"PLC AND SCADA BASED DAM SHUTTER OPERATION FOR FLOW AND LEVEL CONTROL"

[1] Bhavya Pandya,[2]Ram Mistry,[3]Mehul Tamboli.

1:M.Tech student, Dept. of Power system, Pandit Dindayal Petroleum University, gandhinagar, India
2,3: Assi. Professor at R.N.G.Patel .Institute of .Technology ,Bardoli ,India.

Abstract : In India, the water level control problem is a typical process control problem and has been extensively studied in the literature. This report focuses on the design and implementation of a PLC-based water level control system. A dam is a barrier that arrests water. Dams serve the purpose of storing water while other structures such as floodgates are to prevent water flow into specific land regions. The dam gets collapsed when the water level in the dam exceeds certain level. To avoid this, the dam level must be continuously monitored. Water is a scarce resource, it is necessary to preserve and maintain its quality. PLC_SCADA based dam automation system is trying to manage the water level in the dam catchment area and also calculate the flow of water.

***IndexTerms* – PLC and SCADA, Dam automation , calculation of water flow.**

I. INTRODUCTION

1.1 DISCRIPTION:

The water availability is very critical variable virtually for every economic activity, including agriculture, industry, power sector and public use. Moving towards new millennium, there are growing concerns and periodic warnings about an era of water scarcity. With increasing demand for food and competing use within the water sector, the pressure is on irrigation professionals to manage water efficiently. One of the measures that have been considered is the introduction of some level of automation in the dam operation.

The project gives an idea about gate controlled dam system for efficient distribution of water in the fields. The system provides flexible, accurate and reliable control of water supply through dam for irrigation purpose.

1.2 INTRODUCTION OF PROBLEM DEFINATION

Water level in dam needs to be maintained effectively which is performed manually; requiring large staff and full time supervisor. This makes it very costly and inaccurate. Because of several features of PLC namely versatility, flexibility, digital nature and self-diagnostic capabilities, expandability, easy programming, implementing changes and correcting errors and pilot running has been selected to automate the dam system in the present idea.Measure velocity of the water flowing into the dam. Measure pressure at dam walls. Indicate current water level. Properly channelize the water for irrigation and power generation. Monitor vibrations of the dam structure to ensure safety. Our solution helps in improving the ease of monitoring a dam system, thereby enabling measurement of water inflow velocity dam and pressure measurements in dam walls. During floods the dam is subjected to a heavy volume of water. In order to ensure the safety of dam from large volume of water in the upstream and to prevent flooding in the downstream, proper channelizing essential. Our solution provides a scheme in order to channelize the water in dams effectively.

NEWS NATION'S REPORT ON KERALA FLOOD on 30/08/2018 at 9:30 pm.

1.3DESCRIPTION OF WORK FOR THE PROBLEM SOLUTION

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 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. 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) 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 HaraikiBeraj reservoir). 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 introduction.

II.BRIEF THEORY RELATED TO WORK:

PLC:

PROGRAMMABLE LOGIC CONTROLLER it is an industrial computer control system that continuously monitors the stat of input devices and makes decisions based upon a custom program to control the state of output devices.

Primary languages of PLC:

Ladder diagram(LD)
Function Block Diagram(FBD)
Structured Text(ST)
Sequential Function Chat(SFC)
Instruction List(LD)

SCADA:

Supervisory control and data acquisition (SCADA) It is a system of software and hardware elements that allows industrial organizations to Control industrial processes locally or at remote locations.it monitor, gather, and process real-time data directly interact with devices such as sensors, valves, pumps, motors, and more through human-machine interface (HMI) software record events into a log file

SCADA systems at their fundamental level are Industrial Control Systems. They are computer based control systems that monitor and control industrial processes that exist in the physical world. SCADA systems can be found in manufacturing facilities, oil production and processing, pharmaceuticals, energy, water treatment and distribution, and the list goes on. They are the best control method for processes that have large amounts of data that need gathering and analysing, or are spread over large distances, or require critical control in fast paced processes.

SCADA SYSTEM SIGNALS

The very basic components of a SCADA system are these signals:

• DI – Discrete Input

• DO – Discrete Output

Discrete signals (also called Digital signals) provide an ON or OFF input to a SCADA system.

This is the same binary signal format used in computer processors.

The next basic types of signals are:

• AI – Analog Input

• AO – Analog Output

Analog signals are continuous. A change in signal value reflects change in the parameters being monitored. Examples of analog signals are temperature and pressure.

The signals generated by the instruments being monitored by a SCADA system are voltage or current based. Analog signals can be formatted as: 4-20 mA, 0-20 mA, 1-5VDC, 0-5VDC, -10VDC to 10VDC.

Values (whether discrete or analog when used in a SCADA system, they need to be seen by Operators to be of any use.

CALCULATION FOR FLOW OF WATER

Flow rate is the quantity of fluid flowing in the specified time. It is expressed in liters per meter **(lpm)** or gallons per meter **(gpm)** . It is articulated as

$$Q = Av$$

Where,
the flow area is A and

the flow velocity is v.

Flow rate can also be articulated as in a given time **(t)** the capacity of fluid stored **(C)** . It is also articulated as

$$Q = \frac{C}{t}$$

Where,

the capacity of fluid stored is C and

the time taken to flow is t

Here we use

$$Q = Av$$

Where A is the area of dam shutter which we can measure.

And V is velocity of water which can measure by velocity meter.

III. SIMULATION AND RESULTS

SOFTWARE USE FOR PROGRAMING
Name of software: ABB907 AC1131

AC31 and previous series (e.g. Sigmatronic, Procontic) are obsolete and were replaced by the AC500 PLC platform. The Advance Controller 31 series 40-50 offered small and compact PLCs with central and decentralized extensions. The Advant Controller 31 series 90 offered powerful PLCs for challenging applications with various configuration options and up to five communication interfaces. The PLC provided 60 I/Os internally and could be expanded decentrally. The combination of integrated communication fieldbus allowed to connect the PLC to several protocols like e.g. Ethernet, PROFIBUS DP, ARCNET or CAN open. Both AC31 series 40 and 50 utilized the same AC31GRAF software which conformed to the IEC61131-3 standard. AC31 series 90 utilized the 907 AC 1131 programming software, also developed in accordance with IEC61131-3.
The Advance Controller AC31-S was available for safety-related applications.

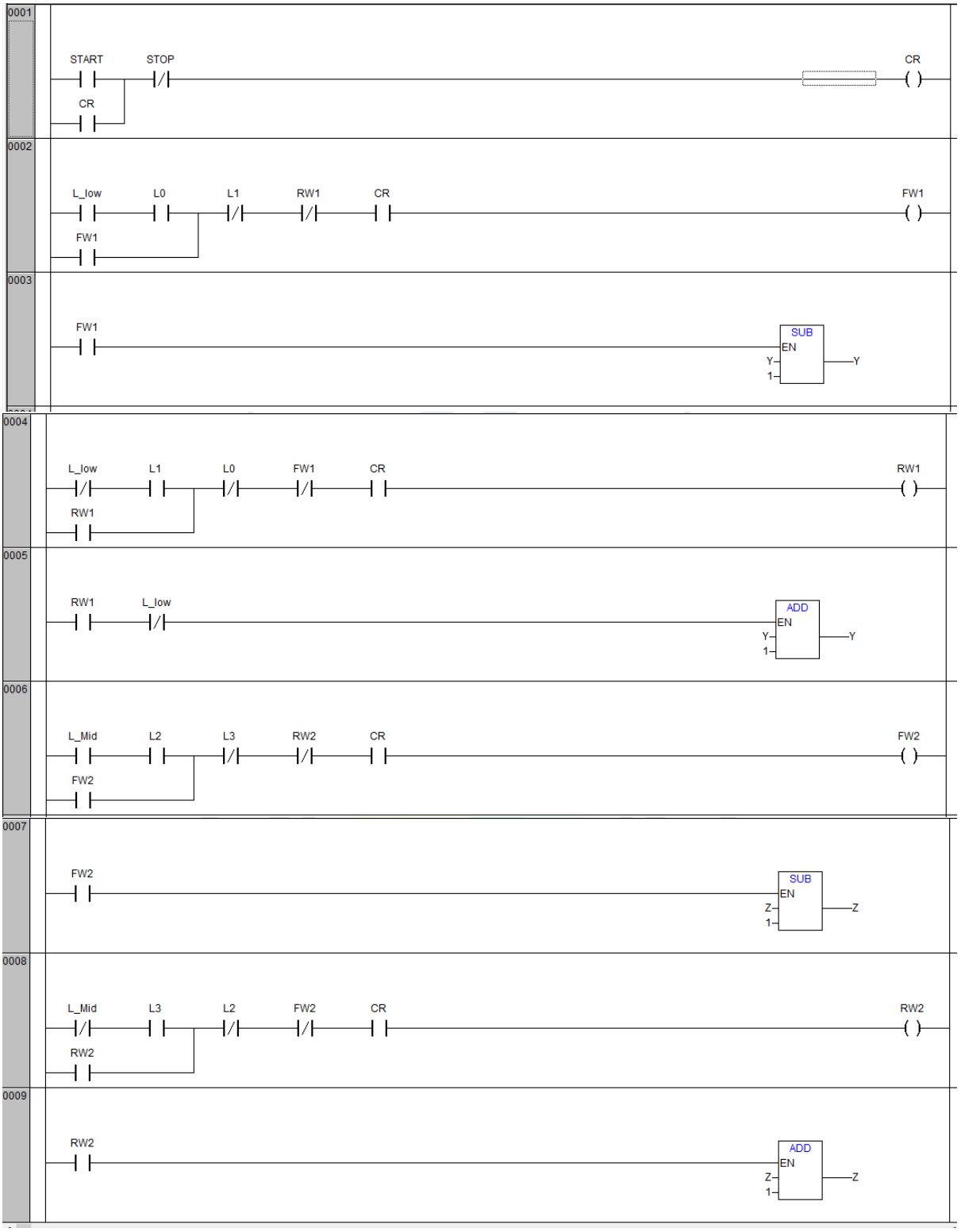
Language use for programming: Ladder Diagram

Pin addressing

INPUTS:
0 = LEVEL SENSOR 1
1= LEVEL SENSOR 2
2 = LIMIT SWITCH 1
3= LIMIT SWITCH 2
4= LIMIT SWITCH 3
5= LIMIT SWITCH 4
6 = START
7 = STOP

OUTPUTS:
0 = FORWARD RELAY 1
1 = REVERSE RELAY 1
2 = FORWARD RELAY 2
3= REVERSE RELAY 2

LADDER DIAGRAM



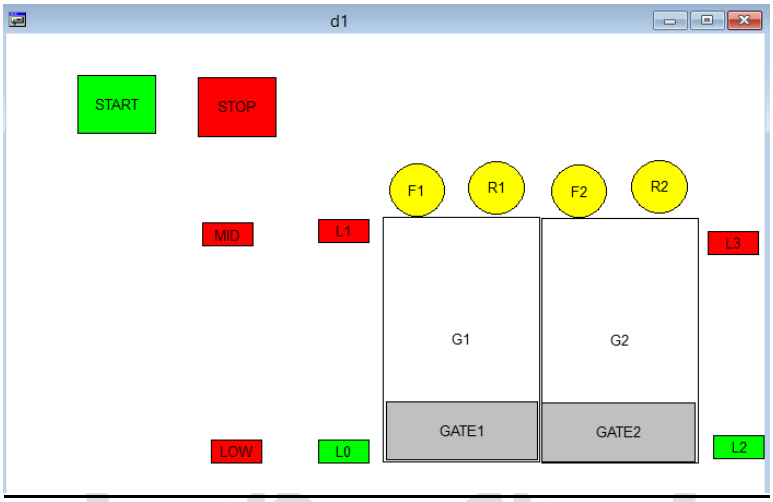
INDICATIONS USED

START = START
STOP = STOP
L_low = LOW LEVEL SENSOR
L_mid = MIDIUM LEVEL SENSOR
L0 = LIMIT SWITCH 1
L1 = LIMIT SWITCH 2
L2 = LIMIT SWITCH 3

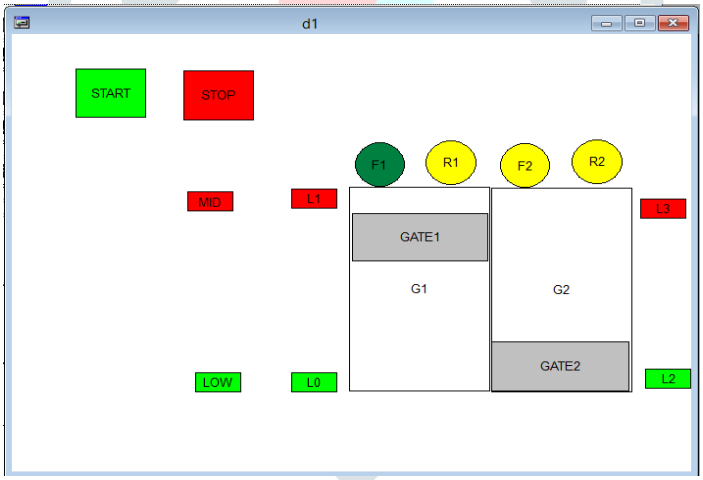
L3 = LIMIT SWITCH 4
FW1 = RELAY FOR FORWARD ROTATION OF MOTOR 1
RW1 = RELAY FOR REVERSE ROTATION OF MOTOR 1
FW2 = RELAY FOR FORWARD ROTATION OF MOTOR 2
RW1 = RELAY FOR REVERSE ROTATION OF MOTOR 2

SCADA REPRESENTATION OF SYSTEM

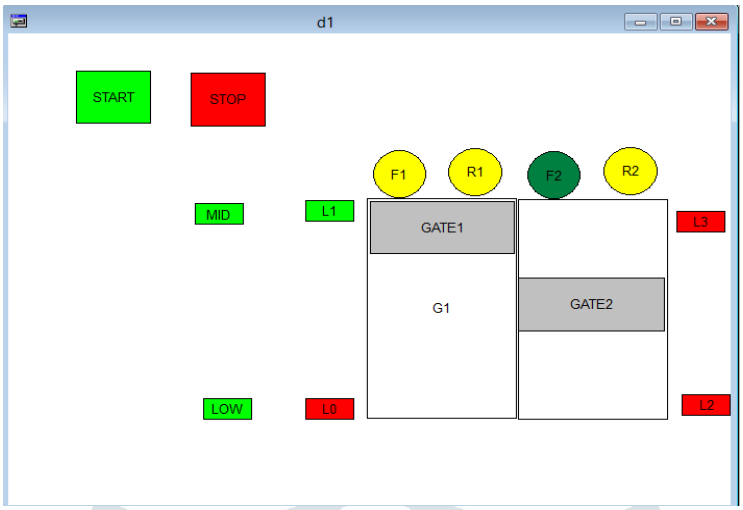
- **INITIAL CONDITIONS OF DAM SHUTTER**



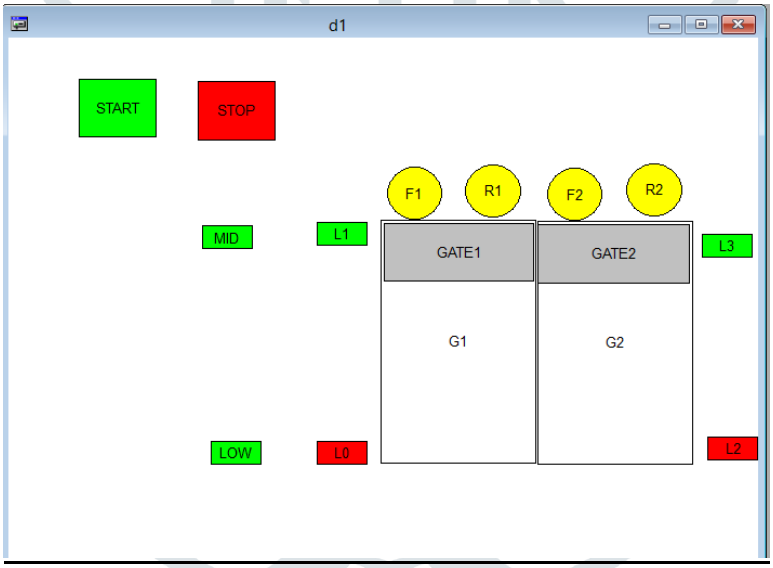
- **OPENING CONDITION OF GATE**



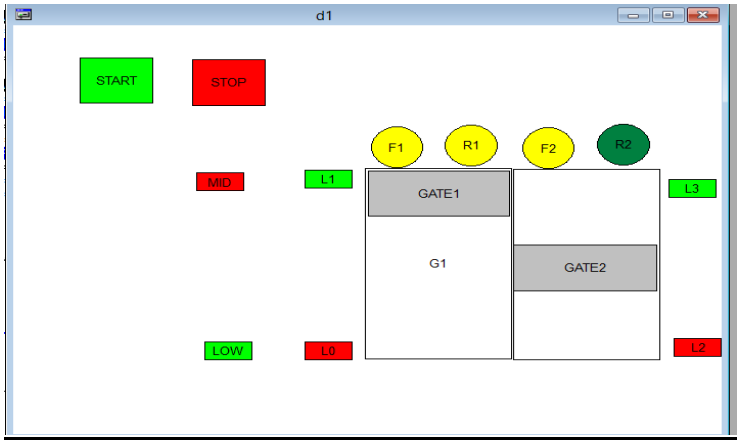
OPENING CONDITION OF GATE 2



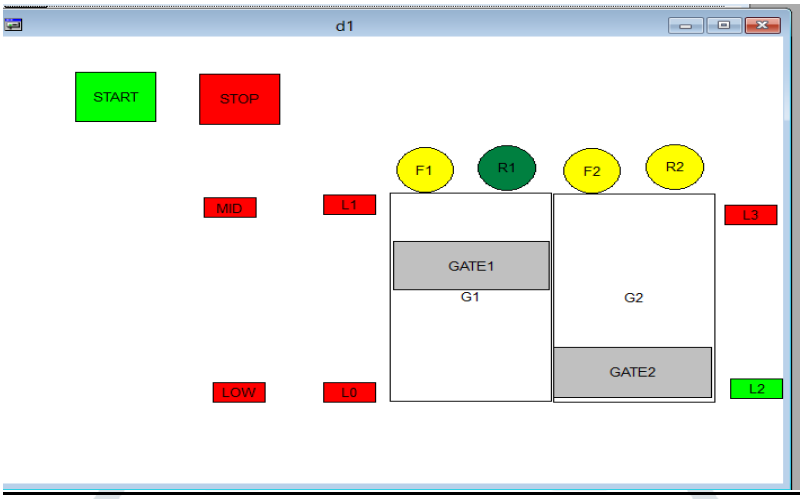
BOTH SHUTTERS ARE IN OPEN CONDITION



CLOSING CONDITION OF GATE 2



CLOSING CONDITION OF GATE 1



IV. HARDWARE IMPLEMENTATION

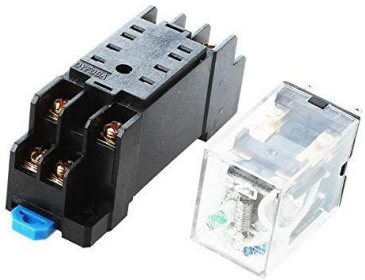
LIST OF COMPONENTS USED

- PLC:HERE we use ABB 07KR51 PLC as controlling device.This plc has 8port of inputs and 6 port of outputs.

- **RELAY:**

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit.

we use 12v DPDT electromagnetic relay module to control direction of motor to open and close dam shutter.



- **LEVEL SENSOR:**

A level sensor is a device for determining the level or amount of fluid, liquids or other substances that flow in an open or closed system.

We use level sensor to detect the level of water at catchment area of dam.

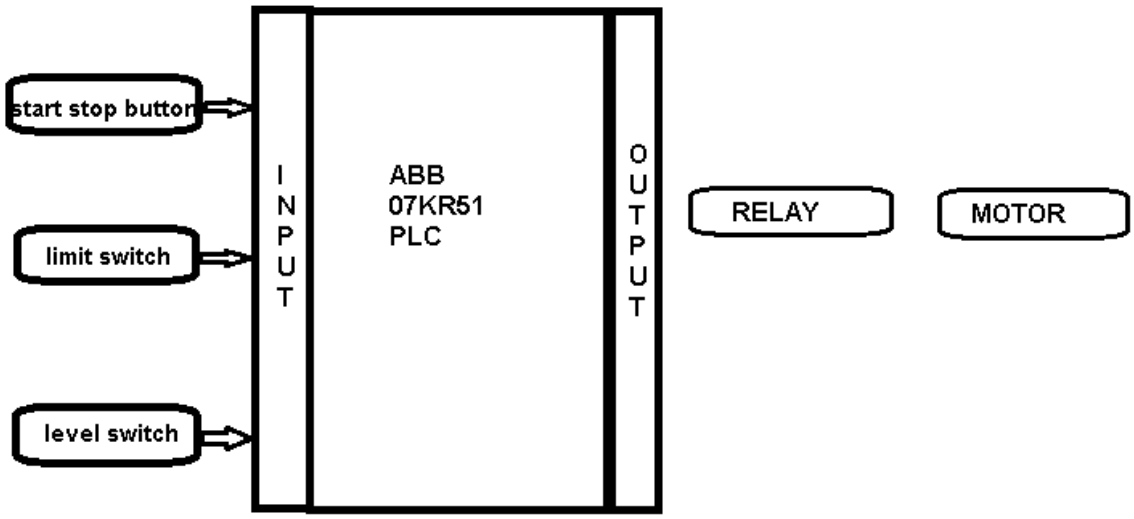
- **LIMIT SWITCH**

Limit switch is use to limit the rang of opening and closing of dam shutter Limit switch is operated with 12 v and it has 3 legs for connection.

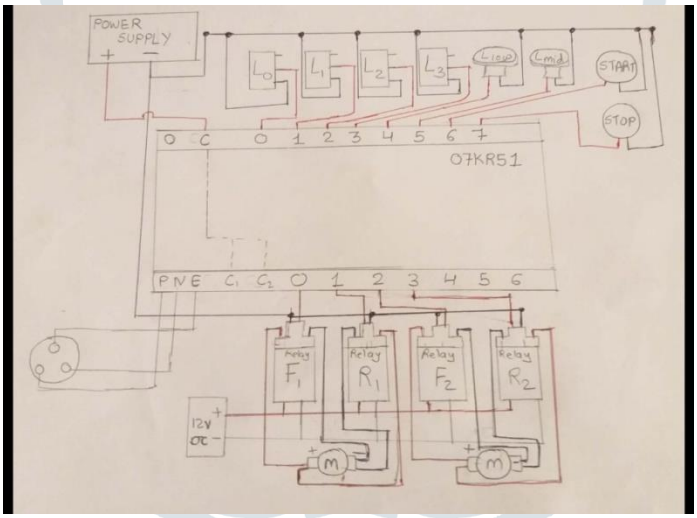
- **DC MOTOR**

We use 12v dc 10 rpm motor for dam shutter operation.

BLOCK DIAGRAM:

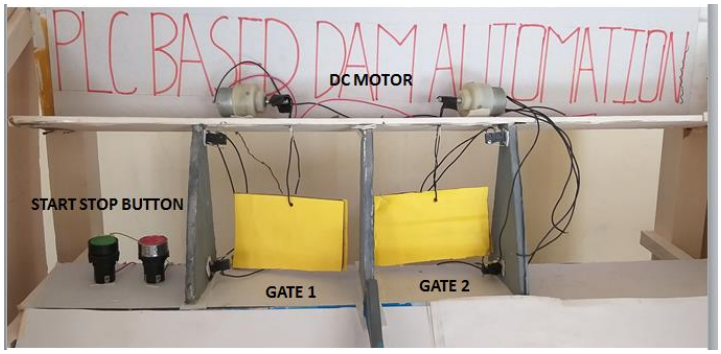


CONNECTION DIAGRAM



HARDWARE IMPLIMENTATION

IMPLIMETATION OF GATES



CONCLUSION

After this project we can say that with the use of this system we can save the water and reduces the wastage of water. Water in dam can be saved by the proper operation of dam shutter. Dam shutter should be operated on time.
Automation becomes this work more efficient.

REFERENCES

Sr. No.	Title of Paper	Author	Publication Journal/Conference
1	ADVANCES IN PLC-BASED CANAL AUTOMATION	Charles M. Burt [1] Xianshu Piao [2]	Irrigation Training and Research Center (ITRC) - www.itrc.org
2	Design for an Irrigation and Monitoring System Of an Automated Dam	Syed Muhammad Umar Talha, Syed Sheraz Mohani, Syed Hassan Ahmed and Mansoor Ebrahim	International multiconferance of Engineers and Computer Scientists (IMECS)
3	Automation of Gates of Water Reservoir Using Programmable Logic Controller (PLC)	Vandana Sahu1, Associate Prof. Nagendra Tripathi2	International Journal for Research in Applied Science & Engineering Technology (IJRASET) *Www.ijraset.com*
4	PLC Programming For A Water Level Control System: Design and System Implementation	Haoqiang Ji	University of Victoria