

BWI Virtour

Telepresence System for Remotely Operated Building Tours

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Roadmap

1. Brief Introduction
2. Building Wide Intelligence Lab
3. Related Work
4. Web client
5. Robot server
6. Scavenger Hunt and IJCAI
7. Conclusion
8. Future work
9. Demo

1. Brief Introduction

- Motivation
 - Tours
 - Robot monitoring
 - Exposure



1. Brief Introduction

- Goals
 - No human intervention
 - Modern technologies
 - Extendable



BWI

2. Building-Wide Intelligence

- Fully autonomous mobile robots
- Research and deployment
- Helping humans



2. Building-Wide Intelligence

- Hardware
 - Segbot V1
 - Segbot V2
 - Segbot V2 arm
 - Segbot V3



2. Building-Wide Intelligence

- Software

BWI segbot

BWI

BWI common



ubuntu®

2. Building-Wide Intelligence

- BWI Research
 - Activity Recognition
 - Gori et al., 2015
 - Learning action costs
 - Yang et al., 2014
 - Khandelwal et al., 2014
 - Multi-robot guidance
 - Khandelwal et al., 2015
 - Khandelwal & Stone, 2014
 - Segbot arm
 - Thomason et al., 2015
 - Thomason et al., 2016
 - Sinapov et al., 2016

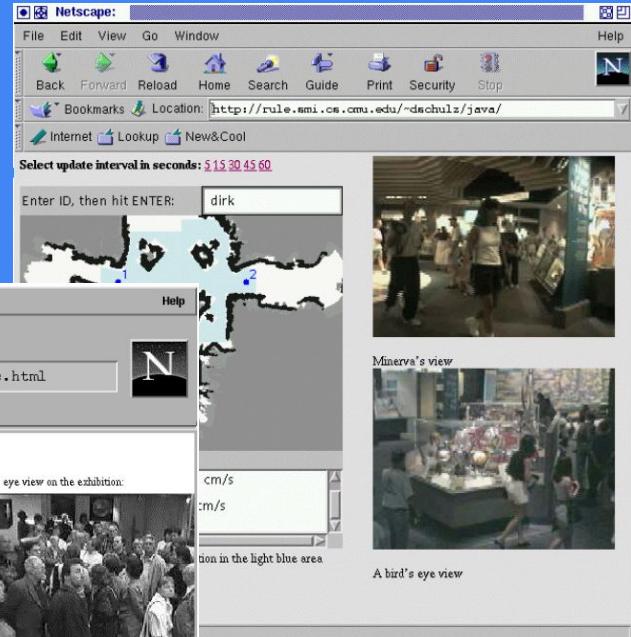
Related Work

3. Related Work

- Rhino
 - Burgard et al., 1998
- Minerva
 - Thrun et al., 1999
- Jinny
 - Kim et al., 2004



Rhino web interface



Minerva web interface

3. Related Work

- Differences
 - Platform agnostic
 - Web-first approach
 - Modern technology
 - More control



Virtour

server



robot

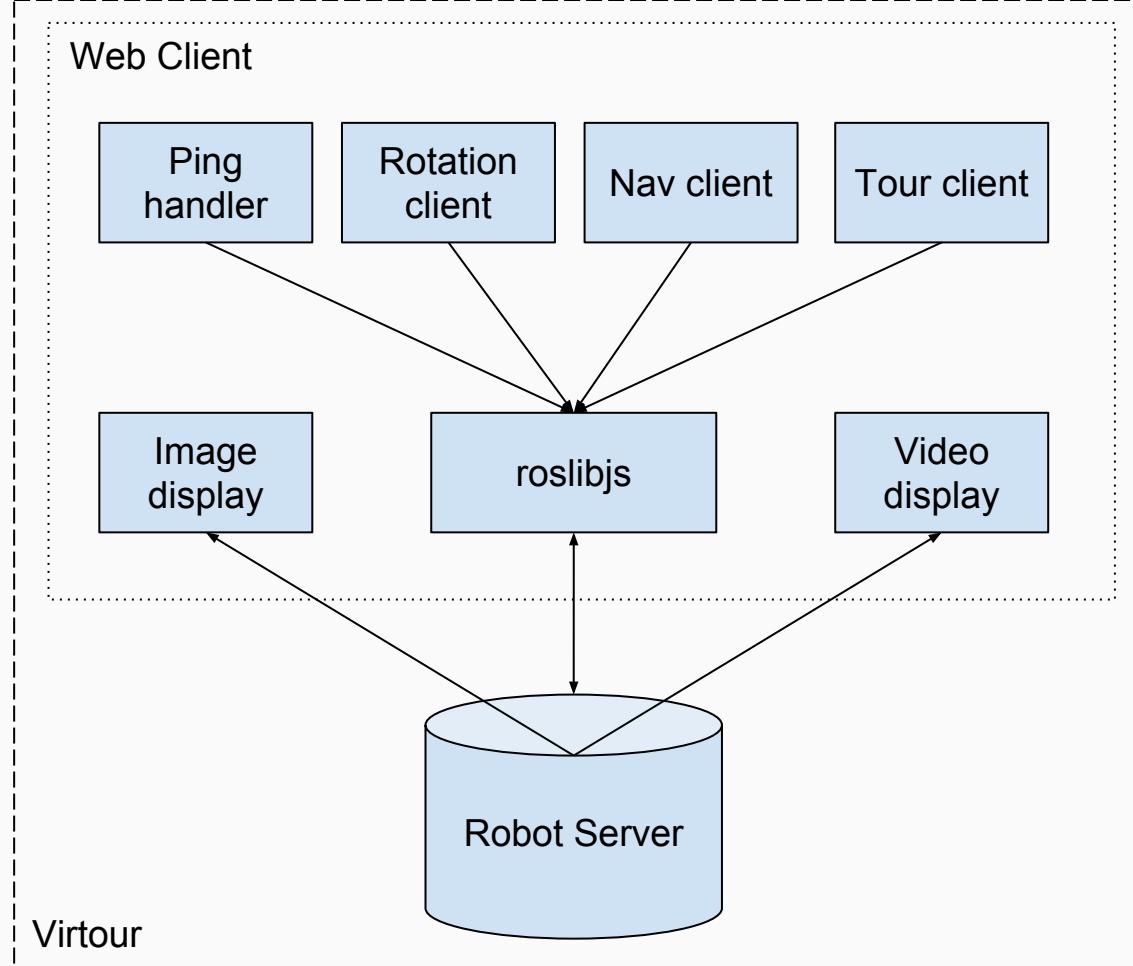


robot

client

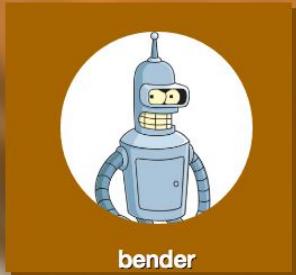


Web Client



Welcome to the GDC Virtual Tour

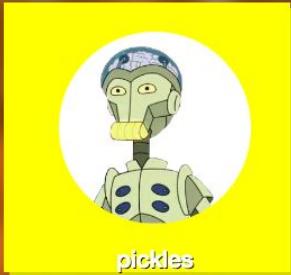
Available robots



bender

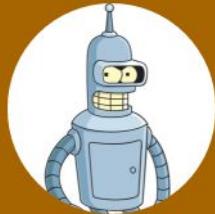


leela



pickles

Available robots



bender



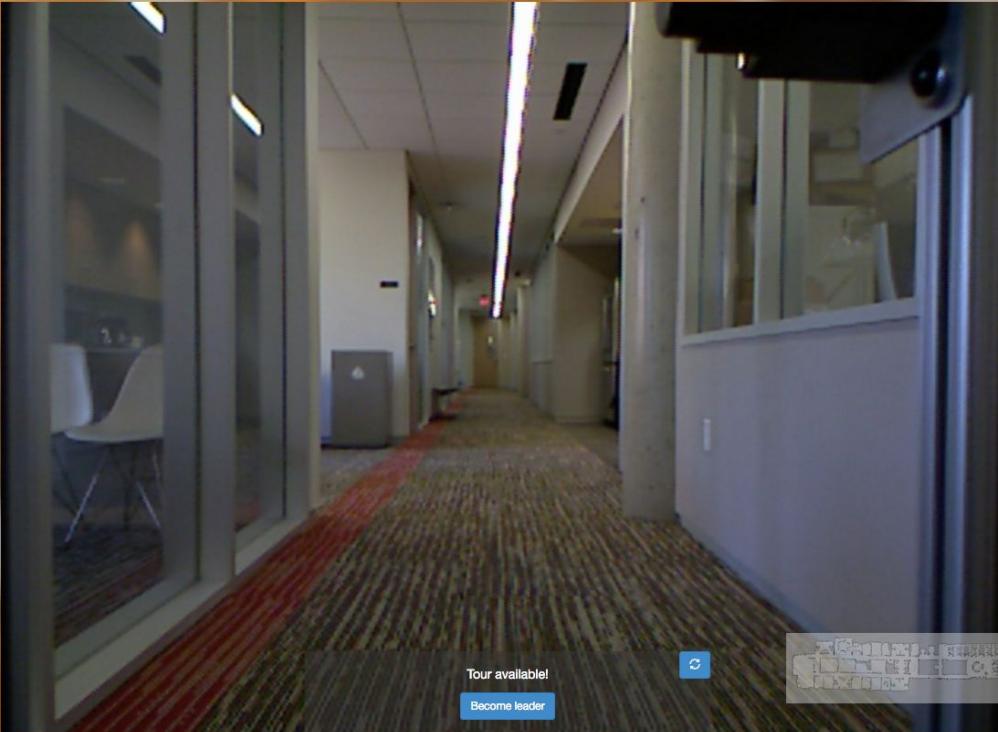
leela



4. Web Client

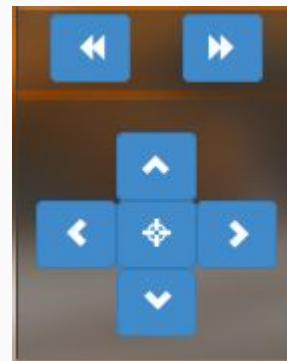
- Guest UI
 - Always enabled
 - Camera feed
 - Tour status
 - Robot position

Viewing bender

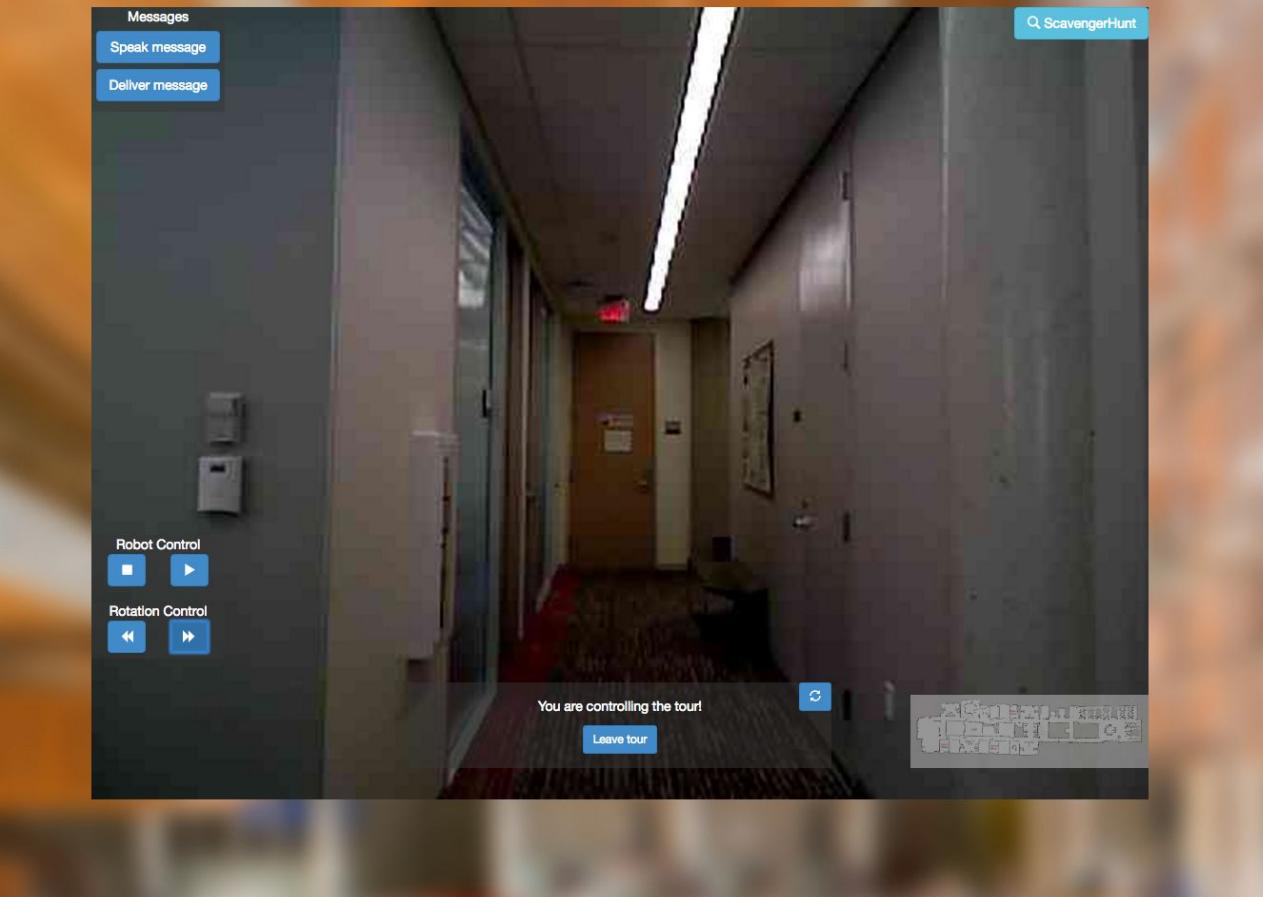


4. Web Client

- Leader UI
 - Optional
 - Allows remote control
 - Navigation
 - Messages
 - Robot rotation
 - Camera pan/tilt
 - Scavenger Hunt integration



Viewing leela



Location Map



Select next tour location



Go to room



Go beside door



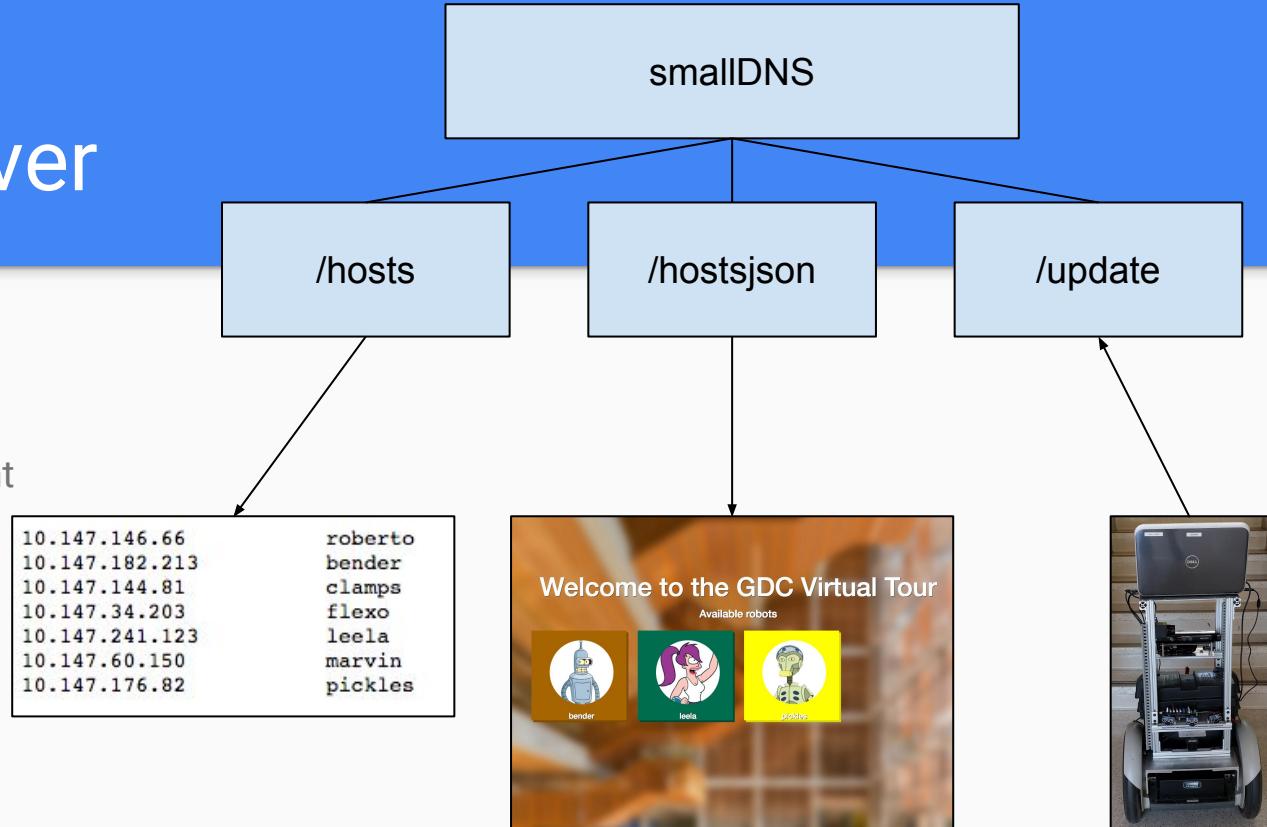
[Close](#)

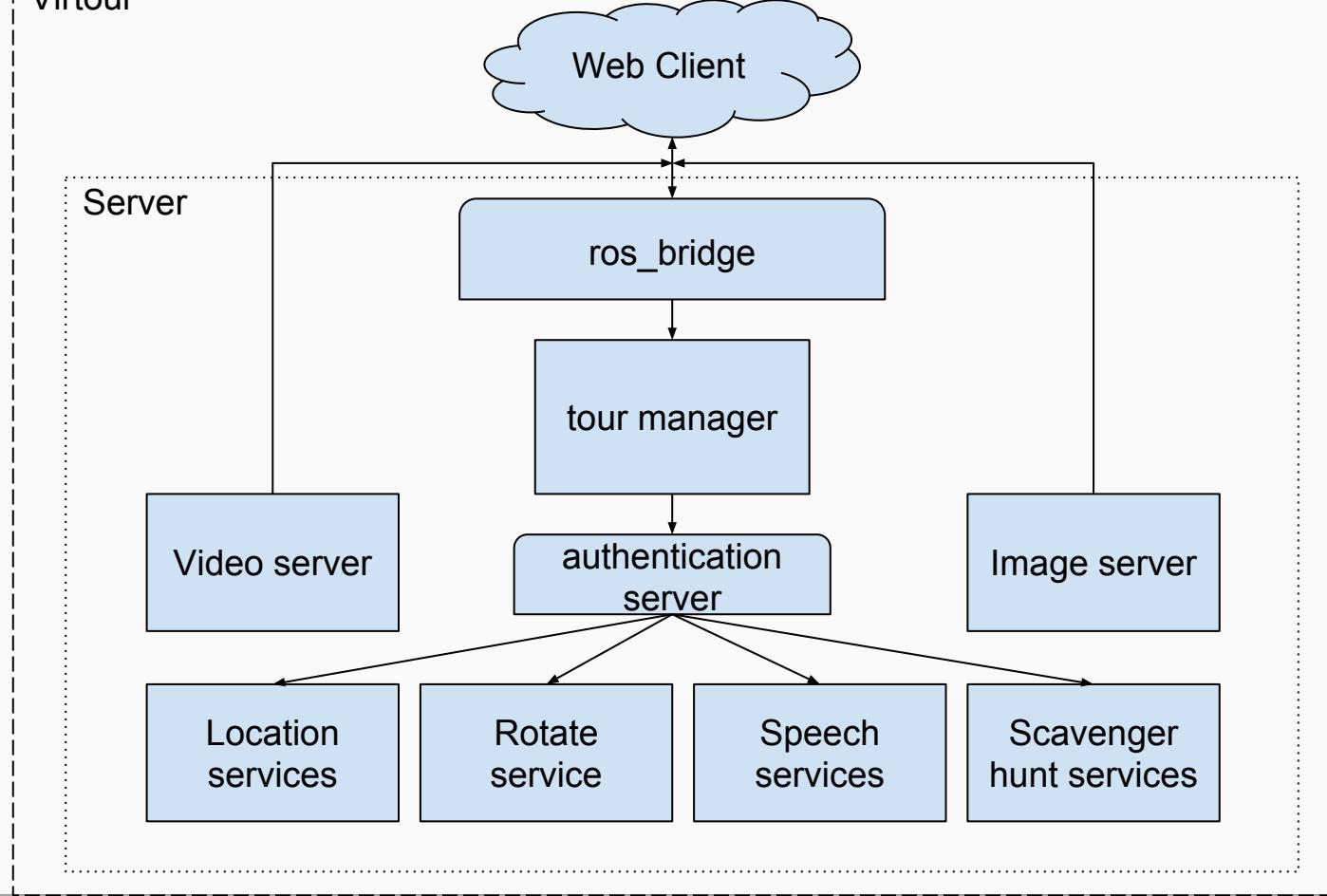
[Navigate](#)

Server Side

5. Robot Server

- IP Management
 - Master server
 - Robot deployment
 - Multiple uses





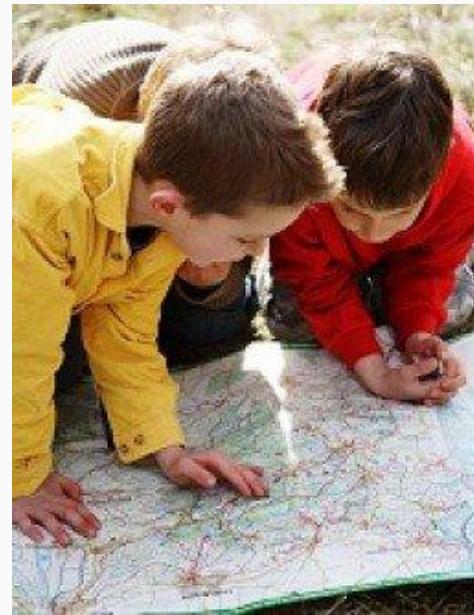
5. Robot Server

- Security
 - Authentication
 - Whitelists
 - Specialized clients
 - Connection monitoring
- Safety
 - Shared autonomy

Integrations

6. Scavenger Hunt

- Scavenger Hunt
 - Zhang et al., 2016
 - AI capable robot competition
- Tasks
 - Human shirt
 - Human following
 - Deliver object
 - Find object



6. Scavenger Hunt

- Client-side
 - Detection
 - Pause/Resume
 - Task list status
 - Certificates
- Server-side
 - Certificate server
 - Scavenger Control Node

Scavenger Hunt Status

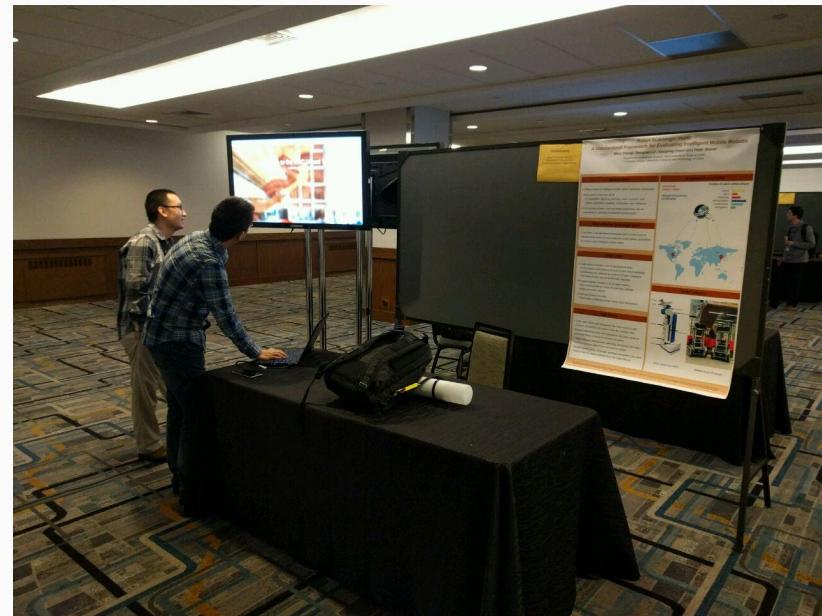
View scavenger hunt

Task	Status	Certificate
White board	✓ Done	
White board	⌚ Ongoing	
White board	📅 To do	
White board	📅 To do	
White board	📅 To do	

[Close](#)

6. Scavenger Hunt

- IJCAI
 - Demo booth
 - Ran for 5 hours, 5.7km



7. Conclusion

- General purpose system
- Stability
- Deployment
- Modern and portable

8. Future Work

- Navigation
 - Point-click
 - Multi-floor
- Information
 - Battery
 - Distance Travelled
- Tracking

https://cs.utexas.edu/~larg/bwi_virtour

Demo

