C2SMART

CONNECTED CITIES WITH M SMART TRANSPORTATION

ANNUAL REPORT 2017-2018



C2SMART is a solution-oriented research center taking on some of today's most pressing urban mobility challenges. We use cities as living laboratories to study challenging transportation problems and find solutions from the unprecedented recent advances in communication and smart technologies. Our three main research areas are:



Urban Mobility and Connected Citizens



Urban Analytics for Smart Cities



Resilient, Smart, and Secure Transportation Infrastructure



TABLE OF CONTENTS

INTRODUCTION

Director's Address	2
OUR CONSORTIUM	3
RESEARCH	
Year 1 Projects Key Accomplishments Upcoming Research	4 6 8
OUTREACH	10
EDUCATION AND WORKFORCE DEVELOPMENT	15
PARTNERSHIPS	21
OUR TEAM	22

DIRECTOR'S ADDRESS

Dr. Kaan Ozbay

Dear Colleagues,

While we are getting ready for another exciting and rewarding academic year, I am very pleased to introduce the first annual report of the C2SMART Center, a USDOT Tier 1 University Transportation Center. Our main mission at C2SMART is to study connected and smart cities and transportation systems that are revolutionizing the way we live. We are keen to be on the leading edge of this wave as mobility in cities around the world is transformed by emerging technologies.

The most challenging but rewarding aspect of our mission is the fact that everything we are dealing with is brand new or has never been tested at a large scale. For example, while the concept of connected and autonomous vehicles (CAV) is not a novel one, the implementation of these technologies in real-world urban environments is completely new. The short- and long-term implications of CAVs need to be carefully studied, and engineers and decision-makers need to be trained in all aspects of these vehicles. This is exactly where C2SMART researchers come in — by carrying out research, development, and deployment projects, as well as developing education, training, and technology transfer activities, we can respond to the needs of this new era.

We are very excited to have the opportunity to build a brand new University Transportation Center designed to address all aspects of this revolution. C2SMART is led by NYU, which is located in the largest and most dynamic city in the country. However, we recognized from the beginning the importance of building a consortium of universities across cities of different sizes and demographic characteristics to ensure we develop solutions that are applicable throughout the nation. We are very honored to have longtime colleagues from the City College of New York, Rutgers University, the University of Texas at El Paso, and the University of Washington as part of this Center. We are also closely involved with local, state, and city agencies, as well as private sector companies, which are enthusiastically supporting our activities through invaluable financial and intellectual support. C2SMART's networks of partners enables us to lead the way in our field.

In closing, our long-term goal is to be one of the most important resource centers in the country when it comes to deployable research, innovative education and training, and effective technology transfer in smart and connected cities and transportation systems. I hope you will find our first annual report interesting and informative, and I invite to you to continue to follow our work through our website, newsletters, conferences and seminars. Please feel free to contact me or any of our C2SMART researchers if you have questions and ideas that you would like to share with us. I wish you a very productive and rewarding academic year.

Kaan Ozbay

C2SMART Center Director



"Our long-term goal is to be one of the most important resource centers in the country when it comes to deployable research, innovative education and training, and effective technology transfer in smart and connected cities and transportation systems."

OUR CONSORTIUM



New York University is the largest private university in the United States with over 57,000 students enrolled and campuses in New York City, Abu Dhabi, and Shanghai. At the Tandon School of Engineering, the UrbanMITS and BUILT labs are leading numerous large-scale research and education projects related to smart and connected cities. Researchers are partnering with related centers, including INTERCEP, the Rudin Center for Transportation, and the Center for Urban Science and Progress, bringing together a wealth of expertise and resources for cutting-edge transportation research.

UNIVERSITY of WASHINGTON

The University of Washington is a public research university based in Seattle. Founded in 1861, the UW is home to 29,000 undergraduates and 14,000 graduate students and has consistently ranked first in federal research funding among public universities, and among the top five for total funding among all universities in the country. UW is home to three transportation-focused research labs: the Intelligent Urban Transportation (iUTS) Lab, the Smart Transportation Applications and Research (STAR) Lab, and the Sustainable Transportation Lab.



Rutgers, The State University of New Jersey, is a public research institution in New Jersey with 67,000 students. Departments actively involved in transportation run several transportation-related centers, including the RIME laboratory, which brings unique expertise in structural health monitoring in infrastructure applications to the consortium.



The University of Texas at El Paso is designated as a Model Institution for Excellence by the National Science Foundation, one of only six in the country. The university plays a strong leadership role in using educational programs to spur smart cities research, including a dual master's degree program on smart cities with Czech Technical University and a U.S.-Mexico Study Abroad Program on Smart Cities with the University of Guadalajara.



City College of New York is the founding institution of the City University of New York (CUNY) and has a strong tradition of public service through education, research, and workforce development. CUNY's interdisciplinary Institute for Transportation Systems, based at CCNY, trains transportation planners, engineers and managers to plan, design, operate and manage transportation systems that protect the environment and energy resources and minimize social disruption.

<u>CENTER-FUNDED PROJECTS</u> YEAR 1

URBAN MOBILITY AND CONNECTED CITIZENS

Projects in this research area are designed to break new ground in our understanding of urban mobility systems.

URBAN ANALYTICS FOR SMART CITIES

This research area focuses on using sensors, apps, and other data collection tools to study urban mobility patterns and develop smart solutions.

RESILIENT, SECURE, AND SMART TRANSPORTATION INFRASTRUCTURE

Projects in this research area focus on examining and reinforcing the resiliency and security of urban infrastructure systems.







City-scalable Destination Recommender System for On-demand Senior Mobility Principal Investigator: Joseph Chow, NYU

Development of a Mobile Navigation Smartphone Application for Seniors in Urban Areas Principal Investigator: Kelvin Cheu, UTEP

Integrative Vehicle Infrastructure Traffic System (iVITS) Control in Connected Cities Principal Investigator: Camille Kamga, CCNY

Quantifying Uncertainty and Distributed Adaptive Control for Unanticipated Traffic Patterns Principal Investigator: Saif Jabari, NYU Abu Dhabi

Traffic Signal Optimization and Coordination in Connected Cities Principal Investigator: Jeff Ban, UW

Integrated Analytics and Visualization for Multi-Modality Transportation Data Principal Investigator: Claudio Silva, NYU

Understanding Mobility Patterns and Decision-making Using an Integrated, Multi-Modal Sensing Platform in a Quantified Community **Principal Investigator: Constantine Kontokosta, NYU**

A Trusted Data Platform for Transportation Data Sharing Principal Investigator: Bill Raisch, NYU

Sustainability of Urban Consumption Practices Principal Investigator: Sarah Kaufman, NYU

Designing & Managing Infrastructure for Shared Connected Electric Vehicles Principal Investigator: Don Mackenzie, UW

Monitoring and Control of Overweight Trucks for Smart Mobility and Safety of Freight Operations Principal Investigator: Hani Nassif, Rutgers

CURRENT RESEARCH KEY ACCOMPLISHMENTS

C2SMART's Year 1 research program included projects focused on a range of pressing issues in urban transportation, tackling challenges related to connected and autonomous vehicles, sustainability, and accessibility. These selections showcase the progress C2SMART researchers have made in these areas.



DEVELOPMENT OF A SENIOR NAVIGATION APP

Principal Investigator: Ruey Long Kelvin Cheu, UTEP Research Area: Urban Mobility and Connected Citizens



Many seniors face mobility issues and lifestyle changes, such as switching from driving to using a carpool, taxi or fixed-route or demand-responsive public transportation. While there are many navigation apps on the market, very few cater to the specific mobility needs of seniors (such as incorporating information on ADA compliant infrastructure), and the few that exist have limited functions. Researchers at University of Texas at El Paso sought to fill that gap, surveying seniors about their transportation needs and habits and using their findings to design the Urban Connector app, now available for Android devices.



TRAFFIC SIGNAL OPTIMIZATION AND COORDINATION IN CONNECTED CITIES

Principal Investigator: Xiugang Jeff Ban, UW

Research Area: Urban Analytics for Smart Cities



Connected vehicles in smart cities, including vehicle to vehicle (V2V), vehicle to infrastructure (V2I), and vehicle to anything (V2X) communications, can provide more opportunities and impose new challenges for urban traffic signal control. The research team at University of Washington investigated traffic signal optimization techniques based on CV data, such as real-time information on vehicles' locations and speeds, and developed a framework for urban traffic signal optimization in a CV environment.

INFRASTRUCTURE DESIGN FOR SHARED CONNECTED ELECTRIC VEHICLES

Principal Investigator: Don Mackenzie, UW

Research Area: Resilient, Secure and Smart Transportation Infrastructure



The long-term goal of this work is integrating strategic and tactical management of the vehicle-infrastructure system to support electrified shared mobility. The researchers are developing stochastic models of shared car usage patterns based on traveler destination choices and vehicle dwell times, conditional on time of day and day of the week. These models can then be used to plan cost-effective charging systems for shared connected electric vehicles, determining optimal locations, charging rates and number of plugs for each charging station.

PLATFORMS FOR TRANSPORTATION DATA SHARING

Principal Investigator: William Raisch, NYU

Research Area: Urban Analytics for Smart Cities



This project aims to adapt an information sharing and situational awareness technology platform to support transportation data sharing and stakeholder engagement in each of the C2SMART consortium member cities. The platform is designed to help users understand their larger operating environment, identify risks in that environment, and make informed decisions during disruptions using the assembled data. The research team has created dashboards for the New York metro area, El Paso, Seattle, and Newark, which have been made available to C2SMART's researchers.

DESTINATION RECOMMENDER SYSTEM FOR ON-DEMAND SENIOR MOBILITY

Principal Investigator: Joseph Chow, NYU

Research Area: Urban Mobility and Connected Citizens

The goal of this project is to create an algorithm that paratransit services, rideshare companies, and future autonomous vehicle fleets could use to improve operations and lower costs. The research is focused on embedding a type of algorithm called a recommender system—like the technology Amazon uses to suggest products, or that Netflix uses to recommend movies—into a mobility-on-demand service. The project team is conducting computational experiments and constructing simulations to see how well this kind of recommender system can work in different city structures.



01. Regional Overview – Metro NY/NJ/CT 🥒 🖽 😂 🖈





UPCOMING RESEARCH



In one of the first attempts to develop a simulation-based ecosystem for deployment testing and decision support for new transportation technologies and policies, C2SMART researchers are developing an open-source, agent-based model of the NYC area that will allow for modeling and evaluation on a large scale.

Transportation modeling requires significant amounts of data and time-consuming effort to integrate various data sources, like traffic volume, bicycle volume, pedestrian volume, signal timings, geometry, crash data, travel times, and speeds. More importantly, emerging transportation alternatives and technologies, such as connected and autonomous vehicles, electric vehicles, and ridesharing, cannot be readily modeled using existing commercial software tools.

C2SMART's researchers are developing an open-source, largescale transportation model that can incorporate traditional and new data sources with the capability to model several different potential scenarios. The team is developing the model using MATSim, an activity-based multi-agent simulation framework, and calibrating it using public data available in the New York metropolitan area, including unique sources such as NYC taxi data, social media data, and datasets from partner transportation technology companies. A sub-area of lower Manhattan and downtown Brooklyn exists in tandem in SUMO, an open-source microscopic traffic simulation framework. This tool allows for modeling of intermodal traffic systems, including road vehicles, public transport, and pedestrians.

The goal of developing this model is to provide a flexible, opensource tool that can adapt to the changing face of transportation and support planning, operational control, and policy implementation in NYC. This endeavor has never been attempted before at such a large scale and level of detail using a scalable, open-source, framework, and marks a significant milestone in transportation modeling. C2SMART's second year projects were chosen through a competitive peer-review process. Following a Request for Proposals at member institutions in November 2017, proposals were received and reviewed by external reviewers for technical merit and application potential. Final awards for the winning projects were presented in March 2018:



URBAN MOBILITY AND CONNECTED CITIZENS

Integrative Vehicle Infrastructure Traffic System (iVITS) Control in Connected Cities (Year 2 Continuation)

Dual Rebalancing Strategies for Electric Vehicle Car-sharing Operations

Integrative Vehicle-Traffic Control in Connected/ Automated Cities PI: Camille Kamga, CCNY

PI: Saif Jabari, NYU Abu Dhabi

PI: Jeff Ban, UW

URBAN ANALYTICS FOR SMART CITIES

Development of an Open-Source Multi-Agent Virtual Simulation Testbed for Evaluating Emerging Transportation Technologies and Policies	PI: Joseph Chow, NYU
Emerging Leaders in Transportation / The Future of Mobility Workshop Series	PI: Sarah Kaufman, NYU
An Artificial Intelligence Platform for Network-wide Congestion Detection and Prediction using Multi-source Data	PI: Yinhai Wang, UW



RESILIENT, SECURE, AND SMART TRANSPORTATION INFRASTRUCTURE

A Multi-Stakeholder Approach to Developing Effective Policies to Reduce the Impact Costs of Overweight Vehicles on Roads PI: Bill Raisch, NYU and Bridges

Development of Advanced Weigh-In-Motion (A-WIM) System for Effective Enforcement of Overweight Trucks to Reduce their Socioeconomic Impact on Major Highways

Automated Truck Lanes in Urban Areas for Through and
Cross Border TrafficPI: Kelvin Cheu, UTEP

_

<u>OUTREACH</u>

C2SMART takes a multifaceted approach to outreach, seeking to engage stakeholders in academia, industry, and government. As a center, we also go beyond traditional channels for research dissemination to showcase our work to a variety of audiences.



A MULTI-STAKEHOLDER FORUM ON OVERWEIGHT TRUCK ISSUES

C2SMART hosted a forum at the NYU-Tandon campus on May 23, 2018 on new policies and directions for overweight, heavier and larger vehicles. The event convened transportation stakeholders from the public and private sectors to identify concerns and solicit input on regulatory policies from trucking and freight industry stakeholders, review current research on the topic, and identify areas for collective action and further research.

The forum is part of a C2SMART-funded collaborative project between the International Center for Enterprise Preparedness (INTERCEP) at NYU and the Rutgers Infrastructure Monitoring and Evaluation (RIME) Group. Industry representatives, senior public officials and other stakeholders participated in the one-day event, which facilitated multi-stakeholder collaboration to inform sound government policy development.



Above: Representatives from academia, industry, and government gather for the full-day forum. Below: Professor Hani Nassif presents recent research on the impact of overweight trucks on infrastructure.





L to R: Marianne Daude, Paris Deputy Mayor for Transportation, Nicolas Louvet, CEO of 6-t, Alia Verloes, Business Development and U.S. Manager for 6-t, and Sarah Kaufman, Assistant Director of the Rudin Center for Transportation, meet to discuss initial research findings.

ADVISING ON URBAN SUSTAINABILITY IN PARIS

As part of a project investigating the sustainability of urban consumption practices, Sarah Kaufman, Assistant Director of the Rudin Center for Transportation and principal investigator for the project, presented initial findings to Marianne Daude, Paris Deputy Mayor for Transportation, at Paris City Hall.

The Rudin Center partnered with 6-t: Bureau de Recherche in Paris to better understand and compare the consumption practices and mobility behaviors of residents of Paris and NYC. The goal of the research is to understand the challenges of freight and passenger mobility in cities and recommend policies for sustainable consumption practices at the local level.

<u>OUTREACH</u>

RESULTS OF SURVEY ABOUT MOBILITY NEEDS OF SENIORS IN EL PASO Conducted FALL 2017 RESPONDENTS' AGES ELECTRONIC DEVICE USAGE 49% use a smart phone % 🔲 39% use a flip phone PARTICIPANTS 🔢 38% use a home phone 69% Female ST DESIRED API FUNCTIONS SURVEY RESPONSES 50% English 50% Spanisł SEMIDI DE VIERS Most Important RESPONDENT ADDRESS concerns when North Leaf Gentrality DISTRIBUTION planning a trip 1 BIGGEST 4244224424 55 Teathe conge readons CHALLENGES ****** 55% "on time departure" DURING COMMUTE ******** 864 Hilborn II Placer enjors You can now click the Home icon on **Frequent Places menu**

COMMUNITY OUTREACH IN EL PASO

The research team at UTEP, led by Professor Kelvin Cheu conducted surveys to learn about the specific mobility needs and concerns of seniors in urban areas in order to develop a smartphone application to cater to those needs.

To keep their target users informed about the project and the app, the researchers created posters and videos showcasing their results and a video user guide for the app. Dr. Gina Nuñez, Associate Professor of Anthropology at UTEP and project team member, appeared with David Lopez from the City of El Paso Parks and Recreation Department on the El Paso Community College Television Channel to discuss the app.

USER WORKSHOPS FOR TRANSPORTATION APPS

Grocer

The research team at Rutgers, led by Professor Hani Nassif, developed several web applications designed to help improve operations for transportation agencies. The team hosted workshops at which they demonstrated the functions of the apps for New Jersey Turnpike Authority (NJTA) employees and collected feedback to help them improve the technology.

 Screenshots of two web apps developed by the Rutgers team
 Tel Collisions (n APPARENT COLTRE UTING CRUMSCS of N ITHT Poice Clud)

 Screenshots of two web apps developed by the Rutgers team
 Tel Collisions (n APPARENT COLTRE UTING CRUMSCS of N ITHT Poice Clud)

PRESENTING A VISION FOR THE FUTURE AT SMART CITIES NY

C2SMART hosted a mobility workshop as part of Smart Cities New York, a three-day event featuring panels, workshops, and speakers on all aspects of smart cities. The center's Senior Associate Director, Shri Iyer, and Deputy Director, Professor Joseph Chow, served as presenters for a workshop on "The Path of Mobility Solutions: From Ridesharing to Connected Vehicles, Hyperloop and Beyond."



C2SMART PI Sarah Kaufman (far left) moderates a panel on safe, smart streets during the Smart Cities NY conference.

The event was held at the Center for Urban Science and Progress at NYU Tandon on May 8, 2018. The C2SMART presenters were joined by Ryan Janzen, CTO of TransPod and Sebastian Gendron, CEO of TransPod.

Sarah Kaufman, assistant director for technology planning at the NYU Rudin Center for Transportation and C2SMART principal investigator, also served as moderator for a panel on "Integrated Mobility: Safe, Smart Streets," which brought together several high-ranking public and industry members influencing mobility in cities around the world.



C2SMART Senior Associate Director Shri Iyer (left) provides an introduction to C2SMART and Professor Joseph Chow, C2SMART Deputy Director, (right) offers a look at the future of urban transportation at the Smart Cities NY conference.

OUTREACH



PROFESSOR HANI NASSIF RECEIVES LIFETIME ACHIEVEMENT AWARD

Dr. Hani Nassif, C2SMART's Associate Director for Outreach and Technology Transfer, received the Lifetime Achievement Award during the 55th New Jersey Concrete Award dinner on May 10, 2018. The New Jersey American Concrete Institute Chapter (NJACI) and the New Jersey Concrete Aggregate Association (NJCAA) honored him with the award for his research work in the area of structural health monitoring (SHM), advanced cementitious materials, and field implementation on highway bridges in New Jersey for infrastructure resilience.



HOSTING THE WIDER TRANSIT WORLD AT TRANSPORTATION CAMP

C2SMART and NYU-Tandon hosted Transportation Camp NYC 2017, an "unconference" that aims to convene transportation professionals, technologists and others who are passionate about technology and urban transportation. Held on the Brooklyn campus, the one-day event brought together transit enthusiasts from a variety of professional backgrounds to discuss topics including emerging technologies like autonomous vehicles and e-bikes, politics and policy of transportation, parking and congestion, and more.

C2SMART DISTINGUISHED SPEAKER SERIES

C2SMART has established a Distinguished Speaker Series, in which experts give talks on emerging research areas and interact with center students and staff. The seminars are broadcast live on the center's new YouTube channel and embedded on C2SMART's website to allow the events to reach the widest possible audience.

So far, the series has touched on topics such as big data applications in transportation, structural health monitoring of infrastructure, the theoretical, physical, and social aspects of automated vehicle collisions, and more.

This past year's Distinguished Speakers included:



Evangelos Simoudis, Founder and Managing Director of Synapse Partners

Exploring A New Value Chain For Fleet-Based On-Demand Mobility



Professor Zdenek P. Bazant, Professor of Civil and Environmental Engineering, Mechanical Engineering and Material Science and Engineering at Northwestern University

Design of New Materials and Structures to Maximize Strength at Probability Tail: A neglected challenge for quasibrittle and biomimetic materials



Justin Schorr, Collision Reconstruction **Engineer at DJS Associates**

Ambivalent Automation: a multidisciplinary approach to bridging the gap between the theoretical, social, and physical aspects of automated vehicle collisions.



Saad Shaikh, General Manager at Chariot

The Future of Mobility: an overview of Chariot's service and vision for the future of urban mobility.





Dr. Satish V. Ukkusuri, Professor and Director, Lyles School of Civil Engineering at Purdue University

Convergence of Networks, Smarter (Autonomous) Transportation Technologies and Big Data



Dr. Hani Nassif, Professor and **Director of Rutgers Infrastructure** Monitoring and Evaluation Group

The Past, Present, and Future of Structural Health Monitoring (SHM) of Civil Infrastructure



Giancarlo Fortino, Professor of Computer Engineering at the University of Calabria

Agents Meet the IoT: towards cognitive and interoperable ecosystems of networked smart objects.

EDUCATION AND WORKFORCE DEVELOPMENT

C2SMART seeks to train and support the transportation workforce of today and tomorrow, equipping them with the skills needed to handle new and emerging mobility problems.





C2SMART had a strong presence during its first year at TRB, with members and affiliates presenting research at more than 25 sessions. Left: Students in C2SMART Director Dr. Kaan Ozbay's lab. Below: C2SMART Deputy Director Joseph Chow with students in his lab.

AN AWARD-WINNING PRESENCE AT TRB

C2SMART had a significant presence at the 2018 Transportation Research Board Annual Meeting in Washington, DC, with its members and affiliates receiving awards and presenting research findings at more than 25 sessions.

Professor Joseph Chow and Kun Xie, a former

doctoral student of Center Director Professor Dr. Kaan Ozbay, were honored by the Council of University Transportation Centers (CUTC) at its annual awards banquet. Chow received CUTC's Cambridge Systematics New Faculty Award, given annually to a tenure-track faculty member who demonstrates excellence in classroom teaching and makes important contributions to research in the transportation field. Xie received CUTC's Milton Pikarsky Memorial Award, given annually for the best Ph.D. dissertation and Master's thesis in the field of science and technology in transportation studies.

Additionally, C2SMART and NYU Tandon's Department of Civil and Urban Engineering hosted a reception, where attendees had the opportunity to learn more about the Center's and Department's recent work and continuing growth.

EDUCATION AND WORKFORCE DEVELOPMENT



CAD drawings of the scale models.

VIP PROGRAM PARTNERSHIP

C2SMART is currently supporting the Vertically Integrated Projects Program, which provides a multi-year, integrated approach to learning that emphasizes project-based, interdisciplinary, research-active education for undergraduate and graduate students. Students from the Smart Cities Technology VIP team at NYU are working on projects with C2SMART faculty, graduate students, and NEXT Future Transportation, building scale models of the company's autonomous vehicle pods that will be used for physical scale model testing of fleet control algorithms.

UTEP AND CZECH TECHNICAL UNIVERSITY LAUNCH DUAL DEGREE PARTNERSHIP

The University of Texas at El Paso and Czech Technical University has expanded its partnership with Czech Technical University in Prague, launching a dual master's program on smart cities. The new program builds on more than a decade of collaboration between the two universities on a master's degree program in transportation science and logistics systems.

The two institutions signed a new memorandum of understanding establishing the new smart cities master's program and extending their partnership through the 2023-24 academic year.

A delegation from UTEP, including Kelvin Cheu, Ph.D., Professor in the Department of Civil Engineering and C2SMART principal investigator, traveled to the Czech Republic to mark the 25th anniversary of CTU's Faculty of Transportation Sciences. CTU awarded both Cheu and UTEP President Diana Natalicio the Professor F.J. Gerstner Medal of Merit, which recognizes distinguished academic contributions and is named for the first director of CTU when it became a polytechnic school in 1806.



Leaders from The University of Texas at El Paso and the Czech Technical University signed a memorandum of understanding to expand their partnership on a dual master's program.





MATT VECHIONE NAMED FIRST OUTSTANDING STUDENT OF THE YEAR

C2SMART chose Matthew Vechione, a doctoral student in The University of Texas at El Paso's College of Engineering, as its 2017 Outstanding Student of the Year. The annual award recognizes a student, selected based on technical merit and research capability, academic performance, and leadership, from one of C2SMART's consortium member schools, as chosen by the Center's executive leadership committee. It includes a prize of \$1,000 and a certificate from USDOT covers the costs to attend the TRB Annual Meeting in Washington, D.C.

Vechione has been working with Kelvin Cheu, a Professor in the Department of Civil Engineering at UTEP, on one of C2SMART's current projects. The goal of the project is to develop a smartphone mobility app that caters to the specific needs of seniors.





Above: Panelists at the ITS Women in Transportation event. Right: A seminar by Saad Shaikh, general manager at Chariot, organized by NYU's ITS chapter.

STUDENT ITE AND ITS CHAPTERS HOST SUCCESSFUL EVENTS



NYU's student chapters of the Institute for Transportation Engineers

and the Intelligent Transportation Society chapters had a succesful year, organizing a full calendar of events for interested students, many of which were hosted by C2SMART.

This was the ITS chapters' first year in existence, launching at the beginning of Spring 2018 under the leadership of Nick Caros, a Master's student working under C2SMART Deputy Director Professor Joseph Chow. The group was launched to build student interest in emerging transportation technology and bring together students from numerous disciplines who have a passion for transportation.

EMERGING LEADERS IN TRANSPORTATION

Led by NYU Rudin Center Assistant Director Sarah Kaufman, the Emerging Leaders in Transportation program develops early-career transportation professionals to develop and promote innovations within their organizations. In the 2017 edition of the event, sponsored by C2SMART, the Rudin Center for Transportation drew upon leading experts to participate in a four-part workshop series addressing policy issues, leadership skills, and technical innovation. The three-day program included professional development with executive leaders, communication work through networking activities, and site visits to major transportation management locations. Participants learned how to evaluate the feasibility of innovation for their workplaces, incorporate it into the workflow, and build long-term technology plans. These discussions help foster an invigorated leadership cadre with an understanding of planning for the future and how to bring new organizational tools to their agencies.





Panelists discussed revolutionary changes happening in mobility. From left: Mariane Jang, Associate Director of Mobility and Urban Development Sector at 100 Resilient Cities, Ann McGrane, Policy Analyst at the Office of the Deputy Commissioner for Policy, NYCDOT, Sami Naim, Senior Public Policy Manager for Lyft, and Henry Greenidge, Government Affairs Professional and Attorney at Cruise Automation.

THE FUTURE OF MOBILITY WORKSHOP SERIES

The NYU Rudin Center for Transportation is hosting a series of workshops sponsored by C2SMART examining the future of mobility through three different lenses. The first of the workshops, titled The Three Mobility Revolutions, featured four distinguished panelists duscussing upcoming changes in mobility: automated, shared, and sustainable transport.

The next event in the series will focus on women's challenges in mobility, and the final event will be a startup showcase.



NYU TANDON RESEARCH EXPO

C2SMART graduate students showcased their research at the NYU Tandon School of Engineering Research Expo in May 2018.

Clockwise, from top: Students meet with Chandrika Tandon, Chair of the Board of NYU Tandon School of Engineering. Ph.D. student Jinkai Zhou watches simulation models developed by students in Professor Ozbay's lab. Recent Ph.D. graduate Abdullah Kurkcu demonstrates his WiFi, Bluetooth and air quality sensors for Master's student Nick Caros and Ph.D. student Jingqin Gao. Master's student Assel Dmitriyeva explains her work on a destination recommender system for shared mobility services.



C2SMART CONGRATULATES RECENT GRADUATES

NYU

Yuan Zhu, Ph.D. Transportation Engineering
Abdullah Kurkcu, Ph.D. Transportation Engineering
Awais Malik, Ph.D. Civil and Urban Engineering
Lior Melnick, M.S. Transportation Planning & Engineering
Weerapan Rujikiatkumjorn, MS Transportation Planning & Engineering
Daniel Fay, MS Applied Urban Science and Informatics
Joanna Simon, Master of Urban Planning
Ari Kaputkin, Master of Urban Planning

RUTGERS

Greg Brewer, M.S. Civil and Environmental Engineering
Elie Haddad, M.S. Civil and Environmental Engineering
Chris Sholy, M.S. Civil and Environmental Engineering
He Zhang, M.S. Civil and Environmental Engineering

UTEP

Corina Marrufo, Master of Social Work Karina Salcedo, M.S. Civil Engineering David Hoblik, M.S. Civil Engineering

UW

Eric Barber, M.S. Civil and Environmental Engineering
Fan Qi, M.S. Civil and Environmental Engineering
Xiao Wen, M.S. Civil and Environmental Engineering
Luke Peters, M.S. Civil and Environmental Engineering
Tianyi Hu, M.S. Civil and Environmental Engineering
Liming Jin, M.S. Civil and Environmental Engineering
Wenjin Gu, M.S. Civil and Environmental Engineering

PARTNERSHIPS

C2SMART has a large and growing network of partnerships with government agencies, companies in the transportation industry, and other research centers. Contact c2smart@nyu.edu if you are interested in working with us.

NEXT FUTURE TRANSPORTATION

C2SMART and NEXT Future Transportation are collaborating to create a cyberphysical testbed to test NEXT's designs for modular self-driving vehicles. C2SMART will build and use scale models of NEXT's vehicles, along with simulations, to test routing algorithms and operational policies for shared autonomous vehicles, helping the company to propose and start field pilots in cities. For this collaboration, NEXT shared the specifications for its 1:10 scale vehicle models with C2SMART, and the center's students are constructing the models and working with NEXT to set up communications between a computer and the vehicles to start testing algorithms for various fleet control strategies.



Image courtesy of NEXT Future Transportation

PARKOFON

C2SMART is implementing a small-scale parking pilot in Downtown Brooklyn in partnership with Parkofon to better understand parking demand and patterns and increase the efficiency of on-street parking. The in-vehicle Parkofon device and mobile application guide drivers to open parking spaces, tracks exactly where they park, how long they stay, and has the capability to automatically charge them for the actual time they spent parked. The small-scale pilot has validated the feasibility of detecting double parking events via Parkofon's high-accuracy geolocation system as well. A larger

scale pilot will be implemented later this year to robustly evaluate the value of real-time spot availability and parking data (e.g., hourly limit and rate) for reducing parking search time.



ZENDRIVE

Zendrive aims to make the world's roads safe through data and analytics. The company uses smartphones to collect data on dangerous driving events. Zendrive and C2SMART have partnered to analyze some of the company's unique datasets, including an all-U.S. dataset from July 2015 to December 2015 and a New York City metropolitan area dataset from December 2016 to April 2017. Four types of dangerous driving events were included: fast acceleration, hard braking, phone use while driving, and speeding. The 2015 data was used to study time-dependent safety performance in Manhattan. Time-dependent safety performance functions (SPFs), which describe the relationship between crash count and other factors, including the number of dangerous driving events, were built. Time-dependent hotspots in Manhattan were also identified based on the results of SPFs, which can guide the development of safety treatments. This study also shows promise to use dangerous driving event data collected by smartphones and CVs to explore traffic safety issues in the long term.

OUR TEAM

PRINCIPAL INVESTIGATORS

Kaan Ozbay, NYU

Joseph Chow, NYU

Sarah Kaufman, NYU

Constantine Kontokosta,NYU

Saif Jabari, NYU

Claudio Silva, NYU

William Raisch, NYU

Hani Nassif, Rutgers

Jeff Ban, $\,UW$

Don Mackenzie, UW

Yinhai Wang, UW

Kelvin Cheu, UTEP

Camille Kamga, $C\!C\!NY$

C2SMART's consortium includes faculty members from a range of disciplines across its member universities, a fulltime staff based at NYU, as well as numerous postdoctoral researchers and graduate students. The center's team brings together a strong combination of leadership and research expertise and is committed to finding solutions for the future of urban transportation.

AFFILIATED FACULTY

Monica Menendez, $NYU\,Abu \ Dhabi$

Natalia Villanueva-Rosales, UTEP

Jeff Weidner, UTEP

Gina Núñez-Mchiri, UTEP

John Falcocchio, NYU

Elena Prassas, NYU

Mitchell L. Moss, NYU

Zhong-Ping Jiang, NYU

FACULTY SPOTLIGHT



NATALIA VILLANUEVA-ROSALES

Assistant Professor, Computer Science The University of Texas at El Paso

Dr. Villanueva-Rosales' research aims to improve the efficiency and effectiveness of the discovery, integration, and trust of scientific data and discoveries. Her current approaches link human and

machine knowledge to address societally-relevant problems in areas that require interdisciplinary research such as sustainability of water resources and Smart Cities. She is passionate about encouraging and supporting women and Hispanics pursuing a career or education in Science and Engineering. Dr. Villanueva-Rosales has contributed to the Urban Connector, a project initially funded by C2SMART and developed by UTEP to foster smart mobility for seniors in urban areas through mobile devices.

RESEARCHERS

Onur Kalan, NYU Carlos Restrepo, NYU Amelia Riley-Swan, NYU Chaekuk Na, Rutgers Sami Demiroluk, Rutgers Peng Lou, Rutgers Graziano Fiorillo, Rutgers Bekir Bartin, Altinbas University Sandeep Mudigonda, CCNY



Kaan Ozbay Director



Jeff Ban Associate Director for Technology and Data Management



Joseph Chow Deputy Director



Kelvin Cheu Associate Director for Research



Hani Nassif Associate Director for Outreach and Technology Transfer



Jack Bringardner Associate Director for Education and Workforce Development Initiatives



Shri lyer Senior Associate Director



Abdullah Kurkcu Systems Engineer



Alyssa Brewer Communications Associate



Joe Williams Grant Manager

25











C2SMART CENTER

15 MetroTech Center, 6th Floor Brooklyn, NY 11201 c2smart@nyu.edu c2smart.engineering.nyu.edu