Welcome

MoveIt Pro Works Here Webinar Series

Madison Clark-Turner, PhD
Robotics Scientist
Charles River Analytics

Nikolaas Bender
Robotics Software Engineer
Charles River Analytics

Michael Giancola, PhD
AI Scientist
Charles River Analytics

Nathan Brooks, PhD
CTO
PickNik Robotics

Dave Grant
CEO
PickNik Robotics

Housekeeping for Today

More about PickNik Robotics

We want to hear from you! Please drop your questions in the Q&A tab!

More about Charles River Analytics

MoveIt Pro by PICKNIK

PICKNIK

Mission: Empower organizations to deploy robots of all shapes and sizes with human-like intelligence to elevate productivity and enrich lives

MoveIt Pro by PICKNIK

Robotics Application Platform

MoveIt Pro

Concept & Development

- AI Training
- Rapid Development
- Digital Prototype

Pilot & Scale Up

- Deploy & Run Apps
- Adapt to Evolving Use Cases
- Add Enhancements

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Madison Clark-Turner, PhD
Robotics Scientist

- Leads a portfolio focused on human roles in human-in-the-loop operations
- Work spans capturing nonverbal cues, reconstructing casualties for triage, and enhancing situational awareness
- PI for NASA's Person Aware Liaison (PAL), building collaborative robotics that integrate human inputs and foster trust in AI

Nikolaas Bender
Robotics Software Engineer

- Specializes in reinforcement learning for robotic arm control
- Develops and integrates perception systems and deep learning for image analysis
- Plays a key role in advancing the capabilities of the Awarion® Autonomous Lookout System through applied R&D and extensive testing

Michael Giancola, PhD
AI Scientist

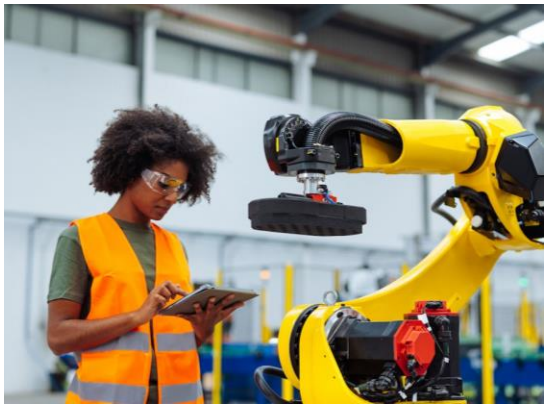
- Expert in natural language processing (NLP), large language models, and automated reasoning methods
- Applies deep learning for speech understanding and information extraction on the PAL system
- Developed a novel algorithm for theory-of-mind reasoning under uncertainty

MoveIt Pro
by PICKNIK

Intro

- **Charles River Analytics** develops advanced robotics and autonomy solutions that combine adaptive AI, leading-edge perception, and intuitive human-machine interaction.
- We specialize in building modular autonomy components that integrate seamlessly with current and emerging robotic platforms.
- Our teams draw on deep expertise in machine learning, computer vision, cognitive science, and human factors to create systems that operate effectively across ground, air, maritime, and space environments.
- From reinforcement learning for manipulation to multimodal sensing for situational awareness, our work enables robots to act safely, intelligently, and collaboratively in dynamic, real-world settings. Whether supporting complex missions or enabling resilient autonomy in the field, we're focused on delivering robust, explainable, and ready-to-deploy robotic solutions.

Contemporary Human-Robot Teaming



- Robots are being placed alongside humans in many settings
  - Especially in unstructured environments
- Robots and humans have roles they excel in and make good teams…
  - …in theory

What Is Out There Today

How are robots currently perceived?

Dumb

- Tools, not partners
- Laborious control
- Structured tasking

Frustrating

- Fail to meet expectations
- Require restatement of commands

Unsafe

- Unaware of humans
- Unable to respond to anomalies

Untrustworthy

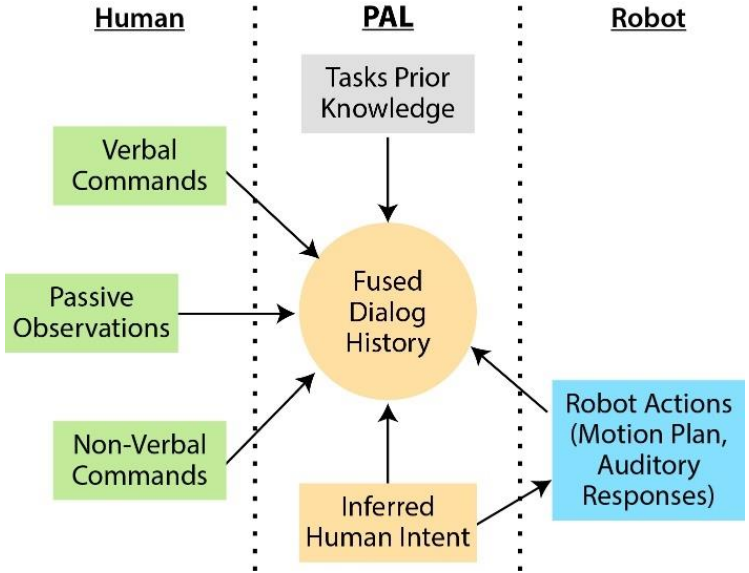
So How Do We Build Trust?

- In humans trust is built through a combination of factors:
  - **Expectation versus capability**
  - **Communication**
- Humans have an expectation of peers when collaborating
- If expectations are higher than capability, we communicate our limitations
  - Spoken words
  - Gesture
  - Engagement
- What we need is…
  - A human-to-robot translator

Our Solution: Person Aware Liaison (PAL)

- Multimodal user input facilitates holistic user understanding
- Enhanced contextual understanding allows the robot to respond intelligently to prompts
- Communicates bidirectionally to ask clarifying questions
- Capable

PAL Design Overview



The generalized PAL pipeline

The human said "can you pick that up and bring it here"

The human user is looking at "screw"

The human user is pointing at "toolbox"

PAL registers that the human wants the "screwdriver"

The robot attempts to grasp the screwdriver

PAL identifies an obstruction

The robot said "I have picked up the screwdriver but I am unable to bring it to you due to an obstruction"

The human user is looking at "toolbox"

The human user said "Ok, I will open that in a minute"

PAL determines that the human is busy and will wait

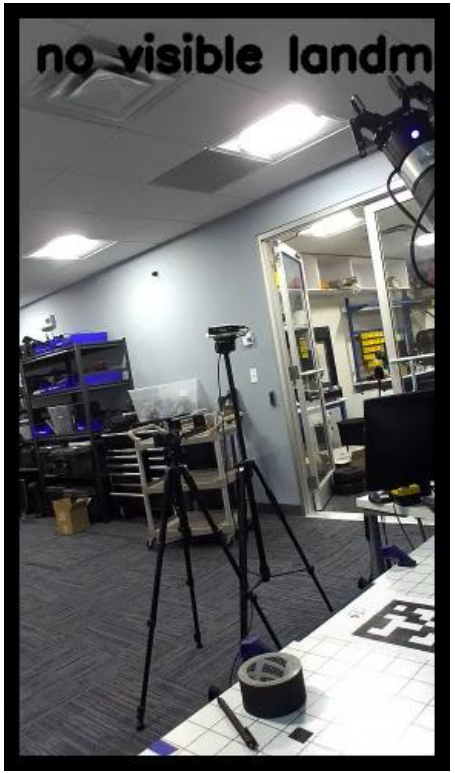
An example interaction transcript

Observations

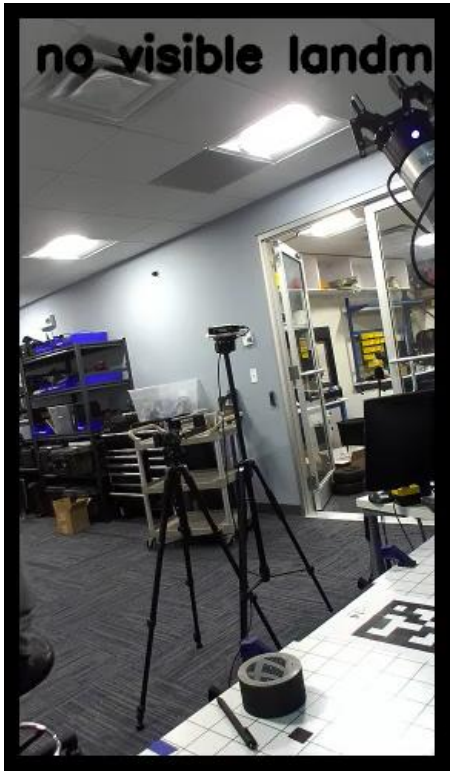
Speech

Point/Gaze

Observations

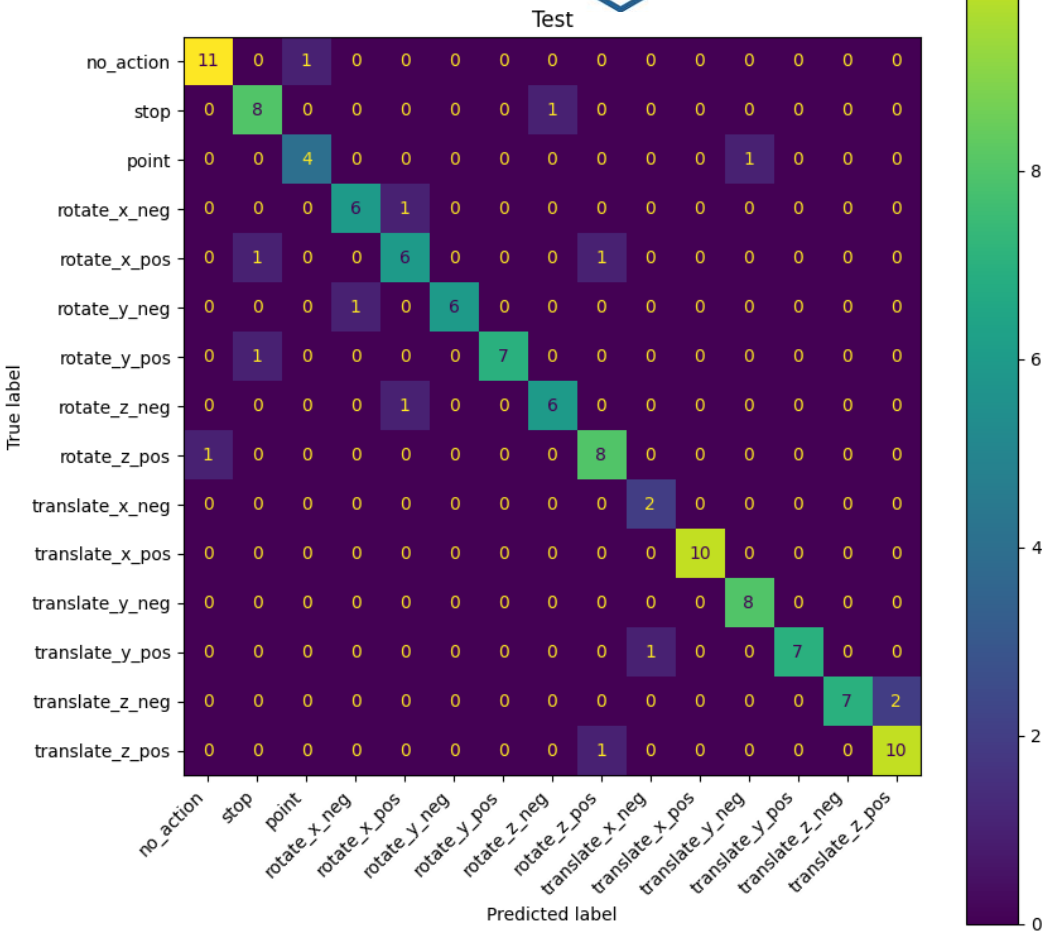


Gesture

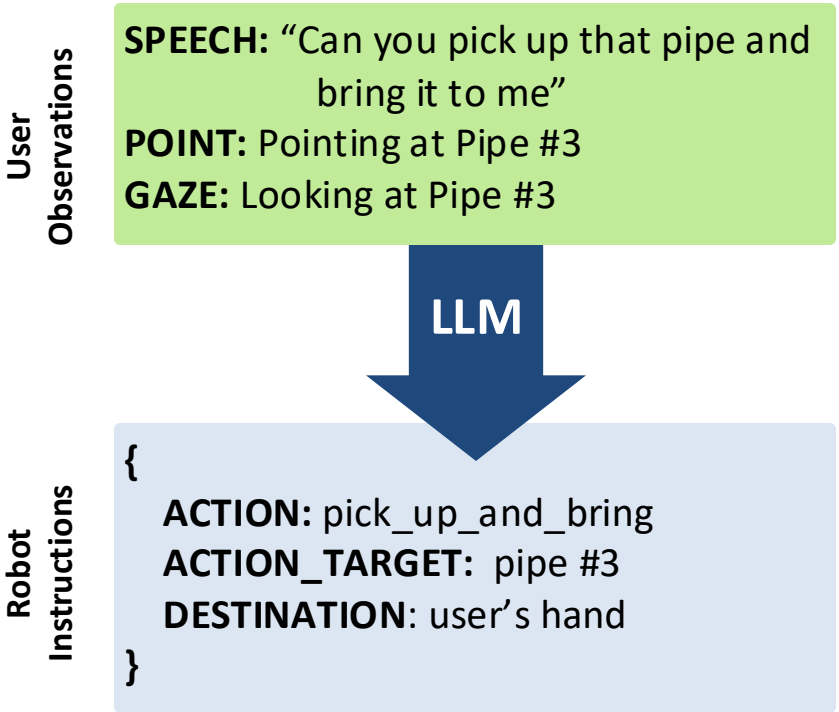


Body Posture

Observations (Gesture Accuracy)



Inference



Large Language Model

- Consumes interaction transcript and generates robot-interpretable output
- Avoids grammar dependency
- Can be easily modified to incorporate new modalities and higher-level insights

Robotic Control (PickNik)

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{
ACTION: pick_up_and_bring
ACTION_TARGET: pipe #3
DESTINATION: user's hand
}

MoveIt Pro by PICKNIK

Factors we considered when choosing MoveIt Pro

- Platform agnosticism
- Advanced grasp behaviors
- Easy to develop and implement robotics behaviors
- MoveIt is well known for work with robot manipulators

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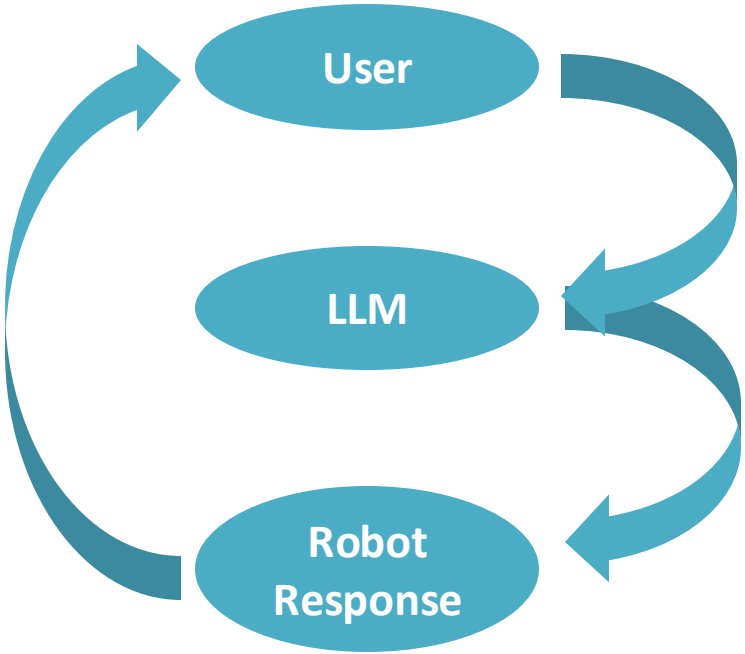
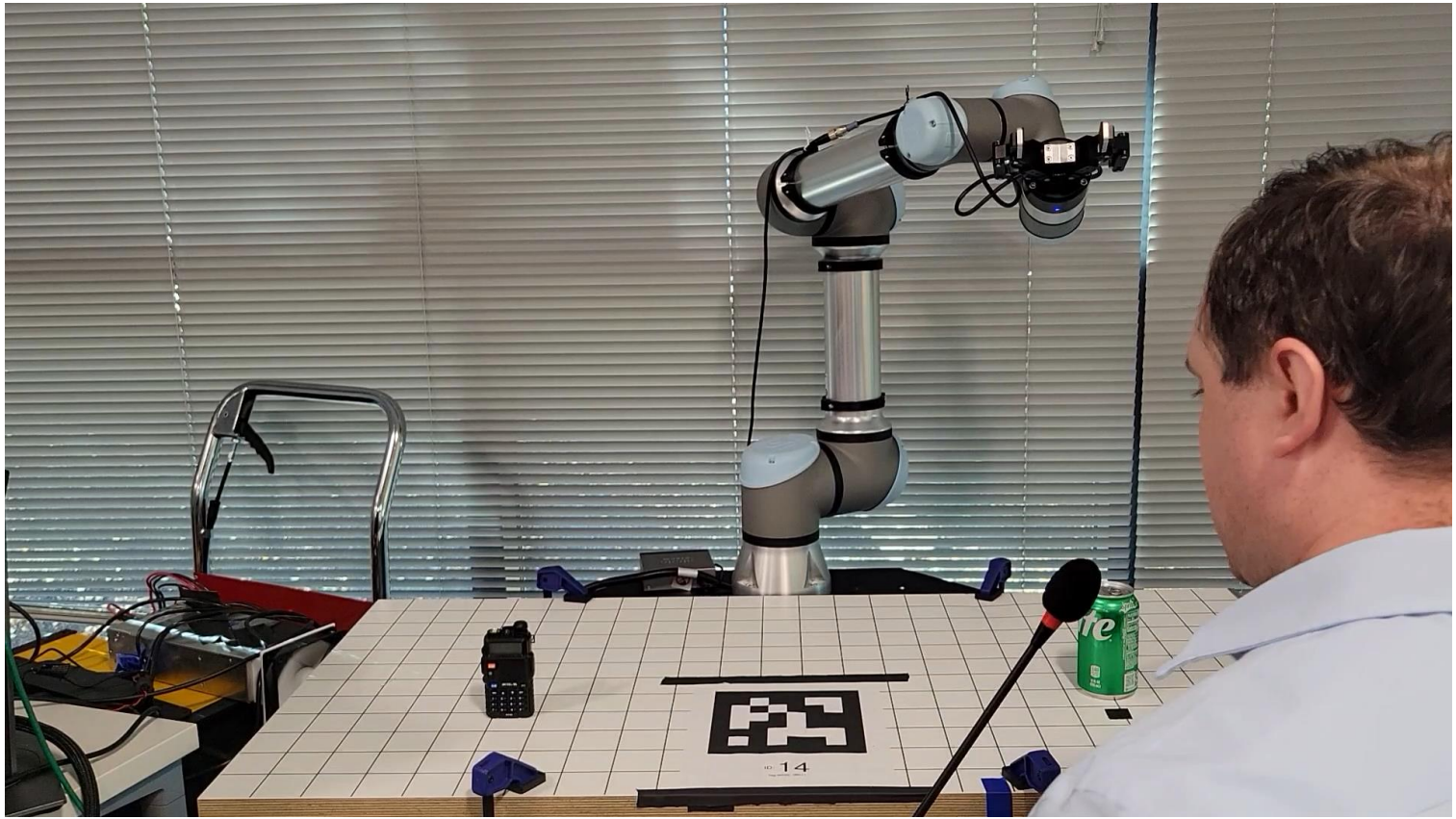
Ongoing Interaction



What We Can Do



- Pick up and place
- Manipulate (translate and rotate)

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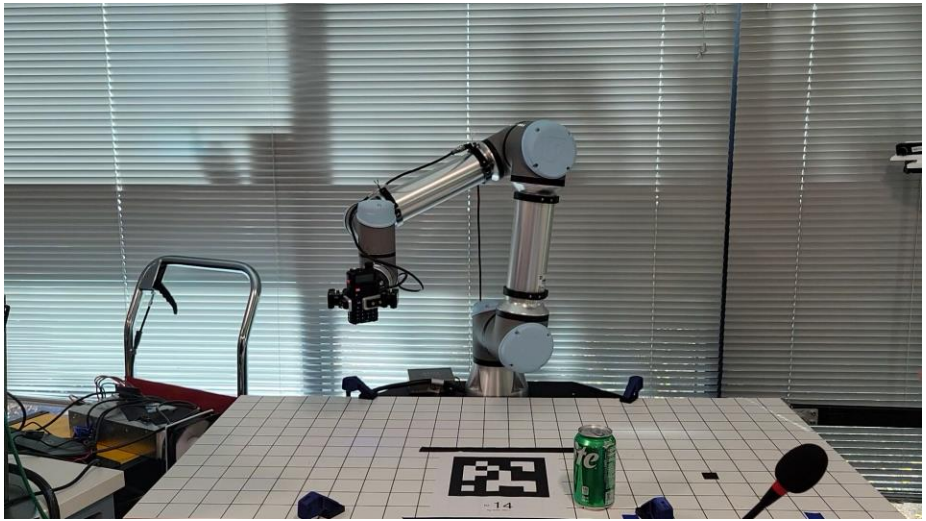
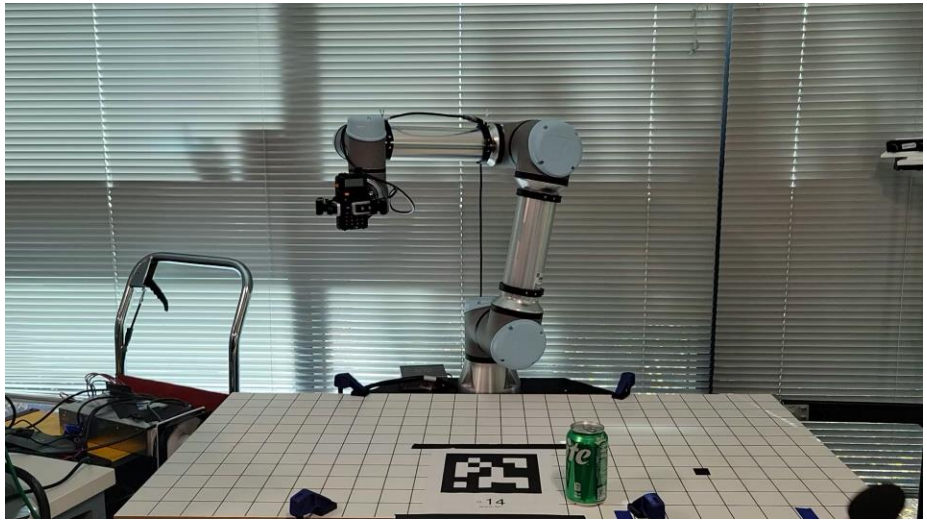
Bidirectional Communication





Leveraging Contextual Cues

- Temporal context
  - “Put the screwdriver back where you found it”
- Spatial context
  - “Pick up the can on the right”
- Descriptive context
  - “Pick up the blue cup”
- Task context
  - While looking at a screwdriver: “Get me a fastener for this tool”

PAL Applications

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Assistive care robotics

Vehicle-level autonomy

Manufacturing and repair

Medical applications

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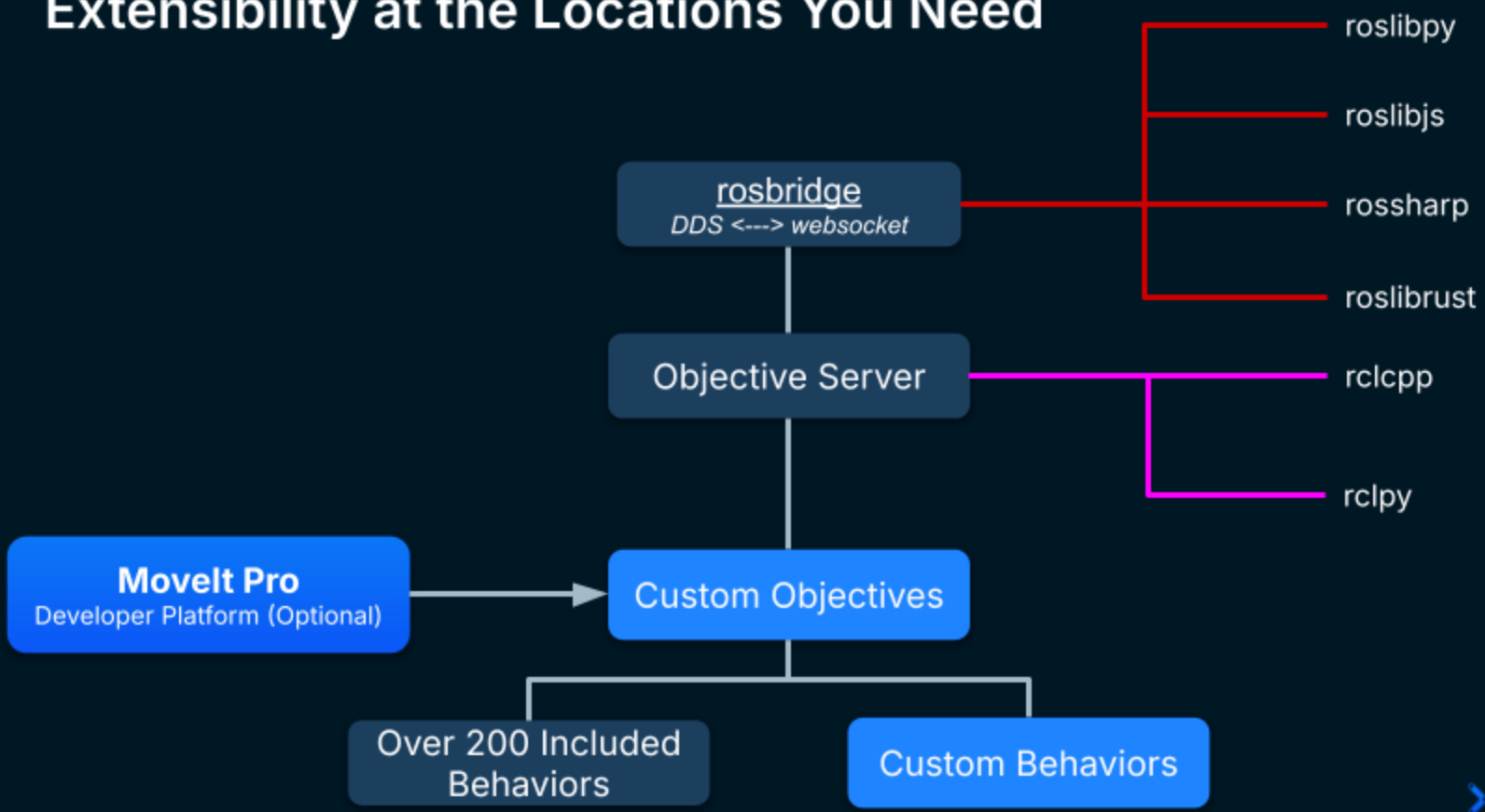
Extensibility at the Locations You Need



MoveIt Pro by PICKNIK

CPU, GPU, and Arm Agnostic

- We package everything in Docker to make machine provisioning easy and new developer spin-up painless.
- Our software runs on x86 and ARM architecture.
- We provide GPU agnostic ONNX models.
  - Our Docker containers pass through CUDA acceleration, including on Nvidia Jetson devices.
- We maintain and expand a growing list of ROS compatible hardware and driver ratings.

A Framework for Using ML Reliably & Safely

	Cycle Time Planners	Segmentation Transformers	Grasp Transformers	Action Policies
Input	*Motion request*	*Vision (2D or 3D), Text Prompt*	*Vision (2D or 3D)*	*Vision (2D or 3D)*
Output	*Joint trajectory*	*Mask specifying location*	*Grasp pose*	*Joint trajectory*
Example	*Cycle time optimal motion between work areas.*	*Find the next component for your task.*	*Grasp novel or deformable objects.*	*Plan contact-rich motion for assembly or manipulation.*

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A Framework for Using ML Reliably & Safely

Deterministic Controls

Input	*Joint commands*
Output	*Joints commands checked for joint limit, velocity, collision, and force limits.*
Example	*Safety layer prevents a visuomotor policy from colliding with a table.*

Robot Hardware or Simulation

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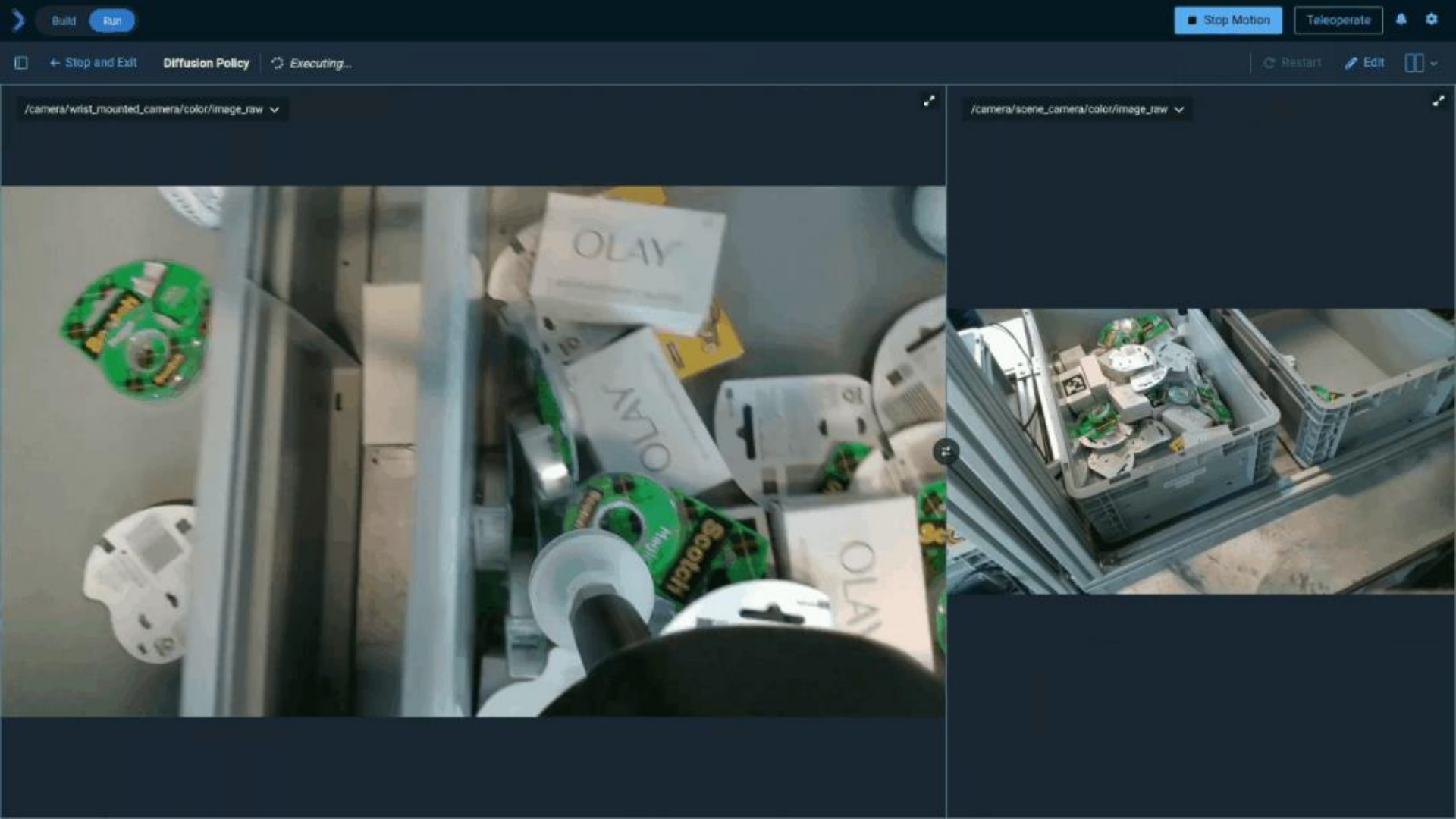
Build
Run
Stop Motion
Teleoperate
Stop and Exit
Diffusion Policy
Executing...
Restart
Edit
/camera/wrist_mounted_camera/color/image_raw
/camera/scene_camera/color/image_raw
OLAY
Scotch

Questions for our Presenters?

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More Success Stories: https://picknik.ai/case-studies/
BMW & Hivebotics Webinar recordings: https://picknik.ai/webinars/

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CleanBotix

Don't Forget to Join us on
Thursday, October 30th at 12p EST
Featuring Adam Jacques of Clean-Botix,
A Food Sanitation Company

Registration Link is in the chat!

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