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CrIS UTC Newsletter

Special interest articles:

- Researchers lead Women in Engineering camp
- First annual External Annual Board meeting
- Ford Motor Company project update
- New laboratories developed for autonomous vehicles course
- Driverless vehicle symposium held in Detroit, Michigan

Welcome from center director Umit Ozguner

Welcome to the first issue of the Crash Imminent Safety University Transportation Center (CrIS UTC) Newsletter. I am delighted to report on all the exciting research, education and outreach activities performed at the CrIS UTC. In addition to providing updates from The Ohio State University—the CrIS UTC lead institution—we will also share activities of partner universities: University of Wisconsin, University of Massachusetts-Amherst, North Carolina Agricultural and Technical State University, and Indiana University-Purdue University-Indianapolis.

CrIS UTC was officially inaugurated September 30, 2013, and held its initial meeting in December 2013. While offices and laboratories were originally housed at Ohio State's Center for Automotive Research (CAR) central location, early in 2014 we moved our offices and laboratories just down the street to CAR West. In addition to the move, CrIS UTC jointly oversaw the development and building of a new garage facility to house vehicles and driverless vehicle laboratories.

In this newsletter, two major events are highlighted: first is the ribbon cutting for the new garage, which was simultaneously accomplished with the center's first annual meeting and External Advisory Board meeting.

Second is our contribution to Ohio State's Women in Engineering (WiE) summer camp program for high school students (page two), of which we are truly proud. An important aspect of the camp was the development of the course by our own center-affiliated students.

The CrIS UTC integrates the activities of many individuals over five campuses. This newsletter will attempt to highlight some of these activities in every issue. We invite you to learn more by following our web page: http://citr.osu.edu/CrIS/ or emailing us at crisutc@osu.edu

Best,
Umit Ozguner
CrIS UTC Director

Meetings and ribbon cutting a success

On August 1, 2014, several events took place at CrIS UTC. In the morning we held the first annual meeting of the CrIS UTC researchers, which included several presentations by project leaders and center coordinators. The day also included the initial meeting of the External Advisory Board and the ribbon cutting ceremony to celebrate the opening of the new driverless vehicle facility.

Researchers showcased several driverless vehicles and projects, along with related demonstrations. Tours of the center were also available for guests. The demonstrations highlighted some of the vehicles' capabilities, including vehicle to vehicle communication and stopping at a 'smart' traffic light. Various industry representatives and media attended the event.

Article continued on page six

Graduate student helping a group of high school students with Sparki the robot during WiE RISE camp

Researchers lead Women in Engineering camp

Every year, Ohio State offers a Women in Engineering (WiE) camp for high school students. This year, during the WiE RISE camp for sophomores and juniors, attendees participated in a week-long workshop where they had the opportunity to learn how to program and use Arcbotics' wheeled mini robot named Sparki.

This workshop was developed by CAR graduate students, as well as staff and faculty at Ohio State 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 at CrIS UTC, the organizers felt that this would be a good representation of what a career in engineering would be like for the students.

Participants seemed to fully enjoy themselves while learning how to operate Sparki and confronting complex concepts during the workshop. One team was even able to get their robot to write a 'script Ohio.'

The week concluded with a luncheon and an awards ceremony for students and their families on Friday, July 18. The camp was a success and CrIS UTC hopes to participate in future such projects.

"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"

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 1st 2014.

CrIS UTC's first External Advisory Board 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) facilities at Ohio State's 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 leaders and key personnel of CrIS. EAB members then attended 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 UTC Director Umit Ozguner gave a presentation outlining the U.S. Department of Transportation's (DOT) UTC program. 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 U.S. DOT 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, P.E., Assistant Director for Transportation Policy and Chief Engineer at the Ohio Department of Transportation (ODOT); Steven Feit, Senior Manager and Chief Engineer in Infotainment

Article continued on page six.

Recent presentations and publications

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

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

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

Students at WiE RISE camp

New laboratories developed for autonomous vehicle course

During spring 2014 nearly twenty graduate and undergraduate students participated in the Autonomy in Vehicles (ECE5553) course at The Ohio State University. The course focused on autonomy analysis and development of modern road vehicles. In this section, 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 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 vehicle to vehicle and vehicle to infrastructure 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.

Control and Intelligent Transportation Research driving simulator

Partner university projects

TASI's adult articulated mannequin

Transportation Active Safety Institute's adult articulated mannequin

The Indiana University-Purdue University-Indianapolis (IUPUI) Transportation Active Safety Institute's **(**TASI**)** 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 miles per hour.

Project in collaboration with Ford Motor Company

One of the autonomous cars used at CrIS UTC

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 adaptive cruise control (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 vehicle to 'x' communications and analytical optimal solutions to fuel-consumption scenarios for faster execution during on board resources.

Senior researcher Arda Kurt presents…

Senior researcher 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, Ohio. A second presentation was given by the two-person team, Matt Van Vleet, Chief Strategy Fulfillment Officer and DJ Daugherty, Software Artisan, from Pillar Technology. Kurt's talk focused on vehicle automation technologies, such as truck platooning from around the world as they applied to the council's interests, with an emphasis on the capabilities and expertise of CrIS UTC, Center of Automotive Research and Ohio State's College of Engineering, in general.

Landmark IEEE Intelligent Vehicles Symposium

CrIS UTC researchers contributed extensively to the 25th IEEE Intelligent Vehicles Symposium held in Dearborn, Michigan, June 8-11, 2014. CrIS UTC members took the lead in organizing the symposium, with Professor Umit Ozguner (Ohio State) and Professor Yaobin Chen (IUPUI) as general co-chairs, Arda Kurt (Ohio State) as the publications chair, Professor Keith Redmill (Ohio State) as the demonstrations chair, and 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 began with a distinguished keynote speaker: Charles "Chuck" Gulash, director of Toyota Collaborative Safety Research Center; Joseph I. Peters, director of Office of Operations Research and Development at Federal Highway Administration (FHWA); Professor Ralf G. Herrtwich, director of the Driver Assistance and Chassis Systems Group at Daimler AG; and Professor Christoph Stiller from Karlshruher Institut für Technologie.

Overall, the symposium was a perfect fit for colleagues from across the world to gather in the greater Detroit metropolitan area and celebrate a quarter of a century of excellence in driverless research and technology development and deployment.

Brief news from CrIS UTC

- CrIS UTC welcomes new Program Manager Marilyn Roberts
- The Ohio State University, representing CrIS, has been selected for membership in Council of University Transportation Centers (CUTC)
- Senior researcher Arda Kurt gives a well-received talk (page four)
- Professor Umit Ozguner presents, “Look Ma, No Hands! The Future of Self-driving Cars,” at Cardinal Solutions in downtown Columbus on July 29, 2014

Highlighted project

Policy analytics project for CrIS UTC at Ohio State

The “Policy Analytics” project is led by Professor Beth-Anne Schuelke-Leech, from Ohio State’s 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 Project 6—Safety Policy Implications and Information Dissemination—is being done by Beth-Anne Schuelke-Leech and Professor Matthew Roberts. Roberts has been working on a project of innovation development and diffusion of alternative automobiles, and has a dataset of vehicle registrations in Ohio. Schuelke-Leech 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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Meetings and ribbon cutting a success, continued

Special guest Ohio State faculty emeritus Robert Fenton was invited to cut the ribbon on the new facilities. Fenton was one of the original pioneers of automated vehicle research, beginning his work back in the 1960s.

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

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's first External Advisory Board meeting, continued

Development for Honda Research and Development; Charles Gulash, Director of Toyota's Collaborative Safety Research Center (CSRC); William Windsor, Jr., CLU, CPCU, Assistant Vice President of Consumer Safety at Nationwide Insurance; Dimitar Filev, Executive Technical Leader of the Modern Control and Computational Intelligence Department at Ford Motor Company's Research and Innovation

Dr. Filev was represented at the meeting by John Michelini. Short biographies of the board members are located on our website: www.citr.osu.edu/cris.

About CrIS UTC

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.