Creating RDF-descriptions for Web of Things devices using WoT SemDesc Helper

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PROBLEM

Whereas the number of distributed systems, working with sensing devices, is growing up quickly, it is still hard to to integrate with them appropriately and in some comfortable way. Huge amount of different protocols and standards implies very different approaches for building such systems. Semantic Web approach suggest a set of powerful instruments, such as OWL-ontologies, RDF and SPARQL to solve this problem by creating simple machine-comprehensible way to describe sensors, its measurements and their interaction. The de-facto standard for presenting knowledge about sensor web is Semantic Sensor Network (SSN) ontology, developed by W3C. But, the SSN ontology declare a very basic concepts, and, to make available using ontology approach when building a sensor-based semantic application, developers must combine SSN with other different device-related ontologies, which are often contains similar concepts, but described in different ways. This makes ontology engineering for Semantic Web of Thing rather differential. The idea to have some unified way for creating semantic description was the point to create the WoT SemDesc Helper tool.

IMPLEMENTATION

WoT SemDesc Helper is a web-based client-server application, that makes available creation of base device models's semantic description in developer and user friendly way. Based on user input, client-side code generate a JSON-LD graph, containing information about model's URI, and a set of it's sensors and their measurement properties. This graph is stored on the back-end using Fuseki server. Application provides it's own SPARQL Endpoint and Linked Data Interface. Based on one of existing model descriptions, user can fill additional fields, such as location, and download a device instance description, which references to the whole model, in any semantic compliant format (RDF/XML, N3, JSON-LD). Application uses a set of ontologies under the hood, such as SSN, Provenance Ontology, QUDT and GeoNames.
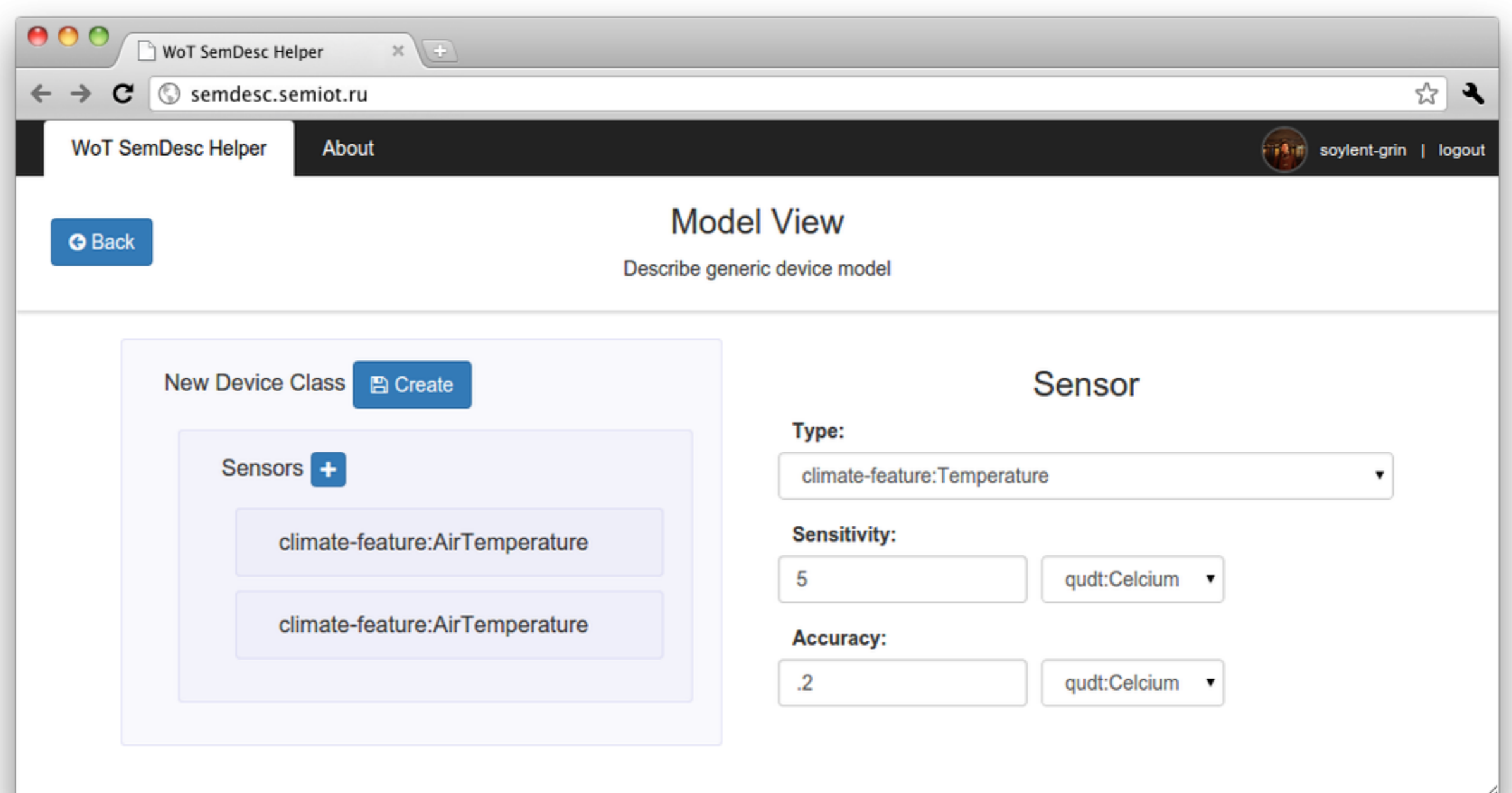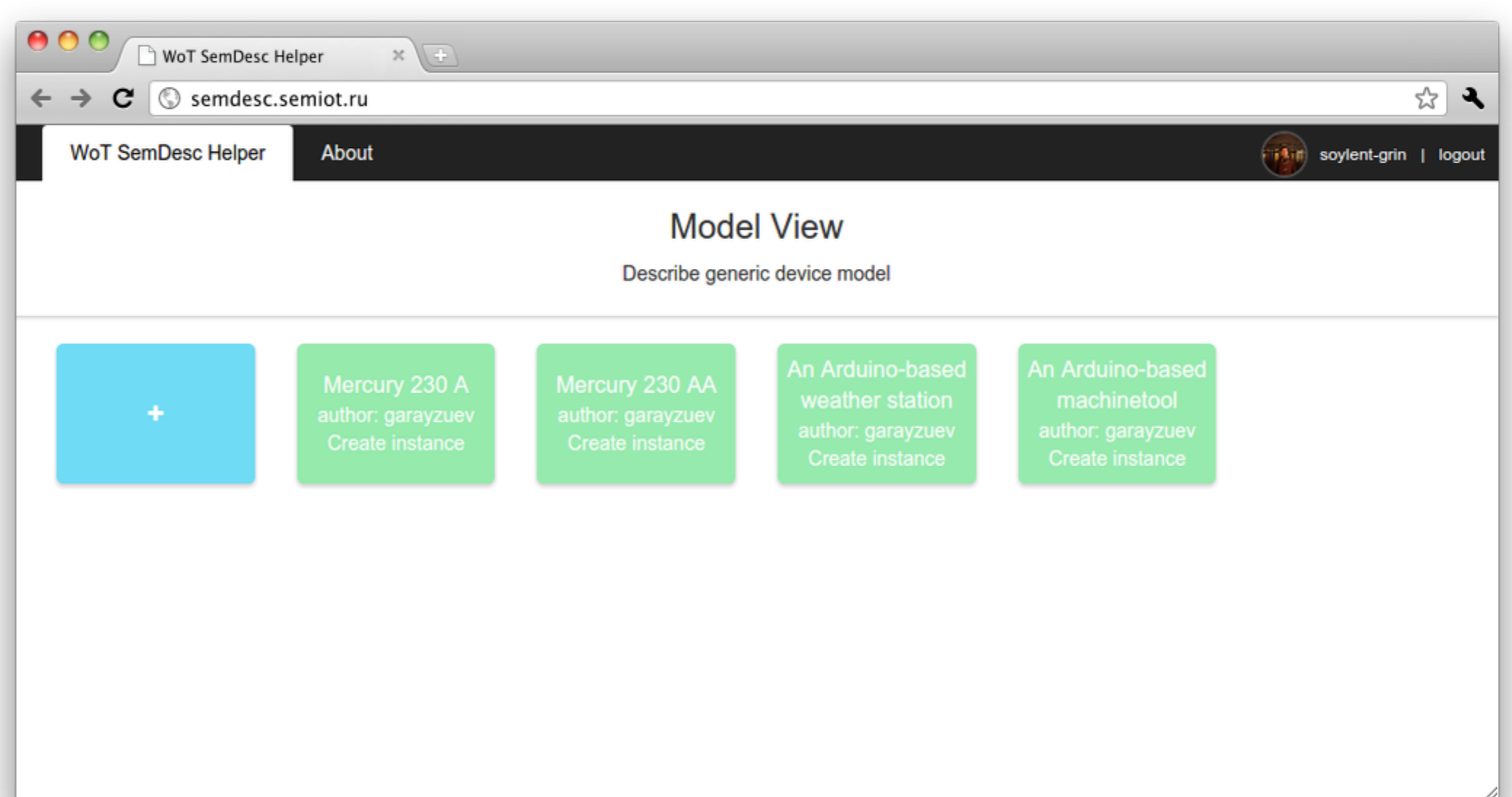
EXAMPLE: GENERATED DESCRIPTION

```
@prefix ssn: <http://purl.oclc.org/NET/ssnx/ssn#> .
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix climate-feature: <https://purl.org/NET/ssnext/climate-feature#> .
@prefix mmi: <http://mmisw.org/ont/mmi/device> .
@prefix : <http://semdesc.semiot.ru/classes/> .

:<weather_station_arduino> {
    :<weather_station_arduino> rdfs:subClassOf ssn:System ;
        a prov:Entity, mmi:Device ;
        prov:wasAttributedTo :<http://github.com/soylent-grin> ;
        rdfs:label "EnvTH-0.0.1"@en ;
        mmi:hasManufacturer [
            a mmi:Manufacturer ;
            rdfs:label "ITMO University"
        ] ;
    ssn:hasSubSystem [
        a ssn:SensingDevice ;
        rdfs:label "Temperature Sensor @ DHT-22"@en ;
        ssn:observes climate-feature:AirTemperature ;
        ssn:hasMeasurementCapability [
            a ssn:MeasurementCapability ;
            ssn:forProperty climate-feature:AirTemperature ;
            ssn:hasMeasurementProperty [
                a ssn:Accuracy ;
                ssn:hasValue [
                    a DUL:Amount ;
                    DUL:hasDataValue "0.5"^^xsd:double ;
                    DUL:isClassifiedBy climate-feature:Celsius
                ]
            ] ;
            ssn:hasMeasurementProperty [
                a ssn:Sensitivity ;
                ssn:hasValue [
                    a DUL:Amount ;
                    DUL:hasDataValue "0.1"^^xsd:double ;
                    DUL:isClassifiedBy climate-feature:Celsius
                ]
            ] ;
            ssn:hasMeasurementProperty [
                a ssn:Resolution ;
                ssn:hasValue [
                    a DUL:Amount ;
                    DUL:hasDataValue "0.1"^^xsd:double ;
                    DUL:isClassifiedBy climate-feature:RelativeHumidity
                ]
            ] ;
        ]
    ]
}

:<http://github.com/soylent-grin> a prov:Agent, prov:Person ;
    foaf:givenName "Nikolay Klimov"^^xsd:string ;
    foaf:mbox <mailto:nikolay.klimov@niuitmo.ru> .
```

WoT SEMDESC HELPER web-UI

TECHNOLOGICAL BACKGROUND

- Public SPARQL endpoint

- Exposed Linked Data Interface

- Online web-UI

- Distribution with Docker

- SSN, Provenance, QUDT, DUL, etc.

OPEN SOURCE

The source code is available at SemIoT project github public repos

semdesc.semiot.ru