THE TRANSPORTER

A NEWSLETTER FROM CENTER FOR INTEGRATED TRANSPORTATION SYSTEMS MANAGEMENT

Center for Integrated
Transportation Systems
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Spring 2010

INSIDE

CITSM welcomes a visit from U.S. Department of Transportation

RECENT EVENTS

Seminar Series

Friday, September 18
Seminar Title: Intelligent Transportation Systems in The District of ColumbiaSpeakers: Yanlin Li and Xianding Tao

Short Biography

Dr. Yanlin Li is the ITS Division Manager of the District Department of Transportation. Dr. Xianding Tao is a recent Ph.D. graduate from University of Maryland and currently works in the ITS Division of the District Department of Transportation.

Abstract

Intelligent Transportation Systems (ITS) play an important role to promote traffic operation effectiveness/efficiency and traveler's information services, given the constraints in roadway infrastructure. The District Department of Transportation (DDOT) develops, operates and maintains its ITS to keep the traffic systems operating effectively to meeting different goals for the nation's capital. This presentation will provide an overview of the ITS systems in DDOT including traffic signals, dynamic message signs, road weather information systems, traffic detection systems, traffic management center, critical infrastructure protection, highway advisory radio and regional information sharing. It also briefs key knowledge required to get into the ITS community to grow and contribute.

Friday, November 6

Title: Integrated Land Use and Transportation Model for Analyzing High Speed Rail, Greenhouse Gases, and Sustainable Development in California

Speaker: Dr. Robert A. Johnston

Abstract

Professor Robert A. Johnston (bio http://www.des.ucdavis.edu/faculty/johnston/bio.htm) talked about the Integrated Urban Model being developed for California. This model projects economic activity and floorspace consumption in about 500 zones and then disaggregates those land uses into 160 million 50m gridcells, to give a fine-resolution map that can be used for impact assessments of noise, runoff, habitats, etc. The land use model is run with the Statewide Travel Model every five years, so that changes to the transport system can be evaluated, as well as land use policies, such as compact growth.

Relevent policies to be evaluated include the High Speed Rail proposal, various policies to reduce greenhouse gases, and other sustainable development proposals. Impacts of interest to various groups include: Housing affordability, wages, exposrts, new development footprint, habitat fragmentation, human health, and others. This model set gives measures of economic welfare for households by income class and for employees by occupation and so can be used for equity analysis, as well as economic efficiency.

Board of Advisors Spring Meeting

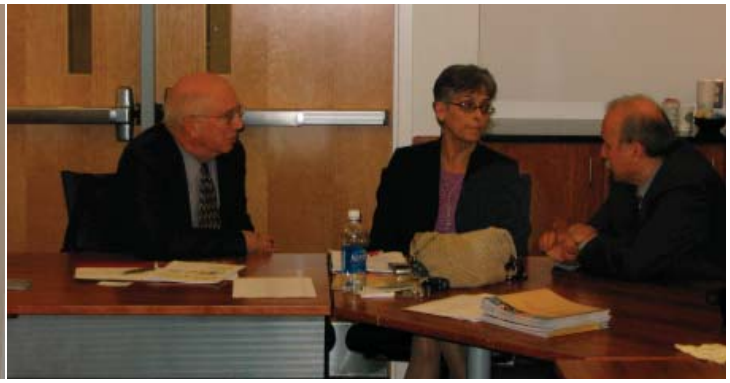
On Thursday, March 12th, we held our first annual Board of Advisors Meeting at the University of Maryland's Riggs Alumni Center. The half day meeting was extremely productive. It started out with an overview of recently awarded projects as well as developments related to those projects. Throughout the meeting, members of the board offered suggestions for applications of current research, directions for new research, and also suggested new partners for the Center. The day ended with a demonstration of the CATT Lab's Real-Time 3-D Traffic Monitoring System.

RITA Site Visit

On November 4th 5 members of the US Department of Transportation came to the University of Maryland for a CITSM Site Visit. Please see the full article about the visit on the next page.

DEPARTMENT OF TRANSPORTATION - RITA: SITE VISIT

Assistant Professor Cinzia Cirillo discusses her research with FHWA's Brian Gardner.



Director Phil Tarnoff (left) and Department Chair Ali Haghani (right) in a focused meeting with Lydia Mercado (center).

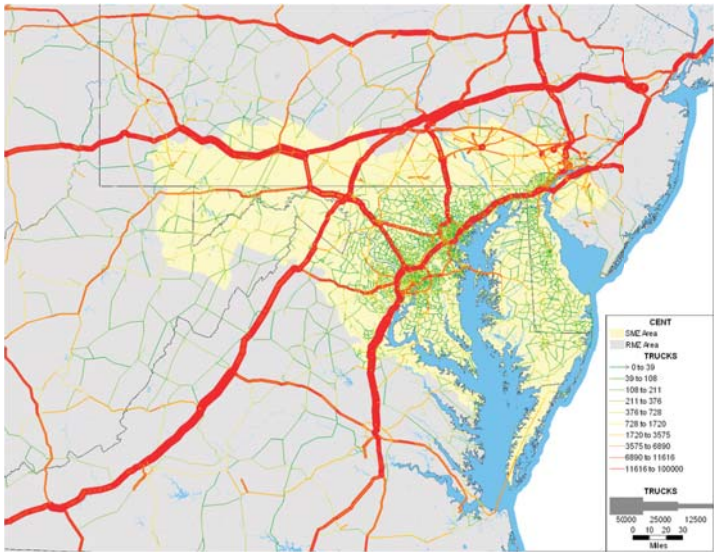
Graduate student John Rzasa explaining his work on a Hi-Def Wireless Networked Imaging System to a packed room.

Faculty and students watch attentively.

On October 4th, the CITSM had its first site visit from the Department of Transportation. Amusingly, the meeting got off to a slightly later start when some of the participants got held up by a catastrophic failure of a nearby district's traffic management system (one unrelated to the systems that are advised by the University of Maryland of course). The day started off with an address from the University's Vice President of Research, Dr. Mel Bernstein. He spoke of the University's commitment to research and its strong track record of support for the research programs. Following Dr. Bernstein, CITSM Director Phil Tarnoff gave a brief overview of the day as well and described some of the broad transportation research initiatives that are taking place at the University, both in the A. James Clark School of Engineering and in other colleges, including the Business School, Urban Studies, and the School of Public Policy. Also emphasized was the diversity and disciplines that make up the CITSM research and researchers. That led into presentations about the research. While all of the faculty members were in attendance, the research was presented by their Graduate Research Assistants. In all, nearly half of the meeting's attendants were students. After presentations were over there was a brief lunch, followed by tours of two of Civil Engineering's largest transportation labs. The first tour was the Department of Civil and Environmental Engineering Center for Advanced Transportation Technology Laboratory, where undergraduate students work with researchers designing various transportation database and GUI applications under the tutelage of lab director Michael Pack. Senior researcher (and former student) Jason Ellison gave the presentation, showing off the lab's work on the Regional Integrated Transportation Information System (RITIS), which pulls together transportation data using information from all the major transportation agencies in the Washington DC Metropolitan area and then allows users to visualize the data in new and innovative ways. For more information, visit the CATT Lab at www.cattlab.umd.edu. The final stop of the tour was to Professor Gang-Len Chang's graduate research lab where students work on innovative solutions to queuing problems as well as incident management on major throughways.

The Maryland Scenarios Project

Gerrit Knaap, School of Architecture - Center for Smart Growth



Maryland's highways are in trouble: they are more than tapped out by decades of unremitting increases in drivers, cars, trips, miles traveled, and congestion. The Chesapeake Bay is in trouble: it can no longer deliver the bounty it once did. Yet development continues, and in locations and patterns that may mean trouble for agriculture, greenhouse gas emissions, water quality, mobility and access, other aspects of quality of life, and—sooner or later—the economic prosperity that is driving the development.

These troubles are not surprises, but they creep up on Maryland so slowly that they become just another familiar part of life's landscape. Each year looks mainly like it predecessor. One needs to take a longer look back to see the arc of the change, and a longer look forward to see where the state of the state might be headed.

But thinking about long-run about big issues for a big geography is difficult. The future is inherently uncertain. Are changes, much less sacrifices, really merited? What are the tradeoffs? What are the possibilities? What are the odds?

These and related questions are at the heart of the Maryland Scenarios Project, an attempt to consider the future of the State's economy, environment, and livability in ways that are systematic, internally consistent, quantitative, understandable, and conducive to public debate.

History of the Project

Maryland has a long and rich history of state activism in land use policy. Beginning in the 1960s, the Maryland General Assembly and various Maryland governors proposed and enacted a series of land use laws, most of them designed to protect Maryland's environment.

Maryland's Smart Growth program (1997), championed by Governor Glendening, sought to (1) encourage growth and revitalization inside existing cities and towns where development was already present, and (2) identify and protect the best farmland, forests and other natural areas from encroaching development. That program is generally to be at the forefront of efforts by states to manage the negative impacts of growth.

Yet despite its successes, Maryland's Smart Growth program has not been able to turn the tide on the deterioration of conditions for the Bay and other natural resources, congestion, greenhouse gas emissions, and various aspects of the form of urban development (which contribute to all the other problems.

In 2000 the University of Maryland created the National Center of Smart Growth Research and Education. The Center is affiliated with School of Architecture, Planning, and Preservation; the School of Public Policy; the A. James Clark School of Engineering; and the College of Agriculture and Natural Resources. The Center's efforts aim to improve public policy related to the nature of Maryland's communities, landscape and environment, and quality of life.

The Center concluded that short-run, local policies will not be sufficient to address the larger overarching problems that Maryland will have to cope with over the next 20 to 50 years. In 2005, the Center and several partner organizations sponsored what, in retrospect, was the start of the Center's Maryland Scenarios Project.. Nearly 850 participants in large groups around the state to create maps of where a forecasted 1.5 million new people and 500,000 new jobs would locate across the state. The future Maryland they envisioned was very different from the one trends pointed to.

In Spring 2007, the Center convened an advisory group of nearly 40 technical land use and planning experts from across Maryland to assist in identifying the future driving forces of Maryland's growth. The group created alternative scenarios for future growth in Maryland, based on the interactions of the driving forces of growth with potential local and state policies.

That effort made clear, however, the magnitude of the technical challenge. The participating experts offered well-informed opinions about some aspects of future growth. But no one person could be an expert in all fields, much less think through all the connections and their directions and magnitudes of influence, now and 50 years into the future. In short, the experts had intuitions about the fuutre, but felt that more analysis, of some type, was needed.

The future is inherently uncertain. No model can predict with any confidence the future that awaits the state under some set of

conditions. But without some type of system for accounting likely interactions among key variables, there is little ability to introduce any consistent quantification into speculative discussions.

Those considerations led to the current (2008-2010) phase of the Maryland Scenario Project: the development of a suite of models to more rigorously evaluate how changes in economic forces and public policy might change the future amount and pattern of development, and its impacts on key aspects of quality of life in Maryland.

Central to the modeling effort is a statewide transportation model. Sophisticated models now exist independently in Metropolitan Planning Organizations in Washington, D.C., and Baltimore. But those models do not talk to each other, and they collectively cover only a small part of the state. The Maryland State Highway Administration (SHA) funded the Center and Parsons Brinkerhoff to build the state's first sketch-level state transportation model. SHA and the Maryland Department of Transportation plan to use this model to prepare the transportation element of the first State Development Plan. Additional elements of the model will help address recently released state goals to have the transportation sector should achieve a 25-50 percent reduction in greenhouse gases by 2020.

The Center's efforts to develop scenarios and models to help evaluate them matches well with the mission of the Center for Integrated Transportation Systems Management (CITSM) at the University of Maryland. The theme of the Center is "Integrated Transportation Systems Management." The ideas of systems and integration are central to the Maryland Scenarios Project; transportation and land use are the core components of the suite of growth models; getting to agreement on policies for the management of transportation systems, land development and, and ecosystems is the main objective of the Scenarios Project.

Given the correspondence of goals, CITSM helped fund some of the Center's research (1) linking the transportation model to a land-use model, (2) enhancing the capacity of the state transportation model to address congestion pricing, and (3) developing a greenhouse gas component of transportation model.

The possibilities for the Scenarios Project continue to grow. Maryland is now creating, for the first time, a State Development Plan. Only a few states have such plans, and Maryland's could be the first to try to integrate policies for climate change. The Center has agreements with the Maryland Department of Planning to assist with that department's improvements to its land use (growth) model, and to use Center's suite of models, which would then include a version of the improved MDP growth model as a component, to evaluate scenarios useful to the development of evaluation of the State Development Plan. Conversations with the Maryland Department of Transportation have begun about the possibility of creating and evaluating statewide, long-run transportation investment scenarios.

Structure of the Models

Ultimately, the Maryland Scenarios Projects wants to evaluate possible futures (scenarios) for growth in Maryland. It wants to provide information useful to discussion questions like "what happens if…?": If gas prices go to $10 per gallon? If a new bridge is built to the Eastern Shore? If higher densities are required for all residential, commercial, and industrial

Thus, it is hard to separate the Maryland Scenarios Project from its effort to develop models to be able to evaluate those scenarios. Concurrent with the creation of the scenarios, the Center has been working with consultants and state agencies to develop a set of loosely coupled impact models. One can think of scenarios as a set of assumptions about variables outside the model that would then be inputs to the

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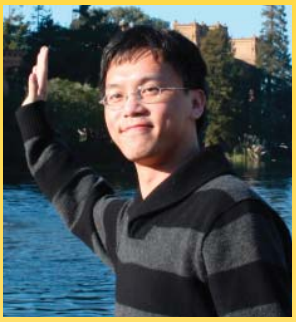
student SPOTLIGHT



FRANK CHEN

Mr. Chen is a Ph.D. candidate in the Dept. of Civil and Environmental Engineering. He received his bachelor's and master's degree in Traffic and Transportation from the National Chiao Tung University, in 2000 and 2002.

In his first research project, sponsored by the U.S. DOT, he developed a method for optimizing the allocation of storage spaces in container ports based on the expected dwell times of containers. He then adapted this method to the allocation of airport parking spaces, demonstrating the possibility of very significant improvements in access distances and operating costs. In another project for the U.S. Army Corps of Engineers he analyzed service times at waterway locks and evaluated lock control policies that could improve those service times. In a recent project for the U.S. DOD, Frank developed methods for evaluating and optimizing the paths of robotic agents on hazardous missions using a genetic algorithm to generate and select paths whose evaluation required the processing of data from a geographic information system (GIS).

In his current research project Frank focuses on analyzing and optimizing logistic transportation systems dependent on reliable transfers at transportation nodes such as truck terminals, airport hubs, ports and rail yards. Such an intermodal timed transfer system has some potential advantages such as: (1) obviating the need for providing direct routes connecting all origin-destinations pairs and concentrate cargos on major routes with fasteror lower cost modes; (2) improving the utilization of existing transportation infrastructure; (3) reducing the requirements for warehouses and storage areas due to poor connections, and (4) reducing other impacts including traffic congestion, fuel consumption and emissions. To realize these potential advantages an efficient planning and control system is needed. In this project Frank starts by pre-optimizing the characteristics of a system's routes, vehicle sizes, schedules, terminal capacities and probabilistic reserve factors built into operating schedules. He then applies real-time control methods to deal with deviations from schedules and other disruptions. Frank is also exploring the effects of control policies on the propagation (or attenuation) of delays through networks and schedules.

After graduation Frank hopes to pursue his great interest in research and teaching through an academic career.

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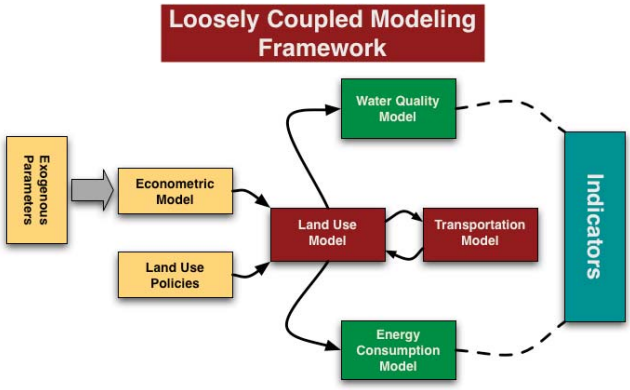
models. The interactive modeling framework will include statewide econometric, transportation, energy, nutrient loading, land use, and fiscal impact models. Figure 1 shows the structure:

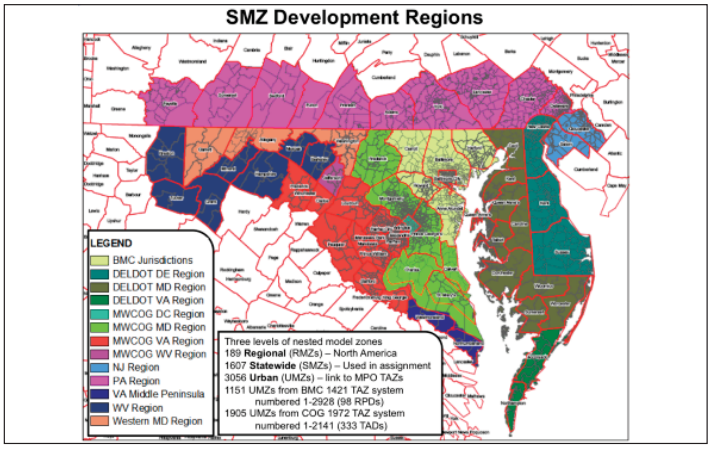
FIGURE 1: ECONOMETRIC MODEL



Econometric Model. The Center has teamed with the Inforum research group at the University of Maryland to adapt Inforum's econometric models to generate detailed economic and demographic forecasts at the state and county levels. These forecasts include estimates made under a variety of assumptions regarding parameters such as energy prices. Until this project, such county-level forecasts were not available at this level of detail in Maryland.

Transportation Model. The transportation model is a sketch-level model that operates at three levels. An upper level represents the U.S. (for freight) and five adjacent states (centered on Maryland) for the modeling of interstate person and freight trips. A middle layer represents the Baltimore and Washington metropolitan areas at an aggregate (super zone) level, as well as the rest of Maryland. The lowest level of the model corresponds to the traffic analysis zones and transportation network level of the Baltimore and Washington models. Flows on each layer, as well as between layers, will allow the visualization and summarization of model data at various levels. The transportation model development was funded by the Maryland State Highway Administration and developed in cooperation with Parsons-Brinkerhoff.

FIGURE 2: TRANSPORTATION MODEL



Land-Use Impact Model. The Center has partnered with the Land Use Evolutions and Impact Assessment Modeling (LEAM) Laboratory at the University of Illinois to develop a land use model. The LEAM model is an innovative approach to simulating the evolution of urban systems in a spatial and dynamic visual decision support tool. LEAM uses a Cellular Automata (CA) approach tightly coupled with an open architecture for model development and high-performance computing capabilities for simulating land-use transformation.

Energy Consumption Model. Funded by a U.S. Environmental Protection Agency Science to Achieve Results (STAR) grant, the energy consumption model compares residential electricity demand across different growth scenarios. The energy consumption model is being developed by Matthias Ruth, director of the Center for Integrated Environmental Research.

Emissions Model. Motorized travel emits pollutants and greenhouse gases. Emissions are a function of vehicle technology, fuel type, and operating conditions (there are more emissions per mile in congested traffic, which is slower and has more starts and stops). The Center is building this model to post-process the output of the transportation model.

Nutrient Loading Model. Also funded under the STAR grant is the development of a nutrient loading model that estimates the impacts of various growth scenarios on nitrogen, phosphorous and sediments loadings on the Chesapeake Bay and its tributaries. The nutrient loading model builds on the work of Glenn Moglen and GISHydro.

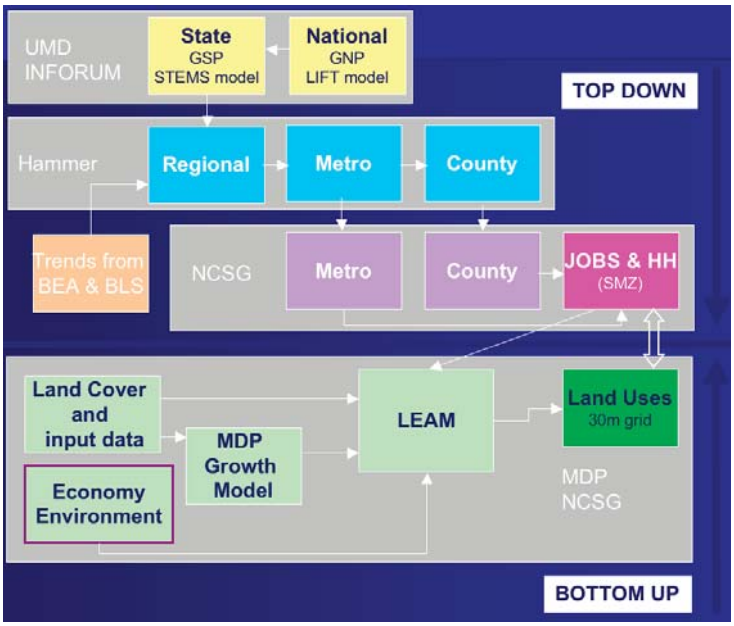
Fiscal Impact Model. The fiscal impact model, produced jointly with the Maryland Department of Planning, provides estimates of the costs of schools, roads, sewer and water, and other public services under alternative development scenarios.

The project also developed methods for allocating growth (of households and employment) that is forecasted by the econometric model at the state level to the much smaller zones that a transportation model requires (about 1600 zones for the multi-state transportation model). Figure 3 shows that methods were both top down (more detailed county-level data and gravity models to take state totals down to State Modeling Zones) and bottom up (using GIS land use and land cover data, and three different land use models—including LEAM and MDP's growth model). Comparing the results of the different models facilitates making more reasonable choices about where growth, by type of household and industry, is likely to locate.

The growth allocations to State Modeling Zones (the outputs of the econometric and land use models) are the inputs to the statewide transportation model. The outputs of the transportation model are then check against the initial inputs of growth: is the match reasonable? If areas expected by the initial growth allocation to have high growth are shown by the transportation model to have ubiquitous high congestion, then adjustments to the growth inputs might be

merited (or changes to the assumed transportation network). Once the transportation and land use models are deemed to be reasonably balanced, the outputs of both (households, jobs, trips) can be used as inputs to other impact models (e.g., energy, emissions, nutrient loading, fiscal, and others that may be added).

FIGURE 3: LAND-USE IMPACT MODEL



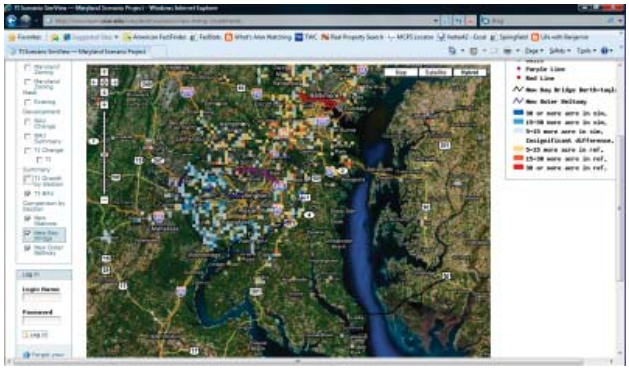
Ultimately, a lot of the data going into and coming out of the models will be "gridded": allocated using GIS to small cells (on the order of 40 to 400 meters on a side) for the entire state of Maryland.

Getting all these models to interact properly requires, among other things, making sure that the output of one model is in exactly the form that a downstream model requires for its inputs. To assist with this and related model management procedures the Center is working with the U.S. Environmental Protection Agency to use "FRAMES," a software package EPA developed for exactly that purpose.

Status and Next Steps

The description above suggests the complexity and size of the undertaking. It is a multi-year development process. The Center now has "proof of concept": the models are operating and delivering results that seem intuitively plausible. Figure 4 shows an example of how the modeled output might be queried to compare where growth might locate 30 years out under two different strategies for transportation investment.

FIGURE 4: ENERGY CONSUMPTION MODEL



But much more needs to be done. The Center expects to have results ready for public viewing and discussion in 2010. That schedule should allow it to help inform public meetings that will occur about the new State Development Plan.

faculty BIOGRAPHY

MEHDI K. KHANDANI

Dr. Mehdi Kalantari Khandani has more than 15 years of experience in industrial instrumentation, high frequency circuit design, low power wireless communication, and wireless networks. Dr. Khandani founded MacroPhage Networks in 2004 (the company was registered in State of Maryland under the name NetImmune, Inc.). The company is based on Dr. Khandani's patents, which offers superior performance in protecting the Internet infrastructure against harmful Distributed Denial of Service (DDoS) attacks. The company received $5.0 Million VC investment. After investment, the company was renamed to RioRey Inc., which is a leading provider of DDoS security in the Internet. Since 2005, he has served as an assistant research scientist at the Department of Electrical and Computer Engineering at the University of Maryland, where he also serves as the director of Master of Science Program in Telecommunications.

Dr. Khandani received his BSc and MSc degrees in electrical engineering from the Sharif University of Technology, Tehran, Iran 1996, and 1998, respectively, and his PhD in Electrical and Computer Engineering from the University of Maryland in 2005. He has more 25 publications in the field of low power communication, security, and sensors networks. Dr. Khandani received Dean's Honor Award of the Sharif University of Technology in 1996, Business Plan Competition Award of UMD in 2004, Student Service Award of Electrical Engineering Department of UMD in 2005, and Award for Entrepreneurship of UMD in 2006. Moreover, he has received research grants from the National Science Foundation (NSF), Center for Integrated Transportation Systems Management (CITSM), Maryland Industrial Partnerships (MIPS), and Maryland Technology Development Corporation (TEDCO).

ABOUT CITSM

The Center for Integrated Transportation Systems Management (CITSM) at the University of Maryland College Park was established as a tier I university transportation center in 2008. The goal of the center is the Development of Advanced Technology, Improved Processes, and Enhanced Organizational Structures for the Integrated Management and Operation of Transportation Facilities and Corridors.

The Center for Integrated Transportation System Management (CITSM) focuses on the development of tools, processes and institutional relations that foster seamless management and operations of today's transportation infrastructure. Such seamless operations will be derived from concentrating on the overall mission of transportation agencies rather than the narrower objectives of individual institutions and facilities. Integrated operation of the transportation infrastructure as a system rather than a collection of individual resources, offers the potential for significant improvements in system efficiency as measured by reductions in travel time and congestion along with improvements in travel reliability. Integrated system operation will have a positive impact on the nation's economy, safety, air quality and energy consumption.

The theme of the Center is "Integrated Transportation Systems Management." The Center conducts research and provides education and technology transfer related to this theme. The objective of this research is to provide improved mobility and reduced congestion for travelers and shippers using the nation's transportation infrastructure. The emphasis of this work is on the integrated management of the transportation systems at all levels including planning, engineering, and operations. The University of Maryland has selected this theme because of its potential for significantly improving transportation system mobility and reliability, as demonstrated by numerous prior research projects conducted by its faculty and staff. A second, but equally important, objective of the Center is to educate the next generation of transportation engineers and planners with the tools needed for seamless management and operations of today's transportation infrastructure and the deep understanding of the benefits of such a fully integrated system.

CITSM

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