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Project Review on Water Level Sensing Using PLC

Osama Mahfooz[*], Mujtaba Memon[**] and Asim Iftikhar[***]

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ABSTRACT

A PLC is a digital computer used to automate electromechanical processes. This research is based on automation of a water tank by using Siemens PLC. Automatic control of water tanks can work continuously and can provide accurate quantity of water in less time. In such process there is no need of labor so there is no human error. Without human error, the quality of product is better and the cost of production would definitely decrease with no error in quantity required. Water level sensing can be implemented in industrial plants, commercial use and even at home

Key terms: Programmable Logic Controller, concrete plant, automatic control, I/O: Input Output Devices, Proximity sensor, water tank

1. INTRODUCTION

A PLC or programmable logic controller is a digital computer used for automation of electromechanical processes. It is used to convert the previously used "Relay Logic" or "Wired Logic" for automation of an industrial process into Ladder Logic as done in PLC-Based Monitoring Control System for Three-Phase Induction Motors in (Birbir.Y, Nogay, 2008) and Automation Control in Painting Line of Steel Plant in (Hao.L, Ruilin.P, 2005). It is used to

[*] Engr. Osama Mahfooz is Assistant Lecturer, Department of Electrical Engineering at Institute of Business Management, Karachi, Pakistan. Email: osama_mahfooz14@hotmail.com
[**] Engr. Mujtaba Memon is Lecturer, Department of Electrical Engineering at Institute of Business Management, Karachi, Pakistan. Email: osama_mahfooz14@hotmail.com
[***] Mr. Asim Iftikhar is Lecturer, Department of Computer Science at Institute of Business Management, Karachi, Pakistan.

automate respective processes but in this research Siemens LOGO is used which lie in the cheapest category or entry level of PLC. The reason of it being cheap is that it has limited number of input and output ports (I/O's).

In this research automation of water tank is achieved by using inductive proximity sensors (type PNP) in order to set a low level and high level inside the tank.

1.1 Proximity Sensors

Inductive proximity switches are used to detect metallic objects without physical contact with the object. Their high-speed switching and compact size make them indispensable in automation applications. Inductive proximity switches consist of a coil driven by an oscillator. The oscillator develops an electromagnetic field which appears at the active face of the switch. When a metal target enters this region, the electromagnetic field is reduced and the switch turns on or off. They may even be used to count metallic objects, monitor the position of elements in a machine, sensing the presence of metallic parts like screws and measure the rotational speed of axial detecting cams

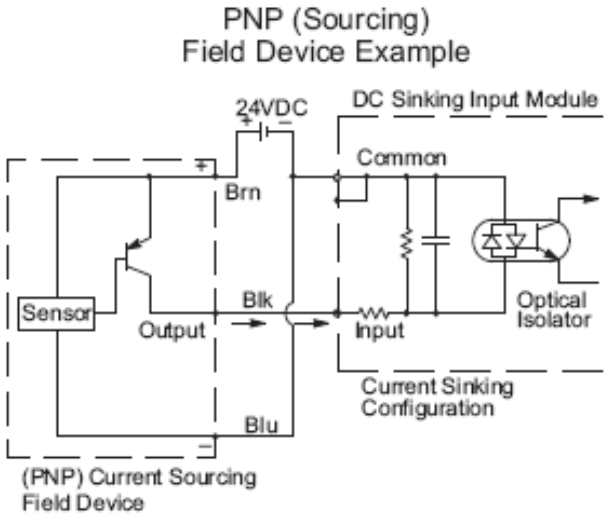


Fig 1: Proximity sensor internal diagram

2. WORKING

As to fulfill the need of two water tanks we used two plastic buckets. One bucket is used for the purpose of a water tank from where water is to be fetched and the other one is used to fill water until a specific quantity.

Assignment list	Symbolic list	Comments
I0.0	I1	Low Level Switch
I0.1	I2	Upper level switch
Q1.0	Q1	Water pump
Q1.1	Q2	Solenoid valve

Fig 2: Input/output Devices

The first tank comprises of an aquarium motor as output Q1 to fetch water for the second tank. The second tank comprises of two levers attached inside that serve as lower level and upper level for water. A nail is fixed inside each lever's joint so as to move to and fro near the wall of the tank when the levers move up or down when water level rises or decay. Two NPN-proximity sensors (input I1 and I2) are used behind these levers and are attached on the outer side of the tank's wall in order to detect the movement of nail inside the levers. When the water is at low level both the sensor will give signal 1 as the nail is close to the wall and in this case pump Q1 will start working and fill water in tank 2. The pump will continue to work until the upper level sensor is turned off when water reaches the upper level. Both the sensors will now give signal 0. At this stage the pump will switch off and a solenoid valve that is output Q2 will open to pour the water out. The flow of water will start from outside the tank. The cycle will repeat then according to the program burned in PLC.

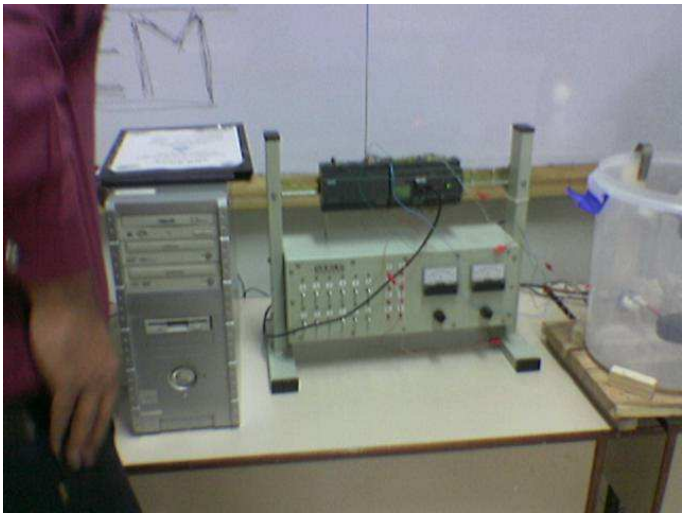


Fig 3: The PLC

Fig 4: Water level control

In-order to understand the process step by step the complete working is explained in detail in terms of a process flow diagram given below

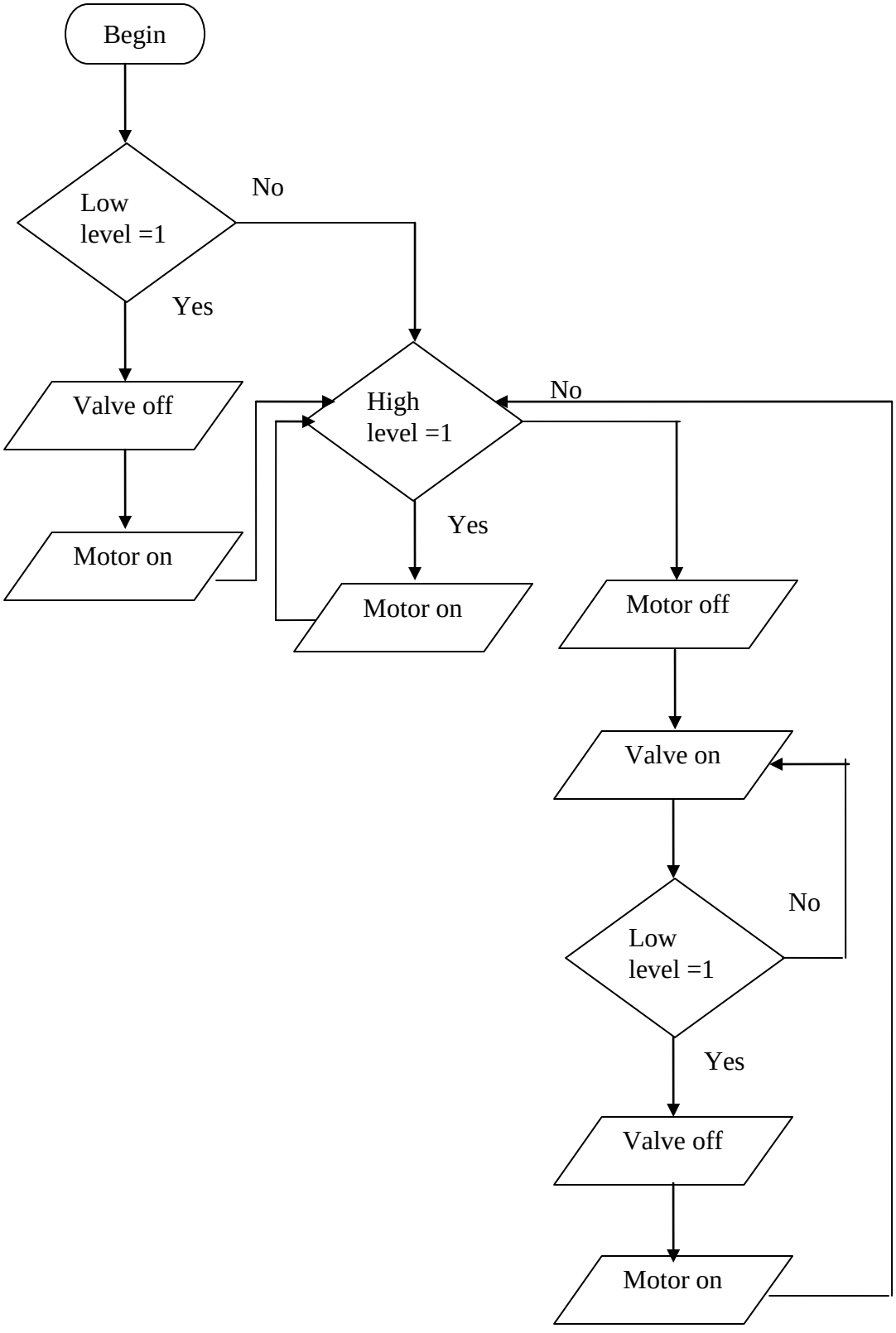
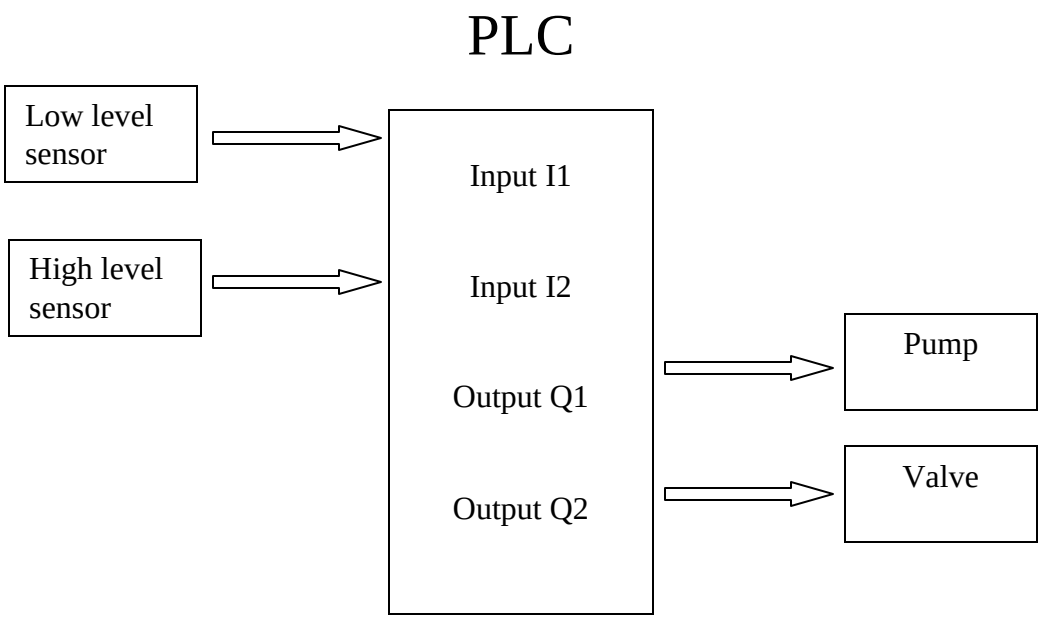


Fig 5: Flow Chart

3. BLOCK DIAGRAM



The low level and high level proximity sensors serve as DC input to the PLC at inputs I1 and I2 and output that is the motor to fetch water and solenoid valve to drain the water are connected at output terminals Q1 and Q2 respectively

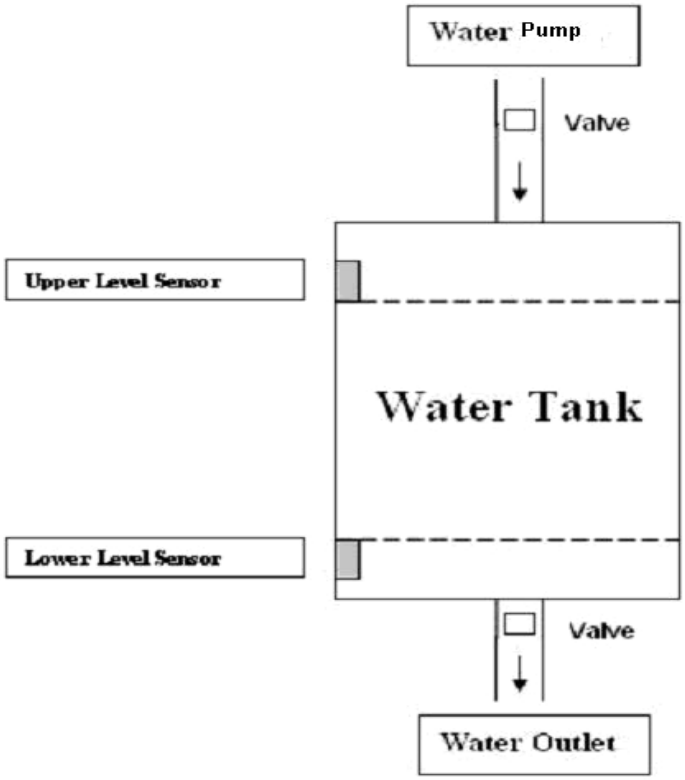
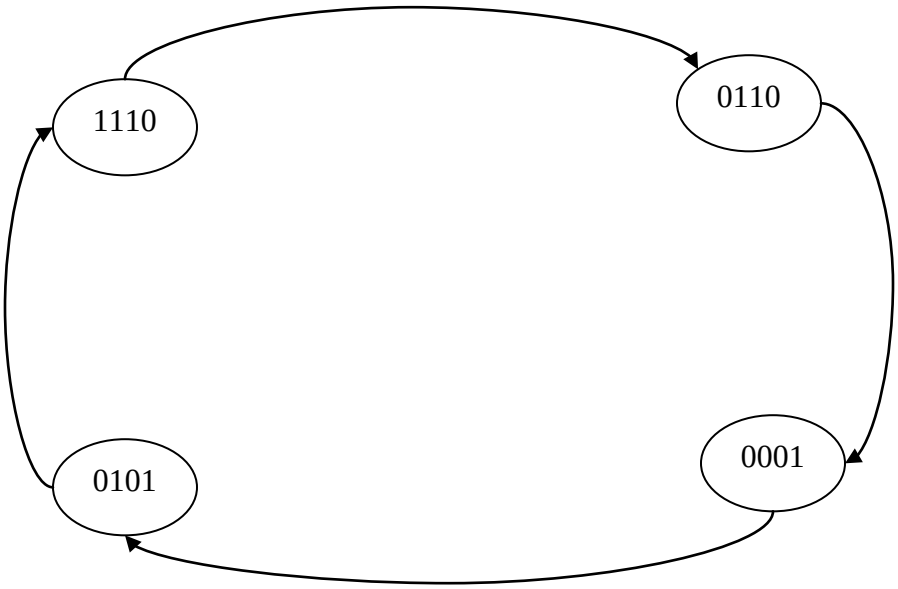


Fig 6: Cross-sectional view of tank

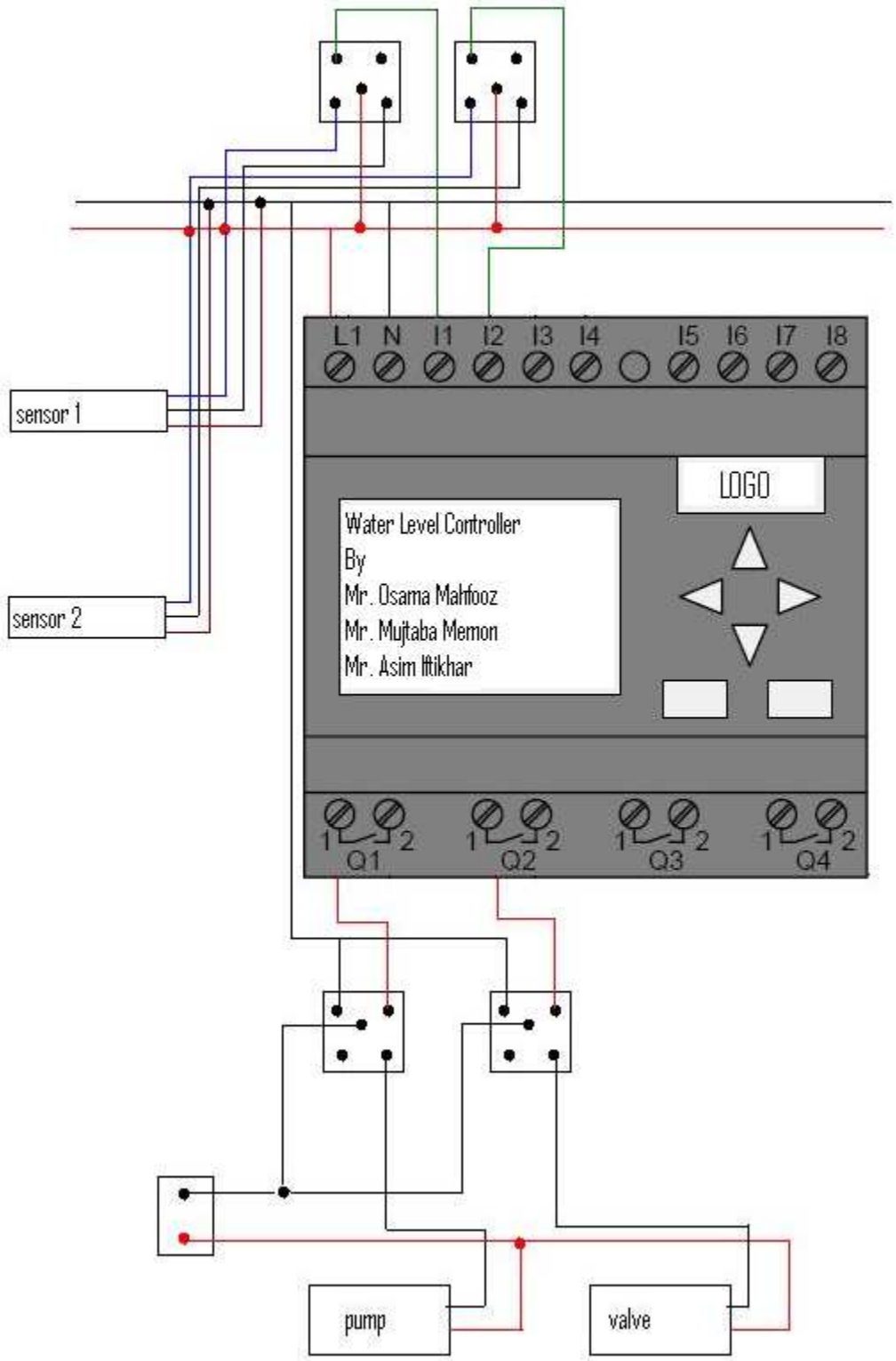
4. STATE DIAGRAM



5. TRUTH TABLE

I1	I2	Q1	Q2
1	1	1	0
0	1	1	0
0	0	0	1
0	1	0	1

6. WIRING DIAGRAM



For all inputs and outputs as shown in above figurer 24V relays are used as safety precaution in order to avoid any short circuit at the input or output of PLC. If any short circuit occurs the relay would open the path connecting to PLC.

7. LADDER DIAGRAM

The ladder diagram shows that Q1 (pump) will only start when either of the inputs I1 (lower sensor) or I2 (upper sensor) is in on. As soon as they both turn off Q2 (valve) will turn on and pour out the water.

8. CONCLUSION

This prototype is specifically designed for the transfer of accurate amount of water desired in any process or system that involves the measurement of a certain amount of water. The adaptability in industry of our research is due to its automatic process. It is more probable that our research is accepted due to ease of usability and very low cost.

In today's world industries can only grow by making themselves advance in technology and by upgrading their machineries and plants. We have proposed an idea of making an automatic water level plant which is normally manual in Pakistani industry.

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