

# Low-cost Smart Cities: Designing Affordable Smart Cities for All Communities

NSF 1952181

Corey E. Baker, University of Kentucky

PG, FY2021



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## Principal Research Investigators

- Baker, Corey E (PI); University of Kentucky
- Erhardt, Greg (Co-PI); University of Kentucky
- Grant, Christan (Co-PI); University of Oklahoma
- Khamfroush, Hana (Co-PI); University of Kentucky



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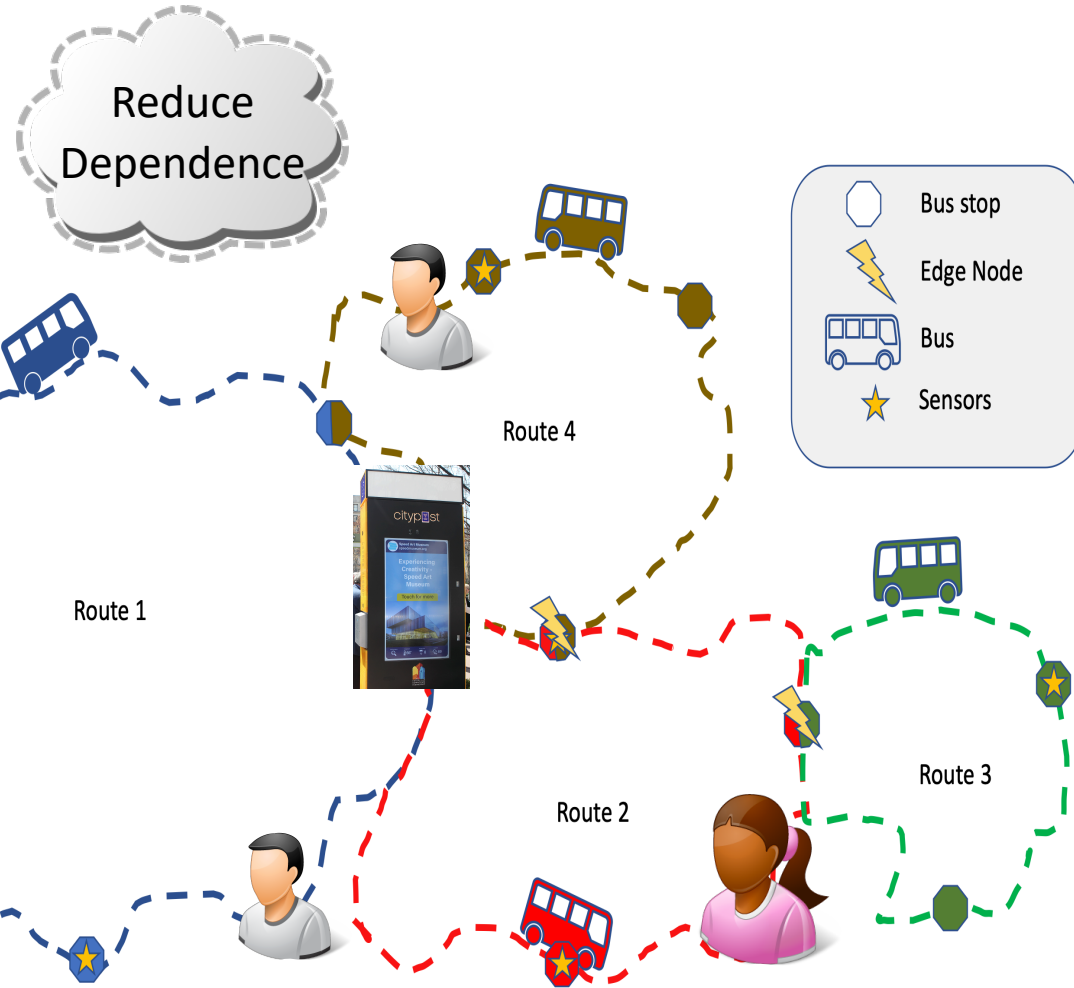
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## Community Partners

- Blayney, Ed; Office of Civic Innovation and Technology
- Clermont, Jason; Duke Energy
- Cleveland, Jamie; Duke Energy
- Hoban, Bruce; Duke Energy
- Kalmbach, Frank; Louisville Downtown Partnership

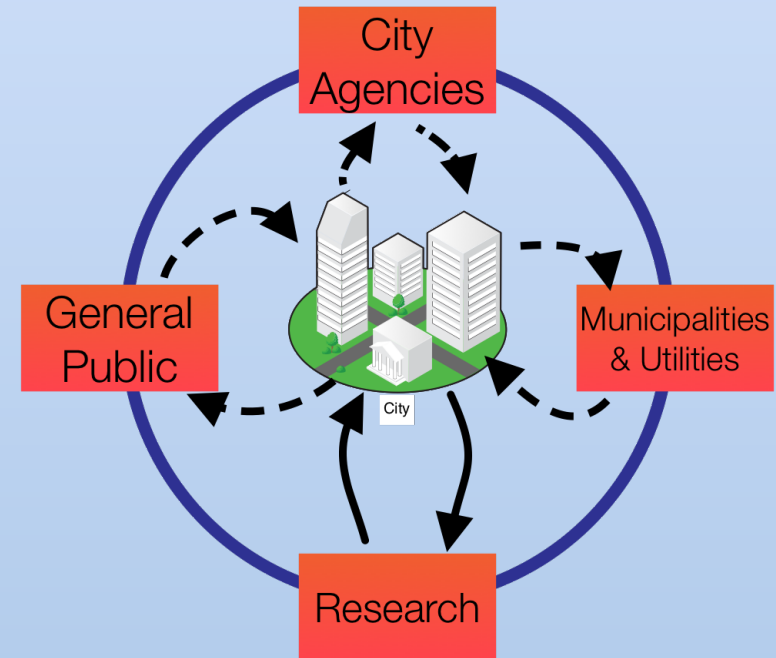


# Project Overview



*Enable any community to become a smart city at a fraction of the cost*

- Use opportunistic D2D communication as a low-cost backbone to disseminate time-insensitive data
- Tailoring technology to the general public privacy concerns

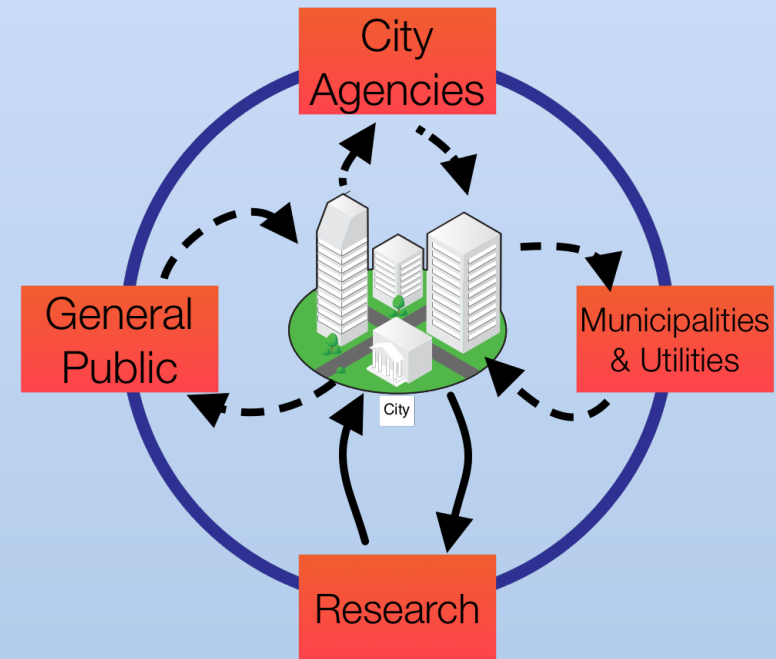


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# Project Overview

## Use-Inspired Research

- Smart cities offer the potential to improve the public health, safety and welfare by integrating intelligent technology into the built environment
- Cities such as San Diego, New Orleans, London, and Songdo have either proposed or invested in smart city projects that cost between \$30 Million and \$40 Billion (a significant amount is cellular)

*The City of Louisville, Louisville Downtown Partnership, Duke Energy, and researchers at UK and OU propose to transform the community of Louisville, KY into the first low-cost smart city*

## PG Activities

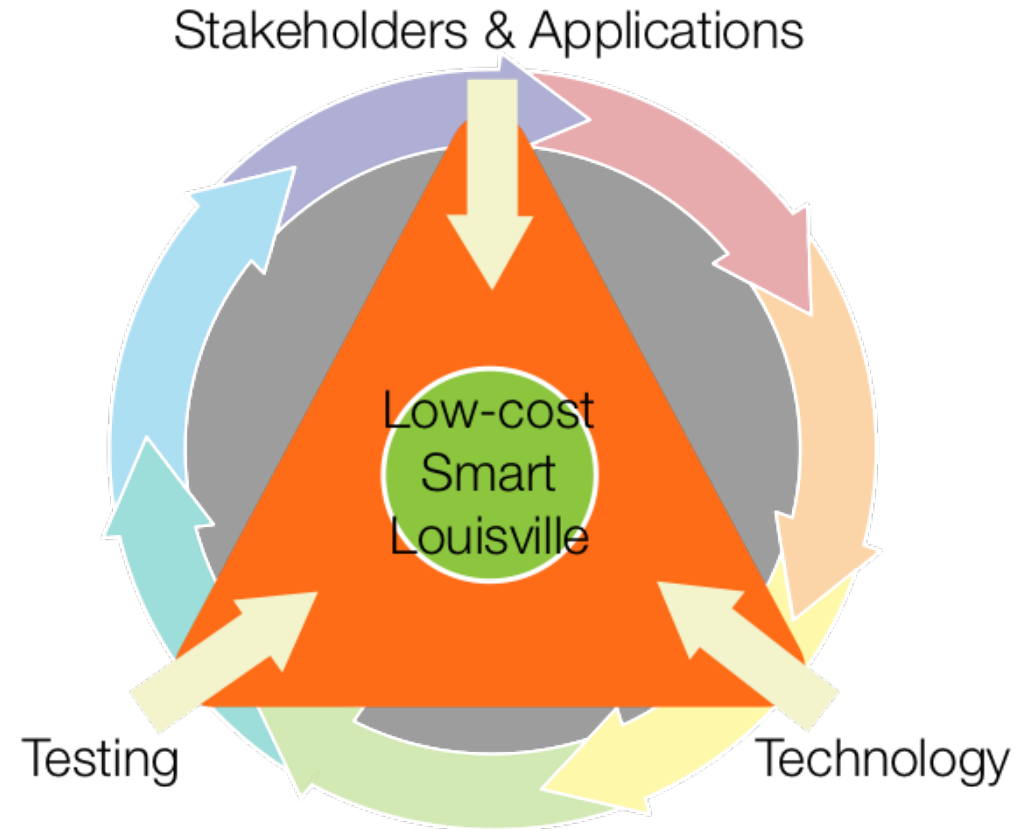
- Sharing of data (public & NDA)
  - Louisville is part of the open access city network
- Established inter-organizational teams
- Preliminary research
  - Downtown pedestrian counting
  - Opportunistic smart city communication
- IRB Exempt Status
- Non-disclosure agreements
- Study: Covid vaccination effect on city vibrancy
- Study: Citizens willingness to accept city technology

# Project Update

- **Bi-weekly team meetings (even)**
  - Includes the whole team (researchers & partners)
  - Discuss high level strategies & planning
- **Bi-weekly inter-organizational sub-team (3) meetings (odd)**
  - Stakeholders & Applications
  - Technology
  - Testing

## Current Outputs

- **Publications**
  - “Enabling opportunistic low-cost smart cities by using tactical edge node placement” - IEEE WONS 2021 (Selected top paper)
    - Fast tracked to Elsevier COMCOM Journal
  - “A latency-defined edge node placement scheme for opportunistic smart cities” - IEEE PerAwareCity 2021
  - “Considerations for designing private and inexpensive smart cities” - IARIA ICWMC 2020



# Project Evolution

*“We learned that cellular and Internet connectivity to support the transmission of smart city data is ~35% of annual costs. This expense is without factoring in the costs of web services such as AWS, Google Cloud, etc. Identifying how to lower these cost will lower the barrier to entry to becoming a Smart City.”*

*“Much of the data generated in a smart city is not needed in real-time, either by the city agencies or the municipalities. Understanding what data is not needed in real-time and the respective delay constraints will be essential.”*

*“Citizens need to be involved with technology and its deployment to bring smart cities to full fruition.”*

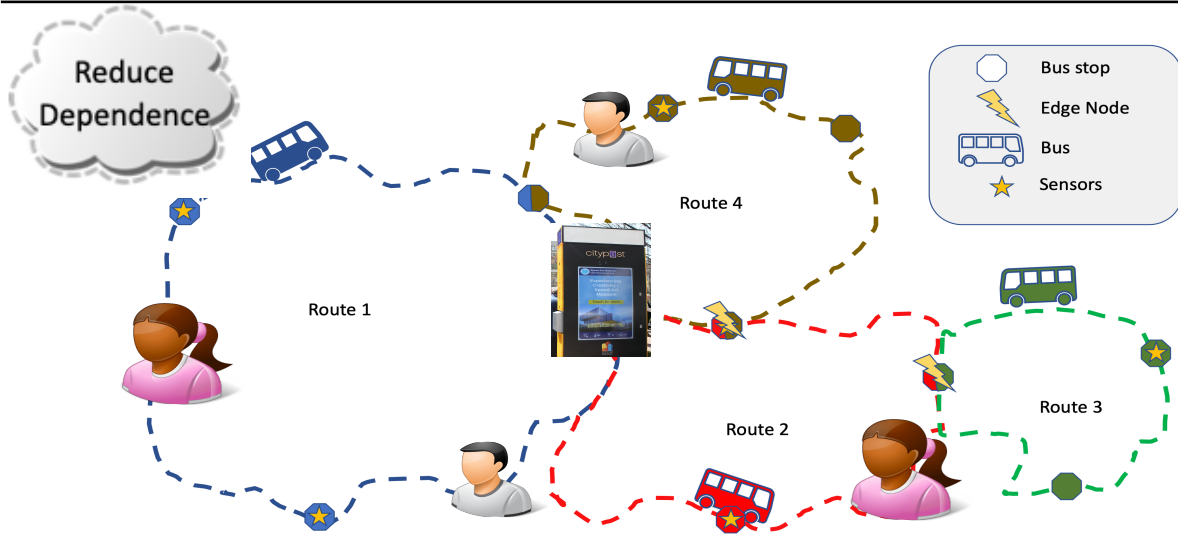




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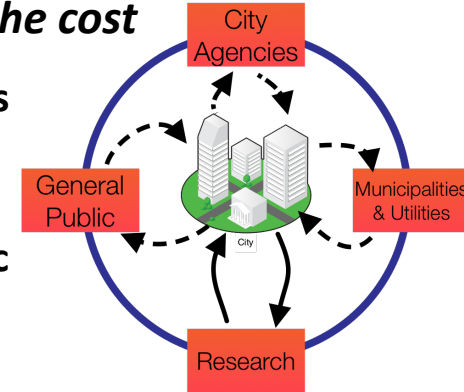
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## Project Vision

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