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VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
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CONTENTS

VISION AND MISSION

DEPARTMENT VISION

To impart excellent education to provide globally competent Electronics and Instrumentation Engineers.

To establish Centre of Excellence and Research in Electronics and Instrumentation Engineering and allied fields.

DEPARTMENT MISSION

To prepare competent Electronics and Instrumentation Engineers who can pursue professional career and/or higher studies.

To promote excellence in teaching with academically good ambiance that allows the learners to be socially responsible with professional ethics.

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Harashitha Malempati
228W1A1035
EIE- IV B-Tech

Ch mounika
228W1A1010
EIE- IV B-Tech

N.N.L.Mounika
238W1A1049
EIE- III B-Tech

Sd.husna Bano
238W1A1060
EIE- III B-Tech

K. Aashritha
24EU07092
EIE- II B-Tech

B. DurgaPrasad
24EU07077
EIE- II B-Tech

From the HOD's desk

Work hard at what you like to do and try to overcome all obstacles

Laugh at your mistakes and praise yourself for learning from them

I am having immense pleasure to note that this year's edition of "**ICSARIA-VISION**" is ready to release. I would like to congratulate the team of active students and faculty leadership for their efforts to ram-up various department activities under the aegis of department association.

The department conducts many programs aimed to nurture a professional interest towards the domain of study among all members of the department and "**ICSARIA-VISION**" is one of the means to publish various creative articles and news which reflects state-of-the art.

Technology related developments are there in the field of robotics, Iot, machine learning, automotive electronics, healthcare and so on which are closely linked with the common man's life.

Plenty of opportunities as well as challenges are awaiting. Hope that "**ICSARIA-VISION**" could be a platform for both students and faculty members to conduct fruitful discussion on all these breakthrough developments. Let us strive together for a greener, technically enriched better India!

As an Instrumentation and Control Engineers, it is the need of the time to follow these changes and understand the state-of-the art technology in order to be updated in the domain.

I wish that, this endeavor is a humble beginning in this direction and wish all the success.

WHY A SUCCESSFUL MODERN MANUFACTURING CAREER HINGES ON A CONNECTED WORKER MODEL

NAME : HARSHITHA MALEMPATI
ROLL NO : 228W1A1035
CLASS : IV- EIE

The threat of ongoing workforce shortages hangs over the manufacturing industry, with experts predicting a shortfall of 1.9 million workers by 2033 if the talent deficit continues. Yet as the industry moves toward more and more AI-enabled digitization, connected workers are stepping up to the plate to merge human expertise with technological progress.

To see how this development will impact manufacturing companies, let's explore how connected worker technology can uplift the four key stages of the career lifecycle: recruitment, retention, retraining and retirement. The benefits are huge, creating a more resilient and dynamic workforce.

1. Find talent that fits the fabric of the factory during recruitment

Recruitment is the first stage in the lifecycle model as it not only sets the tone for long-term retention, but also job satisfaction. At this stage it’s not just about finding candidates with the right qualifications, it’s equally important to identify motivated individuals who align with the company’s values and culture. But how can this be put to the test?

Set employee expectations from the get-go

During the screening process, which extends to the first week on the job, companies can leverage connected worker technology to set realistic job expectations and demonstrate their commitment to employee development. Digital work instructions, for instance, can outline typical examples of expected tasks and showcase factory safety protocols to prospective candidates.

This use of a key frontline-focused technology signals the company’s investment in its workforce and helps candidates feel confident that they would be valued and supported in their potential role. These factors are particularly critical in today’s competitive labor markets, where a company’s ability to position itself as forward-thinking and employee-centric are key differentiators.

2. From first day candidates to long-term fit–the crucial retention stage

Once hired, the focus shifts to employee onboarding and retention, which is important in the current skills climate. The aim of the retain stage is to ensure new employees feel supported from day one and are able to develop the knowledge and skills necessary to meet performance expectations.

As new starters get to grips with tasks, digital work instructions can provide a digital record of tasks completions and interactions to help supervisors see where employees might be struggling and require additional training. But this approach doesn't overlook the importance of worker autonomy.

A connected worker platform provides employees with the pull-based learning tools to find answers on their own or reach out for help when needed. If an employee encounters a problem, such as a machine malfunction, they can log the issue and request assistance from the company's collective knowledge base that spans different shifts and departments. Unlike in a traditional setting where the employee experiencing the issue might need to wait until the next day to seek help, they can instead troubleshoot in real time and benefit from a broader pool of expertise that would otherwise be inaccessible at the moment of need. This "lifeline" ensures that workers feel less isolated and intimidated when they hit the shop floor, helping them feel better prepared.

Discover the unsung workplace heroes

But what about top-performing employees? According to a recent study, 71% of employees would be more likely to stay on at a company if they felt recognized. So how is this possible with a connected worker? Digital work instructions can track skills and certifications to help managers easily identify reward opportunities, such as pay rises and shift upgrades, for employees that excel on the factory floor. This approach allows for a more tailored and continuous development process, which leads to better employee engagement and lower turnover rates.

3. Help employees stay at the top of their game with skill refreshers

As industries evolve and technologies advance, it's essential that all employees, regardless of tenure, keep their skills up to date. The retraining stage is more than just meeting baseline expectations, it's about maintaining and improving operational efficiency by ensuring continuous improvement across the entire workforce. This can sometimes be hard for experienced workers to accept when they feel they already "know it all," so it requires a strategic approach to engage workers in the process of learning new methods and adopting new technologies.

Collective action keeps workers onboard with changes

Resistance is often a challenge during the retrain stage but this is where a connected worker platform comes in. Instead of pushing new information onto the workforce, connected worker solutions allow for a "pull" dynamic, where experienced employees share their opinions, feedback, and suggestions in discussions about standard operating procedures and continuous improvement initiatives.

A Kaizen event is one such example of a structured, team-driven initiative that focuses on improving a specific area of production. It involves gathering diverse perspectives—from engineers, operators, and even sales—to analyze a problem and brainstorm the best possible solutions. When a new procedure is agreed upon and formalized, new work instructions and associated skill certifications can then be issued across the workforce to ensure everyone receives consistent information, and supervisors can confirm that all team members are not only aware of but also trained in the new standards.

These company-wide discussions ensure employees feel valued and directly involved in factory processes but also help to gather valuable insights from those who have extensive experience. Additionally, the collaborative nature of connected worker solutions can help build consensus around new standards, which makes it easier to implement changes without resistance.

4. Capture valuable knowledge before it walks out the door

In the retire stage, employees have accumulated years of experience and expertise, which makes them hugely valuable assets for knowledge transfer. Instead of letting insights and lessons learned walk out the door when employees retire, it's up to companies to add these to the organization's collective knowledge base and use it to inform future recruitment and training efforts.

Insights in, growth out–master the art of continuous learning

Connected worker platforms can play a crucial role in helping companies capture and preserve the knowledge of retiring employees. Interviews or knowledge-sharing sessions with these valuable employees can ensure insights are recorded and integrated into training materials. Connected worker solutions can also preempt this step by asking employees nearing retirement to document their best practices, insights, and personal experiences. This not only helps to retain valuable knowledge but strengthens the workforce at every stage of the connected worker lifecycle.

Career progression isn't a straight line–learn to adapt at every stage

The lifecycle of a connected worker may be described in sequential stages—recruit, retain, retrain and retire—but in reality, it's far from a linear process. Instead, it forms a continuous loop supported by connected worker technology that ensures the constant growth, development, and improvement of the workforce.

Workers may find themselves in different stages of the lifecycle simultaneously, depending on their skills, tasks, or the specific demands of their roles. An operator for instance, might be in the retrain stage for a new process but in the retain stage for their expertise with a different machine. This dynamic flow between stages highlights the flexibility required for true continuous improvement in the workplace.

A connected worker solution is uniquely suited to accommodate this non-linear progression, enabling workers to seamlessly access the resources they need, no matter where they are in the lifecycle. It also empowers workers to take control of their learning, while organizations benefit from a more agile, informed, and connected workforce.

The power of workforce connectivity

Digital-first manufacturing organizations that place workers at the center of their own career development and empower them with connected worker technology at every lifecycle stage, can turn the tide on today's skills shortage. Particularly when it comes to boosting recruitment efforts, increasing retention, nurturing a culture of continuous improvement, and preserving valuable knowledge from retiring employees, the manufacturers that take the time

to connect learning milestones will strengthen their workforce and guarantee themselves a more resilient future over their competitors.

THE AGENTIC PROCESS AUTOMATION SYSTEM

NAME : SD.HUSNA BANO
ROLL NO : 238W1A1060
CLASS : III- EIE

The Agentic Process Automation System (APAS) is an advanced automation solution that leverages artificial intelligence (AI) agents to create flexible, responsive workflows capable of completing tasks without human intervention. Here's a detailed explanation:

1. Introduction

Agentic Process Automation (APA) represents an evolution in Intelligent Automation, enabling orchestrated, autonomous execution of complex, multi-step processes that involve planning and decision-making. Unlike traditional automation, which relies on predefined rules and human direction, APA is a dynamic solution that autonomously navigates real-world workflows.

2. Key Components of APA

- **AI Agents**: These agents are capable of executing complex tasks without continuous human supervision. They interact with business applications, manage APIs, and orchestrate workflows across enterprise systems and teams.
- **Generative AI**: APA leverages generative AI to adapt to changing conditions and unexpected scenarios. This allows the system to handle cognitive tasks and make context-aware decisions.
- **Data Inputs**: APA systems ingest and analyze real-time data through machine learning and natural language processing (NLP) to identify patterns, predict outcomes, and make informed decisions.

3. Benefits of APA

- **Increased Efficiency**: APA reduces the need for human intervention in automated processes involving cognitive tasks, resulting in more efficient workflows.
- **Enhanced Flexibility and Adaptability**: APA introduces adaptability to automated workflows, ensuring that business processes remain optimized even as variables fluctuate.

- **Reduced Errors**: By automating tasks and reducing human intervention, APA minimizes errors and improves overall accuracy.
- **Real-Time Decision-Making**: APA enables real-time intelligent decision-making, allowing businesses to respond quickly to changing conditions.

4. Applications of APA

- **Supply Chain Management**: APA can analyze real-time data, identify potential disruptions, and proactively reroute resources to maintain operational efficiency.
- **Customer Service**: APA can enable live and virtual agents to resolve cases faster and improve customer satisfaction.
- **Finance and Accounting**: APA can streamline processes, accelerate cash flow, and maintain compliance while eliminating risks.
- **IT Operations**: APA can automate time-consuming IT processes and eliminate digital bumps in the road.

5. Implementation Steps

1. **Assessment**: Evaluate the current state of automation within the organization and identify areas for improvement.
2. **Planning**: Develop a comprehensive plan to implement APA, including defining goals, setting metrics, and establishing governance policies.
3. **Execution**: Implement APA systems, integrating AI agents, generative AI, and data inputs to automate complex workflows.
4. **Evaluation**: Continuously assess the effectiveness of APA and make adjustments as needed to ensure optimal performance.

6. Conclusion

The Agentic Process Automation System is a powerful tool for organizations looking to enhance their automation capabilities. By leveraging AI agents and generative AI, APA enables businesses to handle complex, dynamic workflows with increased efficiency, flexibility, and accuracy.

PREDICTING CARDIOVASCULAR EVENTS THROUGH SKIN BLOOD FLOW ANALYSIS

NAME : D. THRILOKYA
ROLL NO : 24EU07082
CLASS : II- EIE

Predicting cardiovascular events through skin blood flow analysis is an emerging field that leverages the relationship between skin blood flow and overall cardiovascular health. Here's a detailed explanation:

1. Introduction

Cardiovascular diseases (CVDs) are a leading cause of morbidity and mortality worldwide. Early detection and prediction of cardiovascular events, such as heart attacks and strokes, are crucial for timely intervention and prevention. Skin blood flow analysis has shown promise as a non-invasive method for assessing cardiovascular health and predicting potential events.

2. Mechanisms of Skin Blood Flow Analysis

Skin blood flow is regulated by the autonomic nervous system and can be influenced by various factors, including temperature, stress, and physical activity. Techniques such as laser Doppler flowmetry, laser speckle imaging, and thermal imaging are used to measure skin blood flow and assess vascular function2. These methods provide insights into the microcirculation and overall cardiovascular health.

3. Relationship Between Skin Blood Flow and Cardiovascular Health

Research has shown that skin blood flow can serve as an indicator of cardiovascular health. Reduced skin blood flow is associated with conditions such as peripheral artery disease (PAD), which is characterized by impaired blood flow to the extremities3. PAD is a significant risk factor for cardiovascular events, and monitoring skin blood flow can help identify individuals at risk.

4. Applications in Predicting Cardiovascular Events

- **Early Detection**: Skin blood flow analysis can be used to detect early signs of cardiovascular dysfunction, allowing for timely intervention and management.
- **Risk Stratification**: By assessing skin blood flow, healthcare providers can stratify patients based on their risk of cardiovascular events, enabling personalized treatment plans.
- **Monitoring Treatment Efficacy**: Skin blood flow analysis can be used to monitor the effectiveness of interventions, such as lifestyle changes, medications, and surgical procedures.

5. Challenges and Considerations

- **Technological Limitations**: Current techniques for measuring skin blood flow may have limitations in terms of accuracy, resolution, and accessibility.
- **Standardization**: There is a need for standardized protocols and guidelines for skin blood flow analysis to ensure consistency and reliability across different studies and clinical settings.
- **Integration with Clinical Practice**: Incorporating skin blood flow analysis into routine clinical practice requires education, training, and acceptance by healthcare providers.

6. Future Directions

- **Advancements in Technology**: Continued research and development of advanced imaging techniques and sensors will improve the accuracy and reliability of skin blood flow analysis.
- **Integration with AI and Machine Learning**: AI-based models can analyze large datasets and identify patterns that may not be apparent through traditional methods, enhancing the predictive power of skin blood flow analysis.
- **Multimodal Approaches**: Combining skin blood flow analysis with other biomarkers and clinical data can provide a more comprehensive assessment of cardiovascular health.

Conclusion

Predicting cardiovascular events through skin blood flow analysis is a promising approach that offers non-invasive, real-time insights into cardiovascular health. By leveraging advanced imaging techniques and integrating AI-based models, this method has the potential to improve early detection, risk stratification, and treatment monitoring for cardiovascular diseases.

Open Automation Systems – Update on the State of the Art

Name : **Ch Mounika**
Roll No : **228W1A1010**
Class : **IV- EIE**

Open Automation Systems (OAS) represent a significant shift in industrial automation, moving away from proprietary, closed systems towards more flexible, interoperable, and standardized solutions. Here's a detailed explanation:

1. Introduction

Open Automation Systems aim to create a more integrated and flexible manufacturing environment by leveraging open standards and technologies. This approach allows for seamless communication and interoperability between different devices, systems, and software, ultimately leading to increased efficiency, reduced costs, and enhanced innovation.

2. Key Components of Open Automation Systems

- **Standardized Communication Protocols**: Open systems use standardized communication protocols, such as OPC UA (Unified Architecture), to ensure seamless data exchange between devices and systems from different vendors.

- **Decoupled Software and Hardware**: Automation software is designed to be independent of the hardware it runs on, allowing for greater flexibility and easier integration of new technologies.
- **Modular Architecture**: Open systems are built using modular components that can be easily replaced or upgraded, reducing downtime and maintenance costs.
- **Event-Driven Architectures**: These architectures enable real-time data processing and integration with other enterprise systems, such as ERP (Enterprise Resource Planning) and MES (Manufacturing Execution Systems).
- **Cybersecurity**: Open systems incorporate robust cybersecurity measures to protect data and ensure the safety of operations.

3. Benefits of Open Automation Systems

- **Improved Interoperability**: Standardized protocols and modular components allow for seamless integration of devices and systems from different vendors, enhancing overall system flexibility and scalability.
- **Cost Savings**: By reducing the reliance on proprietary systems and enabling the use of off-the-shelf components, open systems can significantly lower costs.
- **Enhanced Innovation**: Open systems encourage innovation by allowing manufacturers to easily adopt new technologies and solutions without being locked into a single vendor's ecosystem.
- **Better Return on Investment (ROI)**: The use of standardized, proven-in-use components and IT infrastructure management tools increases the reliability and longevity of plant assets.
- **Agility and Resilience**: Open systems enable modular plants and remote operations, making operations more agile and the global supply chain more resilient.

4. Current Initiatives and Organizations

Several major initiatives and organizations are driving the adoption of open automation systems:

- **Open Process Automation Forum (OPAF)**: Formed in 2016, OPAF is an industry consortium advocating for a standardized reference architecture for process automation systems. The forum aims to enable modular integration of products from multiple vendors into a single control system1.
- **UniversalAutomation.org**: This initiative focuses on developing open-source automation software and promoting the use of open standards in industrial automation.
- **OPC Foundation**: The OPC Foundation develops and maintains standards for secure and reliable data exchange in industrial automation.
- **NAMUR**: The User Association of Automation Technology in Process Industries (NAMUR) promotes the use of open standards and best practices in the process industry.

5. Challenges and Considerations

- **Implementation Costs**: Transitioning to open automation systems may require significant upfront investment in new technologies and training.
- **Integration Complexity**: Integrating open systems with existing infrastructure can be complex and may require careful planning and execution.
- **Cybersecurity Risks**: Open systems must be designed with robust cybersecurity measures to protect against potential threats and vulnerabilities.
- **Skill Gap**: The adoption of open systems requires skilled personnel who are familiar with new technologies and standards.

6. Future Directions

- **Advancements in AI and Machine Learning**: The integration of AI and machine learning algorithms can further enhance the capabilities of open automation systems, enabling predictive maintenance, real-time optimization, and advanced analytics.
- **Expansion of Digital Twins**: The use of digital twins will become more widespread, providing deeper insights into manufacturing operations and enabling more effective optimization.
- **Collaborative Robots (Cobots)**: The integration of cobots will enhance human-robot collaboration, improving efficiency and safety in manufacturing environments.
- **Sustainability**: Open automation systems can contribute to sustainable manufacturing practices by optimizing resource use and reducing waste.

Conclusion

Open Automation Systems represent a significant advancement in industrial automation, offering increased flexibility, interoperability, and innovation. By adopting open standards and technologies, manufacturers can improve efficiency, reduce costs, and stay competitive in a rapidly evolving market. While there are challenges to overcome, the benefits of open automation systems make them a vital component of modern manufacturing strategies.

TECHNOLOGY TRENDS THAT EMPOWER INNOVATION

NAME : BANDARU. SRI LAKSHMI
ROLL NO : 24EU07073
CLASS : II- EIE

Technology trends are constantly evolving, driving innovation across various industries. Here's a detailed explanation of some key technology trends that empower innovation:

1. Artificial Intelligence (AI) and Machine Learning (ML)

AI and ML are at the forefront of technological innovation, enabling machines to learn from data, identify patterns, and make decisions with minimal human intervention. Applications include predictive analytics, natural language processing, and autonomous systems. AI and ML are transforming industries such as healthcare, finance, and manufacturing by improving efficiency, accuracy, and decision-making processes.

2. Generative AI

Generative AI refers to AI systems that can generate new content, such as text, images, and music, based on existing data. This technology is being used in creative industries, content generation, and even drug discovery. Generative AI models like GPT-4 and DALL-E are examples of how this technology is pushing the boundaries of innovation.

3. Quantum Computing

Quantum computing harnesses the principles of quantum mechanics to perform computations at unprecedented speeds. This technology has the potential to solve complex problems that are currently intractable for classical computers, such as cryptography, optimization, and simulation of molecular structures. Quantum computing is still in its early stages, but it holds great promise for future innovations.

4. Edge Computing

Edge computing involves processing data closer to the source of data generation (e.g., IoT devices) rather than in a centralized data center. This reduces latency, improves response times, and enhances data security. Edge computing is crucial for applications requiring real-time data processing, such as autonomous vehicles, smart cities, and industrial automation.

5. Internet of Things (IoT)

The IoT connects physical devices to the internet, enabling them to collect and exchange data. This technology is driving innovation in smart homes, healthcare, agriculture, and manufacturing. IoT devices can monitor and control various aspects of the environment, leading to more efficient and intelligent systems.

6. 5G Technology

5G is the next generation of mobile network technology, offering significantly faster speeds, lower latency, and greater capacity compared to previous generations. This enables new applications such as augmented reality (AR), virtual reality (VR), and real-time remote control of machinery. 5G is essential for the growth of smart cities, autonomous vehicles, and the Internet of Everything (IoE).

7. Blockchain Technology

Blockchain is a decentralized ledger that records transactions across multiple computers. It ensures transparency, security, and immutability of data. Blockchain is being used in supply chain management, finance, and digital identity verification. Its ability to create trust in digital transactions is driving innovation in various sectors.

8. Augmented Reality (AR) and Virtual Reality (VR)

AR and VR technologies create immersive experiences by overlaying digital content onto the real world (AR) or creating entirely virtual environments (VR). These technologies are being used in gaming, education, healthcare, and retail. AR and VR enable new ways of interacting with digital content and enhance user experiences.

9. Cybersecurity

As technology advances, so do the threats to digital security. Cybersecurity technologies are evolving to protect data, networks, and systems from cyberattacks. Innovations in encryption, threat detection, and incident response are crucial for maintaining the integrity and safety of digital infrastructure.

10. Clean Technology

Clean technology focuses on developing sustainable solutions to environmental challenges. This includes renewable energy sources (e.g., solar, wind), energy-efficient buildings, and electric vehicles. Clean technology is essential for addressing climate change and promoting sustainable development.

Conclusion

These technology trends are empowering innovation by enabling new applications, improving efficiency, and creating new business opportunities. As these technologies continue to evolve, they will drive further advancements and shape the future of various industries.

Industrial DevOps Is Redefining PLC Engineering Process

Name : **B.vijaya Lakshmi**
Roll No : **238W1A1008**
Class : **III- EIE**

Founded in Munich, Germany in 2021, Software Defined Automation is a venture-backed company that provides an industrial DevOps platform for automation engineers. The platform offers version control, browser-based engineering, secure remote access, virtual programmable

logic controller (PLC) orchestration, automated backup and artificial intelligence (AI)-powered documentation generation for industrial automation code.

Software Defined Automation got its start because today's automation engineers have a tough job. They manage PLC code in different versions of a vendor's engineering software, the versions are often incompatible, and legacy code that is poorly documented is hard to troubleshoot or update. Increasing the challenge is a lack of young, skilled talent coming online to help. Young engineers just don't want to develop in environments that date back decades, and the whole engineering process has been missing tools that work across vendors, which can cause operational inefficiencies, increased downtime, security risks and higher costs.

To ease the engineers' burden, Software Defined Automation provides a centralized, cloud-based platform for managing multi-vendor industrial automation assets, including PLCs, robotics and drives, without requiring on-premises software installations.

Industrial DevOps is the primary focus

DevOps is a software development methodology. DevOps integrates and automates the work of software development (Dev) and IT operations (Ops) as a means for improving and shortening the systems development lifecycle. Industrial DevOps extends both the "development" and the "operations" part of DevOps to industrial systems. Industrial DevOps tools support emerging best practices for orchestrating both new and legacy PLC systems programmed in a variety of languages in a vendor-neutral framework and offer manufacturers' engineering teams remote collaboration, approval workflows, scalability, accessibility and project management *(Figure 1).*

Figure 1: Industrial DevOps tools support emerging best practices for orchestrating both new

and legacy PLC systems programmed in a variety of languages in a vendor-neutral framework.

For Software Defined Automation, industrial DevOps includes:

- Version control
- Browser-based engineering
- Secure remote access
- Virtual PLC management
- Automated backup
- AI for Automation.

“Industrial DevOps is revolutionizing automation software development and management for all sorts of devices: PLCs, robots and drives,” said Kilfoy. “Manufacturers can now centralize code repositories, enable remote collaboration, enforce their enterprise and regulatory standards, and streamline testing and deployment—all this helps them increase efficiency, reduce costs and downtime, and gain more control over the entire automation lifecycle.”

Automated backup

Software Defined Automation’s automated backups help users avoid costly hardware and software setups. The vendor-agnostic backup solution supports multiple vendors and versions from a single interface. Automated backup deployment reduces recovery time, which improves mean time to recover (MTTR). Backups across multiple factory locations can be managed centrally from a single interface, which ensures consistent business continuity and disaster recovery.

PLCs—or groups of PLCs—can be set to perform scheduled backups automatically, or individual backups manually. “We use our secure connectivity agent to check the code that’s on there, review it and compare it to the repository,” explained Kilfoy. “If it's the same, we do nothing. If it's different, we create a new version. We also can send out notifications on whether the backup was run or if it failed. We can also send a notification if a new version was changed.”

Version control

Version control allows teams to better collaborate more efficiently by knowing who made a change, when the change was made, what was changed and why the change was made. “We keep track of versions; we can tell you the source where those versions came from. We can tell you if it was uploaded or generated from a backup,” he said.

Software Defined Automation’s version control supports industries with stringent manufacturing change control regulations such as pharmaceuticals, food and beverage, medical devices and the like. It ensures that the right people have the right permissions to access the right programs. In addition, version control enhances productivity with tools that enable automation engineers to quickly review and visually compare program versions directly in a browser.

Browser-based engineering

Browser-based engineering is an IDE as a Service (IDEaaS) that lets users securely access integrated development environments (IDEs) from any browser and Internet connection. This technology allows users to access multi-vendor and multi-version IDEs like Rockwell and Siemens directly from their browser. Secure remote access allows virtual private network (VPN)-secured sessions with fresh, disposable IDE copies for each session. License sharing allows users to pool and share licenses to boost utilization and save costs. Browser-based engineering simplifies management because fully patched IDEs are always up to date, avoiding hardware burdens.

“Users can open browser-based functionality directly from the version in the repository,” explained Kilfoy. “Users can open it and can edit that code. The entire [Software Defined Automation] product is 100 percent cloud based, except for a gateway.”

Secure remote access

According to Kilfoy, Software Defined Automation’s cloud-based secure remote access control is 11 times more secure than self-managed VPNs such as Cisco and Citrix, which helps protect against ransomware. It controls who accesses each product and device/PLC. The on-demand connection uses encrypted MQTT and WireGuard VPN for secure OT device access. Secure remote access records every action for full transparency and auditability.

“Our secure gateway is software that runs on an IPC,” explained Kilfoy. “We install it, we configure it and at that point you can start adding PLCs to it. That gateway also gives us the ability to do a full secure remote access solution.”

Virtual PLC management

“Virtual PLC orchestration or management is the same idea as CODESYS,” said Kilfoy. “We can deploy CODESYS the same way that we deploy Rockwell or Siemens. We also manage the DM [device mapper] or the docker. Our virtual PLC, or soft PLC, orchestration goes into version control just like everything else. AI is built into it. Everything is fully integrated.”

Virtual PLC management allows users to gain independence from vendor-specific hardware. It allows users to run soft PLCs with real-time performance on standard IT servers with edge virtualization. It deploys quickly, allowing users to launch virtual PLCs in seconds and manage them alongside conventional PLCs in a single platform. Its unified workloads combine real-time and non-real-time tasks on the same hardware. In addition, because of integrated operations, users can run human-machine interfaces, monitoring and data analysis on the same factory hardware.

AI for automation

Software Defined Automation uses its Factory Agent AI to translate PLC code into human language, which enables engineers to grasp complete automation/PLC projects quickly and also get up to date process documentation. Because PLC code is streamlined into human language, new employees and/or consultants can be onboarded faster. Being able to “read code” in human language ensures always-current program documentation. “Factory Agent

does a reverse translation to provide documentation," said Kilfoy. "There's nobody [else] out there that does this for PLC code that I'm aware of."

Cybersecurity

Kilfoy said that there has been a 41 percent increase in ransomware attacks in manufacturing since 2020. The average cost of recovery from a ransomware attack in manufacturing is $1.67M and 22 percent of them take longer than a month to recover. "The biggest conversations that we get into most recently have been about cybersecurity and ransomware attacks," he said.

According to Kilfoy, Software Defined Automation's advantage is because they are not in the factory. "When a ransomware attack comes in, it attacks the PLC, but it also attacks everything else in the footprint. The blast radius includes things like the Rockwell Studio 5000, the TIA Portal and the machines they are on. It also includes things like the license server for those. In addition, 53 percent of the backups [when they were attacked] are encrypted, so the backups themselves are getting hit. With some of the solutions we compete against, the backup is off-prem, but the tools to do the backup and to recover the backup are on-prem, including the licenses."

The company's cloud-based approach helps protect against ransomware attacks by isolating the backup and recovery processes from the on-premises infrastructure. "From a security standpoint, we're an AWS partner. We help our customers with support on their NIST Cybersecurity Framework 2.0 journey," explained Kilfoy.

Looking ahead

Software Defined Automation envisions a future where PLC management and development is simple, secure and efficient, so that factories can increase uptime, reduce mean time to recover and maximize the productivity of their assets. Industrial DevOps can simplify these PLC management and development tasks, increase factory uptime and efficiency, as well as improve security in a single comprehensive, integrated solution.

Software Defined Automation's solutions allow users to quickly back up and recover code, track PLC code changes across multiple vendors, enable remote and secure access control, streamline development and enhance collaboration, translate PLC code into human language and gain independence from vendor-specific hardware.

Process Users Shift from DCS to PLC: PLC vs. DSC Experience Survey

Name : Pagadala Naga Lakshmi
Roll No : 228w1a1093
Class : IV- EIE

The PLC vs. DSC Experience Survey interim report is an ongoing, crowdsourced, open survey for users to share experience and know-how with the automation community. Take the survey here.

Using a PLC-based system rather than a Distributed Control Systems (DCS) has been a growing discussion for several years. Distributed Control Systems (DCS) have traditionally been the primary solution for process automation, but for a number of reasons, many users implement applications using PLC systems instead of DCS. Some users believe that a single integrated architecture based on PLCs, Industrial Computers, and PACs (Programmable Automation Controllers) is the best approach to total plant automation.

More than 10 years ago, some vendors started advocating for a single PLC control architecture for process plants to displace DCS systems. In a 2011 interview of a business manager at a major PLC company pursuing the process business, I asked what distinguishes their offering from a DCS. He responded by rephrasing the question, noting the real question should be what distinguishes their PLC-based DCS from other DCS systems. Most process plants today have both DCSs and PLCs installed for controls. Traditionally, DCS control and manage the core processes (food, pharmaceutical, refining, etc.). PLCs control non-core process functions, including material handling, water treatment, motor controls, balance of plant operations, air compressor controls, packaging, and other functions. At some plants, PLCs or DCSs control all of the plant functions, but at this point these are the exceptions.

Open Process Automation Standard

The Open Process Automation Forum, part of The Open Group, is developing the new Open Process Automation Standard, O-PAS™ , intensifying discussion around PLC vs. DCS. The O-PAS™ Standard aims to develop, publish and evolve an open architecture and specification supported by industry end users, suppliers and integrators. The O-PAS Standard defines an

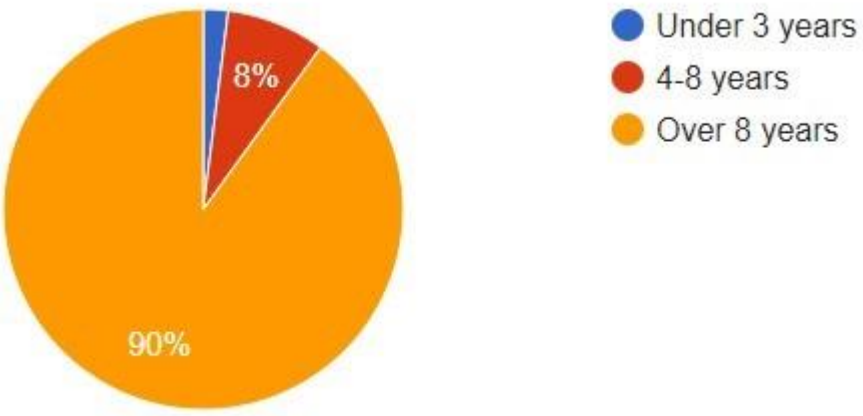
open, interoperable and secure architecture for industrial process automation systems. Starting with the first version of the standard, the edge control and programming is specified as the established IEC 61131 and newer IEC 61499 control engines and programming. For more background, read the Roots of the Open Process Automation Forum.

PLC vs. DCS Survey Interim Results

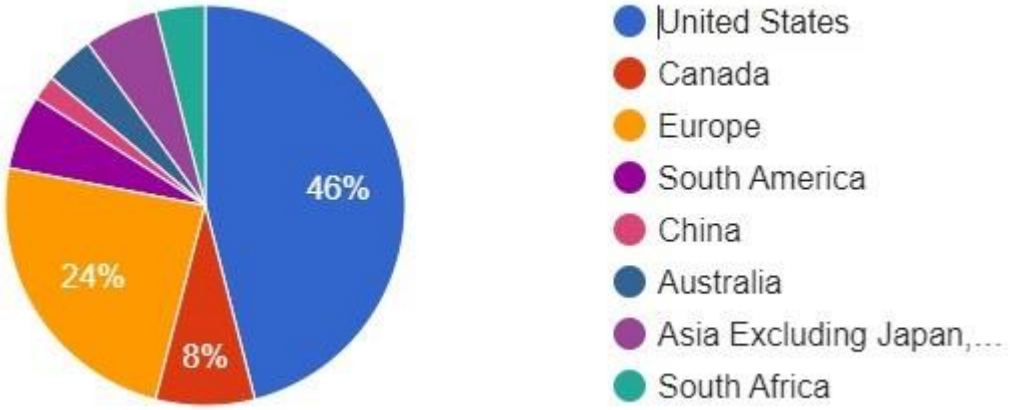
The PLC vs. DCS Survey is ongoing and designed to promote understanding of process automation and control user issues, tradeoffs, concerns and thoughts. A summary of the crowdsourced results will be published periodically as a resource and refence for users. This is an independent survey not sponsored by any suppliers. The ongoing open survey can be taken here.

These are current results based on user experiences with the percentages showing responses to questions. First, let's look at the demographics of the respondents so far, which are shown in the first two graphs. More than 90% of those who filled out the survey have 8 years of work experience or more. Just under half (46%) of respondents are from the USA, but people in Canada, Europe, South America, China, Australia, Asia (excluding Japan) and South Africa also responded.

Survey respondents' work experience

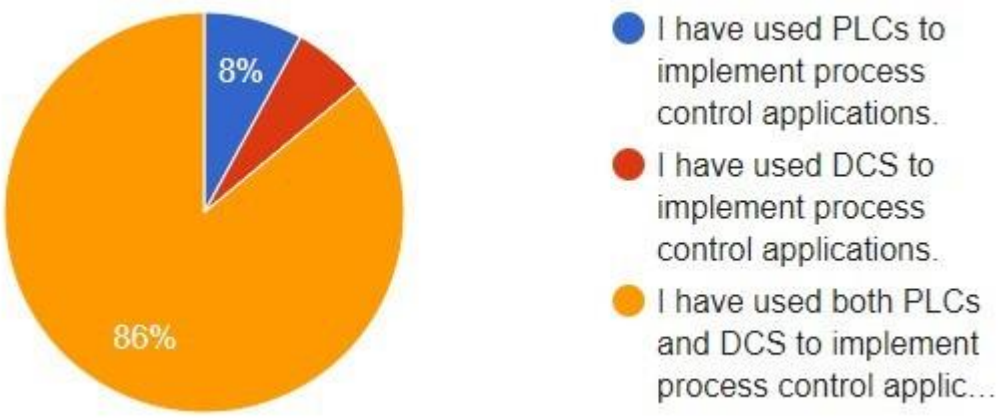


Where the respondents live



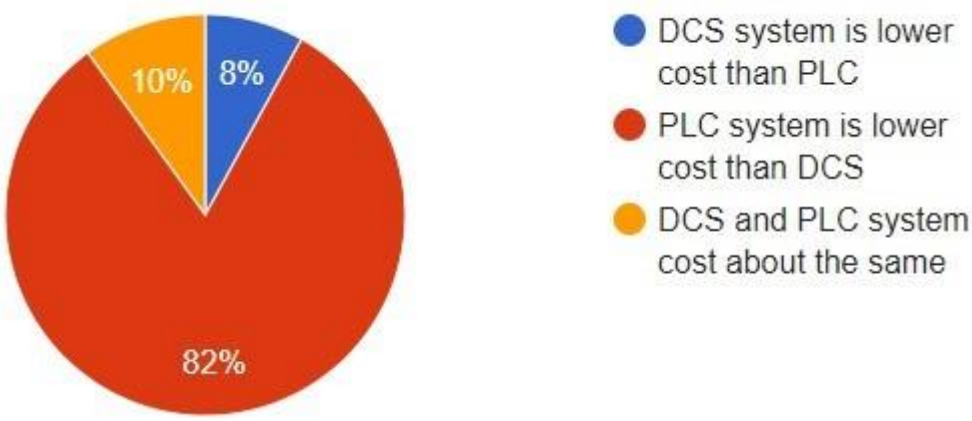
Have you used DCS and PLCs for process control applications?

Before diving into the survey results comparing DCS and PLC, it's important to point out that a majority (86%) of survey respondents had experience using both DCS and PLCs for process control applications. The remaining 14% had experience using either DCS or PLC.



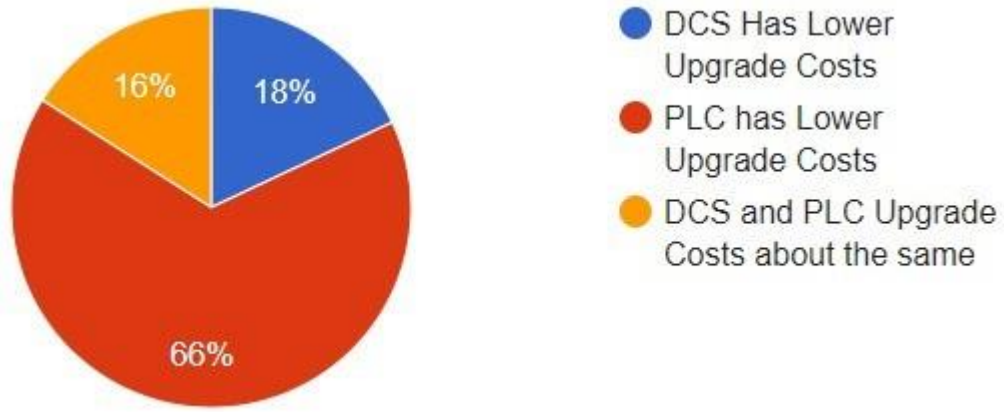
PLC vs. DCS: Overall cost comparison in process applications

Initial survey results indicate that in 82% of cases, PLC systems cost less than DCS systems in process applications. However, some respondents (8%) reported the opposite, and 10% said PLC and DCS systems presented about the same costs.



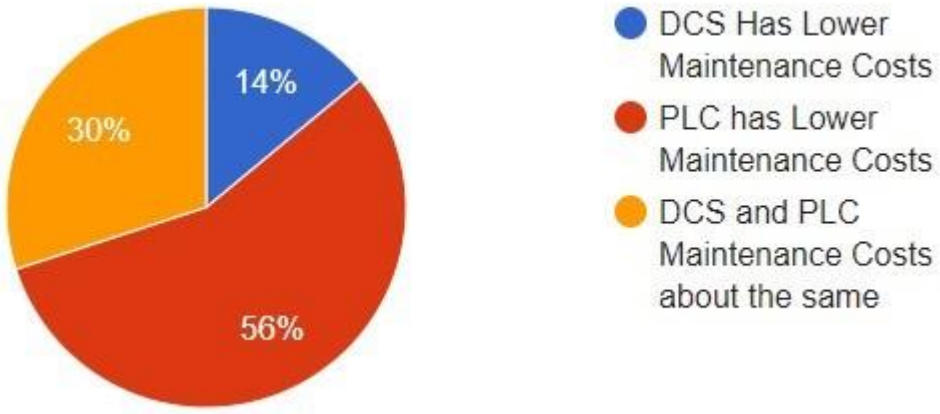
PLC vs. DCS: Upgrade cost comparison

About two thirds (66%) of survey respondents reported that PLC systems offered a lower upgrade cost than DCS systems. Eighteen percent said DCS has lower upgrade costs, and 16% indicated the two systems shared about the same costs for upgrades.



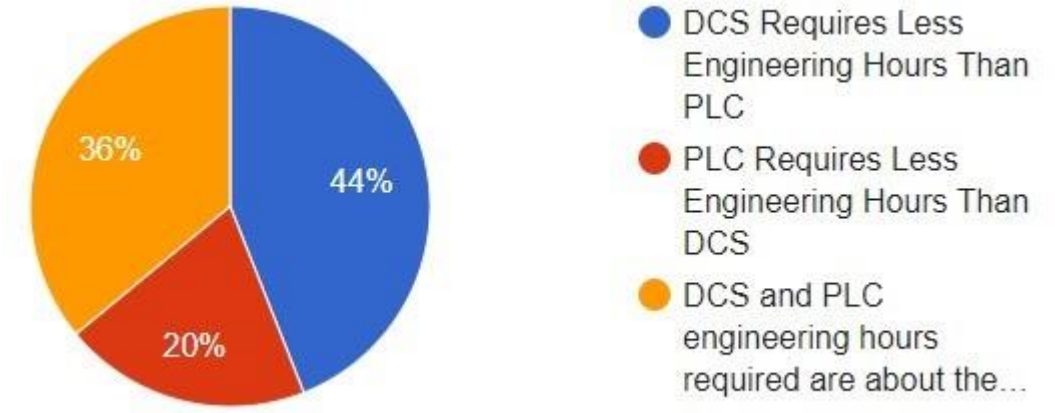
PLC vs. DCS: Maintenance cost in process applications

In yet another cost comparison, respondents were asked to compare the maintenance costs of the two systems. Just over half (56%) of respondents to the survey reported that PLCs have a lower maintenance cost, while 30% said the opposite, indicating that DCS have lower maintenance costs.



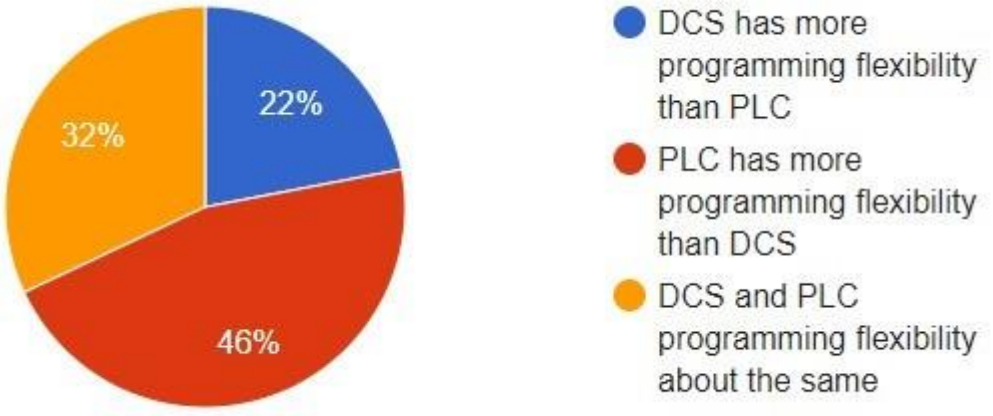
PLC vs. DCS: Engineering hours in process applications

Cost considerations are important, but it's also important to think about the manpower involved with managing systems. Just under half (44%) of respondents said DCS requires less engineering time than PLCs, while 20% indicated that PLC requires less engineering hours than DCS. Thirty-six percent said the required engineering hours are about the same.



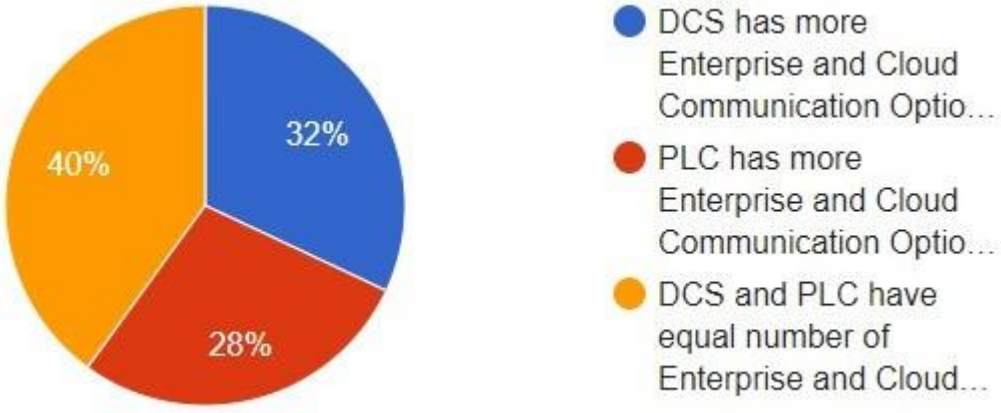
PLC vs. DCS: Programming flexibility

Just under half (46%) of survey responses indicated that PLC possesses more programming flexibility than DCS. 22% said the opposite. The remaining 32% of respondents said the programming flexibility for the two systems was about the same.



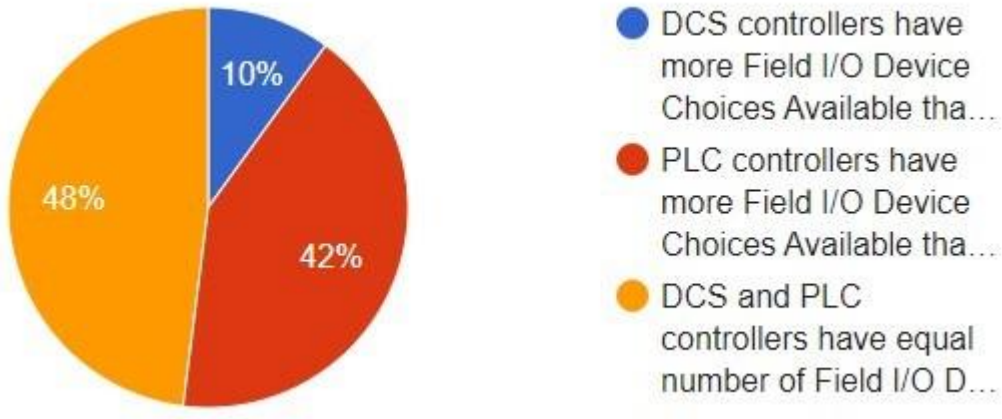
PLC vs. DCS: Enterprise & Cloud Communications Options

Another important consideration involved the number of options the systems offer when it comes to enterprise and cloud communications. Forty percent of those who took the survey said DCS has more Enterprise and Cloud Communication Options than PLC, while 28% asserted the opposite view. The remaining 32% of participants indicated that PLC and DCS systems offer about the same number of enterprise & cloud communications options.



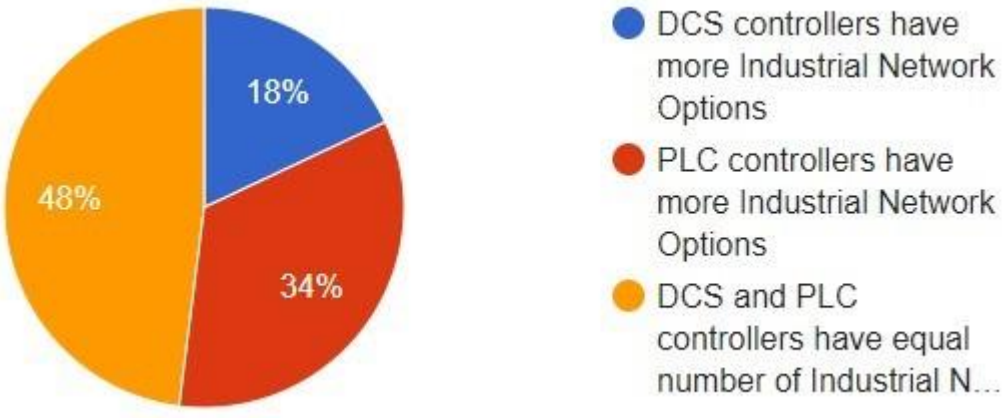
PLC vs. DCS: Process Applications Controller Field I/O Device Selection Availability (Sensors, Actuators, etc.)

Another question asked participants to say whether PLC or DCS offered a wider range of process application control field I/O devices, such as sensors and actuators. Almost half (48%) of survey participants said the two systems offer about the same range of devices. 42% said PLC has more; 10% said DCS has more.



PLC vs. DCS: Process Applications Industrial Network Options (i.e.: HART, ISA100, WirelessHART, Profinet, EtherNet/IP, I-O Link)

Survey respondents also offered their opinions regarding the range of process applications industrial network options for DCS and PLC. While 34% reported that PLC controllers have more industrial network options, just 18% said the same about DCS controllers, and almost half (48%) of respondents said DCS and PLC controllers offer an equal number of industrial network options.



Real-time Digital Manufacturing: Realized

Name : P. Sindhu Sri
Roll No : 24EU07111
Class : II- EIE

Real-time digital manufacturing (RTDM) is a transformative approach that integrates advanced technologies to enable real-time monitoring, control, and optimization of manufacturing processes. This approach leverages data transparency, connectivity, and automation to enhance efficiency, flexibility, and responsiveness in manufacturing operations. Here's a detailed explanation:

1. Introduction

Real-time digital manufacturing represents the convergence of digital technologies with traditional manufacturing processes. By leveraging real-time data, manufacturers can make informed decisions, optimize production, and respond swiftly to changes in demand or supply chain disruptions. This approach is a key component of Industry 4.0, which emphasizes the integration of cyber-physical systems, the Internet of Things (IoT), and cloud computing into manufacturing.

2. Key Components of RTDM

- **Sensors and IoT Devices**: These devices collect real-time data from various points in the manufacturing process, including machine performance, environmental conditions, and material flow.
- **Data Analytics and AI**: Advanced analytics and AI algorithms process the collected data to identify patterns, predict maintenance needs, and optimize production parameters.
- **Digital Twins**: Virtual replicas of physical assets or processes that provide real-time insights into performance, health, and potential issues.
- **Cloud and Edge Computing**: Cloud platforms store and process large volumes of data, while edge computing enables real-time data processing at the source, reducing latency.
- **Communication Networks**: High-speed networks ensure seamless data transfer between sensors, devices, and control systems.

3. Benefits of RTDM

- **Enhanced Efficiency**: Real-time monitoring and control allow manufacturers to identify and address inefficiencies promptly, leading to improved productivity and reduced waste.
- **Increased Flexibility**: RTDM enables manufacturers to adapt quickly to changes in production schedules, demand fluctuations, and supply chain disruptions.
- **Improved Quality**: Continuous monitoring and real-time adjustments ensure consistent product quality and reduce the likelihood of defects.
- **Cost Savings**: By optimizing processes and reducing downtime, RTDM can lead to significant cost savings in terms of energy, labor, and materials.
- **Better Decision-Making**: Real-time data provides actionable insights that help managers make informed decisions, improving overall operational performance.

4. Applications of RTDM

- **Predictive Maintenance**: By analyzing real-time data, manufacturers can predict equipment failures and schedule maintenance proactively, reducing downtime and extending equipment life.
- **Supply Chain Management**: RTDM enables real-time tracking of materials and products, improving inventory management and reducing lead times.
- **Quality Control**: Continuous monitoring of production processes ensures that products meet quality standards, reducing the need for rework and recalls.
- **Customization**: RTDM supports mass customization by allowing manufacturers to adjust production parameters on the fly to meet specific customer requirements.

5. Challenges and Considerations

- **Implementation Costs**: The initial investment in RTDM technologies can be high, particularly for small and medium-sized enterprises (SMEs).
- **Data Security**: Protecting sensitive manufacturing data from cyber threats is crucial, requiring robust cybersecurity measures.
- **Skill Gap**: The adoption of RTDM requires skilled personnel who can manage and operate advanced technologies, necessitating training and education programs.
- **Integration Complexity**: Integrating RTDM systems with existing infrastructure can be complex and may require significant changes to current processes.

6. Future Directions

- **Advancements in AI and Machine Learning**: Continued improvements in AI and ML algorithms will enhance the predictive capabilities and decision-making processes of RTDM systems.
- **Expansion of Digital Twins**: The use of digital twins will become more widespread, providing deeper insights into manufacturing operations and enabling more effective optimization.
- **Collaborative Robots (Cobots)**: The integration of cobots will enhance human-robot collaboration, improving efficiency and safety in manufacturing environments.
- **Sustainability**: RTDM can contribute to sustainable manufacturing practices by optimizing resource use and reducing waste.

Conclusion

Real-time digital manufacturing is a game-changing approach that leverages advanced technologies to transform traditional manufacturing processes. By providing real-time insights, enhancing flexibility, and improving decision-making, RTDM enables manufacturers to stay competitive in a rapidly evolving market. While there are challenges to overcome, the benefits of RTDM make it a vital component of modern manufacturing strategies.