Vertically Integrated Projects (VIP) 38XA
Smart Cities Course Syllabus

Instructors
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Class Meetings
Mondays: 3:00-3:50 pm

Course Description
VIP38XA: The Autonomy of "Smart" Cities is a cross-disciplinary course that is dedicated to finding technology-based solutions to some of the most pressing issues that are currently facing our cities. This course will focus on proposing and analyzing closed-loop systems that promote sustainable urban transportation, energy, and agricultural structures while increasing autonomy and enhancing livability of our cities. Students will be expected to work in teams to develop complete solutions (design and implementation) which integrate ideas and concepts from different disciplines such as: engineering design, machine learning, sustainability assessment, environmental impact assessment, robotics, IoT, hardware design, vision, lighting, and control theory.

Example Projects:
- Self-Drive: an autonomous vehicle project.
- Net-Zero-Surrey: designing a sustainable transportation solution for more livable future cities.
- Urban Agriculture: enabling the urban community to produce their own food.
- Robotics Arms: modeling motion with robotics arms.
- Exoskeleton Evaluations: creating and assessing different metrics to evaluate exoskeletons
- Drones: sling load and cooperative drones

VIP38XA is a multidisciplinary course supporting student and/or faculty-initiated projects, guided by faculty mentorship and professional research. Undergraduate students joining VIP teams earn one credit each semester for their participation in design/discovery efforts that enable them to explore their interests through long term projects. The teams are:

- *Multidisciplinary* - drawing students from all disciplines on campus;
- *Vertically-integrated* - maintaining a mix of freshmen through senior students;
- *Long-term* - each undergraduate student may participate in a project for up to three years.

Course Objectives
- Introduce students to state-of-the-art industry standard technology to better prepare them to enter the workforce.
- Allow students to utilize their specialized knowledge and skills in the context of a team-based research project.
- Provide students with the opportunity to conduct research at an early stage to better prepare them for possible academic careers.
- Enable students to work in multidisciplinary teams to design effective solutions to complex urban issues.

Course Structure
Each team will determine working times, designated as "sub-team meetings." Students are responsible for participating in their team and sub-team meetings. If any meeting is missed, it is the responsibility of the student for knowing what occurred in that meeting (typically by discussing it with other team members). An

excused absence does not relieve a student of that responsibility. Students are encouraged to take the course for at least three consecutive semesters in order to move their project forward.

The continuity, disciplinary depth, and professional breadth of these teams intend 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 students and faculty on the team. The more senior students mentor the undergraduates as they work on the design/discovery projects embedded in the course.
- Enable the completion of large-scale design/discovery projects that are of significant benefit to faculty members' research.

Student outcomes in the first semester are below; students will:

- Familiarize themselves with their chosen project and acquire enough background information to present/communicate their knowledge
- Gain basic skills in prototyping and engineering design
- Make some meaningful contributions to the overall project (with guidance from instructors)

Student outcomes in the second semester are below; students will:

- Master the foundations within the discipline and be able to communicate that mastery orally or in writing to the instructor / other students
- Pursue needed knowledge/skills
- Make several meaningful contributions to the overall project
- Assume some technical/leadership responsibilities

Student outcomes in the third semester are below; students will:

- Demonstrate mastery of the foundations of the disciplines required for their project, demonstrated by their written work or oral presentations
- Acquire deeper knowledge/skills than they had in previous semesters (i.e. can teach those skills to others)
- Make significant contributions to the overall project
- Assume significant technical/leadership responsibilities

Student outcomes in the fourth semester are below; students will:

- Provide leadership in their technical area
- Manage their teammates and their contributions
- Take responsibility for meeting deadlines and moving the project forward

Course Prerequisites

Students must be pursuing their undergraduate degree in order to enroll in VIP for credit. Enrollment is based on a rolling application process with a decision made before the beginning of each semester.

Suggested organizational platforms: Wiki, Github, website, other repositories.
Suggested platforms for notebooks: Indesign, labarchives
Suggested team coordination and communications platforms: miro, monday, Slack, Teams, Trello, MeWe

Course Policies

Outside of the normal class time, 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 1-2 hours with the instructor of the course and it is expected that approximately 2-3 additional hours will be spent on the project each week.

Tentative Schedule

- 9/13: Goals of the Group must be submitted to faculty

- 10/18: First Video Due
- 10/25: Presentations and Notebooks Due

- 12/06: Final Video Due and Peer Evaluations Posted
- 12/13: Presentations, Peer Evaluations, and Notebooks Due

Video: 5 minute recorded 'advertisement' of project which includes goals, what has been accomplished, and future work

Grades

Item	**Breakdown**
Lab Notebook	40%
Mid-semester Presentation (5 minute prerecorded)	20%
End of Semester Presentation (5 minute prerecorded)	30%
Peer Evaluations	10%
Total	**100%**

Academic Honesty

The main principle in VIP academic honesty is that you will not present someone else's work as your own. Tests and specific assignments (homework, lab assignments, etc.) must be your own work. For other work you are encouraged to consult whatever sources are helpful in learning and understanding the issues associated with the material, but you should always provide appropriate references and citations where such material is included in your VIP notebook, programming code, presentations, etc.

Additionally, to provide a good working environment for all students, you're expected to adhere to rules given here, posted, or disseminated in class. Academic Honesty is taken seriously and failure to follow these principles will result in disciplinary actions as stated in the Student/Faculty Handbook here.