Member Spotlight: University of Illinois at Chicago Department of Computer Science

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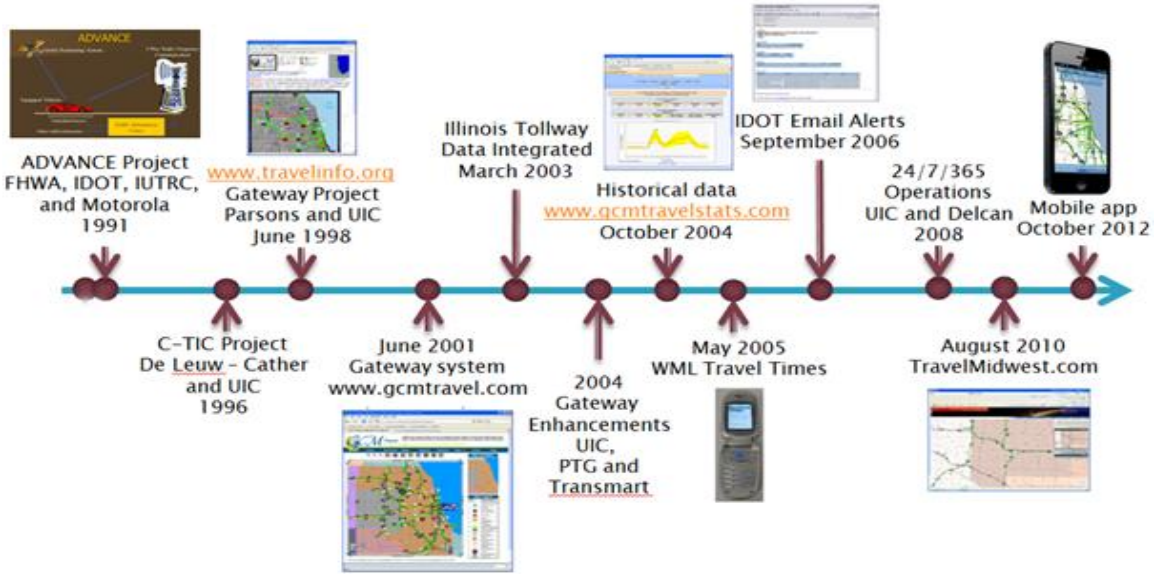
Introduction to UIC-CS

The University of Illinois is a world leader in research and discovery. Our internationally renowned faculty win more federal research dollars than all other public Illinois universities and colleges combined, resulting in priceless new knowledge and life-changing breakthroughs in medicine, agriculture and technology. The University also has an impressive impact on the state's economy. The University's operation means billions in direct spending in Illinois and full-time employment for more than 25,000 employees.

The University of Illinois at Chicago Department of Computer Science (UIC-CS) has been providing Intelligent Transportation Systems (ITS) for government and industry since 1993. UIC-CS consists of 30 computer scientist faculty members engaged in research and education with annual research funding exceeding $6 million. UIC-CS has 320 undergraduate majors, 130 masters and 100 PhD students. UIC-CS has been and is currently involved in a number of ITS related projects and research, each of which will be covered.

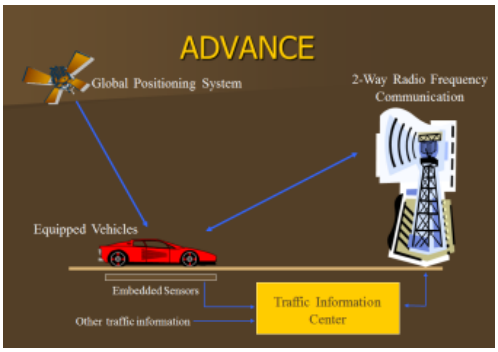
ITS Projects

This section outlines past and current ITS Projects that UIC-CS has been instrumental in developing.



ADVANCE

UIC-CS's involvement in ITS began with the Advanced Driver and Vehicle Navigation Concept (ADVANCE) project in 1993. UIC-CS was tasked with the development of the Transportation Information Center (TIC) portion of the ADVANCE project. The goal was to gather probe vehicle data, fuse it together with embedded in-pavement sensors, and broadcast out any deviations to normal traffic patterns. This system was the first to incorporate a number of innovations, such as GPS equipped probe vehicles, which today have become standard practice.



Gateway

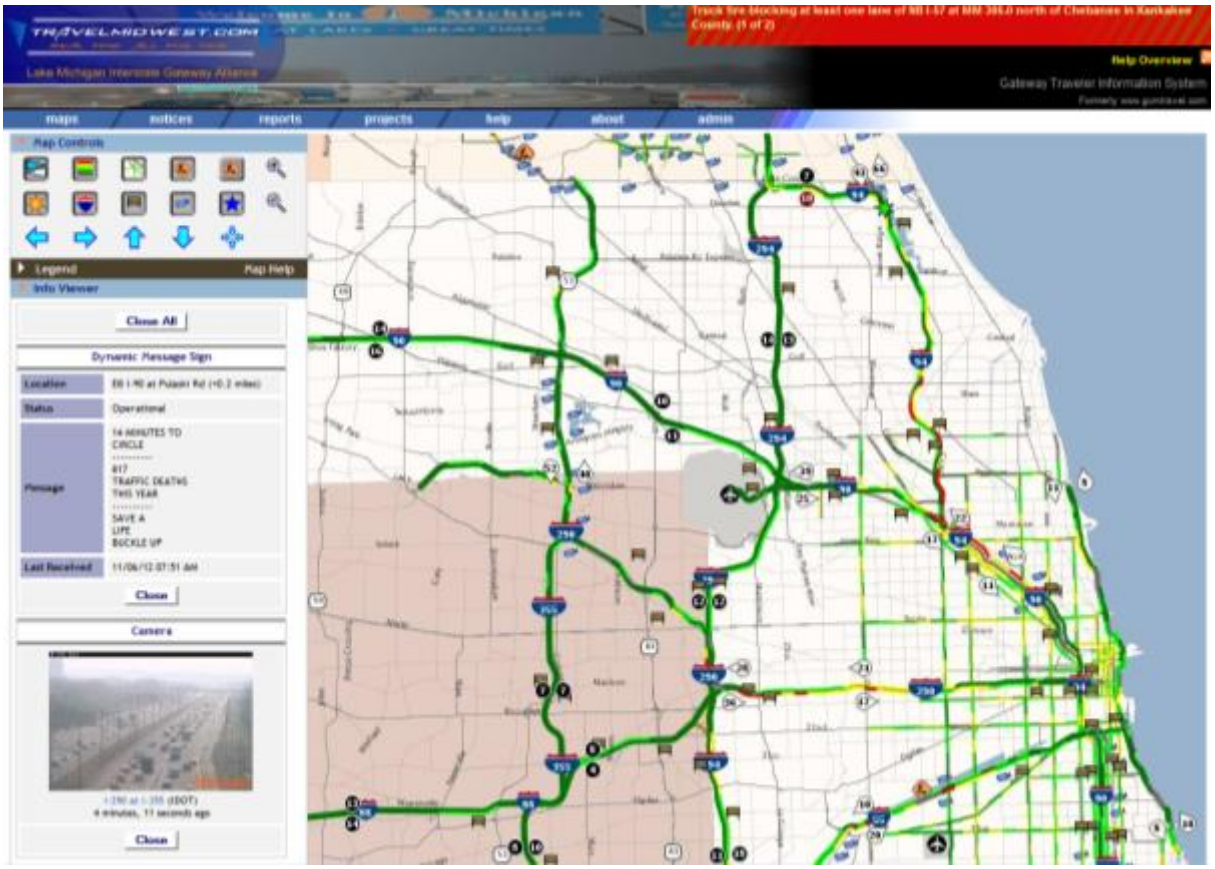
GATEWAY TRAVELER INFORMATION SYSTEM

UIC-CS designed, develops, maintains and operates the Gateway Traveler Information System (GTIS). The GTIS has a long history of serving as a central traveler information repository for the three-state Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor established in 1993. Since 1998, the Gateway has provided traveler information to a growing geography. The mission originally centered on the Chicago area expressway system with www.travelinfo.org, which disseminated travel time and congestion information collected from the IDOT Traffic Systems Center (TSC). In 2001, as additional regional traffic data collection systems came on-line in Wisconsin and Indiana, and at the Illinois Tollway, www.gcmtravel.com became the new web site.

In 2009, UIC-CS supported the transition from the GCM corridor to the Lake Michigan Interstate Gateway Alliance (LMIGA) with the development of the alliance's flagship website, www.TravelMidwest.com. TravelMidwest.com was more than a rebranding of its gcmtravel.com website predecessor. TravelMidwest.com included a number of new features such as a much larger map with a collapsible viewer for displaying camera, dynamic message sign, and other traffic related information, redesigned reports and a new trucker's report.

Significant accomplishments and features of the TravelMidwest.com website and the GTIS include:

- Standards based XML download and upload of traffic data to over 100 subscribers/publishers
- Awarded ITS Midwest Project of the Year 2009 and 2010
- 24/7/365 operations
- Geographic coverage of 51 counties in Illinois, Indiana, Michigan and Wisconsin
- Maps with pan, zoom and multiple layer controls
- Americas with Disabilities Act compliant
- Customizable with My Travel Preferences and cookies to save map position and layers
- Automated heavier than normal congestion notices
- Automated major incident notices
- Automated traffic queue detection from recent incidents displayed on maps and reports
- Truckers report with data filtered to meet needs of commercial vehicle carriers
- Mobile application for iPhone and Android smart phones



Traffic Alerts

The www.iltrafficalert.com website allows users to register to receive traffic information on their desktop or on their cell phone or other device. Users can choose up to six pre-defined routes from an available list of 72 routes within the Chicago region in Illinois. Users can choose one or two time periods per day that they wish to receive these notifications. Notifications can be sent once per time period or up to once every 15 minutes. Users can also limit notifications to when the average speed on their selected route is less than a speed limit they choose. Users can choose to receive travel time, congestion, construction, and/or incident reports in their notification.

Inter-Agency Incident Response and Notification System

The TravelMidwest.com website also provides detailed incident notifications to member agencies in the form of email messages. Individual web pages for tracking incidents are also provided via a web link. A suggested list of dynamic message signs (DMS), suggested text for those signs, and the current text for those signs are shown. Incident notifications are filtered per agency. Only incidents that might have an impact on an agency's expressways are sent out. This filtering is accomplished by gauging the severity and duration of the incident to determine if traffic might back up into the agency's territory. The notification also includes a list of dynamic message signs that should display warning messages to drivers headed towards the incident.

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The Gateway system (http://www.travelmidwest.com) has been notified about a new event:

Location: EB I-94 (Edens Expy) at Niles Center Rd, Skokie, Cook County, Illinois
Description:
Lanes affected: All lanes and shoulders closed
Start time: 11/29/2012 9:33 PM CST
Estimated end time: 11/29/2012 10:45 PM CST
Source: IDOT ComCenter
Features: Accident
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To register to receive incident notifications for your agency, contact webmaster@travelmidwest.com.

Travel Midwest Mobile App

UIC-CS, through its partnership with the Illinois Department of Transportation (IDOT), has recently released an iPhone and Android compatible mobile app called "Travel Midwest". This is the official mobile app for the www.TravelMidwest.com website. The app provides real-time traffic maps and alerts for the Chicago, Milwaukee, Madison, Rockford, Quad Cities, northwest Indiana, and Southwestern Michigan areas.

The Travel Midwest Mobile App is available for free in the Apple Store or on Google Play.

For iPhones

http://goo.gl/8ZGyB

For Android

http://goo.gl/QEzp7

TransitGenie Mobile App

The TransitGenie mobile app, compatible with iPhone devices, was developed by the UIC-CS BITS laboratory. TransitGenie provides real-time transit navigation within the City of Chicago. TransitGenie, using a routing back end, published transit schedules, and crowd-sourced transit tracking, provides the best route whenever the app is used.

The TransitGenie mobile app is available for free in the Apple Store.

For iPhones

http://goo.gl/0dm5o

ITS Research

UIC-CS is also on the cutting edge of ITS research. Some ITS related research projects are outlined in the following sections.

ODALE: Observe Driver And LEarn

UIC-CS is developing ODALE, a methodology for the development of vehicular ad-hoc network (VANET) safety warning applications. These applications aim to disseminate alerts about dangerous events on the road using short-range wireless communication technology and warn the drivers receiving such alerts when necessary. Examples of such applications include the emergency electronic brake light or the highway merge warning. A major issue with such applications is deciding when a warning should be shown. This is because recipient vehicles may be far away from where the dangerous event occurred. Showing warnings to the drivers of those vehicles could therefore result in a large number of false warnings, leading to driver desensitization which will reduce the safety benefit of the application. However, there are a large number of factors that determine this decision and combining these factors is difficult. For example, for a given distance away from where an alert was generated, the decision whether to show a warning may be different depending on the speeds of the vehicles, the weather conditions, or other factors. Relevance estimators are also application specific, so new estimators have to be developed for novel applications. This can be a significant stumbling block for application entrepreneurs. UIC-CS is developing a platform that can be utilized for evaluating novel VANET safety warning applications and their relevance estimators. The platform relies on a framework consisting of traffic micro-simulation and a machine learning approach for finding relevance estimators.

Taxi Ride-sharing

Taxi ridesharing is provides significant social and environmental benefits, such as saving energy, reducing emissions and forging novel mobile social networks. Despite the great potential, taxi ridesharing, especially with dynamic queries, is not well studied by researchers. UIC-CS is developing a centralized system which is capable of providing a large-scale dynamic taxi ridesharing service. A formal definition is given for the dynamic ridesharing problem. For the purpose of reducing query processing time and total travel distance of taxis, fast taxi searching and schedule allocation algorithms are being developed which employ a lazy shortest path calculation strategy. Historical trajectories generated by over 33,000 taxis during a period of 3 months are exploited to build realistic simulation scenarios. Based on the generated scenarios, extensive experiments have been performed to demonstrate the great potential of taxi ridesharing and the efficiency and scalability of this system.

Parking Assistant Software for Smart-phones and Car Navigation Systems

This research project will develop the Parking Assistant (PA), which is a software system that runs on smartphones and/or car navigation systems. It assists drivers in finding a parking spot, and extends the concept of a car navigation system to parking. In other words, existing car navigation systems guide the driver to a destination, but are useless in helping the driver find a parking spot at the destination. PA will

complete a car navigation system in this sense. PA was developed as part of the IGERT: Graduate Program in Computational Transportation Science National Science Foundation Grant.

PA consists of two components, a Parking Detector (PD) and a Parking Navigator (PN). PD estimates the average number of parking spots on each city block that are a candidate for parking. To do so, PD uses smartphone sensors (e.g. GPS, accelerometer, gyroscope), map information, and possibly historical information about parking availability on city blocks (e.g. on average on Tuesdays between 8 and 9am there is one parking spot on this block).

Parking Navigator (PN) guides the driver to a block where he/she is most likely to find a parking spot. This block is selected based on considerations of cost, walking distance, and driving distance. Parking garages are considered in addition to on-street parking. Guidance continues until the driver finds a parking spot.

PN is based on recent papers which developed and evaluated the Gravity-based Parking algorithm to optimize parking searches. In this algorithm, each available parking spot exerts an attraction (or gravitational) force-vector on vehicles. The force is inversely proportional to the square of the match-degree between the vehicle and the spot. The match-degree takes into consideration $-cost, walking distance/time, driving distance/time, and safety; in turn these may be affected by factors such as weather. The resultant force vector on a vehicle is obtained by vector-addition of the forces representing each available spot. The algorithm shows a significant improvement compared to Naive parking, which simply pursues the closest parking spot.

PD is based on a statistical method to combine historical and real-time parking information. Real-time information about parking is obtained from drivers' smartphones, which detect when parking spots are occupied and released by drivers.