UMassAmherst

Team Pishro-Nik

Project Crossroads
Vehicular Ad-Hoc Network for Collision Warning

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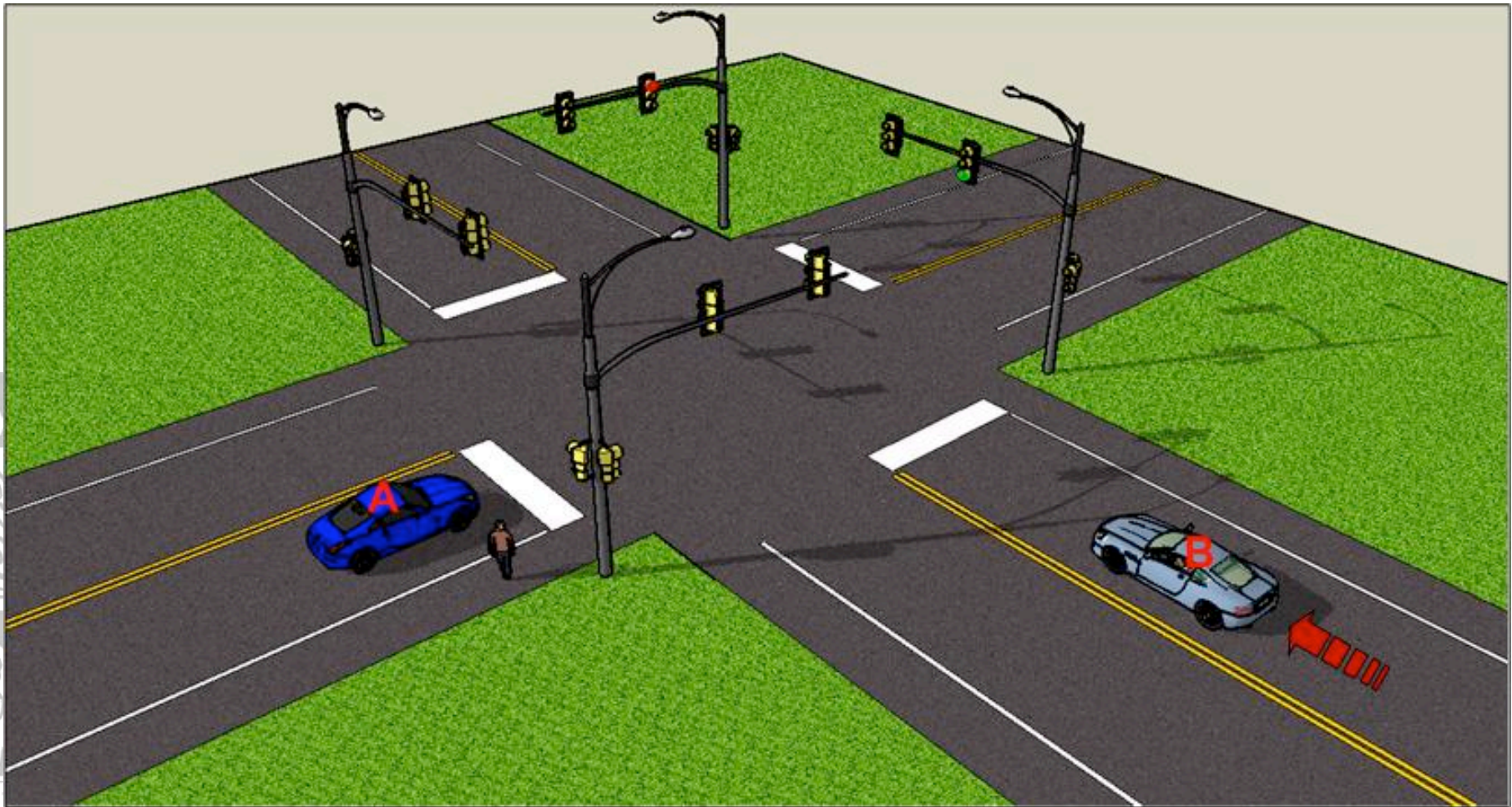   Daniel Marcq, Anthony Swochak

Outline

- Introduction Scenario
- Motivation
- Proposed Solution/Theory of Operation
- Design Constraints
- Block Diagrams
- Time Scenario
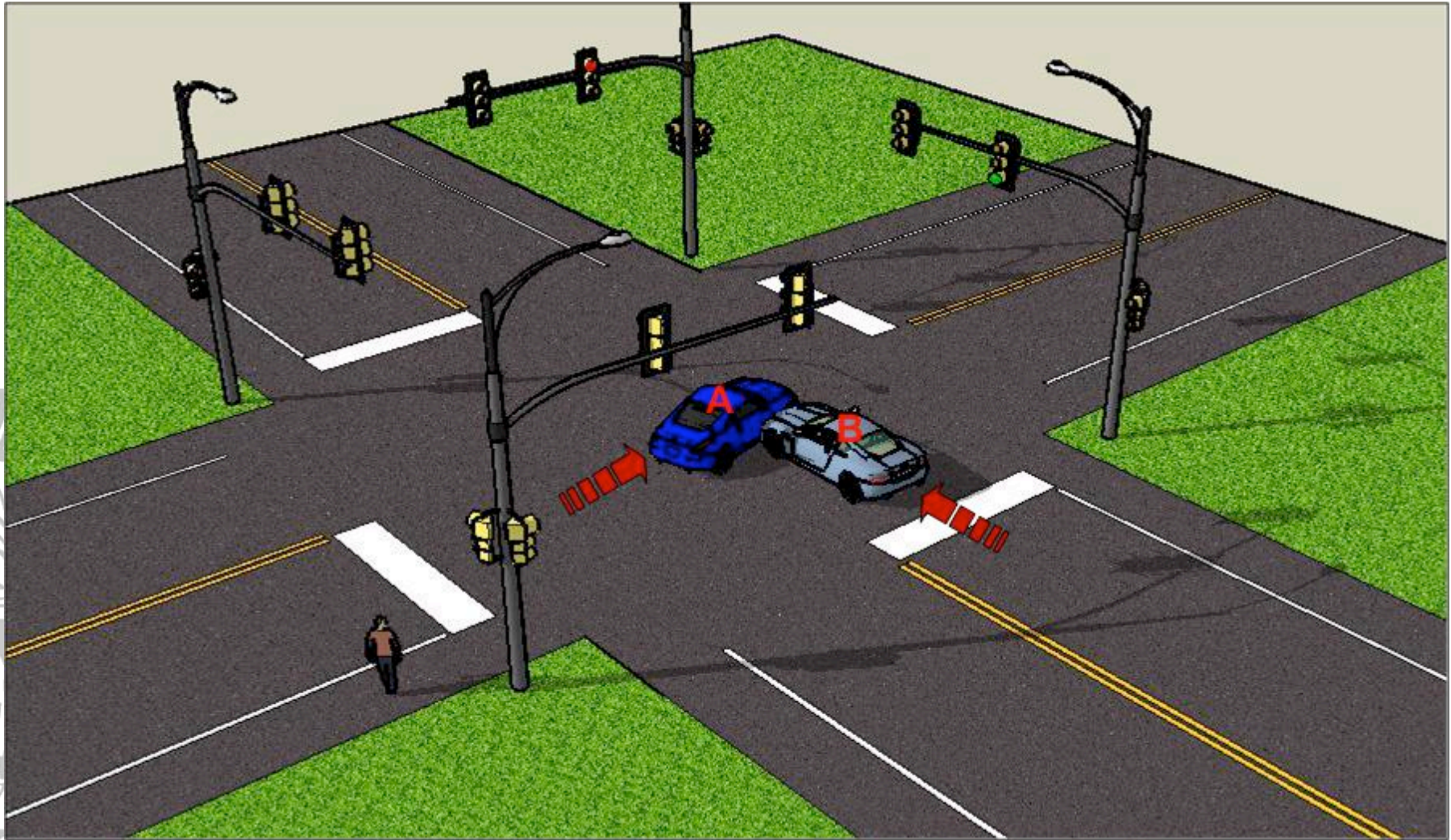- Field Testing
- Realized System
- Conclusion

# Introduction Scenario

Introduction Scenario

Motivation

- In the United States of America
  - 45% of all collisions occur at intersections
  - 21% of these are fatal (9213 Total in 2003)
  - More than one person per hour
- Result: Lost Lives, Money, and Time
- Considered High Priority by DOT
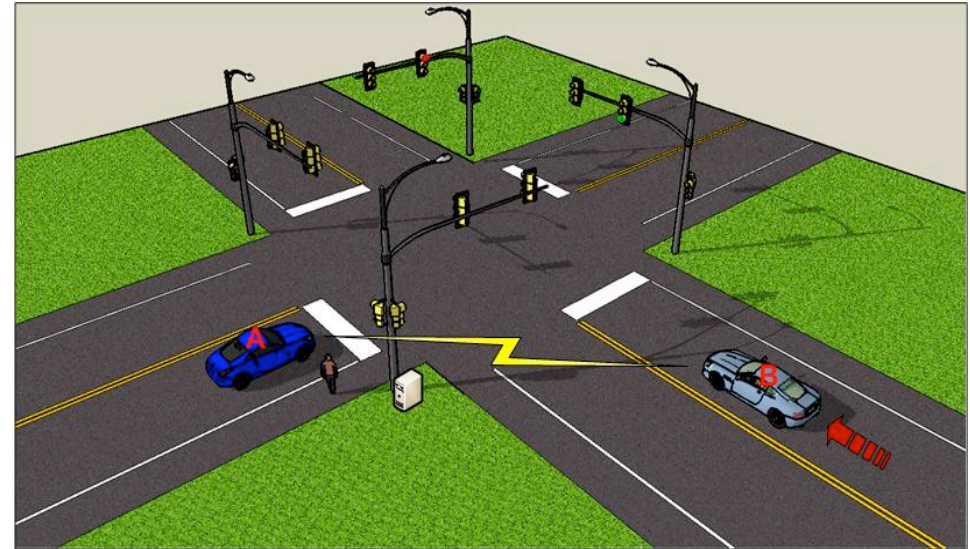- Currently No Adequate Solution
- Easily Adaptable to Other Scenarios

Proposed Solution

Roadside-to-Vehicle Communication
Roadside Equipment (RSE)

Vehicle-to-Vehicle Communication
Onboard Equipment (OBE)
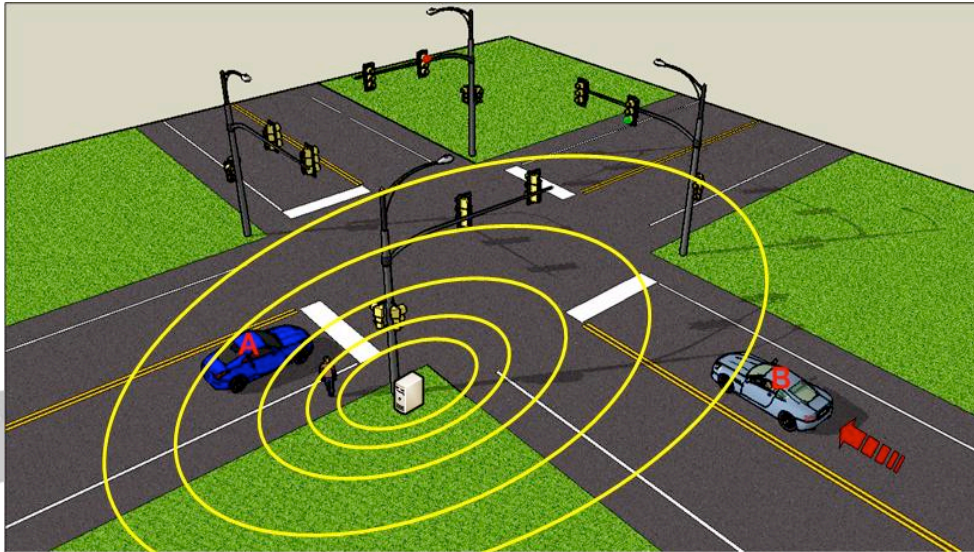
- RSE broadcasts environment variables
  - Stop light conditions
  - Stop line coordinates
  - Intersection ID

- OBE
  - Obtains speed, location from GPS
  - Obtains intersection info from RSE
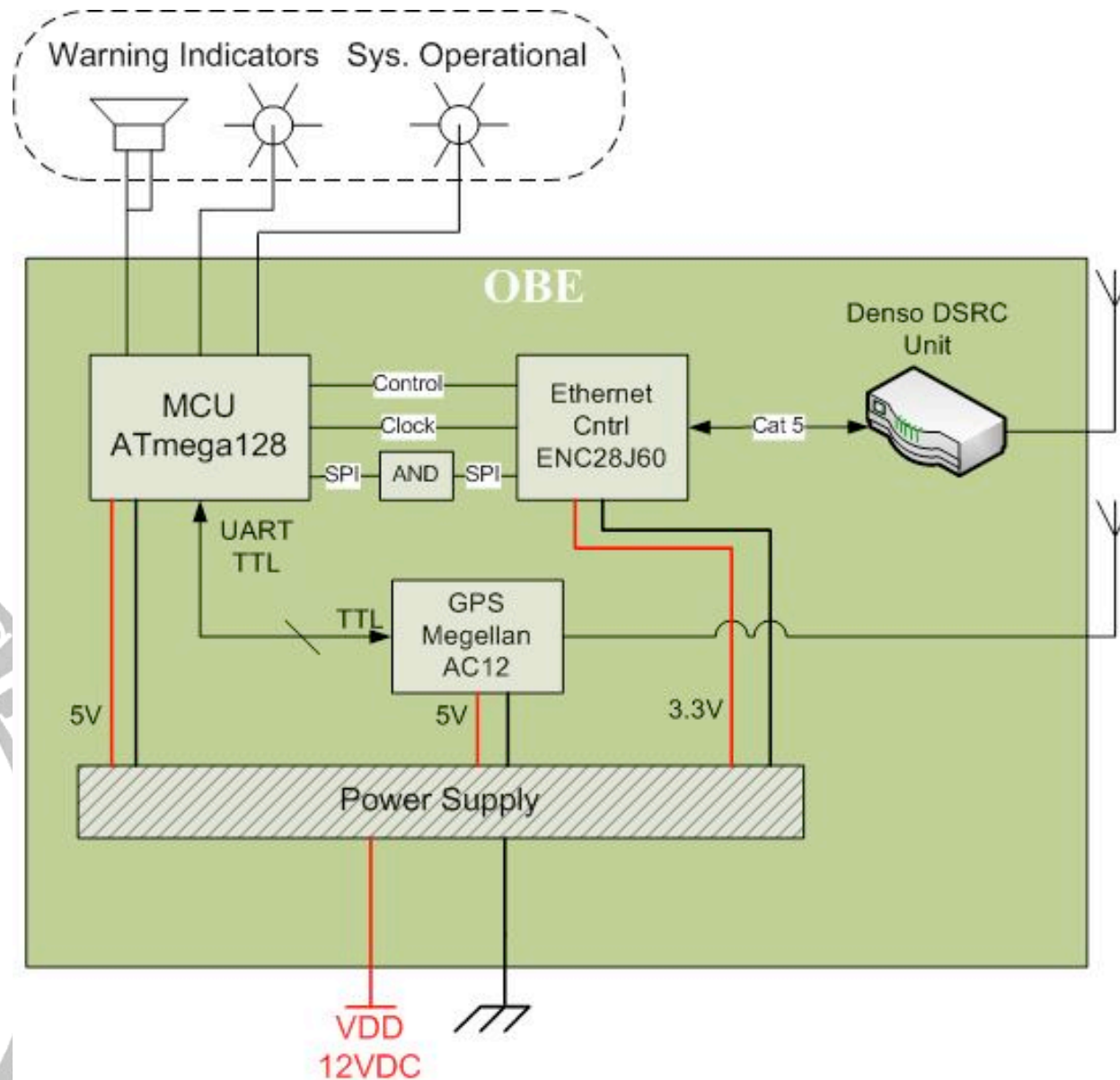 - Calculates warning possibility

Design Constraints

- **Strict Timing Constraints**
  - Safety Critical
  - Consideration toward Human Reaction
- **Budget**
- **GPS Accuracy (within 1.5 meters)**
- **Debug Interface for Testing**
- **Non-Invasive User Interface**
- **Modular Design for Future Adaption**
  - Interface with OBD-II
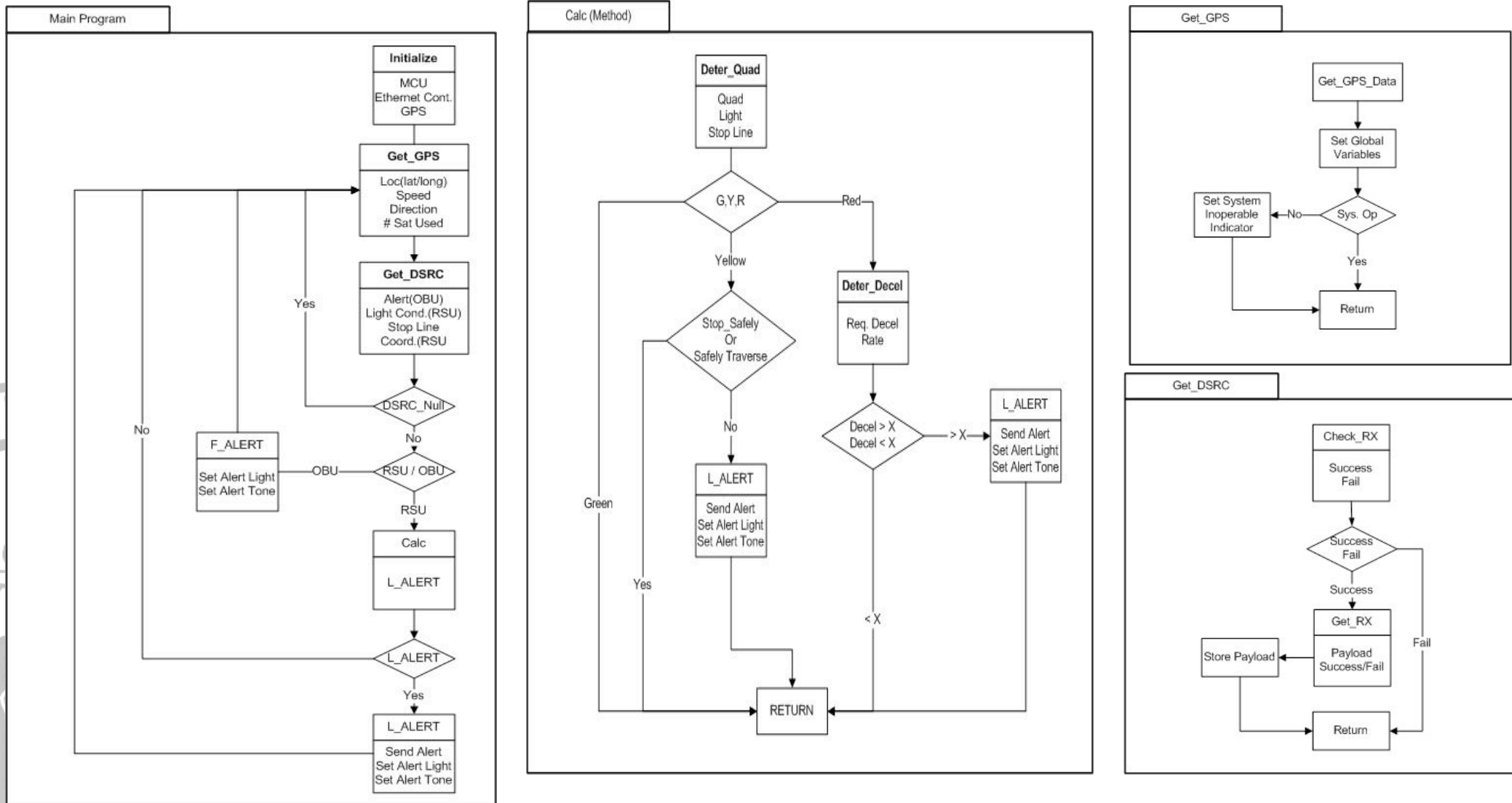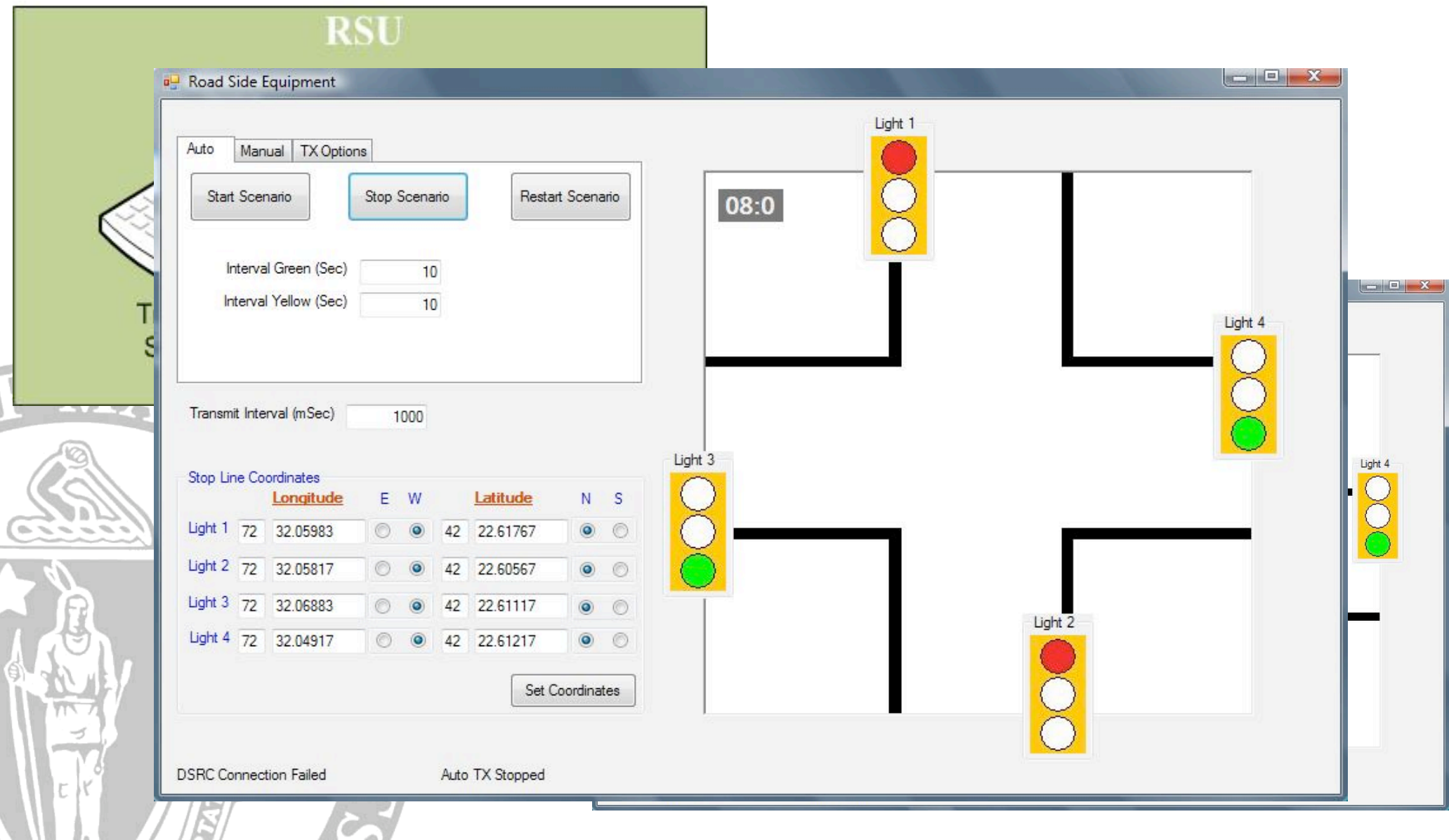 - Future Transportation Applications

OBE Block Diagram

OBE Flow Diagram

RSE Block Diagram
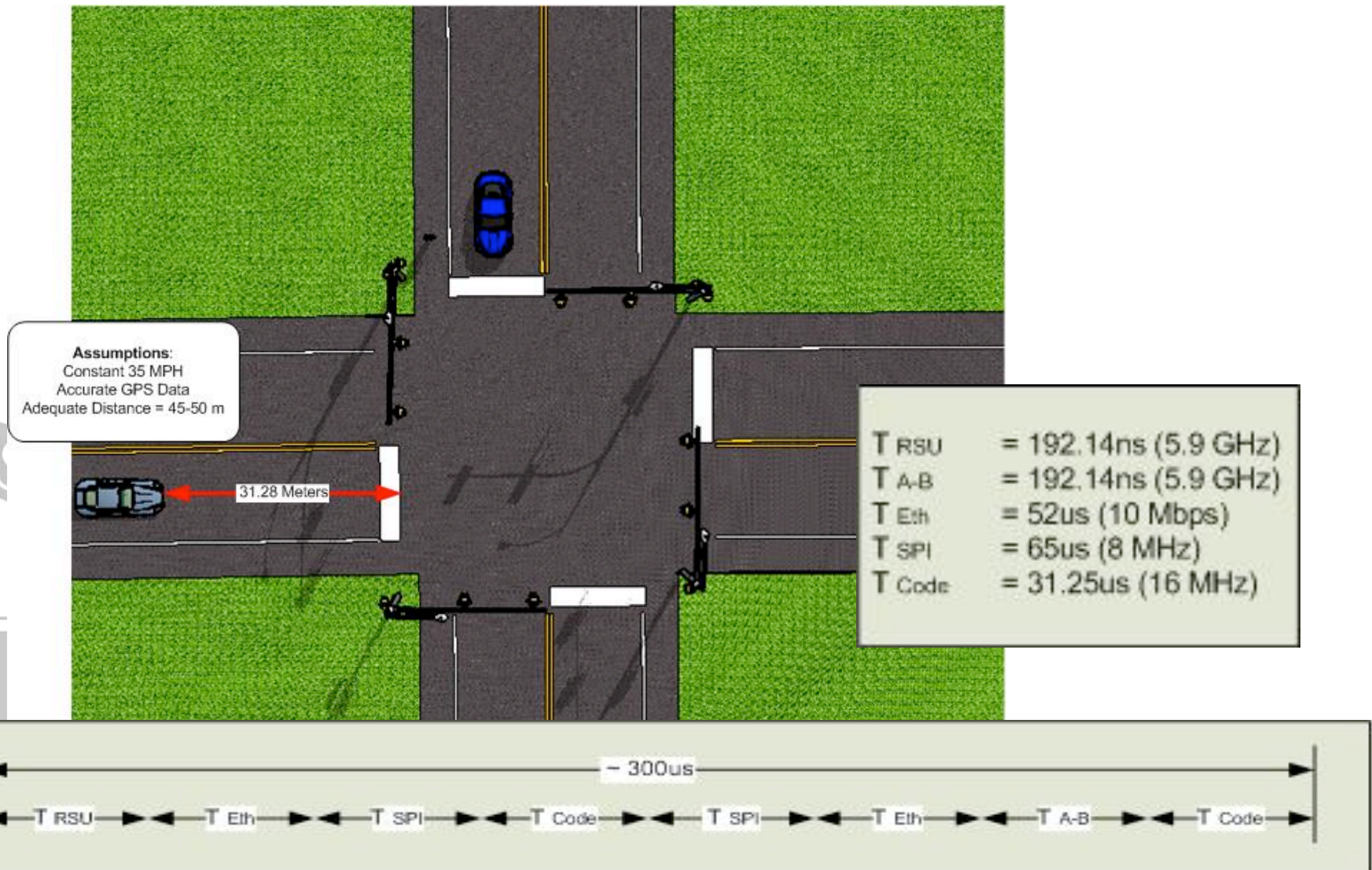
Timing Scenario

Assumptions:
Constant 35 MPH
Accurate GPS Data
Adequate Distance = 45-50 m

31.28 Meters

T_{RSU} = 192.14ns (5.9 GHz)
T_{A-B} = 192.14ns (5.9 GHz)
T_{Eth} = 52us (10 Mbps)
T_{SPI} = 65us (8 MHz)
T_{Code} = 31.25us (16 MHz)

~ 300us

T_{RSU} — T_{Eth} — T_{SPI} — T_{Code} — T_{SPI} — T_{Eth} — T_{A-B} — T_{Code}
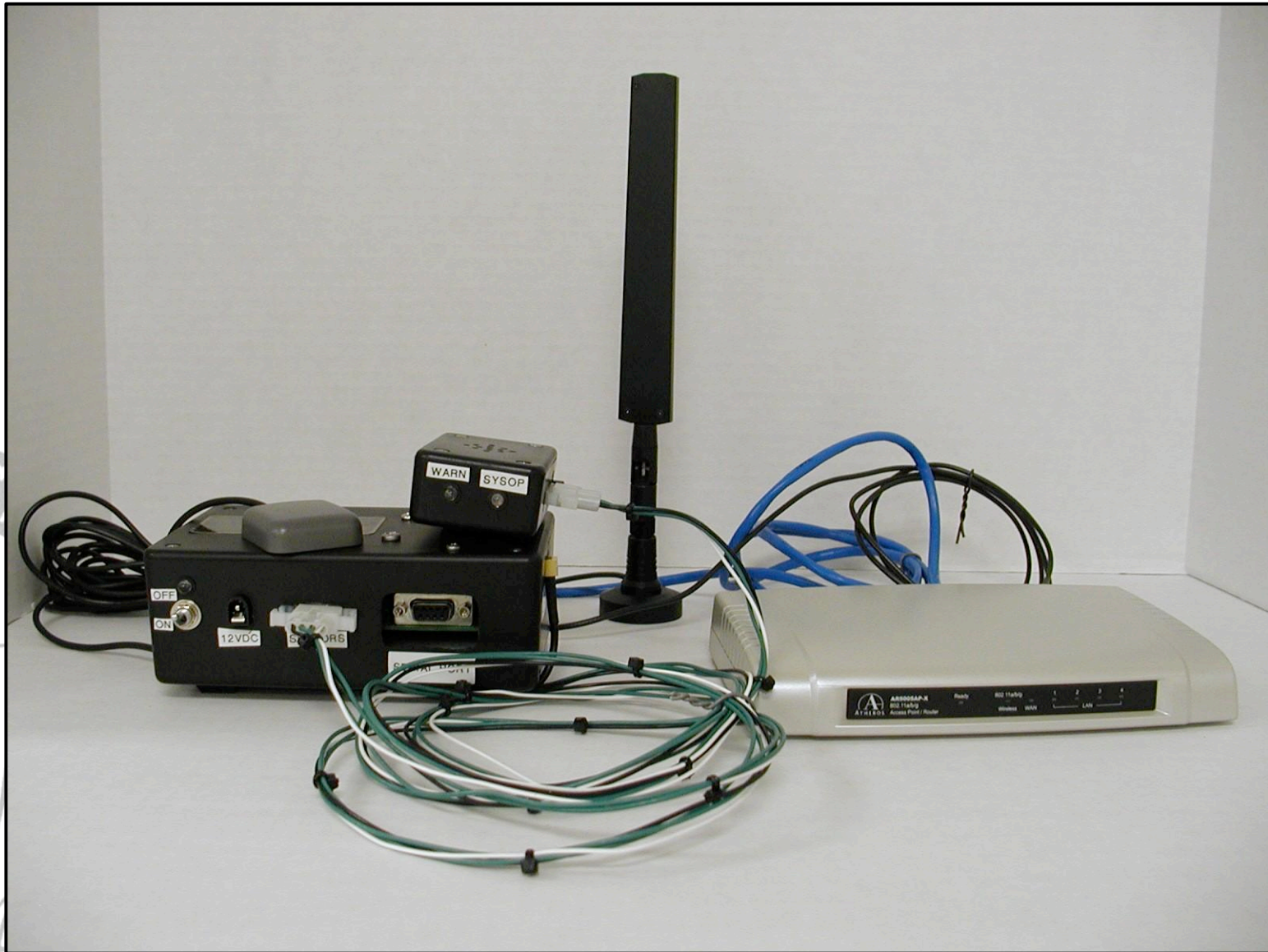
Field Testing

- Conducted at UMass Football Stadium
- Utilized the RSE for Virtual Traffic Scenarios

Realized System

Concluding Remarks

- Functional Testing
- Restrictions with DSRC
- Inaccuracies of GPS
- Full Scale Implementation
  - RSE Integration
  - OBE Integration
- Future Adaptability