Request for Research Funding for FY 2023-2024			
Project Number (Research Center Use Only): TEO-24-11			
Requesting Office	District 5 Traffic Operations	**Priority:** Medium	11 of 11
Proposed Title	Intersection Safety and Mobility Analytics Using Sensor Fusion		
Justification	There is a need for effective, accurate and complete safety and mobility monitoring of intersections for efficient corridor operation and management. Evaluation of various sensors were conducted as a part of ATTAIN. Several metrics of the sensors were evaluated to understand their capabilities in terms of safety and mobility. Sensor fusion algorithms were also investigated. The models developed could lay the foundation for deployment at a major intersection. Moreover, few other promising sensing technologies can be studied that has the potential to be used in a smart intersection. Overall, the project can lead to real-time safety and mobility analytics of an intersection in a cost-effective way.		
Impact	The results of this research will be practice ready with expectations to provide a methodology to improve the efficiency of signal performance and improve safety. The expected time savings, cost and safety would be substantial. The common measures to evaluate an intersection are delay, queue length, cycle and split failure, etc. This project will deploy multiple sensors at a test intersection to provide traffic parameters, safety evaluation and event detections per approach.		
Affected Offices	Affected offices include TSM&O, safety, and traffic design at the District level. Also, the central offices of safety, traffic operations, and technology/data would be involved		
Existing Work	Learning About and Using the Research in Progress (RiP) Database http://www.trb.org/main/blurbs/176215.aspx As a minimum, the Transportation Research International Documentation (TRID) and the Research in Progress (RIP) online databases should be reviewed by an expert in the research subject matter to assure research effort and resources shall not duplicate prior or ongoing work. TRID: https://trid.trb.org/Results RIP: https://rip.trb.org/		
Keywords Used In Existing Work Search **(Cannot leave blank)**	Sensor Fusion, Camera, LiDAR, 4D radar, Sound, RFID, intersection safety, PET, TTC		
Related Contracts (Give contract numbers)	Some of the work at UCF, mostly for the ATTAIN project, extend the use of smart corridor for I2V applications. (BDV24-562-11)		
Funding Request	$280,000	**Anticipated Duration**	Estimated length of time to complete work: 24 months
Project Manager	Jeremy Dilmore, PE Dist 5 TSMO Engineer Co-PM: Mariano Amicarelli	**Contracting Method**	Direct contract with the University of Central Florida to build on their existing advancement in smart corridor with Dr. Aty
Equipment	None	Comments* (understanding leases are preferred, include the proposed use of the equipment, whether lease options are feasible, whether work to be done with equipment could instead be procured through service expenditure, etc.)	

Urgency	Score - 1	Intersection safety is a statewide concern. Strategies to improve safety at signalized intersections have been identified and resources exist to make these improvements. However, with the vast number of signalized intersections in the state there is a need for a screening system to identify the intersections with the most need. All existing vendor systems are very expensive, not accurate, and lack robust safety metrics.
Implementability	Score - 1	Extensive data collection and processing based on multiple sensing technologies and fusion could be carried out at a test intersection from various sensors. Various algorithms can be trained on the collected data to understand intersection safety and mobility in the form on near misses, surrogate safety measures, vehicle counts, etc. Deployment at a major intersection in Central Florida will be implemented for future deployment at other intersections around the state.

Project Benefits (Succinct, complete explanation)

The project will address equipping an intersection with different sensors such as camera(s), LiDAR, 4D-radar, UWB. Microphone, RFID, and weather station. The concepts of sensor fusion from a previous ATTAIN project would be used as blueprint. 4D radar, RFID, and weather station sensor would need some preliminary investigation before deployment. It is expected that the different sensors will work with each other to provide a comprehensive picture of the intersection in terms of traffic parameters (counts, speed, volume, etc.), safety performance (PET, TTC, etc.), and event monitoring (crash, hard brakes, etc.). Traffic parameters and some of the safety metrics can be displayed in real-time on a dashboard while comprehensive post processing can be added to obtain in-depth intersection analytics in terms of safety.

Project Benefits **(Select all that apply and explain)**	**Quantifiable Benefits (units, dollars, etc…if applicable)**	**Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits**
o Materials Enhancement		
o Materials Savings	Reduced need for traditional field data collection	Traditionally, studies with field data collection are used to identify field safety concerns. This project proposes a system to replace/reduce the need for field data collection and traditional studies.
o Time Savings	Aggregate savings in minutes per hour per intersection	Volume per approach Turning movement counts Intersection delay
o Lives Saved/Injuries Prevented	Lives and injuries	Event detection Post Encroachment Time (PET), Time-to-collision (TTC) Deep Multimodal Sensor Fusion in Unseen Adverse Weather for Connected Autonomous Vehicle Navigation
o Other (Explain)	Efficiency and future deployment of CV	Low-cost implementation of intersection analytics using sensor fusion

*Comments should explain and support urgency, financial benefit, and implementability scores