7SHIELD

KR12 – 7SHIELD Knowledge Base

Scope

The KB module is designed to facilitate the elaboration of the many heterogenous data that can be found in the different components of the platform. Additionally, main goal was the module to be applicable in several use cases. The **interlinking of data regarding the detection, alerting, mitigation**, their sources, or other analysis outputs constitutes the model that later can be used as a **historic reference** grouped by temporal or geographical clusters.

KB is fed by information related to physical/cyber events, coming from other 7SHIELD modules, collected by SPGU. The information is then visualized on a 7SHIELD dashboard (CPTM), in form of structured reports.

Contribution

M4D, part of CERTH, is a group intensively involved in miscellaneous European Projects, starting from 7 Framework Programme (FP7) and more extensively in H2020 projects.

It focuses mainly in the areas of computer vision, **semantic multimedia analysis and retrieval**, web data mining, **multimodal analytics and decision support, crisis management**, fight crime and terrorism, border surveillance and digital security, Earth Observation and Migration and applies these technologies mainly in the health, and **security domain**.

M4D focuses on developing cutting-edge technologies and solutions to be applied to real problems.

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Response

Semantic Reasoning

Partners

CERTH
Greece

The **Centre for Research and Technology-Hellas (CERTH)**, founded in 2000, is the largest Research Centre in Northern Greece. It is governed by private law, while it has a non-profit status and it's supervised by the General Secretariat for Research and Innovation (GSRI) of the Greek Ministry of Development & Investments.

Besides other institutes, it contains the **Information Technologies Institute (ITI)**, which is the largest institute of CERTH. ITI is one of the leading Institutions of Greece in the fields of Informatics, Telematics and Telecommunications.

The **Multimedia, Knowledge and Social Media Analytics Lab (MKLab)** which was founded in 2007 is one of the research units of ITI institute. The MKLab has active involvement in numerous Horizon 2020, FP7 and National projects.

In the 7SHIELD project, the **Multimodal Data Fusion and Analytics (M4D)** group, part of the MKLab, leads the scientific and technical initiatives relevant to semantic representation and retrieval for crisis management.

All the modules developed in the frame of 7SHIELD have been designed with the consultancy of identified external stakeholders, first responders and following the **requirements** provided by the partners working in the space sector acting as Pilots, who provided the Critical Infrastructures for **testing and demonstration**.

Purpose

The main purpose of 7SHIELD Knowledge Base (KB) is to create an **ontological framework** that encapsulates the multimodal information that is gathered through the 7SHIELD platform.

Information deriving from several other components is linked and mapped based on the ontology that was developed to a **semantic triple store** from which can be easily retrieved. KB provides historical data reports for each event recorded from the platform.

Potentially this holistic information can be used to provide new more sophisticated knowledge through a **semantic reasoning** process.

Stakeholders

The ontological structures which were created in this module can be useful in several initiatives in the field of **observation and security**, if there is the need of handling heterogenous data.

The advantages of using the semantic integration approach is the ability to **combine information from multiple data sources in a structural way**, that even though it is based on your specific user requirements and needs, allows you to **reuse concepts from external tested factors** and **reuse some of the semantic structures** in 7SHIELD ontology into similar projects in the future.

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Methodology

The complex process of structuring the 7SHIELD ontology contains the following steps. First with proper understanding of the user requirements, an **upper-level ontology** is selected to provide the foundational entities and relations - in our case Sensor, Observation, Sample, and Actuator ontology (SOSA)/ Semantic Sensor Network Ontology (SSN) - and the **initial ontology is being created**. Then state-of-the-art domain ontologies are studied, which are similar to our field of interest, and used to enrich the ontology. After the finalizing of the structure, **a population service is created** (use of semantic library RDF4J) to match all the incoming information to a triple store (= semantic database) (GraphDB). Finally, the process of **retrieving the knowledge** that is stored in the KB is accomplished with the use of SPARQL queries.

Future Improvements

Further improvement of the module is achievable through two ways.

The first one is the **interlinking of the semantic data** that are stored in the KB with other **external sources** so the overall knowledge will be enriched (e.g., entities such as the threats that are spotted in 7SHIELD platform can be linked with data models with better representation of the same concept).

The second option is with the **involvement of machine learning techniques** to the semantic reasoning approach, which will offer better solutions in many sections of the platform (e.g., mitigation action for each event).

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