



Center for Perceptual Robotics, Intelligent Sensors and Machines

Supported by NSF CISE Computing Research Infrastructure Program under Grant No. CNS-0551598



Goals:

1. To enhance comprehensive multidisciplinary research and education infrastructure at CCNY
2. To foster collaboration among faculty members to carry out nationally competitive research in robotics, vision, wireless networking, human-computer interaction and other related fields.
3. To make the PRISM a center of excellence in cutting-edge research as well as a national urban model for minority education in robotics and related fields.

Research Theme: Robotized Intelligent SEnsor NETworks (**RISE-NET**) in 3D space

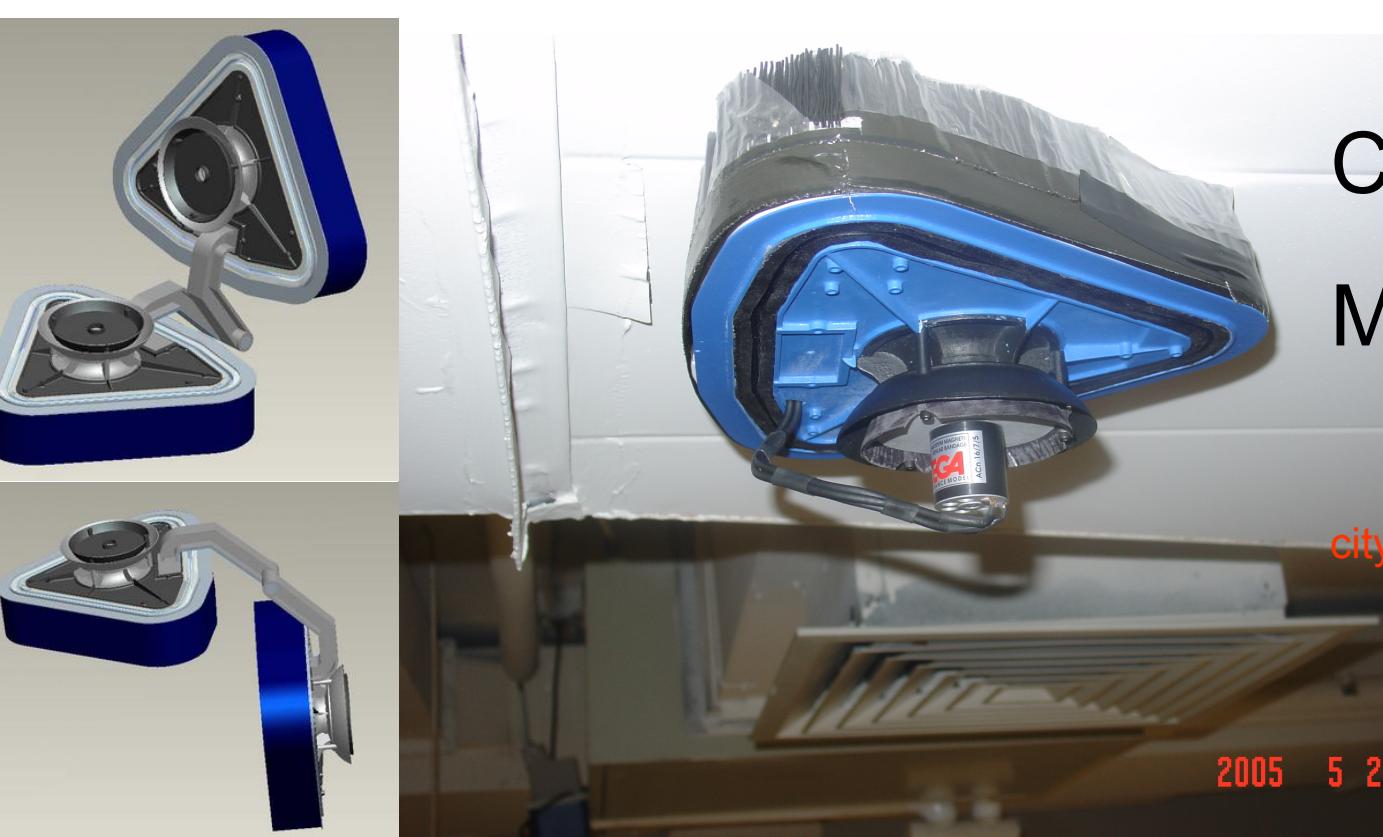
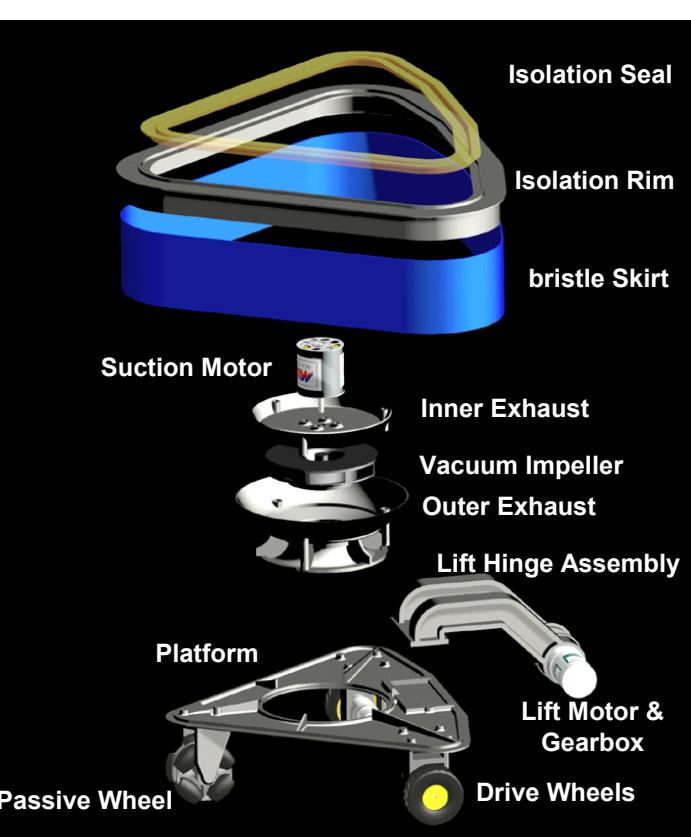
Research Thrusts:

- **Distributed Perceptual Robotics** (RISE-NET, sensing, control and coordination of robot teams in 3D space);
- **Multimodal Intelligent Sensors** (multimodal sensors for target recognition, subject tracking, event understanding);
- **Pervasive Smart Machines** (human-robot interaction, human-machine visual and speech interfaces);
- **Reliable Communications** (wireless sensor networks/mesh networks, dynamic survivable resource pooling).



• Cooperative Wall-Climbing Robots (Xiao, Zhu, Sadegh, Grossberg, supported by ARO and NSF MRI)

- 1) To develop modular, wall-climbing robots being able to operate on any kinds of smooth or rough surfaces
- 2) To investigate intelligent control methods and vision algorithms to control and coordinate a team of such robots to perform various defense, security, and inspection missions.



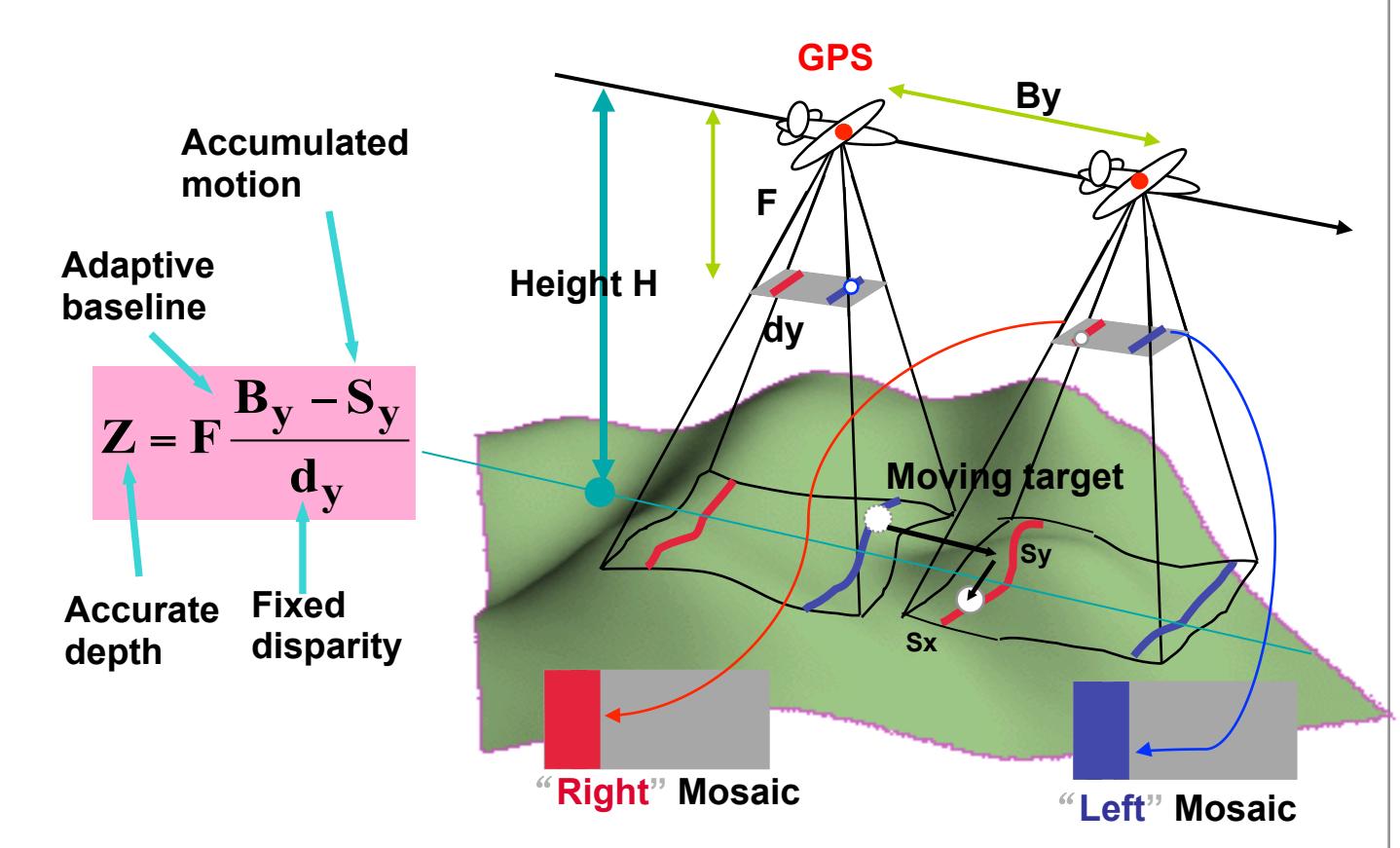
City-Climber Prototypes
Media Coverage by



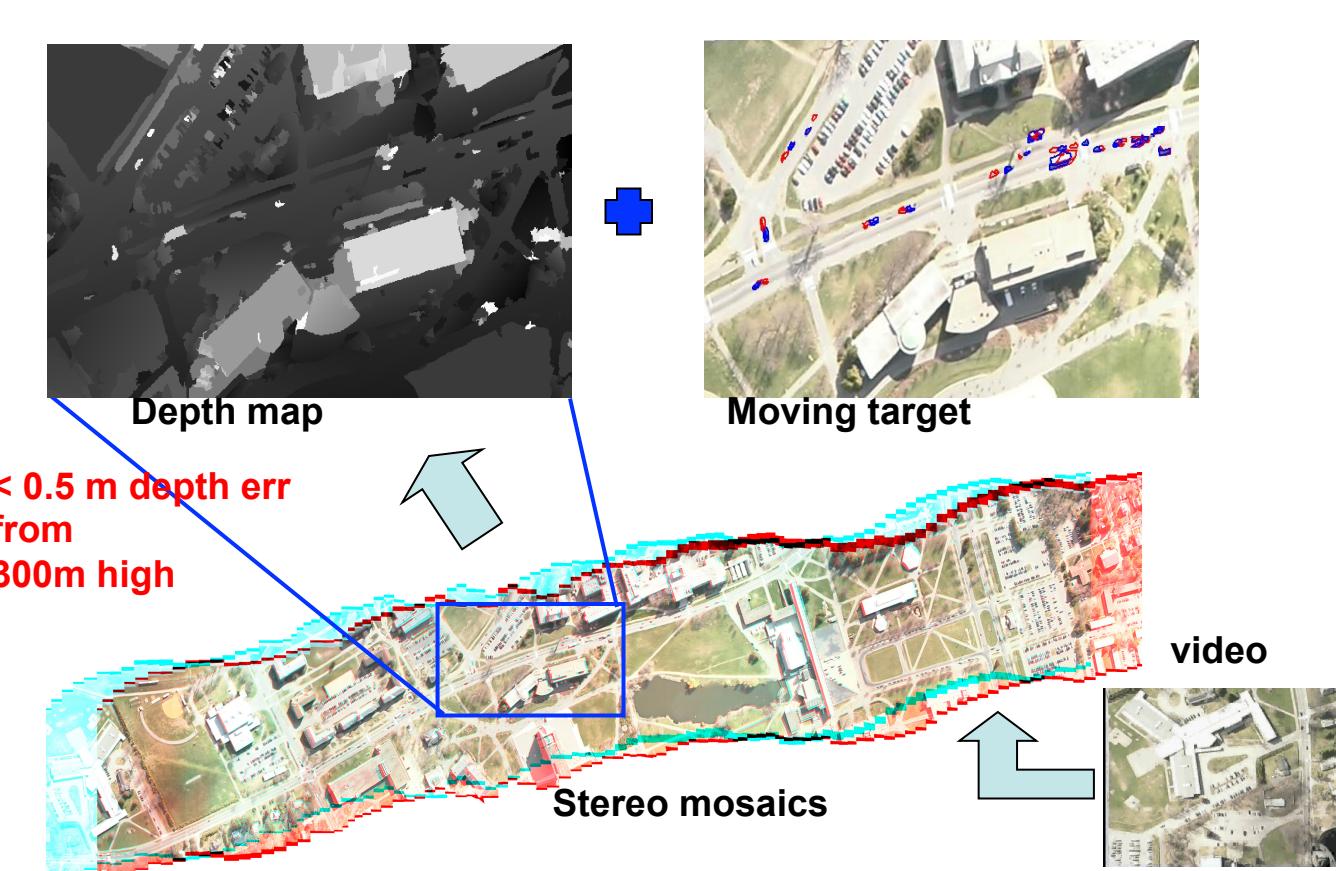
http://dsc.discovery.com/news/briefs/20060612/cityclimber_tec.html

• Dynamic Pushbroom Stereo Mosaics (Zhu, Wolberg, Haralick, supported by AFRL and NSF)

Concept: Dynamic Pushbroom Stereo



Results: Content-Based 3D Mosaics



Description of Research

Video Registration, representation and 3D static or dynamic content extraction from video sequences of dynamic urban scenes taken from aerial or ground robots.

Objectives

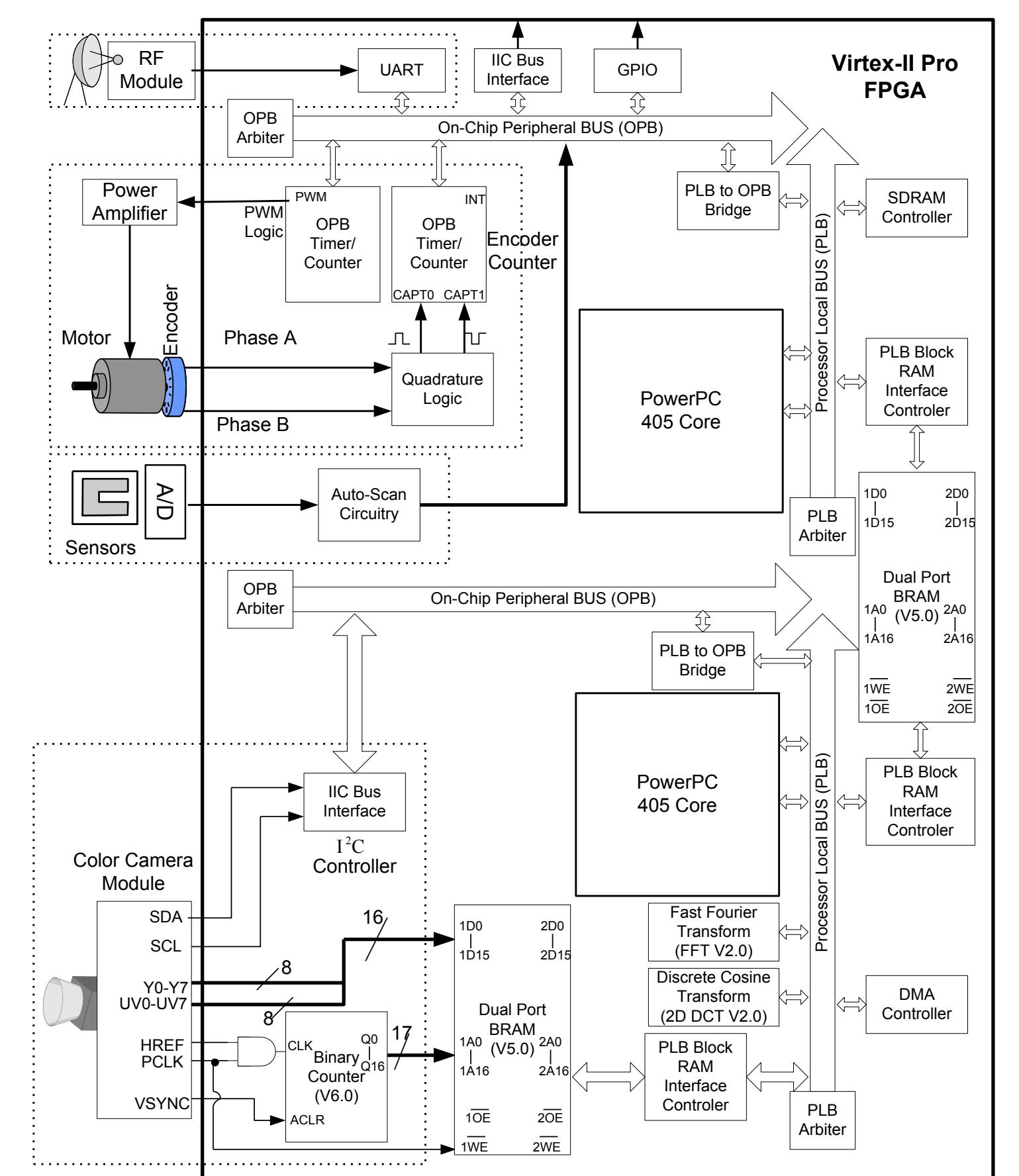
- (1) Rapid panoramic stereo mosaic construction
- (2) Accurate 3D reconstruction and parametric rep.
- (3) Robust moving target extraction and estimation

Innovative Claim

- (1) Pushbroom mosaics for 3D dynamic scenes
- (2) Natural matching primitives for 3D urban scenes
- (3) Content-based 3D mosaics (CB3M) for 3D & motion

- Expected Contribution to Research Area
- An efficient and more accurate representation for large scale scenes;
A new natural matching approach for both urban structures and moving targets

• Smart Brain for Miniature Robots (Uyar, Xiao, supported by NSF MRI)



Principle Investigator:

Dr. [Jizhong Xiao](#), EE Dept., Director of CCNY Robotics Lab



Co-PIs:

Dr. [Zhigang Zhu](#), CS Dept., Director of CCNY Visual Computing Lab



Dr. [Myung Lee](#), EE Dept., Director of Advanced Wireless Networking Lab



Dr. [George Wolberg](#), CS Dept., Director of Image Processing, Graphics, and Vision Lab

Senior Personnel:

Dr. [Ali Sadegh](#), ME Dept., Center for Advanced Engineering Design and Development

Dr. [Esther Levin](#), CS Dept. Director of Speech and Natural Language Lab

Dr. [Michael Grossberg](#), CS Dept., Director of Graphics Learning and Smart Sensors Lab

Dr. [Umit Uyar](#), EE Dept., Director of Multimedia Lab

Steering Committee:

Professors Joseph Barba (Dean, Grove School of Engineering), Roger Dorsinville (Chairman, EE Dept.), Douglas Troeger (Chairman, CS Dept.), Neville A. Parker (Director, NYC-LSAMP)

Advisory Committee:

Eleven experts from leading universities and industry.

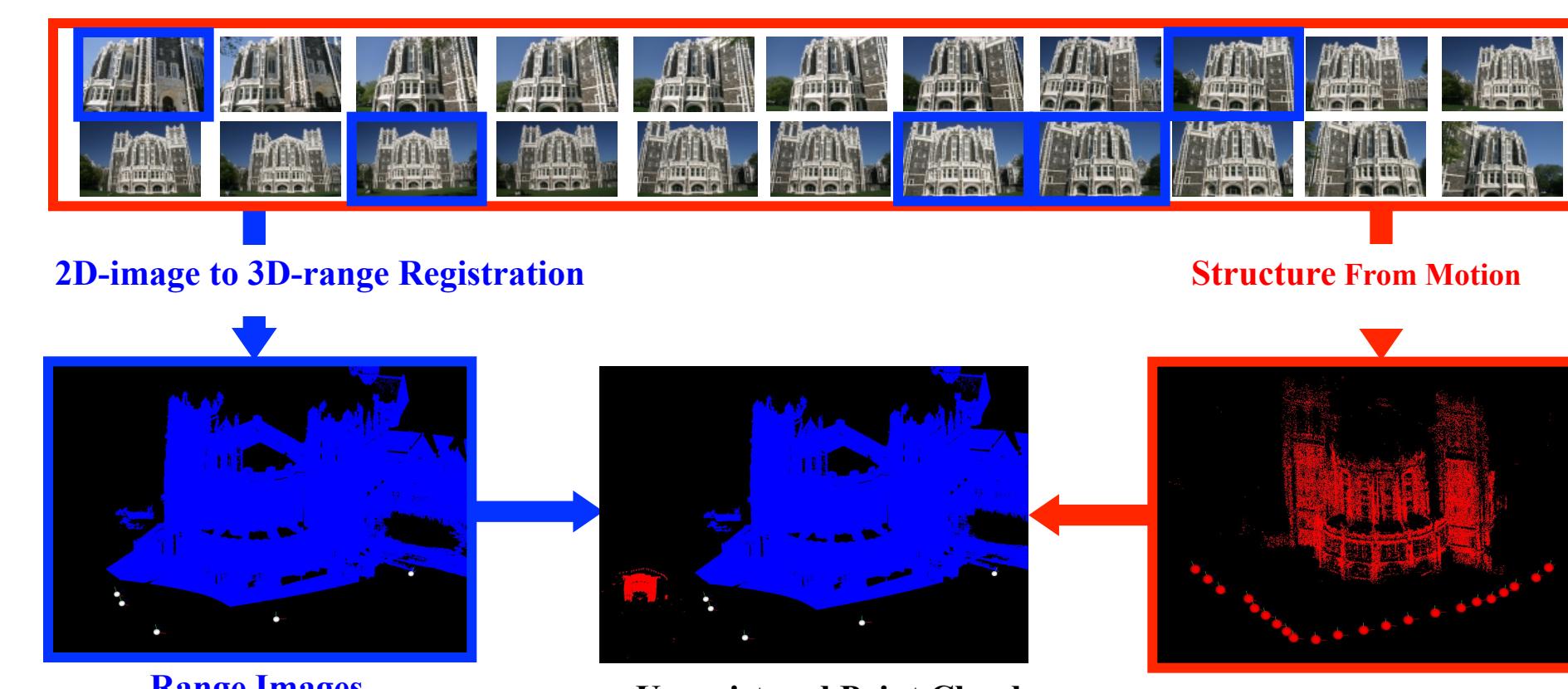


Current Projects

• Speech and Natural Language Processing

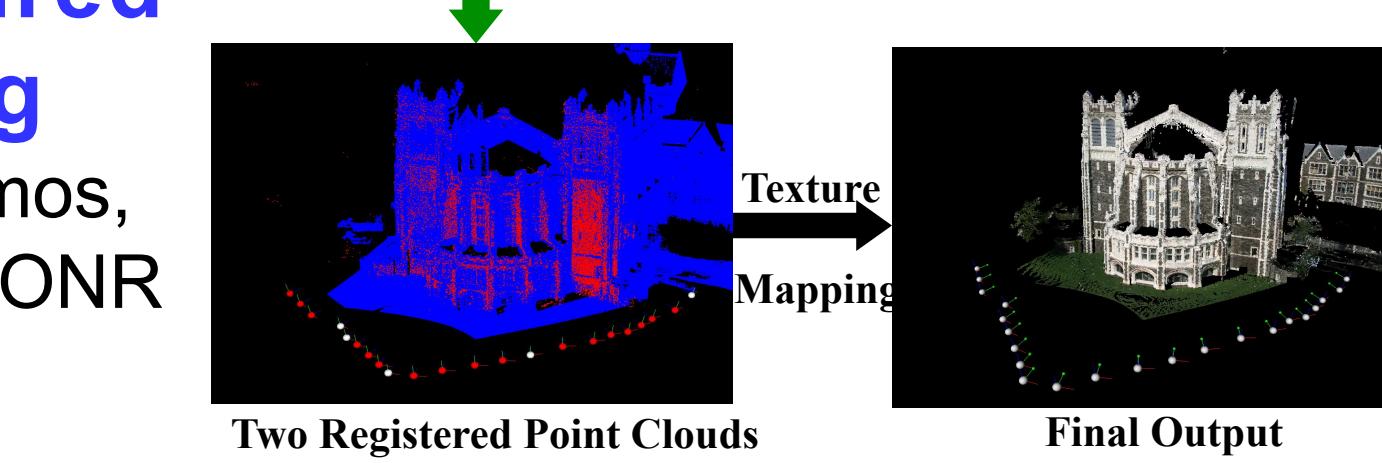
(Levin, with Columbia, supported by AFRL)

- 1) Evaluation of the use of Latent Semantic Analysis (LSA) for unsupervised word sense disambiguation.
- 2) Optimization of dialog manager decisions.
- 3) Automatic annotation of semantic categories using dialog data.



• Phototextured 3D Modeling

(Wolberg, Stamos, Supported by ONR and NSF MRI)



• Advanced Wireless Networking

(Lee, Uyar, Xiao, supported by ARL, Samsung, and NSF)

1) Basic Research

- ◆ Wireless Sensor Networks and Mesh Networks
- ◆ Crosslayer Optimization
- ◆ Cooperative Communications
- ◆ Contention Free PHY/MAC
- ◆ Dynamic Survivable Resource Pooling

2) Test-bed & Prototyping

- ◆ Design practical algorithms and systems in WSNs and WPANs
- ◆ Functional components testing and performance analysis
- ◆ Expansion to new PHY/MAC
- ◆ Deployed 50 nodes covering 5th floor of Steinman Hall
- ◆ RISE-NET Development

3) Standardization Activities

- ◆ Meshed tree (IEEE 802.15.5, WPAN)
- ◆ IPv6 over IEEE 802.15.4
- ◆ IEEE 802.15.3c, mmWave
- ◆ ZigBee
- ◆ Currently all standardization efforts are supported by Samsung

• Multimodal Surveillance

(Zhu, Wolberg, Levin, with UIUC and RPI, supported by AFRL)

