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Market & IP Intelligence

YOUR INVENTION DESCRIPTION

"A modular robotic gripper system for automated assembly lines that adapts grip force and finger configuration in real time based on object geometry, weight, and surface properties. Tactile pressure sensors embedded in compliant silicone fingertips feed a reinforcement learning algorithm that continuously optimizes grasp strategy. The system autonomously reconfigures between pinch, envelope, and parallel grasp modes within milliseconds, eliminating manual tooling changes. It mounts on standard industrial robot arms via a universal flange adapter and communicates grip quality metrics to the production line controller. Target applications include mixed-product automotive and electronics assembly where frequent changeovers make dedicated tooling impractical."

TABLE OF CONTENTS

Report date: 04-03-2026. **Report number:** 82CD89

EXECUTIVE SUMMARY

We analyzed your invention across 120M+ patent publications from 100+ patent offices using keyword matching, claims analysis, and classification codes, then expanded results through Google's citation graph and similarity engine (details in Patent Intelligence).

Beyond patents, we screened scientific literature for prior art and technology readiness, mapped the competitive landscape and market timing, and tracked recent funding activity in the space to provide a complete due diligence picture.

RESEARCH ACTIVITY

2017 2026

Peak in 2023

PATENT FILINGS

2017 2026

Peak in 2019

PUBLIC INTEREST

2017 2026

Peak in 2026

FUNDING ACTIVITY

2017 2026

Peak in 2025

ACTIVE PATENTS

9

Your jurisdiction(s): Europe, US, CA

PENDING PATENTS

6

Your jurisdiction(s): Europe, US, CA

The robotic gripper market exhibits emerging maturity, with research peaking in 2023, patents in 2019, public interest projected for 2026, and funding mainstream through 2025. The IP landscape includes 9 active patents and 6 pending applications, dominated by Ethicon with 3 active patents alongside Cilag GMBH International, Outrider Technologies, Brain, and Richard A. Skrinde. Competitive activity features key players Schunk, OnRobot, Robotiq, Weiss Robotics, and Zimmer, alongside recent deals such as Galaxea AI's $144. 7M Series B, Machina Labs' $124M Series C, and Mytra's $120M Series C. R&D concentrates in the US at 54% of 24 patents. Technical analysis reveals white space in compliant silicone fingertips, pressure-sensitive sensors, and tactile feedback sensors. The US and

EU regulatory environment presents low barriers with general industrial standards compliance.

MARKET INTELLIGENCE

The global robotic grippers market, valued at USD 710 million in 2024, is projected to reach USD 1,061 million by 2032, growing at a 6. 0% CAGR amid accelerating Industry 4. 0 adoption. Competition is intense, with eight key players including Schunk, OnRobot, and Robotiq, while Ethicon leads via four patents (three active) in adaptive gripper technologies. R&D concentrates in the US (54% of 24 patents), supported by six recent deals and a clear regulatory path in US and EU markets featuring low barriers and general industrial standards compliance.

Market outlook

💪 STRENGTHS

- Global robotic grippers market valued at USD 710 million in 2024, projected to reach USD 1,061 million by 2032 at 6. 0% CAGR.
- Industry 4. 0 adoption drives demand in automotive, electronics, logistics with proven precision handling efficiency.
- Cobot integration yields ROI through flexible automation and reduced manual retooling in assembly lines.

📉 WEAKNESSES

- High initial costs limit adoption among SMEs despite modular designs.
- Current grippers face technical limits in real-time adaptation to diverse object geometries.
- Market fragmentation evident with varying CAGRs from 4. 1% to 9. 4% across forecasts.

🎯 OPPORTUNITIES

- AI-integrated force feedback and soft grippers expand into semiconductor precision applications.
- Asia-Pacific leads growth via industrialization, with China driving "Made in China 2025" initiatives.
- Cobot and modular gripper convergence enables high-mix, low-volume manufacturing use cases.

⚠️ THREATS

- Ethicon dominates with 4 patents (3 active) in adaptive gripper technologies.
- Schunk, Festo, Robotiq lead high-performance segment; Flexiv Robotics advances adaptive robots.

- Regulatory pressures on safety standards challenge human-collaborative gripper deployments.

Competitive landscape

Key players developing products in this technology space.

COMPANY	PRODUCT / SOLUTION	HQ
Schunk	Co-act gripper series - flexible modular grippers for automation.	🇩🇪
OnRobot	Plug-and-produce grippers - modular electric grippers compatible with major robots.	🇩🇰
Robotiq	2F-85 adaptive gripper - versatile 2-finger gripper for cobots.	🇨🇦
Weiss Robotics	Electric grippers with force control - high-precision adaptive systems.	🇩🇪
Zimmer	Electric and pneumatic grippers - parallel, angular, and hybrid models.	🇩🇪
Piab	Electric grippers - configurable for automotive and logistics.	🇸🇪
Flexiv Robotics	Adaptive grippers for general-purpose robots - AI-integrated systems.	🇺🇸
Ethicon	Modular robotic grippers - surgical and adaptive gripping mechanisms.	🇺🇸

Recent deals

Recent funding rounds, acquisitions, and partnerships involving key players in this space.

Galaxea AI **— $144.7M Series B** — 02/2026

Robotics and AI company developing hardware and mechanical engineering solutions for manufacturing automation.

Machina Labs **— $124M Series C** — 02/2026

AI-powered robotic manufacturing and mechanical engineering platform for automated assembly and production systems.

Toyota Motor Manufacturing Canada **— Undisclosed** — 02/2026

Agility Robotics signed a commercial agreement with Toyota Motor Manufacturing Canada to deploy its robot Digit in facilities to support manufacturing, supply chain, and logistics operations.

Mytra **— $120M Series C** — 01/2026

Warehouse automation and robotic assembly systems for logistics and manufacturing operations.

RobCo **— $100M Series C** — 01/2026

Flexible robotic automation solutions for manufacturing and assembly applications.

Automata **— $45M Series C** — 01/2026

Lab automation and robotic assembly systems for precision manufacturing environments.

Regulatory snapshot

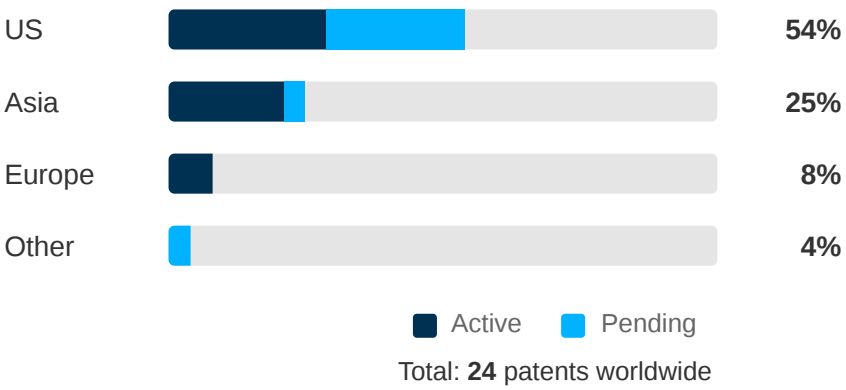
The regulatory path for commercializing smart manufacturing in US and EU industrial markets is relatively clear with low barriers, as verified sources show no major sector-specific mandates and focus on supportive initiatives like DOE's National Smart Manufacturing Strategic Plan; general compliance with existing industrial standards applies. FDA regulations are limited to medical products and irrelevant here.

- US: Comply with permitting reforms under SPEED Act for new facilities and energy infrastructure; monitor evolving AI guidelines amid federal deregulation efforts.
- EU: Adhere to Machinery Directive (2006/42/EC) and upcoming AI Act for high-risk industrial AI systems; ensure cybersecurity under NIS2 Directive.

Upcoming: US — SPEED Act permit reform expected by end-2026; EPA chemical deregulation ongoing; AI federal framework debates.

Regional R&D activity

Global distribution of patent filings by region, indicating where R&D investment is concentrated.

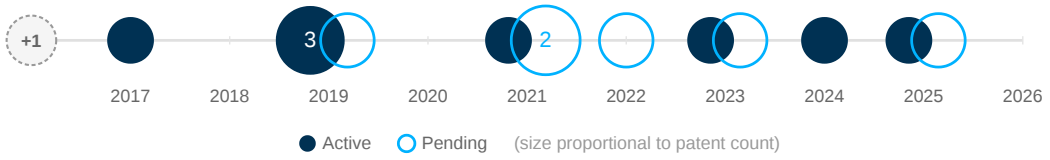


Total: **24** patents worldwide

PATENT INTELLIGENCE

This section provides a **deeper analysis of the patent landscape** by examining technical coverage, classification patterns, and key players.

Your jurisdiction(s): Europe, US, CA



Search strategy

We decomposed your invention into concept groups, key terms for patent claims analysis, and relevant CPC classification codes:

- **Concept groups:** modular robotic gripper, adaptive gripper system, robotic gripping mechanism, automated gripping device | tactile pressure sensors, compliant silicone fingertips, pressure-sensitive sensors, tactile feedback sensors | reinforcement learning algorithm, adaptive learning system, real-time optimization algorithm, machine learning control | universal flange adapter, standard industrial robot mount, robot arm interface, robotic arm attachment.
- **Claims terms:** adapting grip force, reconfiguring grasp modes, embedding tactile sensors, optimizing grasp strategy, universal flange adapter.
- **CPC codes:** B25J15/06, G05B19/418, G06N20/00, B25J19/02.

Using these elements, we ran **three complementary searches** — classification codes + keywords, patent claims analysis, and broad synonym matching — then expanded results through Google's citation graph and similarity engine. Results were deduplicated by patent family.

Technical coverage analysis

Maps your invention's core concepts against the patent landscape. Shows which ideas are heavily patented versus absent, helping identify white space opportunities or crowded areas.

ESTABLISHED COVERAGE

No concepts at this level

MODERATE COVERAGE

No concepts at this level

EMERGING COVERAGE	
modular robotic system	**1** active **1** pending
robotic gripper	**0** active **1** pending
tactile sensors	**0** active

POTENTIAL WHITE SPACE
compliant silicone fingertips
pressure-sensitive sensors
tactile feedback sensors

💡 Emerging coverage in 3 concepts (modular robotic system, robotic gripper) with 1-2 patents each signals early-stage landscape maturity. Gaps in 3 concepts (compliant silicone fingertips, pressure-sensitive sensors) indicate unpatented areas. No established or moderate activity observed.

Adjacent technologies

Identifies technologies present in existing patents but absent from your invention. Shows complementary approaches to consider for product development or defensive patenting.

CONCEPT	PATENTS
autonomous distributed control	**1**
intelligent instrumentation	**1**
universal connection interface	**1**

CONCEPT	PATENTS
surgical robotic arm	**1**
end effector guidance	**1**

💡 Low patent density across autonomous distributed control (1 patent), intelligent instrumentation (1 patent), universal connection interface (1 patent), surgical robotic arm (1 patent), and end effector guidance (1 patent) reveals a sparse competitive landscape with nascent complementary control and interface approaches.

Notable patent holders

Discusses the organizations and inventors dominating patent activity in your field. Shows potential collaboration opportunities, licensing candidates, or competitors requiring careful analysis.

MAJOR PATENT HOLDERS

Ethicon

→ Surgical sutures and wound closure devices manufacturer

4 patents (3 active, 1 pending)

Cilag GMBH International

→ Surgical technologies and devices developer

2 patents (1 active, 1 pending)

OTHER NOTABLE ENTITIES

Outrider Technologies — 1 patents (challenger)
Brain — 1 patents (challenger)
Richard A. Skrinde — 1 patents (challenger)
Meso Scale Technologies — 1 patents (challenger)
KB Medical — 1 patents (challenger)

> 💡 Dominance by Ethicon (4 patents) and Cilag GMBH International (2 patents), both Johnson & Johnson entities, reveals internal consolidation of IP in surgical tech. Concentration indicates high barriers from medtech expertise repurposed for robotics. Robotics giants absent, signaling early-stage adaptation from precision handling.

Patent classifications

We targeted CPC codes B25J15/06, G05B19/418, G06N20/00, B25J19/02. The patents found also carried these additional classifications, indicating adjacent technical domains:

- A61B18/1206 — by passing a current through the tissue to be heated, e.g. high-frequency current (5 patents)
- A61B18/1445 — Probes or electrodes therefor (4 patents)
- A61B17/320092 — Surgical cutting instruments (3 patents)
- A61B18/1233 — by passing a current through the tissue to be heated, e.g. high-frequency current (3 patents)
- A61B18/14 — Probes or electrodes therefor (3 patents)
- B25J9/163 — Programme controls (2 patents)

💡 Classification pattern shows heavy concentration in medical electrosurgery (A61B18/1206 33%, A61B18/1445 27%, A61B17/320092 20%), with supporting codes in ablation/contact (A61B18/1233 20%, A61B18/14 20%) and manipulator control (B25J9/163 13%). Absence of pure industrial gripping codes (B25J15) reveals medical adaptation dominance.

Research activity

Academic research publications related to your invention's technology domain. These indicate R&D activity and emerging scientific foundations.

The Future of Industrial Communication: Automation Networks in the Era of the Internet of Things and Industry 4.0

IEEE Industrial Electronics Magazine (01-01-2017)

→ Industrial communication evolves through IoT and CPS, enhancing automation networks and efficiency.

Deep learning for smart manufacturing: Methods and applications

Journal of Manufacturing Systems (01-01-2018)

→ Deep learning enhances efficiency and decision-making in smart manufacturing processes and applications.

Data-driven smart manufacturing

Journal of Manufacturing Systems (01-01-2018)

→ Integration of data analytics enhances efficiency and decision-making in smart manufacturing systems.

Digital Twin and Big Data Towards Smart Manufacturing and Industry 4.0: 360 Degree Comparison

IEEE Access (01-01-2018)

→ Digital twins and big data enhance smart manufacturing in Industry 4. 0 applications.

Digital Twin-driven smart manufacturing: Connotation, reference model, applications and research issues

Robotics and Computer-Integrated Manufacturing (01-01-2019)

→ Explores digital twin technology's role in enhancing smart manufacturing processes and applications.

💡 University of Auckland in New Zealand leads with 17 papers averaging 835 citations, followed by Beihang University in China with 16 papers averaging 924 citations. Publication volume peaked in 2018-2019 at 35% of papers before declining, indicating a maturing field past initial research surge. Funding appears institution-driven or fragmented, with average citations of 383 per paper across highly cited selected publications from 2017-2019. Open access covers 42% of papers.

YOUR TOP 10 MOST SIMILAR ACTIVE PATENTS

See our patent scoring methodology for details on how scores are calculated.

1. **Electric automobile energy monitoring and swapping network in remote monitoring …**

   Publication number: US10894484B2

   Publication date: 19-01-2021

   Inventor(s): Lei Han

   Patent holder(s): Lei Han

   Jurisdiction: US

   View patent → View similar patents →

   💡 This patent enables remote energy monitoring and swapping for electric vehicles via cloud computing architecture. Unlike the user invention's robotic gripper, it focuses on energy management. Both utilize real-time data processing but serve distinct industries.

   📤 Share patent overview

2. **Apparatus and method for enabling rapid configuration and reconfiguration of a …**

   Publication number: US10265851B2

   Publication date: 23-04-2019

   Inventor(s): Richard A. Skrinde

   Patent holder(s): Richard A. Skrinde

   Jurisdiction: US

   View patent → View similar patents →

   💡 This patent enables rapid reconfiguration of robotic systems using autonomous distributed control through intelligent instrumentation. Overlaps with user invention in adaptive automation. Differentiates by focusing on system-wide coordination rather than localized grip optimization and reconfiguration.

   📤 Share patent overview

3. **Integrated consumable data management system and platform**

   Publication number: US12360130B2

   Publication date: 15-07-2025

   Inventor(s): Jacob N. Wohlstadter

   Patent holder(s): Meso Scale Technologies, Llc.

   Jurisdiction: US

   View patent → View similar patents →

💡 This patent enables assay protocol adjustments using consumable data integration. It shares data-driven adaptability with the user invention but focuses on biological assays rather than robotic gripping, highlighting distinct application domains and technical architectures.

📤 Share patent overview

4. **Surgical generator for ultrasonic and electrosurgical devices**

   Publication number: US10263171B2
   Publication date: 16-04-2019
   Inventor(s): Eitan T. Wiener
   Patent holder(s): Ethicon
   Jurisdiction: US

   View patent → View similar patents →

   💡 This patent enables ultrasonic surgical device optimization via motional branch current analysis across frequencies. Overlaps with user invention in adaptive control systems; differs by focusing on surgical applications, not robotic assembly, and lacks real-time tactile feedback integration.

   📤 Share patent overview

5. **Surgical generator for ultrasonic and electrosurgical devices**

   Publication number: US9623237B2
   Publication date: 18-04-2017
   Inventor(s): Douglas J. Turner
   Patent holder(s): Ethicon Endo-surgery
   Jurisdiction: US

   View patent → View similar patents →

   💡 "This patent enables control signal reception in surgical devices via a switchable circuit, addressing precise energy delivery. Overlaps in real-time adaptability; differs as it targets surgical precision, not industrial grip reconfiguration, focusing on medical applications.

   📤 Share patent overview

6. **Communication capability of a surgical device with component**

   Publication number: US11911030B2
   Publication date: 27-02-2024
   Inventor(s): Frederick E. Shelton, Iv
   Patent holder(s): Cilag GMBH International
   Jurisdiction: US

   View patent → View similar patents →

💡 This patent enables surgical instrument-component communication via parameter determination, enhancing operational precision. Overlaps in adaptive control mechanisms with user invention; however, it focuses on medical applications, contrasting with the user's industrial assembly line adaptability and reconfiguration.

📤 Share patent overview

7. **Apparatus and systems for precise guidance of surgical tools**

Publication number: US9283048B2
Publication date: 15-03-2016
Inventor(s): Szymon Kostrzewski
Patent holder(s): KB Medical
Jurisdiction: US

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💡 "This patent enables precise surgical tool guidance using a portable robotic arm, focusing on manual end-effector positioning. Overlaps with user invention in robotic adaptability; differs by targeting surgical precision, not industrial assembly line automation.

📤 Share patent overview

8. **Systems for detecting proximity of surgical end effector to cancerous tissue**

Publication number: EP3505086B1
Publication date: 15-11-2023
Inventor(s): Iv Frederick E. Shelton
Patent holder(s): Ethicon
Jurisdiction: EP

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💡 This patent enables surgical end effector proximity detection to cancerous tissue using movable jaws and staple deployment. Shares adaptive grasping concept with user invention but focuses on medical applications, not industrial assembly line adaptability or reconfiguration.

📤 Share patent overview

9. **Surgical generator for ultrasonic and electrosurgical devices**

Publication number: EP2578172B1
Publication date: 19-06-2019
Inventor(s): Jeffrey L. Aldridge
Patent holder(s): Ethicon
Jurisdiction: EP

View patent → View similar patents →

💡 "This patent protects a generator producing ultrasonic and RF signals for surgical devices. Shares adaptive control focus with user invention but targets medical applications, not industrial automation, emphasizing signal generation over tactile feedback and grip optimization.

📤 Share patent overview

YOUR TOP 10 MOST SIMILAR PENDING PATENTS

These are patent applications that have been published but not yet granted. They represent potential future patents in your technical domain.

1. **Systems and methods for automated operation and handling of autonomous trucks …**

   Publication number: US20210053407A1

   Publication date: 25-02-2021

   Inventor(s): Andrew F. Smith

   Patent holder(s): Outrider Technologies

   Jurisdiction: US

   View patent application → View similar patents →

   💡 "This patent enables autonomous truck-trailer connections using a manipulator with an end effector. Overlaps with user invention in sensor integration; differs by focusing on vehicle logistics, not adaptive grip strategies for assembly line applications.

   📤 Share patent overview

2. **Autonomous multi-tasking modular robotic system**

   Publication number: US20190248007A1

   Publication date: 15-08-2019

   Inventor(s): Phil Duffy

   Patent holder(s): Brain

   Jurisdiction: US

   View patent application → View similar patents →

   💡 This patent enables a universal connection interface for modular robotic attachments, sharing adaptability focus with the user invention. However, it emphasizes interface standardization, contrasting with the user's real-time grip optimization via reinforcement learning.

   📤 Share patent overview

3. **Cellular system**

   Publication number: US20210112425A1

   Publication date: 15-04-2021

   Inventor(s): Bao Tran

   Patent holder(s): Bao Tran

   Jurisdiction: US

   View patent application → View similar patents →

💡 This patent enables 5G communication via antenna-processor integration, enhancing connectivity. Unlike the user invention's robotic gripper system, it focuses on wireless protocols, not mechanical adaptability. Both involve real-time data processing but differ in application domains.

📤 Share patent overview

4. **Method for mechanical packaging for modular energy system**

Publication number: US20220322523A1
Publication date: 06-10-2022
Inventor(s): Madeleine C. Jayme
Patent holder(s): Ethicon
Jurisdiction: US

View patent application → View similar patents →

💡 "This patent enables modular energy system assembly by connecting stacked modules via a backplane connector subassembly. While both inventions address modularity, the user invention focuses on adaptive robotic gripping, contrasting with the patent's emphasis on electrical connectivity.

📤 Share patent overview

5. **Cellular system**

Publication number: US20230261377A1
Publication date: 17-08-2023
Inventor(s): Bao Tran
Patent holder(s): Bao Tran
Jurisdiction: US

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💡 This patent enables 5G communication via antenna-processor integration, enhancing data transmission efficiency. Unlike the user invention's focus on robotic grip adaptation, both involve real-time data processing but differ in application scope—telecommunications versus industrial automation.

📤 Share patent overview

6. **Backplane connector attachment mechanism for modular energy system**

Publication number: US20250224791A1
Publication date: 10-07-2025
Inventor(s): Madeleine C. Jayme
Patent holder(s): Cilag GMBH International
Jurisdiction: US

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💡 This patent enables modular energy system connectivity via a backplane connector extending past panel edges. Shares modularity with user invention but differs in focus; it targets energy systems, not adaptive robotic gripping for assembly lines.

📤 Share patent overview

NEXT STEPS

Run a new FTO Checker search

Try again with a modified description to explore other patent families or technical variants.

Start New Search →

⚠ This is an **automated early-stage analysis** designed to help you explore potential patent risks. It is **not legal advice**, and we cannot guarantee freedom to operate or absence of infringement risks. If you plan to commercialize your invention, we recommend discussing the results with a qualified patent attorney.