Ann Arbor Connected Environment & Smart Intersections Project

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Acknowledgements

- None of our work would have been possible without extensive cooperation from city staff!
  - Craig Hupy, Raymond Hess, Luke Liu, Chuck Fojtik … and many others
- UM support from Logistics, Transportation and Parking
  - Steve Dolen and crew
- The community
  - SPARK(Komal Doshi), AAPS and AAATA to equip buses
  - Residents for equipping their vehicles/participate

UM's Roots in Connected Vehicles

SAFETYPILOT

SPMD Launched
August 21, 2012

ANN ARBOR CONNECTED VEHICLE TEST ENVIRONMENT

AACVTE Transition started May 11, 2015, Completed March 31, 2019

ANN ARBOR CONNECTED ENVIRONMENT

Operations and Maintenance
Since March 31, 2019

Smart Intersections Project

Kick off in 2021

Connected Vehicle Investment in Ann Arbor

SPMD: $30.3M
- $25.5 M Federal Funds
- $4.8 M Cost Share

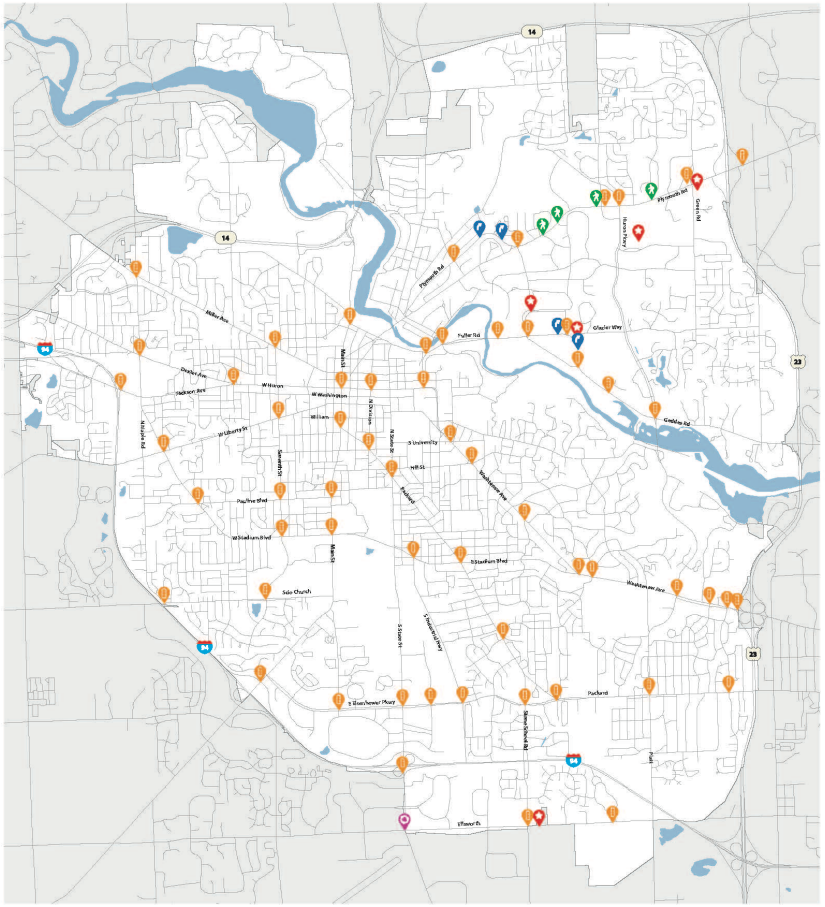
AACVTE: $15.2M
- $9M in Federal Funds
- $6M Cost Share

Additional Mcity Investment: $4.4M

Smart Intersections Project: $19.9M

TOTAL INVESTMENT: $69.8M

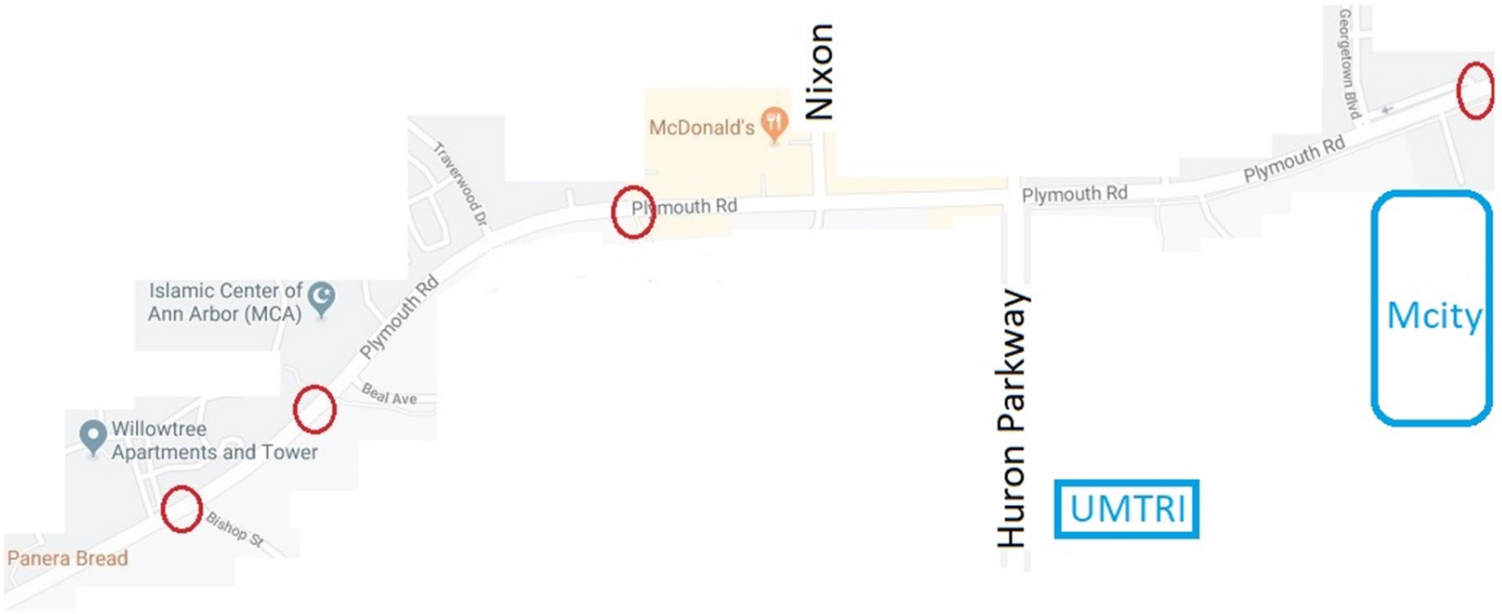
AACE Infrastructure



- **75 Road Side Unit**
  - **70 production sites**
    - **61 Intersections**
    - **4 Pedestrian mid-block crosswalks (4 RSUs)**
    - **2 Curve speed warning sites**
    - **1 Roundabout**

Vehicle-to-Pedestrian (V2P)

- 4 midblock crosswalks along Plymouth Rd
  - Personal safety messages (PSMs) generated whenever a pedestrian is in the crosswalk or cut-out
- Sites



V2P Deployment

V2P Findings

- Investigated the accuracy and limitations of a pedestrian detection systems which employed a coarse, image-based detection system

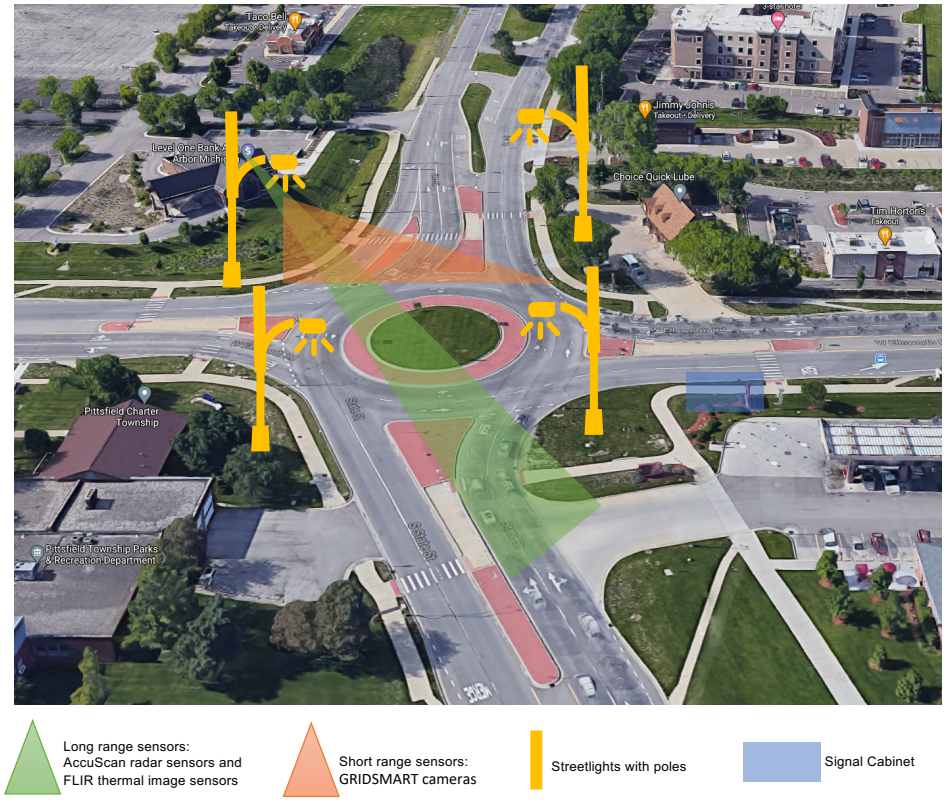
  (Found to be effective when settings were properly tuned)

- Examined drivers' stopping behavior at crosswalks using only vehicle dynamics data

  (Stopping behavior found to be not significantly 'safer' when in-vehicle warnings provided to drivers, but trending in the right direction)

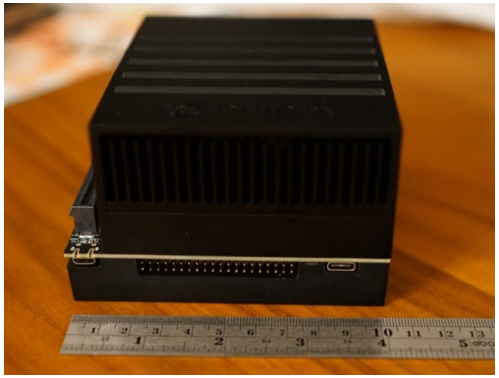
Roundabout Project

- In 2020, State St./Ellsworth Rd roundabout had 69 crashes and 6 injuries and was ranked #14 for the most dangerous intersections in Michigan
- Project focuses on improving the safety and efficiency of roundabouts through artificial intelligence (AI) and connected technology
- Infrastructure-based data monitoring and collection solution tracking the trajectories of all road users using advanced sensors (e.g., LiDAR, thermal imaging, and radar)
- Both safety and mobility impacts will be analyzed with warning messages sent to drivers



Infrastructure Devices Installation

Infrastructure Edge Computer



- Powerful computation for AI applications
- Power efficient
- Robust performance
- Security measures

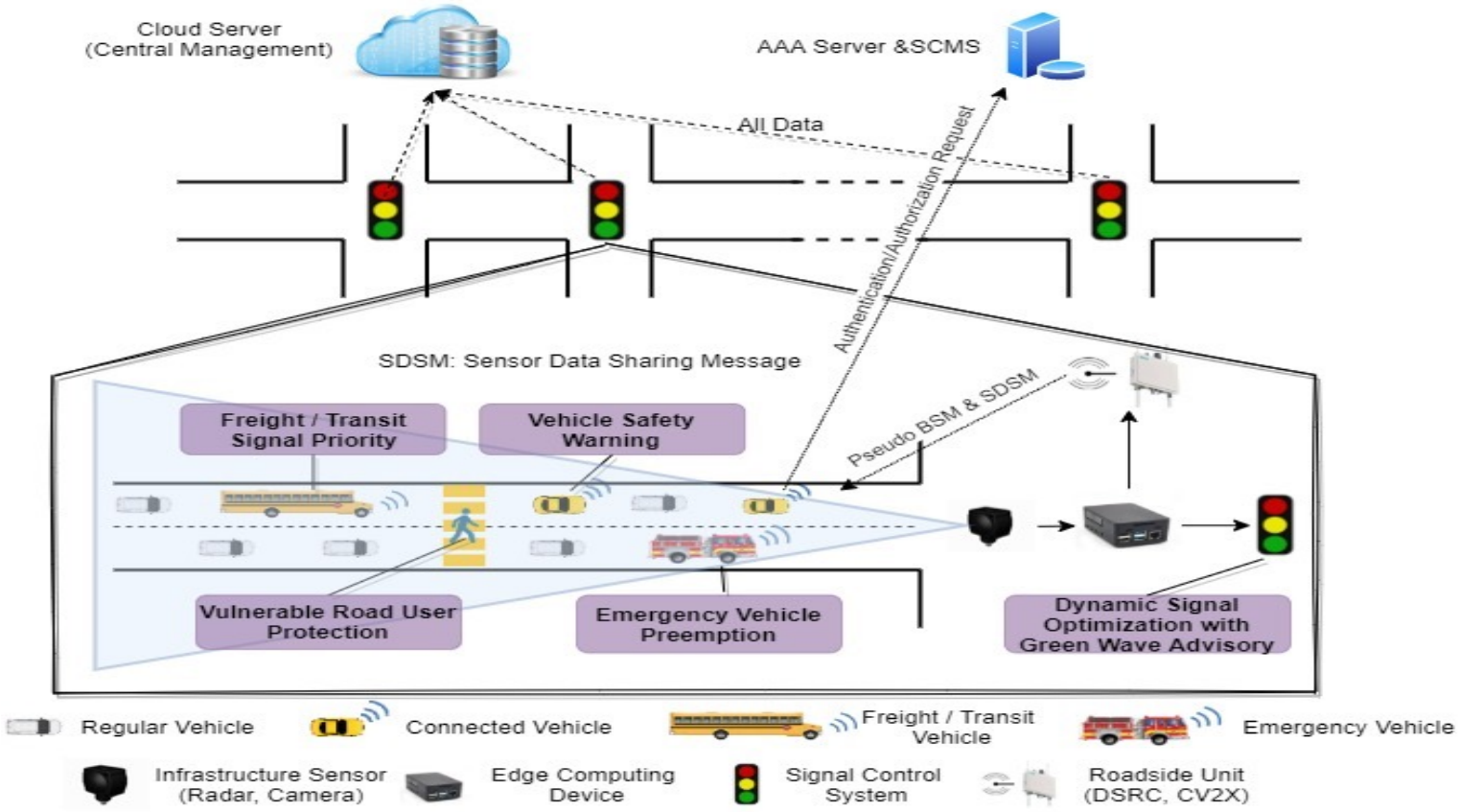
Roadside Detection and Prediction

Smart Intersections Project

- Deploy a network of smart intersections in Ann Arbor, MI
  - Vehicles and infrastructure interact in a connected environment
- At each of 21 smart intersections:
  - Intersections broadcast both proxy BSMs and SDSMs using two competing technologies
- Develop implementation guide – provide tools to build a self-sustainable CAV ecosystem

Smart Intersections Project Team

Concept of Operations



Moving Forward

- Focus on projects with demonstrated needs in the community
  - Not research for the sake of research
- Broaden our “footprint” into adjacent communities
  - Different problems to be addressed
- Increasingly focus our research efforts on addressing known mobility/accessibility challenges
  - Solutions that have societal impact in our own community

SAFE • EQUITABLE • EFFICIENT