

Abstract

As the petrochemical industry generates vast volumes of real-time operational data, traditional analysis tools are increasingly being complemented by advanced digital capabilities. This article, authored by AI Mentor and Strategist Dr. Naresh Chandra Gupta, explores how artificial intelligence is moving beyond basic automation to serve as a foundational layer of predictive intelligence for plant operations.

Key areas of transformation include:

- **Predictive Reliability:** Leveraging machine learning models on historical sensor and maintenance data to detect equipment degradation before failures occur, minimizing unplanned downtime.
- **Process Optimisation:** Acting as a digital process engineer to help teams balance complex variables such as energy consumption, feed composition, and product quality.
- **Enhanced Safety and Anomaly Detection:** Identifying non-linear parameter combinations that historically precede abnormal operating conditions, allowing for proactive risk management.
- **Generative Knowledge Retrieval:** Streamlining access to critical engineering manuals, safety documents, and historical operating procedures to bridge workforce transitions.
- **Digital Twins and Sustainability:** Combining real-time operational models with AI to simulate scenarios, improve energy efficiency, and lower emissions.

Ultimately, the article emphasizes that the future of the industry relies not on replacing human expertise, but on empowering the "AI-enabled engineer" to make faster, safer, and more informed decisions.

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