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A Methodological Survey of Autonomous Mobile Robots and Automated Guided Vehicles in Industrial Logistics

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INTRODUCTION & AIM

INTRODUCTION

- AMRs and AGVs are key technologies in industrial logistics.
- AGVs: Fixed, infrastructure-based
- AMRs: Adaptive, AI-driven

➞ Shift toward intelligent automation.

AIM

Survey AMRs & AGVs focusing on:

- Architectures
- Autonomy

METHOD

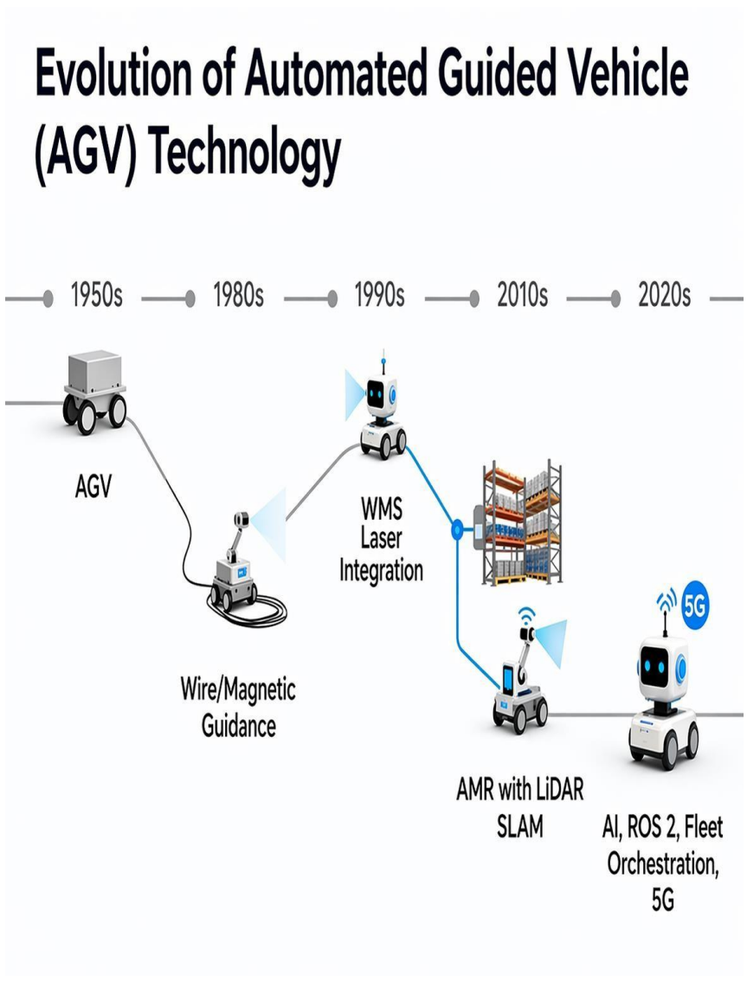
- System-level literature survey.

➢ Analysis of key components:

- Sensing & perception.
- Localization.
- Navigation & planning.

- Classification of **AGV vs AMR architectures.**
- Focus on **technological evolution and autonomy levels**.

RESULTS & DISCUSSION



AGVs

- Fixed routes, infrastructure-dependent
- Reliable, cost-effective, low flexibility

AMRs

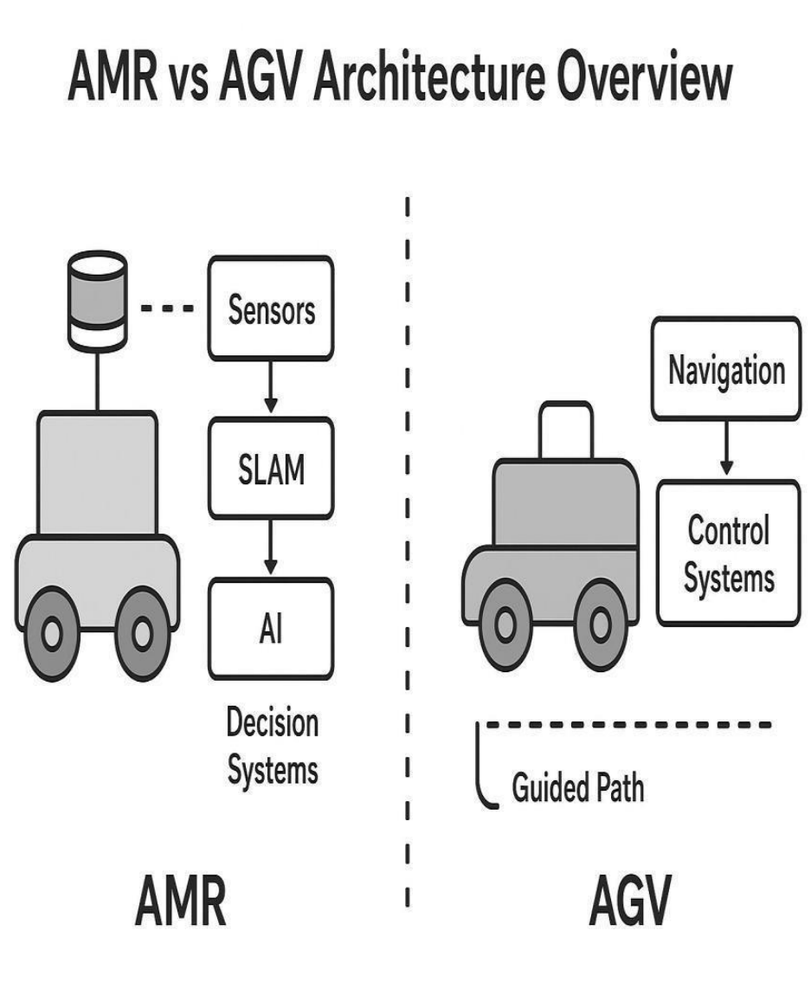
- Adaptive, perception-driven, AI-enabled
- Real-time navigation & obstacle handling
- Flexible and decentralized operations

Technological Evolution

- Rule-based → Data-driven autonomy
- Cloud-edge integration for optimization
- Multi-robot coordination emerging

Key Trends

- Learning-based navigation
- Semantic mapping & scene
- understanding
- Human-robot collaboration
- Scalable fleet management



CONCLUSIONS

- AMRs and AGVs are moving towards **intelligent, adaptable, and scalable systems**
- AMRs allow **perception-based, autonomous navigation**.
- Industry 5.0 alignment: **human-centered, explainable AI, sustainable**.
- Future systems need: **standards, interoperability, energy efficient design, safe human-robot interaction**.

FUTUREWORK

- **Federated learning** for fleet-level intelligence
- **Digital twin** integration for real-time optimization
- **Energy-efficient hardware** and battery monitoring
- **Standardization & interoperability** across vendors
- **Safe human-robot collaboration** in industrial settings

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