Computing Truthworthiness value of all components in physical CPS System

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Physical CPS System

Definition

A physical CPS system S is a tuple (C, A, F, R) where:

- C is a set of physical components.
- A is a finite set of actions that can be execute over CPS system.
- F is a finite set of fluent literals.
- R is a set of relations that map each physical component $c \in C$ with a set of physical component properties that are defined in CPS Ontology. For any $r \in R$, $r : C \longrightarrow 2^P$. P is set of all properties that are defined in CPS ontology.
  For each relation $r \in R$ is encoded by `relation(C1,P1)` which denotes that component $C1 \in C$ is related with property $P1 \in P$.

Compute Truthworthiness Value of Physical CPS System

- Step 1: Representation of concerns, properties and their relations from CPS Ontology for Truthworthiness aspect by predicates `concern/1`, `property/1`, `subconcern/2`, `addressedBy/2`. Represent the observation of CPS initial state (TW aspect) by `obs(p,true/false)`
- Step 2: Representation of Physical CPS System of component, relations between components and properties by `component/1`, `relation/2`.
- Step 3: Reasoning that a component $c \in C$ has property $p \in P$ at step S of evolution by predicate `compHoldProp(c,p,S)` if p holds at step S and there exists a relation between c and p (relation(c,p) holds).
- Step 4: Compute the value `count_relations(p)` of property p. `count_relations(p)` = total number of concerns that are addressed and related to property p (that includes # of concerns that are directly addressed by p and the # of ancestors of these concerns and higher in concern-tree)

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- Step 5: For each component $c \in C$, assuming that $\{p_1, ..., p_n\}$ is a set of properties such that `compHoldProp(c,`p_i`,S)` holds at step S of evolution for any $i \in [1, n]$.
  The Truthworthiness value of component c at step S will be computed by :
  $truthworthiness(c) = \sum_{i=1}^{n} count\_relations(p_i)$
- Step 6: For all component $c \in C$ at step S of evolution, determine which component has the maximum value of $truthworthiness(c)$ — the highest truthworthiness value in physical CPS System