W3C LBD Community Group
Minutes - Call 18/09/2023

Attendees:

- Mathias Bonduel (Neanex Technologies)
- Alex Donkers (Eindhoven University of Technology)
- Katja Breitenfelder (Frauenhofer)
- Sebastian Blechmann (RWTH Aachen University)
- Marin Ljuban (BIM A+)
- Jakob Martin (iabi e.V.)
- Klaus Linhard (iabi e.V.)
- Ali Nakhaee (ICD, University of Stuttgart)
- Diellza Elshani (ICD, University of Stuttgart)
- Hervé Pruvost (Fraunhofer IIS/EAS)
- Al-Hakam Hamdan
- Claudio Mirarchi (Politecnico di Milano)

Presentation slides

- PDF: link
- PPTX: link

Date and time

- 18/09/2023, Monday, 14:00-15:30@UTC/ 16:00-17:30@CEST/ 07:00-08:30@PDT

Moderators

1. Alex Donkers

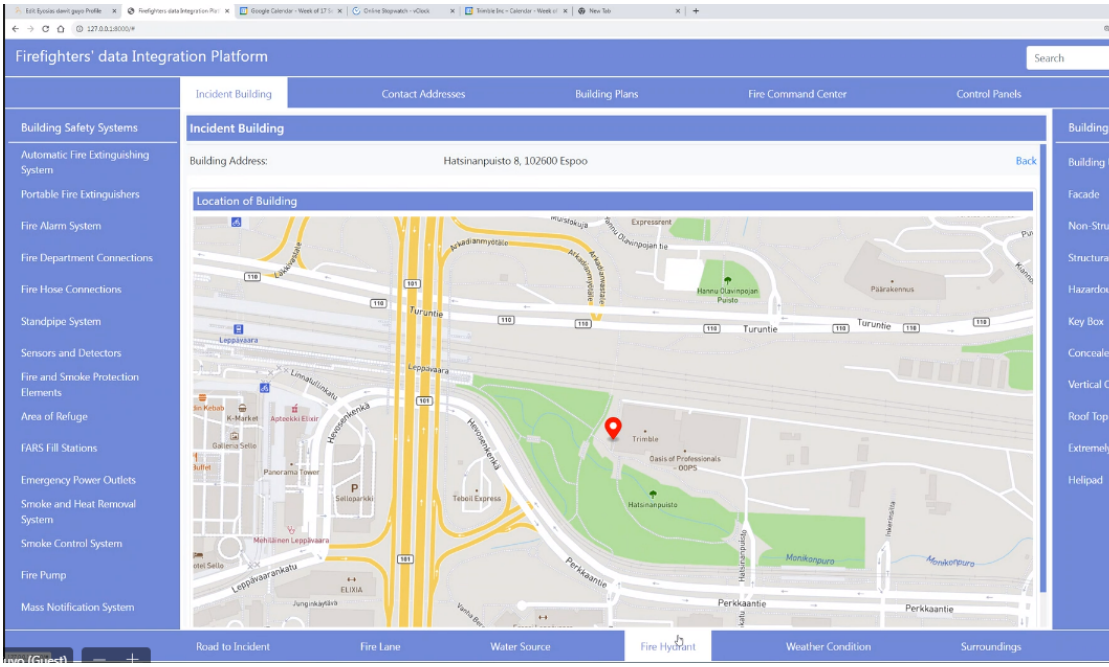
Agenda

1. Introduction of new members
2. Eyosias Dawit Guyo: "Integration of building and environmental data for fire emergency response operations"
3. Discussion
4. Further topics

Minutes

1. **Introduction of new members**
    a. Sebastian Blechmann: attended two meetings before, working at RWTH Aachen, since last year working with ontologies and LD, automation systems, combine data from the field and do fault detection
    b. Ali Nakhaee: started PhD at ICD, invited by colleague Diellza, neuro symbolic AI and Linked Data in architecture and construction

2. **Eyosias Dawit Guyo: "Integration of building and environmental data for fire emergency response operations"**
    a. introduction
        i. presenting part of PhD final stage; also working at Trimble in the CBIM project
        ii. assisting as product owner at Trimble
        iii. PhD on integration of building data and environmental data
    b. research questions/topic
        i. indoor navigation as a fire emergency team: how to explore and navigate? => data needed for
            1. routing and navigation
            2. hazard assessment
            3. required resources (manpower, trucks, etc.)
            4. building safety features (fire hydrants) > location and how to operate
            5. hazards for fire fighters
            6. post-incident analysis (effectiveness of the actions)
        ii. challenges of acquiring data
            1. stressful and physicall demanding
            2. limited visibility in building
            3. paper based sources > often outdated (e.g. plans)
            4. answers from distressed civilians (e.g. number of people in the building)
        iii. research gap
            1. prior research on different sources of information: BIM, sensors, <> gap in integration
            2. multiple units in firefighter teams > exchange data between teams
            3. interaction with other teams: police, paramedics, etc. > use different systems with limited interoperability and terminology for the same things
        iv. research question: how can a formal, well-defined and shared understanding of the building fire emergency response domain be established
            1. application of ontologies => new ontology: firefighters' data requirement ontology (online available)
    c. ontology development methodology
        i. METHONTOLOGY method
            1. specification: domain, purpose, scope,
                a. intended use > data exchange during hazards between existing systems, new information systems, data checking for building and city datasets
            2. out of scope: equipment of firefighters (such as truck) > focus on building
            3. Competency questions
            4. knowledge acquisition: international codes, scientific papers
            5. glossary of terms in Excel > terms that should be incl in the ontology
            6. conceptualization > diagrams
                a. main and split in pieces for readability
            7. implementing using OWL and Protégé application
            8. verification
                a. reasoners for consistency
                b. pitfall scanner OOPS
            9. validation
                a. useful, fulfills needs? => prototype web application

    i. owlready2 in python
    ii. case study building (office in Finland) > real data and mock-up data
d. demonstration of prototype web application (currently offline since end of research)
    i. available on Github
    ii. 

    iii. questions collected from firefighters: what exact info do they need?
        1. try to find the data in the prototype > missing concepts added to the ontology
e. benefits of the research
    i. shared, structured and deeper understanding
    ii. support for standardization
    iii. communication
    iv. interoperability
f. data integration framework > new information system for fire fighters
    i. information sources
        1. mapping from IFC to firesafety ontology > mappings in Excel where possible. Depends on quality of the IFC file
        2. idem for CityGML (environment data)
        3. BMS
        4. web services
        5. …
    ii. integration in graph database (neo4j)
    iii. created different (front-end) tools
        1. hazard assessment > notifications about most critical information
        2. dashboard on-demand > e.g. fire hydrants near building
g. benefits for other stakeholders
    i. building designers > better understanding of safety
    ii. required data in building and environmental datasets > automated checking tool
        1. converted IFC in triples using IFCtoLBD converter
        2. analysis using SHACL > missing properties/attributes in the IFC
            a. quite a lot of firesafety data missing in practice
h. why graph database instead of relational database (SQL)? > comparative study

i. query performance + database design and maintenance
ii. experiments with four datasets:
    1. small building, large building
    2. small (Espoo) and large city model (Tokyo)
iii. research will be published in near future

3. **Discussion**
    a. [Klaus] IFC alignment: static? IFC version?
        i. no ontology for mapping/alignment > visually aligning
        ii. future: using ifcOWL and BOT
    b. [Klaus] graphQL?
        i. used Cypher in neo4j
    c. [Alex] creating the RDF: many of the IFC files have limited content. Used converters for GIS? Other kinds of data (PDF)? For instantiation of the ontology
        i. city level data: Excel, IFC, CityGML > created a MongoDB database (document-based) and imported everything. Quickly prototyping
        ii. focus on the research was creating the ontology
        iii. application of neo4j graph database: converting IFC using ifcOpenShell and create a graph for neo4j, native format (no RDF step). Idem for XML files
        iv. model checking is based on RDF (SHACL) > checking if properties/attributes are available
    d. [Diellza] do you retrieve the data live from the building?
        i. have static data up to date before any emergency > privacy issues with private buildings
        ii. dynamic data: not the focus of the research
    e. [Diellza] future work in recommendations for users/designers/…?
        i. one of the chapters in the PhD focuses on the subject
        ii. e.g. adjacent buildings/rooms, smoke impact for surrounding, etc.
            1. path analysis > better performance for graph databases over relational databases if the number of relations increase
    f. [Mathias] conceptual model drawing > how used in ontology creation?
        i. manually transferred to protégé
        ii. [Alex] UML in diagrams.net > use CHOWLK library to translate to OWL ontology
    g. [Mathias] focus on IFC and CityGML > bottleneck, limited amount of actual files
        i. ontology independent of IFC and CityGML
        ii. how converted: using Python scripts with owlready2 library (python schema)
            1. python schema derived from the OWL ontology acts as a structuring mechanism before importing in the neo4j database
            2. keep track of IFC GUIDs of individual objects in neo4j (link between individual records), no link to concepts and terminology from the ontology inside the neo4j database
            3. [Alex] neosemantics plugin for neo4j: importing/exporting RDF > enforces graph pattern, might be suboptimal for performance
    h. [Mathias] wider agreement on definitions between building designers and firefighters (and beyond)?
        i. need for standardization > ontology as a starting point for discussion
        ii. based on standards for fire safety > good basis
    i. [Sebastian] live data: data availability from the site (fire)
        i. part of the ontology (e.g. sprinkler status), but not in the demo application. Pilot building didn't have any dynamic data
    j. [Sebastian] information center for firefighters?

        i. fire command room in ontology: accessible from outside > schematic data about the building, board with active sprinklers. Use live data from here to instantiate the ontology
    k. [Alex] geometry/location of fire and expansion: how do you deal with geometry representations
        i. topological relations between spaces: adjacency, connecting doors <> detailed geometry
            1. research at UCL for extracting relations from IFC for energy simulations > here used for other use case (fire safety)
            2. didn't import the geometry in the graph database
            3. most IFC files don't have enough semantic information > the used IFC files are already enriched with semantic relations
4. **Further topics**

Next Call

- 16/10/2023, Monday, 14:00-15:30@UTC/ 16:00-17:30@CEST/ 07:00-08:30@PDT

  Agenda: TBD

  We are interested in getting suggestions from the community about potential agenda items and **Elevator Pitches** for the following calls. Please send your suggestions to the chairs or to internal-lbd@w3.org, whether you have a short presentation to bootstrap the discussion, and an approximate duration you think the discussion will last.

Previous minutes

https://github.com/w3c-lbd-cg/lbd/tree/gh-pages/minutes