ORIGINAL RESEARCH PAPER

Volume-8 | Issue-4 | April-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

INNOVATIONS HAVE INDEED GIVEN INDUSTRIAL AUTOMATION NEW SURGES OF GROWTH

Engineering

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ABSTRACT

Automation is becoming increasingly recognized as the "gateway drug" to digital transformation, particularly among the more advanced practitioners. However, the very fact that its impact is potentially enterprise-wide means it requires a coalition of stakeholders in order to be successful. Intelligent Automation can fundamentally transform a business. However, according to a recent report, 50% of automation programs stall between 4-7 automations in production (read: bots). In industrial automation include increased use of analytics, growing use of PLCs, PACs, and increased cloud-based supervisory control and data acquisition (SCADA) systems. These trends will influence the industrial automation control market, according to a report. The report also predicts that these trends will also result in an eight percent compound annual growth rate (CAGR) for the Asia-Pacific region, but the trends are likely to be seen globally. Automation industry is moving towards a future of unparalleled productivity spurred by superior energy efficiency, better design and operator visualization, and rigorous safety standards. Industrial automation would be good enough as every technology is involved with automation techniques. It is the use of various control devices such as PC's, DCs, and PLCs to control various operations of an industry without significant intervention from humans and to provide automatic control performance. In industries, there would be a set of technologies that are implemented to get the desired performance or output, making the automation systems most essential for industries. On the other hand, industrial automation involves usage of advanced control strategies such as cascade controls, control hardware devices and other instruments for sensing the control variables etc.

KEYWORDS

PLC (Programmable Logic Controller), PAC (Programmable Automation Controller), SCADA (Supervisory Control And Data Acquisition), PC (Personal Computer) and DC (Distribution Center).

INTRODUCTION:

Industrial Automation provides state-of-the-art automated solutions for the automotive, medical, computer and electronics, telecommunications, consumer goods, and other industries across North America. Our experience and expertise in designing, developing and building high-quality, cost-effective automated solutions can provide us with a competitive advantage.

Automation helps us to compete better by allowing us to increase productivity, flexibility and quality. By automating repetitive manual tasks, our workers can perform more specialized tasks, providing us with better productivity and in some cases, opportunities to expand our product offering. Automation also helps reduce or eliminate human error, which in turn reduces the cost of error recovery and increases the overall quality of our product.

The Most Used Guiding Force Behind an Automated Industrial Plant is a "Programmable Logic Controller" generally known as a PLC. PLCs Along with certain other necessary ingredients like Sensors, Motors, Actuators, Valves, Conveyors, Boilers, SCADA Systems, Computers & Many More, Makes A Real Automated Manufacturing Plant.

HIERARCHY OF AN INDUSTRIAL AUTOMATION SYSTEM

Industrial automation systems can be very complex in nature, having large number of devices working in synchronization with automation technologies. The figure below describes the hierarchical arrangement of the automation system consisting of different hierarchical levels.

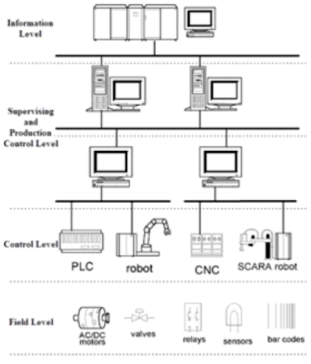

Figure 1: Hierarchical arrangement of the automation system

FIELD LEVEL

It is the lowest level of the automation hierarchy which includes the field devices like sensors and actuators. The main task of these field devices is to transfer the data of processes and machines to the next higher level for monitoring and analysis. And also it includes the controlling of process parameter through actuators. For instance, we can describe this level as eyes and arms of a particular process.Sensors convert the real time parameters like temperature, pressure, flow, level, etc., into electrical signals. This sensor data further transferred to the controller so as to monitor and analyse the real time parameters. Some of the sensors include thermocouple, proximity sensors, RTDs, flow meters, etc., On other hand actuators converts the electrical signals (from the controllers) into mechanical means to control the processes. Flow control valves, solenoid valves, pneumatic actuators, relays, DC motors and servo motors are the examples of actuators.

CONTROL LEVEL

This level consists of various automation devices like CNC machines, PLCs, etc., which acquires the process parameters from various sensors. The automatic controllers drive the actuators based on the processed sensor signals and program or control technique. **Programmable Logic Controllers (PLCs)** are most widely used robust industrial controllers which are capable of delivering automatic control functions based on input from sensors. It consists of various modules like CPU, analog I/O, digital I/O and communication modules. It allows the operator to program a control function or strategy to perform certain automatic operation on process.

SUPERVISING AND PRODUCTION CONTROL LEVEL

In this level, automatic devices and monitoring system facilitates the controlling and intervening functions like Human Machine Interface (HMI), supervising various parameters, setting production targets, historical archiving, setting machine start and shutdown, etc.Mostly, either Distribution Control System (DCS) or **Supervisory Control and Data Acquisition (SCADA)** HMIs are popularly used in this level.

INFORMATION OR ENTERPRISE LEVEL

This is the top level of the industrial automation which manages the whole automation system. The tasks of this level include production planning, customer and market analysis, orders and sales, etc. So it deals more with commercial activities and less with technical aspects. And also industrial communication networks are most prominent in industrial automation systems which transfer the information from one

level to the other. So these are present in all the levels of automation system to provide continuous flow of information. This communication network can be different one level to the other. Some of these networks include RS485, CAN, Device Net, Foundation Field bus, etc.,

From the above hierarchy we can conclude that there is continuous information flow from high level to low level and vice-versa. If we assume this graphical way, it is like a pyramid in which as we go up, the information gets aggregated and while going down, we get detailed information about the process.

INDUSTRIAL AUTOMATION:

Industrial automation is the use of control systems, such as computers or robots, and information technologies for handling different processes and machineries in an industry to replace a human being. It is the second step beyond mechanization in the scope of industrialization.

Automation is basically the delegation of human control function to technical equipment. It is the use of control systems such as computers, PLCs, Microcontrollers to control machinery and processes to reduce the need for human sensory and mental requirements as well.

Industrial Automation i.e. to "Automate Industry" is the basic need of almost every type of manufacturing and production unit today. Food/ Beverage, Metal, Mining, Power, Textile, Petrochemical, Machine Manufacturing, Automobile etc., are the few examples where we see the automation today. The automation industry does NOT extrapolate to smaller and cheaper PLCs, DCSs, and supervisory control and data acquisition systems; those functions will simply be embedded in hardware and software. Instead, future growth will come from totally new directions.

AUTOMATION STRATEGY MUST ALIGN WITH BUSINESS AND OPERATIONS STRATEGY

Automation can achieve four key objectives: improving worker safety, reducing costs, improving quality and increasing flexibility. Automation may deliver improvements in all these areas, but the balance of benefits may vary with different technologies and approaches. The right balance for any organization will depend on its overall operations strategy and its business goals.

AUTOMATION PROGRAMS MUST START WITH A CLEAR ARTICULATION OF THE PROBLEM

It's also important that this includes the reasons automation is the right solution. Every project should be able to identify where and how automation can offer improvements and show how these improvements link to the company's overall strategy.

AUTOMATION MUST SHOW A CLEAR RETURN ON INVESTMENT.

Companies, especially large ones, should take care not to over specify, overcomplicate, or overspend on their automation investments. Choosing the right level of complexity to meet current and future needs requires a deep understanding of the organization's processes and manufacturing systems.

NEW TECHNOLOGY DIRECTIONS

Industrial automation can and will generate explosive growth with technology related to new inflection points: nanotechnology and nanoscale assembly systems; MEMS and nanotech sensors (tiny, low-power, low-cost sensors) which can measure everything and anything; and the pervasive Internet, machine to machine (M2M) networking. Real-time systems will give way to complex adaptive systems and multi-processing. The future belongs to nanotech, wireless everything, and complex adaptive systems.

Major new software applications will be in wireless sensors and distributed peer-to- peer networks – tiny operating systems in wireless sensor nodes, and the software that allows nodes to communicate with each other as a larger complex adaptive system. That is the wave of the future.

THE FULLY-AUTOMATED FACTORY

Automated factories and processes are too expensive to be rebuilt for every modification and design change – so they have to be highly configurable and flexible. To successfully reconfigure an entire production line or process requires direct access to most of its control elements – switches, valves, motors and drives – down to a fine level of detail.The vision of fully automated factories has already existed for some time now: customers order online, with electronic transactions that negotiate batch size (in some cases as low as one), price, size and colour; intelligent robots and sophisticated machines smoothly and rapidly fabricate a variety of customized products on demand.

The promise of remote-controlled automation is finally making headway in manufacturing settings and maintenance applications. The decades-old machine-based vision of automation – powerful super-robots without people to tend them – underestimated the importance of communications. But today, this is purely a matter of networked intelligence which is now well developed and widely available.

Communications support of a very high order is now available for automated processes: lots of sensors, very fast networks, quality diagnostic software and flexible interfaces – all with high levels of reliability and pervasive access to hierarchical diagnosis and error-correction advisories through centralized operations.

The large, centralized production plant is a thing of the past. The factory of the future will be small, movable (to where the resources are, and where the customers are). For example, there is really no need to transport raw materials long distances to a plant, for processing, and then transport the resulting product long distances to the consumer. In the old days, this was done because of the localized know-how and investments in equipment, technology and personnel. Today, those things are available globally.

TYPES OF INDUSTRIAL AUTOMATION SYSTEMS

Figure 2.

1. FIXED OR HARD AUTOMATION

This type of automation is employed to perform fixed and repetitive operations in order to achieve high production rates. It uses special purpose or dedicated equipment to automate the fixed sequence assembling or processing operations. Once it is employed, it is relatively hard to change or vary the product design. Therefore, it is inflexible in providing product variety, but increases the efficiency with higher production rate and reduces unit cost.

Figure-3

Some of these automated systems are distilled process, paint shops and conveyors.

2. PROGRAMMABLE AUTOMATION

In this automation, a specific class of product changes and also assembling or processing operations can be changed with the modification of control program in the automated equipment.

This automation is best suited for batch production process where product volume is medium to high. But in this, it is hard to change and reconfigure the system for a new product or sequence of operations. Therefore, new product or reconfigure of sequence of operations requires a long setup.

Examples of this automation system are numerically controlled machines, paper mills, steel rolling mills, industrial robots, etc.

Figure 4

3. FLEXIBLE OR SOFT AUTOMATION:

This automation system provides the automatic control equipment that offers a great flexibility for making changes in the product design. These changes can be performed quickly through the commands given in the form of codes by the human operators.

This automation allows the manufacturers to produce multiple products with different ranges as a combined combination process rather than separate.

Figure 5.
Some of the examples of this automation system are automatic guided vehicles, automobiles, and multipurpose CNC machines.

LATEST TRENDS IN INDUSTRIAL AUTOMATION:

Latest trends in industrial automation include increased use of analytics, growing use of PLCs, PACs, and increased cloud-based supervisory control and data acquisition (SCADA) systems. These trends will influence the industrial automation control market, according to a report. The report also predicts that these trends will also result in an eight percent compound annual growth rate (CAGR) for the Asia-Pacific region, but the trends are likely to be seen globally. Automation industry is moving towards a future of unparalleled productivity spurred by superior energy efficiency, better design and operator visualization, and rigorous safety standards.

FUTURE SCOPE OF INDUSTRIAL AUTOMATION:

Future scope of industrial automation would be good enough as every technology is involved with automation techniques. It is the use of various control devices such as PC's, DCs, and PLCs to control various operations of an industry without significant intervention from humans and to provide automatic control performance. In industries, there would be a set of technologies that are implemented to get the desired performance or output, making the automation systems most essential for industries. On the other hand, industrial automation involves usage of advanced control strategies such as cascade controls, control hardware devices and other instruments for sensing the control variables etc.

ADVANTAGES OF INDUSTRIAL AUTOMATION:

Lower operating cost:

Industrial automation eliminates healthcare costs and paid leave and holidays associated with a human operator. Further, industrial automation does not require other employee benefits such as bonuses, pension coverage etc. Above all, although it is associated with a high initial cost it saves the monthly wages of the workers which leads to substantial cost savings for the company. The maintenance cost associated with machinery used for industrial automation is less because it does not often fail. If it fails, only computer and maintenance engineers are required to repair it.

HIGH PRODUCTIVITY:

Although many companies hire hundreds of production workers for a up to three shifts to run the plant for the maximum number of hours, the plant still needs to be closed for maintenance and holidays. Industrial automation fulfils the aim of the company by allowing the company to run a manufacturing plant for 24 hours in a day ,7 days in a week and 365 days a year. This leads to a significant improvement in the productivity of the company.

High Quality:

Automation alleviates the error associated with a human being. Further, unlike human beings, robots do not involve any fatigue, which results in products with uniform quality manufactured at different times.

High flexibility:

Adding a new task in the assembly line requires training with a human operator, however, robots can be programmed to do any task. This makes the manufacturing process more flexible.

High Information Accuracy:

Adding automated data collection, can allow you to collect key production information, improve data accuracy and reduce your data collection costs. This provides you with the facts to make the right decisions when it comes to reducing waste and improving your processes.

High safety:

Industrial automation can make the production line safe for the employees by deploying robots to handle hazardous conditions.

DISADVANTAGES OF INDUSTRIAL AUTOMATION:

High Initial cost:

The initial investment associated with the making the switch from a human production line to an automatic production line is very high. Also, substantial costs are involved in training employees to handle this new sophisticated equipment.

ROLE OF ENGINEERS IN INDUSTRIAL AUTOMATION:

Designing of the Automation System Erection and Commissioning, Maintenance and Troubleshooting of existing system.

Job Prospect for Fresher: Today management of almost all manufacturing units are going for industrial automation to survive in globally competitive market. Most of these industrial units are looking forward for trained engineers in the field of industrial automation. Since they are thinking about more accuracy, productivity in less time & with minimum man power, It's a golden opportunity to prepare yourself to take on this task.

Job prospects for Engineers in Industrial Automation: Manufacturing Industries like Reliance, Ceat, Godrej, Colgate …. Automation Solution Products manufacturer/developer like Rockwell, Siemens, Schneider, Yokogawa, ABB System Integrators for Schneider Rockwell, Siemens, etc., Consultants for Automation.

Current Situation: Automation is a high growth sector globally hence it is essential to all professionals and students to have practical knowledge about the hardware and software used in Industrial Automation.

CONCLUSION:

In industrial automation has been rising since 1947 and most of the industries including automation are using PLCs and install control systems to reduce the manual labour and improve the precision and efficiency. PLCs are very popular because of their precision. Industrial automation has recently found more and more acceptance from various industries because of its huge benefits, such as, increased productivity, quality and safety at low costs.

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