



3D Spatial Scanning Using a Rotating 2D LiDAR Sensor

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Outline

- Motivation
- System Architecture & Hardware
- Capturing Protocol
- Data Processing Pipeline
- Results
- Materials
- Applications
- Future Work

Motivation - Phantoms: Extraordinary Exhibition



I see airships in the sky, and beneath the sky, an army of monuments from a thousand-year-old history.



GEOSYSTEMS



RTC



BLK360



BLK2GO



BLK ARC



BLK2FLY



BLK3D



ACCESSORIES

Leica BLK360

Technology

Use cases

Workflow

Contact us

\$26,500

ADD TO CART



1 / 6 ↗

Leica BLK360

\$26,500

Qualifying customers
can finance for as low
as: **\$592/mo.**

ADD TO CART

FINANCE

Free shipping over \$99

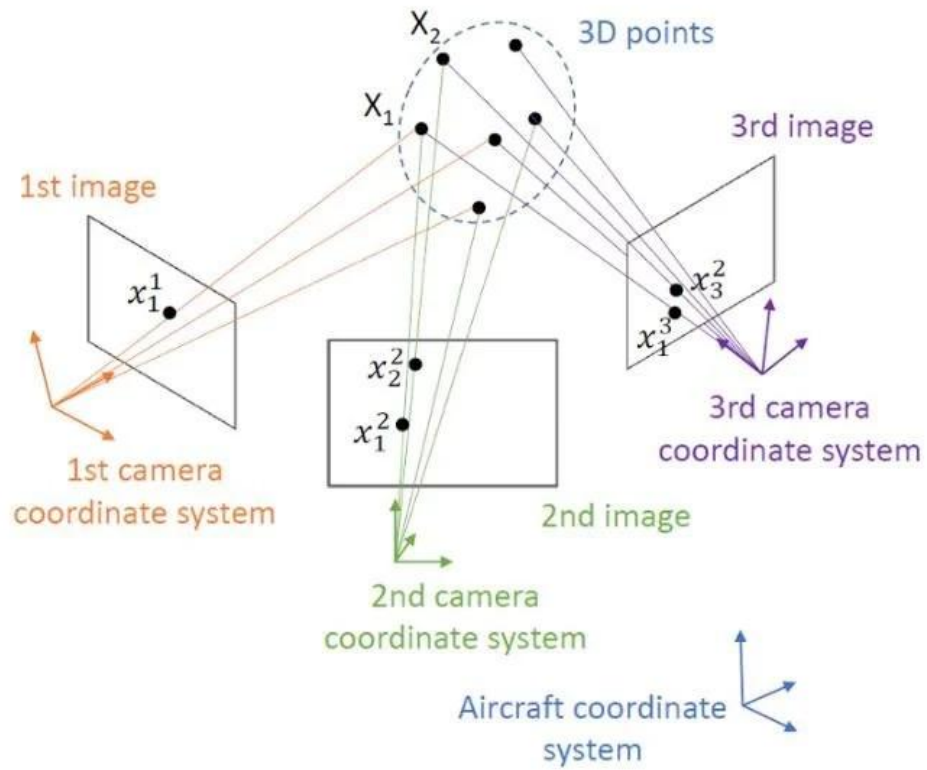
OPTIONS

BLK360 Hardware Pack
with Hexagon GeoCloud

\$26,500

Welcome to the world's smallest and lightest
imaging laser scanner.

Photogrammetry

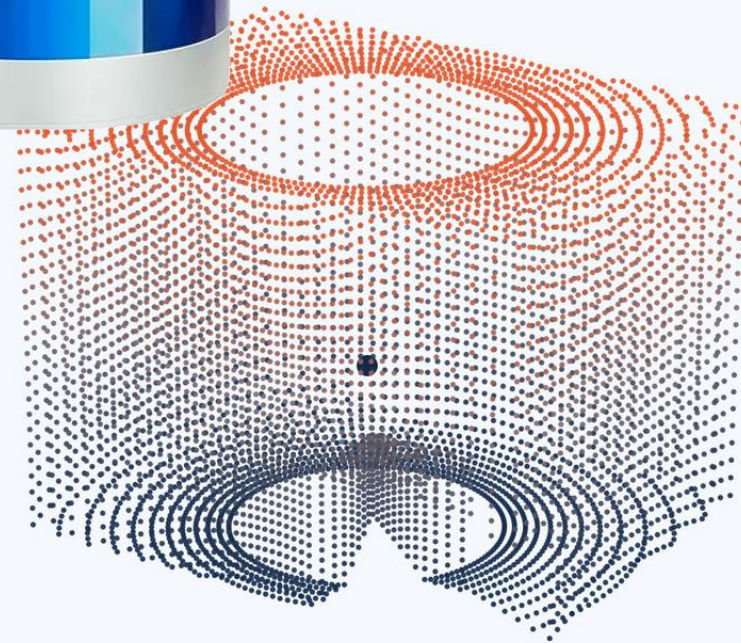


Tens of thousands of images captured

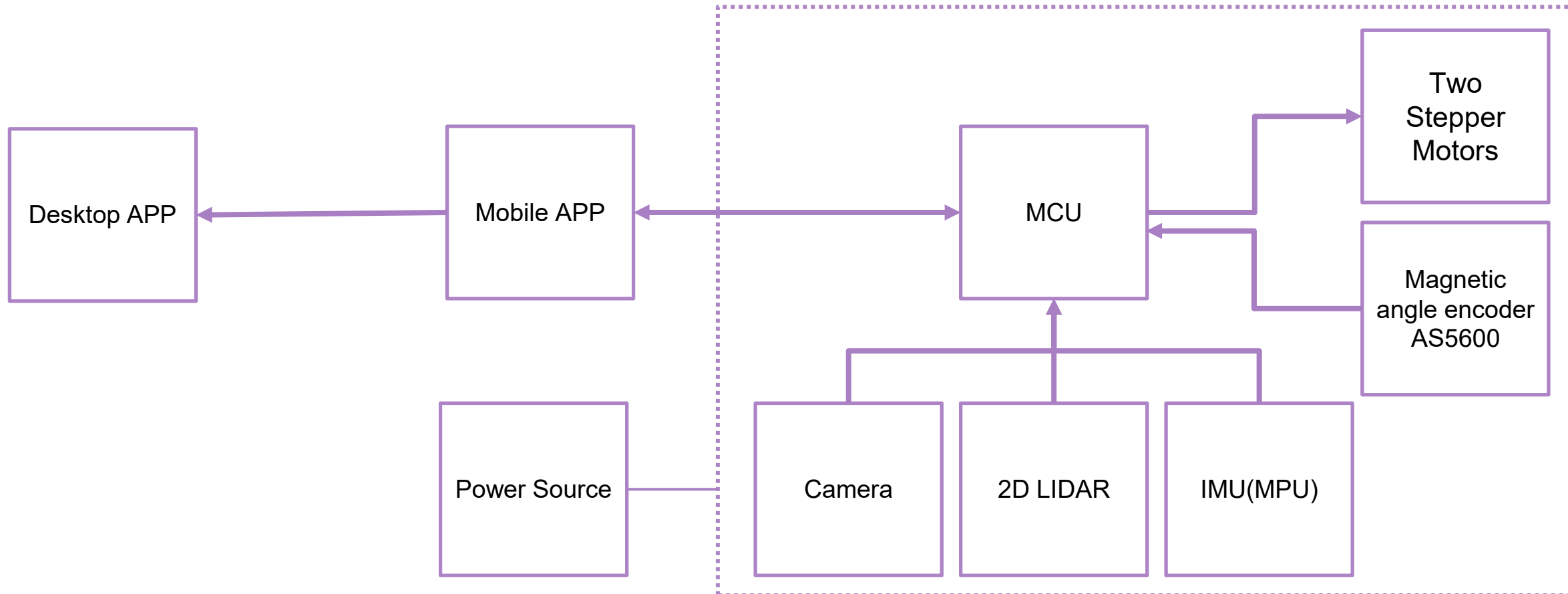




Goal



System Architecture



2D LIDAR(YDLIDAR T-MINI PLUS)

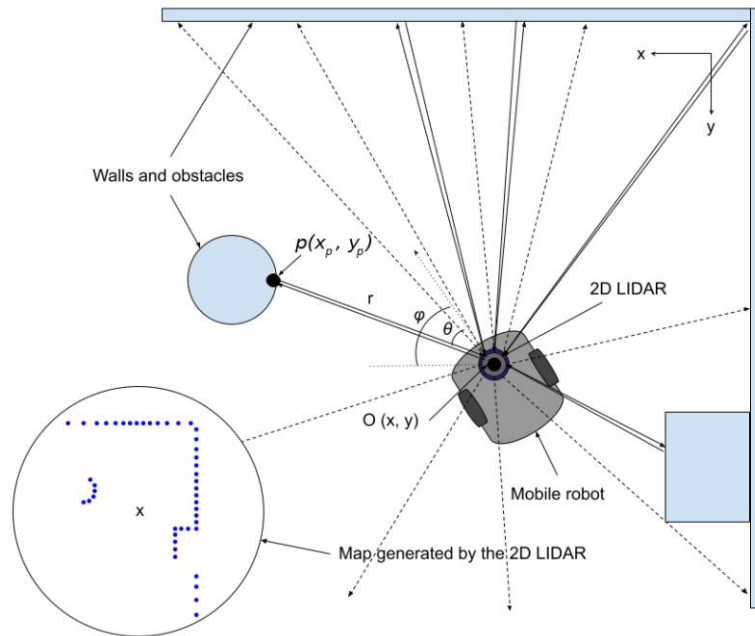
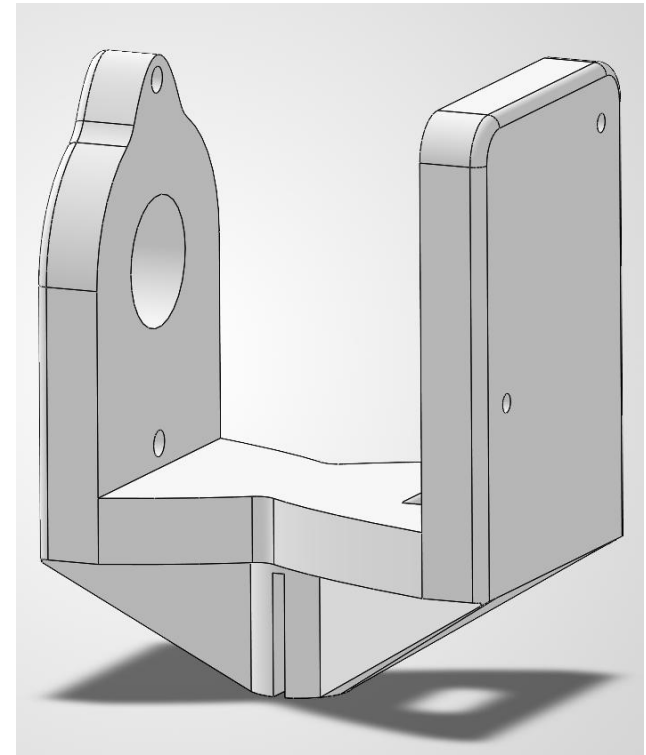
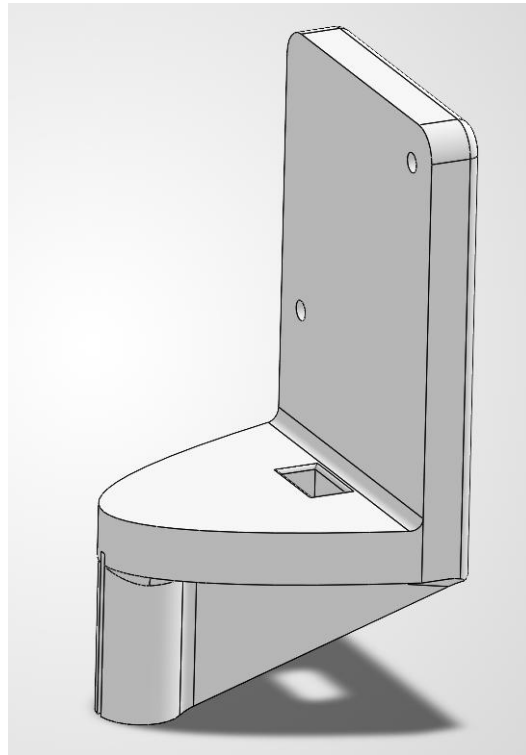
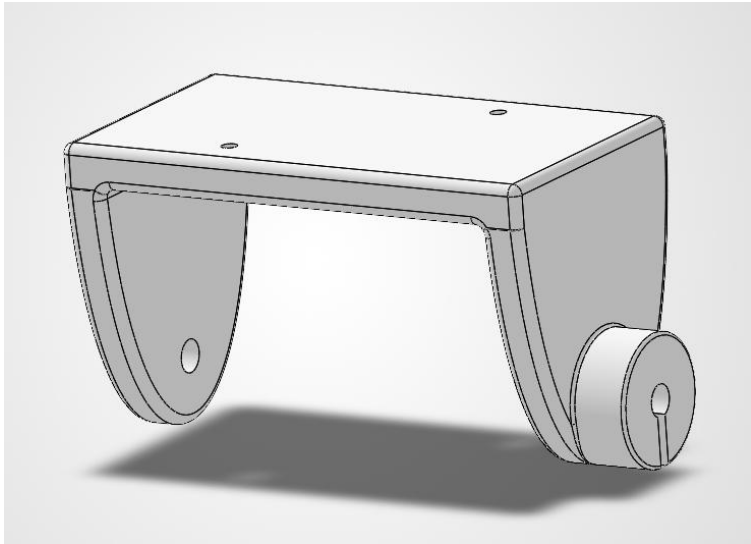
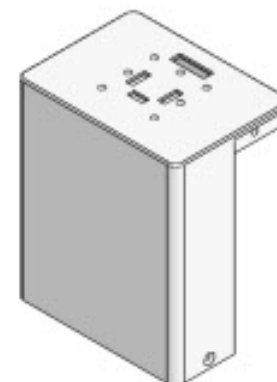
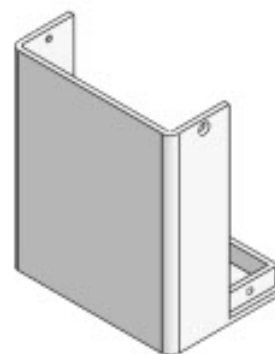
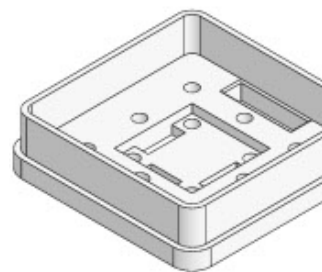
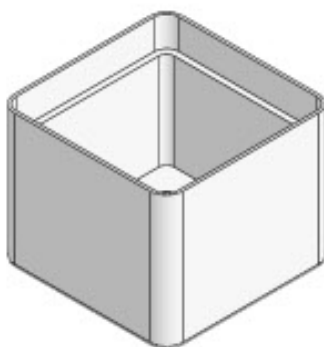
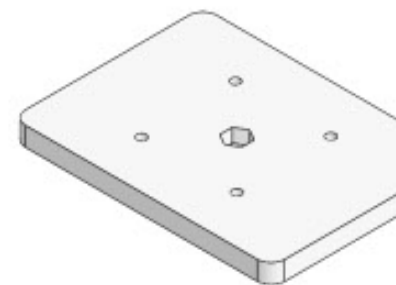
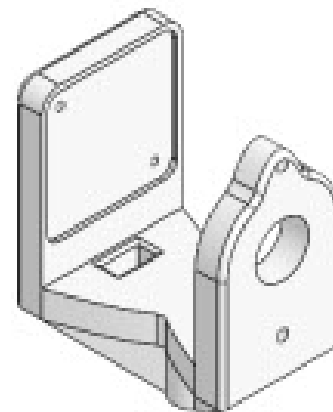
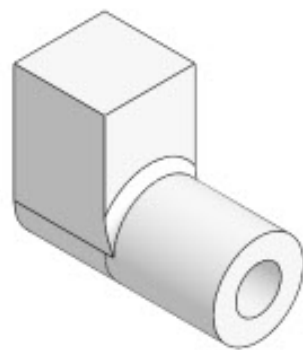
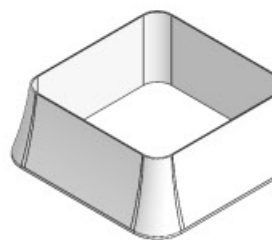


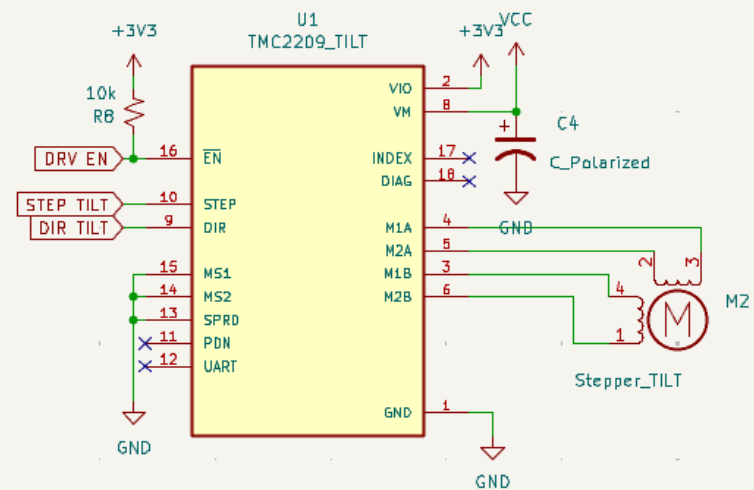
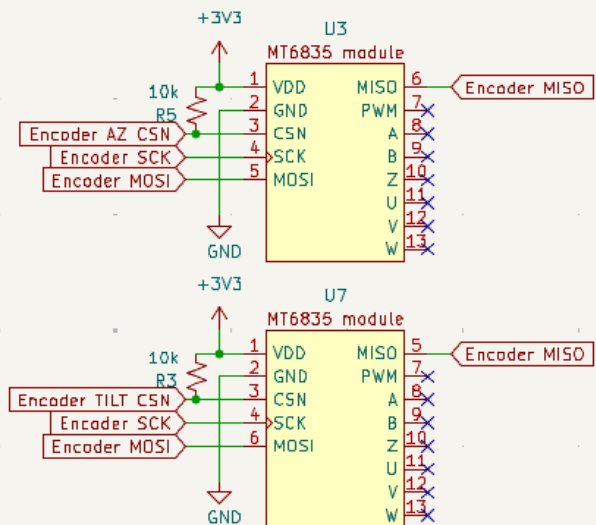
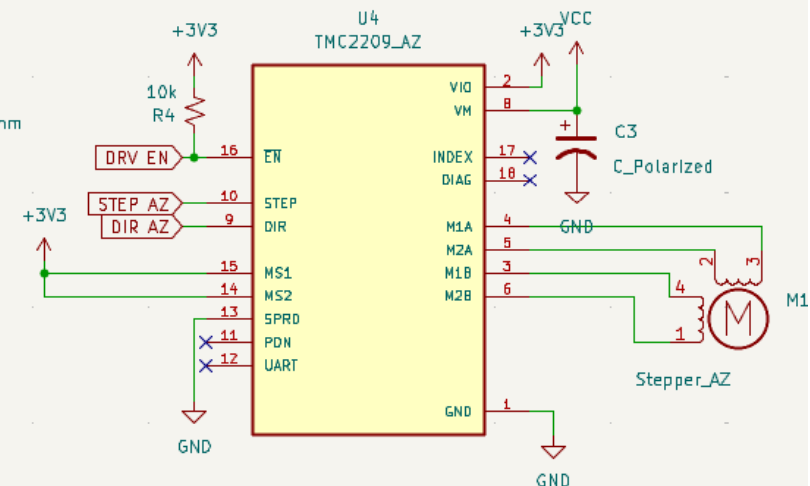
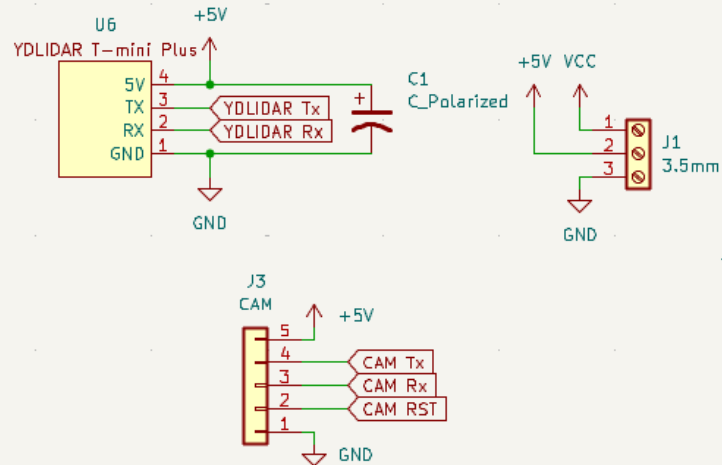
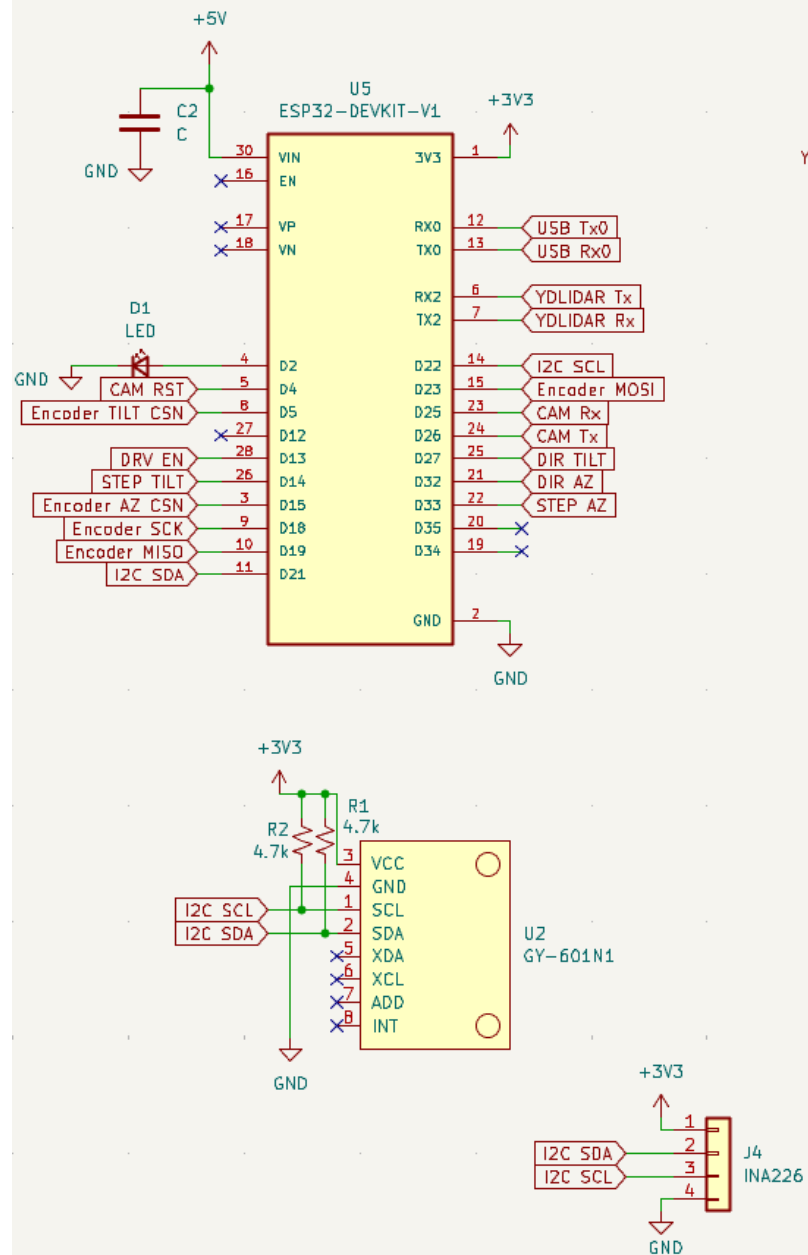
CHART 1 YDLIDAR T-MINI PLUS PRODUCT PARAMETER

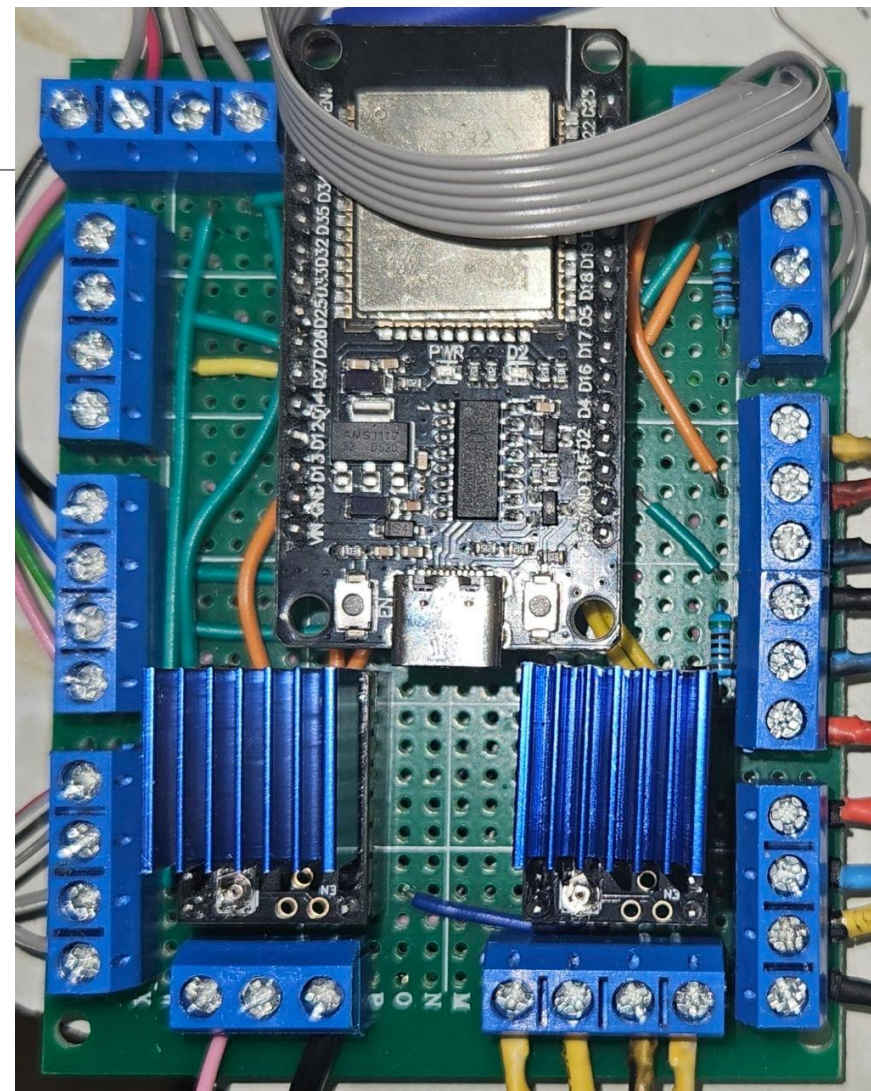
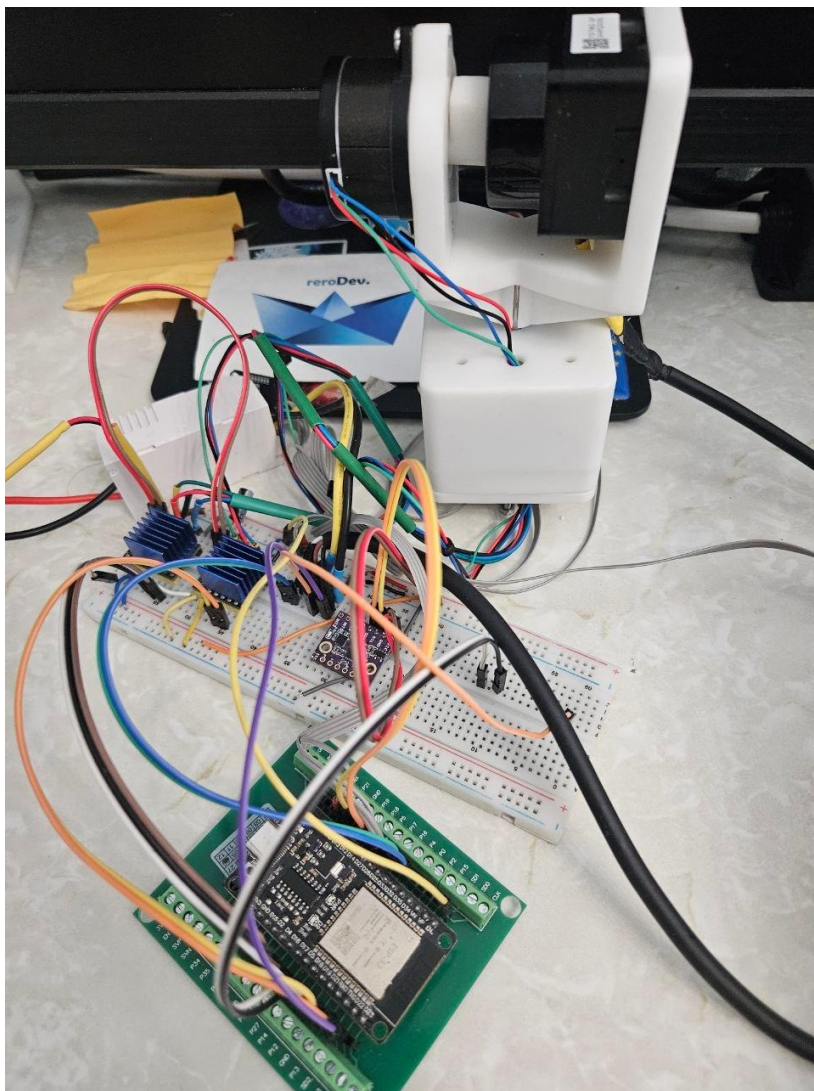
Item	Min	Typical	Max	Unit	Remarks
Ranging frequency	/	4000	/	Hz	/
Scan frequency	6	6	12	Hz	Software speed regulation, default 6Hz
Ranging distance	0.05	/	12	m	80% reflectivity
	0.05	/	4	m	10% reflectivity
Fileld of view	/	0-360	/	Deg	/
Systematic error	/	20	/	mm	0.05m < Distance ≤ 12m
Angle resolution	0.54	/	/	Deg	/
Tilt angle	0	0.75	1.5	Deg	/

3d parts and shape

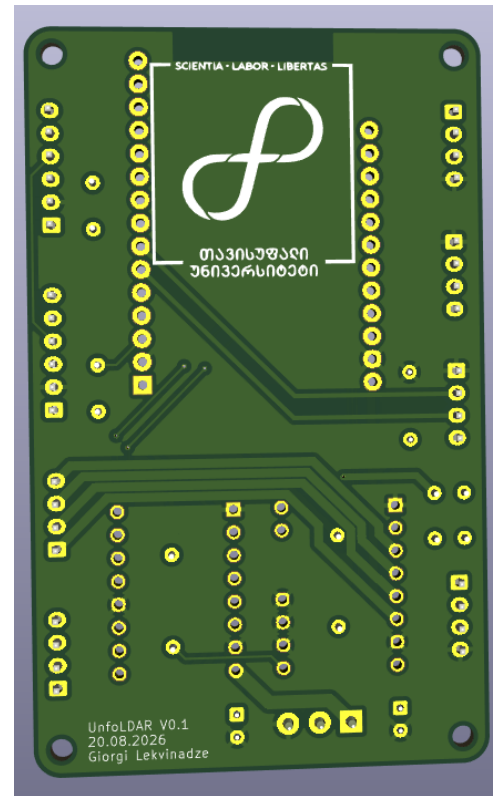
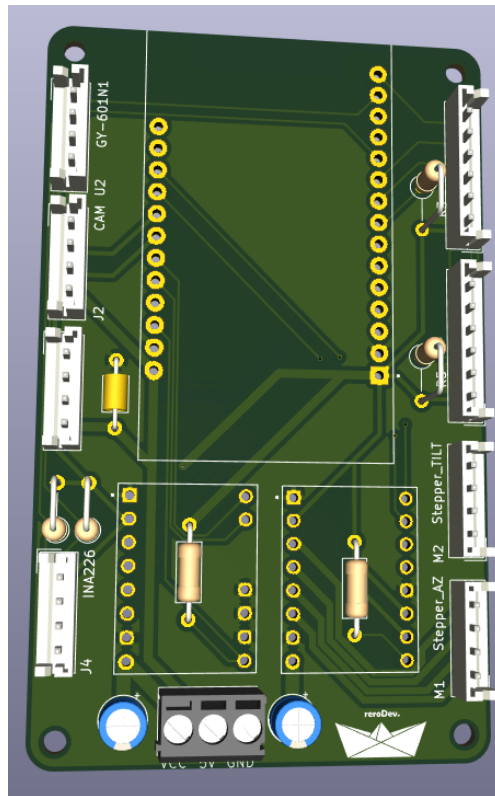
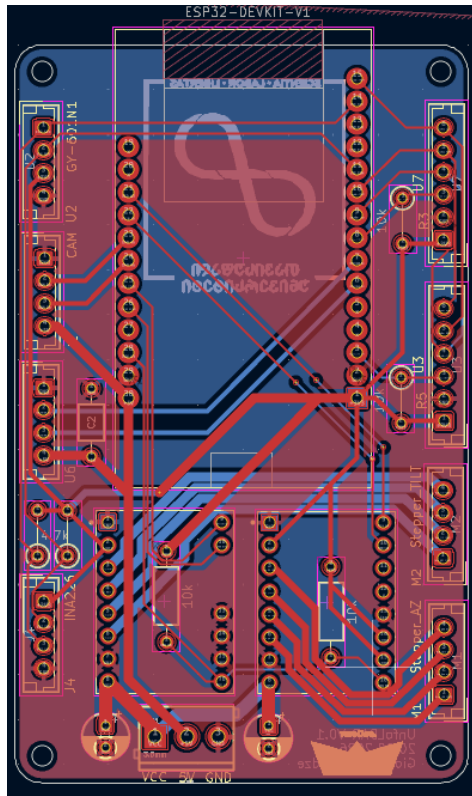




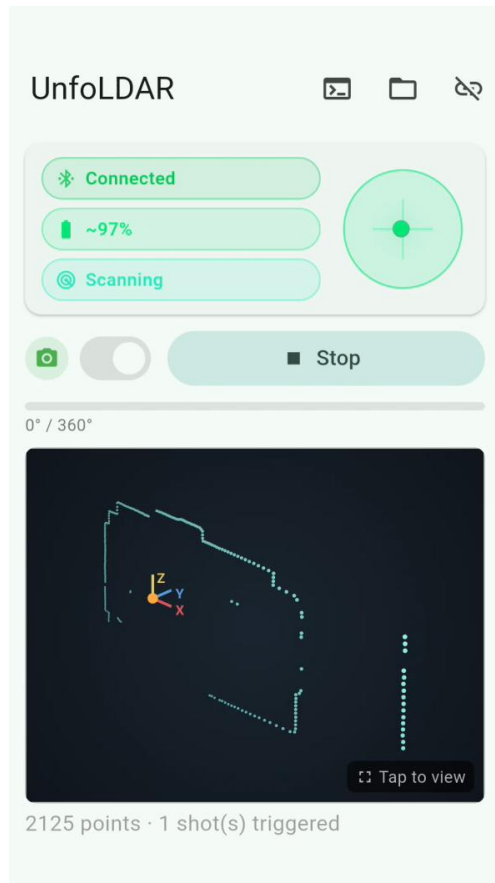




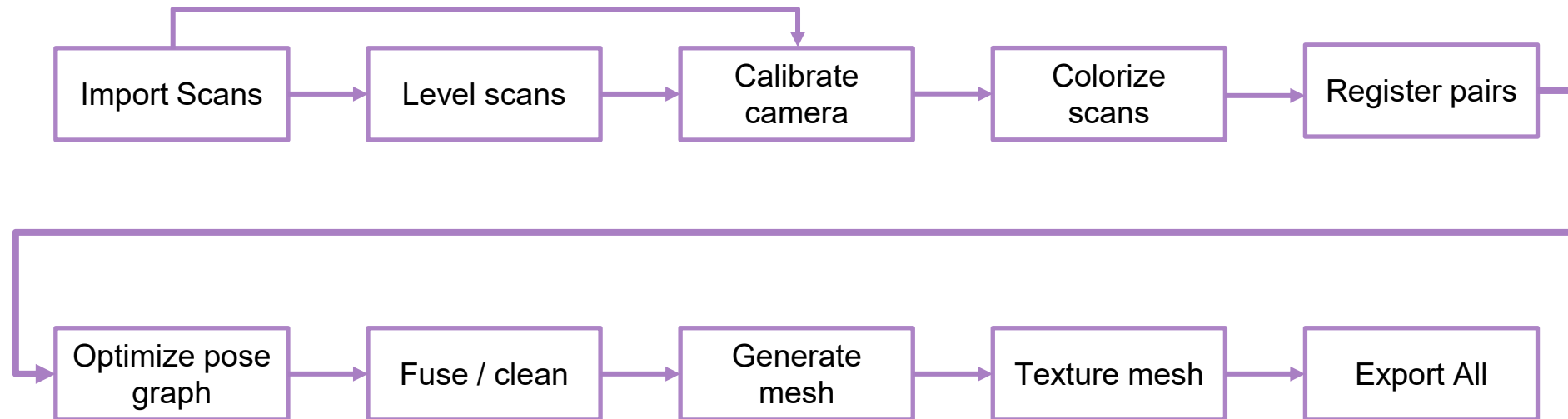
PCB



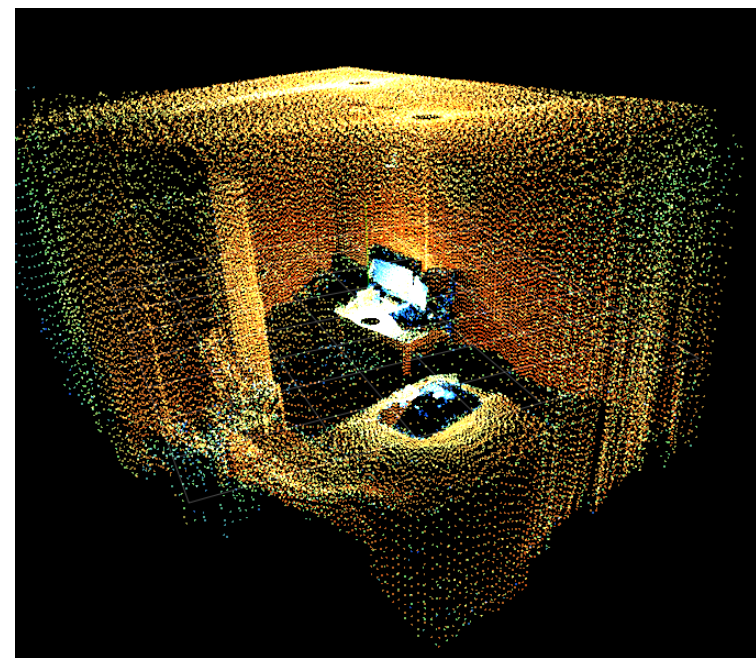
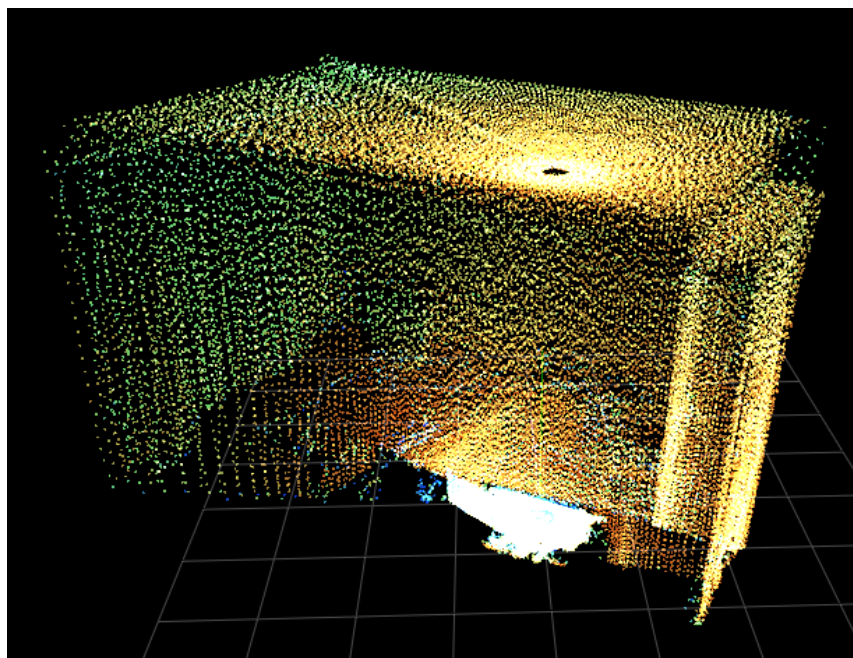
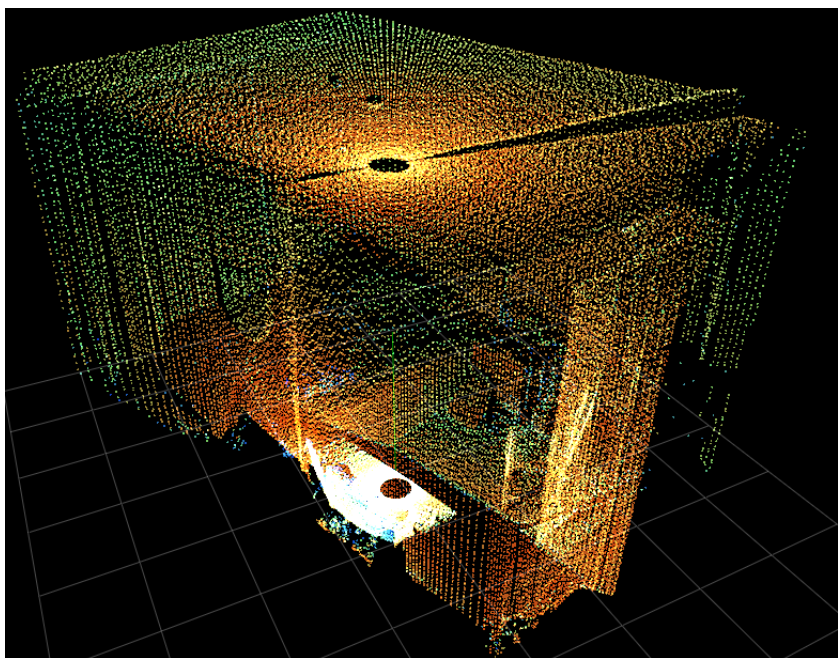
Capturing protocol – mobile



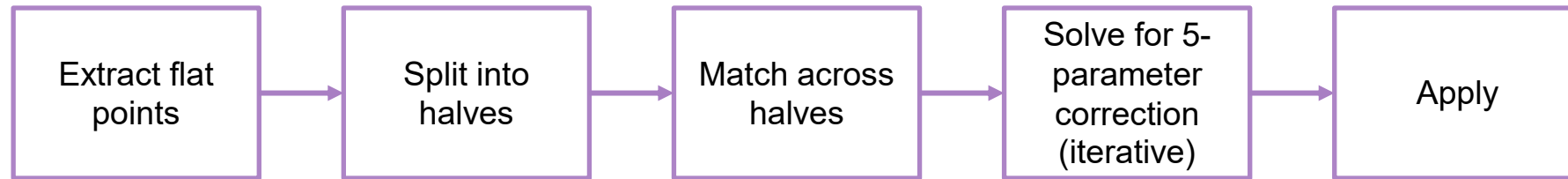
Data Processing



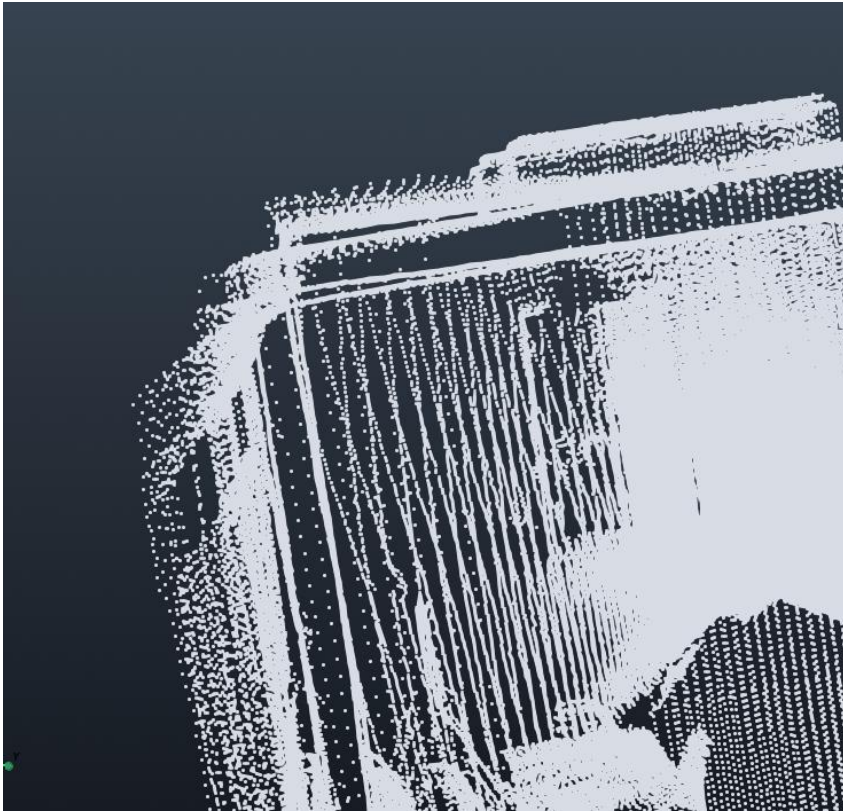
Level scans



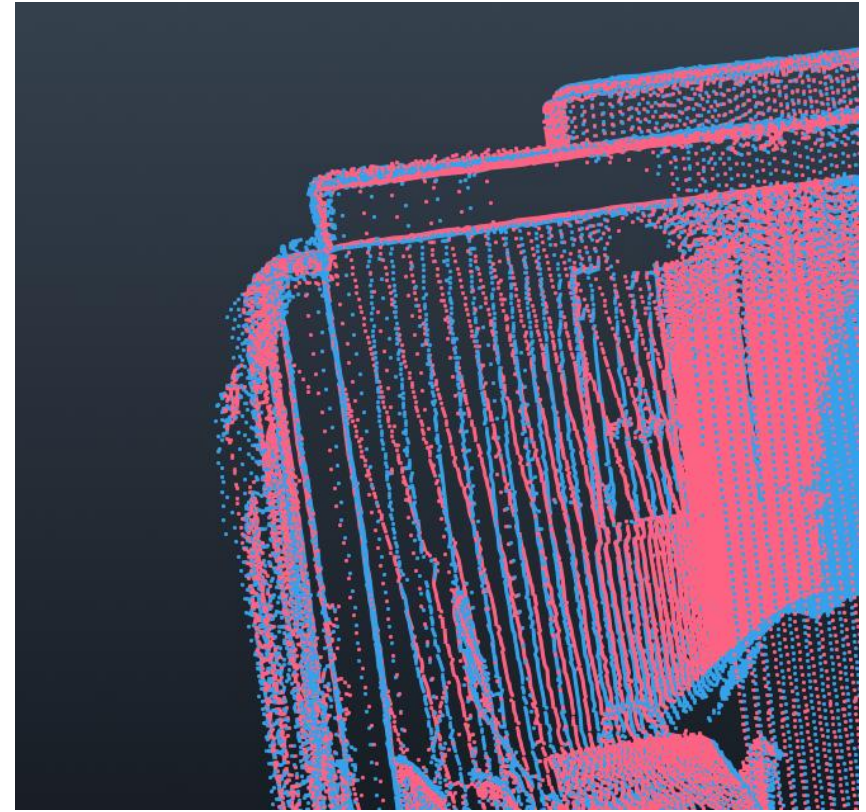
Level scans



Level scans

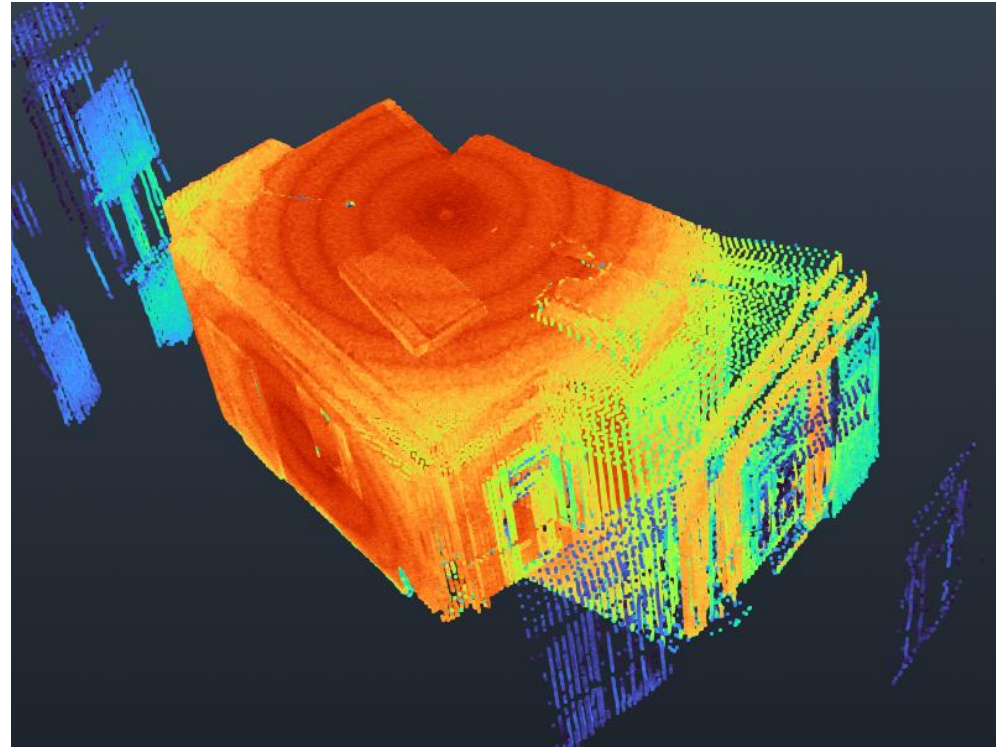
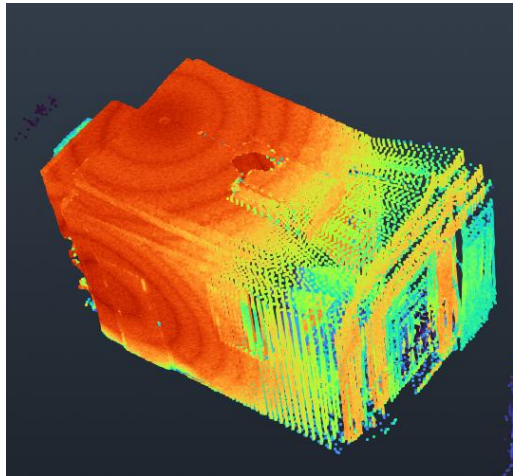
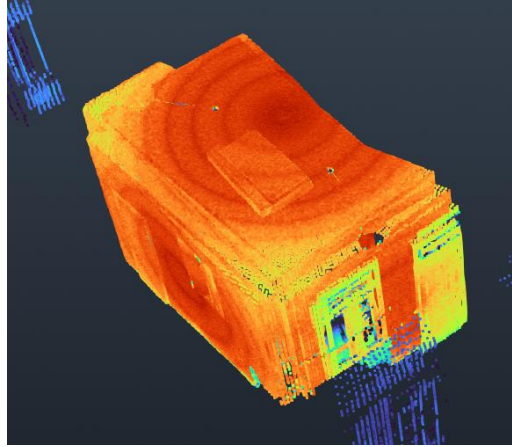


Before

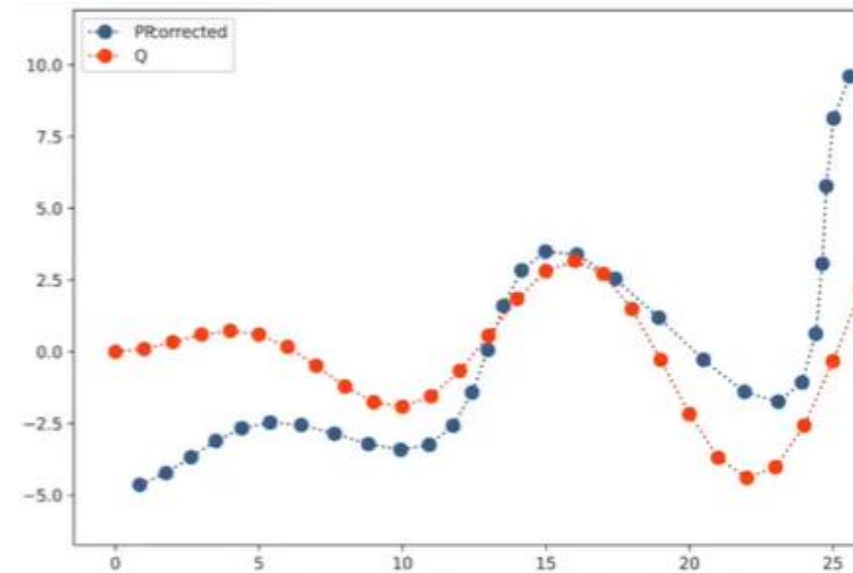
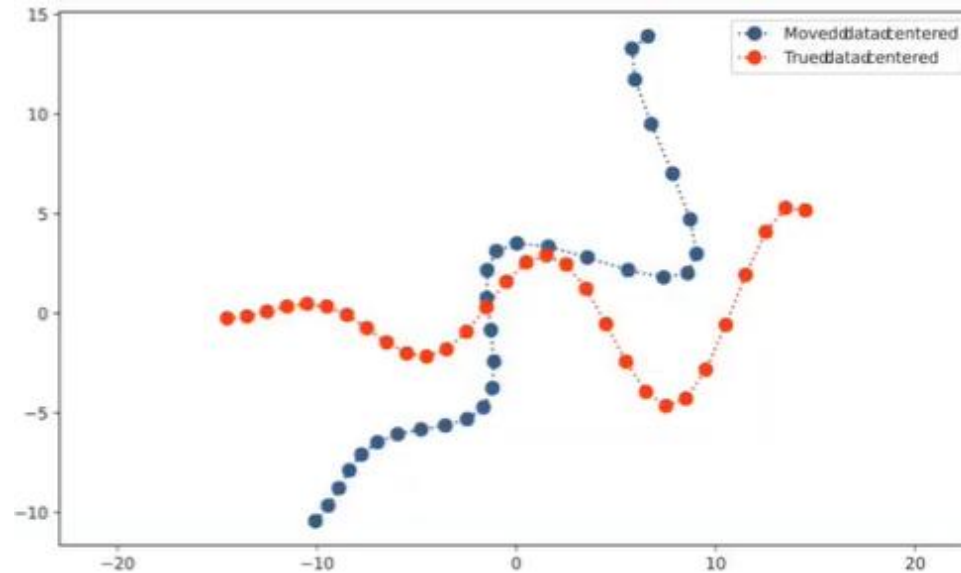
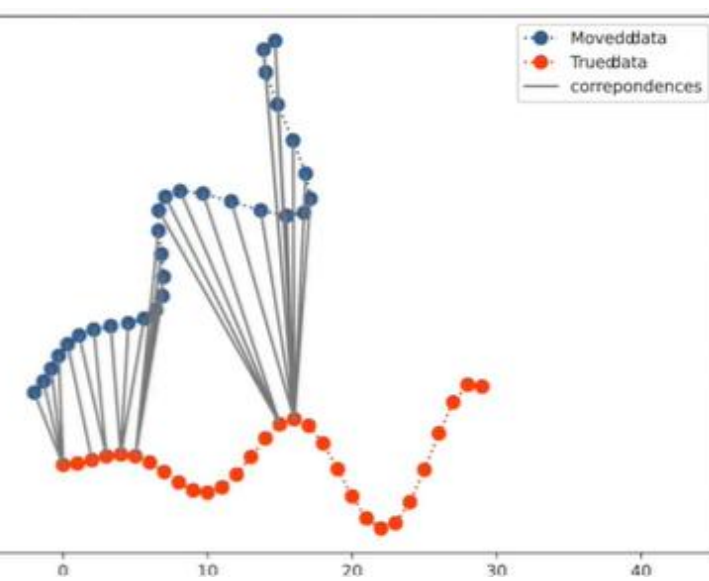


After

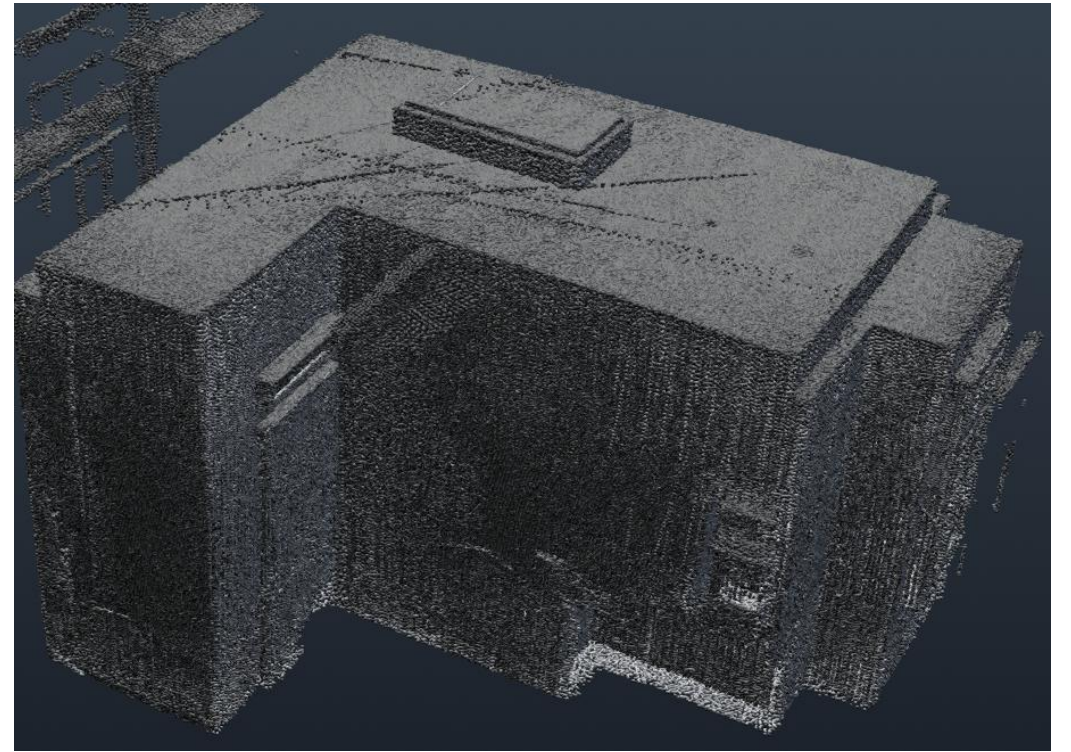
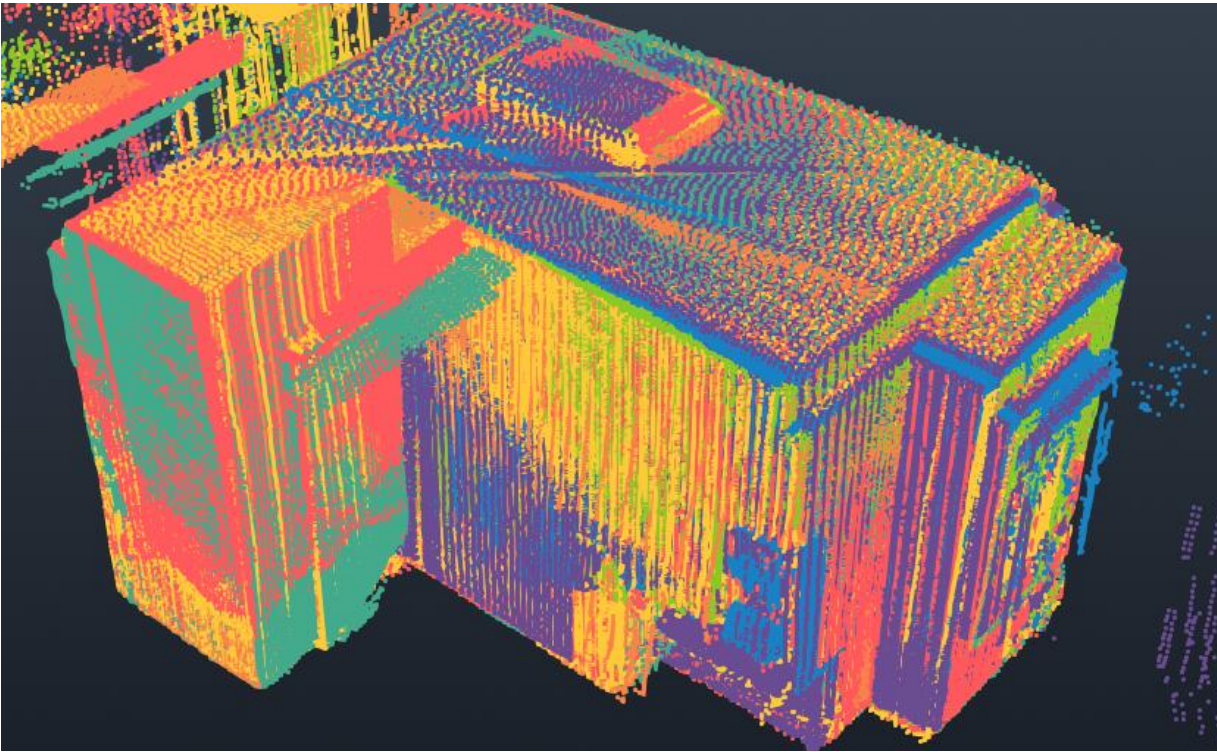
Register pairs and Optimize pose graph



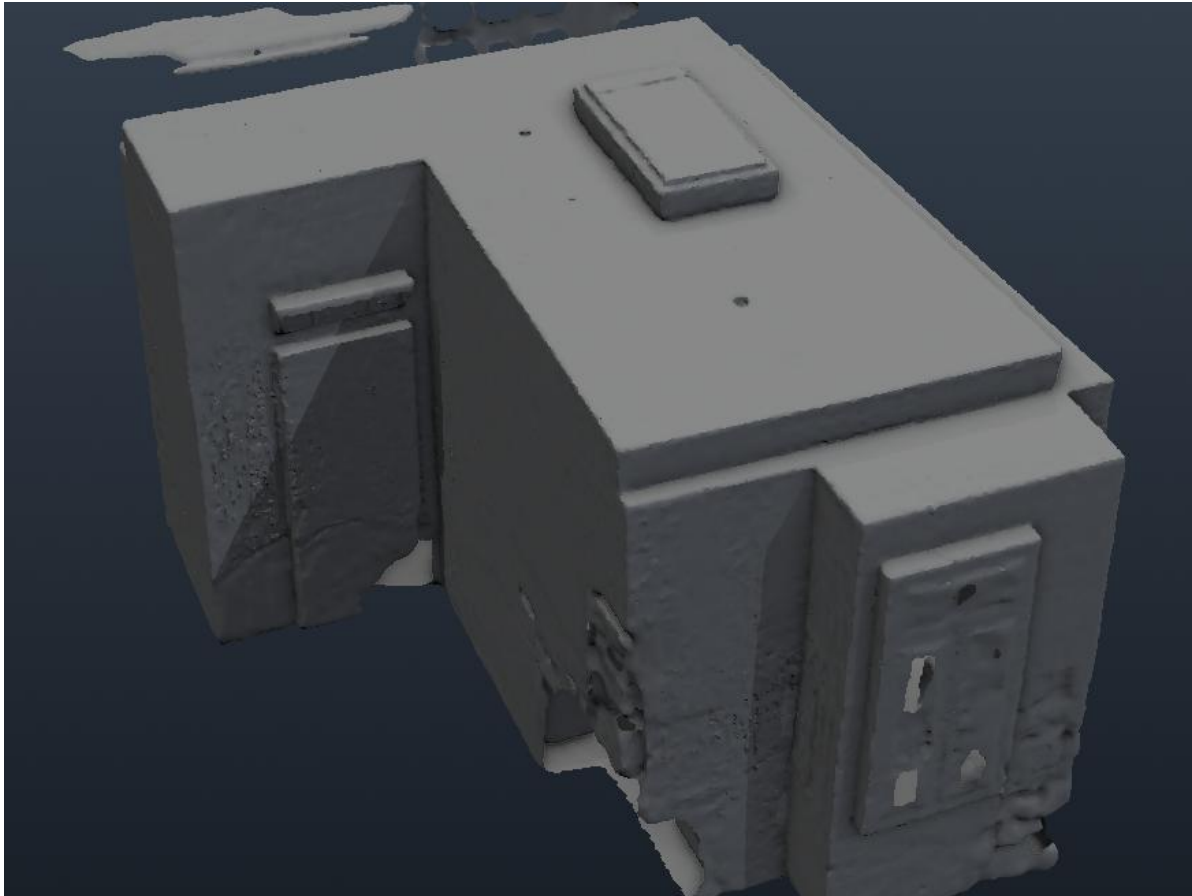
Iterative Closest Point (ICP)



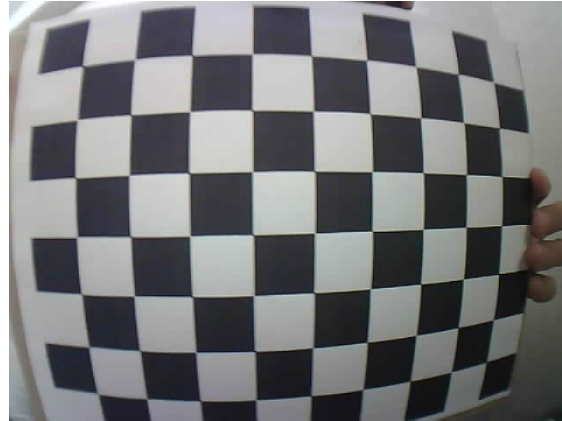
Optimized pose graph



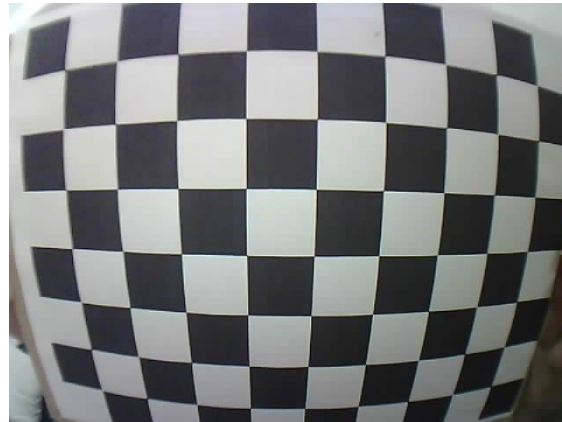
Mesh Generation



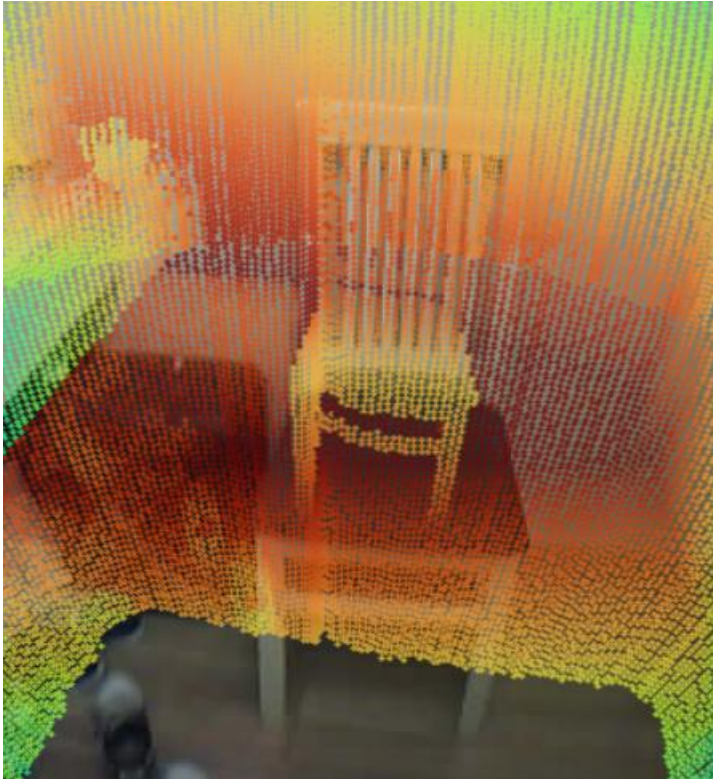
Calibrate camera



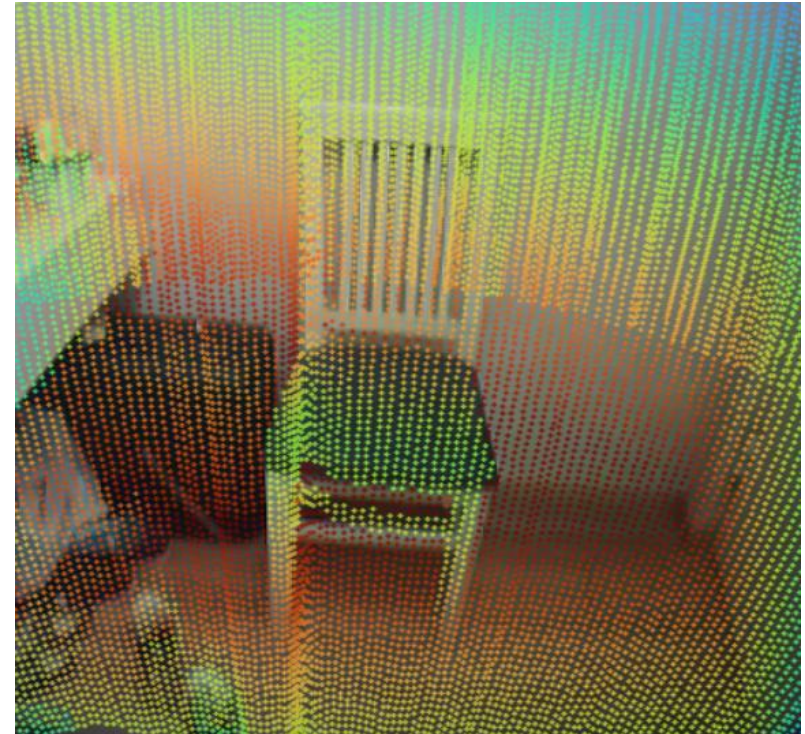
75mm 120deg



Calibrate camera

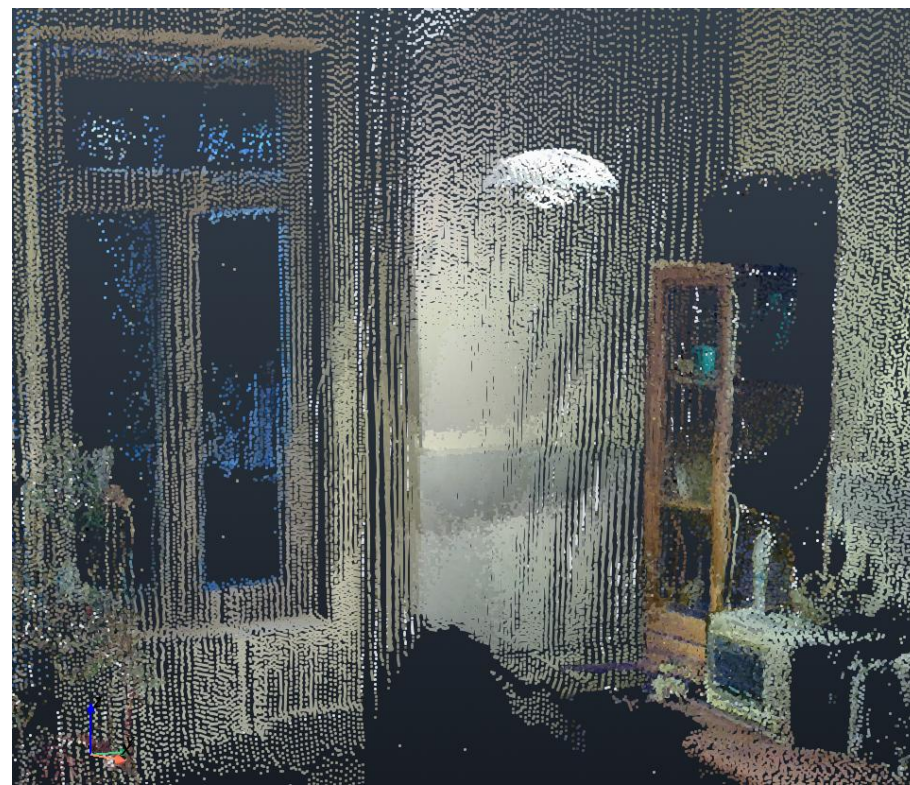


Before



After

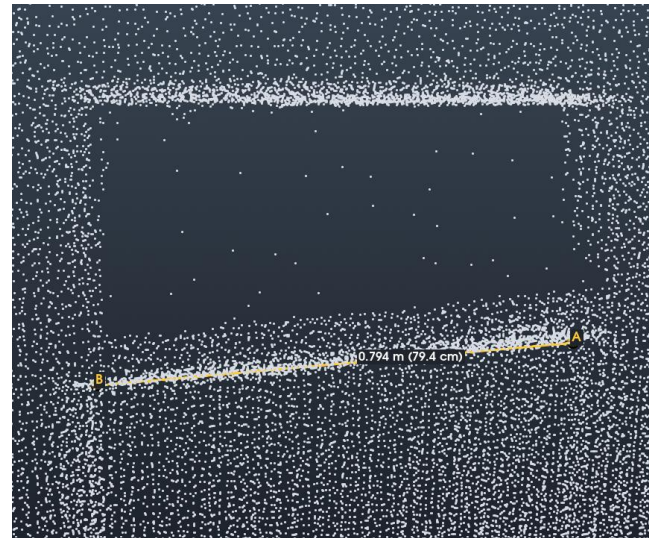
Colorize scans



Final result



Actual 1,5m



Actual 0,8m



Actual 3,7m

Component	Quantity	Price(€)
YDLIDAR T-mini Plus	1	49
Stepper motor Driver	2	2,9
MPU-6050	1	1
ESP32Dev Board	1	3
ESP32-CAM	1	3
LM2596S DC-DC	1	0,5
Camera OV2640	1	4,4
Stepper Motor JS42HS40	1	5,2
Stepper Motor 36HS2110	1	3,5
BMS	1	1,2
Charging module	1	0,6
INA226 power monitor	1	0,73
18650 LI-ON 3.7V	1	15
Battery Holder	1	0,25

90,28

*According to Taobao pricing, No 3D printing materials included

Putting the Output to Work

- AR apps (Unity/Unreal/ARKit/ARCore) - instant 3D room models for virtual walkthroughs or staging, without shooting thousands of separate photos.
- CAD/BIM software (AutoCAD, Revit, SolidWorks, Fusion 360) - as-built reference geometry to check whether new equipment, machinery, or fixtures will physically fit in a factory or room before ordering/installing.
- Game engines (Unity, Unreal) - real-world spaces reused as level geometry or simulation environments.
- Robotics simulation - importing a real room/factory layout for path-planning or navigation testing before deploying on hardware.
- 3D printing - scaled physical models of a scanned space..



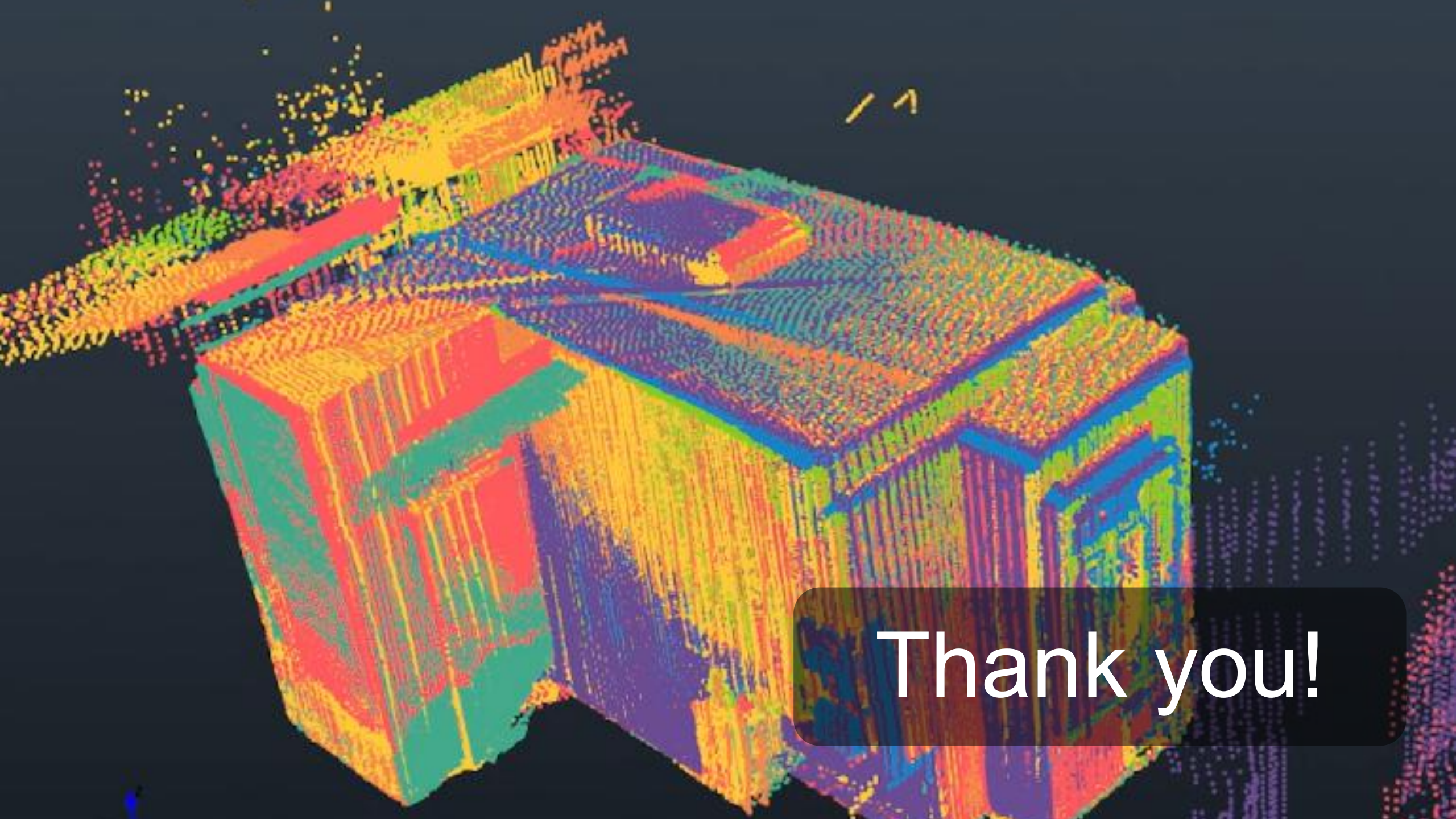
Future

Software / algorithm

- Photo denoising before colorization/texturing
- Multi-view consistency check to detect & exclude mirror/glass reflections
- Encoder feedback (removes gear-ratio error at the source)
- Next-best-view planning (auto-suggest scan positions from live coverage)

Hardware

- Better camera (resolution, global shutter, low-light)
- Higher-accuracy LiDAR unit
- Magnets for the encoder (better angular accuracy)



Thank you!