NCITE Emerging Technologies Meeting

MnDOT Passive Pedestrian Detection

October 19, 2021

SRF

Problem Definition

- Push buttons are a reliable technology when used correctly.
- Why are push buttons not used correctly?
  - Less than desirable location
  - Pedestrian is physically unable to push the button
  - Pedestrian chooses to not push the button
- How can we ensure all pedestrians are accounted for?

Project Purpose

- Research the state of the practice
- Identify and solicit vendor participation
- Ground truth tested systems
- Develop an evaluation matrix highlighting each vendor

Vendor Solicitation

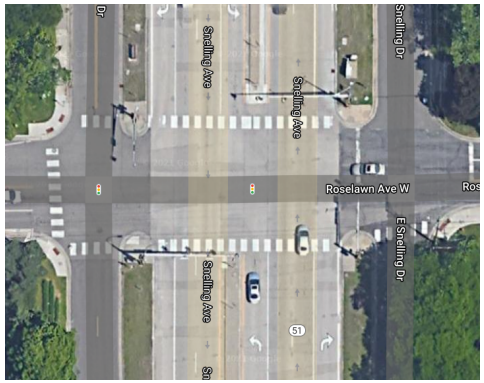
- Identified 8 possible vendors
- Selected a total of 7 systems
  - Flir
  - Miovision
  - Iteris
  - Econolite Evo
  - Autoscope Vision
  - Currux Vision
  - Gridsmart

Deployment Intersections

- TH 47 and 85th
  - Flir and Iteris

- TH 47 and Mississippi
  - Econolite and Miovision

- TH 51 and Roselawn
  - Gridsmart



- TH 51 and Hoyt
  - Currux Vision

Pass/Fail Grading Scheme

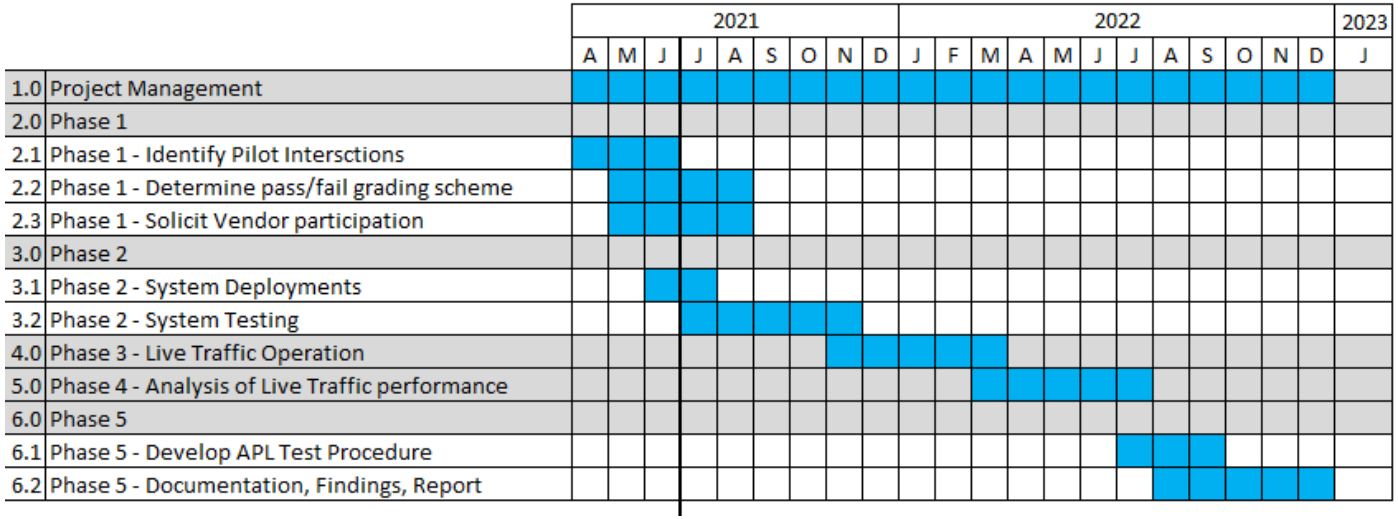
- Push button failure
  - A pedestrian does not push the button and crosses the intersection.
  - The push button is malfunctioning in that the button is pressed, and no call is placed.
  - The pushbutton is stuck and is placing a call.
  - A pedestrian pushes the button but the crosses before the Walk indication is active.
- Very little national research available
- Higher emphasis on missed calls compared to false calls
- Directional accuracy based on distance between push button pedestals

Pass/Fail Grading Scheme

		Pedestrian was detected?	
		Yes	**No**
Pedestrian was present?	**No**	False Positive (False Call) ≤ 0.10	True Negative ≥ 0.90
	Yes	True Positive ≥ 0.95	False Negative (Missed Call) ≤ 0.05

Ground Truthing

Schedule/Next Steps



MAKING CITIES SAFER AND SMARTER

PASSIVE PED DETECTION

JACOB DUBOSE

OCTOBER 19, 2021

TELEDYNE FLIR

FLIR DETECTION SOLUTIONS = SMART SENSORS

VISUAL

TrafiCam
TrafiCam x-stream

VISUAL + RADAR

TrafiRadar

THERMAL

TrafiSense
TrafiSense2
TrafiSense2 V2X

THERMAL + VISUAL

TrafiOne
TrafiSense2 Dual

Thermal Versus Optical

24/7 RELIABLE DETECTION

- At night and in complete darkness
- Through headlights, shadows and sun glare
- In adverse weather conditions

TELEDYNE FLIR

Bicycle Detection and Counting

TRAFFIC CONTROL

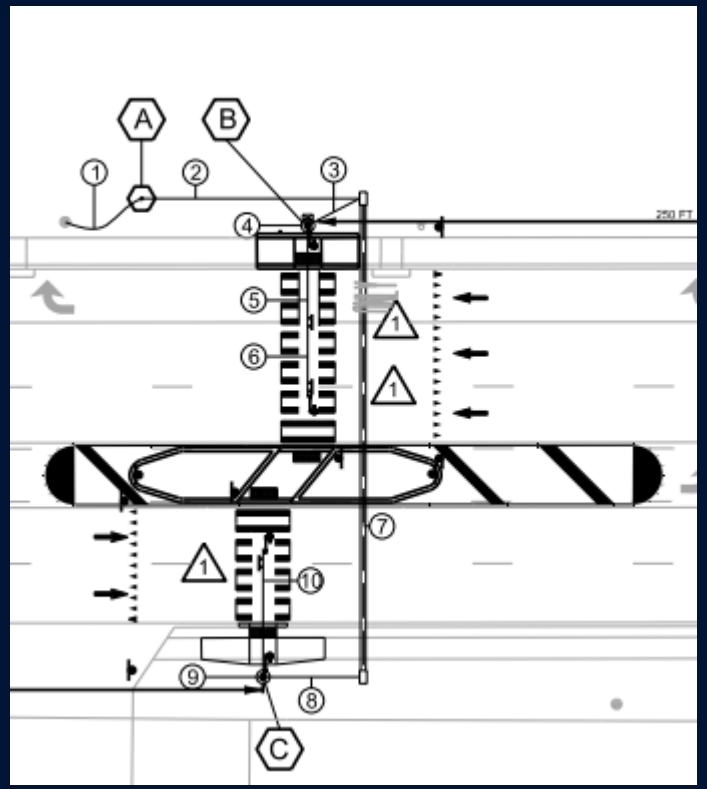
Improving Traffic Flow and Increasing Safety

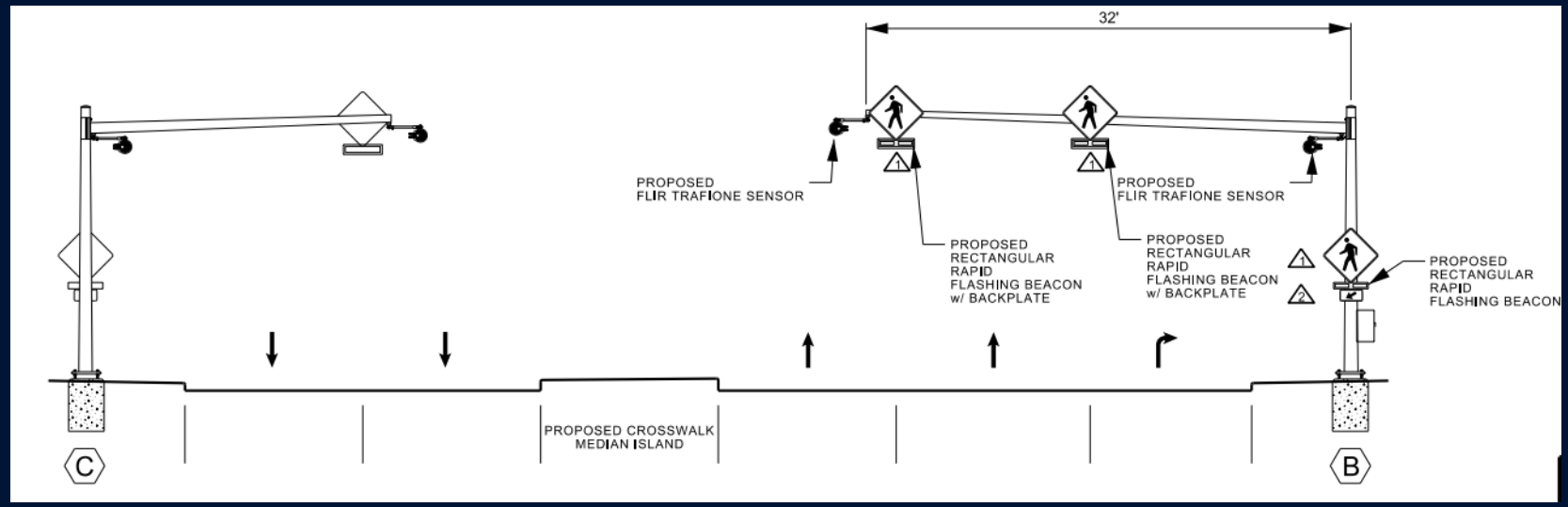
- Ped Call Cancel
  If pedestrian crosses street prior to the pedestrian phase being serviced, drop the call
- Dynamic Clearance Times
  Extend or Shorten the pedestrian timing based upon speed of pedestrian or occupancy
- Priority
  Provide pedestrian head start prior to serving vehicles
- Mid-block applications
  HAWK Signals- reduce ped events by 69%
  RRFB's- increase motorist yield from 18% to 88%

Prioritizing Pedestrian Safety

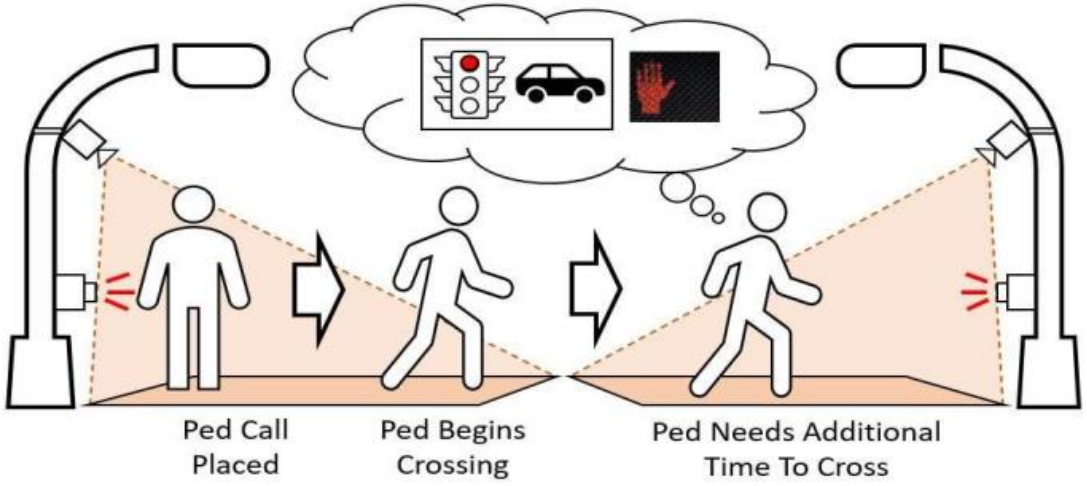
PASSIVE PED DESIGN SPEC

CITY OF SAN ANTONIO

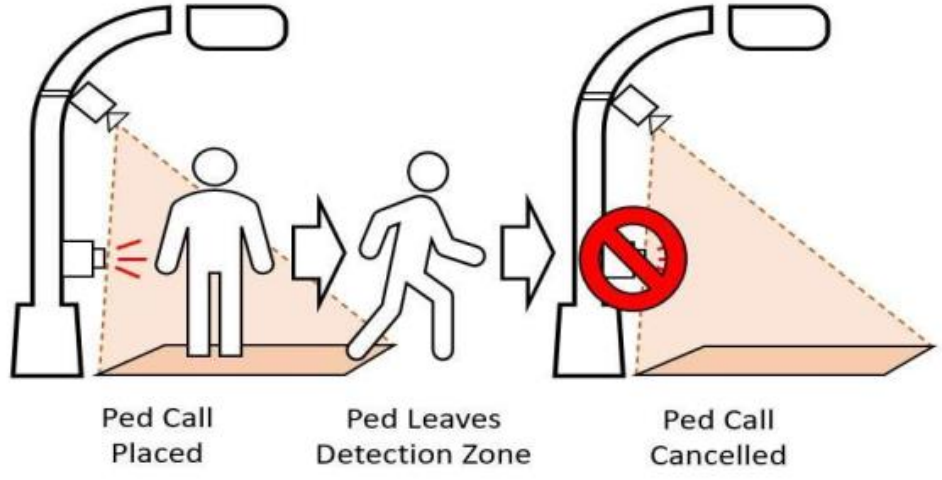




PASSIVE DYNAMIC PED



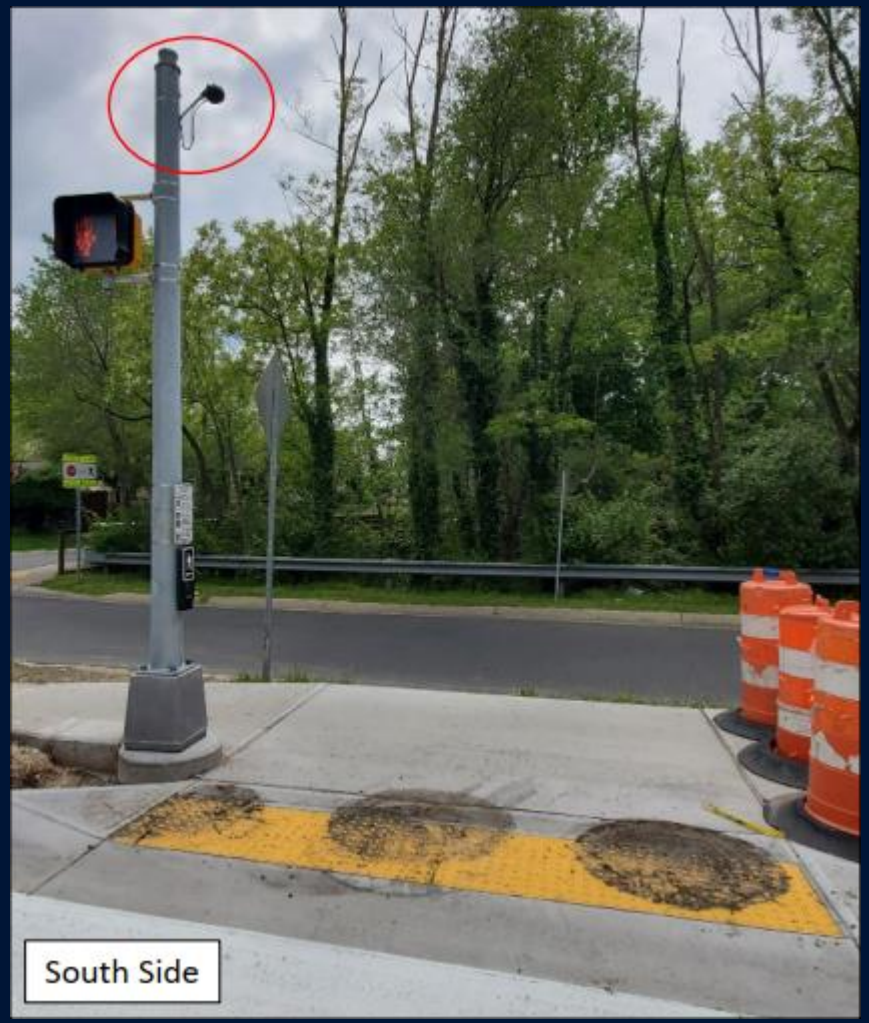
PEDESTRIAN CALL EXTENSION					
SIGNAL INDICATION	PHASE 2 + 6		BUFFER INTERVAL	PHASE 2 + 6	
PEDESTRIAN	WALK	FDW	DON'T WALK EXTENSION	DON'T WALK	
CONCURRENT VEHICULAR	GREEN		GREEN EXTENSION	Y	AR
CONFLICTING VEHICULAR	RED		RED EXTENSION	RED	

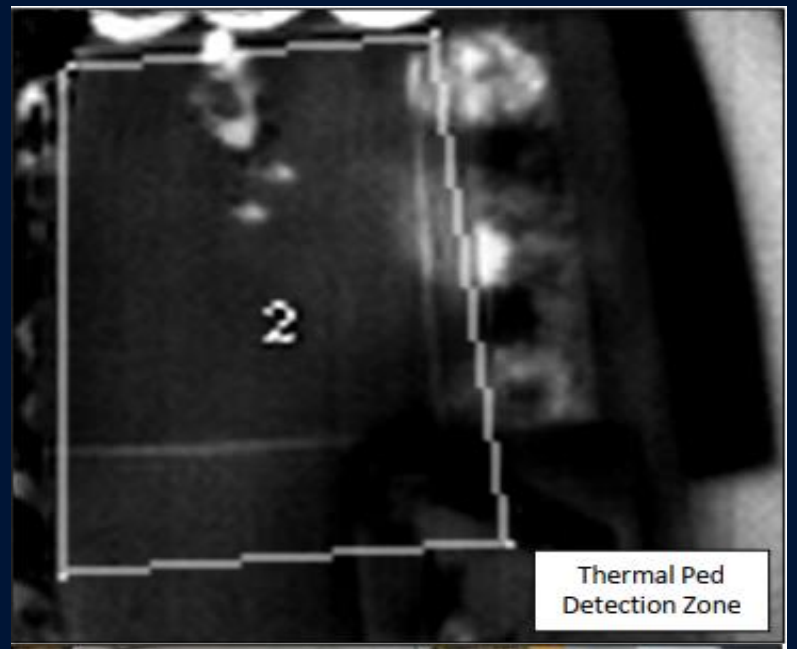


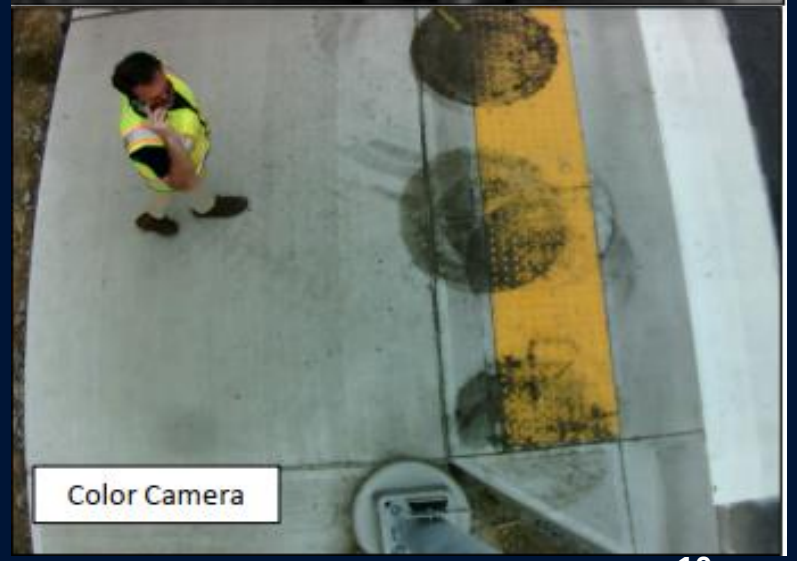
PEDESTRIAN CALL CANCELLATION (PCC)						
SIGNAL INDICATION	PHASE 2 + 6				PHASE 4 + 8 PCC EARLY ONSET	PHASE 4 + 8
PEDESTRIAN: PCC	DON'T WALK				DON'T WALK	DON'T WALK
PEDESTRIAN: NO PCC	WALK	FDW				
CONCURRENT VEHICULAR: PCC	GREEN		Y	AR	EARLY RED	RED
CONCURRENT VEHICULAR: NO PCC			Y	AR		
CONFLICTING VEHICULAR: PCC	RED				EARLY GREEN	GREEN
CONFLICTING VEHICULAR: NO PCC					RED	

FINDINGS

Location	Detector	Mean	Std Dev.
Signalized Intersection	**Thermal (overall)**	**89%**	**10%**
	High-Res	90%	9%
	Low-Res	89%	10%
	Optical	**26%**	**18%**
Mid-Block	**Thermal (overall)**	**82%**	**8%**
	High-Res	87%	6%
	Low-Res	76%	6%
	Optical	**83%**	**18%**





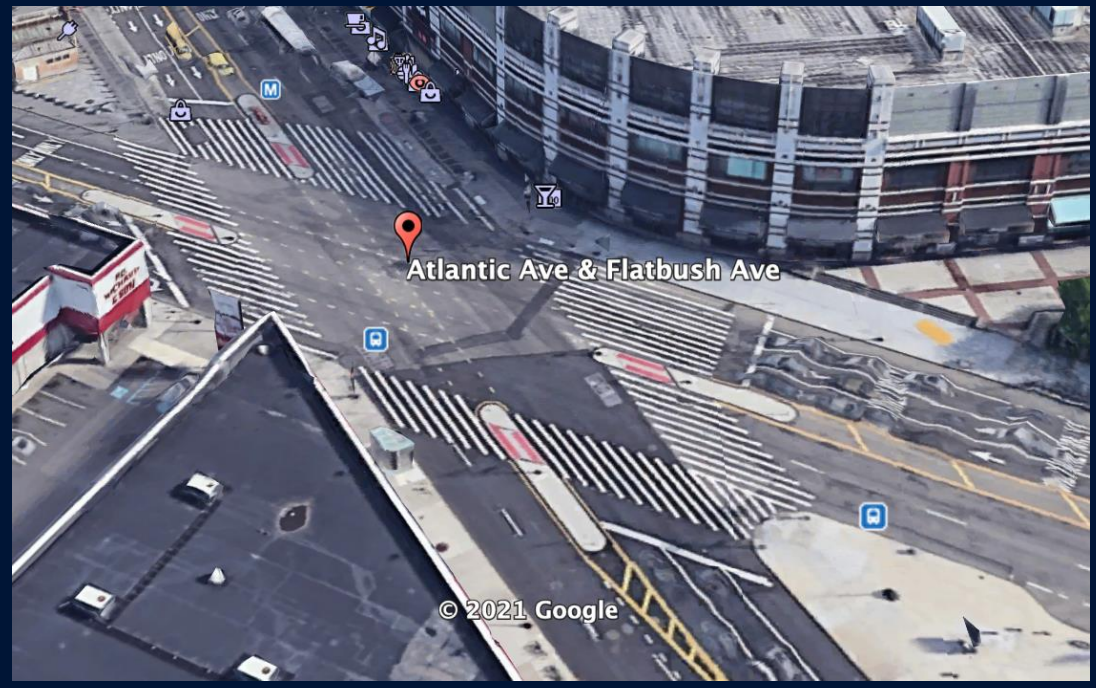


FAIRFAX COUNTY
VIRGINIA

TELEDYNE FLIR

NEW YORK CITY CONNECTED VEHICLE PASSIVE PEDESTRIAN APPLICATION

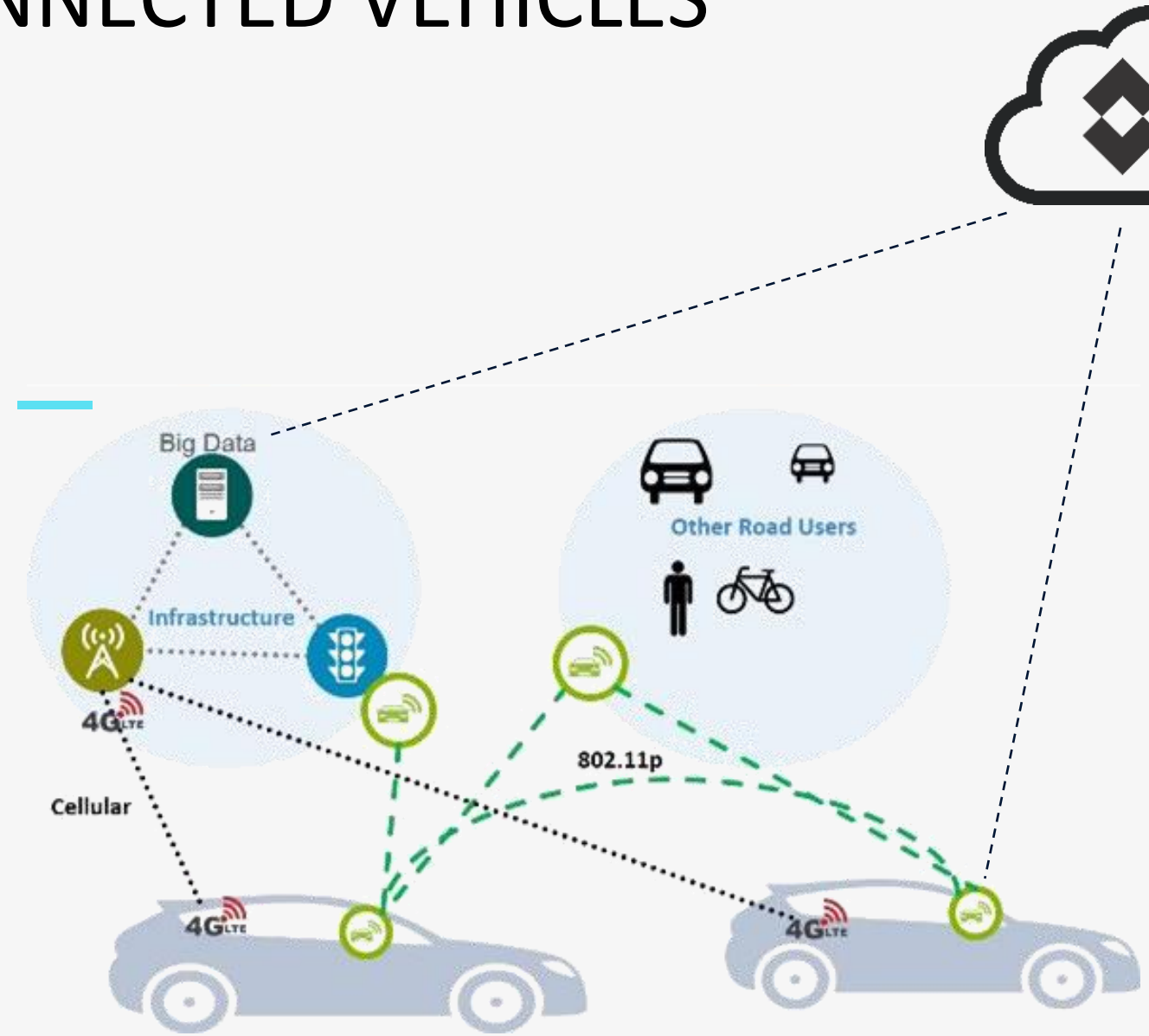
- Pilot Project Goal
  - Detect Pedestrians in the crosswalk
  - Provide Pedestrian Detection Information to Traffic Controller
  - Provide Pedestrian Data sent to RSU to OBU
  - NYC Vehicles with RSU will receive Pedestrian Audible Alert



ADDITIONAL AGENCIES

- City of Las Vegas
- TTI – College Station
- LA County
- Denver, CO
- Oklahoma DOT
- Papillion, NE
- Texas A&M Campus

CONNECTED VEHICLES

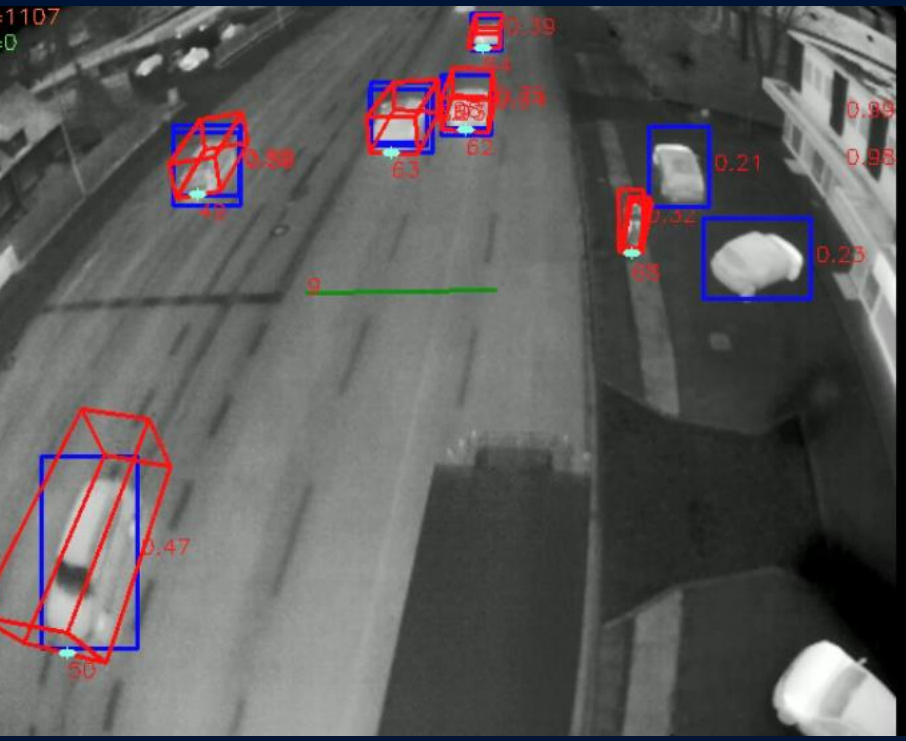


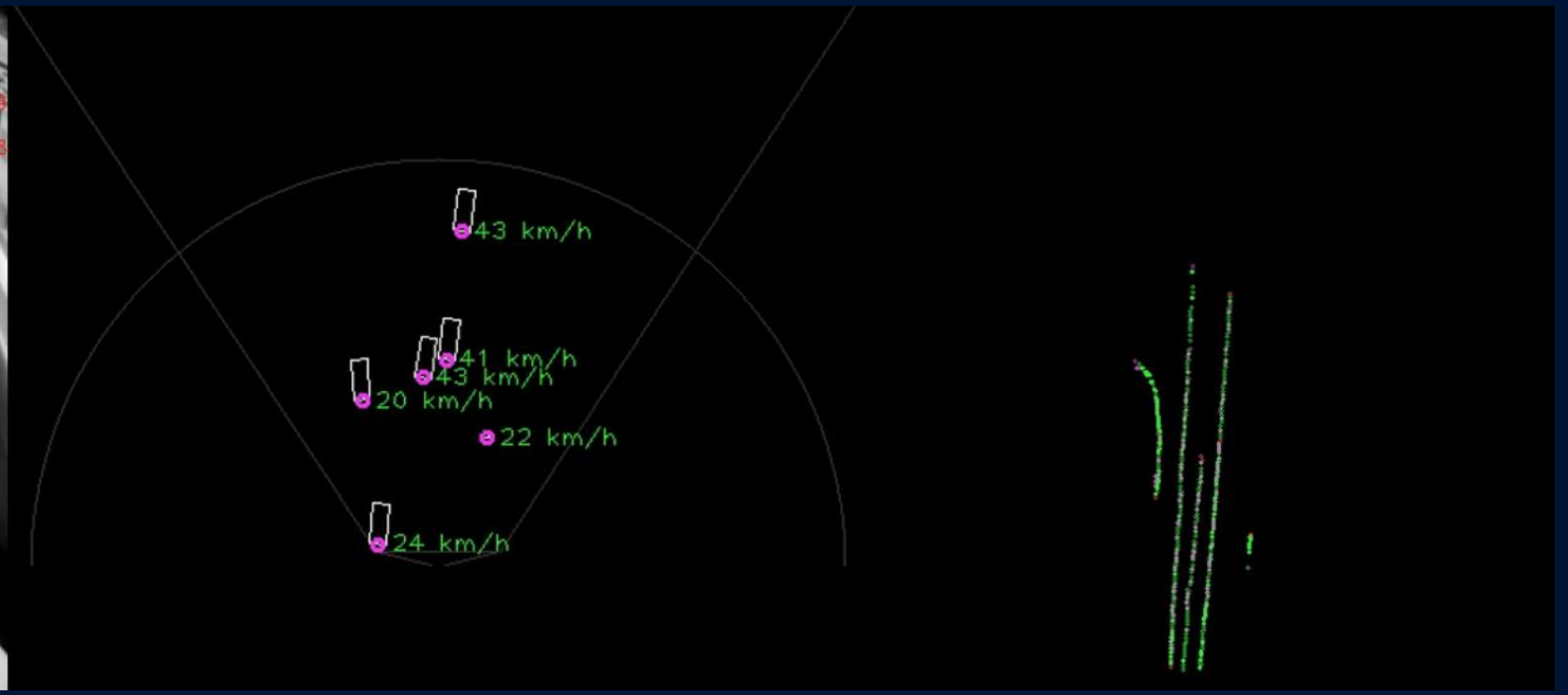
FLIR Detectors

Traffic Signal Controller

Digitizing traffic on the road network

Detect, **locate**, and **classify** road users in the field of view in complex urban environments



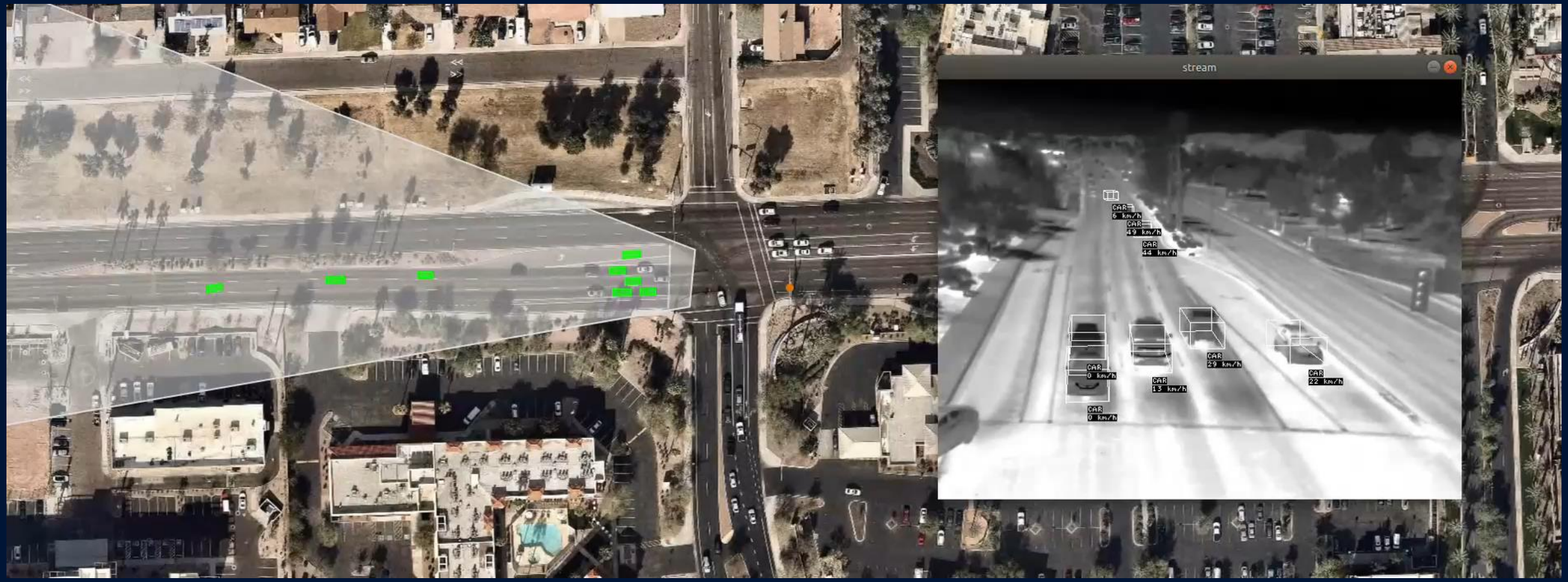


Classification

Position, Speed, Heading

Trajectories

SITUATIONAL AWARENESS



Q&A

TELEDYNE FLIR

THANK YOU FOR YOUR TIME TODAY

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