MANTECH Publications

Journal of Current Trends in Electrical Engineering
Volume 6, Issue 2, May-August, 2021

A Review of Electrical Automation Applications in Electrical Engineering

Gaurav Patil[1], Harshita Mehta[2]
Student[1], Assistant Professor[2]
Department of Electrical Engineering
SVKM's Dwarkadas J. Sanghvi College of Engineering
Corresponding Authors E-mail: *gpatilgaurav@gmail.com[2]*

Abstract

Automation in electrical engineering refers to the employment of a series of devices with automatic detection and control capabilities to provide real-time or remote control, management, and monitoring of the original electrical system. As a consequence, electrical automation technology has a lot of potential in the field of electrical engineering, and it's worth investigating for electrical installation engineering and scientific research departments. In the real manufacturing process, it is vital to optimize the production mode, decrease costs, and maintain the excellent operating performance of electrical equipment. As a result, in the aim of offering a useful reference, this article briefly discusses the application of electrical automation in electrical engineering.

Keywords: *Electrical engineering, Electrical automation technology, Network technology, Electrical equipment*

INTRODUCTION

In terms of electrical engineering, the centralised process of all system operations is handled by the same processor. As a result, the CPU is under a lot of stress and strain, which affects its efficiency. Furthermore, the number of service objects for electrical equipment monitoring is so enormous that the host must carry a substantial load, forcing the use of more cables, resulting in a rise in investment costs.

Furthermore, the use of long-distance cable will have a direct influence on the dependability and stability of the power system. A problem is more likely to occur when it is subjected to heavy load over an extended length of time. As a result, in the use of automation technology in electrical engineering, the idea of centralised monitoring is the most extensively employed.

The use of remoting may not only minimise the consumption of cable, but it can also save money on investment and increase security and stability. However, because this design increases electrical communication, it is widely utilised in smaller electrical engineering. Figure 1. depicts the fundamentals of automated control.

As the information age evolves, network and computer technologies become increasingly commonly employed. Field bus is a form of network technology, and its use can considerably enhance the targeted design of the system. It may also perform varied functions based on the interval, allowing it to meet the real needs. Based on the benefits of remoting, the concept of field bus may minimise equipment separation, analogue quantity, and terminal cabinet. As a consequence, this approach is extensively employed in the field of electrical engineering, and it is projected to be the future trend in the development of electrical automation.

Figure 1: Basic Automation Control

APPLICATION DIRECTIONS

Protection

The strength of experimental research has evolved to an advanced degree in the field of integrated automation. At the same time, it has clear worldwide leadership in the field of intelligent automation technology security. The hierarchical integrated automation device is suited to power plants with changing voltage levels. In the electric automated protection device, the most recent network communication, artificial intelligence, integrated automatic control theory, adaptive theories, computer new technology, and so on are employed. A new research was undertaken on an electrical system's automated protection concept in order to continually increase its degree of safety, resulting in a novel protection device with the benefit of intelligent control.

Distributed networks

The distribution network for automation technology adheres to the public information model, which is the internationally acknowledged minimum requirement. The transmission network employs a theoretical method that mixes real-world operation with cutting-edge software. The calculation is accomplished in the final step of power flow computation by combining grey neuron algorithms for artificial intelligence into the load forecasting process and utilising the distribution network's recursive virtual-flow algorithms. Some of the major breakthroughs in distribution network automation technology in the distribution system are advanced application software, information distribution network integration, medium and low voltage digital network, and distribution network model, which have effectively solved the carrier in the distribution network of the decline, routing, and other technical problems. The adoption of digital signal processing technologies has greatly enhanced the sensitivity of carrier reception and receiving.

Artificial intelligence

Design planning, operation analysis, and fault detection of power systems and their components are carried out for practical application study on the elements of evolutionary theory, expert systems, and fuzzy logic. The intelligent control and use of power systems are explored in tandem with the development requirements of relevant industries. The study of the aforementioned practical software improves the functioning of the power system and the level of intelligent control.

APPLICATIONS

PLC technology

The use of basic programming to control functioning links is referred to as PLC technology. There aren't many prerequisites for programming. Ordinary technicians who understand the objects and the control needs can control through programming. PLC technology distinguishes itself by its ease of use, easy programming, powerful functionality, flexibility to a wide range of working situations, and cheaper cost than comparable technologies. This indicates that PLC technology offers a low barrier to entry and a wide range of applications. As a result, it is widely employed in a wide range of job settings. Electrical automation uses PLC technology to replace the original controller in order to save costs, boost efficiency, and produce high-quality electrical automation work. Figure 2 depicts the Basic PLC Design Board.

When employing PLC technology, it is critical to pay close attention to the programming. The most critical component in allowing PLC technology to play its own role is the software. Any software flaws will have a substantial influence on electrical automation and the steady operation of electrical engineering.

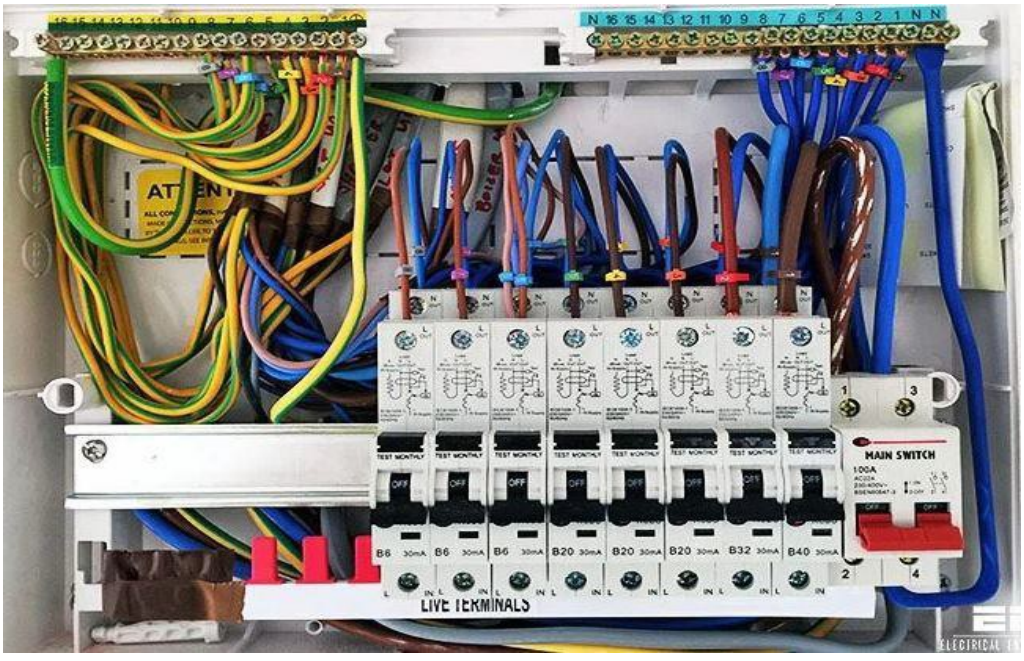

Figure 2: PLC Board Design

Conserving energy

The cost and benefit of production decide whether or not energy-saving and monitoring challenges in electrical engineering construction can be properly addressed. Electrical automation must be expanded in order to accomplish efficient energy savings and monitoring in power plants involved in electrical engineering development. The implementation of electrical automation can analyse the energy consumption status of the power plant's equipment and circuits, and then devise an effective working plan to ensure that the energy-saving concept is reflected throughout the power plant's production process, ensuring good environmental protection benefits while increasing its economic benefit. Based on the actual requirements for decentralised monitoring in the power plant's production process, the introduction of electrical automation can perfect the service function of the monitoring system, improve the control effect in the system's running process, realise the integrated use of monitoring information, and real-time monitoring of the power plant's production process. Furthermore, electrical automation-based monitoring devices may collect data on the performance of the power plant's production equipment, making maintenance easier.

Power grid

The power grid dispatching system is made up of the automatic power plant's point channel, the station end, and the control centre. The key components involved are the power grid dispatching workstation, large screen monitor, and central server. For monitoring reasons, the power plant, power grid dispatching centre, and terminal substation can all be linked to the power system's local area network. Furthermore, automation technology used in electrical engineering can monitor the operation of the power grid at any time, allowing for real-time data gathering and confirmation, as well as validating whether or not the power grid is operational.

Based on data analysis, the power system can load the current power usage, enabling for complete automated operation.

Distributed network

The importance of electrical automation in the distribution system cannot be overstated. Electrical automation's application size must be enlarged to maximise its beneficial impacts. Currently, electrical automation in distribution systems is classified into three types: distribution automation with centralised monitoring, distribution automation with a combination of centralised monitoring and

distribution management, and distribution automation with local control, with the first two being the most common. Both rely on a distributed structure to offer time unification and a dependable link between the substation and the master station, resulting in a highly centralised distribution automation system. The application of electrical automation in distribution systems may aid in the organisation of power information, the execution of efficient and precise distribution operations, and the improvement of power supply dependability and overall electrical engineering efficiency.

ADVANTAGES

Controllability

As a consequence of the country's continuing development and achievement in social economics, science, and technology, breakthroughs in the power sector and power automation technologies have been made. The reliance of automation technology on the growth of many sectors is also growing as the development of contemporary cities intensifies. As a result, electrical automation technology is becoming increasingly important. People are placing more expectations on the controllability of electrical automation systems as electricity becomes more prevalent. Because it is an essential critical connection in the power system, electrical automation technology may collect a large amount of peripheral information. These data must be processed in order to develop an information control management system with high controllability, which boosts the controllability of electrical automation technology and makes the system more stable. Enhancing the controllability of electrical automation can aid in the growth of the power sector while also improving the safety and stability of power system operations.

Protection

The functioning of the electric power system is influenced by a variety of factors, including the complexity of the surroundings, the diversity of equipment, and the non-standard connection of the power supply line. As a result, equipment failure and circuit faults are very likely. Traditional manual monitoring and overhaul are incapable of fully comprehending the operational status of the equipment, offering a variety of potential safety issues. Electrical automation control technology has the ability to safely switch off the power and terminate the operational method, eliminate safety incidents and financial

losses, and ensure the safe operation of electrical equipment when it fails or the circuit becomes unstable.

Integration

Automation technology, which is extensively used in a wide range of businesses and sectors, achieves excellent results. However, due to the complexity of the automation technology process flow, technical researchers optimise and enhance it in order to promote the usage of automation technology in a range of sectors. The most visible change, among other things, is the simplicity of electrical control, measurement, and power protection links. Electrical automation technology optimization and improvement not only improves the quality and efficiency of electrical enterprises' production, but it also significantly reduces the workload of manual production, lowering the error rate of technical operations in the manual production process and, to some extent, lowering the risk of safety accidents in the process.

Production development

The incorporation of the benefits of information technology and computer networks in the development of electrical automation is crucial to the advancement of electrical engineering practice's output level. More specifically, the electrical engineering equipment performance supported by electrical automation can be continuously improved, thereby improving the operating stability of electrical equipment and the production level of electrical engineering practise; the electrical engineering production mode supported by electrical automation can be optimised to provide scientific guidance for the safe implementation of production plans and to continuously raise production.

PROSPECTIVE PRACTICAL APPLICATIONS

Smart grid

The usage of information management systems is one of the most widely used technologies in computer technology. Combining computer technology and electrical automation technology to build an intelligent control technology for the entire grid will result in smart grid technology. Smart grid technologies encompass power generation, transmission and transformation, dispatching, distribution, user and other linkages. The stability control system and the substation automation system are often used in computer technology systems. In some aspects, it may be regarded as a prototype of the present smart grid, and it also lays

the framework for smart grid building. Communication technology, as a smart grid representative, must rely on a wide range of computer technologies during the building process. As a result, reliability, directionality, and real-time performance are essential.

This system necessitates the use of contemporary advanced network connection technology, and its existence is fully dependent on computer technology, therefore it also serves as an information management system.

Openness

Opening is a fundamental strategy for achieving dispatching automation, and it is an inescapable development. The electrical automation structure and the external interface can be coupled to produce the power system movement technology with the network functioning as the carrier. Electrical automation technology can integrate the benefits of computers and simulation technology, create an open technology structure, and meet the application needs of various fields in terms of equipment design and manufacturing, allowing information technology to provide technical support for the development of electrical automation while also playing a practical role.

Substations

The implementation of substation automation is, to some part, based on the evolution of computer technology. Substation automation is necessary, since it is the most fundamental and critical link in the modernisation of power generation. Substation automation is accomplished via the use of computer technology. In this procedure, the computer is completely utilised to accomplish digitalization, networking, and secondary equipment integration. The signal cable completely replaces the computer's optical fibre or power wire. Substation automation is responsible for the computer screen, as well as the automation record statistics and movement management. It also entails operation and monitoring. The success of substation automation can be attributed to the updating of so many components. Transformer substations, as well as transmission and distribution lines, are necessary to link electricity customers and power plants. Automatic substation management is achieved not only to create dispatching automation, but also to meet the demands of diverse substation operations.

Technology based on PLCs

Data collection, analysis, and processing may all be handled by PLC technology, as

well as table checking, sorting, data conversion, computation, bit manipulation, and data distribution. The data gathered and processed can be forwarded to various intelligent devices with communication capabilities to perform some control tasks, compared to the packet's existing reference values, and tabulated for printing. These data may also be utilised in a process control system to manage data from huge control systems, such as a flexible manufacturing system that is autonomous.

Closed-loop process control is the control of continuous-change analogue values in a closed loop, such as flow rate, temperature, and pressure. PLC technology uses an analogue quantity I/O module to enable closed-loop PID control of analogue quantities, as well as D/A and A/D conversion of analogue to digital quantities. A particular PID module or a PID subroutine can be used to control a closed-loop process.

Security

People's living standards have risen dramatically as the national economy has expanded significantly. They are becoming more concerned about their personal security, which raises the bar for product safety and dependability. As a result, security and safety control technologies are being used in the production of electrical automation systems to ensure user security in unsafe settings and to avoid risks to economic property. Furthermore, the electrical automation safety system has secured the safety of electrical automation production while injecting more vitality into its future development as a result of continuous improvement.

CONCLUSION

In short, as science and technology develop, so does people's need for energy. As a result, in order to increase the practical application efficiency of electrical automation technology, power companies must improve their electrical automation technology and power system operating efficiency.

REFERENCES

1. Geng fushun. On the Application of Electrical Automation Technology in Electrical Engineering[J]. Heilongjiang Science and Technology Information, 2016(36):12.
2. John Howard. Artificial intelligence: Implications for the future of work[J]. American Journal of Industrial Medicine, 2019, 62(4):20-31.

3. Luo, Y. (2017) Brief Introduction to the Application of Electrical Automation Technology in Power System. New Communication, No. 1, 105.
4. Vijay Karale and Saurabh Jadhao, “Voltage Sag Mitigation Using Dynamic Voltage Restorer” proceeding of 2nd International Conference on Innovations in Electrical and Electronics Engineering (ICIEEE); pp 184-187, Aug 2015.
5. “Comparative Analysis of Harmonics with and without Shunt Active Power Filter”, Priya Goswami, A. Pachori, IJRREEE, Vol. 2, Issue 2, pp;(156-163), Month: April 2015-June 2015.