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CONTROL SYSTEMS USED IN POWER PLANTS

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ABSTRACT

In this paper, we are exploring the different types of control systems used in industrial settings, and more specifically power generation. Some of the more common control methods involve a DCS (Distributed Control Systems), SCADA (Supervisory Control and Data Acquisition), PLC's (Programmable Logic Controllers) along with others. We will research how each of these systems interact with each other, and gain a better understanding of where and how they are most often used.

KEYWORDS: ***DCS, SCADA, PLC, Control, Systems, Power Generation***

INTRODUCTION

Control Systems are in use everywhere in our society for a multitude of purposes. According to Fauci (1997) "The purpose of the control system is to supervise, control, monitor, schedule, document and record process parameters that are vital to production". What gets produced can range from manufacturing for certain mass produced products, such as novelty consumer items to even the manufacturing of automobiles just to name a few. However, none of this would be possible if it was not for the strides that have been made in power generation, and that is what we are going to be focusing on. What control systems are currently being deployed in the industry setting and how do they differ from more common older methods. Afterwards we will compare some of the strengths and weaknesses for the more prominent control systems.

TYPES OF CONTROL SYSTEMS

Per my research, we have come across several differing types of control systems used in power generation. However, the two main ones that I have encountered has been both DCS (Distributed Control System) and SCADA (Supervisory Control and Data Acquisition). Regarding these two systems, these often-incorporate older methods that took the forefront in industrial control systems in such as PLC's (Programmable Logic Controllers) among many more.

DCS

A DCS (Distributed Control System) according to plantautomation (2018) DCS "are used merely in the innovative emerging process industries as an extension of traditional controllers. The major concept of distributed control systems application is derived from the idea of decentralizing the control unit and establishing a common network between the engineering stations". What this entails is instead of having each controller be the central part of a given process, it instead routes a multitude of differing controllers together, all while having them being connected via a high-speed network such as industrial Ethernet or an equally as fast alternative. Imagine a circuit where every component (in our case a process connected to a controller) is in parallel, where if something was to be changed in one branch it will not affect the others. From this, we often have highly skilled operators who are able to see each collective 'process' or 'processes' as a whole and enact any changes based on what is currently being made by using an onscreen prompt by either a GUI, HMI or a dedicated DCS software. This also allows the operator to log the data, most often to a printer, which usually eliminates any form of human error.

SCADA

Speaking of on screen prompts, that is perhaps what SCADA is best known as. López (2012) best defines SCADA (Supervisory Control and Data Acquisition) as "A SCADA system is a distributed network over large geographic areas where a set of industrial automation services are offered to control the performance and continuity of other critical infrastructures, such as: electric energy systems, nuclear energy systems, water and sewage treatment plants or transportation systems.". For example, Marathon down in Findlay, OH has a SCADA center that allows them to view and monitor the pipelines laid out across America, and this even includes other brands such as BP and others. When comparing SCADA and DCS, they can often overlap with things such as how the operator views the process. However, DCS is more about being process orientated and the processes themselves that undergo changes. SCADA on the other hand is often used as a way to monitor a large spread out geographically location and note any changes, hence the example above regarding Marathon.

PLC's

PLC's (Programmable Logic Controllers) are machines that can be easily programmable and used in an industrial setting. Author (2006) defines them perfectly as "a special form of microprocessor-based controller that uses a programmable memory to store instructions and to implement functions such as logic, sequencing, timing, counting and arithmetic in order to control machines and processes (Figure 1.3) and are designed to be operated by engineers with perhaps a limited knowledge of computers and computing languages.". These PLC's are often used within both SCADA and DCS, more often than note these are actually the 'local controllers' that get attached to the high speed networks which allow operators to view a given process and enact any change that is needed. Before DCS and SCADA, most operations would be accomplishable via just PLC's alone. However, as industries expand and the number of inputs/outputs can reach the thousands we need a multitude of PLC's working together to make a function and efficient manufacturing setting.

HMI

Regarding how the operator enacts changes, I mentioned earlier in the section about DCS's about an operator using GUI's and or DCS specific software. However, regarding PLC's these are often used in a very similar situations to HMI's (Human Machine Interfaces) and how an operator views and read/enacts changes in a certain process. We can almost view DCS/SCADA as a collection of PLC's, and how the operator views these operations is just that of an HMI.

CONCLUSION

These are some of the more common control systems currently being implemented in power generation today. DCS and SCADA both being the most common, which often overlap with more advance and newer systems being developed today. Most of the time, these control systems are often utilizing PLC's in conjunction with other devices such as embedded systems to help control and read/write any changes during their respective processes. Whether that be power generation, water treatment, to even the manufacturing of a consumer product, we can see how they each accomplish a given goal for any given process.

REFERENCES

1. An Overview of Distributed Control Systems | Plant Automation Technology. (2018, May 18). Retrieved May 8, 2019, from https://www.plantautomation-technology.com/articles/an-overview-of-distributed-control-systems-dcs

2. Author, B. W. (2006). Programmable Logic Controllers (Fourth Edition) (4th ed., Programmable Logic Controllers). Elsevier Science Limited. doi:9780750681124
3. Fauci, J. L. (1997). PLC or DCS: Selection and trends (1st ed., Vol. 36, ISA Transactions). Netherlands, Amsterdam: ELSEVIER. doi:https://doi.org/10.1016/S0019-0578(97)00005-0
4. López, J., Setola, R., & Wolthusen, S. D. (2012). Critical infrastructure protection: Information infrastructure models, analysis, and defense. Berlin