Digital Twin for Autonomous Earthwork in Virtual-Reality

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1. Context
2. System
3. Conclusion

1. Context

The Project

HERACLES Robotics

Autonomous Earthwork

https://www.youtube.com/watch?v=EAnrkcWU4TA

1. Context

The Need

Remote fleet supervision :

(1) **Understand** the scene

(2) **Instruct** machines

(3) **Unstuck** machines

(4) Operates in **real time**

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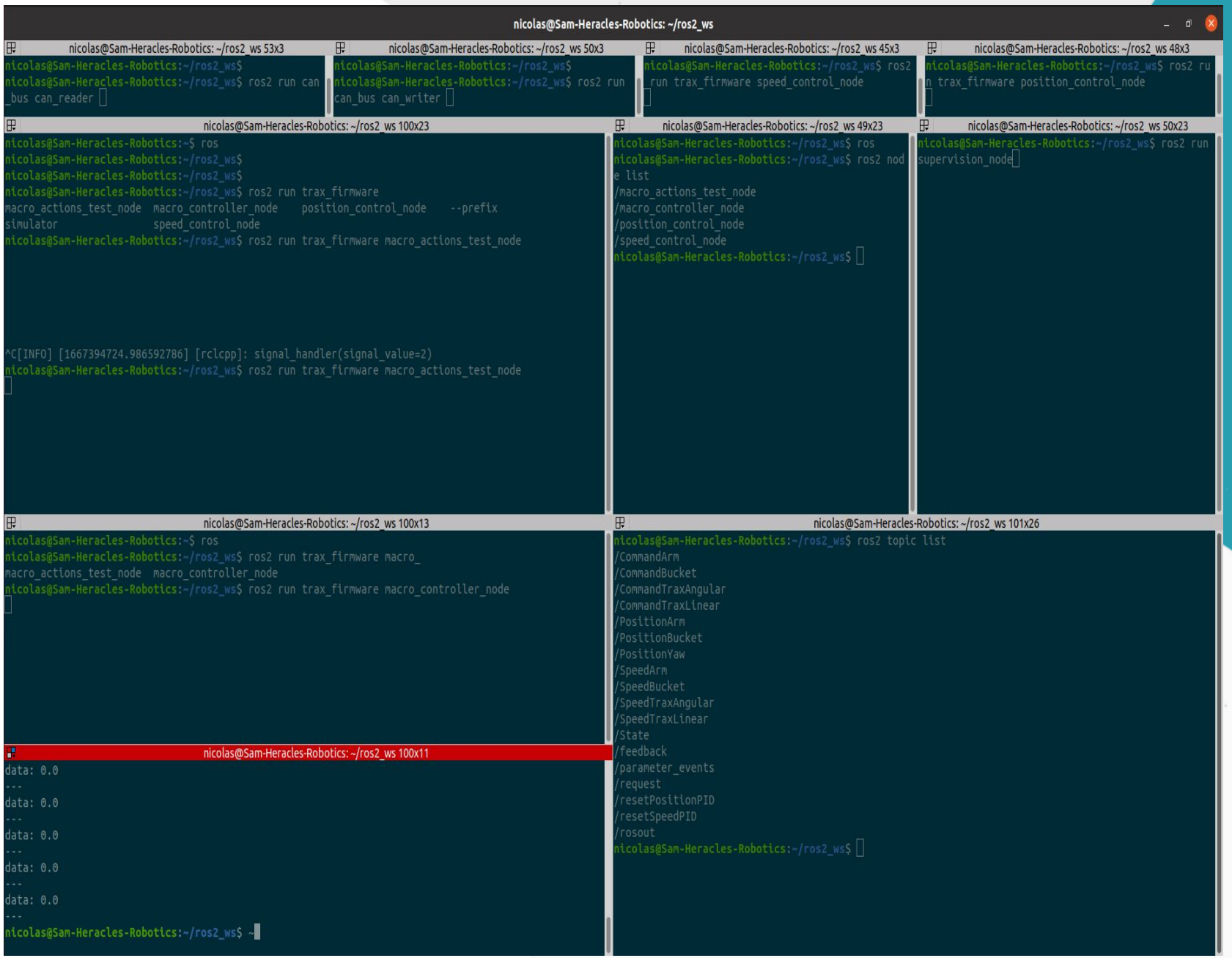

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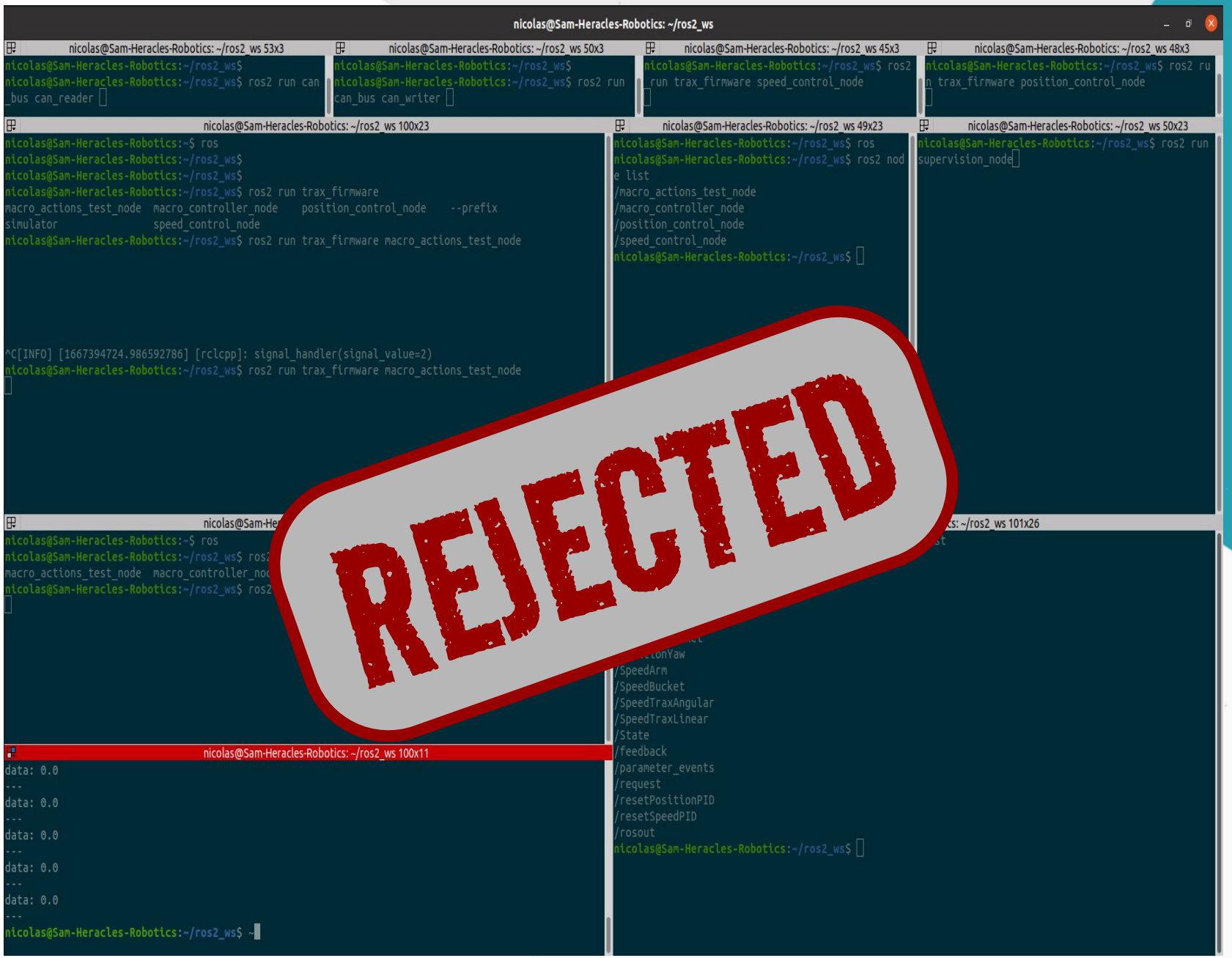

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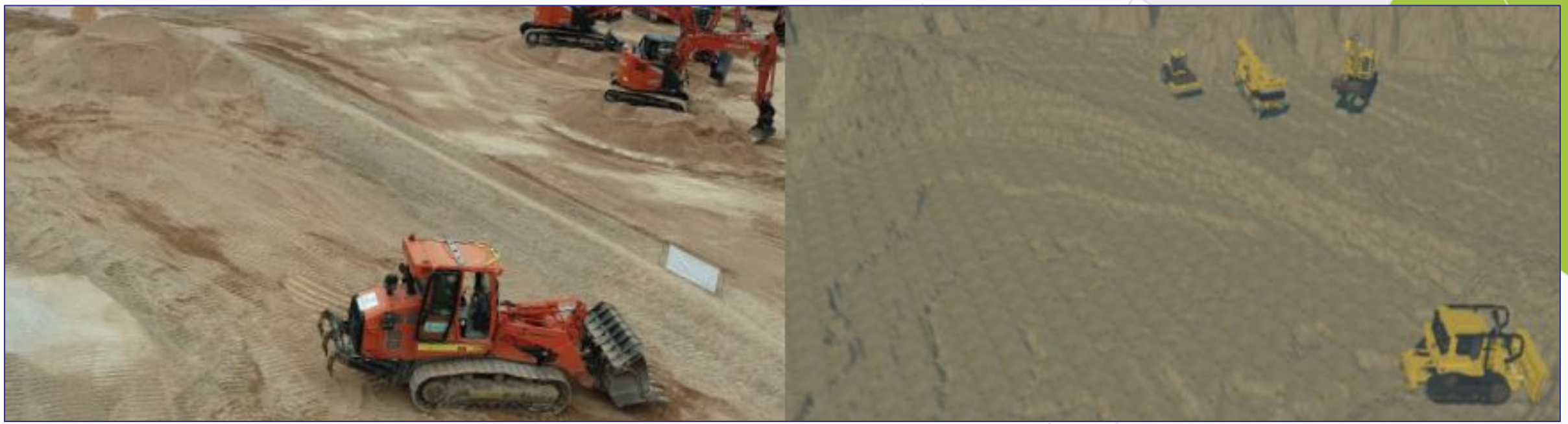
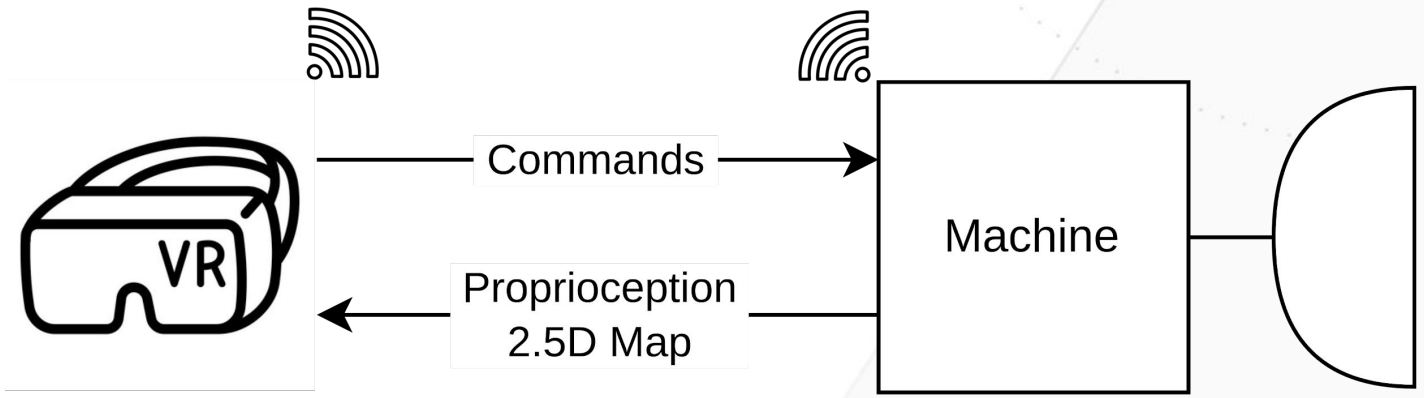
System

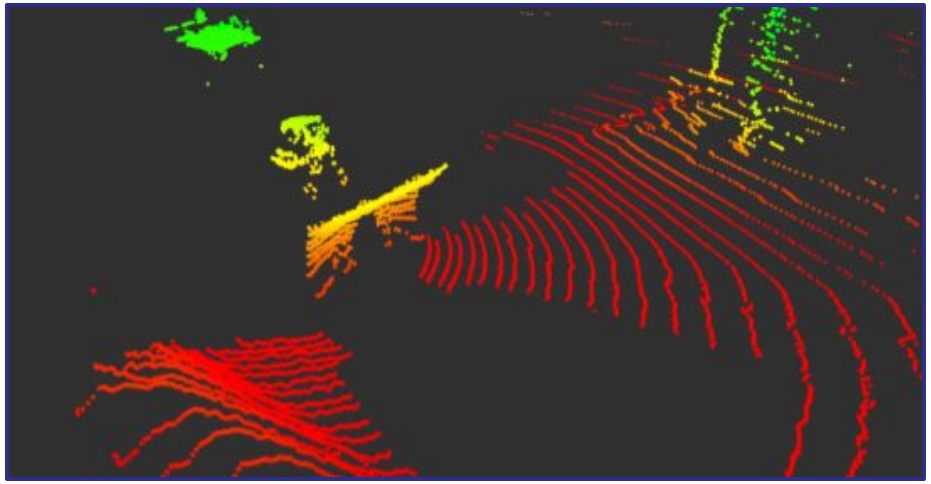
VR Digital Twin

Work In Progress





System
Mapping



LiDAR's Point Cloud

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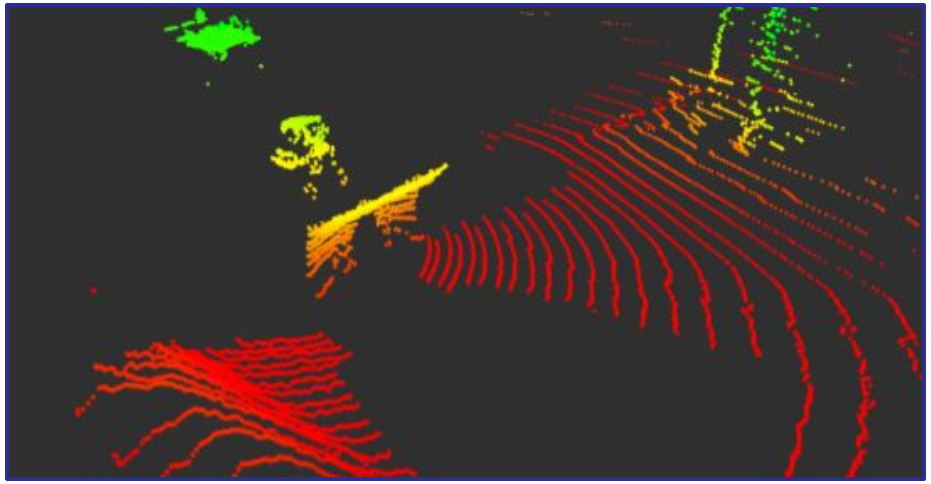
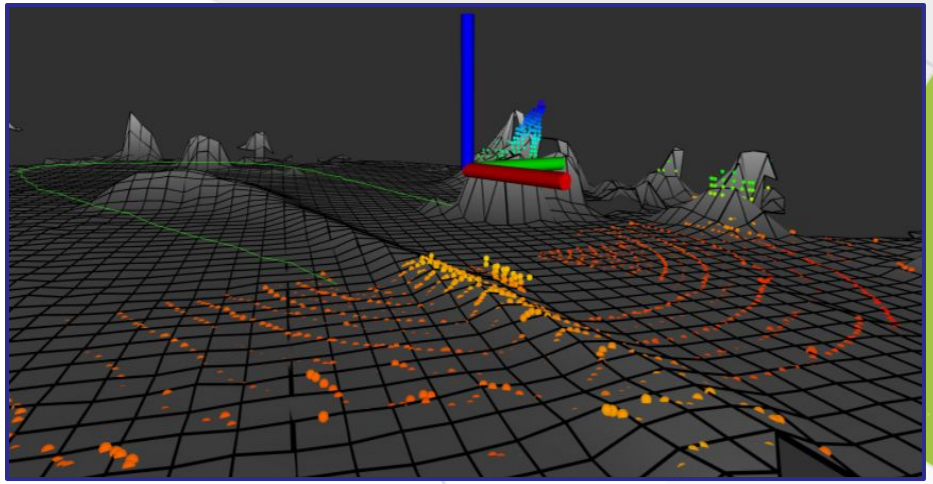


LiDAR's Point Cloud

2.5D Mapping



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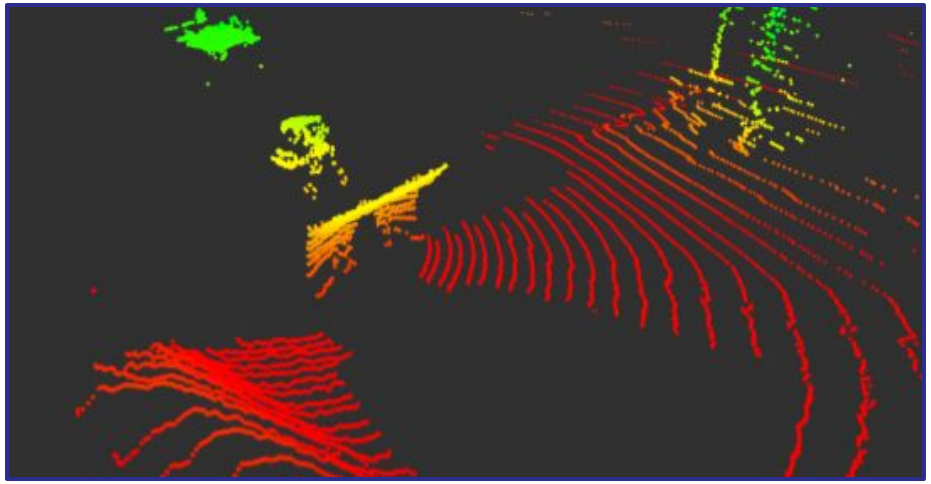

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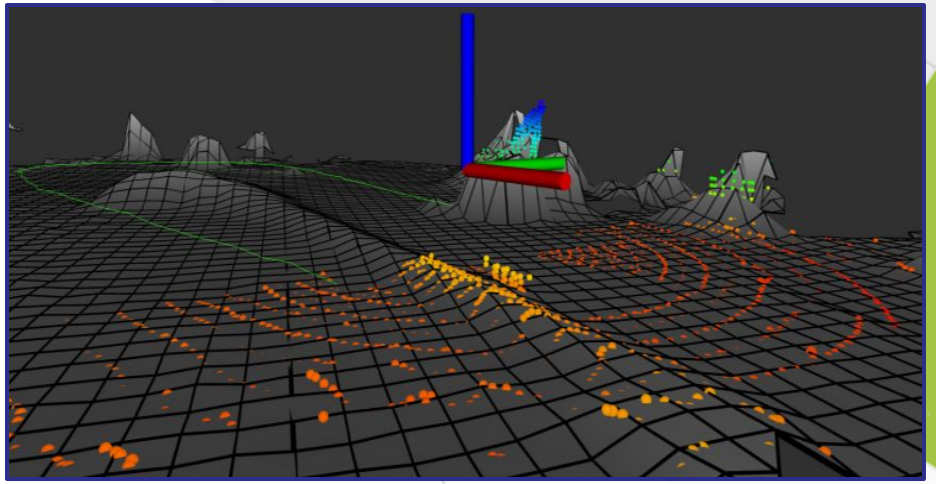
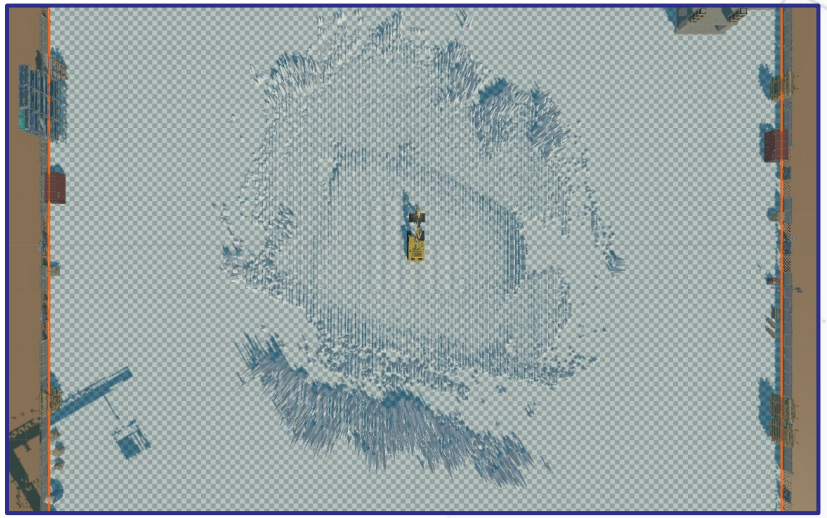




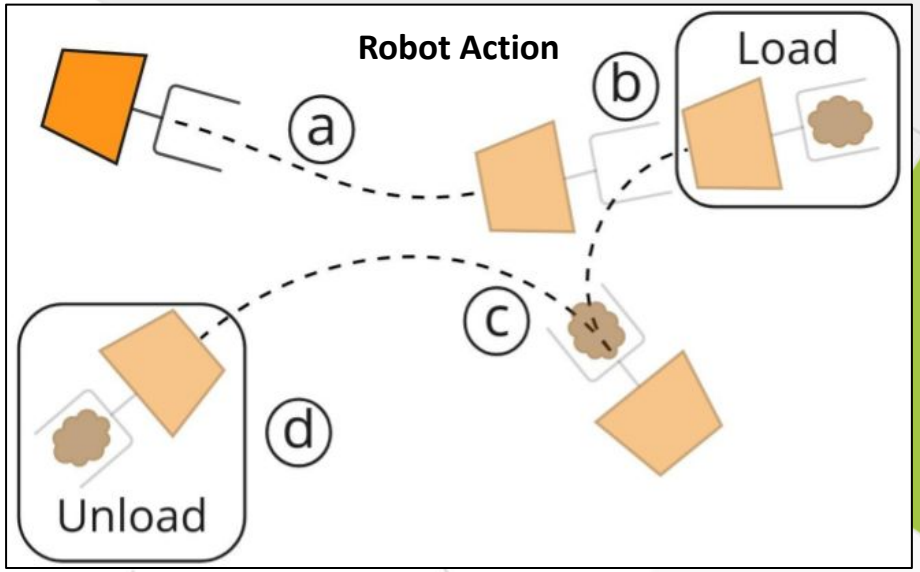
VR Heightmap

System
Control

VR Inputs

System
Control

VR Inputs



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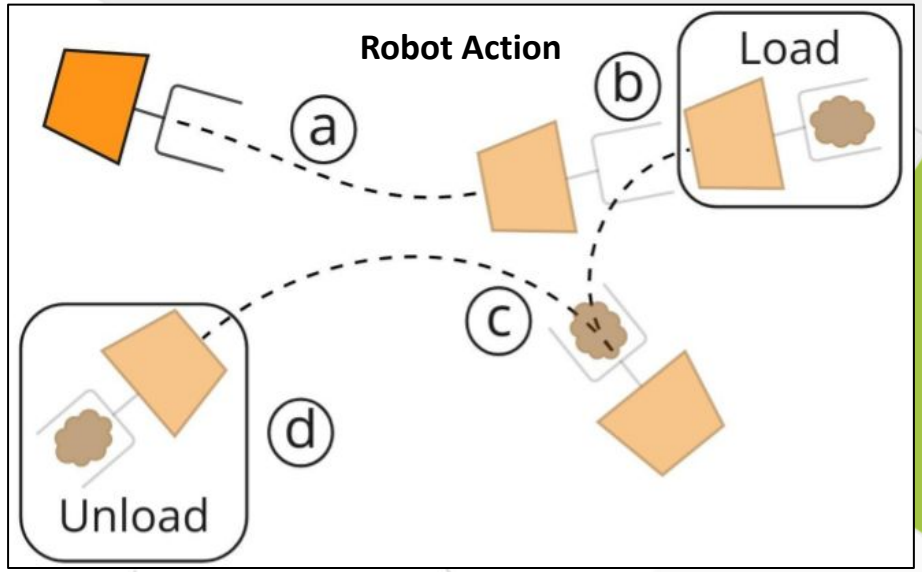
Control

VR Inputs



Robot Motion

System
Control

Low-Level Action

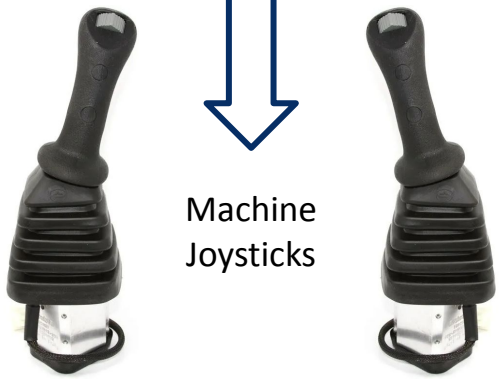
VR Controllers

Machine
Joysticks

System
Control

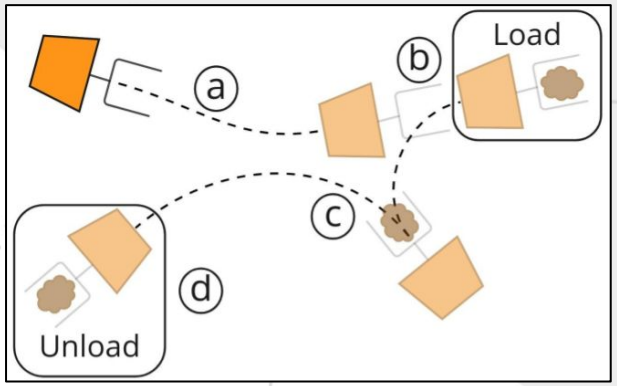
Low-Level Action

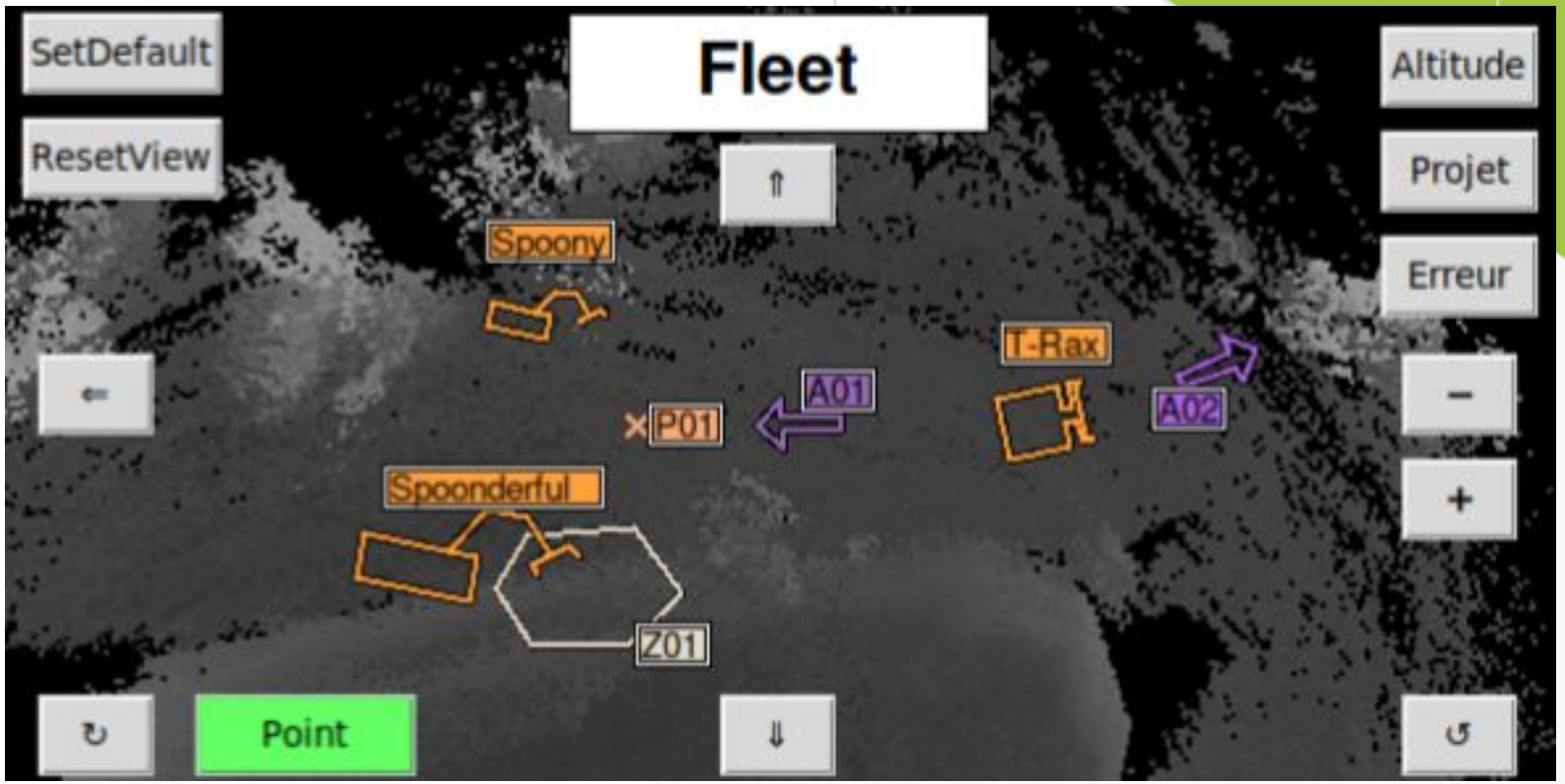
VR Controllers



Machine Joysticks

High-Level Action





System
Results

Current results :

- Digital Twin of one simulated machine
- Real-time technological lock lifted
- Dynamic 2.5D real-time Mapping

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Conclusion

Results & Perspectives

Perspectives :

- Link to actual machine instead of simulation
- Develop user interface :
  - Increase visibility w/ Eye-Tracking
  - Monitor stress & motion sickness w/ EEG
- Implement macro-actions :
  - From geometric primitives
  - Intermediary controls
- Cross-machines interface (Trax, Excavator..)
- Supervise entire site
- Operator training program

Special thank to :
- Léa Saunier
- Samuel Prouten
- Oumayma Serroukh