The Multi Modal Intelligent Traffic Signal System – Using V2X Data for Priority – Based Traffic Control

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Systems and Industrial Engineering
University of Arizona
April 9, 2021
The Multi Modal Intelligent Traffic Signal System (MMITSS) Program

Funded as Connected Vehicle Pooled Fund Project (FHWA, MCDOT, Caltrans, VDOT, FDOT, MnDOT, TxDOT,...)

- University of Arizona (current)
  - Larry Head (PI)
  - Sherilyn Keaton (Software Manager) and Don Cunningham (Senior Software Engineer)
  - GRA: Niraj Altekar, Debashis Das
  - UGRA: Franklin Lam, Rebeca Garcia
- PATH/UC Berkeley
  - Kun Zhou (co-PI)
  - Huadong Meng (Research Engr)
  - John Spring (Software Engr)
  - David Nelson (Hardware Engr)
- Maricopa County DOT
  - Faisal Saleem, April Wire, LeShawn Charlton
- California DOT
  - Greg Larson (retired)

Project Goal:
Utilize data from Connected Vehicles to create a new traffic management system that can provide:
- Priority for Emergency Vehicles, Transit, and Freight Vehicles
- Intelligent Signal Control (i-sig)
- Pedestrian Assistance
The History of the CV Pooled Fund Project

• 2012 – Phase I: Concept of Operations, Requirements, and High Level Design

• 2015 – Phase II: Detailed Design, Prototype Development, Field Testing and Demonstration
  • Worked with SAE DSRC Committee on SRM/SSM
  • Provided 25+ Field Demonstrations

• 2017 – Phase III: Deployment Readiness Improvements
  • Source Code Improvements
  • Documentation
  • 90-day Field Testing (in progress)
MMITSS Basic Concepts

Priority Hierarchy
- Rail Crossings
- Emergency Vehicles
- **Freight Platoons**
- Freight Vehicles
- Coordination
- Transit
  - BRT
  - Express
  - Local (Late)
- Passenger Vehicles
- Pedestrians

Section 1
- Priority for
  - Freight
MMITSS Basic Concepts

Priority Hierarchy
- Rail Crossings
- Emergency Vehicles
- Transit
  - BRT
  - Express
  - Local (Late)
- Vehicle Strings
- Pedestrians
- Passenger Vehicles
- Freight

Section 2
- Priority for
  - Transit
  - Pedestrians
Real-Time Performance Measures – by mode, by movement, by section
- Volume (mean, variance)
- Delay (mean, variance)
- Travel Time (mean, variance)
- Throughput (mean, variance)
- Stops (mean, variance)
- Smoothness (SOFT)
- Time in System
MMITSS Characteristics

- Uses Connected Vehicle Data
  - BSM, MAP, SRM, SSM, SPaT
- ISIG: Adaptive Control
  - RT-TRACS, RHODES, COP, OPAC, ...
  - Yiheng Feng – modified-COP, Dilemma Zone
- PRIORITY (EVP, TSP, FSP): Priority Request Server (MRP)/Generator (OBU)
  - NCHRP 3-66, NTCIP 1211
  - Develops a hierarchical control policy for different modes
  - Qing He (2010), Mehdi Zamanipour (2016), Debashis Das (2022)
  - Priority Based Coordination (Beak, 2018)
- PEDSIG
  - Smartphone APP
  - Sara Khosravi (2018)
Basic Operational Concept: Priority Control

- When an \{EV, freight, transit, coordinator, platoon, string, peer intersection, \ldots\} enters/remains in the range of an RSU
  1. Hears (Listens for...)
    - MAP/SPaT
  2. Vehicle(s) Computes Position on MAP, Desired Service Time (ETA), Desired Ingress and Egress (maybe)
  3. Vehicle(s) Send(s) a Signal Request Message (SRM)
  4. Infrastructure Responds with a Signal Status Message (SSM) and provides priority signal timing
  5. Vehicle(s) Pass(es) through intersection
  6. Vehicle(s) Sends a Cancel Signal Request Message (SRM)
  7. Infrastructure returns to other priorities
Priority Requests

• Who can ask for priority?
  • Emergency Vehicles
  • Transit (BRT, Express, Local, Special, …)
  • Trucks
  • Pedestrians (Disabled, Blind, weather related, …)
  • Coordination

  • Platoons of Trucks
  • Strings of Vehicles

  • Queues
  • Peer Intersection (UDOT)

New work in progress
MMITSS Architecture
MMITSS-AZ Architecture: Infrastructure
MMITSS-AZ Architecture: Vehicle
Vehicle HMI
Open-Source (Github)[MMITSS-AZ]

https://github.com/mmitss/mmitss-az/
Open-Source MMITSS-Common

Contributing Guide

Welcome to the MMITSS Common open source project contributing guide. Please read this guide to learn about our development process, how to propose pull requests and improvements, and how to build and test your changes to this project.

Open source license

By contributing to the Multi-Metal Intelligent Traffic Signal Systems (MMITSS) open source project, you agree that your contributions will be licensed under its Apache License 2.0 license and the IODL 2.0 open source license.

Style Guide

[Code Standards]

Miscellaneous Documentation

MMITSS Common GitHub page
MMITSS Common Wiki: TBD
MMITSS Common Architecture: TBD
MMITSS Common User Guide: TBD

Developed by Kun Zhou, UC Berkeley PATH Program
MMITSS Docker Hub
(https://hub.docker.com/search?q=mmitss&type=image)
MMITSS Traffic Control Principles: Priority Based Control
Traffic Control Terminology

- Movements
- Phases
- Detectors

- Fixed Time
- Actuated
- Coordinated
- Coordinated-Actuated

Dual Ring, 8-Phase Controller
A Core Logic Model

Dual Ring Controller (Core Logic)

Precedence Diagram (works for general precedence relationships – not just dual ring)
Every phase is composed of intervals that control how phases are timed.
Phase Configuration and Real-time Data

### Structural Parameters
- **Flags**
  - X X X X X
  - X
  - Recall
  - Omit, etc.

### Timing Values
- Phase 1 2 3 4
- Min 12 15 10 10
- Max 45 45 30 30

### Real-time Demand Parameters
- Priority requests
- Vehicle/ped calls
- Preemption calls
- Advanced detection data

### Precedence Network Model
Requests for Priority

- Preemption
  - Heavy Rail
  - Emergency Vehicles*

Priority
- Buses
- Pedestrians
- Trucks
- Special Vehicles
- Evacuation

Request for Phase 8 at t=38

Delay

4/9/21
Multiple Requests for Priority

There could be many requests from many vehicles
Model Formulation

\[
\min_{g, \theta} \quad \alpha \left( \sum_m w^m D_m \right) + \beta \left( \sum_{p,k} d^c_{p,k} \right) - \gamma \left( \sum_{p,k} a_{p,k} \right)
\]

Subject to:
Precedence Constraints (Core Logic Model)
Phase Constraints (Min, Max, Walk, Ped Clear, Yellow, Red, etc.)
Phase Service Selection (current cycle or next)

Decision Variables:
phase start times = \( t^j_p \), durations = \( \nu^j_p \)
green time = \( g^j_p \), given yellow = \( y^j_p \), red = \( r^j_p \)

\[
\nu^k_p = \begin{cases} 
  g^k_p + y^k_p + r^k_p & \text{if } g^k_p > 0 \\
  0 & \text{if } g^k_p = 0 
\end{cases}
\]

service phase = \( \theta^j_e, \theta^j_s \in \{0,1\} \), phase and interval skipping = \( S_{p} \in \{0,1\} \)
Precedence Constraints

\[ t_1^1 = 0 \]
\[ t_2^1 = 0 \]
\[ t_2^k = t_1^k + v_1^k \]
\[ t_3^k = t_2^k + v_2^k, \quad t_3^k = t_6^k + v_6^k \]
\[ t_4^k = t_3^k + v_3^k \]
\[ t_5^k = t_7^k + v_7^k \]
\[ t_6^{k+1} = t_4^k + v_4^k, \quad t_1^k = t_8^k + v_8^k \]
\[ t_7^{k+1} = t_4^k + v_4^k, \quad t_5^k = t_8^k + v_8^k \]

for \( k = 1, \ldots, K \)

for \( k = 1, \ldots, K - 1 \)
Phase Duration Constraints

\[ t^k_p \geq 0, \]
\[ g^k_p (\Omega, \Phi, \omega, s^k_p) \leq g^k_p \leq g^k_p (\Omega, \Phi, \omega, s^k_p), \quad \text{for all } p \text{ and } k \]

where,

- \( \Omega \) is a vector of phase parameters (min, max, walk, dfw, ext,...)
- \( \Phi \) is a vector of phase flags (recall, omit, etc.), and
- \( \omega \) is a vector of real-time phase calls (vehicle, ped), and
- \( s^k_p \) are binary interval decision variables (skip, don't skip)
Phase Interval Constraints

\[
g_p = \max \left\{ \begin{array}{c}
D \min_p \cdot (1 - X \min R_p), \\
D \min_p \cdot Cphs_p (1 - S a \min^k_p), \\
(D w_p + D fdw_p) \cdot Cped_p \cdot (1 - S ped^k_p), \\
D \max_p \cdot X \max R_p
\end{array} \right\} \cdot (1 - S C^k_p) \cdot (1 - X omit_p)
\]

\[
\overline{g}_p = \left\{ \max \left( D \max_p, (D w_p + D fdw_p) \cdot Cped_p \right) \right\} \cdot (1 - S C^k_p) \cdot (1 - X omit_p)
\]

Notation
- \( D \) _____ = Phase Parameters (\( \Omega \))
- \( X \) _____ = Phase Flags (\( \Phi \))
- \( C \) _____ = Phase Calls (\( \omega \))
- \( S^{\ k}_{ \ p} \) _____ = Phase Skip Decision Variable
Service Phase Selection Constraints

\[ \sum_{k} \theta_{p,e}^{j,k} + \theta_{p,s}^{j,k} = 1 \]

for every priority request \( R_{p}^{j} \)

\( \theta_{p,e}^{j,k} \in \{0,1\} \) serve Request \( j \) before phase \( (p) \) in the \( k^{th} \) cycle

\( \theta_{p,s}^{j,k} \in \{0,1\} \) serve Request \( j \) during phase \( (p) \) in the \( k^{th} \) cycle
Service Phase Selection Constraints

\[ t_p^1 - R_p^j \geq (\theta_{p,e}^{j,1} - 1)M \]
\[ t_p^1 + v_p^1 - R_p^j \geq (\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} - 1)M \]
\[ t_p^2 - R_p^j \geq (\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} + \theta_{p,e}^{j,2} - 1)M \]
\[ t_p^2 + v_p^2 - R_p^j \geq (\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} + \theta_{p,e}^{j,2} + \theta_{p,s}^{j,2} - 1)M \]
\[ t_p^3 - R_p^j \geq (\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} + \theta_{p,e}^{j,2} + \theta_{p,s}^{j,2} + \theta_{p,e}^{j,3} - 1)M \]
\[ t_p^3 + v_p^3 - R_p^j \geq (\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} + \theta_{p,e}^{j,2} + \theta_{p,s}^{j,2} + \theta_{p,e}^{j,3} + \theta_{p,s}^{j,3} - 1)M \]

\[ R_p^j - t_p^1 \geq -\theta_{p,e}^{j,1}M \]
\[ R_p^j - (t_p^1 + v_p^1) \geq -(\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1})M \]
\[ R_p^j - t_p^2 \geq -\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} + \theta_{p,e}^{j,2}M \]
\[ R_p^j - (t_p^2 + v_p^2) \geq -(\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} + \theta_{p,e}^{j,2} + \theta_{p,s}^{j,2})M \]
\[ R_p^j - t_p^3 \geq -\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} + \theta_{p,e}^{j,2} + \theta_{p,s}^{j,2} + \theta_{p,e}^{j,3}M \]
\[ R_p^j - (t_p^3 + v_p^3) \geq -(\theta_{p,e}^{j,1} + \theta_{p,s}^{j,1} + \theta_{p,e}^{j,2} + \theta_{p,s}^{j,2} + \theta_{p,e}^{j,3} + \theta_{p,s}^{j,3})M \]
Total Priority Delay

Minimize \[ D = \sum_{(p,j)} \sum_k \theta_{j,k}^{p,e} (t_p^k - R_p^j) \]
Visualization tool for priority algorithm: Time-Phase Diagram: Dual Ring Behavior
Phase-Time Diagram

- X-axis is time in the future (or past)
- Y-axis (left side) are intervals for phases 1,2,3,4,1,2,3,.....
- There should be Y-axis on the right for ring-2 (assuming dual ring)
- Dashed lines show the min (max) times for each phase – creates the feasible region (non-convex)
- Green lines represent the possible phase timings for each phase. P1 could time between 5 or 18 seconds
  - Could gap out from detector data
  - Must end by 18 seconds to ensure minimum times for P2 and P3 to allow the Priority Request for P4 to be served without delay
Understanding the Schedule

- The schedule is a very complex and critical part of MMITSS.
- Understanding how MMITSS does timing is important to make sure it is implemented on the controller correctly.
- The Phase-Time diagram is a tool that we have developed that will help us understand signal timing and MMITSS operation.
Phase-Time Diagram: Ring 1 Controls

- **Call (C)**
  - Phases that are to serve must be called
- **Force-Off (F)**
  - Terminates a phase
  - Must be Call on opposing Phase
  - Should be cleared
- **Hold (H)**
  - Holds phase green
  - Must be cleared
- **Omit (O)**
  - Skips a phase
  - (Not shown)
Optimization Model Formulation

\[
\min_{g,\theta} \quad \alpha \left( \sum_m w^m D_m \right) + \beta \left( \sum_{p,k} d^c_{p,k} \right) - \gamma \left( \sum_{p,k} a_{p,k} \right)
\]

Multi-Modal Delay
Coordination Delay
Actuation Flexibility

Subject to:
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\end{cases} \]

service phase = \( \theta^j_c, \theta^j_s \in \{0,1\} \), phase and interval skipping = \( S_{p,j} \in \{0,1\} \)
Priority Policy Weights in the Objective Function

\[
\min_{g, \theta} \quad \alpha \left( \sum_{m} w^m D_m \right) + \beta \left( \sum_{p,k} d^c_{pk} \right) - \gamma \left( \sum_{p,k} a_{pk} \right)
\]

- Multi-Modal Delay
- Coordination Delay
- Actuation Flexibility
Numerical Example

- Priority eligible requests come from Transits and Trucks
- Transit headway is 10 minutes, requesting phase 2, 6
- Trucks are 6% of vehicles, requesting phase 4, 8

<table>
<thead>
<tr>
<th>Request</th>
<th>Range (seconds)</th>
<th>Requested Phase</th>
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<tbody>
<tr>
<td>1</td>
<td>Transit#1</td>
<td>[10, 15]</td>
</tr>
<tr>
<td>2</td>
<td>Transit#2</td>
<td>[42, 47]</td>
</tr>
<tr>
<td>3</td>
<td>Truck</td>
<td>[50, 60]</td>
</tr>
</tbody>
</table>
Preliminary Numerical Results:
Impact of Weight Selection on Policy

- Comparing average truck and transit delay with and without considering priority
Coordination in MMITSS-AZ

• Approach: Coordination is a form of priority
  • Coordination’s goal is to have a phase green when a group of vehicles progresses along the coordinated route
  • Priority’s goal is to have a phase green when a priority eligible vehicle wants to progress along its route
Speedway Blvd: Campbell to Park, Tucson, AZ

Campbell and Speedway Traffic Counts

<table>
<thead>
<tr>
<th>Approach</th>
<th>Northbound</th>
<th>Southbound</th>
<th>Eastbound</th>
<th>Westbound</th>
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<tr>
<td>Turning Movement</td>
<td>Left</td>
<td>Thru</td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Base Volume Input [veh/h]</td>
<td>292</td>
<td>910</td>
<td>220</td>
<td>278</td>
</tr>
<tr>
<td>Total Analysis Volume [veh/h]</td>
<td>282</td>
<td>910</td>
<td>220</td>
<td>278</td>
</tr>
</tbody>
</table>

4/9/21
Time-Phase Diagram – Campbell
Cycle = 105, Offset = 0
Time-Phase Diagram – Cherry
Cycle = 105, Offset = 20
Time-Phase Diagram – Mountain Cycle = 105, Offset = 45
Time-Phase Diagram – Park
Cycle = 105, Offset = 65
Time – Space Diagram
Travel Time: Speedway and Campbell

Cycle = 105, Offset = 0
Travel Time: Speedway and Cherry

Cycle = 105, Offset = 20
Travel Time: Speedway and Mountain

Cycle = 105, Offset = 45
Travel Time: Speedway and Park

Cycle = 105, Offset = 65
Simulation testing reflects MMTISS coordination is essentially equivalent to traditional coordination.

Need to show results from Priority + Coordination Testing:
- Truck and EV: No issues (EV overrides coordination)
- Transit – highlights extent of MAP coverage and station location (random dwell time) issue
  - PRG could know station locations and NOT request priority until leaving the station

TOSCo Integration (string priority) [possible future]:
- Adaptive coordination for strings (platoons)

Adaptive Coordination based on flow of vehicles in corridor
Coordination + Priority: Campbell
Coordination + Priority: Cherry
Coordination + Priority: Mountain
Coordination + Priority: Park
MMITSS Coordination Summary

• MMITSS coordination is “equivalent” to traditional coordination (shown by experiment)
  • Comments and ideas welcome
• Integration of coordination and priority allows multiple priority vehicles to be served efficiently
• MMITSS 90-day Field Test: Coordination in the AM and PM (Phase 3)
Assessing Performance in V2X Environment

- Vehicle Trajectory Data
  - Delay
  - Queues
  - Travel Time
  - Stops

- Smoothness (Soft)
- Time in System

Classic/Local Measures

New/System Measures
Quantitative Analysis of Smooth Progression

- Limitation of vehicle speed profile

(a) SSE : 14.47

(b) SSE : 2280.61

(c) SSE : 236.58

(d) SSE : 50.65
How can “smoothness” of progression be quantitatively measured?

- A new measure of smoothness

  - The Smoothness of the Flow of Traffic (SOFT): a measurement of the ability to provide continuous travel for vehicles through multi intersections with less variation in vehicle speed

  \[ SOFT(v) = 100 \times \left( 1 - \sqrt{\frac{\sum_{k=1}^{N-1} \left( \frac{P_k^v}{P_0^v} \right)^2}{\sum_{n}^N s_v(n T_0) \cdot e^{-2\pi knjt/T_0}}} \right) \]

  - The contribution of the \( k^{th} \) frequency harmonic of the speed profile (signal) of the \( v^{th} \) vehicle

  \[ P_k^v = |X_k^v|^2 \]

  - Root-Sum-Square (RSS) of power in a percentage
Transformation of speed profile

- Fourier transform
  - In order to identify the power of each frequency according to the vehicle speed, a Discrete Fast Fourier Transform (FFT) is used.
  - The speed profile in the time domain is transformed into power spectrum in the frequency domain. (Obtained in real-time from the BSMs)
Speed profile

(a) Free operation

(b) Coordination

(c) Green rest
Average of the SOFT

- Comparison of the trajectories in time-space diagram and average of the SOFT

(a) Free operation

(b) Coordination

(c) Green rest
Multi-modal analysis

• The impact of combined ratio of vehicle mode on smooth progression

➤ SOFT measure of a coordinated system for different proportion of trucks

- (a) 0%
  - Average SOFT of all vehicles = 88.32

- (b) 20%
  - Average SOFT of all vehicles = 83.77

- (c) 40%
  - Average SOFT of all vehicles = 81.22

- (d) 60%
  - Average SOFT of all vehicles = 76.10
Multi-modal analysis of the SOFT

- Box plot for the SOFT of a coordination system

- T-test for each case with 95% confidence level

<table>
<thead>
<tr>
<th>Statistical result</th>
<th>20% of truck</th>
<th>40% of truck</th>
<th>60% of truck</th>
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<tbody>
<tr>
<td>Mean ($\bar{x}$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truck</td>
<td>82.691</td>
<td>81.247</td>
<td>76.561</td>
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<tr>
<td>Regular vehicle</td>
<td>84.064</td>
<td>81.209</td>
<td>75.416</td>
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<tr>
<td>Standard deviation</td>
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<tr>
<td>Truck</td>
<td>12.300</td>
<td>10.712</td>
<td>10.576</td>
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<tr>
<td>Regular vehicle</td>
<td>9.621</td>
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<td>10.487</td>
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<td>P-value</td>
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<td>Result</td>
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<tbody>
<tr>
<td></td>
<td>Reject null hypothesis</td>
<td>Reject null hypothesis</td>
<td>Reject null hypothesis</td>
</tr>
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</table>

4/9/21
Freight Signal Priority (FSP)

- MC-85 Maricopa County
  - 19 Signalized Intersection
FSP: Simulation Estimates of Benefits (with MMITSS at 8/19 Signals)

- Reduced Stops by 20%
  - Reduce the Impact on Pavement
  - Reduce acceleration – Improved Air Quality
  - Less Delay

- Improved “Smoothness” of Traffic Flow
MMITSS Deployments, Products, and Future

**MMITSS Active Projects**

- MCDOT SMARTDrive Test Bed
- MCDOT SMARTDrive (11)
- MCDOT Freight (19)
- MCDOT/Tempe Transit (TBD)
- MCDOT/Mesa Transit (TBD)
- MCDOT SMARTDrive (31)
- MCDOT/SCOTTsdale (Loop 101 Mobility)
- MCDOT/Tempe Transit (TMD)
- MCDOT/Mesa Transit (TBD)
- Tucson Streetcar (25)
- UDOT (137)
- MMITSS - UT
- THEA CV Pilot Project

**MMITSS Web Interface**

- MCDOT SMARTDrive Test Bed
- MCDOT SMARTDrive (11)
- MCDOT Freight (19)
- MCDOT/Tempe Transit (TMD)
- MCDOT/Mesa Transit (TBD)
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**MMITSS System Interface**

- MCDOT SMARTDrive Test Bed
- MCDOT SMARTDrive (11)
- MCDOT Freight (19)
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Arizona Connected Vehicle Test Bed
Anthem, AZ

DSRC Installations:
11 Signalized Intersection
6 Freeway Interchanges
10 Freeway Locations
Approx. 25,000 Residents
Approx. 10,000 Vehicles

1 2021-2022 Expansion Project (ADOT)
Questions?
Discussion

Larry Head
University of Arizona
klhead@arizona.edu
Component Control

Local Console

daisy-gavilan

Supervisor status

All restarted at Sun Oct 4 19:57:00 2020

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
<th>Name</th>
<th>Action</th>
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<td>M_MacSpaRtBroadcaster</td>
<td>Restart</td>
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<tr>
<td>-</td>
<td></td>
<td>M_MacEncoder</td>
<td>Stop</td>
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<td>M_PolicyRequestServer</td>
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<td>M_PriorityRequestSolver</td>
<td>Tail-f</td>
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<td>M_SignalCoordinationRequestGenerator</td>
<td>Restart</td>
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<td>M_SirnaEngine</td>
<td>Stop</td>
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<td>M_SysmemInterface</td>
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<td>M_TrafficComputerInterface</td>
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4/9/21
Component Control

Local Console

daisy-gavilan

Supervisor status

All stopped at Sun Oct 4 19:59:41 2020

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
<th>Name</th>
<th>Action</th>
<th>Log</th>
<th>Tail</th>
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<tbody>
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<td>Oct 04 07:59 PM</td>
<td>M_HMIEventPublisher</td>
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<td>Clear Log</td>
<td>Tail 1</td>
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<td>Oct 04 07:59 PM</td>
<td>M_HMIEventPublisher</td>
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<td>Clear Log</td>
<td>Tail 1</td>
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<td>M_SignalCoordinatorRequestGenerator</td>
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<td>Tail 1</td>
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# Component Control

## Local Console

daisy-gavilan

![Supervisor Status](image)

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<th>State</th>
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<th>Name</th>
<th>Action</th>
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</thead>
<tbody>
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<td>pid 122, uptime 0:00:08</td>
<td>M_MeqQuadBroadcaster</td>
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<td>Restart, Stop, Clear Log, Tail</td>
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MMITSS-AZ Configuration

- JSON File for master configuration
  - IP Addresses of RSU+Controller
  - MAP Payload
  - psid
  - Message ID
  - Channels
  - Controller
  - Phasing
## System Parameters

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<td>System Performance Time Interval (seconds)</td>
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<td>Application Platform</td>
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<td>Peer Data Decoding</td>
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**Buttons:**  
[Save Changes]  [Cancel]
# Intersection Tab

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<th>Intersection</th>
<th>Vehicle</th>
<th>Network</th>
<th>Wireless</th>
<th>Controller</th>
<th>Priority</th>
<th>Data Transfer</th>
<th>Simulation</th>
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Save Changes  | Cancel
Vehicle Tab

Vehicle Type
Transit

HMI Controller IP
10.12.7.3

Save Changes  Cancel
Network Tab

<table>
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<tr>
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<th>Intersection</th>
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Network configuration administration only

Port Number: Message Transceiver / Message Sender
10003

Port Number: Message Transceiver / Message Receiver
10002