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Canal Automation and Ship Transportation Using PLC

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Abstract: Canal is an artificial waterway. Canals are been constructed to allow the passage of boats or ship inland or to convey water for irrigation. Canals and navigations are human-made channels for water. It is a human made water transportation system, which is best alternative for road transportation. These can be subdivided into two kinds: Waterways: canals used for carrying transporting goods and people. These can be subdivided into two kinds: i.e. 1. These are connecting to existing lakes, rivers, other canals & seas & oceans, 2. These are also connected in a city network. Absolute: water supply canals that are used for the conveyance and delivery of potable water for human consumption, municipal uses, hydro power canals and irrigation for agriculture. The paper named as CANAL AUTOMATION and SHIP TRANSPORTATIOPN USING PLC. Canals are mainly used for two major purposes, i.e. irrigation and transportation. This project is prototype of canal transportation. As we know water transportation is good alternative for costly road and air transportation. It is always not feasible to implement this transportation because level of water at every place is not same. To face such uneven geographical conditions of water level, and overcome them canal can be constructed. And to maintain transportation through such canal manually is difficult task to handle so this project provides an optimize solution to all crisis mentioned above.

Keywords: Infrared Sensor, Level sensor, Limit switch, Solenoid Valve.

I. INTRODUCTION

Canal is waterline which is mainly used for two main purposes, irrigation and transportation. Under irrigation aspect of canal water is distributed and supplied to all farmers according to their requirement and water available in canal. For appropriate supply of water, canal automation is being used. Critical water level and flow monitoring via automated gates ensures precise amount of water to be delivered to avoid draught conditions.

Another aspect is that, canals are used for transportation of ships carrying goods as well as people. But it is not always easy to use this canal transportation due to uneven geographic condition of earth. There may be difference between two water levels at two distinct points. Under such condition canal is broken down into small parts and separated by moving gates. And then level in these stages is controlled in such way to bring it equal accordingly. Whole these tasks are difficult to operate manually. So applying an automatic solution for this problem of canal is optimized solution over this problem.

II. HARDWARE IMPLEMENTATION

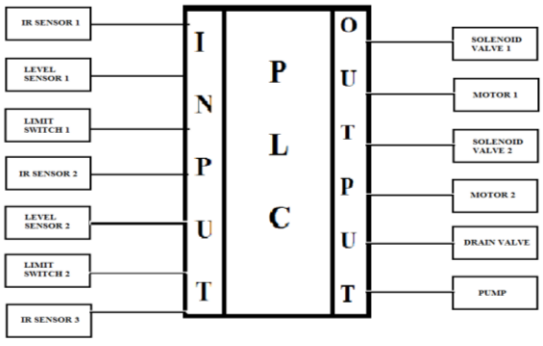

Fig. 1 Basic Block Diagram

Description:

As shown in block diagram IR sensors, limit switch, and level switch are inputs of process. IR sensor is being used to detect the position of ship in canal. Float type Level switch has been used to detect the water level of canal, while limit switches mounted on gate of canal to ensure gate is closed or not. Motor, solenoid valve and pump are output devices to controller. Motor is for backward and forward moment of gate and solenoid valve is control element used for level control loop. Role of pump in process is to reset the initiate water level of all stages of canal after completing one cycle. Whole this process in being controlled by Programmable Logic Controller.

III.BASIC WORKING

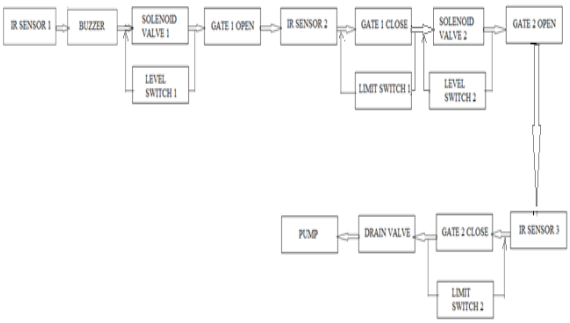

Fig. 2 Basic Working Diagram

The project "Canal Automation" aims in automatic transportation of ships through canal by adjusting water level in it. There are two level control loops in all which are controlled with help of Programmable Logic Controller (PLC). The actual transportation process through canal is presented in this proto-type including

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some automation in it. The diagram shown above represents flow of project from start to end.

Basically there are two phases in whole prototype namely,

A. Level control phase of consecutive stages
B. Parameter initialization phase
C. Text Font of Entire Document

HARDWARE DESIGN

1. PLC

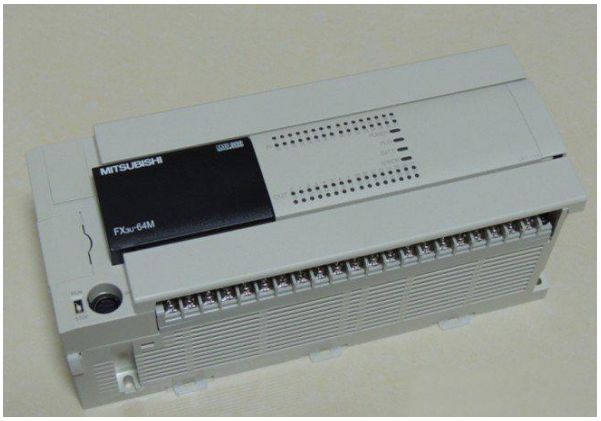

Fig. 3 Mitsubishi PLC

The hardware design starts with selection of PLC. A PLC system consists of following major components:

- Rack
- Power Supply Module
- CPU
- Input/ Output Modules
- Programming Device

The PLC is a sequential device, i.e. it performs one task after another sequentially. A PLC performs three major tasks in following order :

1. Read Inputs – PLC checks the status of input to see if they are on or off and updates it's memory with their current value.
2. Program Execution – PLC executes program instructions one by one sequentially and stores the results of program execution in memory for later use.
3. Write Outputs – PLC updates status of its outputs based on results of program execution stored in task 2.

Keeping these aspects in mind, the selection of PLC is done. For this project we selected Mitsubishi PLC which is being sponsored to us by Mitsubishi Electric Private limited, Pune.

INPUT DEVICES

1. Infrared Sensor

Fig. 4 Infrared Sensor

Specifications:-

1. Sensing range :- 2 to 15cm
2. Voltage:- 5 to 5.5v
3. Current :- 40ma
4. Temp :- 40 degree
5. Emitted beam :-LED

2. Switching Circuit 5V-12V:

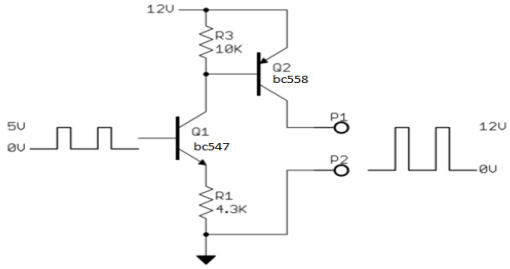

Fig. 5 Switching Circuit

Basically IR sensor output is near 5v, but PLC requires approximately 12v input so this arrangement is made to boosting 5v to 12v by simple transistor switching circuit. In this circuit, Q2 is the high side switch that turns the 12V output on or off. Q1 switches the high side switch; It isolates the 12V voltage on the base of Q2.

When the base of Q1 is kept at 5V, the emitter will be at 4.3V, so there will be 1mA through R1. Most of this also flows through the collector of Q1, which thereby acts as a switchable 1 mA current sink. Most of this can only come from the base of Q2. Figuring the two transistors each have a gain of minimum 50, then the output is good for at least 45mA for Q2 to stay in saturation. The purpose of Resistance 3 is only to make sure Q2 is really off when Q1 is off.

3. Limit Switch:

Fig. 6 Limit Switch

Limit Switch are basic switches. Limit switches have been fixed to protect against external forces, water, oil & dirt.

A limit switch is a switch operated when there is the motion of object or presence of an object. They are used for controlling machinery in a control system as a safety interlocks. They are also used to count objects passing a point. A limit switch is an electromechanical device that consists of an actuator linked to a set of contacts. When an object comes into contact with the actuator, it operates the contacts to make and break an electrical connection.

Limit switches are used in a variety of applications and environments because they are rugged. There installation is easy & operation is reliable. They can detect the

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presence and absence of the object, as well as passing, positioning, and end of travel of an object.

OUTPUT DEVICES

1. Submersible Devices:

Fig. 7 Submersible Device

Specification:

- Model: AT-380
- Head: 160cm
- i/p Voltage: 220-240v
- Frequency: 50/60Hz
- HP: 0.5Hp
- Power: 15W
- o/p: 900 LPH
- Centrifugal type

2. Solenoid Valve:

Fig. 8 Solenoid Valve

Specifications:

- Type: 4T01
- Max. pressure: 0.02-1.0M Pa
- Nominal DN : ½ Inch
- Action Method: Normally closed direct action
- Working media: water, steam air
- Fluid Temp.: 140 degree max
- Manufacturer : component I
- Operating voltage: 24 Volts D.C.

3. Wiper Motor:

Fig. 9 Wiper Motor

Specifications :

1. Operating voltage: 12 -27 Volts D.C.
2. Breaking torque: 26 N.m
3. Working torque : 5 N.m
4. No load speed : 62 RPM
5. Working speed : 50RPM

Software Design: Ladder Diagram in PLC

CONCLUSION

In this paper, we have presented the research, done to Automation of canal and Ship Transportation by using PLC. This system proposed to minimize power consumption and costing issue. It is fast, reliable and more secure.

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