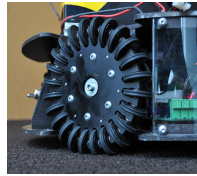# CoBot – Mobile Collaborative Service Robots

Manuela Veloso, Joydeep Biswas, Brian Coltin, Stephanie Rosenthal,

Mehdi Samadi, Thomas Kollar, Cetin Mericli, Max Korein, JP Mendoza, Rodrigo Ventura

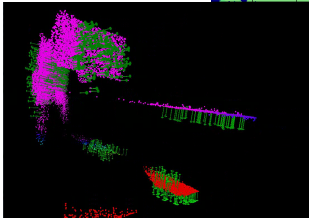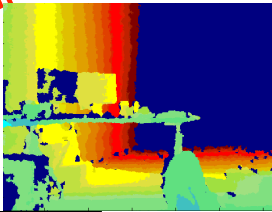School of Computer Science, Carnegie Mellon University

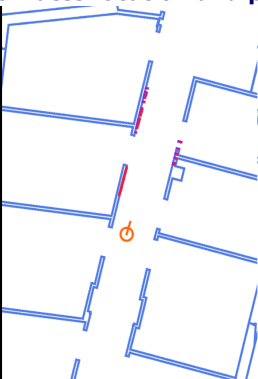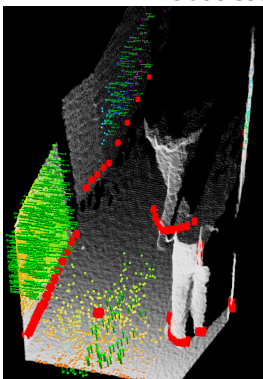**PUBLICATIONS AT www.cs.cmu.edu/~coral/cobot**

Robot Platform

Integrated perception, cognition, and action
Kinect – RGB+Depth, Omnidirectional motion
Onboard computation, Wireless access

3D Depth-Based Plane Filtering Scene Understanding

Robot designed and built by Michael Licitra

Symbiotic Autonomy: Ask Humans

• **CoBot can localize, navigate, plan**
• **CoBot has perceptual, cognitive,**
  and actuation limitations
• **CoBot asks for help from humans**
• **HUMAN-CENTERED PLANNING:**
  plan, reason, learn human models

Symbiotic Autonomy: Ask the Web

.3
.85
.42

"Please, bring me coffee" (where is coffee??)

Ask the web: Is coffee in office, kitchen, classroom?

Plan probabilistic path according to response

Active Environment Learning

Learning from Human Correction

Execution Monitoring

Localization & Navigation

• **Real-time plane filtering**
• **Planes are mapped as walls, floor**
• **People are reliably removed**
• **Robot estimates location and pose**

Multi-Floor Deployment

Multi-Robot Task Planning

Floor 7

• **>200km test and deployment**
  in four floors ~300-office building
• **Web-based user task requests**