



RUTGERS

Center for Advanced Infrastructure
and Transportation

USDOT Region 2 University Transportation Center

AR/VR in Life-Cycle Management of Transportation Infrastructure Projects

Jie Gong, Ph.D., Associate Professor

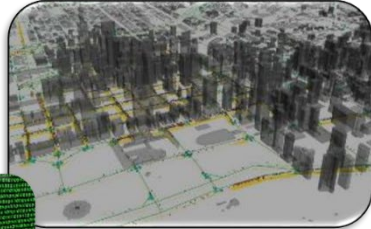
Yi Yu, Ph.D. Student

Rutgers University

Research Area and Current Research Team



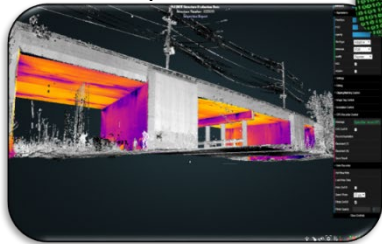
Virtual Design,
Construction, and
Operation



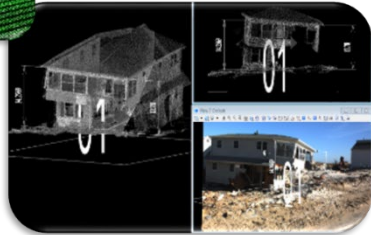
Smart and
Accessible Cities



Sensing, Artificial
Intelligence, and
Optimization



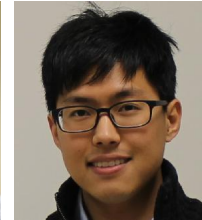
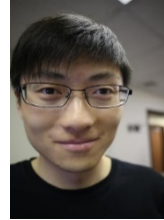
Infrastructure
Condition Assessment



Artificial Intelligence for Disaster
Science

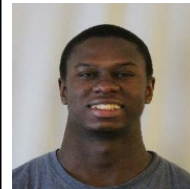


Jie Gong, Ph.D. Associate
Professor,
Department of Civil &
Environmental Engineering
Rutgers University



Ph.D.
Students

NSF Coastal Climate Risk & Resilience Research Trainees



M.S. Students



M.S. Students



Ph.D. Student



Project goals

- Help transportation stakeholders achieve better understanding of the utility of AR/VR technologies.
- Encourage wider acceptance of VR/AR technologies in life-cycle management of transportation infrastructure systems through literature synthesis, technology evaluation, application development, and technology demonstration.



Research Approaches

- Document the technical capabilities, advantages, and limitations of the technology through literature analysis and hand-on evaluation of the representative VR/AR technologies
- Evaluate the feasibility of the above VR/AR technologies in supporting a selected set of use cases in transportation infrastructure management.
- Conduct additional development on the most promising platform to explore the deep integration of VR/AR technologies with project data in supporting real-time interactive computing and simulation in VR/AR environment.

Research Approaches

UAV-borne Sensing



DJI S1000+ (15 lb payload)


 Sensefly Albris
 (close inspection)

Vehicle-borne Sensing



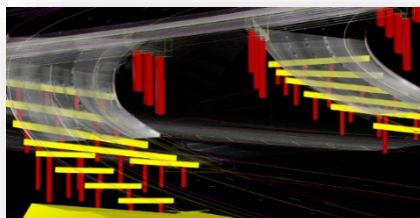
Mobile LIDAR


 Spatially-Resolved Infrared
 Thermography System
 (SPIRIT)

Foot-on-ground Sensing



Static Lidar

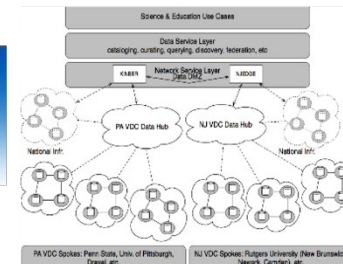

 SLAM based Indoor
 Mapping


Content and Model Development



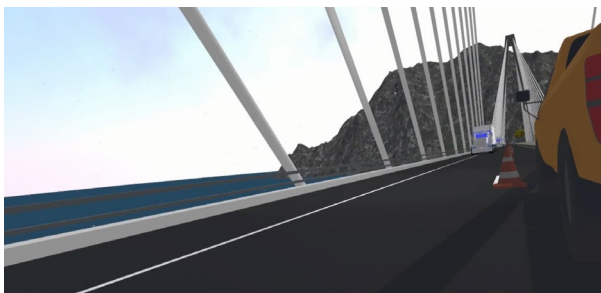
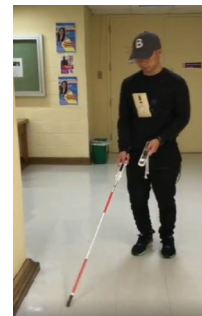
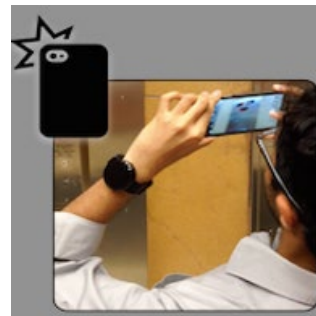
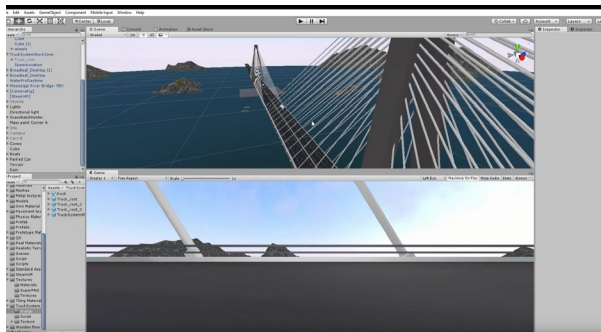
From Virtual Reality to Mixed Reality to CAVE


 GPU Cluster for Machine
 Learning

 Cloud Computing
 (Microsoft Azure and
 Amazon AWS)

 NSF DIBBS: Virtual Data Collabratory (A
 Petabyte Scalable Data Infrastructure)


Demonstration and Focus Groups

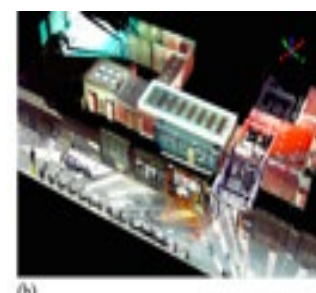
Project Examples



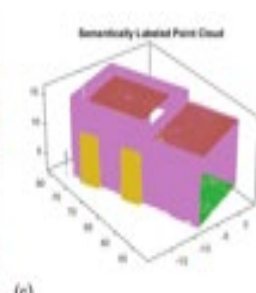
Bridge Maintenance and Repair



Critical Facility



(b)



(c)

Live Facility Model for Indoor
Navigation

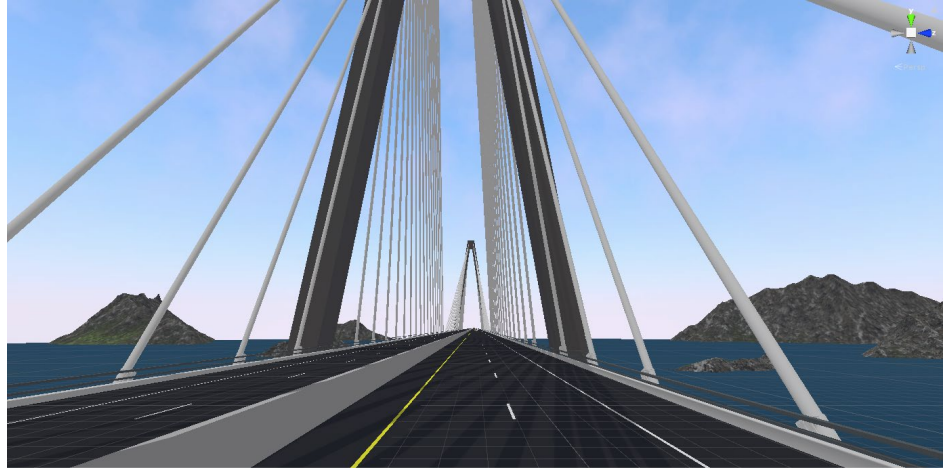


Virtual Bridge for Maintenance Training

This VR training module is a full-scale cable stayed bridge which was modeled after the Stan Musial Veterans Memorial Bridge.



The real bridge



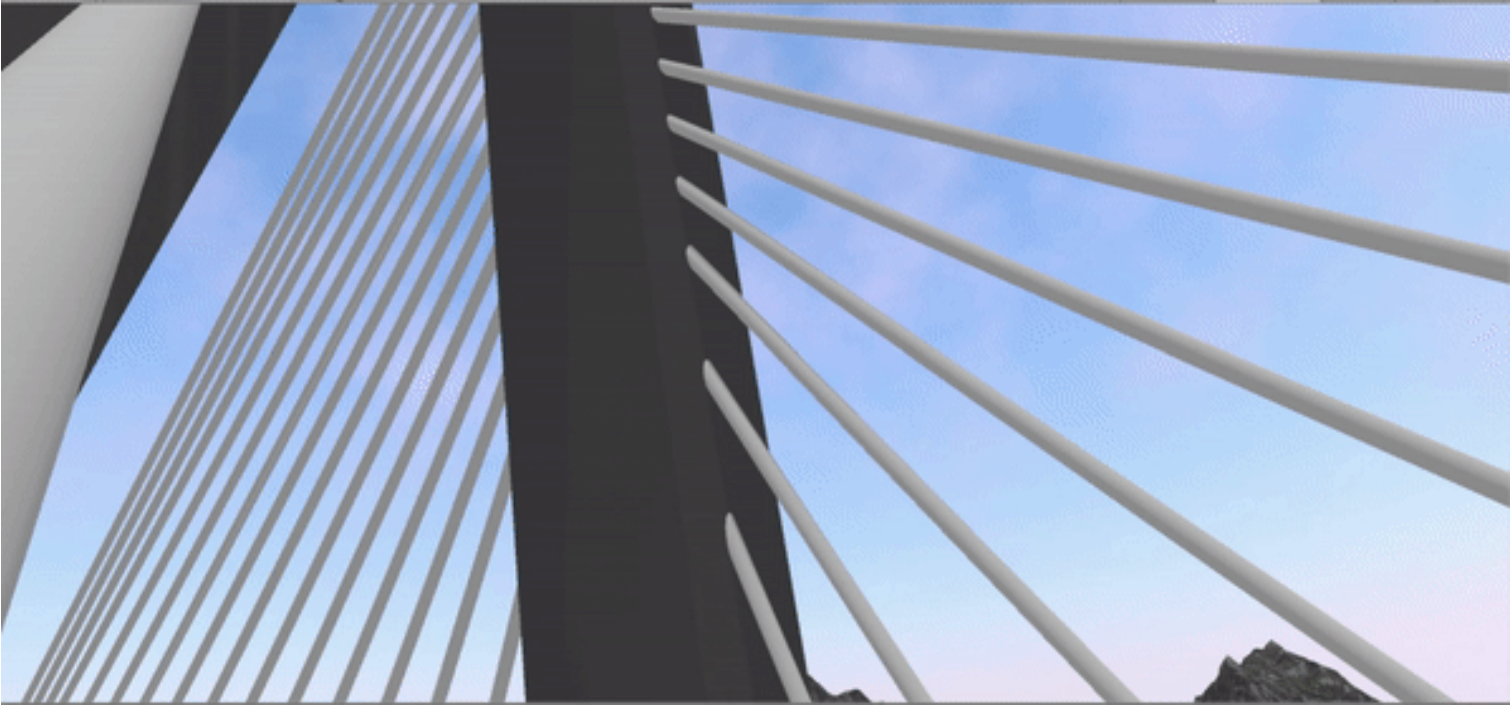
The VR bridge

This bridge VR module can be used for training bridge inspection activities and for training work zone setup .



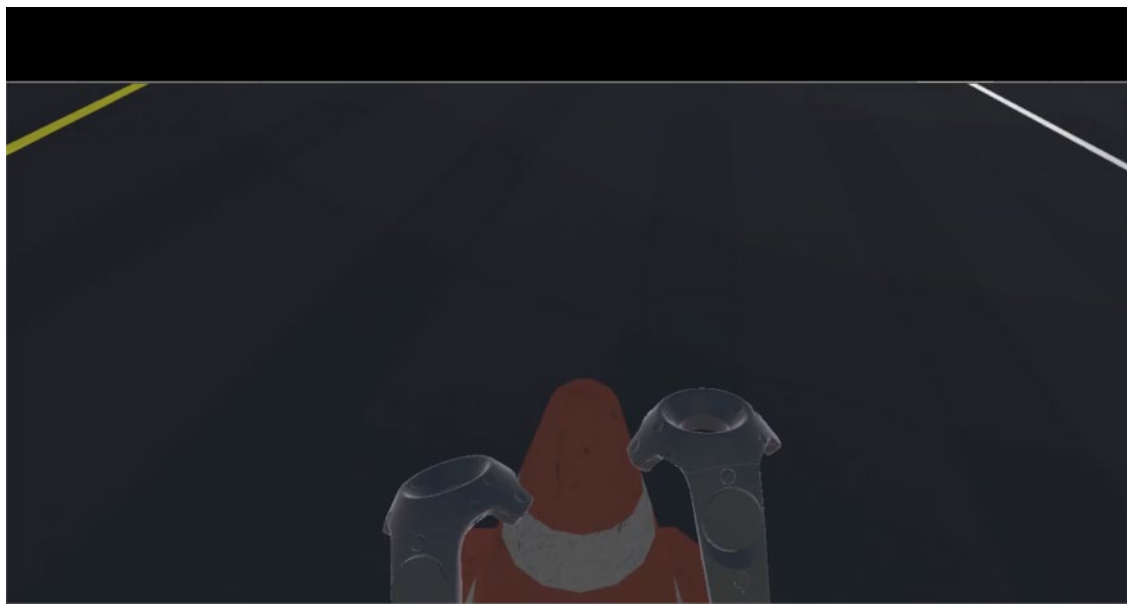
Virtual Bridge for Maintenance Training

Users can navigate to any part of the bridge and examine structure components.



Virtual Bridge for Maintenance Training

The module provides mechanisms to interact with work zone objects such as, working vehicles, traffic cones and signs.





Virtual Bridge for Maintenance Training

The traffics are programmable, so does the weather conditions.





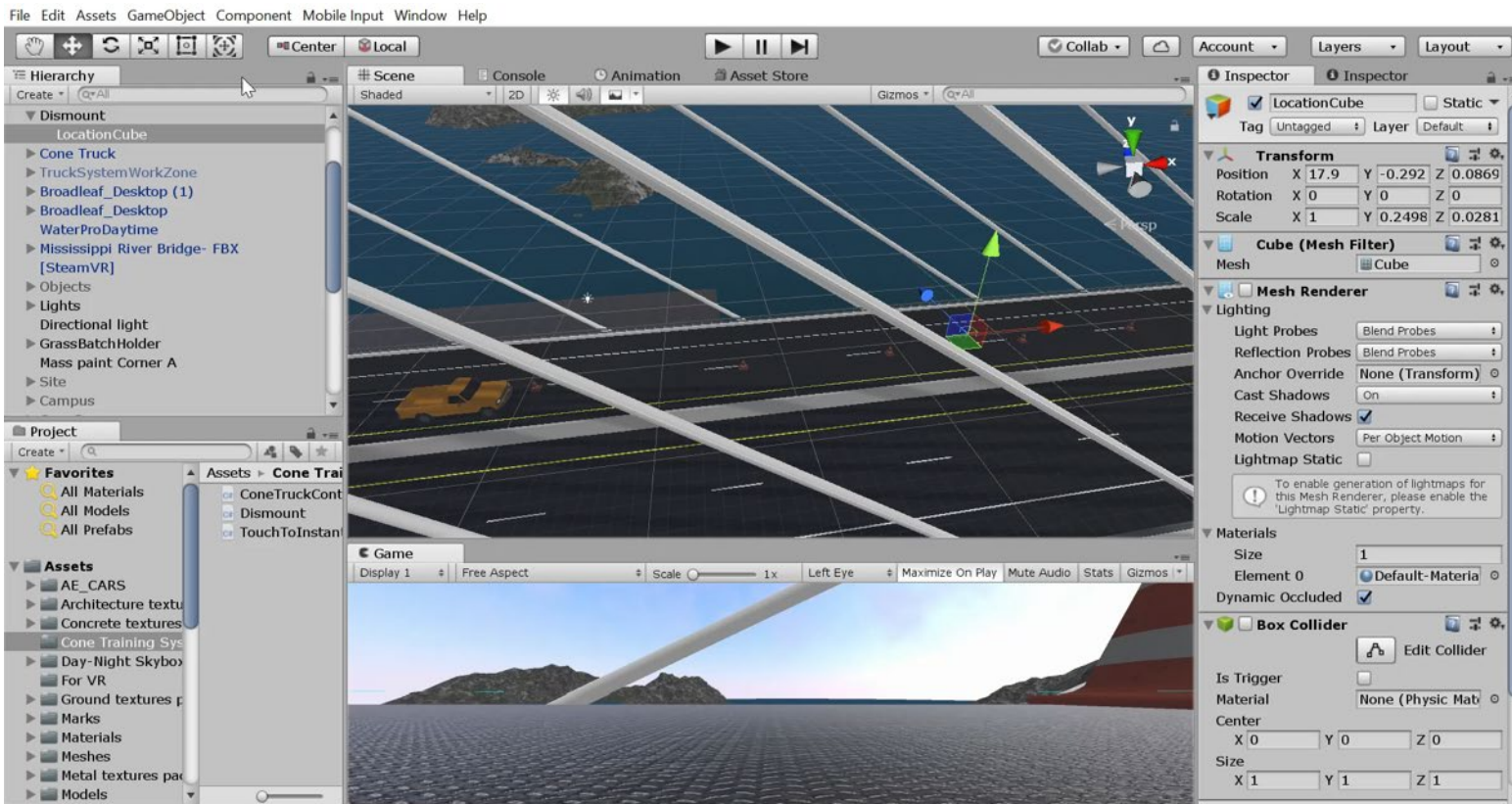
Virtual Bridge for Maintenance Training

Simulation of accidents



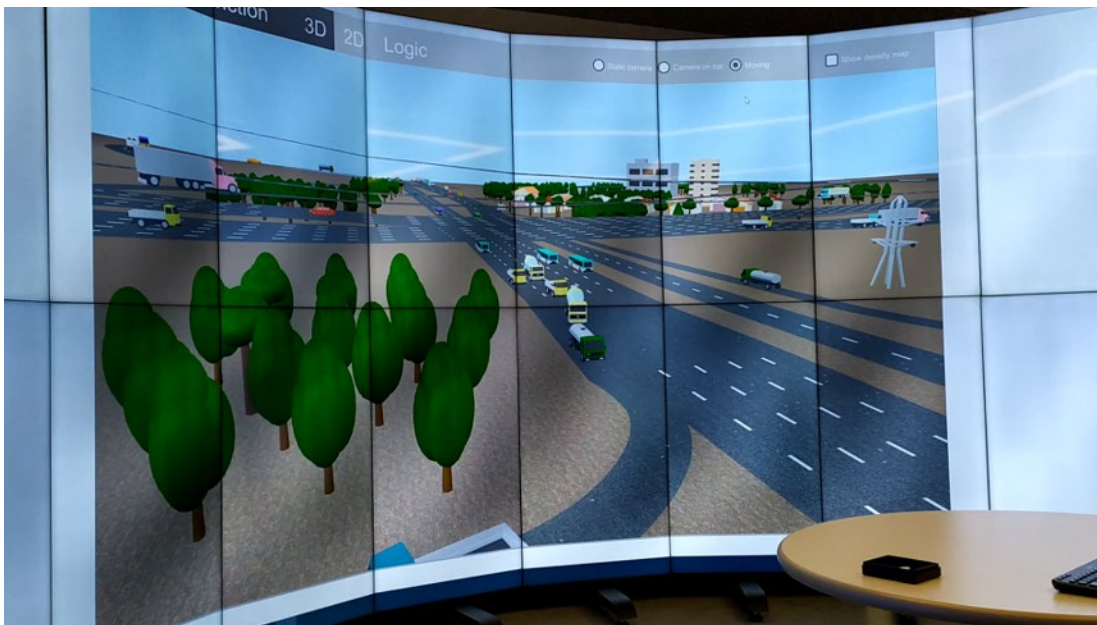


Traffic Cone Placement from a Moving Platform





Path Forward:



Integrating Traffic Simulation into VR environments for immersive training



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Questions and Comments