



Simulation Training and Control System for Bridge Inspection

Dr. Siming Liu, Lecturer
UNR
August, 2018



Outline

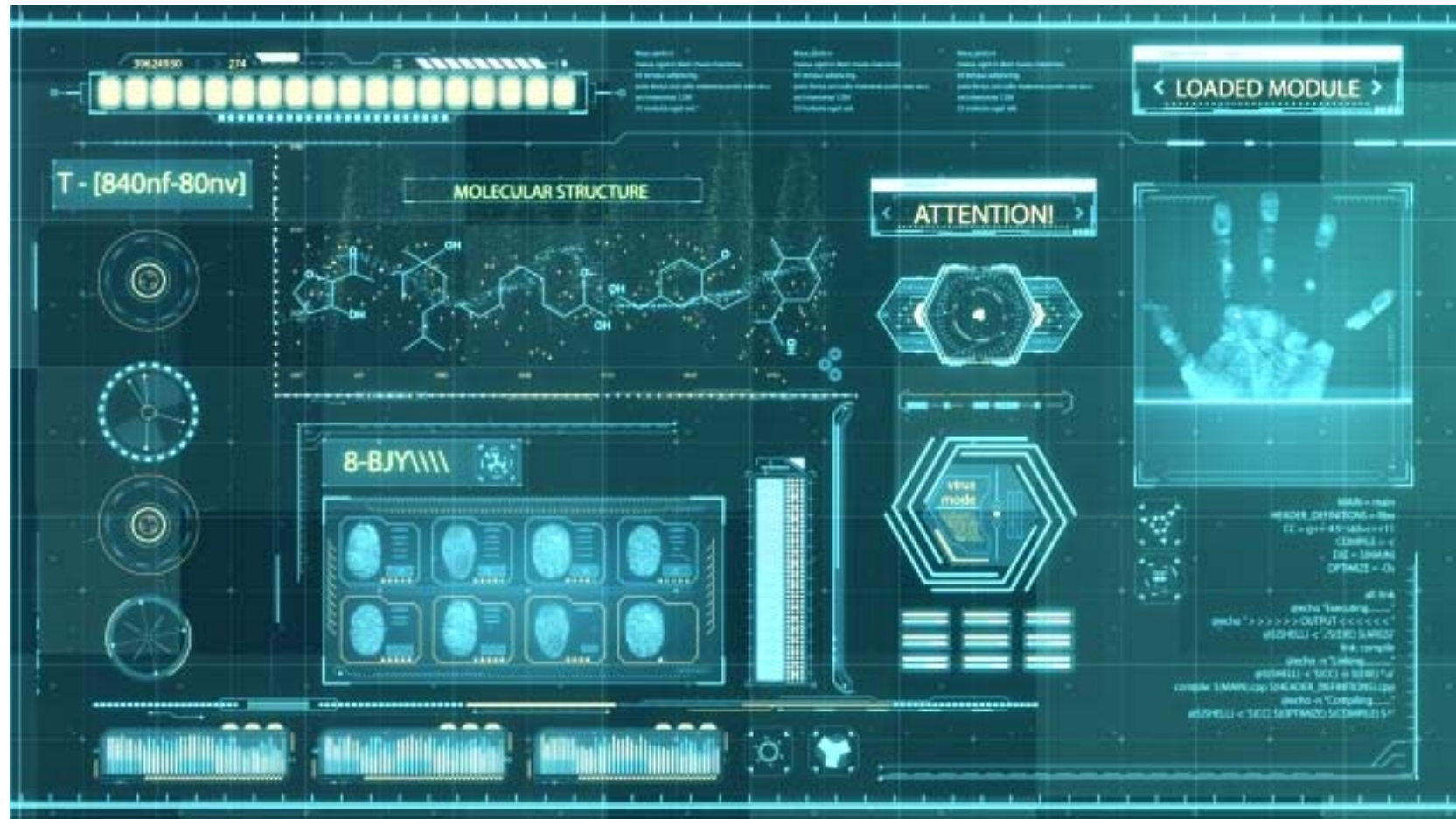
- **Background**
- **Project Objectives**
- **Current Status**
- **Future Work**



Traditional Transportation Interface



What We Want...

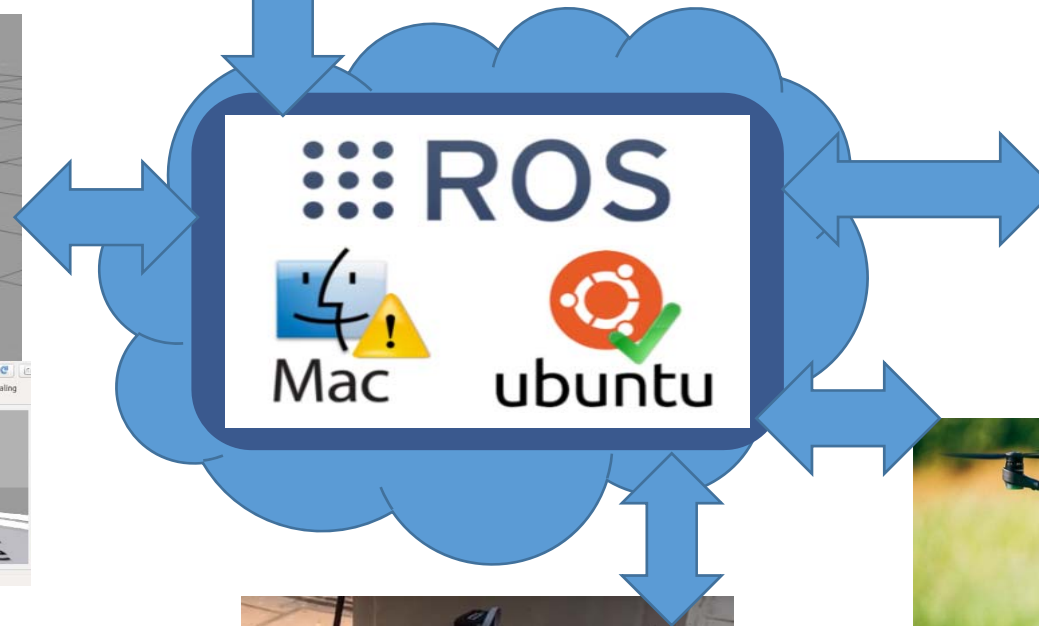
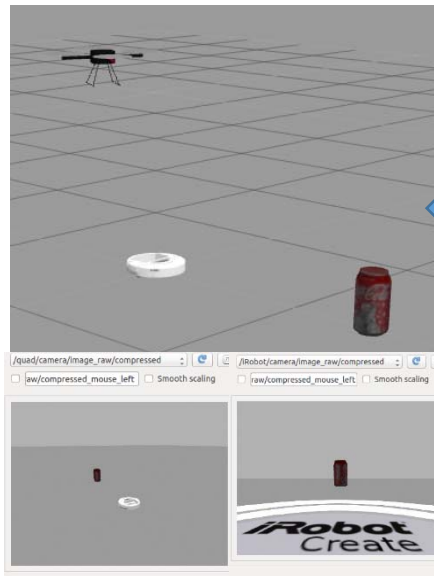
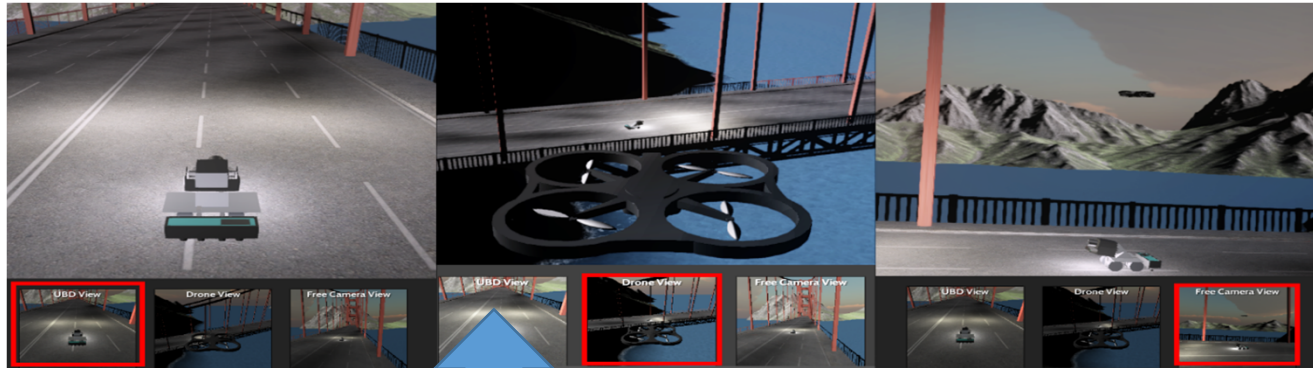


Project Objectives

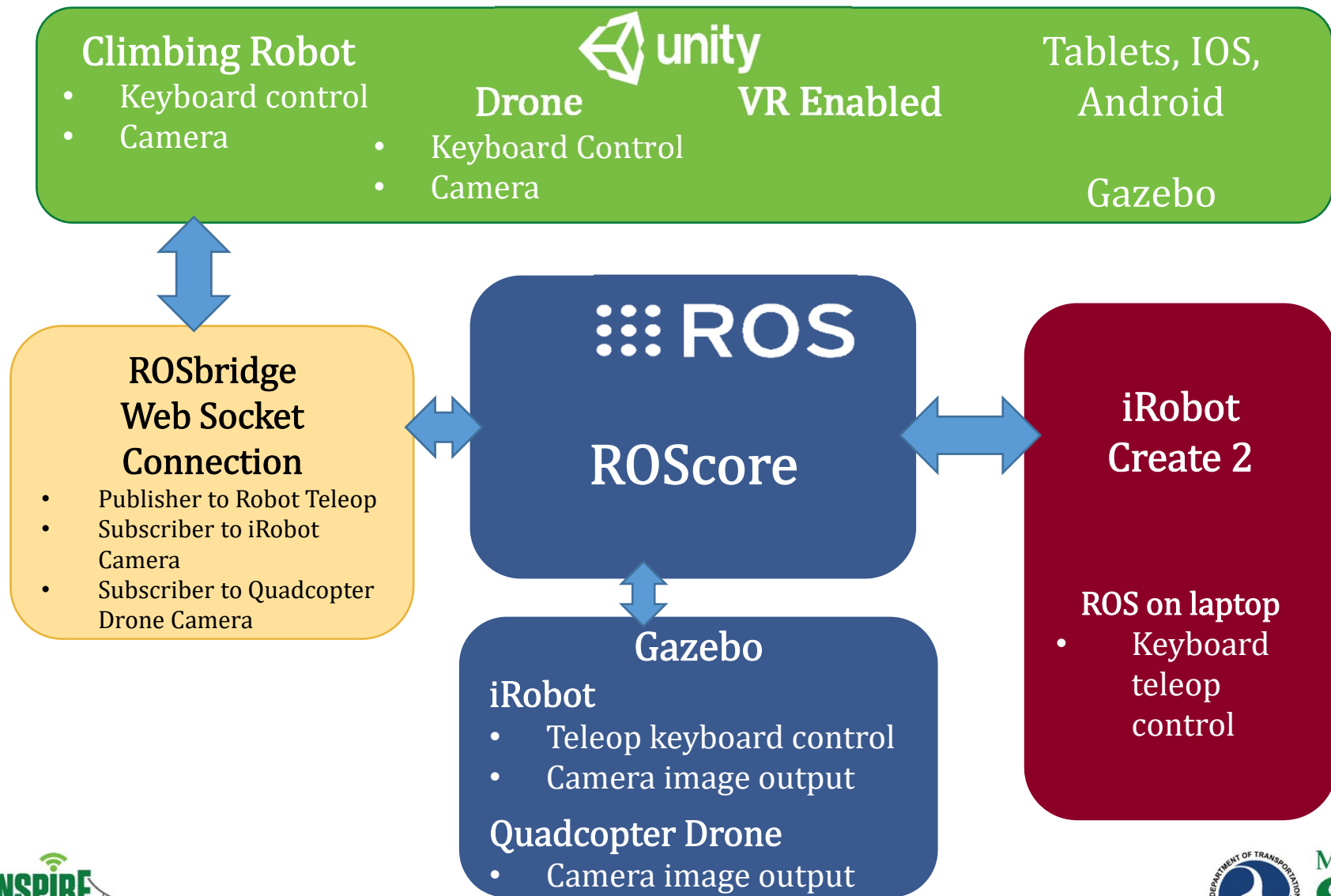
- Build a STACS in a 3D environment and develop a realistic training environment
 - Design of GUI and Interaction for STACS
 - ✓ *Integrated user interface*
 - ✓ *All platform support (PC, Mac, Tablets, IOS, Android, etc.)*
 - ✓ *Virtual Reality support (HTC Vive, Oculus Rift, etc.)*
 - ✓ *Replay support for training purpose*
 - Inspection task planning
 - ✓ *Robot inspection routes planning*
 - ✓ *Multiple robots support (10 robots inspecting the golden bridge)*
 - Autonomous control
 - ✓ *AI control over climbing robots*
 - ✓ *AI control over drones*
 - ✓ *Reduce the number of human operators*



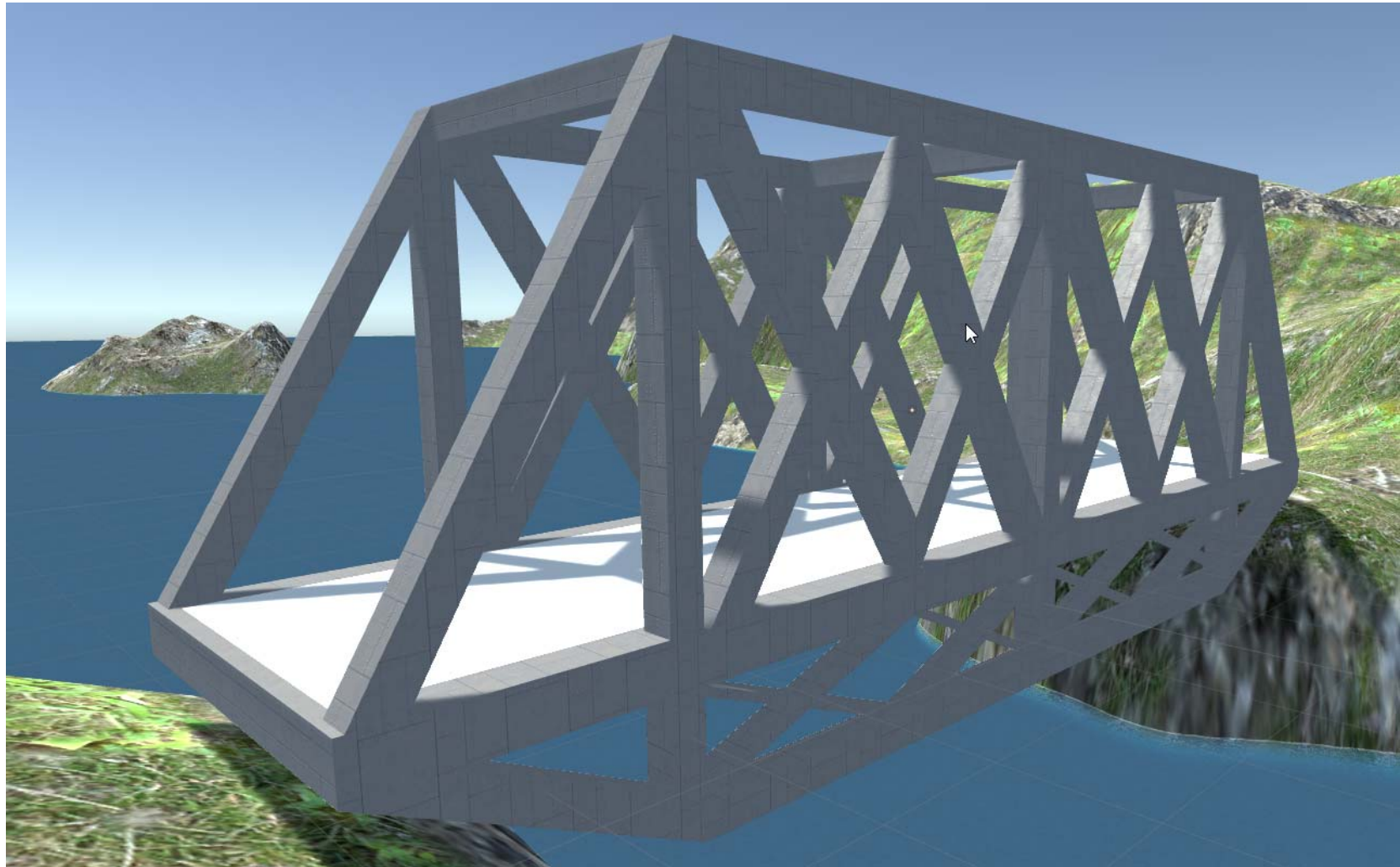
System Architecture



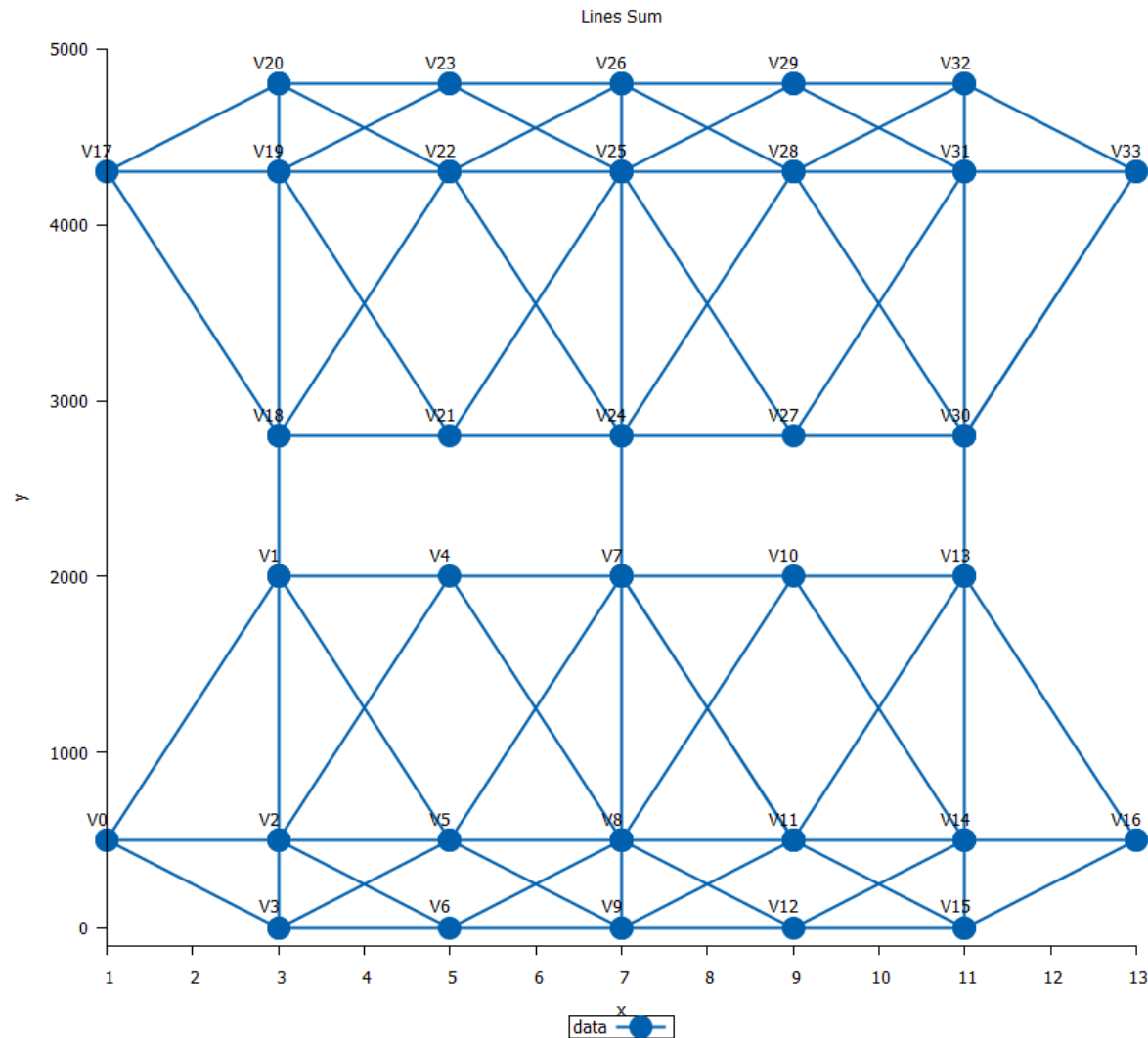
System Architecture



Bridge Inspection Example

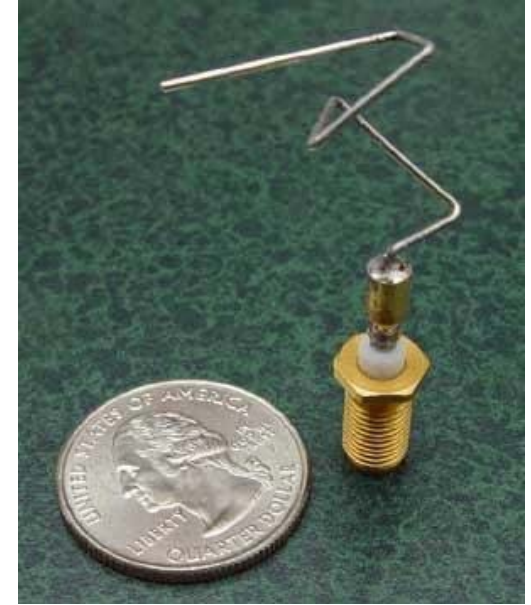


Graph Representation - ARP



Genetic Algorithms

- **Search Algorithms**
 - **Concentration**
 - **Exploration**
- **Why GAs?**
 - **Being used to problems that cannot be solved easily using other techniques**



A NASA spacecraft antenna

Genetic Algorithms

- **Terminology**

- **Chromosome**

- ✓ *A possible solution*

- **Population**

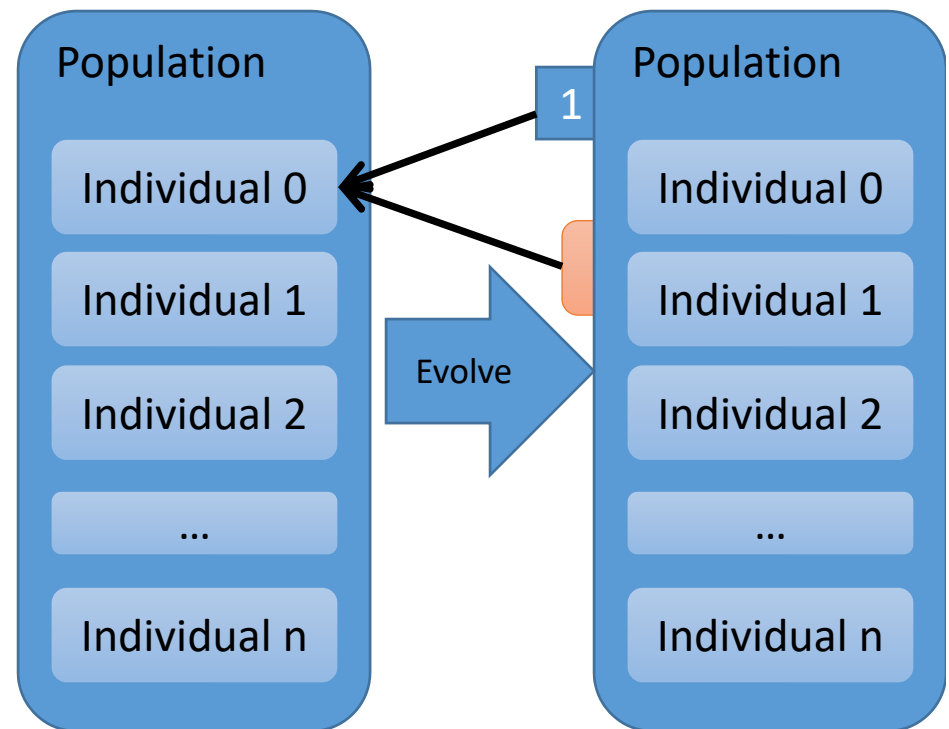
- ✓ *A set of chromosomes*
 - ✓ *Typically, initial population contains completely random chromosomes*

- **Fitness**

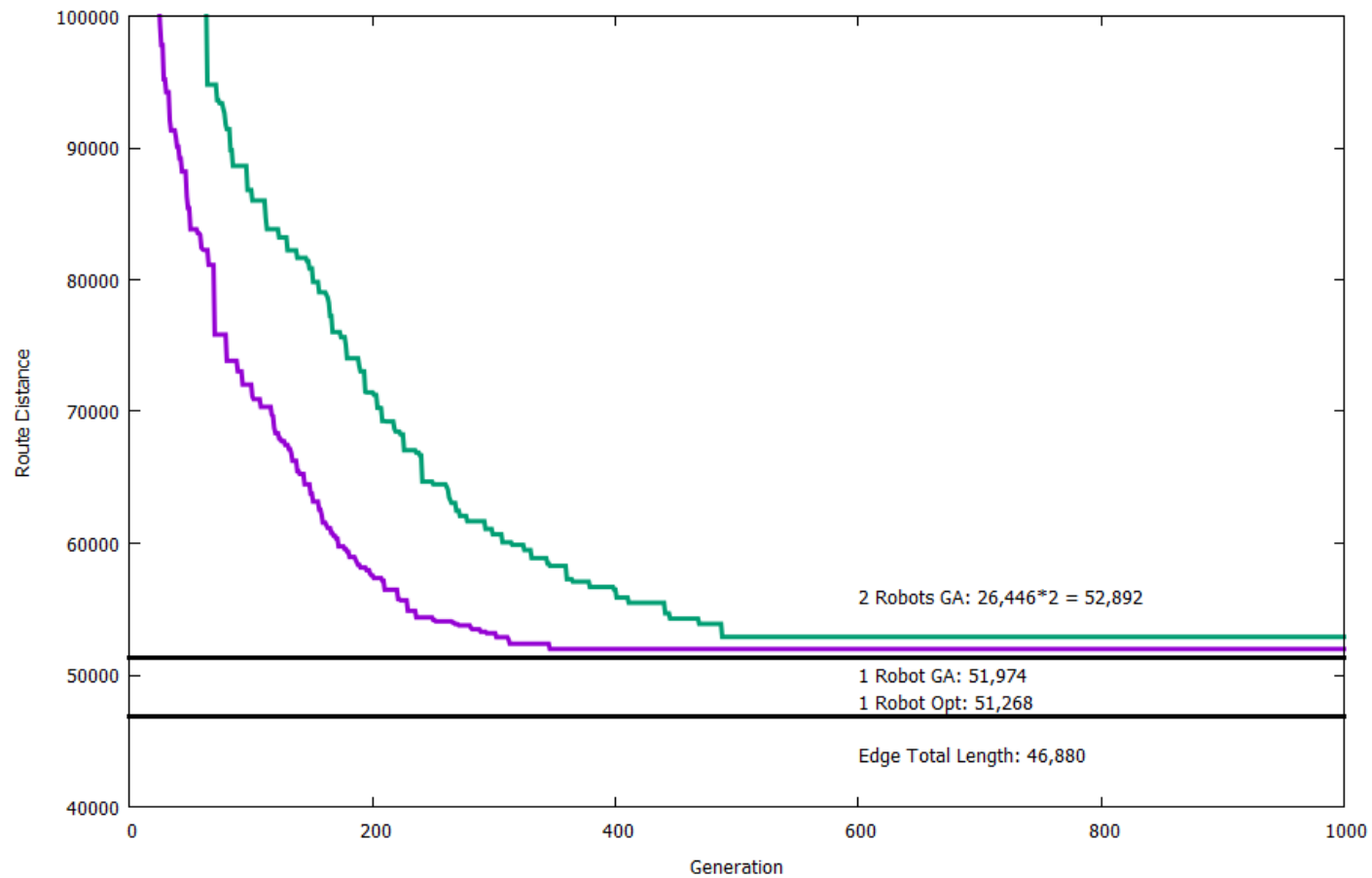
- ✓ *A measure of how well a solution/chromosome solves a problem*

- **Generation**

- ✓ *The number of iterations we repeat the process*



Results



Future Work

- **Integrate STACS with robots on field**
- **Route Planning Integration**
- **AI control over robots and drones**
- **Training support**
- **Video game for education purpose**



Acknowledgement

- This project was partially funded by the **INSPIRE University Transportation Center (UTC)**.
 - Financial support for INSPIRE UTC projects is provided by the U.S. Department of Transportation, Office of the Assistant Secretary for Research and Technology (USDOT/OST-R) under Grant No. 69A3551747126 through INSPIRE University Transportation Center (<http://inspire-utc.mst.edu>) at Missouri University of Science and Technology. The views, opinions, findings and conclusions reflected in this publication are solely those of the authors and do not represent the official policy or position of the USDOT/OST-R, or any State or other entity.

