New York University Tandon School of Engineering
Vertically Integrated Projects
Course Syllabus VIP Smart Cities Technology (1 Credit Each Semester for 3 Semesters)
Spring 2018
Professor Jack Bringardner
Team and Sub-team Meetings by Schedule Below
Course Website: https://wp.nyu.edu/jack_bringardner/smart-cities-vip/

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Office hours: By Appointment

Course Pre-requisites
Students must be in their sophomore, junior, or senior year in order to enroll in VIP for credit. Enrollment is based on a rolling application process with a decision made at the beginning of each semester.

About VIP
The Vertically-Integrated Projects (VIP) Program operates in a research and development context. Undergraduate students that join VIP teams earn one credit each semester for their participation in design/discovery efforts that assist faculty and graduate students with research and development issues in their areas of expertise. Students are required to take the course for three consecutive semesters.

The teams are:
- *Multidisciplinary* - drawing students from all disciplines on campus;
- *Vertically-integrated* - maintaining a mix of sophomores through PhD students each semester;
- *Long-term* - each undergraduate student may participate in a project for up to three years and each graduate student may participate for the duration of their graduate career.

The continuity, technical depth, and disciplinary breadth of these teams are intended to:
- Provide the time and context necessary for students to learn and practice many different professional skills, make substantial technical contributions to the project, and experience many different roles on a large, multidisciplinary design/discovery team.
- Support long-term interaction between the graduate and undergraduate students on the team. The graduate students mentor the undergraduates as they work on the design/discovery projects embedded in the graduate students’ research.
- Enable the completion of large-scale design/discovery projects that are of significant benefit to faculty members’ research programs.
During the semester there will be two meetings times every week and you must meet with your sub-team each week. The Cities and The Spring 2018 Meetings table indicates the times and locations for the meetings. The Spring 2018 Schedule table shows what assignments are due each week.

**Spring 2018 Meetings**

<table>
<thead>
<tr>
<th>Meeting Description</th>
<th>Day, Time, and Location</th>
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<tbody>
<tr>
<td>Cities Sub-team</td>
<td>Thursday, 6-7 PM, MakerSpace</td>
</tr>
<tr>
<td>Infrastructure Sub-team</td>
<td>Thursday, 6-7 PM, MakerSpace</td>
</tr>
<tr>
<td>Vehicles Sub-team</td>
<td>Wednesday, 1-2 PM, MakerSpace</td>
</tr>
<tr>
<td>Transportation Users Sub-team</td>
<td>Wednesday, 1-2 PM, MakerSpace</td>
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**Fall 2017 Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Assignments Due</th>
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<tbody>
<tr>
<td>1/22/2018</td>
<td>When2Meet Survey</td>
</tr>
<tr>
<td>1/29/2018*</td>
<td>Orientation and Review of Last Semester&lt;br&gt; Setup VIP Notebook, Google Drive, Slack&lt;br&gt; 2 References Outlined and Cited in VIP Notebook&lt;br&gt; <strong>Topic: Research Methods</strong></td>
</tr>
<tr>
<td>2/5/2018</td>
<td>Mock-VIP Notebook Check (Only if this is your first semester)</td>
</tr>
<tr>
<td>2/12/2018*</td>
<td>2 References Outlined and Cited in VIP Notebook</td>
</tr>
<tr>
<td>2/19/2018</td>
<td>Milestone 1 Presentations&lt;br&gt; Document code, drawings, and/or data analysis&lt;br&gt; <strong>Topic: Design and Prototyping</strong></td>
</tr>
<tr>
<td>2/26/2018*</td>
<td>2 References Outlined and Cited in VIP Notebook</td>
</tr>
<tr>
<td>3/5/2018</td>
<td>Document code, drawings, and/or data analysis&lt;br&gt; Engineering Design Canvas</td>
</tr>
<tr>
<td>3/12/2018*</td>
<td>VIP Notebook Check&lt;br&gt; Peer-Evaluations&lt;br&gt; Milestone 2 Presentations&lt;br&gt; <strong>Topic: Professional Skills</strong></td>
</tr>
<tr>
<td>3/19/2018</td>
<td>2 References Outlined and Cited in VIP Notebook</td>
</tr>
<tr>
<td>3/26/2018*</td>
<td>Document code, drawings, and/or data analysis</td>
</tr>
<tr>
<td>4/2/2018</td>
<td>2 References Outlined and Cited in VIP Notebook</td>
</tr>
<tr>
<td>4/9/2018*</td>
<td>Milestone 3 Presentations&lt;br&gt; Document code, drawings, and/or data analysis&lt;br&gt; <strong>Topic: Data Analysis and Ethics</strong></td>
</tr>
<tr>
<td>4/16/2018</td>
<td>Prepare for Research Expo 2018&lt;br&gt; Rough draft of poster&lt;br&gt; Engineering Design Canvas&lt;br&gt; 2 References Outlined and Cited in VIP Notebook</td>
</tr>
<tr>
<td>4/23/2018*</td>
<td>Final Poster Presentation (Research Expo 2018) Due</td>
</tr>
<tr>
<td>4/30/2018</td>
<td>Final Report Due&lt;br&gt; VIP Notebook Check&lt;br&gt; Peer-Evaluations&lt;br&gt; <strong>Topic: New Technology and Ideas</strong></td>
</tr>
</tbody>
</table>

* Faculty will be present for these meetings
Course Description
This project-based course will form research teams that design and prototype technological innovations to address the needs of smart cities. This technology will be designed within the context of the data collection and processing network essential to connected cities. This VIP course will coordinate with the NYU Tandon School of Engineering and CUSP.

The team will research the needs of smart cities related to the technical issues outlined in the Report to the President "Technology and the Future of Cities" with an emphasis on transportation including: cities, vehicles, infrastructure, and transportation users. These sub-teams will develop hardware, software, data analysis, application, and project management of their problem definition.

Course Objectives
- To interpret and select the needs for consumers and stakeholders in smart cities.
- To propose a technological solution to an urban infrastructure need.
- To design, create, and test an innovative technology with smart cities applications.
- To formulate and describe an engineering research project as a team.

Course Structure
Each team has determined working times, designated as “sub-team meetings.” Students are responsible for participating in their team and sub-team meetings. If you miss any meeting, you are responsible for knowing what occurred in that meeting (typically by discussing it with other team members). An excused absence does not relieve you of that responsibility.

Required Materials
There is no required textbook for this course.

Course Policies
Expectations for this course include weekly meetings with your team, sub-teams, or the team members designated for specific tasks related to the project. Weekly meetings should take place for 1 hour and it is expected that approximately 3 additional hours will be spent on the project each week.

Grades
<table>
<thead>
<tr>
<th>Item</th>
<th>Breakdown</th>
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<tbody>
<tr>
<td>Documentation and records (VIP Notebook)</td>
<td>30%</td>
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<tr>
<td>Personal accomplishments and contributions to your team’s goals</td>
<td>30%</td>
</tr>
<tr>
<td>Teamwork and interaction (5% from full team meetings)</td>
<td>30%</td>
</tr>
<tr>
<td>End of Semester Presentation and Report</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>
Sub-Teams

- **Cities**
  - Project Leader: Shayan Khan
  - Develop the Quantified Communities devices
  - Build, test, deploy, and analyze data from environmental sensors in NYC

- **Vehicles**
  - Project Leader: Sagari Datta
  - Design and test autonomous vehicle LiDAR sensors
  - Apply autonomous vehicle sensors to autonomous drones

- **Infrastructure**
  - Project Co-Leaders: Amy Yin and Henrique Mendonca
  - Optimize locations of solar-powered electric vehicle charging stations
  - Develop inductive charging pads for drone data collection

- **Transportation Users**
  - Project Leaders: Robe Zhang
  - Optimize pick-up and delivery for shared autonomous vehicle fleets
  - Adapt algorithms for retrieving data from Quantified Community devices

Course Topics

1. **Research**
   a. Smart cities
      i. Initiatives
      ii. Innovations
   b. Internet of things
      i. Making connected devices technology
      ii. Big Data
      iii. Cybersecurity
   c. Urban Systems
      i. Sustainable environments
      ii. Intelligent transportation systems
         1. Shared autonomous electric vehicles
         2. Drones
         3. Infrastructure
         4. Transportation user services
      iii. Quantified communities

2. **Design**
   a. Arduino, Raspberry Pi, soldering, sensors
   b. Computer-aided design
   c. Programming: Python and MATLAB

3. **Entrepreneurship**
   a. Engineering design canvas
   b. Consumer and market research
   c. Societal Impact
Resources

1. Beyond Traffic 2045 – US Department of Transportation
2. Technology and the Future of Cities – The White House
3. Smart City Challenge Lesson Learned – US Department of Transportation
4. Critical Issues in Transportation – Transportation Research Board
5. (ITS) Strategic Plan 2015-2019 – Intelligent Transportation Systems
6. NYC DOT’s Strategic Plan 2016 – New York City Department of Transportation
7. Shared Mobility Current Practices and Guiding Principles – US Department of Transportation
8. Vehicle-to-Infrastructure (V2I) Deployment Guidance and Products – Federal Highway Administration
10. The Smart/Connected City and Its Implications for Connected Transportation – US Department of Transportation
11. The Next Generation of Mobility A Public Policy Roadmap for 2017 – Intelligent Transportation Society of America

Moses Center Statement of Disability

If you are student with a disability who is requesting accommodations, please contact New York University’s Moses Center for Students with Disabilities (CSD) at 212-998-4980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 2nd floor.

NYU School of Engineering Policies and Procedures on Academic Misconduct
(from the School of Engineering Student Code of Conduct)

A. Introduction: The School of Engineering encourages academic excellence in an environment that promotes honesty, integrity, and fairness, and students at the School of Engineering are expected to exhibit those qualities in their academic work. It is through the process of submitting their own work and receiving honest feedback on that work that students may progress academically. Any act of academic dishonesty is seen as an attack upon the School and will not be tolerated. Furthermore, those who breach the School’s rules on academic integrity will be sanctioned under this Policy. Students are responsible for familiarizing themselves with the School’s Policy on Academic Misconduct.

B. Definition: Academic dishonesty may include misrepresentation, deception, dishonesty, or any act of falsification committed by a student to influence a grade or other academic evaluation. Academic dishonesty also includes intentionally damaging the academic work of others or assisting other students in acts of
dishonesty. Common examples of academically dishonest behavior include, but are not limited to, the following:

1. Cheating: intentionally using or attempting to use unauthorized notes, books, electronic media, or electronic communications in an exam; talking with fellow students or looking at another person’s work during an exam; submitting work prepared in advance for an in-class examination; having someone take an exam for you or taking an exam for someone else; violating other rules governing the administration of examinations.

2. Fabrication: including but not limited to, falsifying experimental data and/or citations.

3. Plagiarism: intentionally or knowingly representing the words or ideas of another as one’s own in any academic exercise; failure to attribute direct quotations, paraphrases, or borrowed facts or information.

4. Unauthorized collaboration: working together on work that was meant to be done individually.

5. Duplicating work: presenting for grading the same work for more than one project or in more than one class, unless express and prior permission has been received from the course instructor(s) or research adviser involved.

6. Forgery: altering any academic document, including, but not limited to, academic records, admissions materials, or medical excuses.