Title

Sensing Cityscapes: Sensors, Cities, Policies/Basic Protocols for New Media | Fall 2014 Studio Course

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SENSING CITYSCAPES:
SENSORS, CITIES, POLICIES-
BASIC PROTOCOLS
FOR NEW MEDIA

GLOBAL URBAN HUMANITIES
INTERDISCIPLINARY
GRADUATE METHODS COURSE
CASE STUDY

The rise of digital media and related technologies are rapidly reshaping how cities are planned and managed, and how people experience the urban environment on a daily basis. Environmental sensors, video cameras, electronic data collection, digital maps, satellite photography, and drones (to name a few) are involved in urban service delivery, traffic analysis and control, public safety, wayfinding, monitoring weather and climate events and more.

This graduate methods studio, **Sensing Cityscapes**, was led by art practitioner and new media expert Greg Niemeyer and architect and 3-D fabrication innovator Ron Rael. The studio included students from a variety of disciplines including architecture, information science, archeology, public health, geography, city planning, and performance studies. All were interested in learning more about new media, data visualization, digital fabrication, and urban field methods. The faculty-student team worked with the City of San Leandro to fabricate 3-D printed street installations equipped with actuators designed to tackle a public safety

problem in a sustainable way: how to improve pedestrian path safety without having energy-intensive street lights on all night?

Students created and interrogated tools for collecting data on urban metabolisms. Through practical projects, students experimented with methods for retrieving and working with existing city data, investigating cities through surveys and mapping, generating data through digital sensing, and ways of presenting data to a public audience. Students actively partnered with the San Leandro's Information Technology Division, to find new ways of collecting and using data to improve city planning. Their final collaborative project illustrated how sensors responsive to pedestrian movement could turn on the lights when needed – and then turn them off.

Keywords:

Sensing Cityscapes: new media, design and public policy, urban safety, public lighting, urban field methods, sensing technologies, San Leandro
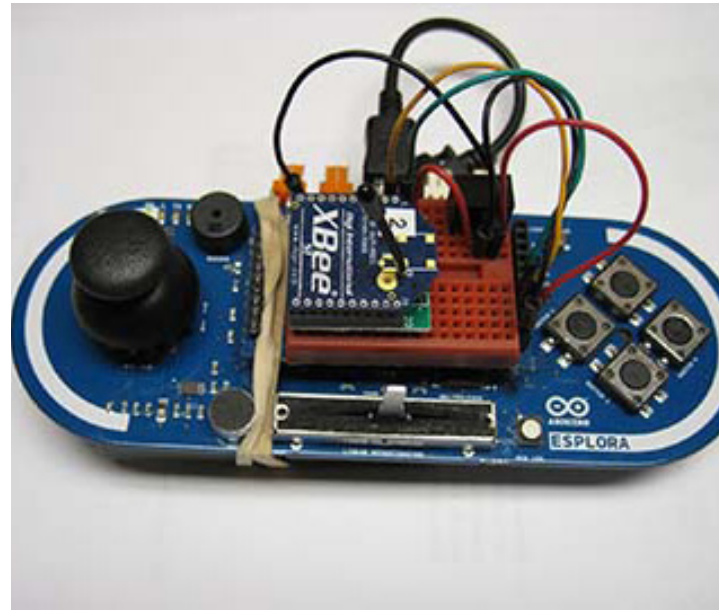
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COURSE DESCRIPTION

SENSING CITYSCAPES:

SENSORS, CITIES, POLICIES-

BASIC PROTOCOLS FOR

NEW MEDIA

GLOBAL URBAN HUMANITIES
INTERDISCIPLINARY
GRADUATE METHODS COURSE

Architecture 229 / Art Practive 229 / New Media 202

Fall 2014, 3 Units

Faculty:

Greg Niemeyer (Art Practice, Berkeley Center for New Media)

Ronald Rael (Architecture)

The course was be taught by Ronald Rael and Greg Niemeyer. Rael has a background in ecological design at the intersection of architecture, art, digital design, culture, and the environment. Niemeyer has a background in new media art, sensing, networking and data visualization. Together, they introduced participants to basic methods of urban mapping, sensing, and design. Guest lecturers will include Eric Paulos (Electrical Engineering and Computer Sciences/Berkeley Center for New Media) and Kimiko Ryokai (I-School/Berkeley Center for New Media).

One of the oldest continuous human records is the water level of the Nile. Measured in a special edifice, the Nilometer provided many successions of Egyptian governments with the basic data to determine ideal times for farmers along the river to plant and harvest. With new media tools, we can measure ever more aspects of our interactions with natural and built environments, which could be described as urban metabolisms.

But whether we can support better experiences for urban citizens with better measurements depends on many technical, political, cultural and design factors. How can we scale data from tiny sensors to individual people and to regional policies? In this methods course we studied the long chain of references which connect ground truth to data, data to information, information to people, and people to actions. We addressed key questions about sensing the city including:

- Who is watching and why?
- What data is relevant to whom and in which timeframes?
- How can we collect and store data?
- How can we validate such data?
- How can we share and distribute data fairly?
- For whom will data yield actionable outcomes?
- Can the impact of actionable outcomes be validated with new data?
- How do data support or challenge existing city policies?
- How can designs and even policies respond to data?

We addressed these questions conceptually and practically, as we follow the circulating references from need to data, and from data to action through applied studies. We learned to make use of both technical and theoretical tools to create a common ground of sensing, and to make invisible dynamics of urban metabolisms visible to those who are affected the most. We studied existing data sources from airnow to nextbus, learn to connect to existing data streams, design, build and test new devices and interfaces, all with the objective of alleviating risk, stress, waste, and neglect in urban settings. All along, we critically considered the limits of optimization and data-driven decision making, the conditions of inclusion and exclusion created with any technology, and the impact of data on intangible human experiences.

Through a suite of practical projects, the course introduced methods for retrieving and working with existing city data, investigating cities through surveys and mapping, generating data through digital sensing and ways of presenting data publicly. Project partners for this course are BART, EBALDC, the City of Berkeley, Youth Radio and data.acgov.org.

INSTRUCTORS

Greg Niemeyer

Greg Niemeyer is a data artist and Professor of Media Innovation, Toban Fellow, Director of the Art Practice Graduate Program. Loading his web page consumes about 65 watts per hour. Niemeyer co-founded the Berkeley Center for New Media, focusing on the critical analysis of new media and human experiences. His work focuses on data circulations among individuals, communities and environments. His projects often materialize data in a way that people can feel.

Niemeyer's work includes collaborations across disciplines and media, always focusing on emotional responses to data. His work on data sonification goes back to 2000, when he worked with Chris Chafe to sonify network response rates in an interactive installation for SFMOMA's visionary 010101 show. Currently, Niemeyer is working on visualizing water resource dynamics.

Niemeyer's work is data-driven: Large datasets and data streams are raw materials for visual and sonic experiences. They act as mirrors, reflecting to us what we don't see about our essential resources (air, water, care) from novel points of view. These patterns hold the hope that we can learn something new about what is to come and that we can evolve from the impossible present to more possible futures.

Ronald Rael

Ronald Rael is the Eva Li Memorial Chair in Architecture in the Department of Architecture in the College of Environmental Design, and is also a member of the art faculty in the Department of Art Practice at the University of California Berkeley. His past leadership roles have included serving as Department Chair, Director of the Masters of Architecture, and Director of the Masters of Advanced Architectural Design programs.

He is a designer, architectural researcher, author, entrepreneur, and thought leader in the fields of additive manufacturing and earthen architecture. He is the author of Borderwall as Architecture: A Manifesto for the U.S.-Mexico Boundary (University of California Press 2017), an illustrated biography and protest of the wall dividing the U.S. from Mexico (featured in a TED talk by Rael), and Earth Architecture (Princeton Architectural Press, 2008), a history of building with earth in the modern era. Rael San Fratello, the studio he co-founded with architect Virginia San Fratello, was named a 2014 Emerging Voice by The Architectural League of New York—one of the most coveted awards in North American architecture. Most recently, Rael San Fratello has installed "Teetertotter Wall," three pink see-saws on the US-Mexico border, named 2020 Design of the Year.

COURSE SUMMARY

CONTEXT

Each week, the course met for three hours. In the first hour, students and instructors reviewed student work from the last week. In the second hour, instructors presented concepts and tools for student work in the next week. In the third hour, we conducted workshops for students to explore and test the tools and concepts we introduced in the second hour.

Guest lecturers:

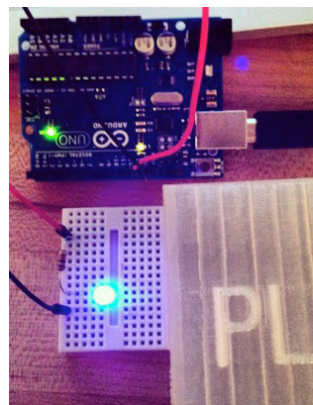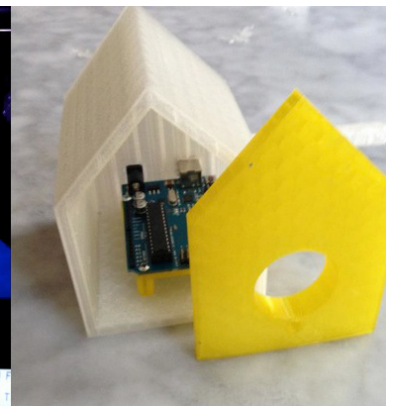Eric Paulos, EECS/BCNM, eric@paulos.net
Kimiko Ryokai, I-School/BCNM, kimiko@ischool.berkeley.edu

Extramural Partners:

Debbie Acosta, Chief Information Officer, City of San Leandro
Mike Holland, Director of Innovation, Kaiser Permanente
Tom Eppenberger, Innovation Researcher, Kaiser Permanente

CONCEPT 1: THE URBAN LAYER: URBAN METABOLISMS

Viewing the city as an organism, we can characterize its inputs and outputs as a kind of metabolism. We list these intakes and outputs, and discuss the roles of all urban citizens, of specific communities, and of individuals in generating these intakes and outputs. We then switch scales and present data systems as small cities with in- and outputs, and search for isomorphs between the two systems. What regulatory systems, what protocols and policies control these metabolisms? The functional comparison between systems of different scales will remain a fundamental tool for innovation in this course.
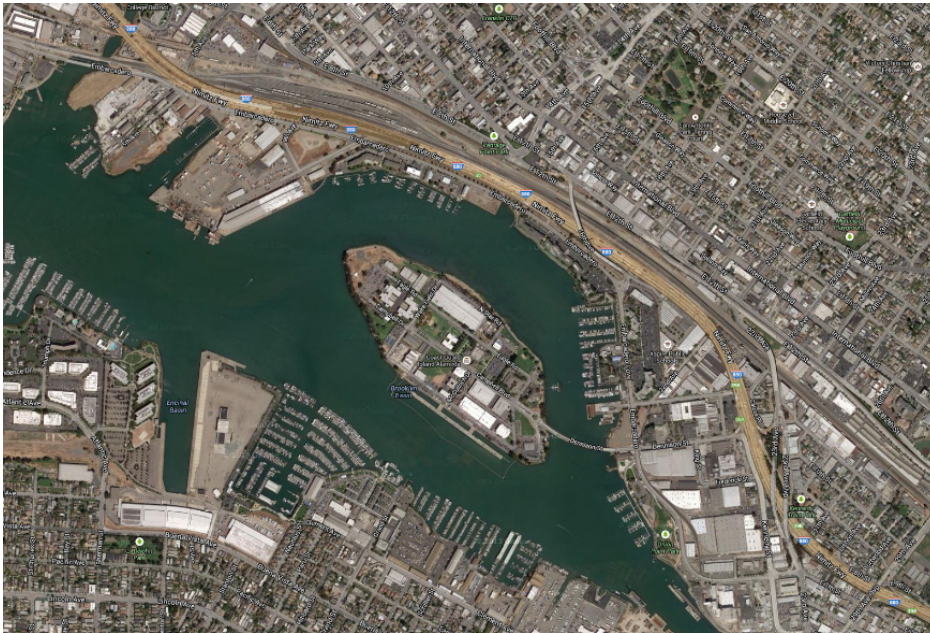
- Technical Terms: Input, Storage, Dynamic Memory, Logic, Instruction, Output, Code, Compiler, Executable
- Conceptual Terms: circulation, urban metabolism, subversion, inclusion, exclusion, boundary, zone of autonomy
- Text: de Certeau, Michel. The Practice of Everyday Life, 1984 (link)

CONCEPT 2: THE COMPUTATIONAL LAYER: CIRCULATIONS IN MICROPROCESSORS AND CITYSCAPES

Implementing the concept of metabolism to microprocessors, we learn how to get data into and out of a microprocessor, which we understand to be a kind of Invisible City, that rebuilds itself based on words. These words are programs, and we explore simple tools including the programming language "Arduino" to create basic programs. Required: A laptop. We provide an Arduino kit and a few basic electronic components. n in this course.
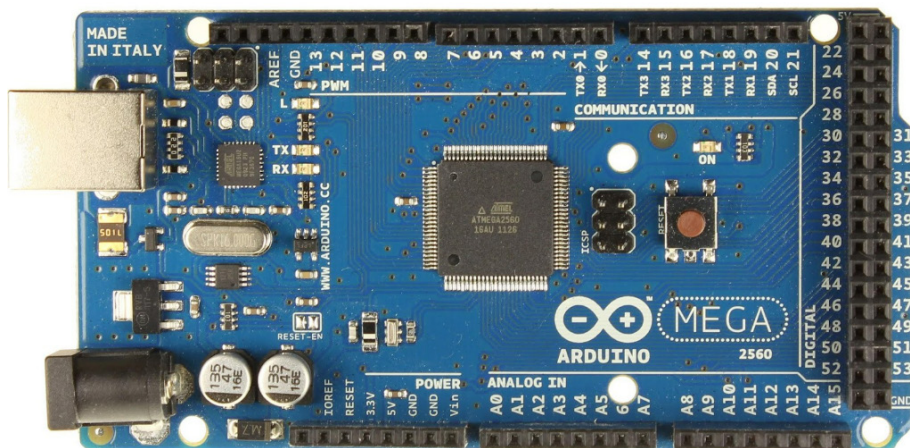
- Welcome to programming a microprocessor with Arduino

- Technical Terms: serial interfaces,

- Text: Banzi, Massimo: Getting Started with Arduino

CONCEPT 3: THE COMPUTATIONAL LAYER: GATES AND SWITCHES

We continue our exploration of "Microprocessor City" by reviewing all participants demonstrations of a program to make LED's blink. We then program the microprocessor to collect and digitize real-world inputs from switches. Switches come in many flavors: tactile, gateway, light, tilt, and step switches are all welcome. We learn to timestamp all our switch inputs and store them in a database. We can configure these elements to act like a stopwatch, a step counter, or a traffic counter. To continue the concept of isomorphs, we attach our switches to urban gateways such as park entrances, thoroughfares, turnstiles and gates.

- Blink demo

- Configure pins for input with 5 types of switches

- Program outputs for specific inputs

- Build your own switch

- Text: Tom Igoe: Making Things Talk

CONCEPT 4: THE COMPUTATIONAL LAYER: ANALOG TO DIGITAL CONVERSION (GUEST LECTURE BY KIMIKO RYOKAI)

After reviewing data collected from our switches project, we program the microprocessor to collect and digitize real-world inputs beyond switches. We connect the Arduino microprocessor to sensors of our choice, including EMF, light, or Volatile Organic Compound sensors. We learn the basics of Analog-to-Digital conversion, and of MySQL data storage. We discuss specific sensor issues such as signal-to-noise ratio, crosstalk, and data loss protocols.

- Gates and Switches demo

- A to D conversion: Sensor inputs, advanced outputs and serial protocol

- Text: Pfister, Cuno: Getting Started with the Internet of Things

CONCEPT 5: THE PERSONAL LAYER

After reviewing data collected by our sensors, we create a bridge from the microprocessor to the city with a data visualization interface. We learn a new programming language called "processing" to convert data streams into diagrams and graphs which can be interpreted by those whom the data concerns. In the process, we discuss both the digital divide issue and privacy issues. We review a few examples of data visualization and discuss ways in which space and time are typically represented, from Minard's early work to the latest efforts by stamen.

- Introduction to Processing

- Hello world of processing

- Drawing and text functions

- Arrays and classes

- Gathering external data

CONCEPT 6: THE PERSONAL LAYER

We explore techniques for collecting data from third party sources such as news sites. This additional data provides context for data we collect, and helps with the process of converting data into information, information into imaginations of possible futures, and finally from imagination to action.

- Scraper demo

- Basic data visualization techniques

- Graphing

- Charting

- User input and interaction

CONCEPT 7: THE GEOGRAPHIC LAYER

We add one more component to our data: GPS location data. We discuss how to work with latitude and longitude, and how to acquire GPS data. We show how data can be added to a map with Google Maps API (Application Protocol Interface) using markers and heat map techniques.

- Introduction to GIS language (Guest Lecture by Nicholas de Monchaux)

- GIS data formats

- Basic data mapping

- GPS tracking formats, GPS drawing

- Text: Sherman, Gary. Desktop GIS

CONCEPT 8: THE MATERIAL LAYER

In making a leap from topics of Digital to Analog and Personal to Material, we will consider how these important facets of city sensing materialize as a physical object. We will learn how techniques of digital design and methods for producing these designs physically using open source software coupled with 3D printing. How the crafted objects for sensing jump scales as both personal objects and as objects of the city will be a primary design concept that is investigated and realized. Texture, color, surface, material and interface will all be important topics of design investigation.

- Introduction to 3D modeling for 3D Printing

- 3D data formats: polygon, vertex, vector, transforms, volume

- dimensions and scaling of 3D objects

- 3D Modeling with 123D Design/Meshmixer/Makerware

- Basic concepts of 3D Printing: supports, limits, material processes

- Form and function: Designing a case for a microprocessor

- Designing a case

- Prototyping a case: form, function, surface, meaning, siting

- 3D printing: a case for a microprocessor

- Case maquette demo

- 3D printing of final design

CONCEPT 9: THE SOCIAL LAYER

We discuss the social aspects of data: Who can access it, who cannot. Who can interpret it, who can validate it, and how can what we make be a tool for empowerment rather that a tool for oppression and control.

- Introduction to HTML5

- Browser Protocols

- Basic server protocols and

- Command Lines

- HTML5 syntax and Canvas Object

- 3D features of HTML5

- Javascript syntax and resources

- HTML5 hello world

CONCEPT 10: THE POLICY LAYER

How can we transfer insights to policy makers?

- Accessing GIS and GPS via javascript

- GIS, Javascript and Google Maps

- Distribution of online content

- Integration of microprocessors and the web
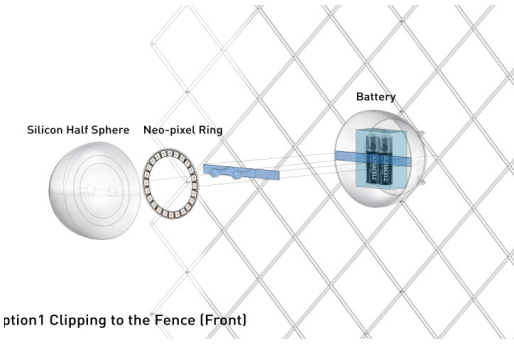
- Internet of Things Art (IOTA)

- Team development

CONCEPT 11: SYNTHESIS PROTOTYPING

- Team Wizard of Oz Demo

- Prototyping assessment

- Path to "First Playable"

- Expert feedback featuring guest lecturers

- Expert feedback featuring guest lecturers

- Progress documentation

- The Economic Layer

- Scalability and Sustainability (Guest Lecture with Ananya Roy)

CONCEPT 12: IOTA PRESENTATION

- Public Guest Lecture with Tom Igoe or Cuno Pfister, leading figures in IOTA

- Public demo of student projects

- Critical response by James Holston, Professor of Urban Anthropology, UC Berkeley

SEMESTER MAP

ARC OF THE SEMESTER

WEEK 1- THEME: URBAN CIRCULATION

Do: Collaborative Maps Engine
Tools: Google Maps Engine

WEEK 2- THEME: OPTIMIZE LIVE AND WORK EXPERIENCES IN SAN LEANDRO

Objective: Join a urban observational tour to identify issues and opportunities concerning diversity, wellness, equality and efficiency in the city
Prepare: Collaborative Maps Engine San Leandro
Tools: Google Maps Engine, Coordinates.google.com

WEEK 3-COUNTING THINGS, GARBAGE IN GARBAGE OUT, RELATIVE VS. ABSOLUTE MEASUREMENTS

Do: Arduino Counter / Code / Hardware Basics
Bring: Laptop, camera, arduino
Tools: Arduino Electronics

WEEK 4- THEME: WRAPPING AND SITUATING COUNTERS

Do: Arduino Counter / 3D modeling tutorial / Conceptualizing the Wrapper
Bring: Laptop, camera, arduino, counting things project, junk, 3D
Tools: 123 Design, Meshmixer, Makerbot Desktop, 3D printing

Location of the Fence

WEEK 5- THEME: REFINING THE WRAPPER / DEPLOYING THE WRAPPER

Do: Data Display / Review of Wrapper / Situated Proposals
Bring: Junk Designs, Hybrid Designs, 3D Printed Designs, Laptop, camera

1 7

WEEK 6- THEME: REPRESENTING THE COUNT: HYPOTHESIS-FREE INQUIRY, NOISE AND SIGNAL, AUTOGENIC DATA, AESTHETICS AND PSYCHOPHYSICS OF PERCEPTION

Bring: csv file, 3D Printed Wrapper, Installation Instructions.

WEEK 7- THEME: SITUATING THE INSIGHTS: CO-DESIGN, AUDIENCE, DELIBERATION, ACTIONABILITY

Do: Team formation for Collaborative Course Project
Bring: Completed visualization in web, 2D or 3D

WEEK 8- THEME: SYNTHESIS: FROM DATA TO ACTION

Do: Develop and design newspaper ad to support course project
Bring: Laptop,
Tools: Newspaper Ad with Illustrator Template

WEEK 9- THEME: COURSE PROJECT: CIVIC DATA PROCESS PROPOSAL PRESENTATION LOCATION: SAN LEANDRO CITY HALL

Bring: Newspaper Ad
Tools: Poster
Note: KP selected one group for a presentation at KP Innovation. City of San Leandro selected one group to make a presentation at the City Council Meeting

WEEK 10- THEME: COURSE PROJECT: DATA LAYER

WEEK 11- THEME: COURSE PROJECT: OBJECT LAYER

WEEK 12-THEME: COURSE PROJECT: SOCIAL LAYER

WEEK 13- THEME: WORK IN PROGRESS PRESENTATION

Location: San Leandro High School
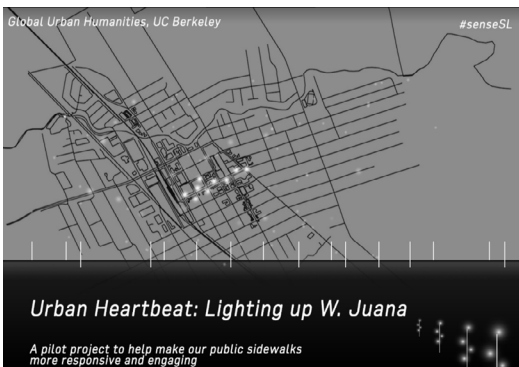Bring: Work, 3 minute slide show
Do: Demonstration of 3D printing—Type A Machines presentation.
Note: Espen Sivertsen, High School Principal, will organize.

WEEK 14 - WEEK 15- THEME: COURSE PROJECT DEVELOPMENT, FEEDBACK INTEGRATION

Bring: new data, new analysis, new ways of sharing
Do: Demo all hardware, software, and presentation media

WEEK 16- THEME: COURSE PROJECT CAPSTONE PRESENTATION- FINAL PUBLIC PRESENTATION

Location: Banatao Center, Sutardja Dai Hall, UC Berkeley
Bring: Team, demo, props and slides

SHOWCASES OF WORK

Course Presentation
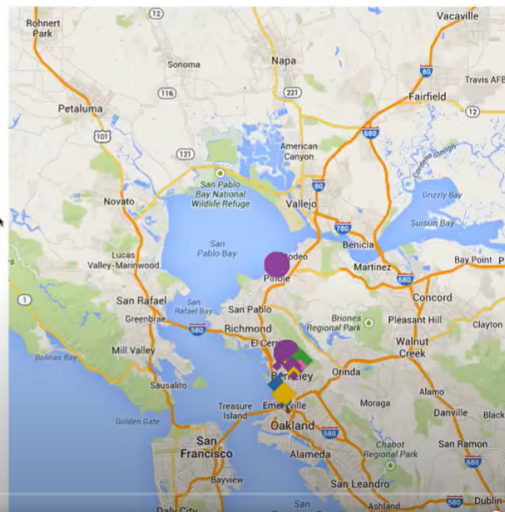
To learn more about the course and dive deeper into the work created, please click the link below.

A slideshow on the course narrated by Prof. Niemeyer can be seen above.

Student Presentations to San Leandro City Council

To learn more about the course and dive deeper into the work created, please click the link below.

Sensing Cityscapes students presented their Pilot Urban Lights Projects to the City of San Leandro City Council during their December 1, 2014, meeting.

MEDIA

UC BERKELEY GRAD STUDENTS LIGHT UP SAN LEANDRO

ARTICLE BY SAN LEANDRO OFFICE OF INNOVATION

December 3, 2014

Urban Heartbeat

Underglow

Walk With Me

Actually, these are the names of experiential installations created by three teams of graduate students from University of California, Berkeley* that will be installed in San Leandro this week. These students, under the guidance of U.C. Berkeley Professor Greg Niemeyer/ Director of the Center for New Media and Asst. Professor Ronald Rael/Architecture, spent one day in September walking all over San Leandro not just to discover our City, but also to find "secret gems" that are begging to be discovered in new ways. San Leandrans will experience these installations through

delightful visual interactions via lights that will react to their immediate presence; the sensors connected to the playful lighting will provide the students and the City with real time information about how these unique spaces are used — or not used — by people walking by and interacting with the lights.

The City Council heard from the students Monday evening about their innovative use of sensors, arduino boards, and 3D prints to create their projects — this is a fun and fast-paced presentation, so please click here or on the picture below to enjoy the video!

We look forward to your joining us for these unique, interactive — and temporary — installations. Dates and times are listed below. Did you enjoy your experiences? Which was your favorite? Would you like to see permanent installations like these? Please let us know!

* These projects represent a collaboration of students from various departments throughout the University and sponsored by the Global Urban Humanities Initiative, a joint venture between the UC Berkeley Arts & Humanities Division of the College of Letters and Sciences and the College of Environmental Design.

UC Berkeley Graduate students from Sensing Cityscapes course presenting to the San Leandro City Council on 12/1/2014.

Project Advertisement

Project Advertisement

Project Advertisement