

Envoy: Cloud-enabled Robot Assistant



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- Greets visitors
- Escorts people through multi-floor buildings
- Retrieves and delivers objects
- Key capabilities:
 - Situational awareness
 - Natural interaction with people
 - Asking for assistance

Situational Awareness

- Rich semantic map
- Object-level awareness
 - ✓ Depth & color segmentation
 - ✓ One-shot reacquisition
 - Pose tracking
- Human detection and tracking
- Knowledge acquisition
 - ✓ Learns map via human-guided tour
 - Builds semantic map from speech

Cloud Robotics

- Limited onboard resources
- Utilize cloud for non-safety tasks
 - ✓ Speech recognition
 - ✓ Map database
 - Object learning and detection
 - Manipulation learning
- Fault-tolerant cloud integration
 - Seamless transition to local resources
 - Gradual capabilities degradation
 - Capabilities transparent to user

Natural Interaction

- Intuitive user interface
 - ✓ Interprets natural language speech
 - ✓ Synthesizes speech
- Safe interaction with bystanders
 - ✓ Executes predictable behaviors
- Knowledge & intent transparency
 - ✓ Panning head follows user
 - ✓ External tablet conveys state
 - ✓ Robot speaks actions
 - Projector indicates knowledge & intent

Asking for Assistance

- Requests help for unachievable tasks
 - ✓ Opening doors
 - ✓ Operating elevators
- Learns from user to perform tasks
 - Increases independence over time
 - Interactive guided tour of manipulation