



Innovation
Central Perth

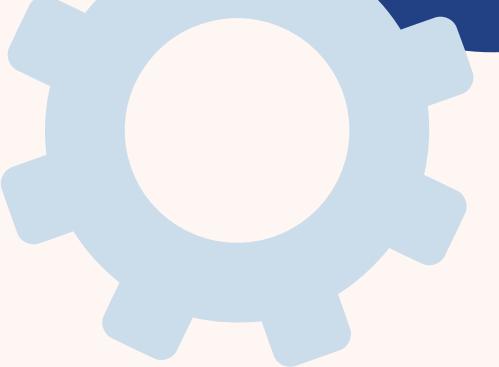
A collaboration led by 

Presented by **Dave Mitchell Qiu**





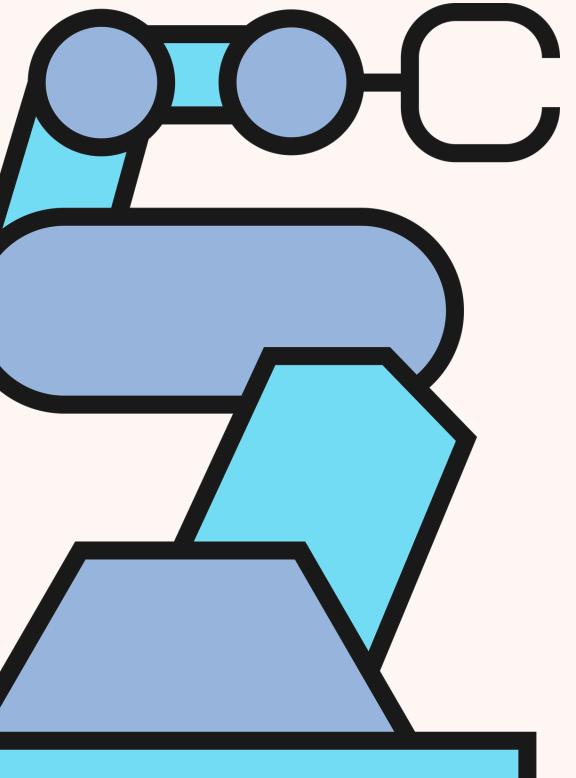
For us?
Inconvenience



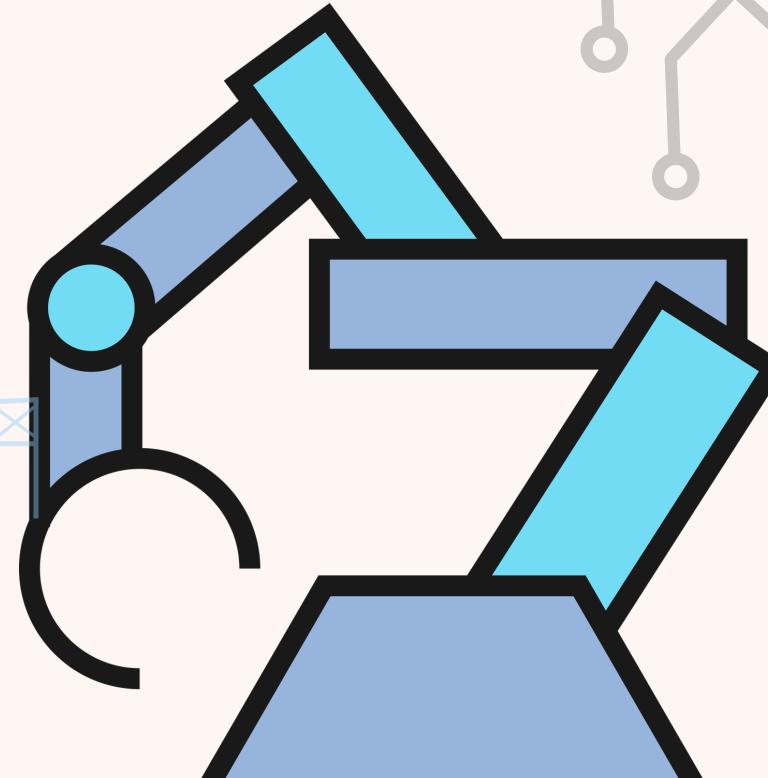
Restriction



Limitation



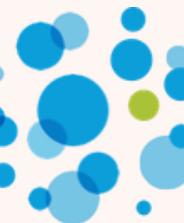
**For people
with mobility
impairments?**



Reliant



Dependence

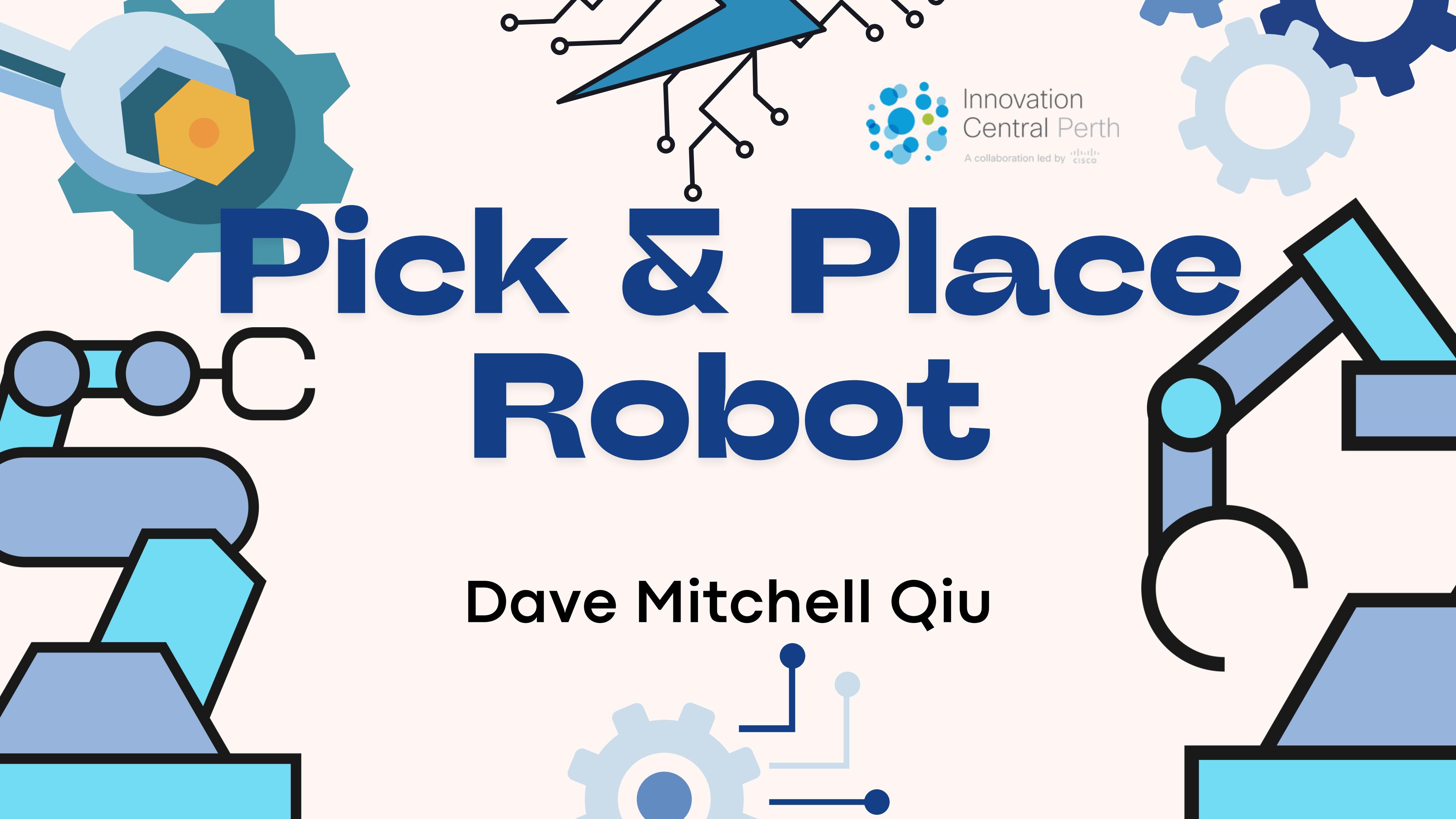


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Pick & Place Robot

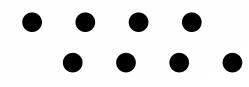
Dave Mitchell Qiu





Continuing

Listen & Act



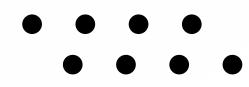
- Pre-defined position
- Interpret Voice
- Send to LLM
- LLM finalize position
- Send to robot
- Execute pre-set movement
- Save & Finalize position





Continuing

Listen & Act



- Pre-defined position
- Interpret Voice
- Send to LLM
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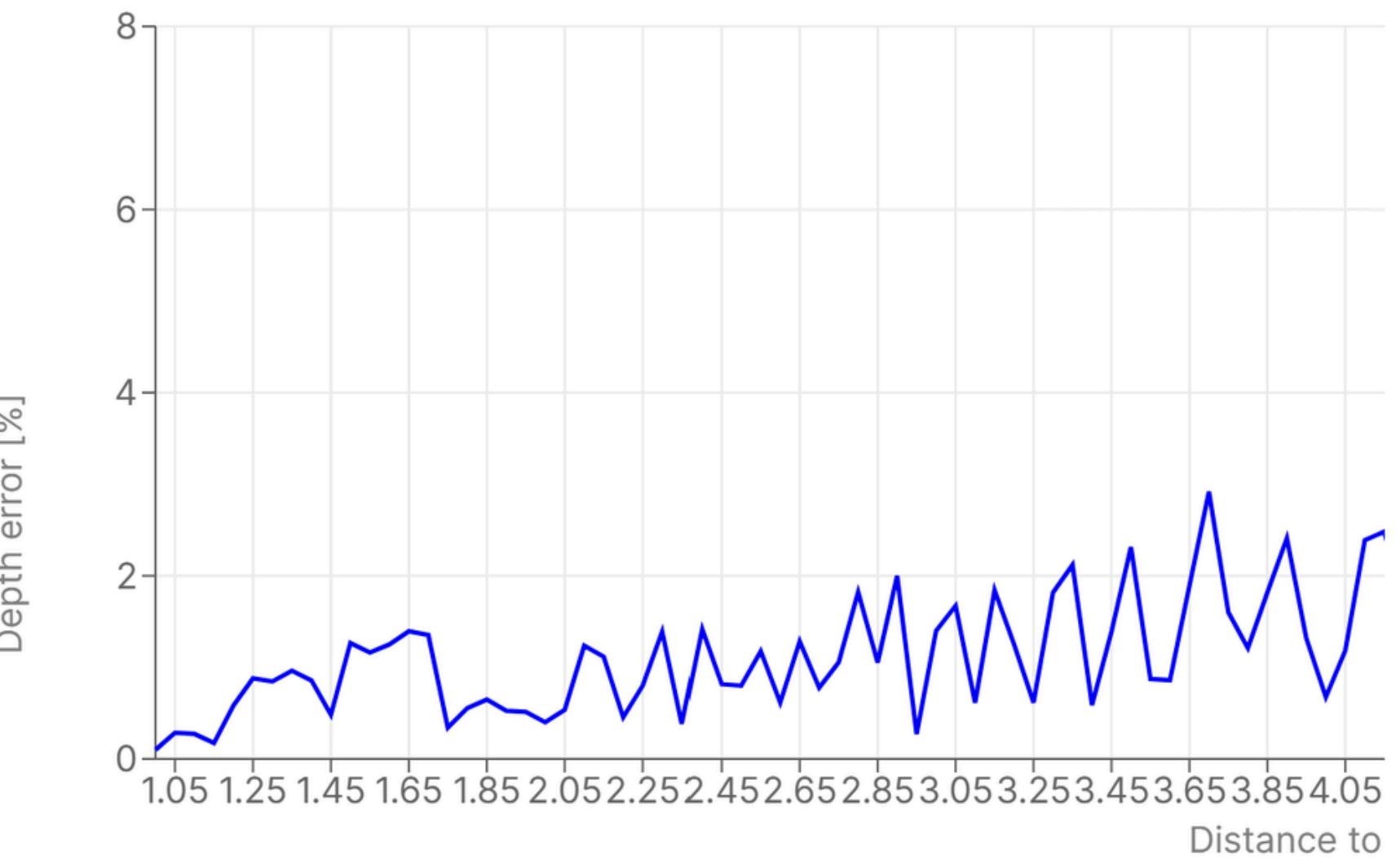
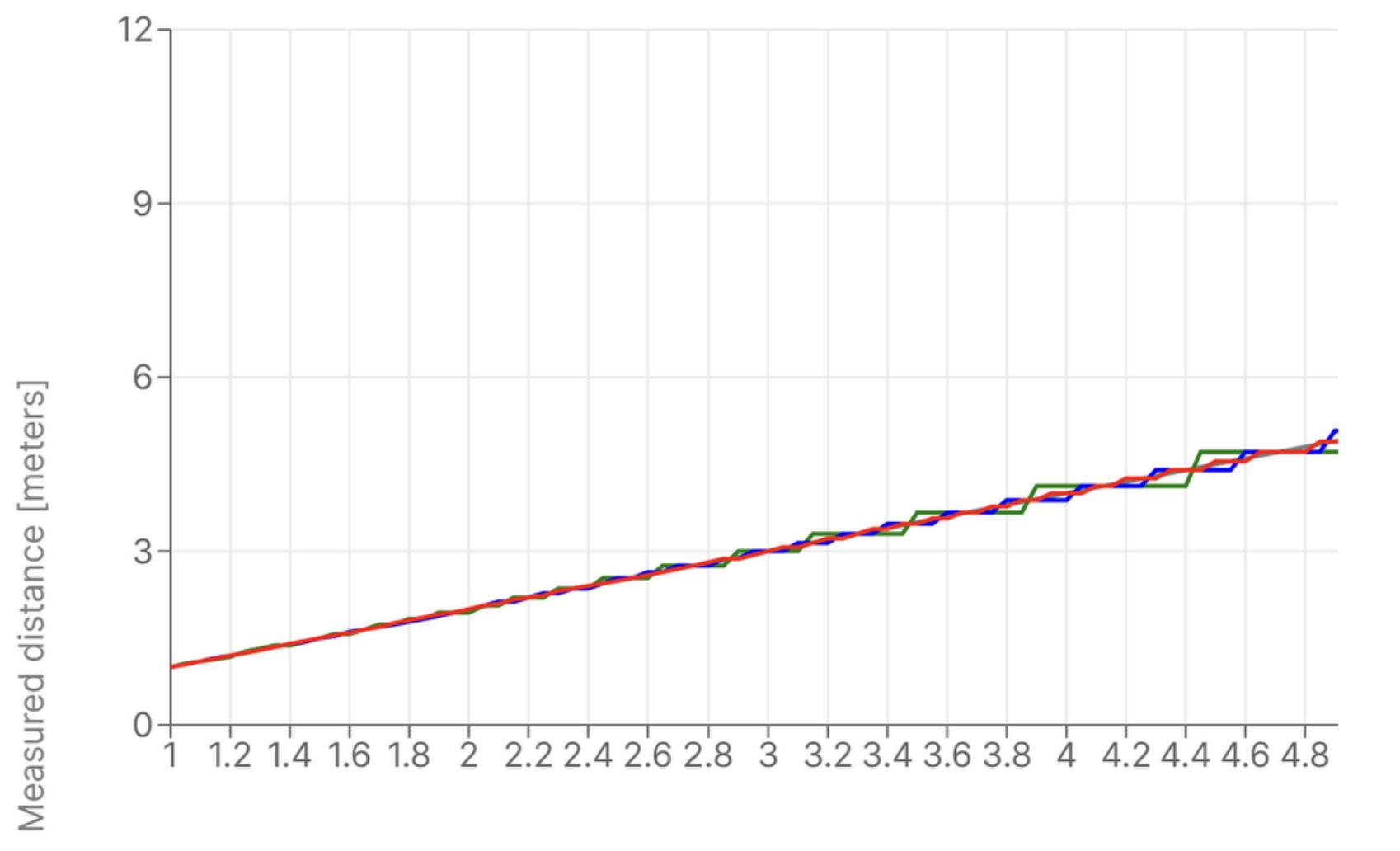


Vision Protocol

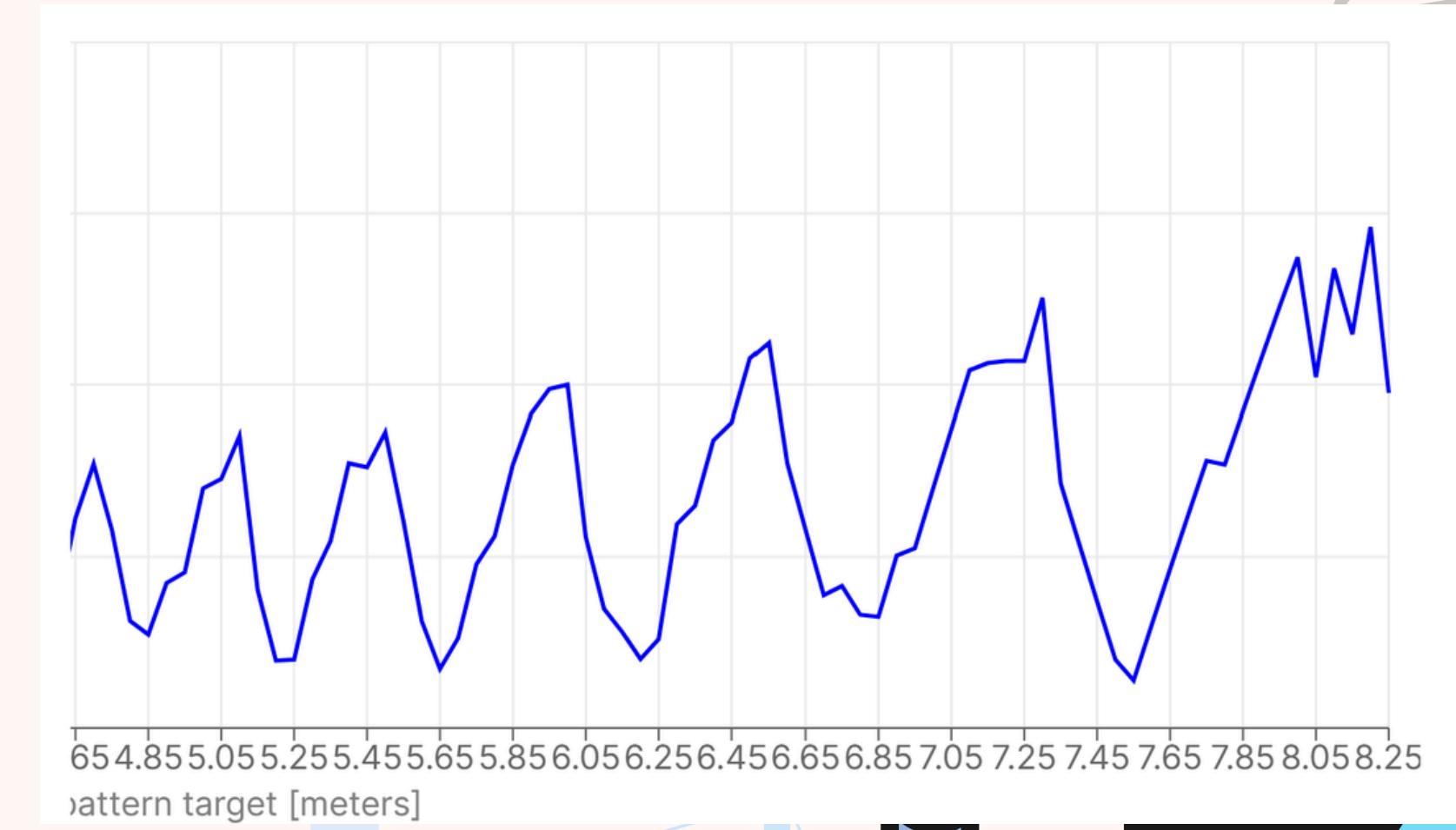
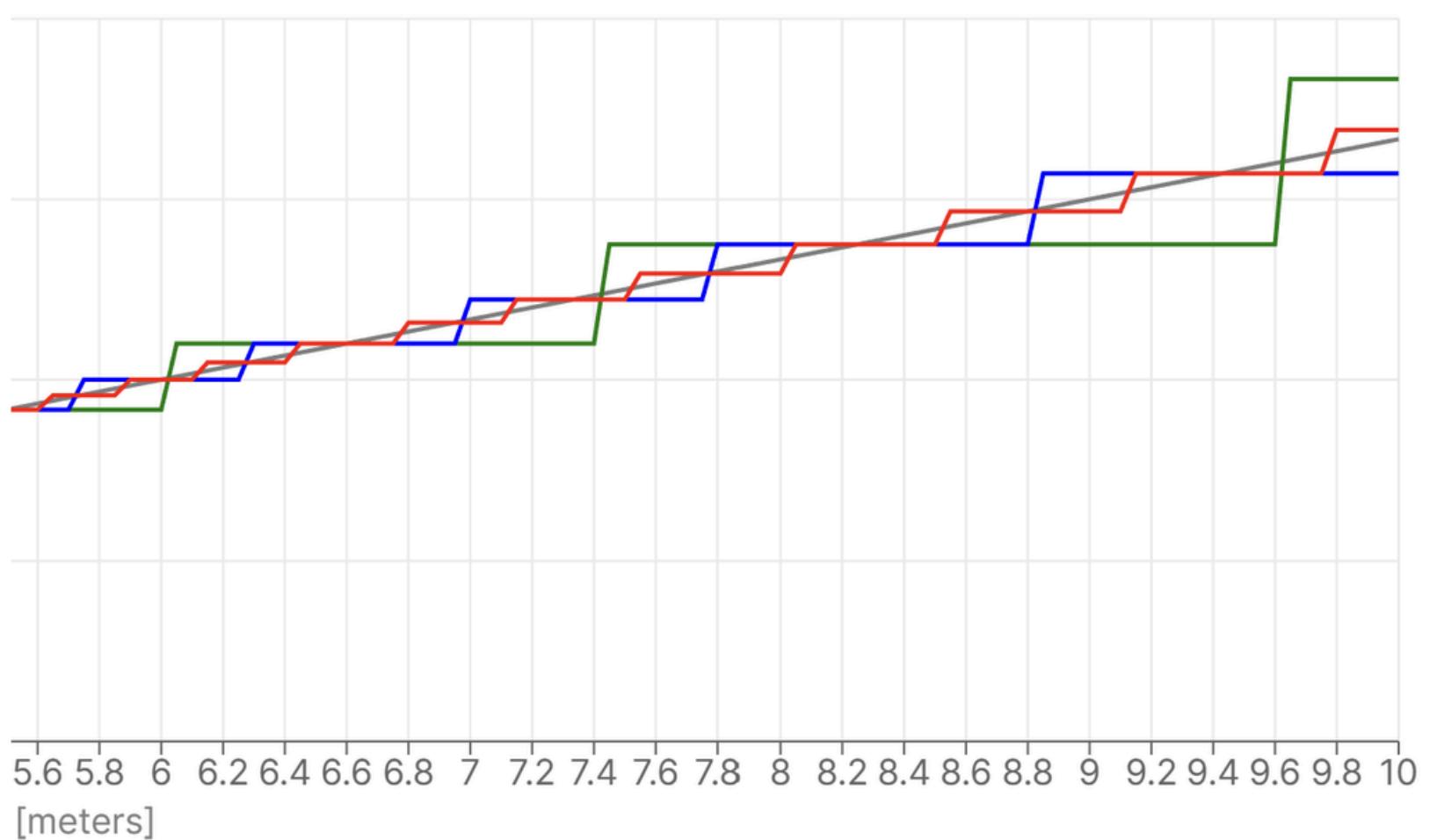
Oak D Lite



Vision Protocol



Vision Protocol



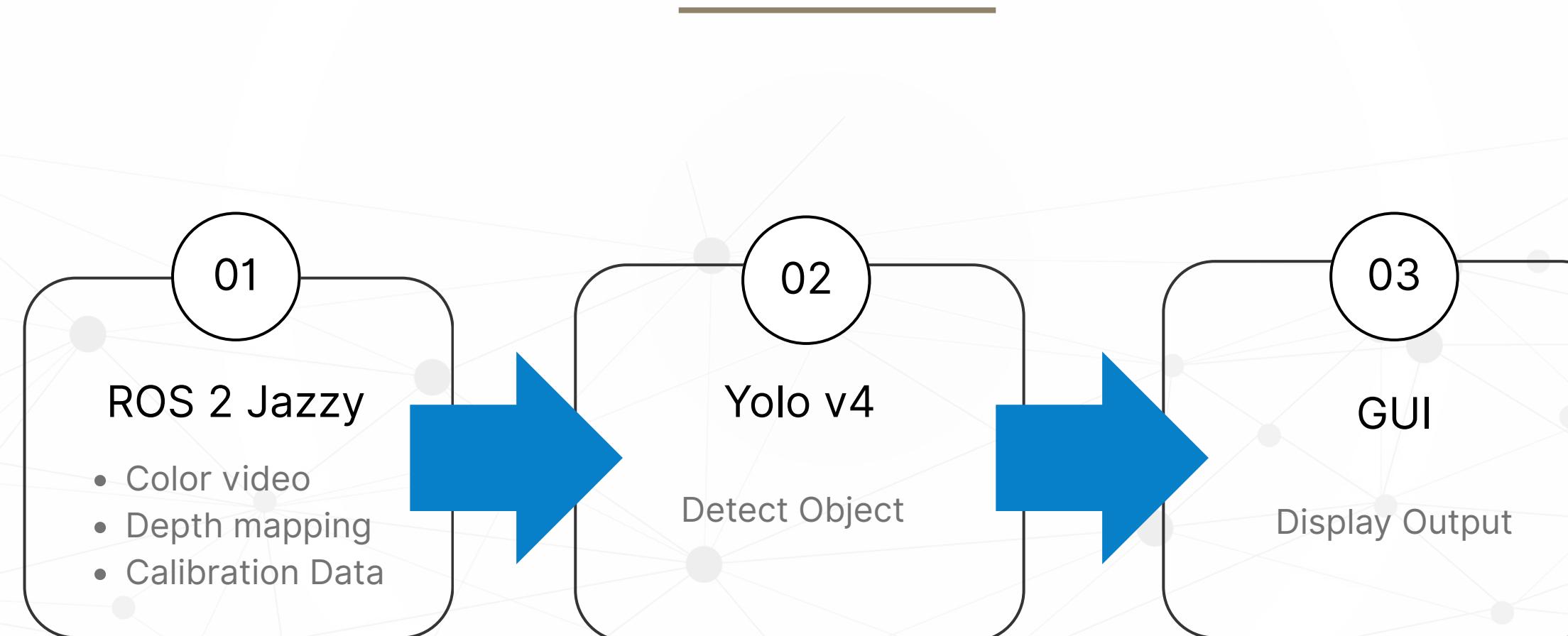
Vision Protocol

Item Recognition
+ Depth



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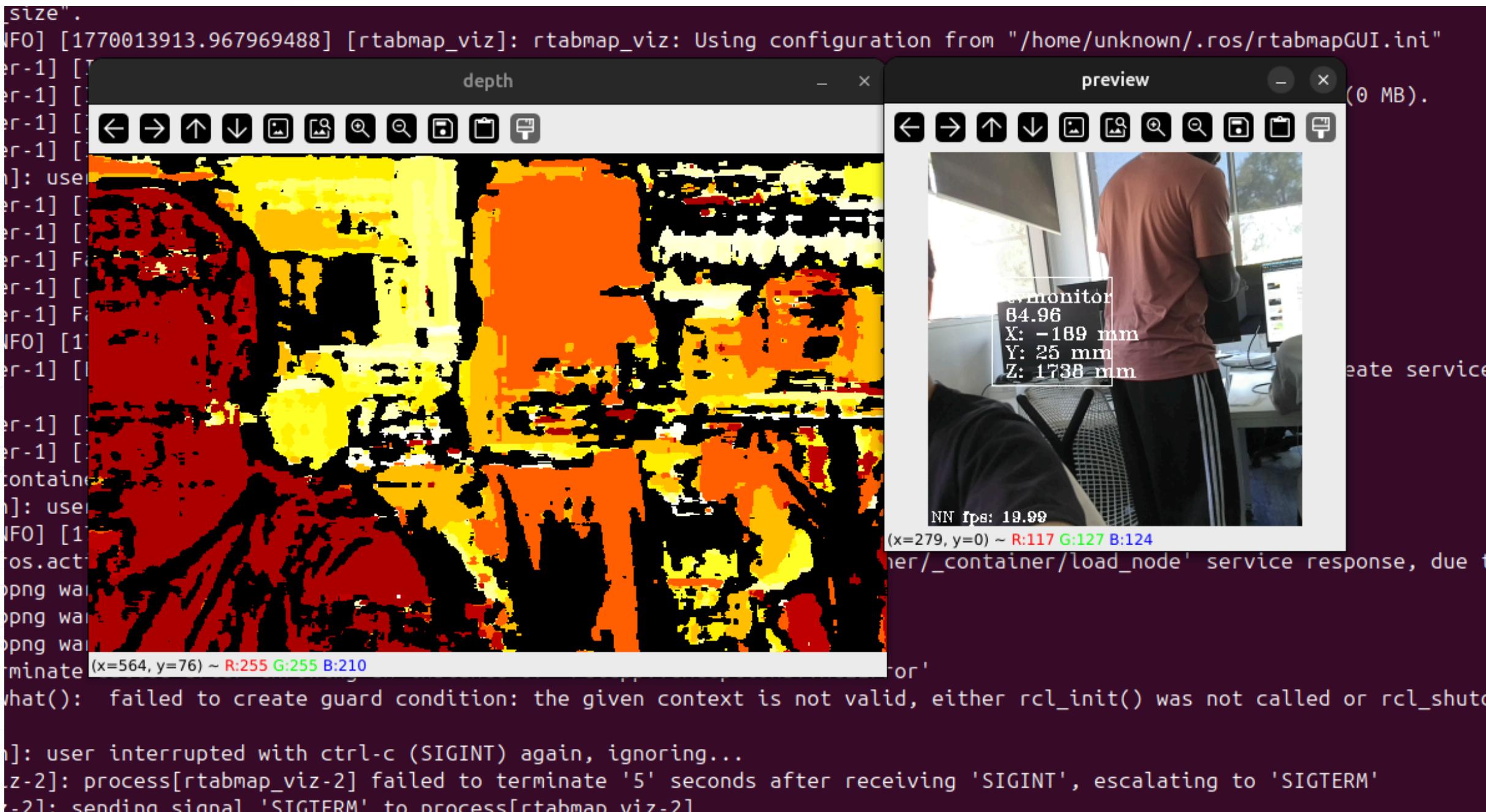
Item Recognition + Depth





A horizontal row of five black dots, arranged in a single line.

Item Recognition + Depth



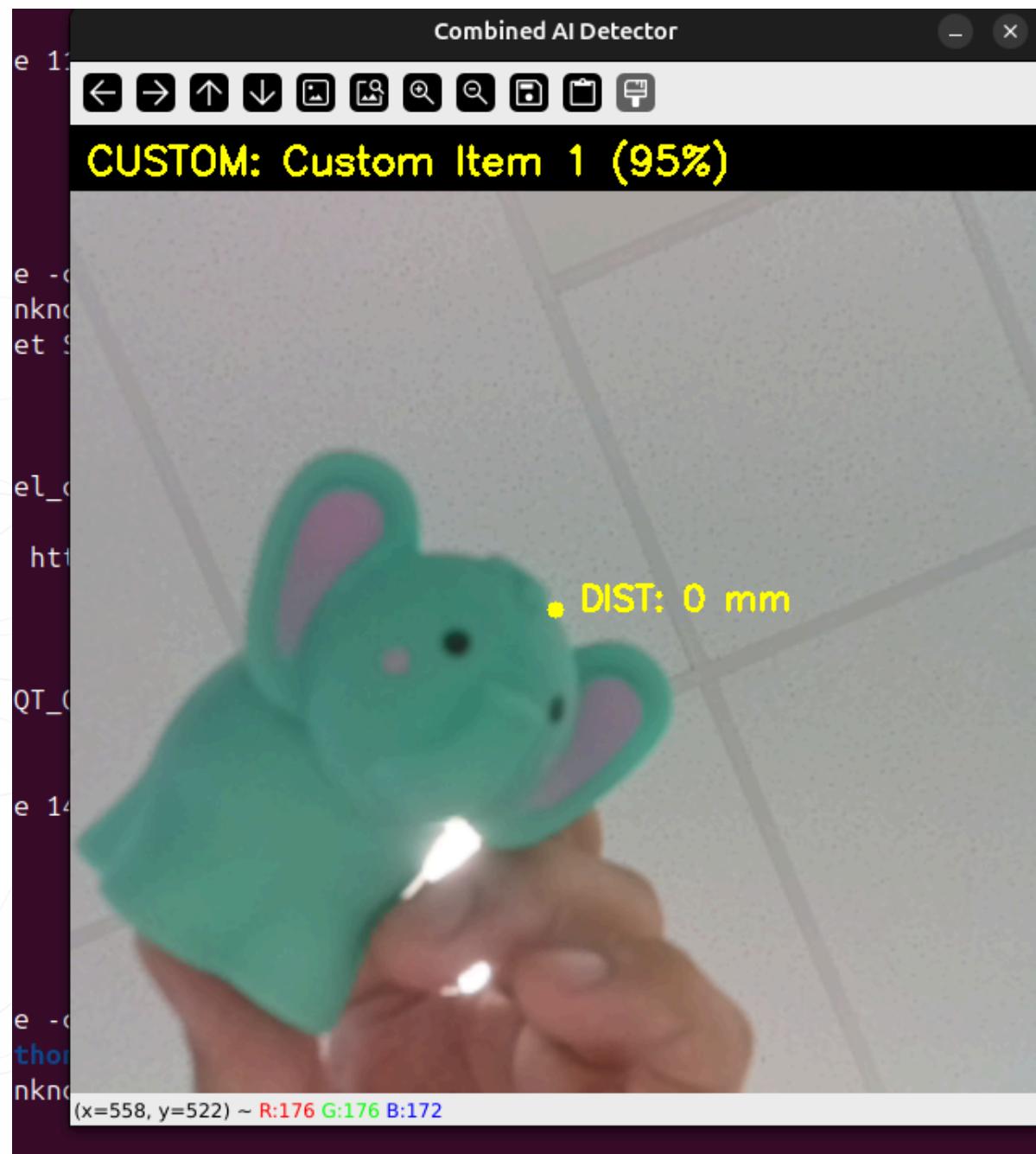


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Item Recognition + Depth





A horizontal row of five black dots, evenly spaced from left to right.

Item Recognition + Depth

The image shows two side-by-side ROS 2 visualization windows. The left window is titled 'depth' and displays a heatmap of depth information, with colors ranging from red (far) to yellow (near). A status bar at the bottom indicates coordinates (x=584, y=35) and RGB values (R:255 G:242 B:0). The right window is titled 'preview' and shows a live camera feed of a room. Overlaid on the feed are two green boxes with text: 'NEAREST: tvmonitor 1524 mm' and '+ CENTER: 2066 mm'. A status bar at the bottom of this window shows 'NN Ips: 20.00'. Both windows have standard Linux window controls (minimize, maximize, close) and a toolbar with various icons.

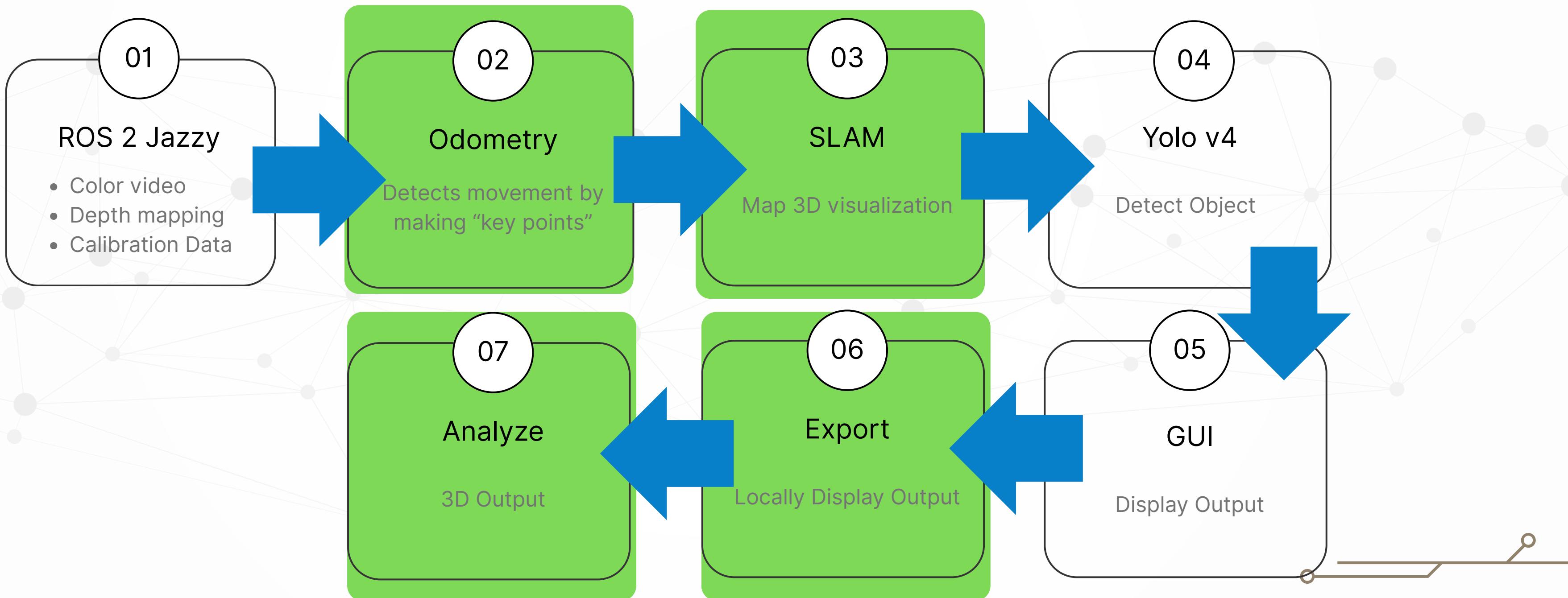
Vision Protocol

3D Tracing



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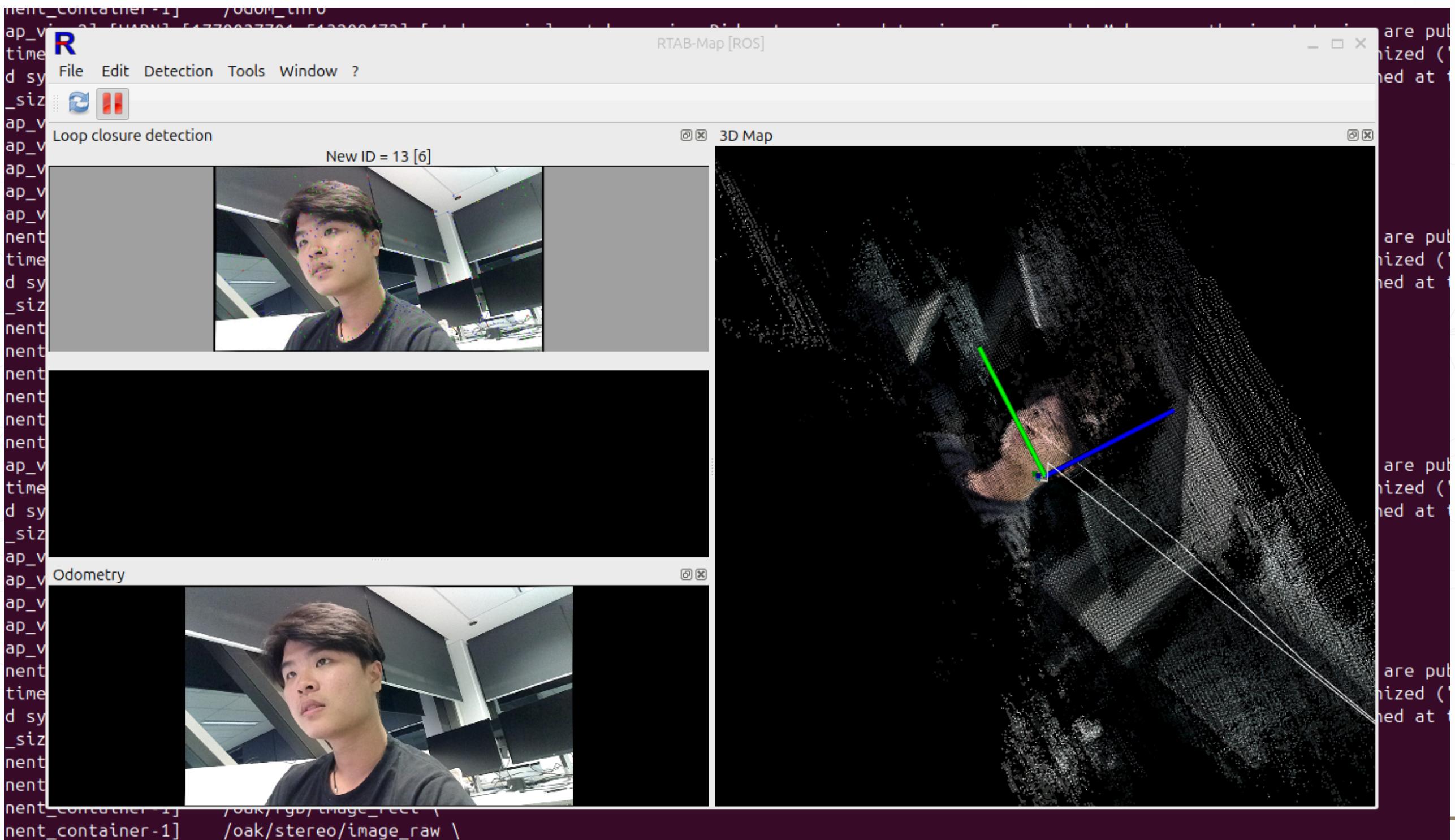
3D Tracing





A horizontal row of five black dots, arranged in a single line.

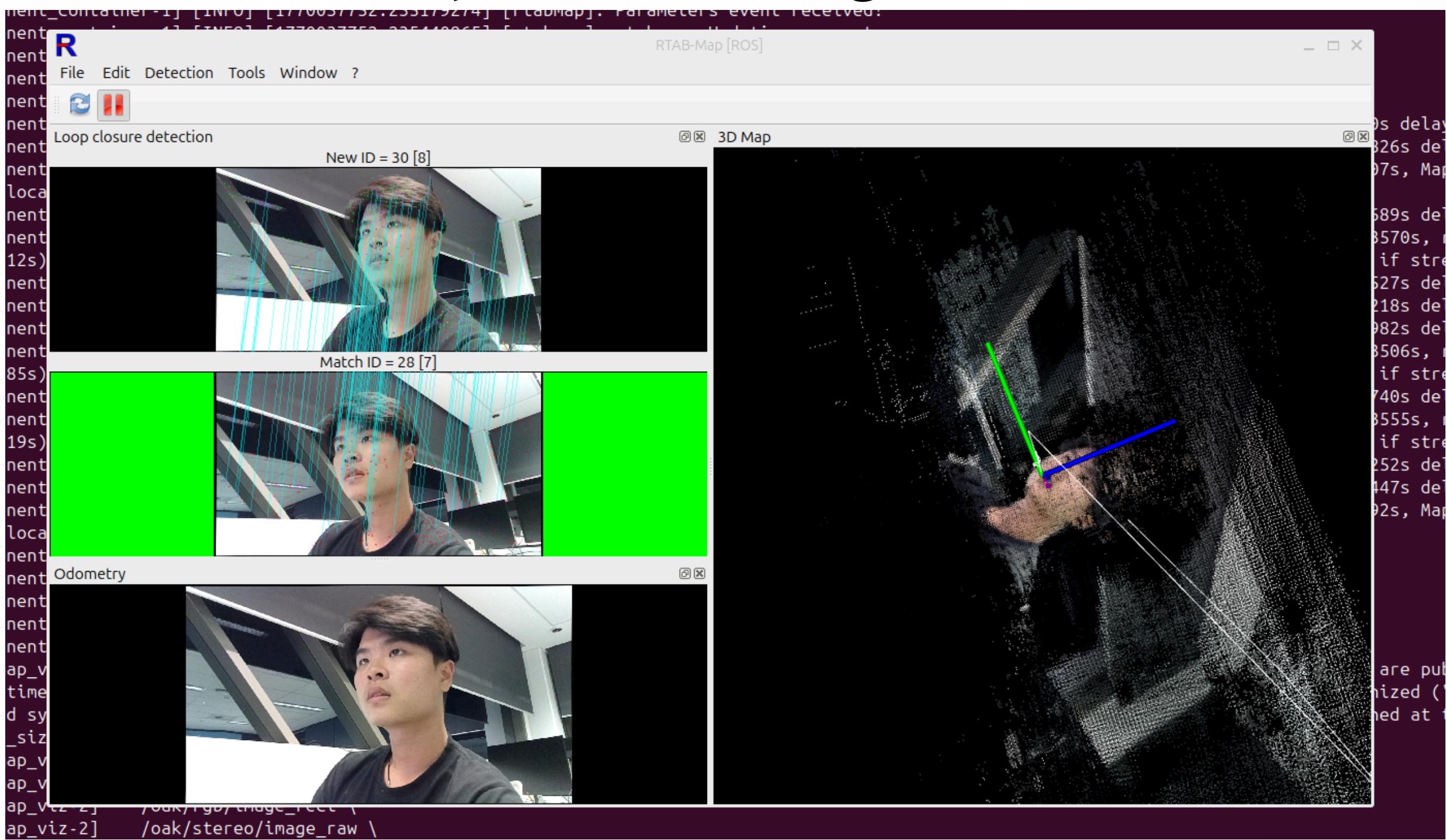
3D Tracing

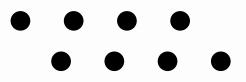




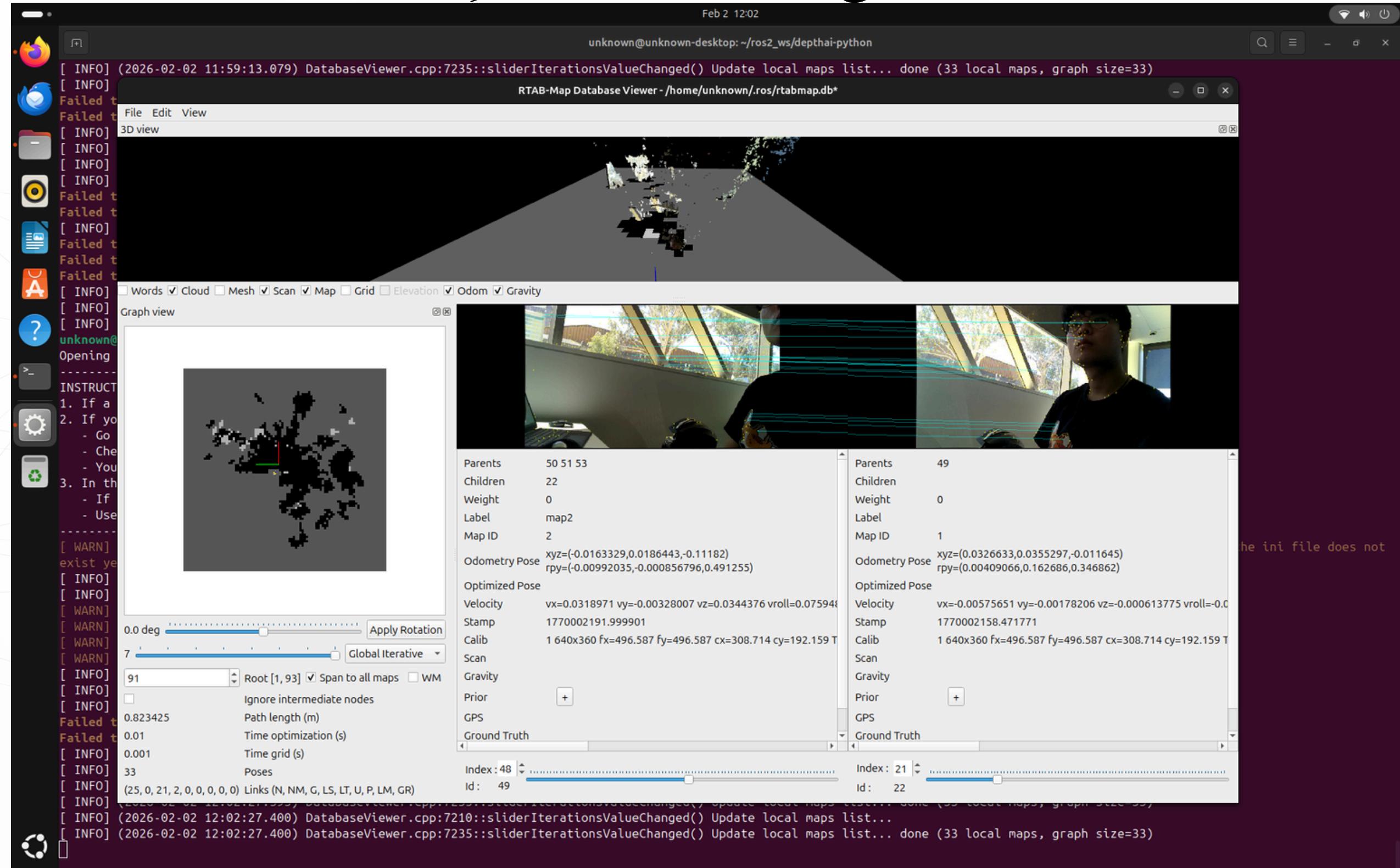
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3D Tracing





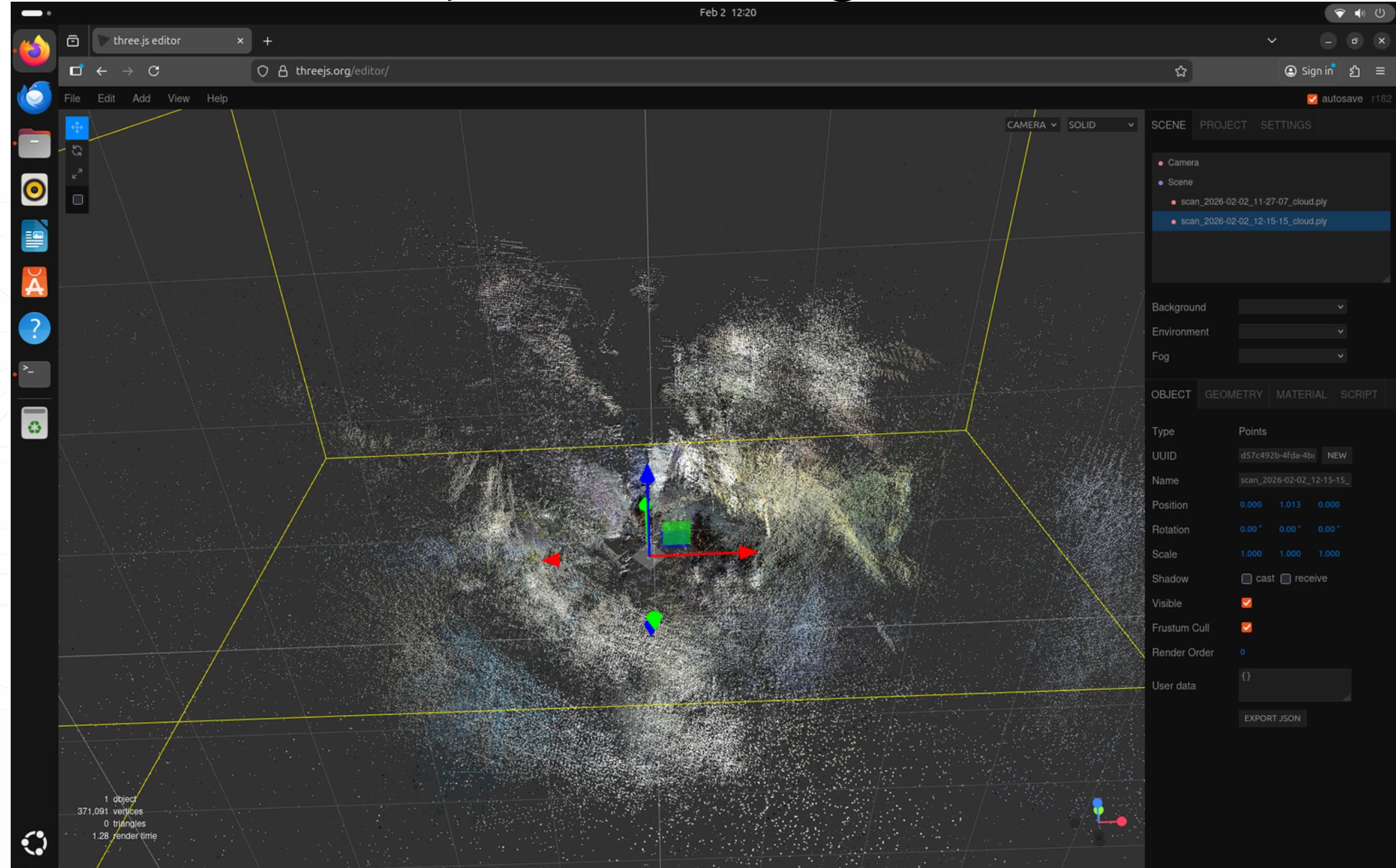
3D Tracing





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3D Tracing





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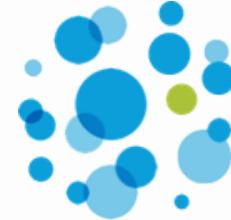
3D Tracing



D435, D455, ZED 2, OAK D Pro

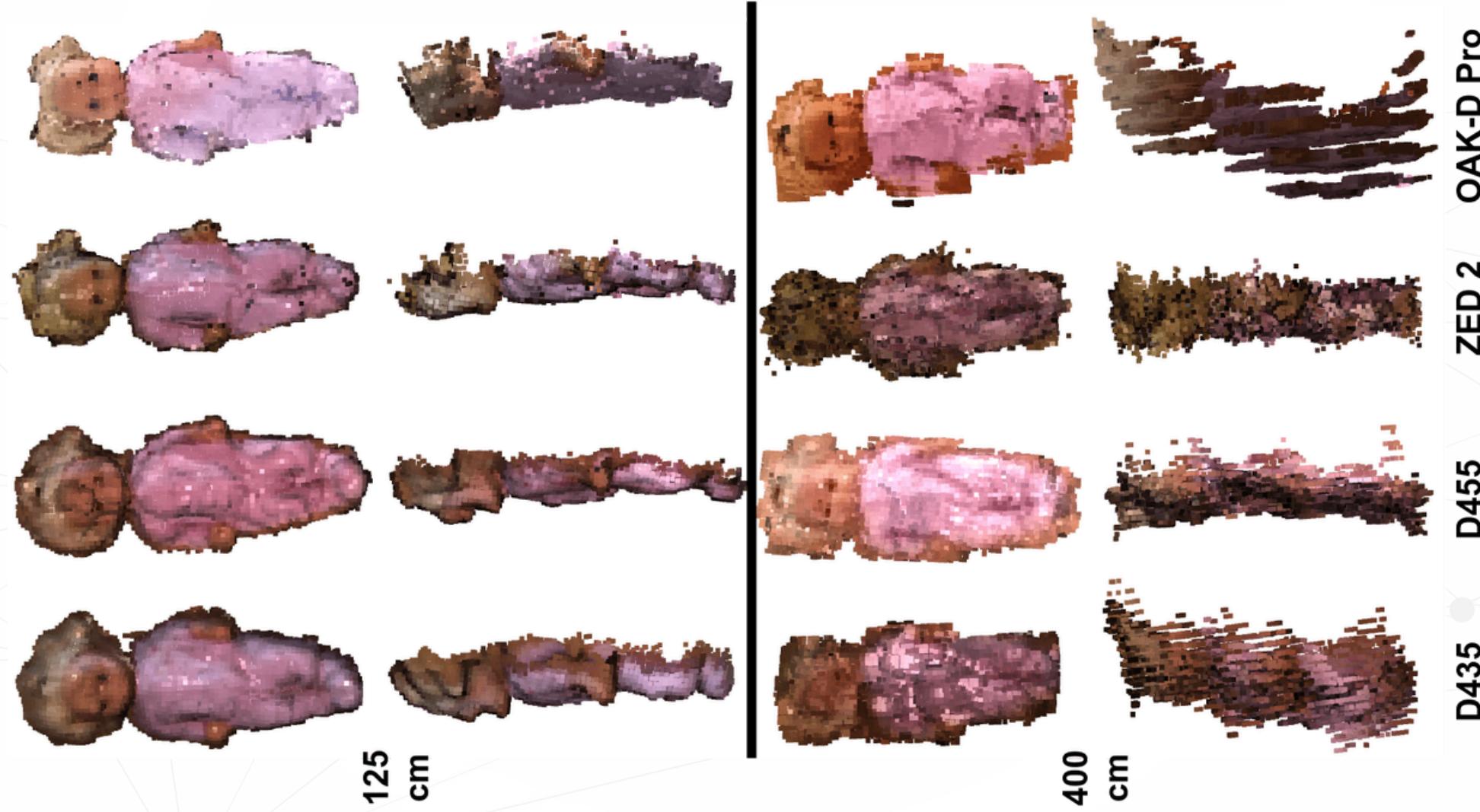
(Rustler et al., 2025)



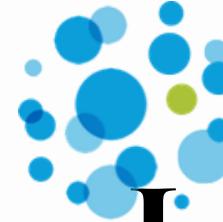


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3D Tracing



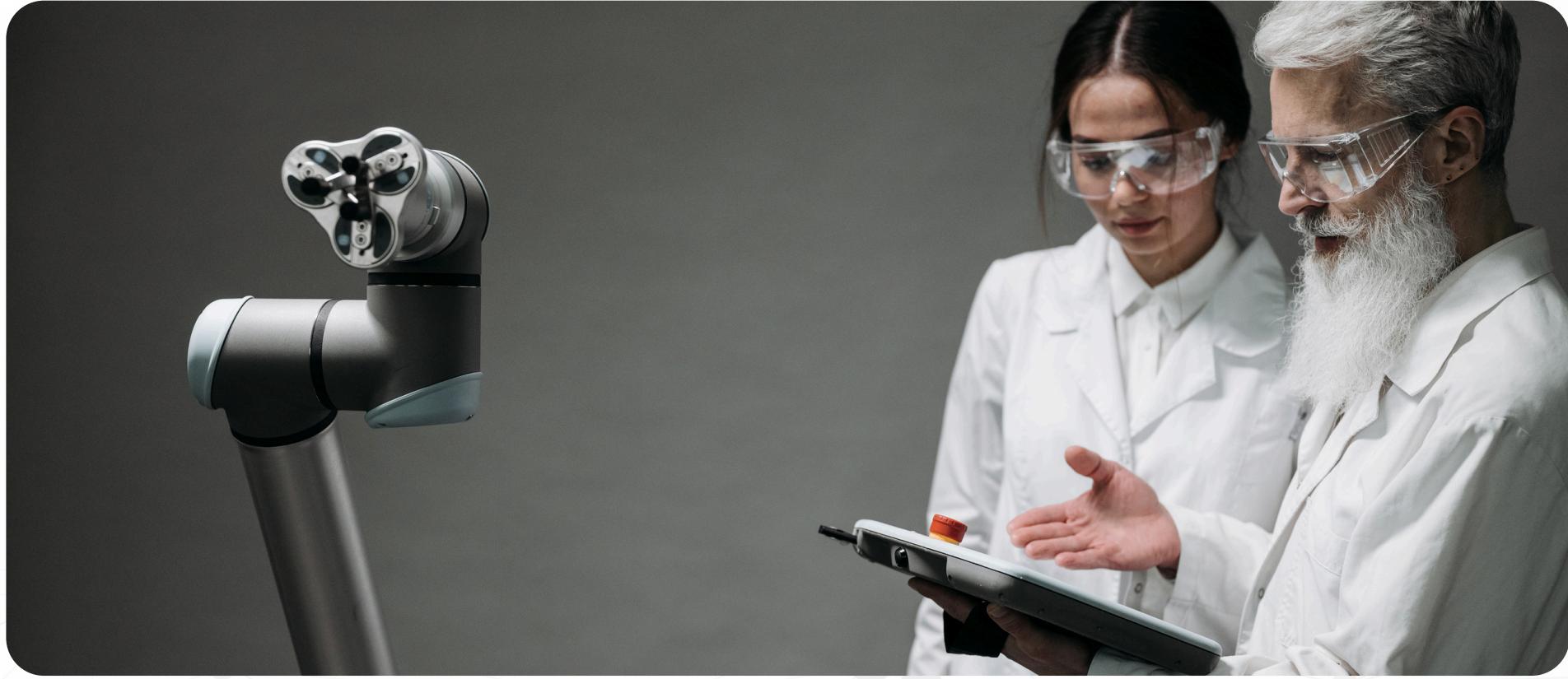
(Rustler et al., 2025)



Integration Summary

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→ Object Recognition

80+ object classes can be detected

→ Object Training

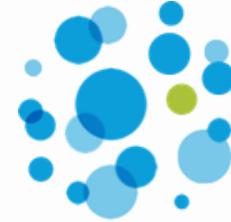
Additional object can be trained to be recognized

→ Fine-Tune Depth Recognition

Camera can recognize distance to object, error rate <2% for 1 - 300 cm

→ 3D Room Mapping

Mapped area can be accessed for analyzing and recalibration



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3D Tracing + Robot Integration

01

Command Input

- Voice Interpretation
- item & to do task
- Send to Vision

02

Vision Protocol

- Open Camera
- Detect Object
- Send to Arm Robot

03

Arm Robot

- Execute task
- Adaptive movement according to depth



Vision Protocol

Item Recognition

User Points at item

Command

Robot Check if item in visual

Robot execute command

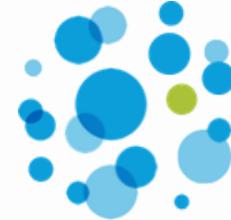
3D Tracing

Command

Robot recall
3D scan

Robot Navigate to item

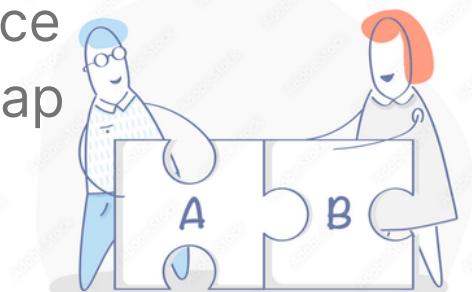
Robot execute Command



Project Summary

Challenges

- Compatibility issues between OS, Visualization, 3D Mapping, and Vision AI
- Outdated Arm Robot
- Weak 3D Mapping Device
- No gyroscope for 3D Map



Adobe Stock | 167045501

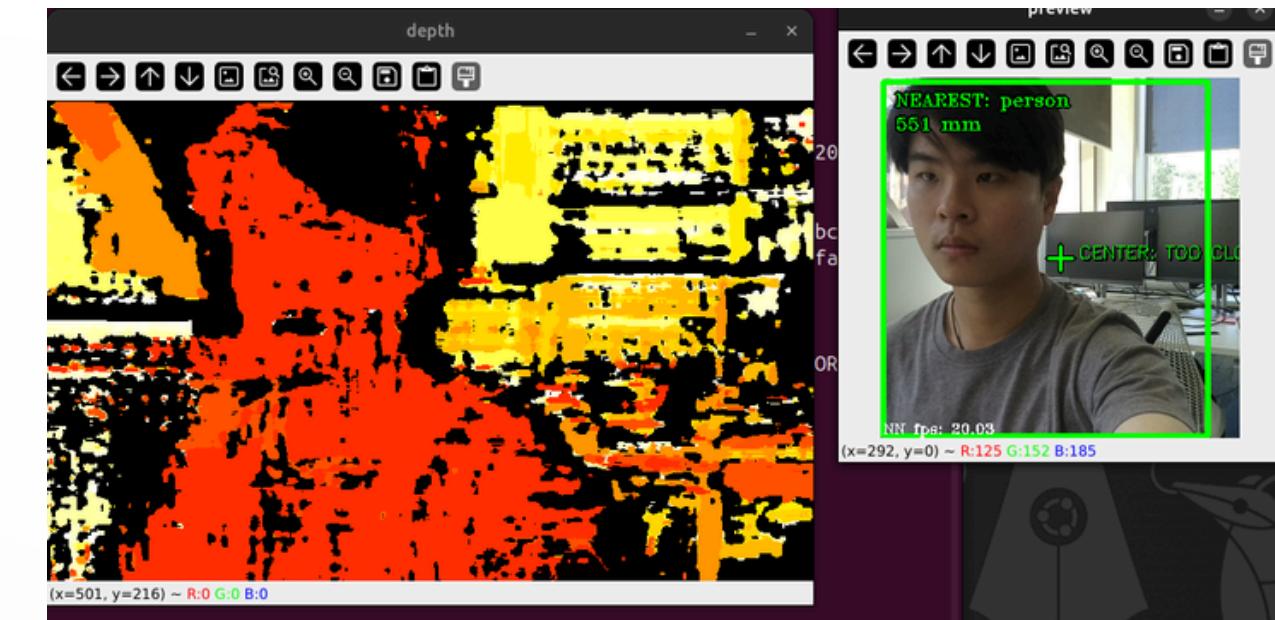
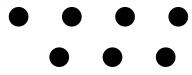
Approach

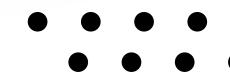
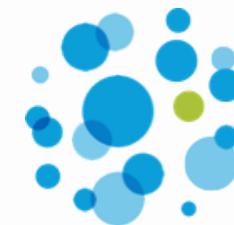
- Dissect program, see each version compatibility
- Focus on vision integration
- Develop odometer algorithm for 3D Mapping Gyroscope



Outcome

- Synchronize between OS, Visualization, 3D Mapping, and Vision AI
- Developed 3 different ways of showing the 3D Scans
- 3D scan is still not reliable with.... device

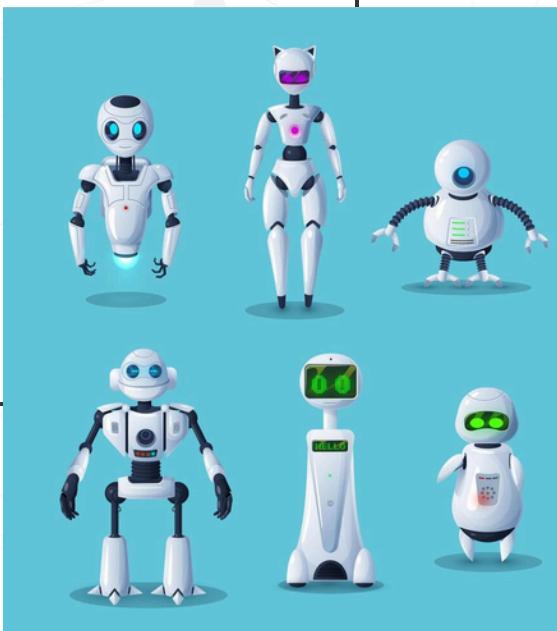




Future Improvements

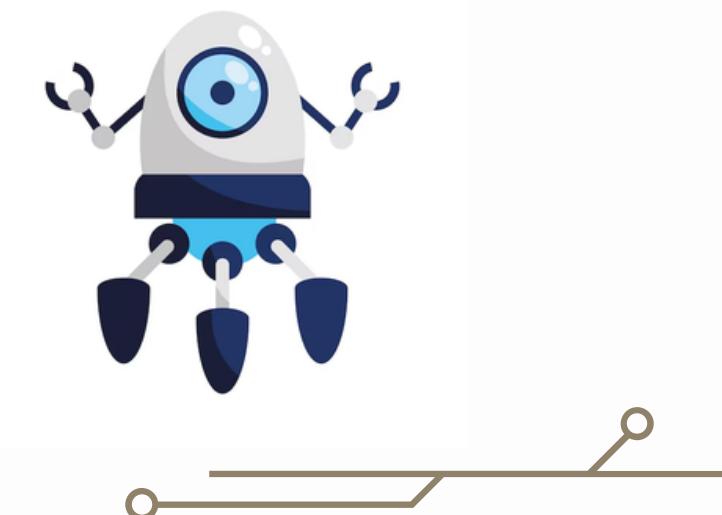
Hardware

- More recent Arm robot
- 3D Lidar Camera
- Gyroscope



Integration

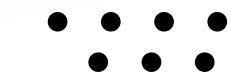
Vision + Arm robot + Depth





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Camera Recommendations



DJI Focus Pro LiDAR



Intel RealSense LiDAR Camera L515

References

Rustler, V., Volprecht, J., & Hoffmann, M. (2025). Empirical comparison of stereoscopic depth sensing cameras. arXiv.

<https://arxiv.org/abs/2501.07421>

Luxonis. (n.d.). Depth accuracy. Retrieved February 2, 2026, from
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accuracy/](https://docs.luxonis.com/hardware/platform/depth/depth-accuracy/)



**Thank
You**

QnA & Demo Time