Smart and Healthy Cities
Connect and Collaborate!

Africa GIS 2019
November 21, 2019
My City
Pittsburgh, Pennsylvania, USA

Kigali, Rwanda, Africa
“Abandon it!”

- Frank Lloyd Wright,
on being asked how he would go about improving Pittsburgh
1903 Pittsburgh chosen as the site for Andrew Carnegie's technical schools

1908 The class of 1908 consists of 58 graduates

- Architectural Practice: 4
- Chemical Engineering Practice: 2
- Metallurgical Engineering Practice: 8
- Civil Engineering Practice: 7
- Electrical Engineering Practice: 23
- Mechanical Engineering: 14
PITTSBURGH
Renaissance City
of America
Pittsburgh Today
from Steel Town...
... to “Eds” and “Meds”
Engineering & Science

Herb Simon and Alan Newell, founders of Artificial Intelligence.

Robotics Institute

1979

nations first unmanned vehicles

1955

Herb Simon and Alan Newell, founders of Artificial Intelligence

nations first unmanned vehicles

1979

Robotics Institute

U.S.’s first undergraduate degree in Drama

1914

1940s

U.S.’s first undergraduate degree in Drama

1914

Andy Warhol student in the Department of Painting & Design

Pioneer in computer generated art

1940s

Humanities & Art

3 Mile Island nuclear accident

1979

3 Mile Island nuclear accident

1979

Andrew Warhol student in the Department of Painting & Design

Pioneer in computer generated art

1940s
Innovation Corridor
CMU Global
Carnegie Mellon University in Australia
Carnegie Mellon University

Heinz College
- Civil and Environmental Engineering
- Computer Science
- Robotics
- School of Architecture

Design
- Drama
- Music
- Library

Entertainment Technology

Allegheny County:
- Health Department & Medical Society
- Allegheny Health Network
- Children’s Hospital of Pittsburgh
- Central Blood Bank
- City of Pittsburgh
- Greater Pittsburgh Food Bank
- New York City Health Department
- Pennsylvania Poison Center
- Pittsburgh Public Schools
- RAND Corporation
- University of Pittsburgh Medical Center
- University of Pittsburgh
- U.S. Department of Defense
- White House

GIS Tutorial for ArcGIS Pro

GIS Tutorial for Crime Analysis

GIS Tutorial

Crossing Boundaries...Connecting and Collaborating
information and communication technologies

sensors       meters       big data       analytics
Smart Cities

are far greater than an assembly of technologies and data

ture mobility  net zero energy

clean air and water  economic prosperity

safe and healthy citizens

Collaboration  Engagement  Transparency
City Partnerships
RD&D
Research and Development and Deployment
Traffic research with Pittsburgh as test bed

2009 traffic21
a transportation research institute of Carnegie Mellon University

CMU and the City of Pittsburgh
Pilot project

EMMISSIONS 20%

IDLE TIME 40%

TRAVEL TIME 25%
2014

Memorandum of Understanding
Between Carnegie Mellon University
Metro21 Initiative
and
The Honorable Mayor of the City of Pittsburgh

This Memorandum of Understanding (MOU) sets forth the terms and understandings between the named parties to pursue the mutual interest to research, develop, deploy and evaluate technology and analytically based solutions to the problems facing the systems and infrastructure that serve the quality of life and economy of the City of Pittsburgh and other communities, cities, counties and metropolitan areas around the globe.

Background
Allegheny County ("the County"), like other urban counties around the country, faces complex challenges involving interrelated infrastructure systems such as transportation, water and sewer, communications, buildings and public services. Carnegie Mellon University ("CMU" or "the University") has established the Metro21 Initiative to examine problems in the community and educational programs that might help solve them. The County, through its Chief Executive, seeks to have the County be a leader in innovation to achieve more effective and efficient government and improve the lives of County residents. Both parties wish to showcase the County as a vibrant, innovative and sustainable community while developing technologies, methods, and models for use across the country and around the world. Both parties also wish to create a pathway for students to remain in and contribute to the Pittsburgh region after graduation.

Purpose
The primary purpose of this MOU is to ensure the communication and coordination necessary to implement research and educational projects agreed upon by the parties. This MOU does not impose a commitment on behalf of either party to pursue specific projects or partnerships. Future projects may require subsequent agreements between the parties and may be subject to County Council approval.

Process
This primary purpose will be accomplished through the following process:
1. The County’s Chief Executive and the Provost of the University shall both designate a lead person on behalf of each party.
2. The County’s Chief Executive and his lead will identify problems that University research and/or educational projects might address.
3. The University and its lead will identify research and/or educational projects that might help address County problems.

Page 1
Street Lighting
Innovative Buildings and Districts
Energy Use
minimum 10% reduction below the national average by 2015, with incremental targets reaching a 50% reduction by 2030

Water Use and Transportation CO2 emissions
minimum 10% reduction below the district average by 2015, with incremental targets reaching a 50% reduction by 2030

Indoor Air Quality
determined by District Partners
The Pittsburgh Arena District Master Development Plan

Energy simulation results - Building A1

![Energy Use Components Graph](image)

![Monthly Energy Consumption Graph](image)

Building A1 Energy End-Use Consumption
In 2013, Steffen Bauereiß worked on combining multiple sources for indoor positioning.

Tested ultrasonic positioning by Lazik/Rowe.

Geofencing and Location-Awareness.
Innovations in Urban Design
3D at CMU
More traffic studies
Gaming
Street Options

- Add New Lane
  - Current Road Width: 39'
  - Current Sidewalk Width: 20'
  - Available Lane Space: 21'
  - Curb Change Required: Yes

Service

- 6' Bike
  - Move

- 12' Bus
  - Move

- 11' Traffic
  - Move

- 11' Traffic
  - Move
BIM and 3D Rendering
OK, let’s build a 3D GIS virtual reality tool

...in less than 3 months!
Master of Urban Design Studio
Smithfield Street Corridor Plan Objective
Site Survey + Systems Analysis

3 Perspectives

1. Regional
2. Downtown
3. Street

Design Principles

1. Walkable.
2. Safe.
4. Want to Return.
5. Create a Place.
6. Recreation.
8. Socially Equitable.

Re-Energize Smithfield Street

Complete Streets Details

History + Preservation
Environment
Demographics + Data
Land + Building Uses
Infrastructure
Pedestrian Movement
Vehicular + Mass Transit

Destination Street
Local Street
Connector Street
Building the model

CMU and Esri
LiDAR data
Kaarta
Residence
Scanned with Stencil in a few minutes by walking around front yard. Path shown in dotted line.
Sketch Up and Revit
City Engine
Unity
Continuing the work...

3D/Data Visualization Research Project
Phase I
Research and Benchmarking 3D
funded by the Deloitte Foundation
Heinz College and Master of Urban Design students and faculty + Pittsburgh City Planning

Utilizing AR in Community Meetings - City of Nashville

The MetroGIS group at the Metro Government of Nashville & Davidson County has experimented with a variety of software and technologies to better engage and share the public. MetroGIS has used 3D visualizations after finding that the visualizations produced more feedback and faster decisions. Much of the modeling is done using CityEngine, which allows for easy manipulation of zoning, development proposals, and the creation of videos and other interactive visualizations. MetroGIS has transferred its CityEngine model into Unity using Vuforia, a software development kit, to create an augmented reality experience. The resulting application allows a person to hover their smart phone over a 2D printout of the city and see the 3D model on their phone. Tapping the screen switches between the various scenarios. While less immersive than a virtual reality experience, the only necessary hardware for the viewer is their phone as opposed to a headset. This reduces costs and allows easier interaction.

**This project uses**
- CityEngine
- Unity
- Vuforia

*Note: the case was conducted through the interview with Micah Taylor at Metro Government, Nashville & Davidson County.*

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<tr>
<th>Software Name</th>
<th>CAD</th>
<th>BIM</th>
<th>GIS</th>
<th>Rendering</th>
<th>Animation</th>
<th>VR</th>
<th>AR</th>
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Phase II

Virtual Reality Demonstration Project

funded by the Heinz Endowments
Entertainment Technology Center, Architecture, Heinz College students and faculty + Pittsburgh City Planning
Phase III

3D Field Testing

funded by the Heinz Endowments
Master Urban Design students + Pittsburgh City Planning
Workflows
Future plans
**ArcGIS Urban**

**Improve planning productivity**
Streamline the creation and sharing of zoning and land-use plans directly in a web browser in 3D.

**Visualize projects citywide**
Visualize, track, and review development projects throughout their life cycle.

**Communicate Trends**
Report on citywide performance indicators and communicate trends to public and private stakeholders.

**Increase community engagement**
Simple community involvement to gain early buy-in through online comments and surveys.
Urban Design and the Innovation Corridor
Healthy Cities
childhood obesity
Emergency Room Visits

Machine Learning and GIS
Encounters By Neighborhood

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<th>Count of Encounters</th>
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<td>Fever</td>
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<td>General Medical</td>
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<td>Respiratory Problems</td>
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Beyond Pittsburgh
45 cities
6 counties
61 universities
focused on civic innovation
connect and collaborate!
kurland@cmu.edu