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PLC based Dam Automation System

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Abstract: : **This paper based on controlling the process variable parameters such as level and limit with real time implementation of gate controlling of DC motor using Programmable Logic Controller. In our proposed system, a programmable logic controller is used as an industrial computer playing the major role of a control devices and micro switch provide incoming signals to the control unit. The system model is provided with two levels in the one level in upper and one level in the lower outputs the ladder logic is actuated. This work uses PLC of ALLEN BRADLEY MICROLOGIX 1400 inbuilt with 20 digital inputs and provides 12 potential free outputs to control the miniaturized process depicted in the work.**

Keyword **—Ladder logic, PLC, SCADA, Level switch, Limit switch, Dam Automation System**

INTRODUCTION

In Our India there are approximately 3200 dam are present. In Gujarat, 202 dams are there out of them 95 dams have gates. Approximately, these dams cover 1,70,000 sq.km catchment area for collecting water. There is also 2067.68 km long and complex canal network through which about 10 lakes hectares land gets water for irrigation and drinking purpose. The farmers are dependent on seasonal rain and after that bore-well water for their crops. Recently, all the farmers use in flood irrigation system for planting their crops which needs more water. As we know, water is gradually becoming one of the most precious natural resources.

As the solution of above problem we are making this project to develop a PLC based system which detects the water level in dam and thereby control the movement of gates automatically. Only 1 dam has partial automated dam controlling system (Ukai dam on Tapi River at surat). In all over India 1 and only 1 canal has fully automated gates. (Indira Gandhi canal on Haraiki Beraj reservoir). [1]
Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention. Some processes have been

completely automated. The biggest benefit of automation is that it is saves labor however; it is also used to save energy and materials and to improve quality, accuracy and precision

I. SYSTEM DEVELOPMENT

In this system we developed the overall method in many ways. First one is that the targeted devices can be controlled by PLC (Programmable Logic Controller).

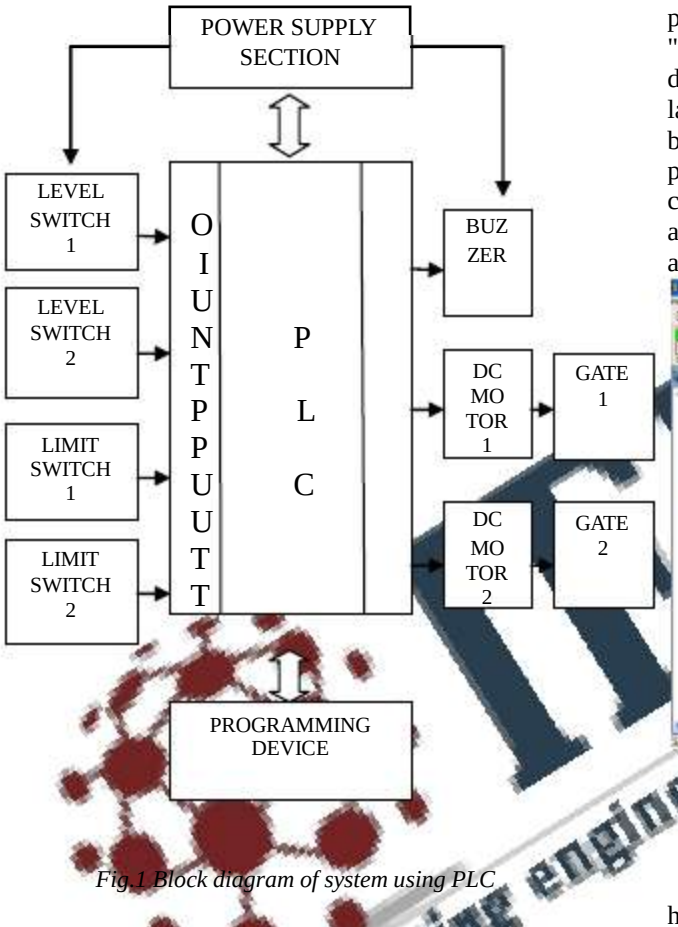

Fig.1 Block diagram of system using PLC

II. IMPLEMENTATION OF PROPOSED SYSTEM

In this section the prototype that we have developed to implement the proposed system has been explained. There are various components we used to implement this system. The whole system is divided into various sections and each are explained separately.

A. Programmable Logic Controller(PLC)

This is heart of our proposed system which controls the entire operation of system. This compact Micrologix 1400 PLC, economical programmable controllers offer several I/O configurations. In this PLC , there are 20 input and 12 output are available .this programmable logic control device of inputs are connected in 5 micro switch and this 5 micro switch are connected toward the SMPS(switch mode power supply) SMPS is connected in our system because this PLC are required in 24volt dc. The micrologix 1400 PLC of output is connected the DC motor. This motor are connected toward relay driver because motor rotation in two direction. The two relay are work as forward direction and two relay are work as reverse direction This all system are perform by ladder logic These PLCs were programmed in "ladder logic", which strongly resembles a schematic diagram of relay logic. **Ladder logic** is a programming languages, that represents a program by a graphical diagram based on the circuit diagrams of relay logic hardware. It is primarily used to develop software for programmable logic controllers (PLCs) [2] used in industrial control applications. In our system, screenshot of programming are as follows

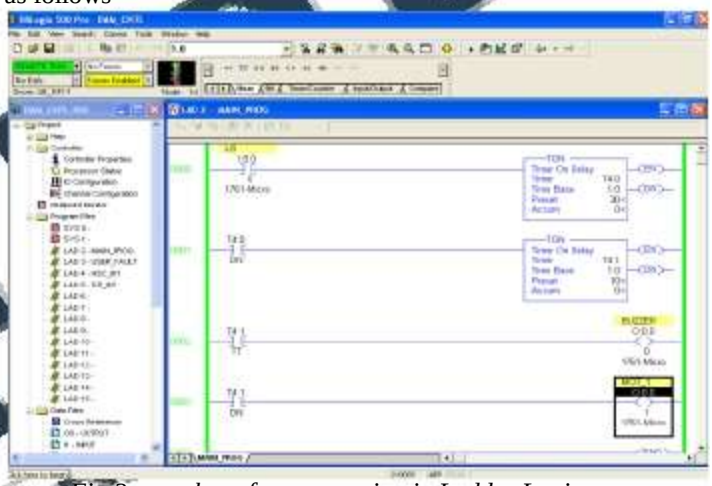

Fig.2 snapshot of programming in Ladder Logic

B. Sensing element

Sensing element in our proposed system is the hollow ball float which attached to the level switch. Whenever the water level increases the ball will keep floating with above the water level. Whenever the desired level achieved then level switch will trigger the input of PLC which controls the action of gate as opening and closing.

C. Gate Control

In gate control assembly there are two doors are used in our proposed system. One gate is used for prior level of water in dam which depends on water level detected by level switch 1. And another gate is used for extreme high level of water in dam which depends on level switch 2. The closing and opening of gate is achieved by the dc motor, the motor shaft is connected with the geared belt which placed on gate assembly. The opening of gate also control by timer with required time application. When the gate is fully opened during this stop action of gate will controlled by limit switch. As gate touches the limit switch the trigger plus is applied to the PLC which stops the motor.

D. LED and Buzzer

The LED and buzzer are used for alert the people about flood. When the water level increases above the

extreme high level at the same time buzzing sound will be produced by the buzzer.

E. SCADA

SCADA stands for supervisory control and data acquisition. The software used in SCADA [3] is wonderware Intouch 9.5. It is used for collecting the data from switches and devices located at remote site and display on computer at control site for monitoring and controlling. In our project we are using SCADA for graphical representation of motor control operation during opening and closing of gates. This entire process will be recorded in data login table at control room. Data login table basically consist of time, date, status of variable processes and devices.

Fig.3 (a) snapshot of process monitoring in SCADA

Fig.3 (b) snapshot of process monitoring in SCADA

III. DESCRIPTION OF MODULE

A. MicroLogix 1400 Programmable Controllers

A programmable logic controller (PLC) or programmable controller is a digital computer or industrial computer used for automation of electromechanical processes of such devices, this control of machinery on factory assembly lines, amusement rides. PLCs are used in many industries, sites and machines. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory.

In this module, Ethernet port provides web server capability and protocol support for DNP3 protocol support. Built-in LCD with backlight lets you view controller and I/O status and built-in LCD provides simple interface for messages. Bit/integer monitoring and manipulation. Expands application capabilities through support for as many as seven 1762 micrologix Expansion I/O modules with 256 discrete I/O as many as six embedded 100 kHz high-speed counters. In this PLC there are two serial ports with DF1, DH-485, Modbus RTU, DNP3 and ASCII protocol support 10 KB words in user program memory with 10KB words in user data memory up to 128KB for data logging and 64KB for recipe.

B. Switch Mode Power Supply (SMPS)

When our system is used in SMPS, it works as rectifier circuit in Switch Mode Power Supply. When this SMPS is converted in ac supply 230 Volt to 12V dc 2 Ampere. This 12V dc supply is provided to level switch and limit switch. There are two levels and two limit switches that work according to operation.

C. Relay Driver

When dam gates perform forward as well as reverse operations then relay driver are being used. When this relay is single pole single through type. This DC motor is performing forward operation. The relay has three terminals one is power, second is normal open, and third is normal closed. The relay of power terminal connected to the 12Volt dc and one terminal which is normally open are connected to DC motor .During opening of gates motor operates in forward direction while during closing of gates motor operates in reverse direction.

IV. FLOWCHART

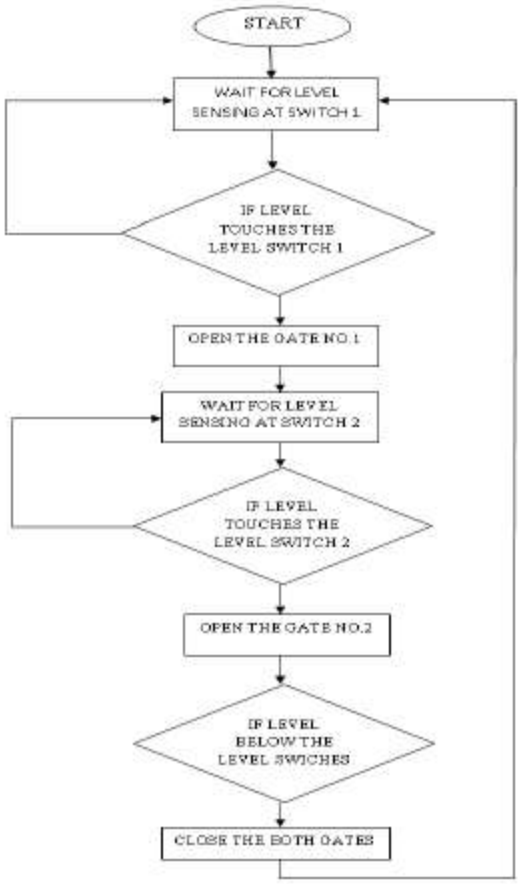

Fig.4 flow chart of proposed control process

FUTURE SCOPE

1. To enhance the sophistication of this process we can make use of level transmitter and standalone PID controller. This system is opening and closing with in particular stages of gates.
2. The level transmitter can be used of RFID devices for wireless communication along with the PLC. In this system we are use also GPS .Global position system are indicating for particular person will receiving message and alert through mobile
3. Authentication process of SO (section officer) are developed to the perform of flood and sprinkler irrigation.

CONCLUSION

In this paper, it represents an automatic controlling of a DC motor using PLC and SCADA. This System model of a Dam automation system which is the completely automated can control the level of the dam gates using backup of the water. Thus using PLC and SCADA the level of water in the dam is controlled effectively there by opening and closing the gates of the dam whenever the level increases. Therefore the use of Programmable logic control has opened doors for a level of automation Dam system and SCADA also monitoring the entire plant and stored the entire information about opening and closing of the gate .

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