

AUTOMATION, QUALITY AND SUSTAINABILITY IN INDIAN FACTORIES

By Vania Goel



PREFACE

I feel truly grateful to the wonderful companies that opened their doors and welcomed me into their facilities, giving me the chance to see firsthand how modern manufacturing and automation come to life. Each visit was an eye-opening experience, offering not just a glimpse into operations, but a deeper understanding of how traditional industries are evolving with smart technology, data-driven systems, and sustainable practices.

What stood out most to me was the harmony between innovation and responsibility: how AI, robotics, and meticulous quality checks work hand-in-hand to make processes smoother, safer, and more reliable. At the same time, I was struck by the seriousness with which large companies are addressing their environmental footprint: investing in cleaner processes, reducing waste, and finding ways to control emissions and resource use. I visited these factories with 20 underprivileged young women who thoroughly enjoyed and loved the automation aspect. I hope they grow up to love computer engineering just as much as I do, and if this experience has contributed even slightly to that, my purpose will be met.

This collection of experiences is not only about what I observed, but also about the ideas, lessons, and values that I hope will stay with me throughout my career.

I am deeply thankful for the time, kindness, and expertise that everyone shared with me, and I look forward to carrying these valuable learnings forward—turning them into action and contributing, in my own way, to the future of smarter, more sustainable industries.

Warmly,
Vania Goel

PARC ROBOTIC SYSTEMS

Phase 4, Plot No. PAP-A-9/2,
Chakan Industrial Area, Pune, Maharashtra, India



Products Manufactured:

- Robotic welding cells
- Robotic assembly lines
- Special Purpose Machines (SPMs)
- Fixtures & gauges
- Inspection systems

Process Flow Chart:

Design & Engineering: Design of detailed 3D models and simulation of robot movements

Fabrication & Assembly: Frames, fixtures, and SPM parts are manufactured and assembled.

Packing: Systems weigh, fill, and seal 50 kg bags.

Handling: Conveyors transfer cement bags for loading.

Quality Control:

- Potential cycle time bottlenecks or clashes are identified early while designing.
- During fabrication, Coordinate Measuring Machines (CMM) confirm fixture dimensions within tight tolerances.

Automation:

- Multi-axis robotic cells: Execute complex welds or assemblies with high repeatability and micron-level precision, delivering consistent quality beyond manual capability.
- PLC-controlled lines: Automate and synchronize robots, feeders, and safety systems, minimizing human error and reducing unexpected downtime.
- Vision & laser sensors: Auto-detect part position, orientation, and fit, cutting manual alignment time.
- Automatic tool changers: Switch welding torches, grippers, or tips mid-cycle, allowing a single robot to handle multiple tasks or product variants seamlessly.
- Integrated inspection: Robots check critical dimensions and spot defects in real time while still in production flow, boosting first-pass yield.
- Data logging & analytics: Continuously capture cycle times, weld quality data, and downtime causes, enabling predictive maintenance and process optimization.

Environmental Control:

- Welding cells include high-efficiency fume extraction units to keep shop air clean, while inverter-based welding power sources lower electricity use.
- Powder-coated frames and solvent-free paints reduce VOC emissions. Automated systems help manage compressed air leaks and lighting, and energy-efficient motors, collectively lowering the plant's carbon footprint.

ITECH ROBOTICS & AUTOMATION

Gat No. 444/2, Success Ind. Park, Nighoje, Chakan, Tal-Khed,
Pune, Maharashtra, India



Products Manufactured:

- Robotic arc welding systems
- Robotic spot welding systems
- Material handling automation
- Customized handling manipulators
- Vision and inspection systems

Process Flow Chart:

Sub-System Fabrication: Produce robotic arms, manipulators, and welding units.

Mechanical Assembly: Assemble frames, joints, for integrated operation.

Electrical & Control Integration: Install PLCs, sensors, and wiring; program automation sequences.

Functional Testing: Run simulations and quality checks

Quality Control:

- iTech Robotics maintains stringent quality control using automated inspections, precise calibration, and standardized testing protocols.
- Continuous monitoring and real-time feedback ensure that all robotic systems maintain reliability across diverse manufacturing processes, guaranteeing high-quality outcomes for clients in various industries.

Automation:

- Robotic welding cells: Execute precise and repeatable welding operations with high consistency.
- PLC-coordinated systems: Synchronize robots, conveyors, and safety mechanisms, minimizing downtime.
- Smart vision sensors: Detect part positions and orientations automatically to reduce errors.
- Automatic tool adapters: Switch welding torches, grippers, or end-effectors mid-cycle for multi-task production.
- Inline inspection robots: Measure critical dimensions and identify defects in real time.
- Data logging & analytics: Capture production metrics and downtime for predictive maintenance.
- Collaborative robots (cobots): Safely work alongside humans to handle delicate tasks, improving flexibility and efficiency.

Environmental Control:

- iTech Robotics integrates sustainable practices into all automation solutions, emphasizing energy efficiency, waste reduction, and process optimization.
- By using recyclable materials and eco-friendly components, the company minimizes environmental impact, conserves resources, and supports environmentally responsible manufacturing while maintaining high operational efficiency and productivity across its robotic systems.

AUTOFINA ROBOTICS

Gat No. 38, Jadhavwadi, Navlakh Umbre, Talegaon Dabhade,
Pune, Maharashtra, India



Products Manufactured:

- Industrial robotic arms (up to 10 kg payload)
- Pick & place robotic systems
- Machine tending robots
- Spray and powder coating robots
- Vision-based inspection systems

Process Flow Chart:

Component Preparation: Fabricate robotic arms, grippers, and end-effectors.

Structural Assembly: Build mechanical frames and integrate moving parts

Electronics & Software Integration

Performance Validation: Testing of products

Quality Control:

- Autofina Robotics ensures product quality through rigorous testing, and precision calibration of robotic systems.
- Automated inspections and adherence to industry standards provide reliable, consistent performance and maintain operational excellence across various automation solutions, ensuring that each system meets the exacting requirements of modern manufacturing.

Automation:

- Industrial robotic arms: Perform complex pick, place, and assembly tasks with precision.
- Pick & place automation systems: Optimize material handling and reduce manual labor.
- Machine tending robots: Automate loading and unloading of machines, lowering cycle times.
- Spray and powder coating robots: Ensure uniform coatings and reduce material wastage.
- Vision-assisted inspection systems: Detect defects and verify critical dimensions in production.
- Data analytics systems: Track performance, downtime, and maintenance needs for optimization.
- Modular robotic workstations: Allow easy reconfiguration for multiple product types and rapid production changes.

Environmental Control:

- Autofina Robotics incorporates energy-efficient designs, process optimization, and sustainable practices into its automation solutions.
- By reducing waste, recycling materials, and using environmentally friendly components, the company minimizes ecological impact while maintaining high productivity and operational performance, demonstrating a strong commitment to sustainable and responsible manufacturing practices.

GEOMETRIX AUTOMATION & ROBOTICS

Gat No. 53/1, Near Talwade Circle, Talawade, Tal. Haveli,
Dist. Pune , Maharashtra, India



Products Packaged:

- Laser cutting robots
- MIG and spot welding robots
- Material handling systems
- Machine tending robots

Process Flow Chart:

Module Fabrication: Manufacture special-purpose machines and robotic units.

Mechanical Integration: Assemble machine frames, conveyor mounts, and robotic joints.

System Wiring & Programming: Install and run automation scripts.

Quality Inspection & Commissioning

Quality Control:

- Geometrix Automation & Robotics maintains high-quality standards using automated inspections, precise calibration, and rigorous testing.
- Continuous monitoring and compliance with international standards, reduced defects, and reliable operation of robotic systems, guaranteeing that all automation solutions meet client specifications and deliver optimal manufacturing efficiency.

Automation:

- Robotic laser cutting systems: Provide precise cutting with minimal material waste.
- Robotic MIG and spot welding systems: Deliver consistent and high-quality welds.
- Robotic material handling: Automate the movement of heavy and delicate parts efficiently.
- Robotic machine tending: Streamline CNC and other machinery operations.
- Special purpose machines: Custom automation solutions tailored to unique production needs.
- Vision-based inspection systems: Verify dimensions and detect defects automatically.
- Remote monitoring and control: Enable real-time performance tracking and troubleshooting from centralized systems.

Environmental Control:

- Geometrix integrates sustainable practices into all operations, emphasizing energy efficiency, minimal waste, and eco-friendly materials.
- Lean manufacturing techniques and process optimization reduce environmental impact, ensuring that the company delivers high-performance automation systems while maintaining responsibility toward resource conservation and environmentally conscious industrial practices.

PERFECTO ROBOTICS PVT. LTD.

B8 Shreya Business Hub, 2nd Floor, Dhayari,
Pune, Maharashtra, India



Products Manufactured:

- Welding robots
- Material handling systems
- Dispensing robots
- Vision inspection systems
- Flexible tooling systems

Process Flow Chart:

Part Preparation: Produce welding units, robotic arms, and pick-and-place tools.

Mechanical Assembly: Build extra parts for automation lines.

Electrical & Control Integration: Wire sensors, actuators, and program robots for specific tasks.

Testing & Calibration

Automation:

- Robotic welding systems: Ensure precise and consistent welding across multiple applications.
- Automated material handling: Move components and products efficiently with minimal manual intervention.
- Pick & place automation: Place components accurately to improve assembly speed and reliability.
- Dispensing robots: Apply adhesives, sealants, or lubricants with high precision.
- Vision-guided inspection: Detect defects and validate product dimensions in real time.
- Data collection and analytics: Track performance metrics and optimize processes.
- Flexible end-of-arm tooling: Quickly switch tools for multiple operations without stopping production lines.

Quality Control:

- Perfecto Robotics applies precise calibration, automated inspections, and standardized testing procedures to maintain quality.
- Real-time monitoring and compliance with international certifications ensure consistent performance, and defect-free operation of all robotic systems, providing clients with high-precision automation solutions across diverse industrial applications.

Environmental Control:

- Perfecto Robotics emphasizes sustainable manufacturing with energy-efficient systems, waste reduction, and eco-friendly materials.
- Optimized processes and recycling initiatives minimize environmental impact, allowing the company to maintain high production efficiency and operational performance while practicing responsible and sustainable industrial automation.

IRATI PUNE

Opposite Dapodi Metro Station, Old Mumbai-Pune Highway,
Pune, Maharashtra, India



Products Manufactured:

- Robotic training systems
- Automation kits for manufacturing and logistics
- Food supplement production automation

Process Flow Chart:

Module Fabrication: Produce training kits, robotic arms, and automation modules.

Structural Assembly: Integrate mechanical parts, joints, and frames.

Electronics & Software Setup: Connect parts and program interactive systems.

Functional Testing & Handover

Quality Control:

- IRATI ensures high-quality performance through standardized procedures, rigorous testing, and continuous monitoring.
- Automated inspections, real-time feedback, and adherence to industry, guaranteeing that training systems and automation solutions deliver consistent, accurate, and effective performance for diverse industrial and educational applications.

Automation:

- Robotic training systems: Provide practical hands-on learning for students and professionals.
- Automation kits for manufacturing: Enable modular automation of assembly and material handling processes.
- Automation kits for welding: Allow precise and repeatable welding for training or small-scale production.
- Automation kits for logistics: Streamline material handling and distribution.
- Food supplement production automation: Automate manufacturing of gummies, capsules, softgels, tablets, and liquids.
- Integrated inspection systems: Ensure quality and consistency during training and industrial production.
- Simulation and programming tools: Allow learners to program and test robots virtually before live operation.

Environmental Control:

- Enclosed conveyor systems and covered storage silos help reduce dust emissions, while high-efficiency bag filters and dust collectors capture fine particles generated during packing.
- Automated systems monitor air quality around the packing lines, ensuring compliance with environmental norms.
- Water sprinklers and sealed transfer points further minimize airborne dust, and energy-efficient machinery helps lower the terminal's overall carbon footprint.

LOGISTICS & PLANNING

Trip Notes:

Maharashtra (Pune, Talawade, Chakan, Dhayari, Dapodi, Talegaon Region)

Companies Visited:

- PARC Robotics Pvt. Ltd. (Talawade, Pune)
- iTech Robotics & Automation Pvt. Ltd. (Chakan, Pune)
- Autofina Robotics (Talegaon Dabhade, Pune)
- Geometrix Automation & Robotics Pvt. Ltd. (Talawade, Pune)
- Perfecto Robotics Pvt. Ltd. (Dhayari, Pune)
- IRATI (Industrial Robotics Automation & Training Institute) (Dapodi, Pune)

Travel Logistics:

Most factories are located within the Pune metropolitan and industrial outskirts. Talawade, Chakan, Talegaon, Dhayari, and Dapodi are between 15–35 km from Pune city center, typically a 40–60 minute drive depending on traffic. Local taxis, app-based ride services, or rental cars are recommended for flexibility when visiting multiple sites in one day.

Planning Notes:

I arranged plant visits geographically to minimize travel time and maximize learning. Pune city served as the base for the trip, enabling efficient coverage of Talawade, Chakan, Talegaon, Dhayari, and Dapodi in a single itinerary. Each company visit was planned to include factory tours, automation demonstrations, and discussions with technical teams.

Additional Notes:

Each visit was scheduled to include safety briefings and guided tours to understand the workflow, automation processes, and quality control measures. Photographs, notes, and process observations were collected for reference. Local staff provided insights into environmental management and sustainability practices at each facility, enhancing the learning experience.