Request for Research Funding for FY 2022-2023			
SPR Subpart B Project: TEO-23-11			
Requesting Office	District 5 Traffic Operations	**Priority High**	11 of 23
Proposed Title	Optimization of Signal timing based on Pedestrian Intervals Using Computer Vision and Deep Learning Technology		
Justification	Pedestrian crossing times are based on slower than average pedestrians. With their long crossing times cycle times often are increased for efficiency, resulting in lower compliance. Further pedestrians press multiple crossing call buttons due to confusion about which is the right one for their crossing. This results in several conditions that leads to delays at intersections. Also, some pedestrians wait long time until their dedicated cycles, causing few to violate the signal and endangering themselves. This research seeks to use passive pedestrian cameras at intersections with Advanced Traffic Controllers to see if configurations can support more advanced methods of handing pedestrian calls. Specifically, shorter pedestrian interval (higher crossing speeds) with elongation of those intervals based on observed behavior, reduction in cycle length or skipped phases during undersaturated conditions, and removed calls due to departed pedestrians. Lastly, this work seeks to provide feedback to pedestrians to increase compliance.		
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 pedestrians' safety. The expected safety from higher compliance and improved intersection efficiency would be substantial.		
Affected Offices	Various district 5 offices will be involved primarily TSMO. Also, the State Traffic Engineering and Operations Office, State Safety Office, Office of Planning		
Existing Work	Computer vision has been witnessing much progress in research and industry in the last few years. All existing systems still have many issues that need to be resolved. Many experience latency problems when implementing in real time. And all have not focused enough on pedestrians and vulnerable road users. None has tried to resolve the problems identified above to improve the efficiency and safety of traffic signals. This research would be unique in improving signal timing and signal design. FDOT funded research by CUTR (USF) into passive pedestrian detection (BDV25-977-44). This work looked into passive pedestrian detection for placing a standard pedestrian call into a signal controller. This research would use this technology differently		
Keywords Used In Existing Work Search	Signal optimization; signal efficiency; pedestrian phases; SPaT; intersection safety; pedestrian safety; computer vision; deep learning.		
Related Contracts	Some of the work at UCF, mostly for other projects, address vulnerable roads users' safety and computer vision applications.		
Funding Request	$200,000	**Anticipated Duration**	12 months
Project Manager	Jeremy Dilmore, PE Dist 5 TSMO Engineer	**Contracting Method**	Direct to UCF (Dr. Abel-Aty)
Equipment	$12,000	Using existing infrastructure and low-cost cameras would be added to select intersections.	
Urgency	1	Pedestrian safety is becoming a large problem in Florida. Intersection efficiency is also a problem. Research shows that half or more of all pedestrians do not push the button to activate a pedestrian phase and those that do push a button, often push both buttons if the button placement is unclear. Finding solutions and improvements to both would have substantial benefits to the whole state.	

		Comments* (elaborate as appropriate on justification/impact comments to explain the urgency of the need . . . is a solution needed immediately, needed within a certain period of time or by a known or anticipated deadline, desired for enhancement, etc.)
Implementability	1	Research into this area has been conducted by several others at a research level. This work is proposed to take these research level topics related to pedestrian technologies (passive detection, call indication, automatic time adaptation) to practice level implementation. This project will look to implement these technologies at one or more intersections to demonstrate implementation ability and evaluate benefits. It is anticipated that some technologies tested may not currently be on the FDOT Approved Products List and may also require FHWA approval in the case of traffic control devices that do not comply with the current Manual on Uniform Traffic Control Devices (MUTCD)

Project Benefits (Succinct, complete explanation)

1. Increase pedestrian compliance with crossing phases
    a. Reduced wait times with skipped phases
    b. Reduced false calls
2. Increase signal efficiency
    a. Reduced cycle length and split times to accommodate pedestrians
    b. Reduced false calls
3. Identify or create a methodology and display to provide feedback to pedestrians that a call has been placed and the approximate wait time.

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		
o Time Savings	Aggregate savings in minutes per hour per intersection	• Signal delay • Green ratio (the ratio of green time to cycle length) • Travel time reliability
o Lives Saved/Injuries Prevented	Lives and injuries	• Pedestrian's compliance rate • Post Encroachment Time (PET), Time-to-collision (TTC)
o Other (Explain)	Efficiency and future deployment of CV	Low-cost implementation of AI and computer vision technology and preparing for the advent of CAV

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