New Progress of DRIVE Net

An E-science transportation platform for data sharing, visualization, modeling, and analysis

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***Abstract*—Big data represents a new era in data exploration and utilization. With the growing quantity and variety of data being collected from intelligent transportation systems and other sensors, data-driven transportation research will rely on a new generation of tools to analyze and visualize those data. To address this need, the Digital Roadway Interactive Visualization and Evaluation Network (DRIVE Net) was developed to enable large-scale online data sharing, visualization, modeling and analysis. By incorporating an increasing variety of data sets from different sensing and acquisition technologies, the new DRIVE Net system provides a more stable, powerful, and interactive platform, and is now able to handle more complex computational tasks, visualize large-scale spatial data, and support data sharing services.**

Keywords—eScience transportation platform; data sharing; data modeling; data visualization

I. Introduction and Background

With the recent developments in mobile communications, data science, and sensing technologies, data-driven science has now made its way into the transportation arena. Emerging computing technology and analytical methods give us the ability to monitor assess traffic networks with greater coverage and granularity, and promise to improve the accuracy of traffic prediction. Drawing inspiration from the field of e-Science, the Digital Roadway Interactive Visualization and Evaluation Network (DRIVE Net) on-line transportation platform is developed for data sharing, visualization, modeling and analysis [1]. The latest version of DRIVE Net has been expanded to incorporate a number of additional third party data sets for online analysis, and to offer the functions needed for real-time performance monitoring, responsive operational decision support, and system-wide analysis. Based on this platform, the data-driven tools can not only help Washington State Department of Transportation (WSDOT) 's decision making and operational practices, but also can act as a platform for data management and retrieval, modeling, and visualization in transportation research [2].

II. Study Data and System Design

A. Study Data

The new DRIVE Net system is supported by a set of databases maintained by the STAR Lab. A variety of data sources are ingested and archived in the STAR Lab server from WSDOT and third party data providers through different data acquisition methods. There are four ways to use the data archive service: direct upload, periodic download via Web services, active data acquisition, and direct data archiving.

The data sources include freeway loop data, INRIX data, NPMRDS data, WITS data, weather station data, roadway geometric data, interstate freeway elevation data, ferry data, transit data, park and ride data, transit data and Car2go data.

B. System Design

The new system adopts the "thin-client and fat server" architecture with three basic tiers of Web application: the presentation tier, logic tier, and data tier. The end-user sends an HTTP(S) request to the web server. The computational tasks are completed in a logic tier which uses a combination of custom-built analytical tools and external statistical modules provided by R Server. In the data tier, the system utilizes several Microsoft SQL Server and PostgreSQL servers to manage the raw and processed data supporting visualization and analytical tools and dissemination/download functions [3]. Analysis results are returned and visualized in the web browser as numeric computation results, analytical plots, and roadway maps based on the popular Open Street Maps API.

III. New Features

A. Multi-source Travel Time Analysis

Effective traffic control and management require the availability of data on current traffic conditions and travel times to characterize the impact of disruptions and recurring delay on a given route. The DRIVE Net system allows user to select pre-defined or customize corridors on which to analyze travel time using three different data sources: freeway loop detectors, NPMRDS, and INRIX data.

Travel time, travel time reliability, and throughput productivity are important performance indicators and, because of this, DRIVE Net now provides the capability to generate these measures for user defined corridors and time ranges. Further, both summarized and detailed analysis results and data comparison graphs are generated faster and with greater coverage than the previous version.

The main interface of DRIVE Net system and the travel time analysis section are shown in Figure 1 (a). Within the figure, a pre-defined corridor and its speed analysis result is shown in the interoperable map region.

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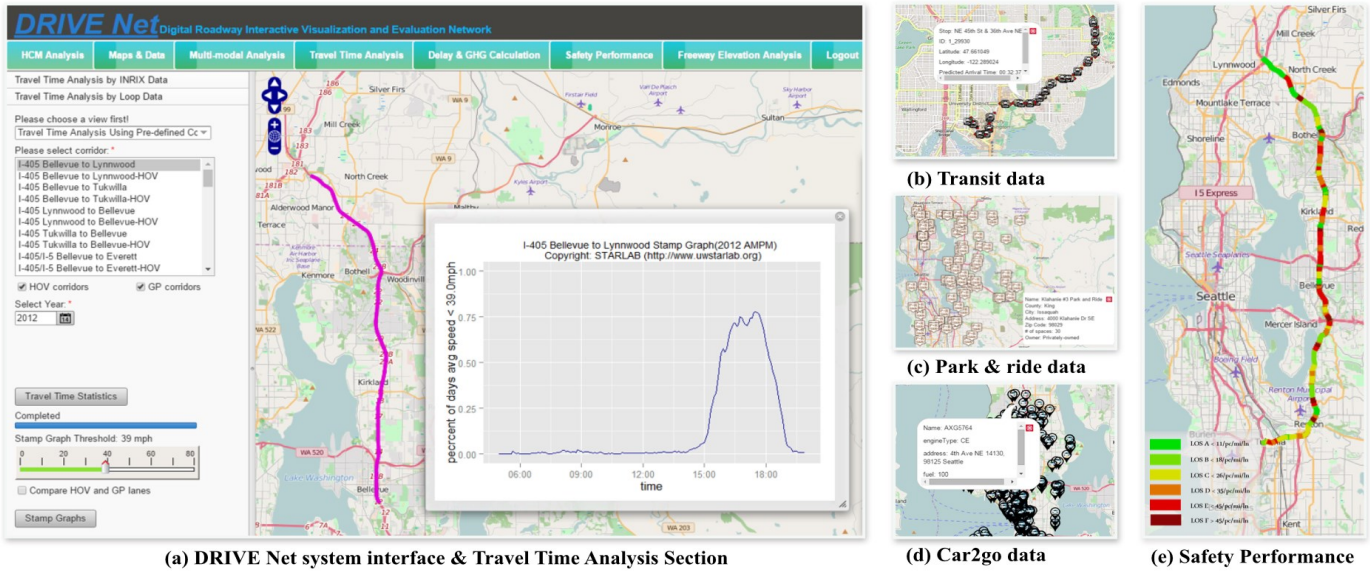

Figure 1 DRIVE Net system interface and new module example

B. *Multi-modal Data and Visualization*

The new version of DRIVE Net system aggregates several multimodal transport data sources from publicly accessible APIs and WSDOT. By visualizing and archiving the real-time multimodal data, DRIVE Net system can be a useful platform for both commuters and researchers.

1) Public Transit Data

DRIVE Net now includes a public transit data interactive visualization panel for users. The data for this panel are obtained from the OneBusAway API, currently providing real-time bus information. An example transit route and related information are shown in Figure 1 (b).

2) Park and Ride Data

By searching by county name, city name, or park and ride locations, users can obtain and visualize the park and ride locations they are interested in as shown in Figure 1 (c).

3) Car2go Data

Car2go is a free floating car sharing system. In DRIVE Net, users can select the region, such as Seattle, Austin, or Denver, where available cars will be shown on the map. By clicking a car icon, its name, address and real-time fuel level will be shown in a pop-up window like Figure 1 (d).

C. *Data Sharing*

To conduct in-depth DRIVE Net analysis, some raw data are available for downloading. In addition to INRIX, NPMRDS, and freeway loop raw data, aggregate speed/volume/congestion data are also available for visualizing and downloading in the new version. These spatial-temporal data, containing location and time information, can be visualized as contour graphs.

D. *Other Data and Analysis*

Besides roadway and related data, the new system is able to visualize real-time weather and ferry data, incident data, and nationwide freeway elevation data. Based on the various data sources, the system now can calculate the travel delay along any corridor specified by user.

For the purposes of prioritizing safety improvements on the roadway network, identifying sites with a consistently elevated accident risk is of critical importance. For this reason, a using negative binomial regression-based highway safety performance analysis module has been built into the DRIVE Net system. Example results generated by this module are shown in Figure 1 (e).

IV. CONLUTIONS

DRIVE Net is a powerful data management, quality control, analysis, and visualization platform that has the ability to layer a diverse spectrum of spatial and temporal data sets on an online digital roadway map. The new version of the platform offers the ability to handle more complex computational tasks and support data sharing services. This system will keep supporting WSDOT's mission and STAR Lab's research in the future.

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