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Smart Irrigation: A Smart Drip Irrigation System Using Cloud, Android And Data Mining

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***Abstract*—Water is an essential component for the development of plants in agriculture or irrigation. The paper stresses on the need of an externally hosted cloud computing platform to manage the database, android and the isolated server by the users across the country for irrigation. The system proposed in this paper uses information and communication technologies, allowing the user to consider and examine the information obtained by different sensors. Here we are using different sensors like humidity, temperature, moisture, light etc. These sensors give signal to the micro controller. Micro-controller gives the data to the isolated server through a serial communication. According to sensor values graph will be display on PC and Smart phone side and by using this graph user can on or off drip devices. In this we keep threshold value for each sensor. The data is sent and processed on an isolated server, which stores the information from the sensors in a database, allowing further interpretation of data in a simple and flexible way. The intended system may lead to enhance the farming practices, overcoming the water crises and developing an upgraded agricultural system for the country.**

Keywords—Cloud, Embedded, Android, Remote Monitoring, Wireless Sensor Network

I. INTRODUCTION

Agriculture has been the spine of the Indian economy and it will continue to remain for the long time. Over 70 per cent of the rural households depend on agriculture. One-third of our National income comes from agriculture. The economic improved, started off in the country during the early 1990s, have put the economy on a higher growth rate trajectory. Annual growth rate in gross domestic product (GDP) has accelerated about 25%. Indian agriculture has registered impressive growth over last few decades. The growth in agricultural production has been still for the past several years.

The significance of agriculture is: 1) Contribution to National Income, 2) Main source of Food, 3) Agriculture and Industrial development, 4) Sources of Revenue, 5) Source of Foreign trade. 6) Transport, 7) Source of saving, 8) Capital formation, 9) International importance, 10) Way of life, 11) Effect on prices, 12) Source of labor supply, 13) Economic development**.** Our land was losing its fertility being put to cultivation continuously for years together. So we have read all the existing system and their working and we have found out that there is no system that uses the micro-controller, cloud, data mining and smart phone all together. So we are combining all the existing system to get the hybrid system.

Sensor-Based irrigation system has been studied in much application. These sensors send real time values to microcontroller and microcontroller send these values to PC via serial communication [1]. The system suggests an economical and easy-to-use Arduino-based automated irrigation system that utilizes the Android smart phone for remote control. The data received by the Android smart phone from the Arduino is displayed on the User Interface [2]. The volumetric data of water utilized and crop yield were collected and the results showed that the water consumption is reduced in the automated field as compared to the manually irrigated field [3].

II. LITERATURE REVIEW

In this paper drip irrigation control using mobile phone. They use different sensors like humidity, temperature, light etc. for detection purpose. The sensor sends real time value to microcontroller send to pc via serial communication. In this

system central monitoring is computer and remote monitoring is mobile phone and mobile send command via network and android application to PC. Then PC will ON or OFF device. They use Hardware like ADC0808, IC89C51IC Microcontroller, MAX 232 for serial communication. Objective of this paper is 1) Android application and implement hardware of drip irrigation control using internet that is suitable for real life implementation. 2) Control drips remotely as well as automatically that reduce overhead of farmer and it also reduce manpower that farmer needs to supply water to plants. 3) Is very beneficial for increasing crops production. This system can be used in area where water resources are less. This type of application we can use for large area farms [1]. This paper makes use of the Arduino based automated irrigation system that uses the android smart phone for remote control. The system is designed using a soil and moisture sensor that provides a voltage signal that is proportional to the moisture content in the soil and then compared with the predetermined threshold value obtained by sampling of various soils for specific crops. The outcome of the comparison is that the appropriate data is fed to the Arduino processor. The Arduino is linked wirelessly via HC-05 to the android smart phone. The data received by the android smart phone using Arduino is displayed on the user interface (UI). The UI in the android smart phone allows the user to use easy remote control for the irrigation system that involves switching on and off of the driver motor through the Arduino wire which is linked to its controller commands from the android smart phone. This type of studies are conducted on a laboratory prototype suggests that this design is valuable and can be easily implemented on real time applications [2]. In this system drip irrigation system are divided into two halves for having automated drip system on one side and non-automated on other side. Water supply for both sides is from separate lines from separate sources and thus has two different designs for the drip system. In this model, data is generated locally but processed globally. Nodes do not analyze the data they collect; they transmit them to a central system, where they are stored and processed. The sensors sense the moisture level of the soil by measuring the conductivity of the soil which is due to the presence of flow ions contained in the soil. The flow of ions increases as the moisture content increases. Thus a decrease in the resistance of the soil indicates an increase in the moisture level. By measuring the voltage drop across the soil and by properly calibrating it against the moisture level, we measured the moisture content of the soil. The sensors are all routed through underground pipelines to the processing system. Here each sensor has a separate circuit dedicated to it. The chosen embedded processor system is PIC16F877A as it is widely used for collecting and processing analog data, quickly becoming a de facto standard. When the voltage across any one of the sensors falls below the lower threshold value, the solenoid valve is turned ON. It turns OFF only when all four sensors feed a value which is above the upper threshold. The ON condition of the relay opens a 15V DC Solenoid valve. The battery is charged at 17V through an LM317 3-Terminal Positive Adjustable Voltage Regulator, designed to supply more than 1.5A of load current with an output voltage adjustable over a 1.2V to 37V[3]. In the paper Automatic irrigation system control using GSM-Bluetooth. This Bluetooth module neglect the usage cost by communicating with the appliances via Bluetooth when the application is in a limited range of few meters [4]. This paper introduce distributed wireless network for detection of soil-moisture and also temperature sensors are placed in the root zone of the plants. The paper was assign threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to Control Water Quantity [5]. In this paper they have used micro-controller AT89C52 that acts as main component of the entire system. It controls the motors and users transmission and receiving signals. A SIM 300 is used to read the messages sent by the user that are stored in the memory. The received signals from the user are processed by the micro-controller. According to the command or operation given by the user the relay circuits of the motors are on-ed/offed. LCD is used to know the working status of the microcontroller [6]. In this proposed system the moisture and fertility measured sensors are used and also used Zigbee for android mobiles to sending the SMS and also used drip irrigation automation for soil moisture measurement [7]. It utilizes wireless sensor network for getting different information from soil properties and environmental data using sensors. In this three nodes are used. One of them is acting as the master node which collects the data from the other nodes. Master node is the one who is communicating with the gateway. The other nodes are sending the data to the master node through Zigbee via USART using RS232. Then the gateway is sending all the data to PC that is stored for the user [9].

In this system we will be including data mining concept for the prediction of future outcomes. Data mining concept examine the large pre-existing data in order to produce the new information. We will be including the cloud computing concept for the communication between the pc and mobile. Cloud computing is a technique in which a large number of computers connected through a real-time communication network.

III. PROPOSED SYSTEM

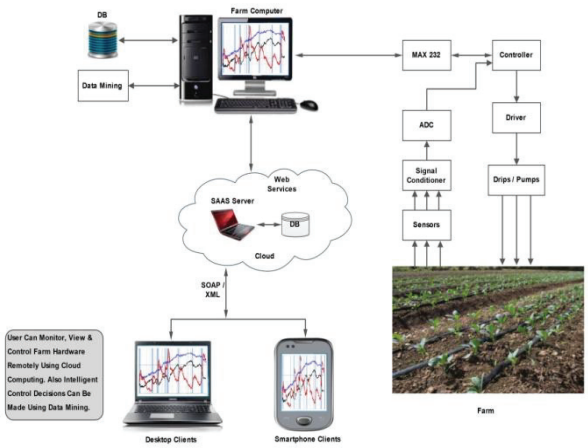

Fig. 1. Proposed System

Working:
Water management system is microcontroller based and web application using the concept of cloud and data mining is used to monitor and control the water management system from remote location. Whole system is in WSN infrastructure. Water management is done through sensor reading from farm. Web application provide easy monitor and control mechanism to farmer. Graph generated in web application make easy analysis. Cloud computing is a technique in which a large number of computers connected through a real-time communication network.

In this system sensor senses the data and sends the reading to the micro-controller. Then micro-controller sends those reading to the farm pc through serial communication. Then these readings get stored in the database that is connected to farm pc in which we use data mining concept. These readings will be displayed on the android phone and pc. The mobile and pc is connected to the database through cloud.

Hardware:
1) **Sensors**: We use sensors like humidity, temperature, Light, Moisture.
2) **Microcontroller:** It is heart of system, means it control all operation of system.
3) **MAX 232:** It converts signals from an RS-232 serial port to signal suitable for use in TTL compatible digital logic circuit
4) **Base station**: It is master unit to control valve and take data from all sensor node which are at the end.
5) **Server**: It collects data from all WSN network and take decision if threshold cross of any sensor unit.
6) **Web application**: It provides graphical interface to user and graph of sensor data value is generated so it is easy to understand for user to analyze and take decision.

Software:
1. Windows 7 system
1 gigahertz (GHz) or faster 32-bit (x86) or 64-bit (x64) processor
Linux system requirements
700 MHz processor, 512 MB RAM, 5 GB of hard-drive space

2. Android OS
Android is a Linux-based operating system designed primarily for touch screen mobile devices such as smart phones and tablet computers.

Flowchart:-

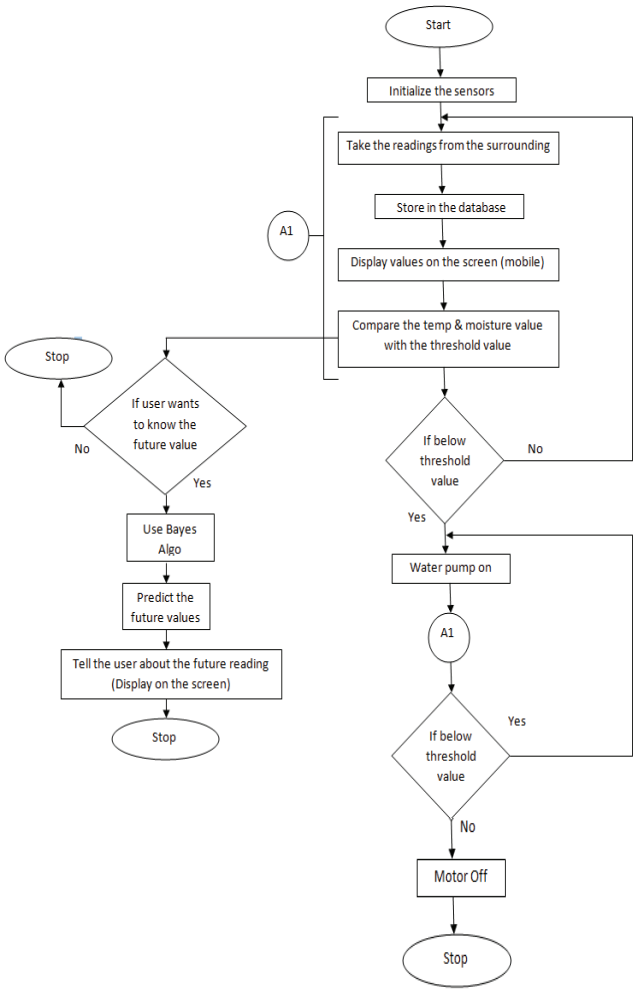

TABLE I. VARIOUS TYPES OF MICROCONTROLLER IN DIFFERENT PAPERS

S.No.	*Paper Name*	*ADC0808*	*PIC16F8774*	*AT89C52*	*Atmega32*	*ARM7*
1.	A Mobile Application to Control Drip Irrigation System	Yes				
2.	Smart drip irrigation system using sensor		Yes			
3.	Remote Access to Agricultural Motor through the Usage of GSM and SMS Technologies			Yes		
4.	Design and Development of an Efficient and Cost-Effective.Micro-controller-Based Irrigation Control System to Enhance Food Security				Yes	
5.	Real-Time Atomization of Agricultural Environment for Social Modernization of Indian Agricultural System Using Arm7				Yes	
6.	A knowledge based Indian Agriculture:					Yes

S.No.	Paper Name	ADC0808	PIC16F8774	AT89C52	Atmega32	ARM7
	With Cloud ERP Arrangement					
7.	Development of WSN System for Precision Agriculture		Yes			
8.	A new Intelligent Low Cost Mobile Phone based Irrigation System using ARM		Yes			
9.	GSM based Automated Irrigation Control using Raingun Irrigation System					Yes
10.	Automated Irrigation System using WSN				Yes	

TABLE II. VARIOUS TECHNOLOGIES USED IN DIFFERENT PAPERS.

S.No.	Paper Name	Zigbee	Arduino	GSM-Bluetooth	ERP-Cloud
1.	Experimental Investigation Of Remote Control Via Android Smart Phone Of Arduino-Based Automated Irrigation System Using Moisture Sensor		✓		
2.	Design of Remote Monitoring and Control System with Automatic Irrigation System Using GSM-Bluetooth			✓	
3.	Control of Irrigation Automatically By Using Wireless Sensor Network	✓			
4.	Wireless Sensor Network Based Irrigation Management System	✓			
5.	Embedded based Remote Control Application using Mobile Phone in Irrigation				✓
6.	Water Saving-Irrigation Automatic Agricultural Controller	✓			

IV. CONCLUSION

A remote control for drip irrigation is the most beneficial approach for the farmers. This system reduces the extra manpower of the farmer for his farm like supplying water to plants. This system uses different sensors like temperature, light, humidity and moisture and according to this sensor parameters farmer can control drip due to internet connectivity between client and servers, farmer can control drip component from anywhere. This system remove drawback of previous systems like distance problem, range problem [1]. The proposed system uses an externally hosted cloud computing platform to manage the database, android and the isolated server by the users across the country. This approach is very beneficial for the farmer for increasing crop production. This system can be used in area where water resources are less. This system can be used for large area farms [1].

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