. DHT11 is resistive-type of humidity measurement sensor which also having NTC temperature component. Connect to microcontroller gives excellent quality, fast response, anti-interference ability. It is cost-effectiveness sensor which sensor both temperature and humidity as both are inversely proportional to each other.

In [2], Irrigation management using soil moisture sensors, gives information about various type of moisture sensor and working of moisture sensor in various condition of soil. Soil moisture sensors having 2 probes use to pass the current through soil and measure the resistance of soil and accordingly give the moisture level present in soil.

In [3] An IOT based weather information prototype using WeMos, view weather condition of any location and allows accessing the current data of any station using WeMos having in-build wifi support. For that it uses the Wemos D1 microcontroller which fetches the weather forecast data store on cloud.

In [4], very fast decision tree algorithm on hadoop , view the information about the decision tree algorithm and comparisons between various decision algorithms which use to predict or take accurate decision on given data. This paper indicate how the VFDT algorithm efficient than other various decision tree algorithms to process large data.

In [5] Improving the prediction accuracy of decision tree mining with data pre-processing, give that the description about decision tree as well as information about weka library which implements the decision tree algorithm very efficiently and easily. Weka implements various algorithms like data pre-processing, classification, regression, clustering, etc.

In [6] secure MQTT for Internet of Things, secure version of MQTT protocol is use for security of data during machine to machine communication. In MQTT protocol, a publisher publishes message under a topic name and all subscriber under the same topic name receives the message through broker, but it is not secure. So for security purpose secure MQTT uses various encryption algorithms.

In [7], Restful web service integration using android platform, view the information about RESTful protocol for communication between android applications to web server. It uses URL for proper communication, so it is light weight and simple.

In [8], Arduino-based smart irrigation using water flow sensor, soil moisture sensor, temperature sensor and ESP8266 wifi module, Smart irrigation system is proposed which uses various sensor to sense moisture, temperature and water requirement. These data send to web server where data compare with standard values and allow controlling the water irrigation from any place which is reduce the water wastage and increase the crop yield.

In [9], smart irrigation and monitoring system, Azure IoT Hub is use for the bi-directional communication among various devices. Machine learning algorithm is used to train the data received from sensor network deployed on farm and weather forecast data at that particular area. It takes the decision whether irrigation needs to be done or not. Notifications send to the farmer through mobile application or through SMS and accordingly farmer can On/Off the water pump.

In [10], IOT Based crop-field Monitoring and irrigation Automation, IoT technique is use to irrigate the crop-field. Various sensors are use to monitor the field, sense data store on Arduino microcontroller. It also uses the ultrasonic sensor which measures the water level that indicates sufficient water available for irrigate the field. It uses Ethernet connection for sending information to server where decision making done by using data mining algorithm. Accordingly it irrigates the crop field.

III. SYSTEM DESIGN

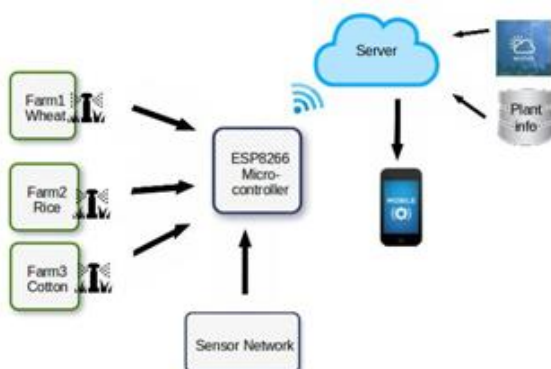Diagram (Fig.1) gives the architecture layout of whole system:

Fig. 1. Automatic water irrigation system

System contains three components:

1. Field Hardware unit
2. Central Server Application
3. Farmer centric android application

1. Field hardware unit

The hardware unit contain Sensors and ESP8266 i.e.

WeMos Microcontroller which has in-build Wi-Fi support to connect to internet. Hardware unit having two sensors

DHT11: It   is temperature and humidity sensor

Output Signal of DHT11 is digital and it required 3.3 to 5V power supply. Temperature range is 0 to 50 degree Celsius / 2 degree Celsius and humidity range is 20 to 90% RH / 5%RH.

Fig. 2. DHT11

Elecmake Soil Hygrometer Detection Module: It is soil moisture sensor which work on 3.3V-5V .It give dual output digital (0 and 1) as well as analog.

These sensors continuously monitor the field and send it to the web server through WeMos Micro-controller. Hardware unit support the MQTT Protocol so that it can communicate with server.
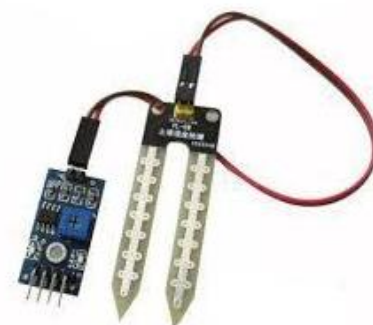

Fig. 3. Soil moisture sensor

2. Central Server Application

Server uses MQTT protocol to communicate with hardware unit and receive the data periodically from sensor. Server fetches real time forecast data from another web server using REST protocol. MySql database is used to store data received from sensor and information related to farmer at the time of registration. By comparing all this data server takes the decision to On/Off the sprinklers or how much water should be given to the crops. For that purpose, server uses decision tree algorithm.

Accordingly farmer received the notification about decision which was taken by server. Sever maintains log4j library where every important event is recorded .Sever also show weekly/monthly report about the quantity of water given to plants in proper graphical format.

3. Farmer Android Application:

Farmer receives notification which gives real-time sensor and forecast information on the android application. Application also support sprinkler On/Off control so that final sprinkler on/off decision is of farmer coming from android application.

IV. CONCLUSIONS

The automated irrigation system has been proposed so as to use water in irrigation effectively. System uses the machine learning algorithm to compare the values obtained from sensors with threshold value. It also checks the result obtained from weather forecast website and decides whether water should be given to plants or not. It sends the notification to farmer accordingly. It reduced the time required to monitor the field and increase the productivity. And because of optimum use of water, erosion of soil could be stopped totally. This system is beneficial for physically disabled people.

V. ACKNOWLEDGMENT

REFERENCES

[1] Dishay Kissoon, Hinouccha Deerpaul and Avinash Mungur " A Smart Irrigation and Monitoring System", International Journal of Computer Applications (0975 – 8887) Volume 163 – No 8, April 2017.

[2] Prof. Ajay Katkar, Mangesh Matke, Bhagyashri Kokate, Chandrakala Lavhare, Rohan Pawar, "IOT based E-Farming", (IJRASET) Volume 5 Issue V, May 2017.

[3] Priyanga Chandrasekar and Prabir Bhattacharya ,"Improving the Prediction Accuracy of Decision Tree Mining with Data Preprocessing", 2017 IEEE 41st Annual Computer Software and Applications Conference.

[4] Ravi Kishore Kodali and Archana Sahu,"An IoT based Weather Information Prototype Using WeMos", 2016 2nd International Conference on Contemporary Computing and Informatics (ic3i)

[5] Meena Singh, Rajan MA, Shivraj VL, and Balamuralidhar P, "Secure MQTT for Internet of Things (IoT)", 2015 Fifth International Conference on Communication Systems and Network Technologies.

[6] Mohammed Husain Bohara, Madhuresh Mishra and Sanjay Chaudhary "RESTful Web Service Integration Using Android Platform" ,4th ICCCNT 2013.

[7] Prof. Sharmishta Desai, Sourav Roy, Brina Patel, Samruddhi Purandare, Minal Kucheria , "Very Fast Decision Tree(VFDT) Algorithm on Hadoop",2016 IEEE.

[8] DHT11 - Humidity and Temperature Sensor.

[9] Rajalakshmi.P and Mrs.S.Devi Mahalakshmi "IOT Based Crop-Field Monitoring And Irrigation Automation",2016 IEEE 10th International conference.

[10] Pushkar Singh and Sanghamitra Saikia, "Arduino-Based Smart Irrigation Using Water Flow Sensor, Soil Moisture Sensor, Temperature Sensor and ESP8266 WiFi Module",2016 IEEE.