IoT Based WSN for Irrigation System- A Review

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Abstract— The IoT (Internet of Things) is fast converting agriculture into smart agriculture known as agriculture-IOT which helps in increasing crop productivity by way of managing and controlling the activities such as monitoring several factors like water management, soil monitoring, routine operations and field monitoring. The main intension of this type of irrigation system is to develop a fault tolerant, reliable, low latency and energy based IoT control system.

Keywords— IoT, Agriculture, WSN, Drip, Smart, Irrigation,

1. INTRODUCTION

Agriculture has a significant impact on the social economy in India. Around 80% of the main agricultural products of the world are fulfilled by five world's largest producers and India is the one among them. Agriculture is the soul and life of India. In India 75% people depends on Agriculture and depends on natural resource of water rainfall. Huge population requires significant water resource. A survey has shown 70% of people consume fresh water in India [1].

The IoT is a technology in which everyday objects form an Internet network through which they can communicate with each other. It ensures the connectivity to physical objects rather than traditional connectivity devices like laptop, desktop and mobiles. Every device in IoT must have an identity, mostly an IP address.

Following are the driving forces for transformation of agriculture from traditional approach to technological aid.

- Farmers unaware of availability of power to pump the water.

- Water requirement depends on variety of climate at different places.

- Different crops or soil like red, black soil requires different amount of water.

- Automation in agriculture can improve the yield and prevents wastage of water resources.

- Automation provides comfort, reduces energy, and saves the waiting time of farmer until farm gets fully watered.

- Real time sensing and control of field remotely.

- Reduces the man power

- Power of IOT automates water management process, create water saving solution.

The remaining part of the paper is divided into four sections. Section II reviews the existing related work. Section III describes IOT in Agriculture which includes types of sensors, applications of IOT in agriculture. Section IV presents various methodologies adopted for irrigation system. Section V gives the conclusion part.

2. RELATED WORK

The agricultural system is modernized using automatic irrigation system. This method uses soil moisture sensor and temperature sensors for variety of applications like bio-medical, security systems, agriculture, bridge health monitoring and so on [2]. The smart irrigation system uses latest technology which is used to sense and controls the parameters in the field [4]. Wireless Sensor Network (WSN) is used for solutions in agricultural problems like precision farming, soil moisture dynamics and so on [3]. Recent research developments in agricultural field with the deployment of WSN have shown that inclination towards technology proved to be correct as tremendous benefit due to increase in the crop productivity by monitoring varying soil moisture values. The implementation of WSN technology in agricultural applications and a case study of precision farming solution in Egypt using WSN have been studied in the literature [16, 17, 18].

IoT is basically used for optimal irrigation using mobile applications. It helps in population growth in India. The requirements of the IOT based precision agriculture system focuses on the hardware architecture, network architecture and software process control. Preliminary tests showed this system is rational and practical [6].

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a. IOT based smart agriculture

Smart agricultural system includes smart GPS based robot system, smart warehouse management system using remote smart devices and number of sensor devices which include wi-fi, zigbee, cameras and so on [7].

b. Sensor based automated irrigation system with IOT

The automatic irrigation method is used in recent days in order to utilize money, time and power in an efficient way by the farmers. Using this latest technology, most of the human intervention can be reduced. The usage of sensors is used for sensing the temperature fluctuations accordingly [8].

c. Automation of irrigation system based on wi-fi technology and IOT

The automated supply of water management can be made in houses as well as fields for gardening and irrigation system. The methodology uses soil moisture and temperature sensors for various climate change conditions [9].

3. IOT IN AGRICULTURE

The framework of Agricultural IOT is shown in the figure 1. As it can be seen that farming industry getting most of the benefit of with respect to crop productivity using IOT.
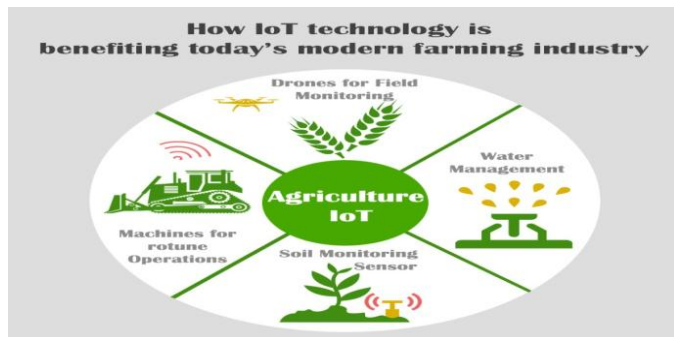

Fig 1. Agricultural IoT [10]

A. TYPES OF SENSORS

In this section few of the sensors which are used to sense some characteristic of the environment in the agricultural applications are presented.

i. Humidity sensor

Humidity is the presence of water in air. The DHT11 humidity & temperature sensor measures relative humidity (RH) and temperature.
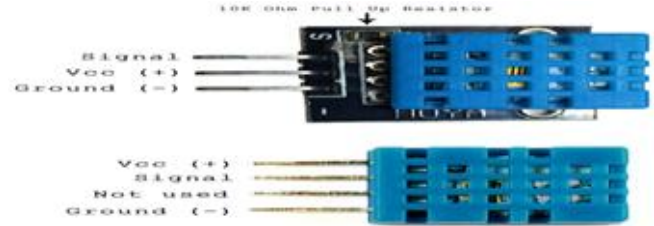

Fig. 2. Humidity sensor

ii. Soil moisture sensor

This measures the content of water in soil. Pin1: VCC (5V DC). Pin2: Ground (0V). Analog Output (A0)
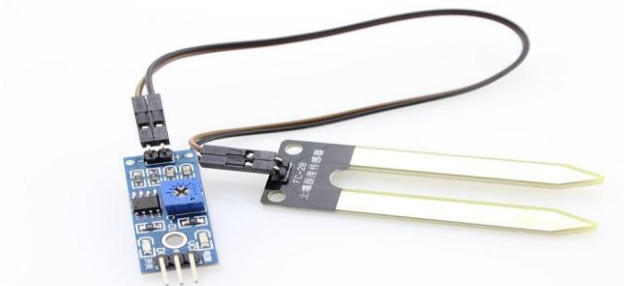

Fig. 3.Soil moisture sensor

Sensor returns analog value between 0-1023, where 0 is for wet soil and 1023 for dry soil in the case of soil moisture sensor.

B. Applications of IOT in Agriculture

Following are the general applications of IOT in agriculture [5].

a. Crop water management

Adequate water supply is an essence for agriculture and the crops can be damaged in either of situation of excess of water supply or in shortage of water supply. Agriculture IOT smartly analyses the water requirement of crop and utilizes the scarce water resource available to reduce wastage of water.

b. Precision Agriculture

The level of accuracy of weather forecasts affects the crop productivity to a great extent. Higher the level of accuracy of weather forecast, the lower would be the chances of crops being damaged thus there would be higher level of productivity.

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c. Agriculture-IOT

Agriculture IOT ensures accurate and timely communication of real time data or information related to dynamic agricultural processes like plantation, harvesting etc. and weather forecasts, soil quality, availability and cost of labor required to the farmers before-hand.

d. Food Production and safety

Agriculture IOT aims not only at attaining optimum food productivity along with quality matching the standards but also aims at food security at different levels like storage, transportation etc. To ensure food safety Agriculture IOT has a system that monitors the various factors like shipping time, storage temperature and cloud based record keeping etc.

4. IOT BASED IRRIGATION SYSTEM

Following are the various types of irrigation system using WSN technology.

- Automated Irrigation System using ZigBee – GSM

This work reviews some of the existing or proposed systems based on the different technologies. The main objective considered is to make use of WSN and communication technology such as ZigBee, GSM in industrial field to make low-cost automated irrigation system to monitor the soil condition. The system helps the farmer to monitor and control the parameters of the soil such as air temperature, humidity, soil moisture. At any abnormal condition, the farmer is informed and will be able to take actions remotely by using GSM. Due to its lower energy consumption and low cost, the system has the potential to be useful in semiarid or arid areas [11].

- Smart Irrigation System using Raspberry Pi

In this system, the main agenda is to identify the area will be parameters such as temperature and soil moisture. This system will be a substitute to traditional farming method. A develop such a system that will help a farmer to know his field status in his home or he may be residing in any part of the world. It proposes a automatic irrigation system for the agricultural lands. Currently the automation is one of the important role in the human life. It not only provides comfort but also reduce energy, efficiency and time saving. Now the industries are use automation and control machine which is high in cost and not suitable for using in a farm field. So here it also designs a smart irrigation technology in low cost which is usable by Indian farmers. Raspberry pi is the main heart of the whole system. An automated irrigation system was developed to optimize water use for agricultural crops. Automation allows us to control appliances automatically [12].

- Fuzzy based decision support model for irrigation system management

An effective and useful irrigation system uses Evapo transpiration system for computing purpose. This type of system uses fuzzy based methodology [13].

- Drip irrigation system

Drip irrigation is artificial technique of providing water to the roots of the plant. It is also called micro irrigation. Drip irrigation system is based on remote monitoring as well as controlling. In proposed system both mobile and computer is monitor and control the drip devices. Following are the technological advancements in irrigation system to overcome the issues faced with the traditional approach irrigation in agriculture [14].

A. Intelligent Drip Irrigation System

In Intelligent Drip Irrigation system, an 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 values the graph will be show on computer and mobile and by using this graph user can switch on or off drip devices. Through modular design, the system builds hierarchical management structure to meet different applications requirements. It can monitor the changes in soil humidity, air temperature, humidity and light and feedback the sensor signals by wireless sensor network. Farmer can control as well as monitor the drip devices from anywhere. Proposed system removes drawbacks of previous systems like distance problem, range problem. Due to the automatic mode, drip devices can be controlled automatically by hardware. This approach is very beneficial for increasing crop production [15].

5. CONCLUSION

The developmental changes in technology are combined with WSN. The IoT is fast converting agriculture into smart agriculture. Agriculture IOT helps in increasing crop productivity by way of managing and controlling the activities. The smart agriculture system performs various jobs like sensing the moisture, scaring birds and animals, spraying, vigilance control, weeding etc. The smart irrigation control system uses perfect real time data in the field.

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