Community Sensor Registry

Capstone Design Project – April 2022
Developing a remote sensor registry for the City of Toronto
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SCHOOL OF CITIES

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Background

- **Sensors**, from sound level meters to security cameras, are among the various types of digital infrastructure used by the City of Toronto.
- In accordance with their **Digital Infrastructure Strategic Framework** (DISF), the City of Toronto aims to **enhance transparency** when it comes to where and how sensors are used throughout the city's public realm.
- To meet this objective, the City of Toronto is interested in building a **public registry** that **catalogues and classifies** these **sensors**.

Image of an Arterial Traffic Camera at Front and University from Toronto.ca

Requirements

The City of Toronto's sensor registry, which is to be deployed on their website, needs to:

1. **Comprehensively describe** City-owned sensors installed across Toronto.
2. Present this information in a **clear** and **accessible** way to all registry users, which include members of the general public, researchers, policymakers, and other City employees.

These requirements are in service of **growing public understanding** of sensors and their uses across the city and **enhancing public trust** in the City of Toronto's ability and commitment to handling their digital infrastructure.

Research and Methods

- **Jurisdictional Scan:** Captured best practices from other municipalities with online sensor, open data, and IoT device registries.
- **Policy and Legislation Review:** Informed relevant attributes to describe each sensor from legal, governmental, and policy perspectives, such as the privacy impact assessment score.
- **Ontology and Formal Knowledge Representation Research:** Informed the structure and meaning of relevant sensor attributes based on industry standards.

Final Design

1. Sensor entities
2. Search bar
3. Filtering options
4. Full sensor table
5. Click for details

Prototype Access:

Select Sensor Attributes

- Location
- Model #
- Date Deactivated
- Publication Frequency
- Image
- Organization
- Time Coverage
- Unit of Measurement
- Type
- Date Installed
- Purpose
- Privacy Impact Assessment Score

Impact of Registry on Stakeholders

- **Subject Matter Experts** require detailed sensor metadata. The registry provides access to associated datasets; contact details.
- **Members of the General Public** require more transparency on sensor details in public spaces. The registry specifies location, what information is being collected, and duration of data collection.
- The **City of Toronto** requires a democratic and responsible method of tracking sensors. The registry addresses this need by providing a breadth of sensors, relation of sensor(s) to other City divisions and associated projects.
- **System Maintainers** require sensor information to be managed sustainably. The registry satisfies this requirement by categorizing sensor attributes to easily identify what information is out of date.

Testing Insights

From 16 prototype tests, the team applied 5 critical design changes to ensure any sensor information of interest is **accessible, comprehensive,** and **meaningful**:

1. Described sensor metadata with more clarity on publication frequency, temporal resolution, and last updated attributes.
2. Prioritized the sensor owner filter to easily sort sensors of interest based on relevant City of Toronto subdivisions.
3. Provided pop-up boxes explaining certain attributes in more detail, such as the privacy impact assessment score.
4. Organized sensor metadata into batches for easier navigation.
5. Assigned numbers to distinguish between sensor types via the interactive map and full details pop-up.

Conclusion and Future Work

Through this research and design process, the above prototype was developed as a demonstration to the City of such a sensor registry. With it, the team developed a set of **operational recommendations** for the City to develop the registry, including:

- **Notes on technical implementation** of the registry front-end and data back-end.
- A **marketing plan** for informing citizens of the registry.
- A **data collection plan** for collecting City and possibly private-sector sensor metadata.
- A **maintenance plan** outlining staffing and data integrity practices for regular registry upkeep.