

REVERSE ENGINEERED

ELECTRIC SCOOTER

The electric scooter seen on city streets all over the world, based on the widely replicated Xiaomi Mijia. A design built for mass production, reverse engineered here down to the last screw.



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A digital twin where every edge, radius and thread was **measured, inferred** and rebuilt from scratch.

- | | | |
|----|--------------|---|
| 01 | SURVEY | The physical scooter is stripped down, documented and photographed. Materials, standards and manufacturing processes are identified for every part. |
| 02 | 3D SCAN | Core components are captured with a high-precision laser scanner, producing detailed meshes and point clouds that act as the source of truth. |
| 03 | MODELLING | Every part is built parametrically in CAD from the scan data, including standard components like fasteners and the full wiring harness. |
| 04 | ASSEMBLY | Parts come together as accurate sub-assemblies, structured for manufacturing and BOM, and built to handle every configuration and moving part. |
| 05 | PRESENTATION | Realistic renders, exploded views, detailed drawings, multi-level BOMs, harness tables and every other deliverable the project needs. |



LAID OUT PART BY PART

Before any modelling, the scooter was stripped down to **336 PARTS**. Every sub-assembly, fastener, standard component and wiring harness was identified, and the critical components were separated and prepped for 3D scanning.

- | | | | |
|---|---------------------------|----|----------------------|
| 1 | Display junction | 9 | Folding lever lock |
| 2 | Chassis frame | 10 | Rear wheel and tyre |
| 3 | Motor stator and hall PCB | 11 | Brake lever |
| 4 | Motor rotor and tyre | 12 | Fender and trims |
| 5 | Motor hub cap | 13 | Folding mechanism |
| 6 | Drum brake | 14 | Handlebar assembly |
| 7 | Rear swingarm and shocks | 15 | Controller and looms |
| 8 | Front fork | 16 | Battery pack and BMS |

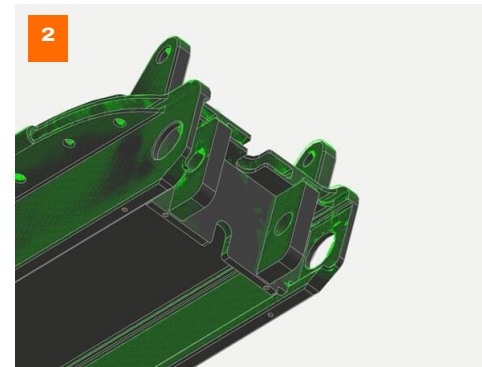


FROM SCAN TO SOLID

A total of **26 COMPONENTS**, including sub-assemblies and organic parts, were laser scanned with a maximum deviation of 0.1 mm. Each mesh was used as a point cloud inside CAD, and every sketch, feature and part was modelled from scratch.

■ SCAN MESH ■ CAD SOLID

- 1 Chassis front welded frame
- 2 Chassis rear welded frame
- 3 Folding mechanism
- 4 Rear wheel and tyre
- 5 Rear fender
- 6 Handlebar joint
- 7 Brake lever casing
- 8 Throttle switch housing
- 9 Throttle switch base





DECK HEIGHT
140 mm

GROUND CLEARANCE
79 mm

FOLD RAKE
102 deg

WHEEL
216 mm

WHEELBASE
830.5 mm

VEHICLE SPECS

BUILD

TOP SPEED	25 km/h
POWER	250 W
RANGE	30 km
PAYLOAD	120 kg
WEIGHT	12 kg

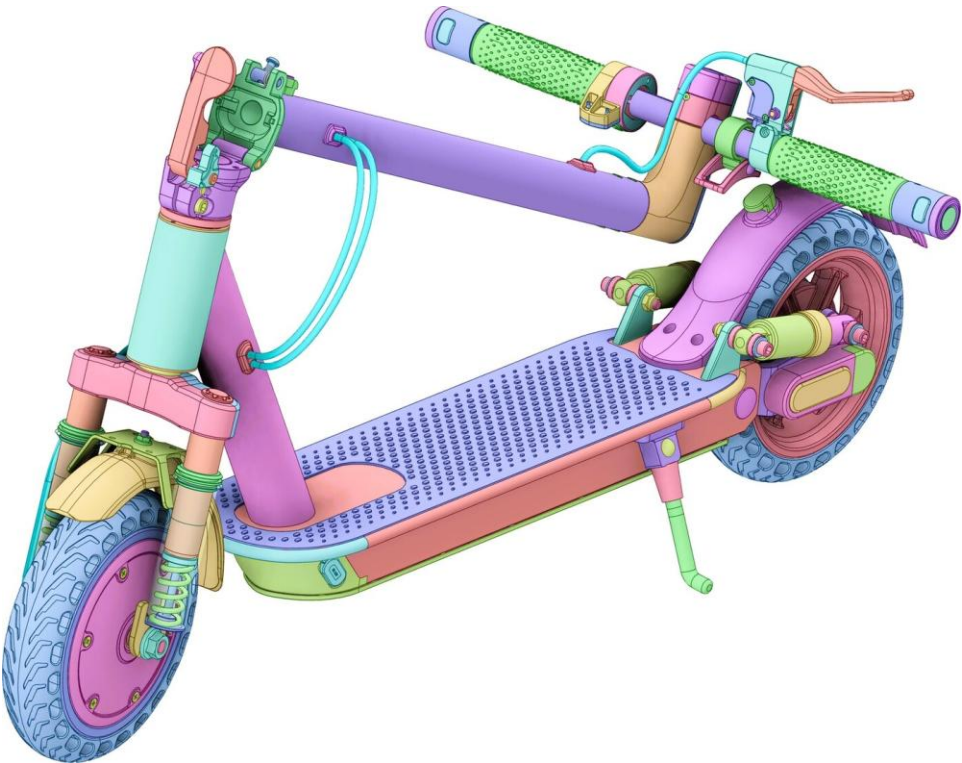


COMPONENTS

FRAME	Aluminium alloy
FRONT SUSPENSION	Telescopic fork
REAR SUSPENSION	Damper shocks
TYRES	Airless PU
BRAKES	Drum brake
LIGHTS	Front, tail and turn
BATTERY	36 V 8.0 Ah
MOTOR	Hub motor 350 W

NUMBERS THAT DEFINE

200–250 HOURS of teardown, 3D scanning, modelling and documentation, built natively in Autodesk Inventor, with the fold, steering and springs all moving in real time.



01 PARTS

172

Unique parts

1,064 occurrences across the full assembly

30

Supplier parts

Connectors, sensors, springs etc.

44

Standard fasteners

ISO and DIN screws, nuts, rivets etc.

02 BUILD

30

Sub-assemblies

Stator, suspension, brake etc.

13

Material categories

ABS, 440C steel, 6061 aluminum etc.

9

Manufacturing processes

Extrusion, HPDC, CNC machining etc.

03 HARNESS

46

Connection pairs

Eg. motor hall GND to controller GND

90

Length-cut wires

Eg. 16 AWG YEL, 12 AWG BLU

21.86 METER

Total wire length

Across all 90 length-cut wires

04 WORKFLOW

6

iLogic scripts

Parameter sync, unique part colors, batch export, etc.

4

Inventor environments

Cable & Harness, Tube & Pipe, Design Accelerator, Studio

4

Supporting tools

Creality Scan, CloudCompare, Meshmixer, ReCap Pro

NATIVE FILES .ipt .iam .idw .ipn



04 CHASSIS FRAME



05 HUB MOTOR



06 REAR WHEEL



07 FRONT FORK



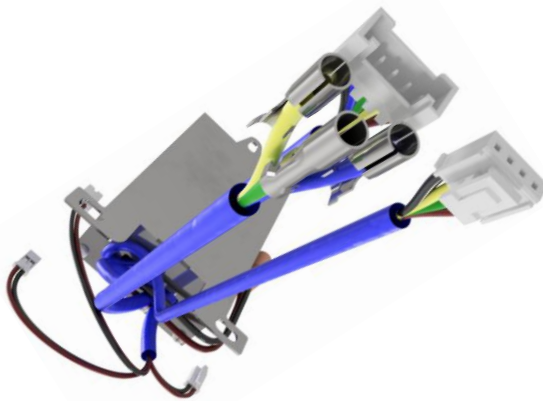
08 FOLDING MECH



09 HANDLEBAR



10 BATTERY PACK

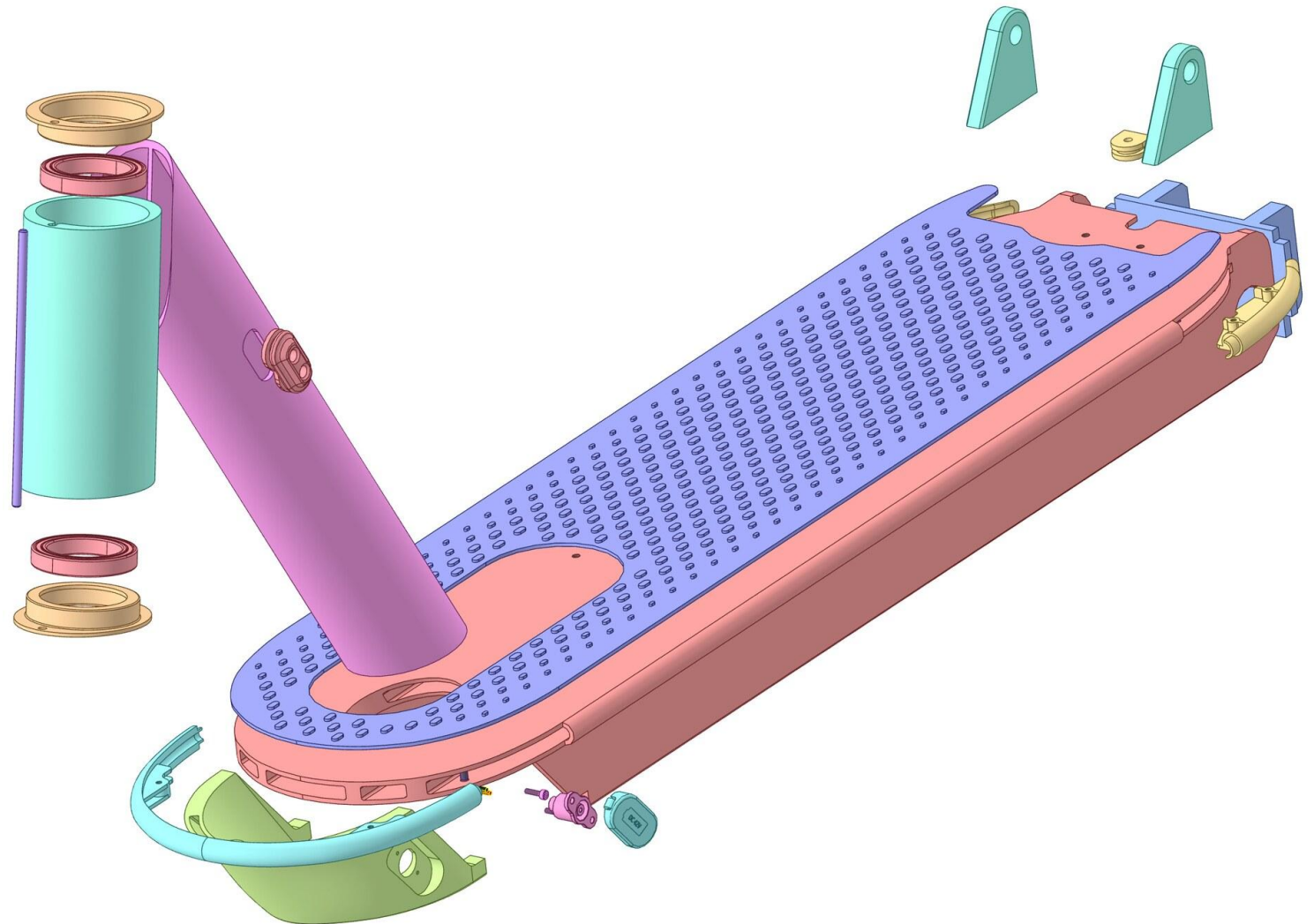


11 CONTROLLER

THE FOUNDATION OF EVERYTHING

A single welded aluminium frame forms the core structure, built to carry a sustained 120 kg load. The deck is one long aluminium extrusion, a process made for volume, and the whole frame is finished in a textured powder coat.

- Head tube
- Pivot bearings
- Bearing seats
- Neck tube
- Deck grip
- Deck extrusion
- Crash trims



CURRENT MAKES MOTION

A brushless hub motor sits inside the front wheel, with hall sensors keeping it running smoothly and safely. It is built around a 30-pole BLDC stator with a 48-layer, 0.5 mm laminated core, delivering 350 W and a peak torque of 14 Nm, and reaching around 600 rpm at full speed.

■ Stator and windings

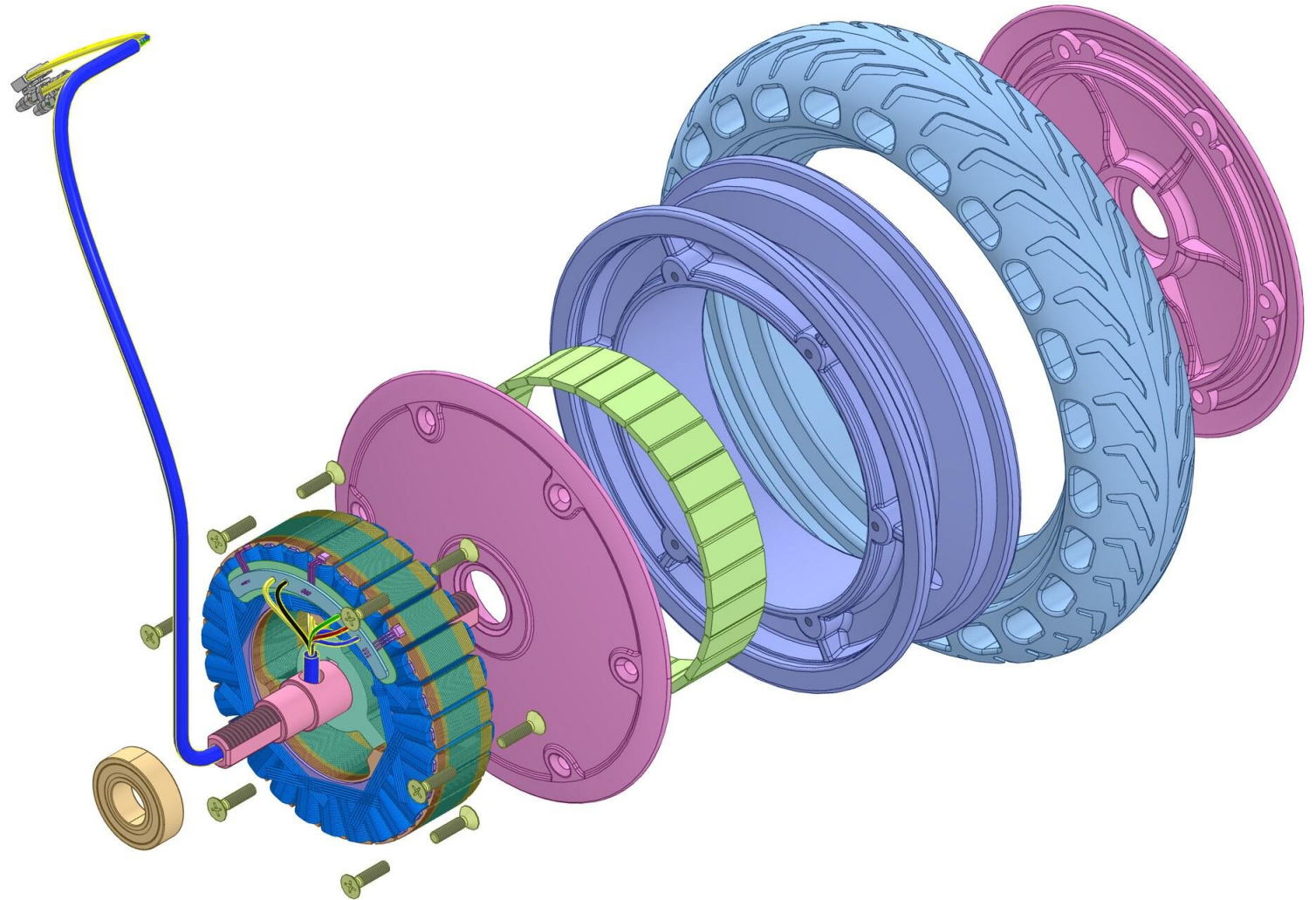
■ Magnet ring

■ Rotor shell

■ Side covers

■ Honeycomb tyre

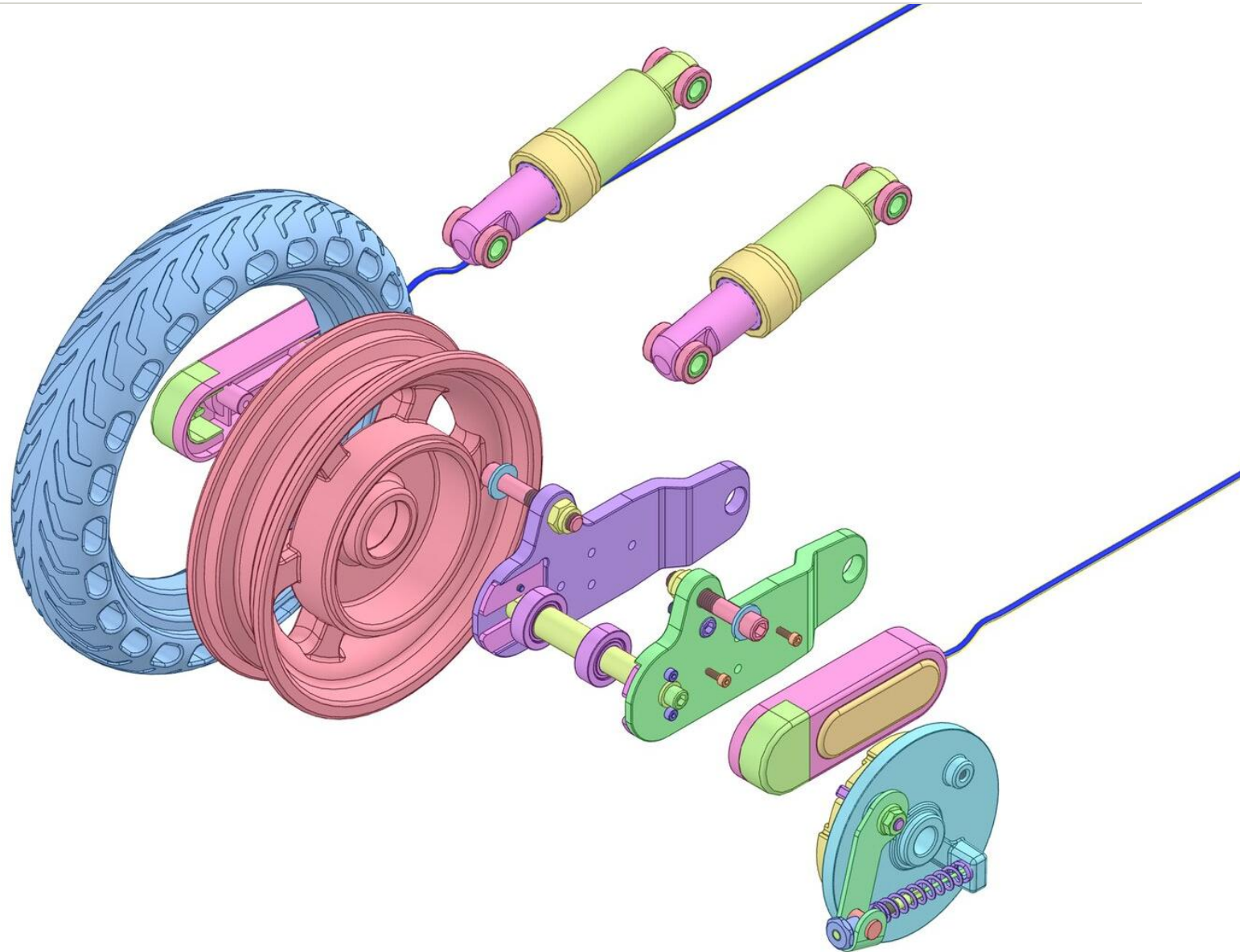
■ Bearings



REAR WHEEL RUNS FREE

The rear wheel turns on its axle between two swingarm plates, carried by twin damper shocks. A cable-drum brake sits inside the hub. Rear turn indicators also mount securely on the swingarms.

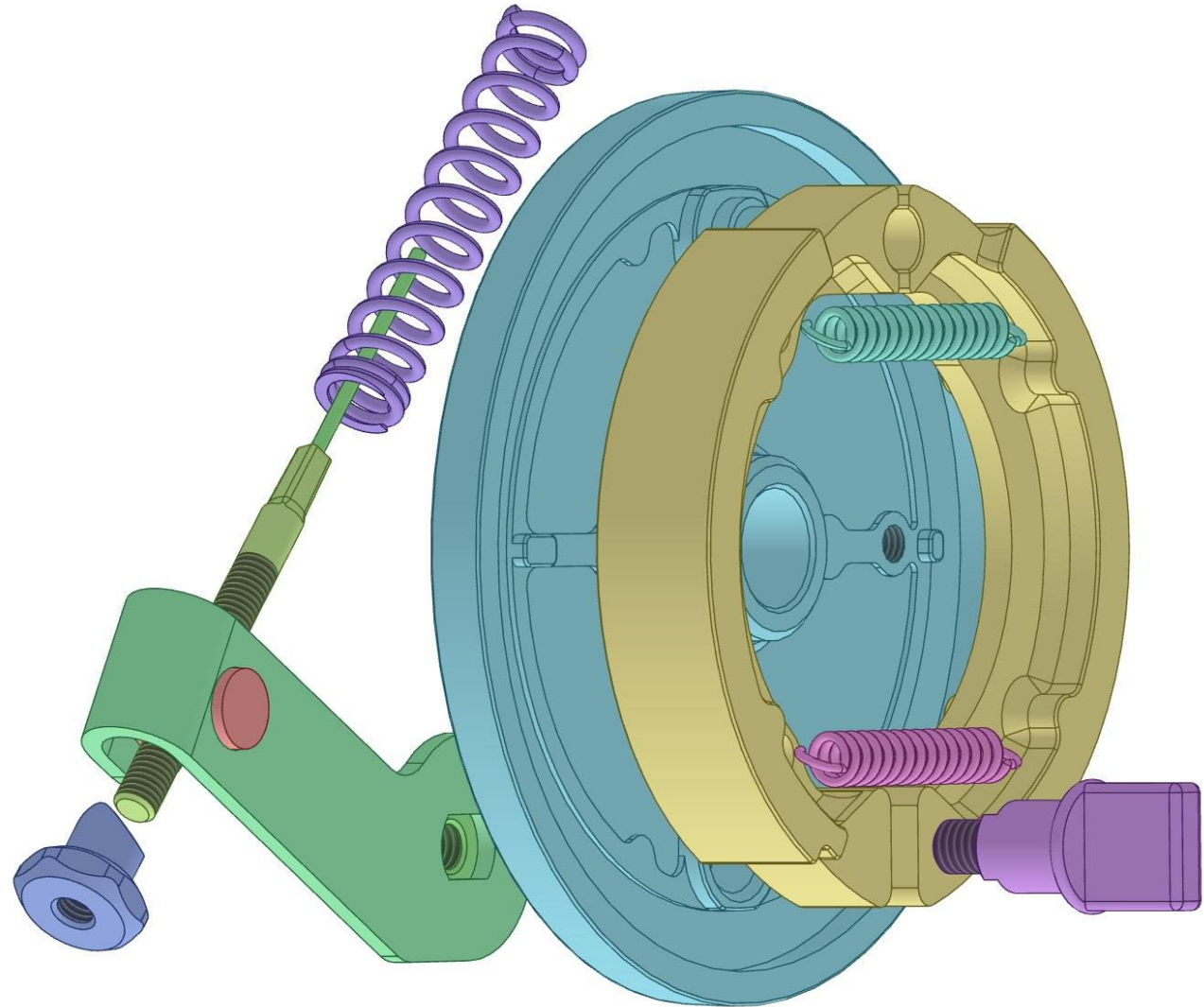
- Solid tyre
- Wheel rim
- Swingarm plates
- Twin shocks
- Drum brake
- Indicator cable



DRUM BRAKE, OPENED UP

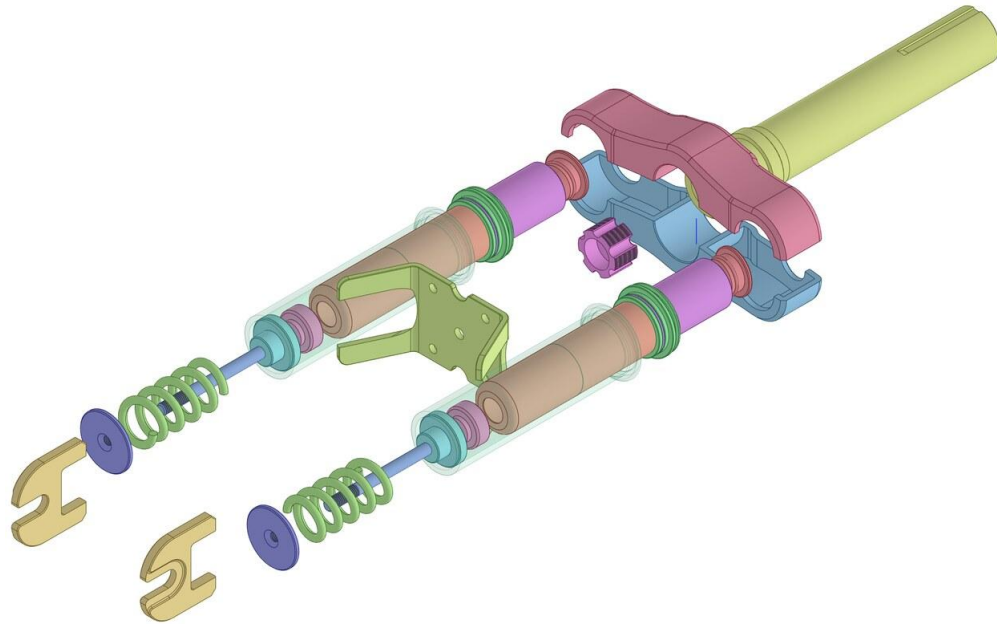
Pulling the lever turns the cam, which pushes both shoes out against the drum. The return spring pulls them back as soon as you let go, and the whole mechanism sits inside the hub, away from outside elements.

- Brake plate
- Brake shoes
- Return spring
- Brake cam
- Brake arm
- Cable adjuster
- Lock nut



TELESCOPIC FRONT FORK

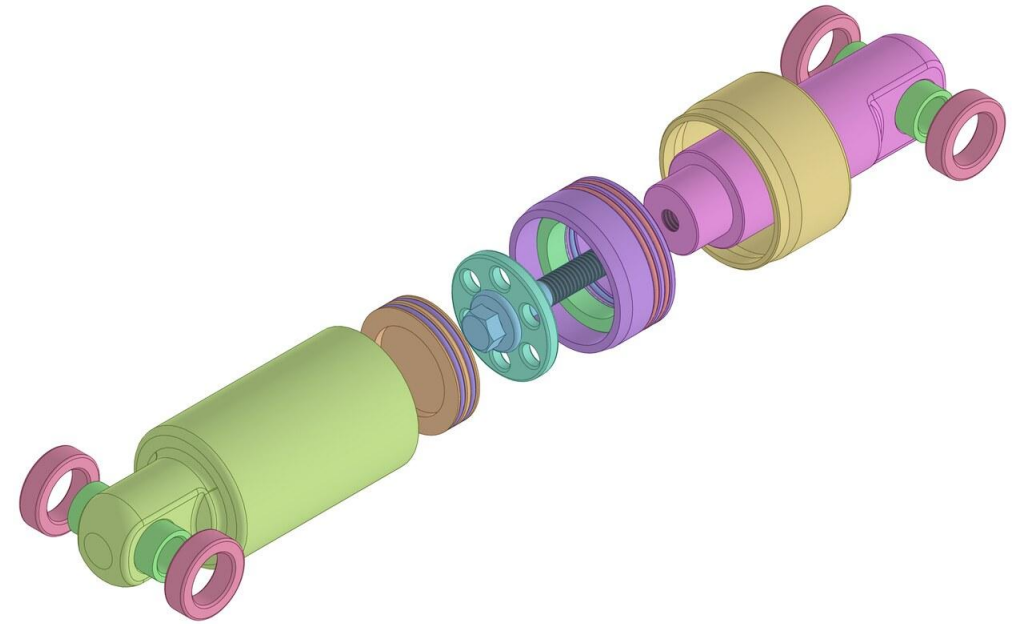
Each fork leg holds a coil spring, and the inner tubes slide inside the legs to take bumps before they reach the bar. The welded crown clamps both legs to the steerer tube.



- | | | |
|--------------|--------------|------------|
| Steer shaft | Fork crown | Inner bush |
| Fork sleeves | Coil springs | Mounts |

TWIN REAR SHOCKS

Two damper shocks link the swingarm to the deck, one each side of the rear wheel. Each one is hydraulic giving it a stiff low-travel damping.

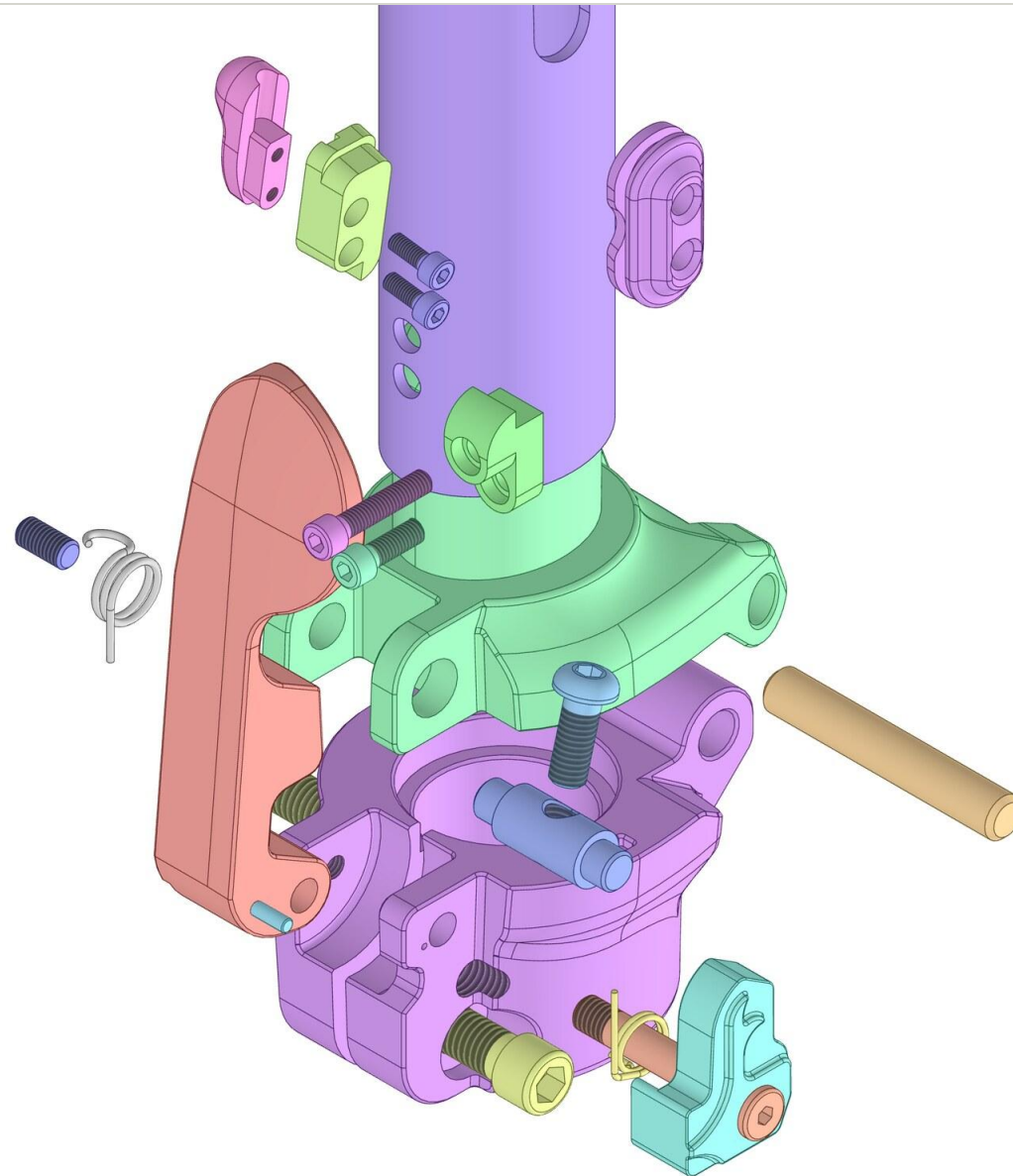


- | | | |
|-------------|--------------|------------------|
| Damper body | Piston shaft | Piston and seals |
| Valve disc | Bushes | Upper housing |

FOLD THAT NEVER FAILS

The stem tube folds at a die-casted machined hinge. Engineered with fits that ensure the handlebar rests at any angle. The clamping mechanism ensures a dual lock with a constant spring force opposing rider pressure on the handlebar. Full metal body construction and designed with reliability.

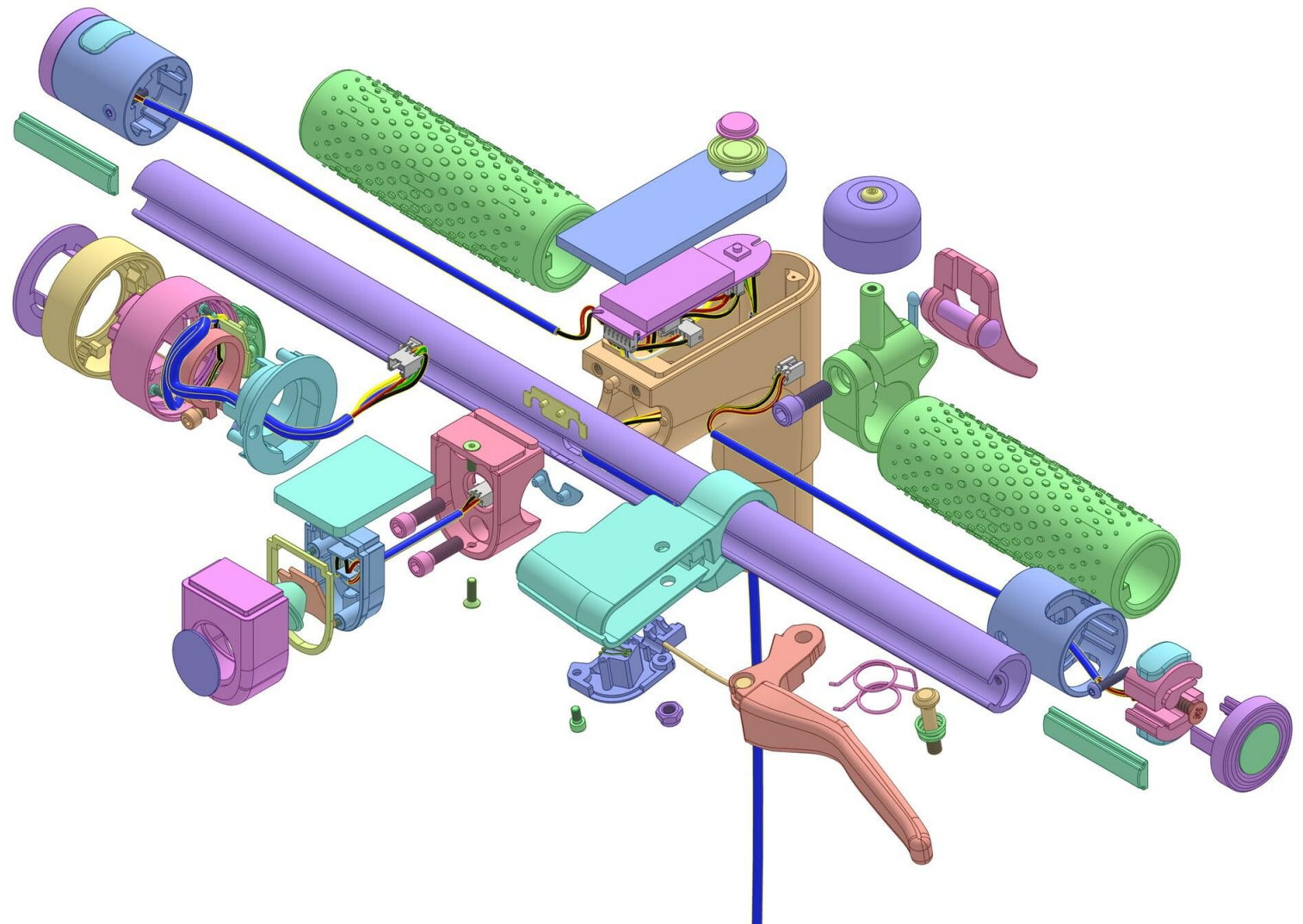
- Stem tube
- Upper hinge
- Lower base
- Fold lever
- Hinge shaft
- Lock pin
- Safety latch
- Lever spring



THE RIDER-MACHINE INTERFACE

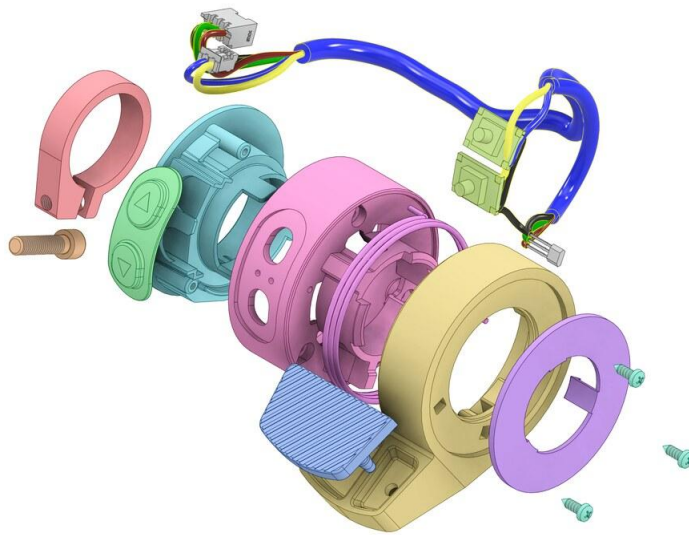
The bar carries the throttle, brake lever, bell, display board, turn-indicators and headlight, with the wiring run inside the extruded bar. Each control is its own sub-assembly with its own harness. All components are precision die-cast and injection molded with tight tolerances, snap-joints and ribbed plastic design.

- Handlebar tube
- Grips
- Display housing
- Display board
- Throttle pod
- Brake lever
- Lever body
- Headlight
- Bell



THUMB THROTTLE

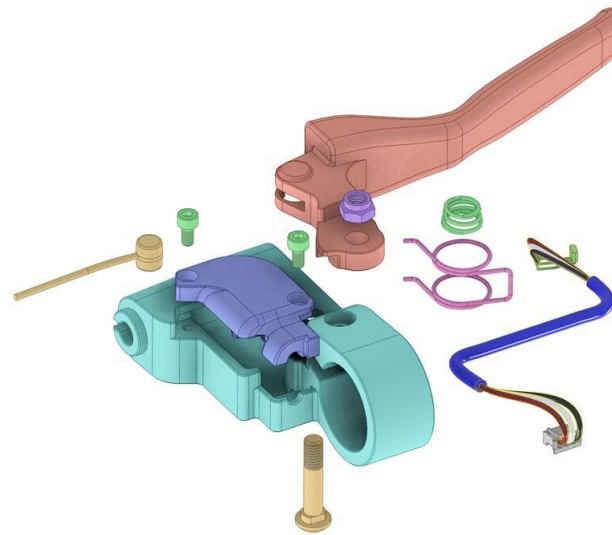
The spring paddle sets the speed with a hall-sensor and magnet array. Two buttons control the lights, the housings mount around the bar and locks with a single clamp bolt.



- Bar clamp
- Pod base
- Thumb paddle
- Button pad
- Switch housing
- Outer housing

BRAKE LEVER

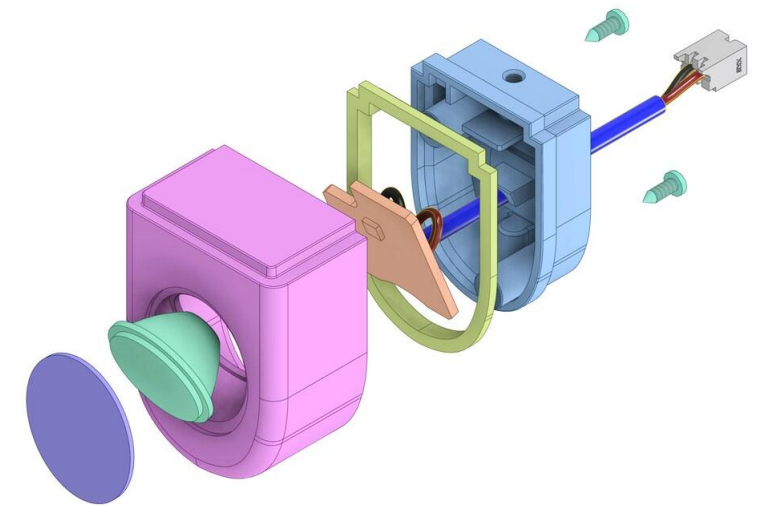
The spring lever pulls the mechanical cable to the rear drum. A hall-sensor and magnet inside the lever body tells the controller when the brake is pulled.



- Lever blade
- Brake switch
- Cable nipple
- Lever body
- Return spring

LED HEADLIGHT

An LED board sits behind a reflector and lens in a two-part housing, sealed with a gasket and wired back along the bar. Mounted using 2 internal and 2 external screws.



- Front housing
- Lens
- Gasket
- Reflector
- LED board
- Rear housing

THE POWER SOURCE

A 36V, 8.0 Ah, 10s3p pack built from 18650 cells in a molded holder, spot-welded with nickel strips and managed by a BMS board at one end. The whole pack sits inside the deck extrusion, securely mounted on the chassis.

INR18650 cells

Cell holders

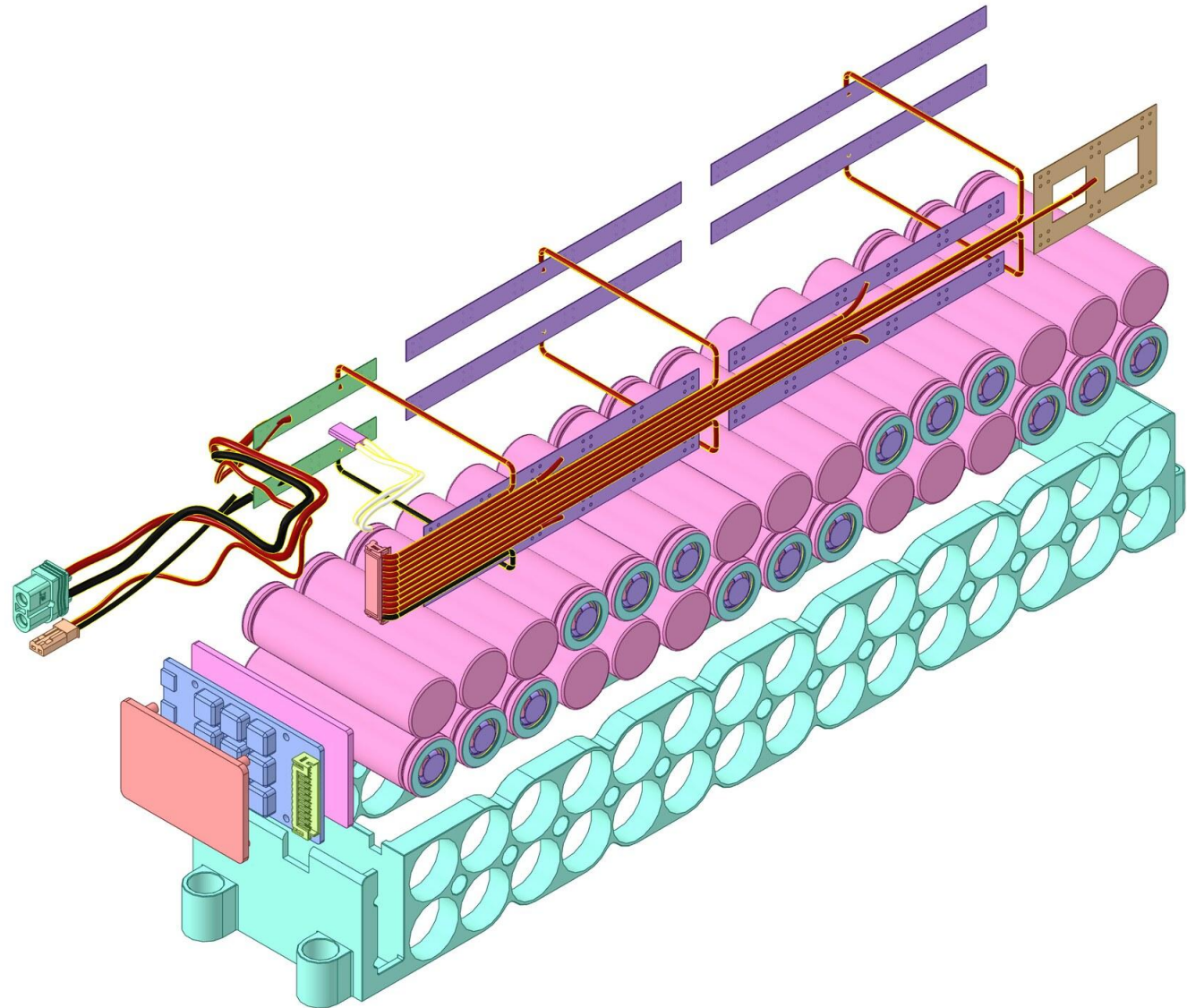
Nickel strips

BMS board

Balance leads

Discharge plug

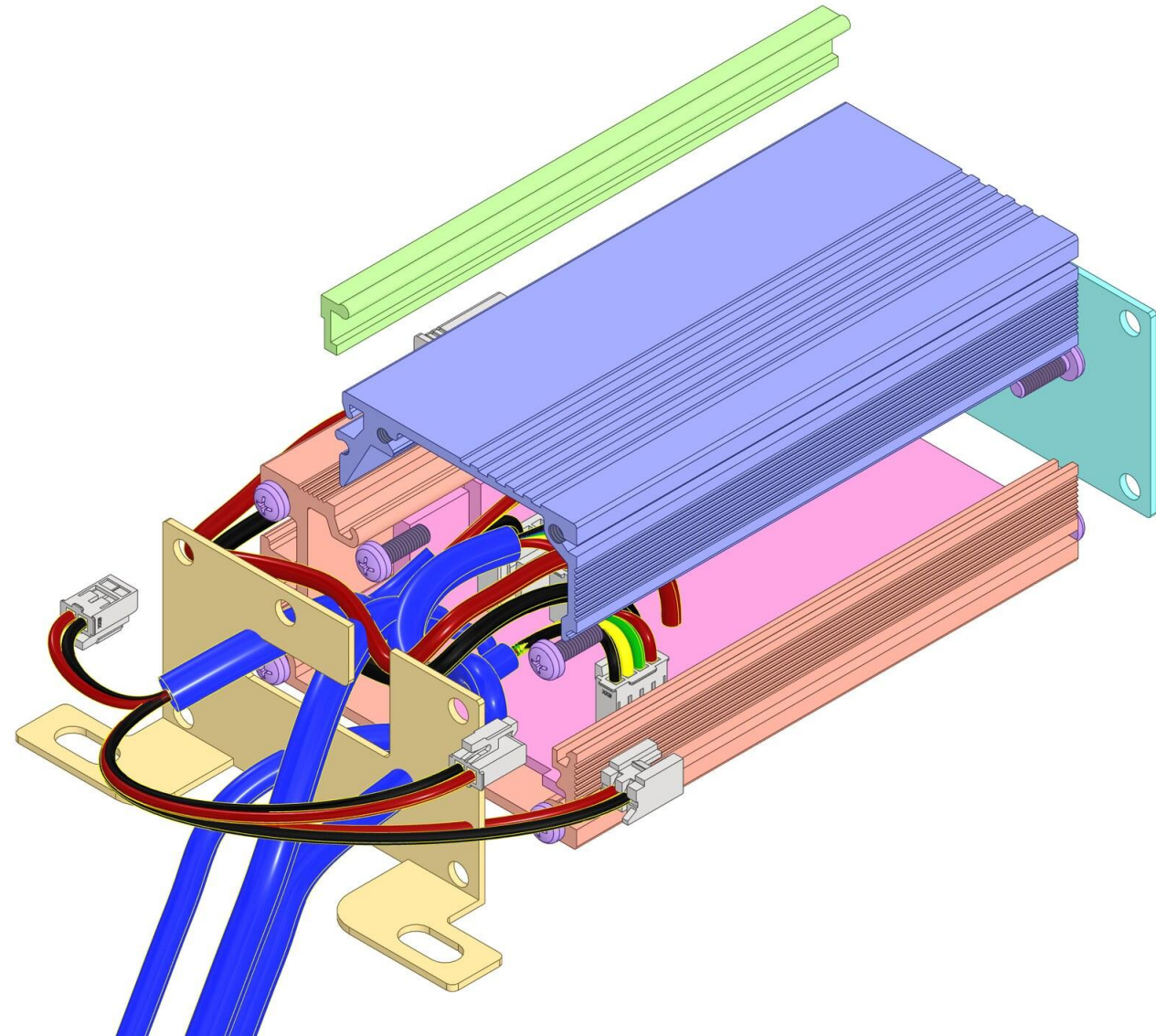
Insulator



THE BRAIN IN A BOX

The controller sits at the front of the deck bay. Its PCB board is clamped between heatsinks inside a finned aluminum housing. Every power, phase and signal wire runs through this junction across the vehicle.

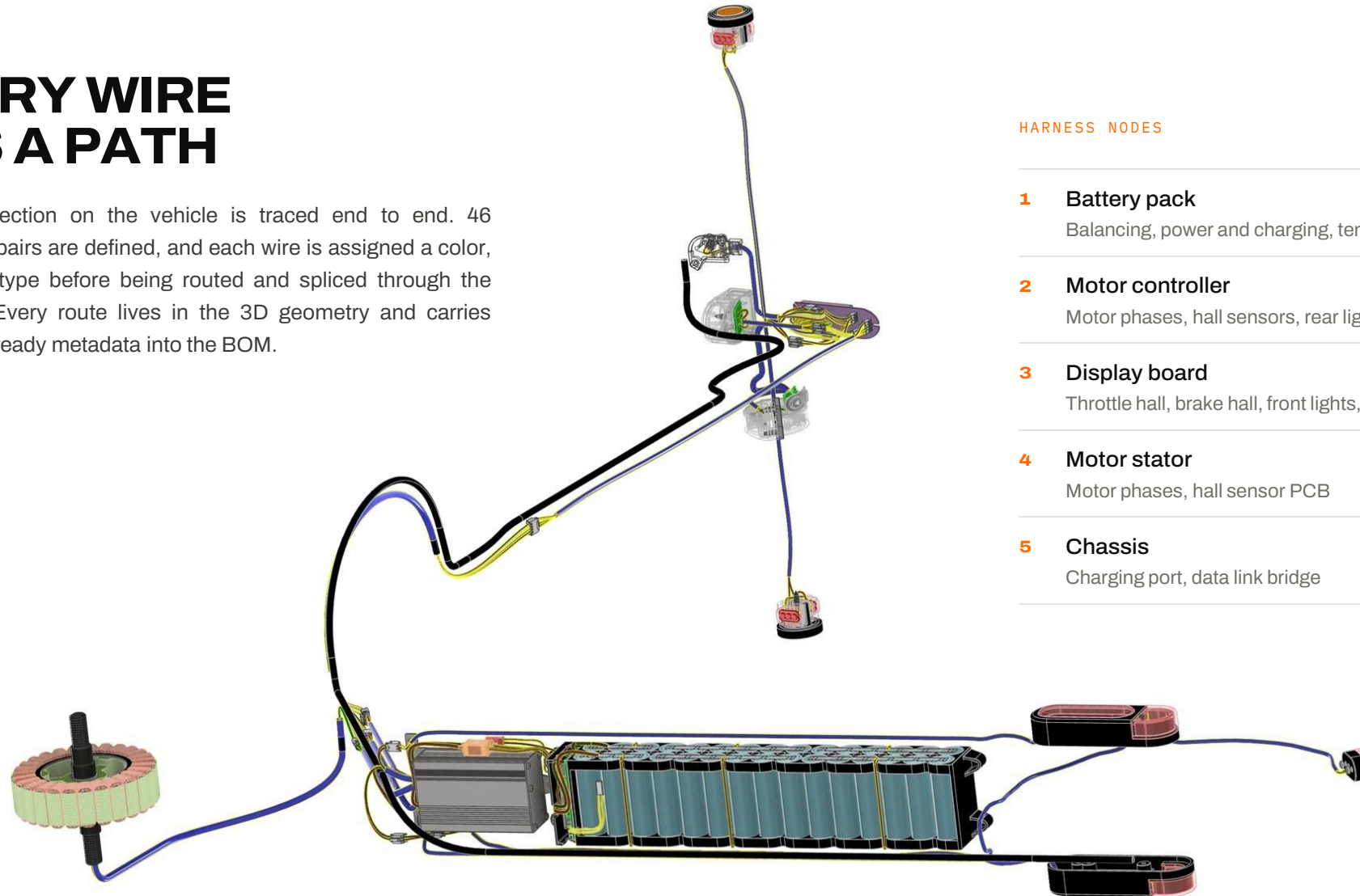
- Finned housing
- Controller board
- Heatsink housing
- End plates
- Mounting bracket
- Insulation rail
- Harness segments



THE ELECTRICAL HIGHWAY

EVERY WIRE HAS A PATH

Every connection on the vehicle is traced end to end. 46 connection pairs are defined, and each wire is assigned a color, gauge and type before being routed and spliced through the assembly. Every route lives in the 3D geometry and carries production-ready metadata into the BOM.

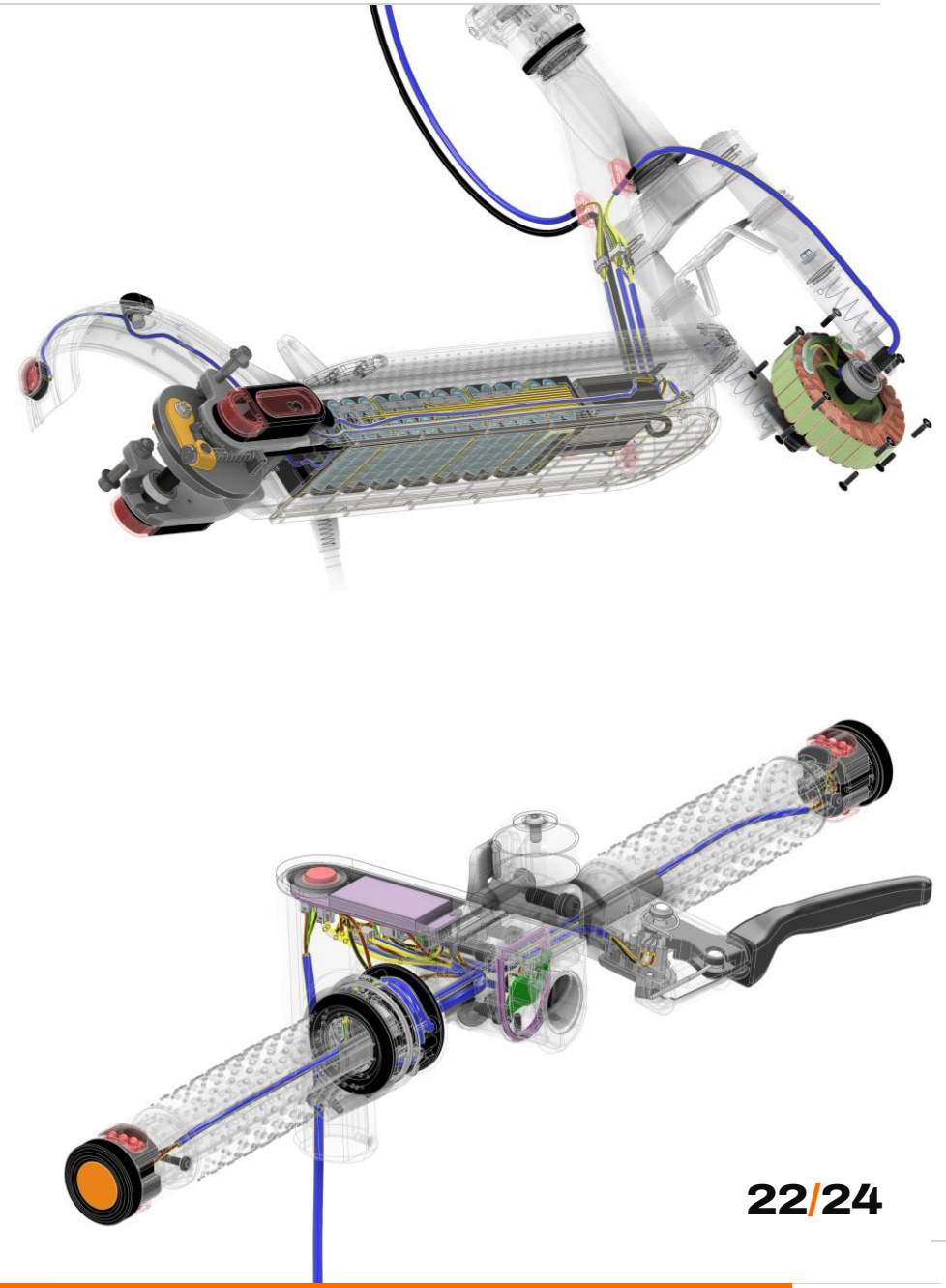
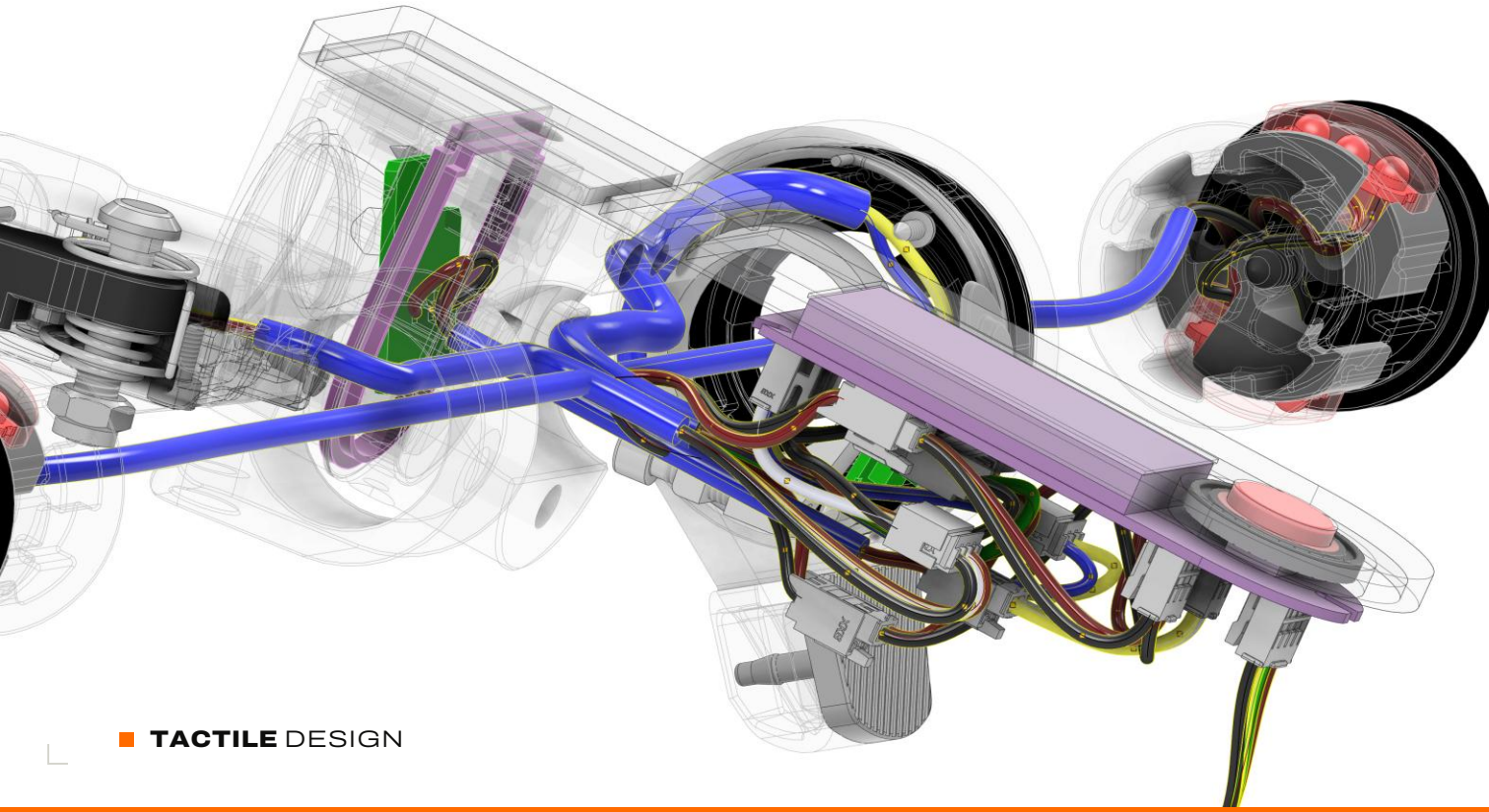


HARNESS NODES

- 1 Battery pack**
Balancing, power and charging, temperature
- 2 Motor controller**
Motor phases, hall sensors, rear lights, data link
- 3 Display board**
Throttle hall, brake hall, front lights, data link
- 4 Motor stator**
Motor phases, hall sensor PCB
- 5 Chassis**
Charging port, data link bridge

THE HANDLEBAR SPAGHETTI

The handlebar carries the most densely packed routing on the vehicle. The display board and the motor controller act as two independent brains, kept in sync in real time over the data link.





ONE MODEL, EVERY DELIVERABLE

Every aspect of the design comes from a single master model. The same source drives the detailed drawings, multi-level BOMs, harness tables, exploded views and renders, so everything stays PLM ready.

LET'S BUILD THE NEXT ONE

Reverse engineering, production-ready CAD, wiring harness design and complete technical documentation, from a single part to a full product.

CONTACT

EMAIL **business@tactiledesign.in**

PHONE **+91 7276090421** CALL OR WHATSAPP

WEBSITE **www.tactiledesign.in**

