

# A Natural, Multi-Modal Interface for Unmanned Platforms

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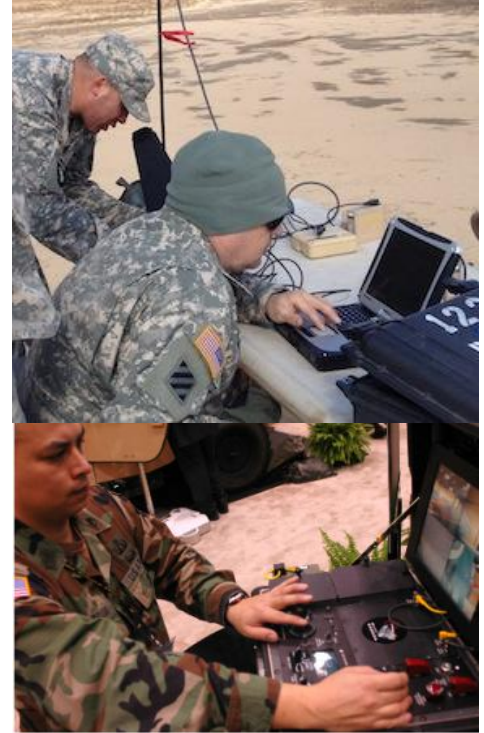


**SOARTECH**

Modeling human reasoning.  
Enhancing human performance.

# Motivation

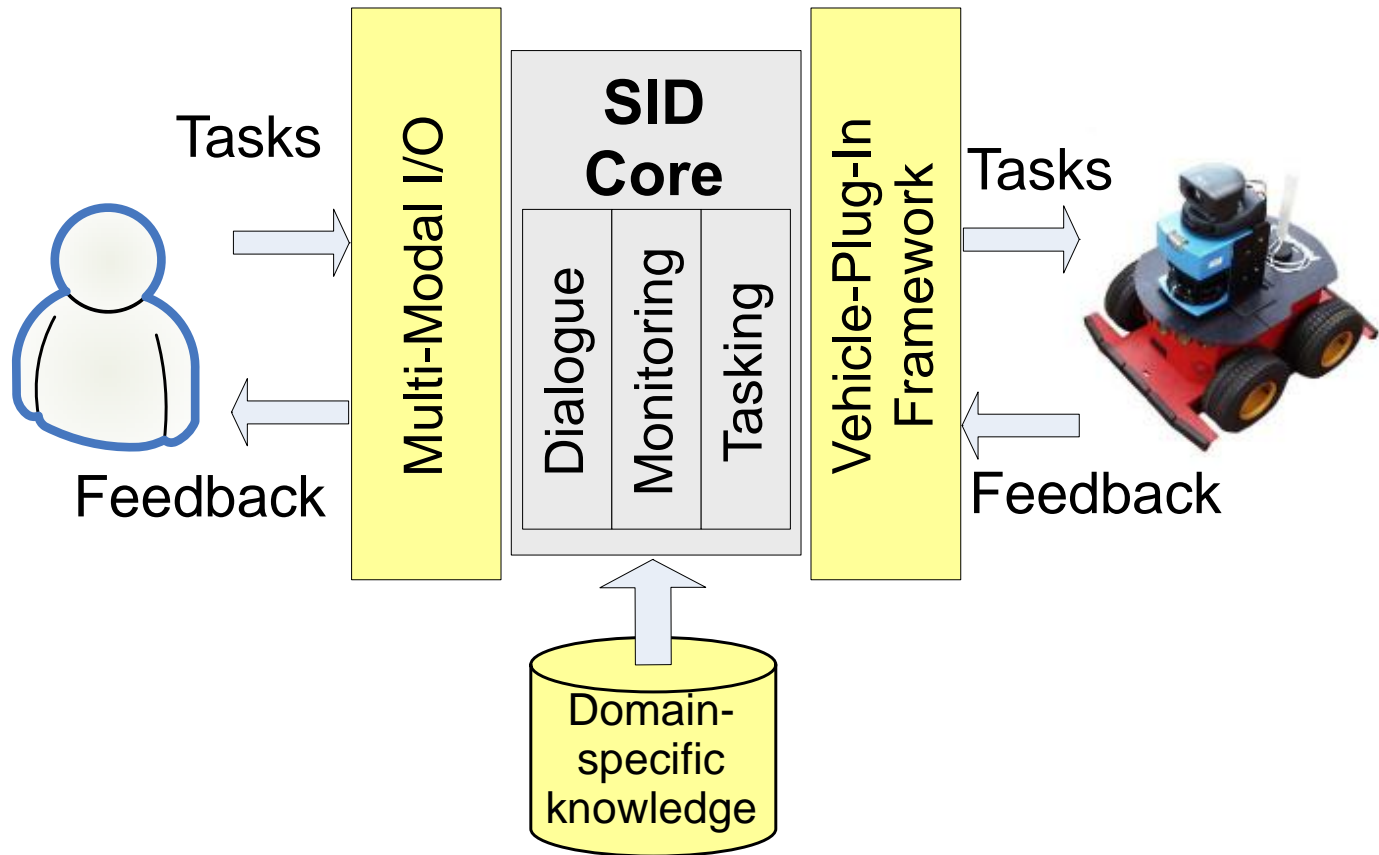
- Robots are hard to use:
  - Low-level control – even joysticks
  - Require constant attention
  - Require months of training
  - Physical burden (heavy control stations)
  - Cognitive burden (attention/translation)
- **Goal:** Make human-robot interaction more natural and intuitive to be easier to use, less taxing, require less training



## Technical Approach: Intelligence in the Interface

- Make the user interface smarter to make the robot easier to use:
  - Enable natural interaction (different modes)
  - High-level commands and high-level feedback
  - Follow interaction protocols that people expect
  - Let the user interface do work for the user (reduce the cognitive burden)
- **Result: Smart Interaction Device (SID)**

# Smart Interaction Device (SID) Architecture



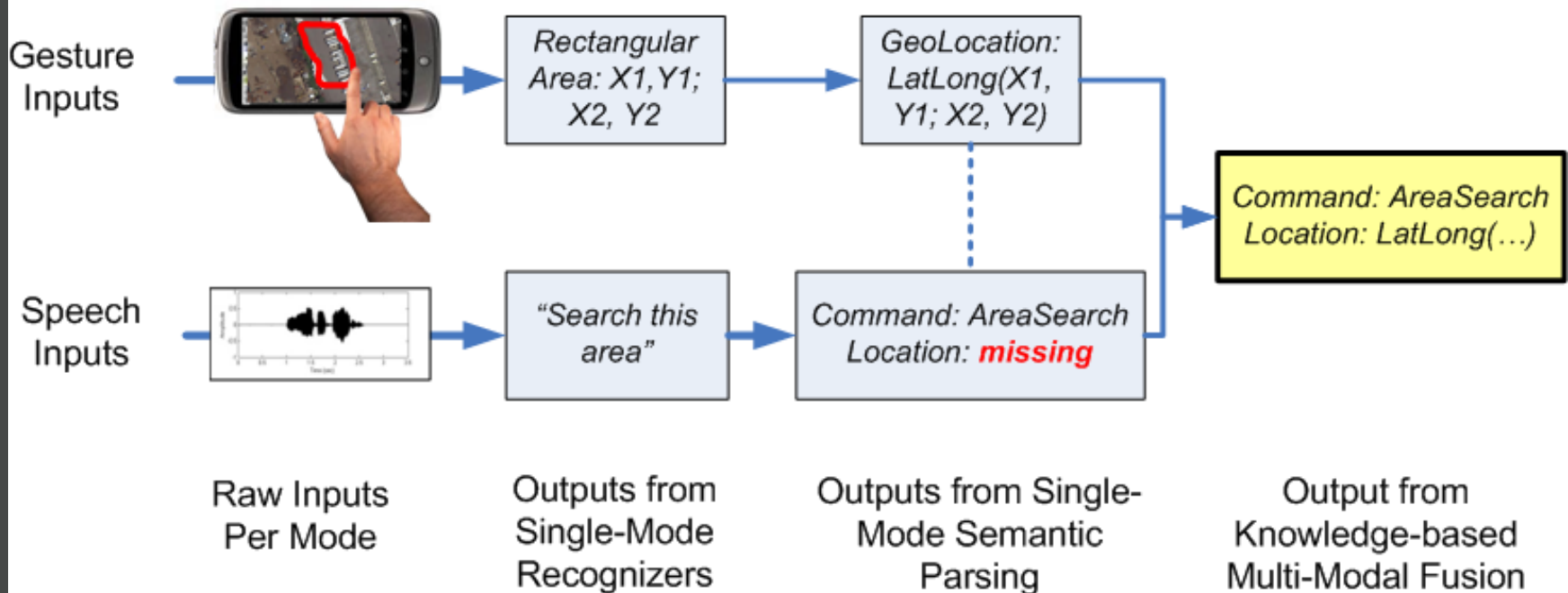
SID acts as a 2-way facilitator between a user and the system.

# What Is “Natural Interaction”?

- Varies per domain and per task
  - Face-to-face contact? Verbal, gestures, ...
  - Map-based tasks? Verbal, sketch, markup
- How to figure out what’s natural?
  - Direct observation, Wizard of Oz, ...
- Multiple modes occur in many interactions
  - Often more efficient in spatially oriented domains\*
- Dialogue is ubiquitous



# Multi-Modal Interaction as Data Fusion



Each mode contributes some information to the overall meaning.

# Human-Robot Interaction as a Dialogue

Human interaction happens over time, includes references to prior utterances, shortcuts, ambiguities, mis-hearings or noisy/missed inputs, etc...

Human interaction is a ***dialogue*** on purpose to solve some of the problems of human-human interaction.

**Our approach:** Use human-inspired dialogue strategies to make for natural interaction and overcome communication problems.

*Operator:* "Robot, go to this point."

*Robot:* "Which waypoint do you mean?"

*Operator:* "This one" (sketch)

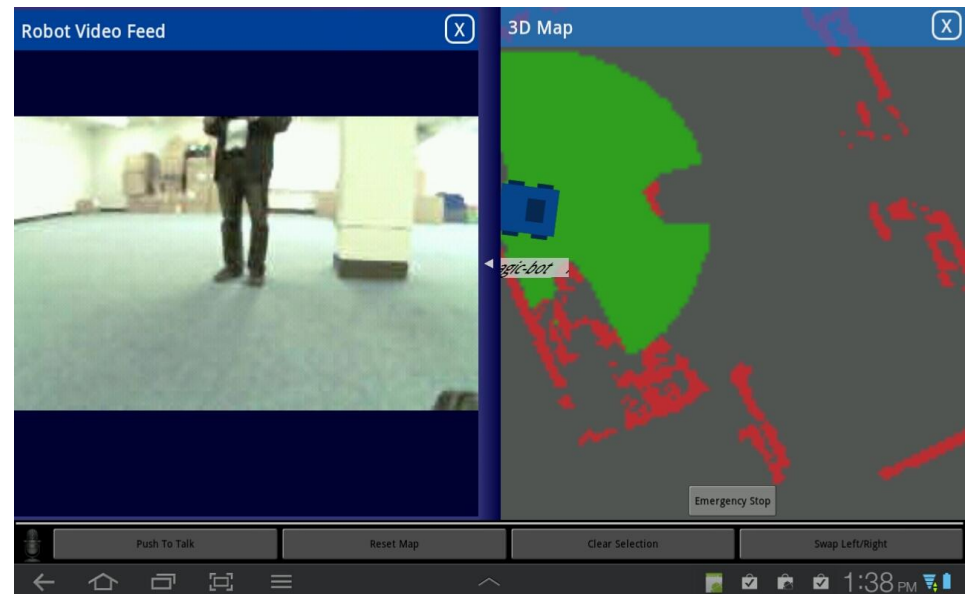
*Robot:* "Roger wilco. Going to point Chevy."

# Application Examples



- **Device:** iPhone
- **Natural interactions:** speech and pointing
- **Platform:** Pioneer P3AT

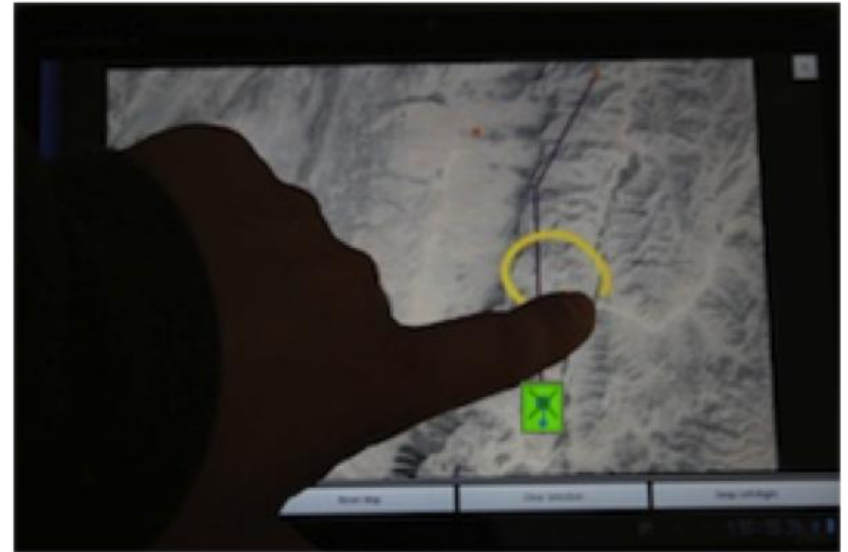
- **Device:** Android Tablet
- **Natural interactions:** speech and sketch on map and video
- **Platform:** UMichigan April Bot





# Application Examples

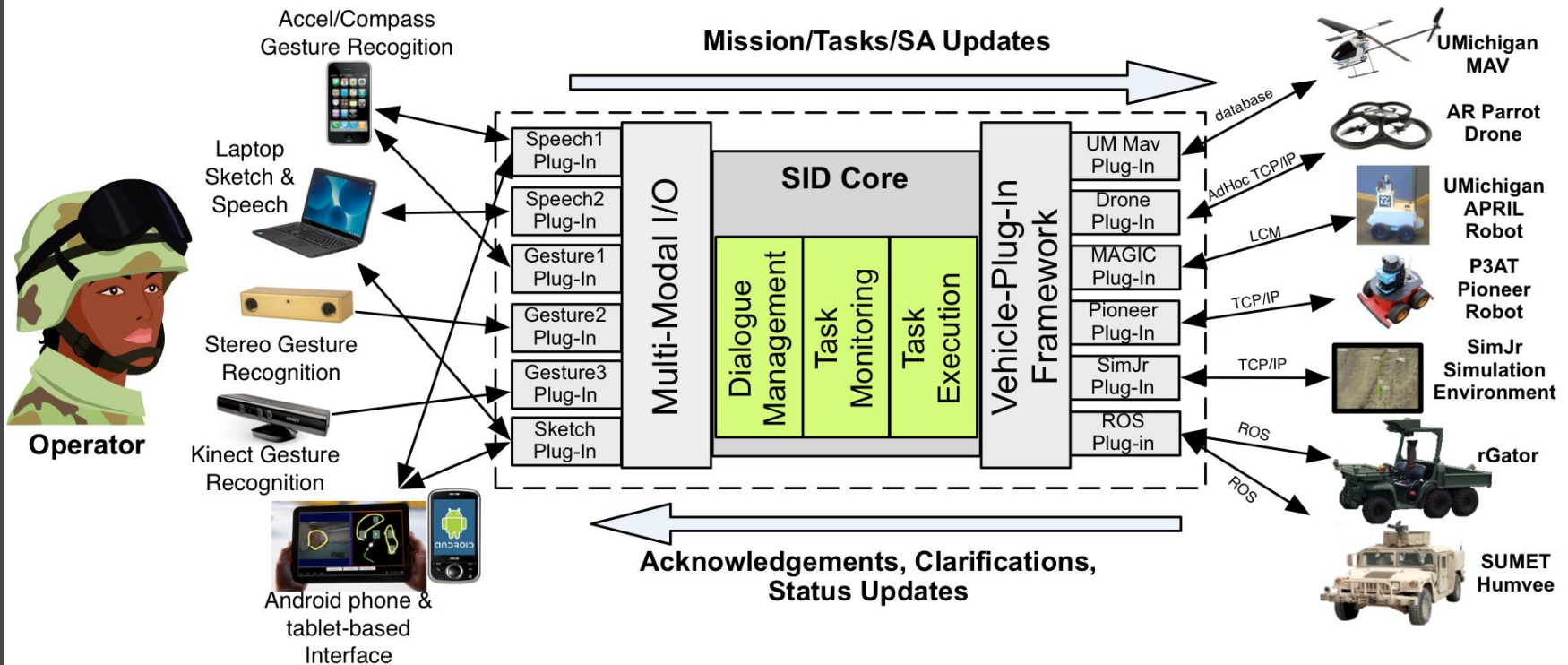
- **Device:** Android Tablet
- **Natural interactions:** speech and sketching
- **Platform:** Simulated UAV



- **Device:** microphone and stereo camera
- **Natural interactions:** speech and gesture
- **Platform:** Robotic Humvee

# Summary

- SID is a multi-modal dialogue interface to unmanned platforms that has been demonstrated with speech, sketch, gesture, and text chat on several devices and commanding several platforms



# Thank you!

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