Digital Twin for Autonomous Earthwork in Virtual-Reality

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1. Context

2. System

3. Conclusion
1. Context
The Project

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
1. Context

The Need

Remote fleet supervision:
1. **Understand** the scene
2. **Instruct** machines
3. **Unstuck** machines
4. Operates in **real time**
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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REJECTED
1. Context
2. System
3. Conclusion
System
VR Digital Twin

Work In Progress
System Mapping

LiDAR’s Point Cloud
System
Mapping

LiDAR’s Point Cloud

2.5D Mapping
System Mapping

LiDAR’s Point Cloud

2.5D Mapping

VR Heightmap
System Control

VR Inputs
System Control

VR Inputs

Robot Action

Load

Unload

1. a
2. b
3. c
4. d

IP PARIS
System Control

VR Inputs

Robot Action

Load

Robot Motion

Unload
System Control

Low-Level Action

VR Controllers

Machine Joysticks
System Control

Low-Level Action
VR Controllers
Machine Joysticks

High-Level Action

SetDefault
ResetView

Fleet

Altitude
Projet
Erreur

Current results:
- Digital Twin of one simulated machine
- Real-time technological lock lifted
- Dynamic 2.5D real-time Mapping
1. Context
2. System
3. Conclusion
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

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