AI IN INTELLIGENT MANUFACTURING:
PREDICTIVE MAINTENANCE CASE STUDY

This material is specifically designed for beginner-level students. It provides a clear, jargon-free introduction to how Artificial Intelligence is transforming modern production environments, featuring a deep dive into a real-world automotive predictive maintenance scenario.

The 13-slide deck begins by defining Intelligent Manufacturing and Industry 4.0, explaining the crucial shift from simple automation to autonomous, data-driven cyber-physical systems. It then outlines the foundational role of AI as the "factory brain," highlighting key technologies such as Machine Learning, Computer Vision, Natural Language Processing, and IoT sensor integration.

The core of the presentation is a detailed case study set in an automotive manufacturing context. It addresses the critical challenge of costly, unexpected robotic assembly line stoppages. The proposed AI-driven solution involves deploying vibration and temperature sensors, utilizing IoT gateways for seamless real-time data collection, and applying Machine Learning models to detect early signs of equipment wear before failures occur. The results are compelling: a 30% reduction in unplanned downtime, a 25% decrease in maintenance costs, and significantly improved Overall Equipment Effectiveness (OEE).

Beyond financial metrics, the presentation explores broader strategic advantages, including enhanced worker safety, extended machinery lifespan, optimized production planning, and meaningful contributions to environmental sustainability. However, it also maintains a realistic perspective by addressing common implementation hurdles, such as ensuring data quality consistency, integrating with legacy systems, upskilling the existing workforce, and managing initial investment costs.

Finally, the deck looks ahead to emerging future trends like Digital Twins, Autonomous Mobile Robots (AMRs), Generative AI optimization, and safe human-robot collaboration. It concludes with a concise summary of key takeaways and an interactive Q&A session, serving as a comprehensive, engaging, and highly visual educational tool to inspire the next generation of manufacturing professionals.

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