Traffic Signal Systems and Connected Vehicles:  
Co-Deployment of DSRC & C-V2N  
Alex Hainen  
University of Alabama  
TEAM EFFORT:  
Dedicated Short Range Communication Radios – 2017

First installation on SR-69 (V2I, V2V, V2X, etc.) – No Vehicles 😊
**National Science Foundation $500K 2017-2020**

**Interdisciplinary Team Investigating the Future of DSRC**

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**Award Abstract #1710062**

**NeTS: Small: VC-VANET: A Sustainable Vehicle-Crowd Based Vehicular Ad Hoc Network Supporting Mobile Cloudlet Computing**

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<tr>
<th><strong>NSF Org:</strong></th>
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<tbody>
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<td><strong>Initial Amendment Date:</strong></td>
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<td>April 24, 2018</td>
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<td><strong>Investigator(s):</strong></td>
<td>Xiaoyan Hong <a href="mailto:hxy@cs.ua.edu">hxy@cs.ua.edu</a> (Principal Investigator) Travis Alkoon (Co-Principal Investigator) Alexander Haimen (Co-Principal Investigator)</td>
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<td><strong>Sponsor:</strong></td>
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Travel Safely: DSRC / SPaT Translation @ 85 Intersections
Connected Vehicles and V2X Applications / Research (C-V2N)

SPaT Translator (From Controller to DSRC Radio)
CAV Platform and Smartphone Application in Place!

Free to download and ready to expand for Alabama
## Travel Safely: Applied Information – Glance

**SPaT and BSM Platform for Data Collection**

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**VEHICLE PRIORITY SCHEDULING USING VEHICLE-TO-INFRASTRUCTURE COMMUNICATIONS**

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*Keywords: Travel Safety, Data Collection, Vehicular Communications*
Travel Safely: Real-Time Signal Info to Drivers
Countdown to green, red light warning, bikes, preempt, schools
Applied Information’s TravelSafely System

This system uses DSRC, C-V2X, C-V2N, and other forthcoming technology.
Video Demonstration of SPaT and BSM Safety – 2018

SPaT Broadcasting and Red Light Warning https://youtu.be/ETUcefkm3hl

Already have 17 included generic applications

- SPaT/MAP display of signal timing
- Red-light running at traffic signals
- Bus/transit priority
- Intelligent school beacons
- Emergency vehicle preemption
- Emergency vehicle notification
- Motorist – Cyclist communication
- Motorist – Pedestrian communication
- Work zone warnings
- Curve warning/reduce speed
- Rear end collision warning
- Wrong way detection *Freeway 😊
- DMS message sign annunciation
- Weather Warnings
- Congestion Ahead Warning
- Railroad crossing active ahead
- Event management area management

Any vehicle can use this app!
Proposed Application #1: Freight Preemption (2019-2020)
Improving Reliability for JIT/JIS Manufacturing

Idea
• Use connected cellular preemption for freight CMVs.
• Only use when needed based upon schedule and/or route conditions

Benefits
• Enhance travel time reliability to improve manufacturing performance
• Reduce overall travel time and emissions
• Increase safety of CMVs at intersections
Proposed Application #2: Signal BSM Logic (2019-2021)

Use Basic Safety Messages to Call/Extend Signal Phases

**Existing System Output**

![Existing System Output Diagram](image1)

**Proposed System Input**

![Proposed System Input Diagram](image2)

**Idea**

- Develop controller logic to use CAV BSMs to call / extend phases
- Use vehicle trajectory information to anticipate vehicle movements

**Benefits**

- Reduce delay at intersections; consider vehicles on all approaches
- Increase safety by protecting the dilemma zone
- Expands detection coverage; reduce future detection maintenance
Trajectory Based Signal Control from BSM (2030? 2020!?)

Completely New Logic! Radars → Virtual BSM Pilot https://youtu.be/dy323KI6rrM
FHWA ATCMTD $16M (2019-2022)
Partnering with ALDOT, TDOT, TCRIC for Smart & Connected Communities

21st Century Operations Using 21st Century Technologies

FY 2018 Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Project Awards

Awards
ATCMTD Applicants 2018

Awards
Advanced Connected Transportation Infrastructure & Operations Network (ACTION)
University of Alabama
Award: $8,034,003
The funds will be used to deploy advanced technologies — including camera, communications, sensor, and data-collection technologies — on roadways in and around Tuscaloosa.

West Central Alabama ACTION
Advanced Connected Transportation Infrastructure and Operations Network
Improving Efficiency, Capacity, and Safety through Technology Deployment
Action: 32 Miles Fiber, >140 DSRC/CAV, >110 SPM

Machine Learning for Congestion and Incident Detection on 50+ Cameras

Automated Truck Parking
Exit 86 has 132 parking stalls for commercial vehicles. This is the last parking option for 45 miles heading to Mississippi. Through Action, driver notification of parking availability will be made through apps and dynamic message signs so that drivers will be better informed. This will reduce the number of vehicles parking on ramps and shoulders of the freeway, thereby increasing safety.

Mercedes-Benz U.S. International – Vance, AL

Legend

- Freeway Camera
- Signal Upgrades (Gray = Complete)
- Fiber Optic Communication
- Cable Median Crash Sensors

Map of locations and upgrades:
- Lurleen B Wallace Blvd
- University Blvd
- Greensboro Ave
- University Blvd East
- University Blvd West
- I-59/I-20 Exit 86
- US-11 Skyland Blvd
- Buttermilk Rd

MBUSI Suppliers

University of Alabama
Alabama Transportation Institute

Map with marked locations and upgrades.
CONCLUSION: Grow TSMO, Identify Needs and Applications

Technology will change, we are focused on operations impacts

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40-49%
50-59%
60-69%

alexhainen.com
CONCLUSION: Grow TSMO, Identify Needs and Applications

Technology will change, we are focused on operations impacts.
CONCLUSION: Grow TSMO, Identify Needs and Applications
Technology will change, we are focused on operations impacts