

2018 CURIE Academy

Center for Transportation, Environment, and Community Health Smart and Healthy Cities



School of Civil and Environmental Engineering
Faculty Director: Professor H. Oliver Gao



<https://www.slideshare.net/prayukth1/smart-cities-2020>

In the 2018 CURIE Academy, participants will learn how urban infrastructure provides critical services for the health, economic well-being, and security of modern communities, and represents one of the defining characteristics of the modern world. Stress in the physical infrastructure is reflected in structural deterioration and interruption of service from increased exposure to both natural and anthropogenic hazards including environmental pollution. Physical infrastructure and interdependent social, economic, and environmental systems are also stressed by population growth, social inequities, and the institutional barriers to integrated and intelligent infrastructure management. The social, economic, and political dimensions of urban life are intimately tied to functional infrastructure.

In the meantime, natural resources and environments have become a scarce commodity and have thus posed a challenge which civilization must confront to enable healthy living, economic growth, safety

and security. This relates to issues such as water, air quality, transportation and energy efficiency, which are all driven by increasing world population growth and urbanization, accompanied by decreasing natural resources. Stressors such as environmental pollution, natural resource depletion, and climate change impose special challenges for sustainability. For instance, in the last century the US ground transportation fleet expanded from 450,000 vehicles in 1910 to 200 million vehicles clocking 2.5 trillion vehicle miles today. It is projected that by 2050 US vehicle-miles-traveled will grow to 4.8 trillion miles. A similar trend is true in many other countries worldwide. Transportation-related air pollution (e.g., ground-level ozone and particulate matter (PM) pollution) is an issue of significant importance. The World Health Organization estimates that urban air pollution causes 200,000 deaths per year worldwide and that it will be responsible for 8 million premature deaths between the years 2000 and 2020.

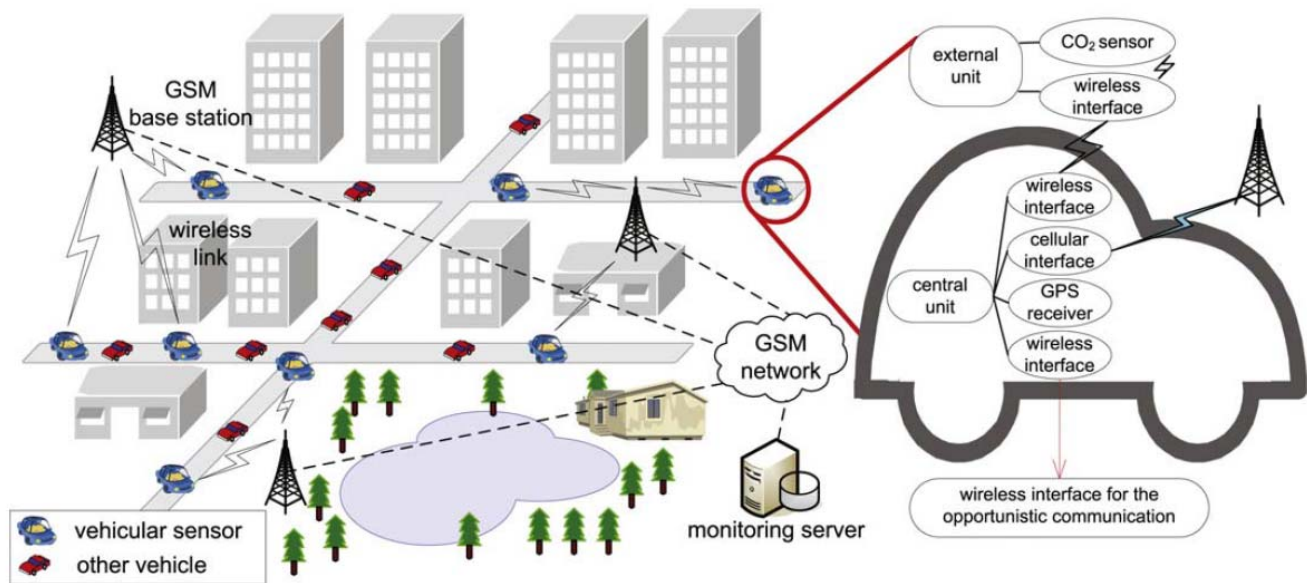


Fig. 1. The proposed VSN architecture for micro-climate monitoring.

Sacrificing environmental quality and public health for urban infrastructure is simply not feasible. Fortunately, the convergence of several trends and technologies, ranging from internet of things (IoT), new mobility services enabled by advances in information technology and the cloud, to connected and automated electric vehicles, to millennials' attitudinal changes towards auto travel (solo driving in particular) provide new openings for innovations that address the livability challenges of people without further degrading the environment and public health. Smart and Healthy Cities are emerging on the horizon with urban innovation, technology advancement, and new demographic trends (Fig. 1).

The Center for Transportation, Environment, and Community Health (CTECH, <http://ctech.cee.cornell.edu/>) is a USDOT Tier 1 University Transportation Center awarded in 2016 to advance transportation sustainability in its broader human and environmental contexts. In this CTECH and Smart and Healthy Cities summer CURIE program, CTECH aims to expose program participants to a wide spectrum of project topics from human behavior/decisions, to data analytics of environment and human health. The students will study the concept and management of smart and healthy cities. Specific topics may include 1) planning, design and management of smart multimodal transportation systems in which engineers can contribute to addressing a wide variety of challenges, ranging from congestion to security to environmental impact; 2) Analysis, design, and construction of smart built environment such as energy smart buildings; and 3) mobile sensing data of public exposure to traffic.



<http://www.healthcommunity.be/kennisessie-smart-healthy-cities>

2018 CURIE Academy

Center for Transportation, Environment, and Community Health Smart and Healthy Cities



Lesson Plan

Professor H. Oliver Gao

Sunday, July 15, Bethe House Dining Room

6:30 – 7:00 p.m.

Overview of Research Project

Professor H. Oliver Gao

School of Civil and Environmental Engineering

Monday, July 16, 142 Upson

1:00 – 5:00 p.m.

Systems engineering and systems design thinking for urban mobility challenge

Professor David R. Schneider

Systems Engineering

and

Sirietta Simoncini, M. Arch.

Systems Engineering

Albert Einstein once said, “If I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and five minutes thinking about solutions”. The challenge of creating Smart and Healthy Cities is a complex one, filled with numerous stakeholders and interactions between stakeholders, that must be well understood if one is to develop a truly high performing sustainable solution. In this lab, students will explore an urban mobility challenge, which at first glance may appear to have some clear solutions, but through an application of systems engineering and systems design thinking approaches in a real world setting (across campus, interviewing clients, etc.), students will uncover a broader understanding of the complex needs within. In doing so, students will also gain valuable experience in problem definition skills that can be applied towards any future career they may pursue.

Tuesday, July 17, 366 Hollister and Carpenter Red, Orange and Green Accel Labs

1:00 – 5:00 p.m.

Ride sharing, transit systems, and performance measure of sustainable transportation system

Professor Samitha Samaranayake

School of Civil and Environmental Engineering

and

Bridgette Brady, CAPP

Senior Director of Cornell Transportation and Mail Services

Division of Infrastructure, Properties and Planning

In this lab session, students will get introduced to the diverse and interdisciplinary elements that are considered in the design of ride-sharing and transit systems, with a focus on the new technological advancements surrounding on-demand services. We will discuss the problem through both high level concepts

and an interactive design game in which students will compete to build the best subway system improvements for New York City. We will also discuss how new ride-hailing services can help and/or hurt transit services.



Universities function as cities, this is particularly noticeable when you realize the demands placed on the transportation systems. University transportation professionals recognize their roles in supporting Smart and Healthy Cities. However, currently there isn't a tool with which to measure the efficacy of the use of transportation resources. Students will have the opportunity to participate in an interactive polling session to further assist CTECH and the U.S. Green Building Council in the development of methods for measuring the performance of sustainable transportation systems.

Students may have the opportunity to visit the Peterson "Green" Parking Lot Demonstration Site (currently under construction).

Wednesday, July 18, 366 Hollister and 150 Hollister

1:00 – 5:00 p.m.

Urban water challenge and green infrastructure solutions

Marika Nell, Ph.D. Candidate Environmental Processes

Casey Ching, Ph.D. Candidate Environmental Processes

Helbling Research Group

School of Civil and Environmental Engineering

and

Lena Abu-Ali, Ph.D. Candidate Environmental Processes

Reid Research Group

School of Civil and Environmental Engineering

Water is the most essential resource on earth, but rapid population growth and aging water infrastructure systems pose significant challenges for cities to provide water sustainably in the future. In the first part of this session, students will learn about urban water systems and explore water footprints from individual homes to whole cities using interactive software. We will discuss water consumption and identify the most important ways in which cities can adapt to improve water conservation. In the second part of this session, students will investigate water quality throughout the urban water cycle and learn how the use of sensor networks with green infrastructure systems can improve the sustainability of urban water management. We will combine field sampling with interactive laboratory modules to evaluate basic water quality parameters and discuss relationships between water quality, water uses, and public health.

Thursday, July 19, Wiswall Lab (Dry A & B) Schurman Hall, Vet School

1:00 – 5:00 p.m.

Transportation and One Health

Professor H. Oliver Gao

School of Civil and Environment Engineering

and

Professor Alexander Travis

Baker Institute for Animal Health, Department of Biomedical Sciences



While providing critical services for mobility needs, transportation-related air pollution constitutes an important risk factor for cardiopulmonary disease, increases children’s asthma rates and premature mortality, lung cancer fatalities, and substantial loss of average life expectancy. In the first part of this lab session, students will first learn systems thinking about the complexity of transportation, emissions, air pollution, and public health problems. After this, we’ll conduct real-time measurements of respiratory exposures at different places/facilities (e.g., walking, behind a bus, near a stop sign, in a parking lot, etc.) on Cornell’s Ithaca, New York campus. With the collected exposure data, the students will then come back to the lab to analyze the data and discuss the results.

In the second part of this lab session, Professor Travis and his group will expose students to the broader One Health concept in a lecture and discussion session. He will then lead an interactive computer laboratory session in which students will have the opportunity to visualize and explore differences in the global burden of disease, comparing countries of the students’ choosing, and emphasizing differences between high and low income countries, urban vs rural populations, etc.

Friday, July 20, 253 Rhodes

1:00 – 5:00 p.m.

Transportation in Practice *and* What makes a city smart and innovative?

Adria Finch

Director of Innovation, City of Syracuse

and

Sayeeda Jahin Aishee – CATALYST and REU Experience

and

Veronica O. Davis, PE

Nspiregreen, LLC

Across the United States, governments are working to improve infrastructure. Some cities are using technology to leverage the internet of things and become “smart cities”. Projects, like Chicago’s Array of Things utilize sensors to collect real time, location based data that can be used to evaluate the condition of infrastructure as well as the effect that it has on people’s lives. Other cities still struggle to use data to make informed decisions about infrastructure investments. In this session, participants will learn about different ways to collect, analyze, and utilize data to improve infrastructure systems.

Today, urban areas are plagued with congestion. Widening streets and making cars move faster does not work. Cities are grappling with how to move people today and how to move people in the future when new technologies become available. In this lesson, you will learn about technologies available today that are being tested for future use. You will have the opportunity to work in teams to design a transportation system of the future.

Saturday, July 21, Bethe House Dining Room

10:15 a.m. – 12:30 p.m.

Research Presentations