smartparcels
background info
A smart community is an interconnected city, community, or region that leverages the smart use of technologies to benefit its citizens, businesses, and service organizations for economic growth, social benefits, and environmental sustainability. ... Smart city services are not just for “cities”.
applications
smart governance and public safety
environmental monitoring
smart utilities
smart transportation
big market

$83.9 billion in 2019

annual growth rate of 24.7% between 2020 and 2027
trade-offs
wildfires: gas sensors or drones?
streetlight + acoustic sensors = ?
acoustic sensors
challenges

i) what infrastructures and where to instrument

ii) how the data flows via the infrastructure

iii) how to reuse infrastructure under fixed budgets
objective

to develop algorithms to determine:

i) the types and locations of IoT devices to deploy

ii) the locations of computing devices to deploy

ii) the types and locations of network components
‘Parcel’

- from urban planning literature
- refer to a piece of designated land slated for development with a specific use and purpose
- the design and instrumentation to create smart community land parcels
Key Contributions
cross-layer architecture

Need for distinct infrastructure and information layers in order to implement diverse applications
Survey the communities for
- Boundaries
- Candidate locations
- Required applications
- Deployment and operational budgets

**Figure 1:** Overview of the IoT planning problem considered in SmartParcels.
Each application can be realized by multiple information flows which consist of multiple software processing units.

**Figure 1**: Overview of the IoT planning problem considered in SmartParcels.
each information flow needs to be overlaid on an infrastructure flow, which dictates the hardware devices to install.
compute the optimal mappings across the layers, so as to maximize the service utility without incurring excessive costs.

Figure 1: Overview of the IoT planning problem considered in SmartParcels.
service utility

service_utility(coverage, accuracy):

coverage -> geographical area where events are detected

accuracy -> probability an event is correctly detected
Figure 2: Problem decomposition, key inputs/outputs, and proposed algorithms.
Evaluation
Figure 3: Two real-world settings: (a) streetlights on a smart campus and (b) road segments in a smart city.
outdoor shopping center
residential area by highway
wildland and residential area next to wildland
Figure 4: Sample information/infrastructure flows used in our evaluations: (a) gunshot detection and (b), (c) wildfire detection.
key results
Figure 10: Overall service utility from our event-driven simulator, sample results from the clean-slate problems in: (a) smart campus and (b) smart city.
my pros and cons

+
  easy to read
  nicely organized and structured

-
  unrealized costs?
  the maximum reusability algorithm may be too simple to match real life costs of implementation