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CCAT’S MISSION

“To provide research information that will significantly guide the evolution of CAVs in terms of their impact on safety, mobility, and sustainable development.”

COVER STORY: Congressional Testimony by CCAT Researchers

Dr. Henry Liu, University of Michigan and CCAT Director, and Dr. Darcy Bullock, Purdue University and JTRP Director, testified before the House Committee on Science, Space and Technology, Subcommittee on Research and Technology, in summer 2019. Dr. Liu emphasized the importance of UTC research. He stated that further funding would allow for additional research with real-world impacts in terms of traffic safety, mobility, and energy use.

CCAT OVERVIEW

The U.S. DOT Center for Connected and Automated Transportation (CCAT) covers the states of Michigan, Indiana, Illinois, Ohio, and Minnesota.

The Center was established in 2016 based on an award from USDOT’s Research and Innovative Technology Administration (RITA) to conduct a multidisciplinary program of transportation research, education, and technology transfer.

The performance period is Nov 30, 2016 to Sep 30, 2022.
AWARDS EARNED BY PURDUE CCAT RESEARCHERS

PURDUE CE AND CUTC AWARDS -- BEST PHD DISSERTATION

Sikai “Sky” Chen, currently a CCAT and CMU Robotics researcher, received the following awards in 2019, for his CCAT-funded PhD dissertation titled “Safety Implications of Roadway Design and Management: New Evidence and Insights in the Traditional and Emerging (Autonomous Vehicle) Operating Environments”:

- Outstanding dissertation award in Purdue’s Lyles School of Civil Engineering
- Milton Pikarsky Memorial award, the national prize for outstanding transportation thesis, awarded by the Council of University Transportation Centers (CUTC) and the American Road & Transportation Builders Association.

WOMEN-IN-TRANSPORTATION SCHOLARSHIP

CCAT student researcher Naa Bortiorkor Alabi was awarded the WTS Chapter Helene M. Overly Memorial Scholarship for 2019-2020, Greater Indianapolis Chapter. The scholarship recognizes an outstanding graduate female in the transportation industry and academia. The goal is to support and encourage future female leaders in transportation to be successful. Naa is pursuing an MS degree in civil engineering and is also a PhD student in the School of Aviation and Transportation Technology at Purdue.

COTA BEST PHD DISSERTATION

Former CCAT student researcher Dr. Jian Wang (middle in photo) received the 2019 COTA best dissertation award from the Chinese Overseas Transportation Association (COTA), on January 12, at the 2020 COTA Winter Symposium held during TRB Annual Meeting 2020. Dr. Wang’s dissertation is titled “System Modeling for Connected and Autonomous Vehicles”. He was funded by CCAT and the NEXTRANS Center, and completed his Ph.D. in December 2018 at Purdue University under the supervision of the Nextras and Purdue CCAT founder Professor Srinivas Peeta (left in photo).

RADWAN AND CURE AWARDS

CCAT researcher Seyedali Ghahari (left in photo) was awarded the Essam and Wendy Radwan Graduate Fellowship and CCAT researcher Abdullah Nafakh (right in photo) was awarded the James H. and Carol H. Cure Graduate Support Endowment, a scholarship for graduate students. They received their awards at the Civil Engineering Scholarship and Awards Banquet held at Purdue University on October 10, 2019.
Graduation of CCAT-funded PhD Students

CCAT-funded student researchers (Ross Yuntao Guo, Tariq Usman Saeed, Sikai “Sky” Chen) and Julie Yu Qiao celebrate their PhD graduation, with the Purdue CCAT and NEXTRANS director Dr. Samuel Labi.

Paul Young Ha, a CCAT researcher defended his MS thesis titled "Sustainability Considerations for AV-Exclusive Lane Deployment" in fall 2019. Paul will continue his graduate studies as a Purdue doctoral student, and will be carrying out research in CAV controls and operations.

The work of CCAT Researcher, Professor Gkritza was showcased at the USDOT – organized “Accessibility & Mobility for all” summit in Washington DC, in summer 2019. The research is addressing public acceptance and socio-economic impacts of shared autonomous vehicles and the implications for transport policy and planning.
CCAT RESEARCHERS AT INFORMS CONFERENCE 2019

CCAT student researchers presented their work at the 2019 INFORMS conference in Seattle, Washington. Eleven presentations were given by Purdue CCAT researchers.

CCAT PRESENTS AT 2019 INTERNATIONAL CONFERENCE ON SMART CITIES

Location: Seoul, Korea
Date: July 18, 2019

Dr. Samuel Labi was a keynote speaker and presented a speech on “Preparing our Infrastructure for connected and Autonomous Vehicle Operations: Challenges and Opportunities”.

Yujie Li presented her paper titled “Drivers perception of headways in CAV operations”.

Ross Guo presented his paper “Can roadway designs & operational policies influence millennial AV adoption?”

UIUC CCAT VISITS PURDUE CCAT

Professor Yanfeng Ouyang from UIUC visited CCAT Purdue’s driving simulator lab in summer 2019, and discussed potential areas of collaboration with CCAT Purdue.

Photo: From L to R: Dustin Souders, Mahmood Tabesh, Sam Labi, Yanfeng Ouyang, Tara Radvand, Mohammad Miralinaghi, Amir Davatgari.
CCAT STUDENTS ATTEND AAA FOUNDATION’S 2019 FORUM

CCAT Purdue researchers participated in the AAA Foundation’s 2019 Forum held at the University of California, San Diego.

The forum theme was “Impact of Vehicle Technologies and Automation on Users-Design and Safety Implications”.

The forum discussed the different aspects of human factors and the automation of vehicles in the near future.

Photo: From L to R: Rayne Du, Yujie Li, Dustin Souders, Tara Radvand, Ross Guo.

CCAT DISTINGUISHED LECTURE SERIES: PROF. RICHARD DE NEUFVILLE

Professor Richard de Neufville of MIT presented a talk on flexibility in engineering design.

The presentation discussed the uncertainty associated with autonomous vehicle demand and the need to alleviate risks by adopting flexibility in the development of infrastructure to accommodate CAVs.

The seminar was sponsored by the Center for Connected & Automated Transportation (CCAT) at Purdue.

SEMINAR ON “TECHNOLOGY ASSESSMENT & PEACE ENGINEERING”

Professor Fred Phillips, professor at the University of New Mexico and Editor-in-Chief of the Technological Forecasting & Social Change journal, presented on “Technology Assessment and Peace Engineering, on December 3, 2019, at Purdue’s Lyles School of Civil Engineering.

The talk discussed proposed shifts in engineering education to foster exposure to social sciences, system theory, and technology assessment. The goal is to produce graduates who are prepared to consider the social consequences of their work; proactively develop technologies for peace and human welfare; and create a “Peace-Industrial Complex”.

The seminar was sponsored jointly by the Institute of Transportation Engineers (ITE) Purdue Student Chapter and the Center for Connected & Automated Transportation (CCAT).
Drs. Mohammad Miralinaghi and Sam Labi, in Fall 2019, developed and delivered a new course titled “Congestion pricing and its application in the era of smart mobility”.

The course addressed transportation systems planning, the basics of equilibrium analysis, and the fundamentals of optimization. The course also discusses basic formulations of the traffic assignment problem, solution algorithms, and contextual applications in transportation planning.

The last part of the course addresses the impact of emerging technologies (electric, connected, and automated vehicles) on route choice, user equilibrium condition and network modeling. This is expected to help agencies prepare their infrastructure to accommodate these new technologies in future.

Drs. Dustin Souders and Labi, in Fall 2019, developed and delivered a new course titled “Human-centered considerations in road vehicle automation”.

The course addressed human factors and policy issues associated with vehicle automation. It included human capabilities and tendencies when using automation, automated driving system interface design considerations, societal level concerns of AV deployment. Finally, the course addressed how policy could be implemented to help reach favorable outcomes in this context.
### ASCE Journal of Infrastructure Systems

**Theme:** “Smart Cities: Infrastructure, Air Quality, Disaster Response, and Data Management”.

**Editors:**

- Dr. Samuel Labi, associate director of Purdue’s University Transportation Center for Connected and Automated Transportation (CCAT).
- Dr. Sybil Derrible, Associate Professor in the Departments of Civil & Materials Engineering and Computer Science (by courtesy), Research Associate Professor at the Institute for Environmental Science and Policy, and the Director of the Complex and Sustainable Urban Networks (CSUN) Laboratory at the University of Illinois at Chicago.
- Dr. Hosin "David" Lee, Professor in Civil and Environmental Engineering and director of Laboratory for Advanced Construction Technology (LACT) at the University of Iowa. Dr. Lee currently serves on the editorial board for ASCE Journal of Infrastructure Systems.

He is also professor of transportation and infrastructure systems engineering in Purdue University’s Lyles School of Civil Engineering.

Dr. Sybil Derrible, Associate Professor in the Departments of Civil & Materials Engineering and Computer Science (by courtesy), Research Associate Professor at the Institute for Environmental Science and Policy, and the Director of the Complex and Sustainable Urban Networks (CSUN) Laboratory at the University of Illinois at Chicago.

Dr. Hosin "David" Lee, Professor in Civil and Environmental Engineering and director of Laboratory for Advanced Construction Technology (LACT) at the University of Iowa. Dr. Lee currently serves on the editorial board for ASCE Journal of Infrastructure Systems.

The general concept of smart cities has gained significantly in popularity over the past fifteen years. The research community has started to operationalize many smart cities concepts, and this special issue offers a good platform to disseminate the new methodologies, concepts, and case studies in this research area.

The paper topics are expected to include smart concepts in the following areas: infrastructure asset management; buildings; transportation; water distribution; stormwater management; underground pipes and structures; electrical systems and energy metering; clean air and air quality monitoring systems. Others include smart parks and recreation facilities, smart video surveillance and crime prevention systems; smart disaster prevention and response, smart data management; life-cycle analysis of smart management systems, operation, maintenance and safety of smart cities; smart road-transportation vehicles and operations.

### Frontiers in the Built Environment

**Theme:** “Advances in Planning for Emerging Transportation Technologies: Towards Automation, Connectivity, and Electric Propulsion”.

**Editors:**

- Dr. Samuel Labi, Purdue University, Associate Director, Center for Connected & Automated Transportation (CCAT).
- Dr. Panagiotis Ch. Anastasopoulos, University at Buffalo, Director, Still Institute for Sustainable Transportation & Logistics.
- Dr. Mohammad Miralinaghi, Center for Connected & Automated Transportation (CCAT), Purdue University.
- Dr. Ghim Ping Ong, Department of Civil Engineering, National University of Singapore, CCAT cost share partner.
- Dr. Feng Zhu, Department of Civil Engineering, Nanyang Technological University, Singapore, CCAT cost share partner.

Papers will cover the following areas: consumer demand assessments, policy and planning including impact assessments (energy, noise, land-use, safety, mobility, economic productivity, highway revenues, sustainability, operational resilience, etc.), human factors and driving simulation, enabling technologies (including machine vision, machine learning, AI, etc.), infrastructure design and management to accommodate CAVs, CAV operations and controls, CAV modeling (including microsimulation), and implementation including pilot tests.

This special issue is intended to crystallize current thinking and future directions regarding the science, engineering, and economic issues associated with the development of electricity-propelled connected and automated vehicles (CAV &EV).

The special issue provides an international forum for presenting and discussing innovative research work that involve CV, AV, or EV.
## UPCOMING CAV-RELATED EVENTS

### 1. STUDY ABROAD COURSE

**LOCATION:** Singapore

**Course nr and title:** CE 497 – Automation & Connectivity for Sustainable Development of Resilient Infrastructure. 3 credit hours, May 9-24, 2020, Purdue University.

The course will involve a study of the concepts of systems engineering and related issues (autonomy, connectivity, sustainability, resilience) in the classrooms and under the guidance of faculty from some of the world’s best universities (National University of Singapore, Nanyang Technological University). The students will visit project sites, production sites, research centers and operations hubs of major engineering systems (materials processing plants, wastewater processing plant, water supply plant, land transport and subways, Changi Airport, Port of Singapore, Robotics Labs. CCAT Purdue is providing non-financial sponsorship for the course.

The tour destinations will also include automation and connectivity applications in digital twins and scaled-down real-life replicas of Singapore’s electric grids and water supply systems, and 3D printing centers at the Singapore University of Technology and Design. Through cultural field trips and exotic dining, students will be exposed to opportunities to enhance their intercultural skills by experiencing Singapore’s unique blend of different cultures and fascinating history.

The course instructors will be Dr. Sam Labi (Purdue), CCAT researcher; Dr. Raymond Ghim Ping Ong (NUS), CCAT cost-share partner; and Dr. Feng Zhu (NTU), CCAT cost-share partner. The teaching assistants will be Ms. Yujie Li and Ms. Rayne Runjia Du, CCAT graduate researchers.

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<tr>
<th>Event Name</th>
<th>Date</th>
<th>Location</th>
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<tr>
<td>ASCE INTERNATIONAL CONFERENCE ON TRANSPORTATION &amp; DEVELOPMENT 2020</td>
<td>May 26-29, 2020</td>
<td>Seattle, Washington</td>
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<tr>
<td>CCAT ANNUAL SYMPOSIUM</td>
<td>April 14-15, 2020</td>
<td>Washtenaw Community College, Michigan</td>
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<td>AVS ANNUAL SYMPOSIUM</td>
<td>July 27-30, 2020</td>
<td>Hilton San Diego Bayfront, San Diego, CA</td>
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<tr>
<td>2ND NEXT-GENERATION TRANSPORT SYSTEMS CONFERENCE 2020 (RUN BY CCAT STUDENTS)</td>
<td>Summer 2020</td>
<td>Discovery Park, West Lafayette, IN</td>
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“Driverless: Intelligent Cars and the Road Ahead”
By Hod Lipson and Melba Kurman, MIT Press, 2016.

The subject of driverless cars has pervaded the national conversation because this new technology is poised to engender profound disruptions in our transportation systems, urban landscapes, society, and economy. However, most written material on the subject tend to be technical and difficult for non-scientists and non-engineers to comprehend.

Motivated not only by this lacuna, but also by a long-standing propensity to monitor disruptive game-changing technologies and personal desire to enjoy the benefits of driving automation, the authors have produced a book that presents this highly technical subject in a manner that appeals to a wide spectrum of readers. In their prescient book, “Driverless: Intelligent Cars and the Road Ahead”, Lipson and Kurman state that deep learning (the new generation of AI software) and advancements in hardware technology have helped to finally resolve the century-old series of failed attempts to automate the driving task. Their book tells the story of this evolution.

They present a thoughtful and comprehensive assessment of driverless vehicles, and the issues and implications relating to its adoption. In doing this, they address some of the keys themes of driverless vehicle research: the enabling technologies (including machine learning); policy and planning (including technological, societal, and ethical impacts), human factors (including driver inebriation or incapacitation), infrastructure readiness, and implementation (gradual evolution vs. giant leaps to autonomy).

The authors offer cogent predictions that in the coming decades, human-driven vehicles will be replaced gradually by driverless vehicles, transportation will evolve into an automated on-demand service, and there will be changes in the way we make choices related to work and residential locations. They also predict that this technology will usher in drastic increases in safety, mobility, transport equity, and air quality. Cautioning of the “dark side”, the authors warn that this new technology could pose a double-edged sword”, as it may engender loss of public transport market share to mobility-on-demand services and loss of driver employment.

The book is a valuable resource for government agencies and other stakeholders that currently seek to prepare roadmaps and policies to facilitate smooth transition to a world of driverless vehicles, and for legislative bodies that currently mull new laws and regulations for this purpose. It is recommended that this book serve as a required or at least a supplementary reading resource for both graduate and undergraduate students in engineering and public policy courses related to autonomous vehicles. Some of these courses include artificial intelligence, human-machine interface, machine learning, control theory, sensor fusion, and technology & policy.

-- reviewed by Samuel Labi, January 2020

Hod Lipson is a professor of engineering at Columbia University, where he directs the Creative Machines Lab. Dr. Lipson’s work focuses on evolutionary robotics, design automation, rapid prototyping, artificial life, and development of machines that can demonstrate some aspects of human creativity.

Melba Kurman is a professor at Singularity University where she focuses on smart cities and autonomous vehicles. In the past, she has worked at Microsoft Corporation and Cornell University. Dr. Kurman writes and speaks about exponential technologies and how they affect us. She has been interviewed on NPR and Politico, and her work appears in media outlets including Popular Mechanics and Forbes Middle East.