swARm

Multi-user robotic swarm control through two Magic Leaps

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Why Robotic Swarms?

- Robotic swarms can solve tasks which are too complex for one robot
- Multiple robots can work together to solve distributed problems faster
- Robotic swarms are more robust to failure than a single robot

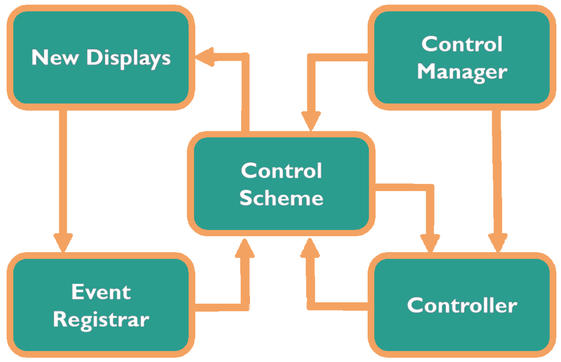
Why Head-mounted Augmented Reality?

- Understanding robotic swarms is difficult
- Augmented Reality allows users to visualize and understand real world environments through an immersive experience
- Head mounted displays free users' hands allowing them to use them for other tasks

Contributions

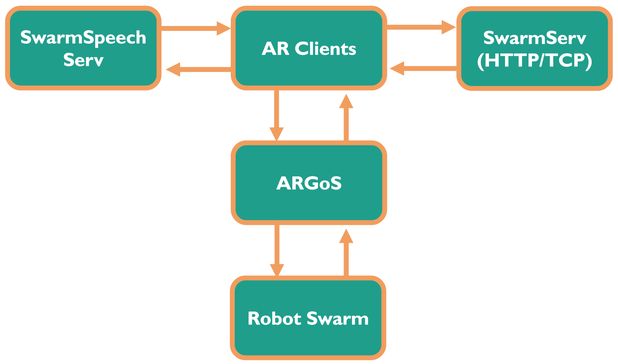
- We create the first multi-user head-mounted augmented reality control system for robotic swarms in order to balance cognitive load between operators
- Improve on previous year's control and visualization system by introducing entity locking, marker placement and voice commands
- Extend last year's MQP features to move from simulation to real world space
- Decouple control system architecture allowing us to easily reuse components speeding up our development time

Event-driven Architecture



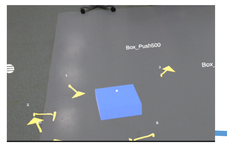
Supports modular control configurations

Service Map



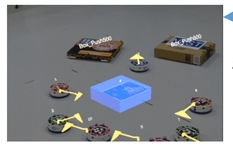
Services support multi-user and voice command functionality

Calibrating to real world



Pre-calibration, all overlays are in wrong physical location

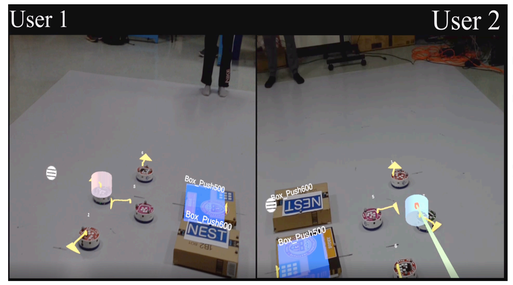
Operators calibrate by looking at the calibration image and pressing the calibration button



After calibration, all overlays are positioned correctly

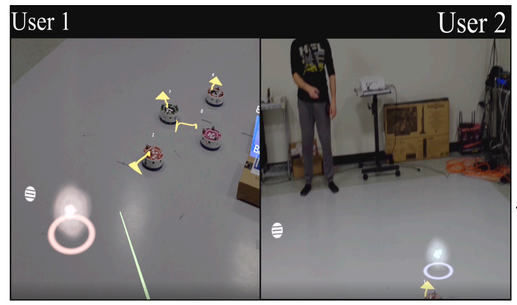
Non-verbal communication

Pointing Highlighting



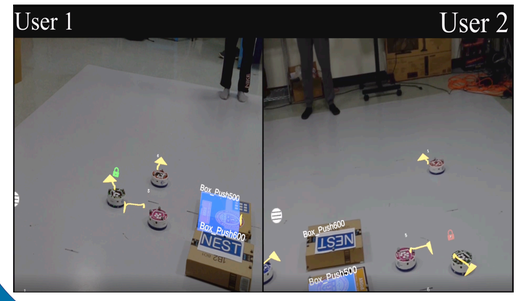
Operators communicate by pointing at important system components

Markers



Operators convey important locations by placing markers in their environment

Resource Locking



Operators reserve system components they need for tasks by placing locks on entities

Recommendations

- User testing to evaluate efficacy of non-verbal communication features and speech commands
- Natural language filtering of displays and control of robots