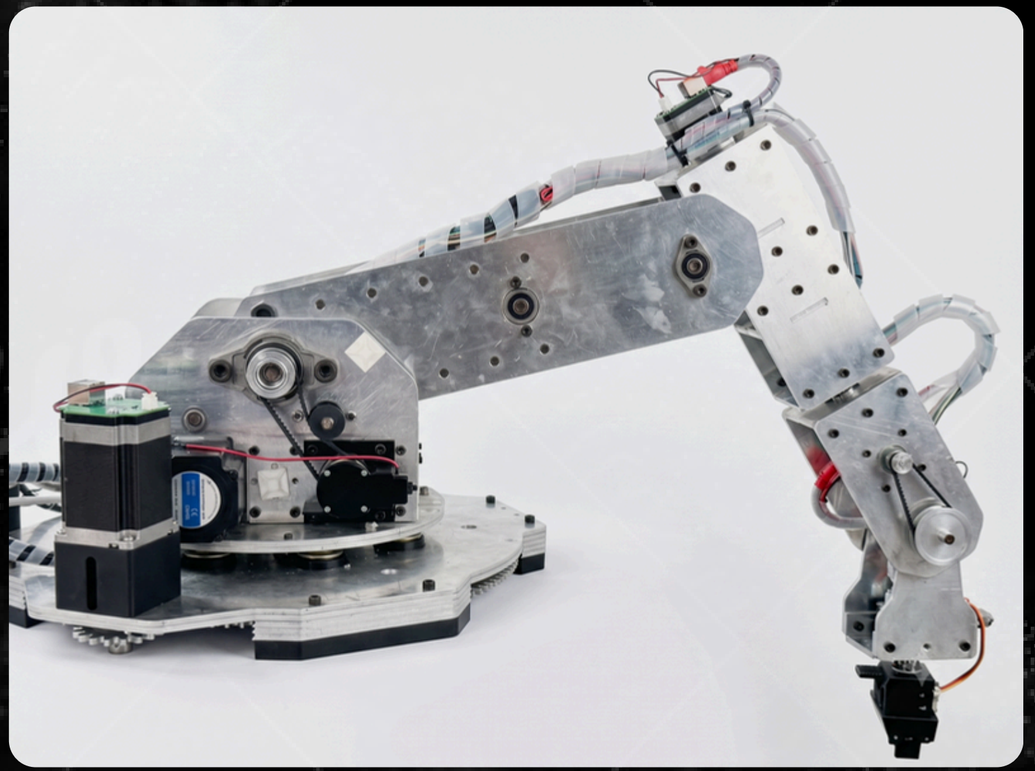
UNIVERSITY
OF MORATUWA

Neural Nexus

Advanced 6-DOF Robotic Arm for Precision Automation



Team Neural Nexus

PROBLEM ADDRESSED & MARKET JUSTIFICATION

Problem

Industrial 6-DOF arms cost $15,000–$80,000 — inaccessible to SMEs and academic labs.
Low-cost alternatives sacrifice precision, payload, and software capability.
Educational institutions lack affordable, programmable platforms for hands-on robotics curriculum.
No reliable mid-tier solution exists with sub-mm repeatability

Market Justification

Global market: $1.2B (2023) → $10.5B projected by 2030 (CAGR 36%)
SME automation adoption rate increased 28% post-pandemic — demand for affordable arms surging.
STEM robotics education market valued at $2.8B globally in 2024.
Sri Lankan engineering faculties: 0 institutions own a programmable 6-DOF arm.

AVG COST
$15K+

MARKET BY 2030
$10.5B

CAGR
36%

LOCAL FACULTIES
0

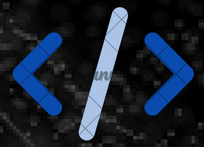
PRODUCT SPECIFICATION

The “WHAT”

A 6-DOF articulated robotic arm utilizing metal structural components with 3D-printed parts and precision stepper-based actuation

Expected Outcome

Deployment of a desktop-sized automation unit capable of complex pick-and-place, assembly, and research tasks paired with Computer Vision



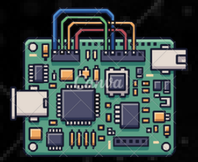
Software Stack

MATLAB-based Digital Twin handling Inverse Kinematics and collision validation, combined with a custom STM32H743VIT6 PCB for real-time control. HMI is available as a premium add-on

PRODUCT ARCHITECTURE

HMI interface

Command and control routing via a PC/Terminal Interface. Routes Cartesian targets (X, Y, Z) to the MATLAB Digital Twin for 3D visualization and IK validation



Real-Time Firmware

Receives validated joint angles via high-speed UART from the MATLAB Digital Twin. Translates angles into deterministic stepper pulses and polls AS5047P magnetic absolute encoders over SPI for closed-loop position feedback.

Physical Hardware

The Mechanical Actuation

6-DOF Aluminum structural links driven by NEMA stepper motors and TMC2209 drivers executing the physical motion

Command Routing (PC Terminal) → IK Solver (MATLAB Digital Twin) → Custom PCB (STM32H743VIT6) → Physical Motion & SPI Encoder Feedback

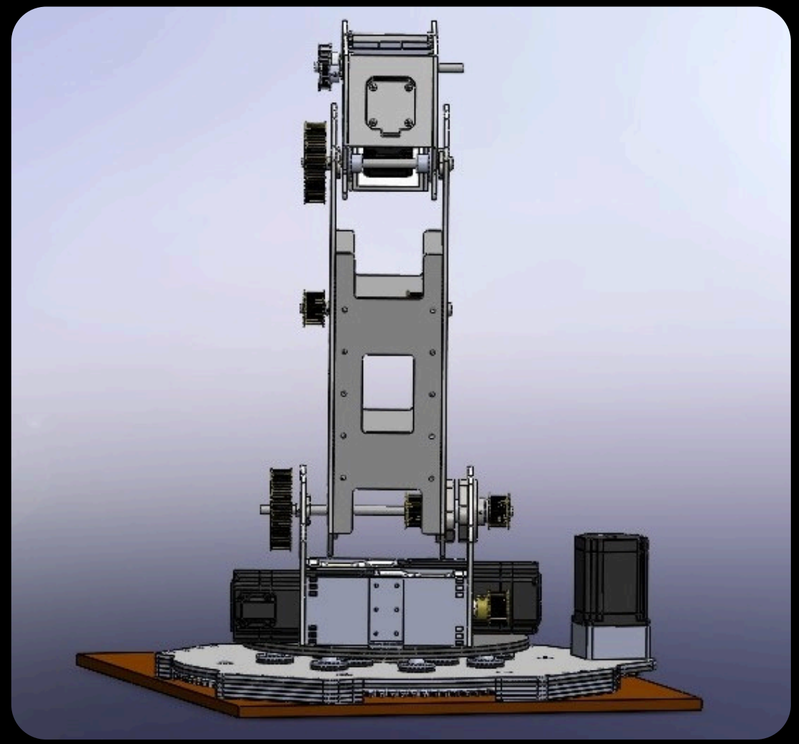
TECHNICAL SPECIFICATIONS

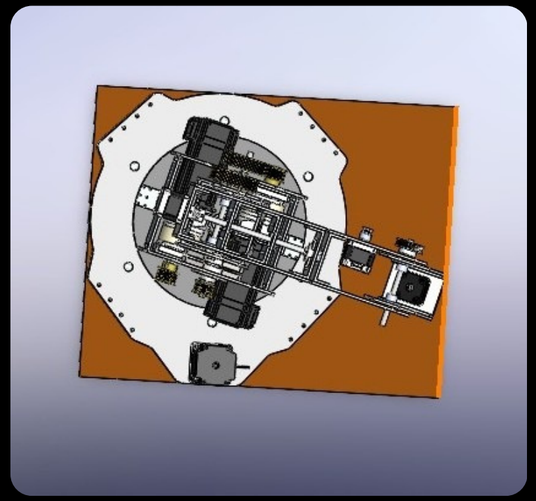
Parameter	Specification	Justification
Degrees of Freedom	6 DOF	Matches industrial standard; enables full 3D workspace with arbitrary end-effector orientation.
Payload Capacity Maximum	2kg(inversely related to the span)	Optimal for a wider range of SME automation, machine tending, and assembly tasks without requiring expensive high-voltage industrial servos.
Reach (Arm Span)	800mm	Enables the arm to cover a standard industrial workbench or conveyor setup, making it highly viable for machine tending and packaging
Joint Motors	2 × NEMA 24, 1 × NEMA 23, 3 × NEMA 17	Torque-matched per joint load — heavier base joints use the high-torque NEMA 24s, the mid-arm uses the NEMA 23, and the lighter wrist uses NEMA 17s to reduce moving mass

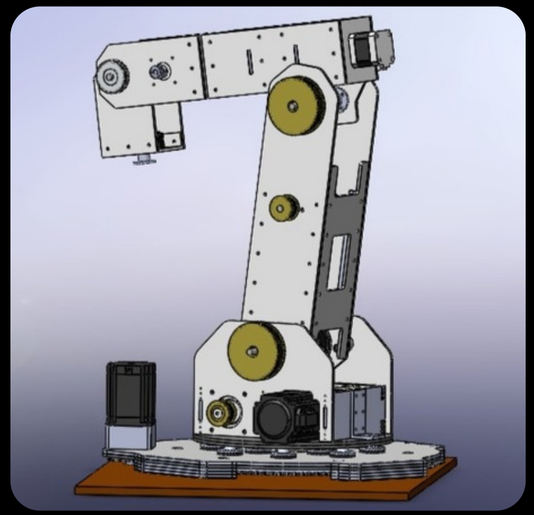
TECHNICAL SPECIFICATIONS

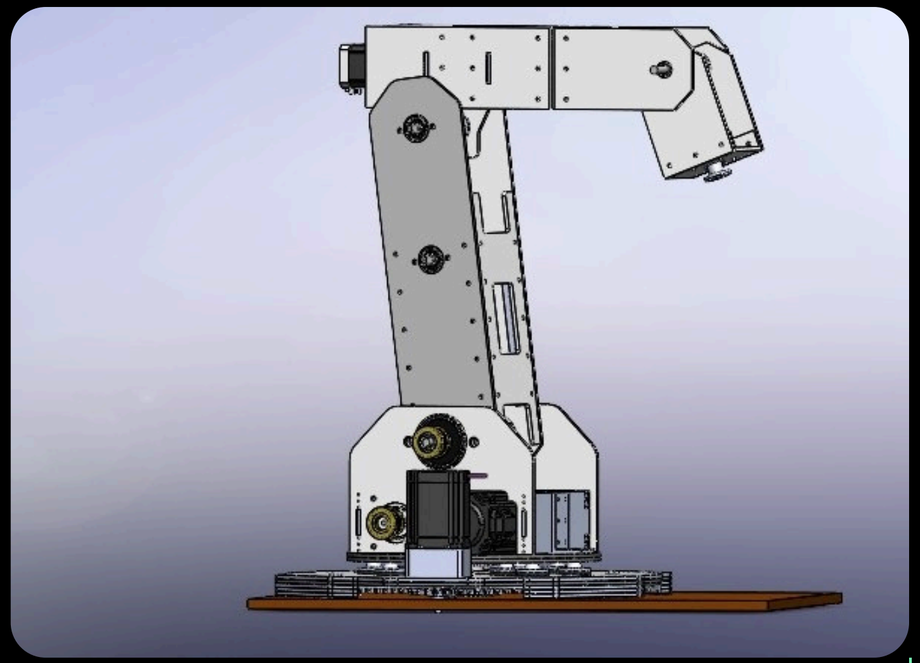
Parameter	Specification	Justification
Structural Material	Aluminium	Provides superior structural rigidity under load, excellent heat dissipation, and eliminates flex over the long 700mm lever arm to maintain high repeatability.
Control Architecture	Distributed: Raspberry Pi + STM32	Distributed: PC (MATLAB) + Custom STM32H743VIT6 PCB" / "MATLAB Digital Twin handles complex Inverse Kinematics and collision avoidance. The custom STM32 PCB handles real-time stepper pulse generation and closed-loop SPI encoder feedback.
HMI Interface	Digital Twin	PPC Terminal (Standard) / Touch HMI (Premium Add-on)" / "Standard operation utilizes a tethered PC for robust MATLAB simulation. A dedicated physical touch-screen console is offered as a monetizable upgrade for enterprise clients requiring dedicated floor-level control

FINAL 3D DESIGN - ARM

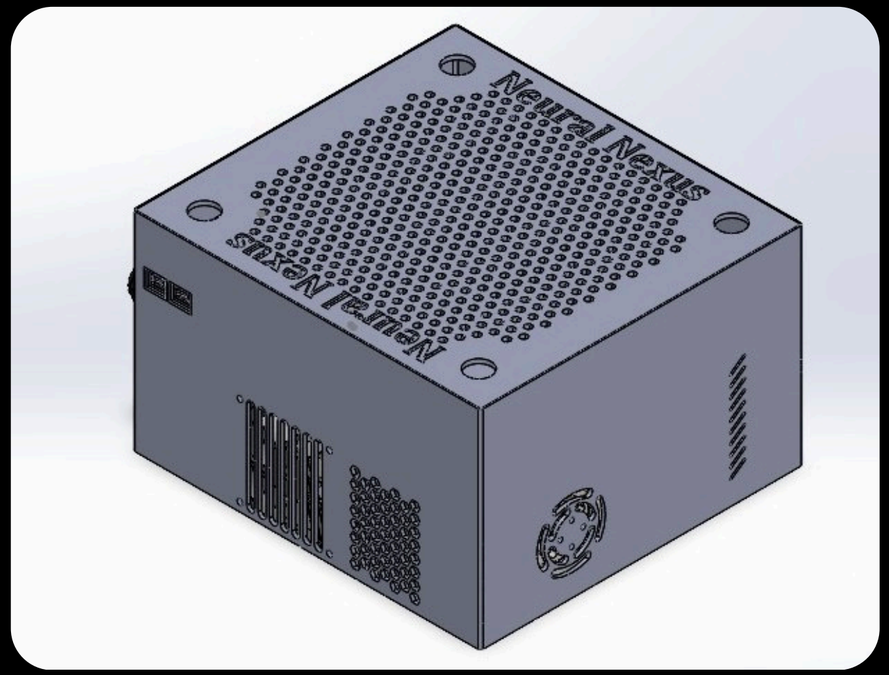


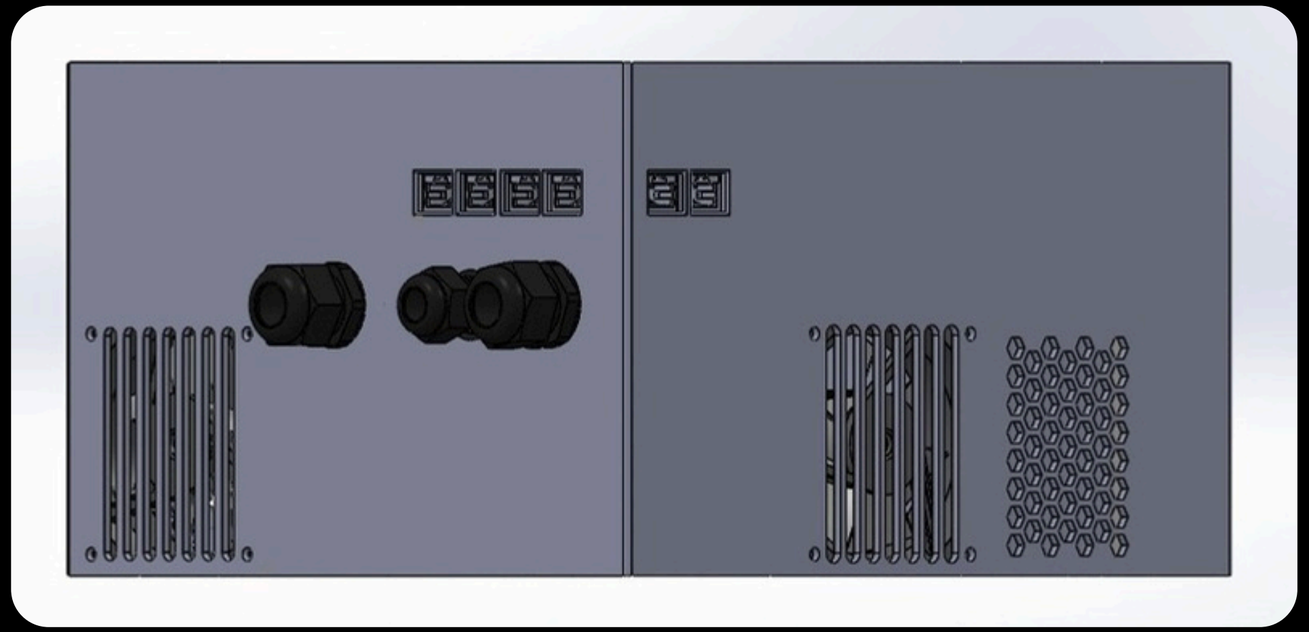




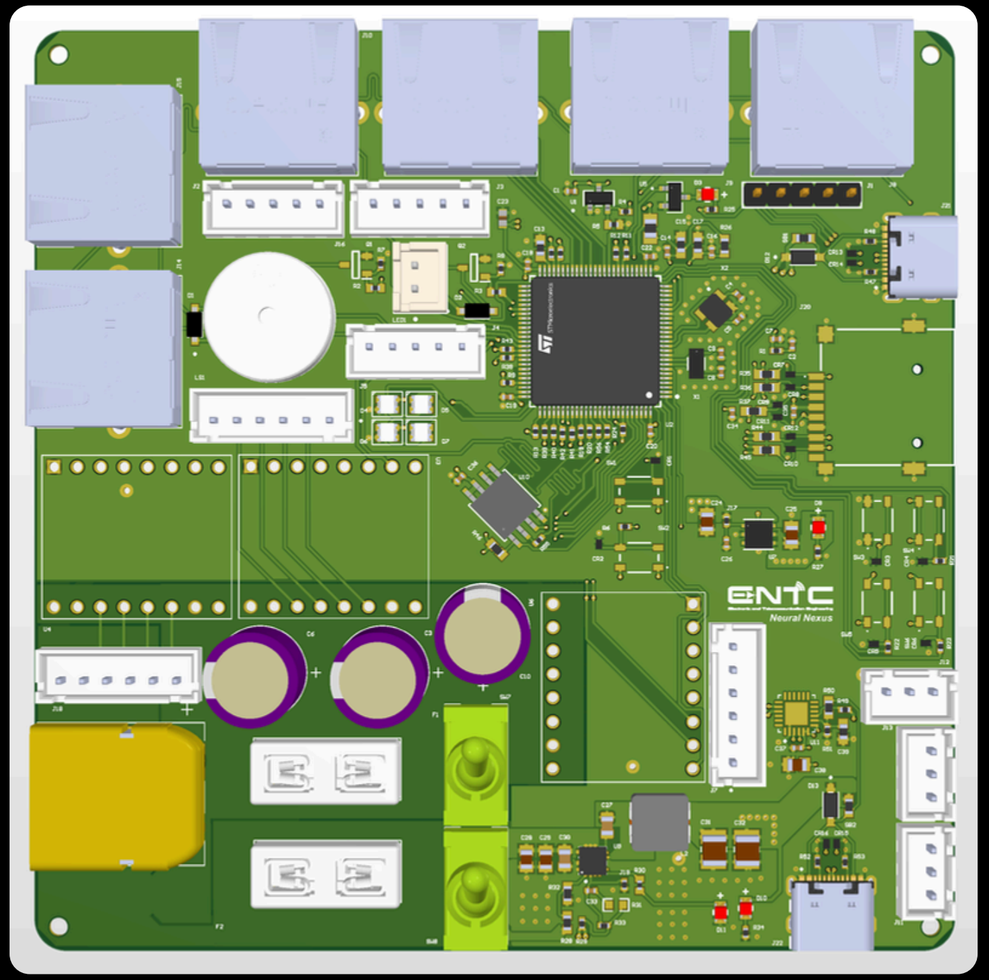


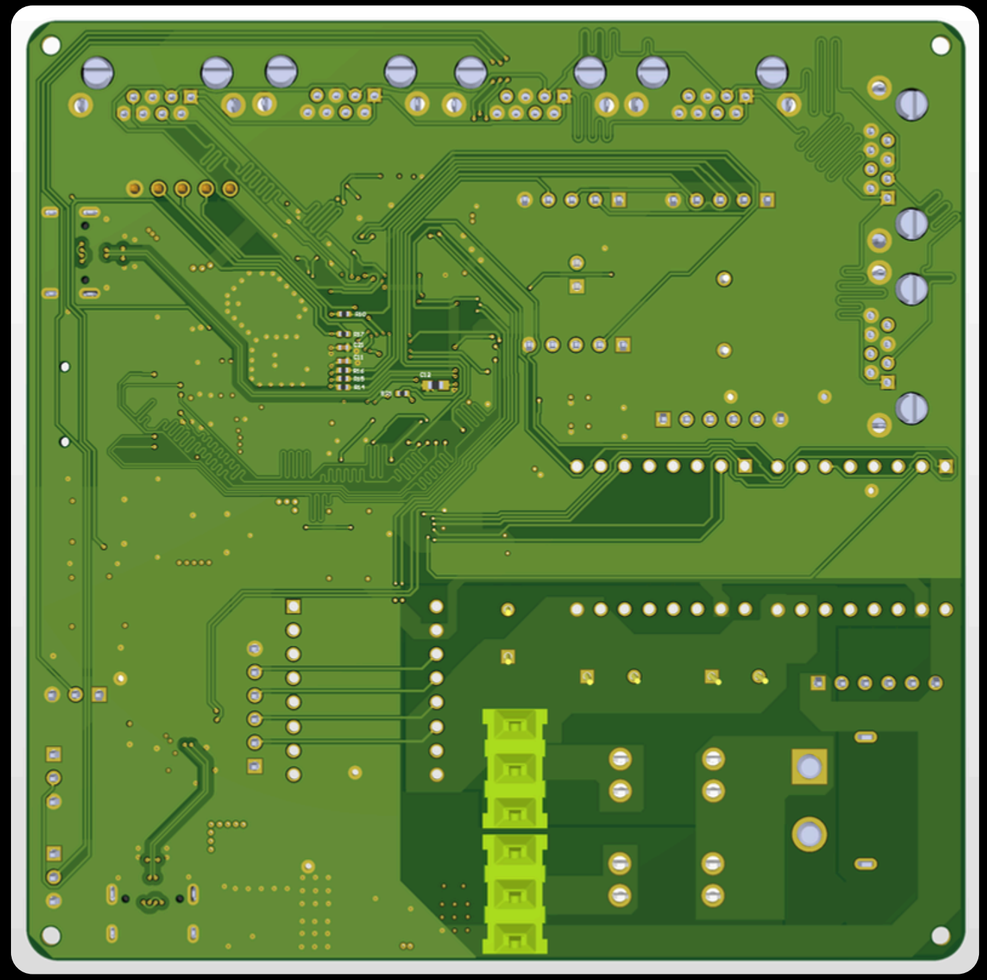
ELECTRONIC BOX





PCB STACK





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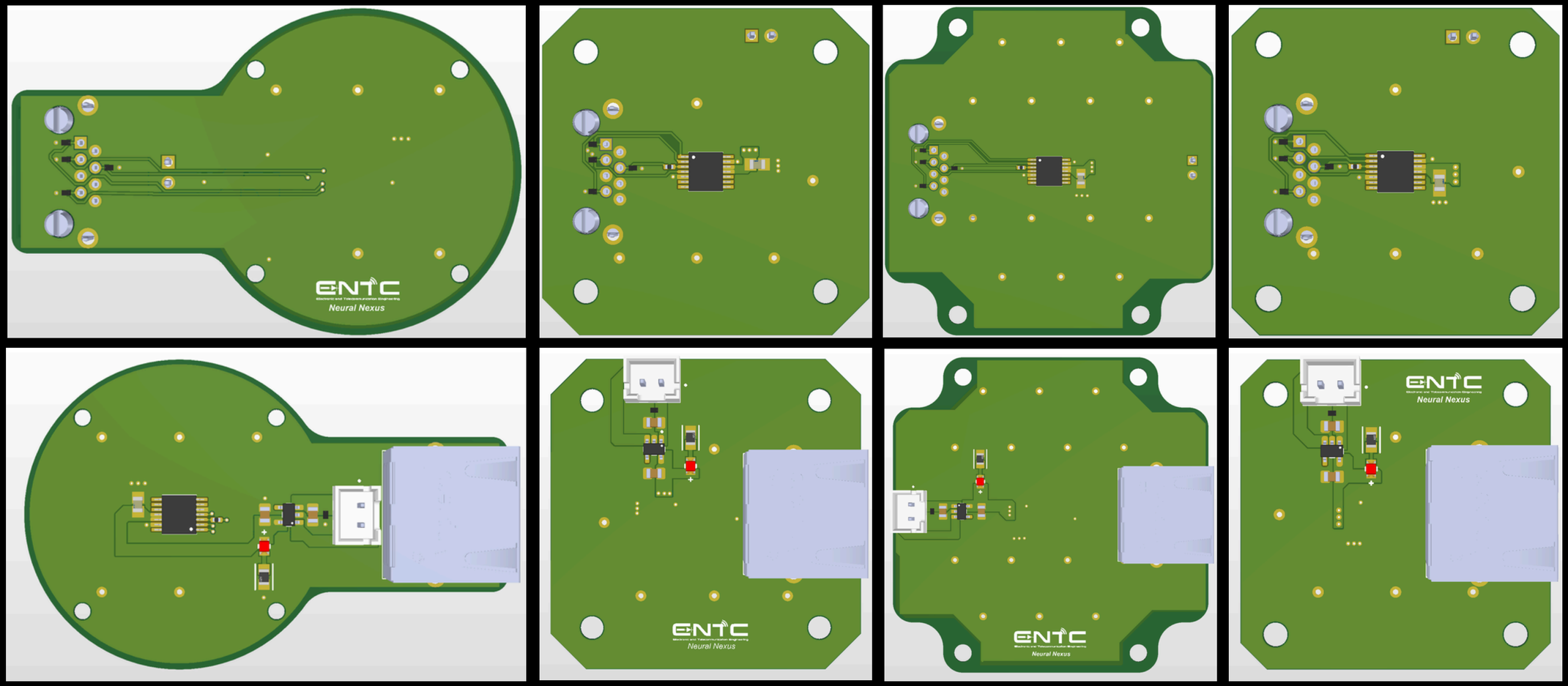


THE MARKET OPPORTUNITY

THE PROBLEM

Most local factories want to automate, but imported robotic arms cost over 2 million LKR, take 6 to 8 months to arrive, and offer zero local repair support. With arising transport issues this delays are much more substantial

Our Solution

We provide an industrial-grade robotic arm designed and built in Sri Lanka, offering high precision at a fraction of the cost.

Target Market

WHO WE SERVE

Small & Medium Factories: Perfect for repetitive tasks like packaging products, sorting garments, or assembling electronics.
STEM Ed: An affordable, programmable platform to train students on modern robotics and AI.

The Local Advantage
We eliminate import delays, offering deployment in just 3 months alongside with on-site technical support.

BUSINESS MODEL & SALES STRATEGY

How We Make Money

Base Robot Sales: Priced at 1,500,000 LKR (cheaper and superior than imported alternatives), with a very healthy profit margin.
Custom Attachments: Selling specific tools like vacuums or grippers tailored to a factory's unique needs (45k – 85k LKR).
Software Subscriptions: An optional yearly fee to unlock smart computer vision and advanced software updates
Service fee : Annual charges for service of robotic arm along with upgrade charges

Sales Strategy

Start Small to Prove Value: We don't try to change the whole factory at once. We automate just one slow task to prove the robot pays for itself in less than 6 months.
Flexible Leasing: For businesses that cannot afford to buy the robot upfront, we offer a lease model where they simply pay based on how much the robot works.
Education Bundles: Selling starter kits to universities ensures the next generation of engineers is already trained on our system.

COST BREAKDOWN (PER UNIT)

Item	Quantity (pcs)	Unit Cost (LKR)	Total Cost (LKR)
NEMA 24 Closed Loop Motor	2	80000	160000
NEMA 17 Closed Loop Motor	1	15000	15000
NEMA 23 Open Loop Motor	1	7600	7600
NEMA 17 Open Loop Motor	2	3000	6000
Aluminum Sheet (8' x 4' x 6mm)	1	75000	75000
Mechanical Parts (Pulleys, Rods, etc.)	1	88000	88000
CV Equipments	1	70000	70000
PCB manufacturing cost	1	30000	30000
3D printing cost	1	25000	25000
Fabrication Cost	1	50000	50000
Miscellaneous Expenses	1	50000	50000
		Grand Total	**576600**

INDUSTRIAL PRICING STRATEGY

The Mid-Tier Pricing Model

In hardware manufacturing, sustainability requires a financial buffer. By pricing the Neural Nexus arm at an industry-standard 2.5x multiple of our component cost, we secure the capital required for continuous R&D and reliable after-sales support.

Financial Unit Economics

- Production Cost: ~580,000 LKR
- Retail Price: 1,500,000 LKR

The Market Advantage

- Customer Value: We deliver high-end industrial capabilities at substantially less than the cheapest imports, significantly lowering the barrier to entry for local SMEs.
- Business Viability: Generating over 900,000 LKR in profit per unit ensures we can rapidly scale our AI software features and maintain a zero-downtime repair network across Sri Lanka.

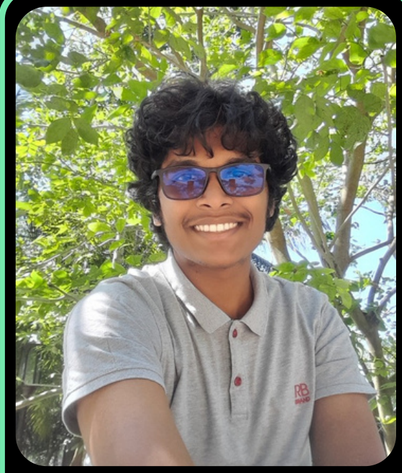
OUR TEAM

Lasan Perera
LEAD

Deneth Priyadarshana
3D Designer

Isitha Dinujaya
CV and 3D Design

Dulana Pitiwaduge
PCB Designer



Mokshan Colombage
3D Designer

Thank You

For all your attention

NEURAL NEXUS

ADVANCED ROBOTIC & AI ECOSYSTEMS