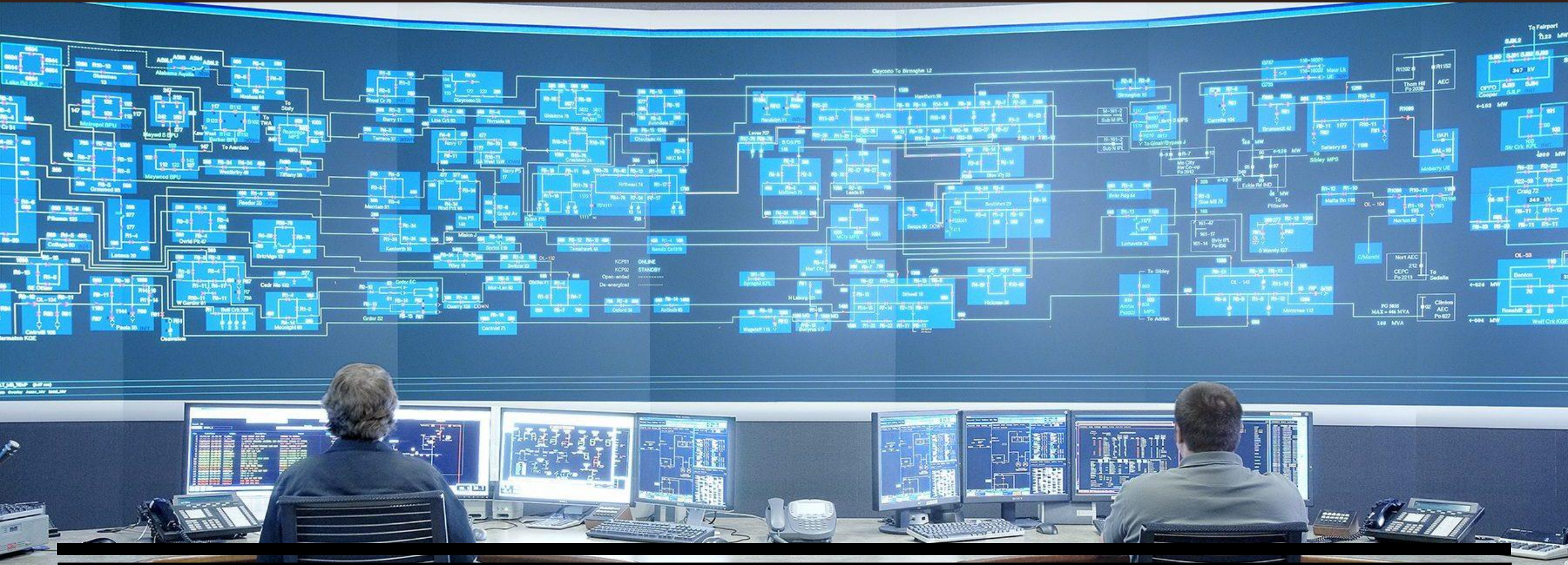


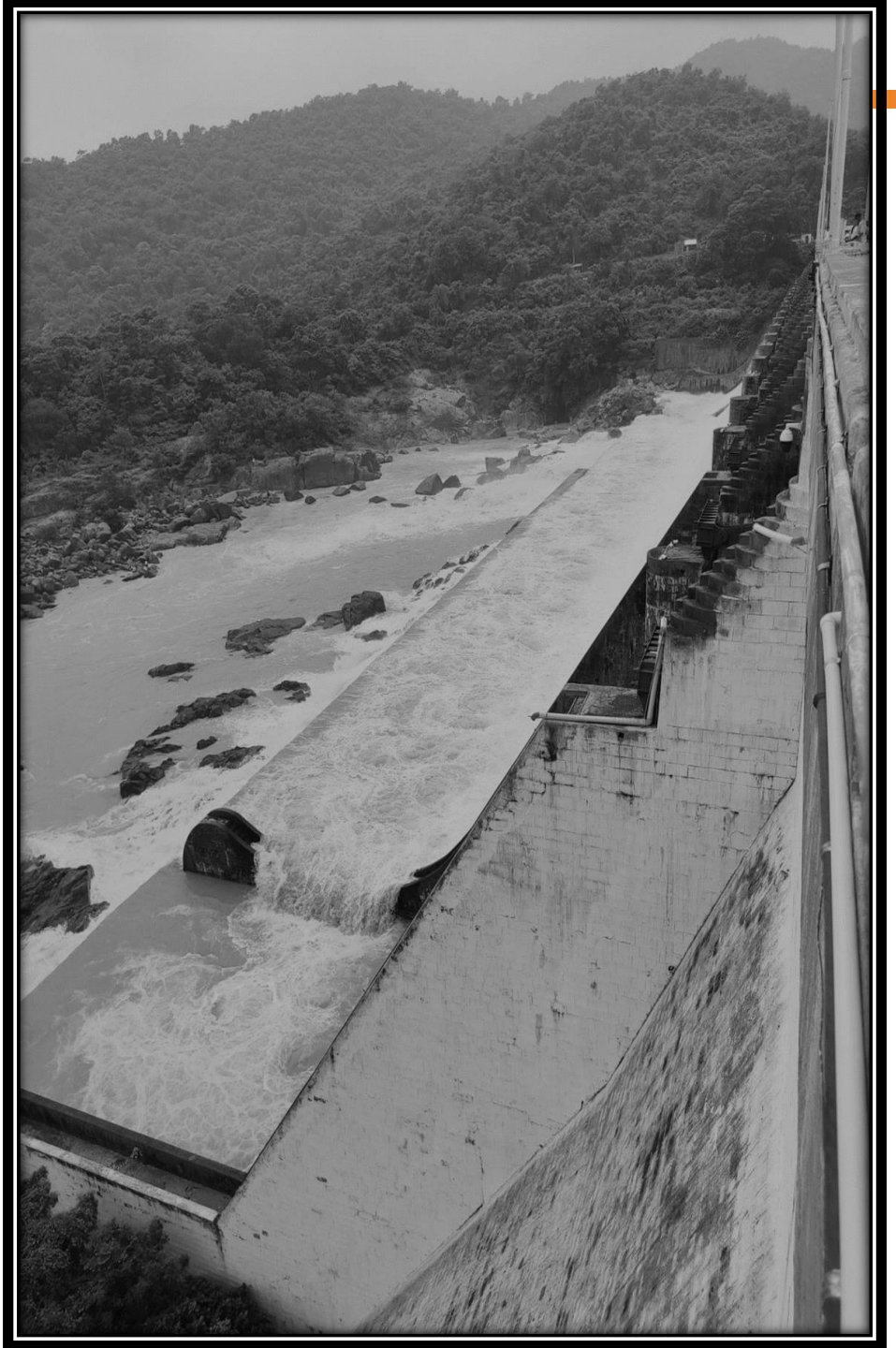
SCADA IN DAM AUTOMATION

A DETAILED PROJECT REPORT

CONTENT

SCADA OVERVIEW

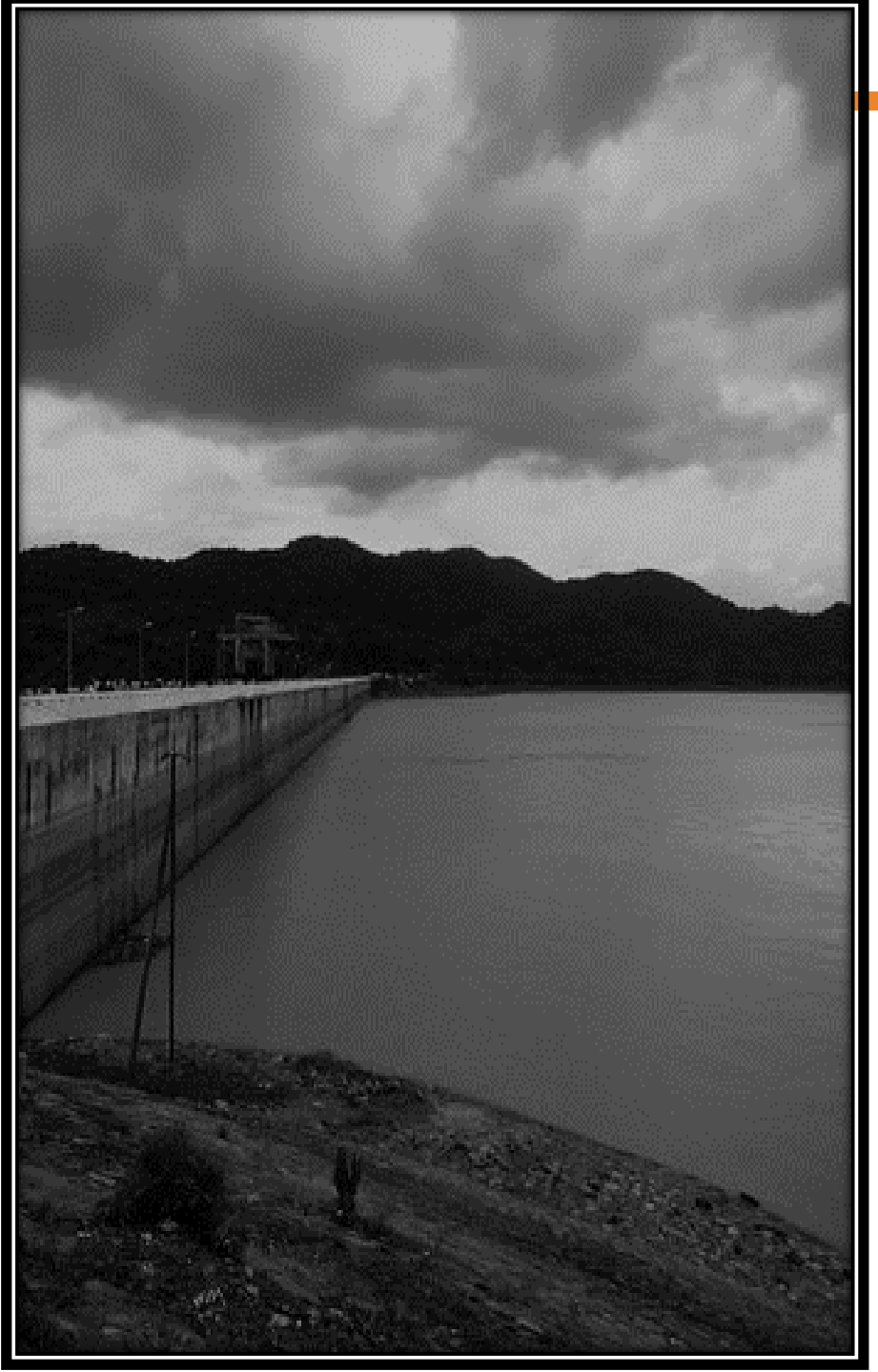
- Introduction
- Parts Involved
- Programming Required
- Connectivity
- System Architecture



INTRODUCTION

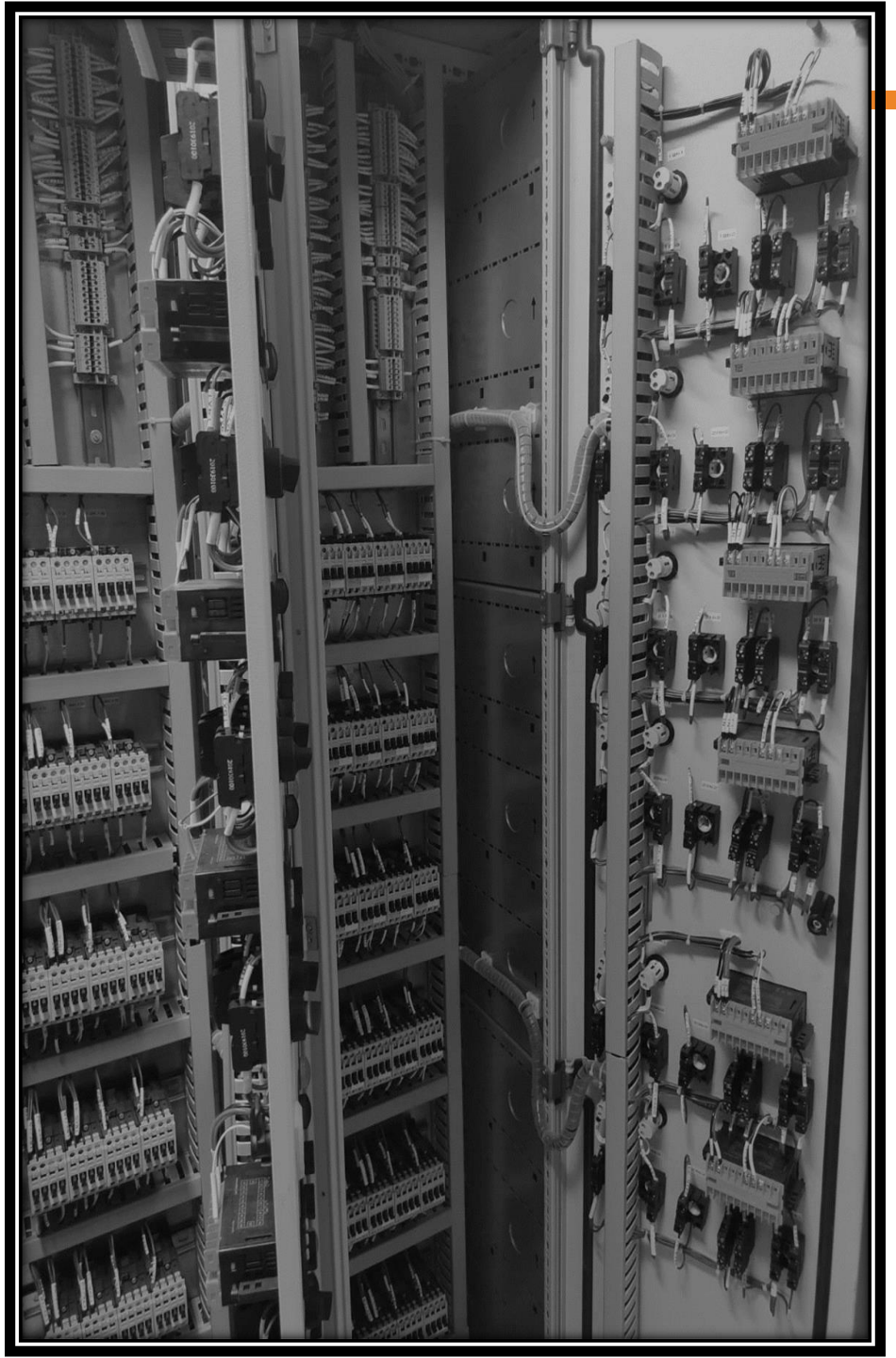
SCADA stands for Supervisory Control and Data Acquisition. It basically consists of data accessing feature and controlling process remotely. Data is converted as and when required from analog to digital and vice versa. It is a long distance methodoly which helps to control SCADA operated machineries from impeccably long distances. Its usage is not solely dedicated to Dams and barrages, rather many oil plants , nuclear plants, etc. have taken advantage of the SCADA systems.

SCADA is not a 100% controller, it is just a software which has to be linked with controllers. Ultimately it is to be connected to PLC / PID / DCS systems which in turn are connected to field instruments. Hazardous areas , unhygienic places , hilly areas where a person can't be sent regularly but process has to be watched continuously, should be controlled using SCADA.



PARTS INVOLVED

- Sensors
  - Reservoir water level Sensors
  - Gate Position Sensors
  - Automatic Weather Station Sensors(Air Temperature, Relative Humidity, Rainfall, Wind Speed, Wind Direction, Solar Radiation)
- VSAT Communication
- Alarm Generation for Faults
- Motor Drives
- RTU/ PLC
- Human Machine Interface (HMI)



PROGRAMMING REQUIRED

Ladder Programming Language is used to run PLC.

There are certain software used to program this language like **Logic Pro** .

Some common symbols used in Ladder Logic Programming are Normally Open, Normally Closed, Binary, Interlocking , etc.

This language operates on the binary concept of 0 and 1, True and False, Yes and No, etc.

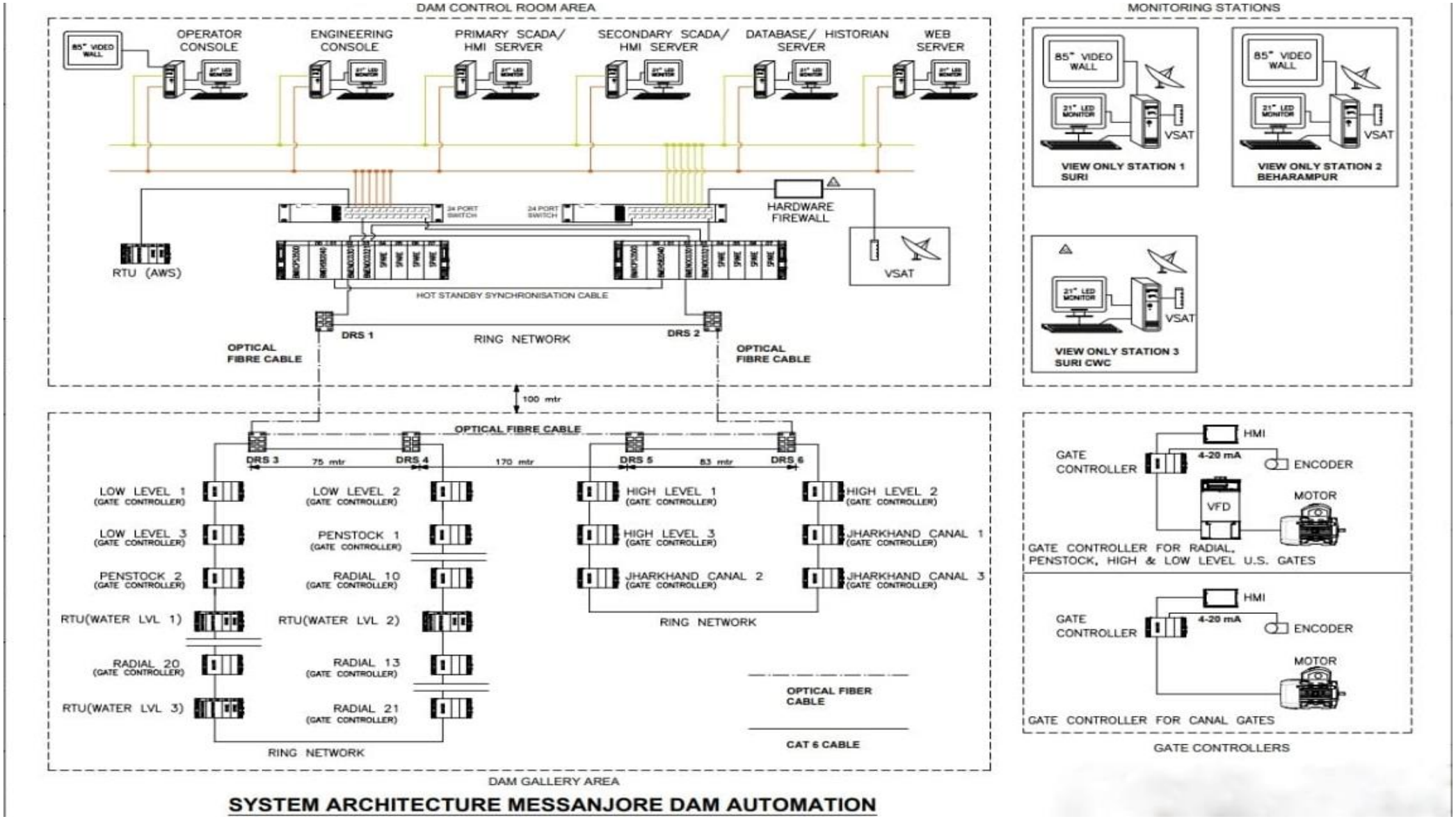
CONNECTIVITY

A wire line communication with optical fibre (backbone) media in ring topology is established to communicate between field units(PLC and RTU) and the Master Control Station.

To ensure better transfer of data and signals , short hauls of copper cables between sensors and RTUs; RTUs and the media converters can be used.

In the main Control Station , the Display Screen , the Operator Console , the Engineer Console and all the major appliances are also connected with high quality , high speed Optical Fibers.

SYSTEM ARCHITECTURE



SYSTEM ARCHITECTURE MESSANJORE DAM AUTOMATION

DAM OVERVIEW

- Structure Information
- Gate Classification
- Machinery

STRUCTURE INFORMATION

History of Massanjore Dam:

- **Massanjore Dam** is a hydropower generating dam over the located at Mayurakshi River, Massanjore near Dumka in the state of Jharkhand, India
- The Massanjore dam (also called Canada Dam), across the Mayurakshi, was commissioned in 1955.
- It was formally inaugurated by Lester B. Pearson, Foreign Minister of Canada.

Salient Features:

- The river at the dam site has a catchment area of 1869 sq.km
- It is Masonry structure of 661.416 Meter (2,170 feet) long with a roadway on the top.
- Live storage – 548.8986 MCM (4,45,000 Ac. Ft)
- Dead storage – 67.8414 MCM (55,000 Ac. Ft)
- Catchment area : 1859.61 Sq. Km (718 Sq. Miles)
- Submerged area: 69.9297 Sq. Km (27 Sq. Miles)

GATE CLASSIFICATION

Low Level Under sluice Gates:

There are 3 such gates with Sill Level 300.00 R.L.

Size of these Gates are 4.50 Ft. x 8.50 Ft.

High Level Under sluice Gates:

There are 3 such gates with Sill Level 340.00 R.L.

Size of these Gates are 4.50 Ft. x 8.50 Ft.

Flood Gates:

There are 21 such gates with Sill Level 383.00 R.L.

Size of these gates are 30 Ft. x15 Ft.

Hydel Gate:

There are 2 such gates in the dam. These gates use the waterflow to rotate turbines leading to generation of Electricity, used by WBSEDCL to supply current everywhere.

High Level Under sluice Gates

Low Level Under sluice Gates

Flood Gates

MACHINERY

Hydral Gate Machinery

The PLC monitors and electronically controls the motor that rotates to open or close the turbine gates.

Low Gate Machinery

The PLC controls the Motor electronically to open or close the Low Level Under sluice Gates .

High Gate Machinery

The PLC controls the Motor responsible for opening or closing the High Level Under sluice Gates

Flood Gate Machinery

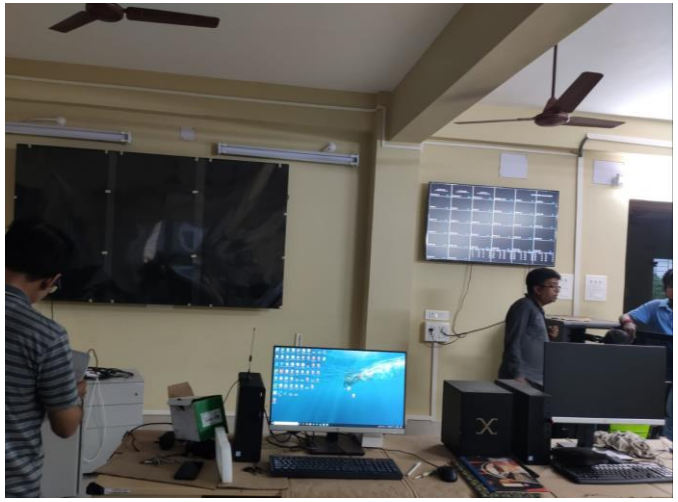
The PLC helps to open and close the 21 Flood Gates in time of high water flow.

EXECUTION PROCESS

- How Scada works in Massanjore Dam
- Pros, Cons & Suggestions

HOW SCADA WORKS IN MASSANJORE DAM

A Scada system typically helps in automation. The system installed in Massanjore Dam has diverse structure helping in the automation of the Dam gates.



A Video wall/large LED screen is provided for mimic display of SCADA interface with 24/7 duty operation capability. It is connected to an operator console ,which the operator uses to handle the gate operation and an engineering console, which an engineer uses for the maintenance of the electrical and electronic connectivity.

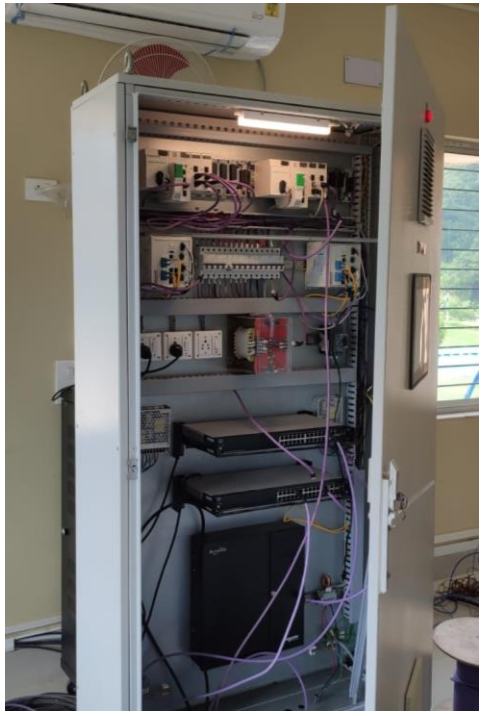
Then a primary scada or HMI(Human Machine Interface) , secondary scada or HMI are also connected.

A database server is present for the storage of day to day weather report and water level. Automatic Weather Station, Ambient Temperature, Relative Humidity Rainfall, wind speed & direction, Solar Radiation Sensors are used for this purpose.

Also a web server exclusively for the SCADA operation is installed. It is protected by VSAT (Very Small Aperture Terminals) .VSAT communications are required in applications IP / Ethernet based **SCADA** communications where there are no other economical terrestrial-based alternatives. Ethernet communications allows connectivity of IP based PLC/RTU/EFM/HMI equipment at remote sites.

This is the SCADA computer Box

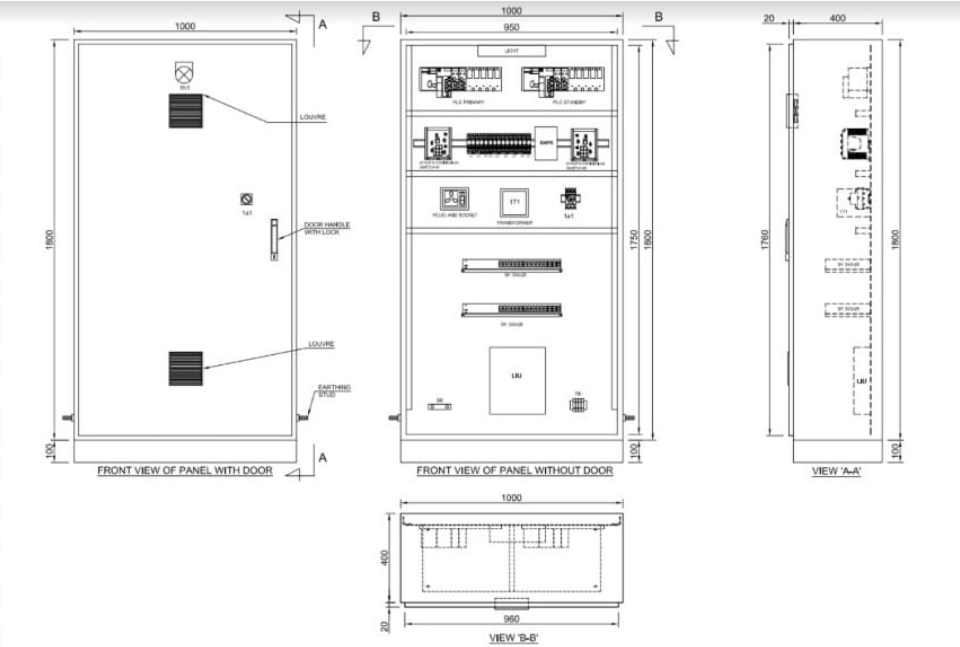
All of the aforesaid appliances are connected parallelly to the main PLC panel.

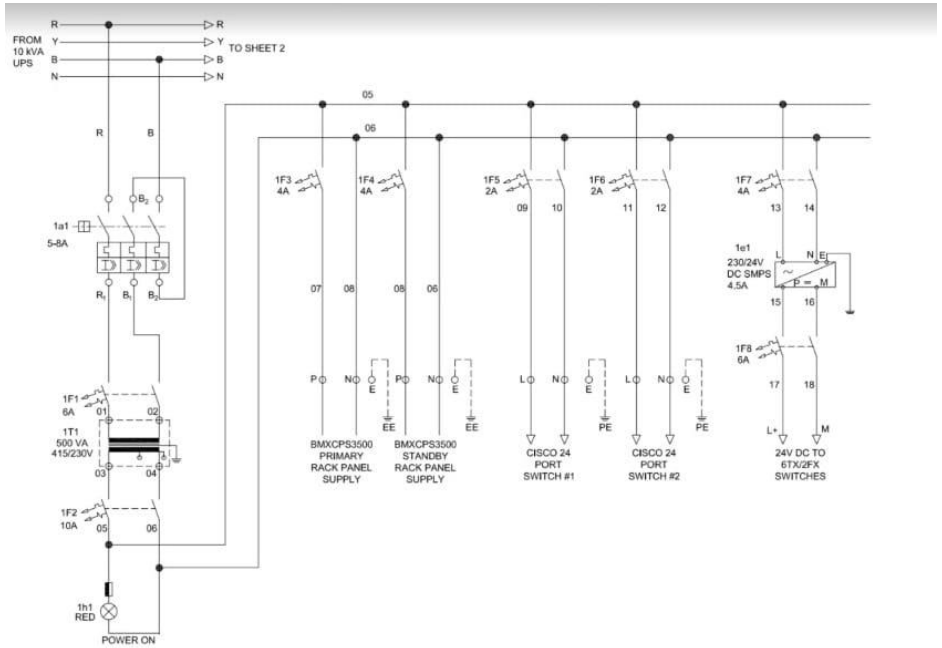


The main PLC panel consists of 2 PLCs , 2 DRS(Distributed Resource Scheduler), an MCB , plug , a transformer, an MPCB(Motor Protection Circuit Breaker) , 2 24-port switches , 2 SMPS and an LIU for the optical fiber connection. The SMPS helps in backup power in case of sudden power loss to prevent hindrance in the workflow.

There also exists a control relay panel which connects to the relay circuits near the gates. It is a backup for the Main PLC.

Every gate in the Massanjore Dam can be controlled either manually or with the help of a PLC connected directly to the field unit. Field PLCs are connected in ring topology to the relay panel in control room. The gates can be operated even from the relay panel. These connections are farther extended to the main PLC which is connected to the scada computer. The scada computer with the help of its programming controls the working of the main PLC by using certain commands thus leading to automation.
However if the scada programming or the main PLC fails, we have the relay panel to control the gates from a longer distance. If even the relay panel somehow shows problems we have the field PLCs to cover up for the faults.





PROS , CONS & SUGGESTIONS

PROS

- **ACCURACY**: Data is provided with utmost authenticity to the most accurate decimal.
- **TIMELINESS**: Lack of any delay in command processing helps in rapid gate operation.
- **TREND SPOTTING**: Huge Database for day to day weather and water level reports help in predicting future trends.
- **EARLY FAULT DETECTION**: Due to installation of alarms and sensors , all faults can be easily spotted and rectified well before some accident occurs.

CONS

- **PRICE** :SCADA System installation and automation costs a fortune . It requires added security expenses too.
- **TRAINED PERSONNEL REQUIRRED**: SCADA automation is to be operated by skilled technicians and engineers with proper training to avoid accidental command mis-interpretation.
- **NETWORK PERFORMANCE**: When we rely on remote monitoring, we'll need to resolve issues related to peak usage, capacity planning, latency, reliability and security.
- **MAINTENANCE :** Electronic based automation needs proper and regular maintenance to avoid faults or lag in the system.

SUGGESTIONS

- To prevent over expenses , frequent checking of all the field PLC Units(since they are of highest priority) should be executed.
- To prevent connectivity issues , a wireless methodology can be implemented in place of cable wiring(which has the danger of being cut off by trespassers or other calamities) keeping the costing in mind.

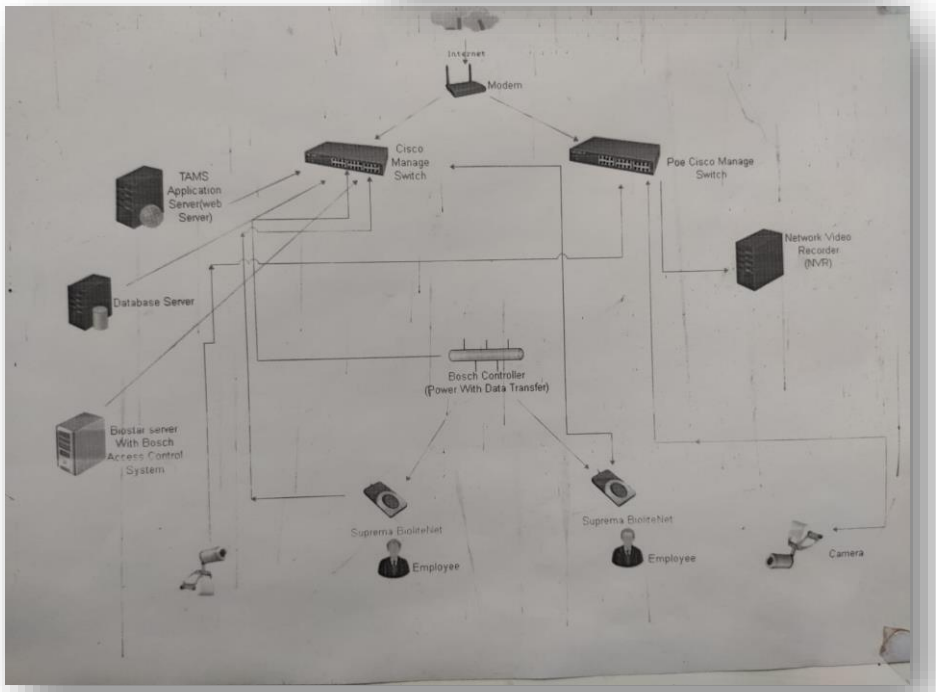
SECUIRITY

- Biometric Scanning
- Video Conference Network
- Camera Surveillance

BIOMETRIC SCANNING

Biometric scanning is a new age security system which monitors the entry and exit of the employees of an association by scanning their biometrics a.k.a fingerprint and face recognition.

The main server contains data of all the registered employees of the association. It is directly connected to Time Attendance Management System(TAMS) and a web based server. Data stored and updated is shown on the SQL best web page that is operated by a skilled operator. Firewall connected to both the servers protects the web-based server from malwares and viruses and the main server from losing precious data.



VIDEO CONFERENCE NETWORK

A video conference network is important for long distance meetings and especially during the covid situation video conference meetings are an essential commodity for important decision making.

So protecting the important conversations from being leaked to harmful organizations is a major responsibility of the security system of any organization. That's why a video conference unit(MCU) is secured by a special protected unit

Also the video conference system is protected by a firewall to avoid drainage of important data or hacking by other harmful malwares.

CAMERA SURVELLIANCE

Cameras are installed for security purposes as well as to govern the proper opening and closing of sluice are spill gates.

There are three types of cameras installed dome shaped, bullet shaped and c mount cameras.

They are connected through PoE(power over Ethernet.)
The NVR(Network Video Recorder) records and shows real time camera view to the security for proper surveillance.
The firewall protects the camera servers from being attacked over the internet.

The main switch is located in a protected main Control Room.

THANK YOU

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