



# MOTIUS

WE R&D.

## Low Cost AGV

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# Low Cost AGV

 Manufacturing

 Automation

We developed a revolutionary low-cost AGV platform for spinning mills, achieving:

- ✓ **Under \$80,000 total budget** for complete AGV system
- ✓ **80kg payload capacity** for transporting textile manufacturing products (yarns, bobbins, and sliver cans) up to 1200mm height
- ✓ **Modular design** supporting interchangeable platforms and future enhancements
- ✓ **Dust-resistant construction** optimized for fiber-dense textile environments



## Project Vision

The vision was to revolutionize material handling within spinning mills through development of a cost-effective, modular, and scalable under-carriage Automated Guided Vehicle (AGV). This AGV serves as a modular robot platform with potential for future enhancements, including robotic arms and specialized tools.

The AGV streamlines transport of materials such as yarn, bobbins, and sliver cans between processing stations, improving operational efficiency and reducing manual labor in textile manufacturing environments.

## Technical Approach

### System Architecture

| Component       | Specification                      | Details                                 |
|-----------------|------------------------------------|-----------------------------------------|
| Base Dimensions | 600mm × 800mm                      | Accommodates 600mm diameter sliver cans |
| Drive System    | Differential drive + caster wheels | 2x stepper motors for precise control   |

|                         |                                |                                                        |
|-------------------------|--------------------------------|--------------------------------------------------------|
| <b>Navigation</b>       | Line following / magnetic tape | IR/camera-based sensors with $\pm 5\text{mm}$ accuracy |
| <b>Power System</b>     | 24V/48V LiFePO4 battery        | 2-6 hours runtime per charge                           |
| <b>Control Platform</b> | ARM-based IPC with Linux/ROS   | Modular software architecture                          |

## Modular Platform Design

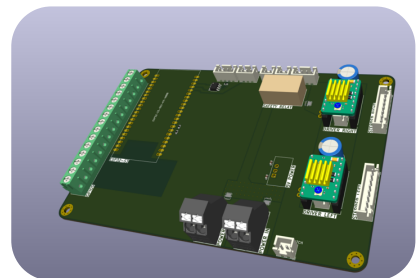
Despite the cost, the AGV features a sophisticated modular system designed for rare but necessary component swaps:

### Mechanical Interface

- **Docking plate with quick-lock bolts** for rigid, vibration-resistant connections
- **Guide pins** for precise alignment during module changes
- **Tool-assisted swap** process (10-15 minutes per module)

### Electrical Integration

- **Anderson Powerpole 45A connectors** for industrial-grade power connections
- **M12 Industrial CAN Bus connectors** for real-time control communication
- **EEPROM-based automatic module detection** for plug-and-play functionality



## Navigation & Safety

- **Line following capabilities** using IR or camera-based sensors
- **Basic obstacle detection** with ultrasonic/infrared sensors
- **Dust-resistant mechanisms** preventing fiber accumulation
- **Low-speed operation** optimized for safety in industrial environments

# Implementation Strategy

We applied a hybrid Agile-Systems Engineering approach combining iterative development with structured validation:

## Development Phases

| Phase   | Deliverable                          | Timeline  |
|---------|--------------------------------------|-----------|
| Phase 1 | Business needs & system requirements | Weeks 1-2 |
| Phase 2 | Detailed design completion           | Weeks 2-3 |
| Phase 3 | Sub-system manufacturing             | Weeks 2-6 |
| Phase 4 | System integration & testing         | Weeks 5-7 |
| Phase 5 | Fleet management integration         | Weeks 7-9 |

## Key Working Packages

- **Drive System Development:** Motors, gearboxes, wheels with dust protection
- **Lifting System:** Servo-driven mechanism with 80kg capacity
- **Navigation System:** CPU/microcontroller with line-following sensors
- **Power Management:** Battery system with wire harness and indicators
- **Modular Platform:** Standardized interfaces for future expansions



## Cost Analysis

Our preliminary Bill of Materials achieved the target budget of ~2000€ of hardware costs per AGV, assuming a fleet of 50 units:

| System Category       | Components                | Cost (€)       |
|-----------------------|---------------------------|----------------|
| Drive System          | Motors, drivers, wheels   | 375            |
| Lifting System        | Servo, spindle, mechanism | 100            |
| Navigation            | CPU, sensors, line module | 480            |
| Power & Signals       | Battery, BMS, harness     | 240            |
| Structure             | Chassis, body, assembly   | 780            |
| Modular Platform      | Connectors, interfaces    | 60             |
| <b>Total Hardware</b> |                           | <b>2,185 €</b> |

## Application at CustomerName

Our modular AGV platform demonstrates how cost-effective automation can transform traditional manufacturing processes. CustomerName can now automate material handling in areas that are not covered by AGV suppliers, or would have been too costly to automate with existing solutions.

The scalable design approach enables rapid deployment across various industrial environments while maintaining flexibility for future technological enhancements and specialized sensor integration requirements.

Compared to AGVs from Asia, our solution is comparable in cost, but can be supported locally, and is designed for European standards.

