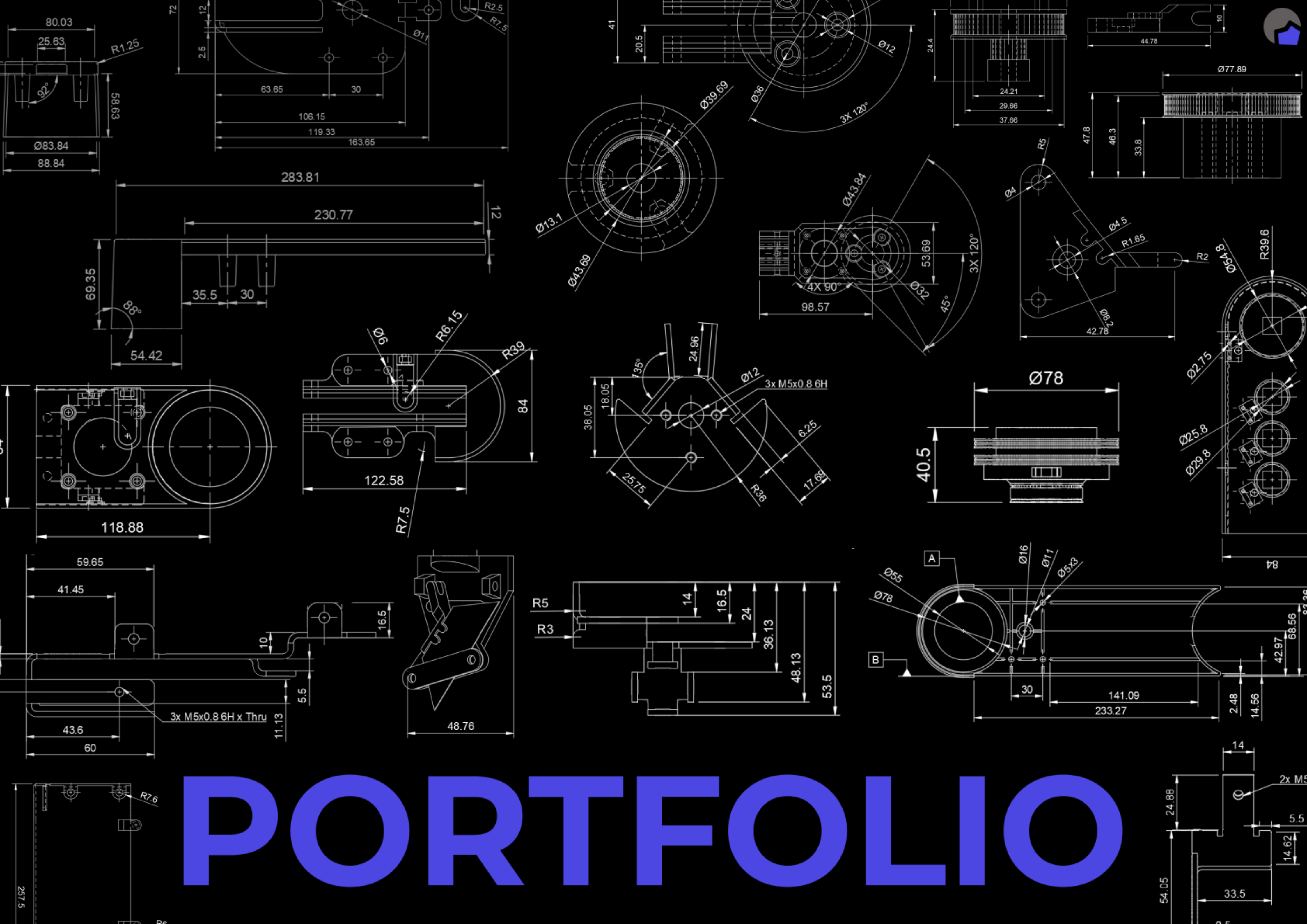
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R1.25
92°
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Ø83.84
88.84
63.65
30
106.15
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R2.5
R7.5
Ø11
283.81
230.77
12
69.35
88°
35.5
30
54.42
Ø6
R6.15
R39
84
122.58
R7.5
118.88
Ø39.69
Ø13.1
Ø43.69
Ø36
Ø12
3X 120°
24.21
29.66
37.66
Ø77.89
47.8
46.3
33.8
44.78
Ø43.84
53.69
3X 120°
4X 90°
Ø32
98.57
45°
R5
Ø4
Ø4.5
R1.65
R2
Ø8.2
42.78
Ø54.8
R39.6
135°
24.96
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3x M5x0.8 6H
18.05
38.05
6.25
25.75
R36
17.68
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Ø2.75
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84
59.65
41.45
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3x M5x0.8 6H x Thru
43.6
60
11.13
48.76
R5
R3
14
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24
36.13
48.13
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A
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Ø55
Ø78
Ø16
Ø11
Ø5x3
30
141.09
233.27
42.97
68.56
2.48
14.56
14
24.88
2x M5
5.5
14.62
33.5
54.05
R7.6
257.5

PORTFOLIO

About Me

I'm a second-year Design Engineering student at Imperial College London with a strong interest in mechanical design, robotics and mechatronics. My main strength is CAD, particularly designing parts and assemblies that can be manufactured, integrated and used in the real world, drawing on experience that ranges from research-led, user-centred design to technical projects involving rapid prototyping, coding and electronics.

I enjoy considering how mechanical, electronic and software elements interact to create complete, functional systems.

Outside university, I am a NIBAS- and NICAS-certified lead climber and former Glasgow Youth Squad competitor. I have also completed the Lakeland Mountain Marathon and hold an RYA Day Skipper licence. In my spare time, I enjoy climbing, sailing and game development.

STAN

A Teach-by-Touch Robotic Arm

The challenge was to create a mechatronic system on a tight budget, using simple electronics and a small number of components, while relying on resourceful mechanical design to create complex interaction.

STAN is a robotic arm that allows users to create movement sequences by physically positioning its joints. Motions are recorded, stored and replayed with colour-coded cartridges on demand, turning programming into a tangible and playful interaction without requiring any coding knowledge.

Joints built from 5V DC motors, gear reductions and potentiometers rather than integrated servos. All CAD, code and structure produced in-house, mostly 3D printed.

Contributions:

Hardware Integration
Embedded Software
Rapid Prototyping
Mechanical Design

STAN

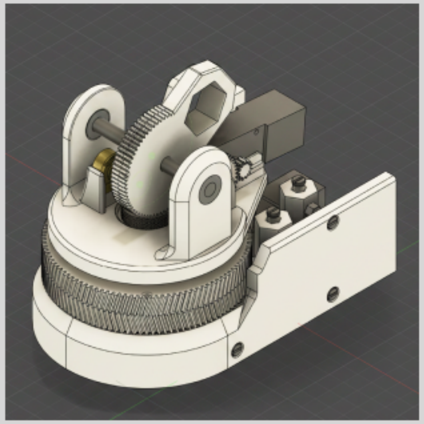
Design Process

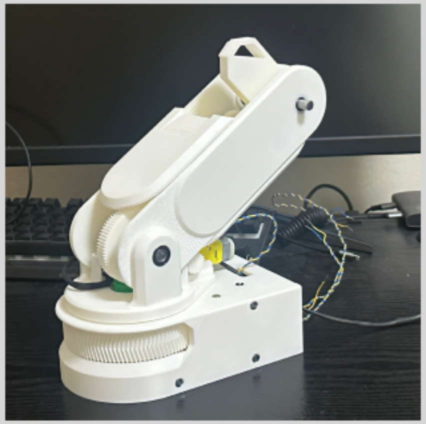
The joint mechanism went through multiple full redesigns before settling on the final geartrain and bearing layout. Early versions used different gear ratios and motor mounts, tested and rejected based on backlash, torque, and how cleanly they could be 3D printed and assembled.

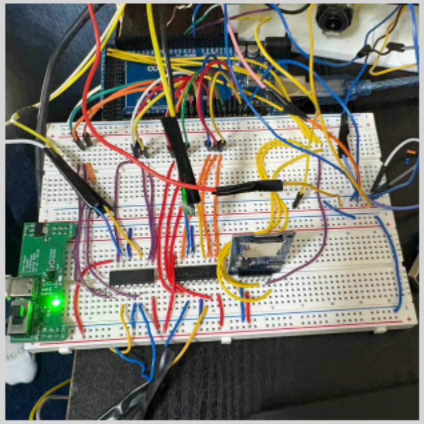
Each sub-assembly was iterated individually; print, test, fail, redesign, before being combined into the working arm.

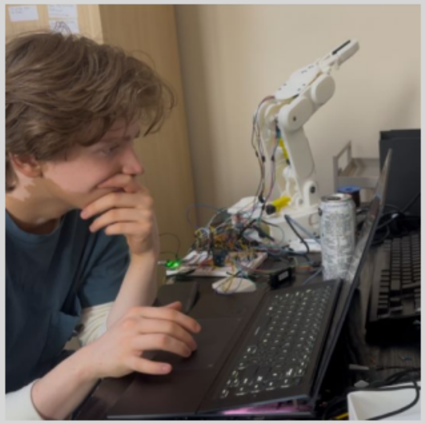
As the system developed, the arm geometry, transmission ratios and internal layout were refined to improve movement, strength and reliability.

The cartridge interface and electronics were then integrated into the final assembly, creating a resourceful system built largely from custom 3D-printed components.







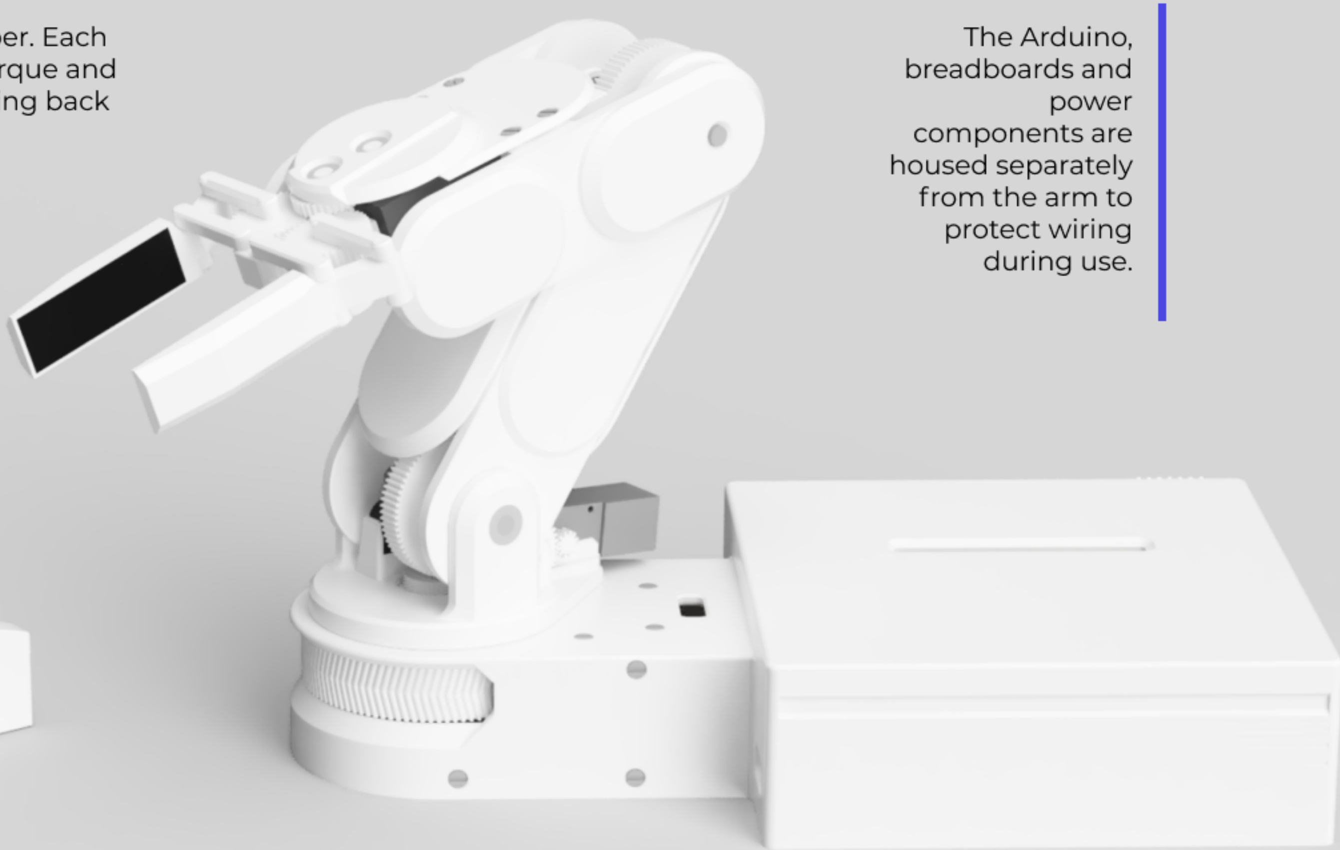


STAN

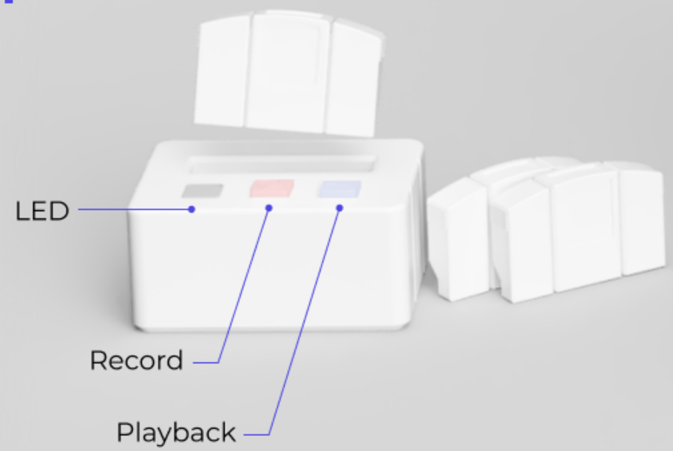
Final Design

Four joints: swivel, shoulder, elbow and gripper. Each runs through a gear reduction to increase torque and control resolution, with potentiometers feeding back exact position as the arm is moved by hand.

Each recording stores up to 800 frames, providing around 20 seconds of motion. Record captures joint angles in real time, while Playback reproduces the motion at its original speed.



The Arduino, breadboards and power components are housed separately from the arm to protect wiring during use.



Each cartridge has a colour patch read by an RGB sensor, linking it to a sequence. Swapping them instantly loads the matching recording.

SwivelCut

A Desktop Cardboard Cutting Tool

Cardboard is widely used for early-stage prototyping in school Design & Technology workshops, yet accurate cutting is often slow, inconsistent and unsafe. Craft knives require skill, produce variable results and can discourage students from iterating.

> SwivelCut is a safe desktop tool that lets students trace a design before reproducing it with consistent accuracy. Interchangeable heads and integrated safety features make cardboard prototyping faster, more accessible and less reliant on traditional cutting methods.

Contributions:

Concept Development | User Testing | DFMA
Visual Design | Mechanical Prototyping | Videography

Academic project. Not affiliated with or endorsed by Bambu Lab.

SwivelCut

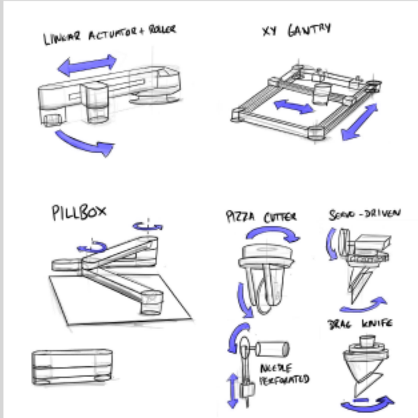
Design Process

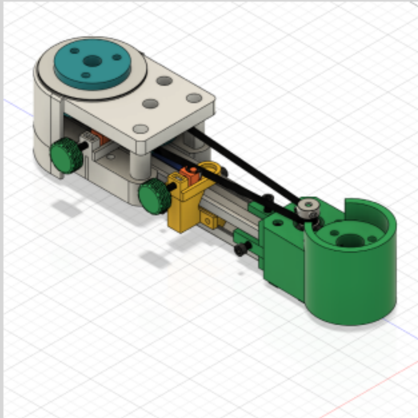
Early concepts were developed through morphological analysis, comparing different mechanisms before selecting a 2DOF flat arm with interchangeable heads. Foam and card prototypes were used to test joint movement, workspace and reach before progressing into CAD.

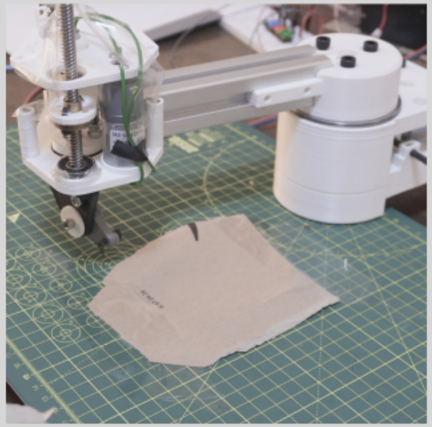
Custom test rigs then measured the piercing and drag forces required to cut cardboard, helping define the motor torque, gear reduction and structural requirements.

The joints were belt-driven rather than directly geared, allowing tensioners to absorb build tolerances without relying on tightly machined fits. The prototype was largely 3D printed before being redesigned for manufacture using sheet metal and injection moulding, with DFM and DFA principles applied throughout.

DT students and teachers were involved across the process, from early feedback to final user-guide testing.







SwivelCut

Final Design

Trace a path by hand with the tracing head, then swap to the cutting head to follow that same path and cut it. The base clamps to a workbench from the end, and battery, motors and electronics are all housed inside.

Repeat: re-runs the last stored path for batch cutting

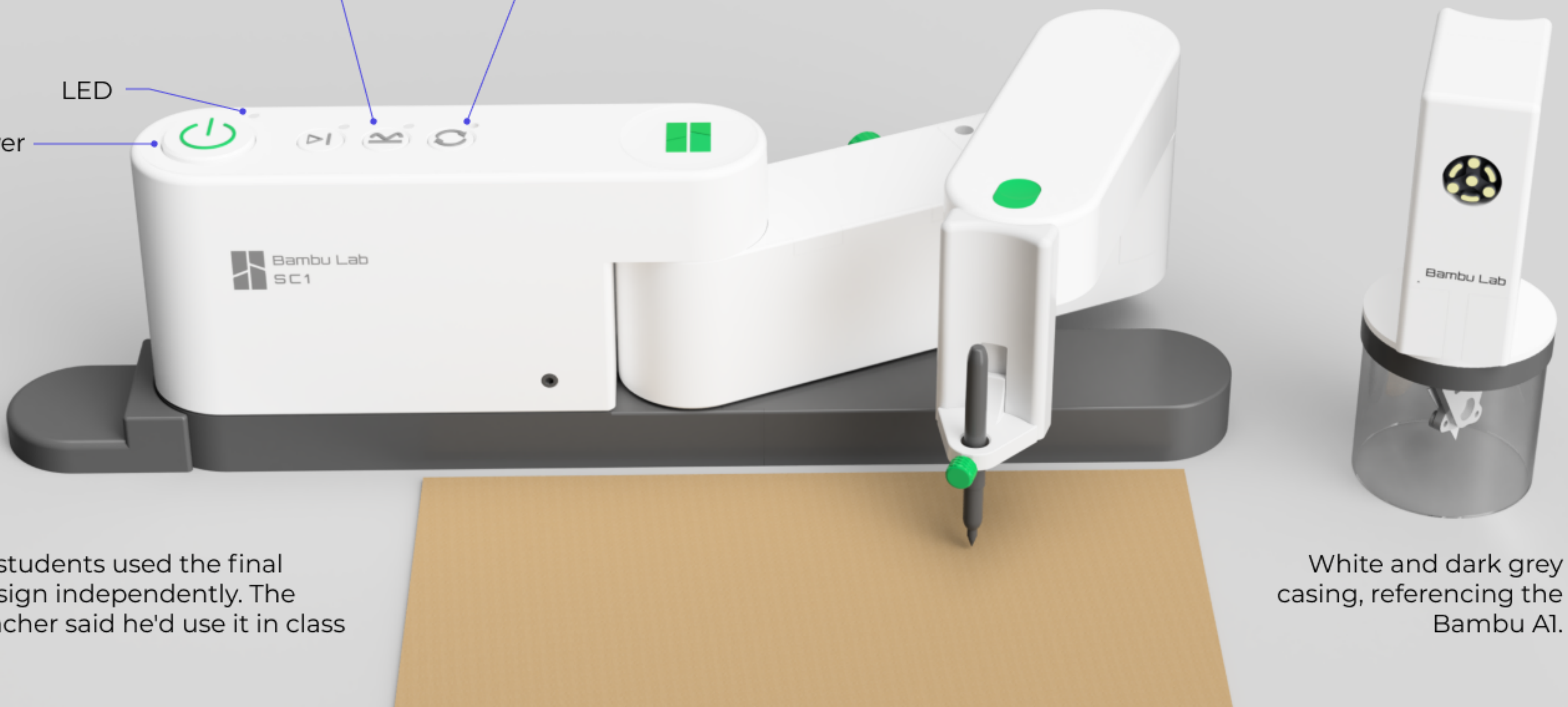
Stabilisation: smooths wobble in the hand-traced path before cutting

Both arms fold flat for compact storage and give A3 cutting coverage. Aluminium-reinforced structure with thrust bearings supporting each joint.

Cutting head features a spring-mounted blade on a linear actuator, enclosed by a removable safety tube. Rotating wheel shows when the blade is cutting.

LED

Power



18 students used the final design independently. The teacher said he'd use it in class

White and dark grey casing, referencing the Bambu A1.