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Supervisory Control and Data Acquisition System (SCADA)

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ABSTRACT

In India, we have huge number of road network which plays an important role in development of a country and provides large number of economic development as well. Main challenge our country faces at current times is road qualities and its maintenance. SCADA system at their fundamental level is Industrial Control System. SCADA has many applications on various disciplines for observing and control in real time. SCADA technologies are widely used in construction industries. Public Works Department (PWD) has made SCADA compulsory in a manner to resolve all quality related issues. This paper describes the SCADA technology implementation in construction field. This paper provides an overview of SCADA, its journey from beginning, functionality of the system, and use of this system. The main challenge this technology faces is nothing but real-time control of power network and their subsequent sections explaining about the development of SCADA system for computerized monitoring and control of power system.

Keywords : Data Acquisition, Information Display, Alarm Processing, Information Storage and Report, Quality Control

I. INTRODUCTION

Definition of SCADA: A collection of equipment that will provide an operator at remote location with enough information to determine the status of a particular piece of equipment or entire substation and cause actions to take place regarding the equipment or network.

What is SCADA?

How: By collecting Information from plant / Load center bend reducing it to the EMS
Where: Control Centre. Both at Plant and Load
Why: To gather Information as here (voltage, current, frequency, power, circuit breaker status) and to perform online actions.

SCADA is a technology that stands for Supervisory Control and Data Acquisition. SCADA system is industrial control system. SCADA system is used to control or monitor one or more field's data to the remote location. SCADA is equipment that will provide all the information to the operator at remote location. This will help to know the condition of the work as well as quality of the work taking place at other field remote location. SCADA system refer to a system consisting of a number of remote terminal units collecting field data connected back to a master station through communications system. The master station displays the gain data and also allows the operator to perform tasks from remote locations. The accurate and timely data allows for hassle free operation of the plant and process. A further benefit is more efficient, reliable and most importantly, safer operations. This all results in a lower cost of operation compared to earlier non-automated systems.

SCADA is used as a quality control system in various sectors such as electric power generation, transmission and distribution, water and sewage, building facilities and environment, manufacturing, mass transit, traffic signals, etc. SCADA system gives data about a system in order to control that system is a SCADA application. Communication plays a major role in SCADA. It collects the data with the help of network; the information is send to the remote location.

SCADA provide the facility to the operator so that they can know the quality of the work ongoing on field. SCADA can do this at low cost with high output which directly cause the increase in profit with optimum use of resources. Similar, SCADA is used as quality control unit on construction industry as on experimental basis by PWD Maharashtra on few sites. The aim of the paper is to know the application of SCADA for quality control in construction field or sites.

II. Methodology

SCADA system is used in construction industries for quality control and easy work done with huge profit. The PWD Maharashtra is implementing the SCADA system for quality control in construction field. Also this is huge beneficial for less time consuming. It also provides cost cutting operations with optimum use of the resources. The study utilizes three important research methods; first, the literature review was to find the use of SCADA in various fields. Second, SCADA system was used in batch mixing plant by contractor of PWD, Maharashtra. The researcher sent three working days onsite, which helped to understand the working procedure of batch mixing plant with SCADA technology. Third, the interview sessions with expert were held to know advantages observed by adopting SCADA technology and barriers occurred during the functional stage of the system at junior engineer office at PWD. The PWD engineers who were using this system would be able to view all the data on remote location, thus, the quality was maintained.

Important features of SCADA:

- Acquire quantitative measurements immediately and over time
- Detect, Diagnose and correct problems as soon as they arise
- Measure trends over time and prepare reports and charts
- Discover and eliminate bottlenecks over time and improve efficiency
- Ability to Control large and complex processes with a few specialized staff.

SCADA System:

SCADA technology has existed since the early sixties and there are now two other competing approaches possible - distributed control system and programmable logic controller. In addition there has been a growing trend to use smart instruments as a key component in all these systems. Distributed control system is another variant of SCADA where data acquisition and control functions are performed by a number of distributed microprocessor-based units situated near to the devices being controlled or the instrument from which data is being gathered. Distribution control system has evolved into systems providing very sophisticated analog control capability. A closely integrated set of operator interfaces (or man machine interfaces) is provided to allow for easy system configurations and operator control. The data highway is normally capable of fairly high speeds. Another variant of SCADA components widely used is the Programmable Logic Controller. These have replaced hardwired relays with a combination of ladder-logic software and solid state electronic input and output modules. They are often used in the implementation of a SCADA Remote Telemetry Units as they offer a standard hardware solution, which is very economically priced.

- Data Acquisition

The systems you need to monitor are much more complex than just one machine with one output. So SCADA system needs to monitor hundreds or thousands of sensors. Some sensors measure inputs into the system and some sensors measure. These are analog sensors, which can detect continuous changes in a current input. Analog sensors are used to track fluid levels in tanks, voltage levels in batteries, temperature and other factors that can be measured in a continuous range of input.

- Data Communication

In real life, you want to be able to monitor multiple systems from a central location, so a communications network is to transport all the data collected from the sensors. Early SCADA networks communicated over radio, modem or dedicated serial lines. Older SCADA systems depended on closed proprietary protocols, but today the trend is to open, standard protocols and protocol mediation. Therefore the remote telemetry unit (RTU) is needed to provide an interface between the sensors and the SCADA network.

- Data Presentation

The only display element in our model SCADA system is the light that comes on when the switch is activated. A real SCADA system reports to human operators over a specialized computer that is variously called a master

station. The SCADA master station has several different functions. The master continuously monitors all sensors and alerts the operator when there is an "alarm" — that is, when a control factor is operating outside what is defined as its normal operation. An advanced SCADA master can add a great deal of intelligence and automation to your systems management, making your job much easier.

- Control

The human operator also has a button on his control panel. When he presses the button, it activates a switch on. Now let's add the full computerized control of a SCADA master unit that controls the entire factory. You now have a control system that responds to inputs elsewhere in the system.

III. CASE STUDY

Location: Nikhil Construction, Manjri, RMC Plant, Pune. SCADA System with sensor remotely monitors the RMC plant. This system gives a warning when the equipment fails or process upsets,. The weight of cement, sand, and aggregates can also be seen on remote location with the help of SCADA. The gates of the control panel would be able to view on SCADA system monitor at remote location.

Please refer below mentioned images for detailed view of SCADA system:

Figure 1. Batch Mixing Details on Monitor

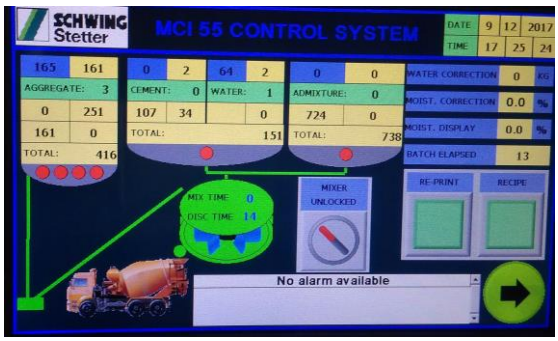

Figure 2. SCADA Control Panel

Figure 3. SCADA Equipment

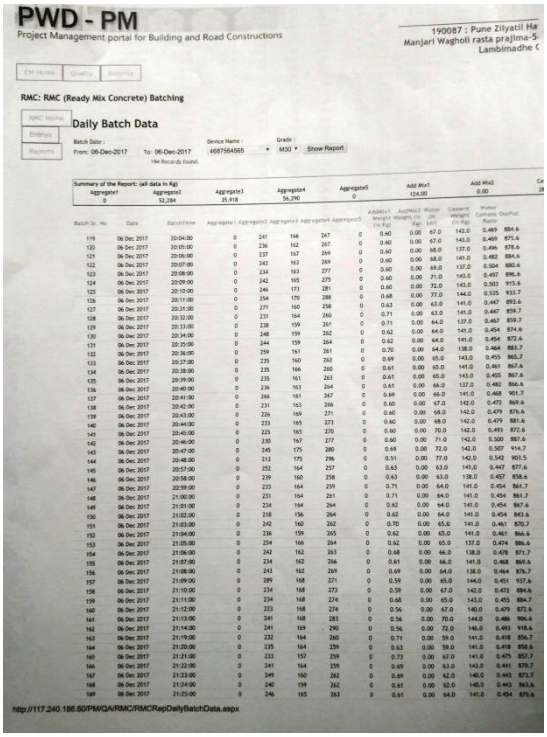

Figure 4. Daily Batch Data

Advantages

- Continues monitoring process
- Real time control
- Automation and protection
- Remote Control & operation

Function of SCADA

- Data calculation
- Information Display
- Alarm processing
- Data acquisition
- Supervisory control

These functions are performed by four kinds of SCADA components:

- Sensors and control relays that directly interface with the managed system.
- Remote telemetry units are small computerized units used in the field at specific sites and locations. These units work as local collection points for collecting reports from sensors and delivering commands to control relays.
- SCADA master units are larger computer consoles that work as the central processor for the SCADA system. Master units provide a human interface to the system and automatically regulate the managed system in response to sensor inputs.
- Communications network that connects the SCADA master unit to the Remote Telemetry Units in the field.

IV. CONCLUSION

Accuracy is achieved by using SCADA technology. It provides future benefits and applications. All the operations can be controlled from a single central location. Therefore, this reduces the dependency on labor force. This technology is easy to operate and can be used in construction industries to avoid delay of work with quality control.

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