

## Special Interest Articles:

- Women in Engineering Camp a Success.
- 1<sup>st</sup> annual EAB meeting.
- New labs developed for autonomous vehicles course.

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## Welcome from Center Director, Umit Ozguner



Welcome to the first issue of the CrIS Newsletter, reporting on all the exciting research, education and outreach activities performed in the Department of Transportation (DOT) Crash Imminent Safety University Transportation Center (CrIS UTC). We shall

be providing news on all the Center related activities of Ohio State University participants, leading the consortium, and the member Universities: University of Wisconsin, University of Massachusetts-Amherst, North Carolina State A & T and IUPUI.

CrIS officially was initiated in September 2013, but had its Kickoff meeting in November, just after we moved our offices to the Center for Automotive Research CAR-West facilities at the OSU ElectroScience Complex. Although we have a number of labs in the main building, the development and building of our garage took a while.

So in this issue of the

Newsletter, two major events are worth highlighting: The Ribbon Cutting for our new facilities, including the garage, which was simultaneously accomplished with the Center's first annual meeting, and the first External Advisory Board Meeting.

The second event to be reported, and one we are truly proud of, is our contribution to a "OSU Women in Engineering" organized Summer Camp program for Sophomore and Junior girls in High School. Within a week we introduced them to problems in developing self-driving vehicles by guiding them to program wheeled robots.

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## Aug 1<sup>st</sup> Meetings and Ceremony a Success

On August 1<sup>st</sup>, 2014, several events took place. In the morning we held the first Annual Meeting of the CrIS UTC researchers which included several presentations by projects leads and center coordinators. The External Advisory Board meeting and a Ribbon Cutting Ceremony to celebrate the opening of the brand new garage facility behind CAR west were all held in the afternoon.

Several demos and tours were also available for guests

to see in the afternoon. These demos showcased the automated cars CrIS UTC focuses on, along with much of the research done at the center. The demos showed off some of the automated cars' capabilities, including communicating with each other, slowing down and, if needed, stopping at a traffic light. Various industry representatives and Channel 6 News attended the event, and videotaped the Ribbon Cutting and the Demos.

As a special guest, Center Director Umit Ozguner invited Professor Bob Fenton to do the actual ribbon cutting. Fenton was one of the original pioneers of automated vehicle research, beginning his work back in the 1960s.

The brand new garage facility was added to the center to house Ohio State's fleet of intelligent and autonomous vehicles.

See pg 6 for rest of article...



Grad student helping a group of high school girls with Sparki the robot during WiE RISE week

## Women in Engineering Camp a Success

Every year, OSU offers a Women in Engineering (WiE) camp for high achieving high school girls. This year the girls attending will participate in a week-long workshop where they'll get to learn how to program and use a wheeled mini robot named 'sparki'.

This workshop was put together by several grad students, as well as several members of the staff and faculty at OSU and CrIS UTC.

The program was chosen because "sparki's" abilities as a robot car can mimic

the same automated capabilities as the regular cars that are investigated at CrIS UTC. These include concepts such as convoying, lane changing, line following, and object avoidance. Because these are the same concepts used when working on automated cars here at CrIS UTC, the organizers felt that this would be a good representation of what a career in engineering would be like for the girls.

The camp was a success. The girls seemed to fully enjoy themselves while

learning how to operate 'sparki', and while they confronted complex concepts during the workshop, it proved to be not too difficult for the girls. One team was even able to get their robot to write a script Ohio, just like the marching band does at football games.

The week concluded with a luncheon and an awards ceremony for all the different student groups on Friday, which was also attended by family members. This marked the close of the WiE RISE camp.

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*"The garage gives our students and researchers a closed location for year round access to our vehicles and easy links to our lab based testing and simulation environment"*

## CrIS UTC External Advisory Board's 1<sup>st</sup> Annual Meeting

The CrIS UTC held its inaugural External Advisory Board (EAB) meeting on August 1, 2014, just prior to the ribbon cutting and open house for the new Intelligent Transportation Systems (ITS) wing at the Ohio State Center for Automotive Research (CAR). The Board is comprised of key industry stakeholders who have an interest or direct influence on the trend of autonomous vehicle technology use on the nation's roadway system.

The Board Members were introduced to the Project Leads and key personnel of CrIS. These individuals then left for a parallel meeting on the topic of

increasing collaboration among CrIS Universities. Members of the Internal Advisory Board sat in and had an opportunity to listen to the comments of the External Advisory Board.

After introductions, CrIS Director Prof. Umit Ozguner gave a presentation outlining the DoT UTC Program and the process which ended up with our selection. He also provided data on the expectations and reporting needed. He requested continuing advice and counsel from the members of the External Advisory Board.

The Board reviewed the parameters of the USDOT

Program and held discussion of what areas of influence they best provide feedback to the university research group in order for the research work to be most impactful to the efforts they see within their industries.

The EAB consists of five members, including: James Barna, Steven Feit, Chuck Gulash, Bill Windsor, and Dimitar Filev.

James Barna, P.E. is the Assistant Director for Transportation Policy and Chief Engineer at the Ohio Department of Transportation (ODOT). Steven Feit is a Senior Manager and Chief Engineer in Infotainment

*Article continued on pg 6...*



John Michelini, Bob Fenton, Bill Marras, Giorgio Rizzoni, Umit Ozguner (with scissors), James Barna, Chuck Gulash, and Bill Windsor at the Ribbon Cutting Ceremony, Aug 1<sup>st</sup> 2014.

## Some Recent Presentations and Publications

Park, J., Kurt, A., & Özgüner, Ü. (2014). "Hybrid Systems Modeling and Reachability-Based Controller Design Methods for Vehicular Automation." *Unmanned Systems*, 2(02), 101-119.

Gadepally, V., Krishnamurthy, A., & Özgüner, Ü. (2014). "A Framework for Estimating Driver Decisions Near Intersections." *IEEE Transactions on Intelligent Transportation Systems*, 15(2).

Peng, Y., Boyle, L. N., & Lee, J. D. (2014). "Reading, typing, and driving: How interactions with in-vehicle systems degrade driving performance." *Transportation Research Part F: Traffic Psychology and Behaviour*.

Borowsky, A., Horrey, W. J., Liang, Y., Garabet, A., Simmons, L., & Fisher, D. L. (2014). "The effects of momentary visual disruption on hazard anticipation and awareness in driving." *Traffic injury prevention*.

Mehranian, H., Pollatsek, A., & Fisher, D. L. (2014). "Novice and Experienced Drivers-Evaluating Hazard Anticipation, Hazard Mitigation, and Attention Maintenance Skills in Complex Driving Scenarios." In *Transportation Research Board 93rd Annual Meeting* (No. 14-2646).

Fisher, D. L., & Strayer, D. L. (2014). "Modeling situation awareness and crash risk." *Annals of advances in automotive medicine*, 58, 33.



Students at WiE RISE Camp

## New Labs Developed for Autonomous Vehicles Course

This past spring, almost twenty graduate and undergraduate students participated in the Autonomy in Vehicles (ECE5553) course at the Ohio State University. The course focuses on autonomy analysis and development of modern road vehicles. This year, students were the first to experience a new set of laboratory experiments designed to explore different aspects of intelligent transportation systems in a scale robot indoor test-bed and on full-scale hardware. The experiments involved first testing new control strategies, including lane keeping, convoying, and traffic light handling, in a

Player/Stage software simulation before utilizing the OSU CITR SimVille indoor test-bed. In prior years, only the simulation portion was performed, but with sponsorship from CrIS, the students were able to get more hands on experience with real robots.

Two additional experiments were able to be added as well. Using the CITR Driving Simulator, students collected data from several people as they drove through two lane change maneuvers. After analyzing this data, students created a simulated vehicle which would perform similar maneuvers in a human-

like manner.

For the final experiment, through the help of a grant from the Denso Foundation, students used Denso Wireless Safety Units (WSU), mounted on two golf carts, to receive and process V2V and V2I messages to navigate traffic light and stop sign intersections. Speed advisors were created and displayed on an advanced driver assistance system (ADAS) display to tell the driver the speed required to pass through the traffic light during a green phase. A similar Stop/Go advisory was generated for a stop sign intersection to tell the driver when the intersection is clear of other vehicles.

Driving Simulator



**In Other News...** *In this section we report on other relevant Projects that CrIS Researchers are involved in at their Universities*

**TASI's Adult Articulated Mannequin**



TASI's Adult Articulated Mannequin

TASI's adult articulated mannequin is used for performance evaluation of vehicle's auto-braking system.

The mannequin is wirelessly controlled and battery operated with 6 active motor driven joints

and two passive joints. The size of mannequin was determined according to the research of representative US fit adult.

The skin of the mannequin represents the characteristics of the human skin from

automotive 77GHz radar. The gait of the mannequin is programmable based on the human gait research data in medical fields. It can be crashed many times at 25 mph.

**Project in Collaboration with Ford Motor Company**

CrIS UTC is involved in a project regarding Cloud-based routing and velocity profile optimization for everyday driving, in collaboration with Ford Motor Company:

Using detailed vehicle fuel consumption models, map databases including road grade, infrastructure estimation such as traffic light states, and inter-vehicle dynamics, significant fuel savings and environmental impact reduction are achieved.

Advanced Driver Assistance Systems (ADAS) focusing on the solutions of this class of vehicular optimization problems using Intelligent Transportation Systems (ITS) technologies are developed and tested to generate driver guidance or direct integration with semi-automation systems such as ACC.

Specific algorithms and techniques that are investigated include Model

Predictive Control (MPC) for more efficient car following, multi-vehicle convoy speed prediction using sparse V2V data, traffic-light cycle estimation using low-penetration V2X communications, and analytical optimal solutions to fuel-consumption scenarios for faster execution on on-board resources.



One of the autonomous cars used at CrIS UTC

**Dr. Arda Kurt Gives Talk**

Dr. Arda Kurt (Ohio State) gave a speech in a Columbus Region Logistics Council Education event on August 19 - "Driverless Logistics- Autonomous Delivery Technology", where the group explored the development, viability and potential of driverless truck/ drone delivery technology. The Council

serves as the catalyst for the growth of the Region's logistics capability and leads the implementation of a strategic road map. The event was held at Huntington Park, Columbus, OH, and there was one other speech, given by the two-person team, Matt Van Vleet/ Chief Strategy Fulfillment Officer and DJ Daugherty/ Software Artisan, from

Pillar Technology. Dr. Kurt's talk focused in vehicle automation technologies such as truck platooning from around the world as they applied to the Logistics Council's interests, with an emphasis on the capabilities and expertise of CrIS, Center of Automotive Research, and Ohio State Engineering in general.

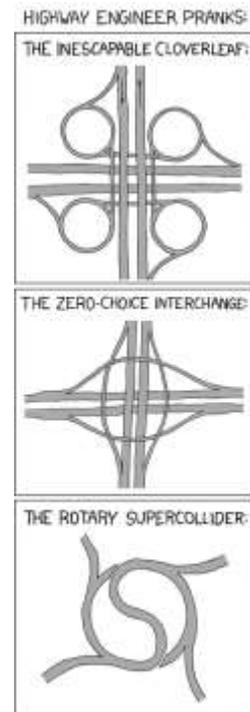
## The 25<sup>th</sup> IEEE Intelligent Vehicles Symposium

CrIS researchers contributed extensively to the 25<sup>th</sup> IEEE Intelligent Vehicles Symposium held in Dearborn, Michigan, June 8-11, 2014. CrIS UTC members took the lead in organizing the symposium, with Prof. Ümit Özgüner (Ohio State) and Prof. Yaobin Chen (IUPUI) as general co-chairs, Dr. Arda Kurt (Ohio State) as the publications chair, Prof. Keith Redmill (Ohio State) as the demonstrations chair, and Dr. Tamar Forrest (Ohio State) as

the registration chair. A diverse group of almost 350 registrants participated in oral presentations and poster sessions, and workshops that were held on the first day of the symposium. Each day of the symposium was kicked off with a distinguished keynote speaker: Charles "Chuck" Gulash, the director of Toyota Collaborative Safety Research Center, Joseph I. Peters, the director of the Office of Operations Research and

Development at FHWA, Prof. Ralf G. Herrtwich, the director of the Driver Assistance and Chassis Systems Group at Daimler AG, and Prof. Christoph Stiller from Karlsruher Institut für Technologie.

Overall, IV2014 was a perfect fit for us from across the world to gather in the greater Detroit metro area and celebrate a quarter of a century of excellence in IV research and technology development and deployment.



The Far Side®

### Brief News from CrIS UTC

- Our New Program Manager is Marilyn Roberts
- OSU, representing CrIS, has been selected for membership in CUTC, the Council of University Transportation Centers.
- Dr. Arda Kurt gives a well received talk (see p.4)
- Prof. Umit OZguner gives a talk, "Look Ma, No Hands! The Future of Self-driving Cars," at Cardinal Solutions in downtown Columbus on July 29<sup>th</sup>, 2014

### Highlighted Project:

#### Policy Analytics Project for CrIS UTC at OSU

The "Policy Analytics" project is led by Prof. Beth-Anne Schuelke-Leech, from the John Glenn School of Public Affairs. The project was designed to understand how safety, crashes, and autonomous vehicles (also known as intelligent vehicles and smart cars) are discussed in the policy realm and what this tells us about the development of the technology, regulatory discussions, and barriers to the adoption of the technology. The data and methodology for this project employs Big Data Analytics,

specifically using corpus and computational linguistics on large policy data collections.

Another research project under the Project 6 area is being done by Beth-Anne Schuelke-Leech and Matt Roberts. Matt Roberts has been working on a project of innovation development and diffusion of alternative automobiles, and has a dataset of vehicle registrations in Ohio. Beth-Anne is collecting data on the safety features available for each make and model of vehicle. The researchers are going to merge their datasets

and combine it with census-level data at the 1000-person level. This will allow them to look at patterns of access to newer vehicles, more fuel efficient vehicles, and safer vehicles to determine if there are systemic differences in the access to safety features. The researchers hypothesize that there is this systemic difference, which they are referring to as the safety divide. This research will also lead to research looking at the correlations between safety and fuel efficiency, as well as potential disparities in access to fuel efficiency technologies.

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## Welcome from Center Director cont.. from pg 1

An important aspect was the development of the course by our own Center-affiliated students.

The CrIS UTC integrates the activities of many

individuals over many campuses. This Newsletter will attempt to highlight some of these activities in every issue. We urge you to learn

more by following our web-page: <http://citr.osu.edu/CrIS/>, or emailing us at: [crisutc@osu.edu](mailto:crisutc@osu.edu)

## August 1<sup>st</sup> Events a Success cont... from pg. 1

The staff and students at CrIS UTC have been awaiting this garage for some time. CrIS UTC director, Umit Ozguner,

describes the significance of the new facility. "The garage gives our students and researchers a closed location for year round

access to our vehicles and easy links to our lab based testing and simulation environment."

## CrIS UTC EAB's 1<sup>st</sup> Annual Meeting cont... from pg. 2

Development for Honda R&D. Charles Gulash is the Director of Toyota's Collaborative Safety Research Center (CSRC). William Windsor, Jr., CLU, CPCU is the Assistant Vice President of

Consumer Safety at Nationwide Insurance. Dr. Dimitar Filev, the newest member of the EAB, is the Executive Technical Leader of the Modern Control & Computational Intelligence Department

at Ford's Research & Innovation Center. Filev was represented by John Michelini. The Board members' bios can be found on our website at [www.citr.osu.edu/cris](http://www.citr.osu.edu/cris).

## About Our Organization...

Researchers at the Ohio State University's Crash Imminent Safety (CrIS) University Transportation Center (UTC) hope to save lives and reduce the severity of human injuries

in auto accidents by looking closely at what happens in the final seconds before vehicle collisions. Research at the CrIS UTC includes seven interconnected research

projects that will improve our understanding of driver interaction with vehicle systems in crash imminent situations.

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