Supervisory Control for Metro Station Using PLC & SCADA

Rajesh Kr Ahuja, Piyush Rastogi, Abhinesh Gupta

Abstract— The paper discuss the fact that development of control theory and technology of computer together with communication pushes PLC ahead. It introduces PLC's analyses feature, application in building materials industry, supervisory control and automated metro station, trend for development in future. The PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. PLC play an important role in control field. The paper is directive and protective for PLC (Programmable Logic Controller) and Supervisory Control and Data Acquisition (SCADA) technology to remotely operate and monitor large scale on-site systems.

Index Terms— Feature of PLC;,Supervisory control at Metro station,Trend of Development, PLC, Principle of PLC.

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1 INTRODUCTION

THE development of computer technology and microprocessor technology along with control theory, digital communication technology, PLC's birth and development conformed to modern industry requirements for rapid changes of market demand. In year 1969 the first PLC was made, with advantage of high reliability and performance but equally high price ratio. PLC is not only applied in industry but also in civil application such as elevator, traffic signal, tunnel ventilation system, metro station.

Honeywell introduces its next generation MasterLogic-200 programmable logic controller (PLC) system. The Master-Logic-200 CPU is designed using state-of-the art 32 bit processor technology which provides extremely fast speed for program execution, backplane data transfer and communication. MasterLogic-200 system is in modular configuration and scalable to address wide range of applications across all industry verticals. User friendly engineering tool with integrated PLC programming and network configuration provides single platform for user.

Open network communication interface makes the Master Logic 200 system interoperable with other systems and devices.

Safety Manager combines Honeywell's proven Quadruple Modular Redundancy (QMR®) technology with extensive process safety management expertise in integrating process safety data, applications, system diagnostics and critical control strategies.

2 PLC SYSTEM UNDER STUDY

2.1 Principle of PLC

Detailed The CPU of PLC also consists of operating system and user program.

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The CPU is also referred as QPP (Quadra Processor Pack). Operating system is used for dealing with tasks, for example start stop of PLC, refreshing process map area, managing storage area and communication

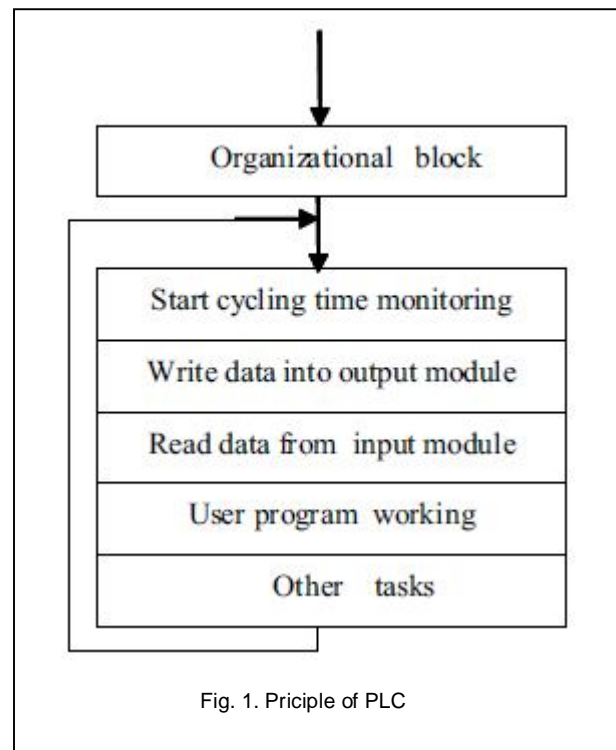PLC adopts working mode of cycling scanning

Fig. 1. Priciple of PLC

1. QPP writes data from out process map area to output module.
2. Read data from input module and store them into input process map area.
3. QPP deals with data from input module and executes program.

4. In the end of cycling scan, operating system implement all hang up task, for example to download, receive and send data. This data is sent to SCADA system to monitor and to make the control from the main system, as per requirement. The system or PLC can be made to operate in manual or automatic mode.

The process can be more briefly be understood by the flow chart given in Fig.1

2.2 Why we require this

The ventilation system greatly influences important parameters of the overall tunnel design. The earlier the aerodynamic concept and emergency response to fire are taken into account, the greater the efficiency and cost effectiveness with which these requirements can be harmonized with those of construction design, safety engineering and all other electro-mechanical equipment. Company has dealt with the holistic and interdisciplinary design of tunnels including ventilation systems

The TVS (Tunnel Ventilation System) has successfully designed and supported the implementation of extremely complex ventilation systems all over the world . This can be achieved using plc ML200.

2.3 Maintaining the Integrity of the Specifications

The monitoring and control of the system is accomplished using SCADA arrangements in the field to FID (Fan Isolation Damper) and air flow, and to enable supervision of the operational aspects of the site. The onsite alarm and control system are powered with an un-interruptible power supply (UPS) with a reserve capacity of at least 12 hours. The SCADA units communicate to a central monitoring location via redundant links of differing formats. Supervisory Control and Data Acquisition (SCADA) gathers information and controls on a supervisory level, a mechanical process and/or numerous processes. It is purely a software package that is located with the hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs), or other commercial hardware modules. This type of program has been commonly used to control and monitor local and manual operation at metro station.

The system is defined in different modes of operation these are generally Mode 21, Mode 74, Mode 76, etc.

TVS (Tunnel Ventilation System)

3   INTEEGRATED PROGRAMMING

SoftMaster software package provides integrated engineering environment from basic programming to different special module settings as well as diagnosis. This package consists of Soft Master(PLC programming) and Soft Master-NM (Network Management).

3.1 Soft Master

• Engineer friendly software (multiple PLCs monitored in a single window /project)
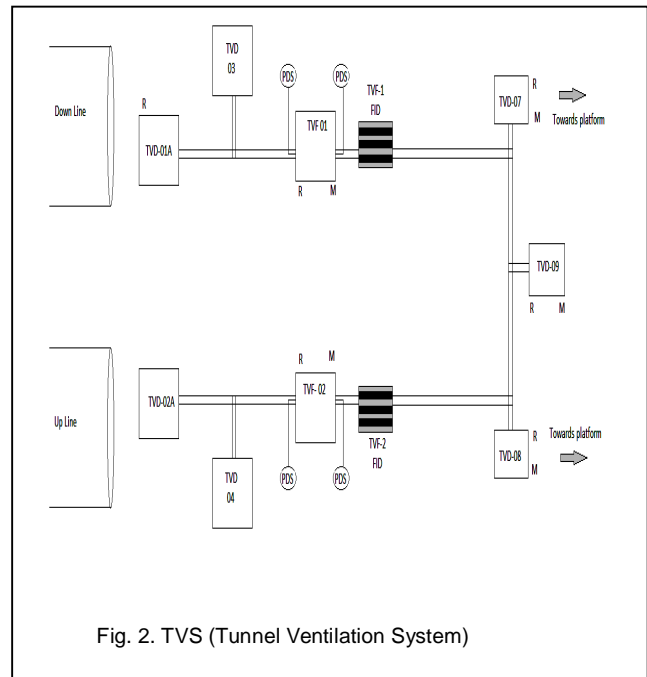• Easy project documentation - programs, variable assign-

ments, comments, etc

Fig. 2. TVS (Tunnel Ventilation System)

A Blank slot for optional module   H Power Supply Module
B Blank slot for optional module   J I/O *
C Memory Module   K I/O *
D Register Module   L I/O or Serial Link Module *
E System Control Module   M I/O or Serial Link Module *
F Processor Module   N Parallel Link Driver Module
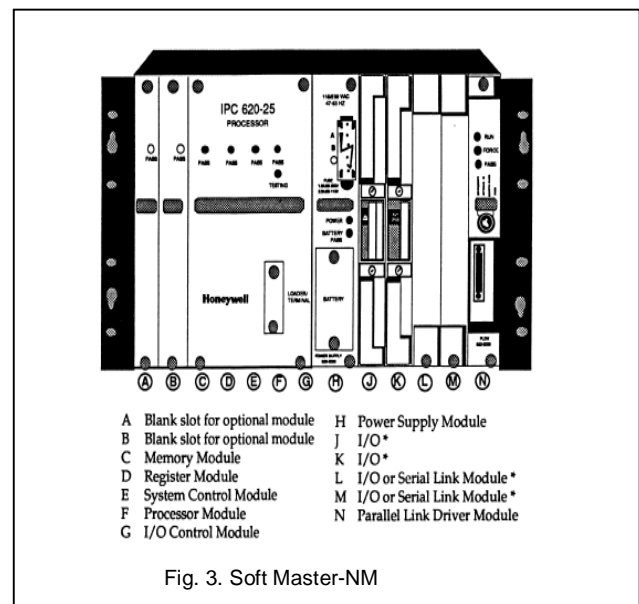G I/O Control Module

Fig. 3. Soft Master-NM

• Import/Export - configuration file can be imported or exported
• Two levels of remote connections
• Online editing & Debugging facility
• A special wizard for hot swapping of modules

3.1 Soft Master-NM

•Slot assignment & configuration of all communication modules (Ethernet, Serial ProfibusTM-DP, DeviceNetTM etc)
• Peer-to-Peer networking configuration
• Data transfer (transmission & receive) definitions

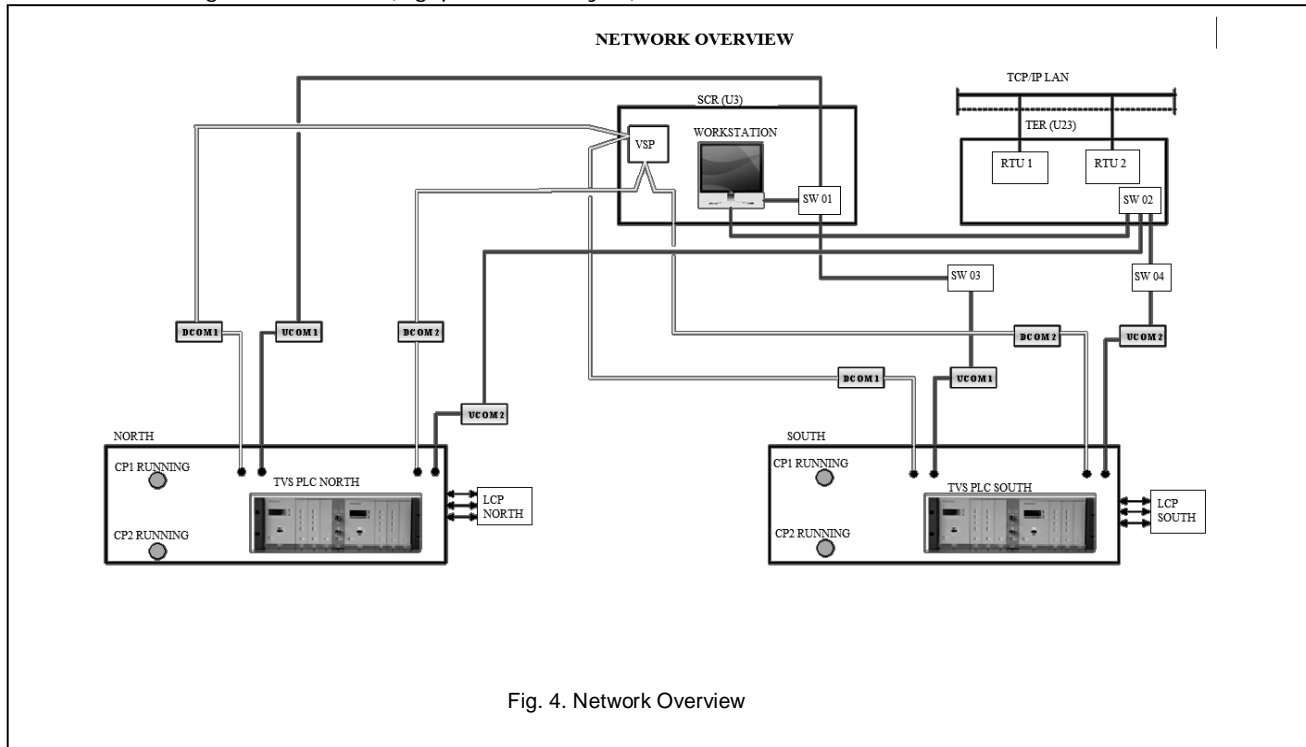• Various network diagnostic features (e.g. protocol analysis)

Fig. 4. Network Overview

5 SAFETY MANAGER

Safety Manager combines Honeywell's proven Quadruple Modular Redundancy (QMR®) 2oo4D technology with extensive process safety management expertise in integrating process safety data, applications, system diagnostics and critical control strategies. It provides the optimal level of safety and process integration while still maintaining functional safety separation as mandated by those standards. Through Experion operational integration, all systems are unified into one architecture, providing a unique opportunity to improve safety, process availability and efficiency.

- The networking capabilities of Safety Manager are unsurpassed. Up to 1024 redundant nodes can be included in one safety network, acting as one integrated safety solution. The SafeNet communication protocol guarantees fast and safe communication over any media and distance.

- The Peer Control Data Interface (PCDI) supports peer-to-peer communication between Safety Manager and the controller over a redundant infrastructure.

- The unique and field-proven QMR diagnostic-based technology with 2oo4D architecture. QMR enhances system flexibility, increases diagnostic messaging capabilities and improves system fault tolerance for critical applications.

6 APPLICATION FIELD OF PLC

PLC is widely applied in all industrial departments in developed countries, which include Steel Industry, automobile industry, electricity industry, construction material industry, metro station. With the development of all kinds of technology, function of PLC has enlarged continuously.

- Logical Control of Switch signal

This is the most important function. The design idea of PLC is logical control of switch signal. For example injection molding machine, printer, grinding machine

- Analog Signal Processing control

PLC can realize digital- analog conversion and analog digital conversion by means of I/O analog module, and finish PID closed loop control. The function is used in some situation as temperature.

- Data Processing

The new PLC possesses mathematical operation function, such as four arithmetic operation of integer, matrix operation, function operation, logical operation of word, complementary operation, shift operation/ and transmit data, then .finish collecting data, analyzing data, processing data.

6 OBSERVATION

MasterLogic-200 Programmable Logic Controllers features Analog and Digital I/O Modules along with special modules like High Speed Counter Module, Position Control Module and Smart I/O Modules. The open communication standards have continuously evolved and so has MasterLogic-200 PLCs

capability to interface with them. In addition to Modbus (Ethernet and Serial), MasterLogic-200 supports several open protocols in control industry standards e.g. DeviceNet™, Profibus™-DP etc.

- LED for channel status indication
- 24V DC Input Modules (8,16,32 and 64 channels) in sink/source or source only type available
- Photo coupler isolation
- Easy maintenance – Terminal block type

Digital Input Modules Features

- Available in 8, 16, 32 and 64 channels
- 110V AC DI cards (16 channels) available
- 220V AC DI cards (8 channels) available

TABLE 1

Item	DC Input*							AC Input	
Type	2MLI-D21A	2MLI-D22A	2MLI-D22B	2MLI-D24A	2MLI-D24B	2MLI-D28A	2MLI-D28B	2MLI-A12A	2MLI-A21A
Input Points	8	16		32			64	16	8
Rated Input Voltage	DC 24V							AC100-120V (50/60Hz)	AC100-240V (50/60Hz)
Rated Input Current	4mA							8mA(AC100,60Hz) 7mA(AC100,50Hz)	17mA(AC200,60Hz) 14mA(AC200,50Hz)
ON Voltage/ Current	DC19V or higher/ 3mA or higher							AC80V or higher/ higher (50Hz, 60Hz)	7mA,AC100,5
OFF Voltage / Current	DC11V or lower/1.7mA or lower							AC30V or higher / 1 mA or lower (50Hz, 60Hz)	
Response Time	Off-> On	1ms/3ms/5ms/10ms/20ms/70ms/100ms : Default:3ms						15ms or less	
	On-> Off	1ms/3ms/5ms/10ms/20ms/70ms/100ms : Default:3ms						25ms or less	
Common (COM)	8 points/Com	16 points/Com		32 points/Com				16 points/Com	8 points/Com
Insolation Method	Photocoupler Isolation								
Current Consumption (mA)	20	30		50		60		30	20
Weight(Kg)	0.1	0.12		0.1		0.15		0.13	0.13

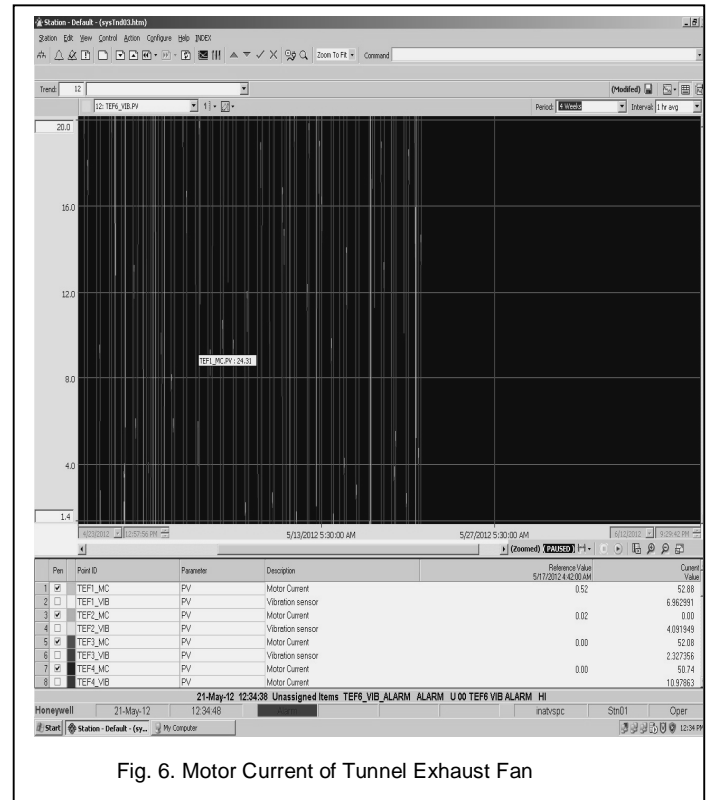Fig. 5. Vibration of Tunnel Exhaust Fan

Fig. 6. Motor Current of Tunnel Exhaust Fan

7 CONCLUSION

PLC has been developing, being improved because PLC was made according to design idea of computer and adaptation of any circumstance of industrial field along with unique and field-proven QMR diagnostic-based technology with increasing diagnostic messaging capabilities and improved system fault tolerance for critical applications.

Therefore when blended with SCADA system, digital communication technology, PLC must ultimately restore to perfect its function, so can match with developing trends of industrial automation.

ACKNOWLEDGMENT

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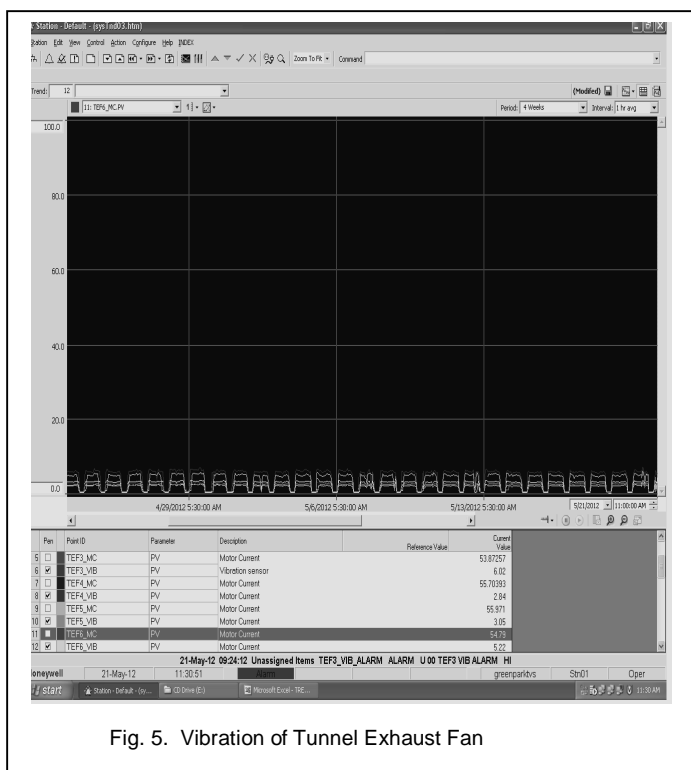
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