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Automation in Irrigation System Based on Content of Soil Moisture Sensing

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ABSTRACT: Image This project on "Automatic Irrigation System on Sensing Soil Moisture Content" is intended to create an automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the moisture content of the earth. In the domain of farming, utilization of appropriate means of irrigation is significant. The benefit of employing these techniques is to decrease human interference and still make certain appropriate irrigation. In the conventional drip irrigation system, the farmer has to keep watch on irrigation timetable, which is different for different crops. With the use of low cost sensors and the simple circuitry makes these project a low cost product, which can be bought even by a poor farmer. This project is best suited for places where water is scares and has to be used in limited quantity. The project makes the irrigation automated. This automated irrigation project brings into play an Atmega328 microcontroller, is programmed to collect the input signal of changeable moisture circumstances of the earth via moisture detecting system. The Soil Moisture sensors are constructed using aluminum sheets and housed in easily available materials. The aim is to use the readily available material to construct low cost sensors.

KEYWORDS: Microcontroller, Irrigation, Soil Moisture Content, Automated Irrigation Mechanism.

I. INTRODUCTION

Image The continuous increasing demand of the food requires the rapid improvement in food production technology. In a country like India, where the economy is mainly based on agriculture and the climatic conditions are isotropic, still we are not able to make full use of agricultural resources. The main reason is the lack of rains & scarcity of land reservoir water. The continuous extraction of water from earth is reducing the water level due to which lot of land is coming slowly in the zones of un-irrigated land. Another very important reason of this is due to unplanned use of water due to which a significant amount of water goes waste. In the modern drip irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants as per requirement to which a large quantity of water is saved.

At the present era, the farmers have been using irrigation technique in India through the manual control in which the farmers irrigate the land at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Water deficiency can be detrimental to plants before visible wilting occurs. Slowed growth rate, lighter weight fruit follows slight water deficiency. This problem can be perfectly rectified if we use automatic micro controller based drip irrigation system in which the irrigation will take place only when there will be intense requirement of water.

Irrigation system uses soil moisture sensor to turn irrigation ON and OFF. These valves may be easily automated by using controllers and Soil moisture, Temperature & Humidity sensors. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate

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water and nutrients when needed. It also helps in time saving, removal of human error in adjusting available soil moisture levels and to maximize their net profits.

II. Problem definition

In this project multiple sensors are used, such as moisture for the better growth of the plant. These components are interfaced with the Microcontroller which is used to forward the values from these sensors to the Motor.
The microcontroller which read the data sent by the sensor by means of ADC. Now a comparison is made by the system to the values read and processes a command to the Microcontroller whether or not to supply the required amount of water to the plant.
This project however depicts a communication mechanism that has been developed between a Micro-Controller and amongst various sensors in order to maintain the resources required for the growth of the plant in appropriate amount.

III.Proposed System

The project discussed here, makes use of a very popular Atmega328 microcontroller, ADC 0808, Relay & Motor. The important components we are using here are ADC0808 and our Microcontroller.
The ADC0808 will fetch the inputs from the various sensors and forward it to the Micro controller. The microcontroller in turn communicates with the Relay switch, which decides whether to turn on or off the water supply.
It basically follows the principle of continuous data logging from the soil contents by using soil moisture sensors and feeding the output of the sensors to the Microcontroller.

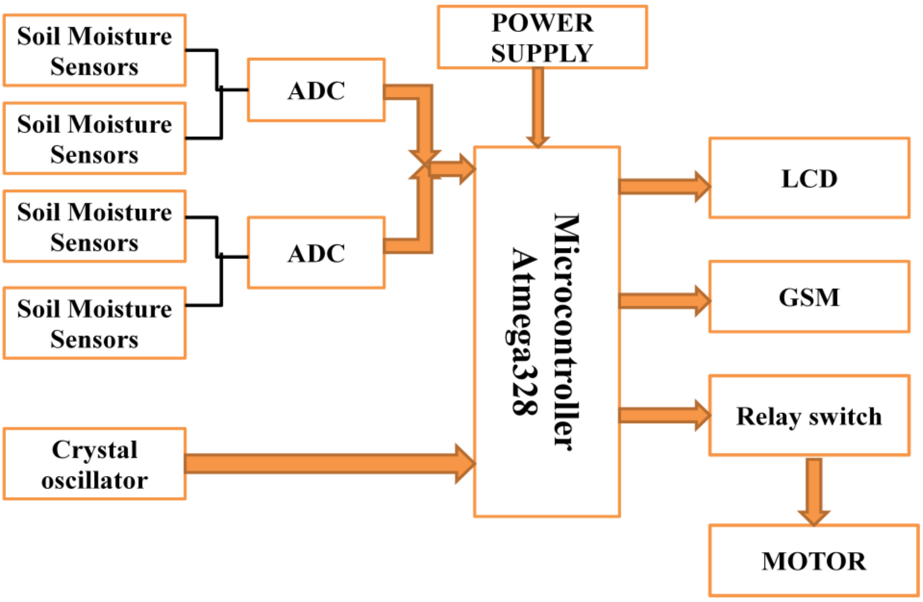

Fig. 1. Proposed System

A. Sensors

Soil moisture sensors (SEN13322) measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. One common type of soil moisture sensors in commercial use is a Frequency domain sensor such as a capacitance sensor. Another sensor, the neutron moisture gauge, utilize the moderator properties of water for neutrons.
Soil moisture content may be determined via its effect on dielectric constant by measuring the capacitance between two electrodes implanted in the soil. Where soil moisture is predominantly in the form of free water (e.g., in sandy soils), the dielectric constant is directly proportional to the moisture content. The probe is normally given a frequency excitation to permit measurement of the dielectric constant. The readout from the probe is not linear with water content

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and is influenced by soil type and soil temperature. Therefore, careful calibration is required and long-term stability of the calibration is questionable.

- In This sensor We are using 2 Probes to be dipped into the Soil
- As per Moisture
- We will get Analogue Output variations from 0.60volts - 5volts Input Voltage 5V DC

Fig 2: Soil Moisture Sensor

B. ADC 0808

ADC stands for analog to digital converter a data acquisition component which is a monolithic CMOS device with an 8 bit analog to digital converter, 8 channel multiplexer and microprocessor compatible control logic.
The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register..
Hence, the function of the ADC here is to take the analog signal from the sensors and pass the digital signal to the microcontroller.

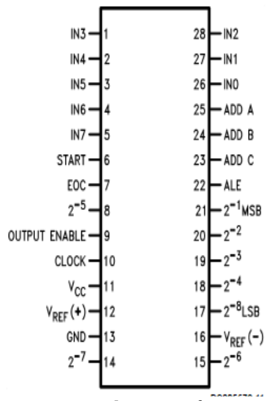

Fig 3: Pin diagram of ADC 0808

C. Microcontroller (Atmega328)

Atmega328 *is an* 80C51 microcontroller with 16/32/64 kB flash and 1024 B of data RAM. We choose to run the application with the conventional 80C51 clock rate (12 clocks per machine cycle).
The flash program memory supports both parallel programming and in serial ISP. Parallel programming mode offers gang programming at high speed. ISP allows a device to be reprogrammed in the end product under software control.
The Micro Controller reads the input digital signal from the ADC and puts these values on its output pins so that it can be forwarded to the computer software. The ADC is interfaced at pins from AD0 to AD7 where the signals are sent and these signals are forwarded on the port 3 pins.

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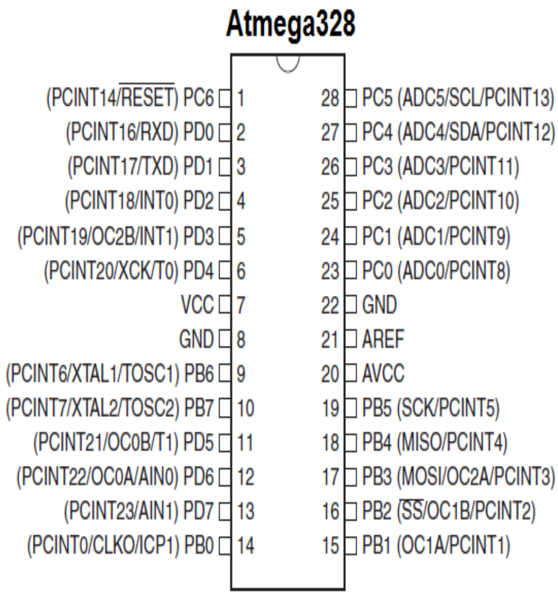

Fig 4: Atmega328 pin diagram

D. Relay Switches

A relay is an electrically operated switch and uses an electromagnet to operate a switching mechanism mechanically. It is used wherever necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

A type of relay used here is a high power, required to directly control an solenoid valve. It is used as a means of providing a signal to open the valve for supplying water.

Fig 5: Relay as a Switch

E. Transistor Switching

Transistors are commonly used electronic switches, for high-power applications as well as for low-power applications such as logic gates. In this Project the transistor acts as a make and break circuit hence, takes the signals received from the microcontroller and depending on the logic the switch is connected to the system or disconnected.

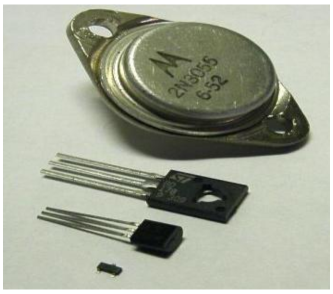

Fig 6: Transistor Switch

F. GSM Module

A GSM modem is a wireless modem that works with a GSM wireless network. Computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. So we can use a GSM modem just like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. GSM is one of the most vital components in our set up since all the communication between the users and centralized unit takes place through this modem. An external GSM modem is connected to a computer through a serial cable or a USB cable. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. The current status of the soil will be send to the farmer as SMS.

IV. SYSTEM IMPLEMENTATION

The circuit diagram shows how the entire system is assembled on a PCB (Printed Circuit Board). It clearly depicts how each instrument is interfaced with each other so that the signals can be easily transmitted and processed from one region to another.

On the PCB the track layout is made and care should be taken that the tracks do not collide with each other else it may lead to shorting the circuit.

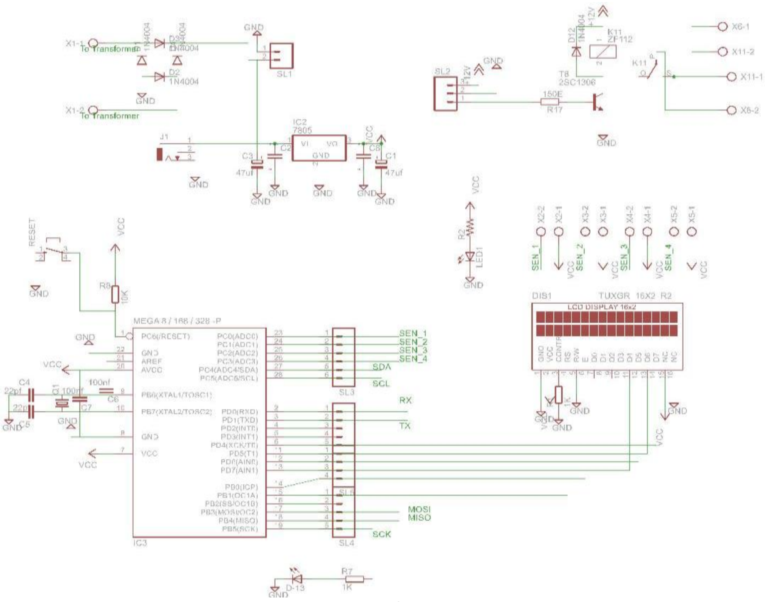

Fig 7: Circuit Diagram of the proposed system

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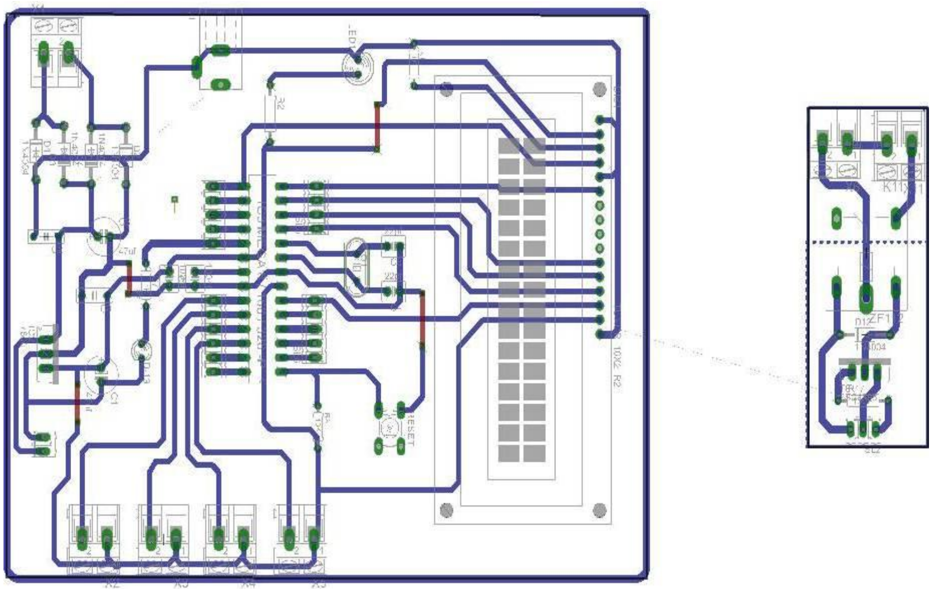

Fig 8: Track and Component Layout on PCB

V. CONCLUSION

The system is relatively simple to design and install and is very useful to all climatic conditions any it is economic friendly. It enhances productivity and reduces water consumption and safe with no manpower is required. Permits other yard and garden work to continue when irrigation is taking place, as only the immediate plant areas are wet. Reduces soil erosion and nutrient leaching. Prevents the chance of plant disease by keeping foliage dry. The key elements that can be considered while designing an advanced mechanical model are:

A. Flow

You can measure the output of your water supply with a one or five gallon bucket and a stopwatch. Time how long it takes to fill the bucket and use that number to calculate how much water is available per hour. Gallons per minute x 60=number of gallons per hour.

B. Water Supply & Quality

City and well water are easy to filter for drip irrigation systems. Pond, ditch and some well water have special filtering needs. The quality and source of water will dictate the type of filter necessary for your system.

C. Soil Type and Root Structure

The soil type will dictate how a regular drip of water on one spot will spread. Sandy soil requires closer emitter spacing as water percolates vertically at a fast rate and slower horizontally. With a clay soil water tends to spread horizontally, giving a wide distribution pattern. Emitters can be spaced further apart with clay type soil. A loamy type soil will produce a more even percolation dispersion of water. Deep-rooted plants can handle a wider spacing of emitters, while shallow rooted plants are most efficiently watered slowly (low gap emitters) with emitters spaced close together. On clay soil or on a hillside, short cycles repeated frequently work best. On sandy soil, applying water with higher gap emitters lets the water spread out horizontally better than a low gap emitter.

D. Timing

Watering in a regular scheduled cycle is essential. On clay soil or hillsides, short cycles repeated frequently work best to prevent runoff, erosion and wasted water. In sandy soils, slow watering using low output emitters is recommended. Timers help prevent the too-dry/too-wet cycles that stress plants and retard their growth. They also allow for watering at optimum times such as early morning or late evening.

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E. Watering Needs

Plants with different water needs may require their own watering circuits. For example, orchards that get watered weekly need a different circuit than a garden that gets watered daily. Plants that are drought tolerant will need to be watered differently than plants requiring a lot of water.

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