Contribution to Contextual Representation of the Maritime Environment using Spatio-temporal Ontology Application to Electronic Navigation

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Application to Electronic Navigation

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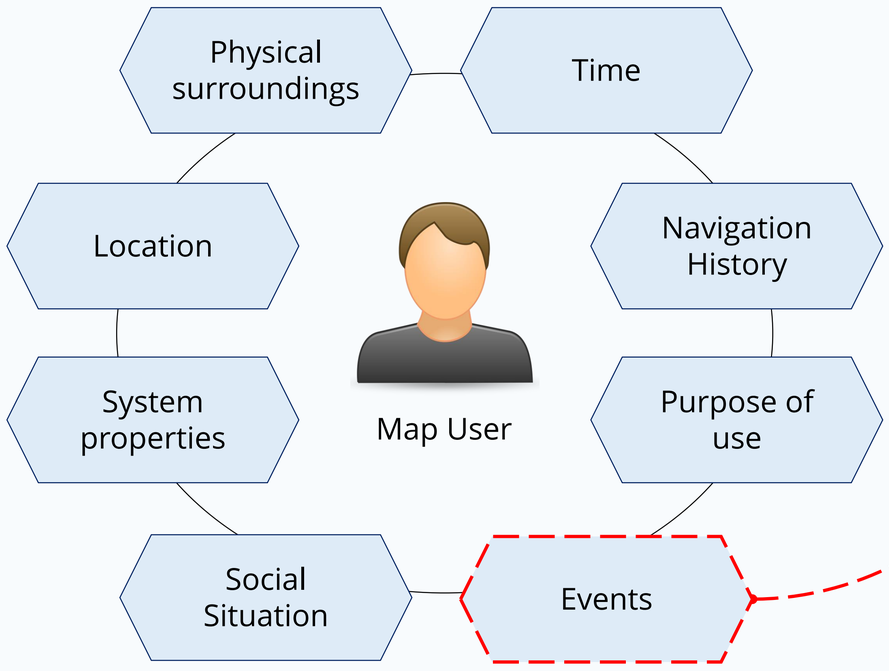
Research Problem

- Every geographical map delivers to its readers a message which is supposed to be in accordance with the intentions of its author.
- However, despite scientific and technical progress, Personalized Map is a very expensive service because it requires qualified human resources.
- A bland map does not catch the attention, a too colourful map does not deliver a clear visual message.
- An information can be useful in a given context, and useless in another, hence the problem of selecting relevant information to be mapped.
- How to precisely meet user requirements and ensure the production of a high quality map while reducing the cost of its preparation?

Context Modeling

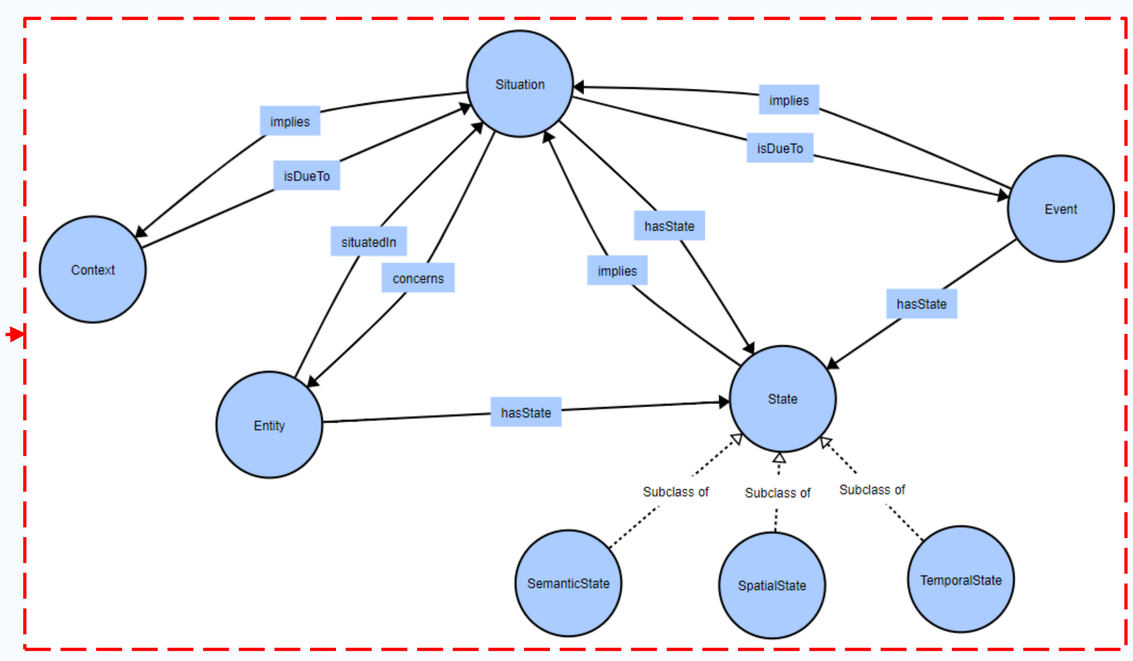
- Several approaches have been proposed to model the context: Key-Value Models, Markup Scheme Models, Graphical Models, Object Oriented Models, Logic Based Models, Ontology Based Models.
- Based on the evaluation conducted by [1], the authors concluded that the most promising model for context modeling with respect to the requirements identified can be found in the Ontology approach.
- Different context ontologies exist such as CONON, CoBrA, SOUPA, CoDAMoS, SmartSpace and CACOnt.
- According to the comparison study in [2], there are some limitations of these different ontologies to deal with our research problem. In the present work, these limitations have been overcome using an additional ontology-based model.

User Context



The surrounding context of the map user is composed of different elements.

Ontology-Based Model



A part of the ontology presenting the *Event* concept.

Use Case

- Application to Electronic Navigational Charts (ENC).
- Assuming the following assertion:

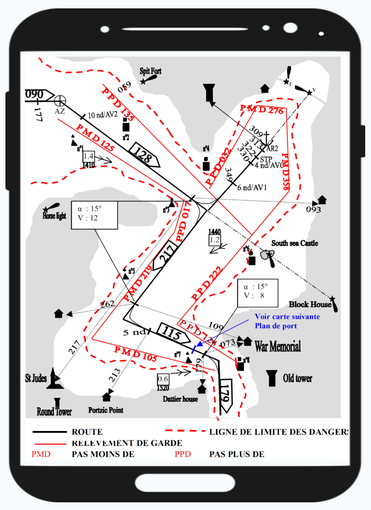
  Event (Passing through a narrow area).
- By reasoning, this event infers:

  - Situation (Reduced ability to steer a boat)

  - Context (Navigation in confined waters)

  - Concerned entities to be mapped:

    Entity (Danger limit line)



Example of contextual ENC.

Our Goals

Context representation

A Generic ontology-based model for representing context taking into consideration the user's profile and preferences, as well as events related to an environment (spatio-temporal dimension).

Formalization of concepts

Formalization of concepts in Description Logic to ensure reasoning with axioms.

SWRL rules

Formalization of rules in SWRL to ensure a reasoning complementary to axiomatic reasoning, while ensuring the principle of decidability.

Application to On-demand navigational chart

Developing an application that automates the process of selection of relevant informations to be mapped using reasoning technics.

[1] Strang T., Linnhoff-Popien C., A Context Modeling Survey, Workshop on Advanced Context Modelling, Reasoning and Management as part of UbiComp 2004 - Sixth International Conference on Ubiquitous Computing, Nottingham - England, September 2004.

[2] Malik S., Jain S. . Ontology based context aware model. In 2017 international conference on computational intelligence in data science (ICCIDS), p. 1-6, 2017