PLC/SCADA Based Machine Data Enumerator

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Abstract— The issue of fault analysis is very paramount in any electrical network, therefore we aid in analysis of faults by bringing a continuous parameters analyser of equipment connected in an electrical network. The parameter analyser will help in depicting real time data of the connected machine on to a graph. This graphical representation onto a computer screen will be done with the help of Wonderware **SCADA** using **Intouch software.** This software will be connected through a programmable logic controller (**PLC**). We will be using a Micrologix 1000 series of PLC, with communication software- **RS linx 2.4version** and programming software- **RS logix 500 English.** This PLC will acts a linkage between hardware and our Intouch software of SCADA and with the help of parameters detection troubleshooting in the electrical network can be performed. The basic advantage of automated machine data enumerator is to determine and protect the machine from the various faults such as over current, over voltage etc. An additional benefit of this project is to plot various parameters which describe the complete specifications of connected machinery.

Index Terms-- Automation; PLC; SCADA; Applications of PLC/SCADA; Data Enumerator; Fault Analysis.

I. INTRODUCTION

THE automation is virtually required in industrial engineering so that process will occur faster, safer, cheaper, reliably, and with greater precision. Increased automation is a key for desired increased production. In scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the muscular requirements of work, automation greatly reduces the need for human sensory and mental requirements as well. Processes and systems can also be automated. Automation plays an increasingly important role in the global economy and in daily experience. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities. Many roles for humans in industrial processes presently lie beyond the scope of automation. Human level pattern recognition, language recognition, and language production ability are well beyond the capabilities of modern mechanical and computer systems. In this project we are about to perform similar experiment to make a more reliable setup for industries increasing productivity and efficiency simultaneously.

Intelligent Automation is the combination of Artificial Intelligence and Automation, which is starting to change the scenario of business, in nearly every sector. Intelligent automation systems detect as well as, produce vast amounts of information and automate entire work-flows, processes, learning and innovations. Their areas of application ranges from collecting, analysing and making decisions to guiding autonomous vehicles and robots. It is therefore, helping many companies to achieve unprecedented levels of quality and efficiency. Automation can be achieved very efficiently with the help of programmable logic controller or in short PLC. This PLC is a digital computer used for automation of industrial processes, such as control of machinery on factory assembly lines. 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 or non-volatile memory. This analysis of the parameters will be performed by interlinking of the controller and SCADA. An Enumerator can be termed as a machine, which lists elements of some set S. Also it can be acknowledged as a census taker, used to gather demographic data.

PLC/SCADA Based Machine Data Enumerator is designed to analyze the parameters of electrical machinery by interfacing it with PLC/SCADA (automation) to provide the information regarding its parameters, i.e. voltage variation, current variation, power factor, speed in rpm etc. These parameters would be sufficient to analyse the brief description of the electrical machinery provided. The basic advantage of automated machine data enumerator is to determine and protect the machine from the various faults such as over current, over voltage etc. An additional benefit of this project is that, it provides plot or graphical representations of various parameters, which describe the complete specifications of connected machinery. Inorder, to move ahead towards automation, automatic on/off control of the connected machinery is provided from the SCADA panel. Hence, facilities in terms of user-friendly equipment is provided. Although this system is quite expensive but it can make a huge difference in the field of automation, as it provides a new approach towards human machine intervention.
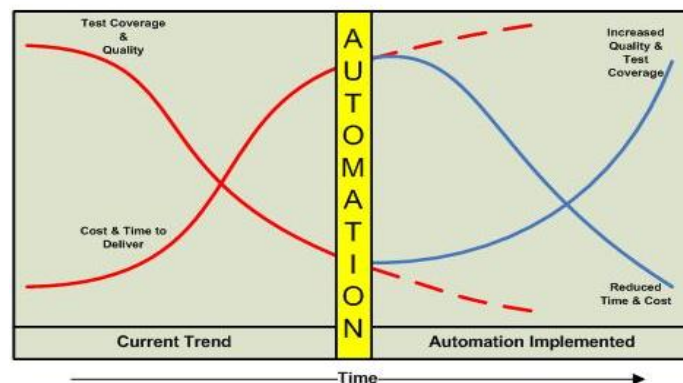

Fig.1: Trends of pre and post effects of Automation in industries

II.   ROLE OF PLC/SCADA IN MACHINE DATA ENUMERATOR

PLC/SCADA has immense role in the automation processes in industries. . A PLC is an example of a real time system since output results must be produced in response to input conditions within a bounded time, otherwise unintended operation will result. The PLC when operated along with computer software like SCADA can show up wonderful results in the field of automation we are to perform one such operation using both PLC and SCADA as a platform to provide real time data of the machinery under operation, which will analyse its parameters and help in preventing the faults caused by over current or over voltages of machine running out of frequency and may more. SCADA stands for Supervisory Control and Data Acquisition. As the name indicates, it is not a full control system, but rather focuses on the supervisory level. As such, it is a purely software package that is positioned on top of hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs) or other commercial hardware modules and perform operations.

A.   Programmable Logic Controllers (PLCs)

According to NEMA (National Electrical Manufacturer Association): "PLC is a digitally operated electronic system, designed specially for the use in industrial environment, which use programmable memory for internal storage of user oriented instructions for implementing specific function such as logic, sequencing, timing, counting & arithmetic to control, through digital & analog inputs & outputs for various types of machines & processes."

PLC possesses numerous advantages over Hardwired panel as they are very time consuming and less adaptive to change. The input and output devices connected to PLC, can easily be modified. Along with that, the programming or control can easily be performed by plant electrician. However, we can deduce that PLC is completely adaptable to function in an industrial environment, over hardwired panels. The applications of PLC in industrial environment   are listed below.

- Control of cutting machine with variable length.
- 3- axes position control.
- Conveyor control
- Elevator control
- Batching Process.
- Level Control

In PLC/SCADA Based Machine Data Enumerator, PLC is serving as an elementary role in analysing the parameters of an electrical machinery. The PLC generally used, is extremely reliable. It have been developed for application in harsh industrial environments. Also, it is designed to operate correctly over wide temperature ranges and in very high electromagnetic noise and high vibration environments, as well.
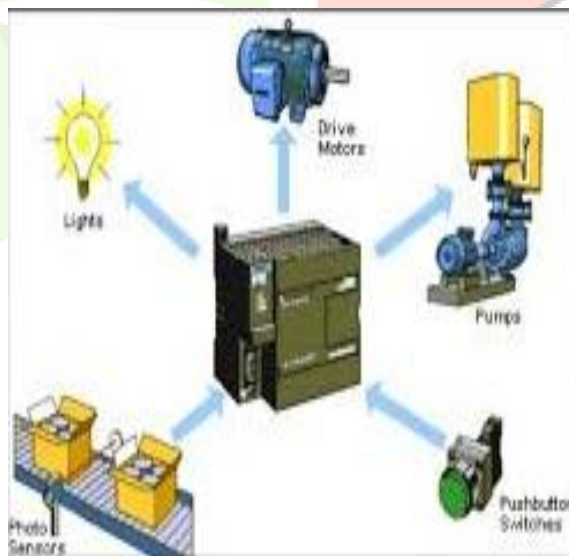

Fig.2: Applications of PLC

B.   Supervisory Control and Data Acquisition (SCADA)

SCADA systems are much efficient, and are utilized to monitor and control a plant or vast machinery connected in industries. These systems include the transfer of data between the SCADA Master Terminal Unit (MTU) and a number of Remote Terminal Units (RTUs) and/or   Programmable Logic Controllers (PLCs), and the MTU to the operator workstations.

Many industries require   many monitoring and control capabilities that SCADA offers. In most cases, SCADA is used to manage a physical process (manufacturing and water processing are common). In other uses of the word "SCADA", a telecom or IT system of communications is being managed instead. The applications of SCADA in industrial environment are listed below.

- Manufacturing
- Food Production
- Electric and Gas Utilities
- Other Supervisory systems
- Waste Water Treatment
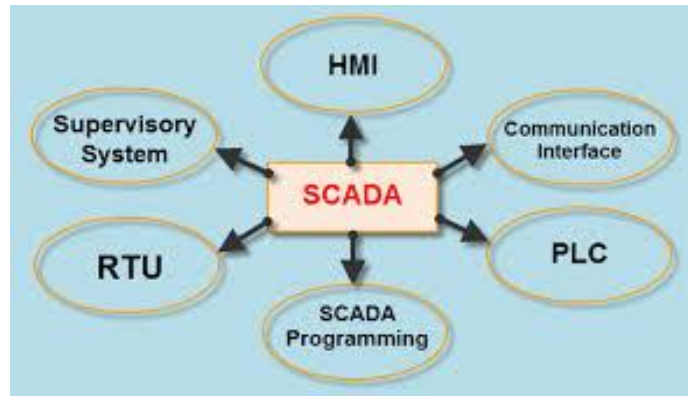- Telecom and Information Technology (IT)

Fig.3: Applications of SCADA in Automation

III.   MECHANISM OF PLC/SCADA BASED MACHINE DATA ENUMERATOR

Automated data enumerator is designed under automation technology with the help of programmable logic controller and software support through supervisory control and data acquisition. In this project a three phase induction motor connected to the power supply acquiring varying parameters which will be kept under supervision so that its parameter fluctuations can be read through a graph. For these parameters to be appearing on a graph SCADA will be operating and the signals provided to SCADA software are through the help of PLC. PLC here is giving the data of machine to the software where it is being read and converted in graphical forms.

Initially the 3 phase supply is connected to a MCB afterwards current transformer is connected in between MCB and contactor. Contactor is further connected to motor. CT further feeds to power transduce. Power transducer lowers the parameters to be read under suitable rating for PLC. Then, finally through communication cable PLC connects with SCADA which reads the data and makes it appear in the graphical form. The data thus obtained, are the real time parameters of the connected equipment, in terms of current, voltage, power, no. of rotations, etc. Here, three phase induction motor is connected as the sample equipment, for better observations any number of equipments can be connected. Along with that, connected equipment can be operated from the Wonderware SCADA software, which serves as another operation towards automation.

Therefore this project can aid in analysis of faults by bringing a continuous parameters analyzer of equipment connected in an electrical network.
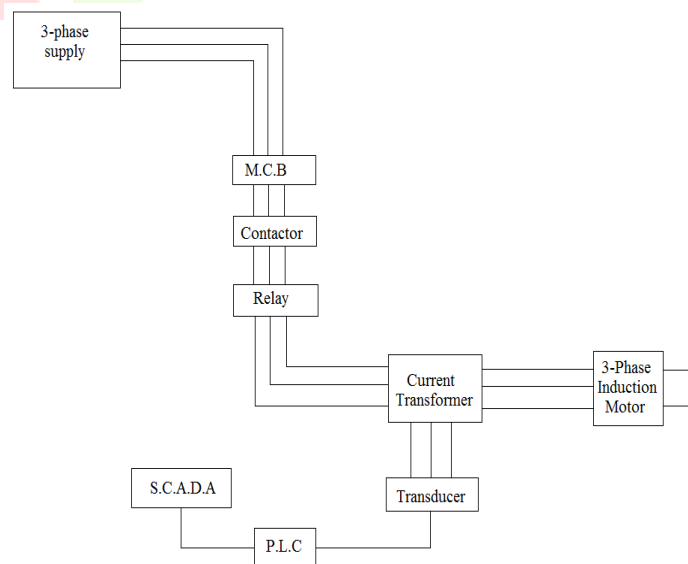

Fig.4: Block Diagram of PLC/SCADA Based Machine Data Enumerator

IV. APPLICATIONS OF PLC/SCADA BASED MACHINE DATA ENUMERATOR

Unlike plant process control system, PLC/SCADA based machine data enumerator helps creating a control system which typically includes a remote telecommunication link. Real time measurements and controls at remote stations are transferred to a CPU through the communication link. Various functions can be performed by this project into use which can be as follows:

- **Building maintenance:** It provides a quick and easy method for creating graphical views of your building monitoring and control systems. Use a common web-enabled user interface to integrate facility functions such as HVDC, lightning, energy, security, fire and elevator giving maintenance personnel and other operators and easy way to display, monitor and control critical key operating parameters in multiple facilities from a single location.

- **Energy:** The energy industry is one of today's most dynamic business environments with decisions being driven by increased regulation, growing demand and escalating costs. Using this project in analysing utility control centres to present a graphical view of the power system and the capability to analyze past and current events as well as to predict potential future issues

- **Manufacturing:** it makes easy to monitor and control multiple floor processes from a single location and have immediate visibility to data trends, making it easy to anticipate potential problems.

- **Water and waste water:** the following water and waste water industries that can be benefited from this project solutions: sanitation system, water utilities, municipalities, distribution, filtration, distillation, remediation, etc. It provides water and waste water processing organizations with powerful real-time data visualization tools to display, monitor and control all the areas of the process.

- **Healthcare:** The following health care industry segments that can benefit hospitals and other health care facilities, drug and pharmaceutical, water purification systems, packaging, medical equipment manufacturing, etc. Offers a data visualization solution that saves time and efficiency supports the overall management of today's health care and pharmaceutical industry.

- **Petrochemical:** The oil, gas and petrochemical companies need to be able to easily manage their daily operations while adhering to regulatory requirements. It enables monitoring and control data at well heads, pumping stations and cooling towers, etc. – between geographically isolated locations from single location. The following oil, gas and petrochemical industries that can benefit from Mobiform data visualisation solutions refiners, logistics, productions, manufactures, suppliers, etc.

V. RESULTS

The figure shown below is the real time data of a three phase induction motor (1/4 HP), when connected to PLC/SCADA Machine Data Enumerator platform. The data is adopted with the help of communication software- **RS linx 2.4version**, programming software- **RS logix 500 English** and **Wonderware SCADA** using **Intouch software.** Smart controlling of the motor can also be performed using pushbuttons and through the software window**.**

Fig.5: Results obtained from three phase induction motor (1/4 HP) using PLC/SCADA Based Machine Data Enumerator

VI. CONCLUSION

The paper presents a discussion on Automation Strategy occurring in various fields, with the advent of PLC/SCADA Based Machine Data Enumerator. Along with its pitfalls in various technical and non-technical themes, with an organized approach to evolve the conceptualization of 'Automation in Industries'. Industrial sector in India is now evolving as the strong pillar of the economy, which hereby, became possible with the introduction of PLC/SCADA to the medieval automation strategies. Use of PLC/SCADA as a tested for development and deployment of parameters of an electrical machinery can serve as a medium to analyze the impact of various faults occurring in our power system. Instead operated on single machinery, when operated over large combination of machinery, building or a large campus, unexpected results in terms of smart and efficient control can be obtained. Along with that detailed characteristics can be obtained of electrical machinery. Though, the system is quite expensive but it can make a huge difference in the field of automation, as it provides a new approach towards human machine intervention.

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