

Stop Building from Scratch:

The Smarter Way to Build AI Hardware

Violet Su

What Causes Hardware Projects to Fail?



Mechanical



Electrical



Software



Assembly



Process

In mechatronic products, failure rarely comes from a single part — it comes from **the system**.



THE REAL CONSEQUENCES



Delays
in timeline



Higher
costs



High defect
& rework



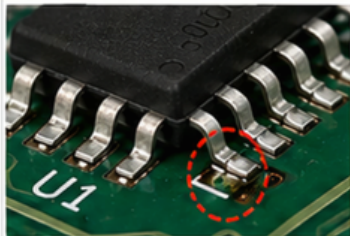
Poor reliability
in real use



Dissatisfied
customers

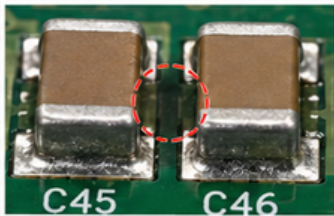
Top 10 Most Frequent DFM Errors

1 Package Lead / Pad Size Mismatch



Lead width does not match solder pad size.

2 Insufficient Component Clearance



Components are too close, restricting placement and rework.

3 Missing or Unclear Polarity / Orientation Marking



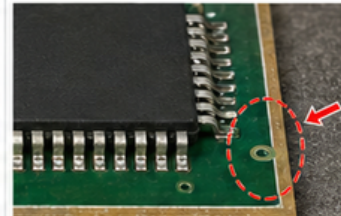
Polarity or pin-1 orientation is missing or ambiguous.

4 BOM Qty Does Not Match PCB Ref Des

BOM (Extract)	
Ref Des	Qty
R100	1
C201	1
C200	2

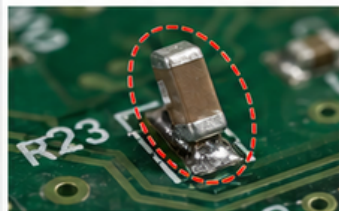
BOM quantities do not match PCB reference designators.

5 Components Too Close to Board Edge



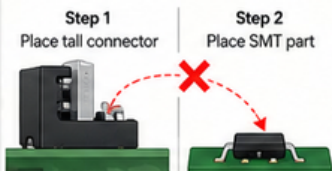
Component is placed too near the board outline.

6 Unbalanced Pads Causing Tombstoning



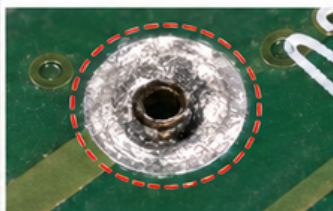
Asymmetric pad sizes create uneven solder, causing tombstoning.

7 Process / Assembly Sequence Conflict



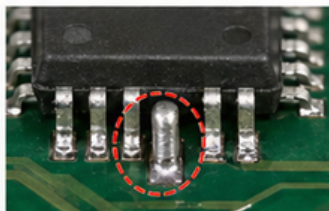
Assembly sequence causes access or placement interference.

8 Via-in-Pad Without Proper Plugging



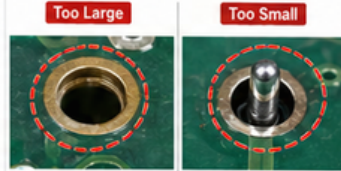
Via in pad can cause solder loss, voids, or reliability issues.

9 Through-Hole Parts Under SMT Components



Through-hole component causes interference with SMT placement or soldering.

10 Hole Size Too Large or Too Small



Loose fit causes poor reliability; undersized holes cause insertion difficulty or damage.

These issues can increase assembly risk, defect rate, and rework cost.



Structural Projects

1 Small-Batch Validation Does Not Guarantee Mass Production Consistency

Sample (Small Qty)



✓ Good appearance, smooth assembly

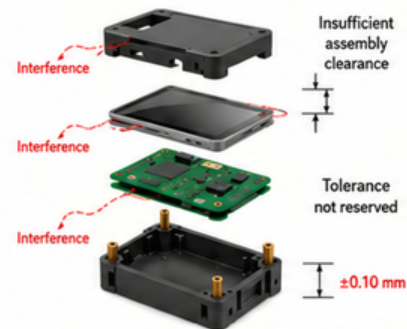
Mass Production (Large Qty)



- ❗ Dimensional variation
- ❗ Warping or deformation
- ❗ Poor assembly

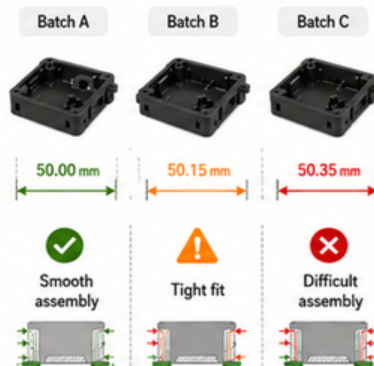
- Problems can often be fixed manually during the sample stage
- In mass production, differences in dimensions, materials, and equipment can amplify risk

2 Design Does Not Fully Consider Manufacturing Tolerances



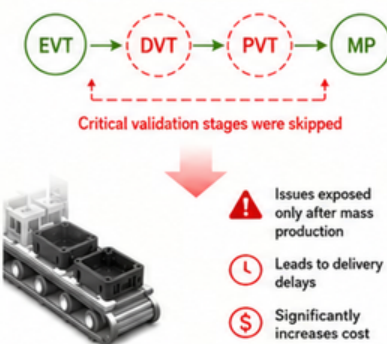
- Insufficient assembly clearance or dimensional tolerance was reserved.
- This can cause interference between the screen, PCB, and housing.

3 Structural Part Consistency Risk



- 3D-printed or CNC parts may vary from batch to batch.
- After scale-up, this can cause assembly difficulty and unstable quality.

4 Lack of Mass Production Validation and Process Review



- Key validation stages such as DVT and PVT were skipped.
- Problems are exposed only after formal production starts, causing delays and extra cost.



KEY TAKEAWAY

Customers validate whether a sample can be made; mass production requires the product to be **stable, consistent, and scalable**.

Harsh Environments

1. High / Low Temperature



Overheating / performance drop / freezing failure

2. Humidity / Water Ingress



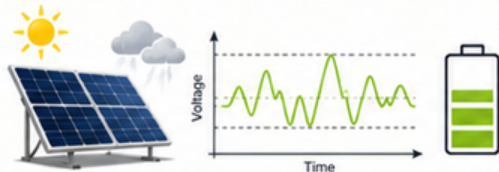
Condensation / water ingress / corrosion / short circuit

3. Dust



Blocked heat dissipation / poor contact / abrasion

4. Unstable Solar Power Supply



Changing sunlight / voltage fluctuation / power loss and reboot

5. Industrial Environments



Vibration / impact / oil mist / strong electromagnetic interference



Hardware projects face failure risks

Possible Results



Crashes

Device offline / service interruption



False Alarms

Inaccurate data / interference-triggered alarms



Shortened Lifespan

Component aging / premature failure



Higher Maintenance Costs

Frequent servicing / equipment replacement

Mechatronics Integration: Real Assembly Issues

Case study: reBot ARM B601-DM/B601-RS

A growing inspection system for finding, tracking, and closing mechatronic issues.

WHAT WE CHECK



Mechanical



Electrical



Assembly



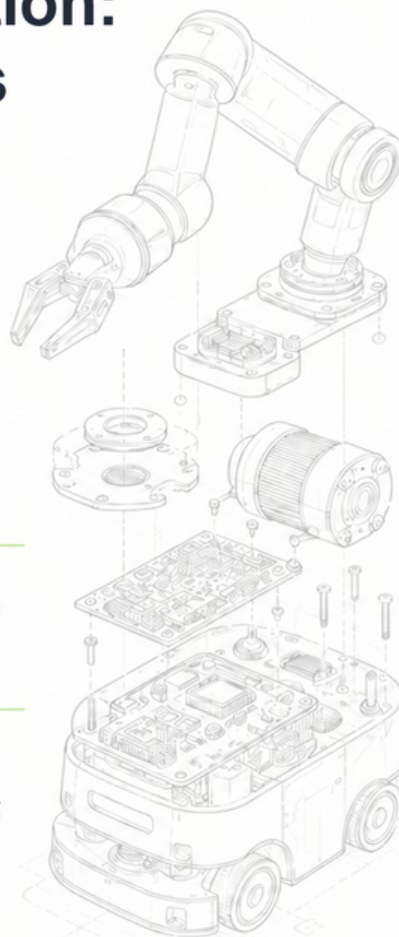
Control &
Software



Function &
Performance



Safety &
Reliability



70



CHECKS LOGGED

64
CLOSED

4
ONGOING

2
OPEN



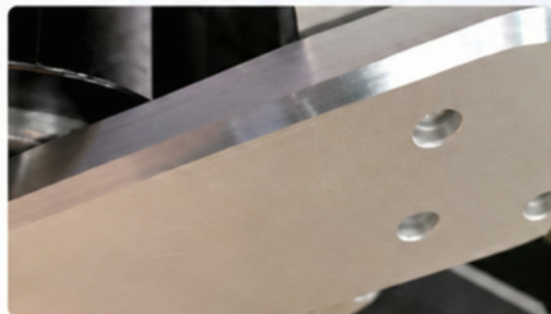
This is not the final checklist —
we are still exploring, validating,
and building the playbook.

Mechatronics Integration: Real Assembly Issues

reBot ARM B601-RS

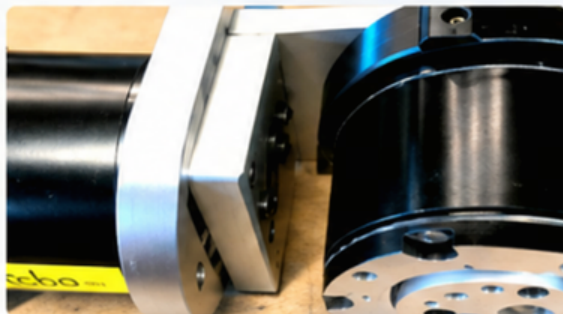


1. Surface Finish & Handling



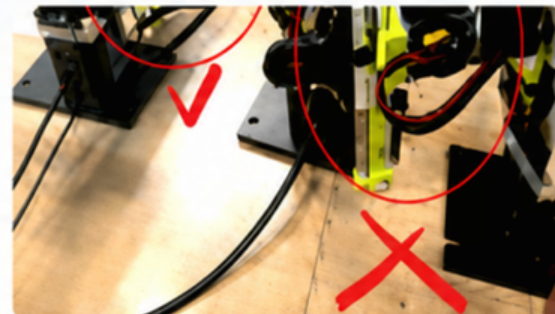
- **Problem:** Scratches on visible anodized aluminum surfaces.
- **Root Cause:** Insufficient protection during handling and transport.
- **Improvement:** Added protective film and tray packaging.

2. Fastener & Structural Fit



- **Problem:** Screw length did not match hole depth, causing improper fit.
- **Root Cause:** Fastener spec and structure were not fully matched.
- **Improvement:** Adjusted countersink depth and optimized the fastener spec.

3. Cable Routing & Assembly



- **Problem:** Cable length and routing created assembly interference.
- **Root Cause:** Mechanical structure and cable routing were designed separately.
- **Improvement:** Updated cable length, connector orientation, and 3D assembly layout.

Key takeaway: These were not isolated component failures - they were integration gaps between mechanics, electronics, cabling, suppliers, and assembly.

none of above really matters.

suppliers:

It will be ready
next week!

It will be ready
next Month!

They are
the same!

The components
are in shortage

The MOQ is 50000!



How to build trust?

client:

The need is
huge and rising

I will surely pay
you on time!

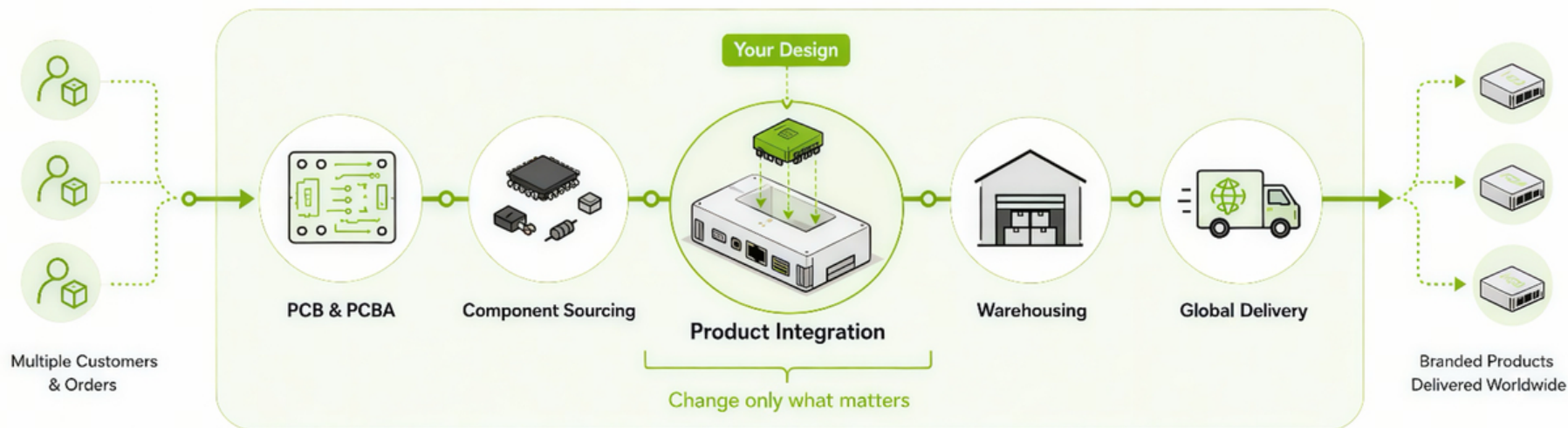
Just a few
simple changes!



the new paradigm

Built on an **Established** Supply Chain

Customize what makes your product unique — while leveraging Seeed Studio's proven supply chain for everything else.



**Proven Supply
Network**



**Shared Scale
Advantages**



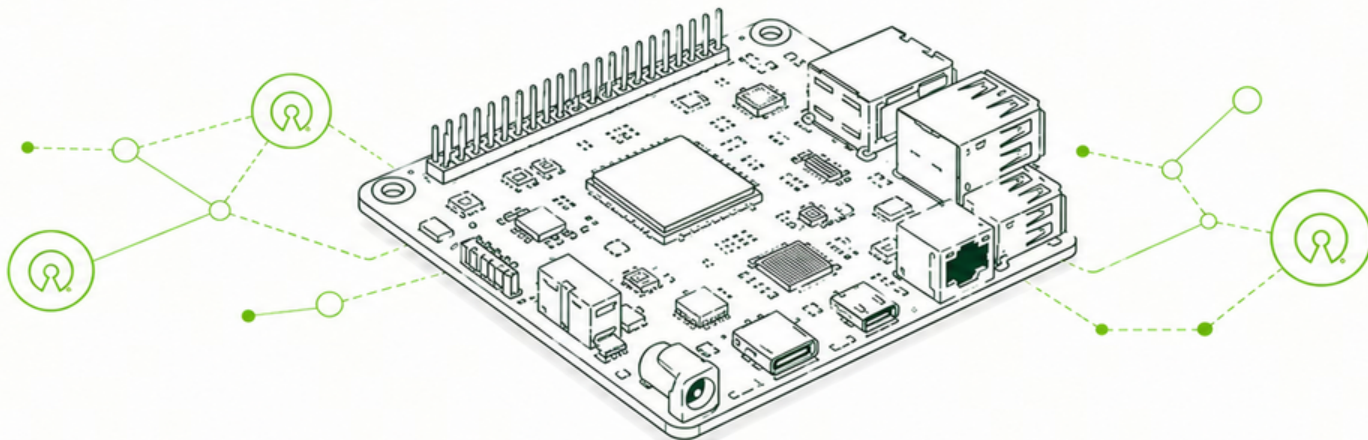
**Lower Development
Risk**



**Faster Time
to Market**

Why Build on Open-Source Hardware?

A proven foundation for faster, more reliable production.



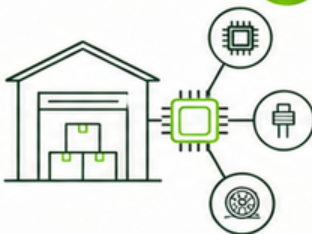
01



Proven & Validated Designs

Reduce development time and technical risk.

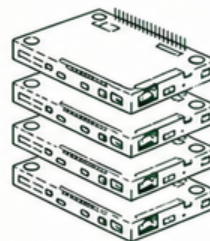
02



Established Supply Chains

Source components and scale production with confidence.

03



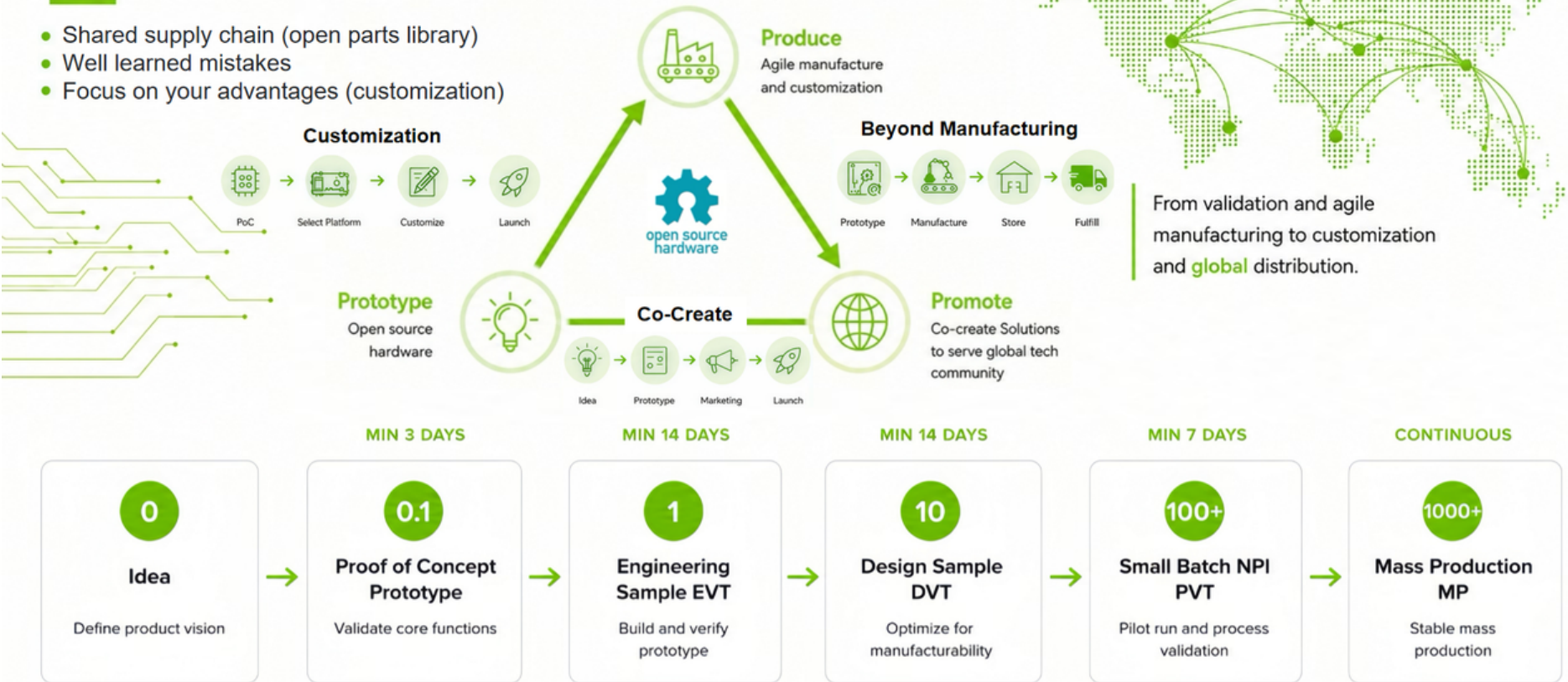
Economies of Scale

Lower unit costs through shared platforms and volume.



Design from open source hardware

- Shared supply chain (open parts library)
- Well learned mistakes
- Focus on your advantages (customization)



The New Paradigm



From Prototype Success to Production-Ready Execution



DFM / PCBA Errors

- Design not manufacturable
- BOM / reference mismatch
- Spacing, via, soldering issues
- Process / sequence conflicts



Structural Inconsistencies

- Sample OK, mass production unstable
- Tolerance not considered
- Batch variation
- Critical validations skipped



Harsh Environment Risks

- High / low temperature
- Moisture / water / dust
- Vibration / impact / oil mist
- Power fluctuation / EMI



Mechatronic System Issues

- Mechanical / electrical / software
- Assembly & manufacturing
- Cross-team misalignment
- Process and documentation gaps



1. Prevent Issues Earlier

Free DFA/DFM review, file checks, and pilot-build feedback to catch risks before production starts.



2. Validate Beyond the Sample

Support prototype to pilot transition, assembly feasibility, tolerance control, and scale-up readiness.

Seed Studio
Your Partner for
Hardware Success



3. Build for Real-World Deployment

Design and production thinking for harsh environments to improve reliability in real applications.



4. Integrate the Execution Chain

Connect manufacturing, assembly, customization, warehousing, and fulfillment into one smooth workflow.



Seed Studio helps hardware teams **reduce rework**, **improve readiness**, and **deliver scalable products** with confidence.



Faster Time
to Market



Lower Total
Cost



Higher Quality
& Reliability



Smoother Scale
& Delivery



**One Partner.
One Process.**
From Idea to Impact.

Open Technology for everyone since 2008

seeed studio
The AI Hardware Partner

1 Born in Shenzhen

Founded in 2008 at the heart of China's maker movement.

Rooted in innovation, collaboration, and open hardware.



2 Community Roots



 Chaihuo Makerspace

Connecting makers, ideas, and resources.



 Early Maker Gatherings

Where ideas became prototypes.

3 Growing the Ecosystem



Maker Camp Shenzhen

Learn, build, and collaborate.



Agile Manufacturing

From prototype to scalable production.



Maker Faire Shenzhen

Connecting global innovators.



4 Our Journey



2026 Global Hardware Impact



2020 Built for Resilience



2014 Maker Ecosystem Growth



2010 Open-Source Expansion



2008 Founded in Shenzhen



100+

Manufacturing products in reference design



8-24 Weeks

To customize a new product



15+ Years

Experience in hardware design



660K+

Customers served globally



30000+

SKU

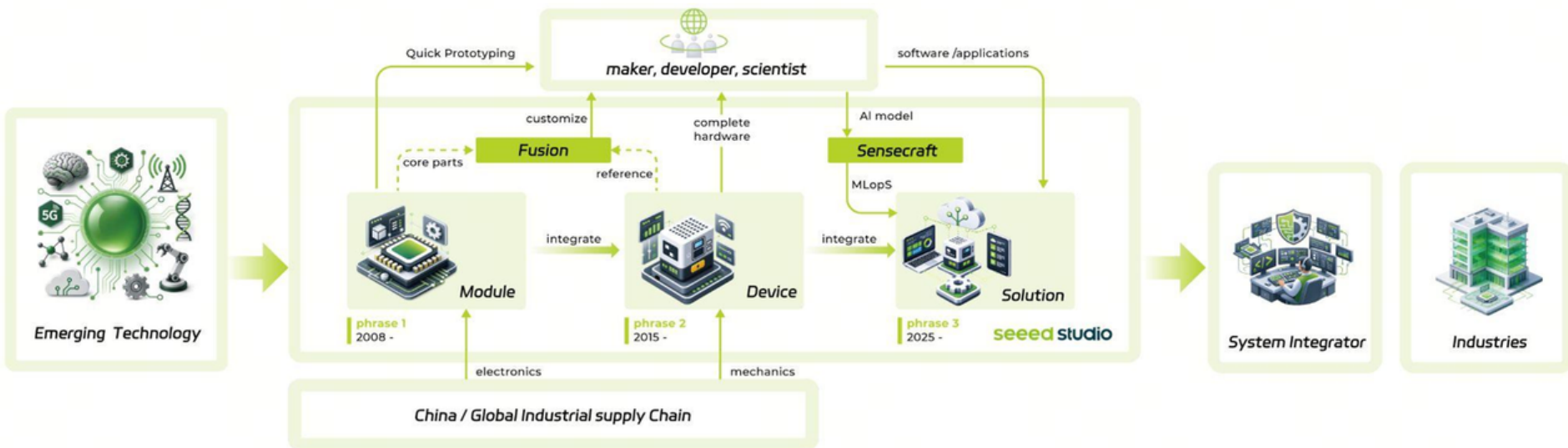


50M+

Shipments

AI hardware incubation platform

Open hardware + Agile manufacturing



Global Supply Chain & Manufacturing Network



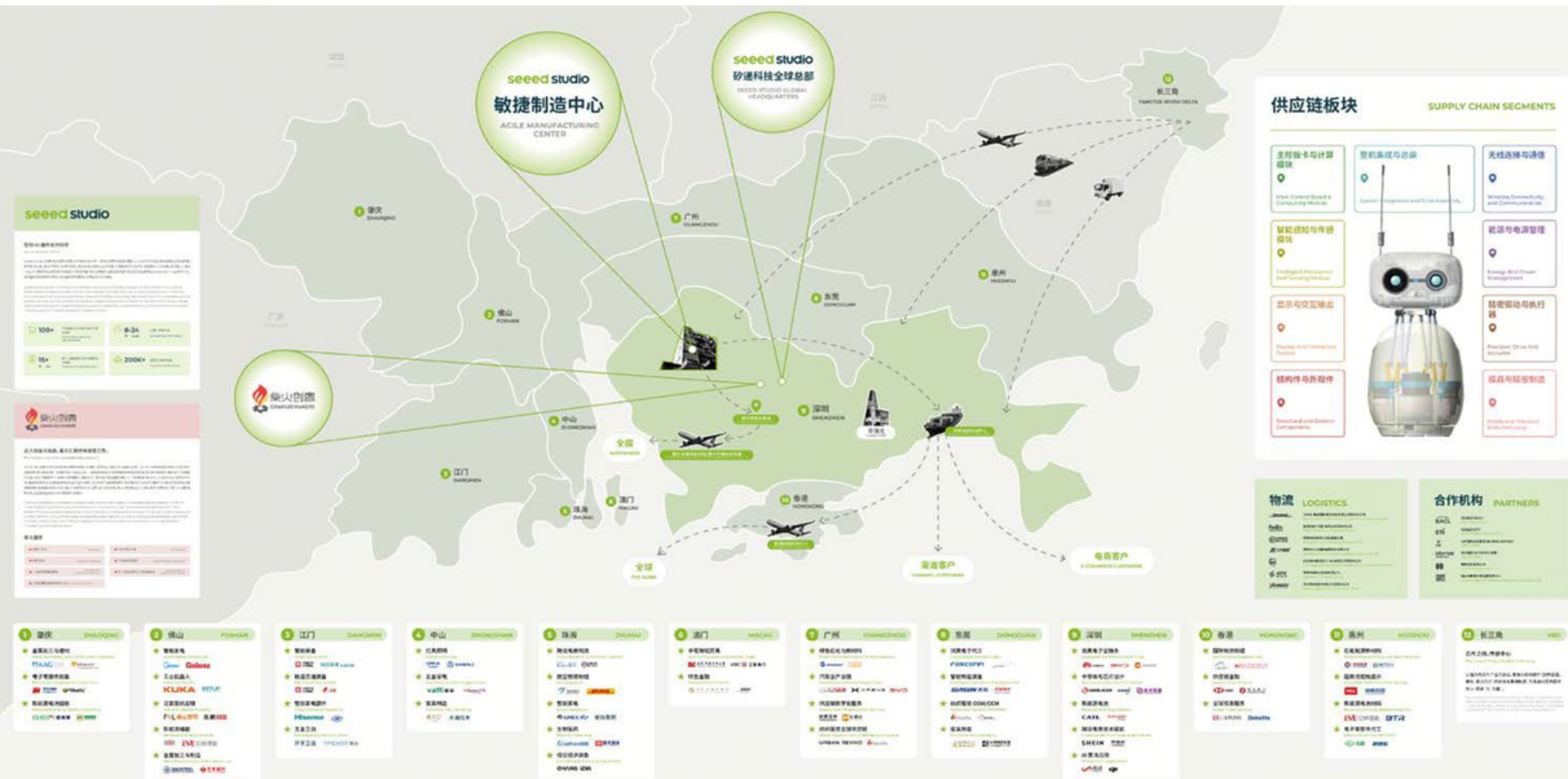
Extensive Supply Chain Resources
- Network of 600+ qualified Suppliers



Diversified Global Manufacturing
- Shenzhen, Vietnam, Japan



Strategic Global Warehouse and Logistics
- US & Europe Overseas Warehouse



USA
Regional Warehouse

EU / Germany
Regional Warehouse

China / Shenzhen
Headquarters &
Regional Warehouse

Manufacturing Footprint
Shenzhen • Vietnam • Japan

Network of
600+ qualified suppliers

Shenzhen • Vietnam • Japan

China / Shenzhen • USA • EU / Germany



Advanced Robotics Manufacturing



1. Robot Subassembly & Mechanical Integration

- ✓ Structural assembly and fastening
- ✓ Module, actuator, and frame integration
- ✓ Standardized work instructions



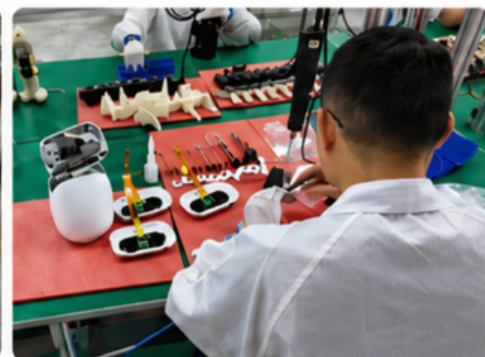
2. Functional Testing & Quality Assurance

- ✓ End-of-line functional testing
- ✓ Quality checkpoints and traceability
- ✓ Consistent assembly verification



3. Scalable Production & Delivery

- ✓ Pilot run to mass production
- ✓ Supply chain and material readiness
- ✓ Packaging and global shipment



Bring Your Idea. Let's Build It Together.

Bring your idea and initial design. Together, we refine it and bring it to production.



Idea & Design



Co-create & Refine



Produce & Launch

We should not do this alone

Success story: Smart Citizen

From open community innovation to a globally accessible environmental monitoring tool



Smart Citizen Kit

An open-source environmental monitoring kit that enables citizens, educators, researchers, and communities to monitor their environment and contribute data through the **Smart Citizen Platform**.



Open data

Share and access data openly



Citizen science

Generate knowledge together



Community participation

Stronger impact, together



Monitor what matters



Air Quality /
Particulate Matter



Temperature



Humidity



Noise



Light



CO₂



VOCs



More sensors
& flexibility



Smart Citizen
Platform
Share • Visualize • Act

Why this story matters



Open innovation

- Built for citizen science
- Supports community participation
- Open data platform



Seed Fusion value

- Productization support
- Manufacturing, sales, and distribution
- More accessible to global users



Outcome



Empower communities

Enable anyone to monitor and protect their environment



Bring open hardware to market

From community innovation to a globally available product



Evolve to SCK 2.3

More accurate, easier, more customizable, stronger

Success Story

Home Assistant Voice Preview Edition

A privacy-focused voice assistant device for Home Assistant, designed to help users experience and develop a community-driven private voice assistant.

Our client Nabu Casa sought support to build a first-of-its-kind, privacy-focused voice assistant for Home Assistant. The Home Assistant Voice Preview Edition is a dedicated hardware device that enables users to experience and develop this community-driven and private voice assistant.



Custom PCB



Advanced
audio processor



Semi-transparent
injection-molded case
with tactile buttons



Success story: Crazyflie

From open-source flying platform to swarm robotics research



Crazyflie 2.1 Brushless Version

A 27g, palm-sized open flying platform for limitless possibilities.

- 27g**
Ultralight
- Open-source**
Hardware & Software
- Low-latency**
Long-range radio
- Bluetooth LE**
Connectivity
- High-performance**
Brushless motors
- Indoor & Small-space**
Optimized

Perfect for education, research, prototyping and swarm robotics.

2020 Caltech Research Highlight

Neural-Swarm / GLAS Project

Caltech researchers developed a data-driven method to control the movement of multiple Crazyflie drones in coordinated swarms.

- Up to 16 drones**
in swarm tests
- Data-driven**
swarm control
- Improved**
coordination & scalability



Crazyflie swarm in Caltech experiments



Data-driven swarm coordination

Success Story

Reachy Mini Christmas Miracle

How Seeed Studio Dispatched 3,000 High-Tech Robots in 72 Hours

When Pollen Robotics launched Reachy Mini ahead of the holiday season, Seeed Studio's integrated fulfillment support helped turn a high-stakes delivery window into a global success story.



3,000+ Units

Total orders fulfilled globally



72 Hours

From production line to final dispatch



100% On-Time

Delivered before Dec 25



The Challenge

- Holiday launch deadline
- High order volume
- Risk of missing the Christmas delivery window



Seeed Solution

- Factory-to-door fulfillment
- Priority processing and fast dispatch
- Global compliance and cross-border logistics support



The Result

The first batch was shipped globally within 72 hours, helping Reachy Mini land with customers across North America, Europe, and Asia in time for the holiday season.

Fast fulfillment. Global delivery.
Holiday-ready execution.

Empower 0.1 → ∞

Empowering innovators to bring ideas to life and go further.

We provide product designers an entrance to utilize Seeed's back-end and front-end resources.

- **Back-end:** components sourcing; testing & manufacturing capabilities
- **Front-end:** worldwide distribution network; marketing platforms & resources; global sales experience



More Mature Designs

From idea to validated product



More Case Studies

Successful stories, proven together



More Solutions Possibility

More ways to create value

Who We Support



Solution Architect Builders

System architects & integrators



Embedded Software & Hardware Engineers

Developers & engineers

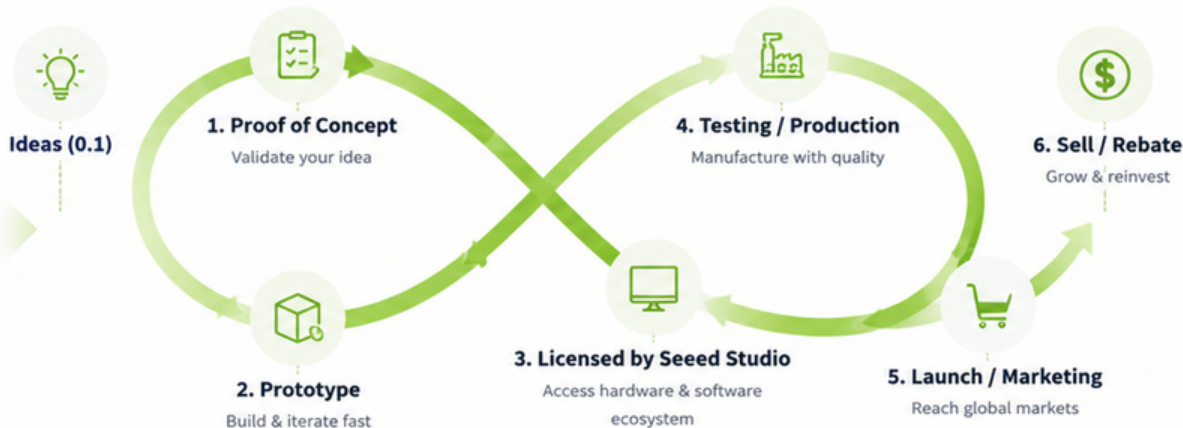


IoT Solution Providers

Product companies & innovators



Creators



From idea to impact. We're with you at every step.

Q & A

Thank you !

Looking forward to co-creating with you

fusion@seeed.io