Research Project Statement

Fiscal Year: 2005  Project Statement Date: January 22, 2004

Project Number: 0-5013

Title: Smart Controller for ITS Technology Deployment

RMC Number: 4

Developed By: TAP

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Duration (# of years): _______  Total Budget: _______

First Year  FY  Second Year  FY  Additional FYs  FY

Project Description: Description: It is estimated that TxDOT operates more than 6000 signalized intersections, all of which use either a NEMA TS-1 or TS-2 type cabinet. The safe and efficient operation of these intersections is a high priority to TxDOT as is the cost associated with installing and maintaining these intersections. Over the years, TxDOT research funds have developed several innovative traffic control strategies intended to improve the safety and/or operation at signalized intersections through real-time, adaptive methods. However, their deployment was relatively expensive as the hardware was typically custom-made for each installation and consisted of the assembly of numerous individual components.

New, real-time control strategies are being developed in Texas and throughout the nation. These new strategies are intended to make more intelligent decisions from available sensor information, relative to existing signal controllers. Most notable are the strategies being developed for signal coordination, signal preemption, and ramp metering. Unfortunately, their development is outpacing the ability of controller manufacturers to incorporate them into the controller.

Several new controller platforms (ATC, etc.) and communication standards (NTCIP) are being developed that are intended to facilitate deployment of real-time control strategies for signal systems. However, it is not clear that multiple control strategies; e.g., truck priority and signal coordination, will operate simultaneously with these platforms. Moreover, these new platforms are not expected to see wide scale deployment for a few more years and may not constitute a significant portion of TxDOT’s existing controller inventory for 5 to 10 years.

New roadway sensors (microwave, infrared, video, etc.) and communication methods (wireless, ether, etc.) make it possible to get more information, more quickly, and from more distant locations. The new sensors and communications methods are available now but the existing controller CPU does not have the power to process and store this data. Moreover, sensor information is currently being collected for single-use applications (stop-line detection), but it is not being fully interrogated and used to support a wider range of control strategies (incident management and dynamic maximum green adjustment).

A research project is needed to develop and integrate intelligent, real-time intersection traffic control strategies and a platform that can facilitate the immediate deployment of the new strategies. The research would focus on:

1.) The development of a “smart” controller platform; i.e., a low-cost platform with open architecture that uses an
external computer to slave the existing TS-1 and TS-2 controllers in TxDOT’s inventory; and

2.) The development of multiple control strategies; i.e., dynamic advance warning signs and truck priority green extension, that can be integrated into the smart controller and used simultaneously, if desired by the engineer.

Initially, the strategies developed for past TxDOT research projects would be integrated into the smart controller. Next, new control strategies needed by TxDOT would be developed and deployed. Alternative sensors and sensor communication systems needed to support the associated strategies would be evaluated for cost and practicality.

The approach outlined above will allow the motoring public in Texas to realize the safety and operational benefits of state-of-the-art control strategies immediately using TxDOT’s existing controller inventory. It will also allow TxDOT to take immediate advantage of the ATC platform as it is deployed by having a full complement of innovative, intelligent, real-time control strategies suitable for ATC implementation.

Objective: The objective of this research is to develop and integrate a series of intelligent, real-time intersection traffic control strategies as well as a controller platform that can facilitate the immediate deployment of the new strategies. The “smart” controller platform will add functionality and life to TxDOT’s existing inventory of traffic signal controllers. The open architecture will allow other universities and agencies to participate in the development of control strategies for TxDOT.

Research tasks should include:

1. Develop a smart controller deployment platform using an open architecture;
2. Develop a process for integrating several control strategies such that they can be used simultaneously;
3. Identify essential new control strategies and develop algorithms to facilitate their deployment; and
4. Deploy the control strategies and associated hardware at several intersections in Texas and work with controller manufacturers to facilitate the implementation of these strategies in off-the-shelf control products.

Deliverable Products And Reports:
- P1 - Smart controller deployed at two intersections in Texas.
- P2 - Design guidelines describing the design and application of the smart controller
- P3 - Specifications describing the functionality and hardware requirements of the smart controller and the control strategies.
- R1 Research Report at the end of FY 05 that describes: 1.) The smart controller hardware, functionality, and cost; and 2.) The strategies considered and selected for incorporation in the smart controller.
- R2 Research Report that provides detailed documentation of all research performed, methods used, and that fully supports the recommendations and conclusions contained therein.
- PSR Project Summary Report

Implementation: The research will develop a system for deploying multiple, intelligent control strategies at isolated signalized intersections. The system and several new strategies will be deployed at two intersections in Texas. Researchers will work with controller manufacturers to facilitate the implementation and testing of these new strategies in off-the-shelf control products.

Pre-proposal Meeting: ☑ Yes ☒ No

Sole Source Justification, if applicable:

Additional Information:

Proposal Submission: Proposals are required to be submitted in both hard copy (4 copies) and PDF format (1 PDF file per proposal). Both formats are used within TxDOT for evaluating the proposals and must contain identical information.

The “Background and Significance” portion of the proposal should be limited to 10 pages.

All proposals from researchers should be sent directly to your university’s Research Liaison for submission to RTI. The Research Liaison is TxDOT’s official contact with the university.

1. All individuals interested in proposing are encouraged to contact the PC or PD by February 12, 2004.

Deadlines (for RTI use only): 2. Proposals are due to RTI by 4:00 p.m. CST on March 24, 2004.