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Intelligent Drip Irrigation System

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Abstract–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 are monitor and control the drip devices. 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 computer (Cloud server) via 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. Rest of the paper followed by Introduction, Related work, proposed system, hardware schematics, experimental results, wireless sensor network, advantages, disadvantages, conclusion.

Keywords: Android, Irrigation, Hardware control, PC.

I. Introduction

In the drip irrigation technique, the water is provided to the root zone of herb drip by drip because of which the large amount of water can be saved. Figure1 shows typical drip irrigation system [1]. At the present time, the farmers use the irrigation technique in country manually in which the farmers must irrigate the lands at every regular intervals. This technique may require additional amount of water or sometimes the water provide latterly to roots of the plants because of which the crops may be get dried. Slowed growth rate, lighter weight of fruits etc. like problems are arises because of slight water insufficiency. This issue can be resolve if farmers will use automatic and remote drip irrigation technique.

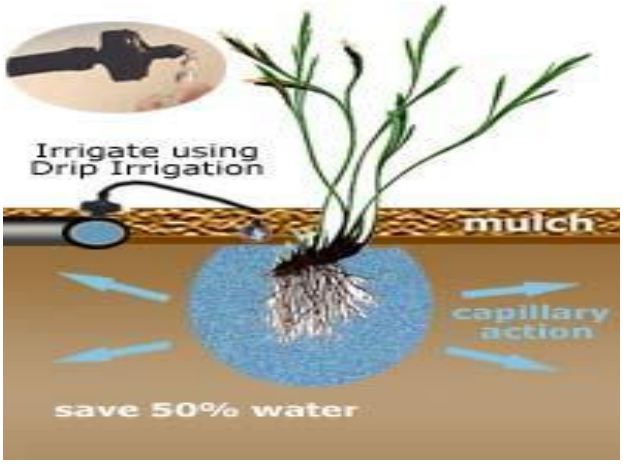

Fig.1. Drip Irrigation

This paper proposes one way of controlling drip components like valves automatically and remotely by using internet and android mobile phone. The advantage of this technique is that farmer can control drip irrigation from anywhere and at any time. It reduces issue for flooding irrigation and reduces the problem of range and distance due to use of internet between computer and mobile.

II. Related Work

In existing system, farmer has to work physically to control the drip irrigation system. Traditional instrumentation based on distinct solutions, presents many difficulties on measuring and control systems especially over the large geographical areas. Every time excess amount of water is given to the fields if conventional irrigation system is used.

Limitations of existing system

- Needs actual physical work of farmer to control drip irrigation
- Wastage of water.
- Wastage of time.

"Larsen & Tubro" has implemented a 'Drip Irrigation System' based on GSM. In this system, drip irrigation is controlled by sending a text message from mobile device to turn on or off the drip irrigation devices.

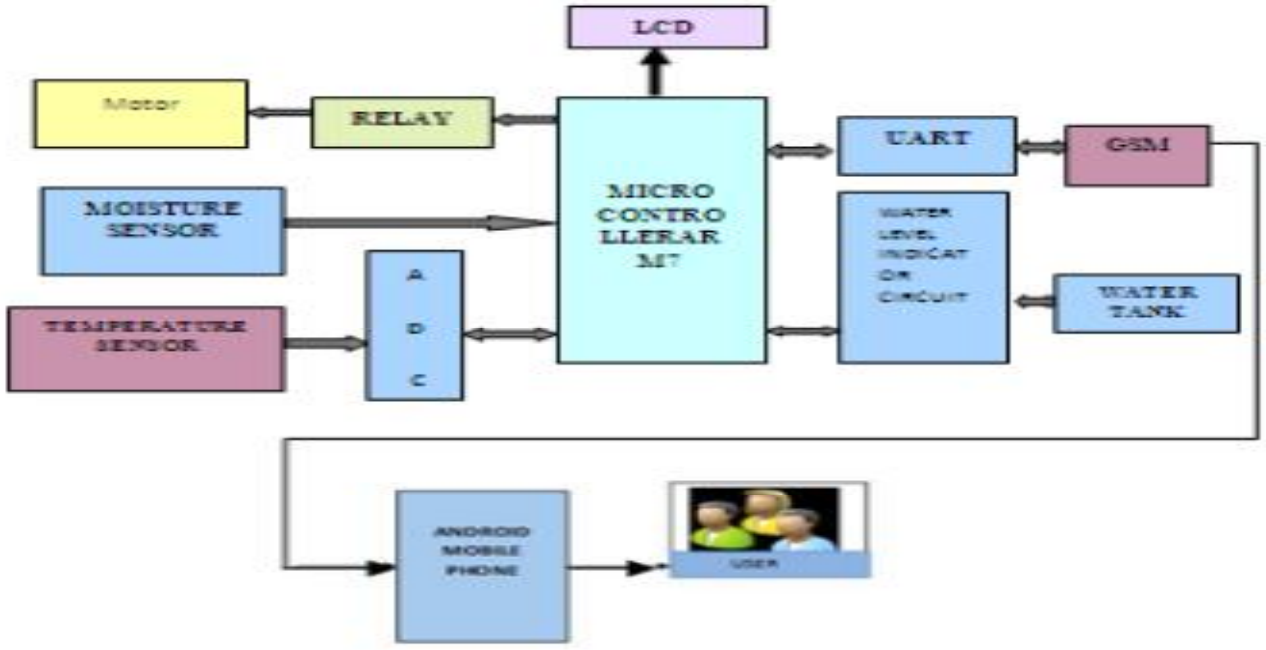

Fig.2: GSM based drip irrigation system.

The connections between the two mobiles are done using GSM. The GSM modules as well as micro-controller both are connected using UART (universal asynchronous receiver / transmitter). When the moisture sensor identifies the low moisture content of the soil, it sends a signal to the micro-controller. Then the micro-controller sends a signal to the called mobile (which is kept in the auto answering mode). The called mobile automatically activates the buzzer. Hence when the mobile calls, the buzzer indicates the valve needs to be open. When button is pressed in the called function, the signal is send to the micro-controller. The signals send to the valves by micro-controller which causes it to get open. The water is providing to the root of the plant drop by drop, and when the soil moisture becomes sufficient, the sensor analyze the moisture level and gives back the signal to the micro-controller and the buzzer becomes off. After that by pressing the button in the calling function again the valve is gets off. The power supply needed by the controlling system is +5V. The entire unit is as shown in Fig.2 [2] An UART is responsible for performing the main task in serial communications with computers. The device changes the incoming parallel information into serial data which can be sent on a communication line. A UART can be used to receive the information. The UART carry out all the tasks like timing, parity checking, etc. which are necessary for the communication. The only extra devices connected which are line driver chips capable of transforming the TTL level signals to line voltages and vice versa. The micro-controller ARM7 structure is a general purpose 32-bit microprocessor, which provides high performance and very low power consumption. The ARM architecture is actually based on Reduced Instruction Set Computer (RISC) principles, and the present instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers can be used to control water flow.[2]

III. Proposed System

The aim is to design a micro-controlled and computer driven automated drip irrigation system. An ADC connected to micro-controller gather the humidity values for soil at various points. These values must be envisioned in software using 3D plots. A PC interface is provided for easy programming of the hardware. The 3D graphs generated from sensor values located across the entire field will helps us to visualize, explain and take decisive actions for the particular situation. In this a mobile send command to

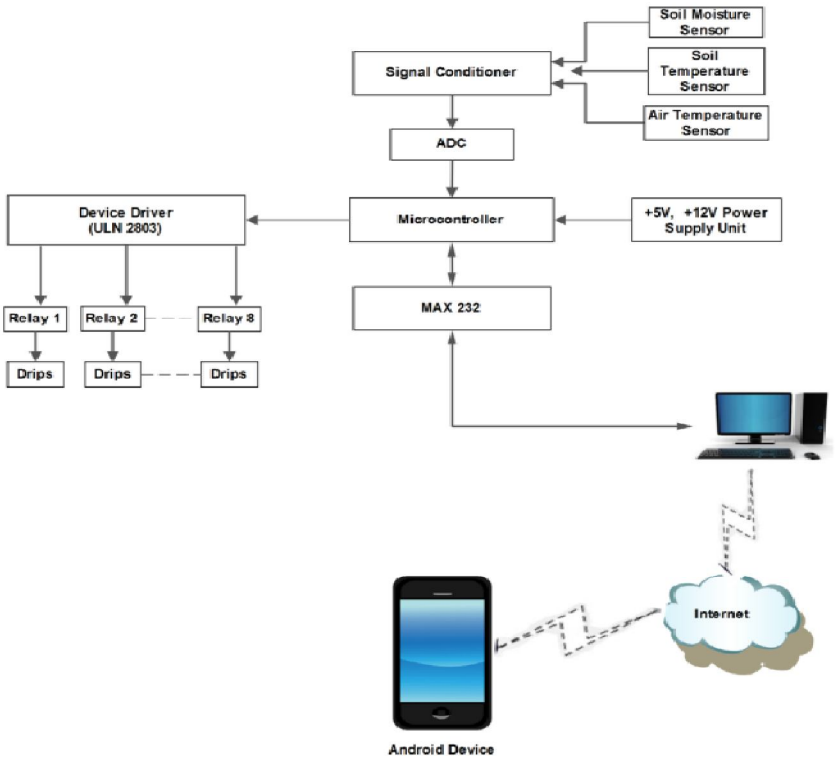

Fig.3: Proposed system architecture

PC to control drip irrigation as shown in Fig.3.Here we use various sensors like humidity, temperature, light etc. for identification purpose. These sensors send the real time values to micro-controller and these values send to PC by micro-controller via serial communication. According to the sensor values the graph will be display on computer and mobile side And by using this graph user can switch on or off the drip devices. In this we keep the threshold value for every sensor. The drip irrigation technique can be control by mobile from anywhere and also he can change threshold values of sensors via mobile. This Technique is more advantageous for agriculture area.

As shown in Fig.4 [3] the proposed system architecture overview contains following components

1)**Sensors**(Light, Temperature, PH Value, Humidity): Sensor Sense the different physical parameters like light, PH value of soil, temperature and humidity and converts these sense data into electrical signals (either voltage or current)[6]

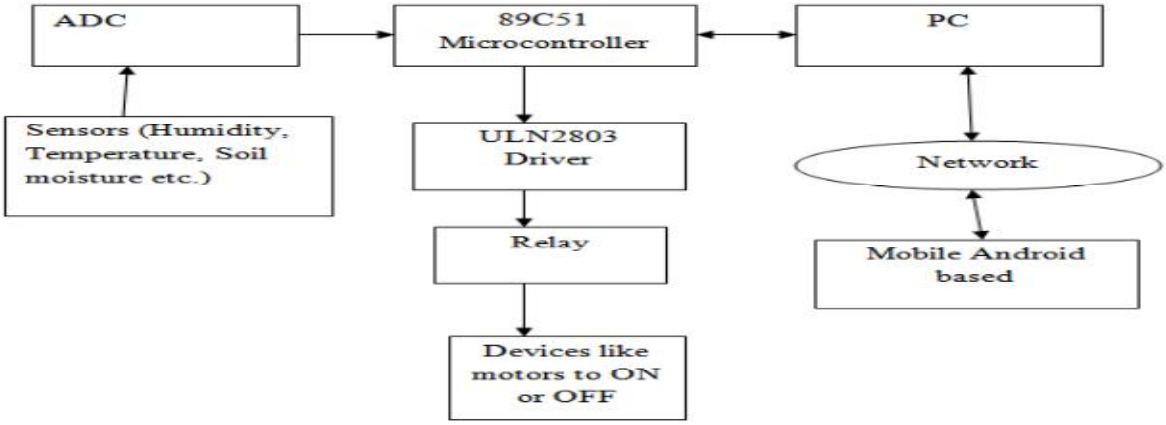

Fig.4: Proposed system architecture overview

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. [6]

3) **Micro-controller**: It is heart of the entire system, which means it controls the all activities of the system. It has memory in which control programs are saved. [6]

4) **Relay**: It is an electromagnetic switch. It is used to control high current circuit with a low current signal.

5) **ULN 2803**: It is a small integrated circuit that contains 8 transistor driver channels. A ULN 2803 with a set of relays is simple and effective way of switching main voltages.

6) **PC** (Personal Computer / Server): Basically for Data Acquisition as well as logging purpose we are going to use personal. The graphical visualization displays 3Dgraphs generated from sensor values are located across the field.

7) **Mobile** (Client): The android mobile is act as client which gets current values of the sensors which is used to switch ON or OFF the drip devices.

IV. Hardware Schematic

As shown in Fig5 [7] the intelligent drip irrigation system circuit diagram the current sensors values are converted into digital format using ADC (Analog to digital converter). These values are taken as input and send it to micro-controller. These values are working in TTL logic level so the TTL logic level values are converted into RS232 logic level by using MAX232. Then this RS232 logic levels are forwarded to the PC link.

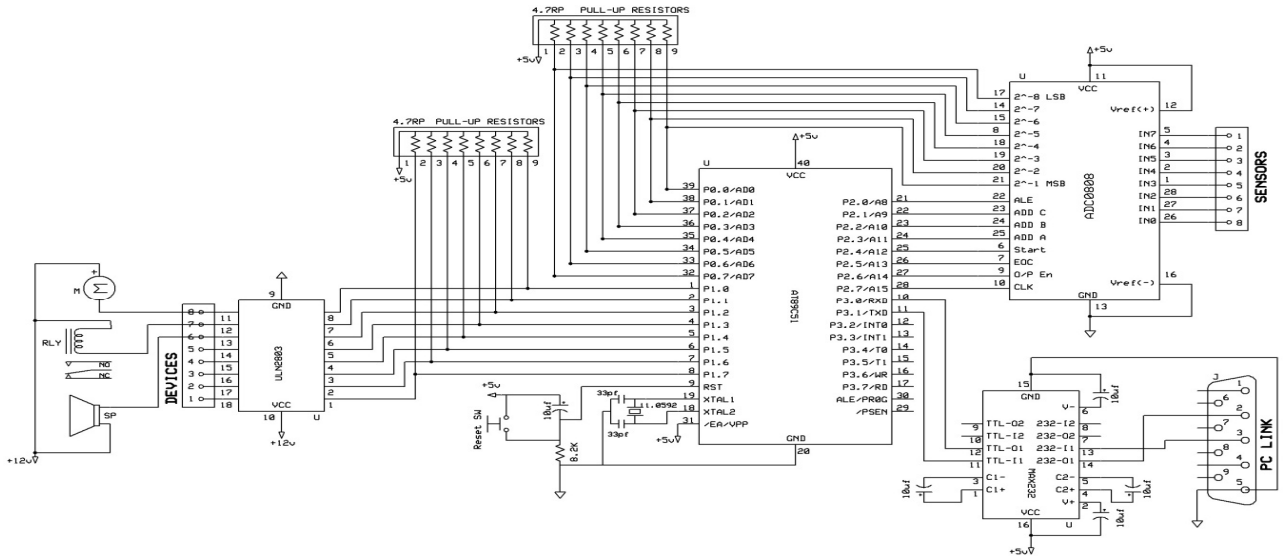

Fig.5: Intelligent Drip Irrigation System - Circuit Diagram

In this system Computer Can read the ADC values also receives sensor data. On the basis of values that we have read from ADC and Sensor through which we can generate drip control commands and later on we transmit that drip commands to the hardware device. Hardware device is totally operated on wireless network. i.e. computer can communicate with hardware device through wireless sensor network . The important parameters to be measured for automation of irrigation system are soil moisture, temperature and light. The entire field is first divided in to small sections such that each section should contain one moisture sensor, a temperature sensor and one light sensor. These sensors are buried in the ground at specific depth. Once the soil has reached desired moisture level the sensors send a signal to the micro controller to turn off the relays, which then control the valves of drip irrigation system.

V. Wireless Sensor Networks

A wireless sensor network (WSN) consists of spatially distributed autonomous sensors to monitor physical or environmental conditions like temperature, sound, vibration, pressure, motion or pollutants and thus these sensors used to cooperatively pass their data through the network to a main location. The more modern networks are working in bi-directional also allow the enabling control of sensor activities. The development of wireless sensor networks was motivated by military applications like battlefield surveillance.

Such networks are used in many industrial and consumer applications like industrial process monitoring and control etc. Wireless sensor networks can be used in applications like environment monitoring, medical applications, robotic systems and home and industrial automation. Wireless sensor networks (WSN) have recently been proposed for a large range of applications in home and industrial automation. It consists of many tiny nodes, which have several sensors and a radio interface that depends on the IEEE 802.15.4 standard that supports large number of embedded devices in one network. [6]

VI. EXPERIMENTAL RESULTS

- Save water, energy and manpower in the agriculture sector
- Automatically as well as manually system handling.
- Detect water level.
- Efficient and effort reducing system design.
- Resource optimization technique is achieved in intelligent drip irrigation system.
- Provide the decision support for intelligent drip irrigation system.
- Control the drips remotely as well as automatically that reduce overhead of farmer and it also reduce manpower that farmer needs to supply water to plants.
- 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.

Fig.5: Android Application

VII. Conclusion

This paper gives one way of controlling drip irrigation remotely. Using these system productivity increases and water consumption reduces. The system architecture is also explained that can be used to control drip irrigation components remotely. The main focus on system architecture of proposes system that can be used for implementation of agricultural projects. The propose system is beneficial for farmers and avoid the wastage of water as well as no manpower is required and system is relatively quick. This system requires frequent maintenance for efficient operation. As compared to conventional irrigation system cost of equipment are more.

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