© 2016 IJSRSET | Volume 2 | Issue 4 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Intelligent Irrigation System using PLC

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ABSTRACT

In the present work, attempt has been made to automate the irrigation system without the human interface by using the programmable logic controller. The purpose of this paper is to utilize the available water and electricity in an effective way with increase in the productivity. This paper is to develop a self-governing irrigation system with the use of soil moisture sensor to schedule the irrigation.

Keywords: Irrigation, Automation, PLC, Sensors

I. INTRODUCTION

Agriculture is the back bone of India where 70% people are dependent on it. But in the current generation specifically in the field of agricultural sector most of the countries do not have skilled labour. So that it affect the growth of developing countries like India. So there is a need to automate the agriculture sector to overcome this problem. In 21st century industrial automation growing very rapidly, but it is not developed as much in the field of agriculture. The availability of water is also reduced and it is difficult to find labours at low wages for irrigation. Automation in the field of agriculture is very much necessary because the world population is increasing steadily and there will be demand for providing abundant high quality, nutritious and hygienic food with the minimal use of water. Our goal is to develop an autonomous portable system which automatically controls the entire irrigation system of the field without the human interference. This is achieved with the use of programmable logic controller, soil moisture sensor, water pump, solenoid valve and power supply.

II. METHODS AND MATERIAL

In this section we discuss about the different types of components used for controlling the amount of water used for irrigation.

A. System Description

The block diagram of the autonomous irrigation system using PLC is shown in below figure 1

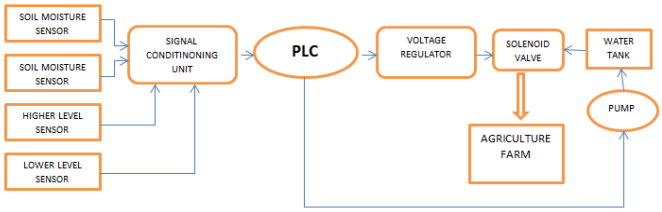


Figure 1: Block diagram of PLC based irrigation system.

B. Sensor

Here we use two types of sensor, Soil moisture sensor and Level sensor.

1) *Soil moisture Sensor:* It indirectly measures the volumetric water content in the soil by other properties of the soil such as electric resistance. Soil moisture content is determined by measuring how strongly the soil resists the flow of electricity between two electrodes. The soil moisture sensor is shown in figure 2(a)

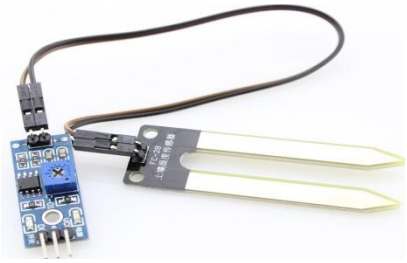


Figure 2(a): soil moisture sensor

2) *Level Sensor:* High level and low level sensor is used to indicate the water present in the tank. The high level sensor turns ON when the water in the tank touches the high level sensor. Likewise the low level sensor turns ON when the water in the tank goes below the low level sensor. (ie) when the sensor is not in contact with the water. The level sensor is shown in figure 2(b)

Figure 2(b): Level Sensor

C. *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 as shown in figure 3.

Figure 3: Water Pump

D. *PLC Controller*

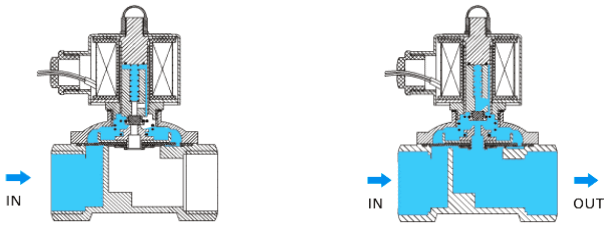
In this research work i have used DVP-SS2 series controller shown in figure 4, having following specifications shown below.
Specifications:

- I/O ports : 14 (8inputs + 6outputs)
- Max I/O ports : 494 (14 + 480)
- Program capacity : 8k steps
- Communication port : Built in RS-232
- Operating voltage : 24V
- Programming Software : Delta WPLSoft 2.41

Figure 4: DVP-SS2 Controller

E. *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. Shown in figure 5(a)&(b).



a) Normally Closed b) Normally Open

Figure 5: Solenoid Valve

III. RESULTS AND DISCUSSION

In this research work I have used DVP-SS2 controller. 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 to maintain the water level in the tank for irrigation purpose. As a result of this programming i received the following type of conditions of the valves and pump as shown in below figures 6(a),(b),(c),(d),(e),(f)&(g). And the input, output coil descriptions are shown in table 1.

TABLE 1
I/O COILS DESCRIPTION

Coil Number	Device Name	Device Type
X0	Start Pushbutton	Input
X1	Stop Pushbutton	Input
S1	Zonal Soil moisture sensor 1	Input
S2	Zonal Soil moisture sensor 2	Input
S3	Low level sensor	Input
S4	High level sensor	Input
Y0	Master valve	Output

Y1	Zonal valve 1	Output
Y2	Zonal valve 2	Output
Y3	Water Pump	Output

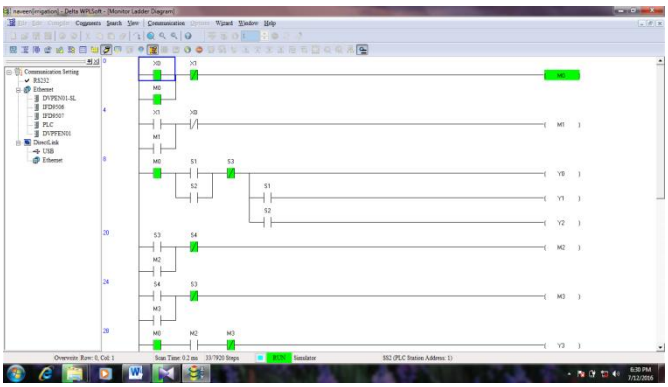


Figure 6(a): start button is initiated to start the process

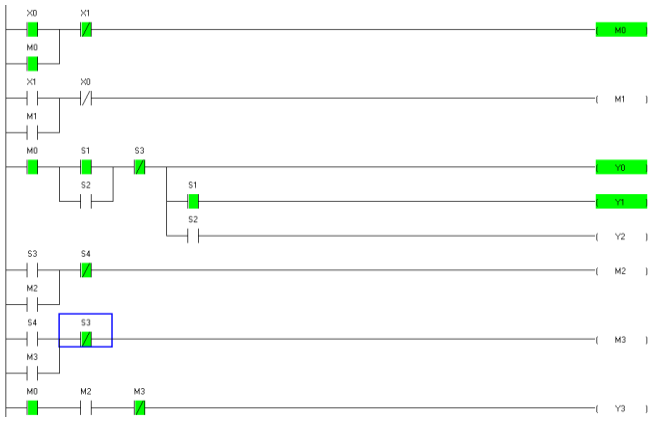


Figure 6(b): Master valve and zonal valve1 Turns ON

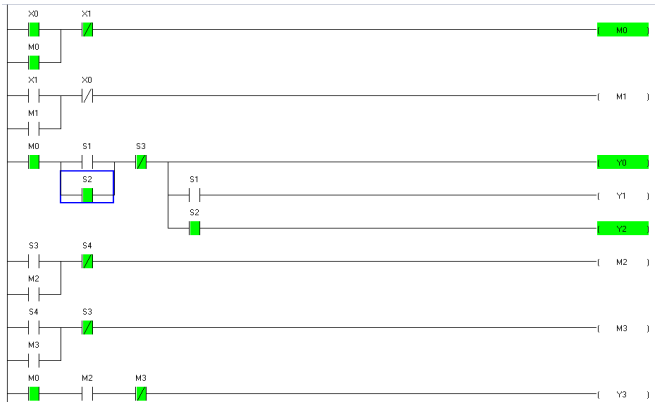


Figure 6(c): Master valve and zonal valve 2 Turns ON

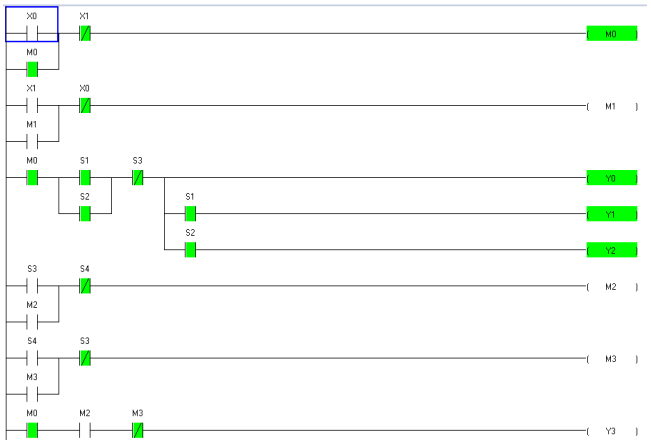


Figure 6(d): Both zonal valves and master valve Turns ON

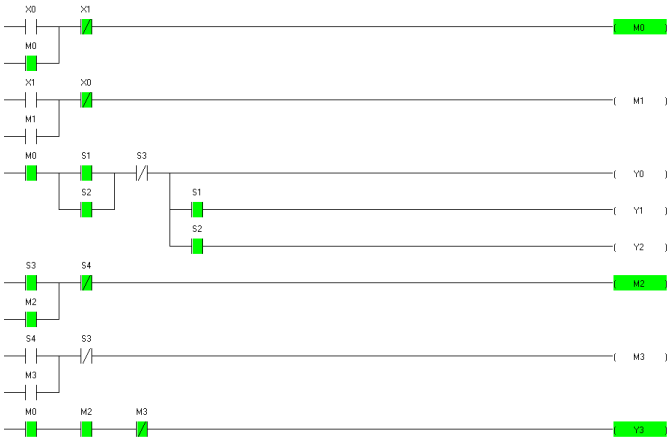


Figure 6(e): Low level sensor is ON which turns ON the Water Pump.

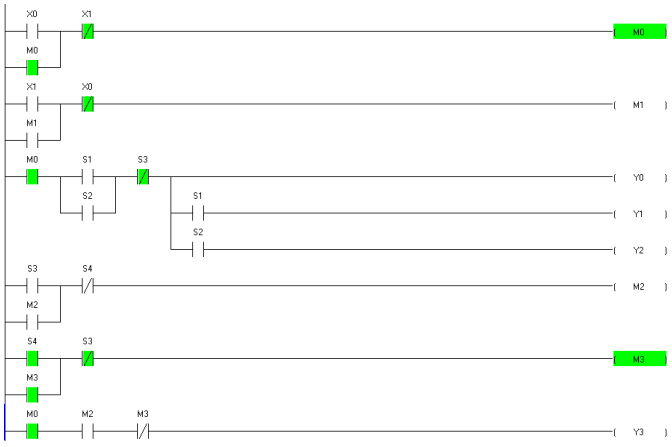


Figure 6(f): High level sensor is ON which turns OFF the Water Pump.

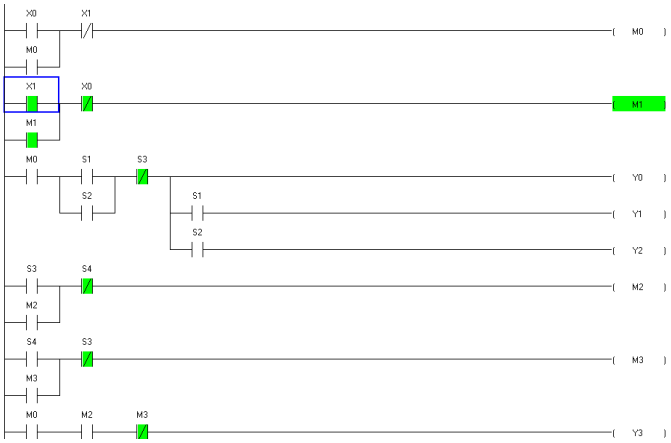


Figure 6(g): Stop button is initiated to stop the entire process.

Figure 6: Valve and Pump control conditions

IV. CONCLUSION

By implementing new technologies in the agriculture could improve irrigation efficiency, promoting water conservation and reducing the environmental impacts. The closed loop automatic control system helps farmers to save his valuable time and effort. 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 can be done several times, one time investment.

V. REFERENCES

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