ROBOREACH: Democratizing Medical Prosthetic Access Through Technology

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Global Leaders and Scholars in STEM (GLASS) Program | UN SDG 10: Reduced Inequalities

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Abstract

Nearly 2 million Americans live with limb loss, yet functional prosthetic technology remains out of reach for most, priced between $10,000 and $100,000 and locked behind a clinic-dependent distribution system that fails low-income, uninsured, and geographically isolated populations. Globally, fewer than 15% of people in low- and middle-income countries who need prosthetic devices can access them.

RoboReach is a social enterprise designed to dismantle this barrier. Built as a $1,000 prototype through the NYU Prototyping Fund, RoboReach pairs a fully functional, modular 3D-printed prosthetic arm featuring EMG-controlled finger movement, 360-degree rotation, and a Raspberry Pi interface with a direct-to-consumer mobile app that allows users to scan their residual limb, customize their device, and order on demand. By eliminating the clinic bottleneck entirely, RoboReach makes prosthetic access as straightforward as ordering eyeglasses online.

Operating on a hybrid B2C and NGO partnership model, RoboReach targets a scalable 5% profit margin while prioritizing distribution to underserved communities across the U.S., Caribbean, and sub-Saharan Africa. Aligned with UN SDG 10: Reduced Inequalities, RoboReach reframes prosthetic access not as a privilege but as a right, and proves that affordability and functionality are not mutually exclusive.

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1. Venture Idea

The Problem We Solve

Nearly 2.3 million Americans live with limb loss, yet only 30% ever receive a prosthetic device. The barrier is not medical necessity—it is cost. A functional prosthetic arm costs $10,000–$100,000, pricing out uninsured individuals, rural populations, and anyone without comprehensive insurance. Globally, 30 million people in low- and middle-income countries need prosthetics, yet up to 95% lack access. This is not an engineering problem. It is a structural failure rooted in clinic-dependent distribution models, prohibitive costs, and inequitable access.

I witnessed this gap firsthand during a service trip to Puyo, Ecuador within the Amazon Rain Forest. Working at the Yana Cocha Animal Rescue Center in a region with limited healthcare infrastructure, I saw how geographic isolation and resource scarcity create invisible barriers to care. What struck me was not just the absence of technology, but the absence of pathways to access it. Communities that needed medical support most had no means to obtain it. That experience cemented my commitment to building solutions that function beyond high-resource settings—solutions designed for the people who have been systematically excluded. What stayed with me wasn't just the lack of devices, but how normalized that absence was. People weren't choosing between options, they were adapting to having none. That gap is what RoboReach is built to close.

The Product: RoboReach Prosthetic Ecosystem

RoboReach is a complete ecosystem that decentralizes prosthetic access through three integrated components:

Hardware	Software	Distribution
A fully functional below-elbow prosthetic arm featuring 360-degree wrist rotation, individual finger movement via EMG sensors and DC motors, and an integrated Raspberry Pi touchscreen for object detection and customization. Built using modular 3D-printed components, the device costs $1,000 to produce (prototype validated through NYU Prototyping Fund).	A direct-to-consumer marketplace app that enables users to scan their residual limb via smartphone camera for precise sizing, customize functional and aesthetic features, and place orders on demand—eliminating clinic appointments and multi-month waiting periods.	Hybrid B2C and NGO partnership model. Individual consumers purchase directly via app; nonprofits, hospitals, and community health organizations order in bulk for subsidized distribution to underserved populations.

Target Market and Customer Segments

Primary: NGOs, community health clinics, and hospitals serving low-income, uninsured, or geographically isolated populations in the U.S., Caribbean, and sub-Saharan Africa.

Secondary: Individual consumers seeking affordable, customizable prosthetics without clinic mediation (e.g., young adults, parents of children with limb differences, individuals in rural areas).

Unique Selling Benefit: Why They Will Buy

Affordability	Accessibility	Speed	Mission alignment
At \$1,000–\$5,000, RoboReach is 50–95% less expensive than Open Bionics Hero Arm (\$5,999) or traditional prosthetics (\$10K–\$100K).	Direct web-based ordering removes clinic gatekeeping. Users can order from home, rural areas, or regions without prosthetic clinics.	Eliminates 3-6 month insurance approval and clinic wait times. Users receive devices in weeks, not months.	For NGOs, RoboReach offers bulk pricing and volume discounts, enabling distribution at scale to communities that have been priced out of traditional markets.

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2. Venture Model

Revenue Streams and Funding Sources

1. **NGO & Institutional Partnerships (Primary, 60% of revenue):** Bulk sales to nonprofits, hospitals, and community health organizations at \$3,000–\$4,000 per unit with volume discounts. Contracts provide predictable revenue and align with mission.

2. **Direct-to-Consumer Sales (Secondary, 30% of revenue):** Individual purchases via app at \$4,000–\$5,000 per unit. Higher margins fund R&D and subsidize low-income users.

3. **Open-Source Licensing & IP Partnerships (Long-term, 10% of revenue):** License modular design components or app software to other manufacturers. Creates scalable revenue while accelerating global innovation.

First-Year Cash Needs and Path to Funding

Year 1 capital requirement: \$150,000–\$200,000

R&D and app development: \$50K (finalize production-ready hardware, build marketplace app with scanning functionality)

Manufacturing setup: $40K (establish 3D printing partnerships, procure EMG sensors and Raspberry Pi components at scale)

Initial inventory (25–50 units): $30K

Operations and partnerships: $30K (legal, initial NGO outreach, pilot program coordination)

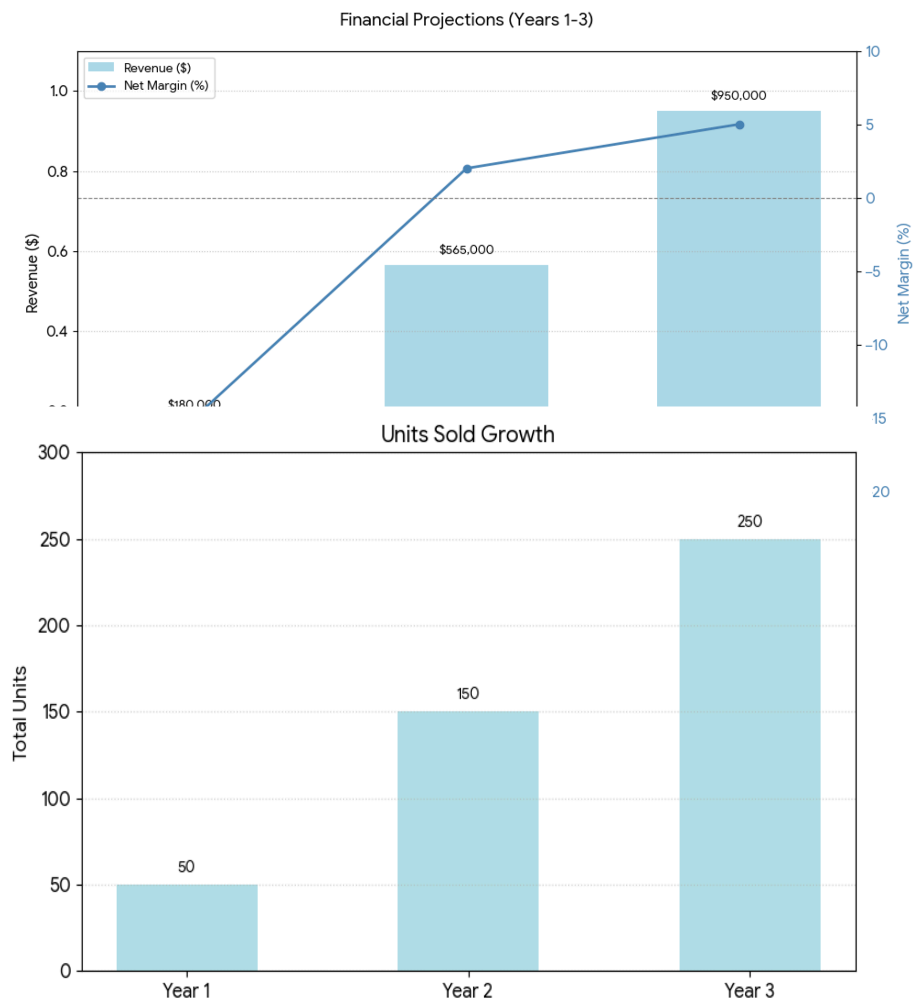
Funding pathway: Social impact grants (e.g., NIH SBIR, NSF I-Corps), angel investment from impact-focused investors, and pre-orders from NGO partners. Long-term: hybrid nonprofit-for-profit structure or B-Corp certification to attract impact investment while maintaining mission focus.

Financial Projections (Years 1-3)

Year 1:
Units sold: 50 (40 NGO partnerships, 10 B2C)
Revenue: $180,000 (NGO avg. $3,500/unit, B2C avg. $4,500/unit)
COGS: $100,000 (manufacturing, components)
Gross margin: 44%
Net margin: -15% (investment phase; reliant on grants/seed funding)

Year 2:
Units sold: 150 (110 NGO, 40 B2C)
Revenue: $565,000
Net margin: 2% (approach breakeven)

Year 3:
Units sold: 250 (175 NGO, 75 B2C)
Revenue: $950,000
Net margin: 5% (sustainable profitability; reinvest in international expansion)



How We Scale the Business

RoboReach scales through geographic expansion and partnership diversification. Year 1 focuses on U.S.-based pilots with disability advocacy groups and community health organizations. Year 2 expands to Caribbean markets via health ministries and regional NGOs. Year 3 launches sub-Saharan Africa pilots through partnerships with international development organizations. As production volume increases, per-unit costs decline through economies of scale, enabling lower pricing for NGO partners while maintaining margins. Long-term scaling includes licensing the app and modular design components to other manufacturers, creating a platform model that accelerates global prosthetic access beyond our direct manufacturing capacity.

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3. Market Analysis

Competition and Possible New Entrants

High-cost incumbents: Otto Bock, Touch Bionics, and Össur dominate with myoelectric prosthetics priced at $20K–$80K. Require insurance and clinic mediation.

Mid-tier entrants: Open Bionics (Hero Arm, $5,999) targets younger demographics but still requires clinic access. Distribution limited to U.S., U.K., and select European countries.

Low-cost academic prototypes: Projects like Zero Arm (~$600) exist in research settings but lack commercial distribution infrastructure or regulatory approval for widespread use.

Potential new entrants: 3D printing startups or global health NGOs could enter the low-cost prosthetic space. However, most lack integrated app-based distribution or proven manufacturing scalability.

Critical Success Factors

1. **Cost efficiency:** Maintain production costs under $2,000/unit to enable $3K–$5K pricing.
2. **NGO partnerships:** Secure 3–5 anchor partners in Year 1 for bulk orders and pilot validation.
3. **App functionality:** Deliver accurate scanning and seamless ordering experience to drive B2C adoption.
4. **Regulatory compliance:** Obtain FDA clearance (U.S.) and CE marking (Europe) for medical device classification.
5. **User outcomes:** Demonstrate improved mobility, employment, and quality-of-life through pilot data.

Critical Risks and Mitigation Strategies

Risk 1: Regulatory delays. Mitigation: Begin FDA De Novo pathway application in Year 1; pursue international pilots in countries with streamlined medical device approval (e.g., Kenya, Ghana).

Risk 2: Low adoption by NGOs. Mitigation: Offer pilot programs with subsidized pricing; leverage existing relationships with disability advocacy groups and community health networks.

Risk 3: App accuracy concerns. Mitigation: Partner with computer vision experts; conduct beta testing with 50+ users before public launch; offer virtual fitting consultations for complex cases.

Risk 4: Manufacturing scalability. Mitigation: Establish partnerships with contract manufacturers experienced in medical device production; use modular design to enable distributed manufacturing.

Competitive Advantage and Sustainability

RoboReach's competitive advantage is threefold: (1) Direct-to-consumer app distribution eliminates clinic gatekeeping, a barrier no competitor has removed. (2) Mission-first design prioritizes underserved markets from Day One, rather than treating accessibility as an afterthought. (3) Hybrid revenue model (B2C + NGO partnerships) ensures financial sustainability while maximizing social impact.

This advantage is defensible because it requires both technical capability (app-based sizing, modular manufacturing) and mission alignment (willingness to serve low-margin markets). Competitors optimizing for profit margins will not replicate this model; those focused solely on mission lack the technical infrastructure. RoboReach occupies the intersection. That intersection is not accidental. It reflects a deliberate decision to build for populations that are often excluded from both innovation and investment.

Target Customer Segments

Segment 1: U.S. low-income/uninsured populations	Segment 2: Rural U.S. populations	Segment 3: Caribbean and sub-Saharan Africa
21% of U.S. amputees are Black, 8% Hispanic—disproportionately affected by limb loss but underserved by traditional prosthetic markets.	Limited access to certified prosthetic clinics; app-based ordering removes geographic barriers.	30 million people in low- and middle-income countries need prosthetics; 95% lack access. RoboReach targets NGO-led distribution in these regions.

Marketing Plan

Year 1: Direct outreach to disability advocacy organizations (Amputee Coalition, Limbs for Life), community health clinics, and prosthetic NGOs. Pilot programs with subsidized pricing to generate case studies and user testimonials.

Year 2: Digital marketing (social media, SEO) targeting B2C segment. Partnerships with healthcare influencers and prosthetic user communities. Expand to Caribbean via health ministry partnerships.

Year 3: International conference presence (ISPO World Congress, AOPA National Assembly). Launch ambassador program with prosthetic users. Scale NGO partnerships in sub-Saharan Africa.

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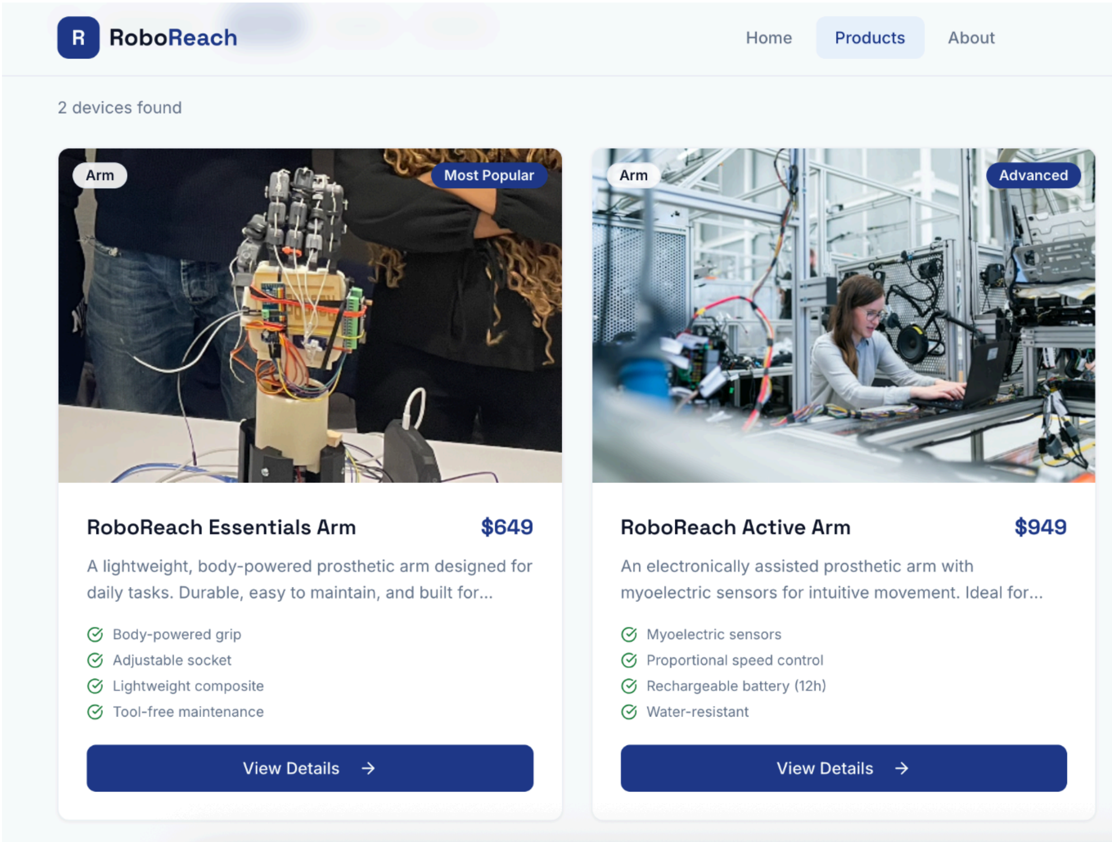
4. Operations Plan

How This Business Works

Development	Finalize production-ready hardware design (completed prototype: NYU Prototyping Fund). Build marketplace app with computer vision scanning, customization interface, and order processing.
Manufacturing	Partner with contract manufacturers for 3D printing and assembly. Procure EMG sensors, DC motors, Raspberry Pi components at scale. Initial capacity: 10 units/month (Year 1), scaling to 25/month (Year 3).
Sales cycle	B2C: User downloads app → scans limb → customizes device → places order → ships within 3–4 weeks. NGO: Outreach → pilot proposal → bulk order contract → delivery and training support.
Logistics	U.S. fulfillment via third-party logistics (3PL) partner. International shipping coordinated with NGO partners for bulk orders.
Human resources	Year 1 team: Founder/CEO (me), hardware engineer (co-founder from Prototyping Fund team), app developer (contract), operations manager (part-time). Year 2: Add prosthetist consultant, NGO partnership manager. Year 3: Expand to 8–10 FTEs.

Milestones and Current Status

✓ **Completed (2024–2025):** Functional prototype validated ($1,000 production cost, two $300 NYU Prototyping Fund rounds + personal investment). Team of 4 co-designers. Website MVP completed: robo-reach-nyu.lovable.app.



Current (Q1 2026): Completed business plan for GLASS program. Initiating conversations with disability advocacy groups and prosthetic NGOs for pilot partnerships.

Q2 2026: Complete app MVP with basic scanning functionality. Secure first NGO pilot partner.

Q3 2026: Launch pilot program with 10–15 devices. Collect user feedback and refine hardware/app.

Q4 2026: Finalize production-ready design. Submit FDA De Novo application. Secure seed funding ($150K–$200K).

2027: Scale to 50 units distributed. Expand to 2–3 additional NGO partners. Launch B2C app publicly.

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5. Management Team

Current Team Qualifications

Chelsea Patrick, Founder/CEO: Fourth-year BTM + STS student at NYU Tandon. Experience in business development (Reskyt, ecommerce native app startup), financial strategy (J.P. Morgan Private Bank internships), and healthcare AI (Mediktor). Led RoboReach prototype development and secured NYU Prototyping Fund grant. President, NYU Women in Business and Entrepreneurship. GLASS Honors Scholar with international experience (Ecuador, Italy, Portugal). Committed to accessible innovation for underserved communities.

Co-founder (1 member): Fourth-year BTM student (Zachary Nemni-Jones) with technical expertise in robotics, 3D printing, and hardware prototyping. Contributed to original RoboReach design and iteration.

Key Hires Needed

1. **Hardware Engineer (Year 1):** Finalize production-ready design, oversee manufacturing partnerships, ensure regulatory compliance.

2. **App Developer (Year 1, contract):** Build marketplace app with computer vision scanning, e-commerce backend, and user customization interface.

3. **Certified Prosthetist Consultant (Year 1, part-time):** Validate design, provide clinical feedback, support NGO training programs.

4. **NGO Partnership Manager (Year 2):** Develop relationships with community health organizations, disability advocacy groups, and international NGOs. Coordinate pilot programs and bulk orders.

5. **Operations Manager (Year 2):** Oversee manufacturing logistics, inventory management, and international shipping coordination.

Conclusion: From Prototype to Impact

RoboReach is not just a prosthetic device—it is a challenge to the assumption that advanced healthcare technology must be inaccessible to those who need it most. By eliminating clinic gatekeeping, slashing costs by 50–95%, and prioritizing underserved communities from Day One, RoboReach redefines what equitable innovation looks like. The prototype is validated. The market is massive and underserved. The team is committed. What remains is execution: securing funding, refining the app, and building the partnerships that will turn a university project into a global solution. This is how we bridge the prosthetic access gap. This is how we build technology that serves everyone.

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