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
- New Displays -> Control Manager
- Event Registrar -> Controller
- Supports modular control configurations

Service Map
- SwarmSpeech Serv -> AR Clients -> ARGoS
- ARGoS -> SwarmServ (HTTP/TCP)
- 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