SMART CITY WORKS in partnership with
the Center for Innovative Technology (CIT)
Technical Specification:
Indoor Building Sensor Technologies & Prototypes
Capability Areas: Rendering & Change Detection

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Background

Smart City Works is the world's first business actuator – a next generation business accelerator – with a mission of accelerating infrastructure innovation and commercialization to improve the resilience, operations, and livability of cities. In conjunction with the Virginia Center for Innovative Technology, Smart City Works is looking for companies with technologies, solutions, and tools to achieve the goals set out in this specification.

Scope of Technology – Indoor Sensor Prototypes

Companies will be asked to demonstrate their capabilities in one or more of the areas described below for "fixed inside building sensor suites for deployment on EXIT signs or similar common building features such as smoke detectors". Demonstrative technology or prototypes are requested in three specific capability areas of the technology including rendering, change detection, and form factors as described below. Responders do NOT need to be responsive to all three elements and may respond to a single element of the request.

Rendering

Using video, digital imagery, or other sensing technologies provide interior renderings of buildings and structures. The technology shall include the following characteristics:

- Illustrate building features such as walls, structural elements, interior furnishings, doors, fixtures, etc.
- Provide "line-of-sight" throughout the entire building
- Provide 360 degree view of the building interior
- Rendering shall endeavor to provide visual rendering of all building features and locations
- Provide unique identification parameters as to location (relative building location) and direction being viewed (e.g. viewing east down 4th floor sector 1)
- Include ability to "stitch together" views to see continuous elements of the building interiors.
- Overlapping "field of view" renderings depicted between sensors must provide for a virtualized single view and the ability to "fly-thru" the building floor plan.

Change Detection

Using video, digital pictures, or other sensing technologies, and real-time data processing, identify changes in the interior renderings of buildings and structures. The technology shall include the following characteristics:

Identify changes in building shape, characteristics, locations of furnishings, changes in interior sight lines, changes in structural elements, walls, or furnishings.

Provide thermal signature concentration renderings to distinguish human versus other heat emissions sources like equipment, mechanical, fires, ambient, etc.

Change detection results do not necessarily need to be explicit (e.g. column NE12 collapsed) but may be implicit in the visual data provided.

Of particular interest will be the ability to proactively identify anomalies and provide actionable data versus large data sets of results.

Form Factors

To support a commercialized approach to these sensor suites, it is anticipated that they will be co-located with or integrated into existing ubiquitous or common building structures (with a power source) such as exit signs or smoke detectors.

The building sensors in exit signs and/or smoke detectors or other structures must be packaged and placed in a way which meets all existing codes and standards for commercial exit signs, smoke detectors, and/ or whatever structure is adopted.

Any proposed modifications to exit signs, smoke alarms, or other structures to accommodate the sensor suite must be within accepted industry standards so they could be retro-fitted into, for example, existing smoke alarms or exit signs without impacting existing building codes or standards or other requirements.

General Requirements

Sensor Technologies

To provide maximum fidelity and use across a broad spectrum of use cases, sensor suites may include multiple sensors and/or capabilities such as cameras, infra-red, cell phone Wi-Fi and radio-frequency (RF) detection, and and/or others that add additional capability.

Open Standards

All data exchange, data formats, APIs and usage shall be based on open source software and open standards.

Codes and Standards

Additional credit will be given to solutions (sensors and form factors) that can be deployed to meet applicable elements of relevant codes & standards including but not limited to:

- NFPA
- UL

- ASTM
- ANSI
- CPSC
- IBC
- OSHA

Sensor Packaging

It is preferred to have the sensor suites deployed in existing building features such as smoke detectors or exit signs as they are ubiquitous, have good building coverage, have un-interruptible power supplies, and are accepted elements of current buildings and structures. They are also required by building codes and standards.

Data Collection & Storage

Data shall be collected and available in a cloud platform and/or server environment. Data shall be available real-time and scaled to meet storage requirements for timeframes from one hour, one day, one week, and one month. Data review, playback, and retrieval shall be real-time or as desired in the increments noted above.

RFID Tracking

Each sensor package shall have a unique active radio frequency identification chip to distinguish the source of all data and information sources in the building.

Electrical Power Needs

Ideally the indoor sensor suite will use existing un-interruptible power sources used, for example, for smoke detectors and exit signage. Sensor electrical power needs shall be described under all operating conditions. Additional or unique power demands shall be described in detail with recommendations on how power will be supplied to sensors.

Operating Conditions

Sensor suite shall be suitable for a variety of conditions including light, dark, strobe, wet (e.g. sprinklers deployed), clear, smoke-filled and/or dusty or disturbed conditions. Sensors shall operate effectively in a variety of structure and material type including concrete, glass, steel, wood, drywall, etc. and adjust appropriately for various sensor differences in terms of reflection, scatter, penetration, attenuation, and other factors that may impact sensor performance.

Operations & Maintenance

The sensor suite, either individually or collectively, shall be designed in such a way as to be modular, that is, the ability to switch sensor elements or combined sensor packages in and out,

and shall be practical in terms of operations and maintenance requirements consistent with typical commercial or industrial building requirements.

Commercialization

The ideal solutions will be those that leverage existing commercial capabilities or lead to "commercialize-able" solutions that can be incorporated into new buildings and structures or retro-fitted into existing buildings and structures in a cost-effective manner.

Alternative Solutions

These specifications lay out a set of standards and expectations based upon current known capabilities and technologies. Alternative recommendations on achieving the same or similar outcomes with different or unique solution sets are encouraged and will be reviewed in the context of the overall objectives.