Virtual Coaching Activities for Rehabilitation in Elderly

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D4.2 Baseline ontology, ontology meta models an frameworks SW component, 1st release

Extended summary

The deliverable presents a first version of the vCare ontology, comprising models and meta-models for representing knowledge in vCare.

The vCare ontology models the structure and required information as well as pairwise relationships of *vCare profiles* with respect to **users, diseases, activities, treatment plans, health progress, environments, devices and coaching applications**. As a result, the vCare ontology integrates all required information for developing advanced recommendation and motivation capabilities for the Virtual Coach.

The vCare ontology is modelled with the **Resource Description Framework (RDF),** thereby building on Semantic Web technologies (SWT). By using RDF, the vCare ontology is directly linked to other relevant and important ontologies and structured knowledge bases (i.e. knowledge graphs), such as (i) RadLex, Gene Ontology, Logical Observation Identifiers Names and Codes, Human Disease Ontology, universAAL Health Measurement, Stroke Ontology or Medical Subject Headings for the medical domain, (ii) Semantic Sensor Network Ontology or Machine-to-Machine Measurement for the Internet-of-Things (IoT) domain, and (iii) Friend-of-a-Friend, vCard or Product ontology for generally applicable concepts and relations. The linking procedure enables to **reuse and extend available domain knowledge**, which is especially important for the medical domain, as we are able to directly reuse rich, structured models of medical diseases, where causes and possible treatment are documented.

In addition to RDF, the vCare ontology builds on using **SHACL, the Shapes Constraint Language,** to foster a sustainable vCare ontology schema with correct instances. SHACL enables to **define important constraints** with respect to required information and possible values or ranges. To this end, the vCare ontology also builds on **Notation3 (N3)**, in order to enable inference of novel information based on expert rules (e.g. evidence indicators).

The deliverable dwells on the evolution from the medical ontology outline to the initial version of the vCare ontology schema as presented in this Deliverable. We find that all classes of the medical ontology outline can be mapped to the vCare ontology, where we use the terminology of Profiles analogously. The feedback class will be explicitly modelled during the Tech Lab phase for which close collaboration with medical experts will refine the possible feedback mechanisms for patients.

This deliverable presents the first version of the vCare ontology, comprising **necessary vCare profiles to support the TechLab phase**. The deliverable also includes examples for specialized vCare Stroke profiles from a narratives and knowledge representation perspective, to provide a starting point for exploring the required interplay among technical- and medical components and expertise as targeted in the Tech Lab phase. By the end of the TechLab phase, a final version of the vCare ontology with specialized vCare profiles for all use cases will be presented. The final version will be based on extensive collaboration with technical- and medical experts in increasingly complex and challenging use case implementation, such that current profile schemas are finalized (and thus comprise all necessary information) and respective profile instances (i.e. for all vCare use cases) are available.

For instance, after implementing a rule-based Machine Learning agent where a single activity (e.g. the choice of an adequate treatment activity, such as a serious game or memory training) needs to be personalized, all vCare profiles, and their vCare ontology schemas and instances

are updated. The successful implementation then enables us to easily model finalized vCare profiles.

In order to enable adaptive decision-making for the Virtual Coach, such as clinical pathway adaption based on patient-specific preferences, **the vCare ontology also models decision-theoretic concepts and relationships**. More specifically, next to already mentioned vCare profiles, the state profile models the required information for choosing and parameterizing sustainable activities for individual patients. The required information consist of vCare profiles, such as the patient profile with personal- and clinical state or the device- and environment profiles for further situational information about the patient, but also historical information about the successful (or unsuccessful) recommendation of activities in past days or weeks as well as expert guidelines in the form of expert rules.