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PLC Based Automated Irrigation System

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Abstract: In a developing country like India, automation plays an important role in the development and advancement of the country. In the field of irrigation, proper method of irrigation is important . At the present era, the gardeners have been using irrigation technique in India through the manual control in which the gardeners irrigate at the regular intervals. This process sometimes consumes more water or sometimes the water reaches late due to which the grass and plants get dried. Over-irrigation can increase energy consumption and water cost as well as leaching of fertilizers below the root zone, erosion, and transport of soil and chemical particles to the drainage ditches. Irrigators who monitor soil moisture levels in the field greatly increase their ability to conserve water and energy and avoid soil erosion and water pollution. The objective of this paper is to develop sensor based automated gardening system to reduce water requirement and balanced gardening in smart city projects in India. Manpower isn`t required in this system and moisture content of soil will be balanced all the time.

I. INTRODUCTION

Nowadays, every work can be done in the easiest way by the use of machines. No doubt, automation increases the productivity and saves a lot of time and effort. Irrigation is the most important part of agriculture and gardening
to yield maximum profit from your investment in the field. However, there are several machines which can be used in agriculture field by farmers and gardeners to ease their work. In this paper, we will be discussing a smart and simple irrigation system that is designed using high quality systems. The aim of this irrigation system is to detect the moisture content in soil and run the motor pump automatically. Apart from the agriculture field, we also need an automated plant irrigation system at our home to take care of our plants in our absence. Through this paper, we will be discussing the design process of automated irrigation system project than can be used to water the plants automatically while you are sitting at the comfort of your home.
About 50% of water losses are caused due to inefficiencies of traditional irrigation systems that cause overwatering. To overcome this problem, we are going to design a smart irrigation system that checks the moisture level in soil and provide water to the plants automatically. When the circuit finds enough moisture in the soil, the motor pump gets off.

II. METHODS OF IRRIGATION

Irrigation methods is further divided into two categories traditional irrigation methods and modern irrigation systems A.Traditional irrigation methods includes .level basin method ,Furrow irrigation method ,Basin irrigation method,
In traditional irrigation methods large amount of water is used. Large manpower is required in this method. The Productivity is also less in these methods. Problems of soil erosion is major . large amount of ground water goes waste. Problem of water logging arises.

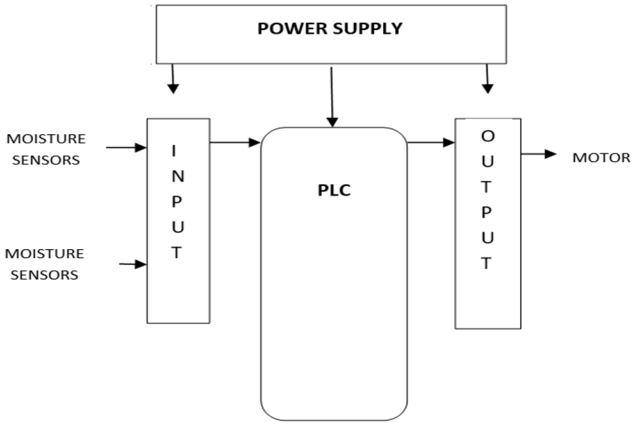
A. Modern Irrigation Methods

1) *Sprinkler Irrigation Method:* A method of applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground. The pump supply system, sprinklers and operating conditions must be designed to enable a uniform application of water
2) *Drip Irrigation System:* Drip irrigation is the most efficient water and nutrient delivery system for growing crops. It delivers water and nutrients directly to the plant's roots zone, in the right amounts, at the right time, so each plant gets exactly what it needs, when it needs it, to grow optimally. Thanks to drip irrigation, farmers can produce higher yields while saving on water as well as fertilizers, energy and even crop protection products. Water and nutrients are delivered across the field in pipes called 'dripperlines' featuring smaller units known as 'drippers'. Each dripper emits drops containing water and fertilizers, resulting in the uniform application of water and nutrients direct to each plant's root zone, across an entire field.
3) *Pot Irrigation System:* **Pot** or pitcher method is one of the most efficient traditional **systems** of **irrigation** known and is well suited for small farmers in many areas of the world. Buried clay **pot irrigation** uses buried, unglazed, porous clay **pots** filled with water to provide controlled **irrigation** to plants.

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III. AUTOMATED IRRIGATION SYSTEM



A. *Material Required*

1) *Soil Moisture Sensor:* Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons between the two electrodes



2) *Water Pump:* A water pump is considered as the heart of the irrigation system because it is used to pull out the water from the well, cannel, bore well, etc. the water pump pulls the water out and stores in the tank. The water pump consumes electrical energy to perform mechanical work by moving the water.



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3) *Programmable Logic Controllers (PLC):* In this research work, I have used SIEMENS LOGO 230 RC controller shown in figure, having following specifications shown below.

Specifications

Depth	55 mm
Usage/Application	Industrial
Width	72 mm
Current	0.5 A
Voltage	240 V
Brand	Logo
Ambient temperature during operation	0-55 Degree C
Height	90 mm
Model No	230 RC
Material	MS
Input	8x AC/DC



4) *Expansion Module:* SIEMENS expansion module DM8 12/24R



5) *DC Power Supply (24 volts):* I have used SIEMENS SITOP PSU8200 in this research as shown in figure below



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6) *Solenoid Valve:* The solenoid valve converts the electrical energy into mechanical energy, which in turn opens and closes the valve. It is an electromechanically operated device. The pilot operated solenoid valve will have two functions 1) Normally closed, when the coil is de-energized (without electricity), 2) Normally open, when the coil is energized or activated by an electric current.



IV. RESULTS AND DISCUSSION

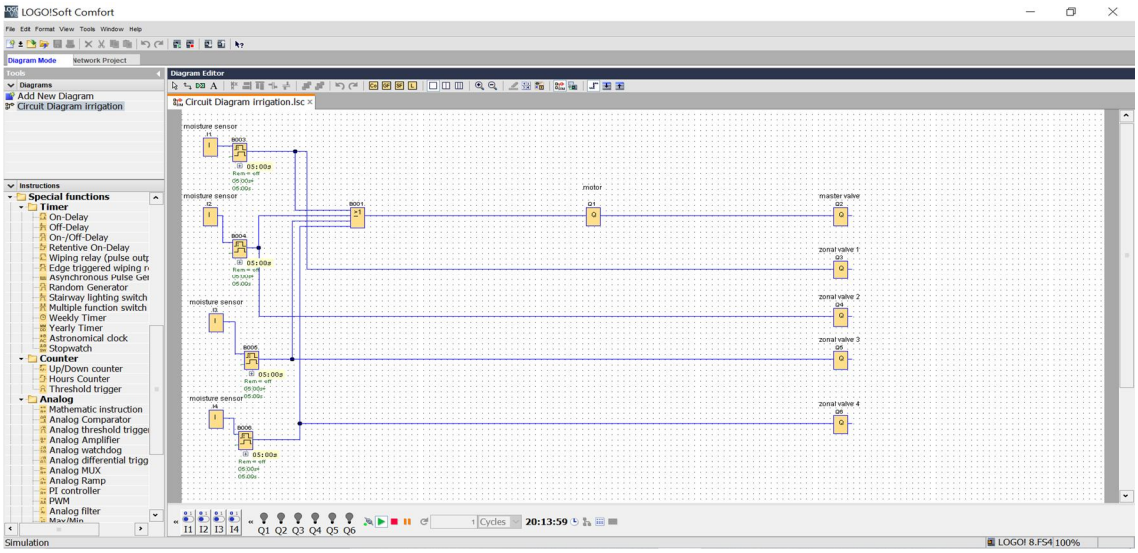
I have used SIEMENS LOGO 230 RC. I have programmed this controller so that it controls the opening and closing of the master valve and zonal valve of the irrigation system. And also controls the ON and OFF position of the water pump automatically. I have set the value of moisture sensor manually as 22 to Turn ON and 55 to Turn OFF. As a result of this programming I received the following type of conditions of the valves and pump as shown in below figures. And the input, output coil descriptions are shown in table 1.

Coil No.	Device name	Device Type
I1	Moist sensor 1	Input
I2	Moist sensor 2	Input
I3	Moist sensor 3	Input
I4	Moist sensor 4	Input
Q1	Motor	Output
Q2	Master valve	Output
Q3	Zonal valve 1	Output
Q4	Zonal valve 2	Output
Q5	Zonal valve 3	Output
Q6	Zonal valve 4	Output

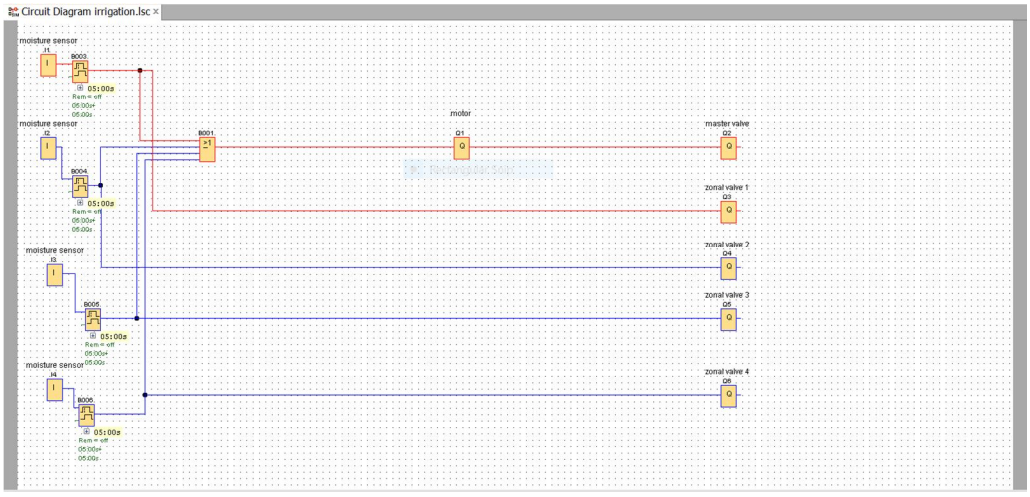
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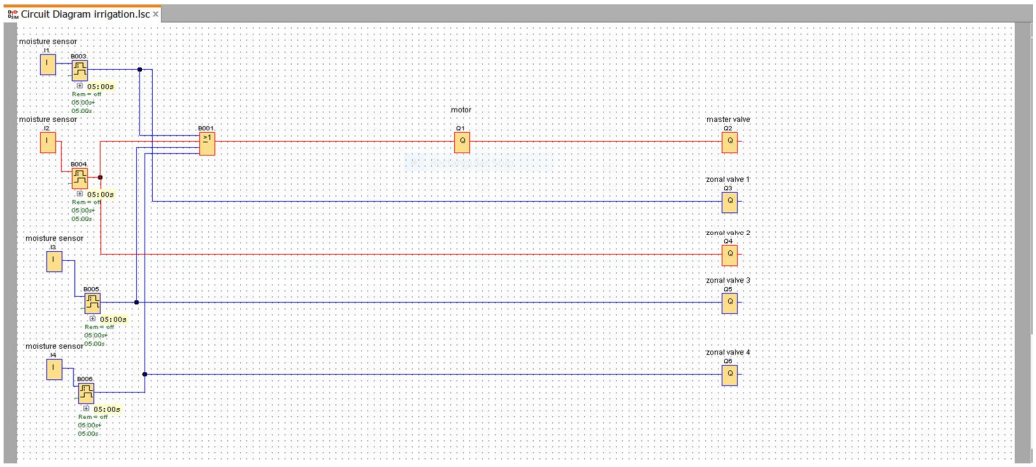
A. Circuit Diagram



1) when moisture sensor 1 is initiated , master valve and zonal valve 1 gets open

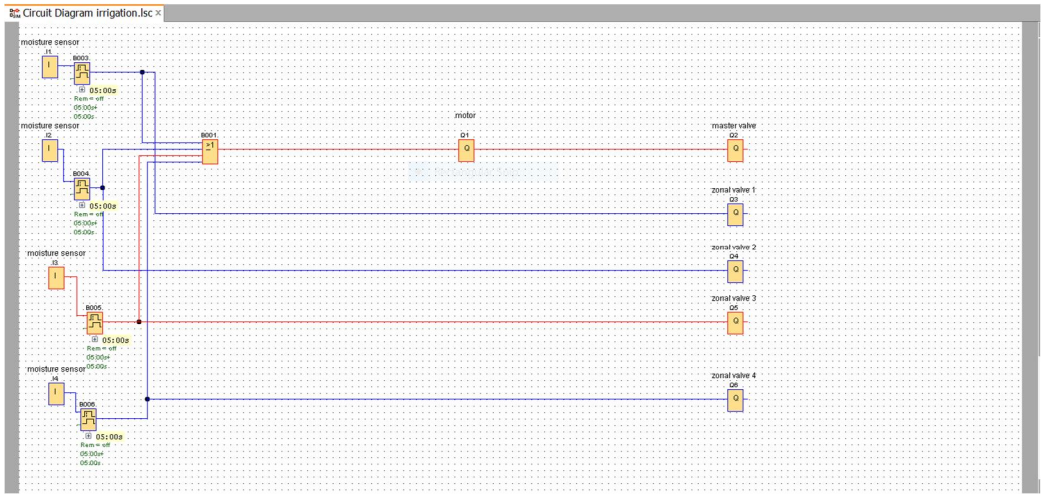


2) When moisture sensor 2 is initiated , master valve and zonal valve 2 gets open

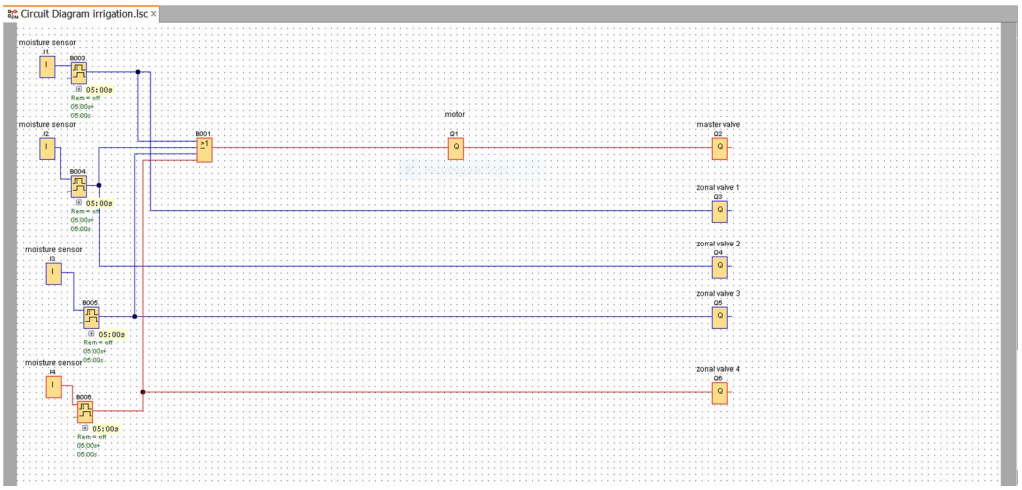


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3) When moisture sensor 3 is initiated ,master valve and zonal valve 3 gets open



4) When moisture sensor 4 is initiated ,master valve and zonal valve 4 gets open



5) When all moisture sensors are initiated all zonal and master valves gets open



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V. CONCLUSIONS

By implementing new technologies in the agriculture could improve irrigation efficiency, promoting water conservation and reducing the environmental impacts. This system will help farmers to save their valuable time and effort. As the demand for water increases, along with the need to protect aquatic habitats, water conservation practices for irrigation need to be effective and affordable. Precision irrigation will optimize irrigation by minimizing the waste of water, and energy, while maximizing crop yields. The most effective method for determining the water demands of crops is the based on the real time monitoring of soil moisture, and direct water application used in conjunction with the information about soil hydrological properties and Use of soil moisture sensor helps to reduce the water wastage and thus prevent from excessive irrigation of land. PLC provides us several advantages such as pre stimulation in pc before implementation, troubleshooting is quite easy, can work in all environment, I/O can be changed or increased according to our requirements, programming and reprogramming By implementing new technologies in the agriculture could improve irrigation efficiency, promoting water conservation and reducing the environmental impacts. This system will help farmers to save their valuable time and effort. As the demand for water increases, along with the need to protect aquatic habitats, water conservation practices for irrigation need to be effective and affordable. Precision irrigation will optimize irrigation by minimizing the waste of water, and energy, while maximizing crop yields. The most effective method for determining the water demands of crops is the based on the real time monitoring of soil moisture, and direct water application used in conjunction with the information about soil hydrological properties and Use of soil moisture sensor helps to reduce the water wastage and thus prevent from excessive irrigation of land. PLC provides us several advantages such as pre stimulation in pc before implementation, troubleshooting is quite easy, can work in all environment, I/O can be changed or increased according to our requirements, programming and reprogramming

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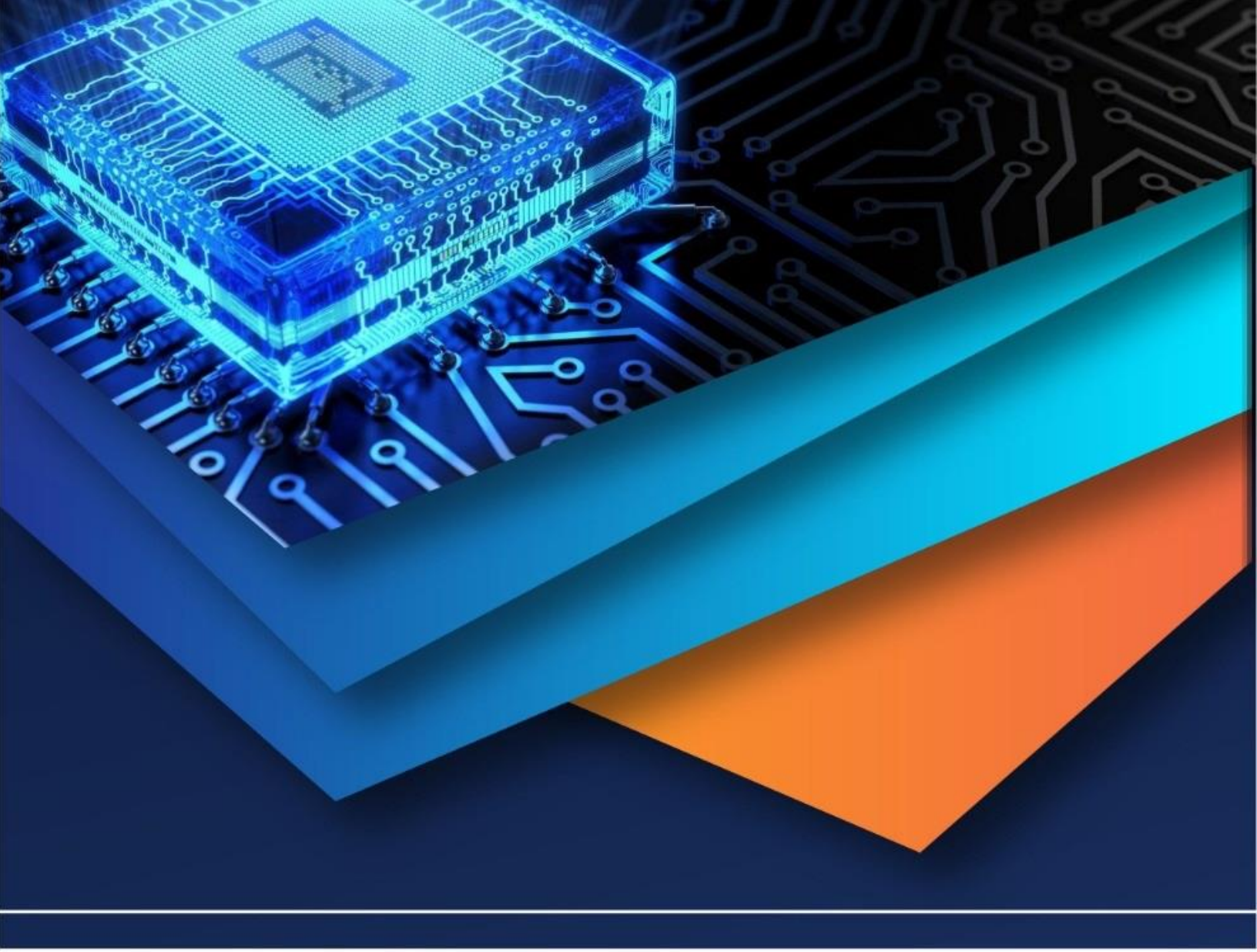
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