Water Saving Technologies in Agriculture-A Survey

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Abstract— Nowadays, Water is an essential part of our life. Hence water is considered to be basic need of human. In recent years, water consumption increases due to globalisation and population growth. There is a challenge in day to day life of every country to sustain the fresh food requirement and reducing the farm water consumption. Agriculture is the main occupation of human being. Water is required in tremendous quantity in agriculture field. Water wastage is one of the major problem in agriculture. Water wastage occurs when excess of water has been used to the fields. Many technologies are improved to decrease the water consumption and human involvement in the particular task in an agricultural field. This paper mainly deals with the survey of different technologies used in agriculture.

Index Terms—Water Saving, Agriculture, soil

I. INTRODUCTION

Watering is the most important and labour-intensive task in daily greenhouse operation. Watering systems ease the burden of watering plants. Knowing when to water and quantity of water required is two important aspects of watering process. Irrigation is the artificial method of watering the plant. It is used to assist the growth of agricultural crops, maintenance of landscapes, and re vegetation in dry areas and during periods of inadequate rainfall [1].The irrigation based agriculture is one of the biggest consumer of fresh water with a share up to 80-90% in the developed countries. The increased demand for water and the climatic changes are anticipating that the water resources for agriculture will be lower in the forthcoming decades. The efficient use of the water is becoming an important issue since the competition in terms of cost reduction and high crop quality is more and more tight [2]. The accurate scheduling of the irrigation will become a major challenge for agriculture to avoid wastage of water [3].At present, the requirement of water is growing at more than twice the rate of population increases. Due to the shortage of water resources, we need to adapt water saving irrigation technology for agriculture. The rainwater is used for agriculture in rainy seasons and the well or bore well water is used for other times [4].Therefore, water is required in tremendous quantity in agriculture field. Water wastage is one of the major problems in agriculture. This water wastage occurs excess of water is been provided to the fields [5].The dry regions having very little amount of water and that has to be utilized very efficiently. In conventional irrigation system the wastage of water is very high. Therefore, the conventional method can be replaced by drip irrigation technology. A new idea for saving each drops of water by the way to test the soil conditions before supplying water to the crop field. This mechanism will reduce the workload of the

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cultivator and helps to maintain the suitable soil conditions for the better crop production. This technology advancement is possible to design systems that eradicate the direct involvement of the cultivator with respect to irrigation of their field. For the sustainable use of water resources, the rainwater is generally stored in a tank and then utilized for irrigation or directed to recharge groundwater. Nowadays so many technologies are improved to decrease the human involvement in the particular task. So, farmers are moving towards new innovations to build their agricultural field as better [6].

II. TECHNOLOGIES USED IN WATER SAVING

A Wireless sensor network is the one which is used to monitor physical or environmental conditions, such as temperature, humidity and moisture to cooperatively pass their data through the network to a main location [7]. A Wireless Sensor Network (WSN) generally consists of processing component and communication components which is used for routing purpose and for gateway purpose [8].

III. BLUETOOTH TECHNOLOGY

A Bluetooth is a device which is mainly used to connect phones or computer by using radio waves. It is suitable for short range communication. Bluetooth technology is used to connect piconet network devices in which one device acts as a master and other all devices acts as a slave. Piconets are established dynamically and automatically as Bluetooth devices enter and leave radio proximity. Bluetooth not only connect the devices together but also connect the devices to mobile phones or computer.

Dinesh kumar et al., have proposed a system based on Water Level Monitoring and Controlling Using Bluetooth in Agriculture. In this system, moisture sensors are used to measure the water level. This measurement was sent to the farmer through mobile phones. This phone is connected to electricity water pump and sensor devices. Therefore the electricity water pump is controlled by the farmer on wireless network by using mobile application. The Water level values are displayed in digital values in the mobile application screen page. After identify the water level the mobile application was also adopted with the electric water pump motor to control the switch ON/OFF [1].

Figure 1: Bluetooth network

IV. WIFI TECHNOLOGY

Wi-Fi stands for Wireless Fidelity, which refers to wireless technology that allows devices to communicate over a wireless signal. The standard for Wifi is IEEE 802.11.It is mainly used to connect the computer to the internet [9]. It is suitable for short range communication (~l0's of meters). It was developed for mobile computing devices such as laptops,mobile phones etc [10].

Kabilan et al., have proposed a system based on Surveillance and Steering of Irrigation System in Cloud using Wireless Sensor Network and Wi-Fi Module. In this approach, the amount of water flow can be controlled by automatic system with the help of Internet Of Things. Various infield sensors and thermistors are used to measure the volumetric water content and humidity of the air. According to the images of soil and plant the database is created. This database mainly contains the information such as moisture content, humidity etc. The colour of the plants and the soil images can be retrieved using Fisher's linear discriminant analysis (LDA).This LDA approach is used to convert the RGB images of plant and soil to database. The processing of the images should be performed by differentiating the plant and soil segments. Therefore transductive support vector machine (TSVM) algorithm is used for classification and qualification. In this system Wifi module is mainly used to connect the microcontroller and arduino to wireless technology which allows the device to communicate over various network [11].

Figure 2:Wifi network

V. WIMAX TECHNOLOGY

Wimax is a wireless technology of wireless broadband access. It is an alternative to cable and Digital Subscriber Line (DSL).The standard of Wimax is IEEE 802.16.It has higher bandwidth when compared to other wireless technologies. It provides two classes of service they are fixed wimax and mobile wimax for different applications. Some of the characteristics features are flexible structure, high security, cost effective etc [12].

Usha Rani et al., have proposed a system based on an Integration of Wireless sensor Network through Wi-Max for Agriculture .Now a days the importance of water level management is increased in agricultural field. Monitoring of

environmental factors such as temperature, moisture content in the soil depends on the amount of water flow will be allowed. In this paper two types of method are used by taking the measurement manually and by automatic process using sensors. It is mainly based on Wimax technology. By using this wimax technology, the agricultural field with smart irrigation can be monitored anywhere [6].

Figure 3:Wimax network

VI. XBEE TECHNOLOGY

Xbee was created by Zigbee alliance and it was suitable for high level communication protocol. The standard for Xbee is IEEE 802. 15.4.It is simpler and low cost. It covers a range of about 10-100m.Power consumption is very low in xbee technology [13].

Kumar et al., have proposed a system based on Smart Irrigation Using Low-Cost Moisture Sensors and XBee-based Communication. This paper aims to control the water supply in water deficient area by using bespoke and low cost moisture sensor. This sensor is fabricated using affordable material. This sensor works on the principle of moisture dependent resistance. The information's collected by the moisture sensors are sent to centralised server through xbee wireless communication that controls the flow of water. The main advantage of using this technology is power consumption [14].

VII. ZIGBEE TECHNOLOGY

ZigBee is a IEEE 802.15.4 based **low power, low data rate supporting wireless networking standard**, which is basically used for two-way communication between sensors and control system. It is a short-range communication standard like Bluetooth and Wi-Fi, covering range of 10 to 100 meters. It supports low data rate of about 250 kbps. The operating frequencies are 868 MHz, 902 to 928 MHz and 2.4 GHz. ZigBee Technology is used mainly for applications requiring low power, low cost, low data rate and long battery life [15].

Ayman have proposed a system based on Web-Based Irrigation Management for Open Canals Using Wireless Sensor Networks. The paper demonstrates a Wireless Sensor Network configuration that is used for managing crop irrigation from open canals using water pumps. The system comprises water level sensors attached to main irrigation

canals, as well as flow sensors attached to water pumps. Each sensor is connected to a solar-powered wireless Zigbee module to form a sensor node. All sensor nodes are connected to a Zigbee gateway that collects sensor data periodically and sends it to web server using GPRS connection. The back-end of the system consists of a web server linked to a database to keep track of irrigation water level at all main and auxiliary canals. The amount of water used for each area of land is also monitored and compared to the optimum amount according to crop type. A prototype of the proposed system has been implemented, deployed and tested at a typical village in delta of Egypt, where a severe problem of fair distribution of irrigation water is encountered [16].

Figure 4:Zigbee network

VIII. COMPARISON OF TECHNOLOGIES

Reference	Technology	Standard	Range	Power consumption	Frequency
[9,13,17]	Bluetooth	802.15.1	10m	Medium	2.4GHz
[9,13,17]	Wifi	802.11	100m	High	2.4GHz 5GHz
[13]	Xbee	802.15.4	10-100 m	Low	868/915 MHz 2.4GHz
[5,9,17]	Zigbee	802.15.4	70-300 m	Very low	2.4GHz 868MHz 915MHz

Table 1:Comparison table

From the above comparison table, it is clearly seen that Zigbee technology has wide range and very low power consumption.

IX. CONCLUSION

It is concluded that Zigbee has low data rate, long battery life, and secure networking when compared to other technologies used in an agricultural field. It is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. In future, the raspberry pi along with pi camera can be used to monitor the crop field in agriculture.

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