Surtrac for the People

A Data Management Plan created using DMPTool

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Project abstract:

The goal of this project is to update the current 50-intersection Pittsburgh SURTRAC deployment to run the latest version of the system, both to incorporate recent technology advances and to lay the groundwork for turning management of the SURTRAC deployment over to the City. Principal among the advances included in the latest release of SURTRAC are (1) new coordination of traffic signals with pedestrian walk signals that significantly increases pedestrian crossing time at intersections, (2) new web-based performance monitoring and data analysis capabilities for use within a traffic management center, and (3) enhanced predictive modeling of traffic flows from detector information that emphasizes multi-modal optimization and use of connected vehicle communication technology, and improves overall traffic flow optimization. In addition to providing these new capabilities, installation of this new release will prepare the City for its planned expansion of the adaptive signal network; if they are truly interested in expanding multi-modal, real-time signal control more ubiquitously through the City, then there is really no alternative to Surtrac and installation of the latest release will be a prerequisite. CMU will work with Rapid Flow Technologies, the commercial supplier of SURTRAC, to install the latest version and perform experimental analysis to show the overall multi-modal performance benefits (particularly to pedestrians).

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Data description

This project is not specially aimed at gathering data, but rather at providing a new traffic signal control infrastructure (i.e., the latest version of the SURTRAC system) that will enable system administrators at the City to collect, view and analyze data relating to traffic flow efficiency (in addition to incorporating the latest improvements). Fundamentally the data generated during operation of the system that can be provided to traffic management enter personnel includes:

- traffic volumes and turning proportions moving through controlled intersections,

- individual and average vehicle "link" delays through the controlled network, where a link is a road segment connecting two intersections,

- phase duration information at controlled intersections over time, and (as detection and connectivity between traffic flows and intersections increases),

- data organized by travel mode (bus, passenger vehicle, bicyclist, pedestrian).

This data is currently used to update system paramaters over time, and is transitently stored to support online display of current performance efficiency within the SURTRAC remote monitoring interface that is included with the current system upgrade.

It is possible and feasible for the SURTRAC system to forward this data to the City of Pittsburgh for permanent storage within their Open Data concept. We will shortly meet with the City's data management group to start the process of conveying to them the types of data we are currently collecting (or could be collecting) and understanding what data they would might be interested in consolidating and exploiting as the SURTRAC system is turned over to City of Pittsburgh control.

Over the course of this SURTRAC system upgrade process, we will also be evaluating performance advantages over the original installation with respect to benefits to pedestrian traffic. The data we generate to support this evaluation and the quantitative results that we produce will consitute a different type of data that will likely be of interest to the city, and will also establish performance benchmarks that may prove useful in assessing future ITS technology innovations.

Data format and metadata standards

Currently, the data collected by the SURTRAC system on approaching (multimodal) traffic flows to support both adpative signal control operations and online display of intersection performance are represented using internal data formats of the SURTRAC system, and are not exported for permanent storage. To support vehicle-to-infrastructure communication between SURTRAC and Dedicated Short Range Communication Radio (DSRC) equipped vehicles (and pedestrians), SURTRAC also encodes data for exchange using standard DSRC Message types, as defined by the current (2016) J2735 DSRC Message Standard. SURTRAC currently supports communication of the following message types:

MAP Message - for commuicating geometric information about the intersection and allowable traffic patterns to vehicles and pedestrians

SPaT (Signal Phase and Timing) Message - for continually broadcasting the current green phase and time remaining before a switch to the next phase to all equipped vehicles and pedestrians.

BSM (Basic Safety Message) - which is broadcast pperiodically by a vehicle or pedestrian to give location, heading and speed information to the intersection

SRM (Signal Request Message) - which is used by equipped pedestrians or vehicles to request sufficient green duration

SSM (Signal Status Message) - which is used by SURTRAC to respond to signal requests.

Although not explicitly a part of the statement of work of the current SURTRAC 2.0 project, one goal of the previously mentioned meetings with the City of Pittsburgh's "Open Data" Management group that are about to get underway is to establish appropriate external API's for transferring this data into more accessible and permanent data formats. Once the question of what data is of interest to the City has been answered, the next step will be to develop suitable data formats for passing information to external data management facilities.

Policies for access and sharing

The data currently collected and used by the SURTRAC has no associated personal identifiable information (PII), and hence there is no issue associated with disclosing confidential information. As the world becomes increasingly connected and more and more vehicles become equipped with V2I communication capabilities, then precautions may be necessary to obfuscate vehicle IDs. But DSRC technology, for example, pays explicit attention to redefining IDs frequently to avoid specific vehicle identification. If necessary, we ae prepared to extract vehicle/pedestrian ID information from input data streams and anonymize all received data.

More generally, Rapid Flow Technologies (the commercial distributor of SURTRAC) makes no claim of ownership of the data that it collects and uses, but rather sees its unique advantage in the ability to put this information to actionable use in real-time.

That said, we tend to rely on the municipality (in this case the City of Pittsburgh) for guidance on whether or not to release data when requests are made to obtain and/or make us of the information we collect and maintain. As we move forward with transfer of the SURTRAC system to the City of Pittsburgh, we expect their "Open Data" managmeent policies to drive questions of whom is able to access and utilze the data.

Policies for re-use, redistribution, derivatives

As indicated previously, SURTRAC collects data on traffic inflows in order to optimze traffic flows, and no intellectual property rights are ascribed to this data. It can be seen as a biproduct of basic system operations, and by default, we assume this observed data belongs to the municipality. As the City of Pittsburgh takes over control of the SURTRAC system, for example, we expect the City to make decisions on whether to release their traffic data, etc.

On the other hand, data derived by SURTRAC, such as the signal timing plans that are created at any point in time for the immediate future, is considered to have associated intellectual property rights that Rapid Flow Technologies (the commercial provider of SURTRAC) owns and retains. If, for example, it was desirable to share current signal timing plans and consequential projected traffic flows with a company like WAZE, then this would strictly be a Rapid Flow technologies business decision.

Plans for archiving and preservation

The publishable data that we see as resulting from this project will be the results obtained by analyzing the performance benefits of the new SURTRAC release to pedestrians. We will preserve the basic observed data on traffic flows that was used to derive the performance results in a password controlled repository on a server at CMU. We will rely on the School of Computer Science's substantial computing infrastructure for data security. To the extent that this data might be used to replicate the experimental context and enable future comparison of competing approaches, and under the condition that the City of Pittsburgh approves its release, we will be happy to make this data available to requestors.