Symbiotic Evolution of Application and Networks of Connected and Automated Vehicles: A Case Study of Transportation and Public Safety

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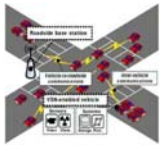
Symbiotic Evolution of CAV Applications and Networks

Vehicle paradigm shift

Individual, human-driven vehicles

Connected, automated vehicles (CAV)

Driving safety

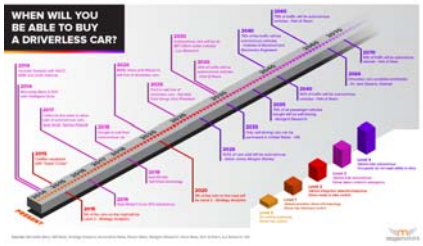


Eliminate up to 90% accidents

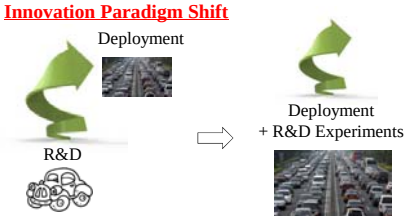
Networked fuel economy optimization

8-16% fuel consumption by simple strategies

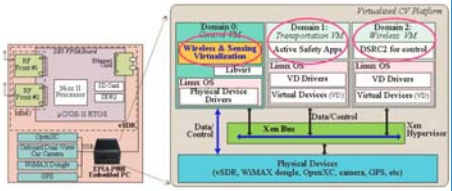
Continuous evolution of applications & networks



Innovation Paradigm Shift



Enabler #1: software-defined platform virtualization



Physical platform

Virtualized platform

Enabler #2: open platform for vehicular sensing

OpenXC-based internal sensing: fuel consumption, emission etc

Camera-based external sensing: surrounding vehicles, pedestrians etc

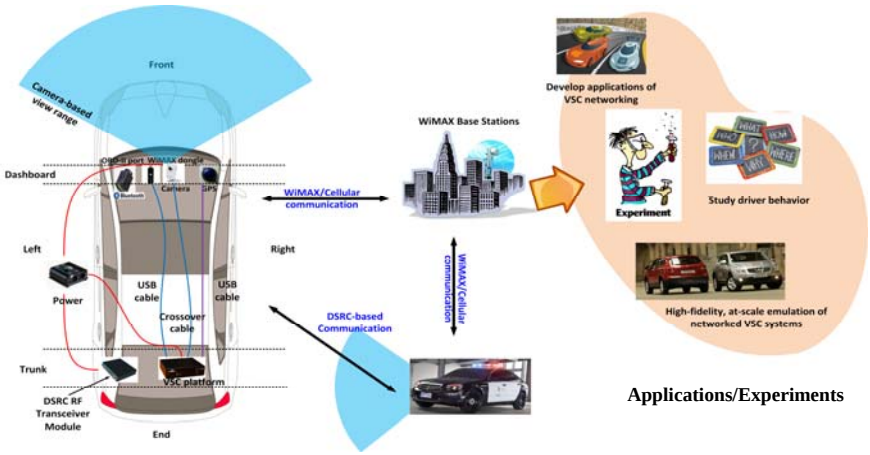
CAV Application in Public Safety: 3D Mapping

Surveillance

Driving safety in emergency response

In US alone, >1 fatality per day;
1 officer killed every six weeks;
$\frac{1}{3}$ killed being innocent bystanders

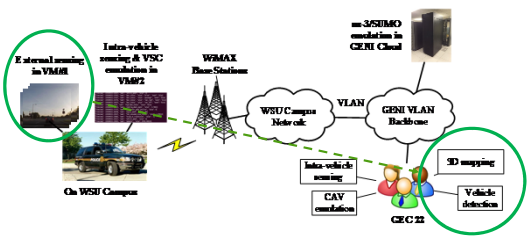
Wayne State University deployment



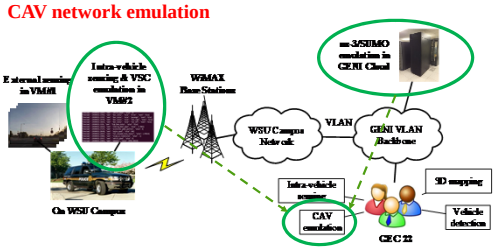
Applications/Experiments

Case study: public safety, CAV sensing, and CAV network emulation

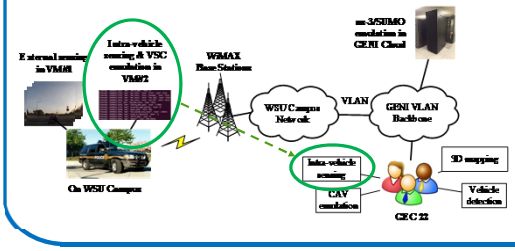
3D mapping



CAV network emulation



Vehicle state sensing



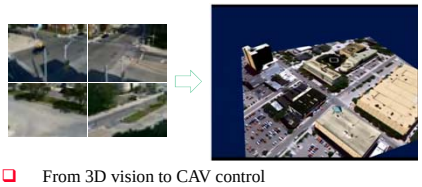
Detroit police radio car, 1921

Glimpse into future: networks

- From infrastructure networks to infrastructure-less/hybrid networks
  - ✓ Vehicular sensing and control networks
  - ✓ Mesh networks for community safety surveillance
  - ✓ D2D in 5G
- Seamless evolution of CAV control networks
  - ✓ Predictability, security etc
  - ✓ Research, development, deployment

Glimpse into future: applications

- From 3D mapping to real-time collaborative 3D vision



- From 3D vision to CAV control