



Michigan Ohio University Transportation Center

Alternate energy and system mobility to stimulate economic development

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Winter 2008

TECHNOLOGY TOUR ----- the MIOH UTC Operating Committee Visits Projects at Partner Universities



UT Mechanical Engineering masters student, Chris Schroeder explains the hydraulic hybrid pump/motor test stand to Dr. Mark Schumack, UDM, and Sujay Bodke, graduate ME student at UDM. Dr. Schumack leads the team that will create a virtual replica of the physical test stand for use in a teaching module.

Meetings of MIOH UTC Operating Committee members and invited transportation professionals to review and discuss progress of MIOH research projects were held at Grand Valley State University on February 22 and at The University of Toledo (with participation by Bowling Green State University) on February 27, 2008.

The focus of the GVSU meeting was "Transportation System Efficiency and Utilization". Dr. Charlie Standridge and Dr. Shabbir Choudhuri, both of GVSU, with contributions by Dr. Snehamay Khasnabis, Wayne State University, are leading a research project that addresses the problem of *dynamic rerouting of traffic in a near real time basis such that rerouting of all traffic to the same new route does not create a new congestion problem*. A total of four faculty and seven students have participated in this project which has been funded to continue for a second year. During the presentation, four students demonstrated their data collection and/or model development.

Dr. Choudhuri demonstrated a model that will send vehicles to the one "optimal" solution until the load on that route deteriorates the flow making another route optimal. A novel hardware based (analog) solver was demonstrated to allow very rapid determination of this optimal route. Eventually, this hardware solver will be placed on a chip.

MIOH UTC

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Graduate student Ashfaq Rahman demonstrates his research on the hardware based solver for the routing problem during the Feb. 22, 2008 technology visit at Grand Valley State University.



MIOH ON TARGET

One only needs to read the headlines to realize that the MIOH UTC mission ... *alternate energy and system mobility to stimulate economic development* ... is directly responsive to the most critical challenges facing our region and our nation. Oil prices have topped \$110 a barrel, leading to predictions of \$4.00 per gallon gasoline. The economy of Michigan is deeply troubled as the nation edges into a recession. Construction on I-75 in southwest Detroit has closed it completely for the next two years.

On the positive side, Next Energy (a MIOH partner) is creating new alternative fuels and new companies. Three transit projects in Detroit (one supported by a MIOH study) are moving forward toward transit systems that promise to mitigate congestion, save energy, stimulate development and reduce the need to expand freeways.

The recent *Road to Renaissance* economic development plan includes an aerotropolis supply chain hub to support Michigan's corporations and create new ones.

During our first year, the MIOH UTC has directly and indirectly met these challenges and supported these initiatives through specific education, research, K12 outreach and technology transfer projects. A sampling of MIOH's projects and other activities are included in this Newsletter.

You can get involved in MIOH by contacting me at 313-993-1216 or at HANIFINL@UDMERCY.EDU.

Dr. Leo E. Hanifin
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Technology Tour

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While this strategy may not create the optimal flow for the overall system, it can be implemented without having vehicle specific communication ... that is, communication that would allow different alternative routes to be sent to different vehicles. In a VII enabled world, a multiple routing strategy would be possible. Ironically, on the morning of the visit to GVSU there was an accident on I-96 between Detroit and Grand Rapids closing the expressway. This delayed several participants coming from Detroit between 45 and 60 minutes...and demonstrated the need for such rerouting systems.

Another result of this project is a valuable data set that other researchers can employ. This captures the traffic data from 24 sensors for one full year (Nov 2005 thru 2006). This data is available on the GVSU website (utc.egr.gvsu.edu/mdot/) for use by researchers. Users can select the period of the data, as well as, the format in which it is provided and download the traffic data that they seek.

The visit at The University of Toledo to see two projects focusing respectively on Hydraulic Hybrids (UT) and Paratransit (BGSU) was equally impressive as the Grand Valley meeting. Dr. Mohammad Elahinia, UT, with UT students and colleagues presented their work to *develop education modules for use in courses to enhance students' understanding of the performance of a hydraulic pump or a hydraulic motor through its complete range of operation.*

Collaborating with them are Dr. Mark Schumack, UDM, and UDM engineering graduate students. The main components of the modules will be laboratory experiments based on the hydraulic hybrid vehicle components. The developed experiments can be used to facilitate students' understanding of engineering principals in fluid dynamics, hydraulics, energy systems, vibrations, mechatronics and controls. The UT team is building a physical test stand. The UDM team is creating a virtual replica of the physical test stand for use in a teaching module. All designs and software for these real and virtual systems will be available to other universities for their use.

Finally, an early review of the research plan to study Toledo's paratransit system was presented by Dr. Hokey Min of Bowling Green State University.

A Novel Image Database Analysis System for Maintenance of Transportation Facility

Drs. Makki, Chou and Lin, UT, propose to develop a functioning prototype system to automatically process, store, analyze and extract information from images for the purpose of inspection and monitoring of transportation facility using image analysis, pattern recognition and decision making for transportation applications.

Modeling Paratransit Services in the Toledo Metropolitan Area

Dr. Hokey Min, BGSU presents his project to develop a paratransit vehicle routing/scheduling model. This model can potentially aid public transit authorities, such as the Toledo Area Regional Transit Authority, in creating more user-friendly, cost-efficient vehicle routes and schedules while meeting the Americans with Disabilities Act.

Right: Dr. Min presents at the UT-BGSU technology visit on February 27, 2008.





Christopher C. Schroeder (third from left), MIOH UTC Outstanding Student of the Year, receives the US DOT award from Paul R. Brubaker (second from left), Administrator of RITA. With them are Ron Diridon (left), 2008 President of the Council of University Transportation Centers and Former Secretary of Transportation Norman Y. Mineta (right).

2007 Outstanding Student of the Year

The Michigan Ohio University Transportation Center is pleased to introduce Christopher C. Schroeder as its 2007 Outstanding Student of the Year.

For the past sixteen years, the U.S. Department of Transportation (USDOT) has honored an outstanding student from each UTC at a special ceremony held in Washington DC on the weekend prior to the TRB Annual Meeting. In January 2008 these students were recognized and individually presented with a certificate during the ceremony by Paul R. Brubaker, Administrator of the Research and Innovative Technology Administration.

Christopher C. Schroeder is a graduate mechanical engineering student at The University of Toledo. He is working with Dr. Mohammad Elahinia on a project to develop "Multipurpose Educational Modules to Teach Hybrid Vehicle Technologies". Specifically, Christopher says I am "working with colleagues to make hydraulic hybrid vehicles more suitable for commercialization.... I am excited and thrilled to be part of a university and a project which has the potential to make big changes in the automotive industry."

In addition to his academic endeavors, Christopher is an officer for the Engineering Graduate Student Association. During his undergraduate career at The UT, he worked for Tenneco, Inc. for four semesters to satisfy his co-op requirements. There, Christopher says, he received valuable engineering experience and learned many new skills.

Right: Christopher Schroeder, 2007 Outstanding Student of the Year, receives the MIOH UTC Award from Dr. Leo E. Hanifin (left). Present is Dr. Mohammad Elahinia who is Principal Investigator of the Hydraulic Hybrid project on which Chris is doing research.

MIOH UTC'S Mission

MIOH will work to significantly improve transportation efficiency, safety and security in Michigan and Ohio and across the nation by increasing the effective capacity of existing transportation infrastructure, reducing transportation energy dependence through alternative fuels, and enhancing supply chain performance.

- This will be accomplished through the development and organization of new knowledge, technology and management systems;
- the effective transfer of new and existing knowledge to commercial enterprises and educational communities; and
- the development of a cadre of transportation professionals that is larger, more diverse and better prepared to address the challenges and opportunities of 21st century transportation systems.

Projects Approved to Continue in Year 2

Four projects funded in 06-07, the first MIOH UTC year of operation, have been approved to pursue their proposed second year objective.

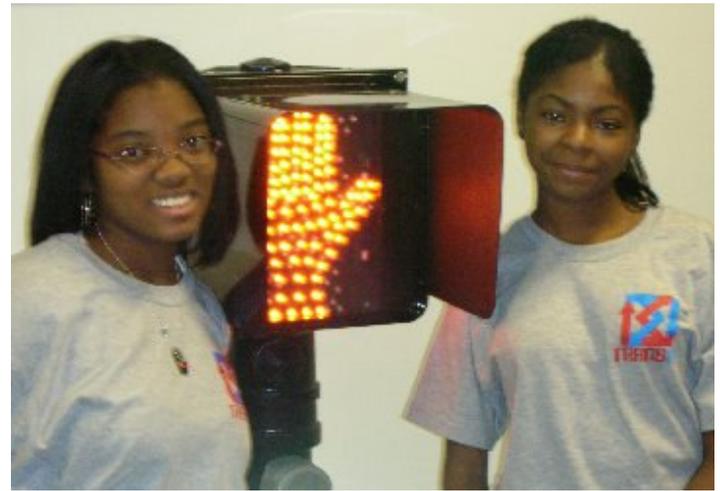
AF1, "Multiple Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies" led by Dr. Mohammad Elahinia of UT and partnered by Dr. Mark Schumack of UDM.

AF4, "Improved Oxidative Stability of Biodiesel Fuels: Antioxidant Research and Development" led by Dr. Steve Salley of WSU.

SC2, "Enabling Congestion Avoidance and Reduction in the Michigan-Ohio Transportation Network to Improve Supply Chain Efficiency: Freight ATIS" led by Dr. Ratna Babu Chinnam of WSU and partnered by Dr. Gregory Ulferts of UDM.

TS1, "Congestion Relief by Travel Time Minimization in Near Real Time – Detroit Area I-75 Corridor Study" led by Dr. Charlie Standridge of GVSU and partnered by Dr. Snehamay Khasnabis of WSU.





Above and left: Campers visit the Road Commission for Oakland County - TOC

K-12 Outreach ---- Students Encounter New Concepts at TRANSIT Camp

TRANSIT Camp is one-week commuter summer camp focused on types of transportation and transportation flow. The camp objectives included: (1) Increasing the students' awareness of the study of transportation flow; (2) Raising the students' understanding of the impact of transportation on communities; (3) Enabling the students to evaluate technological solutions to improve transportation efficiency; (4) Allowing the students to propose intelligent solutions to congestion; (5) Helping the students appreciate the value of coordinating transportation systems; and (6) Making it possible for the students to provide intelligent input to discussions on traffic improvement.

Twenty campers participated in daily activities that included simulation modeling of traffic flow, a field trip to a transportation operations center, urban planning, the role of SEMCOG in the control of traffic, components of a traffic management system, and social justice & traffic flow.

Students completed projects and presented the results to parents and faculty at the closing ceremony. Learning outcomes were assessed.

Below: TRANSIT Campers begin their exposure to the profession of transportation.



Professionals share their career perspectives



Above: Virginia Stanard, Brittany DesRocher, Christina Heximer and Crystal Whithers present the many faces of Architecture, Urban Planning and Transportation to campers.



Above: TRANSIT Campers develop graphic skills as they learn about the tools of Transportation Professionals and construct their own projects.

Thank you to the many professionals who generously shared their time and expertise with these young people.



2007 TRANSIT Campers at Road Commission for Oakland County-TOC

NEW 2007-2008 Alternative Fuel & Congestion Mitigation Research

Improving the Energy Density of Hydraulic Hybrid Vehicles

Dr. Mohammad Elahinia of The U. of Toledo and Dr. Mark Schumack of UDM's Mech. Engineering Dept. are initiating a project building on their prior curriculum development collaboration.

Hydraulics (often called fluid power) offers the best solution for hybridizing heavier vehicles such as SUV's trucks and buses to improve fuel economy. In this project, a new concept is being evaluated through analysis and simulation to address the energy density limitation of the HHVs. In addition to improving the energy density and providing longer operation for the vehicle, this new system will provide the electric plug-in capability for HHVs.

Modeling Metropolitan Detroit Transit

Dr. Snehamay Khasnabis of the Civil Engineering Department, WSU and Dr. Utpal Dutta of the Civil & Environmental Engineering Department, UDM are developing a quick response model that can be used by planners and/or engineers to test the cost and operating implications of changes in vehicular and station parameters of a rapid transit system in the Metropolitan Detroit Region.

Such a testing model will address one of the many challenges associated with building a rapid transit system in this region. Additionally, the resulting model will be a valuable tool for transit professionals in other regions of the U.S.

Combined Technology Will Aid Drivers

VII = Vehicle Infrastructure Integration

and

ITS= Intelligent Transportation Systems

Dr. Nizar Al-Holou of UDM's Department of Electrical and Computer Engineering has been approved to undertake a project that addresses the challenge of developing a test bed that accommodates testing different inter-vehicle communication protocols and yet keeps the cost at a reasonable level. The result will be a versatile test bed with realistic measurements at a low cost that will be used to evaluate different wireless protocols. There are many difficulties involved in building such a test bed, including: the draft, and continuously updated, status of the proposed inter-vehicle communication protocols; the large number of nodes that are required to reflect a real world scenario of inter-vehicle communication; and the high cost of the available tools in this field. The proposed test bed will provide a tool to investigate minimizing message delay, obtaining sufficient channel throughput, and evaluating real world inter-vehicle communication scenarios with actual vehicles.



Alternate energy and system mobility to stimulate economic development.

MIOH UTC issues RFP for research year 2008-2009

Submission deadline June 1, 2008.

For an electronic copy contact Pat Martinico at martinpa@udmercy.edu or 313-993-1510

or visit the MIOH UTC web site at

<http://mioh-utc.udmercy.edu>.



TRANSIT Campers make and test concrete under the direction of Dr. Jim Lynch, Professor of Civil Engineering, University of Detroit Mercy. See more pictures on page 4.

Register NOW for TRANSIT Camp

Camp Dates: July 21-25, 2008

For: 9th-11th grades in 2007-08

Registration deadline: June 1.

TRANSIT Camp is a one-week commuter program exploring the world of transportation. It is open to any high school student currently in the 9th through 11th grades. A Minimum 2.75 GPA is required. Enrollment is limited to 24 participants. Please inquire about scholarships.

TRANSIT Camp will run July 21-25, 2008, 9:00 a.m. to 2:30 p.m. daily. The camp is held at the University of Detroit Mercy. For more information or to request a brochure/application, please contact Director of Pre-College Programs, Dan Maggio at maggiodd@udmercy.edu.

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