Towards multi-agency sensor information integration for disaster management

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Summary

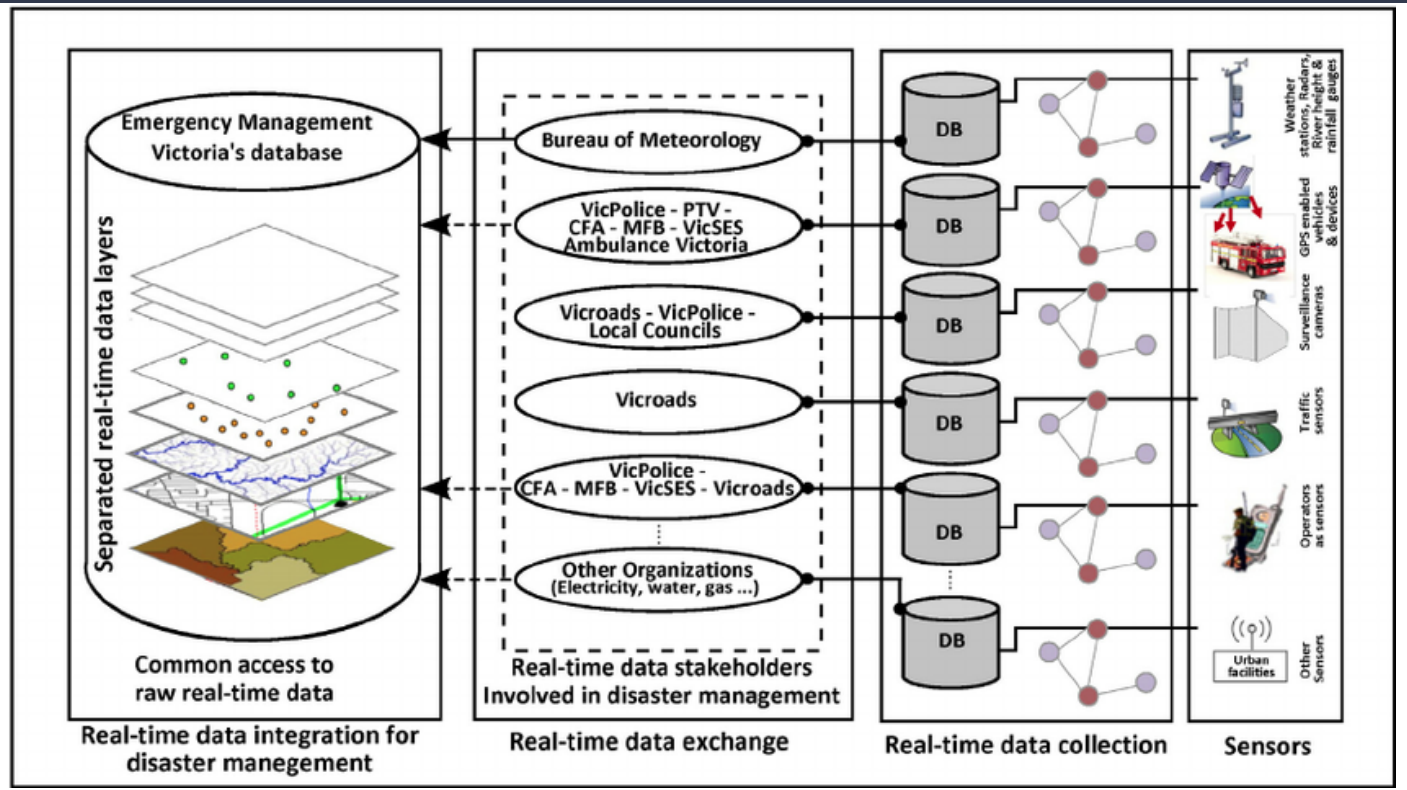
- “Improves real-time spatial information usage by integrated multi-agency(sensor data from many different sources) in a disaster management system.”
- Displayed as maps.

- Identifies current issues of multi-agency integration.
- Proposes a standardised approach to overcome current integration issues.
- Introduces Geographic Information System(GIS)-based software, and Intelligent Decision Support System-(IDDSS)Sensor to provide the functions of the standardised approach.

Background

- Victoria, Australia
- Aimes at urban floods and water levels firstly
  - Wildfires etc
  - Large and small scales
- Geographical situation displayal(Maps)

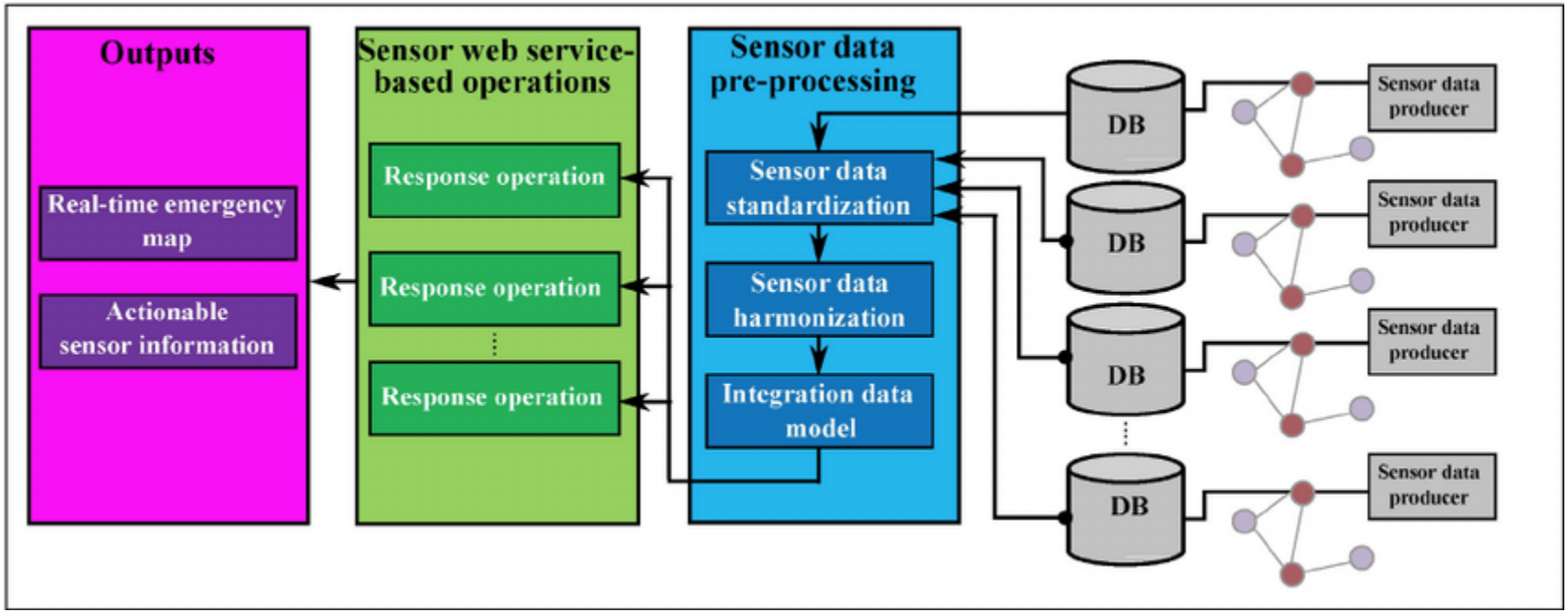
Current multi - agency sensor integration



Issues with the current process

- Lack of access to multi -agency sensor data
  - Mostly only road cluster, and meteorological observations
- Lack of interoperability in multi -agency sensor data exchange
  - Different data format(Raw text data, binary, different XML variants).
  - Different data access interfaces.
- Inconsistency in multi -agency sensor data
  - Many different sensor data stakeholders, leads to inconsistent or incomplete sensor data specifications.
- Lack of automated usage of multi -agency sensor data
  - Only raw real-time data feeds, which are not machine-readable.

The new proposed approach



Introduced steps

- Standardization
- Harmonization
- Integrate data model
- Sensor web service-based operations

Standardization

- Introduces OGC SWE framework of standards
  - Domain independence
  - Producer independence
  - Openness
  - Inter-organizational interoperability
- Especially for real-time management

“Ensure consistency between sensor stakeholders by providing a common agreement.”

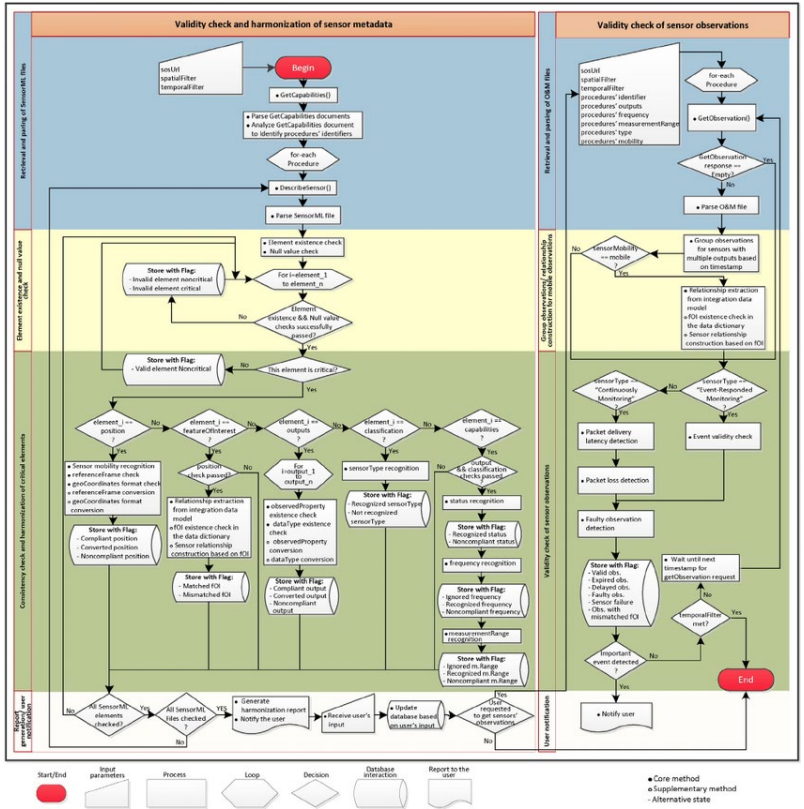
Open Geospatial Consortium (OGC)
Sensor Web Enablement initiative (SWE)

Harmonization

“Automatically identify and resolve the remaining inconsistencies in the received data.”

- On-the-fly validation
  - Consistency checking
  - Validity checking
- Element existence
- Element null
- And more...

Harmonization process chain



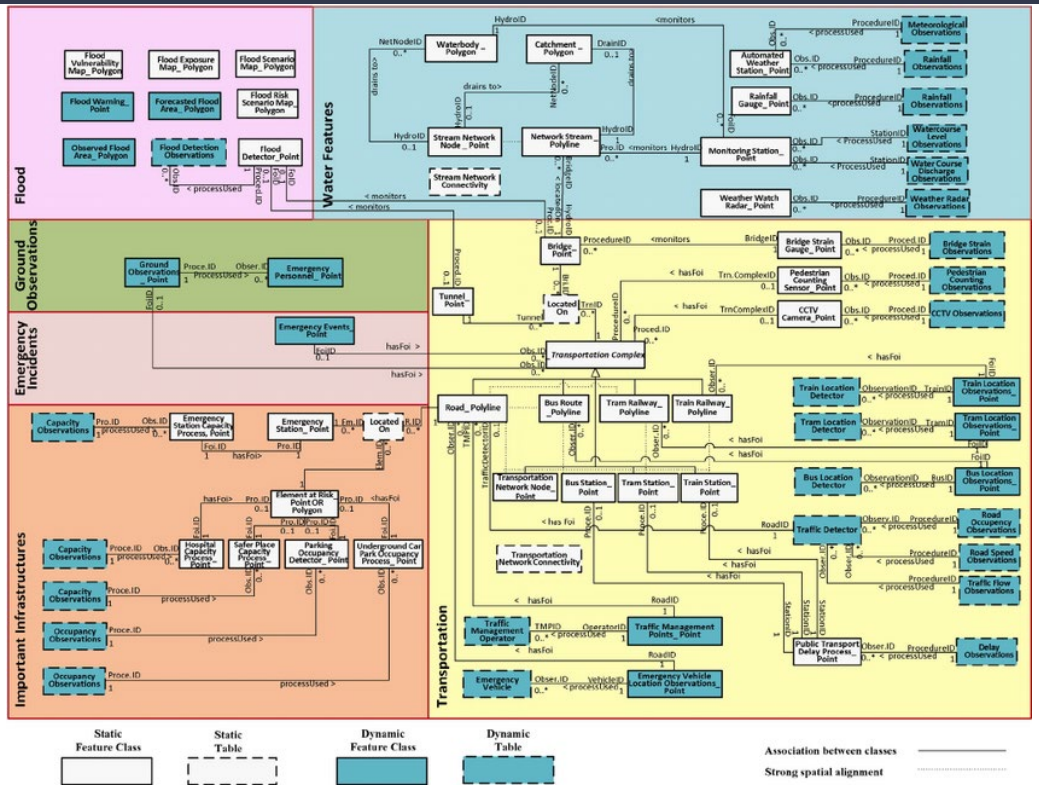
Data model integration

“Establish the relations between organizational sensor data that reach EMO with static spatial data stored in EMO's database.”

- Prevents separate and detached data layers
- A database model that provides linkage between the sensor and spatial data sources
  - Flood risk scenario maps
  - Flood forecasts, warnings and observations

Emergency Management Organization(EMO)

Integration class diagram



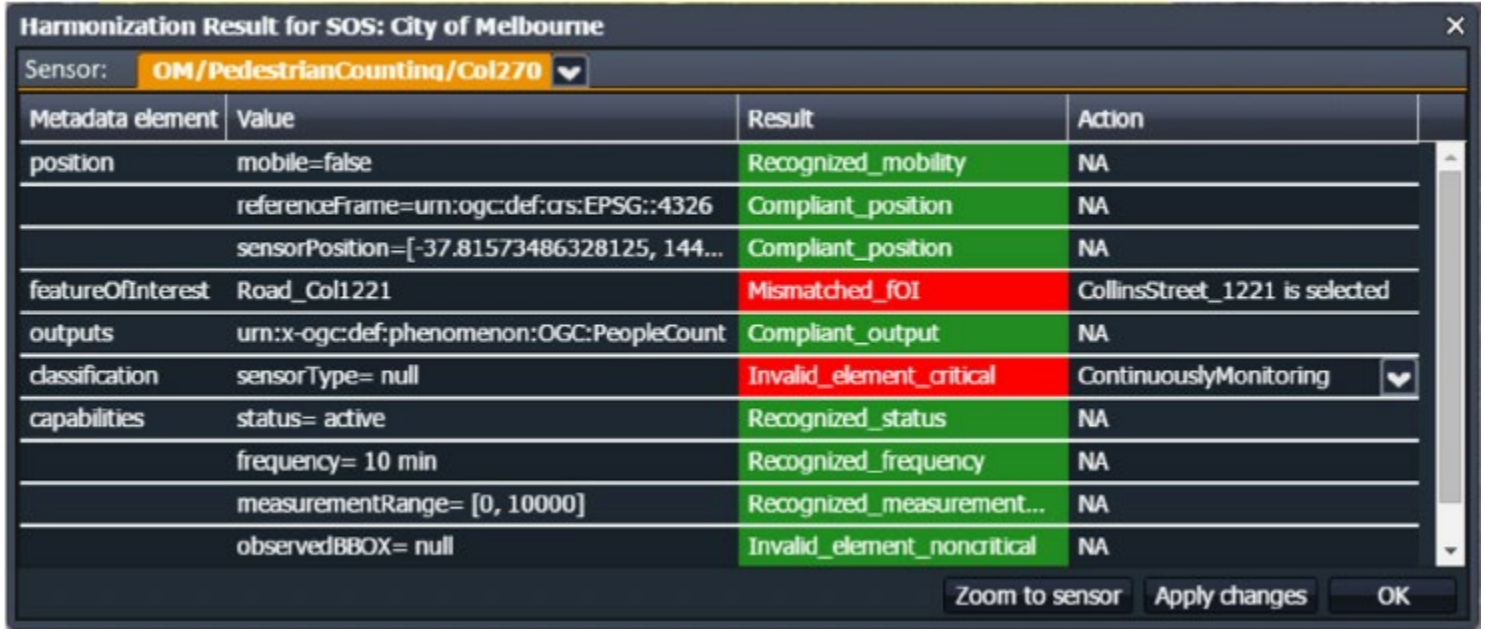
Sensor web service - based operations

“Consume the standardized, harmonized and connected sensor data and send back the value-added emergency information”

- Creates a Response operation

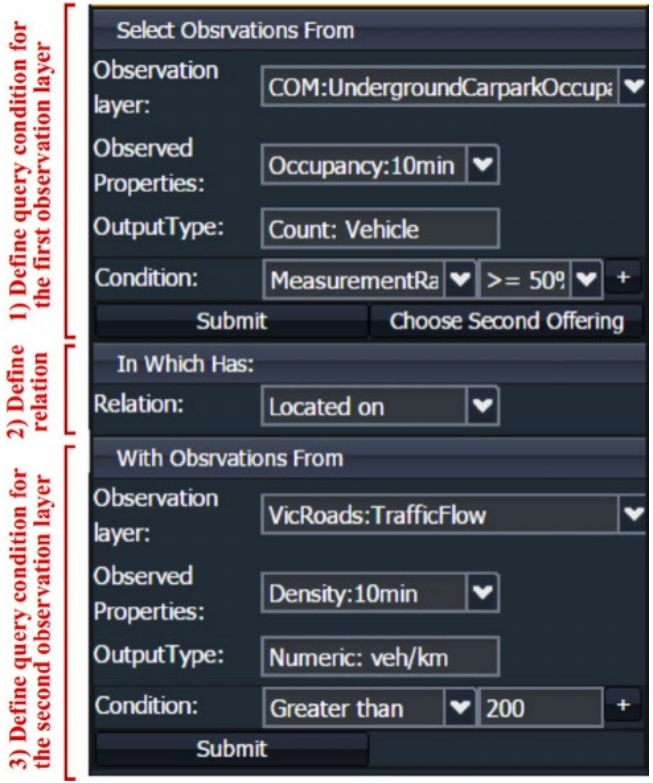
The GUI of IDDSS - Sensor client application

Harmonization results

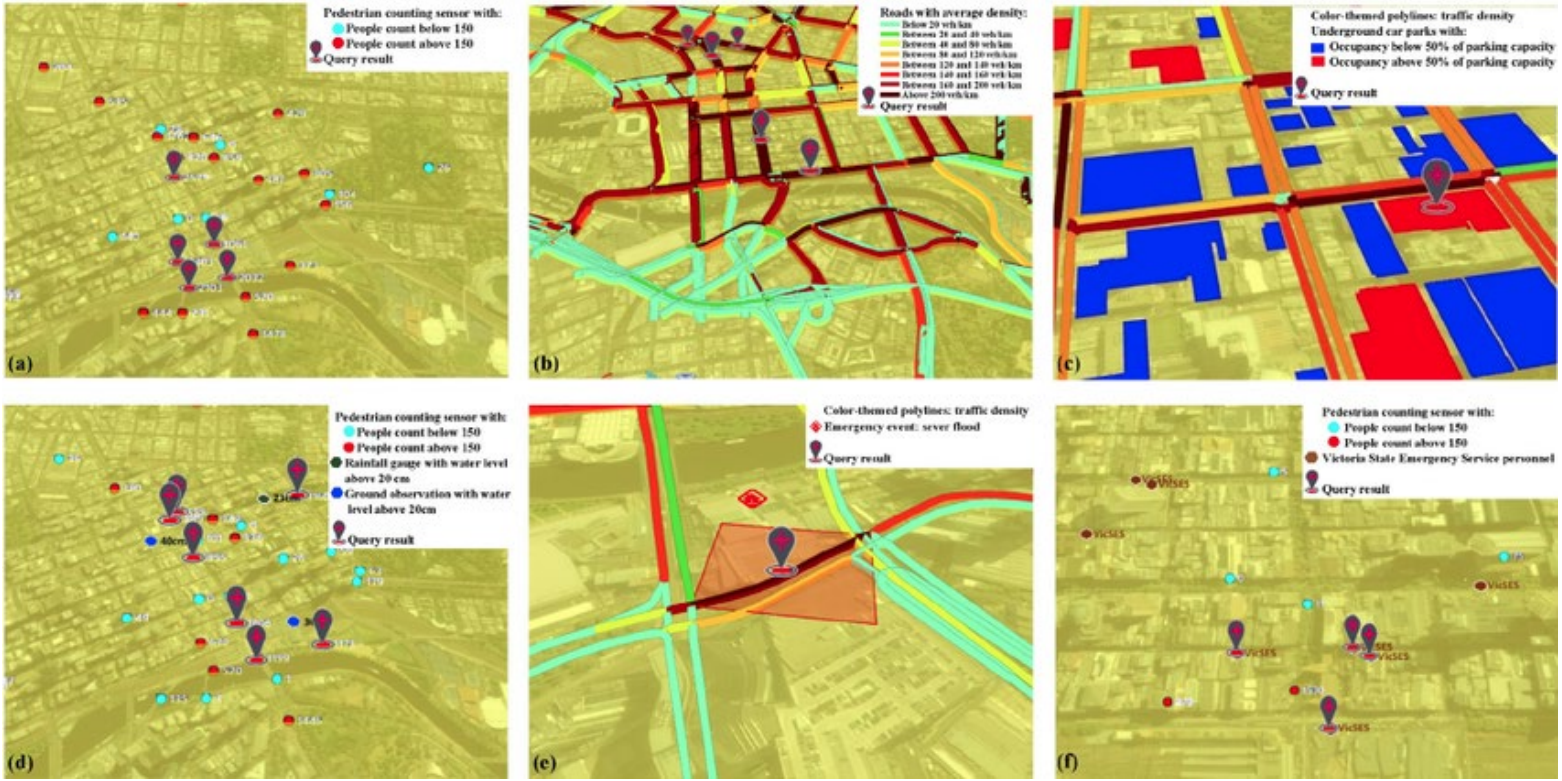


Query management interface

- 2 layers
  - Define query condition for the first observation layer
  - Define query relation
    - relational query based on the relations defined in the integration data model
    - Proximity
  - Define query condition for the second observation layer



Result of 6 different queries



Conclusion

“Multi-agency sensor data as a potential source for providing real-time spatial information for disaster management”

- GIS-based software IDDSS-Sensor is implemented to support the decision-making of emergency agencies by integrating multi-agency sensor information in real-time
- Particular useful during emergency events
- Improvement in inter-agency collaboration through providing more automation in the interaction between organizations

Geographic Information System(GIS)
Intelligent Decision Support System-(IDDSS)

Future work

- Expand to other disaster
- Evaluate by questionnaire of based survey of industry expert