INTRODUCTION

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TOPIC- PROJECT ON CONTROL SYSTEM

ACKNOWLEDGEMENT

I would like to convey my sincere gratitude to HOD MR.RANJAN BHATTACHARYA ,MR.AMITAVA CHATTOPADHYAY(DGM),MR.JOYDEEP BHATTACHARYYA and all other professionals of (Instrumentation department)of Haldia Petrochemical ltd for the continious support and encouragement through out this summer training and helping me out and guiding me throughout in completion of this project.

DISTRIBUTIVE CONTROL SYSTEM

A **distributed control system** (**DCS**) is a computerised control system for a process or plant usually with a large number of control loops, in which autonomous controllers are distributed throughout the system, but there is central operator supervisory control. This is in contrast to systems that use centralized controllers; either discrete controllers located at a central control room or within a central computer. The DCS concept increases reliability and reduces installation costs by localising control functions near the process plant, with remote monitoring and supervision.

Distributed control systems first emerged in large, high value, safety critical process industries, and were attractive because the DCS manufacturer would supply both the local control level and central supervisory equipment as an integrated package, thus reducing design integration risk. Today the functionality of SCADA and DCS systems are very similar, but DCS tends to be used on large continuous process plants where high reliability and security is important, and the control room

Process where dcs might be used include

1.Chemical plant

2.Petrochemical(oil) plant

3.Boiler Control and Powerpoint systems

4.And many more

Structure of DCS

The key attribute of a DCS is its reliability due to the distribution of the control processing around nodes in the system. This mitigates a single processor failure. If a processor fails, it will only affect one section of the plant process, as opposed to a failure of a central computer which would affect the whole process. This distribution of computing power local to the field Input/Output (I/O) connection racks also ensures fast controller processing times by removing possible network and central processing delays.

The accompanying diagram is a general model which shows functional manufacturing levels using computerised control.

Referring to the diagram;

- Level 0 contains the field devices such as flow and temperature sensors, and final control elements, such as control valves
- Level 1 contains the industrialised Input/Output (I/O) modules, and their associated distributed electronic processors.
- Level 2 contains the supervisory computers, which collect information from processor nodes on the system, and provide the operator control screens.
- Level 3 is the production control level, which does not directly control the process, but is concerned with monitoring production and monitoring targets
- Level 4 is the production scheduling level.

Levels 1 and 2 are the functional levels of a traditional DCS, in which all equipment are part of an integrated system from a single manufacturer.

Levels 3 and 4 are not strictly process control in the traditional sense, but where production control and scheduling takes place.

Technical Points

The processor nodes and operator graphical displays are connected over proprietary or industry standard networks, and network reliability is increased by dual redundancy cabling over diverse routes. This distributed topology also reduces the amount of field cabling by siting the I/O modules and their associated processors close to the process plant.

The processors receive information from input modules, process the information and decide control actions to be signalled by the output modules. The field inputs and outputs can be analog signals e.g. 4–20 mA DC current loop or 2 state signals that switch either "on" or "off", such as relay contacts or a semiconductor switch.

DCSs are connected to sensors and actuators and use setpoint control to control the flow of material through the plant. A typical application is a PID controller fed by a flow meter and using a control valve as the final control element. The DCS sends the setpoint required by the process to the controller which instructs a valve to operate so that the process reaches and stays at the desired setpoint. (see 4–20 mA schematic for example).

Large oil refineries and chemical plants have several thousand I/O points and employ very large DCS. Processes are not limited to fluidic flow through pipes, however, and can also include things like paper machines and their associated quality controls, variable speed drives and motor control centers, cement kilns, mining operations, ore processing facilities, and many others.

DCSs in very high reliability applications can have dual redundant processors with "hot" switch over on fault, to enhance the reliability of the control system.

Although 4–20 mA has been the main field signalling standard, modern DCS systems can also support fieldbus digital protocols, such as Foundation Fieldbus, profibus, HART, Modbus, PC Link etc., and other digital communication protocols such as modbus.

Modern DCSs also support neural networks and fuzzy logic applications. Recent research focuses on the synthesis of optimal distributed controllers, which optimizes a certain H-infinity or the H 2 control criterion.[1][2]

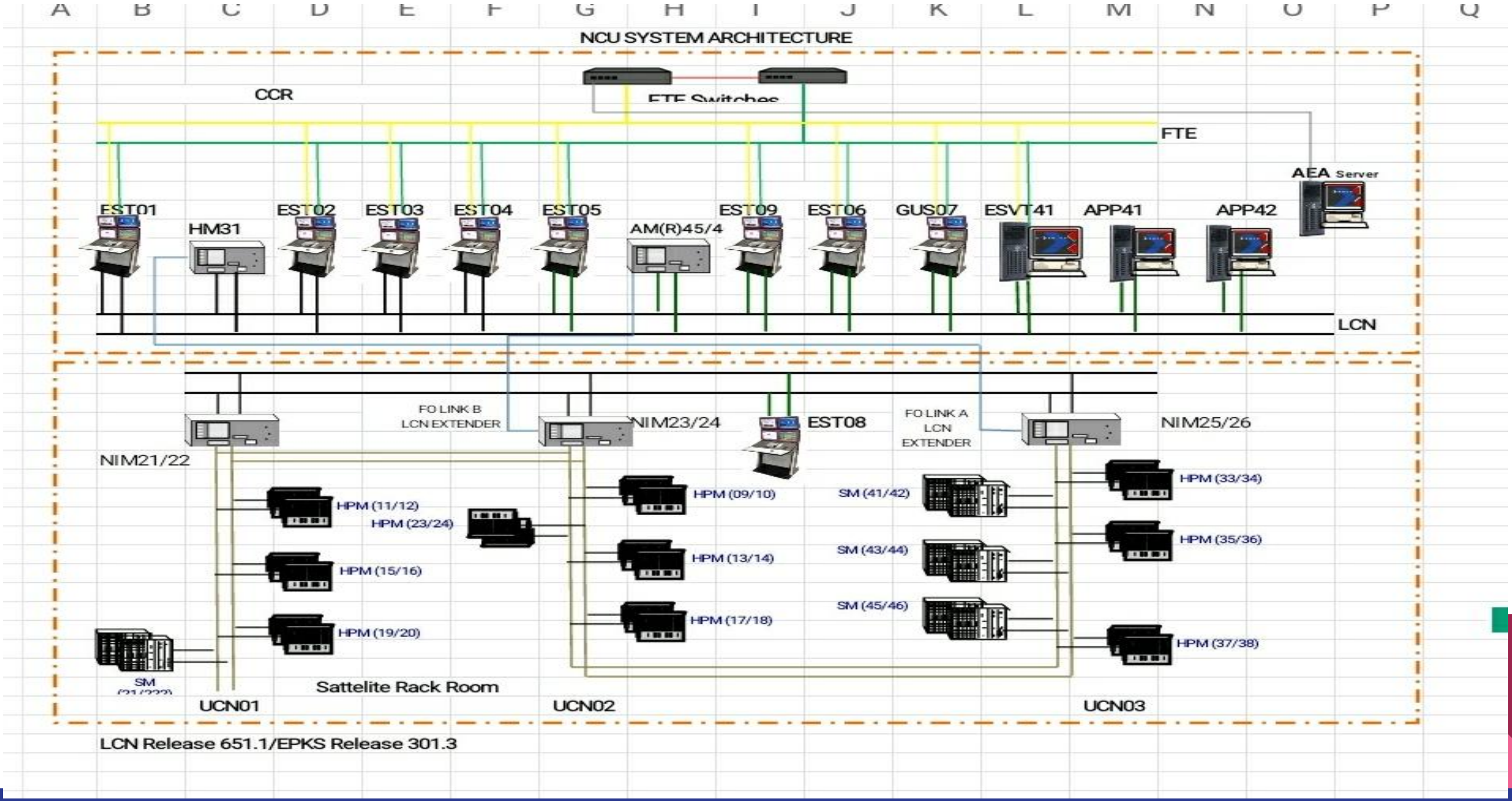
Industrial Control System

Industrial control system (**ICS**) is a general term that encompasses several types of control systems and associated instrumentation used for industrial process control.

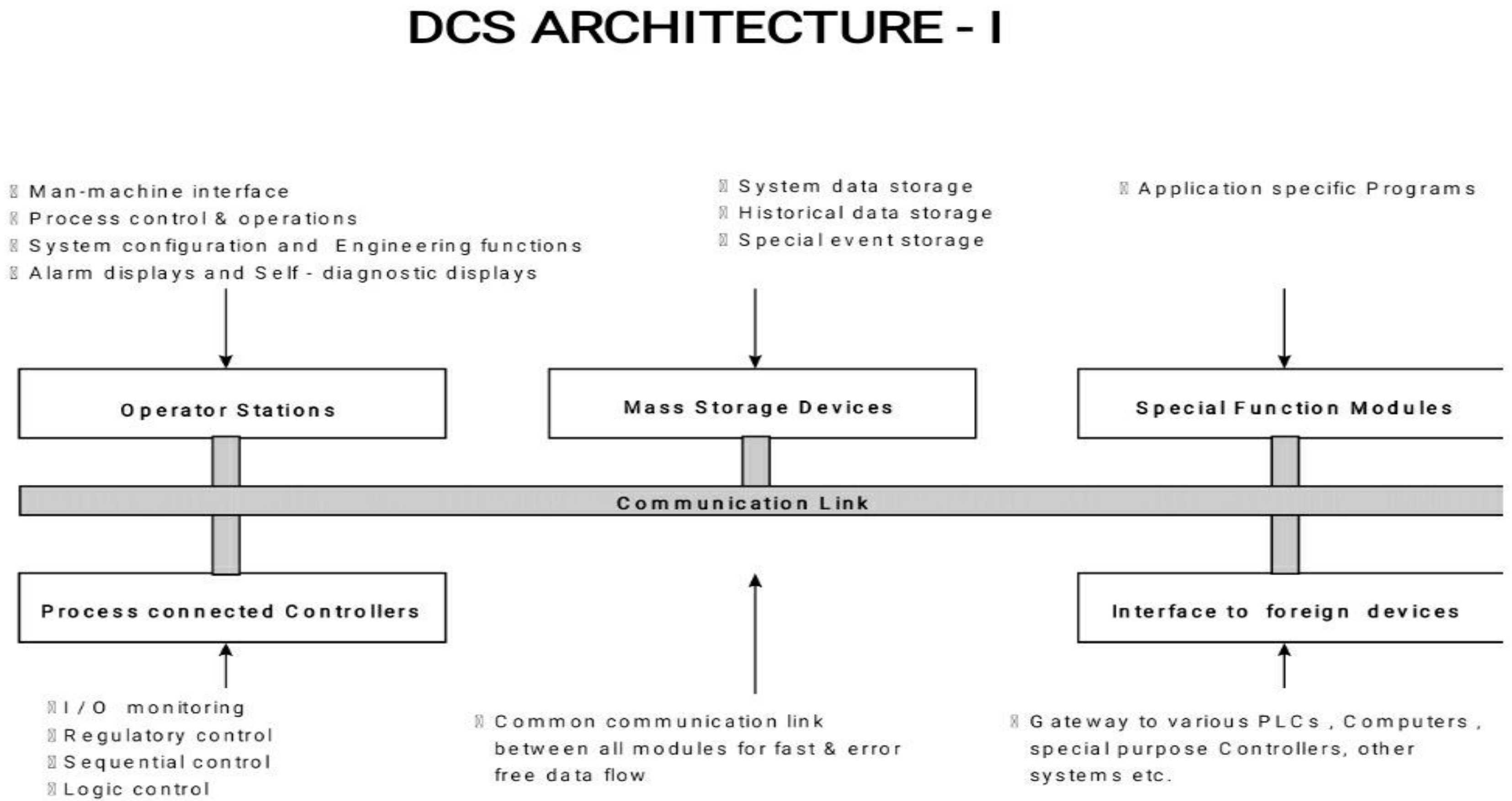
Such systems can range from a few modular panel-mounted controllers to large interconnected and interactive distributed control systems with many thousands of field connections. All systems receive data received from remote sensors measuring process variables (PVs), compare these with desired set points (SPs) and derive command functions which are used to control a process through the final control elements (FCEs), such as control valves.

The larger systems are usually implemented by Supervisory Control and Data Acquisition (SCADA) systems, or distributed control systems (DCS), and programmable logic controllers (PLCs), though SCADA and PLC systems are scalable down to small systems with few control loops.[1] Such systems are extensively used in industries such as chemical processing, pulp and paper manufacture, power generation, oil and gas processing and telecommunications.

DCS ARCHITECTURE



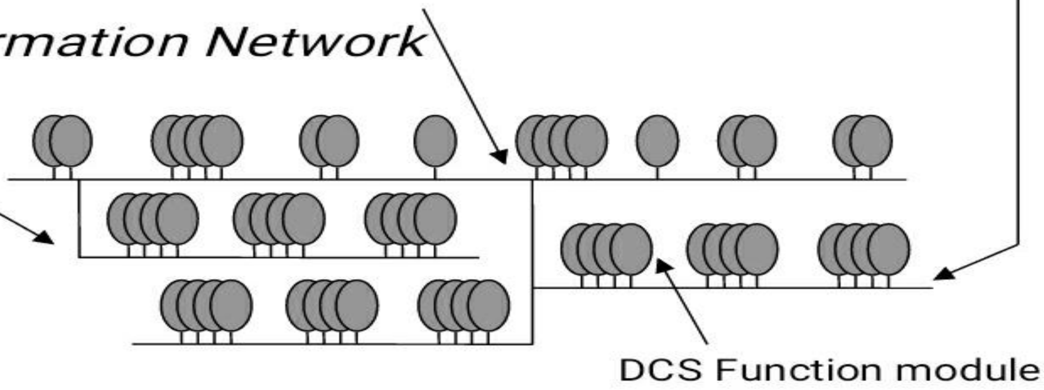
DCS BASIC BLOCK DIAGRAM



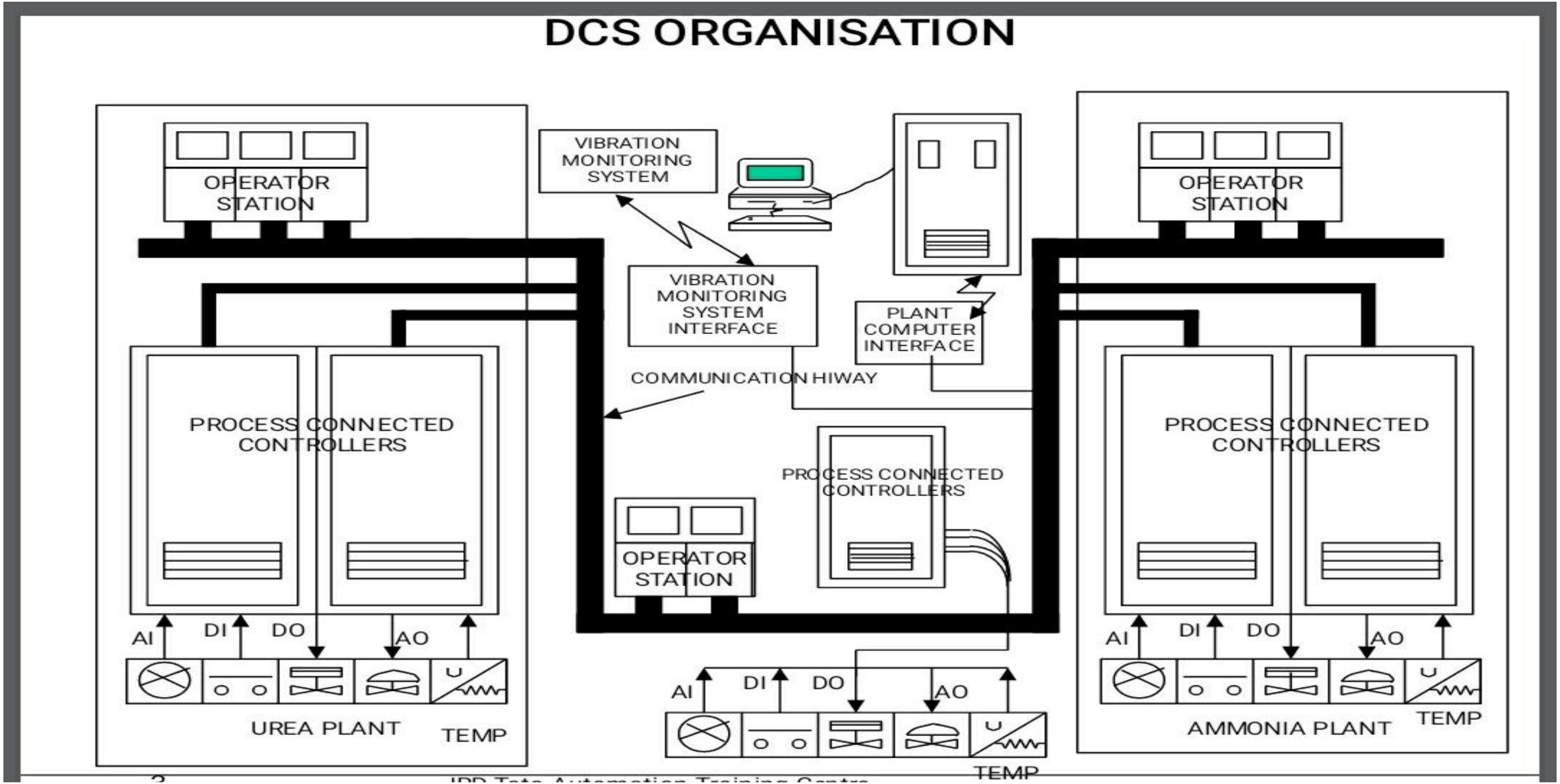
DCS ARCHITECTURE - II

Distributed Control Systems are found distributed around :

- *Process Control Networks*
- *Supervisory Control Network*
- *Plant Information Network*



NETWORK


DCS ORGANISATION
OPERATOR STATION
VIBRATION MONITORING SYSTEM
OPERATOR STATION
VIBRATION MONITORING SYSTEM INTERFACE
PLANT COMPUTER INTERFACE
COMMUNICATION HIWAY
PROCESS CONNECTED CONTROLLERS
PROCESS CONNECTED CONTROLLERS
PROCESS CONNECTED CONTROLLERS
OPERATOR STATION
AI
DI
DO
AO
UREA PLANT
TEMP
AI
DI
DO
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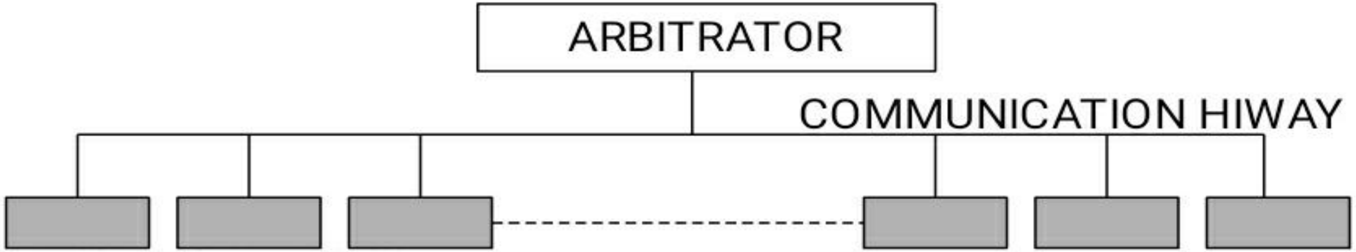
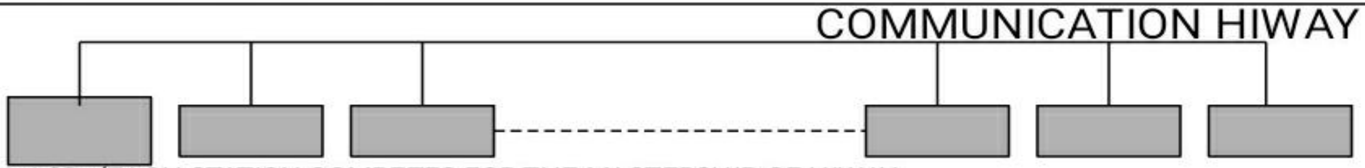
AMMONIA PLANT
TEMP

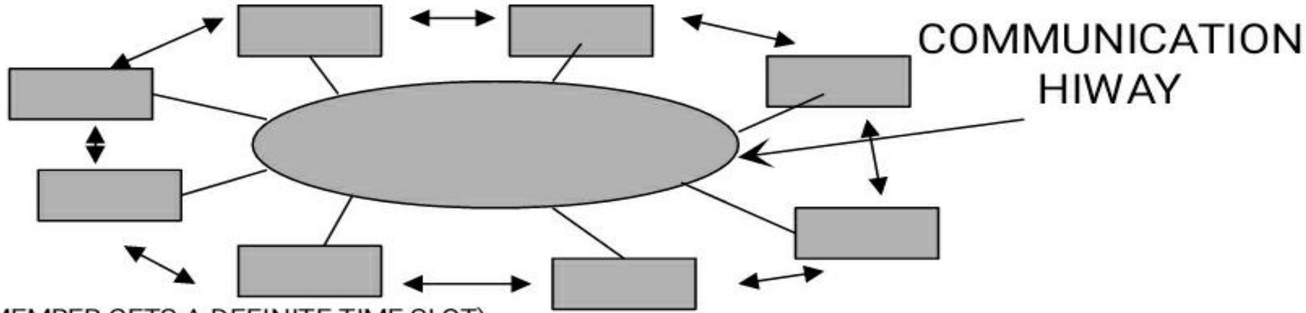
PROTOCOLS



REQUEST/GRANT COMMUNICATION



CSMA / CD (EACH STATION COMPETES FOR THE MASTERSHIP OF HIWAY



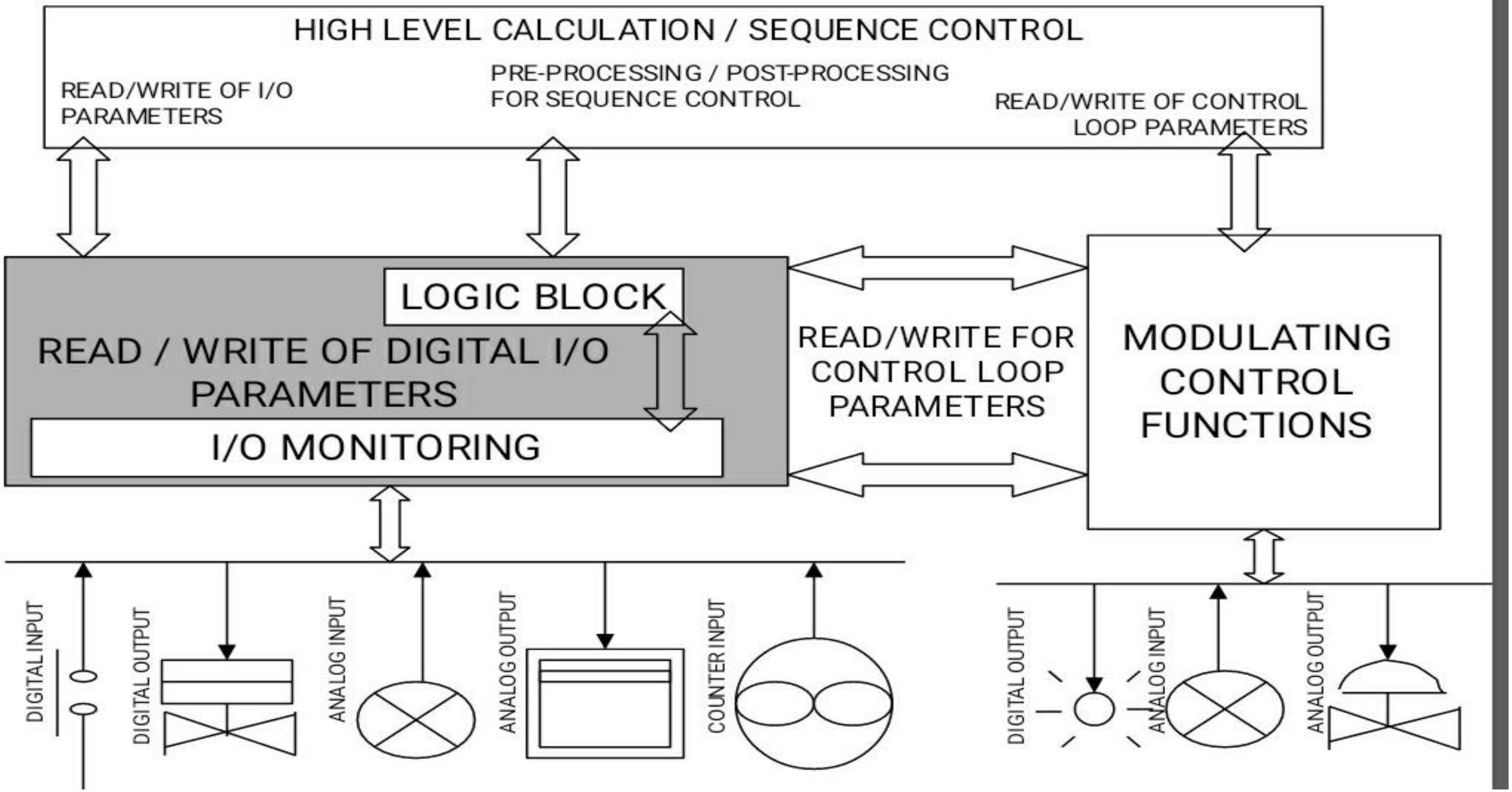
TOKEN PASSING (EACH MEMBER GETS A DEFINITE TIME SLOT)

PROCESS CONNECTED CONTROLLER

FUNCTIONAL DESCRIPTION

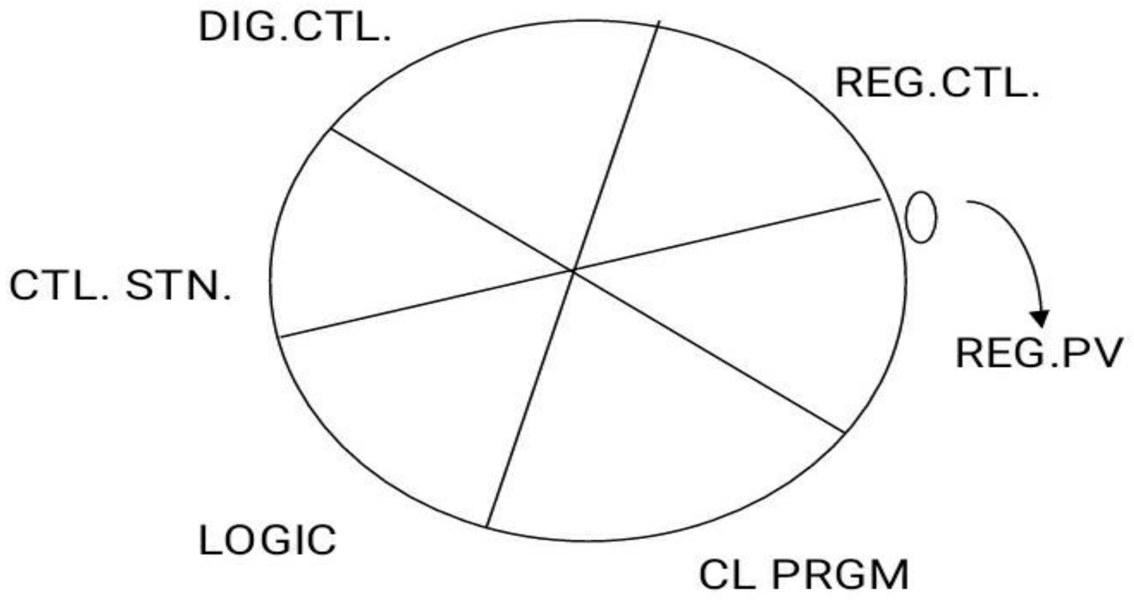
- I/O Monitoring
- Modulating Control
- Logic Control
- Sequence Control (Through Programming)

CONTROLLER FUNCTIONAL ORGANISATION

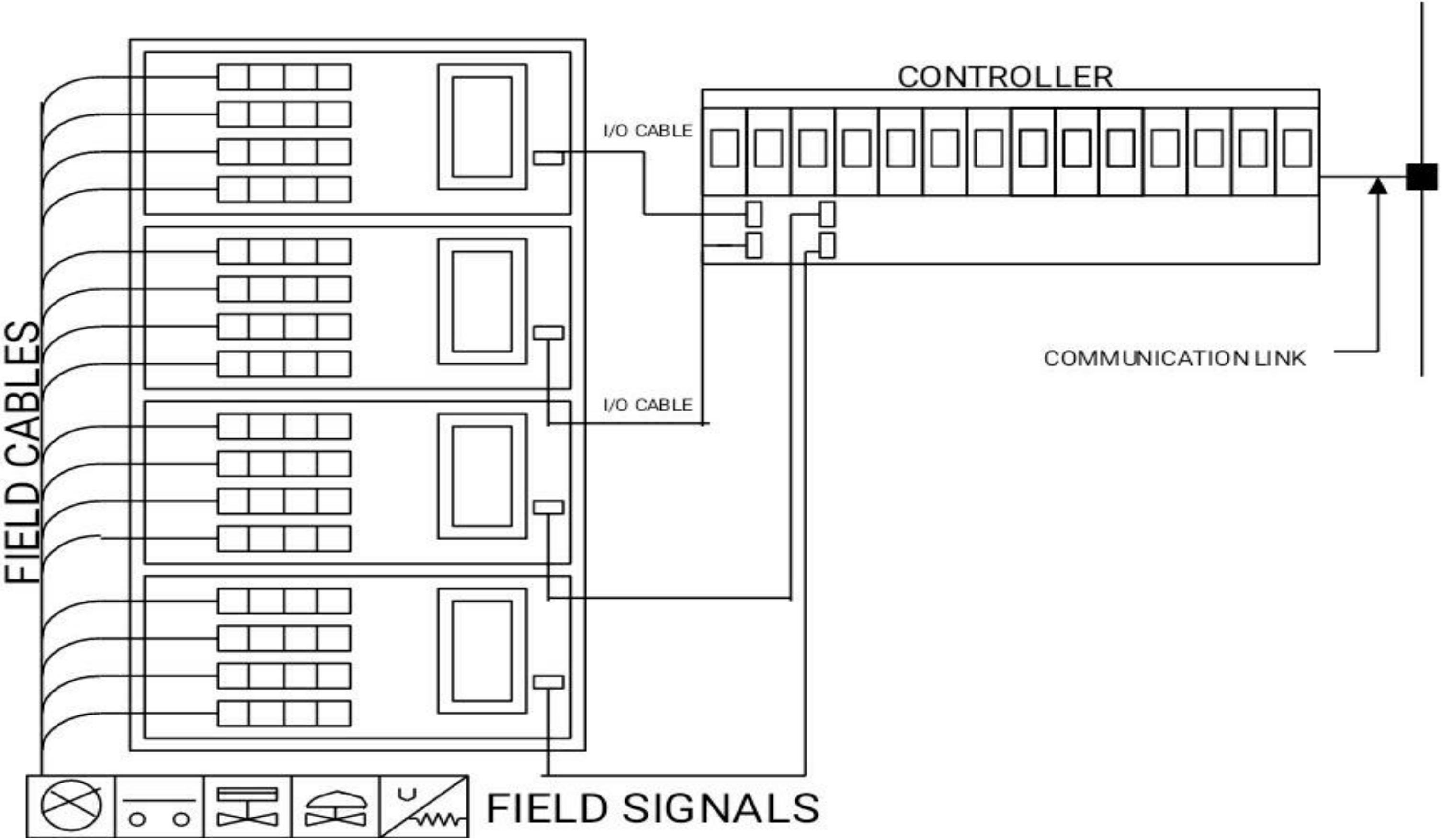


CONCEPT OF CONTROLLER EXECUTION CYCLE

1 SECOND (MAX.) ; 250 MILLISECONDS (MIN.)

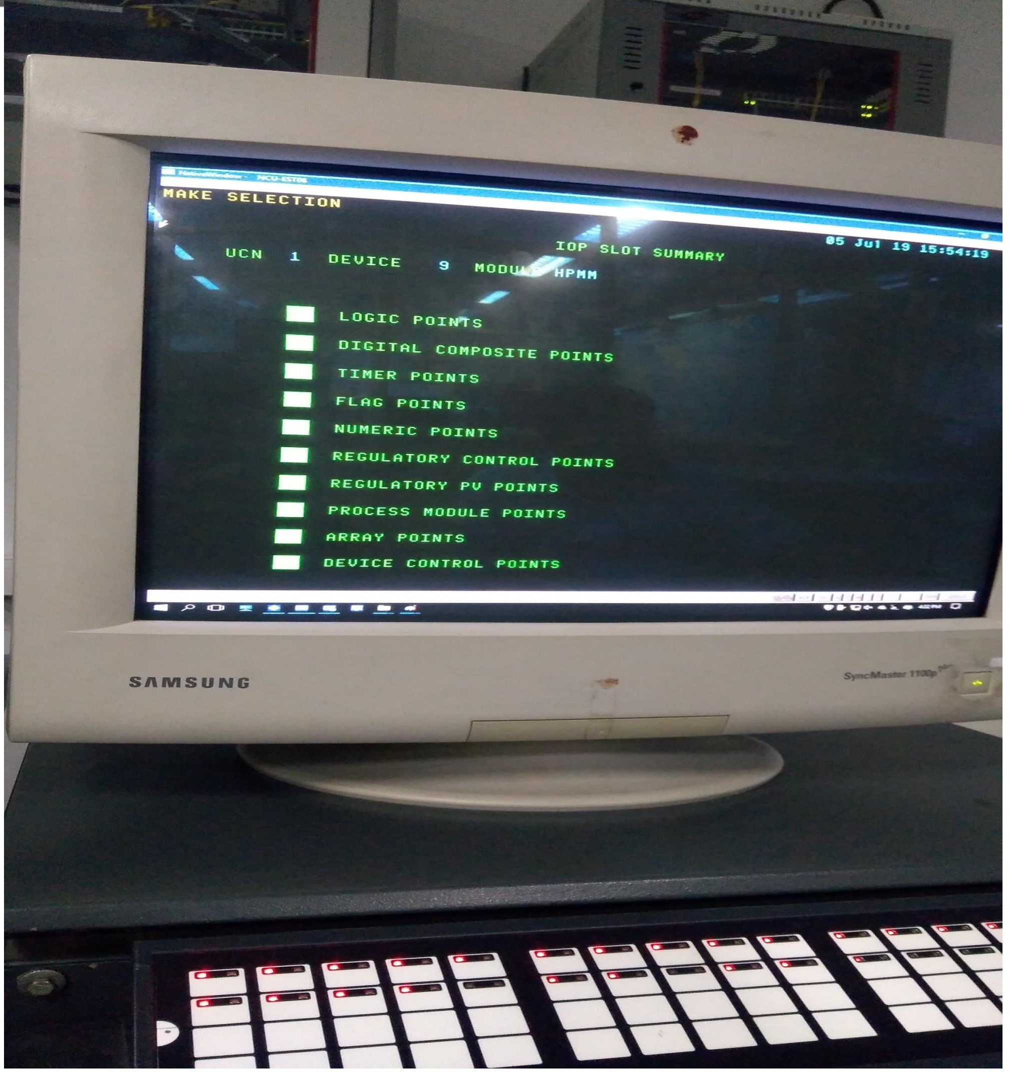


PROCESS CONNECTED CONTROLLERS



POINT TYPES

• Control slots (Loop)	- Temp, Flow, Pressure, Ph
• Digital Output	- Solenoid Valve, Pump
• Digital Input	- Limit Switch
• Analog output	- Control element
• Analog Input	- Recorder,Manual Loader
• Counter Input	- Totalisation
• Logic Block	- Safety Interlocking
• Timer	- Batch time, Events, Duration
• Flags	- Event Status
• Numeric	- Data, Calculation Results

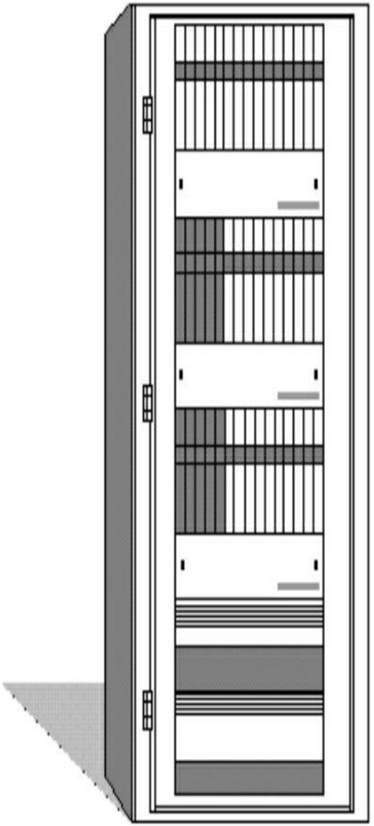


PROCESS CONNECTED CONTROLLER

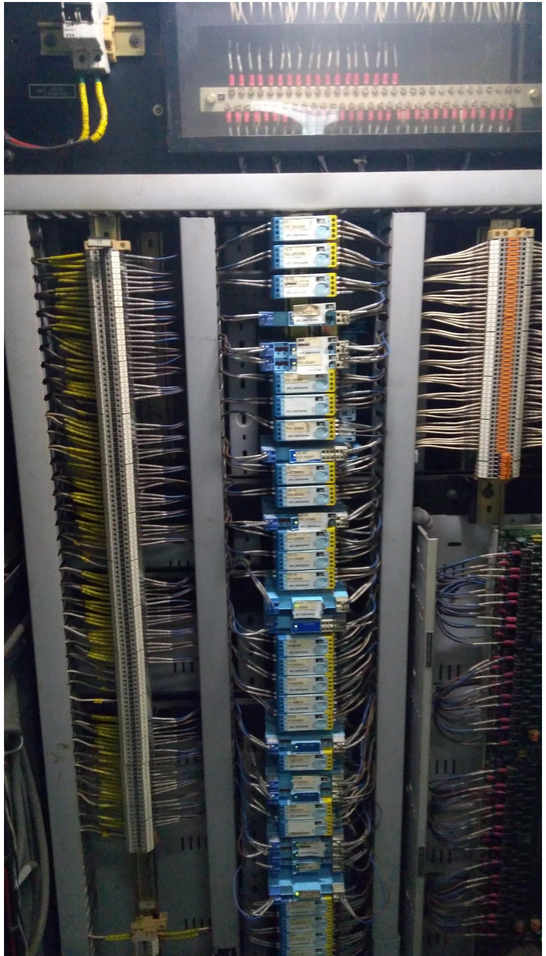
ALGORITHMS

- PID
- PID WITH RATIO AND BIAS
- HIGH/LOW OVERRIDE SELECTOR
- AUTO/MANUAL STATION
- MULTIPLIER/DIVIDER
- SQUARE ROOT EXTRACTOR
- SWITCH
- CALCULATOR
- RAMP/SOAK GENERATOR

CONTROLLER CABINET

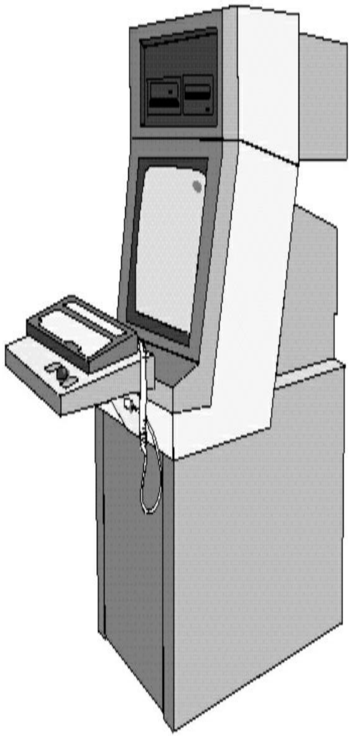


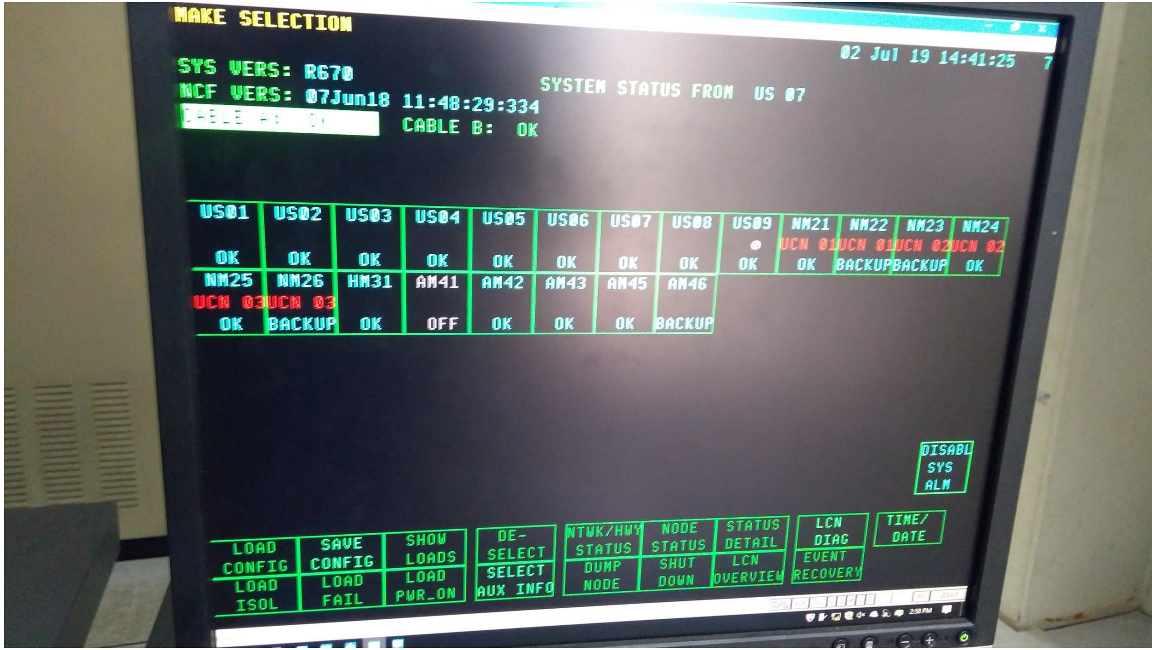
INPUT /OUPUT CABINET



OPERATOR STATION

OPERATOR STATION HARDWARE





Report

a. UCN-The UCN(Universal control network) is connected with almost every equipment with NIM(Network Interface Module) with all the HPM (High Performane Manager) with the SMM(Safety Manager Module)
b. HPM-It control the controlling operation where there are two subparts first the INPUT/OUTPUT cabinet and the controller cabinet.They are 24 in numbers
c. LCN-It stands for LOCAL CONTROL NETWORK.It has engineering stations and operator stations connected within it.

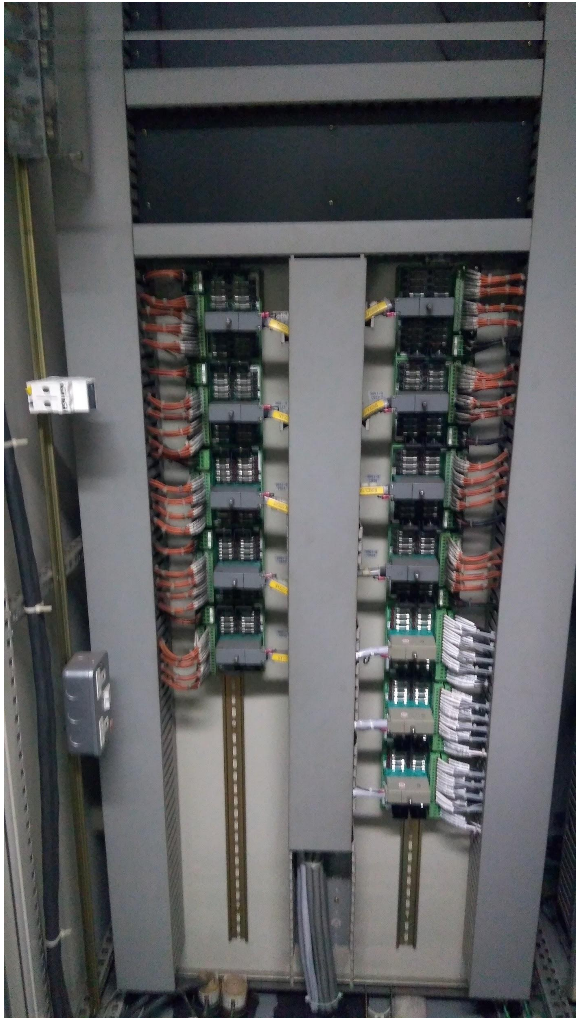
I

d-SMM(Safety Manager Module)

a. It works when there is an urgent need to shutdown the valves or open it as per the requirment of the following process
b. It works when the HPM module fails to work(There may be several reason).
c. All the valves are closed down except the flare outlet is kept open
d. As this works in an urgent condition so there are 3 backup available.If one fails then the other two can work
e. From the CCR Opereational Engineering control a large number of controllers ie sensors and actuators on the field.Even can manipulate them as per their needs like Logic points,Digital Coposite Points,Timer Points,Flag Points,Numeric Points,Regulatory Points etc

SMM(SAFETY MANAGER MODULE IN SRR(SATELLITE RACK ROOM)

INPUT /OUTPUT RACK SMM SRR

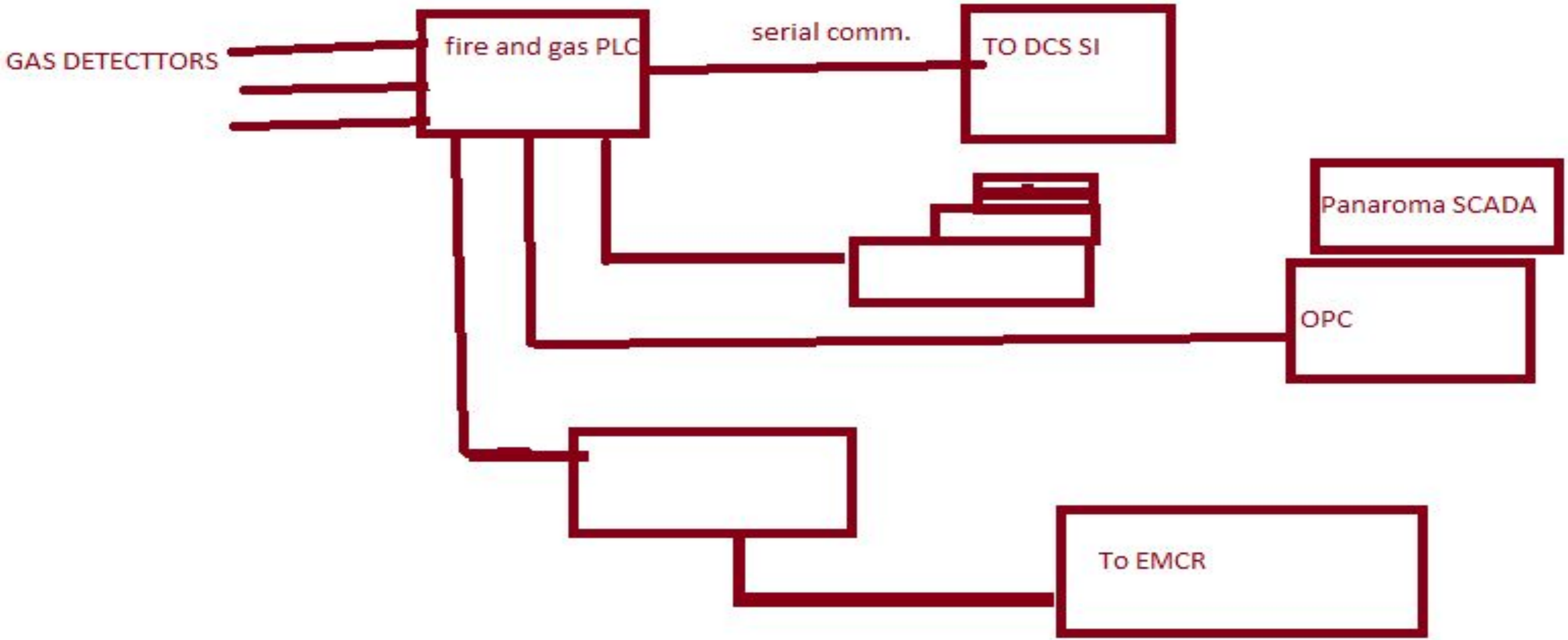


e CCR-Mainly comprised of engineers from chemical discipline.They control and set values for differnt actuators (as per requirments).For maximum productivity international standard values are available.From CCR the control can be provided either through auto mode where it will work according to the set values with HPM in between the command network.Even it can work in a manual friendly environment also.

In general a opertional engineer can control at max 9 alarm in an hour.HPM provides an alarm when there is a rise of a special parametre than the values set for alarm comdition f SRR- It stands for (satellite rack room).It has HPM within it as well as I/O cabinet .The whole thing summed up as an HPM.The i/o cabinet has i/o parts in between there is a system which trip the system in case of short circuits be it in field or any part of network.The input/output cabinet is there before the controller cabinet

G Sensors/Actuators in field-There are numerous sensors of temperature,pressure,flow level,volume.It sensed the signal in which the physical attribute of the signal gets convetred to the electrical signal by transducer.Electrical signal which is analog then pass to the SRR where it gets converted to the Digitto Signal using Analog/Digital card.After getting converted to digital signal HPM operates on the signal and then again reconert it to analog signal which is send to the field to the actuators

GAS DETECTOR



Gas detectors

Gas Detectors is a device that detects the presence of gases in an area often a part of safety system.This type of equipment is used to detect a gas leaks or other emmisions and can interfere with a control system so a process can automatically . A gas detector can sound an alarm to operators in the area where the leak is occuring

CONCLUSION

Thus we get a broad overview of Distributive control system and other Control system through this presentation.